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This study compared the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM–IV–TR*; American Psychiatric Association, 2000) diagnostic 3-factor structure of posttraumatic stress disorder (PTSD) symptoms with leading 4-factor models and the newly proposed 5-factor dysphoric arousal model in a sample of 1,363 juvenile-justice-involved adolescents (990 boys, 373 girls). Structural equation modeling suggested that the 5-factor dysphoric arousal model fit significantly better than each of the other models. The model fit better for girls than for boys, and girls evidenced stronger factor loadings for items on all but the Anxious Arousal factor. The factors of the 5-factor model were then tested as mediators of the association between interpersonal and noninterpersonal trauma and mental health problems. Interpersonal trauma was associated with PTSD symptoms for boys and girls, whereas noninterpersonal trauma exposure was only associated with PTSD symptoms for boys, despite equal levels of exposure across genders, suggesting that girls may be more sensitive to the effects of interpersonal, but not noninterpersonal, trauma. Patterns in mediation were moderated by gender, as girls' data showed stronger paths leading to depression/anxiety, somatic complaints, and suicidal ideation through PTSD symptoms, whereas for boys, paths were stronger leading to anger/irritability symptoms. Mediation results suggested differential patterns of influence for dysphoric versus anxious arousal and also indicate the importance of numbing for delinquent youth. These results add to the evidence base supporting the 5-factor dysphoric arousal model in establishing developmentally sensitive criteria for the diagnosis of PTSD among traumatized youth.

Keywords: PTSD, symptom clusters, gender, delinquency

Supplemental materials: http://dx.doi.org/10.1037/a0035303.supp

The structure of the posttraumatic stress disorder (PTSD) diagnosis has been the subject of debate since its introduction in 1980, and these discussions have continued during recent planning for the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM–5*; American Psychiatric Association, 2013). The criteria in the fourth edition of the *DSM* (text rev.; *DSM–IV–TR*; American Psychiatric Association, 2000) feature a tripartite symptom structure comprised of intrusion, avoidance, and arousal, which has been largely unsupported in the literature (Asmundson, Stapleton, & Taylor, 2004). In contrast, King, Leskin, King, and Weathers (1998) proposed a four-factor emotional numbing model that separates symptoms of avoidance and numbing, for which subsequent studies have found support (e.g., Ayer et al., 2011; Wang, Zhang, et al., 2011). Alternatively, Simms, Watson, and Doebbling (2002) proposed a four-factor dysphoria model combining symptoms of arousal and numbing, which also has been replicated (e.g., Armour & Shevlin, 2010; Biehn, Elhai, Fine, Seligman, & Richardson, 2012; Yufik & Simms, 2010). More recently, Elhai et al. (2011) have argued for a separate dysphoric arousal response that is distinct from the anxious arousal characteristic of fear-based PTSD reactions. The utility of this five-factor dysphoric arousal model has been confirmed in a number of studies (Armour et al., 2012; Hukkelberg & Jensen, 2011; Pietrzak, Goldstein, Malley, Rivers, & Southwick, 2010).

Despite the promising results of these studies to date, Ayer and colleagues (2011) pointed out a number of limitations that need to be addressed. Preferences for one model over the other are often based on small differences in fit indices, resulting in conflicting model-fit conclusions being drawn from the same sample. Inconsistent results have also resulted from studies using different definitions of trauma exposure, types of traumatic events, and models for comparison. Another problem for determining whether one model fits better than others is that some symptom clusters are comprised of few indicators and thus may not form a reliable factor.

A further limitation of the existing research is that only a few confirmatory factor studies have focused on PTSD among children and adolescents. Evidence is strong that exposure to trauma is not

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rare for young people, particularly among high-risk samples such as antisocial youth (Ford, Chapman, Mack, & Pearson, 2006; Kerig & Becker, 2010). Moreover, researchers have argued that trauma exposure and PTSD can affect individuals differently depending on their developmental level (Ayer et al., 2011). For the most part, research with youth has extended findings from adult studies, tending to support the emotional numbing or dysphoria models over the *DSM–IV–TR* (American Psychiatric Association, 2000) three-factor model (Ayer et al., 2011; Kassam-Adams, Marsac, & Cirilli, 2010). Most recently, Wang, Li, et al. (2011) and Wang, Long, Li, and Armour (2011) found that the five-factor model fit significantly better than either of the four-factor models in two studies of Chinese youth exposed to an earthquake. Therefore, preliminary evidence suggests the utility of the five-factor model for understanding the symptom structure of PTSD among youth.

However, another shortcoming of the previous research regarding PTSD structure is that inconsistent attention has been paid to the role that gender may play in moderating model fit. Overall, women and girls are twice as likely to be diagnosed with PTSD than men and boys after being exposed to a potentially traumatic event (e.g., Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995), and investigating whether symptoms load onto factors differently for girls and boys may help us to understand these gender effects. Although the emotional numbing and dysphoria models have been supported in both all-male and all-female samples (e.g., Palmieri & Fitzgerald, 2005), and some studies have found equivalent model fit across genders (Ayer et al., 2011), few studies have examined whether gender acts as a moderator in child and adolescent samples. In a recent exception to this, Armour et al. (2011) examined the measurement invariance of the emotional numbing model comparing male and female war-exposed adolescents. The authors found that girls had higher item intercepts and greater residual variance than did boys, suggesting that girls reported greater symptom severity independent of PTSD status. However, no known studies to date have examined gender invariance of the dysphoric arousal model in samples of youth, and thus further research is warranted to establish the equivalence of PTSD symptom structure among boys and girls.

A further limitation identified by Ayer and colleagues (2011) is inconsistency across the types of trauma experienced by participants in the studies conducted to date. The majority of investigations have examined individuals' reactions to specific single-incident traumas such as natural disasters. However, research has established that the type of traumatic event experienced is associated with differential risk for the development of PTSD (Kessler et al., 1995). In this regard, a particularly important distinction is between those traumas that are interpersonal (e.g., physical assault, rape) versus traumas that are noninterpersonal (e.g., accidents, medical events). For example, Kelley et al. (2009) found that, in contrast to noninterpersonal traumas such as a motor vehicle accident, the interpersonal trauma of sexual abuse was associated differentially with symptoms of intrusion, avoidance/numbing, and arousal. Moreover, careful attention to trauma type may also help us to better understand gender differences in PTSD. Evidence suggests that girls are more reactive than boys to interpersonal stressors involving direct victimization by another person (Gavazzi, Lim, Yarcheck, Bostic, & Scheer, 2008), and are more likely than boys to report exposure to these kinds of interpersonal traumas (Kerig, Vanderzee, Becker, & Ward, 2012). Attending to the type of trauma experienced may allow for a better understanding of gender differences in symptom presentation; therefore, this study investigated how interpersonal and noninterpersonal trauma exposure are differentially linked to PTSD symptom clusters among girls versus boys.

Among samples of youth exposed to both interpersonal and noninterpersonal traumas, one group of particular interest for researchers concerned with the study of PTSD is youth involved in the juvenile justice system. A well-replicated finding is that over 90% of youth in detention settings have experienced at least one potentially traumatic event, that rates of PTSD among juvenile justice-involved youth are significantly higher than in the general population, and that PTSD is associated with the severity and frequency of delinquency (see Kerig & Becker, 2010, for a review). However, the mechanisms underlying the link between trauma and delinquency are less well understood, and clarity regarding the structure of PTSD may help to address this question. Whereas the *DSM–IV–TR* (American Psychiatric Association, 2000) criteria require elevated levels on all three symptom clusters, research suggests that traumatized youth, in particular, may demonstrate certain symptoms in lieu of others (Cohen & Scheeringa, 2009). The dysphoric arousal model may offer particularly valuable insights for the understanding of the associations among trauma exposure, PTSD structure, and functioning among delinquent youth by spotlighting the symptom clusters of emotional numbing and dysphoric arousal. Emotional numbing has been hypothesized to play a significant role in antisocial behavior (Ford et al., 2006), and evidence indicates that posttraumatic numbing is associated with adolescent aggression (Allwood, Bell, & Horan, 2011) and that numbing mediates the association between trauma and youth callousness (Kerig, Bennett, Thompson, & Becker, 2012). Moreover, although so far untested, it is possible that symptoms of dysphoric arousal—such as irritable mood and distractibility—might be prevalent among delinquent youth whose functioning is dysregulated by trauma in ways that are characterized by denial of fear rather than fearfulness (Ford, Elhai, Connor, & Frueh, 2010).

A final limitation of note is that research on the structure of PTSD symptoms typically has not investigated the external validity of factors (Ayer et al., 2011; Wang, Li, et al., 2011). Clarification of how symptom clusters affect functioning may also provide more meaningful justifications for choosing one model over another. Additionally, examination of how factors are associated with particular mental health problems may help to better elucidate the commonalities between PTSD and comorbid disorders. For example, studies have shown that PTSD symptom clusters are related to adult functioning in specific ways, such as dysphoric arousal with depression (Armour et al., 2012). Therefore, further research is warranted to investigate differences in functioning related to the five-factor model of PTSD symptoms among youth.

In summary, informed by these limitations of the extant literature, the present study sought to contribute to the research on PTSD structure by comparing the fit of all four of the models proposed to date—the three-factor *DSM–IV–TR* (American Psychiatric Association, 2000) model, the four-factor emotional numbing and dysphoria models, and the newly proposed five-factor dysphoric arousal model—in a sample of juvenile-justice-involved youth. The study was designed to address limitations of

previous research by drawing data from a sample of adolescents exposed to a wide range of traumatic events, by examining differential associations with interpersonal and noninterpersonal trauma, and by investigating the external validity of the best-fitting model by assessing mediational relationships among PTSD clusters, trauma exposure, and mental health problems, with systematic attention to gender differences in these patterns. The specific aims of the current study were to (1) compare the model fit of the leading PTSD symptom models, (2) test how the factors of the best-fitting model are associated with trauma types and mental health problems, (3) examine whether the path model fits different for boys and girls, and (4) test the full mediation model in Aim 2 for moderation by gender.

Method

Participants

Participants included 1,363 youth (990 boys, 373 girls) recruited from two juvenile detention centers located in the West and Midwest. Youth ranged in age from 11 to 18 years ($M = 15.56$, $SD = 1.41$); 64.9% were White/Caucasian, 19.3% Black/African American, 8.7% Hispanic/Latino, 1.1% Native American/Alaskan Native, 1.0% Pacific Islander/Native Hawaiian, 3.1% multiracial, 0.6% Asian American, and 0.6% other.

Measures

Trauma exposure. The University of California at Los Angeles Posttraumatic Stress Disorder Reaction Index–Adolescent Version (PTSD-RI; Steinberg, Brymer, Decker, & Pynoos, 2004) is a widely used screening measure that has demonstrated good convergent validity with other diagnostic measures, high internal consistency, and high test–retest reliability over a period of 7 days. The first set of questions asks youth whether they have been exposed to each of 13 specific traumatic events, and the number of events endorsed is summed to create a total trauma exposure score. The interpersonal trauma exposure scale was comprised of a sum of seven items measuring trauma perpetrated by another person (e.g., physical abuse), and noninterpersonal trauma was comprised of five items measuring other kinds of events (e.g., natural disasters). Youth in the sample reported experiencing between 0 and 23 different traumatic events ($M = 5.34$, $SD = 4.08$), and the average length of time elapsed since these events was 33.19 months ($SD = 37.30$).

PTSD symptom clusters. Additional questions on the PTSD-RI ask youth to rate the extent to which they have experienced, in the past month, any of the symptoms associated with Criterion B (intrusion), Criterion C (avoidance/numbing), and Criterion D (increased arousal). Responses to the questions are presented in a Likert-scale format ranging from 0 (*none of the time*) to 4 (*most of the time*). Youth gauge their responses by viewing the accompanying calendar-like visual diagram of the PTSD-RI. A continuous score for the severity of each cluster is calculated as a sum of the symptom ratings. In addition, in order to address limitations in model stability due to low numbers of items per factor, four additional items measuring avoidance were adapted from the Clinician-Administered PTSD Scale for Children and Adolescents (Newman et al., 2004), for example, "I do things to keep myself from thinking about what happened." For the current sample, Cronbach's alpha for Criterion B = .84, for Criterion C = .80, for Criterion D = .70, and for the Total PTSD score = .90.

Mental health problems. The Massachusetts Youth Screening Instrument–Second Version (MAYSI-2) is a widely used measure used to screen mental health problems in juvenile detention settings (Grisso & Barnum, 2003). The MAYSI-2 includes five scales validated for both males and females: Alcohol/Drug Use (e.g., "Have you gotten in trouble when you've been high or have been drinking?"), Anger-Irritability (e.g., "When you have been mad, have you stayed mad for a long time?"), Depressed-Anxious (e.g., "Have nervous or worried feelings kept you from doing things you want to do?"), Somatic Complaints (e.g., "Has your stomach been upset?"), and Suicidal Ideation (e.g., "Have you felt like life was not worth living?"). Each scale contains five to nine dichotomous items requiring a "yes" or "no" response. "Yes" responses are tallied to create a total score for each scale. The MAYSI-2 scales have established good reliability and validity (Grisso & Barnum, 2003), and internal consistencies of the scales in this sample were as follows: Alcohol/Drug Use, $\alpha = .82$; Anger-Irritability, $\alpha = .81$; Depression-Anxiety, $\alpha = .73$; Somatic Complaints, $\alpha = .76$; and Suicide Ideation, $\alpha = .79$.

Procedure

All study procedures were approved by the institutional review boards of three separate organizational bodies. At visitations to detention centers, legal guardians provided signed informed consent, after which youth were invited to provide signed assent. To eliminate any perceptions of coercion, no incentives were offered for participation. PTSD-RI interviews were conducted individually by a research assistant in a private room within the detention center. The MAYSI-2 was administered within 24 hr after admission via voice format, whereby questions were simultaneously presented on a laptop computer screen and spoken aloud via recording over wireless headphones.

Data Analysis

Study aims were tested using a series of structural equation models performed with Mplus version 6.11 (Muthén & Muthén, 1998–2011). Aim 1 (overall model fit of the four competing theoretical models of PTSD symptoms) was tested by performing a separate confirmatory factor analysis for each of the theoretical model of PTSD symptoms. Each model was comprised of the same 24 indicators, with specific factor loadings listed in Table 1, and was conducted using maximum likelihood estimation. Factors were allowed to correlate in all models. Comparisons of overall model fit were performed using chi-square difference tests for nested models (i.e., the *DSM–IV* [American Psychiatric Association, 2000] model with the numbing and dysphoria models, and each of those with the dysphoric arousal model) and with the Bayesian information criterion (BIC) for non-nested models (i.e., the dysphoria compared with the numbing model). Factorial invariance of factor loadings, factor covariances, and item intercepts for boys and girls were examined for each model using a multigroup model in which individual parameters were equated across gender.

Aim 2 (PTSD symptom clusters as mediators of the associations between trauma exposure and mental health problems)

Table 1
Item Indicators of Competing Factor Models for PTSD Symptoms

PTSD symptoms	*DSM-IV-TR*	Dysphoria	Emotional numbing	Dysphoric arousal
B1. Intrusive thoughts	I	I	I	I
B2. Nightmares	I	I	I	I
B3. Flashbacks	I	I	I	I
B4. Emotional reactivity	I	I	I	I
B5. Physical reactivity	I	I	I	I
C1. Avoidance-thoughts (3 items)	A	A	A	A
C2. Avoidance-reminders (3 items)	A	A	A	A
C3. Amnesia for aspects	A	D	N	N
C4. Loss of interest	A	D	N	N
C5. Feeling distant	A	D	N	N
C6. Feeling numb (2 items)	A	D	N	N
C7. Foreshortened future (2 items)	A	D	N	N
D1. Sleep disturbance	H	D	H	DA
D2. Irritability (2 items)	H	D	H	DA
D3. Difficulty concentrating	H	D	H	DA
D4. Hypervigilance	H	H	H	AA
D5. Exaggerated startle	H	H	H	AA

Note. PTSD = posttraumatic stress disorder; *DSM-IV-TR* = *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.); I = intrusion; A = avoidance; H = hyperarousal; N = numbing; D = dysphoria; DA = dysphoric arousal; AA = anxious arousal.

was tested using a two-step process. First, we established adequate fit of the measurement model for the trauma exposure and mental health symptom variables using confirmatory factor analyses. This step was conducted separately, rather than included in the mediation model, because including all individual indicators as well as paths created difficulty for model convergence, due to the number of estimated parameters (Bentler & Chou, 1987; Jaccard & Wan, 1996). Given that the indicators for the trauma exposure and mental health problem latent variables were dichotomous (yes–no), this model was estimated using weighted least squares means and variance adjusted (WLSMV) because other estimators, including the maximum likelihood (ML) estimator, tend to result in incorrect standard errors, attenuate the relationships between observed variables, and produce possible pseudofactors (Brown, 2006). Second, factor scores were created for all constructs and used to estimate the path model (e.g., de Jonge et al., 2001). The path model was run examining direct effects from interpersonal and noninterpersonal trauma to PTSD symptoms, and from PTSD symptoms to mental health problems.

Aim 3 was tested by examining the equality of path coefficients for boys and girls. A multigroup model equating all path coefficients for boys and girls was run to determine whether there was factorial invariance. Next, a series of multigroup models were run, equating each path coefficient individually to determine which varied across gender. To address Aim 4, path models were examined separately for girls and boys to test how the symptom factors act as mediators of the associations between trauma and mental health problems. These path models included both direct effects and indirect effects from trauma exposure to mental health problems via PTSD symptoms in a multiple mediator model (see Figure 1), and results were compared with a model including only direct effects from trauma exposure to mental health problems. All models for Aims 2, 3, and 4 were estimated using the ML because the use of summed scores precluded the necessity to have categorical indicators included in the model.

Results

Main Effects for Gender

Comparisons of mean differences in PTSD-RI trauma exposure and MAYSI scales were performed using *t* tests and are displayed in Table 2. Results indicate that scores for boys and girls differed significantly on measures of interpersonal trauma exposure and mental health problems, with the exception of drug/alcohol use. Intercorrelations are shown separately for boys' and girls' scores, and reveal overall positive associations among trauma exposure, PTSD symptoms, and mental health problems for all youth, with fewer associations among these variables for girls than for boys.

Model Fit Comparisons

Table 3 reports comparisons of the overall model fit of the four competing models of PTSD symptoms. The three-factor model was found to be a poor to adequate fit to the data, and chi-square difference tests indicated that the four-factor numbing and dysphoria models both provided a significantly better fit, with indices in the adequate range. Because the chi-square difference test cannot be used to compare non-nested models, the dysphoria and numbing models were compared using their BIC values. Given that a 10-point difference suggests a 150:1 likelihood that the lower BIC represents a better fit (Raftery, 1995), the results indicate that the numbing model provided a better fit to the data. Interfactor correlations ranged from .57 (hyperarousal and intrusion) to .68 (avoidance and intrusion) for the *DSM–IV–TR* (American Psychiatric Association, 2000) three-factor model, .38 (avoidance and hyperarousal) to .61 (numbing and hyperarousal) for the numbing model, and .29 (avoidance and hyperarousal) to .61

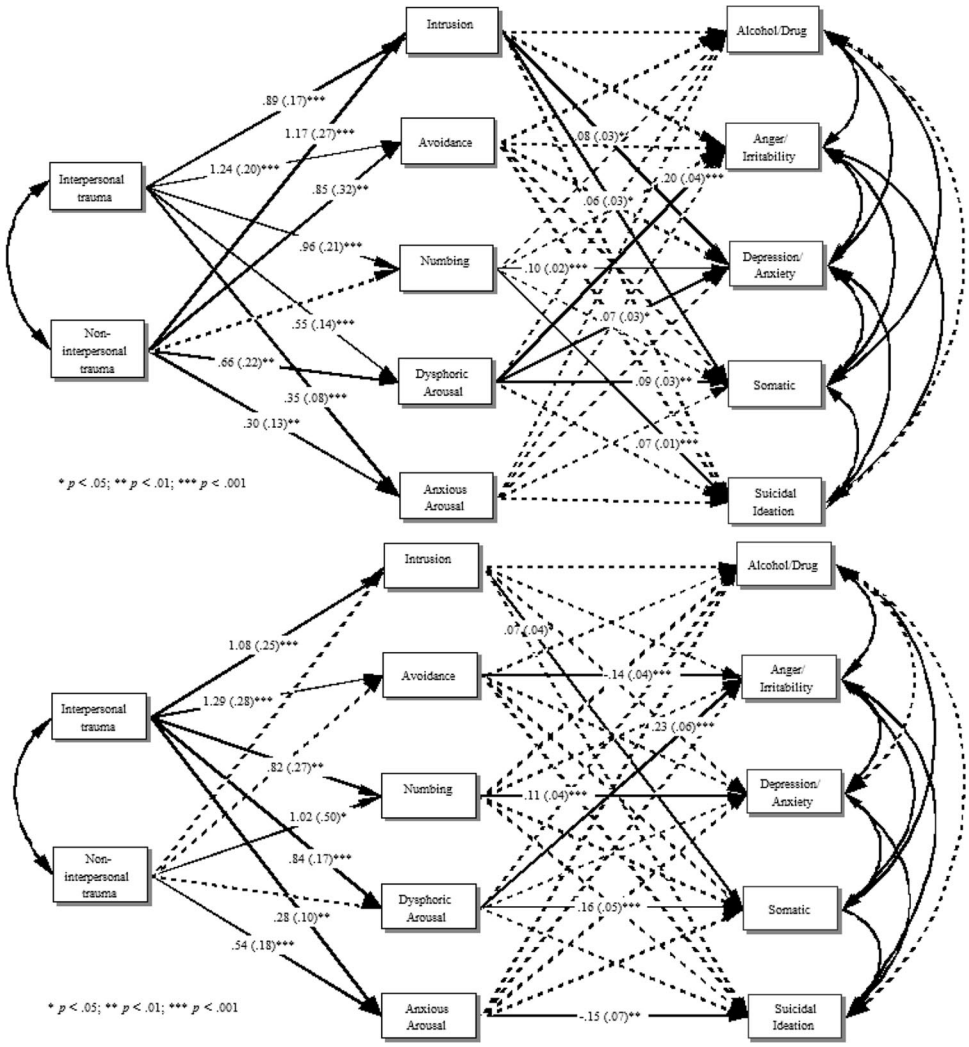

Figure 1. Path models for boys and girls. Path model for boys is displayed on top; path model for girls is displayed on bottom. Nonsignificant paths and covariances are displayed as dashed lines; significant paths are displayed as solid lines. Unstandardized coefficients (with standard errors in parentheses) are displayed for all significant paths. Direct effects from trauma to mental health symptoms are omitted from the figure for clarity but were included in the model.

(dysphoria and intrusion) for the dysphoria model. The dysphoric arousal model also provided an adequate to good fit to the data, and was superior to any of the other models. Therefore, the five-factor dysphoric arousal model was determined to provide the best fit to the data. Interfactor correlations ranged from .28 (avoidance and anxious arousal) to .61 (numbing and dysphoric arousal). Details regarding factor loadings for each model are available upon request, and for the dysphoric arousal model are shown in Table 4 of the online supplemental materials.

Having selected the five-factor model as the best-fitting model, we next ran a multigroup comparison to test equality constraints across gender in order to determine if the model fit equally well for both boys and girls. When examined separately by gender, results of the unconstrained model showed that the five-factor model fit the boys' data with an adequate-to-good fit, $\chi^2(242, N = 680) = 718.55$, $p < .001$, root mean square error of approximation (RMSEA) = .054, 90% confidence interval (CI) [.049, .058], standardized root mean residual (SRMR) = .052, comparative fit index (CFI) = .91, and also fit the girls' data adequately to well, $\chi^2(242, N = 291) = 442.26$, $p < .001$, RMSEA = .053, 90% CI [.055, .061], SRMR = .066, CFI = .92. To formally test for factorial invariance across gender, we next ran a model constraining the factor loadings for each factor across groups. The constrained model fit the data adequately, $\chi^2(536) = 1596.638$, $p < .0001$, RMSEA = .064, 90% CI [.060, .067], SRMR = .08, CFI = .89. A chi-square difference test between the constrained and unconstrained models was significant (χ^2 difference = 339.718, $df = 14$, $p < .001$), indicating that the factor loadings were significantly different across gender. Further examination by constraining each factor separately indicated that factor loadings for girls were significantly stronger than for boys for each factor except anxious arousal. Factor loadings for the dysphoric arousal

Table 2
Means, Standard Deviations, and Intercorrelations Separately for Girls and Boys

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. AD	—	.28**	.13	.24**	.20**	.12	.17	.06	.02	.14	.18*	.12
2. AI	*.30***	—	.60**	.34**	.40**	.26**	.45**	.24**	.39**	−.06	.13	.05
3. DA	*.20***	*.64***	—	.41**	.63**	.37**	.40**	.19*	.45**	.15	.29**	.09
4. SC	*.30***	*.48***	*.54***	—	.39**	.39**	.44**	.23**	.32**	.20*	.12	.07
5. SI	*.15***	*.39***	*.57***	*.31***	—	.25**	.25**	.01	.26**	.20*	.12	.05
6. IN	*.08*	*.27***	*.36***	*.26***	*.17***	—	.53**	.39**	.59**	.53**	.37**	.20**
7. DA	*.13**	*.37***	*.35***	*.27***	*.20***	*.49***	—	.46**	.56**	.35**	.37**	.22**
8. AA	*−.01*	*.17***	*.19***	*.16***	*.06*	*.43***	*.42***	—	.32**	.27**	.29**	.21**
9. NU	*.12**	*.30***	*.43***	*.26***	*.34***	*.54***	*.60***	*.38***	—	.32**	.29**	.18**
10. AV	*.10**	*.14***	*.21***	*.12**	*.18***	*.55***	*.34***	*.28***	*.41***	—	.30**	.13*
11. IT	*.21***	*.22***	*.25***	*.18***	*.21***	*.31***	*.27***	*.24***	*.28***	*.28***	—	.40**
12. NT	*.13***	*.16***	*.17***	*.15***	*.10**	*.24***	*.20***	*.15***	*.12***	*.16***	*.36***	—
M boys	2.43	3.08[a]	1.93[a]	2.49[a]	0.60[a]	5.47[a]	7.22[a]	2.92[a]	7.37[a]	4.75[a]	2.52[a]	0.78
SD boys	2.40	2.64	2.04	1.95	1.15	4.79	3.87	2.15	5.94	5.08	1.64	0.91
M girls	2.61	4.05[a]	2.92[a]	3.58[a]	1.17[a]	8.14[a]	8.99[a]	3.55[a]	9.97[a]	5.75[a]	3.02[a]	0.87
SD girls	2.43	2.64	2.23	1.85	1.57	5.44	3.84	2.16	6.47	5.40	1.85	0.91

Note. *N* for girls = 373; *N* for boys = 990. Correlations for girls are displayed above the diagonal and correlations for boys are displayed below the diagonal in italics. AD = alcohol/drug use; AI = anger-irritability; DA = depressed-anxious; SC = somatic complaints; SI = suicidal ideation; IN = intrusion; DA = dysphoric arousal; AA = anxious arousal; NU = numbing; AV = avoidance; IT = interpersonal trauma; NT = noninterpersonal trauma.
[a] *t* tests (*df* = 822, 969, 1183 for MAYSI, PTSD symptom, and trauma exposure scales, respectively) indicate means for boys and girls are significantly different from one another, $p < .01$.
* $p < .05$. ** $p < .01$.

model are displayed in Table 4 of the online supplemental materials. Covariances between intrusion and numbing (.32 for girls; .23 for boys), and factor variances for intrusion and numbing (.92 and .14 for boys; 1.23 and .18 for girls), also differed across gender. These results indicate that the dysphoric arousal model may explain greater variance for boys than for girls.

Associations Among Trauma Exposure, PTSD Symptoms, and Mental Health Problems

A two-step process was used to determine the associations between trauma exposure, PTSD symptoms, and mental health problems, with the goal of identifying which PTSD symptom clusters act as mediators. The first step in the two-step approach was to test the fit of the measurement model. Results showed that the model fit was good (WLSMV, $\chi^2[2346] = 3350.887$, $p < .0001$, RMSEA = .018, 90% CI [.016, .019], CFI = .93). With the measurement model established, the second step was to examine the path components among the constructs by treating the summed scores as observed variables using the ML estimator. Results indicated that the path model was a good fit, $\chi^2(10) = 19.74$, $p = .032$, RMSEA = .043, 90% CI [.012, .071], SRMR = .022, CFI = .995, Tucker Lewis Index (TLI) = .968. Significant paths ($p < .05$) include from interpersonal trauma to intrusion ($B = 1.05$, $SE = .14$), avoidance ($B = 1.23$, $SE = .16$), dysphoric arousal ($B = .72$, $SE = .12$), numbing ($B = 1.00$, $SE = .17$), and anxious arousal ($B = 1.23$, $SE = .16$); from noninterpersonal trauma to intrusion ($B = .93$, $SE = .24$), avoidance ($B = .73$, $SE = .27$), dysphoric arousal ($B = .53$, $SE = .18$), numbing ($B = .71$, $SE = .28$), and anxious arousal ($B = .37$, $SE = .10$); to alcohol/drug use from dysphoric arousal ($B = .09$, $SE = .04$); to anger/irritability from avoid-

Table 3
Fit Indices for Models

	χ^2 (*df*)	RMSEA (95% CI)	SRMR	CFI	TLI	BIC
DSM-IV-TR	1517.139 (249)	.072 (.069, .076)	.068	.837	.819	65149.533
Numbing	897.729 (246)	.052 (.049, .056)	.050	.916	.906	64550.757
Dysphoria	1006.484 (246)	.056 (.053, .060)	.050	.902	.890	64659.512
Dysphoric arousal	857.354 (242)	.051 (.047, .055)	.048	.921	.910	64537.896
Comparisons of model fit						
Numbing superior to *DSM-IV-TR*	χ^2 difference = 619.41, *df* = 3, $p < .001$					
Dysphoria superior to *DSM-IV-TR*	χ^2 difference = 510.655, *df* = 3, $p < .001$					
Numbing superior to dysphoria	BIC difference = 108.76; likelihood that difference significant > 150:1					
Dysphoric arousal superior to *DSM-IV-TR*	χ^2 difference = 659.785, *df* = 7, $p < .001$					
Dysphoric arousal superior to numbing	χ^2 difference = 40.375, *df* = 4, $p < .001$					
Dysphoric arousal superior to dysphoria	χ^2 difference = 149.13, *df* = 4, $p < .001$					

Note. *df* = degrees of freedom; RMSEA = root mean square error of approximation; CI = confidence interval; SRMR = standardized root mean residual; CFI = comparative fit index; TLI = Tucker Lewis Index; BIC = Bayesian information criterion; *DSM-IV-TR* = *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.).

ance ($B = -.07$, $SE = .02$), numbing ($B = .06$, $SE = .02$), and dysphoric arousal ($B = .22$, $SE = .04$); to depression/anxiety from numbing ($B = .11$, $SE = .02$), dysphoric arousal ($B = .09$, $SE = .03$), and intrusion ($B = .08$, $SE = .02$); to somatic complaints from dysphoric arousal ($B = .16$, $SE = .03$) and intrusion ($B = .08$, $SE = .02$); and to suicidal ideation from numbing ($B = .06$, $SE = .01$) and anxious arousal ($B = -.07$, $SE = .03$). Overall, the model predicted the following percentages of variance: 24.50% for depression/anxiety, 19.9% for anger/irritability, 16.5% for somatic complaints, 12.1% for suicidal ideation, and 2.9% for alcohol/drug problems.

Moderation by gender. To examine whether the strengths of these paths varied across gender, a multigroup model was run equating the path coefficients across groups. Results of a multigroup model suggested a good fit to the data, $\chi^2(20) = 26.49$, $p = .15$, RMSEA = .035, 90% CI [.00, .068], SRMR = .024, CFI = .997, TLI = .977. We tested the path model for moderation by gender by constraining individual paths in the model. First, the paths from interpersonal and noninterpersonal trauma to each of the five factors of PTSD were examined. These paths were not moderated by gender, as signified by nonsignificant chi-square difference tests between the constrained and unconstrained models. Next, individual paths from each of the five factors of PTSD to the mental health symptoms were investigated. Results are displayed in Figure 1. Chi-square difference testing using models constraining paths separately from the PTSD symptom factors to mental health problems indicated that girls' PTSD factor scores explained more variance in depression/anxiety, somatic complaints, and suicidal ideation than did those of boys, whereas for boys, paths were stronger leading to anger/irritability. No significant gender difference emerged for the association with substance use.

PTSD symptom clusters as mediators. Finally, the path model was tested to determine whether the five PTSD symptom factors mediated the association between trauma exposure and mental health problems. Given that differences in mediation patterns for girls and boys were established through constraining paths in a multigroup model, indirect paths between trauma exposure and mental health problems via PTSD symptoms were examined separately by gender. An examination of a model with only the direct effects between interpersonal and noninterpersonal trauma and mental health problems for girls indicated significant associations between interpersonal trauma and alcohol/drug use ($B = .21$, $SE = .10$) and depression/anxiety ($B = .27$, $SE = .10$). For girls, a separate model including both indirect and direct effects indicated significant indirect paths between interpersonal trauma and mental health problems were as follows: avoidance ($B = -.18$, $SE = .06$) and dysphoric arousal ($B = .19$, $SE = .07$) to anger/irritability; numbing to depression/anxiety ($B = .09$, $SE = .04$); and dysphoric arousal to somatic complaints ($B = .13$, $SE = .05$). There were no significant mediating paths between noninterpersonal trauma and mental health problems for girls. No direct effects remained between trauma and mental health variables once the indirect effects were included. The total effects for girls explained 7.1% of the variance in alcohol/drug use, 29.6% of the variance in anger/irritability, 23.8% of variance in depression/anxiety, 21.5% of variance in somatic complaints, and 11.9% of variance in suicidal ideation.

For boys, a model with direct paths between trauma exposure and mental health problems indicated significant direct effects between interpersonal trauma and alcohol/drug use ($B = .27$, $SE = .07$), anger/irritability ($B = -.31$, $SE = .08$), depression/anxiety ($B = .28$, $SE = .06$), somatic complaints ($B = .17$, $SE = .06$), and suicidal ideation ($B = .14$, $SE = .04$), as well as a direct path between noninterpersonal trauma and somatic complaints ($B = .22$, $SE = .10$). A model including both direct and indirect paths indicated significant indirect effects between interpersonal trauma and mental health problems via PTSD symptoms as follows: anger/irritability was mediated by dysphoric arousal ($B = .11$, $SE = .04$); depression/anxiety by numbing ($B = .10$, $SE = .03$), dysphoric arousal ($B = .04$, $SE = .02$), and intrusion ($B = .07$, $SE = .03$); somatic complaints by dysphoric arousal ($B = .05$, $SE = .02$) and intrusion ($B = .05$, $SE = .03$); and suicidal ideation by numbing ($B = .07$, $SE = .02$). Paths from noninterpersonal trauma had indirect effects as follows: anger/irritability was mediated by dysphoric arousal ($B = .13$, $SE = .05$); depression/anxiety by intrusion ($B = .09$, $SE = .04$); and somatic complaints by dysphoric arousal ($B = .06$, $SE = .03$). Only the direct effect of interpersonal trauma on alcohol/drug remained significant once the indirect effects were included in the model. For boys, the direct and indirect effects explained 6.3% of variance in alcohol/drug use, 15.8% of variance in anger/irritability, 21.7% of variance in depression/anxiety, 11.8% of variance in somatic complaints, and 12.4% of variance in suicidal ideation.

Discussion

Consistent with previous studies of juvenile-justice-involved youth (e.g., Ford, Elhai, Connor, & Freuh, 2010; Kerig, Vanderzee, et al., 2012), trauma exposure was associated with diverse mental health symptoms among the youth in this sample. As Ford and colleagues have argued, particularly for the many youth in this population who have experienced multiple forms of victimization, a complex array of behavioral and emotional problems might ensue (D'Andrea, Ford, Stolbach, Spinazzola, & van der Kolk, 2012). In addition, the present analyses demonstrated that these associations were mediated in specific ways by individual PTSD symptom clusters. In particular, these results contribute to a growing body of literature demonstrating the validity and utility of the five-factor model of PTSD structure distinguishing between dysphoric and anxious arousal (Elhai et al., 2011). Of particular interest in the present sample of delinquent youth was that dysphoric arousal was associated with mental health problems in ways that did not emerge for anxious arousal, serving as a mediator of the link between interpersonal trauma and somatic complaints in all youth, as well as depression/anxiety and anger/irritability in boys. As Elhai and colleagues (2011) argue, although anxious arousal is associated with the kind of fear-based responses that traditionally have informed the conceptualization of posttraumatic stress, significant research is emerging that suggests our understanding of the trauma response must include a range of reactions beyond those associated with fear (Friedman, Resick, Bryant, & Brewin, 2011; Kerig & Bennett, 2012). Such non-fear-based reactions may be particularly relevant to the antisocial youth included in the present study, who may be prone to displaying emotional distress in fear defying rather than fearful ways (Ford et

al., 2006). Attention to dysphoric arousal symptoms, such as poor sleep, moodiness, and difficulty concentrating, may be helpful for identifying posttraumatic reactions among antisocial boys whose difficult behavior is not readily recognized, by themselves or by others, as being potentially related to underlying trauma.

Further, in contrast to studies of community youth, in which numbing has not emerged as a significant predictor of disturbance (Ayer et al., 2011), the data from the present study are consistent with theories that posit numbing as a key marker of posttraumatic stress specifically among delinquent youth (Allwood et al., 2011; Ford et al., 2006; Kerig & Becker, 2010; Kerig, Bennett, et al., 2012). In the present sample, numbing served as a mediator of the association between interpersonal trauma and depression/anxiety for all youth and suicidal ideation for boys. Although the numbing of emotions may represent a youth's attempt to downregulate distress, particularly in the aftermath of cumulative, interpersonal trauma (Ford, Chapman, Connor, & Cruise, 2012), this is a coping strategy that is likely to achieve only incomplete effects and may even be associated with an exacerbation of mental health problems.

The mediational analyses revealed gender differences in the patterns of mental health problems that were associated with PTSD symptoms, with PTSD being more strongly related to internalizing symptoms among girls and externalizing symptoms of anger/irritability among boys. Although a number of studies have suggested that comorbidity of internalizing and externalizing problems is more evident among samples of juvenile-justice-involved girls than boys (Cauffman, Lexcen, Goldweber, Shulman, & Grisso, 2007), these results also suggest the possibility that the sequelae of trauma are evidenced differently in delinquent boys and girls, with boys' irascible and aggressive behaviors perhaps distracting our attention from recognizing their underlying roots in psychological trauma. The inclusion of such reactions in the new *DSM-5* (American Psychiatric Association, 2013) criteria for PTSD offers a step forward for the detection of these trauma-related symptoms (Friedman et al., 2011).

Finally, and as also found in previous samples of juvenile-justice-involved youth, noninterpersonal traumas were linked with boys', but not girls', mental health problems. For boys only, the association between noninterpersonal trauma and anger/irritability was mediated by dysphoric arousal, the association with depression/anxiety was mediated by intrusion, and the association with somatic complaints was mediated by dysphoric arousal. It is possible that this gender difference emerges as a function of the larger number of boys in this sample, consistent with the gender ratio among juvenile-justice-involved youth generally, which allows for greater power to find statistically significant effects for boys than for girls. However, this finding also may reflect the differential sensitivity of girls to traumas that are interpersonal in nature (Kelley et al., 2009; Kerig, Vanderzee, et al., 2012), resulting in any sequelae associated with noninterpersonal stressors to pale in comparison when both kinds of trauma are endured, as is most frequently the case among these multiply traumatized youth. In turn, the unexpected finding that a pattern of associations emerged between intrusion and mental health problems for boys but not girls also might be attributable to ways in which girls' experiences of interpersonal victimization—particularly in the context of close relationships—promote the use of distress regulation strategies that serve to dampen rather than heighten reexperiencing (Freyd, 1996).

Among its strengths, the current study expands the current research on the five-factor model in a number of respects. Whereas previous research with youth has been limited to studies of those exposed to a discrete natural disaster (e.g., Wang, Li, et al., 2011), this study included a sample of adolescents who had experienced a wide range of trauma types. Other limitations identified in the previous research also were addressed, including adding questions to bolster the reliability of low-item factors and systematically examining gender differences (Ayer et al., 2011). In addition, this study extended the research beyond comparisons of model fit by also investigating associations of PTSD symptoms with specific trauma types and mental health problems. These efforts toward external validation offer further support for the five-factor model and demonstrate its utility for the study of PTSD symptom structure among youth.

The results of the current study should also be interpreted in the light of a number of limitations. Most importantly, these data were collected cross-sectionally, and therefore, although the traumatic experiences reported all predated youth ratings of their current symptoms, conclusions about temporal causality cannot be drawn regarding the associations among traumatic experiences, PTSD symptoms, and mental health problems. Moreover, all measures were based on self-report and a single measure was used to assess each construct, resulting in monoinformant and monomethod biases. Additionally, this sample of detained offenders represents only a subset of the larger population of delinquent youth, and thus the results may not generalize to other samples. Finally, although the sample was fairly large and ethnically diverse, it was comprised of fewer girls than boys, which may have implications for the availability of statistical power to find comparable differences for each gender.

In regard to potential clinical implications of these findings, continuing investigations focused on individual symptom clusters may help to inform assessment and intervention efforts, particularly in regard to the ways in which PTSD affects the functioning of young persons (Ayer et al., 2011; Cohen & Scheeringa, 2009). Traumatized youth frequently exhibit elevations in only certain clusters and thus may not meet full criteria for PTSD diagnosis, despite having symptoms severe enough to interfere with functioning (Cohen & Scheeringa, 2009). Symptom specificity also is consistent with trauma theory, which posits that individual differences in trauma response may arise as a function of overreliance on a certain affect regulation strategies—for example, "freeze" (hypervigilance), "flight" (avoidance) "fight" (dysphoric arousal), or "fright" (dissociation; Gray, 1988). In turn, youth with these symptom profiles may respond differentially to particular treatment techniques. For example, symptoms of dysphoric arousal might respond best to distress reduction techniques such as mindfulness, whereas youth who engage in numbing might benefit most from cognitive processing of the underlying thoughts and feelings that are keeping the youth "stuck" in the trauma (Cohen, Mannarino, & Deblinger, 2006). The development of empirically supported strategies for tailoring treatments to the individual needs of clients is a valued but still-aspirational component of evidence-based practice (Norcross & Wampold, 2011), which findings such as those reported here may help to inform.

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