Posttraumatic Stress Symptom Trajectories in Children Living in Families Reported for Family Violence

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The present study examined latent class trajectories of posttraumatic stress disorder (PTSD) and associations between demographics, prior trauma, and reason for referral on class membership. Children ages 7–18 (n = 201) were recruited for participation in the Navy Family Study following reports to the U.S. Navy's Family Advocacy Program (FAP). Initial interviews were conducted 2–6 weeks following FAP referral, with follow-ups conducted at 9–12, 18–24, and 36–40 months. Growth mixture modeling revealed two latent class trajectories: a resilient class and a persistent symptom class. Relative to youth in the resilient class, participants in the persistent symptom class were more likely to be older and to report exposure to a greater number of trauma experiences at Time 1.

Although between one half and two thirds of youth report exposure to at least one traumatic experience by 16 years of age, epidemiologic estimates suggest that as few as 6.2% of male and 10.1% of female trauma-exposed youth meet 6-month diagnostic criteria for posttraumatic stress disorder (PTSD; Kilpatrick, Acierno, et al., 2003; Kilpatrick, Saunders, & Smith, 2003; Kilpatrick, Ruggiero, et al., 2003). Using variable-centered approaches, longitudinal investigations of PTSD symptoms in youth have shown that these low levels of PTSD symptoms often decline over time (Nugent et al., 2007; Vila, Porche, & Mouren-Simeoni, 1999). However, these variable-centered approaches, including most applications of change scores or indices of residualized change, only analyze mean-level data. In contrast, analytic strategies such as growth mixture modeling (GMM) permit modeling of individual growth trajectories and identification of subsets of participants who evidence similar symptom patterns over time.

Distinct subpopulations, or latent growth classes, are characterized by within-class homogeneity in the pattern and shape of symptom course. To date, only one published investigation has explored latent class PTSD symptom trajectories in trauma-exposed adults, and we were unable to locate any investigations with youth. The present investigation attempts to (a) identify distinct latent classes of youth PTSD symptom trajectories, and (b) examine predictors of class membership including demographic variables, referral allegation type, and number of traumatic experiences reported by youth at initial assessment.

Our literature review identified one published study that examined subgroups of child PTSD symptom course. Perkonigg and colleagues (2005) examined PTSD diagnostic status in a subset of respondents (*n* = 125) with full or subthreshold PTSD at baseline who were part of a longitudinal epidemiological study of 2,548 German adolescents and young adults (ages 14–24). Diagnostic

status was assessed at baseline and 35–50 months later, with 4.4% of the entire baseline sample meeting subthreshold criteria and 1.3% meeting full criteria for PTSD. One quarter (25.6%) of respondents with PTSD at baseline showed a chronic course and met criteria for PTSD at follow-up, 52.0% of respondents with either full or subthreshold PTSD reported remission of symptoms, and 4.2% of respondents with subthreshold PTSD at baseline met full criteria for PTSD at follow-up. Posttraumatic stress disorder diagnostic chronicity in the overall sample was predicted by exposure to new traumatic event(s) during the interim period. Respondents with PTSD at follow-up also had higher rates of avoidant symptoms at the first time point.

Investigations of symptom course in adults have adopted similar strategies involving assignment to groups based on change in PTSD diagnostic status (i.e., Adams & Boscarino, 2006; Breslau & Davis, 1992; Davidson et al., 1991; Marshall et al., 2006). We identified only one published investigation that explored latent classes of PTSD symptom trajectories. Orcutt and colleagues (2004) used GMM to examine PTSD symptom trajectories across three time points in a sample of Gulf War veterans. Findings supported two distinct growth curves, one depicting low levels of PTSD symptoms ($M = 1.14$ symptoms) with little increase over time and a second showing higher levels of initial symptoms with a significant increase over time ($M = 1.61$ symptoms). Respondents in the class characterized by low PTSD symptoms with little increase over time were more likely to report lower combat exposure, male gender, Caucasian race, and higher education. However, the study methodology is limited because the PTSD assessment measure was changed across the time points. Additionally, this study examined classes of growth trajectories across three time points, whereas a minimum of four time points is recommended for GMM (Muthén, 2004).

The present investigation characterized latent growth classes of PTSD symptoms among a sample of children and adolescents reported to authorities due to allegations of exposure to family violence, and examined early predictors (i.e., demographics, referral reason, number of prior trauma experiences) of class membership. Participants were prospectively interviewed at four time points over 3 years. Counts of PTSD criteria B, C, and D symptoms were constructed for youth, and parents completed self-report measures of their own PTSD symptoms, including levels of avoidance. Growth mixture modeling procedures were applied to examine possible latent class membership. Although traditional analytic strategies have examined up to four potential patterns of change over time based on change in PTSD diagnostic status (Adams & Boscarino, 2006; Breslau & Davis, 1992; Davidson et al., 1991; Marshall et al., 2006; Perkonigg et al., 2005), prior GMM with adults has identified only two discrete latent class trajectories (Orcutt, Erickson, & Wolfe, 2004). Accordingly, although prior GMM research led us to expect two latent classes, we planned to examine four or more possible latent class trajectories. To further characterize latent class trajectories, we tested whether class trajectory was associated with factors that would be available to clinicians upon initial assessment, including demographic variables (sex, age, and race), referral reason (allegations of child physical abuse, child sexual abuse, or exposure to intimate partner violence), and number of trauma types reported upon initial assessment.

METHOD

Participants

Study participants were a subset of families participating in the Navy Family Study (Banyard, Williams, Saunders, & Fitzgerald, 2008). Navy Family Study participants were 530 families reported to the U.S. Navy's Family Advocacy Program (FAP) in 1998 to 2001 because of allegations of child sexual abuse (CSA; 18.5% of the families), child physical abuse (CPA; 38.9%), or intimate partner violence (IPV; 42.6%). The FAP provided clinical assessment of risk, safety planning, and determination of appropriate interventions and/or treatment. Due to the volume of reports, cases of partner violence and child physical abuse were randomly sampled, whereas all cases of sexual abuse of a child by a parent were accepted for further screening (enrolled $N = 530$). Allegations of family violence did not have to be substantiated by authorities for the family to be eligible for the study.

Participant families were recruited from 12 naval bases in four areas of the United States (Mid-Atlantic, Southeast, West, and Pacific Northwest). Inclusion criteria were (a) a report to FAP for allegations of intra-familial CSA, CPA, or IPV; (b) presence in the household of at least one child younger than 18 (the index child); (c) two adults living in the household who were married or in a romantic, cohabiting relationship for at least 6 months prior to the report to FAP; and (d) both adults had functioned in parental roles with the index child for at least 6 months prior to the report. All families had at least one parent who was a Navy service member (usually the father) at the time of the report.

Assessments were conducted with the alleged offending parent, nonoffending parent, and index child. For child sexual abuse and child physical abuse cases, the index child participants in the study were the victims of the alleged incidents that caused the report to FAP. In cases of multiple child victims of physical or sexual abuse, the oldest child victim (under the age of 18) was selected as the index child. In cases of reported partner violence, the oldest child in the home was selected as the index child. Due to age constraints of the standardized measures used for assessment, only children who were at least 7 years of age at the onset of the study were interviewed.

Of the 530 families, 245 children (46%) were not eligible for the first interview because they were too young. Of the 285 eligible children, 201 (71%; 73 boys, 128 girls) were interviewed, with 195 children present at Time 1 (T1) and an additional 6 participants first interviewed at Time 2. The average age of children completing the first interview was 12 years ($SD = 3$; range: 7–18).

Children were predominantly Caucasian (52%) and African American (30%), with remaining participants reporting Asian (6%), Hispanic/Latino (3%), and Other/unknown (10%) race.

Parent demographic data were taken at T1 and reflect the subset of parents with child interviews. The majority of the parents were married (72%), with an additional 2% reporting that they were divorced, 24% reporting that they were separated, and 2% reporting that they were cohabitating but not married. The average age of mothers was 34 ($SD = 5$) and of fathers was 34 ($SD = 5$) and the majority of mothers (92%) and all fathers had at least a high school degree. Personal income ranged from under $10,000 to in excess of $60,000 (median range: $10,000–$19,999).

Measures

Exposure to traumatic experiences was measured using a victimization history survey adapted from a similar interview used in the National Survey of Adolescents (Kilpatrick et al., 2003). The instrument includes multiple items to assess exposure to traumatic events meeting Criterion A of the PTSD diagnosis, including witnessing serious community violence, sexual assault, physical assault, physical abuse by a caregiver, and observing parental violence.

Posttraumatic stress symptoms among child participants were assessed using a revised version of the National Survey of Adolescents PTSD interview module (Kilpatrick et al., 2003). This structured clinical interview assesses each Criteria B, C, and D symptom of PTSD, as well as Criteria E and F (*DSM–IV*; American Psychiatric Association, 1994), permitting calculation of symptom counts as well as determination of diagnostic status. Symptoms were not exclusively tied to a single traumatic event; interviewers used open-ended queries to clarify the referent for reexperiencing and avoidance symptoms and symptoms were not counted if they were not about a previously screened victimization event. Although some research has emphasized linking symptoms to specific stressor events, Saunders et al. (1999) noted numerous strengths associated with the use of a nonevent specific approach. Most salient to the present investigation, we did not expect all youth to have the insight necessary to draw associations between exposure to a specific event and subsequent symptoms. Further, some youth may have felt afraid to be honest about their exposure to family violence or may have experienced a trauma that was not captured by our list of potential trauma events. Accordingly, we felt that the clinical implications of experienced symptoms and symptom course, regardless of the precise trauma(s) experienced, was of sufficient importance to warrant empirical description. Assessment of all youth who have been referred for possible family violence is further consistent with recommendations provided by Margolin and Vickerman (2007). Finally, given evidence that functional impairment, number of comorbid disorders, rates of comorbid major depressive disorder, and current suicidal ideation increase linearly with increases in the number of PTSD symptoms (Marshall et al., 2001), as well as additional statistical power permitted in analy-

ses with count variables, PTSD symptom count (range: 0–17) was used for the present analyses. Time 1 internal consistency of PTSD symptom count was good ($\alpha = .87$), even in youth under the age of 12 ($\alpha = .83$).

Procedure

Research assistants offered participation to all families referred to FAP for reports of CSA. Due to the large number of reports, cases of CPA and IPV were randomly selected. After completing the informed consent procedures, interviews were conducted either in family homes (66%), at a private research office located adjacent to the FAP agency (27%), or at another publically available location such as a library conference room (7%). Interviewers were trained in assessment of sensitive topics. Confidentiality and participant comfort were further promoted by the use of a Federal Certificate of Confidentiality and by the use of specific data collection, management, and storage procedures to assure confidentiality. A "progressive person in danger protocol," including potential for breach of confidentiality, was used in cases of imminent danger to study participants. The initial assessment occurred 2–6 weeks following the family's referral to FAP, with follow-ups conducted at 9–12, 18–24, and 36–40 months after the report. All procedures were approved by internal review boards at the University of New Hampshire, Wellesley College, and the Medical University of South Carolina.

Data Analysis

Identification of distinct classes of PTSD symptom count trajectories was completed using GMM with latent variables conducted using Mplus Version 4.21 (Muthén & Muthén, 1998–2006). Categorical latent variables indicating classes of PTSD symptom trajectories were estimated through division of the overall population into homogenous subgroups whose class membership is inferred from the data (Li et al., 2001). Growth mixture modeling combines a person-oriented approach with conventional variable-oriented growth curve modeling, permitting continuous latent growth factors (intercept and slope) to model the relationships of PTSD symptoms and time across unobserved subpopulations (Muthén, 2004). Whereas conventional growth modeling assumes a single population and estimates a mean growth curve, GMM allows direct exploration of the presence of discrete trajectory classes. That is, participants are grouped into common symptom trajectories. In MPlus, GMMs are estimated with maximum likelihood with robust standard errors (MLR), permitting parameter estimation informed by the proposed model and by existing patterns of missing data in cases where data are missing at random (MAR). The MPlus missingness option was applied to all analyses with minimum coverage in the present study at .10, suggesting sufficient covariance coverage for a reliable model (Muthén & Muthén, 2004).

Posttraumatic stress disorder symptom class trajectories were characterized in accordance with actual symptoms over time, with

time parameterized using the midpoint of each interview window (i.e., 1 month, 10.5 months, 21 months, and 38 months). Additionally, nonlinear models were evaluated, including quadratic and square root terms as well as analyses using the log of time (Singer & Willett, 2003). Evidence for different trajectory classes exists when models with two or more latent classes provide a better fit to the data. Respondent classification is based on estimated posterior probabilities that indicate the likelihood of a particular case belonging to each trajectory class. Model fit is indicated by the log-likelihood value. The Bayesian Information Criterion (BIC) was also examined to compare nonnested models with different numbers of latent classes to evaluate model fit to the data (Muthén, 2004); a lower BIC value signifies a better-fitting model. Other considerations in selecting the preferred model include distinguishable latent classes based on classification quality with posterior probabilities, divergence of class trajectories, and adequate class sizes (Lubke & Neale, 2006; Muthén, 2004). Recent simulations using available fit indices and tests also suggest that the bootstrap likelihood ratio test (BLRT) may be a preferred indicator of classes across all models considered (Nylund, Asparouhov, & Muthén, 2007). Class assignment was calculated using posterior probabilities.

To further characterize latent class membership, logistic regression analyses were used to test whether latent class trajectories were predicted by data that would be available to clinicians upon initial assessment. Variables were entered in blocks to examine whether class membership differed as a function of (a) demographic (sex, race, age) factors, (b) referral type (CSA, CPA, IPV), or (c) number of trauma types reported at the first time point.

RESULTS

At T1, the majority of child participants reported that they had witnessed serious community violence (70%), with nearly half of the sample reporting witnessing domestic violence (44%) or experiencing physical abuse (48%). Roughly one third of child participants reported experiencing a physical assault outside the home (34%) or a sexual assault (29%). Twenty-two (11%) participants denied experiencing any of the types of violence assessed at T1. Child participants reported an average of 2.0 symptoms of PTSD ($SD = 3.3$; range: 0–14) at the time of the T1 interview. The average number of symptoms endorsed decreased to 1.6 at Time 2 (T2; $SD = 2.6$; range: 0–13), increased to 2.0 at Time 3 (T3; $SD = 3.3$; range: 0–15), and further increased to 2.6 at Time 4 (T4; $SD = 2.6$; range: 0–17). Table 1 presents bivariate correlations among variables of interest. Female participants were older, with referral for reason more likely to be CSA and less likely to be IPV. Female participants reported more symptoms of PTSD across all time points. Families of Caucasian participants were less likely to have been referred for IPV. Relative to youth whose families were referred for CPA or IPV, youth whose families were referred for CSA reported more PTSD symptoms at T1 and T4. Finally, relative to youth whose families were reported for CSA or CPA, youth whose families were referred for IPV were more likely to report decreased symptoms of PTSD at T1, T2, and T4.

To examine PTSD symptom trajectories, a traditional growth curve analysis (one-class model) was conducted, followed by 2-, 3-, and 4-class models. Estimation difficulties were encountered in attempts to add quadratic and square root terms. Fit statistics for both linear and log of time models are presented in Table 2. Two-class models evidenced the best fit in both linear and log of time models according to the BLRT. Entropy and comparisons between 1- and 2-group BIC values also suggested that the linear 2-group model provided a slightly better fit. Posterior probabilities for latent class membership in the linear 2-class model were reasonably high (resilient class = .93; persistent symptom class = .94). The 2-class solution is shown in Figure 1, with parameters for each class provided in Table 3. Consistent with prior adult GMM findings, analyses revealed a resilient class (60.7%), characterized by minimal

Table 1. Associations Among Variables ($N = 201$)

	Female	Caucasian	Age	T1 PTSD	T2 PTSD	T3 PTSD	T4 PTSD	CSA	CPA
Caucasian	−.00								
Age	.22**	.01							
T1 PTSD Symptoms	.22**	.10	.29***						
T2 PTSD Symptoms	.16*	.03	.12	.28***					
T3 PTSD Symptoms	.19*	.11	.18*	.43***	.50***				
T4 PTSD Symptoms	.25**	.05	.19*	.38***	.40***	.57***			
Child Sexual Abuse	.38***	.12	.17*	.39***	.11	.15	.27**		
Child Physical Abuse	−.12	.08	−.09	−.12	.06	−.03	.02	−.50***	
Partner Violence	−.21**	−.20**	−.05	−.21**	−.16*	−.12	−.27**	−.36***	−.63***

Note. Pearson's *r* is provided above for all continuous variables, with point-biserial correlations provided for associations between dichotomous and continuous data. PTSD = Posttraumatic stress disorder; CSA = child sexual abuse; CPA = child physical abuse.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2. Fit Statistics for Growth Mixture Models

Model	Number of groups (k)	BIC	Entropy	Smallest group n	BLRT
Linear	1	2366.14	NA	201	NA
	2	2362.05	.74	74	LL $= -1169.81$, $p = .00$
	3	2371.35	.62	55	LL $= -1159.81$, $p = .43$
Log of time	1	2360.77	NA	201	NA
	2	2362.05	.68	77	LL $= -1168.14$, $p = .00$
	3	2377.95	.80	0	LL $= -1167.79$, $p = .01$

Note. Entropy and BLRT values are not available for single group models (NA). BIC = Bayesian information criteria; BLRT = bootstrap parametric likelihood ratio test; LL = Loglikelihood.
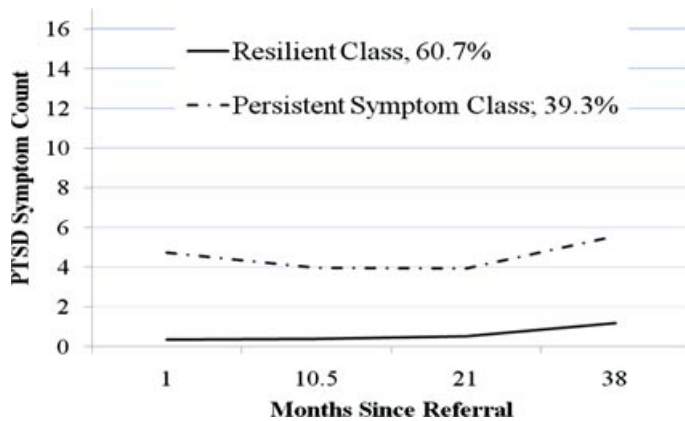

Figure 1. Latent class trajectories of posttraumatic stress disorder symptom counts.

symptoms with a slight increase over time. The persistent symptom class (39.3%) showed moderate, relatively stable symptom levels over time.

To test whether demographic factors, referral type, and number of trauma types reported predicted latent class trajectory, we conducted logistic regression analyses (see Table 4). The final overall model was found to fit the data adequately; Hosmer and Lemeshow $\chi^2(8) = 3.97$, $p = .86$. Pseudo R-square analyses further support the utility of the overall model; Cox and Snell $R^2 = .19$; Nagelkerke $R^2 = .26$. As shown in Table 4, analyses revealed that age and number of trauma types reported at T1 significantly pre-

Table 3. Parameters for Two-Class Growth Mixture Model

		Intercept		Slope	
Class	N	Estimate	SE	Estimate	SE
Resilient	127	-1.22	.30	.01	.01
Persistent symptom	74	1.39	.16	$-.02$	.01

dicted membership in the persistent symptom class; odds ratio (OR; 95% CI) = 1.14 (1.02–1.28); OR (95% CI) = 1.55 (1.18–2.03). A trend was also found for non-Caucasian youth to be assigned to the persistent symptom class; OR (95% CI) = 0.51 (0.26–1.00). Finally, a trend was found for youth referred from families referred for CSA, relative to families referred for IPV, to be members of the persistent symptom class; OR (95% CI) = 2.70 (0.99–7.35).

DISCUSSION

Consistent with prior PTSD GMM with combat veterans (Orcutt et al., 2004), the present findings support the existence of two latent class trajectories, with the majority of participants (60.7%) falling into the resilient class. On average, participants in the resilient class reported few to no symptoms (Sequential Ms = 0.35, 0.39, 0.52) over the course of the first three time points, with symptoms increasing slightly at the last time point ($M = 1.18$). The persistent symptom class consisted of 39% of youth and was characterized by relatively stable moderate symptom levels (Ms = 4.73, 3.97, 3.94, 5.56). Mean symptom levels evidenced by the persistent symptom class were notably higher than those found in the more symptomatic group (ranging from approximately 1.5 to 2.5) of the Orcutt and colleagues (2004) investigation. Although mean PTSD symptom counts falling between 3 and 6 may seem unremarkable given the minimum seven-symptom endorsement required for full diagnostic criteria, these mean symptom counts fall easily within the range of most definitions of subthreshold or partial PTSD (Breslau, Lucia, & Davis, 2004; Marshall et al., 2001). Furthermore, research has shown statistically significant increases in functional impairment and comorbidities as symptoms increase from one, two, three, and four symptoms of PTSD (Marshall et al., 2001). Symptom counts were also linearly associated with reports of suicidal thoughts, with one third of participants with four symptoms endorsing suicidal thoughts.

The present study's identified patterns of change, demonstrating relative stability of moderate symptoms over time for nearly 2 out of 5 participants, are contrary to prior reports of decreases in PTSD symptoms over time (e.g., Blanchard et al., 1996; Ehlers,

Table 4. Class Membership and Demographic Variables, Referral Type, and Number of Traumatic Events Experienced

	Resilient class		Persistent symptom class				
	Count		Count				
	M	SD	M	SD	Wald	OR	95% CI
Block 1. Demographics							
Female sex	72.0	57%	56	76%	0.29	0.81	0.38–1.73
Caucasian race	61.0	48%	45	63%	3.86*	0.51	0.26–1.00
Age	11.5	3.16	13	2.68	5.06**	1.14	1.02–1.28
Block 2. Referral type							
Intimate partner violence[a]	47.0	37%	15	20%	3.96	1.00	
Child physical abuse	61.0	48%	33	35%	0.44	1.30	0.60–2.83
Child sexual abuse	19.0	15%	26	35%	3.79*	2.70	0.99–7.35
Block 3. Number of trauma types	1.9	1.25	2.92	1.44	10.01***	1.55	1.18–2.03

Note. % values reference within-class proportions.
[a]Reference category.
$^* p = .05.$ $^{**} p < .05.$ $^{***} p < .01.$

Mayou, & Bryant, 1998; Shalev et al., 1998). Both the present investigation and the Orcutt and colleagues (2004) GMM study identified a slight increase in mean symptoms reported by both latent classes after the 18–24 month posttrauma assessment. Although we could not examine exposure to new traumatic experiences between each assessment, prior longitudinal research with youth has reported that PTSD diagnostic chronicity is predicted by exposure to new traumatic events (Perkonigg et al., 2005); hence, one possible explanation for this increase in symptoms reported could be exposure to a new trauma.

The present investigation also examined potential differences in demographic data, referral type, and number of prior traumas in each latent class. Consistent with risk factors identified through both variable-centered and GMM studies, findings supported a nonsignificant trend for greater minority group membership in the persistent symptom class relative to the resilient class (Caffo, Forresi, & Lievers, 2005; Orcutt et al., 2004). Although the Orcutt and colleagues investigation reported no association between latent classes and age, youth in the persistent symptom class were older than youth in the resilient class. However, it is important to note that age in the present investigation spanned multiple developmental stages, with relevant (often sex-related) differences in social, emotional, and biological functioning observed in each stage (e.g., Dahl & Gunnar, 2009). Additionally, older age was also associated with family referral for CSA, warranting future examinations to tease out contributions of age and type of abuse experience to PTSD symptom trajectory. This factor is particularly important as a trend was found for youth in the persistent symptom class to come from families referred for CSA. Finally, youth reporting a greater number of traumatic experiences at T1 were more likely to show persistent symptom class trajectories than resilient class trajectories.

Although these findings provide needed information about child PTSD symptom trajectories, further research is needed to determine whether similar trajectories can be identified with other samples. More specifically, as the present investigation was conducted with naval families, it is hard to know the degree to which findings generalize to civilian populations. In particular, historic events occurring during the study period undoubtedly impacted families as naval personnel were increasingly deployed for service away from family members. Additionally, although inclusion criteria for the present investigation consisted of households with two adults, cohabitating and functioning in parental roles with the index child for at least 6 months, we acknowledge that many other definitions of family are possible. Finally, as prior research has found that new incidents of victimization are associated with increases in PTSD symptoms (Boney-McCoy & Finkelhor, 1996; Perkonigg et al., 2005), future examinations should examine the impact of new traumatic experiences on symptom course.

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