Published in final edited form as:
J Am Acad Child Adolesc Psychiatry. 2011 April ; 50(4): 364–375. doi:10.1016/j.jaac.2011.01.004.

Latent Classes of Adolescent Posttraumatic Stress Disorder Predict Functioning and Disorder After 1 Year

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Abstract

Objective—To identify latent classes of posttraumatic stress disorder (PTSD) symptoms in a national sample of adolescents, and to test their associations with PTSD and functional impairment 1 year later.

Method—A total of 1,119 trauma-exposed youth aged 12 through 17 years (mean = 14.99 years, 51% female and 49% male) participating in the National Survey of Adolescents–Replication were included in this study. Telephone interviews were conducted to assess PTSD symptoms and functional impairment at Waves 1 and 2.

Results—Latent Class Analysis revealed three classes of adolescent PTSD at each time point: pervasive disturbance, intermediate disturbance, and no disturbance. Three numbing and two hyperarousal symptoms best distinguished the pervasive and intermediate disturbance classes at Wave 1. Three re-experiencing, one avoidance, and one hyperarousal symptom best distinguished these classes at Wave 2. The Wave 1 intermediate disturbance class was less likely to have a PTSD diagnosis, belong to the Wave 2 pervasive disturbance class, and report functional impairment 1 year later compared with the Wave 1 pervasive disturbance class. The Wave 1 no disturbance class was least likely to have PTSD, belong to the pervasive disturbance class, and report functional impairment at Wave 2.

Conclusions—This study suggests that PTSD severity– distinguishing symptoms change substantially in adolescence and are not characterized by the numbing cluster, contrary to studies in adult samples. These results may help to explain inconsistent factor analytic findings on the structure and diagnosis of PTSD, and emphasize that developmental context is critical to consider in both research and clinical work in PTSD assessment and diagnosis.

Keywords

posttraumatic stress disorder; functional impairment; latent class analysis

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Disclosure: Drs. Ayer, Danielson, Amstadter, Ruggiero, Saunders, and Kilpatrick report no biomedical financial interests or potential conflicts of interest.

Posttraumatic stress disorder (PTSD) is estimated to affect 7.7 million adults in the United States.[1] However, the diagnosis has been subject to debate,[2,3] and revisions to its criteria have been proposed for the *DSM-V*. In the *DSM-IV-TR*,[4] a diagnosis of PTSD requires that the individual experienced a traumatic event, and includes three clusters of symptoms: intrusive re-experiencing (Criterion B), avoidance/emotional numbing (Criterion C), and hyperarousal (Criterion D). Criterion C and its numbing symptoms in particular have been shown to predict PTSD severity and functional impairment above and beyond the effects of other PTSD symptoms,[5–7] depression, and dissociation.[8] These findings have been replicated across cultural groups in multiple studies.[9–11]

Consistent with the distinct clinical relevance of numbing[5] and consistent with evidence that avoidance and numbing are distinct constructs, [12–15] confirmatory factor analytic (CFA) studies have suggested that a four-factor model of PTSD, which divides Criterion C into two separate factors (i.e., avoidance and numbing), is superior to the *DSM-IV* three-factor model.[16] An alternative four-factor model[17] similarly separates avoidance from numbing symptoms but combines numbing with three hyperarousal symptoms to form a “dysphoria” factor. This model also has been found to be superior to the *DSM-IV* model in factor analytic investigations. [17–19] However, CFA studies have reported that several models, including *DSM-IV* and single-factor models, fit very well and that the PTSD factors are highly correlated regardless of number of factors yielded.[18–21] This was the case in a recent CFA study using the current data set as well.[20] Thus, if multiple structures (i.e., PTSD construct theories) fit multiple samples well, the validity of the PTSD construct, its symptoms, and their measurement remain unclear.[22]

In considering CFA as an analytic tool to determine the latent structure of a diagnostic construct, it is also important to consider its limitations. Factor analysis describes variation in symptoms, but does not address heterogeneity in patterns of symptom endorsement.[23] However, recent studies have suggested that subgroups of individuals are indeed empirically distinguishable based on different patterns of PTSD symptoms. [24,25] Using latent class analysis (LCA) in two adult community samples, Breslau et al.[24] revealed three latent classes of PTSD symptoms, which were indicative of no disturbance, intermediate disturbance, and pervasive disturbance. Consistent with taxometric studies reporting that PTSD is a dimensional construct,[26–28] the classes yielded from the Breslau et al.[24] analysis generally represented differing levels of PTSD severity. Using ratios comparing item endorsement probabilities between classes, the authors found that emotional numbing symptoms distinguished the pervasive disturbance class from the other two classes.

Breslau et al.[24] reported that the pervasive disturbance class was associated with the highest levels of functional impairment in adults. Naifeh et al.[25] replicated these findings within an adult clinical sample, identifying two classes similar to the intermediate and pervasive disturbance classes identified by Breslau et al.[24] The authors hypothesized that a “no disturbance” class was not found because of the clinical nature of the sample. Scores on the numbing scales of two different PTSD measures qualitatively distinguished the two classes. The investigations by Breslau et al.[24] and Naifeh et al.[25] therefore suggest that PTSD-affected individuals with elevated levels of numbing symptoms are more likely to experience distress and impairment, and may represent a qualitatively distinct subset of the clinical population.

LCA can inform clinical practice because it allows for the identification of empirically derived symptom patterns as they actually occur within subgroups of individuals. These two previous LCA studies imply that, rather than weighting all PTSD symptoms equally or assuming that an overall symptom count best predicts impairment, clinicians should pay particular attention to the occurrence and treatment of numbing symptoms. Although these

studies have indeed made important contributions to the PTSD diagnosis literature, the generalizability of their results is limited. First, to our knowledge, there are only two such investigations to date[24,25]; therefore replication is necessary. Second, these studies used adult samples, and the latent structure of PTSD may differ in adolescents.[19] Third, cross-sectional designs were used. Therefore, although the increased impairment within the pervasive disturbance class is noteworthy, the extent to which this portion of the population is at risk for chronic PTSD and long-lasting impairment (i.e., as could be studied in a longitudinal design) is unclear. In this study, we aimed to replicate and extend the findings of Breslau et al.[24] and Naifeh et al.,[25] first, by identifying latent classes of PTSD symptomatology in a nationally representative sample of adolescents at two time points, and second, by testing the longitudinal associations of these classes with PTSD diagnosis and functional impairment across time. CFA has already been conducted thoroughly in this sample[20] and thus was not repeated in this investigation. It was hypothesized that three latent classes would be revealed at each time point, with the pervasive disturbance class displaying relatively high levels of emotional numbing symptoms. It was further hypothesized that at 1-year follow-up, the pervasive disturbance class would report the highest levels of functional impairment and distress, as well as the greatest odds of PTSD diagnosis. Given that PTSD is more prevalent in female than male individuals, [29,30] we explored gender differences within each PTSD symptom class.

METHOD

Participants and Weighting Procedures

The current study is an analysis of data from the 2005 National Survey of Adolescents—Replication (NSA-R), an epidemiological study of American youth aged 12 to 17 years that included a national household probability sample with an oversample of urbandwelling adolescents. The main purpose of this study was to determine the prevalence of adolescents' exposure to potentially traumatic events and associated emotional and behavioral problems; methodological procedures have been reported in detail elsewhere[31] and are briefly summarized here.

The NSA-R included 3,614 youth aged 12 to 17 years at Wave 1, with 2,358 of these youth participating at Wave 2 approximately 1 year later. Only the trauma-exposed subsample (Wave 1: N = 1,119, 52% female; Wave 2: *N* = 728, 51% female) of participants was included in the current analyses. Mean age of this sample was 15.0 years (SD = 1.6) at Wave 1, and 16.0 years (SD = 1.6) at Wave 2. Mean time between Waves 1 and 2 was 15.4 months (SD = 4.6). At Waves 1 and 2, there were 643 and 448 Caucasians, 201 and 111 African Americans, 159 and 98 Hispanics, and 73 and 48 youth of another race/ethnicity (e.g., Pacific Islander, Native American), respectively.

Weighting was used to increase the degree to which our results would generalize to the U.S. population at the time of the study. The full sample (*N* = 3,614) was weighted to maximize representativeness to the 2005 U.S. adolescent population based on population density, age, and gender, resulting in weighted sample distributions that closely approximated 2005 Census estimates. Details on the weighting procedure have been described elsewhere.[31]

Measures

A structured telephone interview was used to collect information on demographic characteristics, traumatic event history, and mental health history.

Demographic Variables—Wave 1 age and gender were determined via parent interview and confirmed in the adolescent interview Racial/ethnic group was assessed using standard questions employed by the U.S. Bureau of the Census.

Potentially Traumatic Event Assessment—Exposure to potentially traumatic events was assessed using behaviorally specific, closed-ended questions. If exposure to a potentially traumatic event was endorsed, a closed-ended follow-up question was asked to assess if the participant was afraid of dying or severe injury. To be most consistent with *DSM-IV*–defined trauma exposure, participants must have experienced at least one of the following potentially traumatic events and endorsed the subjective response item to be included in the present analyses.

Sexual Assault—These items asked about experiences involving forced (a) vaginal or anal penetration by an object, finger, or penis; (b) oral– genital contact; (c) touching of the respondents' breasts or genitalia; and (d) respondent's touching of another person's genitalia. Substance-facilitated rape was also assessed.

Physical Assault/Abuse—This was defined as having been: (a) attacked or threatened with a gun, knife, or some other weapon; (b) attacked by another person with perceived intent to kill or seriously injure; (c) beaten and injured (i.e., "hurt pretty badly") by another person; (d) spanked so forcefully that the respondent sustained welts or bruises, or required medical care; or, (e) cut, burned, or tied up by a caregiver as a punitive consequence.

Witnessed Violence—This included having personally observed someone: (a) shoot someone with a gun; (b) cut or stab someone with a knife; (c) threaten someone with a gun, a knife, or other weapon; (d) mug or rob someone; or (e) rape or sexually assault someone.

Other Potentially Traumatic Events—Participants were also asked in a yes/no format if they had been exposed to a dog attack, motor vehicle accident, fire, and/or a natural disaster.

PTSD—Current (past 6 months) PTSD was assessed using the PTSD module of the National Survey of Adolescents (NSA),[32] a structured diagnostic interview that assessed each *DSM-IV* symptom with a yes/no response indicating the presence of a symptom for at least 2 weeks (not anchored to any specific traumatic event). To meet criteria for DSM-IV PTSD, one re-experiencing symptom, three avoidance symptoms, and two hyperarousal symptoms were required. Research on this measure has provided support for concurrent validity and several forms of reliability (e.g., temporal stability, internal consistency, diagnostic reliability)[33,34] including good reliability with the Structured Clinical Interview for the *DSM* (SCID)[35] administered by mental health professionals.[36]

Functional Impairment—Adolescents were asked whether their PTSD symptoms had caused problems with school or schoolwork, family members or friends, or a job with the following three questions: (1) Did the bad moods, feelings, and memories you just told me about ever cause problems with your schoolwork? (2) Did they ever cause problems with family members or friends, including getting into more arguments or fights than you did before, not feeling you could trust them as much, or not feeling as close to them as you did before? and (3) Did they ever cause problems with a job, including not being able to do as well as you could before, having to quit, trouble with your boss or co-workers, or being fired? For this study, endorsing impairment in at least one area of functioning was coded as functional impairment (FI).

Procedure

Procedures for Waves 1 and 2 were similar. A highly structured telephone interview was designed to collect information. Participants were selected for Wave 1 using a multistage, stratified, random-digit dial procedure within each region of the country. The interview was administered by trained interviewers employed by Schulman, Ronca, and Bucuvalas, Inc., a survey research firm with significant experience managing survey studies. A computer-assisted telephone interview system aided this process by prompting interviewers with each question consecutively on a computer screen. Supervisors conducted random checks of data entry accuracy and interviewers' adherence to assessment procedures.

A total of 6,694 households were contacted during initial recruitment. Parents completed a brief structured interview and were asked to identify at least one eligible adolescent. Of these, 1,268 (18.9%) parents refused; 188 (2.8%) adolescents refused to be interviewed after parental consent; 119 (1.8%) adolescent interviews were incomplete; and 1,505 (22.5%) identified adolescents were unreachable or unavailable for interview. At Wave 1, 3,614 adolescent interviews were completed, with 2,358 (65%) adolescents completing the Wave 2 assessment. Only those who participated at Wave 1 were re-contacted at Wave 2. The 1,256 uncompleted Wave 2 assessments resulted from unknown participant (19%) or household (20%) at the original telephone number, adolescent refusal during Wave 2 re-contact (19%) or when asked for permission to re-contact at Wave 1 interview (10%); ineligibility (19%); only partial completion of the interview (5%); inability to contact the participant (3%); or other reason (5%). Only adolescents endorsing exposure to at least one potentially traumatic event at Wave 1 (N = 1,119) were included in this study, with 728 (65%) of these adolescents completing the Wave 2 interview. African American ($\chi^2(1) = 10.97$, $p < .01$) and Hispanic (χ^2 (1) = 4.67, $p < .05$) adolescents were less likely to complete the Wave 2 interview compared with Caucasians. Wave 2 completers did not differ from noncompleters in gender χ^2 (1) = 0.06, NS), Wave 1 age (χ^2 (1) = 0.01, NS), or Wave 1 PTSD diagnosis (χ^2 (1) = 0.53, NS).

Descriptive Analyses

χ^2 Tests were conducted to explore how gender, race/ethnicity, PTSD diagnosis (Waves 1 and 2), and Wave 2 FI were related. A one-way ANOVA was conducted to examine age as a predictor of Wave 2 PTSD and FI.

Primary Analyses

Latent Class Analyses—Empirically based classes of Wave 1 and Wave 2 PTSD symptoms were estimated using latent class analysis (LCA), which hypothesizes that individual patterns of symptom endorsements can be accounted for by a small number of mutually exclusive classes. LCA assumes there are discrete latent classes (vs. continuous latent variables as in factor analysis) with specific symptom endorsement probabilities.[37]

LCA was applied to the 17 *DSM-IV* PTSD symptoms, coded as present or absent using Mplus.[38] To choose the best-fitting model, the Bayesian Information Criterion (BIC)[39] and Lo–Mendell–Rubin adjusted likelihood ratio test[40] were used as per the recommendations of Nylund et al.[41] Models with lower BICs are considered to be better fitting than those with higher values.[42] Because it is not possible to obtain the Lo–Mendell–Rubin adjusted likelihood ratio test and simultaneously include sampling weights in Mplus, weights were not included in this portion of the analysis. Models including sampling weights were run separately, however, and although not reported here, yielded nearly identical results. The first LCA was conducted using the sample of 1,119 adolescents reporting trauma exposure at Wave 1. The second LCA was conducted using the subsample of these trauma-exposed adolescents who also participated at Wave 2 (N=728).

Gender Differences and Between-Wave Potentially Traumatic Event Exposure—χ^2 Tests were conducted in SPSS to test whether gender and trauma exposure between Waves 1 and 2 predicted class membership.

Prediction of Wave 2 PTSD and FI by Wave 1 PTSD Classes—The SUDAAN statistical package, version 10.0, was used for logistic regression analyses to account for complex sampling design and survey weighting.

RESULTS

Descriptive Analyses

At Wave 1, 9.6% of this trauma-exposed sample met criteria for PTSD. Of those completing the interview at Wave 2 (N = 728), 7.8% were diagnosed with PTSD, and 13.8% reported FI related to the PTSD symptoms that they endorsed (regardless of meeting PTSD criteria). Among the adolescents participating at Wave 2 in this study, 49% reported re-exposure to at least one additional potentially traumatic event since Wave 1. Gender (χ^2 (1) = 24.53, p < .001) and Wave 1 PTSD diagnosis (χ^2 (1) = 83.47, p < .001) were significantly related to Wave 2 PTSD diagnosis, with girls and youth with PTSD at Wave 1 more likely to have PTSD at Wave 2 than boys or those without PTSD 1 year prior. African-American (χ^2 (1) = 0.20, NS) and Hispanic (χ^2 (1) = 0.10, NS) adolescents did not differ from Caucasian youth in likelihood of Wave 2 PTSD.

Similarly, gender (χ^2 (1) = 28.87, p < .001) and Wave 1 PTSD diagnosis (χ^2 (1) = 58.94, p < .001) were significantly related to Wave 2 FI, with girls and youth with PTSD at Wave 1 more likely to report impairment. African American (χ^2 (1) = 0.01, NS) and Hispanic (χ^2 (1) = 3.22, NS) adolescents did not differ from Caucasian youth in likelihood of Wave 2 FI. One-way ANOVA indicated that mean age did not differ as a result of Wave 2 PTSD diagnosis (F(6) = 1.31, NS) or Wave 2 FI (F(6) = 1.63, NS).

Primary Analyses

Wave 1 Latent Class Analysis—LCA confirmed our hypothesis that a three-class model (Figure 1) would best fit the Wave 1 PTSD data. The two-class solution (BIC = 13984.53) was superior to the one-class solution (BIC = 16,201.54), adjusted Lo–Mendell–Rubin 2LLDiff(18) = 2324.98, p < .001. The three-class solution (BIC = 13,740.67) was superior to the two-class solution, adjusted Lo–Mendell–Rubin 2LLDiff(18) = 367.32, p < .001. However, the four-class solution (BIC = 13,777.70) did not provide a better fit to the data compared to the three-class solution, adjusted Lo–Mendell–Rubin 2LLDiff(18) = 88.63, p > .05. Of the 1,119 trauma-exposed youth participating in Wave 1 of the NSA-R, 119 (11%) adolescents were members of Class 1, displaying the most severe PTSD symptomatology. Class 2 included 406 (36%) youth and reported moderate levels of PTSD symptoms, and 594 (53%) were members of Class 3, described by low levels of PTSD symptoms. The median posterior class probability for Class 1 was 0.98 (range = 0.51–1.00), 0.95 for Class 2 (range = 0.50 –1.00), and 0.99 for Class 3 (range = 0.51– 0.99). Consistent with the findings of Breslau et al.,[24] these classes are indicative of pervasive disturbance (Class 1), intermediate disturbance (Class 2), and no disturbance (Class 3). Prevalence of PTSD diagnosis within each class at Wave 1 were consistent with the severity of each class: Class 1 (pervasive disturbance) = 75%, Class 2 (intermediate disturbance) = 9%, and Class 3 (no disturbance) = 0.5%.

Comparing Classes 1 and 2, the odds ratios of the probability of symptom endorsement were greatest for the following five symptoms: C4 (loss of interest), C3 (amnesia), D1 (sleep difficulties), C5 (detachment), and D5 (exaggerated startle response) (Table 1). Thus, the

symptoms most distinguishing the pervasive disturbance class included three numbing and two hyperarousal symptoms.

Wave 2 Latent Class Analysis—LCA also confirmed our hypothesis that a three-class model (Figure 1) would best fit the Wave 2 PTSD data. The two-class solution (BIC = 8,537.19) was superior to the one-class solution (BIC = 10,450.60), adjusted Lo–Mendell–Rubin 2LLDiff(18) = 2,015.05, $p < .001$. The three-class solution (BIC = 8,323.15) was superior to the two-class solution, adjusted Lo–Mendell–Rubin 2LLDiff(18) = 329.89, $p < .001$. However, the four-class solution (BIC = 8,362.94) did not provide a better fit to the data compared to the three-class solution, adjusted Lo–Mendell–Rubin 2LLDiff(18) = 78.18, $p > .05$. Of the 728 trauma-exposed youth participating in Wave 2 of the NSA-R, 63 (9%) adolescents were members of Class 1, displaying the most severe PTSD symptomatology. Class 2 included 226 (31%) youth and reported moderate levels of PTSD symptoms, and 439 (60%) were members of Class 3, described by low levels of PTSD symptoms. The median posterior class probability for Class 1 was 1.00 (range = 0.56 –1.00), 0.99 for Class 2 (range = 0.52–1.00), and 1.00 for Class 3 (range = 0.52–1.00). Similar to the Wave 1 data, these classes were indicative of pervasive disturbance (Class 1), intermediate disturbance (Class 2), and no disturbance (Class 3). Prevalence of PTSD diagnosis within each class at Wave 2 were again consistent with the severity of each class: Class 1 (pervasive disturbance) = 62%, Class 2 (intermediate disturbance) = 38%, and Class 3 (no disturbance) = 0%. There appeared to be moderate stability of class assignment between Waves 1 and 2 (Table 2).

Comparing Classes 1 and 2, the odds ratios of the probability of symptom endorsement were greatest for the following five symptoms: B1 (intrusive memories), B4 (psychological reactivity), B5 (physiological reactivity), D2 (irritability), and C1 (avoid thoughts/feelings) (Table 1). Thus, the symptoms most distinguishing the pervasive disturbance class included three re-experiencing, one hyperarousal, one avoidance, and no numbing symptoms.

Gender Differences and Post–Wave 1 Potentially Traumatic Event Exposure—Classes with a higher endorsement of symptoms included a greater prevalence of females (Wave 1: χ^2 (2) = 40.18, $p < .001$; Wave 2: χ^2 (2) = 40.06, $p < .001$). At Wave 1, the proportions of females within Classes 1, 2, and 3 were 72%, 55%, and 42%, respectively. At Wave 2, the proportions of females within Classes 1, 2, and 3 were 73%, 60%, and 40%, respectively.

Adolescents with higher symptom levels were more likely to report exposure to potentially traumatic events during the year between the Wave 1 and 2 interviews. Specifically, at the Wave 2 interview, 69% of the pervasive, 54% of the intermediate, and 43% of the no disturbance Wave 1 classes (χ^2 (2) = 20.54, $p < .001$) reported additional event exposure. These differences were somewhat more pronounced among Wave 2 classes (χ^2(2) = 80.37, $p < .001$), with 86% of pervasive, 64% of intermediate, and 37% of no disturbance classes reporting potentially traumatic event exposure since Wave 1.

Prediction of Wave 2 PTSD Diagnosis, PTSD Classes, and FI by Wave 1 PTSD Class—Wave 1 PTSD class significantly predicted Wave 2 PTSD diagnosis above and beyond the effects of gender and Wave 1 PTSD diagnosis (Table 2). Compared with Class 1 (pervasive disturbance), Class 2 and Class 3 were significantly less likely to meet *DSM-IV* PTSD criteria at Wave 2. Approximately 46% of Class 1, 13% of Class 2, and 5% of Class 3 met criteria for PTSD at Wave 2. Similarly, Wave 1 PTSD class significantly predicted Wave 2 PTSD class such that individuals in the Wave 1 pervasive disturbance class were significantly more likely to be members of the Wave 2 pervasive disturbance class compared to other Wave 1 classes (Table 3). In the prediction of Wave 2 FI, Wave 1 PTSD class

membership was also significant, above and beyond the effects of gender and Wave 1 FI (Table 4). The odds of endorsing Wave with Class 1, with the lowest odds of FI for Class 3, as expected. Approximately 56% of Class 1, 22% of Class 2, and 9% of Class 3 endorsed FI at Wave 2.

DISCUSSION

In the current study, a three-class model best fit the data for PTSD symptoms at Wave 1 and Wave 2. Like the best-fitting models in two previous LCA studies of PTSD in adults,[24,25] these classes were generally indicative of levels of symptom severity: no disturbance, intermediate disturbance, and pervasive disturbance. The posterior probabilities (medians = ~1.0) suggest that the three distinct class assignments and related symptom endorsement levels are reliable. Although these classes were suggestive of severity levels overall, there was evidence that patterns of symptom endorsement varied between classes. The odds ratios of symptom endorsement comparing the pervasive and intermediate disturbance classes imply that some symptoms better distinguish the pervasive disturbance class than others. In comparing odds ratios between symptoms and between waves, it is important to offer a few caveats. First, a general rule of thumb is that if the confidence intervals (CIs) for two symptoms do not overlap, their odds ratios are significantly different. For example, at Wave 2, the CI for intrusive memories (B1) does not overlap with that of loss of interest (C4; Table 1). Therefore, it can be said that the odds of endorsing intrusive memories (OR = 25.64) is significantly greater than the odds of endorsing loss of interest (OR = 3.28) when comparing the pervasive and intermediate disturbance classes. Conversely, if the odds ratio for one symptom is encompassed by the CI of another (e.g., Wave 2 symptom C3 OR = 4.65, which falls within the CI of symptom C4, 1.63– 6.58), the two odds ratios are not significantly different. In cases where CIs overlap but odds ratios do not fall within the comparison symptom's CI, it is less clear whether the symptoms differ significantly, but any difference is also unlikely to be large. In combination with these odds ratios as discussed below, this suggests that the PTSD classes, particularly at Wave 2, may be distinct not only quantitatively, but also qualitatively.

We hypothesized that the five numbing symptoms would best distinguish the pervasive disturbance class from the intermediate disturbance class at Waves 1 and 2, consistent with previous studies.[24,25] At Wave 1, however, the pervasive and intermediate disturbance classes differed most in the endorsement of three numbing plus two hyperarousal symptoms: loss of interest (C4), amnesia (C3), sleep difficulties (D1), detachment (C5), and exaggerated startle response (D5). It is important to note, however, that although these symptoms seem to better distinguish the pervasive and intermediate disturbance classes than others based on yielding the greatest odds ratios, they do not necessarily do so at a statistically significant level, as evidenced by the many overlapping confidence intervals.

At Wave 2, LCA suggested that a different set of symptoms distinguished the pervasive disturbance from intermediate disturbance class: intrusive memories (B1), psychological reactivity (B4), physiological reactivity (B5), irritability (D2), and avoidance of thoughts/ feelings (C1). Here, there were clearer differences between confidence intervals, indicating that the odds of endorsing certain symptoms were indeed significantly greater than the odds of endorsing others. For example, the confidence interval for intrusive memories (B1) does not overlap with the confidence intervals for nightmares (B2), loss of interest (C4), detachment (C5), foreshortened future (C7), insomnia (D1), or exaggerated startle (D5), suggesting that the odds of endorsing intrusive memories is significantly greater than the odds of endorsing these other six symptoms when comparing pervasive and intermediate disturbance classes. This implies that, at least at Wave 2, intrusive memories may be

significantly better than these other symptoms at differentiating adolescents with pervasive, severe PTSD problems who may also require more intensive and immediate treatment.

The Wave 1 finding that three numbing and two hyperarousal symptoms appear to be the five most powerful in distinguishing the pervasive disturbance class is partially consistent with literature suggesting the PTSD numbing (Criterion C) symptoms are most indicative of disturbance. [5] Interestingly, the discriminating symptoms identified at Wave 2 are inconsistent with previous literature, although the vast majority of this evidence comes from adult populations.[5–10]

This change in class structure from Wave 1 to Wave 2 indicates that the specific symptoms best distinguishing adolescents with severe PTSD change over the course of 1 year, underscoring the need to consider developmental factors in the diagnosis and treatment of PTSD. For example, neurodevelopment throughout adolescence is likely to mediate the impact of trauma on the adolescent's emotions, cognition, and behavior, which may result in age- or development-related differences in the manifestation of PTSD and its most clinically relevant symptoms. The latent structure, diagnosis, and assessment of adolescent PTSD should not be presumed to be identical to the adult disorder, and future research should examine the predictive validity and neural correlates of these distinguishing symptoms within adolescent samples. Furthermore, as *DSM-V* considers a more dimensional and quantitative approach to the diagnosis of psychopathology in general, inclusion of age and gender norms[43] may be extremely useful. The Wave 1 to Wave 2 class structure change could also reflect the difference between acute and chronic PTSD. Unfortunately, the current study did not assess the recency and chronicity of each traumatic event, and therefore it is not possible to know whether the Wave 1 PTSD profiles are evidence of an acute posttraumatic stress response. However, future studies can be designed to specifically answer this question.

The prevalence of reports of potentially traumatic event exposure during the year between Wave 1 and Wave 2 interviews among PTSD classes is also informative. Consistent with other research,[44] youth with high levels of symptomatology at Wave 1 reported higher rates of exposure to potential trauma during the following year. Not surprisingly, adolescents in the Wave 2 pervasive disturbance class were also most likely to report re-exposure since the first interview. Thus, exposure to more traumatic events may partially contribute to the change in symptom patterns seen between Waves 1 and 2 as well. Future research should explore this specific issue, for instance to determine whether timing, number, type, or severity of traumatic events predicts PTSD symptom patterns.

A substantial portion of each pervasive disturbance class (25% at Wave 1, 38% at Wave 2) did not meet PTSD criteria, although a comparable proportion of the intermediate disturbance class did meet PTSD criteria (9% at Wave 1, 38% at Wave 2). This implies that there were a number of individuals with high levels but without the "right combination" of symptoms (e.g., at least three avoidance/numbing symptoms) to meet *DSM-IV* criteria. Consistent with taxometric studies suggesting that PTSD is a dimensional construct,[26–28] this suggests that the current PTSD diagnosis may be omitting a substantial number of individuals who have clinically significant symptoms but who do not experience the specific constellation of symptoms required by the *DSM* to meet PTSD criteria. Furthermore, the frequency of PTSD diagnosis decreased in the pervasive disturbance class and increased in the intermediate disturbance class from Wave 1 to Wave 2. This may suggest that either (1) an increasing number of "profiles" of PTSD develop with age (e.g., more vs. less impaired, more vs. less re-experiencing symptoms), or (2) the current PTSD diagnosis is lacking sensitivity and/or specificity. Future research using longer-term longitudinal designs and

analytic techniques (e.g., receiver operating characteristic curve analyses) designed to directly test sensitivity and specificity will help to disentangle these issues.

In addition to developmental explanations for these findings, the preponderance of female participants within the pervasive disturbance class (72% at Wave 1, 73% at Wave 2) suggests that this symptom presentation could be gender-specific. However, it is also important to consider that, overall, female subjects have reported higher rates of PTSD than males.[29,30,45] Thus, the large proportion of female individuals in the pervasive disturbance class is likely to simply reflect the epidemiology of PTSD in the general population.

As hypothesized, compared to the Wave 1 intermediate disturbance class, the Wave 1 pervasive disturbance class was three times more likely to meet criteria for PTSD at Wave 2, twice as likely to report functional impairment at Wave 2, and approximately 11 times more likely to be a member of the Wave 2 pervasive disturbance class. Therefore, the symptom elevations in the Wave 1 pervasive disturbance class may predict chronic, unremitting PTSD and related impairment. Future research should examine longer-term associations between latent classes of PTSD and measures of psychopathology and functioning. Follow-up studies should be conducted to determine whether these classes predict other psychiatric disorders (e.g., mood disorders) and to explore the relations between PTSD classes and later adaptive functioning in PTSD-independent domains.

This study's limitations are important to note. First, the sample excluded adolescents residing in households without telephones. Second, the measure of functional impairment was specifically related to PTSD symptoms. It is therefore not known whether these latent classes of adolescent PTSD also predict ratings of functional impairment collected independent of a diagnostic interview. Third, this study used a single method of data collection (i.e., adolescent interview). Multi-informant designs are warranted in future work. Fourth, although previous research has shown strong reliability and validity of the current method of PTSD assessment,[33,34,36] our PTSD interview specified a 2-week duration and did not anchor each symptom to a specific traumatic event, which may not have perfect overlap with the *DSM-IV*.

Although not without its limitations, the present methodology has several strengths that make the findings generalizable and relevant for future clinical and research work. First, over 1,000 trauma-exposed adolescents from a nationally representative sample were included. Second, to our knowledge, it is only the third investigation to examine PTSD symptomatology using a person-centered data analytic approach (i.e., LCA) and the first to do so in adolescents. Because of its prospective design, the results reported here indicate that latent classes of PTSD symptoms in adolescents are predictive of later PTSD diagnosis and impairment, building on previous work suggesting cross-sectional associations between these variables.[24,25] Although replication is necessary, our findings suggest that the most clinically relevant adolescent PTSD symptoms may cut across all symptom clusters and change with age. Follow-up studies are needed, but this investigation suggests that for adolescents, numbing symptoms do not necessarily hold the most prognostic value compared to other PTSD symptoms. As the American Psychiatric Association moves toward making final decisions regarding diagnostic criteria for the *DSM-V*, it will be important to consider empirical investigations of the existing and proposed symptom clusters, including the present findings. The presence of specific symptoms—rather than a specific *number* of symptoms—considered in a developmental context may be the most representative of PTSD in "real world" trauma-exposed adolescents and the most parsimonious model for diagnosis and assessment. Furthermore, interventions targeting the PTSD symptoms distinguishing the most highly impaired trauma-exposed adolescents might prove most efficacious.

Acknowledgments

This research was supported by National Institute of Child Health and Human Development Grant 1R01 HD046830-01 (PI: D.G.K.). The preparation of this article was partially supported by Grant K23DA018686 (C.K.D.), Grant R21MH086313 (C.K.D.), grant R01 MH81056 (K.R.), and Grant 5RC2MH089995-02 (PI: James J. Hudziak).

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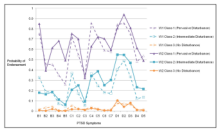

FIGURE 1.

Three-class models of adolescent posttraumatic stress disorder (PTSD) symptoms at Wave 1 and Wave 2. Note: Symptoms B1–B5 belong to the “Intrusive Re-experiencing” PTSD cluster (criterion B in *DSM-IV*); symptoms C1–C7 belong to the “Avoidance/Emotional Numbing” PTSD cluster (criterion C in *DSM-IV*); symptoms D1–D5 belong to the “Hyperarousal” PTSD cluster (criterion D in *DSM-IV*). W1 = Wave 1; W2 = Wave 2.

TABLE 1

Odds of Symptom Endorsement of Class 1 (Pervasive Disturbance) vs. Class 2 (Intermediate Disturbance) at Waves 1 and 2

	Wave 1		Wave 2	
	Pervasive vs. Intermediate		Pervasive vs. Intermediate	
PTSD Symptom	**OR**	**95% CI**	**OR**	**95% CI**
C4 (Loss of interest)[a]	10.35	5.10–20.97	3.28	1.63–6.58
C3 (Amnesia)[a]	8.88	4.20–18.81	4.65	2.08–10.31
D1 (Insomnia)	7.78	4.04–14.97	3.46	1.57–7.63
C5 (Detachment)[a]	7.76	4.43–13.59	4.12	1.95–8.70
D5 (Exaggerated startle)	7.44	4.25–13.05	3.52	1.80–6.90
B4 (Psychological reactivity)	7.24	3.82–13.72	**17.24**	7.30–40.00
B5 (Physiological reactivity)	7.01	3.33–14.74	**14.49**	5.68–37.04
D4 (Hypervigilance)	6.77	3.73–12.26	5.29	2.63–10.64
C7 (Foreshortened future)[a]	6.57	3.85–11.21	3.41	1.79–6.49
C6 (Restricted affect)[a]	6.49	3.78–11.14	7.09	3.33–14.93
B1 (Intrusive memories)	6.24	3.18–12.24	**25.64**	8.77–76.92
D2 (Irritability)	6.13	3.10–12.10	**12.82**	3.77–43.48
D3 (Concentration problems)	6.00	3.40–10.58	5.29	2.63–10.64
C2 (Avoid activities)	5.89	3.46–10.05	7.04	3.28–15.15
C1 (Avoid thinking)	4.51	2.59–7.87	**11.63**	4.88–27.78
B3 (Flashbacks)	3.68	2.11–6.40	6.99	3.51–13.89
B2 (Nightmares)	3.63	2.14–6.16	3.36	1.70–6.62

Note: Symptoms B1–B5 belong to the ”Intrusive Re-experiencing” posttraumatic stress disorder (PTSD) cluster (criterion B in DSM-IV); symptoms C1–C7 belong to the ”Avoidance/Emotional Numbing” PTSD cluster (criterion C in *DSM-IV*); symptoms D1–D5 belong to the ”Hyperarousal” PTSD cluster (criterion D in *DSM-IV*). Boldface type indicate the five highest odds ratios (OR) for Wave 2. CI = confidence interval.

[a]Emotional numbing symptom.

TABLE 2

Overlap Between Wave 1 and Wave 2 Posttraumatic Stress Disorder Class Assignment

	Wave 2 Class			
Wave 1 Class	**Pervasive Disturbance (Class 1)**	**Intermediate Disturbance (Class 2)**	**No Disturbance (Class 3)**	**Total**
Pervasive disturbance (Class 1)	28 (35%)	37 (46%)	16 (20%)	81 (100%)
Intermediate disturbance (Class 2)	20 (8%)	109 (43%)	125 (49%)	254 (100%)
No disturbance (Class 3)	15 (4%)	80 (20%)	298 (76%)	393 (100%)
Total	63 (31%)	226 (9%)	439 (60%)	728 (100%)

Note: Percentages have been rounded to the nearest whole number and indicate percentage of Wave 1 Class (row percentages).

TABLE 3

Results of Logistic Regressions Examining Wave 1 Posttraumatic Stress Disorder (PTSD) Classes Predicting Wave 2 PTSD Diagnosis and Wave 2 PTSD Classes

	β	SE	*p*	df	OR	95% CI
DV: Wave 2 PTSD Diagnosis (0 = no diagnosis; 1 = PTSD diagnosis)						
Step 1						
Gender[a]	−1.01	<0.001	.28	1	0.36	0.21–0.63
Wave 1 PTSD[b]	−2.02	<0.001	.29	1	0.13	0.07–0.24
Step 2						
Gender[a]	−0.91	<0.01	.27	1	0.40	0.23–0.70
Wave 1 PTSD[b]	−0.52	NS	.48	1	0.59	0.23–1.52
Wave 1 Class 2[c]	−1.24	<0.01	.47	1	0.29	0.11–0.73
Wave 1 Class 3[c]	−2.27	<0.001	.52	1	0.10	0.03–0.29
DV: Wave 2 PTSD Class (Class 1 is reference category)						
Gender[a]	−1.14	0.34	<.001	1	0.32	0.16–0.63
Wave 1 Class 2[c]	−2.40	0.43	<.01	1	0.09	0.04–0.21
Wave 1 Class 3[c]	−3.40	0.45	<.001	1	0.03	0.01–0.08

Note: Class 2: intermediate disturbance; Class 3: no disturbance. β = standardized beta; CI = confidence interval for odds ratio; df = degrees of freedom; DV = dependent variable; NS = not significant; OR = odds ratio; SE = standard error.

[a] Female is the reference category.

[b] Wave 1 PTSD diagnosis is the reference category.

[c] Class 1 (pervasive disturbance) is the reference category.

TABLE 4

Results of Logistic Regression Examining Wave 1 Posttraumatic Stress Disorder (PTSD) Classes Predicting Wave 2 Functional Impairment

DV: Wave 2 Functional Impairment (0 = no Functional Impairment; 1 = Functional Impairment)	β	SE	*p*	df	OR	95% CI
Step 1						
Gender[a]	−0.97	0.25	<.001	1	0.38	0.23–0.62
Wave 1 functional impairment[b]	1.76	0.23	<.001	1	5.81	3.69–9.14
Step 2						
Gender[a]	−0.93	0.25	<.001	1	0.39	0.24–0.64
Wave 1 functional impairment[b]	1.03	0.32	<.01	1	2.79	1.49–5.25
Wave 1 Class 2[c]	−0.92	0.35	<.01	1	0.40	0.20–0.80
Wave 1 Class 3[c]	−1.42	0.44	<.01	1	0.24	0.10–0.57

Note: Class 2: intermediate disturbance; Class 3: no disturbance. β = standardized beta; CI = confidence interval for odds ratio; df = degrees of freedom; OR = odds ratio; SE = standard error.

[a] Female is the reference category.

[b] Wave 1 FI endorsement is the reference category.

[c] Class 1 (pervasive disturbance) is the reference category.