Context counts: Solitary drinking explains the association between depressive symptoms and alcohol-related problems in undergraduates

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HIGHLIGHTS

- We test the mediating roles of drinking contexts in depression-related alcohol use.
- High-risk pathway via solitary drinking in those with elevated depressive symptoms.
- Low-risk pathway via drinking at parties in those high in depressive symptoms.
- Context may be a malleable target for treatments for depression-related drinking.

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ABSTRACT

Introduction: According to theory, depressed individuals self-medicate their negative affect with alcohol. Due to isolation and interpersonal difficulties, undergraduates with elevated depressive symptoms may do much of their drinking alone and/or in intimate contexts (e.g., with family or romantic partners) rather than at normative social events (e.g., parties). Evidence suggests drinking in these contexts leads to heavy use and alcohol-related problems. Accordingly, context may be an explanatory mechanism linking depressive symptoms to problematic drinking. This pathway remains understudied in the literature. Our study aimed to examine solitary and intimate drinking as distinct mediators of the depression–problematic drinking association. We hypothesized that depressive symptoms would be positively associated with solitary and intimate drinking which in turn would be associated with elevated alcohol use and related problems.
Methods: Undergraduates ($N = 295$; 72% women) completed online self-reports.
Results: Consistent with hypotheses, path analyses supported depressive symptoms as a positive predictor of solitary drinking, which in turn was a positive predictor of alcohol-related problems, but not of alcohol use. Counter to hypotheses, depressive symptoms were unrelated to intimate drinking. Interestingly, depressive symptoms were negatively associated with drinking at parties, which in turn led to reduced risk for elevated alcohol use and related problems.
Conclusions: Our results shed new light on the depression pathway to problematic drinking in undergraduates by considering the role of drinking context. Our findings suggest undergraduates with elevated depressive symptoms are at risk for potentially problematic drinking because they are drinking alone. Solitary drinking represents a malleable target for clinical interventions aimed at reducing risky depression-related alcohol use.

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1. Introduction

Problematic drinking (i.e., heavy use and alcohol-related problems) poses risks in undergraduates. Roughly 30–40% of students drink heavily, 19% miss class due to hangovers, and 14% have unplanned sex while intoxicated (Adlaf, Demers, & Gliksman, 2005). To advance etiological models, more theory-guided research is needed to identify predictors of problematic drinking.

Depressive symptoms relate to problematic drinking (Grothues et al., 2008). This may be particularly relevant among young adults, as nearly 30% of undergraduates report depressive symptoms (Ibrahim, Kelly, Adams, & Glazebrook, 2013). The self-medication hypothesis predicts that those high in depressive symptoms drink for alcohol's analgesic effects (Khantzian, 1997). Complimenting this, according to social

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learning theory (SLT), depressed persons should be highly responsive to these analgesic effects, and thus will learn that drinking dampens ruminative thoughts and numbs painful memories (Castellanos-Ryan & Conrod, 2012). Supporting theory, research links elevated depressive symptoms to drinking for coping with depression motives (Grant, Stewart, & Mohr, 2009) and to problematic drinking outcomes (Mushquash et al., 2013; Stewart et al., 2010). Despite this work, much remains to be understood about how the depression–problematic drinking risk pathway unfolds.

Due to low behavioral activation (e.g., low motivation or energy), undergraduates with elevated depressive symptoms spend less time at social events–where undergraduates normatively drink–and instead spend more time alone and in intimate settings (e.g., with family or romantic partners; Baddelely, Pennebaker, & Beevers, 2012). When alone and when around loved ones, those high in depressive symptoms experience particularly elevated negative affect (Pulkki-Raback et al., 2012). According to SLT, the heightened negative emotionality when alone may lead to solitary drinking in an effort to dampen loneliness and isolation (Castellanos-Ryan & Conrod, 2012). Given that depressive symptoms are also associated with interpersonal difficulties (Beach, Jones, & Franklin, 2009), undergraduates with elevated depressive symptoms may also drink in intimate settings to cope with interpersonal distress and low mood (Reyno, Stewart, Brown, Horvath, & Wiens, 2006). In turn, SLT indicates that it is *through* frequent self-medication drinking in solitary and intimate contexts that depressive symptoms predict heavy use and alcohol-related problems.

Many undergraduates drink at social events (e.g., parties, bars), which is associated with problematic drinking in young people; however, 15% drink outside of normative social contexts and this is considered particularly risky behavior (Neff, 1997; O'Hare, 1990). Research indicates solitary drinkers (vs. social drinkers) use alcohol excessively, report more alcohol-related problems, and drink to self-medicate (Christiansen, Vik, & Jarchow, 2002; Holyfield, Ducharme, & Martin, 1995). Solitary drinkers are at higher risk for developing alcohol use disorders compared to those who limit drinking to social events (Abbey, Smith, & Scott, 1993). Far less is known about risks related to intimate drinking. Knowledge from a handful of studies suggests interpersonal conflict situations are associated with heavy drinking (Mohr et al., 2001; Reyno et al., 2006) and alcohol-related problems (Buckner, Schmidt, & Eggleston, 2006).

While the link between solitary drinking and heavy/problem drinking is well-established, the few studies examining links between depressive symptoms and solitary and intimate drinking in undergraduates show inconsistent results. For example, some studies demonstrate that depressive symptoms are positively associated with solitary heavy drinking (Christiansen et al., 2002; Gonzalez & Skewes, 2012), while others indicate that depressive symptoms are unrelated to solitary drinking (e.g., Gonzalez, Collins, & Bradizza, 2009). A notable limitation of this work is that participants were often classified arbitrarily as solitary (i.e., solitary binge drinking ≥1 in past month) and social (i.e., no solitary binge drinking) drinkers. Apart from statistical limitations of dichotomization (Streiner, 2002), it is likely some individuals drink both while alone and while with others. A better method would be to ask about frequency of drinking in different contexts. In terms of intimate drinking, a daily process study by Mohr and colleagues (2001) showed on days with elevated interpersonal conflict, undergraduates high in neuroticism (i.e., a dispositional tendency toward negative affect) drank more frequently at home. Likewise, Reyno et al. (2006) demonstrated that in women with alcohol problems, elevated depressive symptoms predicted heavy drinking in situations involving conflict with others. One central theoretical limitation of extant work is that no study to date has examined the mediating roles of solitary and intimate drinking contexts in depression-related drinking. SLT suggests that *through* these contexts, individuals with elevated depressive symptoms may engage in problematic drinking (Pihl & Peterson, 1995); however, this remains to be tested.

Our primary goal was to advance etiological risk models by providing the first empirical test of solitary and intimate drinking as explanatory variables in depression-related problematic drinking. Also, contrasting previous work, we examined solitary and intimate drinking (i.e., with family or romantic partners) as distinct mediators in the *same* model to tease apart the relative explanatory contribution of each context on depression-related drinking. This distinction is theoretically relevant, as these contexts may be associated with distinct patterns of risk; however, this has yet to be examined in the literature. We also included drinking at parties in the model. Extant literature indicates undergraduates drink frequently at social events, where many of their peers engage in heavy drinking (Kuntsche, Knibbe, Gmel, & Engels, 2005). Our rationale for including drinking at parties was to control for normative context-related drinking, and thus examine the unique explanatory power of solitary and intimate drinking. Based on SLT and existing work (Christiansen et al., 2002), we hypothesized that elevated depressive symptoms would be associated with increased frequency of solitary and intimate drinking, and that these drinking contexts would in turn be unique predictors of relatively high levels of alcohol use and alcohol-related problems.

2. Material and methods

2.1. Procedure and participants

Our study was approved by the Health Sciences Research Ethics Board at Dalhousie University. We used baseline data from a larger study on personality and drinking motives (Mackinnon, Kehayes, Clark, Sherry, & Stewart, in press). Undergraduates completed prescreening through mass screening protocols or via telephone screening interviews. Only drinkers (≥4 drinking occasions in the past month) were included in this larger study. Participants completed self-report measures in the lab and were compensated with course credit or money ($10/hour).

Undergraduate drinkers (72% women; $M_{age} = 20.77$, $SD = 3.77$) were recruited via posters and an online participant pool website. The initial sample was $N = 302$, but due to extensive missing data on key study variables (>50%) from a few participants; the final sample in our study was 295. Most participants were Caucasian (90%).

2.2. Questionnaire measures

2.2.1. Mood and Anxiety Symptom Questionnaire

One of the questionnaires used was the Mood and Anxiety Symptom Questionnaire (Clark & Watson, 1991; Watson et al., 1995). The anhedonic depression subscale was used to assess depressive symptoms. This subscale originally contained 22-items, but we omitted the item asking about suicide for ethical reasons (Grant et al., 2009).[1] Participants indicated how much they experienced each symptom in the past 6 months. Responses were made on a 5-point scale (1 = *not at all*; 5 = *extremely*). Summed scores were used. Research suggests excellent internal consistency ($\alpha = .91$; Keogh & Reidy, 2000) and good concurrent and predictive validity for the anhedonic depression subscale (Buckby, Yung, Cosgrave, & Killackey, 2007). The present alpha was .93, which is excellent.

2.2.2. Drinking contexts

Adapted from Cooper's (1994) drinking contexts measure, undergraduates rated how often they drank in these four contexts in the past 6 months: alone, with family, with a romantic partner, and at

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[1] Data were collected by undergraduate research assistant volunteers who were not experienced in conducting suicide risk assessment and intervention. Thus, for ethical reasons, we omitted the one MASQ item from the anhedonic depression subscale assessing suicide ideation.

parties. Responses were made on a 5-point scale (1 = *almost never/ never*; 5 = *almost always/always*). Each single item was used in analyses.

2.2.3. Alcohol use

Participants indicated their typical weekly frequency (days/week) and quantity (number drinks/occasion) of alcohol use over the past month. Responses were multiplied to yield a composite reflecting total weekly alcohol use. This is a standard measure in alcohol research (Keough & O'Connor, 2014; Sobell & Sobell, 1990).

2.2.4. Rutger's Alcohol Problem Index

The Rutger's Alcohol Problem Index (RAPI; White & Labouvie, 1989) is a 23-item measure of alcohol-related problems. Participants indicated how often they experienced each problem in the past 6 months. Responses were made on a 5-point scale (0 = *never*; 4 = >8 *times*). Sum scores were calculated. Previous research supports good internal consistency, test–retest reliability, and concurrent validity of the RAPI in undergraduates (Miller, Miller, Verhegge, Linville, & Pumariega, 2002). The present alpha was .90, which is excellent.

2.3. Data analytic overview

Descriptives and correlations were inspected for all variables. Path analysis tested the proposed mediation model from depressive symptoms (predictor) to problematic drinking outcomes (criterion) via drinking contexts (mediators). Model fit was considered good if the comparative fit index (CFI; Bentler, 1990) was >.95, the root mean square error of approximation (RMSEA) was <.08 (Kline, 2011), and the model χ^2/df ratio was <3.0 (Kline, 2011). Covariances were estimated among drinking contexts and among problematic drinking outcomes to control for shared variance. Bias-corrected bootstrapping tested the presence and magnitude (with 95% confidence intervals [*CI*]) of hypothesized indirect effects. Mediation is present if the indirect effect *CI* does not contain zero (Fritz & MacKinnon, 2007).

3. Results

3.1. Data screening

Before analyses, data were screened (Kline, 2009). Some variables (see Table 1) were positively skewed (skew >3; kurtosis >10; Kline, 2009), which often occurs with drinking variables in non-clinical samples (Miller et al., 2002). To correct for non-normality, we used robust maximum likelihood estimation (MLR) to calculate path coefficients and fit indices. MLR and bootstrapping are robust to violations of multivariate normality (Muthén & Muthén, 2012).

Table 1
Descriptive statistics and bivariate correlations.

	1.	2.	3.	4.	5.	6.	7.
1. Depressive symptoms	–	.31[b]	−.06	−.12[a]	−.24[b]	−.04	.15[a]
2. Drinking alone		–	.08	−.04	−.25[b]	.02	.09
3. Drinking with family			–	.12[a]	−.05	−.15[a]	−.13[a]
4. Drinking with partner				–	.09	.01	−.09
5. Drinking at parties					–	.20[b]	.11
6. Alcohol use						–	.35[b]
7. Alcohol-related problems							–
M	51.43	1.28	1.87	2.26	3.04	9.73	9.86
SD	13.61	0.55	0.73	1.34	1.31	6.92	8.41
Skew	3.91	12.94	5.14	5.57	1.14	10.35	10.85
Kurtosis	0.78	8.46	2.53	2.43	−4.57	7.28	8.35

Note. [a] *p* < .05. [b] *p* < .01.

3.2. Descriptive statistics and bivariate correlations

Descriptives and correlations are presented in Table 1. Relative to research in North American undergraduate drinkers, our sample endorsed comparable mean levels of alcohol use (Grant et al., 2009) and mean number of alcohol-related problems (Merrill et al., 2014). Undergraduates in our sample drank most frequently at parties and least frequently alone ($t_{(294)} = 19.69$, $p = .00$). Depressive symptoms were a statistically significant positive correlate of alcohol-related problems, but not alcohol use. Depressive symptoms were also a statistically significant positive correlate of drinking alone, but unexpectedly they were a negative correlate of drinking with family and drinking with a partner. Drinking alone and drinking with a partner were not meaningful correlates of alcohol use and alcohol-related problems, while drinking with family was a statistically significant negative correlate of both drinking outcomes.

3.3. Hypothesis testing

The hypothesized model (see Fig. 1) fit the data well ($\chi^2_{(2)} = 4.95$, $p = .08$, $\chi^2/df = 2.48$, CFI = .98, RMSEA = .07 [90% CI = .00, .15]). Effects from depressive symptoms to drinking contexts and from drinking contexts to problematic drinking represent unique associations after controlling for shared variance. As hypothesized, depressive symptoms was a positive, and statistically significant, predictor of drinking alone. Counter to hypotheses, depressive symptoms were not a statistically significant predictor of drinking with family or with a partner. Interestingly, depressive symptoms were a negative, and statistically significant, predictor of drinking at parties. Partially supporting hypotheses, drinking alone was a positive, and statistically significant, predictor of alcohol-related problems, however, it was unrelated to alcohol use. Drinking with family, but not drinking with a partner, was a negative, and statistically significant, predictor of both alcohol use and alcohol-related problems. Finally, drinking at parties was a positive, and statistically significant, predictor of alcohol use and alcohol-related problems.

Bias-corrected bootstrapped 95% *CI*s were used to test indirect effects. The only hypothesized indirect effect that was supported was from depressive symptoms to alcohol-related problems via drinking alone. Specifically, having elevated depressive symptoms was associated with an increased frequency of drinking alone, which in turn was linked with experiencing an elevated number of alcohol-related problems ($b = .030$, 95% *CI* [.004, .063]). Interestingly, indirect effects from depressive symptoms to both alcohol use and alcohol-related problems, via drinking at parties, were also supported. Specifically, having elevated depressive symptoms was associated with a reduced frequency of drinking at parties, which in turn was linked with decreased alcohol use ($b = −.001$, 95% *CI* [−.002, −.001]) and alcohol-related problems ($b = −.020$, 95% *CI* [−.043, −.004]).

4. Discussion and conclusions

We aimed to clarify the explanatory role of context in depression-related alcohol use. Partially supporting hypotheses, we found that elevated depressive symptoms were associated with relatively more frequent solitary drinking, which in turn was associated with experiencing an increased number of alcohol-related problems, when controlling for level of alcohol use. Unexpectedly, depressive symptoms were unrelated to intimate drinking. Finally, elevated depressive symptoms were associated with a reduced frequency of drinking at parties, and this in turn seemed to align with protection against heavy alcohol use and related problems. Our study points to the role of drinking context in etiological models of depression-related problematic drinking risk.

Our study advances models of depression-related problematic drinking risk. SLT emphasizes the influence of both individual *and* environmental level factors on addictive behavior (Cox & Klinger, 1988; Krank, Wall, Stewart, Wiers, & Goldman, 2005). Yet, extant work on
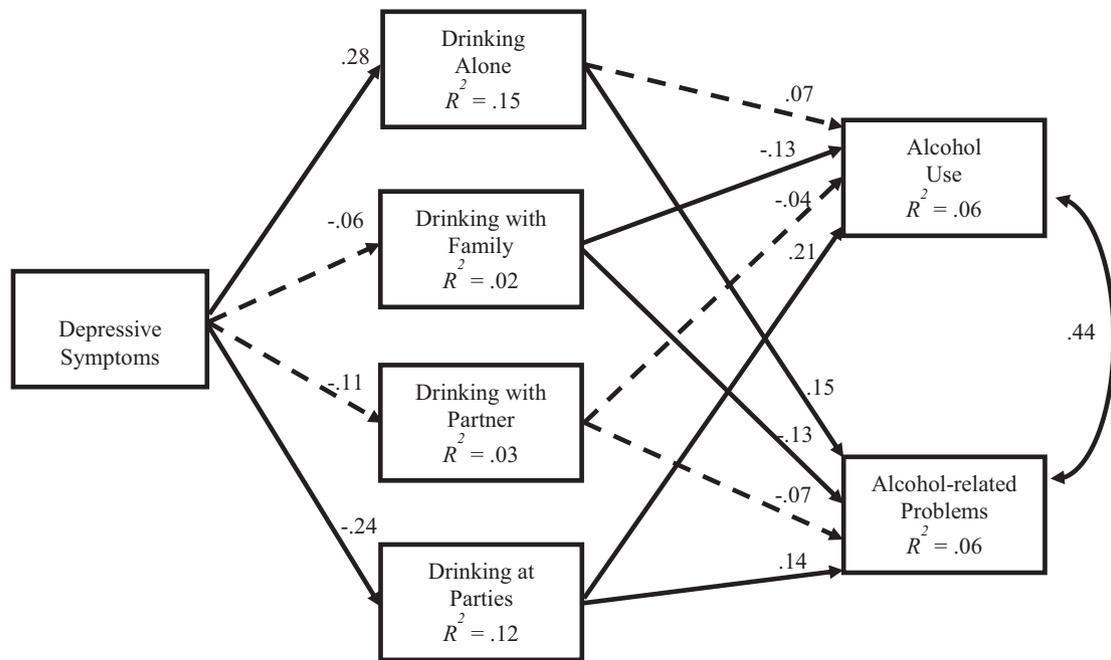
Fig. 1. Path model of depressive symptoms predicting alcohol use and alcohol-related problems as mediated by drinking contexts. Standardized path loadings are presented. Bold lines represent specified paths that were statistically significant ($p < .05$) and broken lines are specified paths that were not statistically significant ($p > .05$). Correlations among drinking contexts were estimated but were omitted from the diagram for clarity.

depression-related drinking in undergraduates has focused, for the most part, on individual risk factors (e.g., Mushquash et al., 2013), thereby largely ignoring context. Theory suggests context is central to clarifying problematic drinking among undergraduates because different contexts are associated with increased or decreased risk (Christiansen et al., 2002). Our study is novel as it builds an integrative model of depression-related drinking—one that considers both individual and contextual factors.

Supporting SLT, we found that the link between depression and problematic drinking was explained by two different drinking contexts. First, we found support for a central *high-risk pathway* via solitary drinking. Consistent with work on self-medication drinking (Kuntsche et al., 2005), solitary drinking explained the overall positive association between depressive symptoms and alcohol-related problems, irrespective of alcohol use. At university events, peers encourage each other to use alcohol heavily (Johnston, O'Malley, & Bachman, 2001). Without social companions to facilitate heavy drinking (Bourgault & Demers, 1997), solitary drinkers may be able to limit their use to some degree, but given their coping reasons for use, they remain at risk for alcohol-related problems. Moreover, there was a lack of association between depressive symptoms and intimate drinking. Possibly, interpersonal conflict may still be an important trigger for alcohol use in those with elevated depressive symptoms, but they may respond by engaging in solitary drinking to hide their use from loved ones. Second, we unexpectedly found evidence of a *low-risk* pathway via decreased drinking at parties among those with elevated depressive symptoms. It is possible that undergraduates with elevated depressive symptoms may attend normative social events less frequently (relative to peers) due to low behavioral activation and this may reduce risky drinking in these social contexts. Also possible is that when students with depressive symptoms are behaviorally activated (i.e., out at a party), their mood is likely to be much better than when they are alone. Accordingly, they may be less motivated to self-medicate with alcohol when at social gatherings; thus reducing their risk in these contexts. It would be an interesting next step to determine if depressive symptoms are related to how much time is spent in party contexts. We argue, however, that despite this nuance, the party context still functions (theoretically) as a

mediator. Our study points to the unique explanatory roles of different drinking contexts on depression-related problematic drinking among undergraduates.

Our study provides insight into context as a key mechanism underlying depression-related drinking. Drinking in non-normative contexts is conceptualized as particularly harmful (Bourgault & Demers, 1997). Solitary drinkers report earlier onset of regular alcohol use, lower motivation to reduce excessive use, and more alcohol-related problems relative to primarily social drinkers (Christiansen et al., 2002; Gonzalez et al., 2009). Also, a recent study by Creswell and colleagues (2013) demonstrated that solitary drinking in adolescence was positively associated with drinking in response to negative emotions broadly and that solitary drinking predicted prospective risk for subclinical levels of alcohol use disorder (AUD) symptoms in young adulthood (age 25). While this study was useful in identifying the factors that promote escalation of problematic drinking among teens, it was somewhat limited because solitary drinking was not tested as a mediator of the association between negative affect drinking in adolescence and symptoms of AUDs in adulthood. This is problematic because it limits our knowledge of context in conceptual models of depression-related drinking. Accordingly, our findings contribute to the literature beyond these existing studies because we demonstrate that solitary drinking may explain the empirically and theoretically supported risky link between elevated depression and problematic drinking. As noted earlier, the mechanisms underlying the depression-related pathway to alcohol use are poorly understood in the literature. Thus, our study fills an important gap. Some existing work (i.e., Creswell et al., 2013) and our study suggest that losing control over drinking (e.g., being unable to limit use to normative social contexts) may serve to solidify the link between depression and AUDs later in adulthood (Abbey et al., 1993). For example, increases in solitary drinking practices as students' transition from university to the working world–a period when the majority of young adults "mature out" of risky alcohol use–may help to explain the escalation of hazardous drinking to clinical levels in those with elevated depressive symptoms. Moving forward, future studies should extend the present work by testing this prediction using longitudinal methods.

Our results have potential clinical implications for interventions aimed at reducing risky drinking among undergraduates. Context is a malleable target for treatments and thus clinicians should provide psychoeducation about the immediate and long-term risks of solitary drinking when working with depressed students. Clinicians should also help boost motivation and self-efficacy for reducing solitary drinking.

Our work has limitations. First, this study is cross-sectional, making it hard to rule out the possibility that the direction of causality is other than specified in our study. For example, depression may lead to problematic drinking which in turn leads to drinking alone or depression may be a common cause of both problematic drinking and drinking context. Future studies should address this by using experimental/longitudinal methods to definitively test solitary drinking as a causal mechanism underlying the depression–alcohol-related problems association. Second, given the gender imbalance in our sample, future studies should replicate our results in a more balanced sample and examine potential gender differences in context-related drinking. Third, we had incomplete data on romantic relationship status due to slight variations in the pre-screening measure administered to approximately half of the participants. Of the 190 participants who completed this item, 82 reported currently being in a romantic relationship. While this is a notable limitation of our study, we observed non-statistically significant correlations in this sub-sample of students (who were in a romantic relationship) between depressive symptoms and intimate drinking ($r = .05$, $p = .66$) and between intimate drinking and alcohol use ($r = .13$, $p = .25$) and problems ($r = -.04$, $p = .71$). Thus, these associations are consistent with the results of the model with the full sample, which did not support mediation. One potential reason that drinking with a partner was not supported as a mediator in our model is we did not examine whether intimate drinking was for positive (e.g., enhancing positive mood) or negative (e.g., coping with interpersonal conflict) reinforcement purposes. Future research should integrate this distinction to better understand the role of intimate drinking in depression-related alcohol use in students who are in romantic relationships. An additional potential limitation is the young age of the sample since most young people drink alcohol in social settings whereas the problem of solitary drinking likely emerges more prominently later in life. Nonetheless, there is utility in examining solitary drinking practices in undergraduates since solitary drinking earlier in the risk trajectory may set the stage for continued solitary drinking and associated risks as they move through life.

In sum, using SLT and a strong foundation of emerging work (Creswell et al., 2013; Gonzalez, 2012), our study is a critical step to building an integrative model of depression-related drinking in students–one that considers the interplay of individual and contextual risk factors. Within this framework, solitary drinking is central to explaining the positive relation between depressive symptoms and alcohol-related problems. Our work underscores the importance of integrating context into etiological risk models of undergraduate drinking.

Contributors

All authors contributed meaningfully to the conceptual model presented in the manuscript. Matthew T. Keough conducted literature searches and wrote the first draft of the manuscript with Dr. O'Connor's constant and significant feedback on all aspects of the paper. Drs. Stewart and Sherry designed the study, collected the data as a part of a larger longitudinal study, and provided significant edits on the entire manuscript. The final manuscript reflects the combined substantial effort of all co-authors and together we declare that we approve of this submission.

Conflict of interest

All authors declare that they have no conflicts of interest.

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