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Alcohol Use and Suicide Proneness in College Students: A Proposed Model

Dorian A. Lamis,
Emory University School of Medicine

Patrick S. Malone, and
University of South Carolina

Danielle R. Jahn
Texas Tech University

Abstract

This study was designed to assess relations among alcohol use, alcohol-related problems, negative-life events, depressive symptoms, and suicide proneness in a cross-sectional sample of undergraduate college students ($N = 1100$). Alcohol use was assumed to be causally prior to alcohol-related problems and negative life events, which were in turn modeled as occurring prior to depressive symptoms, which were in turn modeled as prior to suicide proneness. Results revealed that, as expected, suicide proneness was positively related to depressive symptoms, alcohol-related problems, negative life events, and alcohol use, and depressive symptoms were positively associated with alcohol-related problems and negative life events. Additionally, the relation between alcohol use and depressive symptoms was partially mediated by alcohol-related problems and negative life events; and the alcohol use-suicide proneness link was significantly mediated by alcohol-related problems, negative life events, and depressive symptoms. Implications are offered for the improved identification and treatment of at-risk young adults.

Keywords

alcohol use; suicide proneness; alcohol-related problems; negative life events; depressive symptoms

Suicide is the second leading cause of death among college students (American Foundation for Suicide Prevention, 2010), accounting for approximately 1,100 suicides each year in the United States (CDC, 2009). Rates of suicidal ideation and attempts among college students are also alarming. Approximately 18% of undergraduates report seriously considering a suicide attempt in their lifetime, and 8% of undergraduates report attempting suicide in their lifetimes (Drum, Brownson, Denmark, & Smith, 2009). Given the clinical and public health significance of suicidal thoughts and behaviors, the National Strategy for Suicide Prevention's Objective 4.3 called for increasing "the proportion of colleges and universities with evidence-based programs designed to address serious young adult distress and prevent suicide" (U.S. Department of Health and Human Services, 2001, p. 66). Accordingly, considerable interest has focused on identifying factors that increase suicide risk in this population. Alcohol use is one risk factor which is consistently implicated in college student suicidality (Lamis & Bagge, 2011). A focus on alcohol use as a risk factor for suicide has particular relevance to college students, a population which has high rates of past-year drinking (75.5%), heavy episodic drinking (18.7%), and alcohol use disorders (38.1%; Dawson, Grant, Stinson, & Chou, 2004). In the current study, we propose a theoretical

model which guides our investigation of the relations among suicide risk factors that may be particularly relevant in college students who consume alcohol.

Associations between suicidal ideation and frequency of drinking, binge drinking, alcohol consequences, and diagnoses of alcohol abuse and dependence have been documented in several studies of college students (e.g., Ellis & Trumpower, 2008; Gonzalez, Collins, Bradizza, 2009; Stephenson, Pena-Shaff, & Quirk, 2006). For example, Brener, Hassan, and Barrios (1999) found that college students who reported higher rates of any alcohol use within the past 30 days relative to other students were at an increased risk of seriously considering suicide during the past 12 months. Moreover, in a multivariate analysis of college students who reported low levels of depression (Arria et al., 2009), an alcohol use disorder diagnosed within the past year was associated with the presence of suicidal ideation within the past few days independent of affective dysregulation and social support. In another identified study in college students, Schaffer, Jeglic, and Stanley (2008) found a significant association between any lifetime alcohol use and a lifetime history of a past suicide attempt, as well as a relation between the number of drinks consumed in the week prior to completing the survey and respondents' estimates of their likelihood of attempting suicide in the future. The researchers also reported a significant relation between the presence of any lifetime binge drinking behavior and lifetime suicide attempt (Schaffer et al., 2008). The above studies provide support for the associations between alcohol use and suicide ideation and attempts in the college student population.

There are several risk factors that have been implicated in the alcohol use-suicidality link among college students including negative life events (e.g., relationship breakup, death of a friend; Dejong, Overholser, & Stockmeier, 2010) and alcohol-related problems (e.g., missed a day of school or work because of drinking; Lamis & Malone, 2011; Lamis, Malone, & Langhinrichsen-Rohling, 2010). College students often regularly consume more alcohol than their non-enrolled counterparts (Ham & Hope, 2003), which may place them in situations that increase their likelihood of experiencing a negative life event and/or an unfavorable consequence due to their drinking. Furthermore, multiple studies (e.g., Geisner, Larimer, & Neighbors, 2004; Uhrlas & Gibb, 2007) have demonstrated that individuals who have encountered negative life events and/or alcohol-related problems are at an increased risk of developing and experiencing depressive symptoms, which are a frequent precursor to suicidal ideation and attempts (Conner, Gunzler, Tang, Tu, & Maisto, 2011; Nock et al., 2009; Wilcox et al., 2010). For example, in a longitudinal study of university undergraduate students, O'Neill, Cohen, Tolpin, and Gunthert (2004) found negative life events to prospectively predict depressive symptoms. Researchers (e.g., Rafnsson, Jonsson, & Windle, 2006; Sher et al., 2008) have also found negative life events to predict depression and depressive symptoms among alcohol users. Moreover, other studies (e.g., Boden & Fergusson, 2011; Martens et al., 2008) have found support for the relation between alcohol use-related problems and depressive symptoms. Taken together, these results suggest that the negative life events and consequences associated with alcohol use may precipitate the onset and development of depressive symptoms among college students.

Alcohol-related problems and negative life events have also been found to precede suicidal behaviors in a number of studies (e.g., Joiner & Rudd, 2000; Windle & Windle, 2005). Furthermore, college students with severe symptoms of depression were more likely to have current thoughts of suicide than those with mild to moderate symptoms (Garlow et al., 2008). Similarly, in a prospective study of young adults, Nruham, Holen, and Sund (2010) revealed that suicide attempters experienced persistent and significantly higher levels of depressive symptoms than nonattempters. Konick and Gutierrez (2005) found that depressive symptoms served as a mediator in the relation between negative life events and suicidal ideation in college students, providing further support for the associations among

these variables. In sum, research has clearly revealed significant relations among alcohol-related problems, negative life events, and depressive symptoms as suicide risk factors; however, more research is needed in this area to determine the role of alcohol use in the interplay among these variables in college students.

Consequently, in the current study, we propose a conceptual model (Figure 1) that can be used to explain why college alcohol users may engage in suicidal behaviors. The model is grounded in the context of previous empirical research on established factors found to confer risk for suicidality among alcohol-using adults. Our goal is to provide a model that is a good fit to the data, is parsimonious, and identifies variables that directly account for variance in the relation between alcohol use and suicide proneness in college students. As such, we excluded variables that may be risk factors for suicidal behavior but do not directly relate to alcohol use and suicide proneness (e.g., age, exposure to the suicide of a family member, other drug use), or those that may temporally precede alcohol use or act as more distal risk factors for either alcohol use or suicide proneness (e.g., specific personality traits). In the theoretical framework, alcohol use was assumed to be causally prior to alcohol-related problems and negative life events, which were in turn modeled as occurring prior to depressive symptoms, which were in turn modeled as prior to suicide proneness. We chose these variables based on the empirical support for their direct connection to alcohol use and suicide proneness, as well as a theoretical basis for their causal or temporal relations. We tested specific hypothesized paths among these variables simultaneously in an undergraduate sample of college students. It is expected that a better understanding of the contributory roles that each of these factors have with each other as well as with suicide proneness has implications for the improved identification and treatment of young adults at risk for suicide. Specifically, on the basis of existing literature and consistent with the proposed theoretical model, we hypothesized that:

1. Alcohol-related problems and negative life events will be positively associated with alcohol use.
2. Depressive symptoms will be positively associated with alcohol-related problems and negative life events as well as with alcohol use.
3. Suicide proneness will be positively related to depressive symptoms, alcohol-related problems, negative life events, and alcohol use.
4. Effects of alcohol use on depression will be partially mediated by alcohol-related problems and negative life events.
5. Effects of the alcohol use on suicide proneness will be partially mediated by depressive symptoms, alcohol-related problems, and negative life events.
6. Effects of alcohol-related problems on suicide proneness will be partially mediated by depressive symptoms.
7. Effects of negative life events on suicide proneness will be partially mediated by depressive symptoms.

Method

Participants

Our sample consisted of 1100 undergraduate students (75.4% female, 24.6% male), who ranged in age from 18 to 24 years old (M age = 19.42, SD = 1.39). All participants attended a large public university in the southeast United States. A majority of participants identified as Caucasian (n = 862, 78.4%), followed by African American (n = 130, 11.8%), Asian American (n = 37, 3.4%), and Hispanic American (n = 33, 3.0%). An additional 3.5% (n =

38) of the sample indicated “other” for race/ethnicity. Freshmen accounted for 47.2% of the sample ($n = 519$), followed by 20.7% sophomores ($n = 228$), 17.3% juniors ($n = 190$), and 14.8% seniors ($n = 163$). A total of 619 respondents (56.3%) reported they were single (i.e., not in a relationship), whereas 43.7% indicated that there were currently in a romantic relationship. A majority of respondents indicated that they lived on campus (57%; $n = 625$), and 24% of respondents ($n = 264$) reported that they were a member of a social fraternity or sorority.

Procedure

The university's institutional review board approved this study prior to initiation, and all procedures were conducted in accordance with the approved protocol, including obtainment of informed consent from all respondents prior to participation. No adverse events were reported. Responses were anonymous and participants could leave any items blank. The study design consisted of a cross-sectional online survey, and all measures were presented in a randomized order. Data was collected during two academic semesters. Approximately equal numbers of participants completed the study during each semester. Participants were informed about the study in psychology courses and via an online participant pool website. Participation was voluntarily and, in return for participation, students received extra credit in a psychology course.

Measures

The Alcohol Use Disorders Identification Test—(AUDIT; Saunders et al., 1993) is a 10-item measure designed to identify individuals whose alcohol use places them at risk for alcohol-related problems, or who are actually experiencing such problems. The time reference of the AUDIT is the past year, although a few items have no specified time period. It is comprised of two scales measuring both alcohol Consumption (3 items) and Dependence (7 items), which add together to yield a total AUDIT score measuring risk for alcohol related problems. For the purposes of the current analyses, only the following three items on the alcohol consumption scale (AUDIT-C) were used: How often do you have a drink containing alcohol? How many drinks containing alcohol do you have a typical day when you are drinking? How often do you have 6 or more drinks on one occasion? Response options for each item are scored 0 to 4 points and possible AUDIT-C scores range from 0 to 12. In the present study, AUDIT-C scores were computed and used as a continuous variable in all analyses. The AUDIT-C has been extensively validated in the detection of the entire spectrum of alcohol misuse and has been recommended as an effective alcohol measure in college students (Dawson, Grant, Stinson, & Zhou, 2005). The coefficient alpha was .88 in the current sample.

The Negative Life Events Questionnaire—(NLEQ; Saxe & Abramson, 1987) was developed specifically for use with college students and includes several categories of events to ensure broad coverage (e.g., school, work, family, friends; Metalsky & Joiner, 1992; Needles & Abramson, 1990). The NLEQ includes 66 negative life stressors (e.g., “Boyfriend/girlfriend/spouse ends relationship”, “Laid off or fired from job”) rated on a scale from 0 (*never present*) to 4 (*always present*) regarding how frequently they occurred in the past two weeks. Total scores on the NLEQ range from 0 to 264 and the scale has been shown to be reliable (Saxe & Abramson, 1987) and valid (Metalsky & Joiner, 1992). In the present study, the reliability estimate was .95.

The Rutgers Alcohol Problem Index—(RAPI; White & Labouvie, 1989) was used to assess alcohol-related problems common among college students (e.g., missing class, getting into fights or arguments, driving after drinking). The RAPI assesses the occurrence of 23 alcohol-related problems within the last year using a 4-point Likert scale (0 = *never*, 1 = *1-2*

times, 2 = 3-5 times, 3 = more than 5 times). Some researchers (e.g., Thombs & Beck, 1994) have suggested a cutoff score of >15 to describe “high consequence drinkers.” In the current study, 17.3% of the sample scored above 15 on the RAPI. In order to maximize the information available for analysis, we used the total summed score as a continuous variable. Further, the total score on the RAPI was positively skewed (1.84) and leptokurtic (4.08), so we conducted a natural log transform of the score (plus one) to address normality issues with resulting skewness being acceptable (-0.25) and slightly negative kurtosis (-1.01). The RAPI has regularly demonstrated good internal consistency in college student samples (e.g., Cronbach's $\alpha = .92$; Carey & Correia, 1997). Similarly, in the present study, the internal consistency reliability estimate for the RAPI was .92.

The Beck Depression Inventory—II—(BDI-II; Beck, Steer, & Brown, 1996) is a widely used 21-item self-report measure of severity of depressive symptoms experienced within the past two weeks. The items (i.e., groups of specific statements) are scored from 0 to 3 to assess the level of symptom severity. Responses on the items are summed to derive a total scale score, with higher scores suggestive of higher depressive symptom severity. Strong internal consistency reliability and concurrent validity have been identified in clinical and non-clinical samples (Bisconer & Gross, 2007; Naragon-Gainey, Watson, & Markon, 2009; Osman, Kopper, Barrios, Gutierrez, & Bagge, 2004), including high correlations with other measure of depressive symptoms. Scores on this measure were positively skewed (1.53) and leptokurtic (2.90), so we transformed the variable scores (plus one) using a natural log transformation to create a more normal distribution. The resulting skewness was acceptable (-0.42) and kurtosis was slightly negative (-0.68). In this sample, Cronbach's alpha was .93, indicating excellent internal consistency reliability.

The Life Attitudes Schedule-Short Form—(LAS-SF; Rohde, Lewinsohn, Langhinrichsen-Rohling, & Langford, 2004) is a 24-item self-report measure designed to assess current suicidal and health-related behaviors, and was used in the current study to assess suicide proneness. Each item is scored as “true” or “false,” and the scores are summed to obtain a total scale score. Two example items on the LAS-SF are, “I enjoy thinking about death” and, “I think that I am worthless.” High scores are suggestive of greater suicide-related and health risk concerns. This scale has shown good reliability and validity estimates in clinical and non-clinical samples (Ellis & Rutherford, 2008; Langhinrichsen-Rohling & Lamis, 2008), and has been used successfully with college students in previous studies (Langhinrichsen-Rohling, Arata, Bowers, O'Brien, & Morgan, 2004). Moreover, the total score on the LAS-SF has been found to correlate with both current suicide ideation and a history of past suicide attempts (Rohde, Seeley, Langhinrichsen-Rohling, & Rohling, 2003). The estimate of internal consistency on this instrument for the current sample was .75.

A number of covariates were included in analyses. These were: age, gender, ethnicity, year in school, social club membership (i.e., fraternity or sorority affiliation), relationship status (single versus in a relationship), and residency status (on campus versus off campus). Additionally, we included a measure of social desirability as a covariate because previous research has found a significant negative correlation between scores on a social desirability measure and reports of suicide ideation (e.g., Miotto & Pretti, 2008).

The Marlowe-Crowne Social Desirability Scale-Form B (MCSD-B)—The MCSD-B (Reynolds, 1982) assesses the extent to which participants respond in a socially desirable manner on self-report measures. Participants respond either “true” or “false” to 12 items that ask about situations which allow respondents to endorse a socially desirable presentation. The form used in the current study was developed from the original, longer Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960). Previous research suggests

that the internal consistency reliability of the MCSD-B is adequate, ranging from .76 to .88 (Spanierman & Heppner, 2004). In the current study, the internal consistency estimate was .70.

Results

Descriptive statistics for the key study constructs are presented in Table 1. All of the correlations were significantly different from zero, $p < .05$, in the hypothesized direction, except for the expected association between alcohol use and depressive symptoms, which was not significantly different from zero in the partial correlation (adjusting for the sociodemographic covariates), but was significant and positive in the zero-order correlation.

Hypotheses 1, 2, and 3 concerned relations among study constructs in the context of the theoretical model depicted in Figure 1. We examined these relations as paths in a saturated (thus perfectly-fitting) path model estimated in *Mplus* v.6.1 (Muthén & Muthén, 2010), again adjusting for sociodemographic covariates, which were modeled as exogenous variables. Path coefficients are presented in Table 2.

Consistent with Hypothesis 1, alcohol use was positively related to alcohol-related problems and negative life events. In line with Hypothesis 2, depressive symptoms were positively associated with alcohol-related problems and negative life events. Contrary to this hypothesis, the path coefficient from alcohol use to depressive symptoms in this model was significant and negative, though the zero correlation in the sample was significantly different from zero and positive. Consistent with Hypothesis 3, suicide proneness showed significant unique contributions of depressive symptoms, alcohol-related problems, negative life events, and alcohol use, each in the expected direction.

The remaining hypotheses concerned mediation of relations implied by the theoretical model depicted in Figure 1. We examined these mediated paths in the same model, testing the significance of indirect (mediated) effects using the percentile bootstrap with 3,000 draws to generate empirical confidence intervals for the products of the coefficients composing the mediated path, one of the methods recommended by MacKinnon (2008) for specific indirect effects in more complex models. Figure 1 includes standardized coefficients for ease of reading; unstandardized path coefficients and standard errors are presented in Table 2. As shown, all individual path coefficients were significant and in the expected directions except, again, the direct path between alcohol use and depressive symptoms, which was significant and negative.

The hypothesized specific indirect effect of alcohol use on depression via negative life events was significant, estimate = 0.021, 95% Confidence Interval (CI): 0.011, 0.032. As expected, the specific indirect effect via alcohol-related problems was significant, est. = 0.040, 95% CI: 0.025, 0.054. Effects of alcohol use on suicide proneness were significantly mediated by the hypothesized system of variables (depressive symptoms, alcohol-related problems, and negative life events), total indirect effect est. = 0.125, 95% CI: 0.073, 0.181. These variables accounted for 80% of the variance in the direct path between alcohol use and suicide proneness (Mackinnon & Dwyer, 1993). Finally, as hypothesized, the effects on suicide proneness of both alcohol-related problems (est. = 0.124, 95% CI: 0.072, 0.183) and negative life events (est. = 0.010, 95% CI: 0.007, 0.013) were significantly mediated by depressive symptoms.

Discussion

In the present study, we investigated alcohol use, alcohol-related problems, negative life events, and depressive symptoms as potential risk factors for suicide proneness in undergraduate college students. Past research across a range of samples has demonstrated that each of these factors confer substantial risk for suicidality. However, previous studies have not reported findings regarding the relations among these four variables and the nature of their associations with suicidal behaviors in college students. Consequently, in the current study, we examined these four important variables simultaneously in a single path analytic model (Figure 1) with suicide proneness as the outcome variable. Overall, the results were consistent with the study hypotheses and proposed model.

As hypothesized and consistent with previous research (e.g., Quinn & Fromme, 2011; Veenstra et al., 2006), alcohol-related problems and negative life events were positively associated with alcohol use. These findings suggest that students who consume higher levels of alcohol more frequently are at an increased risk for experiencing negative life events and/or alcohol-related problems. For example, a student who consumes increased quantities of alcohol or is frequently intoxicated may be more likely to make impulsive decisions and/or act aggressively (Chermack & Blow, 2002), in turn precipitating a fight with a family member or friend. Given that distress often accompanies the unfavorable results related to alcohol use, clinicians should assess these possible adverse outcomes of students' drinking behaviors and intervene before they negatively impact psychological well being.

Consistent with our second hypothesis, depressive symptoms were positively related to alcohol-related problems and negative life events; however, contrary to expectation, depressive symptoms were negatively associated with alcohol use. The unexpected negative direct path between alcohol use and depressive symptoms was inconsistent with both the literature and the positive zero-order correlation. Given that inconsistency, unless and until this finding is replicated, we believe it is likely to be an artifact of correlated variables in the regression and do not discuss it further in this paper. However, the aforementioned significant finding is in line with past research (e.g., O'Neill et al., 2004; Urlass & Gibb, 2007), suggesting that students who encounter alcohol-related problems and negative life events are at an elevated risk for experiencing a depressed mood. One explanation for this finding is that college students who experience negative consequences may suffer from the associated distress, which in turn may contribute to feelings of guilt, shame, worthlessness, and ultimately depression. This interpretation supports the hopelessness theory of depression (Abramson et al., 1989), which posits that individuals who endure stress related to adverse events in their life are vulnerable to develop depression, particularly in the light of one's negative attributional style. Although attributional style was not specifically assessed in the current study, the relation that alcohol-related problems and negative life events have with depressive symptoms provides additional evidence for the large body of research (e.g., Hankin et al., 2004) supporting the hopelessness theory of depression in college students.

As anticipated, suicide proneness was positively associated with alcohol use, alcohol-related problems, negative life events, and depressive symptoms. The significant alcohol use-suicide proneness relation is consistent with previous research revealing that alcohol use is a strong predictor of suicidal behavior in college students (e.g., Schaffer et al., 2008; Stephenson et al., 2006). This result indicates that college students who consume alcohol more frequently and at higher quantities are at an increased risk for suicide. While the current finding offers further support that alcohol use is a strong risk factor for suicidal ideation and behaviors, more research utilizing long-term designs of alcohol use, suicidality, and the relation between these variables in college students is warranted. Future studies will need to utilize more sophisticated longitudinal models to establish the alcohol use-suicide

risk relation in terms of directionality, temporality, and mechanisms of action. Moreover, as anticipated, suicide proneness was positively associated with alcohol-related problems and negative life events, suggesting that mental health professionals on college campuses should inquire about students' stressful experiences when determining risk for suicide, in addition to assessing for students' alcohol use. This finding is in accordance with previous research (e.g., Joiner & Rudd, 2000; Lamis & Malone, 2011; Windle & Windle, 2005) and suggests that in addition to the direct relation that alcohol-related problems and negative life events have with depressive symptoms, these distressing incidents may increase college students' proneness to suicide as well even in the absence of depressive symptomatology. It is possible that these students may be so distraught immediately following an encounter with a problem relating to alcohol or negative event that they may begin to impulsively entertain the idea of suicide without necessarily experiencing symptoms of depression. Furthermore, results indicated that depressive symptoms were positively related to suicide proneness in college students, which is in line with a wealth of previous research (e.g., Garlow et al., 2008; Lamis, Malone, Langhinrichsen-Rohling, & Ellis, 2010) documenting depression as a significant risk factor for suicidal behaviors among college students. Thus, having a better understanding of students' adverse experiences and associated psychological distress may aid in the development of more efficient suicide prevention programs at a collegiate level.

Consistent with our hypotheses, the effect of alcohol use on depression was significantly mediated by both alcohol-related problems and negative life events. This finding suggests that students who consume alcohol are at an increased risk of experiencing depressive symptoms through their encounters with consequences related to alcohol and other negative life events. Although there are no studies to our knowledge investigating this specific mediational model in college students, previous research (e.g., Rafnsson et al., 2006) has documented a relationship among these variables. Mental health professionals should assess for current alcohol-related problems and negative life events when students are experiencing symptoms of depression, particularly in the context of their drinking behaviors.

Similarly, the effects of alcohol use on suicide proneness were significantly mediated by both alcohol-related problems and negative life events. Previous researchers (Dejong et al., 2010; Sher et al., 2008) have demonstrated that alcohol users are more prone to experience stressful life events contributing to a heightened suicide risk. The present findings in conjunction with the work of others suggest that individuals who consume higher quantities of alcohol at greater frequencies are at an elevated risk of experiencing negative consequences related to their drinking, which in turn place them at an increased risk for suicide. As expected, the results revealed that the effects of alcohol use on suicide proneness were also significantly mediated by depression. This result is consistent with previous studies indicating a relationship among these variables (Bossarte & Swahn, 2011) and further supports our proposed model. Additionally, the majority of variance (80%) in the direct path between alcohol use and suicide proneness was accounted for by the three mediators (i.e., alcohol-related problems, negative life events, and depressive symptoms), suggesting that these are the critical factors explaining this variance. This finding also suggests that the proposed model is likely the most parsimonious model possible, as additional mediators would be unlikely to account for significantly more variance in the direct path because so little remains unaccounted for. However, further longitudinal work is warranted to examine causal relationships and validate this model in other samples, ensuring that it simultaneously is parsimonious and fits the data well.

Consistent with our final hypotheses, depressive symptoms mediated the relation between alcohol-related problems and suicide proneness, as well as between negative life events and suicide proneness. These findings suggest that students who encounter alcohol-related problems and/or negative life events are at an increased risk for experiencing depressive

symptoms, which in turn make them more prone to suicide. Indeed, past research has shown these unintended adverse consequences to contribute to depressive symptoms (Barrett & Barber, 2007; Bjorck & Thurman, 2007; Sher et al., 2008) and subsequent suicide risk. Although it is possible that students become suicidal directly following an encounter with a stressful event, it is more likely that distressed students become depressed before they begin thinking of suicide as a viable option (Hardt & Johnson, 2010). Thus, it will be important for mental health professionals to assess students for their recent experiences with alcohol-related problems and negative life events, particularly when it has been concluded that they are currently depressed or presenting with symptoms of depression. Assessment procedures utilizing self-report instruments as well as clinical interviewing techniques may aid in the identification of students who are at elevated risk for suicide.

The findings should be considered within the context of the study's limitations. First, although we included a measure of social desirability as a covariate in the analyses, the current study was limited to self-report data, which raises the potential problem of response bias. This socially desirable responding may increase the chances of finding associations that are due to shared method variance, rather than demonstrating real relationships among constructs. Moreover, given that the data was collected through a voluntary online survey in return for extra credit in a psychology course, the students who participated may not be representative of all college students. Future studies should utilize a multi-modal data collection strategy with college students, such as conducting interviews with the participants in addition to administering self-report questionnaires. Another possible solution to this problem is to employ more sophisticated, objective measures such as the implicit association test (Nock et al., 2010) to assess suicide cognitions or the alcohol Stroop task (Cox, Yeates, & Regan, 1999) to assess drinking behaviors, in addition to self-report instruments measuring these variables. Second, the sample consisted predominantly of young adult European-American college students at a single university, and so the results may not be generalizable to other samples, such as clinical inpatients, older adults, and minorities. Additionally, although we included gender as a covariate in all analyses, the sample was comprised of primarily (approximately 75%) women. Future researchers may want to test the hypothesized relations in samples of only women or only men to assess for differences in the pattern of findings across genders.

Our measure of alcohol use included a broad continuum of use to ensure that we captured a variety of alcohol consumption patterns in college students; however, this limits our ability to differentiate between students with various types of alcohol use (e.g., binge drinking); therefore, future research may investigate the relations identified in the current study among college students with specific patterns of alcohol use to validate our findings across various alcohol use patterns. Moreover, college students are typically generally well-adjusted and may not be experiencing much psychological distress or having many thoughts about suicide. Consequently, the risk factors for suicide may not be as easily identifiable as they might be for clinical populations, limiting the generalizability of the present findings. Replication of these results across adult samples and populations is encouraged.

Third, there are other possible mediators that could help account for the obtained relation between alcohol use and suicide proneness, though our mediators accounted for a large majority of this relation. Variables to consider might include impulsivity, exposure to violence, hopelessness, and aggression. Future longitudinal work exploring the roles of specific mediators is needed to determine subpopulations at highest alcohol-related suicide risk, and mechanisms underlying the alcohol use-suicide proneness relation. Fourth, participants were asked to report on some variables that occurred within the past year, which, given the large proportion of freshmen in our sample, could have happened while they were in high school. Future researchers should consider a timeline for asking the target

population when certain behaviors may have occurred and inquire about these behaviors accordingly. Lastly, this study relied exclusively on data collected using a cross-sectional survey research design. Although our path analyses of mediating effects presumed a causal ordering, the methodology used to collect these data precludes a causal interpretation of associations among variables. More sophisticated methodologies and longitudinal designs should be employed before causal inferences can be made regarding the directional and developmental pathways that connect these variables in college students. Qualitative analyses of respondents' beliefs about the temporal ordering of these variables may also provide valuable insight for future researchers, but could not be conducted in the current study due to design limitations.

In spite of these limitations, the current findings along with the work of others (e.g., Conner et al., 2011; Dejong et al., 2010; Lamis & Malone, 2011) suggest that the assessment of alcohol use, alcohol-related problems, negative life events, and depressive symptoms could potentially aid in the prediction of suicide proneness. The results from the current study may have several practical implications. For example, mental health professionals and prevention specialists could use the proposed model and the findings from the present study to effectively identify students who may be at risk for suicide. Accordingly, students who report experiencing alcohol-related problems, negative life events, and depressive symptoms due to their alcohol use may need to be assessed for suicidal behaviors on a regular basis or referred to treatment. Further investigation of the interrelations among these identified risk factors should aid in the understanding of suicide in this high-risk group. Once the nature of these associations is better understood, more effective suicide prevention programs may be designed and implemented on college campuses.

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Note. $N = 1100$. * $p < .05$. ** $p < .01$.

Figure 1.
Path model with standardized regression coefficients.

Table 1

Correlation Matrix, Means, and Standard Deviations of Study Measures

Measure	1	2	3	4	5
1. Alcohol Use	--	.15*	.62*	.07*	.30*
2. Negative Life Events	.13*	--	.34*	.53*	.46*
3. ARPs (log-transformed)	.57*	.29*	--	.30*	.39*
4. Depressive Symptoms (log-transformed)	.04	.49*	.25*	--	.42*
5. Suicide Proneness	.24*	.40*	.32*	.37*	--
Mean	3.95	50.64	7.62 ^a	8.89 ^a	4.89
SD	3.01	32.51	9.07 ^a	8.83 ^a	3.41

Note. $N = 1100$. Tabled values are zero-order correlations (above diagonal) and partial correlations (below diagonal) after covarying out age, gender, ethnicity, year in school, social desirability, social club membership, relationship status, and residency status. ARP = Alcohol-Related Problems.

^a Nontransformed.

* $p < .05$.

Table 2

Path Coefficients

	Suicide Risk Factors			
	AUDIT-C	L-ARP	NLE	L-BDI
Outcome				
L-ARP	0.223 ^{**} (0.010)	--	--	--
NLE	1.491 ^{**} (0.370)	--	--	--
L-BDI	-0.049 ^{**} (0.012)	0.181 ^{**} (0.033)	0.014 ^{**} (0.001)	--
Suicide Proneness	0.156 ^{**} (0.039)	0.361 [*] (0.104)	0.024 ^{**} (0.004)	0.684 ^{**} (0.104)

Note: $N = 1100$. Table values are path coefficients regressing the row variable on the column variable. AUDIT-C = Alcohol Use Disorders Identification Test – Consumption Scale. L-ARP = Log-transformed Alcohol-Related Problems. L-BDI = Log-transformed Depressive Symptoms. NLE = Negative Life Events.

^{*}
 $p < .05$

^{**}
 $p < .01$.