

# Gender-Specific Predictors of Posttraumatic Stress Disorder in Adolescents: The Role of Problematic Substance Use and Interpersonal Relationships

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**Abstract** Gender is an important risk factor for both posttraumatic stress disorder (PTSD) and substance use disorders (SUD) in adolescents; however, little is known about the influence of gender when considering their common co-occurrence. This study examined independent predictors of PTSD severity between genders in a Danish probability sample of 15- to 18-year-old males ( $n=863$ ) and females ( $n=1,125$ ). The results showed that drug abuse and avoidant attachment to best friends were significant predictors of PTSD severity in male adolescents, whereas alcohol abuse and the absence of posttraumatic social support from parents remained significant predictors for female adolescents. The results support the influence of gender-specific substance abuse patterns and dysfunctional interpersonal relationships on the PTSD severity of traumatized adolescents.

**Keywords** Gender differences · Trauma · Substance use disorder · Substance abuse · Co-morbidity · Adolescence

## Introduction

According to the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV; American Psychiatric Association 1994) posttraumatic stress disorder (PTSD) is

classified as an anxiety disorder, which is the most common category of mental disorders among adolescents. A recent nationally representative survey of US adolescents revealed that PTSD is observed in 1.6 % of individuals (Kessler et al. 2012). Further, female adolescents consistently report PTSD more frequently than males across trauma types and cultures (Danielson et al. 2010; Ditlevsen and Elklit 2010; Giaconia et al. 2000; Kessler et al. 2012; Kilpatrick et al. 2003; Schiff et al. 2012). According to a meta-analysis performed on studies over the past 25 years, females experience potentially traumatic events less often than males (Tolin and Foa 2008). Despite this, being female is a strong predictor of PTSD (Perkonig et al. 2000), which has led to increased interest in examining PTSD in female samples (Nooner et al. 2012). The majority of individuals suffering from PTSD have also been found to report at least one other mental health disorder, with comorbid substance use disorders (SUD) being common among male adolescents in particular (Macdonald et al. 2010). In general, adolescent males are more likely than females to report SUD (Giaconia et al. 2000; Kessler et al. 2005, 2012; Kilpatrick et al. 2003; Macdonald et al. 2010; Swendsen et al. 2009), and the male gender remains a significant risk factor for alcohol and drug abuse, even when a history of previous traumatic experiences is taken into account (Danielson et al. 2009). However, it is worth mentioning that among individuals recruited from substance abuse treatment, males appear to be equally vulnerable to PTSD as females (Stewart et al. 2006).

Research shows consistent gender differences when examining PTSD and SUD as independent diagnoses; however, the impact of gender on their co-occurrence is less clear. Research nevertheless suggests that gender plays an important role in the different prevalence rates found for males and females, and the results of previous studies have, therefore, motivated research examining genders separately to further explore the gender-specific mechanisms underlying substance abuse, PTSD, and their common co-occurrence (Bornovalova et al.

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2009; Guay et al. 2006; Miettunen et al. 2014). These gender differences are believed to result from complex etiologies associated with different emotional and behavioral problems (Zahn-Waxler et al. 2008). Accordingly, this study aimed to contribute to this research field by examining specific types of problematic substance use, attachment strategies, and post-traumatic social support as possible gender-specific predictors of PTSD severity.

### Gender and Substance Use-Related Posttraumatic Pathology

PTSD has been related to drug use disorders more often than alcohol use disorders in both representative (Kilpatrick et al. 2000; McCauley et al. 2010; Perkonig et al. 2000) and at-risk adolescent samples (Cornelius et al. 2010; Lipschitz et al. 2003). Consistent with the self-medication hypothesis, the use of specific substances may provide effective short-term relief from overwhelming emotional, social and behavioral disturbances. Hence, certain character traits are believed to predispose individuals to substance dependence, including problems in interpersonal relationships and affect management (Khantzian 1985). Indeed, among substance-abusing adolescents, affect regulation, opposed to problem-focused or avoidant coping strategies, is more common in adolescents diagnosed with PTSD than in adolescents without PTSD (Staiger et al. 2009), suggesting that increased substance use after a traumatic event may be an effective, yet maladaptive, strategy for diminishing trauma-related emotions. This maladaptive emotional and behavioral self-regulation has been argued to result from a disruption in normative biological maturation processes that are often observed in trauma-exposed adolescents (Nooner et al. 2012), and gender differences have been revealed in the organization of the neural system that is responsible for motivation and addiction, particularly in the early stages of problematic substance use. These findings indicate that males are primarily driven by positive reinforcement to participate in risky behaviors, such as drug experimentation, whereas females tend to use drugs for self-medication to reduce stress or to alleviate psychological distress (Becker et al. 2012).

In substance abuse treatment-seeking adolescents, PTSD symptom severity has been associated with drinking-to-cope (Lehavot et al. 2014) and marijuana coping motives, regardless of the individual's gender and negative affectivity (Bujarski et al. 2012). These findings indicate that once substance use has manifested at a clinical level, males and females seem to apply similar affect regulation strategies when experiencing posttraumatic symptoms. However, when considering the quantity of substance consumption, females tend to exhibit a particular vulnerability toward trauma-related psychopathology.

PTSD symptoms have been associated with drug and alcohol use among treatment-seeking females (Clark et al. 1997; Lipschitz et al. 2000), and underlying drinking-to-cope motives seem to influence alcohol consumption in females only (Lehavot et al. 2014). These findings may be partly explained by females' increased sensitivity to anxiety, which is often observed in individuals with PTSD, and their increased vulnerability to internalizing mental problems in general (Zahn-Waxler et al. 2008). These internalized emotional difficulties are often associated with substance use, particularly alcohol use, which provides a calming effect (Miettunen et al. 2014). Overall, research supports the self-medication model (Khantzian 1985) in which individuals experiencing elevated levels of distress use substances to regulate negative mood states, such as those identified in posttraumatic processing, irrespective of gender, especially at clinical levels of substance abuse. Further research in nonclinical samples is nevertheless needed to examine gender differences in the mechanisms underlying comorbid PTSD-SUD. This study aimed to examine whether substance use (alcohol or cannabis) or substance abuse (alcohol or drug) represent unique gender-specific risk factors of PTSD severity.

### The Role of Interpersonal Relationships

The capacity to establish emotional bonds with others is a primary feature of successful personal functioning and mental health, and the need for comfort and support from others is believed to be crucial to an individual's feeling of security in close relationships (Bowlby 1988). Female adolescents tend to report less avoidant attachment structures than males in parental relationships (Ruhl et al. 2014), however, when exposed to childhood mistreatment females report increased avoidant attachment, particularly toward mothers (Reinert and Edwards 2009). Because relationship experiences, such as support, strongly influence individuals' attachment security (Ruhl et al. 2014), a supportive relationship with one's mother may serve as a buffer for negative emotional effects in trauma-exposed female adolescents in particular.

Although parents play a predominant role in early development, peers become increasingly influential from school age onward. Research shows that adolescents are highly influenced by peers, as assessed in terms of social network quality, and that peer relationships have a greater effect on adolescents' substance use than adolescents' parental relationships and level of posttraumatic distress (Mason et al. 2011). Furthermore, interactions with substance-using peers and participation in high-risk behaviors have a greater influence on substance use among adolescent males than among adolescent females (Mennis and Mason 2012), particularly with respect to cannabis abuse (Mason et al. 2013).

The attachment system during adolescence is a complex process that undergoes emotional, cognitive, behavioral, and social alterations (Allen 2008), and adolescents, therefore, appear to be particularly vulnerable to the development of psychopathology during this life period. Attachment security, especially low anxiety levels, has been found to be a strong predictor of decreased risk for a range of psychopathologies, suggesting that a positive view of the self is an important aspect of attachment for both normative and at-risk samples (McLewin and Muller 2006). By contrast, research indicates that the fearful attachment subtype is related to both substance abuse (Schindler et al. 2005) and PTSD symptoms (O'Connor and Elklit 2008), suggesting that individuals suffering these specific disorders lack a useful strategy for regulating negative emotions through the exhibition of high avoidance and anxiety attachment structures. Hence, insecurity in specific relationships may reflect gender-specific vulnerabilities for increased pathology during posttraumatic processing.

During posttraumatic processing, interpersonal relationships are also crucial for providing social support, which seems to have a greater effect on females than on males (Guay et al. 2006). Further, a lack of parental social support has been found to directly influence levels of PTSD symptoms independently of trauma exposure in adolescents two years after a natural disaster (Bokszczanin 2008) and has been related to increased risk for a range of psychopathologies, including emotional and behavioral problems, irrespective of an individual's abuse history (McLewin and Muller 2006). Therefore, the impact of social support on PTSD severity seems to represent a protective effect on psychological distress in general, toward which females seem more susceptible than males. However, little is known about the mechanisms underlying this relationship, necessitating research investigating genders separately to explore these mechanisms further (Guay et al. 2006).

### The Current Study

Research shows that gender is a highly influential factor in the development of PTSD and SUD; however, the effect of gender in the co-occurrence of PTSD and SUD is less clear. Previous findings clearly support the importance of analyzing genders separately when assessing different patterns of vulnerability in the development of PTSD severity. To our knowledge, however, no study has examined substance use and abuse types as gender-specific risk factors in the common co-occurrence of problematic substance use and PTSD in adolescents. Additionally, the few studies that have explored gender-specific risk patterns have primarily focused on either clinical samples or female participants; thus, gender-specific problematic substance use in the development of PTSD in a nonclinical probability sample remains unexplored. This

study, therefore, analyzed genders separately when examining specific types of problematic substance use as predictors of increased PTSD severity in a Danish adolescent probability sample. Additionally, this study considered the contribution of relationship-specific dysfunctional relationships in the form of parental and peer attachment insecurity and the absence of posttraumatic social support.

## Method

### Study Design and Sample

This study was part of a larger cross-sectional study conducted between December, 2011 and March, 2012 by the Centre for Alcohol and Drug Research at Aarhus University in Denmark (Pedersen and Frederiksen 2012). The participants were 15- to 18-year-old adolescents from four municipalities and were randomly selected by the Danish Civil Registration System, resulting in a final sample of 1,988 participants (a 46.6 % response rate). The sample comprised 52 % females with an average age of 16.44 years ( $SD=1.11$ ). Most of the participants were Danish natives (87.5 %) who were currently enrolled in school (95.5 %): the youngest individuals were attending the 8th or 9th grade (21.5 %), 12 % of the older adolescents were voluntarily enrolled in 10th grade, and the remaining individuals were attending higher secondary school (47.8 %), were receiving vocational training (14.3 %), or were not currently receiving education or training (4.5 %).

### Measures

The study comprised two online surveys, both containing batteries of self-report questionnaires designed to assess demographic characteristics, alcohol and drug use patterns (survey 1), and a range of psychosocial topics (survey 2). A selection of these questionnaires was used for this study.

### Posttraumatic Stress Disorder

PTSD was measured according to the DSM-IV diagnostic criteria (APA 1994). The participants were asked to select their current most distressing event (criterion A1) and to associate it with at least one of the following subjective experiences: fear, helplessness, or horror (criterion A2). The Harvard Trauma Questionnaire (HTQ; Mollica et al. 1992), comprising 17 items, assessed the level of distress experienced in the three main PTSD symptom clusters (re-experiencing, avoidance, and hyper-arousal), which were reported on a Likert scale ranging from 1 (not at all) to 4 (all the time). To fulfill diagnostic criteria B, C, and D, a minimum score of 3 was required for at least one, three, and two items, respectively, within each of the three symptom clusters. The HTQ has been previously

used with Danish adolescents (Elklit 2002) and shows good psychometric properties in the Danish language version (Bach 2003). To fulfill a PTSD diagnosis, symptoms must have been consistently present for at least one month (criterion E), and the adolescent must be less likely than usual to enjoy normal daily activities because of these symptoms (criterion F). The participants were assigned to one of four possible PTSD severity groups corresponding to the requisite criteria: (1) no trauma exposure, (2) trauma exposure (criteria A1-2), (3) partial PTSD (criteria A-D), or (4) full PTSD (criteria A-F).

### Trauma-Related Variables

#### *Direct Trauma Exposure*

From a list of 22 negative life events, including the option “others”, the participants reported all events that they experienced in terms of direct (personally experienced) or indirect (witness to an event or experienced by a person close to them) exposure. The participants were assigned the category “direct trauma exposure” when their most distressing event was classified as being both a direct exposure and a trauma (A1 & A2).

#### *Retraumatization*

Being retraumatized was defined as experiencing the most distressing event two or more times.

#### *Posttraumatic Social Support*

The participants were asked whether they had spoken to their parents and/or peers (including a romantic partner, friends, or other nonprofessionals) regarding their most distressing event. These questions were responded to with a yes/no answer.

### Problematic Substance Use

#### *Alcohol and Cannabis Use*

A single-item measure was used to assess current alcohol use patterns on a Likert scale ranging from 1 (none) to 9 (every day). Current cannabis use patterns during the previous month were reported on a Likert scale ranging from 1 (none) to 7 (nearly every day).

#### *Alcohol and Drug Abuse*

The diagnostic criteria for substance abuse compatible with the DSM-IV (APA 1994) were used to assess alcohol and drug abuse separately. To fulfill the diagnosis of alcohol or drug abuse, nine items assessed whether the participants had exhibited a maladaptive pattern of alcohol/drug use during the previous year by fulfilling at least one of four possible diagnostic

criteria. All criteria required recurrent substance use that had consequentially resulted in a failure to fulfill major role obligations at work, school, or home (criterion 1), physically hazardous situations (criterion 2), legal problems (criterion 3), or social/interpersonal problems (criterion 4). Two scales ranging from 1 (low) to 4 (high) were used to reflect the severity of alcohol or drug abuse in terms of the four diagnostic criteria.

### Psychosocial Measures

#### *Attachment*

The Experiences in Close Relationships-Relationship Structures (ECR-RS; Fraley et al. 2011) scale was designed to measure relationship-specific avoidance and anxiety attachment structures. The ECR-RS assessed these attachment structures in parental and best friend relationships by using nine items rated on a Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The parental domain was assessed with reference to a self-selected parental figure. The Danish version of the ECR-RS was recently validated in a sample of Danish adolescents, showing good psychometric properties (Donbaek and Elklit 2013).

#### *General Mental Health*

The General Health Questionnaire-12 (GHQ-12; Goldberg 1978) was designed to assess mental health in the two weeks prior to assessment in the following three dimensions: anxiety/depression, social dysfunction, and loss of confidence. Responses on a 4-point Likert scale ranging from 0 (not at all/much less than usual) to 3 (much more than usual/more so than usual) were used to compute a total score between 0 and 36 points, which indicated an increased level of psychological distress reflected by the inability to perform normal daily functions and the appearance of new and distressing symptoms. The Danish version of the GHQ-12 (Loldrup et al. 1991) is considered both reliable and sensitive, rendering it ideal for research studies.

### Procedure

In cooperation with Statistics Denmark,<sup>1</sup> the participants were contacted by mail and provided with written information on the sample selection, the study’s purpose, and a link to the online survey with a personalized password. Three attempts were made to contact each participant. On the first page of the survey, the participants provided their informed consent. Throughout the survey, filters ensured that each participant was only confronted with relevant questions, which were

<sup>1</sup> Statistics Denmark is an independent institution that develops, produces and disseminates statistics about the Danish society

forced choices to ensure no missing data. The participants received a gift voucher for their participation in the survey.

**Ethics**

Before the data collection, the Danish Data Protection Agency granted the researchers permission to conduct the study. Danish research ethics committees only cover biomedical research and do not apply to research in the social sciences or research using questionnaires (Hartlev 1996). However, because the questionnaire involved serious psychological issues, including information regarding traumatization, the researchers adhered to the Ethical Principles for Nordic Psychologists, and the following actions were taken to address ethical concerns. Each respondent gave consent to participate; received information regarding anonymity of the data, the possibility to withdraw from the study at any point, and the possibility to resume the survey if he or she was unable to complete the survey all at once; and received contact information to address any questions or concerns arising following participation in the survey.

**Method of Analysis**

Data were collected with the online survey program SurveyXact, whereas statistical analyses were performed with IBM Statistical Package for Social Sciences (SPSS) 19. Sample characteristics and diagnostic rates were evaluated with descriptive statistics. One-way between-group analyses of variance (ANOVAs) with Tukey’s Wholly Significant Difference (WSD) post-hoc comparisons and independent-sample t-tests were used to assess differences in psychosocial and problematic substance use scale scores between individuals with levels of PTSD severity and individuals of different gender, respectively. Furthermore, chi-square tests for independence were used in the pre-analyses to assess the degree to which PTSD severity and gender were associated with a lack of social support. Finally, in the main analyses, hierarchical multiple regression models were used to assess gender-specific problematic substance use, attachment patterns, and social support as predictors of PTSD severity for the male and female subgroups, while controlling for the influence of other demographics, mental health problems, and trauma-related factors.

**Results**

In the current data set of 1,988 Danish adolescents, slightly over one-fourth (25.6 %) of the adolescents were currently affected by a traumatic event and consequently reported a variety of posttraumatic symptomatology. The descriptive statistics for the sample distribution across PTSD severity are

illustrated in Table 1. The most severely affected adolescents, composing 2.2 % of the total sample, met the full diagnostic criteria for PTSD. Females were found to report full PTSD three times more frequently than males. Most participants in the sample reported consuming alcohol during the previous year (86.8 %), and another 7.3 % had used illegal drugs; in the group using illegal drugs, nearly all the participants reported cannabis use (98.6 %). The diagnostic criteria for alcohol abuse were met by 8 and 6.9 % of males and females, respectively, whereas drug abuse was reported by 2.4 and 1.4 % of males and females, respectively.

Because there were no missing data, all analyses were conducted on the complete sample.

Adolescents who reported more severe levels of PTSD symptomatology were also significantly more likely to report more general mental health problems, substance use problems, attachment insecurity (Table 2), and a lack of social support from parents ( $X^2(3, n=1,988)=208.11, p<.001, Cramer’s V=.324$ ) and peers ( $X^2(3, n=1,988)=99.810, p<.001, Cramer’s V=.224$ ). These results suggest that support received during the posttraumatic process influences the extent of pathological development, as demonstrated by the large effect sizes. One-way ANOVAs with Tukey’s WSD post-hoc comparisons showed a significant main effect for PTSD severity (with the group of adolescents with partial or full PTSD compared with the group of adolescents without PTSD symptoms) across all variables, except for alcohol use.

General mental health had a significant impact on PTSD severity level, with close to a large effect, whereas the influence of the remaining variables was small. Therefore, PTSD severity was interpreted to be meaningful as the dependent variable for testing the main hypothesis of the study. T-tests also indicated that exploring gender further in separate analyses would be statistically valuable, as males and females scored differently on the majority of the problematic substance use-related and psychosocial variables (Table 3), with the exception of alcohol use, parental anxiety, and lack of posttraumatic social support from parents ( $X^2(3, n=1,988)=1.16, p>.05$ ) or peers ( $X^2(3, n=1,988)=.47, p>.05$ ). Among the psychosocial variables, avoidant attachment toward friends and general mental health scores were revealed to have the greatest influence by gender, with close to moderate

**Table 1** PTSD severity prevalence rates

	Males (n=863)	Females (n=1,125)	Total (n=1,988)
No trauma	82.0	68.2	74.2
≥Trauma	14.5	21.5	18.5
Partial PTSD	2.5	7.2	5.2
Full PTSD	1.0	3.1	2.2

Percentages provided within subsamples

**Table 2** Differences between PTSD severity levels in psychosocial and substance-related scores

	PTSD severity				F	$\eta^2$
	No Trauma $\mu$ ( $\sigma$ )	$\geq$ Trauma $\mu$ ( $\sigma$ )	Partial PTSD $\mu$ ( $\sigma$ )	Full PTSD $\mu$ ( $\sigma$ )		
<b>Psychosocial variables</b>						
GHQ-12	23.95 (5.48)	25.25 (5.63)	31.36 (5.91)	32.93 (7.25)	90.21**	0.12
ECR-RS avoidance - parent	15.52 (7.39)	15.93 (7.60)	18.73 (8.12)	19.88 (10.19)	10.09**	0.02
ECR-RS anxiety - parent	4.12 (2.97)	4.14 (2.75)	6.01 (5.20)	6.26 (5.51)	17.41**	0.03
ECR-RS avoidance - friend	14.00 (7.25)	13.22 (7.16)	14.71 (7.54)	17.91 (10.42)	5.79*	0.01
ECR-RS anxiety – friend	5.89 (4.17)	6.28 (4.26)	7.69 (5.15)	8.98 (5.39)	12.70**	0.02
<b>Substance-related variables</b>						
Alcohol use	4.75 (2.03)	4.90 (1.78)	4.85 (1.93)	5.07 (1.84)	.92	–
Cannabis use	1.13 (.63)	1.18 (.71)	1.36 (1.12)	1.26 (1.00)	4.19*	0.01
Alcohol abuse	.19 (.55)	.23 (.58)	.44 (.80)	.35 (.69)	6.82**	0.01
Drug abuse	.04 (.29)	.06 (.30)	.19 (.67)	.21 (.68)	9.54**	0.01

n=1988 / df=3,1984

Significance level (two-tailed): \*p<.01 \*\* p<.001

effects. Because alcohol use was influenced by neither PTSD severity nor gender, it was not included in further analyses. The remaining three variables for assessing problematic substance use (cannabis use, alcohol abuse, and drug abuse) were assessed as possible gender-specific predictors of PTSD severity.

**Gender-Specific Predictors of PTSD Severity**

The hypothesis that gender-specific problematic substance use patterns would underlie an increased risk for developing

PTSD was tested by using hierarchical multiple regression. Male (Table 4) and female (Table 5) subgroups were analyzed in separate four-step models. In step 1, the demographic variables age and education were entered, and the psychosocial variables were entered in step 2. The substance use-related variables were then added to the model in step 3, and the trauma-related variables were controlled for in the final step. The overall hierarchical regression models were significant for both males ( $F(17, 845)=158.60, p<.001$ ) and females ( $F(17, 1107)=172.97, p<.001$ ). The demographic variables accounted for 1.5 and 1.1 % of PTSD severity, the

**Table 3** Differences between genders in psychosocial and substance-related scores

	Gender		T	$\eta^2$
	Male $\mu$ ( $\sigma$ )	Female $\mu$ ( $\sigma$ )		
<b>Psychosocial variables</b>				
GHQ-12	23.46 (5.30)	25.78 (6.20)	-8.99****	0.04
ECR-RS avoidance - parent	16.94 (7.47)	15.02 (7.58)	5.65****	0.02
ECR-RS anxiety - parent	4.39 (3.37)	4.17 (3.05)	1.48 <sup>a</sup>	–
ECR-RS avoidance - friend	16.12 (7.54)	12.34 (6.77)	11.61****	0.06
ECR-RS anxiety - friend	5.86 (4.08)	6.32 (4.47)	-2,37 <sup>a</sup> *	0.02
<b>Substance-related variables</b>				
Alcohol use	4.73 (2.02)	4.83 (1.94)	-1.16	–
Cannabis use	1,23 (.85)	1.09 (.53)	4.23****	0.01
Alcohol abuse	.28 (.68)	.16 (.48)	4.40****	0.01
Drug abuse	.09 (.42)	.04 (.26)	3.21***	0.01

n=1988 / df=1986

Significance level (two-tailed): \*p<.05 \*\*p<.01 \*\*\*\* p<.001

<sup>a</sup> Corrected value for equal variances not assumed

**Table 4** Summary of hierarchical multiple regression model on PTSD severity for male adolescents

	Step 1			Step 2			Step 3			Step 4						
	B	SE	T	p	B	SE	t	p	B	SE	T	p	B	SE	t	p
Constant	-.72	.35	-2.03	.043**	-1.12	.36	-3.14	.002***	-1.09	.36	-3.06	.002***	-.50	.18	-2.76	.006***
Age	.06	.02	2.61	.009***	.06	.02	2.43	.015**	.05	.02	2.29	.022**	.02	.01	1.88	.06
Education																
8th/9th grade (reference)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10th grade	.04	.07	.54	.59	.05	.07	.73	.47	.05	.07	.69	.49	.01	.03	.18	.86
Higher secondary	-.12	.06	-1.89	.06	-.14	.06	-2.20	.028**	-.14	.06	-2.23	.026**	-.05	.03	-1.49	.14
Vocational training	-.08	.08	-1.11	.27	-.10	.08	-1.35	.18	-.12	.07	-1.59	.11	-.06	.04	-1.56	.12
No education/training	.02	.10	.20	.84	-.02	.10	-.17	.86	-.07	.10	-.74	.46	.04	.05	.84	.40
ECR-RS avoidance - parent					.00	.00	.86	.39	.00	.00	.72	.47	.00	.00	.39	.70
ECR-RS anxiety - parent					-.01	.01	-1.82	.07	-.01	.01	-1.82	.07	-.00	.00	-1.04	.30
ECR-RS avoidance - friend					.00	.00	.81	.42	.00	.00	.80	.43	.003	.001	2.19	.029**
ECR-RS anxiety - friend					.01	.01	1.12	.27	.01	.01	1.09	.28	-.00	.00	-.53	.60
GHQ-12					.02	.004	5.26	.000***	.02	.004	5.14	.000***	.007	.002	4.02	.000***
Cannabis use									.04	.02	1.55	.12	-.01	.01	-1.10	.27
Alcohol abuse									-.01	.03	-.41	.68	-.03	.02	-1.76	.08
Drug abuse									.13	.05	2.51	.012**	.07	.03	2.88	.004***
Direct exposure													1.16	.03	40.96	.000***
Retraumatization													.12	.03	3.91	.000***
No social support - family													.02	.04	.45	.65
No social support - peers									.08	.05	1.58	.11	.08	.05	1.58	.11
R <sup>2</sup>					.015				.074				.761			
Adjusted R <sup>2</sup>					.009				.060				.757			
R <sup>2</sup> change					.015**				.016***				.687***			
F change in R <sup>2</sup>					2.542				5.023				608.211			

\* n = 863 \*\*p < .05 \*\*\*p < .01 \*\*\*\*p < .001

**Table 5** Summary of hierarchical multiple regression model on PTSD severity for female adolescents

	Step 1			Step 2			Step 3			Step 4						
	B	SE	T	p	B	SE	t	p	B	SE	t	p				
Constant	-.02	.45	-.04	.97	-.79	.42	-1.88	.06	-.61	.43	-1.43	.15	-.57	.24	-2.32	.02**
Age	.03	.03	1.17	.24	.01	.03	.31	.76	.00	.03	.06	.95	.01	.02	.83	.41
Education																
8th/9th grade (reference)																
10th grade	-.17	.09	-1.93	.05	-.14	.08	-1.72	.09	-.15	.08	-1.89	.06	-.06	.05	-1.31	.19
Higher secondary	-.15	.08	-1.91	.06	-.15	.07	-1.99	.047**	-.15	.07	-1.98	.048**	-.06	.04	-1.36	.17
Vocational training	.01	.10	.13	.89	.04	.10	.45	.66	.03	.10	.29	.77	-.02	.05	-.34	.73
No education/training	.01	.14	.06	.95	-.08	.13	-.59	.56	-.09	.13	-.68	.50	-.05	.08	-.67	.50
ECR-RS avoidance - parent					.01	.003	2.10	.036**	.01	.003	2.05	.041**	.00	.00	.02	.98
ECR-RS anxiety - parent					.03	.01	3.95	.000****	.03	.01	4.00	.000****	.01	.01	1.75	.08
ECR-RS avoidance - friend					-.00	.00	-.68	.50	-.00	.00	-.39	.70	.00	.00	1.01	.31
ECR-RS anxiety - friend					.00	.01	.24	.81	.00	.01	-.06	.95	.00	.00	-.03	.98
GHQ-12					.04	.004	10.42	.000****	.04	.004	9.84	.000****	.01	.002	6.42	.000****
Cannabis use									-.04	.05	-.72	.47	.02	.03	.65	.52
Alcohol abuse									.12	.05	2.57	.010**	.06	.03	2.37	.018**
Drug abuse									.22	.11	2.07	.039**	.03	.06	.55	.59
Direct exposure													1.19	.03	36.04	.000****
Retraumatization													.22	.04	5.90	.000****
No social support - family													.14	.05	2.77	.006***
No social support - peers													.01	.06	.20	.84
R <sup>2</sup>	.011				.155				.166				.726			
Adjusted R <sup>2</sup>	.006				.147				.156				.722			
R <sup>2</sup> change	.011**				.144****				.011***				.561****			
F for change in R <sup>2</sup>	2.398				37.957				4.967				567.329			

\* n = 1,125 \*\*p < .05 \*\*\*p < .01 \*\*\*\*p < .001 \*\*\*\*\*p < .001



psychosocial variables contributed an additional 4.3 and 14.4 %, and the substance use-related variables independently added 1.6 and 1.1 % to the total variance for male and female adolescents, respectively.

After the trauma-related variables were controlled for in step 4, the models explained 76.1 and 72.6 % of the total variance for male and female adolescents, respectively, with the trauma-related variables accounting for 68.7 and 56.1 % of PTSD severity, respectively. The adjusted  $R^2$  revealed small to moderate effects for the psychosocial variables, a moderate effect when the problematic substance use-related variables were entered into the model, and a very large effect for the trauma-related variables in accounting for PTSD variance in male adolescents. Large effects were found when these same variables were added to the model for female adolescents. Not surprisingly, the trauma-related variables conveyed the strongest risk for developing PTSD for both genders, which corresponds well with previous studies (Brewin et al. 2000).

After demographics, general mental health, and the trauma-related variables were controlled for, drug abuse ( $\eta^2=.0014$ ) and avoidant attachment toward best friends ( $\eta^2=.0013$ ) independently significantly increased PTSD severity for males. Avoidant attachment toward best friends was a unique predictor only in the final male model, indicating that while drug abuse contributed to PTSD severity before the trauma-related variables were controlled for, avoidant relationship structures toward best friends became more influential when the most severe trauma cases were taken into account. For female adolescents, alcohol abuse ( $\eta^2=.0011$ ) and lack of posttraumatic social support from parents ( $\eta^2=.0019$ ) were independent predictors of PTSD severity in the final model. Attachment anxiety and avoidance toward parents were significant only before the impact of the trauma-related variables was controlled for, after which the lack of social support from parents seemed to overrule the influence of parental attachment insecurity by representing a unique and statistically significant predictor of PTSD severity. Despite exhibiting very small individual effect sizes, specific substance abuse types, relationship-specific attachment structures, and the absence of posttraumatic social support were identified as unique gender-specific risk factors of PTSD severity. These risk factors are discussed further below.

## Discussion

This study examined gender-specific relationships between problematic substance use and PTSD severity. Although consistent gender differences in PTSD and problematic substance use prevalence rates are widely acknowledged, few studies have analyzed genders separately when examining the interrelationship between PTSD and SUD. A relationship between the two disorders was observed at a diagnostic level,

indicating that when adolescents met the diagnostic criteria for substance abuse they were at increased risk for developing PTSD, where alcohol abuse represented a unique risk factor for female adolescents and drug abuse (primarily cannabis abuse) represented a unique risk factor for male adolescents. Although drug abuse has been most often related to PTSD in representative adolescent samples (McCauley et al. 2010; Perkonig et al. 2000), the current findings indicate that when genders are examined separately, alcohol abuse also represents a unique contributor to PTSD for females. However, the current results showed a relationship between the two disorders at a diagnostic level only; thus, earlier results showing that females increased their substance consumption when they reported more severe PTSD symptoms (Lipschitz et al. 2000) were not supported.

Males and females seemed to exhibit different affect regulation strategies when they were exposed to trauma, and females appeared to be more susceptible to PTSD when their self-medication with alcohol developed into socially maladaptive patterns of use. This result may be related to underlying drinking-to-cope motives that have previously been found to increase not only PTSD symptoms for both genders but also alcohol consumption quantities for females (Lehavot et al. 2014).

Although male adolescents have been found to be driven toward substance use by high-risk behaviors, they also appeared to self-medicate, specifically with drugs, after trauma exposure. The finding that alcohol abuse was associated with PTSD severity among females and drug abuse was related to PTSD severity among males may indicate that males and females have different motivations for selecting specific substances to regulate underlying psychological distress based on their intoxication properties, as proposed by the self-medication hypothesis (Khantzian 1985).

Males have been found to exhibit more externalized behaviors, and females have been found to develop more internalized problems (Zahn-Waxler et al. 2008). These differences may render affect regulation strategies more efficient depending on gender. Indeed, among adolescent substance abusers, the relationship between substance use and PTSD symptoms was stronger for females with difficulties controlling impulsive behaviors and for males with a lack of emotional awareness and clarity (Bornovalova et al. 2009). These results suggest that the mechanisms underlying the relationship between PTSD severity and alcohol and drug abuse for females and males may be explained by a range of interrelated, gender-specific behavioral, emotional, and social factors that require more research attention.

Furthermore, the findings revealed that interpersonal relationships had an effect for both genders, but in different forms and domains. In line with attachment theory (Bowlby 1988), insecure attachment structures were related to increased pathological severity. As reflected in the present findings, males

usually report using more avoidant strategies in close relationships than females (Schmitt et al. 2003), and the current study showed that when adolescent males exhibited increased avoidant attachment towards best friends in particular, they were uniquely at heightened risk for greater PTSD severity. Because the influence of best friend attachment insecurity on increased risk of PTSD severity for males was evident only after retraumatization and direct trauma exposure were controlled for, this result is believed to relate primarily to severely traumatized males. For females, PTSD severity levels were related to parental attachment only before the trauma-related variables were controlled for. Females appeared to be more vulnerable to trauma-related psychological distress when parental support was absent during the trauma processing; this finding supports previous studies showing a favorable effect of social support for female subjects (Guay et al. 2006). The finding that parental support specifically influenced PTSD symptoms in traumatized adolescents also supports earlier findings (Bokszczanin 2008); however, the present findings extend previous results by revealing gender-specific vulnerability for females only.

Given that PTSD is a highly complex mental disorder affecting individuals at all levels of functioning, as reflected in its very high comorbidity rates with other mental health disorders, the present findings, despite being based on very small effect sizes, are believed to be important in identifying gender-specific risk factors that uniquely contribute to increased PTSD severity among adolescents, even beyond the impact of direct trauma exposure and retraumatization. The current results may be valuable to professionals working in trauma-related therapeutic settings and may encourage different approaches aimed at adolescent males and females. Integrating family interventions for females and focusing on emotion-strategies in terms of learning to open up and to depend on close friends for males may result in better outcomes in treatment aimed at preventing the further development of PTSD symptomatology.

### Limitations and Further Research

The current study was methodologically sound but was not without methodological concerns. Because substance use typically begins in adolescence and because substance use is a highly common adolescent-specific experimental behavior, substance use-related problems may be particularly difficult to examine in this age group. Furthermore, alcohol consumption has become highly normalized in the Danish culture, and consuming a large amount of alcohol is rarely perceived as a problematic behavior among 15- to 18-year-olds, who show some of the highest prevalence rates for alcohol use across European countries (Hibell et al. 2012). Therefore, cultural-specific expectations regarding substance use may have influenced the results, leaving this age group more susceptible than

older populations to misinterpretations of their own levels of problematic substance use, particularly with respect to alcohol-related patterns. To explore whether the gender-specific patterns revealed by the current results are adolescent specific or whether they can be generalized to other populations and cultures, the results should be replicated in adult samples and other Western cultures.

Another limitation concerns the cross-sectional design, which limits the interpretation of the causal directions between substance abuse and PTSD severity. PTSD symptoms typically precede the onset of substance abuse in adolescents (Perkonigg et al. 2000); however, the relationship between the diagnoses is far from unidirectional. When substance abuse is manifested, this condition is believed to further exacerbate PTSD symptoms and to thereby increase an individual's likelihood of developing full PTSD (Jacobsen et al. 2001). The current results highlight the crucial role of a socially maladaptive pattern of substance use in increasing the severity of posttraumatic stress by promoting a vicious cycle of self-regulation and reveal a long-term, complex interaction between PTSD and SUD at the prediagnostic and diagnostic levels. Further, the results underline important gender differences that may be further explored by using longitudinal designs to assess the complex interactional relationship between substance abuse and PTSD over time.

A final limitation concerns the use of self-reports to assess adolescents' subjective experience of their current psychological well-being. The self-reported diagnostic criteria described in this study were intended for research purposes only, and the results may be useful to provide a basis for important theoretical reflections and inspiration for further research in this field. However, generalization of findings to clinical practice should be considered with caution.

### Conclusion

In summary, this research contributes new knowledge to the literature on the relationship between substance abuse and PTSD in adolescents. The current results strongly support the importance of analyzing genders separately to better understand the interrelationship between PTSD and SUD. Although males in nonclinical samples are consistently less likely to report PTSD, which has led to an increased focus on female subjects in research on PTSD (Nooner et al. 2012), this study showed that both genders appear to have unique risk factors that increase their vulnerability to the development of pathology when exposed to trauma. When patterns of problematic substance use corresponded to a clinical level of abuse, problematic substance use was found to influence PTSD severity beyond the influence of general mental health problems. Drug abuse increased PTSD severity for male adolescents, whereas alcohol abuse increased PTSD severity for

females. PTSD severity was further associated with avoidant attachment structures in best friendships for males and lack of parental posttraumatic social support for females. These valuable findings contribute to advancing the understanding of gender differences associated with increased PTSD severity. However, this research explains only a limited range of possible gender-specific mechanisms, and further research is needed to explore the common co-occurrence of PTSD and SUD.

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