Examination of Anxiety Sensitivity and Distress Tolerance as Transdiagnostic Mechanisms Linking Multiple Anxiety Pathologies to Alcohol Use Problems in Adolescents

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Abstract

Background—Multiple forms of anxiety psychopathology are associated with alcohol use problems in adolescents. Yet, the mechanisms underlying this association are unclear. Anxiety sensitivity (AS) and distress tolerance (DT) represent 2 distinct, conceptually relevant transdiagnostic constructs implicated in multiple manifestations of anxiety that may also underlie alcohol use problems and thereby explain why people with anxiety are more likely to have alcohol problems.

Methods—The current cross-sectional study examined whether AS and DT accounted for (i.e., statistically mediated) the relationship between manifest indicators of the 3 common anxiety phenotypes (generalized anxiety, social anxiety, and panic disorders) and alcohol problems in a sample of 534 high school students (14 to 15 years old).

Results—Multiple manifestations of anxiety were associated with greater alcohol use problems. AS statistically mediated multiple anxiety–alcohol associations, but DT did not.

Conclusions—These findings provide preliminary evidence suggesting AS may be an important transdiagnostic target for alcohol prevention programs for those in early adolescence that experience elevated anxiety symptoms.

Keywords

Anxiety; Alcohol Use; Anxiety Sensitivity; Distress Tolerance; Mediation

A number of anxiety disorders are associated with alcohol use problems (e.g., Grant et al., 2004) starting as early as young adolescence (e.g., Zimmermann et al., 2003). Compared to adolescents without these disorders, those with panic disorder (PD) and social anxiety

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disorder are nearly 6 and 4 times more likely to develop alcohol dependence by age 30, respectively (Buckner et al., 2008). Thus, there is a clear need to uncover the mechanisms explaining the relationship between anxiety and alcohol-related problems in adolescence to better understand the etiology of alcohol problems and their comorbidity with anxiety pathology. If the mechanisms linking anxiety and alcohol use problems are malleable individual characteristics that can be targeted in prevention interventions, such research may have beneficial effects in interventions for curbing the development of alcohol use disorders and improving mental health. Furthermore, if common factors that explain the anxiety–alcohol relation are observed across multiple forms of anxiety psychopathology, the results may inform interventions relevant to wide-spanning and symptomatically heterogeneous groups of adolescents with anxiety problems at risk for alcohol use disorders.

We hypothesize that it is not the presence of anxiety symptoms and syndromes in and of themselves that entirely drive risk for alcohol use disorders, but rather, that it is the underlying traits present among those high in anxiety that enhance motivation to seek alcohol for relief. That is, transdiagnostic "reactive vulnerability" traits that reflect maladaptive responses to anxiety-related sensations (rather than anxiety symptoms per se) may be core processes underlying anxiety–alcohol comorbidity. These reactive vulnerabilities putatively underlie multiple forms of anxiety psychopathology by amplifying the maladaptive emotional and cognitive effects of various types of anxiety-related states and motivating avoidance behaviors, thereby maintaining anxiety states (see Barlow, 2004). Transdiagnostic reactive vulnerability traits may promote alcohol use behavior as a manifestation of the maladaptive tendency to execute behaviors aimed at avoiding, reducing, or eliminating anxiety symptoms, irrespective of the quality and severity of manifest anxiety symptoms.

One such transdiagnostic variable that may account for the relationship between anxiety symptoms and alcohol use problems is anxiety sensitivity (AS). AS, sometimes referred to as "fear of fear," is a fairly stable yet malleable trait characterized by the cognitive misappraisal of anxiety symptoms as having harmful or negative consequences. These perceived consequences fall into 3 factors: physical concerns, mental concerns, and social concerns. High-AS individuals perceive anxiety-related sensations as a sign of imminent harm. Consequently, they are likely to respond to anxiety-related experiences and other aversive internal states with elevated levels of anxiety, which in turn, may contribute to more threat-based cognitions and vicious cycles of fear and anxiety. AS plays a key role in the etiology and maintenance of many forms of anxiety psychopathology (Olatunji and Wolitzky-Taylor, 2009; Schmidt et al., 2006). Conceptual models posit that a fear of physical symptoms is most strongly linked to PD; a fear of showing publicly observable signs of anxiety is most strongly linked to social phobia (SP); and a fear of cognitive dyscontrol is most strongly linked to generalized anxiety disorder (GAD; see Olatunji and Wolitzky-Taylor, 2009). Furthermore, reductions in AS have been observed after treatment for anxiety disorders (Arch et al., 2013), and improvement from cognitive behavioral therapy (CBT) for certain anxiety disorders has been shown to be mediated by changes in AS (Smits, et al., 2004).

A significant body of work has also demonstrated that AS is related to alcohol problems (for reviews, see Stewart et al., 1999; Stewart and Kushner, 2001) and greater coping-oriented motives for alcohol use (Stewart et al., 2001). Importantly, AS is incrementally related to coping-related drinking motives, as well as alcohol problems and (risk of) alcohol use disorder, over and above manifest anxiety and negative affect (Howell et al., 2010; Novak et al., 2003; Schmidt et al., 2007), suggesting that AS per se is an important affective mechanism underlying drinking independent of the quality or severity of anxiety symptoms. Indeed, AS may be elevated especially among those who use substances to dampen autonomic arousal (Lejuez et al., 2006), presumably because high-AS individuals are motivated to drink in order to avoid or delimit the experience of anxiety-related sensations that they perceive as personally dangerous. Moreover, brief CBT for high AS has been found to decrease emotional relief alcohol expectancies and problem drinking in young adults (Watt et al., 2006). Research on AS and alcohol problems in adolescents is scant, but the extant literature does suggest that although AS tends to be unrelated to drinking frequency or quantity in adolescence (Castellanos-Ryan et al., 2013; Woicik et al., 2009), it may be related to more severe alcohol problems (Lammers et al., 2013; Woicik et al., 2009). Given that AS is manifested in youths and plays a role in adolescent anxiety (for a review, see Silverman and Weems, 1999), it is possible that AS is an explanatory construct linking anxiety syndromes to alcohol problems in adolescents.

Distress tolerance (DT) is another transdiagnostic construct that may explain why individuals high in anxiety symptoms use alcohol. Although nested conceptually within a broader network of risk and protective processes, DT is theorized to be related to, though conceptually distinct from, other transdiagnostic variables (e.g., avoidant coping, AS, emotion regulation, experiential avoidance; Leyro et al., 2010). DT is defined as (i) the *perceived* capacity to withstand negative emotional and/or other aversive states (e.g., physical discomfort), and (ii) the *behavioral act* of withstanding distressing internal states elicited by some type of stressor (Leyro et al., 2010). Individuals who perceive themselves to be lower in DT tend to report maladaptively responding to distressing states by avoiding distress-eliciting contexts, disapproving of their own ability to handle distress, and becoming cognitively absorbed and behaviorally incapacitated with the experience of distress. Importantly, DT is conceptually distinct from AS in 2 important ways: (i) DT reflects maladaptive reactivity to a broad range aversive experiences (including anxiety, but extending to other types of aversive states, such as sadness), whereas AS is focused on anxiety-related experiences; (ii) DT reflects a wider range of maladaptive reactions (including cognitive reactions, but extending to other types of reactions, such as behavioral), whereas AS is focused on cognitive expectations of negative consequences of anxiety. Factor analytic work further suggests that while DT and AS tap a common higher order construct of maladaptive emotional reactivity, they also reflect empirically distinct lower-order manifestations with unique patterns of correlation with theoretically relevant criterion variables (Bernstein et al., 2009). Hence, DT and AS appear to represent distinct transdiagnostic processes.

DT is implicated in the etiology of several manifestations of anxiety, including panic, general worry, and social anxiety symptoms (Keough et al., 2010; Marshall-Berenz et al.,

2010; Norr et al., 2013), perhaps because individuals with poorer DT do not engage in adaptive coping strategies in response to anxiety and instead execute avoidance behaviors that prevent habituation to anxiety as well as the development of adaptive coping mechanisms. A growing literature also documents a relation between low DT and the motivation to use alcohol to cope with negative affect (Howell et al., 2010; Marshall-Berenz et al., 2011; Vujanovic et al., 2011), which would be expected as a manifestation of the maladaptive response to distress in low-DT individuals. Further, poorer DT has been found to mediate the relation between depressive symptoms and alcohol problems in college students (Buckner et al., 2007). In addition, given recent evidence linking DT to alcohol use and anxiety in adolescents (O'Neil Rodriguez & Kendall, 2014; Winward et al., 2014), it is reasonable to suspect that poor DT may explain the association between multiple forms of adolescent anxiety and alcohol problems.

The current cross-sectional study addresses the question, "If an adolescent has elevated symptoms of anxiety, what is it about that adolescent that makes her/him more likely to have alcohol use problems?" We explored AS and DT as 2 putative transdiagnostic factors linking the association between several types of anxiety pathologies and alcohol problems in a sample of 14- to 15-year-old high school students. To this end, we tested the hypothesis that AS and DT would account for (i.e., statistically mediate) relations between symptom levels of 3 types of anxiety syndromes (i.e., PD, GAD, and SP) and alcohol problem status. By doing so, we hoped to identify "key ingredients" that may underlie affective sources of alcohol use problems among adolescents with various types of anxiety.

MATERIALS AND METHODS

Participants

The current report is a secondary analysis of a subset of data from 9th grade students enrolled in 2 public high schools in the Los Angeles, CA, USA, metropolitan area who were invited to take part in a study of emotion, addiction, and health behaviors. The schools were selected based on their adequate representation of diverse demographic characteristics; 14 and 29% of students in each respective school were eligible for free or reduced price lunch (i.e., parental income is equal to or <185% of the national poverty level). All 807 students not enrolled in special education (e.g., severe learning disabilities) or an English as a second language program were eligible to participate. Of the 689 (85%) eligible students who assented to participate, 585 (82%) provided active written parental consent and attended at least 1 of the 2 days of survey administration. Some students did not complete all questionnaires throughout the entire survey packets due to restrictions in allotted class time available for this study and student absence on 1 of the 2 assessment days. Because the measures analyzed in the current report were distributed in different places within the overall survey packet (some distributed toward the end), 534 (91%) of participating students completed surveys utilized in this report (there were no significant differences in demographics between completers and noncompleters). Participants in the final sample were on average 14.5 years old (SD = 0.54), and 49% were female. They were 23.2% Caucasian, 2.1% African American, 5.8% Asian American, 50.1% Hispanic, 2.5% Native Hawaiian/

Pacific Islander, 0.7% American Indian/ Native American, and 15.7% other or mixed race/ ethnicity.

Measures

Revised Children's Anxiety and Depression Scale—The Revised Children's Anxiety and Depression Scale (RCADS; Chorpita et al., 2005) instructs respondents to rate the frequency of DSM-IV based anxiety and depression symptoms using a 4-point scale from 0 (*never*) to 3 (*always*) (American Psychiatric Association, 1994). The 9-item SP (α = 0.90 in this sample), 6-item GAD (α = 0.87), and 9- item PD (α = 0.87) subscales were included, and mean score per item within each subscale is used for analyses; the prevalence-surpassing clinical threshold scores are reported for descriptive purposes. The RCADS has shown good psychometric properties, including internal consistency and a factor structure consistent with the DSM-IV anxiety disorder diagnoses (Chorpita et al., 2000; de Ross et al., 2002).

Rutgers Alcohol Problem Index—The Rutgers Alcohol Problem Index (RAPI; White and Labouvie, 1989) is a 23-item self-report measure of the frequency and severity of the negative consequences associated with drinking in young populations, which uses a scale from 0 (*never*) to 4 (*10 or more times*). Participants reported on problem frequency within the last 12 months. The RAPI contains objective, behavioral anchors to assess problem drinking, and has satisfactory psychometric properties, including good test–retest reliability and internal consistency (White and Labouvie, 1989; White et al., 1988). There was a non-normal distribution of RAPI sum and count total composite scores in this study (i.e., most adolescents reporting no or minimal alcohol use). Therefore, similar to prior work (Noel et al., 2010; Thombs and Beck, 1994; Watt et al., 2006), we dichotomized the RAPI scores to distinguish "high-consequence drinkers (scores 15)" and "low problem and nondrinkers (scores < 15)".

Childhood Anxiety Sensitivity Index—The Childhood Anxiety Sensitivity Index (CASI; Silverman et al., 1991) measures fears of the negative consequences of anxiety symptoms in children and adolescents. The 18-item scale asks participants to rate how much they agree with statements such as "It scares me when I feel 'shaky'" from 0 (*none*) to 2 (*a lot*); α = 0.85 in this sample. The measure has good psychometric properties, including convergent validity (Rabian et al., 1999; Silverman et al., 1999).

Distress Tolerance Scale—The Distress Tolerance Scale (DTS; Simons and Gaher, 2005) is a 15-item questionnaire that measures an individual's ability to tolerate affective and physical distress. Participants responded to statements regarding distress response (e.g., "I'll do anything to avoid feeling distressed or upset") from *Strongly Disagree* (=5) to *Strongly Agree* (=1). Average score per item was calculated, with higher scores being indicative of higher levels of DT (α = 0.88 in this sample). The DTS has been used in prior work and has shown good psychometric properties (Keough et al., 2010).

Procedures

All procedures were approved by the University of Southern California's Institutional Review Board. Participants whose parents consented to their participation (and who provided assent) were administered a paper-and-pencil survey on-site in the spring of 2013 during 2 in-class 40-minute survey administrations separated by no more than 2 weeks. Measures described above were part of a larger questionnaire battery. Data collectors informed students that their responses would be confidential and not shared with teachers, parents, or school staff.

Statistical Analysis

Preliminary analyses involved reporting descriptive statistics for key variables. Primary analyses were conducted in SPSS 22.0 using the PROCESS macro for mediation (as described in Hayes, 2013). Using bootstrapping methods, PROCESS has the capacity to use both ordinary least squares and logistic regression-based path analytical frameworks to estimate direct and indirect effects in mediator models. The dichotomized RAPI cutoff score was entered as the dependent variable in each primary analysis due to the non normal distribution of RAPI scores, and a parallel set of analyses using the continuous RAPI score as the dependent variable was also conducted. In all analyses, the continuous score of each of the 3 RCADS anxiety subscales (GAD, PD, and SP) were entered individually as the independent variables in separate models. CASI scores and DTS scores were entered as mediators in separate models. To empirically identify potential demographic covariates that could be confounders, gender, ethnicity, and parental education level were entered as predictors in a series of models predicting each RCADS subscale and RAPI. Only gender was significantly associated with the any of these variables and was thus entered as a covariate in all models because of the possibility of gender differences in both psychopathology and alcohol problems confounding any relations. We also conducted a series of follow-up analyses including gender as a moderator of the mediated effect of CASI and DTS to explore whether boys and girls exhibited different patterns of mediation.

The unstandardized parameter estimates (*b*-values), 95% confidence intervals (CIs), and corresponding *p*-values are reported for the total effects of X (RCADS subscales) on Y (RAPI cutoff status), the effect of X (RCADS subscales) on M (CASI or DTS), the effect of M (CASI or DTS) on Y (RAPI cutoff status), the direct effect of X (RCADS subscales) on Y (RAPI cutoff status) after accounting for M (CASI or DTS), and the indirect effect of X (RCADS subscales) on Y (RAPI cutoff status) through M (CASI or DTS) are reported for all analyses. *p*-Values for the indirect ("mediated") effects are derived from the Sobel test.

RESULTS

Table 1 shows the descriptive information for each of the variables included in the models, including intercorrelations among variables. In our sample, 41.7% of participants reported lifetime use of alcohol. Of those reporting lifetime use, past 30 day use was 53.2% no use, 26.6% 1 day, 12.8% 3 to 5 days, 3.7% 6 to 9 days, 2.1% 10 to 14 days, and 1.6% 15 to 19 days. Of those reporting lifetime use, the average drinks per episode was 53.2% none, 22.9%

1 to 2 drinks, 6.9% 3 drinks, 3.7% 4 drinks, 5.3% 5 drinks, 3.7% 6 to 7 drinks, 2.1%, 8 to 9 drinks, and 2.1% 10 or more drinks.

The *M* (SD) of RAPI scores was 6.72 (9.21), and 18.3% of the sample were categorized as high-consequence drinkers (RAPI   15). Based on recommended age and gender normed cutoffs from the RCADS (Chorpita et al., 2000), the proportions of participants who surpassed borderline clinical and full clinical thresholds for each subscale were as follows: GAD (borderline/subclinical or higher: 19%, clinical: 12%), PD (borderline/subclinical: 17%, clinical: 11%), and SP (borderline/subclinical: 16%, clinical: 9%). The distribution of RCADS scores is similar to distributions reported in other school samples (Chorpita et al., 2000).

Does Anxiety Sensitivity Mediate the Association Between Anxiety Symptoms and Alcohol Use Severity?

As shown in Table 2, consistent evidence of mediation via CASI was found for each type of anxiety syndrome. Models adjusting for gender showed that there were significant relations of each RCADS anxiety syndrome subscale (X) to CASI (M) and from CASI (M) to RAPI cutoff status (Y) after adjusting for the respective RCADS subscale (X). A significant total effect from each RCADS subscale (X) to RAPI cutoff status (Y) was also observed for each type of anxiety syndrome. The indirect effect of each RCADS subscale on RAPI cutoff status through CASI scores was significant for each type of anxiety syndrome, indicating that AS mediated the association between all 3 types of symptoms and high-consequence drinking The remaining direct effect of each RCADS subscale (X) to RAPI cutoff status (Y) (after accounting for CASI) remained statistically significant for GAD and PD but dropped below significance for SP. Thus, CASI scores partially mediated the associations of GAD and PD to high-consequence drinking and fully mediated the association between SP and high-consequence drinking). Secondary analyses using the RAPI continuous score as the dependent variable yielded an identical set of findings to those involving the binary RAPI outcome, as shown in Table 2.

Is the Mediating Effect of Anxiety Sensitivity Moderated by Gender?

Significant moderated mediation effects were found in models involving RCADS GAD scores, *b* = −0.09, 95% CIs: −0.24 to −0.01, with the mediating effect of CASI explaining the association between GAD symptoms and RAPI cutoff score being larger among females (*b* = 0.23) than males (*b* = 0.15). Despite the larger effect among females, the indirect effect was statistically significant at both levels of the moderator (95% CIs for females: 0.01 to 0.48 and 95% CIs for males: 0.01 to 0.31). Gender did not moderate the mediating effect of CASI scores in explaining the associations between RAPI cutoff status and either of the other RCADS subscales.

Does Distress Tolerance Mediate the Association Between Anxiety Symptoms and Alcohol Use Severity?

As shown in Table 3, a similar pattern was observed across the 3 analyses of each anxiety pathology type. In all cases, the RCADS subscale was significantly associated with DTS scores and with RAPI cutoff status. However, DTS scores were not associated with RAPI

cutoff status over and above the respective RCADS subscale, and the indirect effects through DTS were not significant for any type of anxiety symptom. As shown in Table 3, the total and direct effects from X to Y only differed slightly in their magnitude for each RCADS subscale, further highlighting the lack of evidence of mediation through DTS. Secondary analyses using the RAPI continuous score produced a similar set of findings. As shown in Table 3, only one difference emerged: although not attaining statistical significance, DTS scores were marginally associated with RAPI scores, and there was evidence of a marginally significant indirect effect of the SP subscale on RAPI scores through DTS.[1]

Is the Mediating Effect of Distress Tolerance Moderated by Gender?

There were no moderating effects of gender on DTS scores as a mediator explaining the relationships between RCADS subscales and RAPI cutoff score (effect sizes ranging from b = 0.01 to 0.05, with all 95%CIs including zero).

DISCUSSION

As expected, the current study found that AS statistically mediated associations between symptoms of 3 anxiety disorders (i.e., PD, GAD, and SP) and problem drinking in adolescents. Patterns of findings were generally similar between males and females, with AS playing a larger role in explaining the relationship between GAD symptoms and alcohol use problems in females (though the mediational effect was observed in males as well). This set of findings is an important advancement from prior work. Indeed, the scant extant research attempting to uncover the mechanisms explaining anxiety–alcohol associations has focused primarily on drinking motives and has focused on one type of anxiety syndrome (e.g., particularly social anxiety; for a review, see Buckner et al., 2013), dedicating relatively little attention to adolescent populations. We advance prior work by identifying a psychopathologic transdiagnostic process, AS, as an explanatory factor underlying the association between a variety of anxiety disorder symptoms and problem drinking in adolescents.

These findings suggest that AS may be a key reason why teens with various types of anxiety pathology are more likely to have drinking problems. We suspect that high-AS individuals use alcohol to dampen physiological arousal associated with panic symptoms that they appraise as harmful. High-AS individuals with GAD symptoms of worry and concentration difficulties may fear the implications of those symptoms and use alcohol to slow and dampen worry processes. High-AS socially anxious adolescents may tend to drink to avoid displaying publically observable anxiety and fit in, which is likely conducive to maladaptive drinking patterns (Comeau et al., 2001; Lammers et al., 2013; Woicik et al., 2009).

One clinical implication of this work is that adolescents who undergo an AS reduction intervention might also have corresponding reductions in drinking. In line with this idea, a previous study found that brief CBT that targeted AS among high-AS high school students

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[1]We also conducted a follow-up set of analyses including CASI and DTS scores simultaneously in multiple mediator models and found no significant effects of mediation, which may have been due to the shared variance between CASI and DTS scores.

resulted in increased alcohol abstinence and decreased drinking problems as well as decreased AS (Conrod et al., 2006). We extend this idea by suggesting that any preventive effects on alcohol use by targeting AS may be relevant to adolescents with a variety of anxiety manifestations, such as GAD, SP, and PD. Future research should more thoroughly examine whether prevention interventions that identify anxious adolescents and target AS (e.g., through interoceptive exposure and psychoeducation to correct misinterpretations of the negative consequences of anxiety) not only prevent anxiety pathology (e.g., Schmidt et al., 2007) but also prevent problematic drinking.

While AS did explain anxiety–alcohol covariance for each of the anxiety syndromes, only the association between social anxiety symptoms and problem drinking was *fully* mediated by AS. Previous work has identified a uniquely strong relationship between social anxiety and alcohol use (Buckner and Schmidt, 2009; Stewart and Conrod, 2008; Wolitzky-Taylor et al., 2012). Given that social anxiety has an earlier age of onset than other anxiety disorders, with most onsets by adolescence (Kessler et al., 2005), social anxiety symptoms that present as early as elementary or middle school may be important to identify for targeted alcohol prevention programs in middle or high school. The current study suggests that interventions aimed at reducing AS in these young adolescents may not only prevent social anxiety disorder onset but could possibly prevent problem drinking. Despite the clear need to prevent problem drinking among adolescents with social anxiety symptoms, AS may not be an immediately obvious target for problem-drinking intervention among those with social anxiety symptoms, given its typical and particularly strong link to PD (see Olatunji & Wolitzky-Taylor, 2009). These findings further highlight the importance of mediational testing to uncover these mechanisms. Indeed, the current study extends the idea that AS is a transdiagnostic psychological construct that may be a relevant target across a variety of anxiety manifestations in reducing or preventing problem drinking.

In contrast with findings involving AS, DT did not account for covariation between anxiety syndromes and alcohol problems in this sample. The discordance of results across AS and DT are likely not explained by differences in reliability across the 2 measures, given that the internal consistency estimates were nearly equivalent in this sample (CASI: $\alpha = 0.85$; DTS: $\alpha = 0.88$). In addition to the lack of evidence for mediation, DT was not bivariately related to problem drinking. This finding contrasts with a recent study that reported poor DT among adolescents displaying heavy episodic drinking (Winward et al., 2014). This discrepancy may be explained by differences in the alcohol construct examined in each study. That is, there may be differences in the influence of DT on heavy episodic drinking compared to problem drinking. Also, participants in that particular study were between 16 and 18 years of age, whereas our sample was 14.5 years old on average; it may be that DT becomes increasingly associated with alcohol problems as individuals approach and enter adulthood, similar to AS (but perhaps in an even more pronounced manner). Concordant with this possibility, some studies have linked DT to alcohol problems in young adult samples (Buckner et al., 2007; Dennhardt and Murphy, 2011; Wray et al., 2012). However, this hypothesis is speculative, and we interpret these null findings with caution, as there is always the possibility that our sample lacked sufficient power to detect effects, particularly those that may have been small in magnitude. Regardless, these findings are suggestive that

AS and DT are distinct constructs that may play unique roles in anxiety-related alcohol problems.

The current study has several limitations. First, although we covaried for gender in all analyses and did not find significant relations between key variables and other demographic characteristics (i.e., ethnicity and parental education level), the correlational nature of the current study leaves open the possibility that an unaccounted for extraneous variable is responsible for the interrelations presented herein. Second, the cross-sectional design employed in the current study does not allow us to infer temporality of associations. Indeed, alcohol withdrawal experiences and other alcohol-related consequences may lead to increases in anxiety symptoms and/or AS over time, which could have accounted for a portion of the relations demonstrated herein. This study paves the way for future longitudinal work, which examines whether AS (or other transdiagnostic processes) explain why teens with a proneness to anxiety (e.g., subclinical anxiety symptoms, parental history of anxiety) go on to develop alcohol problems or demonstrate parallel increases in trajectories of anxiety and alcohol use progression into late adolescence/ early adulthood. Third, only self-report measures were included, which may be influenced by common method variance and inaccurate reporting. Finally, only high school 9th graders were included. It would have been informative to include adolescents with a wider span of ages to shed light on age-related and developmental variability in these findings.

Taken together, the current study supports a transdiagnostic framework, whereby AS may parsimoniously explain why multiple anxiety syndromes tend to be comorbid with alcohol problems. By focusing on a youth sample, we leverage this transdiagnostic framework to inform alcohol prevention programs in early adolescence. Future prospective work is needed to explore the extent to which AS and other trandiagnostic factors account for relations between anxiety and other alcohol use processes (e.g., motives for use, expectancies for use). Such work may be critical for advancing theoretical models and preventive interventions of emotional disturbance and alcohol use among youth.

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Table 1

Descriptive Information for All Variables in the Models and Intercorrelations Among Variables

Variable	Mean (SD)/%	RCADS PD	RCADS SP	CASI	DTS	Pos. RAPI status
RCADS GAD	1.35 (0.70)[a]	0.51***	0.62***	0.49***	0.27***	0.21***
RCADS PD	0.47 (0.53)[a]	–	0.47***	0.53***	0.28***	0.23***
RCADS SP	1.34 (0.73)[a]	–	–	0.58***	0.35***	0.14**
CASI	31.13 (6.75)	–	–	–	0.39***	0.19***
DTS	2.89 (1.02)	–	–	–	–	0.12**
Pos. RAPI status	18.3%	–	–	–	–	–

CASI, Childhood Anxiety Sensitivity Index; DTS, Distress Tolerance Scale; GAD, generalized anxiety disorder; PD, panic disorder; Pos. RAPI status, positive RAPI status indicating problem drinking; RAPI, Rutgers Alcohol Problem Index; RCADS, Revised Children's Anxiety and Depression Scale; SP, social phobia.

[a]Based on average score per item within each scale.

**
$p < 0.01$,

***
$p < 0.001$.

Table 2

Interrelations Among Anxiety Disorder Symptoms, Anxiety Sensitivity, and High-Consequence Drinking

Outcome variable	Predictor variable		Mediation RCADS subscale → CASI → RAPI	
	RCADS subscale[a] b (95% CIs)	CASI[b] b (95% CIs)	Indirect effect b (95% CIs)	Remaining direct effect b (95% CIs)
Models using generalized anxiety disorder symptoms subscale				
CASI	4.00 (3.28 to 4.72)***	–		–
RAPI cutoff status	0.75 (0.41 to 1.09)***	0.05 (0.01 to 0.09)*	0.19 (0.01 to 0.38)*	0.57 (0.19 to 0.95)**
Models using panic disorder symptoms subscale				
CASI	5.84 (4.93 to 6.76)***	–	–	–
RAPI cutoff status	0.88 (0.48 to 1.28)***	0.05 (0.003 to 0.09)*	0.28 (0.02 to 0.58)*	0.62 (0.15 to 1.08)**
Models using social phobia symptoms subscale				
CASI	4.50 (3.83 to 5.17)***	–		
RAPI cutoff status	0.47 (0.14 to 0.80)**	0.07 (0.03 to 0.11)**	0.31 (0.10 to 0.54)**	0.17 (30.21 to 0.56)
Models using generalized anxiety disorder symptoms subscale				
CASI	4.00 (3.28 to 4.72)***	–		–
RAPI continuous	2.62 (1.41 to 3.81)***	0.24 (0.10 to 0.39)*	0.97 (0.31 to 1.79)**	1.65 (0.32 to 2.98)*
Models using panic disorder symptoms subscale				
CASI	5.84 (4.93 to 6.76)***	–	–	–
RAPI continuous	4.55 (2.99 to 6.12)***	0.18 (0.03 to 0.34)*	1.07 (0.16 to 2.14)*	3.49 (1.69 to 5.28)***
Models using social phobia symptoms subscale				
CASI	4.50 (3.83 to 5.17)***	–		
RAPI continuous	1.65 (0.46 ot 2.84)**	0.33 (0.17 to 0.48)***	1.48 (0.71 to 2.41)***	0.18 (31.19 to 1.54)

CASI, Childhood Anxiety Sensitivity Index; RAPI, Rutgers Alcohol Problem Index; RCADS, Revised Children's Anxiety and Depression Scale.

[a] Coefficients reflect main effects of respective RCADS subscale on CASI and the total effect (i.e., combined indirect and direct) of the RCADS subscale on RAPI status.

[b] Coefficients for CASI predicting RAPI cutoff score vary by analysis because they are adjusting for variance explained by the RCADS subscale in each analysis (i.e., the RCADS subscale relevant for each analysis is included in the model with CASI predicting RAPI cutoff and its variance is thus accounted for). Note that we include the continuous RAPI scores as dependent variables as a secondary way of presenting the data. These data were highly skewed and thus are reported only to show robustness across methods of analysis and should be interpreted with caution.

*$p < 0.05$,

**$p < 0.01$,

***$p < 0.001$.

Ns range from 522 to 534 due to different patterns of missing data across the RCADS subscales. All analyses included gender as a covariate.

Table 3

Interrelations Among Anxiety Disorder Symptoms, Distress Tolerance, and High-Consequence Drinking

Outcome variable	Predictor variable		Mediation RCADS subscale → DTS → RAPI	
	RCADS subscale[a] *b* (95% CIs)	DTS[b] *b* (95% CIs)	Indirect effect *b* (95% CIs)	Remaining direct effect *b* (95% CIs)
Models using generalized anxiety disorder symptoms subscale				
DTS	0.38 (0.24 to 0.51)***	–	–	–
RAPI cutoff status	0.74 (0.40 to 1.09)***	0.15 (30.09 to 0.39)	0.06 (30.03 to 0.17)	0.69 (0.34 to 1.05)***
Models using panic disorder symptoms subscale				
DTS	0.52 (0.34 to 0.69)***	–	–	–
RAPI cutoff status	0.88 (0.48 to 1.29)***	0.14 (30.10 to 0.38)	0.07 (30.05 to 0.21)	0.82 (0.40 to 1.24)***
Models using social phobia symptoms subscale				
DTS	0.47 (0.34 to 0.60)***	–		
RAPI cutoff status	0.46 (0.12 to 0.80)**	0.19 (30.05 to 0.43)	0.09 (30.02 to 0.22)	0.38 (0.03 to 0.73)*
Models using generalized anxiety disorder symptoms subscale				
DTS	0.38 (0.24 to 0.51)***	–	–	–
RAPI continuous	2.56 (1.32 to 3.80)***	0.70 (30.12 to 1.53)	0.27 (30.02 to 0.64)	2.30 (1.03 to 3.57)***
Models using panic disorder symptoms subscale				
DTS	0.52 (0.34 to 0.69)***	–	–	–
RAPI continuous	4.56 (2.96 to 6.16)***	0.51 (30.31 to 1.34)	0.26 (30.13 to 0.74)	4.29 (2.64 to 5.95)***
Models using social phobia symptoms subscale				
DTS	0.47 (0.34 to 0.60)***	–		
RAPI continuous	1.60 (0.38 to 2.82)*	0.85 (30.01 to 1.71)[t]	0.40 (0.04 to 0.85)[t]	1.20 (30.08 to 2.48)[t]

DT, distress tolerance; DTS, Distress Tolerance Scale; RAPI, Rutgers Alcohol Problem Index; RCADS, Revised Children's Anxiety and Depression Scale.

[a] Coefficients reflect main effects of respective RCADS subscale on DTS and the total effect (i.e., combined indirect and direct) of the RCADS subscale on RAPI status.

[b] Coefficients for DT predicting RAPI cutoff score vary by analysis because they are accounting for variance explained by the RCADS subscale in each analysis (i.e., the RCADS subscale relevant for each analysis is included in the model with DT predicting RAPI cutoff and its variance is thus accounted for). Note that we include the continuous RAPI scores as dependent variables as a secondary way of presenting the data. These data were highly skewed and thus are reported only to show robustness across methods of analysis and should be interpreted with caution.

*
$p < 0.05$,

**
$p < 0.01$,

***
$p < 0.001$,

[t]
$p \ 0.07$.

*N*s range from 522 to 534 due to different patterns of missing data across the RCADS subscales. All analyses included gender as a covariate.