JOURNAL OF AMERICAN COLLEGE HEALTH
https://doi.org/10.1080/07448481.2022.2063023

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MAJOR ARTICLE



# Protective behavioral strategies as a protective factor against suicidal ideation among college student drinkers

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**ABSTRACT**

**Objective:** Research shows that alcohol use is linked to suicidal ideation (SI), while depression is strongly associated with SI. Protective behavioral strategies (PBS) are safe drinking strategies. PBS are broadly protective across alcohol-related problems; however, it is unclear if these effects extend to those at risk for SI. We hypothesized that alcohol use and depressive symptoms would be risk factors for SI, and that these factors would moderate the effects of PBS. PBS was hypothesized to be protective for individuals with elevated depressive symptoms and alcohol use. **Participants:** College student drinkers ($n = 990$; $M$ age = 19.97, $SD$ = 3.75) from a Southeastern University. **Methods:** Participants completed an online survey inquiring about demographics, depressive symptoms, SI, alcohol use, and PBS use. **Results:** Depressive symptoms were associated with an increased likelihood of SI; however, alcohol use was not. PBS were most protective for individuals with high levels of alcohol use and/or depressive symptoms. **Conclusions:** PBS may be protective for heavier drinkers who are at heightened risk for SI.

**ARTICLE HISTORY**
Received 13 April 2021
Revised 8 March 2022
Accepted 3 April 2022

**KEYWORDS**
Alcohol; depression; protective behavioral strategies; suicidal ideation

## Introduction

College students' mental health risks pose significant concerns, as these students tend to experience a heightened vulnerability to internalizing symptoms (e.g., depressive symptoms, suicidal ideation), and externalizing behaviors (e.g., harmful alcohol use). In fact, Major Depressive Disorder is one of the most common psychological disorders among college students, with 53% of students experiencing depressive symptoms at some point throughout their time in college.[1,2] Depressive symptoms are a robust predictor of Suicidal Ideation (SI). Suicidal ideation (SI), consists of thinking about and planning suicide, which ranges from wishing to be dead without a plan, to thoughts of suicide with a full or partial plan.[3] One latent class analysis study found that approximately 97.6% of college students with SI endorsed moderately severe depressive symptoms.[4–6] Additionally, it is estimated that more than 100,000 college students report a suicide attempt each year.[7] SI is an important precursor to attempted and completed suicide, and is estimated to range between 6% to 11% among college students.[8–10] SI is also associated with various risk factors, including injury from risky behaviors and substance use.[5,11,12] Moreover, among college students, alcohol use is highly prevalent.[13] In a large epidemiological study by the World Health Organization, 6.8% of college students worldwide met criteria for an Alcohol Use Disorder.[14] This is important to keep in mind since college students are at a heightened risk of experiencing problematic alcohol use and depression, with both considered to be significant risk factors for suicidal ideations in this population.[4,15–17]

The robust relationship between depressive symptoms and SI has been found across populations, with large reviews concluding strong associations among substance use samples (e.g., alcohol use disorder)[18] and individuals in higher education (e.g., college students, medical students).[19] Among college students specifically, individuals with elevated depressive symptoms have evinced almost three times greater odds of SI relative to their less depressed counterparts.[9] However, while greatest risk of SI is attributable to high severity of depressive symptoms, alarmingly, students who indicate moderate or even low depressive symptom severity may still endorse SI at significant rates.[20] Such findings may be due in part to other vulnerability factors for SI among students. For example, depression-related factors such as lower self-reported quality-of-life and greater endorsement of hopelessness have been associated with greater SI among college students.[19] Similarly, elevated rates of alcohol use and alcohol-related problems have been directly linked to suicidal ideation among college students with depression.[6] This is especially concerning given the elevated rates of alcohol use among this population.

Moverover, it is important to consider the significant risk problematic alcohol use poses for college students. Approximately 40% of college student drinkers participate

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in heavy episodic drinking, consisting of four or more drinks for females, or five or more drinks for males within a two-hour time period.[21] Additionally, about 53.6% of college students engage in monthly alcohol consumption, and approximately 34.8% endorse monthly binge-drinking.[21] These rates of drinking are higher compared to non-college attending same-aged individuals, placing college students at an increased risk of experiencing adverse alcohol-related consequences.[22] These consequences include outcomes such as physical assaults,[23] sexual assaults,[24,25] alcohol poisoning,[26] driving under the influence,[27] poor grades,[28] health problems,[29,30] mental health problems,[18,21] and suicide attempts.[21] Thus, problematic alcohol use not only increases the risk of experiencing adverse alcohol-related consequences, but it is also related to depressive symptoms and SI, thereby increasing the risk of harm (e.g., suicide attempt, death, injury, etc.) for college students.

While findings regarding the associations between alcohol use, SI, and completed suicide are mixed, the combined experience of depressive symptoms, problematic alcohol use, and SI among college students pose a major public health issue. Various studies have failed to find an association between alcohol misuse and suicidal behaviors, including SI, among college students.[4,9,31–35] Yet, other studies have associated problematic alcohol use with depressive symptoms, SI, and even completed suicide.[6,16,36–39] Particularly, among individuals with suicide proneness (those who engage in risk-taking thoughts and behaviors related to suicidality), a positive association has been found with problematic alcohol use, impulsivity, and depressive symptoms.[6] This is particularly concerning given the high rates of heavy episodic drinking, depressive symptoms, and alcohol-related consequences among college students.[40–42] Understanding factors that may attenuate these associations is of significant public health interest.

The integrated motivational-volitional model (IMVM) of suicide posits that background factors such as high-risk environments and general diatheses, such as depression symptoms, set the stage for the motivation for suicide.[43] In the motivational stage of this model, these primary factors are directly linked to suicidal ideation. However, these links can be attenuated or potentiated by (a) threat-to-self moderators or (b) motivational moderators. Both threat to self and motivational moderators include risk and protective factors.[43] Threat to self-protective factors are factors that allow for a reappraisal of feelings of entrapment, as they assist in problem resolution. These include such things as positive emotional coping and social problem-solving skills. Motivational protective factors are factors that allow individuals to see alternatives to suicide, and include things such as thoughts about the future, goals, norms, and social support.[43] The authors of the IMVM have noted that some aspects of each factor may cross-over into the other.[43] Specifically, they have pointed out that coping may act as both a threat to self and a motivational moderator. Interestingly, protective behavioral strategies, behaviors people can engage in while drinking to offset, prevent, or reduce harm, may also be directly related to both threat to self and motivational protective factors as the varied behaviors reinforce a process of thinking of alternatives as well as reappraisal of situations.

### Protective behavioral strategies

Protective behavioral strategies (PBS) are a harm reduction approach that can be adopted while drinking alcohol to reduce the likelihood of experiencing adverse alcohol-related outcomes.[44] PBS are broken down into three subtypes: manner of drinking (MD; e.g., “avoid mixing different types of alcohol”), stopping/limiting drinking (SLD; e.g., “determine not to exceed a certain number of drinks”), and serious harm reduction (SHR; e.g., "use a designated driver").[44] Engaging in PBS mitigates alcohol-related risk. Indeed, a review paper found that PBS are broadly protective against alcohol-related problems.[45] PBS have been found to mediate other aspects of risk, including self-control,[46] self-regulation,[47] sensation-seeking,[48] conscientiousness,[49] and unplanned drinking,[50] thereby reducing alcohol-related risks among drinkers.

Furthermore, PBS use includes behaviors that are the antithesis of threat to self, the first moderator in the IMVM.[43] Indeed, while all PBS are considered “harm reduction” strategies, one subscale in particular (serious harm reduction) may be especially important in the IMVM. These behaviors are basic social problem-solving strategies used when drinking (e.g., having a designated driver) and/or coping with potentially serious adverse events (e.g., keeping your glass in sight at all times).[44] These may reduce risk by preventing exacerbation of environmental risk. Similarly, manner of drinking and stopping/limiting behaviors require future planning and goal directed behaviors (e.g., designating the number of drinks or a specified time to leave), as a way to reduce adverse events.[44] These strategies map onto the motivational moderator of the IMVM. Protective behavioral strategies have also been examined in relation to problematic alcohol use and depressive symptoms. Past research has indicated that greater symptoms of negative affect are associated with less PBS use.[51–54] In the context of depression, PBS have been found to partially mediate the relationship between depressive symptoms and alcohol-related negative consequences.[54] Findings suggest that college students with greater depressive symptoms may benefit from interventions that target protective factors, such as PBS, as a way to address negative reinforcement motives and mitigate alcohol-related harms.[55] This is especially important considering the link between depression and SI among college student drinkers.[6,16,36–38] Thus, individuals at the greatest risk of SI (e.g., individuals with depression and problematic alcohol use) may benefit the most from use of PBS. The current study tests this hypothesis.

### Current study

The purpose of this study was to examine the relationship between PBS and SI among college student drinkers and determine whether PBS are more protective for individuals at increased risk for SI. It was hypothesized that both

problematic alcohol use and depressive symptoms would be risk factors for SI and that these risk factors would moderate the protective effects of PBS. Specifically, we hypothesized that PBS would be most protective among individuals with elevated depressive symptoms (H1) and/or elevated problematic alcohol use (H2).

## Methods

### Participants

The analyzed sample ($n = 990$; 60.51% female) consisted of undergraduate students from a Southeastern University, with a mean age of 19.97 ($SD = 3.75$). The racial composition consisted of 74.34% Caucasian, 29.80% Hispanic/Latinx, 10.91% Black, 5.76% Asian/Pacific Islander and 0.30% Native American/Alaskan Native. Additionally, 14.24% of the sample were of a minority sexual orientation. All participants were treated in accordance with American Psychological Association ethical guidelines for research.[56]

### Procedures

Participants were recruited to complete a survey titled "College Student Experiences of Regret" through the university research pool, for which participants received course credit. Participants completed an informed consent to engage in the study and provided demographic information, depressive symptoms in the past month, suicidal ideation in the past month, problematic alcohol use and PBS use. The study also asked participants to provide information on regretted sexual experience, history of sexual assault, symptoms of anxiety, and symptoms of posttraumatic stress (not presented here; see Peterson et al.[57]).

### Measures

#### Demographics

Participants reported basic demographic information, including age, biological sex, race, and ethnicity.

#### Patient health questionnaire-9 (PHQ-9)

The PHQ-9 questionnaire was utilized to measure depressive symptoms in the past month.[58] This nine-item questionnaire assesses the severity of depressive symptoms according to the DSM-5 criteria (e.g., "feeling down, depressed or hopeless"). Responses for each item range from 0 (Not at all) to 3 (Nearly every day), with higher scores indicating greater severity of depressive symptoms. The PHQ-9 has been validated and found reliable for use with college students.[59] The PHQ-9 showed adequate internal consistency in the current study (α = .89).

#### Columbia-suicide severity rating scale (C-SSRS)

The C-SSRS was utilized to measure suicidal ideation in the past month (i.e., "In the past month, have you actually had any thoughts of killing yourself")[3]. The C-SSRS is a six-item questionnaire containing "yes" or "no" responses. In the current study, responses were dichotomized so that "0" indicates no endorsement of any suicidal ideation in the past month and "1" indicates any endorsement of suicidal ideation in the past month across all six questions. The C-SSRS has established validity for use in clinical and research settings.[3] The C-SSRS showed adequate internal consistency in the current study (α = .85).

#### Alcohol use disorder identification test (AUDIT)

The AUDIT is a measure of potentially problematic lifetime alcohol use. The measure consists of 10 items, broken down into three subscales: Consumption, Dependence, and Serious Harm.[60] Items are rated on a scale from 0 (Never) to 4 (four or more times a week), with total scores (summed) ranging from 0 to 40, and higher scores indicating more alcohol use problems. Specifically, scores ranging from 8-15 indicate hazardous drinking, and scores >20 indicate potential dependence.[61] The AUDIT has established validity and reliability for use with college students.[62] The AUDIT showed adequate internal consistency in the current study (α = .83).

#### Daily drinking questionnaire—modified (DDQ-M)

The DDQ-M consists of a grid with each day of the week.[63] Participants report the number of drinks they "typically" consume on each day of the week over the past 6 months and the number of hours they typically drink on each drinking day. These values can be used to calculate average number of drinks per week, average number of drinking days, and average number of heavy episodic drinking (HED) occasions per week. This was included to provide context to the drinking level of the sample.

#### Protective behavioral strategies survey-20 (PBSS-20)

The PBSS-20 is a 20-item survey utilized to measure protective behavioral strategies.[64] This survey assesses three PBS subtypes: Serious Harm Reduction (SHR), Stopping/Limiting Drinking (SLD) and Manner of Drinking (MD).[44] Participants were asked to report the degree to which they engage in each PBS subtype in the past month when using alcohol or "partying." Responses ranged from 1 (Never) to 6 (Always). Previous research indicates that the PBSS-20 has established reliability and validity,[44,65] as well as test-retest reliability and criterion validity with college students, which includes improved content validity for the SHR scale.[64] The PBSS-20 showed adequate internal consistency in the current study (MD α = .86, SLD α = .86, SHR α = .84, Total PBS α = .82).

### Data preparation & planned analysis

Data were reduced to ensure only individuals who endorsed drinking alcohol were included in the analysis. The overall sample consisted of $n = 1{,}403$ participants. There were $n = 413$ participants who reported abstaining from alcohol, and were excluded from the analysis, resulting in a final sample of $n = 990$ participants. The data were examined for outliers as well as leverage and influence; no observations exerting

significant leverage or influence were found. Missing data ranged from none to 5.09% across all measures. This was handled using full information maximum likelihood. Additionally, the three PBS subtypes were combined to generate a single PBS variable. PBS, AUDIT, Depressive Symptoms, Age, and Biological Sex were mean centered to control for multicollinearity. The Suicidal Ideation outcome variable was heavily skewed (82.80% did not endorse suicidal ideation), thus, this variable was dichotomized to represent any suicidal ideation in the past month (0 = no, 1 = yes).

Data were analyzed in Stata 16.0.[66] To examine the hypothesized effects, a logistic regression was conducted. The analyses followed a stepwise procedure to identify the most parsimonious model. In step 1, Suicidal Ideation was regressed onto Age and Biological Sex . In step 2, PBS, Problematic Alcohol Use, and Depressive Symptoms were added to the model. In step 3, the interaction terms between PBS × Problematic Alcohol Use and PBS × Depressive Symptoms were added to the model. Comparative model fit, using likelihood ratio tests, was utilized to identify the most parsimonious model. Finally, simple slopes were calculated to determine the impact of PBS use on Suicidal Ideation at high (+1*SD*) and low (-1*SD*) levels of Depressive Symptoms, and at high (+1*SD*) and low (-1*SD*) levels of Problematic Alcohol Use.

## Results

### Descriptive and bivariate statistics

Descriptive statistics and bivariate correlations are in Table 1. Average AUDIT scores in the sample were 5.55 (*SD* = 4.76) with 23.74% (*n* = 235) endorsing hazardous/harmful drinking (i.e., AUDIT scores ≥15). The sample reported drinking an average of 5.68 (*SD* = 7.09) drinks per week across an average of 1.63 (*SD* = 1.41) days per week. A sizable minority of the sample (25.09%) engaged in at least one weekly HED episode. Depression scores (PHQ-9) ranged from 0-27, with 55.76% of the sample endorsing moderate (PHQ-9 ≥ 10) depressive symptoms over the past month. Suicidal ideation in the past month was endorsed by 18.48% (*n* = 183) of the sample. Significant positive correlations were found between Problematic Alcohol Use , SI, and Depressive Symptoms, as well as between SI and Depressive Symptoms. Significant negative correlations were found between PBS and Problematic Alcohol Use, SI, Depressive Symptoms, and biological sex, see Table 1.

**Table 1.** Bivariate correlations and descriptive statistics.

| Variables | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1. Biological sex | — | | | | | |
| 2. Age | −0.017 | — | | | | |
| 3. Suicidal ideation | −0.08* | −0.03 | — | | | |
| 4. PBS | −0.22*** | 0.02 | −0.09** | — | | |
| 5. Problematic Alcohol Use | 0.07* | −0.04 | 0.09** | −0.34*** | — | |
| 6. Depressive symptoms | −0.17*** | 0.01 | 0.41*** | −0.08* | 0.16*** | — |
| Mean | 0.39 | 19.97 | 0.18 | 4.25 | 5.69 | 7.22 |
| *SD* | 0.49 | 3.75 | 0.39 | 1.03 | 7.11 | 5.90 |
| Skew | 0.43 | 4.81 | 1.62 | −0.43 | 1.94 | 0.89 |
| Kurtosis | 1.18 | 32.53 | 3.64 | 3.14 | 8.65 | 3.19 |
| Range | 0 – 1 | 18 – 57 | 0 – 1 | 1 – 6 | 1 – 40 | 0 – 27 |

*Note.* Problematic Alcohol Use = Alcohol Use Disorders Identification Test (AUDIT); PBS = Protective Behavioral Strategies; *SD* = Standard Deviation. Coding: Biological sex coded as 0 = female, 1 = male; Suicidal ideation coded as 0 = no, 1 = yes; *n* = 990. *$p < .05$; **$p < .01$; ***$p < .001$.

### Logistic regression

A logistic regression was used to analyze whether Problematic Alcohol Use and Depressive Symptoms would be risk factors for SI and whether these risk factors moderate the protective effects of PBS. Each step of the model is depicted in Table 2. In step 1, SI was regressed onto the covariates of Age and Biological sex. This model was statistically significant $\chi^2(2) = 6.95$, $p = .031$, accounting for 1.1% of the variance. In step 2, PBS, Problematic Alcohol Use, and Depressive Symptoms were added to the model. This resulted in significant model improvement, $LR\chi^2(3) = 155.01$, $p < .001$, accounting for 25% of the variance. SI was significantly associated with lower PBS use (OR = 0.79, $p = .015$) and greater Depressive Symptoms in the past month (OR = 4.53, $p < .001$), but not with Problematic Alcohol Use (OR = 1.00, $p = .978$). This indicates that for every 1 unit increase in Depressive scores, there was a 4.53-fold increase in the likelihood of experiencing SI in the past month. Additionally, for every 1 unit increase in PBS scores, there was a 21% decrease in the likelihood of experiencing SI in the past month. In step 3, the interactions between PBS × Problematic Alcohol Use as well as PBS × Depressive Symptoms were added to the model. This resulted in significant model improvement, $LR\chi^2(2) = 9.23$, $p = .010$, accounting for 26% of the total variance. The interactions between PBS × Problematic Alcohol Use (OR = 0.96, $p = .049$) and PBS × Depressive Symptoms (OR = 0.75, $p = .034$) were statistically significant predictors of SI.

### Simple slopes

To further understand when PBS serves as a protective factor for those at heightened risk of SI, simple slopes were calculated. The significant relationship between PBS × Depressive Symptom and past month SI was probed at high (+1 *SD*) and low (-1 *SD*) levels of Depressive Symptoms (see Figure 1). At high levels of Depressive Symptoms, the protective relationship between PBS and past month SI was potentiated and statistically significant (OR = 0.68, $p = .001$). Thus, PBS were found to be more protective, indicating that for every 1 unit increase in PBS there is a 32% decreased likelihood of experiencing SI among those with high Depression scores, controlling for the rate of Problematic Alcohol Use. In contrast, at low levels of Depressive Symptoms, the relationship between PBS and past month SI was not significant (OR = 0.98, $p = .923$), indicating that PBS were not protective for those with low levels of Depression.

Additionally, the relationship between PBS × Problematic Alcohol Use and past month SI was probed at high (+1 *SD*) and low (-1 *SD*) levels of Problematic Alcohol Use (see Figure 2). At high levels of Problematic Alcohol Use, the protective relationship between PBS and past month SI was again stronger and statistically significant (OR = 0.68,

**Table 2.** Hierarchical binary logistic regression predicting the impact of problematic alcohol use, PBS, and depression on suicidal ideation.

| Predictor Variables | OR (SE) | *p* | 95% CI | $\chi^2$ (*df*) | $\Delta\chi^2$ (*df*) | $R^2$ | $\Delta R^2$ |
|---|---|---|---|---|---|---|---|
| **Step 1** | | | | 6.95 (2) | | .011 | |
| Age | 0.98 (0.02) | 0.320 | 0.93 to 1.02 | | | | |
| Biological Sex | 0.66 (0.11) | 0.017 | 0.47 to 0.93 | | | | |
| Constant | 0.22 (0.02) | < 0.001 | 0.19 to 0.26 | | | | |
| **Step 2** | | | | 161.96 (5) | 155.01 (3)*** | .245 | .234*** |
| Age | 0.96 (0.03) | 0.182 | 0.90 to 1.02 | | | | |
| Biological Sex | 0.83 (0.16) | 0.339 | 0.56 to 1.22 | | | | |
| PBS | 0.79 (0.08) | 0.015 | 0.65 to 0.96 | | | | |
| Problematic Alcohol Use | 1.00 (0.02) | 0.978 | 0.96 to 1.04 | | | | |
| Depression | 4.53 (0.63) | < 0.001 | 3.46 to 5.94 | | | | |
| Constant | 0.16 (0.02) | < 0.001 | 0.13 to 0.20 | | | | |
| **Step 3** | | | | 171.19 (7) | 9.23 (2)** | .258 | .013** |
| Age | 0.96 (0.03) | 0.231 | 0.91 to 1.02 | | | | |
| Biological Sex | 0.84 (0.17) | 0.381 | 0.57 to 1.24 | | | | |
| PBS | 0.82 (0.09) | 0.066 | 0.66 to 1.01 | | | | |
| Problematic Alcohol Use | 0.97 (0.02) | 0.276 | 0.93 to 1.02 | | | | |
| Depression | 4.70 (0.66) | < 0.001 | 3.56 to 6.20 | | | | |
| PBS × Problematic Alcohol Use | 0.96 (0.02) | 0.049 | 0.93 to 1.00 | | | | |
| PBS × Depression | 0.75 (0.10) | 0.034 | 0.58 to 0.98 | | | | |
| Constant | 0.15 (0.02) | < 0.001 | 0.12 to 0.19 | | | | |

*Note.* Problematic Alcohol Use = Alcohol Use Disorders Identification Test (AUDIT); PBS = Protective Behavioral Strategies; $n = 990$. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

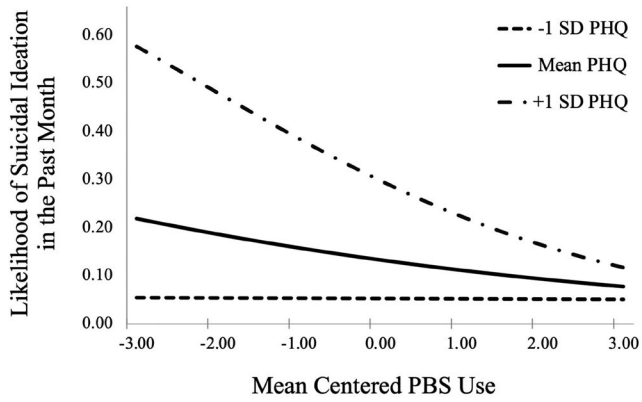


**Figure 1.** Association between suicidal ideation and PBS use at high and low levels of depressive symptoms.

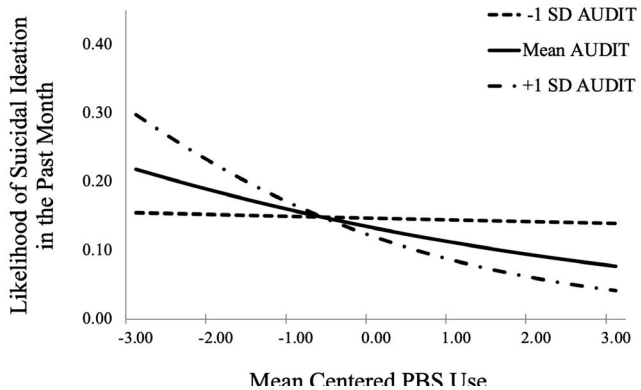


**Figure 2.** Association between suicidal ideation and PBS use at high and low levels of problematic alcohol use.

$p = .015$). This indicates that PBS are more protective among heavy drinkers; for every 1 unit increase in PBS there is 32% decreased likelihood of experiencing SI among heavy drinkers, controlling for Depressive Symptoms. In contrast, at low levels of Problematic Alcohol Use, the relationship between PBS and past month SI was not significant (OR = 0.97, $p = .858$). Thus, PBS were not protective against SI among lighter drinkers in this sample.

## Discussion

The current study sought to understand whether PBS are more protective for individuals who are at a heightened risk for suicidal ideation, with heightened risk indicated by the presence of depressive symptoms and problematic alcohol use (e.g., heavy drinking). This is the first study to examine PBS as a protective factor in the context of SI. It was hypothesized that problematic alcohol use and depressive symptoms would be risk factors for SI, and that these factors would moderate the protective effect of PBS. The hypotheses were partially supported. Depressive symptoms were directly associated with an increased likelihood of SI. However, problematic alcohol use, which has previously been implicated as a risk factor for SI,[15–17,37] was not associated with SI. Consistent with hypotheses, PBS were most protective for individuals with high levels of problematic alcohol use and/or high levels of depressive symptoms.

The Integrated Motivational-Volitional Model of suicide posits that risk factors for SI may be moderated by both threat-to-self and motivational protective factors.[43] We hypothesized that the behaviors encompassing PBS represent both types of protective factors, and thus may affect multiple forms of SI risk. Consistent with this notion, we found that for individuals who are 1 *SD* above the mean on depressive symptoms, PBS use was associated with a robust decreased likelihood of experiencing SI in the past month. This suggests that PBS are protective for individuals with depressive symptoms who are most at risk of experiencing SI (e.g., individuals with high levels of depression), so long as they can engage in PBS use while drinking. These findings are similar to another study, which found that PBS

were protective against alcohol-related problems among individuals with poor mental health, as opposed to those who were mentally healthy.[67] Thus, since PBS are typically used to protect drinkers from experiencing alcohol-related harm (e.g., injury, alcohol poisoning, sexual assault),[44,45] and individuals with depression have been found to be at a heightened risk for harm (e.g., suicidality, increased problematic alcohol use, alcohol-related consequences, alcohol use disorder)[6,53,54,68,69] it is possible PBS may protect individuals with more severe depressive symptoms from experiencing increased SI as well as other types of harm (e.g., suicidal intentions, and plans, alcohol use disorder, injury). Future research should investigate this further to develop a more comprehensive understanding of the extent to which PBS are protective against a variety of alcohol and non-alcohol related harms among individuals with severe depressive symptoms.

Additionally, death by suicide is posited to be most likely when individuals experience SI and have the intent to act on these ideations (e.g., reduced fear of death, having a fully formulated plan), coupled with prior exposure to painful and provocative experiences.[70,71] PBS may be utilized to reduce or guard against exposure to these painful experiences, possibly reducing the likelihood of experiencing SI, and thereby attempted suicide. It is possible that people who are engaging in protective types of behaviors have a general tendency to ensure their own safety,[45,72] which is antithetical to SI, but consistent with the notion of a threat to self-moderator in the context of the IMVM.[43] Research has shown that when people with depression experience increases in aversive consequences (e.g., alcohol poisoning, alcohol-related injury), they are more likely to become preoccupied with escape and avoidance from anticipated aversive consequences.[73,74] These response-contingent reinforcement motivations may be one way through which the likelihood of PBS use is leveraged, as a way to avoid negative experiences (e.g., alcohol-related problems) that would make the individual inevitably feel worse. Thus, this may be one way SI is reduced, by the individual actively trying to prevent the negative emotional side effects that comes with heavy drinking through effortful PBS use.

Alternatively, impulsivity is associated with SI and depression, and PBS is associated with low levels of impulsivity.[6] Thus, it may be that engaging in PBS employs effortful types of cognitive processing that serves as a protective factor against SI. Although some literature has indicated that individuals with depression may not be able to activate the cognitive resources or motivation necessary to use PBS,[51–54] it can be argued that individuals with depression may be more likely to use PBS after experiencing an alcohol-related negative event in order to avoid future aversive consequences. Furthermore, future research should investigate the mechanisms by which PBS is able to reduce the likelihood of SI among college students with depressive symptoms. Additionally, it would be important to determine whether PBS-skill based interventions can be utilized to reduce SI among college student drinkers with more severe depressive symptoms.

Previous research has shown that problematic alcohol use has been positively associated with SI,[6,15–17,75] though some have found no association.[4,9,31,32,34,35] The findings from the present study are consistent with these latter findings, indicating no association between problematic alcohol use and SI. This is consistent with a recent study which reported parallel findings.[35] Similarly, Lamis, Ballard, May, Dvorak[16] found that alcohol problems but not severity, were associated with the likelihood of experiencing SI. Thus, perhaps separating alcohol use from alcohol problems may yield a more nuanced understanding of how problematic alcohol use relates to SI. Future research should investigate how different facets of problematic alcohol use impact the likelihood of SI. This data suggests that lighter drinkers are already using higher rates of PBS, as demonstrated by the correlation table (see Table 1), indicating a potential ceiling effect. Consequently, the effects seen here are more prominent amongst heavier drinkers, who also tend to have more variability in PBS use.[45,76,77]

Nevertheless, this study found that heavier drinkers seem to reap the benefits of the protective effects of PBS. Those who drink at heavier levels, tend to be at risk of experiencing more alcohol-related problems, yet when PBS use is increased, the likelihood of experiencing SI decreased. This may be a byproduct of other issues that people experience when they are drinking. For instance, heavier drinking is associated with alcohol-related negative consequences such as interpersonal conflicts, higher rates of adverse sexual outcomes, and injury.[78,79] Thus, by engaging in PBS use, drinkers may reduce the likelihood of any of these other outcomes that could also be linked to suicidal ideation/thoughts, plans, and potential attempt behaviors. Similarly, low problem-solving skills, negative urgency, and a tendency to use escape mechanisms has been associated with SI and heavy drinking.[37,39] These factors appear to be heightened and increase the risk of SI and attempts as alcohol consumption increases.[39] PBS may guard against this by reducing the likelihood of heavy alcohol consumption and alcohol-related consequences,[42,45,46,48] thereby possibly allowing the individual to inhibit impulsive responding and engage in problem-solving.[45] Future research should investigate the factors that make PBS protective against SI among heavy drinkers.

### Limitations

The current study is not without its limitations. It should be noted first and foremost that levels of severity for both suicidal ideation and depressive symptoms were not assessed. For SI, participant responses were dichotomized, "0" indicating no endorsement of any past month SI, "1" indicating any endorsement of past month SI. Meaning participants could have endorsed fleeting thoughts of suicide in the past month, such as wishing they would not wake up, to active suicidal ideation with a specific plan and intent to carry out their plan. Thus, it is not possible to categorize which level of SI the findings apply to more. We cannot definitively say if PBS are protective for individuals at high risk for suicide attempts, although SI is a robust risk factor for suicide attempts. PBS may be more protective as a preventative measure. The same goes for depressive symptoms.

While scores range from a total of 0-27, with 27 indicating the highest level of depressive symptoms, we do not know which of these participants have a formal diagnosis of Major Depressive Disorder, and which simply experience symptoms throughout the month. In addition, although our sample (74.34% Caucasian; 60.51% female; college students) may not be generalizable to other populations, a study by LaBrie, Kenney, Lac, Garcia, Ferraiolo [67] found that females tend to use more PBS, regardless of their mental health. Finally, data for this study is cross-sectional in nature, which precludes causal inferences regarding the associations between SI, depressive symptoms, problematic alcohol use, and engagement in PBS use.

### *Clinical implications*

The findings of the current study suggest the importance of assessing SI and alcohol use among college students with high levels of depression, as well as assessing SI and depressive symptoms among heavy drinkers. In addition, findings suggest that PBS are broadly protective against alcohol-related consequences, which could ultimately reduce the risk of SI among college students. Therefore, students who are most at-risk of experiencing SI may benefit from alcohol interventions that specifically target PBS use. Currently, multiple interventions exist that target PBS use among college students, such as Brief Alcohol Screening and Intervention for College (BASICS)[80,81]; Brief Motivational Interviewing [82]; Deviance Regulation Theory (DRT)[83]; Counterfactual Thinking Theory;[84,85] and Personalized Normative Feedback[86]. Particularly promising, are the findings from a DRT intervention, which has shown to be associated with significant decreases in negative affect (i.e., anxious symptoms, depressed symptoms) across time among college student drinkers.[87] Thus, it may be important to assess the potential efficacy of a DRT intervention on decreasing SI.

## Conclusion

The current study examined whether PBS serve as a protective factor for college student drinkers at heightened risk for SI. The results indicate that PBS are most protective for individuals with elevated levels of alcohol use and/or elevated depressive symptoms, thus indicating that PBS are broadly protective. These findings are of particular importance in the context of prior literature, which shows that depressive symptoms are associated with higher rates of SI among people who drink,[6,16,75] and college students in particular,[36,41,88] evincing a strong need to identify specific alcohol-related protective strategies against SI for this population. Present results continue to highlight the importance of assessing and understanding the relationship between SI, depressive symptoms, and problematic alcohol use among college students and the importance of finding preventative measures to avoid highly deleterious outcomes for student drinkers. Although PBS have been shown be protective against alcohol related problems,[45,47–50] this is the first study to test the relationship between PBS, SI, and factors that contribute to SI. Future research should assess the elements that make PBS protective against SI among heavy drinkers as well as drinkers with high depressive symptoms. In addition to clinical implications, there are practical applications to these findings at the university level. Most college students are required to complete an alcohol use prevention program at the matriculation of their college experience.[89] Therefore, it may be beneficial for universities to implement programs that specifically promote PBS use, rather than targeting alcohol use alone, as PBS seem to have broad protective effects on SI among college students.

## Acknowledgments

All authors have read and approve of the final manuscript. ADL developed the primary hypotheses; conducted the formal analyses; wrote the majority of the introduction, methods, results, and discussion. RS collected the data; wrote a portion of the discussion; assisted with revisions. AVL assisted in writing a portion of the discussion. EKB contributed to the introduction and revisions of the discussion. JLC assisted in writing the abstract and a portion of the discussion. RDD collected the data; supervised the analysis; assisted in writing all sections.

## Conflict of interest disclosure

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

## Funding

This material is based upon work supported by the National Science Foundation Graduate Research Fellowship Program under Grant No. (2035702) for AVL. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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