HHS Public Access
Author manuscript
Psychol Trauma. Author manuscript; available in PMC 2018 March 01.

Published in final edited form as:
Psychol Trauma. 2017 March ; 9(2): 138–146. doi:10.1037/tra0000147.

Trajectories of posttraumatic stress symptoms after civilian or deployment traumatic event experiences

David S. Fink, MPH[1,*], **Sarah Lowe, Ph.D.**[1], **Gregory H. Cohen, MSW**[1], **Laura A. Sampson, BA**[2], **Robert J. Ursano, MD**[3], **Robert K. Gifford, Ph.D.**[3], **Carol S. Fullerton, Ph.D.**[3], and **Sandro Galea, MD, Dr.PH.**[4]

[1] Department of Epidemiology, Columbia University, New York, New York, USA

[2] Department of Epidemiology, Boston University, Boston, Massachusetts, USA

[3] Uniformed Services University of the Health Sciences, Bethesda, MD, USA

[4] School of Public Health, Boston University, Boston, Massachusetts, USA

Abstract

Objective—Growth mixture model studies have observed substantial differences in the longitudinal patterns of posttraumatic stress symptom (PTSS) trajectories. This variability could represent chance iterations of some prototypical trajectories or measurable variability induced by some aspect of the source population or traumatic event experience. Testing the latter, we analyzed a nationally representative sample of U.S. Reserve and National Guard members to identify the influence of civilian versus deployment trauma on the number of PTSS trajectories, the nature of these trajectories, and proportion of respondents in each trajectory.

Method—Data were collected from 2010 to 2013 and latent class growth analysis was used to identify different patterns of PTSS in persons exposed to both a civilian and a deployment trauma and to test whether respondents' exposure to civilian trauma developed similar or distinct patterns of response compared to respondents exposed to deployment trauma.

Results—PTSS were found to follow three trajectories, with respondents predominantly clustered in the lowest symptom trajectory for both trauma types. Covariates associated with each trajectory were similar between the two traumas, except number of civilian-related traumatic events; specifically, a higher number of civilian traumatic events was associated with membership in the 'borderline-stable,' compared to 'low-consistent,' trajectory, for civilian traumas and associated with the 'pre-existing chronic' trajectory for military traumas.

Conclusions—Holding the source population constant, PTSS trajectory models were similar for civilian and deployment-related trauma, suggesting that irrespective of traumatic event experienced there might be some universal trajectory patterns. Thus, the differences in source populations may have induced the heterogeneity observed among prior PTSS trajectory studies.

---

* Address for correspondence: David S. Fink, MPH, Department of Epidemiology, Mailman School of Public Health, 722 W. 168th Street, Room 1513, New York, NY 10032-3727, USA. *Phone*: +1 212 304 5712. *Fax*: +1 212 305 1460. dsf2130@columbia.edu.

Conflict of interest: None.

Ethical standards: The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on health experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

Keywords

Posttraumatic stress disorder; latent class growth analysis; symptom trajectories; military personnel; prospective study

Evidence suggests that there are four prototypical posttraumatic stress symptom (PTSS) trajectories that develop after a traumatic event exposure (Bonanno, 2004; Bonanno & Mancini, 2012), including (in order of prevalence): minimal-impact resilience (minor symptoms that quickly subside); chronic (steep increase in symptoms that maintains consistent); recovery (severe symptoms that gradually subside); and delayed (moderate symptoms that gradually increase to severe) (see Supplemental Fig. 1). However, substantial differences in the number of trajectories, shape of trajectories, and proportion of persons assigned to each trajectory have been observed across studies. For example, previous studies have observed from 2 (Orcutt, Erickson, & Wolfe, 2004) to 7 (Norris, Tracy, & Galea, 2009) distinct PTSS trajectories in their sample. Absent an alternative explanation, review articles have focused attention on the more consistent (i.e., prototypical) trajectories and assumed that these between-study differences are variations on a core set of universal patterns (Bonanno, 2004; Bonanno & Mancini, 2012). However, it is equally possible that PTSS trajectories have varied across studies because of differences in the source population under study. Studies documenting PTSS trajectories have included studies of: traumatic injury survivors (Bryant et al., 2015; deRoon-Cassini, Mancini, Rusch, & Bonanno, 2010), rape victims (Armour, Shevlin, Elklit, & Mroczek, 2012; Steenkamp, Dickstein, Salters-Pedneault, Hofmann, & Litz, 2012), mass trauma victims (Norris et al., 2009; Pietrzak et al., 2014; Pietrzak, Van Ness, Fried, Galea, & Norris, 2013; Van Loey, van de Schoot, & Faber, 2012), or deployed service members (Bonanno et al., 2012; Sampson et al., 2015). As each of these populations exhibits a different distribution of risk factors and traumatic event experiences, it is possible that these differences induce the heterogeneity of PTSS trajectories that has been observed among PTSS studies.

It is plausible that differences in source populations act together with traumatic event experiences to affect PTSS severity and trajectory. As such, any comparison of PTSS trajectories across studies, even when examining the same type of traumatic event, will be influenced by a differential distribution of the individual and social risk factors that exist among study populations. In order to get around this issue, we need a study that lets the traumatic events experience vary, while holding the population constant. We aimed to carry out such a study by focusing on one particular example of how these differences might shape the trajectories of PTSS, by comparing the influence of deployment versus civilian traumatic events in the same source population.

Exposure to life-threatening situations during combat is associated with new-onset PTSS (Polusny et al., 2011; Smith et al., 2008) and higher odds of membership in a more severe and chronic PTSS trajectory compared to a resilient trajectory (Bonanno et al., 2012). However, the influence of civilian traumatic events on the psychological well-being of service members remains less clear. Indeed, a major shortcoming of most of the military literature is that it restricts the sample to recently deployed service members and does not account for civilian traumatic events that have been documented to affect both deployed and non-deployed personnel (Cerda et al., 2014; Gahm, Lucenko, Retzlaff, & Fukuda, 2007). Nonetheless, service members experience both deployment-related traumatic events and civilian related traumatic events and stressors (Cerda et al., 2014).

In the current study, we focus on the consistency of deployment and civilian PTSS trajectories in a nationally representative sample of U.S. Reserve and National Guard, specifically consistency on the number of distinct PTSS trajectories, the nature of these trajectories, and proportion of trauma-exposed respondents in each trajectory. We chose U.S. Reserve and National Guard service members because of their high propensity to experience stress and trauma in two different life roles, i.e., during their civilian and deployment duties. The goal of this analysis was to empirically test whether the differences observed across growth mixture model studies of PTSS severity represent iterations of universal PTSS trajectories, as proposed by Bonanno (2004), or measurable variability induced by some aspect of the source population under investigation. The comparisons of PTSS trajectories that arise from deployment versus civilian traumatic events are well suited for this analysis. Indeed, the characteristics of traumatic events vary greatly across several dimensions that have been associated with PTSS outcomes, including: type, chronicity, and severity (Fink & Galea, 2015). First, rare exposures during civilian life are ubiquitous exposures during deployment, such as receiving incoming fire and being attacked or ambushed (Gallaway et al., 2014; Hoge et al., 2004). Second, deployment related events are restricted to adults 18 years or older and short deployment intervals that often range from 8 to 13 months, whereas civilian related events—particularly those related to environment—can occur early and often over the life course. Finally, earlier studies of general population samples have tended to observe lower conditional likelihood of current PTSD related to combat compared to other events (Husky, Lepine, Gasquet, & Kovess-Masfety, 2015; Norris, 1992).

In this study, we hypothesized that persons exposed to both deployment and civilian-related traumatic events would follow the four prototypical PTSS trajectories proposed by Bonanno (2004). Furthermore, we hypothesized that a greater proportion of respondents in the deployment-related group, compared to the civilian related group, would fall into the PTSS trajectory with the lowest symptom levels.

Method

Participants

The Reserve National Guard (RNG) Study is a nationally representative prospective cohort survey of U.S. Reserve and National Guard members that were assessed at one-year intervals from 2010 to 2013 (N = 2,003) (Walsh et al., 2014). The longitudinal sample consisted of 1,741 participants, divided into a civilian-related trauma group (*n* = 1429; 82.1%) and a deployment-related trauma group (*n* = 825; 47.4%) who at baseline had experienced, respectively, one or more civilian- or deployment-related traumatic events in their lifetime, responded to the PTSS items, and completed two or more waves of data. For this study, we used data from the 741 participants who had experienced both a civilian and a deployment-related traumatic event. The analytical sample (*n* = 741) was predominantly male (86.8%; *n* = 643), non-Hispanic white (75.6%; *n* = 560), married (59.7%; *n* = 59.7%), junior enlisted (E4-E9; 70.1%; n = 511) service members, with a mean age of 36.1 years (standard deviation = 9.9 years).

Procedures

After obtaining approval from the Human Research Protection Office at the U.S. Army Medical Research and Materiel Command, and the Institutional Review Boards at the Uniformed Services University of the Health Sciences and Columbia University, a two-phase stratified random sample was created. First, the Defense Manpower Data Center randomly sampled 10,000 Reserve and 10,000 National Guard members serving in June 2009. Second, 9,751 service-members were randomly selected, sent an opt-out letter that described the research study, and provided the opportunity to decline study participation, of which 1,097 opted out. Next, we excluded 2,866 with incorrect/non-working telephone numbers, 385 who were not eligible (e.g., hearing problems, retired), 14 who only completed pilot surveys, and 3,386 who had not yet been contacted before we reached our target sample size (N > 2,000) in June 2010. A total of 2,003 Reserve and National Guard service members were interviewed at baseline (January-July 2010). The overall cooperation rate (defined as number consented divided by number of successfully contacted working numbers; [2,003 + 324 + 61] / [6,885–3,386]) was 68.2%, and the overall response rate was 34.1% (defined as those who completed the survey plus those who consented but were ineligible, divided by the number of working numbers minus those disqualified; [2,003 +324] / [6,885–61]) (American Association for Public Opinion Research, 2011); both rates are comparable to other population-based military cohort studies, such as Army STARRS (65.1% and 49.8%, respectively; Kessler et al., 2014).

At baseline, study-trained interviewers explained the study and received informed consent. Questionnaires were administered via a 60-minute computer assisted telephone interview at four time points: Time 1 (January to June 2010), study-trained interviewers explained the study, received informed consent, and administered the questionnaire; Time 2 was conducted from January to December 2011; Time 3 was conducted February to December 2012; and Time 4 was conducted January to December 2013. Each participant was offered $25 compensation at each data collection.

Measures

Lifetime traumatic events were assessed sequentially for civilian and deployment-related experiences. First, civilian-related traumatic events were assessed using a list compiled from two widely used traumatic events inventories (Breslau et al., 1998; Gray, Litz, Hsu, & Lombardo, 2004). Next, deployment-related traumatic events were assessed using that same list, with additional items from the Deployment Risk and Resilience Inventory (King, King, Vogt, Knight, & Samper, 2006), asked in reference to their most recent deployment. In addition, participants were offered an opportunity to describe any other traumatic event that was not listed on the two scales. At baseline (Time 1), respondents were asked to endorse traumatic events that had occurred in their lifetime for civilian-related events and during their most recent deployment for deployment-related events. At follow-up interviews (Time 2-4), respondents were asked to endorse experiences that had occurred since their last interview for both civilian and deployment-related events.

The *PTSD Checklist* (PCL; Weathers & Ford, 1996) is a widely used 17-item scale that asks respondents to indicate how much they were bothered in the last month by each of the 17 *DSM-IV* PTSD symptoms, on a scale from 1 (*Not at all)* to 5 (*Extremely*) with total scores ranging from 17 to 85. As a categorical measure, a score of 31-49 and 50 or greater has been employed to indicate sub-threshold and probable PTSD, respectively (Harrington & Newman, 2007; Skogstad, Fjetland, & Ekeberg, 2015). To better map the screener to the *DSM-IV* definition of PTSD (American Psychiatric Association, 2000), participants were asked to answer each item with respect to symptoms they experienced in the past-year, instead of the past-month. In our sample the scale had an internal consistency reliability (Cronbach's Alpha) of 0.94.

Respondents completed the PCL up to two times per wave; the first time respondents completed the measure in reference to their self-described worst civilian traumatic event, second in reference to their self-described worst deployment-related traumatic event. At subsequent waves of data collection, respondents could either continue with the same event as the prior wave or choose a new worst event that had occurred since their last interview. The PCL for each traumatic event was completed in three steps. First, respondents were asked to review the list of civilian related events and choose the worst. Next, interviewers asked the respondent the approximate year of the selected civilian event. The questionnaires provided interviewers several probing questions to assist respondents in this task. Finally, respondents completed the questionnaire in reference to that particular event. These steps were then repeated for the selected worst deployment-related traumatic event.

Analytical approach

We completed both a variable- and person-oriented analysis as recommended by Bogat et al. (Bogat, Levendosky, & von Eye, 2005). First, we presented descriptive data and correlation analyses (variable-oriented analysis) to complement the person-centered analysis. Second, we employed latent class growth analysis (LCGA) to estimate separate models for the PTSS trajectories related to civilian and deployment-related traumatic events. LCGA uses information about interindividual differences and intraindividual changes over time to identify distinct classes of individuals who follow like trajectories of a single outcome variable across multiple time points. As such, LCGA is a sub-type of growth mixture models that assumes no variation across individual within a class (Nagin, 2005). Missing data were handled through full information maximum likelihood using Mplus version 7.11 (Muthen & Muthen, 1998-2012).

Three steps were required to fit the final models. First, we used conventional polynomial growth models to test whether the data exhibited linear or quadratic growth. After we determined that the quadratic model best fit these data, we utilized LCGA due to estimation difficulties encountered in attempts to allow within-trajectory class variation in intercept and slope. Second, we divided the sum PTSS scores into two datasets based on trauma type, completed the analysis in all civilian PTSS, and then again in all deployment-related PTSS. For each model, we adjusted the intercept, slope, and quadratic term on the number of years since the traumatic event, calculated as the difference between the interview year and self-reported traumatic event year.

For both civilian and deployment-related trauma, we fit a series of LCGA models to determine best fit, beginning with a one-class model and progressing to a five-class model. Best model fit prioritized parsimony, lowest Bayesian Information Criterion (BIC), significant ($p < .05$) Lo-Mendell-Rubin likelihood ratio test (LMR-LRT), and highest entropy. To evaluate the selected trajectory model fit the target construct, we examined whether the average posterior probability ($AvePP_j$) exceeded .70 for each group (Nagin, 2005). Finally, to investigate sociodemographic and trauma-related predictors of class membership, we conducted a multivariable multinomial logistic regression analysis in SAS v 9.3 (Cary, NC) where all baseline predictor variables (i.e., age, sex, ethnicity, marital status, income, rank, cumulative civilian stressors, cumulative deployment stressors[1]) were entered simultaneously as predictors of trajectory membership as outputted from the LCGA.

Results

Table 1 shows the mean and standard deviations for PTSS at each data collection time, for the civilian and deployment-related traumas. The deployment-related traumas had a higher mean PTSS at baseline than the civilian group and similar mean PTSS at subsequent waves. Although analyses revealed that PTSS was very stable over time in both the civilian (*rs* ranged from .37 to .73; $ps < .0001$) and the deployment-related trauma (*rs* ranged from .56 to .82; $ps < .0001$), we observed a higher correlation across the deployment-related PTSS than civilian PTSS.

Table 2 shows that when civilian and deployment-related traumas were estimated separately, the trajectory models were similar in terms of the number and shape of the trajectories. Examination of the statistical indicators provided support for a three-class model of PTSS in both the civilian and the deployment-related trauma. Although the BIC was lower in models with four and five classes, suggesting better fit, the entropy was lower and the LMR-LRT statistic became non-significant ($p > .05$), suggesting worse fit. Taken together, we concluded that the three-class model provided a better fit with these data. In addition, fit indices for the three-class were good for both civilian ($AvePP_j$s > .88; entropy = .89) and deployment-related ($AvePP_j$s > .92; entropy = .92) PTSS trajectories.

Figure 1 shows the PTSS trajectories over time for civilian (Figure 1a) and deployment-related (Figure 1b) traumatic events. For both forms of trauma, we observed the largest group displayed consistently low PTSS scores across the four waves (*low consistent:* 73.9% for civilian trauma, 70.8% for deployment-related trauma). Participants assigned to the second largest group showed stable PTSS that were consistent with sub-threshold, or borderline, PTSD (*borderline-stable:* 18.7% for civilian trauma, 22.7% for deployment-related trauma). Participants in the third and smallest group showed chronically severe symptoms across all waves (*preexisting-chronic:* 7.4% for civilian trauma, 6.6% for deployment-related trauma). The deployment-related preexisting-chronic trajectory had a

[1]Cumulative deployment stressors and cumulative civilian stressors were determined using a scale of 12 stressful life events (e.g., “had a parent who had a problem with drugs or alcohol”, “Lost your job”, “Had serious financial problems”). At baseline, each respondent endorsed whether each stressor occurred in their lifetime and whether that stressor was “related to their most recent military deployment?” Next, we summed the total number of lifetime stressors that each respondent endorsed both in relation to their most recent deployment and not related to their most recent deployment to create the measures for cumulative deployment stressors and cumulative civilian stressors, respectively.

higher mean PTSS than the comparable civilian trajectory at both Time 1 (52.85 and 41.16, respectively) and Time 4 (61.32 and 54.16, respectively). In addition, the deployment-related borderline-stable trajectory contained a higher proportion of participants (22.7%) than the same civilian trajectory (18.7%).

Table 3 shows the baseline predictors of trajectory class membership for civilian and deployment-related trauma. The small count of E1-E3 rank in the preexisting-chronic trajectory prevented estimation for some models. However, participants with E4-E9 rank were more likely than officers to be in both the borderline-stable (adjusted odds ratio [aOR]=1.74; 95% confidence interval [CI]=1.00-3.03) and preexisting-chronic (aOR=19.54; 95% CI=3.87-98.55) trajectories among civilian trauma, and more likely to be in the preexisting-chronic trajectory (aOR=9.89; 95% CI=2.62-37.20) among deployment-related trauma, than the consistently low trajectory. In addition, participants with E4-E9 rank were more likely than officers to be in the preexisting-chronic than the borderline-stable trajectory for both the civilian (aOR=11.21; 95% CI=2.13-58.99) and deployment-related (aOR=6.16; 95% CI=1.57-24.16) traumas. A higher number of cumulative deployment traumatic events were associated with an increased likelihood of a higher PTSS trajectory membership between both types of traumas. For example, for each additional deployment stressor participants were 2.00 times (95% CI=1.58-2.52) more likely to be in the pre-existing chronic compared to the low consistent trajectory for civilian traumas, and 2.05 times (95% CI=1.63-2.58) more likely for deployment-related traumas, after adjusting for all other variables in the model. Compared to the low consistent trajectory, the borderline-stable trajectory, among civilian trauma (aOR=1.12; 95% CI=1.02-1.23), and the pre-existing chronic trajectory, among deployment-related trauma (aOR=1.17; 95% CI=1.01-1.36), were associated with the cumulative number of civilian related traumas.

Discussion

We documented similarities in the number of trajectories, shape of trajectories, and proportion of respondents in each trajectory after both civilian and deployment-related traumatic events among the same sample of guard and reserve members. In contrast to the four prototypical trajectories (Bonanno, 2004; Bonanno & Mancini, 2012), we identified three different clusters of PTSS trajectories over the 4-year period for both civilian and deployment-related traumatic events, including a low-consistent symptom trajectory that was the largest (73.9% and 70.8%, respectively), borderline-stable trajectory that was the next largest (18.7% and 22.7%, respectively), and preexisting-chronic high trajectory (7.4% and 6.6%, respectively). After holding the source population constant, these results show that there are remarkably consistent PTSS trajectory patterns across different traumatic experiences, suggesting that the previous differences observed across PTSS trajectory studies likely arise from differences in the source populations under study.

We found that a three-trajectory model provided the best fit for both types of traumatic events. Overall, symptom trajectories were relatively stable over time, such that the baseline PTSS value remained within about a 10-point range across all four waves, the only exception being the high symptom level trajectory for civilian trauma that was observed to increase from about 40 to 60 between Time 1 and Time 3. A potential explanation for the observed variability in the civilian preexisting-chronic trajectory is that this single trajectory should be two different trajectories. For example, Bonanno et al. (2012) found that 2.2% and 6.7% of a U.S. military group fell into a high-stable and worsening-chronic trajectory, respectively. The average of these two trajectories, high-stable and worsening-chronic, would map well onto the preexisting-chronic trajectory observed in our study. Although the fit indices for this model suggested a good fit, several other studies have observed an increasing PTSS trajectory (Bonanno & Mancini, 2012; Bryant et al., 2015; Norris et al., 2009), suggesting that a four-class trajectory may provide the better conceptual fit to these data.

We found that about one in five respondents were assigned to the borderline stable trajectory, which evidenced consistently sub-threshold PTSS as indicated by total PCL symptoms from 31 to 50 (Harrington & Newman, 2007; Skogstad et al., 2015). Previous studies that employ the PCL have proposed several different thresholds for probable PTSD, including: a total score of 34 (Bliese et al., 2008), 44 (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996), 50 (Weathers & Ford, 1996), or *DSM-IV* criteria plus a total score of 50 or greater (Brewin, 2005). Because the borderline-stable trajectory had a total score less than 40 at nearly every data point, a relatively large proportion of our sample was found to experience substantial PTSS that would not meet criteria for probable PTSD. In addition, persons with PTSS severity below diagnostic criteria have higher rates of disability (Cukor, Wyka, Jayasinghe, & Difede, 2010; Marshall et al., 2001), comorbidity (Cukor et al., 2010; Marshall et al., 2001), and suicidality (Jakupcak et al., 2011; Marshall et al., 2001) than persons with no symptoms, providing clues about an ideal prevention strategy. Specifically, as earlier studies have shown that persons with PTSS severity below diagnostic criteria are no more likely to use mental health services than persons with no PTSD (Grubaugh et al., 2005), the ideal prevention strategy must move from the clinic into the field. It is possible that persons with subthreshold PTSD might be more likely to utilize community-based services than those offered in traditional clinic settings. Community-based interventions for subthreshold PTSD could focus on bolstering social support networks, given that social support has been linked to less symptoms of psychopathology such as distress and posttraumatic stress following a traumatic event experience (Lowe, Chan, & Rhodes, 2010; Smith et al., 2013).

The cumulative number of deployment-related traumatic events was the most consistent predictor of PTSS trajectory membership, such that there were about twice the odds of being in the preexisting-chronic trajectory compared to the low-consistent trajectory with each additional deployment-related traumatic event in both trauma groups. Several studies have shown that an increasing number of cumulative deployment-related traumatic events are associated with an increased likelihood of PTSD (Gallaway, Fink, Millikan, Mitchell, & Bell, 2013; Hoge et al., 2004). However, it remains less clear whether the cumulative number of events or specific types of events explains this dose-response relationship between the number of deployment-related traumatic events and PTSS. That is, a higher number of events could increase the likelihood that a specific high-risk event occurred. For example, Gallaway et al. (Gallaway et al., 2014) employed a structural equation model to this question and found that some traumatic events, such as active combat exposures (e.g., “Direct fire at the enemy”, “Responsible for the death of enemy combatant”), were protective of PTSS, whereas other passive exposures (e.g., "Attached or ambushed," "Received incoming fire") and recalcitrant exposures (e.g., "Know someone seriously injured/killed," "Saw ill or injured women or children") were associated with a higher likelihood of PTSS. Therefore, another approach to investigating the sources of heterogeneity across PTSS trajectory studies is to explore whether the type of traumatic event each respondent experienced, in addition to the context of the traumatic event, induces specific trajectories.

Finally, in both types of traumatic events, military rank was associated with PTSS trajectory; specifically we found that the odds of being in the preexisting-chronic trajectory, compared to the low-consistent trajectory, were 20- and 10-fold greater for senior enlisted personnel (i.e., E4-E9) than officers in the civilian and deployment-related trauma groups, respectively. Senior enlisted personnel, similar to officers, generally have a substantial responsibility for the well-being of junior enlisted service members, yet lack the influence over policy and resources available to officers. Under the job demands-resources model (Bakker & Demerouti, 2007), personnel who have high demands and minimal control in their work environment are hypothesized to be at greater risk of developing psychopathology. Because evidence suggests that performance feedback and social support may buffer this effect (Cohen & Wills, 1985), military specific interventions that increase these buffers should be considered to ameliorate such effects.

Our study findings should be interpreted in the context of five limitations. First, although we analyzed data from a nationally representative sample of U.S. Reserve and National Guard service members, future studies should examine active-duty service members and reservists, as well as service members from different nations, to examine generalizability in military service members. In addition, civilian- and deployment-related traumatic events represent two of potentially several different trauma contexts, with additional contexts including emergency and disaster relief efforts. Second, our analytical sample was limited to study respondents who had experienced both a civilian and a deployment-related traumatic event. As such, our analytical sample exhibited some differences in demographic characteristics than the overall study sample; a finding which was to be expected given all respondents included in our sample had to previously been deployed and prior evidence has found that deployed and non-deployed personnel can differ in some aspects (Jacobson et al., 2008; Smith et al., 2008). Nonetheless, these differences did not alter our study objective to hold the source population constant because, prior to enlistment, all RNG personnel must complete a battery of mental and physical tests to assure fitness for duty. Third, the LCGA approach assumes that homogenous groups exist within the larger heterogeneous population, whereas regression techniques assume that all persons are drawn from a single population with the same growth trajectories. Although these are untestable assumptions, substantial research has documented similar homogenous trajectories, supporting the use of LCGA with its attendant assumptions. Furthermore, we did not include factors that might have occurred over the course of the study during model estimation. Although this was outside the scope of our study, time-varying covariates can be used to both explain within-group variance and improve the posterior probability of trajectory membership. As such, future studies employing growth mixture models should consider the inclusion of time-varying covariates (e.g., mental health service utilization, new potentially traumatic events) to explore their influence on trajectory membership. Finally, we used a self-report inventory, instead of a clinician administered interview, to assess PTSS; however, previous studies have found the PCL and clinician administered PTSD scale (CAPS) to be highly correlated (Blanchard et al., 1996). In addition, respondents completed the two PCLs in the same order throughout the study, such that civilian trauma related symptoms were consistently assessed before deployment related symptoms. Because the two PCLs were not randomly ordered, it is possible that respondents who endorsed both types of traumatic events anchored their PTSS symptoms from their deployment related PTSS to their civilian related PTSS. Future studies that include a PCL for two or more traumatic events should consider randomizing the order that respondents complete each PCL to address this potential for bias.

In conclusion, we found evidence a three-class trajectory model fit that was consistent between deployment-related traumas and civilian traumas among a nationally representative sample of US reservists. This suggests a universal trajectory pattern of PTSS after exposure to traumatic events and that previously observed variability in PTSS trajectories across studies may be best attributed to differences in source population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Financial support: This work was supported by the National Institute of Mental Health (NIMH) (S.G., grant number R01MH082729); National Institute of Drug Abuse (NIDA) (D.S.F., grant number T32DA031099); Department of Defense (S.G., R.J.U., grant numbers W81XWH-08-02-0204, W81XWH-08-2-0650).

References

American Association for Public Opinion Research. Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys. 2011 Retrieved from Lenexa, KS.

American Psychiatric Association. DSM-IV-TR: Diagnostic and statistical manual of mental disorders, text revision. 2000

Armour C, Shevlin M, Elklit A, Mroczek D. A Latent Growth Mixture Modeling Approach to PTSD Symptoms in Rape Victims. Traumatology (Tallahass Fla). 2012; 18(1):20–28. doi: 10.1177/1534765610395627. [PubMed: 22661909]

Bakker AB, Demerouti E. The job demands-resources model: State of the art. Journal of managerial psychology. 2007; 22(3):309–328.

Blanchard EB, Jones-Alexander J, Buckley TC, Forneris CA. Psychometric properties of the PTSD Checklist (PCL). Behaviour Research and Therapy. 1996; 34(8):669–673. [PubMed: 8870294]

Bliese PD, Wright KM, Adler AB, Cabrera O, Castro CA, Hoge CW. Validating the primary care posttraumatic stress disorder screen and the posttraumatic stress disorder checklist with soldiers returning from combat. Journal of Consulting and Clinical Psychology. 2008; 76(2):272–281. doi: 10.1037/0022-006X.76.2.272. [PubMed: 18377123]

Bogat GA, Levendosky AA, von Eye A. The future of research on intimate partner violence: person-oriented and variable-oriented perspectives. American Journal of Community Psychology. 2005; 36(1-2):49–70. doi:10.1007/s10464-005-6232-7. [PubMed: 16134044]

Bonanno GA. Loss, trauma, and human resilience: have we underestimated the human capacity to thrive after extremely aversive events? American Psychologist. 2004; 59(1):20–28. doi: 10.1037/0003-066x.59.1.20. [PubMed: 14736317]

Bonanno GA, Mancini AD. Beyond resilience and PTSD: Mapping the heterogeneity of responses to potential trauma. Psychological Trauma: Theory, Research, Practice, and Policy. 2012; 4(1):74–83. doi:10.1037/a0017829.

Bonanno GA, Mancini AD, Horton JL, Powell TM, Leardmann CA, Boyko EJ, Smith TC. Trajectories of trauma symptoms and resilience in deployed U.S. military service members: prospective cohort study. British Journal of Psychiatry. 2012; 200(4):317–323. doi:10.1192/bjp.bp.111.096552. [PubMed: 22361018]

Breslau N, Kessler RC, Chilcoat HD, Schultz LR, Davis GC, Andreski P. Trauma and posttraumatic stress disorder in the community: the 1996 Detroit Area Survey of Trauma. Archives of General Psychiatry. 1998; 55(7):626–632. [PubMed: 9672053]

Brewin CR. Systematic review of screening instruments for adults at risk of PTSD. Journal of Traumatic Stress. 2005; 18(1):53–62. doi:10.1002/jts.20007. [PubMed: 16281196]

Bryant RA, Nickerson A, Creamer M, O'Donnell M, Forbes D, Galatzer-Levy I, Silove D. Trajectory of post-traumatic stress following traumatic injury: 6-year follow-up. British Journal of Psychiatry. 2015 doi:10.1192/bjp.bp.114.145516.

Cerda M, Richards C, Cohen GH, Calabrese JR, Liberzon I, Tamburrino M, Koenen KC. Civilian stressors associated with alcohol use disorders in the national guard. American Journal of Preventive Medicine. 2014; 47(4):461–466. doi:10.1016/j.amepre.2014.06.015. [PubMed: 25089013]

Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. Psychological Bulletin. 1985; 98(2):310–357. [PubMed: 3901065]

Cukor J, Wyka K, Jayasinghe N, Difede J. The nature and course of subthreshold PTSD. Journal of Anxiety Disorders. 2010; 24(8):918–923. [PubMed: 20655169]

deRoon-Cassini TA, Mancini AD, Rusch MD, Bonanno GA. Psychopathology and resilience following traumatic injury: a latent growth mixture model analysis. Rehabilitation Psychology. 2010; 55(1):1–11. doi:10.1037/a0018601. [PubMed: 20175629]

Fink DS, Galea S. Life Course Epidemiology of Trauma and Related Psychopathology in Civilian Populations. Current Psychiatry Reports. 2015; 17(5):566.

Gahm GA, Lucenko BA, Retzlaff P, Fukuda S. Relative impact of adverse events and screened symptoms of posttraumatic stress disorder and depression among active duty soldiers seeking mental health care. Journal of Clinical Psychology. 2007; 63(3):199–211. doi:10.1002/jclp.20330. [PubMed: 17115432]

Gallaway MS, Fink DS, Millikan AM, Mitchell M, Bell MR. The association between combat exposure and negative behavioral and psychiatric conditions. Journal of Nervous and Mental Disease. 2013; 201(7):572–578. doi:10.1097/NMD.0b013e318298296a. [PubMed: 23817154]

Gallaway MS, Mitchell M, Fink DS, Forys-Donahue K, Pecko J, Bell MR, Millikan AM. Combat Exposure Factors Associated With the Likelihood of Behavioral and Psychiatric Issues. Military Behavioral Health. 2014; 2(2):138–146. doi:10.1080/21635781.2014.897205.

Gray MJ, Litz BT, Hsu JL, Lombardo TW. Psychometric properties of the life events checklist. Assessment. 2004; 11(4):330–341. [PubMed: 15486169]

Grubaugh AL, Magruder KM, Waldrop AE, Elhai JD, Knapp RG, Frueh BC. Subthreshold PTSD in primary care: prevalence, psychiatric disorders, healthcare use, and functional status. Journal of Nervous and Mental Disease. 2005; 193(10):658–664. [PubMed: 16208161]

Harrington T, Newman E. The psychometric utility of two self-report measures of PTSD among women substance users. Addictive Behaviors. 2007; 32(12):2788–2798. doi:10.1016/j.addbeh.2007.04.016. [PubMed: 17507172]

Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL. Combat duty in Iraq and Afghanistan, mental health problems and barriers to care. New England Journal of Medicine. 2004; 351(1):13–22. [PubMed: 15229303]

Husky MM, Lepine JP, Gasquet I, Kovess-Masfety V. Exposure to Traumatic Events and Posttraumatic Stress Disorder in France: Results From the WMH Survey. Journal of Traumatic Stress. 2015; 28(4):275–282. doi:10.1002/jts.22020. [PubMed: 26179388]

Jacobson IG, Ryan MA, Hooper TI, Smith TC, Amoroso PJ, Boyko EJ, Bell NS. Alcohol use and alcohol-related problems before and after military combat deployment. JAMA. 2008; 300(6):663–675. doi:10.1001/jama.300.6.663. [PubMed: 18698065]

Jakupcak M, Hoerster KD, Varra A, Vannoy S, Felker B, Hunt S. Hopelessness and suicidal ideation in Iraq and Afghanistan war veterans reporting subthreshold and threshold posttraumatic stress disorder. The Journal of nervous and mental disease. 2011; 199(4):272–275. [PubMed: 21451353]

Kessler RC, Heeringa SG, Stein MB, Colpe LJ, Fullerton CS, Hwang I, Army, S. C. Thirty-Day Prevalence of DSM-IV Mental Disorders Among Nondeployed Soldiers in the US Army: Results from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS). JAMA Psychiatry. 2014 doi:10.1001/jamapsychiatry.2014.28.

King LA, King DW, Vogt DS, Knight J, Samper RE. Deployment Risk and Resilience Inventory: a collection of measures for studying deployment-related experiences of military personnel and veterans. Military Psychology. 2006; 18(2):89.

Lowe SR, Chan CS, Rhodes JE. Pre-hurricane perceived social support protects against psychological distress: a longitudinal analysis of low-income mothers. Journal of Consulting and Clinical Psychology. 2010; 78(4):551–560. doi:10.1037/a0018317. [PubMed: 20658811]

Marshall RD, Olfson M, Hellman F, Blanco C, Guardino M, Struening EL. Comorbidity, impairment, and suicidality in subthreshold PTSD. American Journal of Psychiatry. 2001; 158(9):1467–1473. [PubMed: 11532733]

Muthen, LK., Muthen, BO. Mplus User's Guide. 7th. Muthen & Muthen; Los Angeles, CA: 1998-2012.

Nagin, DS. Group-based modeling of development. Harvard University Press; Cambridge, MA: 2005.

Norris FH. Epidemiology of trauma: frequency and impact of different potentially traumatic events on different demographic groups. Journal of Consulting and Clinical Psychology. 1992; 60(3):409–418. [PubMed: 1619095]

Norris FH, Tracy M, Galea S. Looking for resilience: understanding the longitudinal trajectories of responses to stress. Social Science and Medicine. 2009; 68(12):2190–2198. doi:10.1016/j.socscimed.2009.03.043. [PubMed: 19403217]

Orcutt HK, Erickson DJ, Wolfe J. The course of PTSD symptoms among Gulf War veterans: a growth mixture modeling approach. Journal of Traumatic Stress. 2004; 17(3):195–202. doi:10.1023/B:JOTS.0000029262.42865.c2. [PubMed: 15253091]

Pietrzak RH, Feder A, Singh R, Schechter CB, Bromet EJ, Katz CL, Southwick SM. Trajectories of PTSD risk and resilience in World Trade Center responders: an 8-year prospective cohort study. Psychological Medicine. 2014; 44(1):205–219. doi:10.1017/s0033291713000597. [PubMed: 23551932]

Pietrzak RH, Van Ness PH, Fried TR, Galea S, Norris FH. Trajectories of posttraumatic stress symptomatology in older persons affected by a large-magnitude disaster. Journal of Psychiatric Research. 2013; 47(4):520–526. doi:10.1016/j.jpsychires.2012.12.005. [PubMed: 23290559]

Polusny MA, Erbes CR, Murdoch M, Arbisi PA, Thuras P, Rath MB. Prospective risk factors for new-onset post-traumatic stress disorder in National Guard soldiers deployed to Iraq. Psychological Medicine. 2011; 41(4):687–698. doi:10.1017/S0033291710002047. [PubMed: 21144108]

Sampson L, Cohen GH, Calabrese JR, Fink DS, Tamburrino M, Liberzon I, Galea S. Mental health over time in a military population: The impact of alcohol misuse on trajectories of psychopathology after deployment. Journal of Traumatic Stress. 2015; 28(6):547–555. doi:doi:10.1002/jts.22055. [PubMed: 26625353]

Skogstad L, Fjetland AM, Ekeberg O. Exposure and posttraumatic stress symptoms among first responders working in proximity to the terror sites in Norway on July 22, 2011 - a cross-sectional study. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2015; 23(1):23. doi:10.1186/s13049-015-0104-4.

Smith BN, Vaughn RA, Vogt D, King DW, King LA, Shipherd JC. Main and interactive effects of social support in predicting mental health symptoms in men and women following military stressor exposure. Anxiety Stress Coping. 2013; 26(1):52–69. doi:10.1080/10615806.2011.634001. [PubMed: 22098413]

Smith TC, Ryan MA, Wingard DL, Slymen DJ, Sallis JF, Kritz-Silverstein D. New onset and persistent symptoms of post-traumatic stress disorder self reported after deployment and combat exposures: prospective population based US military cohort study. BMJ. 2008; 336(7640):366–371. doi: 10.1136/bmj.39430.638241.AE. [PubMed: 18198395]

Steenkamp MM, Dickstein BD, Salters-Pedneault K, Hofmann SG, Litz BT. Trajectories of PTSD symptoms following sexual assault: is resilience the modal outcome? Journal of Traumatic Stress. 2012; 25(4):469–474. doi:10.1002/jts.21718. [PubMed: 22807251]

Van Loey NE, van de Schoot R, Faber AW. Posttraumatic stress symptoms after exposure to two fire disasters: comparative study. PloS One. 2012; 7(7):e41532. doi:10.1371/journal.pone.0041532. [PubMed: 22911810]

Walsh K, Koenen KC, Cohen GH, Ursano R, Gifford RK, Fullerton CS, Galea S. Sexual violence and mental health symptoms among National Guard and Reserve soldiers. Journal of General Internal Medicine. 2014; 29(1):104–109. [PubMed: 23918158]

Weathers, FW., Ford, J. Psychometric review of the PTSD checklist. In: Stamm, BH., editor. Measurement of stress, trauma, and adaptation. Sidran Press; Lutherville, MD: 1996. p. 250-251.

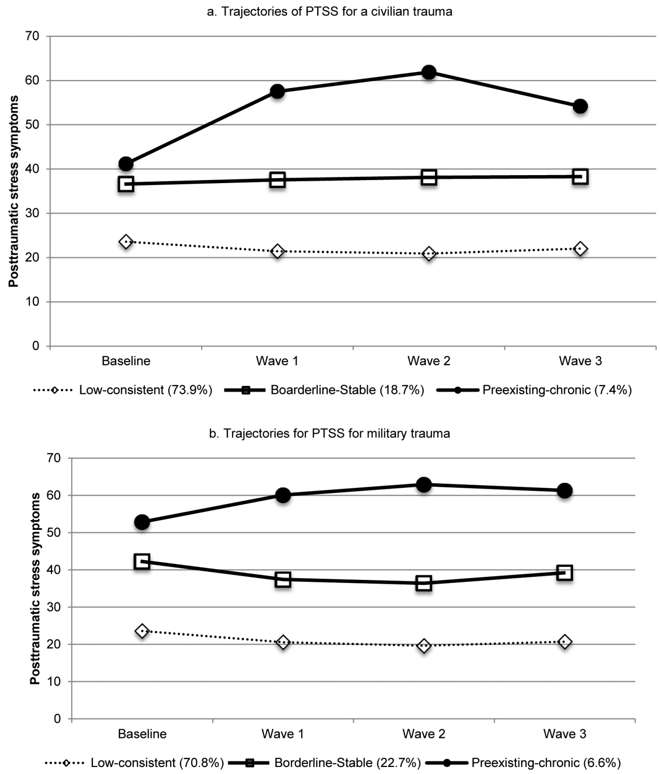

Figure 1.

Trajectories of posttraumatic stress symptoms (PTSS) over time for Reserve and National Guard service members exposed to a civilian or deployment trauma. a: Trajectories of PTSS for a civilian trauma; b: Trajectories for PTSS for military trauma.

Table 1

Means and Standard Deviations of PTSS severity by Trauma Type

	Civilian-related trauma		Deployment-related trauma	
Measure	**Mean**	**SD**	**Mean**	**SD**
PTSS				
Wave 1	27.45	11.72	30.02	14.47
Wave 2	26.79	12.43	26.34	12.52
Wave 3	26.96	12.89	26.11	13.06
Wave 4	27.02	13.63	26.99	13.90

Note. PTSS = posttraumatic stress symptoms; SD = standard deviation.

Table 2

Fit indices for One to Five Class Latent Class Growth Models for PTSS Class

Cohort	Classes	AIC[a]	BIC[a]	Entropy	aLMR-LRT	Lowest posterior probability
Civilian	1	18566.45	18612.53			
	2	17.653.17	17717.68	.92	$p < .01$	.92
	3	17392.58	17475.53	.89	$p < .01$	.88
	4	17240.93	17342.30	.88	$p = .07$	.70
	5	17138.26	17258.26	.89	$p = .27$	.66
Military	1	18417.41	18463.49			
	2	17332.34	17396.85	.91	$p < .01$	.91
	3	16914.43	16997.37	.92	$p = .02$	.92
	4	16748.92	16850.29	.90	$p = .42$	.85
	5	16669.83	16789.64	.89	$p = .08$	.78

Note. PTSS, posttraumatic stress symptoms; AIC, Akaike information criterion; BIC, Bayesian information criterion; aLMR-LRT, adjusted Lo Mendel Rubin Likelihood Ratio test

[a]Lower is better

Table 3

Baseline Predictors by Trajectory Membership

	Civilian Trauma Model						Military Trauma Model					
	Borderline-stable *v.* Low consistent		**Pre-existing chronic *v.* Low consistent**		**Borderline-stable *v.* Pre-existing chronic**		**Borderline-stable *v.* Low consistent**		**Pre-existing chronic *v.* Low consistent**		**Borderline-stable *v.* Pre-existing chronic**	
Variable	**aOR**	**95% CI**	**aOR**	**95% CI**	**aOR**	**95% CI**	**aOR**	**95% CI**	**aOR**	**95% CI**	**aOR**	**95% CI**
Male *v.* Female	0.71	0.41-1.23	0.88	0.34-2.29	1.24	0.45-3.40	1.05	0.60-1.83	1.14	0.42-3.09	1.09	0.38-3.10
Age, years	1.01	0.99-1.04	1.03	0.99-1.07	1.02	0.98-1.06	1.01	0.99-1.04	1.02	0.98-1.06	1.01	0.97-1.05
Minority *v.* white	1.35	0.86-2.14	1.81	0.90-3.65	1.34	0.63-2.84	1.26	0.82-1.96	1.25	0.60-2.57	0.99	0.46-2.12
Never married *v.* Married	1.00	0.59-1.69	0.37	0.12-1.09	0.37	0.12-1.16	1.51	0.93-2.46	0.52	0.19-1.40	0.34	0.12-0.96
Previously married *v.* Married	1.29	0.70-2.36	1.37	0.57-3.29	1.07	0.42-2.73	1.29	0.71-2.34	1.07	0.44-2.61	0.83	0.32-2.14
≤$20,000 *v.* >$80,001	1.28	0.53-3.13	1.45	0.37-5.60	1.13	0.27-4.80	0.66	0.28-1.60	0.71	0.17-2.96	1.06	0.23-4.87
$20,001-$40,000 *v.* >$80,001	1.11	0.57-2.15	0.44	0.14-1.38	0.39	0.12-1.35	1.14	0.61-2.13	0.79	0.28-2.27	0.70	0.23-2.11
$40,001-$60,000 *v.* >$80,001	0.95	0.52-1.75	0.84	0.34-2.08	0.89	0.33-2.39	0.80	0.44-1.43	0.68	0.27-1.76	0.86	0.31-2.38
$60,001-$80,000 *v.* >$80,001	0.51	0.26-1.01	0.24*	0.07-0.83	0.48	0.13-1.79	0.66	0.36-1.20	0.46	0.16-1.34	0.70	0.22-2.20
E1-E3 *v.* Officer	1.64	0.48-5.59					3.08*	1.04-9.11				
E4-E9 *v.* Officer	1.74*	1.00-3.03	19.54***	3.87-98.55	11.21**	2.13-58.99	1.61	0.96-2.68	9.89***	2.62-37.30	6.16**	1.57-24.16
Cumulative civilian stressors	1.12*	1.02-1.23	1.05	0.90-1.22	0.94	0.80-1.11	1.06	0.97-1.16	1.17*	1.01-1.36	1.10	0.94-1.29
Cumulative deployment stressors	1.33***	1.12-1.57	2.00***	1.58-2.52	1.50***	1.18-1.91	1.42***	1.21-1.66	2.05***	1.63-2.58	1.45**	1.15-1.82

Note. aOR = adjusted odds ratio; CI = confidence interval.

* $p < .05$.

** $p < .01$.

*** $p < .001$.