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Gender Differences in the Associations Between Posttraumatic Stress Symptoms and Problematic Substance Use in Psychiatric Inpatient Adolescents

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This study examined gender differences in the associations between posttraumatic stress symptoms and problematic substance use in psychiatrically hospitalized adolescents. Ninety-five adolescent inpatients (38 boys, 57 girls) were systematically evaluated with a battery of psychometrically well-established self-report measures to assess trauma exposure, posttraumatic stress symptoms, problematic alcohol and drug use, and internalizing and externalizing psychopathology. Twenty-three percent (N = 22) of patients met DSM-IV-based symptom criteria for PTSD, and 37% (N = 35) and 34% (N = 32) of patients endorsed problematic levels of drug and alcohol use, respectively. Posttraumatic stress symptoms were significantly associated with problematic drug and alcohol use in girls but not in boys. There were no significant gender differences in posttraumatic stress symptoms and/or problematic substance use, to account for the gender differences in the association between PTSD and substance use. Our findings suggest that the link between substance abuse and PTSD may be especially salient for female adolescents.

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Over the past decade, several large epidemiological studies of Vietnam combat veterans (Kulka et al., 1990) and of civilians (Kessler et al., 1995) have documented a strong association between posttraumatic stress disorder (PTSD) and comorbid substance use disorders (SUDs). Seventy-three percent of Vietnam veterans with PTSD met criteria for lifetime alcohol abuse/dependence (Kulka et al., 1990) and 35% and 29% of civilian adults with PTSD met criteria for lifetime alcohol abuse/dependence and lifetime drug abuse/dependence respectively (Kessler et al., 1995). In substance abuse treatment samples, rates of current PTSD have varied from 12% (Goldenberg et al., 1995) to 34% (Grice et al., 1995).

Despite the strong association between these two disorders in adults, very little research has explored the relationship between trauma, PTSD, and substance use in adolescents. In one study of adolescents, Clark and colleagues (1997a) examined the types of trauma and other adverse life events in 183 adolescents diagnosed with alcohol dependence/abuse and in 73 community controls. Adolescents with alcohol dependence were 6 to 12 times more likely to have a childhood history of physical abuse and 18 to 21 times more likely to have a history of sexual abuse than were the community controls. Deykin and Buka (1997) studied risk factors for PTSD in 397 chemically dependent adolescents enrolled in substance abuse treatment facilities. Twenty-four percent of 225 male and 45% of 75 female subjects had comorbid DSM-III-R (American Psychiatric Association, 1987) diagnoses of lifetime PTSD and a SUD.

A second important issue that has received little empirical attention involves the relationship between gender and co-occurring adolescent PTSD and substance use. In a recent review, Najavits and colleagues (1997) emphasized that the rates of co-occurring PTSD and substance use in adult female substance abusers have been reported as nearly double those of male substance abusers and that the majority of posttraumatic stress symptomatology has stemmed from repetitive childhood physical abuse and/or sexual assault. Similarly, Clark et al. (1997b), in a clinical sample of alcohol dependent adolescents, found that alcohol dependence was highly correlated with PTSD symptoms in female, but not in male subjects. Deykin and Buka (1997) reported that adolescent female substance abusers

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treated in inpatient substance abuse facilities had 3 times the rate of comorbid current PTSD and a SUD as their male counterparts.

The existing empirical literature on PTSD and SUD has focused on adolescents with a primary diagnosis of substance use and/or adolescents in inpatient substance abuse treatment facilities, and not on clinical samples of adolescents in psychiatric treatment settings. Adolescents who present to psychiatric facilities may differ in a variety of ways from adolescents who present to chemical dependency programs. They might display a wider range and/or different base rates of substance use problems and psychopathology (du Fort et al., 1993).

In order to examine the overall rates and gender differences in types of trauma exposure, PTSD symptomatology, and patterns of problematic alcohol and drug use in relation to PTSD symptomatology, we systematically surveyed a group of demographically and diagnostically heterogeneous adolescents who were admitted to a psychiatric inpatient adolescent unit in a private, not for profit, teaching hospital. Our prior research with psychiatrically hospitalized adolescents found high rates of exposure to community violence, childhood maltreatment, and posttraumatic stress symptoms (Fehon et al., 1998), as well as substance use disorders (Grilo et al., 1995). The aims of this study were to: a) assess the co-occurrence of PTSD symptomatology and problematic alcohol and drug use, b) explore gender differences in the relationship between PTSD symptomatology and problematic substance use, and c) explore gender differences between substance use and internalizing psychopathology (such as depression and suicidality) and externalizing psychopathology (such as impulsivity and violence). We hypothesized that female adolescents would have higher rates of co-occurring PTSD symptomatology and substance use problems, that female subjects would be more likely to have substance use problems co-occurring with internalizing symptoms such as depression and suicidal ideation, and that male subjects would be more likely to have substance abuse problems co-occurring with externalizing behaviors such as poor impulsivity and aggression.

Methods

Subjects

Subjects were a nearly consecutive series of 95 adolescent inpatients who were admitted to the evaluation and crisis intervention unit of Yale Psychiatric Institute, a private, not-for-profit tertiary care teaching hospital. Reasons for admission to the unit typically involve acute suicidality, behavioral dyscontrol, or dangerousness to others. Subjects were excluded from the sample pool only if they had difficulty with reading or comprehension, were actively psychotic, or too agitated to complete the assessment instruments. Participation in the study was completely voluntary. At the time of admission, subjects and their parents (or legal guardians) provided written consent for evaluation.

Of the 95 subjects, 38 (40%) were male and 57 (60%) were female. Participants had a mean age of 15.9 years (SD = 1.3; range 13.2 to 18.5 years) and a mean level of education of 9.8 years (range = 7 to 12 years). Sixty-eight subjects (72%) were Caucasian, 11 (12%) were African-American, 12 (13%) were Latino, and 4 (3%) were of other ethnic origins. Boys and girls did not significantly differ in age (t = .53, p = NS), ethnicity (χ^2 = 2.3, p = NS), or educational level (t = .09, p = NS).

Procedure

All subjects were administered via computer a battery of standardized, psychometrically well-established, self-report questionnaires. The battery included measures of general psychopathology, both internalizing symptoms and externalizing symptoms, substance abuse measures of problematic alcohol and drug use, as well as a set of reliable trauma and posttraumatic stress assessment measures. Subjects completed their assessments within the first week of admission. In addition, participants were assigned DSM-IV (American Psychiatric Association, 1994) diagnoses at the time of discharge based on a review of each patient's history and presenting data by a multi-disciplinary treatment team of experienced clinicians, attending psychiatrists, and nurses with faculty supervision. Medical record data, corroboration with family and referral sources, and staff observations were routinely integrated into the process of making final consensus diagnoses. This inpatient study group was diagnostically heterogeneous. The most frequently assigned DSM-IV (American Psychiatric Association, 1994) diagnoses were, in descending order: major depression (48%), dysthymia (21%), depressive disorder NOS (18%), oppositional defiant disorder (16%), attention deficit hyperactivity disorder (12%), conduct disorder (12%), bipolar disorder (10%), and PTSD (6%). The most frequently assigned substance-related diagnoses, in descending order, were: cannabis abuse or dependence (31%), alcohol abuse or dependence (13%), hallucinogen abuse or dependence (6%), inhalant abuse or dependence (5%), and cocaine abuse or dependence (5%).

Trauma and PTSD Measures

Child Exposure to Violence Checklist [*CEVC; Amaya-Jackson L., unpublished manuscript* 1998[4]; *Newman and Amaya-Jackson, 1996*[5]] is a 33-item checklist adapted from the measure *Things I've Seen and Heard* (Richters, 1990).[6] It uses a 4-point Likert scale ranging from "never" to "more than 10 times" to assess frequency of exposure to community violence. Experiences include being the victim of, witness to and/or perpetrator of shooting, stabbing, homicide, and family violence. Items about sexual abuse and perpetration of violence were added to the *Things I've Seen and Heard* questionnaire. Examples of items about sexual abuse include "Has someone ever made you do something with your private parts or with their private parts that you did not want to do?" Perpetration of violence was assessed by questions such as "Have you ever used something beside your hands to scare or hurt someone (like a gun, knife, or other weapon)?" Twenty youngsters were given the CEVC at two time points, 1 week apart. The CEVC had a one week test-retest reliability of $r = .83$ for witnessed community violence, $r = .84$ for witnessed family violence, and $r = .53$ for perpetration of physical assault. For this study all answers were coded categorically as "yes/no."

Child Post Traumatic Stress Disorder Checklist (*Child PTSD checklist; Newman and Amaya-Jackson, 1996*; see footnote 5) is a 28-item scale that asks participants to rate the degree to which each of the 17 symptoms of PTSD are present during the past month. This scale is derived from DSM-IV (American Psychiatric Association, 1994) criteria and uses a 4-point Likert scale from 0 to 3, corresponding to "not at all" to "all of the time" to establish severity. The checklist can also be used to generate a diagnosis of PTSD based on three possible symptom thresholds. (*i.e.*, presence of symptoms, "some of the time," "most of the time," and "all of the time"). For this study, we instructed participants to respond to the PTSD checklist based on the "most upsetting" event that they endorsed on the CEVC and we used the symptom threshold of "most of the time" for each endorsed symptom to establish a diagnosis of current PTSD. Concurrent validity of the Child PTSD checklist was established by comparing diagnoses generated by the checklist with those obtained on a semi-structured interview for PTSD, the Clinician-Administered PTSD Scale for Children and Adolescents (CAPS-CA; Newman et al., in press). The mean intensity rating across the 17 items on the CAPS-CA showed a correlation of $r = .64$ with the Child PTSD checklist (Erwin et al., in press)

Substance Use Measures

Drug Abuse Screening Test for Adolescents (DAST-A; Martino et al., in press) is a 27-item self-report screening instrument that directly queries adolescents about any adverse consequences that they may have experienced secondary to drug use. The DAST-A score is calculated by summing all items that are endorsed in the direction of increased drug use problems, resulting in a total score range of 0 to 27. Scores > 6 yielded sensitivity of 78.6%, a specificity of 84.5% and a positive predictive power of 82.3% in differentiating adolescent psychiatric inpatients with and without drug related disorders. (Martino et al., in press).

Alcohol Abuse Involvement Scale (AAIS; Mayer and Filstead, 1979) is a 14-item, self-report screening measure for alcohol use and abuse in adolescent populations. The measure identifies adolescents whose alcohol use interferes with psychological, social, and family functioning. The AAIS has an excellent internal consistency (coefficient alpha = .96) and test-retest reliability (2-week $r = .91$) in adolescent clinical and population-based samples (Mayer and Filstead, 1979; Moberg, 1983). A cutoff score of 42 is recommended for identifying adolescents who are abusing alcohol (Mayer and Filstead, 1979).

General Psychopathology Measures.

Beck Depression Inventory (BDI; Beck and Steer, 1987) is a 21- item version of a widely used measure of cognitive, affective, motivational, and somatic symptoms of depression. This instrument has sound psychometric properties in adolescent patient samples. In one study with adolescent inpatients, the BDI had an internal consistency of .79, a 5-day test-retest reliability of .69, and a .67 correlation with clinical ratings of depression (Strober et al., 1981)

Suicide Risk Scale (SRS; Plutchik et al., 1989a) is a 15-item true/false self-report measure of feelings of present suicidal thinking and past suicidal behavior. The SRS has good internal reliability (coefficient alpha = .74), sensitivity and specificity with adolescents (Plutchik and van Praag, 1989b).

[4] Amaya-Jackson L (1998) Child Exposure to Violence Checklist (CEVC). Unpublished instrument, Trauma Evaluation, Treatment & Research Program, Center for Child & Family Health, NC.

[5] Newman E, Amaya-Jackson L (1996) Assessment of trauma instruments for children. Paper presented at the Scientific Proceedings of the 12th International Conference on Traumatic Stress Studies, San Francisco, CA.

[6] Richters JE (1990) Screening survey of exposure to community violence, self-report version. Unpublished survey. Child and Adolescent Research Branch, NIMH, Rockville, MD.

TABLE 1
Overall Rates and Gender Differences in Exposure to Violence in 95 Psychiatric Inpatient Adolescents

	Overall Sample (N = 95)		Boys (N = 38)		Girls (N = 57)			
Exposure to Violence	N	(%)	N	(%)	N	(%)χ^2	p	
Witnessed	54	(56.8)	25	(65.7)	29	(50.8)	1.26	NS
Shooting	31	(32.6)	15	(39.4)	14	(24.5)	2.39	NS
Stabbing	35	(36.8)	18	(47.3)	17	(29.8)	3.01	NS
Homicide	21	(22.1)	11	(28.9)	10	(17.5)	1.72	NS
Sexual assault	19	(20.0)	7	(18.4)	12	(21)	.09	NS
Family violence	24	(25.3)	8	(21.0)	16	(27)	.60	NS
Victim	64	(67.3)	27	(71.1)	37	(64.9)	.03	NS
Physical assault	38	(44.0)	21	(55.0)	17	(29.8)	6.14	.01
Shooting/stabbing	11	(11.6)	6	(15.7)	5	(8.7)	1.10	NS
Sexual assault	28	(29.5)	6	(15.7)	22	(38.5)	5.70	.02
Perpetrator	52	(54.7)	24	(63.1)	28	(49.1)	.88	NS
Physical assault[a]	31	(32.6)	14	(36.8)	17	(29.8)	.52	NS
Sexual assault	7	(7.4)	4	(10.5)	3	(5.2)	.90	NS
Heard about homicide	39	(41.1)	17	(44.7)	22	(38.5)	.35	NS

[a]Use of weapons in the assault.

Impulsivity Control Scale (ICS; Plutchik and van Praag, 1989b) is a 15-item, self-report scale designed to assess impulsivity that is independent of aggressive behavior. Items are answered on a three-point frequency scale. The ICS has good internal reliability with adolescents and correlates well with other measures of suicide and violence risk (Grosz et al., 1994).

Past Feelings and Acts of Violence (PFAV; Plutchik and van Praag, 1990c) is a 12-item, self-report scale in which responses are coded on a three point continuum of frequency. The scale inquires about the frequency of feelings of anger, past acts of violence towards others, use of weapons, and history of arrests. The scale has good internal consistency, item sensitivity and specificity in adolescent psychiatric samples (Grosz et al., 1994).

Results

Table 1 summarizes rates of violence for the overall study group as well as for boys and girls separately. This table includes rates of witnessed, directly experienced, vicariously experienced, and perpetrated violence. Overall, 30% (N = 29) of participants witnessed a shooting, 36% (N = 35) a stabbing, and 22% (N = 21) a homicide. Twelve percent (N = 11) of participants reported being shot or stabbed and 33% (N = 31) stated that they have used weapons in an attempt to hurt others. Twenty-five percent (N = 24) of respondents endorsed witnessing episodes of family violence. Rates of experienced and witnessed sexual abuse/assault were 30% (N = 28) and 20% (N = 19), respectively.

For boys, the most common type of traumatic experience was being the victim of a physical assault, usually by a peer, (55%), followed by hearing about the death of a friend, acquaintance or family member (44%). For girls, the most common type of traumatic experience was being the victim of unwanted sexual contact (38%) and hearing about a homicide (38%). Two significant gender differences were observed. Boys were significantly more likely to have experienced a physical assault (χ^2 = 6.14, p = .01) and girls were significantly more likely to endorse an episode of sexual assault (χ^2 = 5.70, p = .02).

Table 2 summarizes the overall rates and gender differences in PTSD symptomatology, substance use, and general psychopathology. Girls endorsed significantly more symptoms of current depression (t = 1.93, p = .05), but there were no other significant gender differences in the other psychopathological measures.

Using the Child PTSD checklist with an endorsement of "most of the time" for each symptom, 23% (N = 22) of adolescents met DSM-IV- (American Psychiatric Association, 1994) based symptom criteria for PTSD. Fifty percent (N = 48) of adolescents met reexperiencing symptom criteria, 38% (N = 36) met avoidance symptom criteria, and 46% (N = 44) met hyperarousal symptom criteria. Using a cut score of 6 on the DAST-A, 37% (N = 35) of adolescents endorsed problems with drug use. Using a cut score of 42 on the AAIS, 34% (N = 32) of adolescents endorsed problems with drinking.

Compared with subjects without PTSD, subjects with PTSD were significantly more likely to report problematic drug use (t = 3.49, df = 94, p < .001) and problematic alcohol use (t = 2.61, df = 94, p < .01). Girls with PTSD were significantly more likely to endorse problematic drug use (69% of girls with PTSD had scores > 6 on the DAST-A *vs.* 22% of

TABLE 2
Gender Differences in Posttraumatic Stress Symptoms Substance Use and Psychopathology in Inpatient Adolescents (N = 95)

	Overall Sample (N = 95)		Boys (N = 38)		Girls (N = 57)			
	Mean	SD	Mean	SD	Mean	SD	$t(1,94)$	p
PTSD related								
PTSD checklist	7.5	7.1	5.9	6.4	8.5	7.5	1.74	NS
# reexperiencing	1.3	1.7	1.1	1.5	1.5	1.7	1.43	NS
# avoidance	2.1	2.0	1.8	1.7	2.5	2.2	1.08	NS
# hyperarousal	1.8	1.8	1.4	1.7	2.0	1.8	1.58	NS
Substance use								
Alcohol	30.5	18.9	29.1	18.6	31.4	19.3	.56	NS
Drugs[a]	6.4	6.3	6.9	6.2	6.1	6.4	.61	NS
General psychopathology								
Depression	18.2	14.3	14.8	12.8	20.5	14.8	1.93	.05
Suicidality	6.2	3.7	5.5	3.5	6.7	3.8	1.62	NS
Violence potential	8.1	5.6	8.3	5.8	8.0	5.4	.22	NS
Impulsivity	17.1	5.6	16.1	5.7	17.9	.5	1.57	NS

[a]Includes marijuana, inhalants, cocaine, and hallucinogens.

TABLE 3
Correlation of Substance Use, PTSD Symptoms, and Internalizing and Externalizing Psychopathology in Inpatient Adolescent Boys (N = 38) and Girls (N = 57)

	#B	#C	#D	C-PTSD-CL	BDI	SRS	PFAV	ICS
AAIS (alcohol)								
Males	.27	.05	.14	.14	.08	.11	.38***	.35***
Females	.38***	.29*	.38***	.34***	.11	.14	.31**	.30**
DAST-A (drugs)								
Males	.27	.10	.18	.19	.08	.10	.53***	.48***
Females	.37***	.41***	.47***	.42***	.34	.28*	.42***	.32***

AAIS: Adolescent Alcohol Involvement Scale; BDI: Beck Depression Inventory; #B: number of cluster B symptoms (reexperiencing); #C: number of cluster C symptoms (avoidance and numbing); #D: number of cluster D symptoms (hyperarousal); DAST-A: Drug Abuse Screening Test for adolescents; ICS: Impulsivity Control Scale; PFAV: Past Acts and Feelings of Violence; SRS: Suicide Risk Scale.
***$p < .001$; **$p < .01$; *$p < .05$.

girls without PTSD, $\chi^2 = 10.64$, $df = 1$, $p < .001$) and alcohol use (50% of girls with PTSD had scores > 42 on the AAIS *vs.* 27% of girls without PTSD, $\chi^2 = 2.78$, $df = 1$, $p = .09$) than girls without PTSD. However, there were no significant differences in problematic drug or alcohol use between boys with and without PTSD (50% of boys with PTSD had scores > 6 on the DAST-A *vs.* 39% of boys without PTSD; $\chi^2 = .23$, $df = 1$, p = NS; 33% of boys with PTSD had scores > 42 on the AAIS *vs.* 30% of boys without PTSD; $\chi^2 = .02$, $df = 1$, p = NS).

In order to more fully explore the gender differences in the pattern of PTSD symptomatology and substance use, we correlated measures of drug and alcohol use with each of the three symptom clusters of PTSD in boys ($N = 38$) and in girls ($N = 57$) (see Table 3).

For girls, drug use was significantly correlated with reexperiencing symptoms ($r = .37$, $df = 56$, $p = .004$), avoidance symptoms ($r = .41$, $df = 56$, $p = .002$), and hyperarousal symptoms ($r = .47$, $df = 56$, $p < .001$). Alcohol use was significantly correlated with reexperiencing symptoms ($r = .38$, $df = 56$, $p = .005$), avoidance symptoms ($r = .29$, $df = 56$, $p = .03$), and hyperarousal symptoms ($r = .38$, $df = 56$, $p = .004$). In contrast, for boys, there were no significant associations in either alcohol or drug use with any of the three symptom clusters of PTSD.

Our final aim was to explore gender differences between substance use, PTSD symptoms, and associated psychopathological measures of depression, suicidality, impulsivity, and violence potential (see Table 3). For girls, problematic drug use was significantly correlated with both internalizing psychopathology such as depression ($r = .34$, $df = 56$, $p = .005$) and suicidality ($r = .28$, $df = 56$, $p = .02$), as well as externalizing behaviors such as impulsivity ($r = .32$, $df = 56$, $p = .008$) and violence ($r = .43$, $df = 56$, $p = .001$). Problematic alcohol use was significantly correlated with externalizing behaviors such as impulsivity ($r = .31$, $df = 56$, $p = .02$) and violence ($r = .32$, $df = 56$, $p = .02$), but not with internalizing psychopathology such as depression or suicidality. For boys, problematic drug use significantly correlated only with impulsivity ($r = .48$, $df = 37$, $p = .001$) and violence ($r = .53$, $df = 37$,

p = .001). Problematic alcohol use correlated only with impulsivity (r = .36, df = 37, p = .03) and violence (r = .39, df = 37, p = .02).

In order to examine the independent and joint effects of the other psychopathological variables in relation to alcohol and drug abuse, we conducted separate multiple regression analyses for each gender. Conceptually, and from the results of our correlational analyses, we hypothesized that both internalizing (depression) and externalizing symptoms (impulsivity) might be related to problematic substance use. Thus, scores from the BDI, ICS, and child PTSD checklist were simultaneously entered as independent predictor variables into multiple regression equations with AAIS scores and DAST-A scores as the dependent variables. For girls, these three variables accounted for 22% of the variance in AAIS scores (F[3,48] = 4.56, p = .007). Posttraumatic stress symptoms made an independent and significant contribution (beta = .61, T = 2.8, p = .006) to the prediction of problematic alcohol use, even after controlling for the joint effects of depression and impulsivity. These three variables accounted for 20% of the variance in DAST-A scores (F[3, 48] = 4.1, p = .01). Posttraumatic stress symptoms made an independent and significant contribution (beta = .43, T = 2.0, p = .05) to the prediction of problematic drug use, even after controlling for the joint effects of depression and impulsivity. For boys, PTSD symptomatology did not make an independent and significant contribution to the prediction of either problematic alcohol (beta = .15, T = .65, p = NS) or drug (beta =.26, T = 1.2, p = NS) use.

Discussion

In this study, there were several salient findings. First, although PTSD symptoms and problematic use of both alcohol and other drugs were highly correlated in our overall sample, these two conditions were significantly related in girls only. For girls, all three symptom clusters of PTSD correlated significantly with both problematic alcohol and drug use. Hyperarousal symptoms had the highest correlation with problematic drug use. For boys, there was no significant relationship between any of the three PTSD symptom clusters and problematic alcohol or drug use. There were no sex differences in PTSD symptoms or problematic drug or alcohol use to account for the gender differences in the co-occurrence of these two disorders. Further, there were no significant sex differences in age or ethnicity.

Our findings are consistent with those from two other studies of substance abusing adolescents in an outpatient setting (Clark et al., 1997b) and in a substance abuse treatment facility (Deykin and Buka, 1997). These authors report that adolescent female substance abusers had much higher rates of PTSD than adolescent male substance abusers. Our findings also parallel findings in the adult substance abuse literature (Najavits et al., 1997).

The reason why the co-occurrence of PTSD and substance use is especially problematic for female subjects is an intriguing and understudied area. One potential hypothesis has to do with the type of trauma. Although, boys and girls experienced similar amounts of overall trauma, consistent with many other studies (Cuffe et al., 1998; Breslau et al., 1991; Lipschitz et al., 1999), girls were more likely than boys to have experienced sexual assault or unwanted sexual contact. In a review of the epidemiology of trauma exposure and PTSD development, Breslau (1998) notes that the conditional risk of PTSD (*i.e.*, the probability of developing PTSD given exposure to a trauma) is highest for assaultive violence and that the conditional risk of PTSD is twofold higher for female compared with male subjects. This gender difference is thought to be due to the "traumatogenic" effects of assaultive violence, particularly sexual abuse. Histories of early assaultive violence (*i.e.*, physical abuse and/or sexual abuse), are extremely common in populations of adult, female substance abusers, and range from 32% (Miller et al., 1993) to 58% (Najavits et al., 1997) for physical assault, and 42% (Fullilove et al., 1993) to 66% (Miller et al., 1993) for sexual assault. They are also commonly noted in adolescent populations of female substance abusers (Deykin and Buka, 1997). Hence, although boys and girls reported symptom criteria for PTSD with equal frequency and endorsed similar rates of problematic substance use, girls who developed PTSD subsequent to sexual assault might be more likely to drink and to use drugs excessively than boys who develop PTSD after exposure to community violence or following victimization or perpetration of a physical assault.

A second possibility is that there are gender differences in the pathways from adolescent substance use to substance abuse and that posttraumatic stress symptoms, like other psychiatric disorders, may mediate those pathways differently for boys and girls. A growing body of research suggests that there are gender differences in the comorbidity pattern of adolescent SUDs. One form of adolescent alcohol and substance abuse has been linked to earlier childhood behavioral problems such as poor impulse control and aggression (Huizinga et al., 1993; Jessor and Jessor, 1977) as well as to a childhood diagnosis of conduct disorder (Bukstein et al.,

1989; Grilo et al., 1996). This comorbidity pattern has been found to hold in male as well as female subjects (Grilo et al., 1995; Rohde et al., 1996; Windle, 1990). A second form of adolescent SUD is linked to preceding or concomitant depression, anxiety, and other forms of internalizing psychopathology. This subtype of adolescent SUD is more commonly found in girls (Clark et al., 1997b; King et al., 1996). Prepubertal depression occurs with equal frequency in boys and girls; however, adolescence is the developmental period when depressive disorders start to become more prevalent in female subjects (Birmaher et al., 1996). Thus, the comorbidity subtype of depression and substance abuse is commonly seen in adolescent females. According to this model, PTSD (one of the anxiety disorders) is a type of internalizing psychopathology that would be more likely to co-occur with substance abuse in adolescent girls than in adolescent boys. In keeping with this model, girls in the current study scored significantly higher on measures of depression than boys, and their depressive symptoms were highly correlated with problematic drug and alcohol use, whereas for boys, their level of depression was not correlated with problematic drug or alcohol use. Problematic substance use for boys was much more closely linked to externalizing forms of psychopathology such as impulsivity and violence. These findings parallel those of Martin and colleagues (1997) in adolescent psychiatric outpatients where substance use in male subjects was correlated with high-risk behaviors and impulsivity, whereas substance use in females correlated with feelings of depression and suicidality.

There are several limitations to this study. The first limitation is our primarily Caucasian study sample, which did not permit us to investigate the influence of ethnicity on the comorbidity pattern of PTSD and problematic substance use. The second limitation is its cross-sectional design. Many models of substance abuse comorbidity in PTSD populations assume that PTSD is the primary disorder and that substance abuse reflects a "self-medication" of symptoms, in particular intrusive and hyperarousal symptoms (Keane et al., 1988). According to this view, PTSD develops first, followed by substance use/abuse. From our cross-sectional design, we cannot make inferences about the order of onset for PTSD and substance use. In future prospective longitudinal studies, we hope to discuss this question. A third limitation is that we did not establish rates of DSM-IV (American Psychiatric Association, 1994) PTSD and SUDs based on structured psychiatric diagnostic interviews. However, self-report methodologies are useful in assessing sensitive topics such as the ones in the present study. For adolescents, some of the interpersonal concerns of embarrassment and distress are removed when using a self-report format, particular for such sensitive topics as disclosure of abuse (Winegar and Lipschitz, 1999). Furthermore, the self-report scales used in this study enabled us to assess data such as the number of posttraumatic stress symptoms, dimensions of depression, violence, and problematic substance use on a continuum and allowed us to closely examine dimensions of these psychopathological variables in relation to adolescent substance abuse. We used a computerized mode of questionnaire administration in our study. Computerized assessments of self-report instruments similar to those employed here have been found to compare favorably to pen and paper versions in their reliability and validity (Lukin et al., 1985; Wilson et al., 1985). Finally, the findings of our inpatient clinical sample with its high rates of PTSD symptomatology, general psychopathology, and substance abuse might not be generalizable to community-based settings. We recommend that gender differences in the comorbidity of PTSD and substance use be explored in epidemiological studies.

Conclusions

In summary, findings from our study point to a significant association of posttraumatic stress symptoms and problematic alcohol and drug use in adolescents who require psychiatric hospitalization. However, the relationship of these two problems is especially problematic for adolescent female subjects. Clinically, all adolescent girls seen in inpatient settings, clinics or in our offices should be carefully assessed, not only for depression and suicidality, but also for posttraumatic stress symptoms and substance abuse.

References

American Psychiatric Association (1987) *Diagnostic and statistic manual for mental disorders* (3rd ed, rev). Washington, DC: Author.

American Psychiatric Association (1994) *Diagnostic and statistic manual for mental disorders* (4th ed, rev). Washington, DC: Author.

Beck AT, Steer RA (1987) *Manual for Revised Beck Depression Inventory*. New York: Psychological Corporation.

Birmaher B, Ryan ND, Williamson DE, Brent DS, Kaufman J, Dahl RE, Nelson B (1996) Childhood and adolescent depression: A review of the past 10 years. Part I. *J Am Acad Child Adolesc Psychiatry* 35:1427–1439.

Breslau N (1998) Epidemiology of trauma and posttraumatic stress disorder. In R Yehuda (Ed), *Psychological trauma* (pp 1–27). Washington, DC: American Psychiatric Press.

Breslau N, Davis GC, Andreski P, Peterson E (1991) Traumatic events and posttraumatic stress disorder in an urban population of young adults. *Arch Gen Psychiatry* 48:216–222.