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Can Web-based preenrollment alcohol brief interventions be effective screening tools? Precollege drinking behavior predicts college retention and alcohol violations

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ABSTRACT

Objective: To test if precollege drinking data gathered during an online brief intervention are associated with problems and could inform screening for campus alcohol prevention efforts. **Participants:** Two cohorts of incoming students ($N = 5300$). **Method:** Precollege alcohol drinking was gathered through an online preenrollment alcohol brief intervention. Drop out was obtained from university records. On-campus alcohol violations were obtained from university judicial affairs, and off-campus alcohol citations were obtained from the city police. The 2011 cohort was tracked for 4 years, the 2012 cohort for 3 years. **Results:** Precollege abstaining and heavy drinking were significantly associated with retention and alcohol violations, even with ethnicity, residency, and gender controlled. Association of precollege drinking with later college problems extended beyond the first year and affected retention up to four years of enrollment. **Conclusions:** The findings support using data from preenrollment alcohol brief interventions as screening tools to customize further campus alcohol interventions.

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Abstaining; alcohol on-line education; binge drinking; college dropout; heavy episodic drinking; longitudinal study; preenrollment brief alcohol intervention; prematriculation brief alcohol intervention

Studies have documented the harms experienced by college students as a result of excessive and problematic drinking that include increased injury and death.^{1,2} Numerous studies have also documented the negative academic consequences students may experience as a result of risky and problem drinking. Students who drink excessively and in risky ways are more likely to have poor academic performance, miss classes, fall behind in school work, and have less student–faculty interaction.^{2–8} These academic problems may interrupt students' academic progress, and ultimately lead to school dropout.

Student retention is a critical issue for both for students and institutions. Estimates are that dropouts cost postsecondary institutions almost \$16.5 billion annually.⁹ Despite the significant personal and institutional consequences of dropping out, only a small number of studies have looked at how student drinking impacts dropout. Scott et al¹⁰ found that drinking did not predict dropout in the Freshmen year, but more recently, Liguori and Lonbaken¹¹ found that excessive and heavy episodic (binge) drinking was associated with higher likelihood of dropping out. In the only study to look longitudinally across all four years of college, Martinez et al¹² found that heavy drinking was associated with dropping out.

In addition to higher rates of dropping out, studies have found that 5–8% of students had involvement with campus security or community police for violation of alcohol laws and policies.² A larger proportion of students who drank heavily reported trouble with law enforcement than those drinking less.^{7,11,13} More occasional and frequent heavy drinkers reported being cited or arrested for driving while intoxicated/driving under the influence (DWI/DUI) and having trouble with police (other than DUI) than non-heavy drinkers.^{3,13} Students who drink more are more likely to face institutional sanctions for campus alcohol violations.¹³ In general, students with higher alcohol consumption were more likely to experience violations of laws and school policies. These violations can have long-range consequences as students who are arrested while in college have 3–5 times higher odds of a later postcollege conviction.^{14,15} In addition to the legal problems and consequences for students, dealing with alcohol violations imposes costs on the institution, such as the costs of police and security personnel, health and counseling services, and administration of sanctions associated with student violations.

To address the negative consequences of problematic alcohol use, postsecondary schools have increasingly turned to Screening and Brief Intervention (SBI), also known as

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Brief Motivational Interventions (BMI) or just Brief Interventions (BI). BIs were Tier 1 approaches in the NIAAA Tiers of Effectiveness and are higher effectiveness approaches in the recent *College AIM*.¹⁶ SBI is used to identify individuals at risk for alcohol use problems based on a structured set of screening questions about drinking and related harms.

Originally, BIs were targeted to college students who were identified as being high-risk drinkers by alcohol sanctions or by known high-risk group membership, such as Greek students.^{16–21} These were generally face-to-face BI such as Brief Alcohol and Screening Intervention for College Students (BASICS), and the individual counseling and the group counseling adaptation of BASICS, the Alcohol Skills Training Program (ASTP).^{16,22} With the expansion of the Web, BIs were adapted into self-contained Web administered programs such as e-CHECK UP TO GO (e-CHUG)^{20,23,24}.

More recently, BIs have been increasingly used as a prevention tool for the general student population, primarily through delivery as a preenrollment or first-year Web program. Sometimes these preenrollment interventions were extensions of existing BIs that were moved from treatment to prevention use with minimal modification; for example, e-CHECK UP TO GO²¹. BI components also have been included in broader preenrollment alcohol education programs such as AlcoholEDU[®] and Alcohol-Wise[®]. There is some evidence that these preenrollment BIs reduce high-risk drinking and associated harms among college students.^{25–28} Also, studies have found that students taking a BI or alcohol education program before or during their first semester had higher retention than students not receiving any alcohol programing.^{29,30} Shell & Newman³¹ found reductions in alcohol on-campus and off-campus citations for students taking a preenrollment BMI.

Like the original SBIs, these preenrollment BIs and alcohol education programs provide a wealth of data about student drinking and harms, including drinking quantity and frequency, experienced harms, normative perceptions, and family history of alcohol abuse, but it is not clear whether these data could potentially be useful for further screening of incoming students beyond the feedback provided in BI itself. In a preenrollment BI, students are reporting their precollege (typically high school) drinking patterns. Schools could potentially use students' preenrollment data to target further programing, but there are only limited studies suggesting that precollege drinking is meaningfully predictive of drinking and harms after students enter college. Sher and Rutledge³² found that students who drank heavily prior college were more likely to continue drinking heavily in the first semester of college. Harford et al.³³ found that college students with heavy episodic drinking in high school had higher probabilities of experiencing problem consequences and impaired driving when background variables were controlled. Scaglione and colleagues³⁴ further found that the odds of experiencing multiple, repeated alcohol-related consequences in college were higher for students who reported drinking, drunkenness, and consequences in high school.

Because of the aforementioned personal and institutional costs associated with student dropout and legal violations, it would be beneficial if the data provided by students in a preenrollment BI could be used to screen students who might be at risk for these negative outcomes. There, however, are no studies of whether precollege drinking patterns, as obtained in a preenrollment BI, are predictive of later student dropout or legal and administrative violations.

The present study

The objective of this study was to examine whether precollege drinking behaviors reported in a preenrollment BI are meaningfully associated with student retention and alcohol-related campus and off-campus citations in ways that could inform potential alcohol-related treatment and prevention programing and intervention. Comparisons were made between drinkers and abstainers to determine if precollege abstinence was a protective factor against dropping out and violations. Precollege heavy-episodic or binge drinkers and non-binge drinkers were compared to determine if precollege binge drinking was predictive for subsequent dropout and violations.

As part of a preenrollment prevention program launched at the University of Nebraska–Lincoln (UNL), incoming first year students were expected to complete an online Web-based brief screening and intervention tool, the Year 1 College Alcohol Profile (Y1-CAP). The Y1-CAP is administered prior to the fall semester. Incoming first-year students under age 21 and their parents receive letters from the Vice Chancellor for Student Affairs directing them to the Web address for the Y1-CAP. The letter expresses that he/she (or their student, in the parent letter) is expected to complete the Y1-CAP prior to coming to campus. Non-completing students are sent up to two follow-up email reminders at approximately 10 days intervals. The Y1-CAP is closed after the first week of classes. Although the institutional expectation is that all students will complete the Y1-CAP, the Vice Chancellor's correspondence represents a "soft" mandate in that there is no consequence for non-completion. Students are informed that while their responses will be kept confidential, their responses may be seen by approved campus personnel and may be used for institutional program and planning purposes. The Y1-CAP incorporates screening information similar to that obtained in other face-to-face or Web-based SBIs.^{16,17,21,23} Students indicated drinking or not drinking in the past year (abstinence), typical weekly drinking in the past month, harms experienced from drinking, drinking and driving, and perceptions of fellow first-year student drinking. Students' responses about abstinence and weekly drinking were used in the study.

For this study, two cohorts of incoming first-year students were examined, Fall 2011 and Fall 2012. Two cohorts were used to determine if there were meaningful differences in screening utility in different entering student populations and to allow replication of any findings across two different cohort samples. Enrollment was tracked for 4 years for the 2011 cohort and 3 years for the 2012 cohort to identify

retention. Records of on-campus and off-campus alcohol violations were tracked for two academic years following enrollment.

Study hypotheses were:

Hypothesis 1: Students reporting precollege abstinence will have higher retention (lower likelihood of dropping out).

Hypothesis 2: Students reporting precollege abstinence will have lower likelihood of (a) on-campus alcohol violations and (b) off-campus community alcohol citations.

Hypothesis 3: Students reporting precollege heavy-episodic (binge) drinking will have lower retention (higher likelihood of dropping out).

Hypothesis 4: Students reporting precollege heavy-episodic (binge) drinking will have higher likelihood of (a) on-campus alcohol violations and (b) off-campus alcohol citations.

Method

The data collected in Y1-CAP have been determined to be non-research administrative data by the University of Nebraska-Institutional Review Board. The use of the Y1-CAP administrative data along with the institutional retention, sanction, and off-campus violation data for this study was approved as exempt secondary data analysis by the University of Nebraska-Lincoln, Institutional Review Board, project # 20170216831 EX. The researchers were provided with anonymous data for analysis.

Participants

Participants were entering first-year students from 2011 and 2012 who completed the university’s preenrollment college alcohol brief intervention (Y1-CAP). Y1-CAP was sent to all first-year students in 2011 and all first-year students except for varsity athletes in 2012 and was completed by 83.9% in 2011 and 79.7% in 2012. The 2011 cohort consisted of 2,821 students (1,366 men, 1,455 women; 2,506 White, 53 African-American, 60 Asian, 10 Native American/Hawaiian/Pacific Islander, 69 multi-racial, 123 no answer, 152 Hispanic; 2,814 age 18 or 19, 7 age 20+). The 2012 cohort consisted of 2,479 students (1,258 men, 1,220 women, 1 unknown; 2,166 White, 35 African-American, 55 Asian, 13 Native American/Hawaiian/Pacific Islander, 75 multi-racial, 135 no answer, 108 Hispanic; 2,458 age 18 or 19, 21 age 20+).

Demographic characteristics for drinkers, abstainers, binge drinkers, and non-binge drinkers are described in Table 1. Because alcohol consumption differed in key demographic variables of race/ethnicity (White vs non-White), residency (Nebraska resident vs nonresident student), and gender (Men vs Women), these variables were controlled in the analysis models.

Table 1. Demographic description of precollege binge drinkers, non-binge drinkers, and abstainers in the 2011 and 2012 cohorts.

	2011 Cohort (n = 2,821)						2012 Cohort (n = 2,479)					
	Abstinence			Binge drinking			Abstinence			Binge drinking		
	Precollege drinker	Precollege abstainer	Precollege binge drinker	Precollege non-binge drinker	Precollege drinker	Precollege non-binge drinker	Precollege drinker	Precollege abstainer	Precollege binge drinker	Precollege non-binge drinker	Precollege drinker	Precollege non-binge drinker
Gender												
Male	742	624	335	1,031	637	621	283	975				
Female	787	668	298	1,157	611	609	215	1,005				
Unknown	0	0	0	0	1	0	0	1				
Ethnicity												
White	1,384	1,122	578	1,928	1,123	1,043	466	1,700				
African-American	16	37	5	48	13	22	3	32				
Asian	20	40	4	56	17	38	4	51				
Native American/Hawaiian/Pacific Islander	5	5	1	9	7	6	3	10				
Multi-racial	30	39	5	64	33	42	4	71				
No answer	74	49	40	83	56	79	18	117				
Nebraska resident student												
Resident	1,266	1,084	515	1,835	997	1,007	403	1,601				
Nonresident	262	208	117	353	252	223	95	380				
Missing	1	0	1	0	0	0	0	0				
Age												
18/19	1,526	1,288	632	2,182	1,238	1,220	494	1,964				
20+	3	4	1	6	11	10	4	17				

Measures

Retention

Student retention was measured by subsequent semester enrollment. The Fall 2011 cohort were tracked from Fall 2012 through Spring 2015. The Fall 2012 cohort were tracked from Fall 2013 through Spring 2015. Retention was recorded in months starting at 12 (for the next academic year) and then at 6-month increments (18, 24, 30, etc) for successive spring and fall semesters. The maximum survival time was 48 months for the 2011 cohort and 36 months for the 2012 cohort. Students who were still enrolled in Spring 2015 constituted the enrolled group; students who were not enrolled at any time period constituted the dropout group. Students were counted as dropping out at their initial non-enrollment semester regardless of whether they subsequently reenrolled. Enrollment records were obtained from the university's registrar.

On-campus alcohol violations and off-campus alcohol citations

Student on-campus alcohol-related violations were obtained from the university's Dean of Students, Office of Student Judicial Affairs. Student off-campus alcohol-related citations were obtained from the city police department. Through a preexisting agreement with the university, the city police forward all minor in possession, DWI/DUI, and disorderly house citations involving university students to the university. On-campus violations and off-campus citations were tracked for the students' first two enrollment years. For the 2011 cohort these were the 2011–12 (Year 1) and the 2012–13 (Year 2) academic (July 1–June 30) years. For the 2012 cohort these were the 2012–13 (Year 1) and the 2013–14 (Year 2) academic (July 1–June 30) years.

Precollege drinking behaviors

Abstinence was determined by student answers on the Y1-CAP to whether they had drunk alcohol in the past year. Students who reported they had not drunk alcohol at all in the past year were classified as *abstainers*. Heavy episodic drinking was computed from a daily drinking diary in the Y1-CAP adapted from the Daily Drinking Questionnaire.³⁵ The diary asked students to report their typical weekly drinking for the past month on a one-week calendar by recording for each day of the week the number of drinks each of beer, wine, and liquor and number of hours drinking. The definition for heavy-episodic or binge drinking used in this study was five (5) or more drinks for men and four (4) or more drinks for women in a single setting.⁷ From the diary, a student was classified as a *binge drinker* if they reported having 5 (men) or 4 (women) drinks on any day. For analysis, drinking behaviors were indicated independently by two binary variables: (a) whether or not they were an abstainer (yes-no) and (b) whether or not they were a binge drinker (yes-no).

Results

Associations with precollege alcohol abstinence

Student retention

Survival analysis was used to analyze the survival time (retention) until the occurrence of dropping out of the university. The *survival function* is the probability of still being enrolled at each semester.

Kaplan–Meier survival curves³⁶ were used to compare the survival of students who reported precollege abstaining to those who reported consuming alcohol precollege. For the 2011 cohort, the survival function of abstainers is shown in [Figure 1](#). Precollege abstainers had significantly higher retention in college than precollege drinkers (Mantel–Cox log-rank test, $\chi^2(1) = 6.66, p = .010$). For the 2012 cohort, the survival function of abstainer is shown in [Figure 2](#). Precollege abstainers had significantly higher retention than precollege drinkers (Mantel–Cox log-rank test, $\chi^2(1) = 12.09, p = .001$).

Cox regression was used to test for the impact of abstinence on survival controlling for demographic variables (ethnicity, residency, and gender). Demographic variables were entered on the first step and the abstainer variable was entered on the second step. Significance of abstinence was determined from Step 2 change.

For the 2011 cohort, the Step 2 change testing the effect of being an abstainer was significant ($\chi^2(1) = 5.962, p = .015$). The overall Cox regression ([Table 2](#)) confirmed Kaplan–Meier survival analysis findings as being a precollege abstainer reduced the odds of dropping out by about 12% relative to the odds for being a precollege drinker when ethnicity, residency, and gender were controlled. Similarly, the effect of abstinence was significant for the 2012 cohort ($\chi^2(1) = 11.683, p = .001$). The overall Cox regression ([Table 2](#)) confirmed Kaplan–Meier survival analysis. Precollege abstinence reduced the odds of dropping out by about 23% relative to the odds for a precollege drinker when ethnicity, residency, and gender were controlled.

On-campus alcohol violations and off-campus alcohol citations

Logistic regressions were run hierarchically to test for the impact of precollege abstinence on on-campus violations and off-campus citations during college while controlling for demographic variables (ethnicity, residency, and gender). Significance of abstinence was determined from Step 2 change.

For the 2011 cohort, the final logistic regressions ([Table 3](#)) for alcohol-related judicial sanctions were significant in Year 1 ($-2 \log\text{-likelihood} = 1557.81, \chi^2(4) = 55.15, p < .001$) and Year 2 ($-2 \log\text{-likelihood} = 522.78, \chi^2(4) = 11.37, p = .023$). The Step 2 change indicated that precollege abstinence had a significant effect on alcohol-related on-campus violations in year 1 ($\chi^2(1) = 44.55, p < .001$) and in year 2 ($\chi^2(1) = 4.66, p = .031$). Precollege abstinence reduced the odds of a year 1 alcohol-related on-campus violation by approximately 62% in year 1 and 46% in year 2

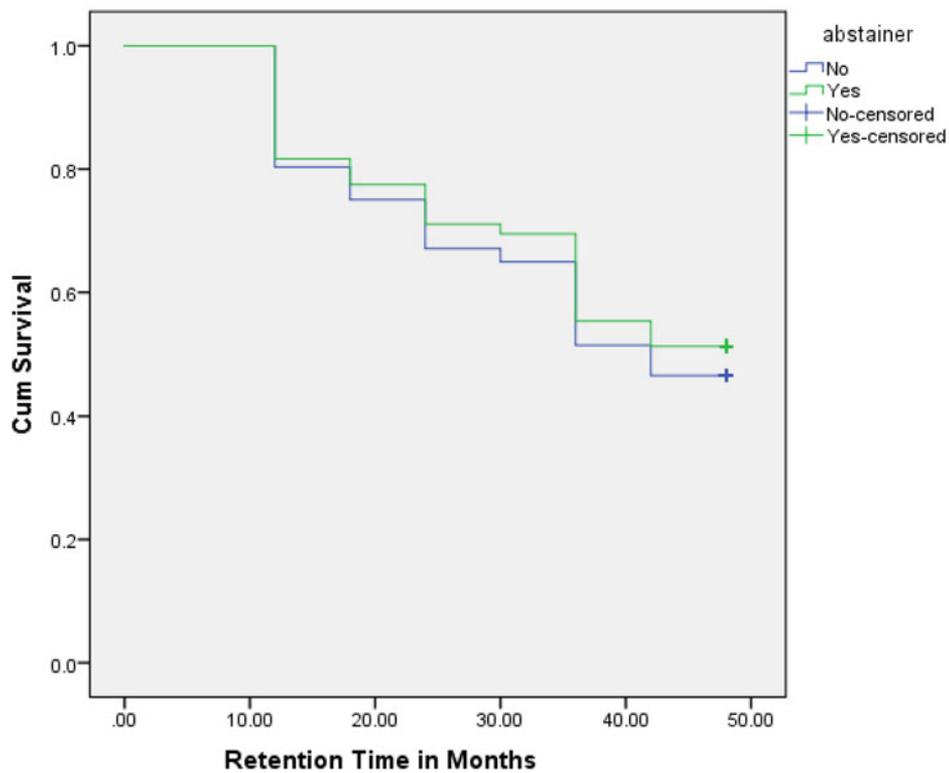


Figure 1. 2011 cohort survival function for precollege abstainers.

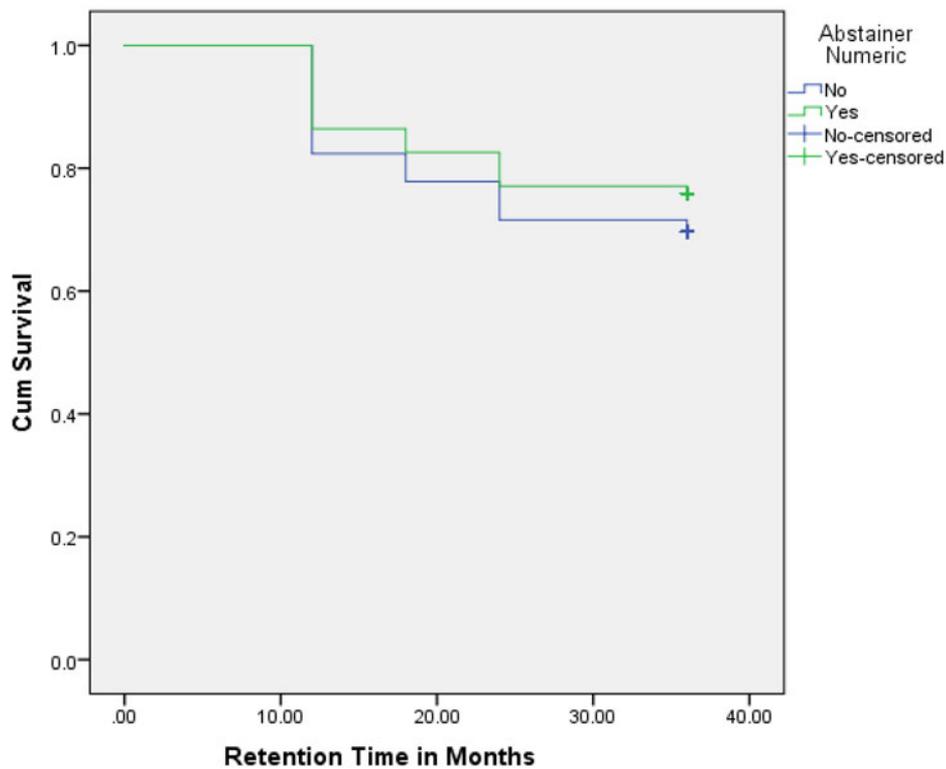


Figure 2. 2012 cohort survival function for precollege abstainers.

relative to students who reported precollege drinking (Table 3). The final logistic regressions (Table 3) for alcohol-related off-campus alcohol citations were significant in Year 1 (-2 log-likelihood = 1073.79, χ^2 (4) = 57.59, $p < .001$) and Year 2 (-2 log-likelihood = 603.48, χ^2 (4) = 44.85, $p <$

.001). Step 2 change indicated that precollege abstinence had a significant effect on off-campus alcohol citations in year 1 (χ^2 (1) = 44.16, $p < .001$) and in year 2 (χ^2 (1) = 22.134, $p < .001$). Precollege abstinence reduced the odds of an off-campus alcohol citation while in college by approximately

Table 2. Cox regression for 2011 and 2012 cohorts' survival of precollege abstainers relative to precollege drinkers.

	B	S.E.	Wald	df	p	Odds ratio	95% C.I.	
							Lower	Upper
2011 Cohort								
Ethnicity	-0.103	0.089	1.339	1	0.247	0.902	0.757	1.074
Residency	0.009	0.070	0.017	1	0.598	1.009	0.879	1.159
Gender	-0.001	0.053	0.001	1	0.981	0.999	0.901	1.107
Abstainer	-0.129	0.053	5.933	1	0.015	0.879	0.792	0.975
2012 Cohort								
Ethnicity	-0.243	0.121	4.055	1	0.044	0.784	0.619	0.994
Residency	0.056	0.096	0.335	1	0.563	1.057	0.876	1.276
Gender	-0.088	0.077	1.311	1	0.252	0.916	0.787	1.065
Abstainer	-0.265	0.078	11.592	1	0.001	0.767	0.659	0.894

Gender: 1 = male, 0 = female; Ethnicity: 1 = White, 0 = non-White; Residency: 1 = nonresident student, 0 = resident student; Abstainer: 1 = nondrinker, 0 = drinker.

Overall model: 2011 Cohort: -2 log-likelihood = 22,318.58, $\chi^2(4) = 7.062$, $p = .133$; 2012 Cohort: -2 log-likelihood = 10,426.78, $\chi^2(4) = 16.54$, $p = .002$.

72% in year 1 and 73% in year 2 relative to the odds for students who were precollege drinkers (Table 3).

For the 2012 cohort, the final logistic regressions (Table 4) for alcohol-related judicial sanctions were significant in Year 1 (-2 log-likelihood = 1,240.61, $\chi^2(4) = 65.22$, $p < .001$) and Year 2 (-2 log-likelihood = 613.90, $\chi^2(4) = 16.35$, $p = .003$). Step 2 change indicated that precollege abstinence had a significant effect on alcohol-related on-campus violations in year 1 ($\chi^2(1) = 51.56$, $p < .001$) and in year 2 ($\chi^2(1) = 4.91$, $p = .027$). Precollege abstinence reduced the odds of an alcohol-related on-campus violation while in college by approximately 70% in year 1 and 43% in year 2 relative to students reporting precollege drinking (Table 5). The final logistic regressions (Table 4) for alcohol-related off-campus alcohol citations were significant in Year 1 (-2 log-likelihood = 701.89, $\chi^2(4) = 31.81$, $p < .001$) and Year 2 (-2 log-likelihood = 573.50, $\chi^2(4) = 20.85$, $p < .001$). Step 2 change indicated that precollege abstinence had a significant effect on off-campus alcohol citations in year 1 ($\chi^2(1) = 29.69$, $p < .001$) and year 2 ($\chi^2(1) = 3.86$, $p = .049$). Precollege abstinence reduced the odds of an off-campus alcohol citation while in college by about 73% in year 1 and 40% in year 2 relative to the odds for students reporting precollege drinking (Table 4).

Associations with precollege binge drinking

Student retention

Kaplan–Meier survival curves³⁶ were used to compare the survival of students who reported binge drinking precollege with students who did not. The non-binge drinking comparison group included both abstainers and students who drank but did not binge. For the 2011 cohort, the survival function of binge drinker is shown in Figure 3. Students who reported precollege binge drinking had similar retention to those who did not binge precollege (Mantel–Cox log-rank test, $\chi^2(1) = 0.216$, $p = .642$). For the 2012 cohort, the survival function of binge drinker is shown in Figure 4. Students who reported pre-college binge drinking had

significantly lower retention than pre-college non-binge drinkers (Mantel–Cox log-rank test, $\chi^2(1) = 6.074$, $p = .014$).

Cox regressions were run in two steps to test the significance of precollege binge drinking controlling for ethnicity, residency, and gender. For the 2011 cohort, the Step 2 change testing the effect of binge drinking was not significant ($\chi^2(1) = 0.221$, $p = .638$). It was consistent with Kaplan–Meier survival analysis findings, as the odds of retention for students reporting precollege binge drinking were not significantly different from those for precollege non-binge drinkers (Table 5). For the 2012 cohort, the effect of binge drinking on retention was significant ($\chi^2(1) = 6.06$, $p = .014$). The final Cox regression showed precollege binge drinking increased the odds of dropping out by 1.26 (26%) relative to the odds for a precollege non-binge drinker when ethnicity, residency, and gender were controlled (Table 5).

On-campus alcohol-related violations and off-campus alcohol citations

Logistic regressions were run hierarchically, with demographic variables entered on the first step and precollege binge drinking status (binger vs not binger) entered on the second step, to test for the impact of precollege binge drinking on on-campus violations and off-campus citations while in college. Significance of binge drinking was determined from Step 2 change.

For the 2011 cohort, the final logistic regressions (Table 6) for alcohol-related judicial sanctions were significant in Year 1 (-2 log-likelihood = 1579.81, $\chi^2(4) = 33.15$, $p < .001$) and Year 2 (-2 log-likelihood = 523.38, $\chi^2(4) = 10.78$, $p = .029$). The Step 2 change indicated that precollege binge drinking had a significant effect on alcohol-related on-campus sanctions in year 1 ($\chi^2(1) = 22.55$, $p < .001$) and in year 2 ($\chi^2(1) = 4.06$, $p = .044$). Precollege binge drinking increased the odds of an alcohol-related on-campus violation while in college by about 2.04 (104%) in year 1 and 1.83 (83%) in year 2 relative to the odds for students who did not binge precollege (Table 6). The final logistic regressions (Table 6) for off-campus alcohol citations were significant in Year 1 (-2 log-likelihood = 1085.37, $\chi^2(4) = 46.00$, $p < .001$) and Year 2 (-2 log-likelihood = 600.66, $\chi^2(4) = 47.67$, $p < .001$). Step 2 change indicated that precollege binge drinking had a significant effect on off-campus alcohol citations in year 1 ($\chi^2(1) = 32.58$, $p < .001$) and in year 2 ($\chi^2(1) = 24.96$, $p < .001$). Precollege binge drinking increased the odds of an off-campus alcohol citation during college by about 2.82 (182%) in year 1 and 3.54 (254%) in year 2 relative to the odds for students who did not binge before college (Table 6).

For the 2012 cohort, the final logistic regressions (Table 7) for alcohol-related judicial sanctions were significant in Year 1 (-2 log-likelihood = 1249.78, $\chi^2(4) = 56.06$, $p < .001$) and Year 2 (-2 log-likelihood = 614.33, $\chi^2(4) = 15.92$, $p = .003$). The Step 2 change indicated that precollege binge drinking had a significant effect on alcohol-related on-campus sanctions in year 1 ($\chi^2(1) = 42.40$, $p < .001$)

Table 3. Logistic regression for the 2011 cohort for alcohol-related on-campus sanctions and off-campus alcohol citations of precollege abstainers relative to precollege drinkers.

	B	S.E.	Wald	df	p	Odds ratio	95% C.I.	
							Lower	Upper
Judicial alcohol sanction								
Year 1								
Gender	0.259	0.138	3.494	1	0.062	1.295	0.988	1.699
Ethnicity	0.548	0.306	3.205	1	0.073	1.730	0.949	3.152
Residency	0.249	0.174	2.059	1	0.151	1.283	0.913	1.802
Abstainer	-0.982	0.156	39.697	1	0.000	0.375	0.276	0.508
Constant	-2.986	0.374	63.761	1	0.000	0.050		
Year 2								
Gender	0.698	0.288	5.868	1	0.015	2.009	1.142	3.534
Ethnicity	-0.136	0.476	0.082	1	0.775	0.873	0.343	2.219
Residency	0.274	0.343	0.638	1	0.424	1.315	0.672	2.575
Abstainer	-0.620	0.296	4.384	1	0.036	0.538	0.301	0.961
Constant	-4.292	0.651	43.519	1	0.000	0.014		
Off-campus alcohol citation								
Year 1								
Gender	0.477	0.176	7.333	1	0.007	1.612	1.141	2.277
Ethnicity	0.554	0.396	1.955	1	0.162	1.740	0.800	3.781
Residency	0.349	0.212	2.703	1	0.100	1.417	0.935	2.148
Abstainer	-1.289	0.215	36.051	1	0.000	0.276	0.181	0.420
Constant	-3.700	0.479	59.786	1	0.000	0.025		
Year 2								
Gender	1.126	0.278	16.434	1	0.000	3.084	1.789	5.317
Ethnicity	1.066	0.723	2.171	1	0.141	2.902	0.703	11.975
Residency	-0.036	0.336	0.012	1	0.914	0.964	0.499	1.863
Abstainer	-1.311	0.311	17.752	1	0.000	0.270	0.147	0.496
Constant	-4.930	0.840	34.450	1	0.000	0.007		

Gender: 1 = male, 0 = female; Ethnicity: 1 = White, 0 = non-White; Residency: 1 = nonresident student, 0 = resident student; Abstainer: 1 = nondrinker, 0 = drinker.

and year 2 ($\chi^2(1) = 4.48, p = .034$). With ethnicity, residency, and gender controlled, precollege binge drinking increased the odds of an alcohol-related on-campus violation in year 1 by about 2.97 (197%) and odds of an alcohol-related on-campus violation in year 2 by about 1.79 (79%) relative to the odds for students who did not binge precollege (Table 7). The final logistic regressions (Table 7) for off-campus alcohol citations were significant in Year 1 ($-2 \log\text{-likelihood} = 710.99, \chi^2(4) = 22.70, p < .001$) and Year 2 ($-2 \log\text{-likelihood} = 572.55, \chi^2(4) = 21.79, p < .001$). Step 2 change indicated that precollege binge drinking had a significant effect on off-campus alcohol citations in year 1 ($\chi^2(1) = 20.59, p < .001$) and year 2 ($\chi^2(1) = 4.81, p = .028$). Precollege binge drinking increased the odds of a student receiving an off-campus alcohol-related citation while in college by about 2.96 (196%) in year 1 and 1.87 (87%) in year 2 relative to the odds for students who did not binge precollege (Table 7).

Comment

Association of precollege drinking behavior with college retention

Precollege drinking behaviors were significantly associated with student retention. For the 2011 cohort, students who reported not drinking alcohol before college were less likely to drop out than drinkers. For 2012 cohort, not only were the precollege abstainers less likely to drop out than drinkers; but also, students reporting precollege binge drinking were more likely to drop out than non-bingers. These findings extend those of Harford et al.³³ who found that

heavy episodic drinking in high school increased the likelihood of problems in college.

The effect of abstinence was more pronounced for the 2012 cohort where survival effects were seen at the end of the first year, with survival increasing each successive semester. Impacts were smaller for the 2011 Cohort and took longer to appear. There was only a minimal survival advantage for precollege abstainers through their first two academic years. Only at the fall semester of their junior (3rd) year did significant survival differences appear. Similarly, there was no effect of precollege binge drinking on retention for the 2011 cohort; whereas, there was small effect increasing dropping out in 2012. There were no obvious differences in demographics between the 2011 and 2012 cohorts, and no changes in admissions standards or policies in the 2 years. So, it is unclear why the effects on retention for both precollege abstainers and precollege binge drinkers were larger for the 2012 cohort. These findings substantiate the need to consider how entering cohorts may be different both in their drinking and the impacts of their drinking on retention and college success and the need to examine other factors that may be mediating associations between precollege drinking and later academic consequences.

Association of precollege drinking behavior with on-campus alcohol-related violations and off-campus alcohol citations

Precollege abstinence was associated with reduced likelihood of students having alcohol-related on-campus violations or off-campus legal citations while in college. In both years, the

Table 4. Logistic regression for the 2012 cohort for alcohol-related on-campus sanctions and off-campus alcohol citations of precollege abstainers relative to precollege drinkers.

	B	S.E.	Wald	df	p	Odds ratio	95% C.I.	
							Lower	Upper
Judicial alcohol sanction								
Year 1								
Gender	0.556	0.161	11.931	1	0.001	1.743	1.272	2.390
Ethnicity	0.064	0.283	0.051	1	0.821	1.066	0.613	1.856
Residency	-0.154	0.207	0.555	1	0.456	0.857	0.571	1.286
Abstainer	-1.189	0.177	44.871	1	0.000	0.305	0.215	0.431
Constant	-2.275	0.390	34.003	1	0.000	0.103		
Year 2								
Gender	0.773	0.263	8.677	1	0.003	2.167	1.295	3.626
Ethnicity	0.082	0.436	0.035	1	0.851	1.085	0.462	2.548
Residency	0.456	0.281	2.638	1	0.104	1.578	0.910	2.738
Abstainer	-0.555	0.255	4.732	1	0.030	0.574	0.348	0.947
Constant	-4.407	0.603	53.373	1	0.000	0.012		
Off-campus alcohol citation								
Year 1								
Gender	0.247	0.226	1.197	1	0.274	1.280	0.822	1.994
Ethnicity	-0.135	0.382	0.125	1	0.723	0.874	0.413	1.846
Residency	-0.289	0.308	0.876	1	0.349	0.749	0.410	1.371
Abstainer	-1.335	0.270	24.480	1	0.000	0.263	0.155	0.447
Constant	-2.554	0.541	22.251	1	0.000	0.078		
Year 2								
Gender	1.038	0.287	13.074	1	0.000	2.822	1.608	4.953
Ethnicity	-0.173	0.410	0.177	1	0.674	0.841	0.377	1.879
Residency	0.495	0.290	2.908	1	0.088	1.640	0.929	2.896
Abstainer	-0.509	0.263	3.745	1	0.053	0.601	0.359	1.007
Constant	-4.506	0.605	55.544	1	0.000	0.011		

Gender: 1 = male, 0 = female; Ethnicity: 1 = White, 0 = non-White; Residency: 1 = nonresident student, 0 = resident student; Abstainer: 1 = nondrinker, 0 = drinker.

odds of a violation or citation were lower for abstainers than for drinkers in both cohorts. In contrast, precollege binge drinking was associated with increased likelihood of students having alcohol-related on-campus or off-campus citations. Odds of a violation or citation were higher for students reporting binge drinking before college than for students who either abstained or drank but did not binge before college.

Findings suggest that no or low alcohol consumption before college is associated with reduced likelihood that students will suffer either campus or community legal consequences from their drinking while they are in college. The effects of both precollege abstinence and precollege binge drinking generally were more pronounced for the students' first year. This is important because the freshmen year is a particularly high-risk time for both personal and legal negative consequences from drinking.³⁷

Study limitations

There are many factors that influence whether students continue in school or dropout. Although we could control for some common demographic influences, we do not have information on other important factors like socio-economic status or students' high-school academic record. Also, we have no way of knowing if students who drink alcohol before college differed in other personal or academic factors that might have differentially affected their retention or likelihood of violations.

Another limitation is that we have no information on students' drinking or abstinence following enrollment. As a result, we cannot determine how their use of alcohol may

Table 5. Cox regression for the 2011 and 2012 cohorts' survival of precollege binge drinkers relative to precollege abstainers and precollege non-binge drinkers.

	B	S.E.	Wald	df	p	Odds ratio	95% C.I.	
							Lower	Upper
2011 cohort								
Ethnicity	-0.094	0.089	1.113	1	0.291	0.910	0.764	1.084
Residency	0.008	0.070	0.013	1	0.910	1.008	0.878	1.157
Gender	-0.003	0.053	0.003	1	0.960	0.997	0.899	1.106
Binge drinker	0.030	0.063	0.222	1	0.637	1.030	0.911	1.165
2012 Cohort								
Ethnicity	-0.230	0.121	3.635	1	0.057	0.794	0.627	1.006
Residency	0.066	0.096	0.475	1	0.491	1.068	0.885	1.290
Gender	-0.098	0.077	1.600	1	0.206	0.907	0.780	1.055
Binge drinker	0.230	0.092	6.319	1	0.012	1.259	1.052	1.506

Gender: 1 = male, 0 = female; Ethnicity: 1 = White, 0 = non-White; Residency: 1 = nonresident student, 0 = resident student; Binger drinker: 1 = Binge drinker, 0 = non-binge drinker. Overall model: 2011 Cohort: -2 log-likelihood = 22,324.32, χ^2 (4) = 1.34, p = .854; 2012 Cohort: -2 log-likelihood = 10,432.40, χ^2 (4) = 11.18, p = .025.

have changed while at college. Clearly, post-enrollment drinking would be a more proximal cause of any retention or legal difficulties. It is notable; however, that despite not knowing students' subsequent drinking, their precollege drinking patterns were still predictive and predictive across multiple years.

Results are limited only to students who completed the Y1-CAP. Of entering first-year students, about 16% in 2011 and 20% in 2012 did not complete the Y1-CAP. As a result, we have no information about the preenrollment drinking of these students and whether these students experienced similar retention and violation outcomes. This does not, however, necessarily compromise the utility of the screening information for those students who did complete the Y1-

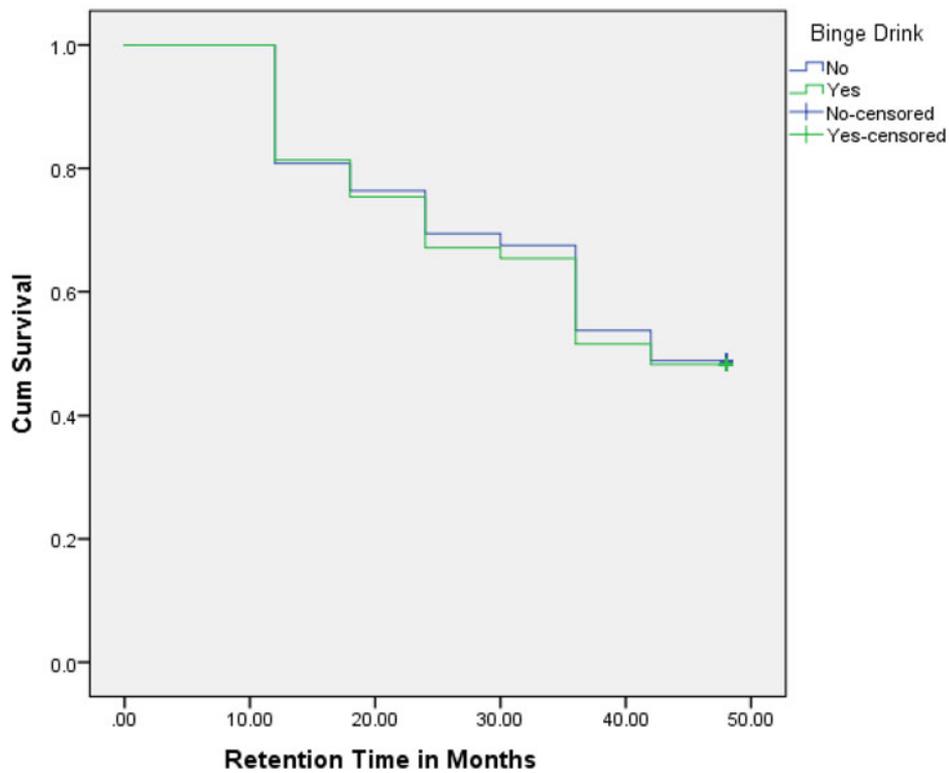


Figure 3. 2011 cohort survival function of precollege binge drinkers.

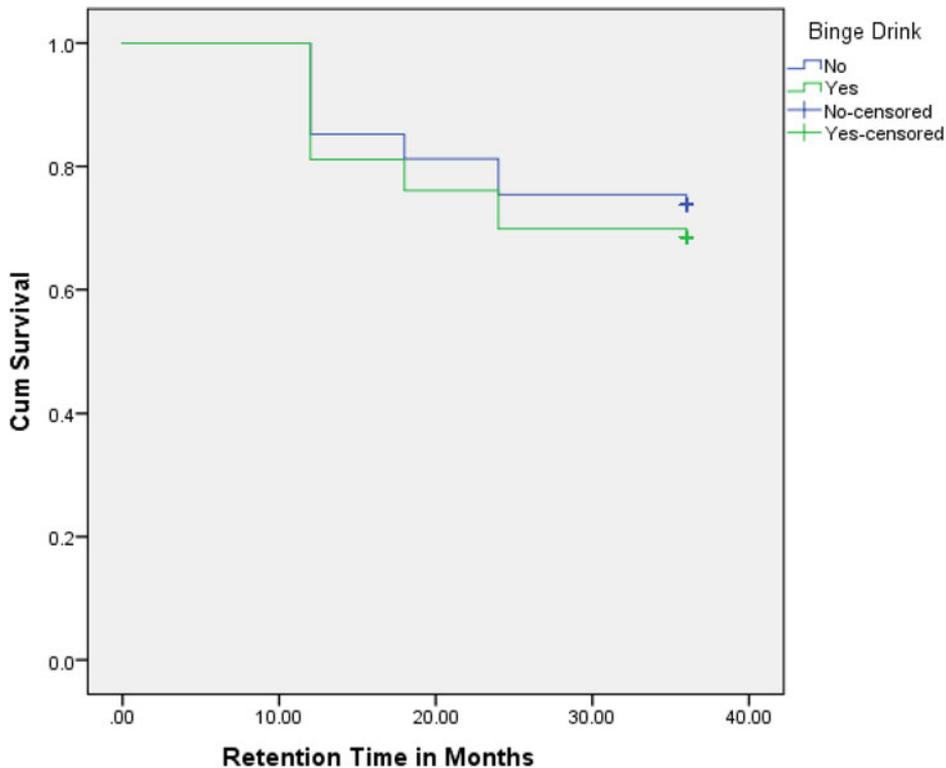


Figure 4. 2012 cohort survival function of precollege binge drinkers.

CAP. But, future research needs to examine whether associations would change if all students completed Y1-CAP or a similar BI screening tool.

Finally, although not a limitation of the study itself, Y1-CAP like all Web-based BIs relies on students providing true and accurate responses to the screening input questions.

Screening potential would be decreased if students regularly provide inaccurate information on their drinking behaviors. We have no way of verifying the accuracy of students' responses. Despite this potential confound, the findings still indicate that the information students do provide appears to have useful screening potential.

Table 6. Logistic regression for the 2011 cohort for alcohol-related on-campus sanctions and off-campus alcohol citations for precollege binge drinkers relative to precollege abstainers and non-binge-drinkers.

	B	S.E.	Wald	df	p	Odds ratio	95% C.I.	
							Lower	Upper
Judicial alcohol sanction								
Year 1								
Gender	0.226	0.138	2.682	1	0.101	1.254	0.956	1.644
Ethnicity	0.597	0.305	3.821	1	0.051	1.816	0.998	3.303
Residency	0.237	0.173	1.878	1	0.171	1.268	0.903	1.780
Binge drinker	0.711	0.145	24.035	1	0.000	2.036	1.532	2.706
Constant	-3.553	0.370	92.031	1	0.000	0.029		
Year 2								
Gender	0.671	0.288	5.416	1	0.020	1.957	1.112	3.444
Ethnicity	-0.106	0.476	0.049	1	0.824	0.900	0.354	2.285
Residency	0.267	0.343	0.606	1	0.436	1.306	0.667	2.559
Binge drinker	0.604	0.290	4.344	1	0.037	1.829	1.037	3.226
Constant	-4.707	0.641	53.849	1	0.000	0.009		
Off-campus alcohol citation								
Year 1								
Gender	0.429	0.176	5.924	1	0.015	1.536	1.087	2.171
Ethnicity	0.609	0.396	2.374	1	0.123	1.840	0.847	3.994
Residency	0.329	0.212	2.405	1	0.121	1.390	0.917	2.107
Binge drinker	1.037	0.176	34.824	1	0.000	2.820	1.998	3.979
Constant	-4.45	0.477	87.111	1	0.000	0.012		
Year 2								
Gender	1.068	0.278	14.704	1	0.000	2.908	1.685	5.019
Ethnicity	1.130	0.724	2.441	1	0.118	3.097	0.750	12.786
Residency	-0.065	0.337	0.037	1	0.848	0.937	0.484	1.814
Binge drinker	1.263	0.247	26.221	1	0.000	3.538	2.181	5.738
Constant	-5.781	0.841	47.276	1	0.000	0.003		

Gender: 1 = male, 0 = female; Ethnicity: 1 = White, 0 = non-White; Residency: 1 = nonresident student, 0 = resident student; Binger drinker: 1 = Binge drinker, 0 = non-binge drinker.

Table 7. Logistic regression for the 2012 cohort for alcohol-related on-campus sanctions and off-campus alcohol citations for pre-college binge drinkers relative to pre-college abstainers and non-binge-drinkers.

	B	S.E.	Wald	df	p	Odds ratio	95% C.I.	
							Lower	Upper
Judicial alcohol sanction								
Year 1								
Gender	0.498	0.161	9.375	1	0.002	1.645	1.200	2.255
Ethnicity	0.063	0.282	0.050	1	0.823	1.065	0.613	1.851
Residency	-0.139	0.207	0.454	1	0.501	0.870	0.580	1.305
Binge drinker	1.089	0.161	45.832	1	0.000	2.973	2.169	4.075
Constant	-3.018	0.383	62.104	1	0.000	0.049		
Year 2								
Gender	0.736	0.263	7.841	1	0.005	2.088	1.247	3.495
Ethnicity	0.080	0.436	0.033	1	0.855	1.083	0.461	2.544
Residency	0.458	0.281	2.658	1	0.103	1.581	0.912	2.741
Binge drinker	0.583	0.266	4.815	1	0.028	1.791	1.064	3.015
Constant	-4.771	0.588	65.872	1	0.000	0.008		
Off-campus alcohol citation								
Year 1								
Gender	0.195	0.226	0.745	1	0.388	1.215	0.780	1.893
Ethnicity	-0.118	0.382	0.095	1	0.758	0.889	0.421	1.878
Residency	-0.262	0.308	0.722	1	0.395	0.770	0.421	1.407
Binge drinker	1.085	0.229	22.458	1	0.000	2.958	1.889	4.632
Constant	-3.364	0.533	39.848	1	0.000	0.035		
Year 2								
Gender	0.999	0.287	12.087	1	0.001	2.715	1.546	4.767
Ethnicity	-0.191	0.411	0.215	1	0.643	0.827	0.370	1.849
Residency	0.489	0.290	2.839	1	0.092	1.630	0.923	2.879
Binge drinker	0.624	0.274	5.177	1	0.023	1.866	1.090	3.193
Constant	-4.842	0.588	67.906	1	0.000	0.008		

Gender: 1 = male, 0 = female; Ethnicity: 1 = White, 0 = non-White; Residency: 1 = nonresident student, 0 = resident student; Binger drinker: 1 = Binge drinker, 0 = non-binge drinker.

Summary and conclusions

Precollege drinking behaviors appear to be meaningfully associated with student retention and alcohol-related on-

campus violations and off-campus citations. Precollege abstinence appears to be a protective factor against dropping out or receiving on-campus alcohol violations or off-campus

alcohol citations. Regardless of whether precollege abstainers subsequently go on to drink during college, they continue to remain at lower risk for negative consequences. Conversely, precollege heavy-episodic (binge) drinking was associated with increased risk of dropping out or receiving a violation or citations. It appears that precollege binge drinkers continue to remain at higher risk regardless of their subsequent post-enrollment drinking.

For on-campus alcohol violations and off-campus alcohol citations, associations were strongest in the first year of college and then weakened. This makes sense as entering drinking patterns likely continued into the freshmen year. But, after the freshmen year it is likely that emerging college drinking patterns such as uptake of drinking by abstainers or increases or decreases in high-risk binge drinking play an increasing role in legal and campus judicial risk relative to students' entering drinking patterns^{2,38}. For retention, however, effects of entering abstinence or heavy-episodic drinking appeared to continue and perhaps accumulate. Especially for the 2011 cohort, differences in retention did not appear until the junior year. This suggests that absent some specific interventions, patterns of pre-college drinking may have substantial impacts on retention and degree completion.

These findings suggest that information about precollege drinking behavior could be useful screening information for informing campus alcohol prevention and treatment programming. It appears that information gained in a pre-enrollment BI could be effectively used to customize alcohol interventions to students' specific needs. For abstainers, interventions might be directed at maintaining abstinence or if drinking is begun to encourage lower-risk drinking. For students reporting pre-college heavy-episodic drinking, more intensive interventions might be warranted to reduce high-risk drinking. These types of interventions could start in tailored feedback within the pre-enrollment BMI itself, as is done in the Y1-CAP at UNL. But, further programming would clearly be desirable post-enrollment. Post-enrollment programming could also be informed by future research that examined mediators and moderators of the relationships identified between pre-enrollment measures and subsequent outcomes. Knowing the intervening variables linking students pre-enrollment drinking and subsequent retention and violation outcomes would allow for more precise targeted programming.

Shell and Newman³¹ found that completing a pre-enrollment BI is associated with reduced dropout and fewer alcohol-related campus sanctions and community violations. It appears, however, that information provided in a pre-enrollment BI has screening value beyond the positive effects of the BI itself. This may make a pre-enrollment BI an important prevention tool that could be used by college health and student services professionals to identify and focus interventions on the student who might be at risk of significant personal and academic harms. Can Web-based pre-enrollment BI be effective screening tools? The answer would seem to be yes.

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Conflict of interest disclosure

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of the United States and received approval from the Institutional Review Board of the University of Nebraska-Lincoln.

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