



# Gender Differences in the Relationship Between PTSD and Youth Alcohol Use

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## Abstract

It has been established that post-traumatic stress disorders (PTSD) contribute to an increased risk of alcohol use and alcohol use disorders. Research has shown that this is particularly true for adult females. However, limited research exists regarding whether PTSD predicts alcohol use among youth, nor has it adequately addressed whether gender plays a differential role in predicting the influence of PTSD on youth alcohol use. Using a nationally representative sample of 2,667 eighth-grade junior high school students (aged 14 to 15) in Taiwan, this study examined the relationship between PTSD and adolescent alcohol use and the moderating effect of gender on the relationship. The findings indicated that gender is a moderating factor when examining the influence of PTSD on alcohol use, with PTSD symptoms predicting alcohol use only for female but not male youth. These results suggest that secondary alcohol prevention programs should prioritize identifying females with PTSD and that further research on post-trauma health behaviors among female youth is needed.

**Keywords** Gender difference · Youth alcohol use · PTSD · Logistic regression · Taiwan

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Alcohol consumption among youth is a significant problem in Taiwan, with nearly half of junior high school students (49.7%) reporting alcohol consumption in a national survey on youth health risk behaviors (Ministry of Health & Welfare, 2022). Fourteen percent of junior high school students reported having consumed alcohol in the previous 30 days, and 63.3% reported drinking more than one serving of alcohol each time they drank in the past month (Ministry of Health & Welfare, 2022).

Adolescence is a critical period of physical, emotional, and cognitive development. The adolescent brain is highly susceptible to the impact of alcohol, predisposing young drinkers to alcohol-related, mental health, and neurocognitive issues that can endure into adulthood (Lees et al., 2020; Yuen et al., 2020). Early onset of alcohol use is associated with a range of concerning outcomes as the youth matures, including increased frequency of drinking, higher risk of heavy alcohol use in the future, and greater likelihood of experiencing alcohol-related health and mental health problems later in life (Kim et al., 2017; Liang & Chikritzhs, 2015).

Trauma experiences have been shown to generate distress or negative psychological consequences that can disrupt the natural progression of development. Specifically, trauma affects the emotional and psychological well-being of youth and often leads to an increase in health risk-taking behaviors (Feng et al., 2019; Hsieh et al., 2016). To our knowledge, however, only limited research has examined the effect of post-traumatic stress disorder (PTSD) on alcohol use among the general youth population. Additionally, while post-trauma reactions have been found more significant for females than for males (Christiansen & Berke, 2020; Garza & Jovanovic, 2017; Street & Dardis, 2018), it remains unclear whether the effect of PTSD on adolescent alcohol use actually differs when considering gender. This study explored the effects of PTSD on youth alcohol use, assessing whether its impact was moderated by gender as different for male versus female teens in Taiwan.

## PTSD and Alcohol Use Among Youth

The connection between PTSD and alcohol use disorders in adults has been consistently demonstrated in studies (Forbes et al., 2015; Guinle & Sinha, 2020; Jackson & Deye, 2015). However, studies on the relationship between PTSD and alcohol use among youth are less prevalent. Research has found that among the general youth population, experiences that are traumatic or potentially traumatic are linked to a higher likelihood of substance use or substance use disorders (Carliner et al., 2017; Feng et al., 2019). A recent study on trauma-exposed youth found that lifetime trauma is associated with both more severe PTSD symptoms and substance use behaviors (Leri et al., 2024). Similarly, another study found that PTSD symptoms explain the impact of adverse childhood experiences on adolescent binge drinking (Arwood & Nooner, 2023). These findings suggest a possible influence of PTSD on alcohol use among young individuals.

For youth with PTSD symptoms, alcohol use has served as a means for self-medication to alleviate related emotional and psychological distress (Hawn et al., 2020; Jester et al., 2015). According to the stress coping model in the substance use literature (Wills, 2013), individuals who have experienced mental health problems often have an increased proclivity for substance use as a coping mechanism to alleviate mental health symptoms. Specifically, Jester and colleagues (2015) found that among youth who had experienced early childhood trauma, those who expressed a higher level of expectancy for using alcohol as their preferred coping mechanism also exhibited higher levels of alcohol use as they

matured. A latent analysis of motives for alcohol use among 3,957 seventeen-year-olds found that adolescents who experienced mental health problems were six times more likely to cite coping as their primary reason for drinking than peers not affected (Stapinski et al., 2016).

## Gender Difference in PTSD and Alcohol Use

Research has identified two gender differences in the relationship between PTSD and alcohol use. First, women have reported higher and earlier lifetime exposure to trauma than men, especially as it relates to high-impact trauma (e.g., sexual trauma) (Olf, 2017). They often exhibit more debilitating social, biological, and psychological responses to trauma that have been shown to significantly impact their health and well-being (Olf, 2017). The differences in how trauma is experienced and responded to may be due to how each gender is socialized (Street & Dardis, 2018). For example, physical assault and psychological abuse of women by an intimate partner can elicit a compromised sense of safety that exacerbates trauma responses. In addition, psychobiological factors, such as genetic predisposition, hormonal fluctuations, and increased perception of threat, may collectively contribute to a more pronounced trauma reaction in women (Christiansen & Berke, 2020; Olf, 2017).

Second, men and women vary in their propensity for using substances as self-medication and/or a coping strategy. Among clinical samples, PTSD symptoms are strongly linked to “drinking to cope” motives for both men and women; however, the correlation between coping motives and “average alcohol quantity” was significant only for women (Lehavot et al., 2014, p.10). Similarly, Peltier and colleagues (2019) found that adult women tend to use alcohol more often than men to manage negative emotions and stress responses. Of note for this study is the finding that these differences can manifest during adolescence (Garza & Jovanovic, 2017). For example, studies have confirmed that, among high school youth, post-victimization depression partially explained how bullying impacted substance use for females but not for males (Kim et al., 2019; Luk et al., 2010).

Research on the relationship between trauma and alcohol use among youth in Taiwan has been particularly limited. Existing studies have shown that childhood adversities are associated with an increase in alcohol use during adolescence (Feng et al., 2019; Lee & Feng, 2024). However, none of these studies have clarified the role of PTSD or considered gender differences in the effect of trauma on youth alcohol use.

## The Current Study

Based on the literature discussed above, the authors sought to answer the following research question: *What has been the influence of PTSD on alcohol use for male and female youth?* Lazarus and Folkman’s (1984) stress and coping theory model guided the study. The theory suggests that in the face of past trauma, an individual’s perceptions of the illness, personal traits, and resources may all be essential predictors of their eventual coping efforts or strategies (such as substance use) to ease the tension (Lazarus & Folkman, 1984; Valtonen et al., 2006). From a stress and coping perspective, levels of PTSD may directly influence alcohol use among youth. Based on the stress and coping theory, the authors generated two hypotheses:

- **Hypothesis 1:** Youth with higher levels of PTSD are more likely to use alcohol than youth with lower levels of PTSD.
- **Hypothesis 2:** Given the same levels of PTSD, female youth are more likely to use alcohol than male youth.

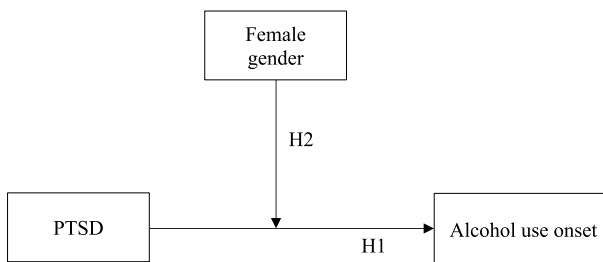
The research model below illustrates the relationships between female gender, PTSD, and youth alcohol use (see Fig. 1). To our knowledge, this study is among the first few empirical studies to examine the gender difference in the predicting role of PTSD on youth alcohol use.

## Methodology

### Sampling

The sample for this study was comprised of 2,667 eighth-grade students (14 to 15 years old) who participated in the third wave of a nationwide longitudinal study of children's and adolescents' family and social experiences (LSCAFSE) conducted in Taiwan in 2018. At Wave 1, the sample youth were four-graders enrolled in a proportionately stratified list of primary schools pulled from all 19 counties and cities in Taiwan. School principals of the selected schools were approached and introduced to the research project. Approximately half of the principals consented (49%), resulting in 314 elementary schools participating in the study. The primary reasons for non-participation in the study included the school's emphasis on academic performance and the lack of available time for extracurricular activities.

Following the principal's approval, students from the participating schools were invited to join the study. Nearly all (99.9%) of the consenting parents' children agreed to participate. Consequently, a total of 6,233 fourth graders were enrolled in Wave 1 of the study in 2014 (Shen et al., 2019). The research team tracked the participants as they progressed to sixth grade in 2016 and eighth grade in 2018. The sample decreased to 3,737 participants due to attrition by Wave 2 and further declined to 2,667 participants by Wave 3 (Hsieh et al., 2021a, 2021b; Yang et al., 2023). Despite attrition rates, the sample of 2,667 youth resulted in a post-hoc statistical power exceeding 0.8 for the analysis of hypotheses. Further details concerning the statistical power analysis are available in the results section.



**Fig. 1** Conceptual figure representing the tested moderated model. Note: Predictor variable: PTSD. Outcome variable: alcohol use onset. Moderator: female gender

## Data Collection

All waves of the study used survey questionnaires as the data collection method. At the time of data collection for each wave of the study, the research team contacted the students and provided them and their parents with a consent form explaining the study's purpose, anonymity, and confidentiality. Both students and parents who agreed to participate in the study signed and returned the form. The research team then scheduled group sessions to distribute self-report study questionnaires and collect responses from the students. All questionnaires were anonymized and contained no personal information. Participants received a unique ID code at baseline, which was solely used to link their responses across study waves. Questionnaires with the assigned codes were stored separately from the consent forms to uphold respondent anonymity. All student participants received stationery as a reimbursement for their time. The study received IRB approval from the Research Ethic Committee of National Taiwan University Hospital. As stated in the IRB protocol, the study data remains available only to the research team. The authors of this paper are all members of the research team.

## Measures

The questionnaires included measures on demographics (e.g., gender, age, parental marital status, and family members), parental alcohol use, peer alcohol use, childhood victimization histories, PTSD, and youth alcohol use. Seven experts from the fields of medicine, psychology, and child development reviewed the measurements to ensure their content validity. A pilot study was also conducted to test the measures' reliability and validity. Below are detailed descriptions of measures of the variables used in the current study.

### PTSD

The Chinese version of the UCLA PTSD Reaction Index for DSM-IV was used to assess youth's PTSD levels. The measure was comprised of 17 statements describing the negative outcomes of traumatic experiences after removing five items from the original scale based on the factor analysis results obtained from the pilot study (Hsieh et al., 2021a, 2021b). Examples of the statements included: "When something or an object reminds me of the situation at that time, I become very angry, scared, or deeply saddened" and "I try my best not to talk about, think about, or feel that dreadful thing anymore." The youths were provided with a 5-point Likert scale on the frequency of each outcome (0 = never to 4 = most of the time). The average frequency score was calculated to represent a youth's PTSD score. Higher scores indicated more severe PTSD symptoms in the youth. The scale has been validated on a randomized sample of Taiwanese students (Hsieh et al., 2021a, 2021b; Shen et al., 2019).

### Youth Alcohol Use

Participants were asked if they had ever drunk alcohol; response options were binary, consisting of "yes" or "no" answers (1 = Yes; 0 = No).

## Gender

Gender was measured by a binomial question asking the respondents' gender (1 = female; 0 = male).

## Control Variables

The control variables in the model included peer alcohol use, parental alcohol use, and childhood victimization. Literature on adolescent alcohol use behaviors has shown that early onset of alcohol use was associated with affiliation with alcohol-using peers (Leung et al., 2014; Mundt, 2011; Trucco et al., 2011) and parental alcohol use (Yang et al., 2023).

**Peer and Parental Alcohol Use** For peer alcohol use, the respondents were asked if their friends usually drink alcohol with response options of "yes" or "no." To assess parental alcohol use, student participants were asked two questions about their father and mother's alcohol use: "Does your father often drink alcohol?" and "Does your mother often drink alcohol?" (0 = No, 1 = Yes). The scores for both questions were then added as the parental alcohol use score, ranging from 0 to 2.

**Childhood Victimization** Childhood victimization has been identified as an important factor contributing to alcohol use among adolescents (Sartor et al., 2018). The youths were asked thirty-seven (37) questions regarding childhood victimization. Types of victimization included physical and psychological neglect (7 items), community violence (2 items), psychological violence from parents (4 items for the father and the same 4 items for the mother), physical abuse from parents (8 items for father and the same 8 items for mother), sexual violence (2 items), inter-parental violence (2 items). The youth were provided with a 5-point scale and asked to rate the frequency at which they had experienced each item in the preceding year (0 = never, 1 = 1 to 2 times, 2 = 3 to 5 times, 3 = 6 to 10 times, and 4 = more than 10 times). An average score of all items was calculated, representing a youth's childhood victimization score.

## Data Analysis

The study used SPSS version 29 with the PROCESS macro to perform statistical analysis. A descriptive analysis was done to determine the demographic information of the sample and distribution of youth alcohol use, PTSD, peer alcohol use, parental alcohol use, and childhood victimization. Second, *t*-test analyses were performed to test the association between youth alcohol use and PTSD, child victimization, and parental alcohol use, respectively. Chi-square analysis was performed to test the association between youth alcohol use and female gender and peer alcohol use, respectively. Finally, logistic regression analyses were performed to examine the effect of PTSD on youth alcohol use and if the relationship between PTSD and youth alcohol use changed when considering the female gender. Specifically, the interaction term of gender and PTSD was added to the logistic regression model to examine the moderating role of gender on the relationship between PTSD and youth alcohol use. Finally, post-hoc power analysis was conducted using G\*Power software (Faul et al., 2007, 2009) to provide insights into the reliability and interpretation of primary study findings. The analysis was based on the effect sizes (i.e., odd ratios) observed in the study, with a significance level ( $\alpha$ ) of 0.05 and a sample size of 2,667.

## Results

### Descriptive Analysis

The majority of participants (98.8%) were between 14 and 15 years old, with a few falling slightly younger or older. Gender distribution among all participants was nearly equal, with 51% identifying as male and 49% as female based on self-reported gender in the survey questionnaire. Additionally, most participants (88.2%) had one or more siblings, while 11.8% were the only child. Regarding parental marital status, the majority (76.3%) reported their parents as married and living together, while 13.9% reported their parents as divorced, and the remaining participants reported various conditions, such as parental death. The vast majority of youth (96.3%) lived with their biological parent(s), while a small percentage resided with grandparents or relatives (3.2%). Only a few participants lived with foster families, stepparents, siblings, or other guardians (0.5%).

Over one out of four (28%) youth have drunk alcohol as an eighth-grade student. The gender ratio for the participants was approximately 1 to 1 (males = 51%; females = 49%). PTSD scores ranged from 0 to 4 (mean = 1.06; S.D. = 0.69). Childhood victimization scores ranged from 0 to 3.18 (mean = 0.27; S.D. = 0.27). Around 4% of the youths had friends who drank routinely. Parental alcohol use scores ranged from 0 to 2, with the mean being 0.1 (see Table 1).

### Youth Alcohol Use and Correlates

According to the results of the bivariate analyses, the likelihood of alcohol use did not differ by gender but was different for youth with varying levels of PTSD. Higher levels of PTSD were associated with a higher likelihood of alcohol use ( $t = -6.46$ ,  $p < 0.001$ ). Youth who reported ever using alcohol also reported higher levels of childhood victimization history ( $t = -8.4$ ,  $p < 0.001$ ). Finally, higher parental alcohol use was associated with a higher likelihood of youth alcohol use ( $t = -4.82$ ,  $p < 0.001$ ). The existence of alcohol-involved friends was also significantly related to youth alcohol use ( $X^2 = 60.15$ ,  $p < 0.001$ ) (see Tables 2 and 3 for results of T-test and Chi-square analyses).

**Table 1** Descriptive Statistics  
( $N = 2,667$ )

|                         | Minimum | Maximum | Mean | S.D |
|-------------------------|---------|---------|------|-----|
| Youth alcohol use       | 0       | 1       | .28  | -   |
| Female gender           | 0       | 1       | .49  | -   |
| PTSD                    | 0       | 4       | 1.06 | .69 |
| Childhood victimization | 0       | 3.18    | .27  | .27 |
| Peer alcohol use        | 0       | 1       | .04  | .18 |
| Parental alcohol use    | 0       | 2       | .1   | -   |

**Table 2** Bivariate analyses on differences in youth alcohol use by PTSD, childhood victimization, and parental alcohol use ( $N=2,667$ )

| T-test                  | Ever drank alcohol<br>M(S.D.) | Never drank alcohol<br>M(S.D.) | <i>t</i> |
|-------------------------|-------------------------------|--------------------------------|----------|
| PTSD                    | 1.21 (.72)                    | 1.01 (.66)                     | -6.46*** |
| Childhood victimization | .35 (.32)                     | .24(.24)                       | -8.4***  |
| Parental alcohol use    | .16 (.39)                     | .08 (.3)                       | -4.82*** |

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

**Table 3** Bivariate analyses on differences in youth alcohol use by gender and peer alcohol use ( $N=2,667$ )

| Chi-square                   | Ever drank alcohol | Never drank alcohol | Pearson $\chi^2$ |
|------------------------------|--------------------|---------------------|------------------|
| Female                       | 26.6%              | 73.4%               | 1.44             |
| Male                         | 28.7%              | 71.3%               |                  |
| Reported peer alcohol use    | 62.8%              | 37.2%               | 60.15***         |
| Reported no peer alcohol use | 26.3%              | 73.7%               |                  |

$p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

**Table 4** Logistic regression analysis with moderation ( $N=2,667$ )

| Variables               | Model 1<br>Odds ratio | Model 2<br>Odds ratio |
|-------------------------|-----------------------|-----------------------|
| Childhood victimization | 2.91***               | 2.85***               |
| Peer alcohol use        | 4.2***                | 4.27***               |
| Parental alcohol use    | 1.63***               | 1.61***               |
| Female gender           | .87                   | 0.62*                 |
| PTSD                    | 1.28***               | 1.11                  |
| Female gender*PTSD      |                       | 1.35*                 |

\*  $p < .05$ , \*\*  $p < .005$ , \*\*\*  $p < .001$

## Logistic Regression Results

### The Effects of PTSD on Youth Alcohol Use

Logistic regression analysis was performed to examine the effect of PTSD on youth alcohol use, controlling for childhood victimization, peer alcohol use, parental alcohol use, and gender. Results show that PTSD significantly increases the likelihood of youth alcohol use. One additional point of PTSD increased the likelihood of youth alcohol use by 28% (OR = 1.28,  $p < 0.000$ ) (see Table 4, Model 1).



### The Moderating Effects of Gender on the PTSD-Alcohol Use Relationship

When examining the interaction terms of gender and PTSD, results indicated that the female gender served as a moderating variable for the effect of PTSD on youth alcohol use, with females showing an increased impact of PTSD on drinking than males. With the same levels of PTSD, females were 35% more likely than males to have used alcohol (OR = 1.35,  $p < 0.000$ ). Also, when considering the interaction terms of PTSD and gender, the sole effect of PTSD was not observed (OR = 1.11;  $p = 0.27$ ), meaning that PTSD levels only predicted alcohol use for females but not for males (see Table 4, Model 2). Figure 2 presented below presents a visualization demonstrating the moderation effect of gender on the relationship between PTSD and youth alcohol use. The likelihood of alcohol use sharply increased with rising PTSD scores among females, as indicated by the corresponding line, whereas males exhibited a more gradual incline in the likelihood of alcohol use with increasing PTSD scores, represented by the respective line (see Fig. 2).

Finally, the post-hoc power analysis revealed satisfactory power levels in the above logistic regression analyses. In Model 1, examining the main effect of PTSD on youth alcohol use, the achieved power was 0.84, indicating a satisfactory sensitivity to detect the observed effect. For the interaction effect between PTSD and the female gender examined in Model 2, the achieved power was 0.94, suggesting an even higher ability to detect this effect.

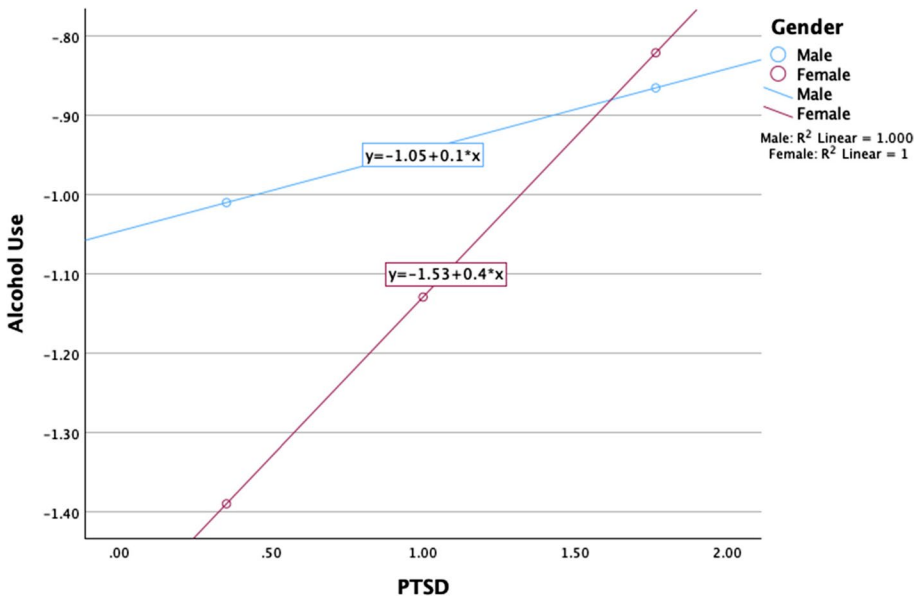


Fig. 2 Visualization of the moderation effect of gender on PTSD and youth alcohol use

## Discussion

This study was among the first few to examine the direct influence of PTSD on alcohol use among junior high school students, with a particular focus on gender differences. Within our sample, 28% of youths reported alcohol consumption, a figure lower than the national survey findings for junior high school students in Taiwan (49.7%) (Ministry of Health & Welfare, 2022). This difference may stem from the self-selective nature of the recruitment process and the high attrition rate. In turn, self-selection and attrition may have led to a sample skewed towards individuals following a more conventional educational trajectory and, therefore, perhaps exhibiting fewer deviant behaviors such as underage alcohol use. Consistent with prior research, bivariate analyses revealed significant correlations between youth alcohol consumption and peer, parental alcohol usage, and childhood victimization, respectively. These findings supported the decision to include these factors as control variables in the multivariate models.

The results supported the authors' first hypothesis, showing a significantly increased effect of PTSD on youth alcohol use (Hypothesis 1). Empirically, the finding aligns with and complements existing research confirming the relationship between PTSD and adult drinking (Forbes et al., 2015; Guinle & Sinha, 2020; Jackson & Deye, 2015) and extends the literature by elucidating the relationship between PTSD and alcohol use among eighth-grade students. This clarification helps explain the prevalent co-occurrence of PTSD and alcohol use disorders among youth (Hawke et al., 2009) and suggests a drinking-to-cope trajectory that starts from adolescence and extends to adulthood. Theoretically, the finding supports the stress-coping model of substance use (Wills, 2013), showing alcohol use as a coping mechanism for youth grappling with the psychological aftermath of trauma experiences and attempting to alleviate the associated symptoms of PTSD. Additionally, given that we controlled for the influence of childhood victimization and still observed a significant impact of PTSD, it suggests that PTSD may exert a distinct adverse effect on youth alcohol use, separate from the influence of childhood victimization. From a neurobiological standpoint, PTSD symptoms may impact the structure and function of developing brains and constrain youths' ability to regulate emotions (Herrington, 2017). In turn, this could heighten the likelihood of turning to alcohol as a means of coping with emotional distress.

Our findings also support the second hypothesis, confirming the substantial moderating influence of gender in the association between PTSD and youth alcohol use (Hypothesis 2). The result shows that female youth, in contrast to their male counterparts, reported a significantly higher likelihood of alcohol use with similar PTSD severity levels. This resonates with previous studies on adults showing that females have a higher tendency to use alcohol as a coping mechanism for PTSD symptoms than males (Lehavot et al., 2014; Peltier et al., 2019). It also aligns with studies on adolescents showing gender differences in the association between depression and alcohol consumption (Kim et al., 2019). Possible explanations include the more pronounced trauma effects on women due to their unique psychobiological traits, i.e., heightened sensitivity to threats and a higher need for a sense of control (Christiansen & Berke, 2020; Olff, 2017). An explanation might be that drinking serves as an effective means for female adolescents to attain security and a sense of control, thereby alleviating PTSD symptoms. Employing the stress-coping model of substance use (Wills, 2013), our findings emphasize the need for adopting a gender-sensitive perspective when trying to understand the role that drinking plays among youth as a coping mechanism. While increased severity of PTSD symptoms was associated with a higher likelihood of drinking onset for both male and female youths, we found a particularly robust

association between women's alcohol consumption and the presence of PTSD symptoms. Our research indicates that a substantial portion of alcohol use onset among male youths may be explained by theoretical frameworks that go beyond the constructs found in the stress-coping model.

Overall, the current study addresses a research gap regarding the relationship between PTSD, alcohol use, and gender among adolescents, demonstrating the critical effect of PTSD on alcohol use among female youth. Findings add to our knowledge of gender differences in post-trauma behavioral health and alcohol use trajectories, suggesting that when experiencing a similar level of severity in PTSD symptoms as their male counterparts, female youth may be more inclined to drink alcohol. Adolescence is a critical period characterized by significant physical, emotional, and cognitive development. Mental health issues during this developmental phase can have lasting and ingrained impacts on the formation of coping mechanisms such as substance use (Eschenbeck et al., 2018; Modecki et al., 2017). The results highlight the need to investigate further the development of substance use behaviors among girls with mental health needs and target PTSD symptoms in female adolescents to mitigate the early onset of alcohol use within this population.

## Limitations

This study, despite its strengths, has some significant limitations. One primary constraint was that the original survey did not specify the exact time when participants initially used alcohol. Consequently, the authors could not establish the temporal precedence of PTSD in relation to the onset of alcohol use among the participants. It remains unclear, therefore, whether participating youths first engaged in alcohol consumption after experiencing PTSD symptoms. Nevertheless, drawing on previous research regarding the impact of PTSD on youth alcohol use, it is not overly assertive to suggest the temporal precedence of PTSD to the onset of youth alcohol use. In addition, the use of a single-item measurement and binary classification for alcohol use (Yes/No) presents another significant limitation: it overlooks the complexity of drinking behavior, such as frequency and intensity. Finally, the reliance on self-reported data from participating youths introduced the possibility of self-report bias.

## Implications

The research verified the impact of PTSD on female youth alcohol use, suggesting that prevention and intervention efforts should be increased when working with female youths grappling with mental health problems such as PTSD. These efforts should encompass addressing underlying trauma, providing social and professional support, and implementing strategies to diminish the risk of underage substance use within the context of PTSD. An intervention model could be based on life skills training that includes decision-making, problem-solving, and interpersonal skills that have been shown to enhance youth's psychological competence and reduce the likelihood of turning to alcohol (Wu et al., 2023). Service providers should also connect affected youth with mental health resources and develop peer support programs that promote positive social interactions and discourage alcohol use.

As the study confirmed the moderating role of gender on the relationship between PTSD and alcohol use, it implied that resources should be increasingly allocated to female youths to promote their capability to cope with PTSD. It is crucial to tailor prevention

or intervention efforts to specific needs based on individual trauma experiences, available mental health resources and social support, and emotional regulation and coping capabilities, with a focus on addressing the drinking-to-cope expectancy. Further research is needed to examine gender differences in the social learning pathways that lead to underage alcohol use.

## Conclusion

The national representative study confirmed the predictive role of PTSD on youth alcohol use; female youths with PTSD are particularly challenged by an early onset of alcohol use. The results informed both mental health and substance use services for youths, suggesting a need to increase efforts addressing the mental health issues of females who have experienced trauma and to guide female youths in developing positive and healthy coping strategies when facing mental health challenges such as PTSD.

**Author contributions** All authors whose names appear on the submission made substantial contributions to the study, approve the manuscript to be published, and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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## Declarations

**Ethics** All procedures followed were in accordance with the ethical standards of the responsible committee and with the Helsinki Declaration of 1964 and its later amendments.

**Informed Consent** Informed consent was obtained from all participants included in the study.

**Conflict of Interest** The authors have declared no conflict of interest.

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