

# Relations between social anxiety and alcohol use problems via depression: The influence of distress tolerance

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## Abstract

It is crucial to investigate factors influencing the relation between social anxiety and alcohol use problems. In separate moderated mediation analyses, we explored whether social anxiety indirectly explained alcohol use problems via depression, and if 1) emotional distress tolerance (self-report) and 2) physical distress tolerance (breath-holding duration) moderated the relation between depression and alcohol use problems. Undergraduates ( $N=208$ , 76.9% women-identified) completed questionnaires and tasks. At low physical distress tolerance, there was a conditional indirect effect of social anxiety on alcohol use problems through depression (effect=.12, 95% CI=.03, .22). At high physical distress tolerance, there was no conditional indirect effect of social anxiety on alcohol use and problems through depression (effect <.001, 95% CI=-.08, .07). Emotional distress tolerance was not a significant moderator. When considering comorbid social anxiety, depression, and alcohol use problems, it is important to consider the role of tolerating physiological discomfort to enhance prevention and intervention efforts for alcohol use problems in undergraduates.

**Keywords:** social anxiety, depression, alcohol, alcohol use problems, distress tolerance, breath-holding duration

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## Introduction

The developmental period of young adulthood is associated with increased risk of hazardous drinking and emerging alcohol problems (Lee et al., 2018). Similarly, social anxiety disorder (SAD) 12-month prevalence is higher in young adults (ages 18-29; 9.1%) compared to other adult cohorts (8.7%, 6.8%, and 3.1% for 30-44-year-olds, 45-59-year-olds, and 60+ years, respectively; Kessler et al., 2007). Compared with other anxiety and mood disorders, SAD uniquely predicts AUD development (Buckner et al., 2008), suggesting that people with SAD may be especially vulnerable to alcohol problems.

Various models on the theoretical basis for co-occurrence of SAD and AUD generally propose that, for people with SAD symptoms, the anxiolytic properties of alcohol negatively reinforce drinking (Morris et al., 2005). These models emphasizing the function of alcohol (reducing unpleasant social and emotional experiences) make sense given findings showing that the link between SAD and AUD symptoms is mediated by coping motives (i.e., drinking to cope with negative emotions; Ham et al., 2009). Further bolstering this idea is the robust finding that SAD is more strongly associated with negative consequences related to use rather than alcohol

consumption. For example, a meta-analysis found that SAD symptoms correlated with lower alcohol use quantity and frequency, but higher alcohol problems (Schry & White, 2013).

### **Social Anxiety, Depression, and Alcohol Use**

One factor potentially impacting the relation between SAD and AUD is depressive symptoms. For example, one meta-analysis showed that social anxiety predicts the onset of major depressive disorder, and vice versa (Jacobson & Newman, 2017). Prospective work suggests that depressive symptoms confer risk for higher alcohol consumption and dependence (Pedrelli et al., 2016). Finally, there is evidence that depression plays an indirect, mechanistic role in the relation between social anxiety and alcohol use problems. In a longitudinal study of undergraduates, drinking to cope with depression mediated the relation between social avoidance and alcohol problems (Collins et al., 2018). Despite prior work on the relations between social anxiety, depression, and alcohol use problems, there is still limited research on factors that may buffer (and could therefore serve as potential targets of intervention) these concurrent relations between social anxiety, depression, and alcohol use problems operating in tandem.

### **Distress Tolerance**

Distress tolerance is the capacity to handle aversive psychological or physiological states (Leyro et al., 2010). It has been measured behaviorally via persistence on challenging physical tasks (referred to here as *physical distress tolerance*) or cognitive tasks (Leyro et al., 2010). One example of physical distress tolerance measurement is assessing breath-holding duration, with longer times indicating higher distress tolerance (e.g.,

Zvolensky et al., 2001). Distress tolerance is also operationalized as a belief in one's ability to handle distressing emotions (referred to as *emotional distress tolerance*) via self-report measures (e.g., Distress Tolerance Scale; Simons & Gaher, 2005).

In prior moderated mediation analyses, panic symptoms explained relations between anxiety sensitivity (fears of anxiety-related sensations) and alcohol use problems for those with lower breath-holding duration (Geyer et al., 2023). Lower distress tolerance has also been linked to higher levels of alcohol-related problems and depression (Buckner et al., 2007). In one study with community members (Gorka et al., 2012), distress tolerance was measured cognitively via persistence on the Computerized Paced Auditory Serial Addition Task. In this study, depressive symptoms were only associated with problematic alcohol use for those with low, but not high, distress tolerance. In another study of individuals in residential substance use treatment using this same task, women with higher depressive symptoms and lower distress tolerance had more substance use problems (Ali et al., 2015). Thus, low ability to tolerate distressing psychophysiological states (e.g., breath-holding duration) may also be an important moderator strengthening the relation between depression and alcohol problems.

### **Current Study Aims**

Despite these noteworthy findings, the relation between depression, distress tolerance, and alcohol-related problems is complex (Khan et al., 2018). For example, different distress tolerance measures (e.g., physical vs. emotional) may relate differently to the same outcomes, potentially speaking to issues of convergent validity and the construct's heterogeneous nature related to the type of distress (e.g., Glassman et al., 2016). Thus, it is critical to understand the

relation between depression, different measures of distress tolerance (physical; emotional), and alcohol outcomes (consumption; problems). Further, given that depression is also a potential mechanism linking SAD and AUD, understanding relations between these four factors concurrently (social anxiety, depression, emotional/physical distress tolerance, and alcohol use) may improve treatment and prevention efforts, especially because distress tolerance may serve as a potential target for future intervention.

This study used secondary data analyses to explore whether 1) the relation between social anxiety and alcohol use consumption/frequency and problems flowed indirectly via depression, and 2) whether distress tolerance (emotional distress tolerance, assessed by self-report, and physical distress tolerance, assessed by a physical breath-holding task) moderated this relation. Thus, this study tested relations between two separate measures of distress tolerance, social anxiety, depression, and alcohol consumption/frequency and/or problems.

## Methods

### Participants

Participants were from an introductory psychology participant pool ( $N=208$ ; mean age=19.0[ $SD=1.90$ ]) at a midsized midwestern university in the United States. Eligibility criteria included English fluency and age of 18 years or older. Data were collected between September-November 2020. Participants reported their race and ethnicities as European American or White (78.4%), South Asian (2.9%), African American or Black (2.9%), East Asian (2.4%), Middle Eastern or North African (1%), Hispanic or Latinx (2.4%), prefer to self-describe (1%), or more than one option

(8.7%); and woman (76.9%) and man (23.1%) for their gender identities.

### Procedures

See Geyer et al. (2022; 2023) for details on the larger online study consisting of self-report and behavioral tasks; measures for current analyses are below. Procedures received IRB approval and commenced following informed consent.

### Measures

#### *Distress Tolerance Scale*

The *Distress Tolerance Scale* assessed emotional distress tolerance (Simons & Gaher, 2005; Cronbach's  $\alpha=.92$ ). This is a 15-item self-report measure; participants indicate how much they agree with statements using a five-point scale ranging from "strongly disagree" to "strongly agree."

#### *Breath-holding Duration*

Participants' self-administered breath-holding duration was used to measure physical distress tolerance (e.g., Zvolensky et al., 2001). Specifically, participants underwent two online breath-holding tests separated by one minute of downtime, with the mean of the two trials used for analyses. During each test, participants were instructed to begin by breathing normally before exhaling and inhaling immediately afterward. Once the participant inhaled completely, breath-holding duration was timed (see Geyer et al., 2022 for procedures;  $r=.80$  across both trials,  $p<.01$ ).

#### *Inventory of Depression and Anxiety Symptoms-II*

The social anxiety (Cronbach's  $\alpha=.86$ ) and depression subscales (Cronbach's  $\alpha=.93$ ), were administered (Watson et al., 2012). Participants were given a list of symptoms (20 for depression; 6 for social

anxiety) and indicated frequency of occurrence in the last two weeks ranging from 1=*not at all* to 5=*extremely*. Scores for social anxiety/depression subscales were calculated separately using the sums of the items from each subscale.

### ***Alcohol Use Disorders Identification Test (AUDIT)***

The AUDIT was used as a continuous outcome measure to determine risky drinking behaviors and the severity of the alcohol use problems (Babor et al., 1989; Cronbach's  $\alpha=.84$ ). The scale has 10 questions measuring alcohol use patterns and others' perceptions of one's use. To examine different alcohol use outcomes, exploratory models were tested examining 1) total AUDIT composite scores (a composite of the ten items combining "alcohol use" and "alcohol use problems"), 2) the total score of the first three items assessing frequency/consumption only ("alcohol use"), and 3) the total score of the next seven items assessing interference only ("alcohol use problems"), similar to prior work (Geyer et al., 2023)

### **Data Analysis Plan**

Exploratory, secondary analyses were conducted (see Geyer et al., 2022 for primary analyses). Bivariate correlations were examined, followed by using PROCESS macro model #14 (Hayes, 2017) for moderated mediation analyses. Six models were run to examine whether social anxiety (IDAS-II Social Anxiety Subscale) indirectly explained alcohol use and/or problems via depression (IDAS-II Depression Subscale), and if distress tolerance moderated the relation between depression and alcohol use and/or problems. The index of moderated mediation was calculated (see Hayes, 2015). This index is a linear estimate of the indirect effect at different levels of the moderator (e.g., at the mean and +/- 1 SD from the mean

of the moderator). 10,000 bootstrap samples were used, with 95% confidence intervals.

The six models differed in distress tolerance measure (physical distress tolerance via breath-holding duration versus emotional distress tolerance via self-report) and alcohol use outcome, as measured by AUDIT Total, AUDIT frequency/consumption only (alcohol use), or AUDIT interference only (alcohol use problems). Across models, social anxiety was the independent variable, and depression was the mediating variable. Thus, the six moderated mediation models included examining *emotional distress tolerance* as a moderator with the outcomes of 1) AUDIT Total Score, 2) AUDIT frequency/consumption, and 3) AUDIT interference (problems); and *physical distress tolerance* as a moderator with the outcomes of 4) AUDIT Total Score, 5) AUDIT frequency/consumption, and 6) AUDIT interference.

According to a sensitivity analysis (via G\*Power), with 80% power ( $\alpha = .05$ ) and four predictors (social anxiety, depression, distress tolerance, and the interaction of depression with distress tolerance), the  $f^2$  effect size to detect a significant effect was .06 ( $R^2 = .06$ ); thus, we had the power to detect main effects and interactions as small as between a small-to-medium effect. Regarding indirect effects, we were likely powered to detect medium effects (Fritz & MacKinnon, 2007).

## **Results**

### **Bivariate Correlations**

Table 1a presents bivariate correlations and descriptive information. AUDIT interference and frequency/consumption items were moderately correlated ( $r=.48$ ,  $p<.001$ ). Breath-holding duration was not significantly correlated ( $p's >.05$ ) with the

**Table 1a***Bivariate correlations and descriptive information*

Variable	1	2	3	4	5	6	7
1. IDAS-II Social Anxiety	-						
2. IDAS-II Depression	.60***	-					
3. Breath-holding Duration	-.01	.02	-				
4. Distress Tolerance Scale	-.31***	-.51***	.11	-			
5. AUDIT Freq/Consume	-.11	-.10	-.04	.06	-		
6. AUDIT Int.	.04	.12	-.05	-.15*	.48***	-	
7. AUDIT Total	-.03	.02	-.06	-.06	.83***	.89***	-
Mean (SD)	12.95 (5.48)	48.13 (15.33)	43.48 (19.80)	3.01 (.83)	3.82 (2.86)	2.17 (3.52)	5.99 (5.49)

*Tables 1a and 1b note:* AUDIT = Alcohol Use Disorders Identification Test; AUDIT Total refers to total AUDIT composite score and includes frequency/consumption and interference items. AUDIT Freq/Consume = AUDIT frequency and consumption items (alcohol consumption). AUDIT Int = AUDIT inference items (alcohol use problems). DV = dependent variable.  $sr^2$  = squared semi-partial correlations. CI = confidence interval for unstandardized beta estimates. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Distress Tolerance Scale ( $r = .11$ ), IDAS-II social anxiety ( $r = -.01$ ), or IDAS-II depression subscales ( $r = .02$ ).

**Emotional Distress Tolerance**

Across all three alcohol-related outcomes assessed (i.e., AUDIT frequency/consumption only, AUDIT interference only, AUDIT total), depressive symptoms did not explain the relation between social anxiety and each alcohol use outcome (use; problems; composite) at either low or high levels of emotional distress tolerance. The index of moderated mediation was not significant for the

frequency/consumption subscale (index = .04, 95% CI = -.02, .10), interference subscale (index = -.02, 95% CI = -.09, .04), nor composite (index = .01, 95% CI = -.01, .13).

**Physical Distress Tolerance*****Alcohol use frequency/consumption***

Depressive symptoms did not explain the relation between social anxiety and alcohol use consumption/frequency items of the AUDIT (index = -.002, 95% CI = -.004, .001).

**Table 1b***Pathways for model with physical distress tolerance and alcohol use problems*

Predictor Variables	<i>b</i> (SE)	95% CI	B	<i>t</i>	sr <sup>2</sup>
<b>DV: IDAS-II Depression</b> (R <sup>2</sup> = .35, F[1, 206] = 112.7, <i>p</i> < .001)					
IDAS-II Social Anxiety	1.67(.16)	1.36, 1.97	.60	10.62***	
<b>DV: AUDIT Int.</b> (R <sup>2</sup> = .04, F[4, 203] = 2.32, <i>p</i> = .06)					
IDAS-II Social Anxiety	-.03(.05)	-.13, .08	-.04	-.49	.001
IDAS-II Depression	.12(.04)	.04, .20	.51	2.87**	.04
Breath-holding Duration	.08(.04)	.001, .16	.45	1.99*	.02
Depression x Breath-holding Duration	-.002(.001)	-.003 -.0003	-.65	-2.35**	.03

***AUDIT Composite and AUDIT Interference***

With both the AUDIT total composite score (index of moderated mediation = -.01, 95% CI = -.009, -.001) and AUDIT interference (alcohol use problems) score, findings were in a similar pattern; thus, presented below are findings for the AUDIT interference.

See Table 1b and Figure 1. Social anxiety was significantly associated with greater depressive symptoms ( $t[206]=10.62$ ,  $p<.001$ ). There was an interaction between depression and physical distress tolerance (i.e., breath-holding duration;  $t[203]=-2.35$ ,  $p=.02$ ) in relation to alcohol use problems (AUDIT interference). Thus, the relations between depression and alcohol interference differed based on breath-holding duration. Specifically, depressive symptoms were associated with greater interference/problems from alcohol use at low ( $t[203]=2.81$ ,  $p=.01$ , 95% CI = .02, .12), but not high ( $t[203]=-0.01$ ,  $p=.9992$ , 95% CI = -.05, .05) levels of breath-holding duration. Finally, there was a statistically significant index of moderated mediation (index = -.003, 95% CI = -.006, -.001). At low levels of breath-holding duration, there was a significant conditional indirect effect of social anxiety on alcohol use problems through depressive symptoms (effect = .12, 95% CI = .03, .22). At high levels

of breath-holding duration, there was not a conditional indirect effect of social anxiety on alcohol interference through depression (effect, <.001, 95% CI = -.08, .07).

**Discussion**

Findings in this sample of undergraduates reveal that for those with lower physical distress tolerance, measured via breath-holding duration, the relation between social anxiety and alcohol use problems flowed through depression symptoms. Findings were consistent with the AUDIT composite (interference and consumption/frequency) and interference only. However, the index of moderated mediation in the model examining breath-holding duration and alcohol frequency/consumption was not significant. Further, the index of moderated mediation was not significant in all three models measuring emotional distress tolerance (via self-report).

Findings are consistent with research that breath-holding duration relates to alcohol use problems (Geyer et al., 2023) and that different distress tolerance measures may not capture the same construct (Glassman et al., 2016). Indeed, it appears that when considering relations between social anxiety, depression, and alcohol use problems, the

ability to handle physiological discomforting sensations is particularly salient. Results are also consistent with literature that the comorbidity between social anxiety and alcohol use problems may be more pertinent than consumption/frequency (Schry & White, 2013), and that there is an interaction between distress tolerance and depressive symptoms in relation to substance use problems (Ali et al., 2015; Gorka et al., 2012). Importantly, to our knowledge, there had not been prior research evaluating multiple forms of distress tolerance with social anxiety, depression, and alcohol use patterns concurrently. Findings suggest a need for future prevention and intervention research specifically targeting breath-holding duration (i.e., capacity to withstand suffocating sensations) when considering

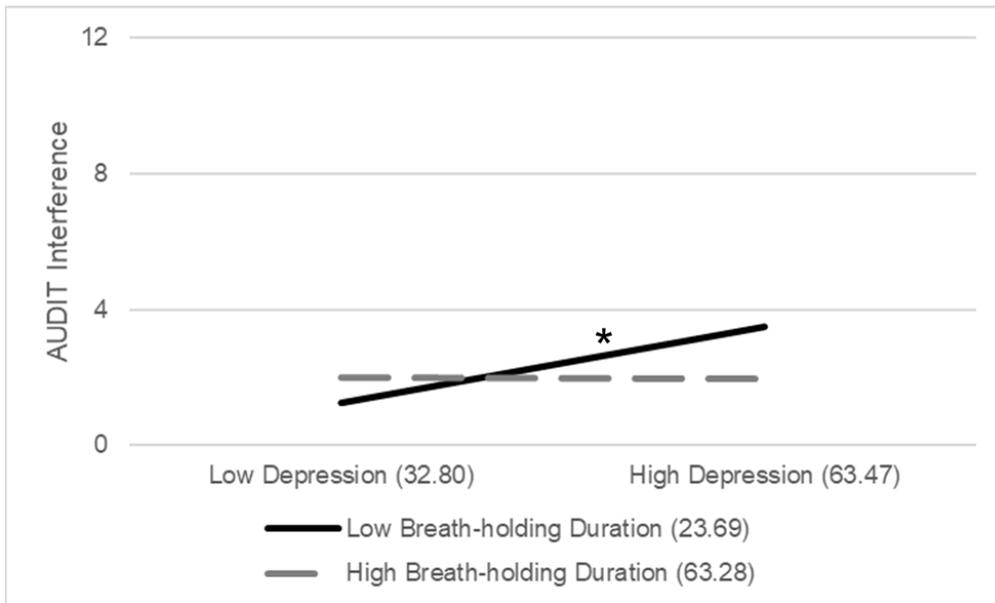
depression’s mechanistic role linking social anxiety and alcohol use problems, as it may serve as a potential buffer for alcohol use problems.

**Limitations**

Using moderated mediation analyses in a cross-sectional study limits causal conclusions (Maxwell & Cole, 2007). It is also possible we were underpowered to detect small effects based upon 1) our sensitivity analysis of the main effects and interactions using G\*power and 2) Fritz & MacKinnon’s (2007) study on sample sizes in mediation analyses. Further, this is a nonclinical undergraduate sample consisting primarily of White women with low-risk levels of alcohol consumption based on

**Figure 1**

*Depression symptoms and breath-holding duration interaction in relation to alcohol use problems (AUDIT Interference)*



*Note:* Scores (high/low) are +1 and -1 Standard Deviation from the mean. AUDIT Interference = alcohol use problems. Low/High depression levels are measured by the IDAS-II depression subscale.

participants' mean score ( $M=5.99$ ) on the AUDIT, which is below the AUDIT "low-risk" cut-off of seven. Research is needed across other samples (demographics; clinical populations). There are limitations of breath-holding duration as a measure of physical distress tolerance. For example, it is possible that other factors that we did not account for, such as smoking cigarettes (Thompson-Lake et al., 2017), physical endurance (Lörinczi et al. 2023), or other indicators of physical health (e.g., cardiovascular; respiratory) may also relate to breath-holding duration, potentially confounding our findings. It is possible that these factors may impact the relation between breath-holding and distress tolerance, depression, social anxiety, or alcohol use.

### **Conclusions and Implications for Health Behavior Research**

Although causation cannot be inferred, findings suggest a number of potential implications for health behavior research. Future work is needed to unpack the overlap between social anxiety and depression as targets for intervention for those with low distress tolerance, including in relation to alcohol use problems. For example, it is possible that depressive symptoms, including loss of interest or pleasure in activities, may relate to increases in negative affect and drive the relation between social anxiety (including avoidance of social interactions) and alcohol use problems. Relatedly, a socio-contextual framework for risk for AUD links drinking in isolation with coping motives (drinking to reduce negative affect; Creswell, 2021). Indeed, a network analyses of SAD and depressive symptoms suggest that worthlessness is one potential bridge symptom between the two (Langer et al., 2019). Our findings suggest that health behavior research should continue exploring specific drivers of the relation between social

anxiety and depression, along with the role of specific depressive symptoms as a mechanism underlying the relation between social anxiety and alcohol use problems.

Our work also highlights the importance of testing interventions targeting physical distress tolerance. There is research that a brief distress tolerance intervention as an adjunctive treatment for those seeking substance use treatment improved distress tolerance, even when controlling for depression (Bornovalova et al., 2012). Likewise, in a study on maladaptive cognitive schemas among college students, distress tolerance moderated relations between defectiveness/shame and alcohol-related problems, such that this relation was greater for those with low distress tolerance (Simons et al., 2018). Interestingly, a study of a brief intervention of Dialectical Behavior Therapy skills training for students (including distress tolerance skills targeting breathing, such as intense exercise and paced breathing) decreased maladaptive coping and improved emotion regulation and adaptive coping patterns (Muhomba et al., 2017). Thus, future work should expand the current study and prior research by longitudinally assessing co-occurring relations between social anxiety, depression, and alcohol use problems in undergraduates, incorporating interventions that specifically target the capacity to withstand difficult physiological sensations.

### **Discussion Questions**

Our results indicate a relation between social anxiety, depression, alcohol use problems, and tolerating physical discomfort. Although our findings cannot suggest a causal relationship between variables, there may indeed be a causal relationship between capacity to tolerate physical discomfort and alcohol problems. Do you think that there

could be this causal relationship, and if so, why?

Do you think that other mental health/behavioral outcomes beyond alcohol use problems, social anxiety, and depression may benefit from someone increasing their distress tolerance? If so, what may they be, and why?

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