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Trajectories of Daily PTSD Symptoms in Recent Traumatic Injury Victims

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Abstract

Objective—Prior research has identified different PTSD symptom (PTSS) trajectories over months and years post-trauma that warrant different levels of clinical attention. Earlier identification of at-risk trauma victims can facilitate efficient/appropriate intervention efforts.

Method—Using latent class growth analysis, we examined daily PTSS trajectories beginning 6-weeks post-injury in 68 injury victims. Resulting classes were compared on key characteristics at 6- and 21-weeks post-injury.

Results—Three trajectories were identified: A non-reactive class (67.8%) with low initial symptom levels that remained low, a moderate-stable class (27.9%) with elevated symptom levels that remained constant, and a severe-increasing class (4.4%) with high symptom levels that increased.

Conclusions—High-risk injury victims can be identified by their daily PTSS, allowing for early identification of those at risk for elevated distress and in greater need for intervention.

Keywords

Traumatic injury; posttraumatic stress disorder (PTSD); latent class growth analysis; PTSD symptom trajectories; daily PTSD assessment; ecological momentary assessment

Twenty two percent of traumatic injury victims develop at least one new psychiatric disorder following their injury – with PTSD and depression being the most common (Bryant et al., 2010). PTSD is a serious public health concern as it has a detrimental effect on health and quality of life (Pacella, Hruska, & Delahanty, 2013). Symptom assessment in trauma victims over months and years post-trauma has revealed four distinct trajectories of PTSD symptoms

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(PTSS): a non-reactive class with persistently low PTSS; a recovering class with elevated PTSS that decrease over time; a delayed class with low initial PTSS that escalate over time; and a chronic dysfunction class with high PTSS that may increase over time (Bonanno & Mancini, 2012). A majority of victims fall into the non-reactive class, a minority into the chronic dysfunction class (primarily interpersonal trauma victims; deRoon-Cassini, Mancini, Rusch, & Bonanno, 2010), and the remaining are split between the recovering and delayed classes.

It is unknown whether these trajectories are detectable on a daily basis shortly following trauma. Evidence of such daily trajectories and their differential association with PTSD risk would have implications for screening and intervention efforts. The present study used latent class growth analysis (LCGA) to examine whether daily PTSS follow distinct trajectories in traumatic injury victims assessed 6-weeks post-injury. We further examined whether trajectories were differentially associated with demographics, psychiatric problems, and trauma-related characteristics at 6- and 21-weeks post-injury.

Method

Participants

Participants were injury victims admitted to a Level-1 Trauma Center. Recruitment occurred during a routine outpatient medical follow-up visit 2-weeks post-injury. Inclusionary criteria included: being 18-65 years old, living within 30 miles of the hospital, having a Glasgow Coma Scale score >13, and meeting Criterion A of the DSM-IV-TR PTSD diagnosis (American Psychiatric Association, 2000); 95.2% (n = 80) of qualifying individuals consented to participate. 41.3% of the sample experienced motor vehicle/cycle crashes while 26.3% experienced assault. The sample was 35.1 ($SD = 12.1$) years old on average, 51.2% male, 71.0% Caucasian, and 51.2% had a high school degree or less. Sixty-eight participants (85.0%) were retained at the 6-week follow-up, and 60 (75.0%) at the 21-week follow-up; retention did not differ based on demographics or time spent in the hospital ($p's > 0.05$).

Procedure

Procedures were approved by the Institutional Review Boards of Summa Health System and Kent State University. Following informed consent, participants completed baseline questionnaires and medical charts were reviewed to determine the index event precipitating hospitalization (coded as interpersonal – e.g., gunshot wound, physical attack, etc. – or non-interpersonal – e.g., motor vehicle crash, falling, etc.). Six-weeks post-injury, participants were trained on the use of a personal digital assistant (PDA). PDA data were collected over 7 continuous days. Participants responded to 3 signals occurring randomly in the morning, afternoon, and evening. When signaled, participants reported PTSS levels experienced since the last daily assessment. Daily assessments were averaged across each day for each participant. At 21-weeks post-injury, participants completed additional questionnaires.

Survey Questionnaires

Demographic information—A standard questionnaire assessed age, gender, race (Caucasian vs. non-Caucasian), and education (high school degree vs. > high school degree).

PTSS/PTSD—At baseline, the Posttraumatic Diagnostic Scale (PDS: Foa, Cashman, Jaycox, & Perry, 1997) was used to assess trauma history and the 17 items reflecting DSM-IV-TR PTSS criteria. Item ratings were summed to yield a total score (possible range: 0-51). The PDS has been used with a variety of clinical populations and has been found to have concurrent validity scores between 0.66-0.80 and a Cronbach's alpha score of 0.92 in PTSD treatment seekers (Foa et al., 1997). In the current study, Cronbach's alpha was 0.91.

The 17-item PTSD Checklist-Civilian (PCL-C: Weathers, Litz, Herman, Huska, & Keane, 1993) was used to assess PTSS at 6- and 21-weeks post-injury. At each time point, ratings were summed to yield a total score (possible range: 17-85). The psychometric properties of the PCL-C are well established. A concurrent validity score of 0.93 and a Cronbach's alpha of 0.94 have been observed when the scale is used with motor vehicle accident victims (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). In the current study, Cronbach's alpha was 0.93 at both follow-ups. Four items adapted from the Clinician Administered PTSD Scale (Blake et. al., 1995) were included to assess impairment and were rated on a scale ranging from 1 to 5. Symptom impairment was counted if participants rated an item as 3 or above. Participants were classified as meeting probable PTSD diagnostic criteria if they endorsed at least 1 re-experiencing, 3 avoidance, and 2 hyperarousal symptoms, plus functional impairment (NCPTSD, 2014).

Depression Symptoms—The depression subscale of the Hospital Anxiety and Depression Scale (HADS-D: Zigmond & Snaith, 1983) was used to assess depression symptoms at baseline and at 21-weeks post-injury. The HADS-D is a 7-item self-report instrument designed for use in hospital settings to screen for depression symptoms experienced in the past week. At each time point, ratings were summed to yield a total score (possible range: 0-21). The HADS-D has been used in medical settings in which concurrent validity scores have ranged from 0.62-0.81 and Cronbach's alpha scores have ranged between 0.67-0.89 (Bjelland, Dahl, Haug, & Neckelmann, 2001). In the present study, Cronbach's alpha for the HADS-D was 0.81 at 6-weeks and 0.85 at 21-weeks post-injury.

Daily Assessments

PTSD Symptoms—The 6-item Short Form PTSD Checklist (SF-PCL: Lang & Stein, 2005) was administered via PDA devices. At each signal participants were asked to “complete the following questions with reference to the event that recently caused you to be hospitalized.” They were then asked to rate how much they had been bothered by each symptom since the last daily assessment on a scale ranging from 1 to 5. The SF-PCL has been shown to have good psychometric properties in medical and community settings, with a concurrent validity score of 0.96 and Cronbach's alpha scores between 0.79-0.89 in these contexts (Lang & Stein, 2005; Hirschel & Schulenberg, 2010). In the current study,

Cronbach's alphas ranged from 0.83-0.90 on day 1 and 0.88-0.91 on day 7. A total score of 14 on SF-PCL is indicative of possible PTSD (Lang & Stein, 2005).

Data Analysis

Latent class growth models consisting of 1-, 2-, 3-, and 4-classes were estimated in Mplus version 5 (Muthén & Muthén, 2007). Model selection was determined by the AIC, BIC, and sample size adjusted BIC (SSA-BIC) fit indices (lower values indicate better fit) as well as the LMR LRT and the BLRT (a statistically significant p -value indicates that the k class is a better fit than the $k-1$ class). Entropy scores provided model classification accuracy estimates (values near 1 reflect better accuracy). Non-statistical criteria were considered by examining class differences on external variables selected according to existing research and theoretical relevance (see Table S2 for variables). Pearson chi-square analyses were used for categorical variables and Tukey's HSD/ Dunnett's T3 post-hoc tests were used following statistically significant one-way ANOVAs for continuous variables.

Results

Latent Class Growth Analysis

Supplemental Table 1 contains descriptive statistics for the external variables. Participants responded to 1041 daily prompts and completed 1037/1428 (72.6%) daily PCL assessments. Supplemental Table 2 (Table S2) contains the fit indices. The AIC, BIC, and SSA-BIC values supported the 4-class model, the LMR LRT supported the 3-class model, and the entropy values did not offer clear support for any particular model. The 3-class model yielded one class that fell below the PCL cut-off score of 14 and two classes that fell above. Additionally, the 3-class model yielded classes that differed significantly on a majority of the external variables, suggesting that it had clinically significant relevance. In contrast, the 4-class model had an additional class falling below the PCL cutoff that did not differ meaningfully from the other classes. As such, the 3-class model (depicted in Supplemental Figure 1) was selected. Class 1 ("non-reactive") evidenced low initial PTSS ($B = 8.16$, $SE = 0.29$, $p < 0.001$) that decreased ($B = 0.16$, $SE = 0.05$, $p = 0.001$). Class 2 ("moderate-stable") displayed elevated initial PTSS ($B = 14.93$, $SE = 0.66$, $p < 0.001$) that remained constant and above the SF-PCL cut-score ($B = -0.05$, $SE = 0.11$, $p = 0.64$). Class 3 ("severe-increasing") was characterized by high initial levels of PTSS ($B = 26.30$, $SE = 1.02$, $p < 0.001$) that increased ($B = 0.42$, $SE = 0.16$, $p = 0.007$).

Differences on External Variables

See Table S2 for class differences on external variables. No differences were observed on gender or education (all $ps > 0.05$). Those in the non-reactive class reported fewer types of past traumas relative to the other classes ($ps = 0.04$) and fewer types of interpersonal traumas compared to the moderate-stable class ($p = 0.04$). Those in the severe-increasing class were more likely to have experienced an interpersonal trauma index event compared to both the non-reactive ($p < 0.001$) and moderate-stable classes ($p = 0.04$), while the moderate-stable class was more likely to have experienced an interpersonal trauma index event compared to the non-reactive class ($p = 0.03$). The non-reactive class reported lower

baseline PTSS ($ps < 0.004$) and depression symptoms ($ps < 0.007$) relative to the other classes. At 6-weeks, the non-reactive class was less likely to meet probable PTSD status compared to the other classes ($p < 0.001$). The moderate-stable and the severe-increasing classes did not differ in likelihood of meeting probable PTSD status ($p = 0.12$). Those in the severe-increasing class reported higher PTSS compared to both the non-reactive ($p < 0.001$) and moderate-stable classes ($p = 0.01$), while those in the moderate-stable class reported higher symptom levels compared to the non-reactive class ($p < 0.001$). Results were identical at 21-weeks, except that differences in PTSS were no longer significant between the non-reactive and severe-increasing classes, nor between the moderate-stable and severe-increasing classes (all p 's > 0.05). At 21-weeks the non-reactive class reported less depression symptoms relative to the other classes ($ps = 0.01$). However, post-hoc power analyses on all statistically non-significant comparisons indicated low observed power particularly for comparisons involving the severe-increasing class (range: 0.05-0.47).

Discussion

The current study is the first to examine daily PTSS trajectories 6-weeks post-injury. A 3-class model reflecting non-reactive, moderate-stable, and severe-increasing classes provided the most parsimonious, clinically-relevant description of daily PTSS. These classes also differed on external variables not included in the LCGA. Although 3 trajectories were evident at 6-weeks, membership in the moderate-stable or severe-increasing class did not differentially predict PTSD or depression at 21-weeks post-trauma. Another noteworthy group difference is the higher prevalence of interpersonal index traumatic events in the severe-increasing class vs. the moderate-stable class, consistent with research showing that interpersonal traumas often result in elevated distress (Breslau et al., 1998).

While prior research examining PTSS trajectories indicates that 4-classes best characterize post-traumatic responses (Bonanno & Mancini, 2012), our results suggest that 3-classes best fit this sample of recent injury victims. This may be due to the timing of assessments and the focus on *daily* symptoms. Although a 3-rather than a 4-class model best described our data, clinical implications remain similar: for the 4-classes typically observed, two classes require clinical attention (Bonanno & Mancini, 2012). The present findings also yielded two classes warranting clinical monitoring (i.e., the moderate-stable and severe-increasing classes). Findings from the current study have important ramifications for early intervention: PTSD researchers have advocated a stepped care intervention approach for recent trauma victims (Zatzick et al., 2013). Our results suggest that identifying patients whose index event involved interpersonal trauma and monitoring their daily levels of distress 6-weeks post-injury may be a way to target those at greatest risk for PTSD.

The relatively small sample size of the study and of the severe-increasing class may have weakened our ability to detect class differences. However, despite some variability in the exact proportions of the classes typically observed in studies of PTSS trajectories (e.g., deRoos-Cassini et al., 2012), the relative sizes of the classes observed here are similar to the majority of those found in other studies – with the most symptomatic class making up ~2-9% of trauma victims (Bonanno et al., 2012; Lowe, Galea, Uddin, & Koenen, 2014; Orcutt, Bonanno, Hannan, & Miron, 2014; Osofsky, Osofsky, Weems, King, & Hansel,

2015). This is consistent with the ~4% of participants in the severe-increasing class in the present study. That being said, future studies employing larger sample sizes are necessary to confirm the current findings. Despite these limitations, these results demonstrate the feasibility of measuring daily PTSS following recent traumatic injury, and identify three symptom trajectories that emerge shortly post-injury. Moreover, these different trajectories vary in clinically meaningful ways – providing an indication of those who should be targeted for intervention, and potentially reducing the burden of traumatic injury.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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