The Interaction between Anxiety Sensitivity and Sleep Disturbance in Relation to Alcohol Use among Adolescents

Gabrielle Meshell Armstrong

University of Mississippi

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ANXIETY SENSITIVITY, SLEEP, AND ALCOHOL USE

THE INTERACTION BETWEEN ANXIETY SENSITIVITY AND SLEEP DISTURBANCE IN RELATION TO ALCOHOL USE AMONG ADOLESCENTS

By

Gabrielle Meshell Armstrong

A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of the requirements of the Sally McDonnell Barksdale Honors College.

Oxford, MS
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Approved By

Advisor: Professor Sarah Bilsky
Reader: Professor Matthew Reysen
Reader: Professor Kristin Austin
ACKNOWLEDGEMENTS

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Abstract

Both substance use and sleep disturbance are common in adolescence. Additionally, alcohol use specifically is positively associated with a number of sleep disturbances. However, little to no research has examined factors that may influence the relation between problematic alcohol use and sleep disturbances among adolescents or adults. One factor that may be particularly important to consider in this regard is anxiety sensitivity (AS; i.e., the tendency to interpret unpleasant physiological sensations as dangerous). Among previous studies, anxiety sensitivity has been found associated with both increased alcohol consumption and sleep disturbances. The current study evaluated the main and interactive effects of AS and sleep difficulties in relation to problematic alcohol use among 186 adolescents ($n = 39$ boys, $n = 112$ girls, and $n = 35$ non-binary) between the ages of 13 and 17 years ($M_{\text{age}} = 16.11; \text{SD} = 1.03$). Participants were recruited using social media platforms (i.e., Facebook and Instagram) to complete a set of surveys. Results of the study suggested that consistent with the first hypothesis, anxiety sensitivity and sleep difficulties were uniquely associated with adolescent alcohol problems. Other hypotheses were not supported. Collectively, these findings highlight the importance of considering the unique and interactive effects of anxiety sensitivity and sleep disturbance on alcohol use among adolescents.

*Keywords:* Adolescents, Alcohol use, Anxiety sensitivity, Sleep disturbance
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<tr>
<td>AS</td>
<td>Anxiety Sensitivity</td>
</tr>
<tr>
<td>ASWS</td>
<td>Adolescent Sleep-Wake Scale</td>
</tr>
<tr>
<td>CASI</td>
<td>Child Anxiety Sensitivity Index</td>
</tr>
<tr>
<td>RAPI</td>
<td>Rutgers Alcohol Problem Index</td>
</tr>
<tr>
<td>TMDQ</td>
<td>Teenage Motivation for Drinking Questionnaire</td>
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</table>
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The Interaction between Anxiety Sensitivity and Sleep Disturbance in Relation to Alcohol Use among Adolescents

Initiation of Substance Use

Substance use is a common, risky behavior that is typically initiated during adolescence and has serious short- and long-term health implications (Wilkinson et al., 2016). The initiation of substance use (e.g., alcohol use, tobacco use, and drug use) is associated with elevated affective symptoms (e.g., depression and anxiety; Tian et al., 202) and risky behaviors (e.g., motor impairment, suicide ideation, decline in education pursuits, heightened risk of sexual assault & academic problems; Windle et al., 2008; Newcomb & Bentler, 1989; NIAA, 2021). Alcohol is the most commonly used substance among adolescents, by the time they reach 18 years old, 64% of adolescents report having tried alcohol in their lifetime (Johnston et al., 2017). Similarly, a study found that by late adolescence, 78.2% of US adolescents had consumed alcohol, 47.1% had reached regular drinking levels defined by at least 12 drinks within a given year, and 15.1% met criteria for lifetime abuse (Swendsen et al., 2012). Collectively, findings suggest greater incidence risk and lifetime prevalence of alcohol use and abuse during adolescence, an important period of rapid change in an individual’s psychological development (Swendsen et al., 2012).

Anxiety Sensitivity

Anxiety sensitivity (AS) is a trait-like cognitive vulnerability factor characterized by fears of the negative consequences of anxiety symptoms and related sensations (Reiss & McNally, 1985). For example, individuals with elevated AS may perceive excessive sweating as a sign of an impending faint, or irregular breathing as a sign of an impending death. In contrast, individuals with lower levels of AS would not perceive such anxiety symptoms as harmful. AS
has been linked to a host of negative health behaviors, such as sleep irregularities and anxiety psychopathology (Knapp et al., 2020; Stewart & Zeitlin, 1995). In addition, AS is associated with an increased risk for the development of numerous problems during adolescence and young adulthood, including anxiety and substance use (Otto et al., 2016).

**Drinking Motives**

One factor that may be important to consider in the relation between AS and drinking behaviors during adolescence are drinking motives. Cooper’s (1994) four-factor model of drinking motives suggests that enhancement (i.e., drinking to obtain positive feelings), social (i.e., drinking to obtain social rewards), conformity (i.e., drinking to avoid social rejection), and coping (i.e., drinking to avoid or reduce negative feelings) are proximal predictors of alcohol use, linking more distal predictors (e.g., anxiety, depression) to increased use of alcohol. Of these, coping-related motives have been most consistently linked to problematic alcohol use (Cooper et al., 1992). Drinking to cope is an internal, avoidance-oriented motive that is characterized by the desire to counteract negative affect through alcohol use (Waddell et al., 2021). Both the motivational model of Cooper (1994) and Cox and Klinger (1988) imply that drinkers’ experience of high negative mood states will be associated with near-term alcohol use and that this association will be moderated by coping motives. Indeed, individuals who use alcohol and endorse coping motives for alcohol use reported higher levels of alcohol use during weeks characterized by elevated levels of anxiety (Armeli et al., 2008).

**Anxiety Sensitivity and Alcohol Use**

Critically, AS evidences a significant, positive correlation with increased frequency of drinking to cope with negative affect (Samoluk & Stewart, 1998). Ultimately, this results in more alcohol-related problems. For example, self-report studies have shown that high-AS compared
with low-AS students are more prone to excessive drinking and alcohol abuse symptoms, report more detrimental drinking motivations (i.e., drinking to cope), and report excessive drinking in risky situations (i.e., negatively reinforcing contexts; MacDonald et al., 2000). As a result, individuals with elevated AS, will likely experience greater negative mood dampening and may be at an increased risk for problematic alcohol use and alcohol-related problems (MacDonald et al., 2000; Stewart & Kushner, 2001). The effect of arousal-dampening negatively reinforces alcohol consumption, in which alcohol becomes identified as a mechanism for coping with anxiety (DeMartini & Carey, 2011). Further evidence suggests that AS is both directly and indirectly (through increased affective symptoms) associated with increased alcohol use problems during adolescence (Knapp et al., 2021; Paulus et al., 2021). Indeed, recent evidence suggests that AS is associated with substance use problems, coping-related substance use motives and expectancies among adolescents (Guillot et al., 2019).

**Anxiety Sensitivity and Sleep Disturbance**

A growing body of research also suggests that anxiety sensitivity (AS) is significantly linked to sleep disturbances among adolescents. For example, evidence suggests that after controlling for both anxiety severity and depression symptoms, anxiety sensitivity significantly predicted prolonged sleep onset latency among a sample of children and adolescents with anxiety disorders (Weiner et al., 2017). Moreover, Hoge et al. (2011) found that among adults with panic disorder were at an increased risk for longer sleep latency and worsened associated sleep disturbance when attending to fear of anxiety and physical sensation before bedtime (Hoge et al., 2011). Similarly, Levin et al. (2009) found that AS was associated with greater sleep-related impairment and sleep medication use among undergraduate students with chronic insomnia. Further, studies have demonstrated that individuals with greater levels of AS report particularly
poor sleep quality (Hoge et al., 2011), longer sleep onset latency (Babson et al., 2008), and
greater daytime disturbances (Vincent & Walker, 2001). Taken together, these data suggest that
AS may be associated with difficulties initiating and maintaining sleep.

Sleep Disturbance

Healthy sleep is characterized by receiving sufficient amounts of sleep, during
appropriate times and in the absence of sleep disturbances or disorders (Paruthi et al., 2016).
Insufficient sleep is associated with several adverse outcomes during adolescence including
cognitive dysregulation, heightened emotional reactivity, impairment of motor responses,
elevated anxiety symptoms, and a higher propensity to engage in risky behaviors such as
experimentation with substances and the use of alcohol (Wong et al., 2010; Kenney et al., 2013;
Owens, 2014). Unfortunately, it is common for adolescents to obtain insufficient sleep due to
biological and psychological factors during this developmental period, including the onset of
puberty, stress, as well as depression, and anxiety (e.g., Crowley et al., 2018; Orchard et al.,
2020). Marked changes in circadian rhythm begin with the onset of puberty, and over the course
of adolescence, sleep timing shifts toward later timing of sleep/wake behavior (Hasler &
Pederson, 2020; Crowley et al., 2014). The natural shift toward later sleep timing during
adolescence is mismatched with early school start times, resulting in difficulty falling asleep
(insomnia), insufficient sleep, daytime sleepiness on weekdays, and later wakeup times on the
weekends for many adolescents (Owens, 2014; Hasler & Pederson, 2020). Collectively,
frequent/chronic insomnia and mental health issues (i.e., anxiety/stress) are factors related to
adolescents’ reduced sleep duration resulting in a greater degree of sleepiness during the daytime
(Wong et al., 2010; Owens, 2014).

Sleep Disturbance and Alcohol Use
Findings demonstrate that insufficient, and poor-quality sleep among adolescents is prospectively associated with the onset and/or escalation of alcohol use and alcohol related problems during adolescence and early adulthood (Hasler & Pederson, 2020). Studies have shown that sleep difficulties, particularly insomnia, are positively associated with increased alcohol consumption among adolescents, particularly among those with higher coping motives (i.e., drinking to reduce anxiety; Hasler & Pederson, 2020; Wong et al., 2004). Because of alcohol’s sedative effects that induce feelings of relaxation and sleepiness, alcohol use initially reduces negative affect. However, these benefits are short lived, in the long term, alcohol use is associated with an increase in negative affect (Wong et al., 2004). Further studies indicate that alcohol ingestion generally disrupts sleep patterns during the night, despite its initial sedative effects (Roehrs & Roth, 2001; Wong et al., 2004). This effect results from the body’s adjustment to the presence of alcohol to maintain a normal sleep pattern, however, the adjustments soon result in sleep disruption once the alcohol is eliminated from the body (Roehrs & Roth, 2001). Moreover, a national survey reported that nearly 67% of individuals with insomnia view alcohol as effective for improving sleep (Roth & Ancoli-Israel, 1999) This may result in individuals with insomnia developing a tolerance for alcohol rather quickly, leading them to drink more before bed to initiate and aid sleep, when in fact, it actually serves to worsen sleep difficulties.

Anxiety Sensitivity, Sleep Disturbance, and Alcohol Use

Despite the literature suggesting that both AS and sleep disturbance are independently associated with alcohol use, to date, no study has examined both AS and sleep difficulties in relation to alcohol use among adolescents or adults. However, prior research has assessed AS, sleep difficulties, and other related substances (e.g., cigarette use) among both adolescents and adults. For example, Bilsky et al. (2016) found that among adolescents, as levels of AS
increased, smoking levels were more strongly, positively related to prolonged sleep onset latency. Extending on those findings, Farris et al. (2020) found that among adult daily smokers, the combination of elevated AS and heavier smoking (relative to lighter) contributed to longer sleep onset latency. Additional evidence suggests that among daily smokers, pre-quit insomnia symptoms were associated with higher risk of smoking cessation failure, whereas post-quit insomnia symptoms were not, these effects were significant over and above anxiety sensitivity, and number of cigarettes smoked per day (Short et al., 2017). Additionally, among adult patients with substance use disorders and co-occurring anxiety disorders, AS cognitive concerns were significantly related to insomnia and somnolence symptoms (Dixon et al., 2018). Taken together, these data coalesce to suggest that AS and sleep disturbances may be associated with substance use.

**Current Study.** The goal of this current study is to address this gap in the literature by examining how adolescent AS and adolescent sleep disturbance interact in relation to adolescent problematic alcohol use. Four primary hypotheses were tested. First, it was anticipated that adolescent AS and sleep disturbances will be uniquely, positively associated with adolescents’ problematic alcohol use (Hypothesis 1). Second, it was hypothesized that adolescent AS and sleep disturbances will be uniquely, positively associated with adolescents coping motives for alcohol use (Hypothesis 2). Third, it was predicted that that adolescent AS and sleep disturbances will interact in relation to adolescent problematic alcohol use such that sleep disturbances will be more strongly related to problematic alcohol use when adolescents report higher AS than when they report lower levels of AS (Hypothesis 3). Lastly, it was hypothesized that adolescent AS and sleep disturbances will interact in relation to adolescent coping motives for alcohol use such that
sleep disturbances will be more strongly related to coping motives for alcohol use when adolescents report higher AS than when they report lower levels of AS (Hypothesis 4).

Method

Participants

A sample of 186 adolescents (n = 39 boys, n = 112 girls, and n = 35 non-binary) between the ages of 13 and 17 years (M_age = 16.11; SD = 1.03) from all geographic regions in the US were recruited using social media platforms (i.e., Facebook and Instagram) from February 10, 2022 - March 10, 2022. Racial and ethnic composition of the current sample was approximately 74.7% Caucasian, 8.1% Black/African American, 14.5% Asian American, 12.4% Hispanic/Latino, 4.3% Native American, and 4.3% “other”. Please note that since adolescents could select more than one ethnicity, percentages do not sum to 100. Participants that provided consent and correctly answered Qualtrics data attention-check questions were eligible for the survey. Adolescents who completed the survey were given the option to be entered for the chance to win 1 of 10 $20 Amazon gift cards.

Measures

A battery of measures was administered using Qualtrics.

Child Demographics. Adolescents reported age, gender, ethnicity, educational level, weight, height, and number of siblings.

Adolescent Sleep-Wake Scale (ASWS; LeBourgeois, Giannotti, Cortesi, Wolfson, & Harsh, 2005). The Adolescent Sleep-Wake Scale is a valuable 28-item measure tool for assessing the multifaceted nature of the overall subjective sleep quality including five sleep behavior domains (going to bed, falling asleep, maintaining sleep, reinitiating sleep, and returning to wakefulness) across a range of adolescent aged 12-18 years. The five subscale scores
corresponding to each behavior domain and a total sleep quality score can be yielded with higher scores reflecting better sleep quality. Twenty-eight items describing the occurrence of various behavioral sleep characteristics over the previous month are scored on a six-point Likert scale (1 = *Always*, 2 = *Frequently-if not always*, 3 = *Quite often*, 4 = *Sometimes*, 5 = *Once in a while*, 6 = *Never*). The 28-item sleep-wake scale included statements such as “I have trouble making myself go to bed at bedtime” or “after waking up during the night, I feel scared”.

**Child Anxiety Sensitivity Index** (CASI; Silverman, Fleisig, Rabian, & Peterson, 1991). *The Child Anxiety Sensitivity Index* is an 18-item self-report measure designed to assess the degree to which youth aged 6-17 years fear or worry about anxiety symptoms related to physical (e.g., “When my stomach hurts, I worry that I might be really sick”), social (e.g., “I don’t want other people to know when I feel afraid”) and psychological (e.g., “When I am afraid, I worry that I might be crazy”) concerns. The CASI uses a 3-point Likert-type scale (1 = *None*, 2 = *Some*, 3 = *A lot*). The CASI is a developmentally sensitive version (downward extension) of the Adult Anxiety Sensitivity Index (ASI; Reiss et al., 1986), which was revised to include language more accessible to younger respondents. For example, the ASI item “When I am nervous, I worry that I might be mentally ill was changed to “When I am afraid, I worry that I might be crazy”. Total scores of the CASI ranges from 18 to 54; the higher scores reflect higher levels of anxiety sensitivity (AS).

**Rutgers Alcohol Problem Index** (RAPI; White & Labouvie, 1989). *The Rutgers Alcohol Problem Index* is an 18-item (originally 23-item) self-administered screening tool is designed to measure the frequency and severity of the negative consequences associated with alcohol-related problems experienced in adolescents and young adults. Participants reported on frequency scale (*Never*, *1-2 Times*, *3-5 Times*, *6-10 Times*, *More than 10 times*) how many times each item
occurred within the last 3 years while drinking alcohol or as a result of alcohol use (e.g., “Got into fights, acted bad, or did mean things”).

**Teenage Motivation for Drinking Questionnaire** (TMDQ; Comeau, Stewart, & Loba, 2001). The 20-item questionnaire, *The Teenage Motivation for Drinking Questionnaire*, was used to assess the reasons in which teenagers give for drinking alcohol. The participants are asked to think of all the times they drank alcohol and to indicate how often they drank alcohol for each of the reasons listed in the questionnaire. The TMDQ utilizes a frequency scale (*Almost Never/Never, Some of the Time, Half of the Time, Most of the Time, Almost Always/Always*) to answer questions such as, “to fit in with a group you like” and “to forget your problems”.

**Procedures**

All procedures were approved by the Institutional Review Board.

**Data Analytical Approach**

First, descriptive statistics were conducted, including the computation of zero-order correlations and checks of data normality. Next, in order to test Hypothesis 1, 2, 3 and 4, two separate moderation models were tested using the PROCESS macro (Hayes, 2017) in SPSS. All interactions were tested using PROCESS model 1. First, a model was run examining if adolescent anxiety sensitivity moderated the association between adolescent sleep difficulties and adolescent alcohol use problems. Next, a model was run examining if adolescent anxiety sensitivity moderated the association between adolescent sleep difficulties and adolescent coping motives for alcohol use. Continuous predictor variables were mean-centered prior to analysis.

**Results**

**Descriptive and Correlations**
Table 1 includes means, standard deviations, and zero-order correlations for all continuous predictor and criterion variables. Age was not significantly associated with AS, sleep difficulties, alcohol use problems, or coping motives. As expected, adolescent AS was positively correlated with alcohol use problems and coping motives. However, it was negatively correlated with sleep difficulty scores indicating that higher levels of sleep difficulty were associated with more AS. Also, as expected, alcohol use problems were positively correlated with AS and coping motives. It was negatively correlated with sleep difficulty scores indicating that higher levels of sleep difficulty were associated with more alcohol use problems. Finally, as expected coping motives were positively associated with AS and alcohol use problems. However, it was negatively correlated with sleep difficulty scores indicating that higher levels of sleep difficulty were associated with more coping motives. In terms of gender differences, ANOVAs were used to examine if adolescent anxiety sensitivity, sleep difficulties, alcohol use problems, and coping motives differed as a function of adolescent gender. In terms of adolescent anxiety sensitivity, there were no significant differences between levels of anxiety sensitivity as a function of adolescent gender ($F(2, 183) = 1.69, p = .188$). In terms of sleep difficulties, there were significant differences between adolescent sleep difficulties as a function of adolescent gender ($F(3, 183) = 5.04, p = .005$) such that non-binary adolescents reported more sleep difficulties than adolescent boys and girls. In terms of alcohol use problems, there were no significant differences between levels adolescent alcohol use problems as a function of adolescent gender ($F(2, 183) = 2.78, p = .065$). In terms of coping motives, there were no significant differences between levels of coping motives for alcohol use as a function of adolescent gender ($F(3, 183) = 2.55, p = .081$). Given that levels of adolescent sleep difficulties varied as a function of adolescent gender, adolescent gender was entered as a covariate in all analyses.
Primary Hypothesis Tests

Alcohol Use Problems

The overall model looking at the associations between adolescent sleep difficulties, anxiety sensitivity, and alcohol use problems was significant, $F(4,181) = 10.02, p < .001$. Results were consistent with hypothesis 1, both adolescent sleep difficulties ($B = -0.16, p < .001$) and anxiety sensitivity ($B = 0.21, p = .027$) were related to adolescent alcohol use problems. Unexpectedly, and contrary to hypothesis 3, anxiety sensitivity and adolescent sleep difficulties did not interact in relation to adolescent alcohol use problems ($B = -0.01, p = .168$). Gender was also not significantly associated with adolescent alcohol use problems ($B = 1.70, p = .123$).

Coping Motives for Alcohol Use

The overall model looking at the associations between adolescent sleep difficulties, anxiety sensitivity, and alcohol use problems was not significant, $F(4,181) = 2.14, p = .077$. Results were not with hypothesis 2, neither adolescent sleep difficulties ($B = -0.01, p = .091$) or anxiety sensitivity ($B = 0.02, p = .103$) were related to coping motives for alcohol use. Unexpectedly, and contrary to hypothesis 4, anxiety sensitivity and adolescent sleep difficulties did not interact in relation to adolescent coping motives for alcohol use ($B = 0.00, p = .582$). Gender was also not significantly associated with adolescent coping motives for alcohol use ($B = -0.09, p = .448$).

Discussion

Though the literature indicates an association between anxiety sensitivity and sleep disturbances (Levin et al., 2009; Hoge et al., 2011; Babson et al., 2008; Vincent & Walker, 2001), limited research to date has examined both AS and sleep disturbances in relation to alcohol use. Individuals tend to report higher drinking levels when they report drinking to reduce anxiety.
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(Hasler & Pederson 2020; Wong et al., 2004) or drinking to help maintain a normal sleep pattern (Roehrs & Roth, 2001). These findings suggest that there is a potential relationship between AS and sleep disturbances in relation to alcohol use problems, however, to date, no work has examined the interactive effects of AS and sleep difficulties on alcohol use problems during adolescence. The goal of the current study is to address this gap in the literature.

First, and as hypothesized, adolescent AS and adolescent sleep difficulties were independently associated with adolescent alcohol use problems. The nature of the association was such that as levels of AS and levels of sleep difficulties increased, problematic alcohol use levels also increased. In accordance with previous work (Bilsky et al., 2016; Farris et al., 2020; Short et al., 2017; Dixon et al., 2018), these results suggest that adolescent AS and adolescent sleep difficulties may be uniquely related to adolescent alcohol use problems and suggest a number of possible future directions for researchers. For example, and important next step in this line of work will be to examine these associations longitudinally, and among larger samples. This will help elucidate the direction of these relations, and may add insight into more complex associations among these variables.

Next, and inconsistent with Hypothesis 3, adolescent AS and adolescent sleep disturbance did not significantly interact in relation to alcohol use problems. This suggests that AS and sleep difficulties evidenced independent associations with adolescent alcohol use problems. These results were somewhat surprising as prior research has found that elevated AS individuals tend to report excessive sleep disruption (Hoge et al., 2011; Babson et al., 2008; Vincent & Walker, 2001) and greater risk for problematic alcohol use (MacDonald et al., 200; Stewart & Kushner, 2001) compared to relatively low AS individuals.
Next, also unexpectedly, and contrary to Hypotheses 2 and 4, there was no evidence of an association between adolescent AS and adolescent sleep difficulties in relation to coping motives for alcohol use. This suggests that adolescent AS and sleep difficulties were unrelated to adolescent coping motives for alcohol use in the current sample. These results are inconsistent with previous findings that suggested that individuals with elevated levels of AS report increased coping motives for alcohol use to relieve aversive states (Armeli et al., 2008). Additionally, previous work has demonstrated that poorer (compared with better) sleep quality is associated with high coping motives for drinking among college students (Kenney et al., 2014).

There are a number of possible explanations for the null results in the current study. First, alcohol use was relatively low in the current sample. For example, although all adolescents reported having tried alcohol, many youth in the sample ($n = 108$, 58% of sample) reported having tried alcohol, but quit. Additionally, few youth in the current study reported significant alcohol use problems ($M = 23.96$, $SD = 10.10$ on a 90 point scale). Similarly, relatively few youths endorsed coping motives for alcohol use ($M = 1.76$, $SD = 1.04$ on a 5-point scale). It is possible that some of the null effects observed in the current study may be due to a floor effect, or a lack of variability in the study. Moving forward, researchers would benefit from examining these associations among samples of youth who endorse using alcohol at higher levels.

Additionally, moving forward, future work would benefit from examining how gender may moderate the associations between AS and alcohol use problems. For example, research suggests that relatively high AS compared to relatively low AS individuals are more likely to report increased alcohol use (Stewart et al., 1997). However, our study did not demonstrate similar findings, which may be due in part to gender differences. Research suggests that not only do females fear anxiety to a greater extent than males, the principal feared consequences of
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anxiety experiences also differ in males versus females (Stewart et al., 1998). This suggests that AS may function differently across youth with varying gender identities. Moving forward, examining the moderating effect of gender on these associations will be important. Interestingly, in the current sample, non-binary youth reported significantly more sleep difficulties than adolescents who identified as male or female. This suggests that another important step in this line of work will be to examine gender difference in terms of how sleep may affect both affective symptoms and alcohol use.

Additionally, it would be both beneficial and interesting for future research to examine the interactive effects of AS and sleep disturbances on conformity motives for alcohol use. Evidence suggests that AS is an independent, significant predictor of conformity motives (Stewart & Zeitlin, 1995; Stewart et al., 2002). Conformity motives reflect negatively reinforcing motives for drinking, provoking decisions to use alcohol to avoid social rejection (Cooper, 1994). It is possible that given the salience of social concerns during adolescence, adolescents who are elevated in AS and experience disturbed sleep may report more motives of conformity for alcohol use than coping motives.

To our knowledge, this is the first known study in adolescence to investigate the association between sleep difficulties, anxiety sensitivity, and alcohol use. The present study provides critical insight into the roles of AS and sleep difficulties on alcohol use problems and coping motives for alcohol use. Yet, several limitations will need to be addressed in future research. First, the present study is correlational and cross-sectional. This means that causality between the variables cannot be tested directly, and it does not permit distinction between cause and effect of variables over time. Future work would benefit from examining these relationships experimentally and with longitudinal assessments. Second, all the data used in this study were
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self-report, and thus potentially biased. Lastly, the characteristics of the sample are important to consider in terms of the potential effect on generalizability: the sample was comprised primarily of female participants (60.2%) and Caucasian participants (74.7%). Future work would benefit more from both gender and racial diversity to increase representativeness.

Despite these limitations, the current study extends the literature by examining the interaction between AS and sleep disturbance in relation to alcohol use among adolescents. The findings in this study demonstrate that AS and sleep disturbance are associated with alcohol use problems. Overall, these results lay the groundwork for future research, however, more work is needed to improve our understanding of the effects of AS and sleep disturbance on alcohol use among adolescents.
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### Table 1
Descriptive Data and Zero-Order Relations Between Relevant Continuous Variables

<table>
<thead>
<tr>
<th></th>
<th>M (SD)</th>
<th>Range</th>
<th>Adolescent Age</th>
<th>CASI</th>
<th>ASWS</th>
<th>RAPI</th>
<th>TMDQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16.11</td>
<td>12.00 – 17.00</td>
<td>1</td>
<td>.03</td>
<td>.03</td>
<td>-.04</td>
<td>.05</td>
</tr>
<tr>
<td>2</td>
<td>38.20</td>
<td>18.00 – 54.00</td>
<td>1</td>
<td>-.35***</td>
<td>.26***</td>
<td>.17*</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>91.98</td>
<td>39.00 – 142.00</td>
<td>1</td>
<td>-.38***</td>
<td>-.16*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>23.96</td>
<td>18.00 – 65.00</td>
<td>1</td>
<td>.56***</td>
<td></td>
<td></td>
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<tr>
<td>5</td>
<td>1.76</td>
<td>1.00 – 5.00</td>
<td>1</td>
<td></td>
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</table>

Note: $n = 186$. CASI: Child Anxiety Sensitivity Index. ASWS: Adolescent Sleep-Wake Scale. RAPI: Rutgers Alcohol Problem Index. TMDQ: Teenage Motivation for Drinking Questionnaire.

*p < .05, **p < .01, ***p < .001. (2-tailed)
### Table 2

Descriptive information about variables of interest displayed as a function of participant gender

<table>
<thead>
<tr>
<th></th>
<th>Overall Sample</th>
<th>Female</th>
<th>Male</th>
<th>Non-Binary/Third Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>1. CASI</td>
<td>38.20 (7.81)</td>
<td>38.26 (7.14)</td>
<td>36.54 (9.00)</td>
<td>39.86 (8.29)</td>
</tr>
<tr>
<td>2. ASWS</td>
<td>91.98 (20.97)</td>
<td>94.03 (20.14)</td>
<td>94.97 (22.63)</td>
<td>82.09 (19.30)</td>
</tr>
<tr>
<td>3. RAPI</td>
<td>23.96 (10.10)</td>
<td>22.55 (8.93)</td>
<td>26.23 (11.21)</td>
<td>25.91 (11.74)</td>
</tr>
<tr>
<td>4. TMDQ</td>
<td>1.76 (1.04)</td>
<td>1.62 (0.99)</td>
<td>1.98 (1.05)</td>
<td>1.95 (1.14)</td>
</tr>
</tbody>
</table>

*Note.* CASI: Child Anxiety Sensitivity Index. ASWS: Adolescent Sleep-Wake Scale. RAPI: Rutgers Alcohol Problem Index. TMDQ: Teenage Motivation for Drinking Questionnaire.