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Desire to drink as a function of laboratory-induced social stress among adolescents

Heidemarie Blumenthal[*], **Renee M. Cloutier**[1], **Megan E. Douglas**[2], **Nathan T. Kearns**[3], **Caitlyn N. Carey**

Department of Psychology, University of North Texas, 1155 Union Circle #311280, Denton, TX, 76203, United States

Abstract

Background and objectives: Research consistently demonstrates a link between social anxiety and alcohol-related problems; however, the majority of work has been retrospective, and conducted with adults. Despite an extensive literature highlighting coping-related motives as an underlying mechanism, real-time work presents mixed findings, and no published research has examined an adolescent sample using experimental psychopathology techniques.

Methods: The current study tested whether (1) history of social anxiety symptoms positively correlated with alcohol-related cognitions following laboratory-induced social stress, (2) state anxiety was positively correlated with alcohol-related cognitions, and (3) whether the nature of the stressor (performance versus rejection) impacted the strength of identified relations, in a sample of community-recruited adolescents reporting recent alcohol use. Participants (n = 114; M_{age} = 16.01; 64% girls) were randomly assigned to either a performance- or rejection-oriented task.

Results: Findings indicated that history of social anxiety symptoms was positively correlated with state anxiety elicited by both tasks. Further, history of social anxiety symptoms was not related to change in desire to drink, but was positively related to the belief that alcohol 'would make me feel better.' State anxiety was positively related to both desire to drink and relief outcome expectancies across both tasks. Finally, the nature of the task did not moderate responding.

Limitations: Single site, community sampling confines interpretations, and the tasks did not fully perform as expected.

[*]Corresponding author : heidemarie.blumenthal@unt.edu (H. Blumenthal).

[1]Dr. Cloutier is now at PAMT, Penn State University, 423 Health & Human Development Building, University Park, PA 16802

[2]Dr. Douglas is now at Baylor Scott & White Institute for Rehabilitation, 909 N. Washington, Dallas, TX 75246.

[3]Dr. Kearns is now at the Center for Alcohol and Addiction Studies, Brown University School of Public Health, 121 South Main Street, Providence, RI

CRediT authorship contribution statement

Heidemarie Blumenthal: Conceptualization, Methodology, Formal analysis, Writing - original draft, Supervision. **Renee M. Cloutier:** Methodology, Software, Investigation, Data curation, Writing - original draft, Project administration. **Megan E. Douglas:** Methodology, Investigation, Writing - original draft, Project administration. **Nathan T. Kearns:** Formal analysis, Data curation, Visualization, Writing - review & editing. **Caitlyn N. Carey:** Data curation, Visualization, Writing - review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jbtep.2020.101617.

Conclusions: Further study is needed; however, the current findings support the contention that socially-oriented distress may be a developmentally-relevant, malleable target for prevention efforts aimed at problematic alcohol use among adolescents.

Keywords

Social anxiety; Alcohol use; Adolescence; Social stress; Rejection

1. Introduction

Social anxiety and alcohol use problems commonly co-occur (Morris, Stewart, & Ham, 2005; Schry & White, 2013). Research consistently demonstrates a positive association between problematic social anxiety and alcohol use (e.g., alcohol use disorder [AUD] status) in work conducted with nationally-representative and clinical adult (Kushner et al., 2005; Schnier et al., 2010), large-scale emerging adult (Ham, Bonin, & Hope, 2007; Lewis & O'Neill, 2000; Stewart, Morris, Mellings, & Komar, 2006), as well as adolescent (Conway, Swendsen, He, & Merikangas, 2016) samples. Drawing on early tension-reduction and self-medication models (Khantzian, 1985), contemporary biopsychosocial approaches highlight problematic alcohol use as a learned behavior arising from efforts to manage affective states central to social anxiety dysfunction (e.g., distress in social situations; Buckner, Heimberg, Ecker, & Vinci, 2013). Retrospective and prospective self-report work supports this contention, finding a positive relation between social anxiety symptoms and coping-related alcohol use motives (Lewis et al., 2008; Windle & Windle, 2012). For instance, among adults meeting criteria for both social anxiety disorder and AUD, drinking to cope with anticipated and/or concurrent social anxiety accounts for a large proportion of drinking activity (Cooper, Hildebrandt, & Gerlach, 2014; Thomas, Randall, Book, & Randall, 2008). Further, both Buckner and Heimberg (2010) and Cludius, Stevens, Bantin, Gerlach, and Hermann (2013) found that social anxiety among college students was positively associated with drinking to cope with social anxiety, which in turn correlated with problematic consumption; coping motives statistically mediated the social anxiety-alcohol use relation. Finally, the few studies conducted with adolescents also support specificity in the relation between social anxiety and coping-related drinking motives (Blumenthal, Ham, Cloutier, Bacon, & Douglas, 2016; Blumenthal, Leen-Feldner, Frala, Badour, & Ham, 2010). For example, in a large, school-based study, Windle and Windle (2012) found that social anxiety during high school prospectively predicted coping (but not social or enhancement) motives for alcohol consumption in young adulthood. With a few exceptions (cf. Tomlinson & Brown, 2012), this body of work underscores escaping and/or avoiding social stress as central to understanding the link between social anxiety and alcohol use problems. However, the majority of this research relies on retrospective self-report, and has been conducted almost exclusively with adult samples.

Research including real-time affect induction can help limit concerns related to memory and reporting biases, allow researchers to finely control and assess the influence of multiple, potentially competing influences, as well as address pre-clinical risk and thus speak to etiology and progression while restricting potential confounds related to clinical expression (Nisbett & Ross, 1980; Zvolensky, Lejuez, Stuart, & Curtin, 2001). Although legal and

ethical constraints preclude the use of alcohol administration procedures with adolescent samples, assessment of alcohol-related cognitions (e.g., desire to drink) can serve as a robust proxy for behavioral outcomes (e.g., Ramirez & Miranda, 2014; Roefgs et al., 2011; Rosenberg, 2009). Further, a rich literature supports the safe and effective use of social anxiety induction among adults and adolescents, the majority of which can be categorized as eliciting either performance-oriented (e.g., Trier Social Stress Test; Kirschbaum, Pirke, & Hellhammer, 1993; Buske-Kirschbaum et al., 1997) or interpersonal and/or rejection-oriented distress (e.g., Cyberball; Williams, Cheung, & Choi, 2000; Sebastian, Viding, Williams, & Blakemore, 2010). In support of current coping-focused models, some studies conducted with adults report that socially anxious individuals drink more in response to a speech task as compared to a neutral reading task (Abrams, Kushner, Medina, & Voight, 2002), as well as experience attenuated responding when alcohol is consumed prior to a performance stressor (Stevens, Cludius, Bantin, Hermann, & Gerlach, 2014). However, the published literature is mixed, with other work using speech-based stressors reporting null or contrasting results (Battista, Stewart, & Ham, 2010).

Of note, retrospective work indicates that socially anxious adults often drink in unpleasant interaction situations. For example, Buckner, Eggleston, and Schmidt (2006) found that social anxiety among young adults was positively related to drinking in situations that include interpersonal conflict (e.g., feeling unfairly treated) and negative emotions (e.g., lonely), and that this context-specific drinking partially accounted for the social anxiety-alcohol use problems link. Related findings observed in individuals meeting criteria for social anxiety disorder suggest that interpersonal stress, including fearing/enduring rejection, represents an important stimulus that can elicit alcohol use among socially anxious adults (Thomas, Randall, & Carrigan, 2003). Laboratory work conducted with a sample of male college students found that participants consumed more alcohol in the context of an unsociable/rejecting confederate as opposed to one who was openly social and engaging (Collins, Parls, & Marlatt., 1985). Further, more targeted work found that socially anxious students consumed more unhealthy food following rejection versus inclusion (Oaten, Williams, Jones, & Zadro, 2008). Given preliminary data indicating that socially anxious adults may be more apt to use alcohol to manage distress elicited by social interactions rather than performance situations, and that the majority of the laboratory-based work has used performance-oriented procedures (e.g., speech), interaction- and/or rejection-based assessments may aid in clarifying discrepancies in this literature (Battista et al., 2010).

Finally, adolescence is a developmental epoch during which social stress, and rejection in particular, may play a key role in enhancing social anxiety and related risk for problematic alcohol use (Hawes et al., 2012; Stroud, Salovey, & Epel, 2002). Given the saliency of the social context (Prinstein & La Greca, 2002), social evaluation (“imaginary” audience), sense of isolation (personal fable; Schwartz, Maynard, & Uzelac, 2008), and sensitivity of pertinent neuroendocrine axes (e.g., HPA-axis; Stroud et al., 2009) that characterize this period, social stress may be an especially potent stimulus among youth, particularly among those struggling with social anxiety. Research indicates a normative rise in social anxiety across adolescence (La Greca & Ranta, 2015), and social anxiety disorder is the second-most prevalent anxiety disorder among youth (~9%; Kessler, Pettkhova, Sampson, Zaslavsky, & Wittchen, 2012). Further, although underage drinking often reflects normative

experimentation related to this developmental period, it is nonetheless positively correlated with problematic use in adulthood (Wittchen et al., 2008), and youth progress more rapidly from initial use to substance-related problems as compared to adults (Deas, Riggs, Langenbucher, Goldman, & Brown, 2000). Given the social nature of youth drinking contexts (e.g., parties; Anderson & Brown, 2010), learning to use alcohol in an effort to reduce socially-oriented negative affect may be especially problematic, and result in the telescoping effect observed among socially anxious youth (i.e. more rapid transition to AUD; Behrendt et al., 2011). Although compelling, extant work has yet to include laboratory tests of the link between *adolescent* social anxiety and alcohol use, and the relative influence of social stress generally, versus rejection-oriented distress specifically, has not yet been examined.

With this backdrop, the current study tested whether (1) history of social anxiety symptoms positively correlated with changes in alcohol-related cognitions (e.g., desire to drink) following laboratory-induced social stress, (2) state anxiety elicited by laboratory-induced social stress was positively correlated with alcohol-related cognitions, and (3) whether the nature of the stressor (i.e. performance versus rejection) impacted the strength of identified relations, in a sample of community-recruited adolescents with recent alcohol use history. It was expected that both history of social anxiety symptoms and state anxiety would positively relate to the desire to drink as well as relief expectancies about drinking (i.e., alcohol would make me 'feel better'), and that these relations would be strongest among those completing the rejection task as compared to the performance task.

2. Method

2.1. Participants

The final sample was 114 adolescents (M_{age} = 16.01, SD = 0.95; 64% girls) recruited from the community to take part in a laboratory-based study on emotions and behavior. Inclusionary criteria were (1) age 14–17, (2) consumption of at least one standard alcoholic beverage within the past year, and (3) ability to provide written, informed assent and parent/guardian consent. Individuals also were excluded from task engagement given evidence of potential AUD. In total, 849 individuals contacted the laboratory; 163 individuals who left a message were unable to be re-contacted for screening, and 162 indicated a lack of interest/time following provision of study information. Of the 524 adolescents who completed the telephone screening, 181 met eligibility criteria, 139 of whom attended the laboratory appointment. Participants were re-screened at the laboratory, after which 13 were excluded for possible AUD, 10 for never having consumed a full alcoholic beverage, 1 for most recent consumption greater than one year prior, and 1 due to technical issues (responses not recorded by software). The ethnic/racial composition of the final sample was as follows (each assessed separately/not exclusive): 21.1% Hispanic/Latinx, 75.4% White, 12.3% Black/African American, 7% Asian, 2.6% American Indian/Alaskan native, 0.9% Hawaiian/Other Pacific Islander, 8.8% Other. Finally, 27.2% reported seeing a mental health professional in their lifetime, and 10.5% reported currently being in therapy. Please see Table 1 for additional sample data.

2.2. Measures

2.2.1. Eligibility screening—Interested adolescents first completed a brief telephone screening. Pertinent items from the Youth Risk Behavior Survey (e.g., "[Other than for religious purposes], have you ever had an alcoholic drink; " CDC, 2006) followed by targeted probing (i.e., if alcohol use was endorsed "I'm now going to list the past twelve months; please say yes or no whether you think you drank at least one alcoholic beverage during that month; " "Was it a full alcoholic beverage (or just a few sips)?") were used to screen for recent alcohol consumption. Potential AUD was assessed via the Anxiety Disorders Interview Schedule for DSM-IV-Child Version screening (ADIS; Silverman & Albano, 1996; AUD module includes "have you ever been in serious trouble with school, parents, or police because of your alcohol use?") and follow-up probing. During the laboratory visit, a *Timeline Follow-Back* interview (Chung, Maisto, Cornelius, & Martin, 2004; Sobell & Sobell, 1996; Winters, 2003) was used to confirm recent alcohol use, and the *Alcohol Use Disorders Identification Test* interview (AUDIT; Saunders, Aasland, Babor, De la Fuente, & Grant, 1993) was used to identify participants at risk for an AUD. Consistent with World Health Organization guidelines, a score of 10 was used as a conservative cutoff for AUD risk (Babor, Higgins-Biddle, Saunders, Monteiro, & WHO, 2001).

2.2.2. History of social anxiety symptoms—The Revised Child Anxiety and Depression Scale-Social Phobia subscale (RCADS-SP; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000) assessed history of social anxiety symptoms. Participants rated nine items (e.g., "I feel afraid that I will make a fool of myself in front of people") on a four-point scale (0 = Never to 3 = Always), identifying how often each statement reflects how they characteristically feel. Items were then summed to yield a total score. The widely-used RCADS evidences reliable psychometrics across both clinical and community samples, including test-retest reliability and internal consistency (e.g., subscale α = .86 in the present sample; Chorpita et al., 2000, Chorpita, Moffitt, & Gray, 2005; Mathyssek et al., 2013).

2.2.3. Social stress tasks—Participants were randomly assigned to complete either a performance- (modified Trier Social Stress Task) or rejection-based (Cyberball) social stress task.

2.2.3.1. Performance.: A modified version of the Trier Social Stress Task (TSST-M; Yim, Quas, Cahill, & Hayakawa, 2010) was the performance-based stressor. Specifically, participants were instructed to pretend that they were a new student giving a 5-min speech to their class, with the goal of convincing their classmates that they will like them and the participant will be a good student. Participants were given 3 min to prepare, in which they had to name at least one good and one bad thing about themselves, and they could not use any prepared notes during the speech itself. Participants were then informed that researchers would be observing and assessing their speech using video equipment while in the other room. The participants were left alone for a 3-min period to privately prepare their speech. Next, a research assistant re-entered the room, directed the participant to stand, look directly into the camera, and begin once the researcher left the room and said 'Go'. Participants spoke without restrictions; however, if the participant stopped their speech for more than 10 s a researcher would remind them to resume speaking. If the participant stopped speaking

after several prompts, the researcher would ask pertinent open-ended questions about their speech. Variants of the TSST are the most commonly employed laboratory tasks in work examining human psychosocial stress (Kudielka, Hellhammer, & Kirschbaum, 2007), with evidence consistently supporting efficacy in the elicitation of subjective (e.g., self-reported anxiety) and physiological (e.g., elevated cortisol) stress responses (Kirshbaum, Pirke, & Hellhammer, 1993; Yim et al., 2010).

2.2.3.2. Rejection.: Cyberball (Williams et al., 2000) was the rejection-oriented stressor. Cyberball is presented to the participant as an online ball-tossing game to be played in real-time with two other participants, with the purpose of examining 'mental visualization ability.' Players are represented on the computer screen by cartoon drawings above randomly generated ID numbers, with the participant's character (above the word 'You') always located at the bottom center. They can choose to throw the ball to the players on either their left or right by clicking on the player. The game is preprogrammed so that the 'other players' include (i.e., toss the ball to the participant at a 0.33 ratio), then exclude the participant (i.e., toss the ball to each other, but not the participant after the first eight throws). Although the focus was on the exclusion section of the task, starting the game by including the participant has been shown to facilitate task engagement and enhance the negative experience of exclusion (e.g., Gutz, Kupper, Renneberg, & Niedeggen, 2011). This widely-used task consistently evidences success in eliciting rejection and social isolation (Masten et al., 2009; Sebastian et al., 2010).

To further facilitate engagement/believability in the task, participants were asked to select a random ID number that would 'only be visible to the other players,' structurally matching the numbers seen below the figures from the participants' view. The research assistant wrote this down to 'enter in the program on the other computer'. After the initial instructions, the research assistants staged an incoming phone call, ostensibly with an experimenter from another laboratory. In this conversation (overheard by the participant, from the other room), the research assistant informed the other experimenters that the participant was ready to begin the experiment and inquired as to whether the other (fictitious) participants were ready to commence.

2.2.4. State affect/cognitions—A *Subjective Units of Distress Scale* (SUDS; e.g., Milosevic & McCabe, 2015; Wolpe, 1958) was used to assess state anxiety, desire to drink, and relief expectancies related to drinking. Using a 9-point Likert-type scale from Not at All (0) to Extremely (8), participants were asked to identify how much each of the following items reflected how they *currently* felt: 'Anxious', 'I would like a drink now (alcohol)', and 'An alcoholic drink would make me feel better'. This randomly ordered series of single item assessments was completed prior to task assignment (baseline) and immediately following task completion (post-task).

2.3. Procedure

All procedures were approved by the University IRB prior to recruitment launch. Participants were recruited from the community via flyers posted at locations frequented by adolescents (e.g., coffee shops), information tables at local events (e.g., holiday/musical

events), and social media ads. All advertisements directed parents and adolescents to call the laboratory for further information. Adolescents and guardians who contacted the laboratory were informed about study procedures, and adolescents completed the initial telephone screening. Eligible adolescents were invited to the laboratory, at which time written guardian consent and child assent were obtained. Adolescents then completed a 60-min questionnaire battery (randomly presented to limit order effects), 20-min interviews (TLFB, AUDIT), and were randomly assigned to complete either the performance (TSST-M) or rejection (Cyberball) task. At the end of the laboratory visit, adolescents were thanked, debriefed, and compensated $30 for their time.

2.4. Analytic approach

Across items, missingness ranged from 0.0 to 4.4% (available *n*'s range 109–114); because Little's MCAR test supported that data were likely to be Missing Completely at Random ($p = .818$) and percent missingness fell below accepted thresholds (e.g., 8–10%; Widaman, 2006), a complete cases approach was taken for all analyses. Preliminary analyses included sample demographics and bivariate correlations among all continuous variables. The effectiveness of random assignment to task was examined through series of chi-squared (i.e. reported gender) and independent samples t-tests (e.g., age, baseline state anxiety). Next, manipulation checks included analyses of covariance testing whether state anxiety increased across both tasks (i.e. baseline state anxiety included as a covariate), as well as regression analyses addressing the relation between history of social anxiety symptoms (i.e. RCADS-SP scores in step two) and state anxiety elicited by each task (i.e. post-task state anxiety with baseline state anxiety in step one).

All predictor variables were mean centered, and task assignment (1 = Speech, 2 = Cyberball) was multiplied by RCADS-SP scores as well as post-task state anxiety to create separate interaction terms for the respective analyses. Primary analyses were four hierarchical linear regressions. First, the relation between history of social anxiety symptoms and the state drinking indices were tested via two models including baseline desire to drink/relief outcome expectancy (i.e., 'An alcoholic drink would make me feel better'), respectively, in step 1, RCADS-SP total scores and task assignment in step 2, the interaction term in step 3, and post-task desire to drink/relief outcome expectancy (respectively) as the outcome. Next, relations with state anxiety elicited by the tasks was tested using two similarly structured regressions, with baseline state anxiety included with either baseline desire to drink/relief outcome expectancy in step 1, and post-task state anxiety included in step 2 and the step 3 interaction terms rather than RCADS-SP. In addition to overall step change and statistical significance at the individual variable level, squared semi-partial correlations (sr^2) were examined to determine unique variance accounted for by each variable.

3. Results

3.1. Preliminary analyses

Participants completing the speech ($n = 58$) and rejection ($n = 56$) tasks did not significantly differ in terms of reported gender ($p = .468$), age ($p = .278$), most recent consumption ($p = .777$), RCADS social anxiety ($p = .843$), baseline state anxiety ($p = .334$), desire to drink

(p = .693), or relief expectancies (p = .908). As seen in Table 2, both RCADS-SP and post-task state anxiety were positively correlated with post-task desire to drink (ps = .026, <0.001 respectively) and belief that alcohol would make them feel better (ps = .041, .003). Across the sample, state anxiety significantly increased among participants completing the speech task ($M_{Baseline}$ = 3.91, SD = 2.42; M_{Post} = 5.16, SD = 2.57; p < .001), but state anxiety unexpectedly decreased among those completing the rejection task ($M_{Baseline}$ = 4.46, SD = 2.24; M_{Post} = 3.87, SD = 2.28; p = .016). However, hierarchical regression analyses indicated that anxiety elicited by the tasks was positively associated with RCADS-SP in both the speech (baseline state anxiety sr^2 = .42, p < .001; RCADS sr^2 = .04, p = .038) and rejection (baseline state anxiety sr^2 = .52, p < .001; RCADS sr^2 = .05, p = .018) tasks.

Additional exploratory analyses using groups derived from an RCADS median split suggested that those low in social anxiety (M_{RCADS} = 7.75, SD = 3.19) differed from those high in social anxiety (M_{RCADS} = 18.14, SD = 3.91) across both baseline and post-task state anxiety. Independent samples t-tests indicated that baseline state anxiety was significantly lower among those with low social anxiety (M = 3.50, SD = 2.26 [M_{Speech} = 3.30; $M_{Rejection}$ = 3.69]) as compared to those high in social anxiety (M = 4.94, SD = 2.21; p = .001, Cohen's d = 0.64 [M_{Speech} = 4.62; $M_{Rejection}$ = 5.32]). The difference between post-speech state anxiety among those low in social anxiety (M = 4.00, SD = 2.40) and high in social anxiety (M = 6.14, SD = 2.26; p = .001, d = 0.91) also was statistically significant; further, paired samples t-tests indicated that the increase in state anxiety pre-post speech was significant among high social anxiety (p = .001, d = 0.68) but not low social anxiety (p = .052, d = 0.29) participants. In terms of the rejection task, low social anxiety participants reported significantly lower post-task state anxiety (M = 2.85, SD = 1.85) as compared to those high in social anxiety (M = 5.08, SD = 2.17; p < .001, d = 1.10); finally, paired samples t-tests indicated that low social anxiety participants reported a significant *decrease* in state anxiety post-task (p = .008; d = 0.46), whereas participants high in social anxiety did not report significant change (p = .450, d = 0.11). Together, exploratory analyses indicated that history of elevated social anxiety symptoms was uniquely associated with increases in reported state anxiety as a function of the performance task, as well as maintenance of reported state anxiety in the rejection task.

3.2. Primary analyses

3.2.1. History of social anxiety symptoms—Please see Table 3 for results including individual variable contributions. After accounting for baseline desire to drink (step 1 F[1,107] =79.68, p < .001, ΔR^2 =.42), neither the main effects (step 2 F[3,105] = 27.68, p < .001, ΔR^2 =.01) nor the interaction (step 3 F[4,104] =22.00, p < .001, ΔR^2 = .01) significantly added to the model. Regarding relief expectancies, after accounting for baseline (step 1 F[1,108] = 104.33, p < .001, ΔR^2 = 49), the main effect of social anxiety was significant, but neither task assignment (step 2 F[3,106] = 37.35, p < .001, ΔR^2 = .02) nor the interaction (step 3 F[4,105] = 28.87, p < .001, ΔR^2 = .01) added to the model.

3.2.2 State anxiety—Please see Table 4 for results including individual variable contributions. After accounting for baseline desire to drink (step 1 F[2,107] = 73.99, p < .001, ΔR^2 = .40), the main effect of state anxiety was significant, but task assignment (step

2 $F[4,105] = 23.03$, $p < .001$, $\Delta R^2 = .06$) and the interaction (step 3 $F[5,104] = 18.30$, $p < .001$, $\Delta R^2 < 0.01$) did not significantly contribute to the model. Similarly, regarding relief expectancies, after accounting for baseline (step 1 $F[2,107] = 62.49$, $p < .001$, $\Delta R^2 = .53$), the main effect of state anxiety was significant, but neither task assignment (step 2 $F[4,105] = 33.11$, $p < .001$, $\Delta R^2 = .01$) nor the interaction (step 3 $F[5,104] = 26.41$, $p < .001$, $\Delta R^2 = .00$) added to the model.

4 Discussion

Consistent with work conducted with adults, a small but growing literature supports a link between problematic social anxiety and alcohol use among adolescents (e.g., Conway, Swendsen, Husky, He, & Merikangas, 2016); however, when theoretical models have been subjected to laboratory testing findings are mixed (Battista et al., 2010), and no work has conducted such real-time assessments with an adolescent sample. Further, the most common social stress induction procedures target performance-oriented anxiety (e.g., giving a speech), whereas rejection-oriented distress is not only central to social anxiety (Hawes et al., 2012; Stroud et al., 2002), but also may more closely align with contexts in which alcohol consumption occurs (Anderson & Brown, 2010). The current study tested whether history of social anxiety symptoms as well as state anxiety were related to the desire to drink, and relief expectancies, elicited by a laboratory-based social stressor. Participants also were randomly assigned to either a performance- (i.e. modified TSST) or rejection-oriented (i.e. Cyberball) stressor to ascertain whether the nature of the task influenced responding. Findings indicated that although history of social anxiety symptoms were not related to change in desire to drink, they were positively related to change in the belief that alcohol 'would make me feel better' following both tasks. Further, state anxiety elicited by both tasks was positively related to change in both desire to drink and relief expectancies. Finally, the nature of the task did not directly relate to or moderate alcohol-relevant responding.

The fact that history of social anxiety symptoms did not relate to reported desire to drink may have been a function of the intentional non-clinical sampling. Although the range and mean symptom level reported in the current sample was consistent with that reported in large-scale community (Chorpita et al., 2000) and targeted clinical (Chorpita et al., 2005) samples, factors such as symptom duration, interference, and prior treatment were not addressed. When considered in combination with the finding that state anxiety elicited by the social stressors was correlated with desire to drink, and exclusion of youth reporting possible AUD status, the current data may reflect the initial process of learning the pairing of social stress and alcohol that undergirds the rapid transition to AUDs among socially anxious youth (Behrendt et al., 2011). Indeed, both symptom history and state anxiety were related to relief expectancies elicited by the tasks. Future work addressing real-time responding among youth presenting with social anxiety disorder, AUD, and/or both, as well as longitudinal work examining the links among sensitivity to social stress, expectancies and motives, and later alcohol use problems is needed to clarify this possibility and process.

That the nature of the task did not moderate findings could reflect (1) a lack of distinction among adolescents such that social stress, regardless of context or source, may relate to risk-related decision making (e.g., Reynolds et al., 2013; Steinberg, 2008), or (2) the structure

and potency of the tasks differed enough such that direct comparisons are premature. First, elevated sensitivity to social stress, and attention to such cues/-contexts, is a normative feature of adolescence (La Greca & Ranta, 2015); accordingly, further differentiation of the strength and quality of responding to varied forms of social stress may not fully emerge until later in adolescence. In addition to prospective work, mixed-method cohort studies could provide important data regarding maturation-, experience-, and context-related influences. Second, although matched for time, and representing the 'standard' task for each target, several aspects differentiated the tasks selected (e.g., degree of concurrent interaction with researchers); procedures such as the Yale Interpersonal Stressor (Stroud, Tanofsky-Kraff, Wilfley, & Salovey, 2000) or a computer-based, 'graded' math task may serve as stronger comparators to the selected performance- and rejection-oriented social stress tasks. Finally, although data collection was guided by an a priori power analysis (based on conservatively anticipated medium effects; Buckner & Heimberg, 2010; Martens et al., 2008), observed effects were small-to-medium (e.g., interaction term f^2 range 0.03-.14), thus the current project may have been underpowered nonetheless. Future researchers may consider taking increasingly more conservative approaches to power estimation, particularly when examining novel populations.

Findings must be qualified in light of several methodological considerations. First, manipulation checks indicated that the tasks did not fully perform as expected. Most intriguing was the fact that while state anxiety elicited by Cyberball was positively correlated with history of social anxiety symptoms, there was a significant *decrease* in state anxiety pre-post task across the full sample. Exploratory analyses indicated that compared to youth low in social anxiety, those high in social anxiety began the task with much higher state anxiety, and did not report any significant change in anxiety as a function of the task. Future work is needed to explore the nature of affective responding to rejection, and the Cyberball task specifically, as a function of (adolescent) social anxiety. Such work will help clarify whether socially anxious individuals consistently experience both anticipatory and rejection-related anxiety to a greater degree than those lower in social anxiety (cf. Oaten et al., 2008). Further, rejection tasks are not specifically designed to elicit anxiety, but rather a complex suite of responses including sadness, sense of isolation, and general distress; work addressing multiple manifestations of negative affect, social anxiety specifically, and/or broader indices of general distress may be important to more fully understanding the link between rejection and alcohol use, particularly among socially anxious individuals. It is important to note that state anxiety elicited by the speech task also did not reach statistical significance among participants low in social anxiety ($p = .052$); although potentially related to statistical power, further study of the particular modification employed here will provide important data for the design of future research. Finally, the measurement of alcohol-related cognitions in the current study included single item assessments of desire to drink and relief expectancies. Although highly correlated (rs = .68–0.86), these items were selected and retained as separate markers in an effort to reflect the multidimensional nature of craving (e.g., urges, intentions) while limiting participant burden. The subtle differences observed here provide support for multi-method approaches combining multi-item self--report with indirect assessments of cognition (e.g., Approach-Avoidance Tasks; Roefs et al., 2011) and physiological responding (e.g., salivation; Thomas, Drobes, & Deas, 2005).

Indeed, comparative multi-method testing of both adolescent and adult samples will aid in disentangling the relative role of developmental, conceptual, and methodological influences when findings diverge.

Additional study limitations also must be considered. The sample largely consisted of older adolescents (M_{age} = 16.01), primarily identifying as White (75.4%), all of whom were comfortable reporting recent alcohol consumption during the telephone screening, and were willing and able to come to the research laboratory with a parent/guardian. Research including younger samples, and powered to address under-studied populations (e.g., racial or sexual minority youth), particularly that targeting high-risk, yet 'invisible' youth (e.g., homeless), is an important next step. Further, data regarding relevant demographic (e.g., socio-economic status), environmental (e.g., parental psychopathology), and individual difference (e.g., impulsivity; proclivity toward the use of alcohol/disengagement coping) variables were not examined in the current project; research addressing the potential additive, interactive, and/or functional effects of such factors will aid in understanding the nature and boundaries of the identified relations.

Taken together, findings partially support theoretical accounts and retrospective self-report data linking sensitivity to social stress and coping-related alcohol use among adolescents. History of social anxiety symptoms as well as state anxiety elicited by the stressors both were positively related to relief expectancies following the tasks. Task-response data further support the contention that socially anxious youth may be particularly sensitive to potential social stress experiences, ultimately leading to rapid uptake of short-term coping responses (e.g., alcohol consumption). Given support in continued study, these findings concord with promising selective intervention approaches (e.g., *Pre-Venture*; Conrod, Stewart, Comeau, & Maclean, 2006; Conrod et al., 2013), and suggest that socially-oriented distress may be a developmentally-relevant, malleable target for efforts aimed at problematic alcohol use among adolescents.

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Declaration of competing interest

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Table 1

Sample demographic and primary variable descriptive data.

Variable	Speech	Cyberball	Full sample
Age	16.11 (0.90)	15.91 (1.00)	16.01 (0.95)
Gender (Female)	67.2%	60.7%	64.0%
Race/Ethnicity			
Hispanic/Latinx	20.7%	21.4%	21.1%
White	74.1%	76.8%	75.4%
Black/African American	10.3%	14.3%	12.3%
Asian	8.6%	5.4%	7.0%
Native American	1.7%	3.6%	2.6%
Pacific Islander	1.7%	–	0.9%
Other	12.1%	5.4%	8.8%
Ever in therapy	29.3%	25%	27.2%
Currently in therapy	15.5%	5.4%	10.5%
Last drink (days)	48.58 (53.56)	51.38 (50.77)	49.94 (52.01)
Baseline desire to drink	1.74 (1.34)	1.64 (1.31)	1.69 (1.32)
Baseline relief expectancy	2.31 (1.91)	2.26 (2.00)	2.28 (1.94)
Baseline state anxiety	3.94 (2.42)	4.37 (2.26)	4.15 (2.34)
RCADS-SP	13.01 (5.86)	12.77 (6.81)	12.90 (6.31)
Post-task state anxiety	5.15 (2.55)	3.87 (2.28)	4.53 (2.50) *
Post-task desire to drink	2.22 (2.06)	1.87 (1.80)	2.05 (1.94)
Post-task relief expectancy	2.50 (2.18)	2.25 (2.19)	2.38 (2.18)

Note. $N = 114$. Data are presented as *M*(SD) or percent (%). RCADS-SP: Revised Child Anxiety and Depression Scale - Social Phobia subscale (Chorpita et al., 2000).

* $p < .05$ (task assignment independent samples *t*-test).

Table 2

Correlations among primary study variables as a function of task assignment.

Variable		Range	1	2	3	4	5	6	7	8	Range
1.	Last drink (days)	1–214	–	−.24	−.29*	−.22	−.00	−.21	−.24	−.21	3–220
2.	Baseline state anxiety	1–9	−.17	–	.21	.01	.42**	.70**	.24	.20	1–9
3.	Baseline desire to drink	1–6	.20	.07	–	.68**	.11	.34*	.73**	.74**	1–6
4.	Baseline relief expectancy	1–9	.02	.22	.78**	–	.06	.23	.64**	.78**	1–8
5.	RCADS-SP	0–27	−.06	.32*	.18	.05	–	.50**	.08	.12	0–27
6.	Post-task state anxiety	1–9	−.21	.62**	.10	.12	.40**	–	.42**	.33*	1–9
7.	Post-task desire to drink	1–9	.12	.06	.58**	.47**	.34**	.42**	–	.86**	1–8
8.	Post-task relief expectancy	1–9	.05	.18	.69**	.62**	.27*	.33*	.86**	–	1–9

Note. Data for youth assigned to the Speech task are to the left and below the diagonal (*n*s = 56–58); data for youth assigned to the Rejection task are to the right and above the diagonal (*n*s = 52–56). RCADS-SP: Revised Child Anxiety and Depression Scale – Social Phobia subscale.

* $p < .05$

** $p < .01$.

Table 3

History of social anxiety symptoms predicting alcohol cognitions elicited by acute social stress.

		Adjusted R^2	t	β	p	sr^2
Desire to Drink[a]						
Step 1		.42			<.001	
	Baseline desire to drink		8.92	.65	<.001	.42
Step 2		.42			<.001	
	RCADS Social anxiety		1.48	.11	.140	.01
	Task assignment		−0.76	−.05	.445	.00
Step 3		.43			<.001	
	RCADS*Task Interaction		−1.79	−.50	.076	.01
Relief Expectancies[b]						
Step 1		.48			<.001	
	Baseline relief expectancy		10.21	.70	<.001	.49
Step 2		.50			<.001	
	RCADS Social anxiety		2.14	.14	.035	.02
	Task assignment		−0.55	−.03	.582	.00
Step 3		.50			<.001	
	RCADS*Task Interaction		−1.47	−.38	.143	.00

Note. β = standardized beta weight.

[a] $n = 109$.

[b] $n = 110$.

RCADS: Revised Child Anxiety and Depression Scale (Chorpita et al., 2000). Task assignment: 1 = Trier Social Stress Test-Modified (Yim et al., 2010); 2 = Cyberball (Williams et al., 2000).

Table 4

State anxiety predicting alcohol cognitions elicited by acute social stress.

		Adjusted R^2	t	β	p	sr^2
Desire to Drink						
Step 1		.38			<.001	
	Baseline state anxiety		0.27	.02	.788	.00
	Baseline desire to drink		8.31	.62	<.001	.38
Step 2		.44			<.001	
	Post-task state anxiety		3.61	.35	<.001	.06
	Task assignment		1.00	.07	.318	.00
Step 3		.44			<.001	
	Anxiety*Task Interaction		0.36	.08	.714	.00
Relief Expectancies						
Step 1		.53			<.001	
	Baseline state anxiety		1.10	.07	.270	.00
	Baseline relief expectancy		10.83	.71	<.001	.50
Step 2		.54			<.001	
	Post-task state anxiety		2.12	.19	.036	.01
	Task assignment		0.73	.05	.464	.00
Step 3					<.001	
	Anxiety*Task Interaction	.53	0.61	.13	.538	.00

Note. β = standardized beta weight. n = 110. Task assignment: 1 = Trier Social Stress Test-Modified (Yim et al., 2010); 2 = Cyberball (Williams et al., 2000).