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Suicidality and Alcohol Use as Predictors of Future Suicidal Behavior in College Students

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Abstract

Aims: There has been a marked increase in suicide fatalities among college-age students in recent years. Moreover, heavy alcohol use, a well-known risk factor for suicide, is present on most campuses. Yet, no prospective studies have examined alcohol use patterns among college students as predictors of suicidal behaviors.

Methods: Online screening of 40,335 students at four universities took place at the beginning of four academic years, 2015–2018. Of these, 2296 met criteria for an increased risk of suicidal behavior and completed 1- and/or 6-month follow-up evaluation(s). Baseline assessments included the Alcohol Use Disorders Identification Test to quantify alcohol consumption and resulting problems, and measures of depression, suicidal ideation and suicidal behavior.

Results: Suicide attempts during follow-up were reported by 35 (1.5%) of high-risk students. Regression analyses indicated that baseline severity of alcohol use consequences, but not amount of alcohol consumption, was associated with greater odds of a follow-up suicide attempt after controlling for baseline suicidal ideation, functional impairment and history of suicide attempts.

Conclusions: Among college students at elevated risk for suicide, the severity of alcohol-related consequences was a significant predictor of future suicide attempts. Alcohol consumption was not a significant predictor, suggesting that the amount students drink is less of a concern for suicidal behavior than are the problems (e.g. failing to meet expectations, experiencing blackouts) associated with drinking.

INTRODUCTION

Suicide is the second leading cause of death among college students (Turner *et al.*, 2013), and this population has recently shown marked increases in rates of depression, suicidal ideation and suicide attempts. In particular, the Healthy Minds Survey showed a 157% increase in suicide attempts between 2011 and 2018 (Duffy *et al.*, 2019). Moreover, students participating in a national survey in 2001–2002 were 1.25× more likely to meet DSM-IV criteria for an alcohol use disorder relative to an age-matched cohort not attending college (Blanco *et al.*, 2008). Because alcohol use disorder is a well-established risk factor for suicidal behaviors (Hufford, 2001), its heavy use on campuses may play an important role in the suicidal behaviors that occur there.

The literature pertaining to this relationship is scant, in which nearly all the relevant studies of college students have limited measures of suicidality to suicidal ideation rather than to suicide attempts (Garlow *et al.*, 2008; Arria *et al.*, 2009; Wilcox *et al.*, 2010; Lamis *et al.*, 2014, 2016; Gauthier *et al.*, 2017). Some of these studies have found significant correlations between suicidal ideation and excessive alcohol use (Arria *et al.*, 2009; Lamis *et al.*, 2014, 2016), but others have not (Garlow *et al.*, 2008; Gauthier *et al.*, 2017). Indeed, one study found a significant negative relationship between frequency of alcohol use and the likelihood of seriously considering suicide (Kisch *et al.*, 2005). The same study reported rates of suicide attempts in the previous year but did not assess risk factors for having had attempts.

An earlier report (Coryell *et al.*, 2021) assessed relationships between recent alcohol intake and previous suicidal ideation or attempts in a cohort of 40,335 students collected as part of the Electronic Bridge to Mental Health for College Students (eBridge) (King *et al.*, 2022). Past suicidal ideation and attempts were robustly associated with problems arising from alcohol use as measured by the last seven items of the Alcohol Use Disorders Identification Test (AUDIT) questionnaire (Saunders *et al.*, 1993; Shevlin and Smith, 2007). Suicidality was not, however, related to the quantity of alcohol use per se as reflected in the first three AUDIT items.

Building on this retrospective analysis, the present report aimed to use data from the eBridge study to conduct a prospective analysis of those who, at baseline, were considered

to be at high risk for suicidal behaviors and who were reassessed 1 month and/or 6 months later. The analysis was designed to test the hypothesis that problems associated with alcohol use, but not the amount of alcohol consumed per se, would be predictive of prospectively observed suicide attempts. To our knowledge, this is the first prospective study of how heavy alcohol use might predict suicide attempts among college students.

MATERIALS AND METHODS
Participants

An earlier report from the eBridge team has described the design of the overall study in detail (King *et al.*, 2022). Briefly, during four consecutive Fall semesters spanning 2015–2018, 178,879 undergraduate, graduate and professional students at four universities were sent e-mails that screened for the presence of depressive symptoms, suicidality and substance misuse. The eBridge protocol defined high risk by the presence of two or more of four features: a lifetime suicide attempt, wishing for death or thoughts of suicide in the previous 12 months, depression as indicated by a Patient Health Questionnaire-2 (PHQ-2) (Kroenke *et al.*, 2003) score of three or more, and alcohol misuse as identified by the 10-item (AUDIT) instrument (Saunders *et al.*, 1993) score of eight or more. Of 40,335 (22.6%) students who consented to participate and who completed screening, 5790 (14.4%) met criteria for high-risk status. After the exclusion of students who were already receiving mental health treatment or whose survey was incomplete, 3363 were randomized to eBridge or to a control group. Of these, 2296 (68.3%) met criteria for inclusion in the current analysis. Since we were interested in the incremental predictive validity of alcohol misuse among students at elevated suicide risk and wished to avoid the confounding effects of using alcohol as both a sample screening criterion and predictor variable, students in our analytic sample had at least two of the remaining three (lifetime suicide attempts, past year suicidal ideation and current depression) risk factors (*n* = 2534). Of these students, 2296 completed at least one of the 1- and 6-month follow-up assessments (96.6% retention) and were included in the present analysis. This analytic sample was mostly female (66.6%), White (55.7%) and undergraduate (77.4%).

Procedures

The Institutional Review Board at each of the four universities approved all procedures. All students who were invited to participate were informed that they were eligible to be included in 10 drawings for $100 gift certificates at each university. Students deemed at high risk were randomized to either simply be provided with personalized feedback that described their screening results and with a list of on-campus mental health resources (control), or to be given the option to review personalized feedback reports and to interact online with an eBridge counselor trained in Motivational Interviewing (Markland *et al.*, 2005). Students received $25 for completing the 1-month follow-up assessment and $25 for completing the 6-month follow-up assessment.

Measures

Initial screening for suicidality was comprised of questions from the National Comorbidity Survey (NCS) (Kessler *et al.*,

2004), which assessed, for the past month and year, the presence or absence of any 2 weeks of wanting to die, any thoughts of suicide and any suicide attempt. The instrument also recorded the number of lifetime attempts. The initial screening for depressive symptoms consisted of the PHQ-2 (Kroenke *et al.*, 2003), which assessed three depressive symptoms in the preceding 2 weeks, each scored 0–3. Students who had positive screens for high risk went on to rate the remaining PHQ-9 items (Kroenke *et al.*, 2001). For the following analyses, a PHQ-8 scale was used to quantify depressive symptoms because the ninth item quantifies suicidal ideation. This scale had a Cronbach's alpha of 0.81. High-risk individuals also completed a 10th PHQ item (Kroenke *et al.*, 2001) that rates functional impairment. This asked the participant to choose on a 4-point scale their response to the question 'If you are experiencing any emotional or behavioral problem, how difficult has this made it to do your work at school, take care of things at home, or get along with people?'.

Initial screening also included the 10-item AUDIT scale as applied to the preceding 2 months (Cronbach's alpha +0.83). The first eight items were scored 0–4 and the final two, pertaining to injury due to drinking and expression of concern by others, were scored 0 for never, 2 for ever but not in the past 2 months, and 4 for in the past 2 months. Previous analyses have yielded a varied number of factors potentially derived from this scale. These findings have included a two-factor model in which the first three items quantify the frequency and quantity of alcohol intake (Consumption) and the last seven items the problems associated with alcohol use (Alcohol Problems) (Bergman and Kallmen, 2002; Shevlin and Smith, 2007). Follow-up assessments included NCS questions that covered suicidal thoughts and attempts over the preceding 1 month.

Of the 40,335 students who completed screening, 2534 exceeded this threshold and 2296 completed at least one of the 1- and 6-month follow-up assessments (90.6% retention). Our analytic sample (*n* = 2296) was mostly female (66.6%), White (55.7%) and undergraduate students (77.4%).

Statistical analysis

Comparisons of continuous variables (AUDIT and PHQ Scores) used two-tailed independent *t*-tests and categorical comparisons used Chi-square tests. Binary logistic regression used the presence or absence of any suicide attempt at the 2-month or 6-month follow-up as the dependent variable. Independent variables consisted of the continuous measures baseline AUDIT scores, the PHQ-8 score, the single PHQ-10-item rating, and the dichotomous ratings of past year suicidal ideation, and the presence or absence of past year suicide ideation, and the presence or absence of past year suicide attempt. Subsequent analyses tested all possible interactions between the independent variables, with non-significant interactions dropped from the eventual final model. Alpha was set at 0.05 for tests of statistical significance.

RESULTS
Group differences

Of 2534 students who met baseline criteria for high-risk status, 2296 completed at least one follow-up assessment: 265 (10.5%) completed the follow-up assessment at 1 month only, 182 (7.2%) at 6 months only, and 1849 (73%) at both 1 and

Table 1. Demographics of high-risk students who did or did not attempt suicide during follow-up, *n* (%)

	No suicide attempt	At least one suicide attempt
N	2261	35
Sex assigned at birth		
Male	677 (29.9)	10 (28.6)
Female	1503 (66.5)	25 (71.4)
Age		
18–19	1151 (50.9)	21 (60.00)
20–22	606 (26.8)	6 (17.1)
23+	504 (22.3)	8 (22.9)
Race		
White	1263 (55.9)	16 (45.7)
Black	178 (7.9)	4 (11.4)
Asian	458 (20.3)	12 (34.3)
Hispanic	279 (12.3)	3 (8.6)
Other	83 (3.7)	0
Center		
A	849 (37.5)	16 (45.7)
B	578 (25.6)	5 (14.3)
C	593 (26.2)	12 (34.3)
D	241 (10.7)	2 (5.7)

Table 2. Baseline alcohol use and depression scores among high-risk students who did or did not attempt suicide

	No suicide attempt Mean (SD)	At least one suicide attempt Mean (SD)	*t, P*
AUDIT Consumption	2.6 (2.5)	2.3 (2.9)	0.89, 0.38
AUDIT Dependence	1.5 (2.8)	2.4 (4.4)	1.19, 0.24
AUDIT Total	4.2 (4.8)	4.7 (7.0)	0.43, 0.67
PHQ-2 Score	3.8 (1.4)	4.1 (1.7)	0.77, 0.445
PHQ-8 Score	13.1 (5.0)	14.2 (6.3)	1.02, 0.32
PHQ Item 10 Degree of difficulty caused by emotional or behavioral problem(s)	1.4 (0.86)	1.9 (0.80)	−3.87, 0.0004

6 months. Of these 2296 students, 35 (1.5%) reported at least one suicide attempt in the month prior to either the 1-month or the 6-month follow-up assessment follow-up. These 35 did not differ significantly from the remaining 2261 students by the demographic variables of sex, age, race or site (Table 1). PHQ-8 scores were not significantly higher at baseline among those who reported a later suicide attempt, but those who attempted suicide reported significantly greater impairment due to emotional or behavioral problems at baseline (Table 2).

Those in the attempter group were more likely than other high-risk students to have wished for death and to have considered suicide in the month and year preceding baseline screening (Table 3). They were likewise more likely to have reported multiple lifetime attempts, but the presence or absence of a single lifetime attempt was not predictive. Those with prospectively observed suicide attempts were 6-fold more likely to have made an attempt in the year preceding baseline screening. Those who reported attempts had somewhat lower AUDIT Consumption scores and somewhat higher Dependence scores than did non-attempters (Table 2). The two subscale scores were significantly correlated ($r = 0.605$, $P < 0.001$).
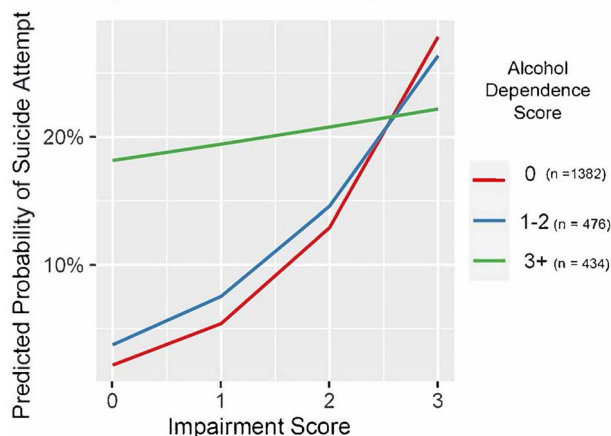

Fig. 1. Alcohol dependence by impairment.

Binary logistic regression

Because of the strong correlation between suicide measures, we limited regression models to the measure of ideation and the measure of suicide attempt status that most significantly distinguished future suicide attempters, past year suicide ideation and past year suicide attempt, together with other baseline measures listed in Table 4. Overall, the model predicting future suicide attempts was significant [$X^2(7) = 56.7$, $P < 0.001$, Nagelkere $R_2 = 0.17$] with past year suicidal ideation, past year suicide attempt, the PHQ measure of impairment and alcohol dependence emerging as significant predictors. It should be noted that the AUDIT Consumption measure, which had borderline significance in the model, was related to later suicidal behavior in a negative direction. Of all examined interactions, only that between Alcohol Problems scores and the PHQ-10 impairment score was significant. To illustrate this interaction, we plot the relationship between the PHQ-10 impairment score and the probability of a prospectively observed suicide attempt for three groups based on the AUDIT Alcohol Problems scores (scores of 0, 1–2 or 3 and above; Fig. 1). Although the predicted probability for suicide attempts increased sharply with increased functional impairment among those with lower AUDIT Alcohol Problems scores, this association was weaker among those with Alcohol Problems scores of 3 or more.

DISCUSSION

In this prospective analysis of 2296 college students deemed at increased risk for suicide, the degree of alcohol problems, but not consumption level, significantly predicted the likelihood of suicide attempts. Other baseline features predictive of suicide attempts included wishes for death, suicidal ideation, suicide attempts and degree of global impairment. A regression analysis that included a significant interaction between the alcohol Problems measure and global impairment found the Alcohol Problems measure to also be predictive of suicidal behavior. The interaction indicated that global impairment was an important predictor only among students with minimal alcohol problems scores.

To our knowledge, this is the first study to prospectively examine the association between alcohol use and suicide attempts among high-risk college students. The results fit well

Table 3. Past suicidality among high-risk students who did or did not attempt suicide during follow-up

	No suicide attempt	At least one suicide attempt	X^2, df, P
	N	2261 (%)	35 (%)
Wishing to die			
Past month	733 (32.4)	20 (57.1)	9.6, 1, 0.002
Past year	1493 (66.0)	33 (94.3)	12.3, 1, 0.000
Suicidal ideation			
Past month	593 (26.2)	19 (54.3)	13.9, 1, 0.000
Past year	1355 (59.9)	32 (91.4)	14.3, 1, 0.000
Past suicide attempts lifetime			
None	1578 (68.7)	12 (34.3)	20.4, 1, 0.000
Single attempt	349 (15.4)	6 (17.1)	
Multiple attempts	332 (14.7)	17 (48.6)	34.4, 2, 0.000
Any in the past 12 months	105 (4.6)	10 (28.6)	41.5, 1, 0.000

Table 4. Binary logistic regression of past suicidality, depressive symptoms and AUDIT scores on follow-up suicide attempt status

	Wald X^2	Odds ratios, 95% CI	P
Past year suicidal ideation	6.70	1.47, 16.45	0.010
Past year suicide attempt	17.36	2.45, 12.03	<0.001
PHQ-8	0.52	0.90, 1.05	0.469
PHQ-10 impairment measure	14.20	1.60, 4.44	<0.001
AUDIT Consumption	3.70	0.69, 1.00	0.054
AUDIT Dependence	15.39	1.21, 1.76	<0.001
AUDIT Dependence × PHQ-10 impairment	7.13	0.78, 0.96	0.008

with retrospective findings in that alcohol dependence, but not consumption, is strongly associated with suicidal behavior among college students. Together with the prospective data described here, the results have clear relevance for the choice of alcohol-related measures used to screen for suicide risk in this population. This is particularly so in light of the fact that the first three AUDIT items alone are often used in studies for the sake of efficiency.

The observation that degree of consumption was not predictive of suicide attempts while alcohol-related problems were may seem counterintuitive since the two measures are highly correlated. Indeed, the simple measure of number of days of alcohol consumption has been shown to separate adolescents who attempted suicide from those who only had ideation (McManama *et al.*, 2014). Studies have also identified alcohol intake as a 'warning sign' that distinguishes a day with suicide attempt from the previous day (Bagge and Borges, 2017; Bagge *et al.*, 2022). As such, alcohol intake comprises a 'proximal' risk factor for suicidal behavior, whereas alcohol dependence is considered a 'distal' risk factor (Hufford, 2001). The disinhibition associated with alcohol intoxication may largely account for its role as a proximal risk factor for suicidal behavior (Choi *et al.*, 2018). A number of factors may work together to produce the results in this cohort of college students. However, amounts of alcohol consumption among college students have been shown to correlate positively with various levels of social activity (Rinker *et al.*, 2016). Any tendency for social activity to protect against suicidal behavior would thus operate to cancel a positive relationship between consumption and risks for suicide attempts. Unfortunately, we did not have a measure of social activity to examine a potential moderation to account for the lack of associations between consumption and suicidal behavior. Also lacking was any measure of motives for heavy alcohol intake. Those who

were drinking in isolation to relieve depressive or anxiety symptoms may have comprised an important subgroup at higher risk for suicidal behavior. Future studies could make use of such measures as the Drinking Motives Questionnaire-Revised to explore this possibility (Cooper *et al.*, 1992).

The mechanisms by which the severity of alcohol-related problems increases risks for suicide attempts are varied. Problems associated with heavy alcohol use are likely to include negative interpersonal life events, which, in turn, add to the sense of guilt and hopelessness that gives rise to suicidal impulses (Bagge *et al.*, 2022). Moreover, individuals with high levels of alcohol-related problems may be more likely to drink while alone, a circumstance which may make the acute effects of alcohol on impulsivity more likely to result in an attempt.

The finding that depressive symptoms as measured with the PHQ-8 were not predictive of suicide attempts during follow-up is also surprising. This is particularly so given the earlier retrospective finding that PHQ-2 scores were robustly associated with both suicidal ideation and attempts independent of alcohol and depression measures (Coryell *et al.*, 2021). Moreover, PHQ-2 scores interacted modestly with the AUDIT Problems measures in their association with suicidal ideation and suicide attempts status in the retrospective analysis, whereas the prospective analysis presented here revealed no significant interaction between PHQ-8 and the AUDIT Alcohol Problems score on the likelihood of suicide attempts.

Strengths of this study include the size of the high-risk cohort and the fact that they were sampled across four separate settings. The prospective nature of the analysis is also a strength, particularly because this is the first study of college students in which distinct components of alcohol use were tested as a predictors of future suicide attempts.

Limitations include highly unequal group sizes and the small number of suicide attempts observed, a somewhat surprising number given that the students followed were selected through screening to be at increased risk for suicidal behavior. The true number of attempts was likely higher because only attempts that had occurred in the preceding month were elicited for both the 1- and 6-month follow-up evaluations. Elevated AUDIT scores were not used to select the sample for these analyses and this is likely to have skewed the study group toward higher levels of suicidality and depressive symptoms. The brevity of the principal measures of depressive symptoms and of alcohol use patterns precludes more detailed analysis, but this was necessary to maximize participation and sample retention. It may also be that since a majority of the students in the present sample screened positive for depression, the resulting limits in the range of depression scores account for their failure to predict attempts.

In summary, problems associated with alcohol use (Alcohol Problems) suicidal ideation, and the history of multiple suicide attempts were predictive of suicide attempts during the 6-month follow-up. No interactions emerged between alcohol-related problems and suicidal ideation or attempts so measures of suicidality and alcohol Dependence can be assumed to be additive.

Funding

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