ORIGINAL ARTICLE

The Structure of Posttraumatic Stress Disorder

Latent Class Analysis in 2 Community Samples

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Context: Latent structure analysis of *DSM-IV* posttraumatic stress disorder (PTSD) can help clarify how persons who experience traumatic events might be sorted into clusters with respect to their symptom profiles. Classification of persons exposed to traumatic events into clinically homogeneous groups would facilitate further etiologic and treatment research, as well as research on the relationship of trauma and PTSD with other disorders.

Objectives: To examine empirically the structure underlying PTSD criterion symptoms and identify discrete classes with similar symptom profiles.

Design: Data on PTSD symptoms from trauma-exposed subsets of 2 community samples were subjected to latent class analysis. The resultant classes were studied in associations with trauma type and indicators of impairment.

Setting: The first sample is from the Detroit Area Survey of Trauma (1899 trauma-exposed respondents with complete data) and the second is from a mid-Atlantic study of young adults conducted by The Johns Hopkins University Prevention Research Center, Baltimore, Md (1377 trauma-exposed respondents with complete data).

Participants: Respondents in the 2 community samples who experienced 1 or more qualifying PTSD-level traumatic events.

Main Outcome Measures: Number, size, and symptom profiles of latent classes.

Results: In both samples, analysis yielded 3 classes: no disturbance, intermediate disturbance, and pervasive disturbance. The classes also varied qualitatively, with emotional numbing distinguishing the class of pervasive disturbance, a class that approximates the subset with *DSM-IV* PTSD. Members of the pervasive disturbance class were far more likely to report use of medical care and disruptions in life or activities.

Conclusions: The 3-class structure separates trauma-exposed persons with pervasive disturbance (a class that approximates *DSM-IV* PTSD) from no disturbance and intermediate disturbance, a distinction that also helps identify population subgroups with low risk for any posttrauma disturbance. The results suggest that the structure of PTSD is ordinal and configurational and that emotional numbing differentiates the class with pervasive disturbance. These results should motivate prospective research of persons who have experienced trauma to trace the emergence of posttrauma symptoms and the timing of emotional numbing relative to other symptoms.

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THE DEFINITION OF POSTTRAUMATIC stress disorder (PTSD) in *DSM-IV* is based on a conceptual model that brackets traumatic events from less severe stressors and links them with a specific syndrome. The syndrome is defined by 3 diagnostic criteria: (1) reexperiencing the trauma (criterion B), (2) avoidance of thoughts or acts that symbolize the trauma and emotional numbing (criterion C), and (3) increased arousal (criterion D). Each of the 3 criteria is identified through multiple constituent symptoms and a different threshold: 1 of 5 symptoms of "reexperiencing," 3 of 7 symptoms of "avoidance and numbing," and 2 of 5 symptoms of "increased arousal." Theoretically, some properly diagnosed cases, those who experienced an etiologic stressor (criterion A) and the specified syndrome (criteria B, C, and D), may not share the same defining symptoms. The *DSM-IV* discusses the inclusion of such polythetic categories, in recognition of the heterogeneity of clinical presentation.[1(pxxii)] The use of multiple defining symptoms in a complex scheme, with ample room for heterogeneity among cases, has motivated the application of statistical methods to examine empirically the underlying structure of the clinically based formulation.

Posttraumatic stress disorder has been the subject of factor analytic studies conducted on data from Vietnam

veterans recruited from Veteran's Administration Medical Centers, patients in primary care clinics, persons who were involved in motor vehicle collisions, and other special populations at risk for PTSD.[2-5] All studies reported multiple factors, although the number of factors varied across studies. Asmundson et al[5] evaluated models suggested in previous studies and confirmed a model with 4 distinct factors of reexperiencing, avoidance, numbing, and hyperarousal. A recent review concluded that a 4-factor model is supported by the majority of studies.[6] Probing for a 2-class (vs a 1-class) model, a taxometric analysis of PTSD symptoms in combat veterans failed to find evidence for a discrete syndrome (a taxon) and concluded that PTSD reflects the upper end of a continuum of reactions to extreme stress.[7] A model with 3 or 4 classes was not tested. In general discussions of taxometric studies, Haslam[8] and Lenzenweger[9] argue for the application of different latent structure models to the same disorder. In this study, we used data from 2 community studies to examine the latent structure of *DSM-IV* PTSD, applying latent class analysis (LCA) to examine alternative multiclass models. In the past, this analytic method has yielded useful nosologic information on a range of psychiatric disorders (eg, major depressive disorder, schizophrenia, eating disorders, and disruptive behaviors)[10-15] but has not been applied to PTSD.

Latent class analysis examines the structure underlying a set of symptoms and forms discrete classes with similar symptom profiles. Latent class analysis makes no further assumptions about the nature of the underlying categorization (eg, nominal, ordinal-discrete, or ordinal-interval) and allows the investigation of both dimensional and configural differences. If a simple ordinal model were correct, and if classes reflected increasing severity, the probability of reporting each symptom would increase monotonically across classes.[16] This condition, however, is not sufficient for concluding that the underlying structure is unidimensional. Heterogeneity in the distribution of symptom probabilities across classes can occur in the presence of monotonicity and, when observed, would suggest configurational differences. Insights of this type cannot be gained when the underlying models are assumed to be strictly unidimensional (latent trait) or dichotomous (latent taxon).

The theoretical rationale for supposing a categorical latent variable in *DSM-IV* PTSD is as follows. The set of diagnostic criteria of PTSD has an internal logic.[6,17-19] Briefly stated, the disturbance has been described as a process in which traumatic memories and increased arousal alternate with avoidance and emotional numbing. The underlying psychological process that the definition aims to capture is distinguished by the co-occurrence of these essential features. Empirical support for the possibility that the configuration of symptoms in PTSD matters, apart from number of symptoms, is suggested by recent epidemiologic findings that trauma-exposed persons who met the specified *DSM-IV* configuration reported markedly more days of work loss and personal distress, controlling for number of symptoms.[20]

METHODS

SAMPLES

The 1996 Detroit Area Survey of Trauma

Participants were 2181 persons 18 to 45 years of age, representative of the Detroit, Mich, primary metropolitan statistical area. The Detroit primary metropolitan statistical area is a 6-county area that contains 4 266 654 residents, nearly 2 million in the age range 18 to 45 years. The vast majority (77%) are residents of suburban areas surrounding the city of Detroit. A random-digit dialing method was used to select the sample. A total of 6110 households were contacted. Screening for age eligibility was completed in 76.2% of households, of which 64.1% contained an age-eligible respondent. In households with more than 1 age-eligible respondent, a random respondent was selected. Cooperation rate in eligible households was 86.8%. A detailed description of the sample and population appears elsewhere.[21,22]

A Sample of Mid-Atlantic Urban Youth

Participants were young adults (mean age, 21 years [range, 19-23 years]) from a prospective study of 2 successive first-grade cohorts selected from a public school system of a large mid-Atlantic city in the United States in 1985-1986 as part of the research of The Johns Hopkins University Prevention Research Center (Baltimore, Md).[23-25] The schools were located in 5 prespecified urban areas, with residents ranging from very poor to low middle class and varying in proportion of African American vs non-Hispanic white individuals. Children were assessed from the first through the eighth grade. Between 2000 and 2002, nearly 75% (n = 1698) of the original sample was interviewed during young adulthood. Detailed information on the study appears elsewhere.[26-28]

The institutional review board of Henry Ford Health Sciences Center, Detroit, approved the first study and the institutional review board of The Johns Hopkins University, approved the second study; the Michigan State University, East Lansing, institutional review board, where analyses were conducted, approved both. Oral informed consent was obtained in the first study and written consent, in the second.

ASSESSMENT OF PTSD

The interview schedule for assessing exposure to traumatic events and PTSD was developed, used, and evaluated in the 1996 Detroit Area Survey of Trauma.[21] A computer-assisted, telephone-structured interview was used. The interview began with a complete enumeration of traumatic events, using a list of 19 types of traumatic events, which operationalized the *DSM-IV* definition as explicated in its accompanying text. An endorsement of an event type was followed by questions on the number of times an event of that type had occurred and the respondent's age at each time. A list of all the traumatic events reported by the respondents was read by the interviewer and the respondent was asked to identify the 1 event that was most upsetting, the worst trauma. Posttraumatic stress disorder was evaluated in connection with this event, using the PTSD section of the Diagnostic Interview Schedule, Version IV, and the World Health Organization *Composite International Diagnostic Interview*, Version 2.1.[1,29] The interview is fully structured and is designed to be administered by experienced interviewers without clinical training. In the 1996 Detroit Area Survey of Trauma, PTSD was also assessed in connection with a computer-selected random event from

the complete list of distinct events reported by each respondent, yielding estimates on PTSD in relation to a representative sample of qualifying traumas.[21,22]

In the mid-Atlantic study of urban youth, the same PTSD assessment schedule was used as part of a longer face-to-face interview. The number of events was 18, excluding combat from the initial list. Posttraumatic stress disorder was assessed in connection with the worst trauma, following the same procedures as in the 1996 Detroit Area Survey of Trauma.

STATISTICAL ANALYSIS

The latent structure of PTSD among trauma-exposed respondents was examined by applying LCA[30-33] to the list of 17 defining symptoms, using Latent Gold software.[34] Each sample was tested separately in a process of systematic replication. Latent class analysis postulates that the association among observed symptoms is due to an underlying class structure. Information about the underlying class structure is conveyed through (1) the latent class probabilities, class prevalence estimates, which indicate the proportion of the sample assigned to each class, and (2) the response probabilities, which are the percentages of class members reporting each symptom. The goal of LCA is to identify the smallest number of latent classes that adequately describes the associations among the observed symptoms, starting with the most parsimonious 1-class model (null model) and fitting successive models with increasing numbers of classes. Goodness-of-fit statistics were used to select the optimal model and to evaluate the standard assumption of local independence between the observed variables.[30,31,35] First, the observed symptom response frequencies were compared with the expected frequencies predicted by the model by calculating a likelihood ratio goodness-of-fit value. When the number of observed response patterns is large, as in this case, the likelihood ratio statistic does not follow the theoretical χ^2 distribution.[36] Therefore, we present a bootstrapped *P* value. For this test, a conservative α level (eg, $P=.05$) is appropriate. Because LCA models with different numbers of classes are not nested, precluding the use of difference χ^2 tests to compare the fit of 2 models, goodness-of-fit measures that are based on information statistics are used as additional tools. We compared successive models by the Bayesian information criterion, average weight of evidence, and percentage classification error.[37] The Bayesian information criterion is a global measure that weights the fit and parsimony of the model. The average weight of evidence criterion additionally weights the performance of the classification.[37] The lower the Bayesian information criterion and average weight of evidence, the better the fit is. Finally, we examined the bivariate residuals between pairs of indicators. In general, bivariate residuals larger than 3.84 identify correlations between the associated variable pairs that have not been adequately explained by the model at $\alpha=.05$.[34]

As an alternative to adding a class to improve model fit, advanced LCA allows for residual interdependence of pairs of indicators by introducing local dependencies (direct effect) in a pair of indicators that have high residuals.[31] We used this technique in this study. Alternative techniques, outlined in Magidson and Vermunt[32] (ie, deleting one in the pair of indicators, combining them into a single "and/or" item, and adding a latent variable), yielded similar results, in terms of the number and size of latent classes and response probabilities, but less adequate model fit (not displayed).

We examined the association of sex and trauma type with class membership, using multinomial logistic regression. We also compared classes on the consequences of disturbance, as indicated by impairment and symptom persistence, using for the latter Kaplan-Meier survival methods.[38] For these analyses, respondents were assigned to classes, using the modal probability, based on posterior probabilities derived from the LCA.

RESULTS

THE DETROIT AREA SURVEY OF TRAUMA

We first summarize results on the epidemiology of *DSM-IV* PTSD (**Table 1**). The lifetime prevalence of exposure to *DSM-IV*–qualifying traumas among the 2181 respondents was 89.7%. The conditional probability of *DSM-IV* PTSD among those with trauma exposure was 7.8%. The conditional probability of PTSD varied across the 4 composite categories into which individual event types were grouped, with the highest probability associated with assaultive violence and the lowest, with learning about trauma experienced by a close friend/relative. The sex difference in the conditional probability of PTSD was greater in relation to assaultive violence than other trauma categories[39] (Table 1).

The LCA models were fit to 16 of the 17 symptoms reported by trauma-exposed respondents with complete data (n=1899; 97% of the exposed). Inability to recall the event or parts of it (criterion C3) ("psychogenic amnesia"), an item with a very low level of endorsement and little discrimination, was omitted. Model fit criteria, specified in the "Methods" section, indicated that a 3-class model was superior to a 2-class model. Further, a 3-class model with a local dependency between physiological and psychological reactivity (ie, high bivariate residuals for criteria B4 and B5) best fit the data, according to the preponderance of model fit criteria and the rule of parsimony. We chose to allow for the local dependency over other alternatives because its most likely expected cause is an external factor.[32] The 2 symptoms are described by similar phrases, refer to the same situations, and are presented to respondents in sequence, first criterion B4 and then criterion B5. **Table 2** presents the goodness-of-fit indexes for 2- to 4-class models.

The conditional probabilities of symptoms, interpreted as the percentages of class members reporting each symptom, appear in **Table 3**. Class 1 (55% of those exposed to a qualifying traumatic event) exhibited little distress. Most symptoms (10 of 16) were reported by less than 3% of the class. Class 3 (11% of the trauma-exposed subjects) exhibited pervasive disturbance, with most symptoms endorsed by the vast majority of class members. Class 2 (34% of the trauma-exposed subjects) exhibited intermediate disturbance. A comparison of class 3 with class 2 reveals differentiation between these classes with respect to the prevalence of numbing symptoms more than for other symptoms (Table 3). Ratios of the proportions of members of class 3 vs class 2 reporting numbing symptoms ranged from 5.2 (0.80/0.15) for "detached" to 15.5 (0.44/0.03) for "foreshortened future," whereas for other symptoms they ranged from 1.0 to 3.1 (Table 3).

Table 3 also presents the mean number of symptoms in each latent class, overall and by symptom cluster. While the mean sum of symptoms of each class represents level of severity, differences among classes in the distribution of the sum across constituent symptom clusters would rep-

Table 1. Lifetime Exposure to Trauma and Conditional Probabilities of PTSD in 2181 Trauma-Exposed Subjects in the Detroit Area Survey of Trauma[21,22] Sample and 1698 Trauma-Exposed Subjects in the Mid-Atlantic Urban Young Adults[23-25] Sample

	Detroit Area Survey of Trauma Sample		Mid-Atlantic Urban Young Adults Sample	
	%	OR (95% CI)	%	OR (95% CI)
Lifetime exposure to trauma				
Men	92.4	1.8 (1.4-2.4)	87.2	1.9 (1.4-2.4)
Women	87.0	Reference	78.4	Reference
Conditional probability of PTSD*				
Sex				
Male	5.1	0.4 (0.3-0.6)	7.4	0.7 (0.5-1.0)
Female	10.7	Reference	10.2	Reference
Trauma type				
Other injury or shocking event	5.4	0.2 (0.2-0.4)	6.6	0.4 (0.2-0.7)
Learn of trauma to close friend/relative	2.5	0.1 (0.1-0.2)	2.9	0.2 (0.1-0.4)
Learning about unexpected death	10.3	0.5 (0.3-0.7)	9.0	0.6 (0.4-0.9)
Assaultive violence	19.2	Reference	15.1	Reference
Sex/event type				
Male/other than assaultive violence	5.2	1.1 (0.5-2.5)	7.5	1.1 (0.5-2.1)
Female/assaultive violence	35.3	11.1 (4.8-25.7)	23.5	4.0 (2.0-8.3)
Female/other than assaultive violence	6.5	1.4 (0.6-3.2)	6.6	0.9 (0.5-1.9)
Male/assaultive violence	4.7	Reference	7.1	Reference

Abbreviations: CI, confidence interval; OR, odds ratio; PTSD, posttraumatic stress disorder.
*Estimated probabilities of survey-based *DSM-IV* PTSD among trauma-exposed subjects. Previous reports from the Detroit Area Survey of Trauma presented weighted estimates that are slightly different.

Table 2. Model Fit Indexes for Latent Classes of PTSD Symptoms in Trauma-Exposed Subjects in the 2 Samples

	L^2	Bootstrap *P* Value	BIC (L^2)	AWE	Classification Error, %
Detroit Area Survey of Trauma[21,22]					
1-Class	10690	<.001	−483918.21	30140.39	0
2-Class	5369	<.001	−489110.68	25419.80	0.03
3-Class	4433	.52	−489918.81	25173.70	0.08
4-Class	4205	.99	−490017.84	25793.32	0.14
3-Class*	4308	.47	−490036.53	25083.27	0.08
Mid-Atlantic urban young adults[23-25]					
1-Class	8500	<.001	−465049.10	24062.51	0
2-Class	5006	.15	−468419.95	21148.00	0.04
3-Class	4277	.34	−469026.47	20958.98	0.08
4-Class	4069	.96	−469111.88	21295.81	0.11
3-Class*	4076	.42	−469220.18	20785.49	0.08

Abbreviations: AWE, average weight of evidence; BIC, Bayesian information criterion; L^2, likelihood-ratio statistic; PTSD, posttraumatic stress disorder.
*Allows for local dependency, yielding an improved model fit (ie, lower AWE and BIC and no change in percentage error).

resent qualitative—configurational—class differences. If classes were unidimensional, varying only in severity, then the distribution of the total sum of symptoms by its constituent parts would be constant across classes. Evidence of differences would suggest instead that classes, although ordinal, are not unidimensional. We found that class 3 members had nearly 12 symptoms, on average, with the numbing symptoms constituting 21% of the total. Class 2 members had 5.4 symptoms, on average, with the numbing cluster constituting 7%. Class 1 had an average of just more than 1 symptom, with the numbing cluster constituting 1.7% of the overall average. The higher weight of numbing symptoms in class 3, relative to other classes, suggests the possibility that classes vary not only in severity but also in symptom configuration.

Members of class 3 (vs classes 1 and 2 combined), with class assignment based on the modal probabilities, overlapped highly with the subset of trauma-exposed subjects meeting all *DSM-IV* PTSD criteria that also include a duration of disturbance of 1 month or greater and clinical significance. There was a very robust association between the LCA-derived assignment to class 3 and the survey-derived *DSM-IV* PTSD case status (odds ratio, 172.0 [95% confidence interval, 97.5-303.3]). With the *DSM-IV* PTSD as the standard, LCA class 3 assignment correctly classified 88.9% of cases and 95.6% of noncases among trauma-exposed subjects.

THE SAMPLE OF MID-ATLANTIC URBAN YOUTH

The lifetime prevalence of exposure to qualifying traumatic events in this sample of 1698 youth was 82.5%.

Table 3. Results of Latent Class Analysis of Data on 1899 Trauma-Exposed Respondents From the Detroit Area Survey of Trauma[21,22]

	Symptom Prevalence, %	Class 1, Conditional Probability (SE)	Class 2, Conditional Probability (SE)	Class 3, Conditional Probability (SE)
Class assignment probabilities		0.55 (0.02)	0.34 (0.02)	0.11 (0.01)
B. Reexperiencing				
1. Intrusive memories	48.8	0.202 (0.016)	0.794 (0.022)	0.960 (0.016)
2. Nightmares	15.0	0.014 (0.005)	0.214 (0.020)	0.631 (0.038)
3. Flashbacks	14.9	0.022 (0.006)	0.218 (0.019)	0.571 (0.038)
4. Psychologic reactivity	40.1	0.157 (0.014)	0.635 (0.025)	0.889 (0.024)
5. Physiologic reactivity	30.3	0.086 (0.011)	0.490 (0.024)	0.807 (0.031)
C. Avoidance and numbing				
1. Avoid thinking	27.4	0.090 (0.010)	0.409 (0.024)	0.775 (0.032)
2. Avoid activities	23.4	0.063 (0.009)	0.347 (0.023)	0.736 (0.034)
3. Amnesia*	1.2	NA	NA	NA
4. Diminished interest	12.0	0.011 (0.004)	0.120 (0.015)	0.664 (0.041)
5. Detached	14.5	0.010 (0.004)	0.153 (0.017)	0.803 (0.039)
6. Restricted affect	9.3	0.002 (0.002)	0.095 (0.014)	0.544 (0.040)
7. Foreshortened future	5.8	0 (0.001)	0.028 (0.008)	0.440 (0.040)
D. Increased arousal				
1. Insomnia	18.4	0.014 (0.005)	0.259 (0.022)	0.804 (0.032)
2. Irritability	20.4	0.013 (0.005)	0.309 (0.025)	0.835 (0.029)
3. Concentration problems	24.4	0.026 (0.007)	0.385 (0.025)	0.898 (0.025)
4. Hypervigilance	61.8	0.474 (0.017)	0.785 (0.018)	0.816 (0.029)
5. Exaggerated startle	13.1	0.012 (0.005)	0.183 (0.018)	0.560 (0.038)

Mean Number of Symptoms in Members of Each Class by Symptom Clusters and Totals

	Mean (%)	Mean (%)	Mean (%)
Reexperiencing (B)	0.48 (40.3)	2.35 (43.3)	3.86 (32.9)
Avoidance (C1-C2)	0.15 (12.6)	0.76 (14.0)	1.51 (12.9)
Numbing (C4-C7)	0.02 (1.7)	0.40 (7.4)	2.45 (20.9)
Arousal (D)	0.54 (45.4)	1.92 (35.4)	3.91 (33.3)
Total (B-D)	1.19 (**100**)	5.43 (**100**)	11.73 (**100**)

Abbreviations: NA, not applicable; SE, standard error.
*Item excluded because of low prevalence and low discrimination power.

Among the exposed, the conditional probability of PTSD was 8.8%. The highest risk of PTSD was associated with assaultive violence and the lowest, with learning of trauma experienced by others. In parallel with the Detroit area findings, the sex difference in the PTSD risk associated with assaultive violence was greater than it was for other trauma types (Table 1).

Latent class analysis conducted on trauma-exposed respondents with complete data (n=1377; 98.3% of those exposed) yielded similar results to those from the Detroit Area Survey of Trauma. A 3-class model with the same local link was selected (Table 2). Class 1 (43% of trauma-exposed subjects) exhibited little distress. Class 3 (14% of trauma-exposed subjects) exhibited clear disturbance and class 2 (43% of trauma-exposed subjects) exhibited intermediate disturbance (**Table 4**). As in the Detroit area sample, differences in the conditional probabilities between class 3 and class 2 were markedly greater for the numbing symptoms than for other symptoms. Ratios of the proportions of class 3 vs class 2 endorsing the numbing symptoms ranged from 4.1 for "diminished interest" to 10.1 for "foreshortened future," whereas they did not exceed 2.7 for symptoms in the other 3 clusters. The mean number of symptoms increased from 1.31 to 5.67 and 11.60, from the first to the second and third classes (Table 4). The contribution of symptom clusters to the overall means varied across classes, with the numbing cluster constituting 22% of the overall mean of class 3 vs 8.5% of class 2 and 1.5% of class 1. The association between the LCA class 3 assignment and the survey-derived *DSM-IV* PTSD was very robust (odds ratio, 58.5 [95% confidence interval, 35.3-96.9]). With the *DSM-IV* case definition taken as the standard, class 3 correctly discriminated 81.0% of PTSD cases and 93.2% of noncases.

GRAPHIC ILLUSTRATION OF CLASS PROFILES IN THE 2 SAMPLES

The **Figure** displays the response probability profiles for each of the 3 classes in the 2 samples, corresponding to Table 3 and Table 4. The figure demonstrates the general convergence of the results in the 2 samples. The 2 samples line up closely, with 2 exceptions, psychological and physiological reactivity (on which the 2 samples diverge in classes 2 and 3) and avoid thinking (on which there is divergence in class 2). The Figure also illustrates the configurational differentiation created by the numbing cluster.

Table 4. Results of Latent Class Analysis of Data on 1377 Trauma-Exposed Respondents From the Mid-Atlantic Urban Young Adults Sample[23-25]

	Symptom Prevalence, %	Class 1, Conditional Probability (SE)	Class 2, Conditional Probability (SE)	Class 3, Conditional Probability (SE)
Class assignment probabilities		0.43 (0.02)	0.43 (0.02)	0.14 (0.01)
B. Reexperiencing				
1. Intrusive memories	67.1	0.360 (0.024)	0.882 (0.016)	0.988 (0.012)
2. Nightmares	24.0	0.024 (0.008)	0.287 (0.023)	0.779 (0.035)
3. Flashbacks	18.7	0.025 (0.008)	0.232 (0.020)	0.560 (0.040)
4. Psychological reactivity	33.0	0.111 (0.017)	0.444 (0.023)	0.665 (0.038)
5. Physiological reactivity	19.2	0.038 (0.009)	0.226 (0.020)	0.570 (0.040)
C. Avoidance and numbing				
1. Avoid thinking	47.9	0.187 (0.020)	0.654 (0.023)	0.851 (0.029)
2. Avoid activities	36.8	0.080 (0.015)	0.509 (0.024)	0.833 (0.032)
3. Amnesia*	2.7	NA	NA	NA
4. Diminished interest	17.5	0.001 (0.003)	0.176 (0.018)	0.724 (0.041)
5. Detached	18.5	0.007 (0.004)	0.159 (0.019)	0.836 (0.037)
6. Restricted affect	12.6	0.012 (0.005)	0.100 (0.014)	0.568 (0.042)
7. Foreshortened future	7.6	0.003 (0.002)	0.042 (0.010)	0.418 (0.040)
D. Increased arousal				
1. Insomnia	26.2	0.022 (0.008)	0.326 (0.024)	0.819 (0.034)
2. Irritability	26.4	0.062 (0.012)	0.300 (0.022)	0.792 (0.036)
3. Concentration problems	27.1	0.012 (0.006)	0.356 (0.024)	0.819 (0.034)
4. Hypervigilance	58.1	0.347 (0.022)	0.739 (0.020)	0.822 (0.030)
5. Exaggerated startle	19.1	0.022 (0.008)	0.244 (0.021)	0.556 (0.039)

Mean Number of Symptoms in Members of Each Class by Symptom Cluster and Totals

	Mean (%)	Mean (%)	Mean (%)
Reexperiencing (B)	0.56 (42.7)	2.07 (36.4)	3.56 (30.7)
Avoidance (C1-C2)	0.27 (20.6)	1.16 (20.4)	1.68 (14.5)
Numbing (C4-C7)	0.02 (1.5)	0.48 (8.5)	2.55 (22.0)
Arousal (D)	0.46 (35.1)	1.96 (34.7)	3.81 (32.8)
Total (B-D)	1.31 (100)	5.67 (**100**)	11.60 (**100**)

Abbreviations: NA, not applicable; SE, standard error.
*Item excluded because of low prevalence and low discrimination power.

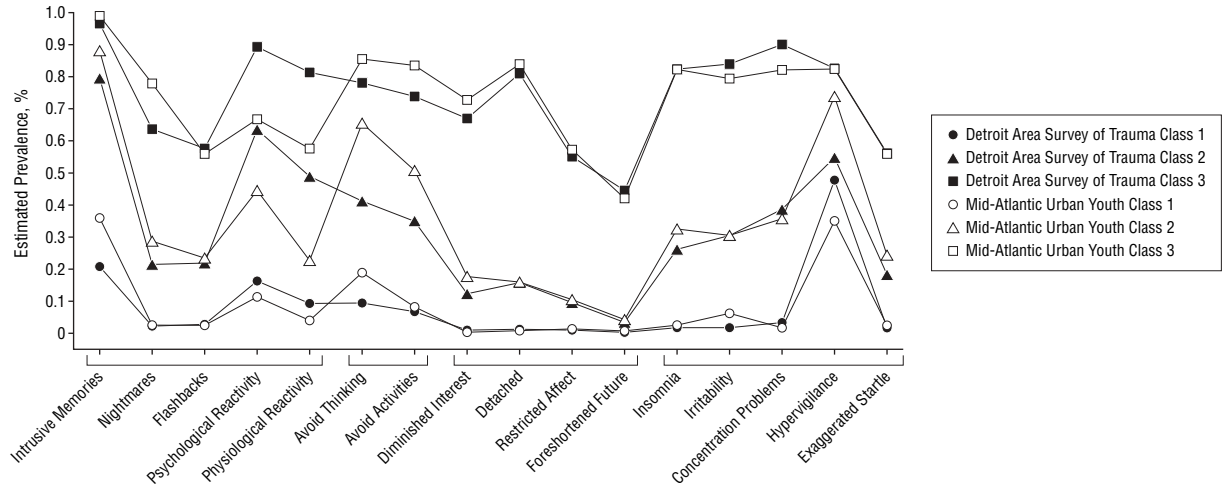

Figure. Estimated prevalence of posttraumatic stress disorder symptoms for each of the 3 latent classes in the Detroit Area Survey of Trauma[21,22] sample and in the mid-Atlantic urban young adults[23-25] sample.

SEX AND TRAUMA TYPE AS PREDICTORS OF CLASS MEMBERSHIP

Table 5 presents the distribution of trauma-exposed subjects, classified by sex and trauma type, across the 3 classes. In both samples, learning about trauma experienced by a loved one was more likely than any other trauma to be associated with no disturbance (class 1). In women, assaultive violence was far more likely than any other trauma to be associated with pervasive disturbance (class 3). In

Table 5. LCA-Derived Class Membership in Relation to Sex, Trauma Type, and Indicators of Impairment for Each Sample

	Detroit Area Survey of Trauma[21,22] Sample			Mid-Atlantic Urban Young Adults[23-25] Sample		
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
Distributions of Subpopulations Defined by Index Trauma Across LCA-Derived Classes*						
Male						
Assaultive violence	0.46	0.42	0.12	0.44	0.47	0.08
Injury or shock	0.62	0.31	0.07	0.46	0.40	0.14
Trauma to others	0.72	0.24	0.04	0.55	0.36	0.09
Unexpected death	0.59	0.31	0.10	0.41	0.44	0.15
Female						
Assaultive violence	0.21	0.39	0.40	0.23	0.47	0.30
Injury or shock	0.49	0.43	0.08	0.45	0.47	0.08
Trauma to others	0.65	0.29	0.06	0.64	0.31	0.05
Unexpected death	0.42	0.40	0.17	0.43	0.44	0.13
Occurrence of Indicators of Clinical Significance in 3 LCA Classes in Each Sample						
Tell a physician/other professional, %	5.7	21.5	58.7	6.2	19.6	42.9
Use medication, %	0.5	4.8	28.2	0.2	1.9	14.3
Interferes with life/activities, %	1.0	8.1	47.6	1.1	3.4	22.5
Any indicator, %	6.5	27.1	77.7	7.4	23.2	63.7

Abbreviation: LCA, latent class analysis.
*Within each sample and sex and for each index trauma type, rows sum to 1.00.

both samples, sex × trauma type (assaultive violence vs other) interactions, tested within the LCA framework, were significant (Detroit area sample, $\chi^2_1 = 11.92$; $P = .003$; mid-Atlantic sample, $\chi^2_1 = 26.51$; $P < .001$).

Probability of membership in class 1 (no disturbance) was lower in female subjects and in subjects who experienced assaultive violence (vs other trauma), with no significant sex × trauma type interaction. In the Detroit Area Survey of Trauma, women's odds ratio for class 1 (vs class 2) was 0.65 (95% confidence interval, 0.53-0.79); the odds ratio for class 1 (vs class 2) associated with exposure to assaultive violence (vs other trauma) was 0.46 (95% confidence interval, 0.34-0.62). Similar results were observed in the mid-Atlantic study.

CONSEQUENCES OF DISTURBANCE AND PERSISTENCE OF SYMPTOMS

Table 5 also presents the percentages of members of the 3 classes who saw a physician or another health professional, took medicine, and reported that the disturbance interfered with their lives or activities a lot. Members of class 3 were far more likely than members of class 2 to report each outcome. Although members of class 2 were more likely than members of class 1 to report these outcomes, the increments in class 2 vs class 1 were smaller than corresponding increments in class 3 vs class 2. For example, in the Detroit Area Survey of Trauma, the increment in class 2 vs class 1 members who saw a physician was 15.8 points; the corresponding increment in class 3 vs class 2 was 37.2 points.

Kaplan-Meier survival methods were used to estimate the time to remission of disturbance in members of classes 3 and 2 in the Detroit Area Survey of Trauma. Disturbance persisted significantly longer in members of class 3 than class 2 (log-rank $\chi^2 = 27.1$; $P < .001$). The median time to remission in class 3 was 60 months and in class 2, 12 months. Data on duration of symptoms in the mid-Atlantic sample were incomplete. However, analysis of the available data yielded a similar pattern.

COMMENT

The application of LCA to data on PTSD-defining symptoms from trauma-exposed subsets of 2 community samples yielded 3 classes that vary by level of severity—no disturbance, intermediate disturbance, and pervasive disturbance. The classes also vary qualitatively, with the emotional numbing cluster affecting a considerably greater proportion of class 3. Class 3, composed of slightly more than 10% of trauma-exposed persons in these community samples, approximates the subset of trauma-exposed persons who met *DSM-IV* PTSD criteria, as indicated by very robust odds ratios and high sensitivity and specificity estimates. In both samples, female subjects who experienced assaultive violence were more likely to be assigned to class 3 than male subjects who experienced assaultive violence and subjects who experienced other trauma types. Members of class 3 were far more likely to report that they saw a physician and took medicine and that their disturbance interfered a lot with their lives or activities compared with other trauma-exposed persons; their disturbance persisted considerably longer.

We applied LCA to data from general community samples, yielding results on the structure of PTSD in community residents exposed to qualifying traumatic events. The availability of 2 independent samples provides assurance that results do not capitalize on sample-specific variability. The 2 samples vary in important respects. The first represents a wide age range (18-45 years) and a population from a large geographic area in southeast Michigan, with the majority (77%) residing in suburbs sur-

rounding the inner city. In contrast, the second sample represents white and African American young adults (19-23 years of age) who had attended a single public school system and had grown up in the inner city. Despite the differences, the results of the LCA converge on the characteristics of the latent structure of PTSD, the relationship with diagnoses based on *DSM-IV* PTSD, associations with trauma type, and impairment indicators.

Several limitations should be noted. First, data were gathered through lay-administered interviews rather than mental health professional–administered interviews. However, a mental health professional reappraisal study in which a subsample was blindly interviewed by trained mental health professionals using the Clinician-Administered PTSD Scale for *DSM-IV*[40] found good concordance with diagnoses based on the structured interview.[41] Second, the respondents were asked to review their lifetime experience to recall traumatic events and PTSD symptoms they had experienced following a selected trauma. Prospective research on traumas as they are experienced, with fine-grained assessment of clinical features as they emerge, would be illuminating.

Notwithstanding these limitations, the results are noteworthy in several ways. While the *DSM* divides persons who experienced trauma events into 2 classes, cases and noncases, the LCA sorts them into a 3-class scheme, with a "no disturbance" class as a discrete group among the noncases. The intermediate class (class 2) formed by the LCA might illustrate previously proposed subthreshold clinical entities, such as partial PTSD. However, only slightly more than half of class 2 members in each study met partial PTSD criteria, defined as 1 or more symptoms from each of the 3 *DSM-IV* symptom groups (criteria B-D) and 1-month or longer duration,[17,42,43] or a more restrictive formulation.[44,45] Another 2% met criteria for PTSD. The remainder met criteria for neither PTSD nor partial PTSD. The LCA exploration did not provide empirical support for separating trauma-exposed subjects without pervasive disturbance in ways other than the 2 classes of no disturbance and intermediate disturbance.

Another aspect of the epidemiological evidence concerns the numbing cluster. We found that emotional numbing occurred primarily in the presence of pervasive disturbance and rarely in trauma-exposed subjects with intermediate disturbance. As such, it might be a marker of pervasive disturbance and, based on the *DSM-IV* PTSD robust association with the class of pervasive disturbance, of *DSM-IV* PTSD. The combined *DSM-IV* criterion of "avoidance and numbing" has been recognized as the "hardest" to fulfill and thus the limiting criterion in the diagnosis of PTSD.[39,46] The role of emotional numbing in prognosis and differential response to treatment has been noted in clinical studies.[6] It might not be obvious that fulfilling the "avoidance and numbing" criterion, and in turn the *DSM-IV* PTSD criteria, as a rule, depends on endorsing at least 1 numbing symptom. The "avoidance and numbing" criterion, which requires 3 of 7 symptoms, contains 3 avoidance and 4 numbing symptoms,[1(p435)] allowing trauma-exposed persons to fulfill the criterion by endorsing only the 3 avoidance symptoms. This theoretical option rarely materializes because 1 of the 3 avoidance symptoms, psychogenic amnesia, is rarely endorsed.

The analysis predicting membership in the 3 latent classes, based on sex and trauma type, reproduced our findings from analysis of *DSM-IV* PTSD,[28,39] as could be expected given the robust association between class 3 and *DSM-IV* PTSD. Men's risk for pervasive disturbance varied little across trauma types, but women's risk for pervasive disturbance was markedly higher if they had been exposed to assaultive violence. With this exception (ie, women's higher risk following assaultive violence), the likelihood of developing pervasive disturbance (or *DSM-IV* PTSD) varied little across trauma types. The LCA, in identifying 3 outcomes—no disturbance, intermediate disturbance, and severe disturbance—allows an additional observation, which the *DSM-IV* PTSD analysis of cases vs noncases could not reveal. Men exposed to any trauma type and women exposed to traumas that do not involve assaultive violence are considerably less likely than women exposed to assaultive violence to exhibit any disturbance, pervasive or intermediate. Their chance of experiencing no disturbance is large.

Elsewhere it has been suggested that PTSD represents the upper end of a continuum of reactions to extreme stress and that PTSD does not qualify as a taxon, as defined by Meehl.[7] As indicated in our introduction, the taxometric approach pits a 1-class model against a 2-class model and is uninformative if the latent structure is one with more than 2 discrete categories—taxon and complement. While LCA provides no formal test of whether the resultant classes differ in severity or qualitatively, by assuming a latent variable with discrete categories and not imposing further structure on the data, LCA allows probing for potential configurational differences that cannot be revealed in a taxometric model.

Like other latent structure approaches, LCA might be considered uninformative with respect to validity, specifically, whether the class with pervasive disturbance brackets a subset of trauma-exposed subjects with clinical disturbance and whether that disturbance is a distinct pathological entity. These questions cannot be determined solely based on covariation among symptoms. The observed relationships with trauma type and behavioral outcomes, all based on self-reports, offer modest support for separating the class with pervasive disturbance as clinically significant. However, these data do not address the question of the integrity of PTSD as distinct from other psychiatric disorders.

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