Published in final edited form as:

J Trauma Stress. 2014 June ; 27(3): 249–256. doi:10.1002/jts.21914.

Prospective Trajectories of Posttraumatic Stress in College Women Following a Campus Mass Shooting

Holly K. Orcutt[1], **George A. Bonanno**[2], **Susan M. Hannan**[1], and **Lynsey R. Miron**[1]

[1]Northern Illinois University, Department of Psychology, DeKalb, Illinois, USA

[2]Teachers College, Department of Counseling and Clinical Psychology, Columbia University, New York, New York, USA

Abstract

In a sample with known levels of pre-shooting posttraumatic stress (PTS) symptoms, we examined the impact of a campus mass shooting on trajectories of PTS in the 31 months following the shooting using latent growth mixture modeling. Female students completed 7 waves of a longitudinal study (sample sizes ranged from 812 to 559). We identified 4 distinct trajectories (n = 660): (a) minimal impact-resilience (60.9%), (b) high impact-recovery (29.1%), (c) moderate impact-moderate symptoms (8.2%), and (d) chronic dysfunction (1.8%). Individuals in each trajectory class remained or returned to pre-shooting levels of PTS approximately 6 months post-shooting. The minimal impact-resilience class reported less prior trauma exposure (η^2 = .13), less shooting exposure (η^2 = .07), and greater emotion regulation skills than all other classes (η^2 > .30). The chronic dysfunction class endorsed higher rates of experiential avoidance prior to the shooting than the minimal impact-resilient and high impact-recovery classes (η^2 = .15), as well as greater shooting exposure than the recovery class (η^2 = .07). Findings suggest that pre-shooting functioning and emotion regulation distinguish between those who experience prolonged distress following mass violence and those who gradually recover.

In the past two decades, there have been increasing incidents of targeted mass violence (Drysdale, Modzeleski, & Simons, 2010), with growing implications for individuals and communities. Such aversive and unpredicted events are typically distressing for those exposed. Investigation on the aftermath of such events, however, has demonstrated that individuals exhibit drastically diverse reactions that often fluctuate over time (Bonanno, 2004).

Empirical approaches to trauma reactions have historically focused on posttraumatic stress disorder (PTSD) diagnostic status, or on average-level analyses of continuous measures of trauma-related adjustment (e.g., posttraumatic stress [PTS]). These approaches are limited, as they fail to capture the heterogeneity of trauma reactions over time (Bonanno, Westphal & Mancini, 2011). In the past decade, however, researchers have begun to model trajectories of post trauma adjustment. Similar sets of trajectories have been observed following exposure to an array of traumatic events (see Bonanno & Diminich, 2013, for review), and

---

Correspondence should be addressed to Holly K. Orcutt, Department of Psychology, NIU, DeKalb, IL 60115. horcutt@niu.edu.

in college student samples more specifically (Galatzer-Levy, Burton, & Bonanno, 2012). Characterizing trajectories following a campus mass shooting would help establish whether response distributions differ from those examined previously.

Some recent studies have employed sophisticated statistical methods, such as latent growth mixture modeling (LGMM), that explicitly assume heterogeneity (Muthén, 2004). LGMM determines the best fitting trajectory models by identifying naturally occurring distributions of distress, resilience, recovery, and change present in the data, as well as predictive factors informing those trajectories. LGMM has been used to identify discrete PTSD symptom trajectories in a variety of samples exposed to traumatic events (e.g., Bonanno, Kennedy, Galatzer-Levy, Lude, & Elfström, 2012a; Bonnano et al., 2012b; Galatzer-Levy, Madan, Neylan, Henn-Haase, & Marmar, 2011). The most common outcome has been a resilience trajectory or minimal impact-resilience, characterized by transient distress, sometimes lasting several weeks, and an otherwise stable pattern of healthy functioning (Bonanno & Diminich, 2013). Also evident is a trajectory of gradual recovery, characterized by an initial period of elevated symptoms followed by a gradual return to pre-event functioning. Other trajectories observed include delayed dysfunction and chronic dysfunction. These patterns are impossible to identify without data on pre-event adjustment.

Despite these methodological advances, preliminary assessment of psychological functioning has typically occurred during or shortly after a traumatic event. Predisaster symptomatology is rarely available and, as a consequence, trajectory models may fail to capture the full range of outcome patterns. Many pre-trauma factors are implicated in the development of PTSD, such as previous traumatic experiences and pre-existing PTS (Cougle, Resnick, & Kilpatrick, 2009; Suliman et al., 2009).

LGMM has not yet been applied to data from a campus mass shooting. In a unique dataset with known levels of pretrauma functioning, we used LGMM to examine trajectories of PTS pre- and post-shooting. On February 14, 2008 a gunman opened fire on the campus of Northern Illinois University (NIU) in a lecture hall; six were killed and 21 were injured. At the time of the incident, a sample of undergraduate women was enrolled in a longitudinal study and had provided extensive data on known risk factors for PTS. These women were recruited to participate in a 30-month longitudinal study examining adjustment post-shooting.

We hypothesized that several distinct response trajectories would emerge, with the most common being a trajectory of minimal impact-resilience, or a pattern of positive adjustment over time with little or no lasting impact on functioning post-shooting (Bonanno & Diminich, 2013). We anticipated that several pre- and post-shooting factors would predict trajectory membership, including: race/ethnicity, age, perceived social support, proximal exposure to the shooting, responses to emotional experiences, and extent of pre-shooting exposure to traumatic events.

We anticipated that social support would predict positive outcomes (Bonanno, Brewin, Kaniasty, & La Greca, 2010), with higher levels of perceived social support associated with a resilient trajectory. With regard to exposure, prior research reveals that higher proximal exposure to traumatic events is associated with greater PTS (Bonanno et al., 2010) and with reduced symptom improvement over time (Hobfoll, Mancini, Hall, Canetti, & Bonanno, 2011). Therefore, we predicted that higher proximal exposure to the mass shooting would be associated with a chronic dysfunction trajectory.

Evidence suggests that inflexible emotional responses following traumatic events may be predictive of higher levels of PTS (Marx & Sloan, 2005). Experiential avoidance and three subscales from the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) were assessed. Experiential avoidance (i.e., discomfort with negative private events [e.g., emotions, thoughts, bodily sensations] and steps taken to avoid the events; Hayes, Wilson, Gilford, Follette, & Strosahl, 1996) has been associated with greater PTS (Marx & Sloan, 2005).

Flexibility in emotion regulation predicted reduced distress in college students following the 9/11 attacks in New York, while inflexible emotion regulation was associated with increased distress 2 years later (Bonanno, Papa, Lalande, Westphal, & Coifman, 2004; Westphal, Seivert, & Bonanno, 2010). Similarly, the ability to flexibly move between multiple coping behaviors predicted greater resiliency in college students exposed to a traumatic event, as well as an increased ability to manage stressors associated with college (Galatzer-Levy et al., 2012). Inflexibility suggests deficits in several components of emotion regulation, including insensitivity to context, lack of regulatory strategies, and failure to monitor feedback about the success or failure of one's emotional reactions (Westphal et al., 2010). Three subscales from the DERS were selected as most representative of inflexibility. Inflexible emotion regulation was hypothesized as less likely to be associated with a resilient trajectory.

Lastly, the number of traumatic events reported before the campus mass shooting was included as a potential predictor. This pre-trauma factor has been shown to contribute to subsequent PTS (Suliman et al., 2009), and lower prior exposure to traumatic events was hypothesized to be more likely to associated with a resilient trajectory.

Method

Participants and Procedure

Data were collected from women who completed seven waves of a Northern Illinois University IRB-approved longitudinal study. Between August 2006 and February 14, 2008, Introductory Psychology students received partial course credit for completing an initial assessment for a longitudinal investigation of risk factors for sexual revictimization (T1; pre-shooting; n = 1,045 with n = 885 participants consenting to follow-up contact). Potential participants were required to be 18 years of age or older and fluent in English; previous trauma history was not an exclusion criteria. T1 measures were computer administered in 1-hour individual sessions following informed consent (i.e., informed consent was read aloud to participant who provided signature and was given an unsigned copy for her records). On February 14, 2008 a gunman opened fire on the campus of Northern Illinois University (NIU) in a lecture hall; six were killed and 21 were injured. Women previously enrolled in the longitudinal investigation of sexual revictimization were recruited to participate in a 30-month longitudinal study examining adjustment post-shooting.

Seventeen days following the shooting, all eligible participants determined to be current NIU students (*n* = 812 of 885) were invited via email to the Time 2 (T2) post-shooting online survey with the option of $40 compensation or course credit. Of the 812 eligible participants, 691 completed the approximately 30-minute T2 survey (85.1%; 689 participants are included in the unconditional growth model and, due to missing data, 660 participants are included in the final conditional model). The average time elapsed between the shooting and T2 completion was 27 days (*SD* = 12), and 80.0% of the sample completed within 40 days. Times 3 (T3) through 7 (T7) were completed at 6-month intervals following the shooting. Similar to T2, participants had the option of receiving $40 compensation and the surveys took approximately 30–40 minutes to complete. Participant number and response rate for time point 3 was 588, 85.1%; for time point 4 was 591, 85.5%; for time point 5 was 586, 84.8%; for time point 6 was 578, 83.7%; and for time point 7 was 559, 80.9%. For time points 2 through 7, participants read the informed consent at the start of the survey and selected the "I agree to participate" option to continue.

The average age of participants was 20.0 years (*SD* = 2.6) at T2. Of T2 survey completers (*N* = 691), 68.9 self-identified as White, 20.1% as Black, 3.0% as Asian, and 6.7% as "Other", with 1.3% failing to provide information. With regard to ethnicity, 7.0% of participants endorsed a separate item self-identifying as Hispanic/Latina.

Measures

Race, age, pre-shooting trauma exposure, and experiential avoidance were assessed at T1. Shooting exposure, emotional regulation, and mass shooting social support were assessed at T2. PTSS was assessed at each time point (T1 through T7). Participants also completed additional questionnaires as part of the larger study that are not reported here.

Trauma exposure was assessed at T1 using the Traumatic Life Events Questionnaire (TLEQ; Kubany et al., 2000a). The TLEQ is a 22-item measure that assesses exposure to a broad range of traumatic events. The TLEQ has demonstrated strong convergent validity with other trauma measures and test-retest reliability (Kubany et al., 2000a). To assess trauma exposure pre-shooting, items endorsed at T1 as having ever occurred were summed to create a count variable ranging from 0 to 22. To reduce kurtosis, scores were truncated at 12, lowering scores for 4 participants who received scores of 13, 13, 14, and 20.

Symptoms of PTSD were assessed at each time point via the Distressing Events Questionnaire (DEQ; Kubany, Leisen, Kaplan, & Kelly, 2000b). The DEQ is a 17-item self-report measure for assessing *DSM-IV-TR* (2000) PTSD criteria. Items are rated on a 5-point scale from 0= *Absent or did not occur* to 4 = *Present to an extreme or severe degree*. Internal consistency for raw items at T1 through T7 was acceptable (α's range from .91 to .93). Symptoms endorsed at a 2 = *Present to a moderate degree* or higher were counted as present in a count variable with a range of 0 to 17. The DEQ was administered at all time points. For T1, the referent event was participant's most distressing traumatic event and for T2-T7, the referent event was the NIU shooting.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Experiential avoidance was assessed at T1 using a 7-item self-report measure (Acceptance and Action Questionnaire – II [AAQ-II; Bond et al., 2011]) administered at T1–T7. Items are rated on scale of 1 = *Never true* to 7 = *Always true*. The AAQ-II has demonstrated good psychometric properties (Bond et al., 2011) and internal consistency at T1 was acceptable (α = .84).

Emotion regulation was assessed at T2 using the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004), which is a 36-item self-report measure. Instructions were modified to specifically reference the mass shooting at NIU. Only three of the six subscales were included in the analyses (e.g., lack of clarity of emotional responses, non-acceptance of emotional responses, and limited access to emotion regulation strategies perceived as effective). Responses for each item ranged from 1 = *Almost never* (0–10%) to 5 = *Almost always* (91–100%). Internal consistency was adequate (α = .84).

In order to assess mass shooting social support at T2, participants rated the item, "To what extent were you satisfied with the support available to you following the mass shooting at NIU on February 14, 2008," using a 5-point scale (0 = *Not at all* to 5 = *Extremely*). In addition, exposure to the mass shooting was assessed using the Physical Exposure to Mass Shooting self-report measure. The Physical Exposure to Mass Shooting measure at T2 contains 12 dichotomous items adapted from a Virginia Tech shooting measure (Littleton, Grills-Taquechel, & Axsom, 2009). A dichotomous score was created (0 = *None*; 1 = *Any*) reflecting endorsement of five items reflecting close proximity and severe exposure to the shooting (e.g., "Did you see the gunman fire upon anyone?", "Were you hurt in the shooting?").

Data Analysis

We employed LGMM using Mplus 6.1 software to identify discrete PTS growth trajectories (classes) and to test predictors of class membership. LGMM assumes and treats error as independent (McArdle & Nesselroade, 2003), utilizes a robust full-information maximum-likelihood (FIML) estimation procedure for handling missing data, and assumes missing data are missing at random.

Each assessment (T1 to T7) was obtained at approximately 30-week intervals (*M*s from 22.87 to 31.03). The T1-to-T2 interval showed the greatest variability, which was accommodated in the growth models by allowing the time score for the slope growth parameter for T2 PTSD to freely vary while fixing the time scores for the slope growth parameter at all other time points in a linear fashion.

We initially examined unconditional models (i.e., no covariates) for the overall sample (a) with an intercept parameter (no growth), (b) with intercept and slope parameters (linear growth), and (c) intercept, slope, and quadratic parameters (nonlinear growth). Next, as recommended, to determine the appropriate unconditional class solution, we examined the Aikaike (AIC), Bayesian, (BIC), and sample-size adjusted Bayesian (SSBIC) information criterion indices, the Vuong-Lo-Mendell-Rubin likelihood ratio test (VLMR) the Lo-Mendell-Rubin adjusted likelihood ratio test (adjusted LRT), and parametric bootstrapped likelihood ratio test (BLRT) for differences between models (Lo, Mendell, & Rubin, 2001;

Nylund, Asparouhov, & Muthen, 2007). We sought a model with lower values for the criterion indices, and significant *p* values for the LMR, BLRT, and adjusted LRT. We also explored random and fixed effects for these models. After determining the final unconditional model, multinomial logistic regression analyses were nested within the LGMM to examine predictors of class membership. Finally, to further illustrate between-class differences, posterior class assignments were exported from MPlus to SPSS and utilized as the independent variable in a series of ANOVAS with planned comparisons conducted on the main study variables.

Results

With regard to unconditional models, the linear model provided the best fit. In addition, the best fitting models had the intercept variances unconstrained (random effects) and the slope variance fixed. Fit indices are presented in Table 1. Each of the information criterion indices indicated lower values (improved fit) as classes were added to the model. The adjusted LRT and VLMR indices were significant for the 4-class model but not the 5-class model. The BLRT remained significant through the 5-class model, however, the best log likelihood was not replicated in a majority of bootstrap draws, even with increased random starts, indicating that this model was untrustworthy. The 5-class model also lacked parsimony and was theoretically uninformative because it split one class into two parallel classes. Accordingly, we selected the 4-class solution as the optimal model based on conventional fit indices and substantive considerations (e.g., interpretability, parsimony). The average posterior probabilities for the 4-class model ranged from .85 to .94.

The 4-class unconditional solution identified four distinct trajectories of PTS symptoms from T1 to T7. Strikingly, although most of the classes evidenced a clear increase in symptoms at T2, the increase did not persist beyond T2 in any of the classes. By T3, each class was at or very close to the level of PTS they had evidenced at pre-shooting baseline. A majority of the sample (65.2%) was classified into the Minimal Impact-Resilience class which was characterized by a trajectory with very little PTS at all measurement points except immediately following the shooting (T2), when mean PTS increased slightly. The next most common class, High Impact-Recovery (25.0%) was characterized by a trajectory with a slightly higher level of PTS prior to the shooting, a dramatic increase after the shooting (T2), followed by an equally dramatic decrease in symptoms by T3 and a continued, gradual decrease in symptoms thereafter. The third class, Moderate Impact-Moderate Symptoms (7.9%) was characterized by a trajectory of moderately high PTS at each measurement point except immediately following the shooting (T2), when PTS increased moderately. Finally, a fourth class, Chronic Dysfunction (1.8%) was characterized by a trajectory of approximately 12 PTS symptoms at each measurement point. This class showed no increase and even decreased slightly in symptoms immediately after the shooting.

We next conducted a series of nested analyses on the 4-class solution to examine possible variables predicting class membership. The T1 to T2 interval was explored as a time-varying covariate, but was not retained due to nonsignificance. The shooting-to-T2 interval was explored and was retained, as T2 PTS significantly decreased as duration between the shooting and T2 increased (critical ratio = −2.44, $p = .015$).

Finally, race, T2 age, shooting exposure, prior trauma exposure, DERS emotional clarity subscale, DERS non-acceptance subscale, DERS limited access to effective emotion regulation strategies subscale, T1 experiential avoidance, and T2 perception of available social support were tested as predictors of class membership in multinomial logistic regression analyses nested within the LGMM. DERS non-acceptance subscale and social support were not retained due to nonsignificance. Because FIML procedures cannot be employed to estimate missing covariate data, the sample size for the conditional model was reduced ($n = 660$), primarily due to race/ethnicity. The structure and proportion of the 4-class solution in the conditional model were similar to the unconditional solution (see Figure 1 for conditional model), with a slight reduction in the peak response for the high impact-recovery class. There was also a modest change in the proportions for two of the four classes in the conditional model, primarily due to reduction in minimal impact-resilience class (65.20% unconditional to 60.91% conditional) and increase in high impact-recovery class (25.04% unconditional vs. 29.10% conditional).

Logistic regression analyses for predictors of class membership are summarized in Table 2. Additionally, descriptive statistics and ANOVA planned comparisons of main study variables by trajectory class are provided in Table 3. The most robust differences emerged between the minimal impact-resilience class and all other classes. Compared to the resilient class, women assigned to the three other classes reported more prior trauma exposure, greater shooting exposure, greater difficulty on the DERS emotional clarity subscale, and greater difficulty on the DERS access to emotion regulation strategies subscale. Significant differences also occurred between the chronic dysfunction class and the minimal impact-resilience and high impact-recovery classes. Participants in the chronic dysfunction class endorsed higher levels of pre-shooting EA compared to those in both the resilient and recovery classes. Participants in the chronic dysfunction class also reported greater shooting exposure than the high impact-recovery class. Differences related to demographic variables also emerged, with significantly more participants in the recovery class identifying as non-Hispanic white than the moderate impact-moderate symptoms class. In addition, participants in the recovery class were older than those in both the resilience and moderate impact-moderate symptoms classes.

Discussion

We sought to establish unique trajectories of PTS symptomatology in a sample of undergraduate women following a campus mass shooting, and to identify predictors associated with trajectory membership. Reactions to the shooting were assessed prospectively in a unique dataset with known levels of pre-shooting functioning. Four distinct trajectories of PTS were identified: minimal impact-resilience, high impact-recovery, moderate impact-moderate symptoms, and chronic dysfunction. Consistent with previous research (e.g., Bonanno & Diminich, 2013), minimal impact-resilience emerged as the most prevalent post-trauma outcome, and was characterized by relatively low PTS at all measurement points except for a discrete, slight peak directly following the event. The high impact-recovery class was the next most common trajectory, and described those with slightly higher levels of PTS at baseline, a dramatic increase in symptoms immediately following the event, an equally dramatic decrease in symptoms six months post-shooting, and then a gradual decrease in PTS thereafter. Participants assigned to the moderate impact-moderate symptoms trajectory evidenced moderately high PTS at baseline, a moderate, discrete peak in symptoms immediately following the event, and a modest decrease in symptoms over time. A small number of participants were characterized by chronically elevated PTS across all time points.

The classes identified are similar to those observed in previous studies of targeted mass violence (e.g., Bonanno et al., 2005) and convey that trauma-exposed individuals exhibit heterogeneous reactions that fluctuate over time (Bonanno et al., 2011). Extending previous trajectory studies, the present study included measurement of pre-shooting functioning. Without data on pre-shooting adjustment it would not be possible to accurately map the stable pre- to post-shooting patterns characterized by the chronic dysfunction and resilient classes, to distinguish the different magnitudes of impact across classes, or to observe the key finding that all classes had returned to baseline adjustment within in a relatively proscribed period of time.

The most robust between-class differences emerged between the minimal impact-resilience class and the other trajectories. In line with previous trajectory research, less difficulty accessing emotion regulation strategies (as assessed by the DERS lack of effective emotion regulation strategies subscale) and less difficulty knowing and being clear about emotions that are being experienced (as assessed by the DERS emotional clarity subscale) also appeared to be protective factors against increased PTS (Bonanno et al., 2004). The minimal impact-resilience class reported less shooting exposure compared to the high impact-recovery, moderate impact-moderate symptoms, and chronic dysfunction classes; again consistent with previous research (e.g., Bonanno et al., 2010). Yet this finding does not suggest that resilient individuals were not exposed to potential trauma, only that reduced exposure increases the likelihood of a stable low distress outcome.

Social support did not predict membership in any of the four classes. While perceived social support has been consistently positively associated with better post trauma adjustment (Bonanno et al., 2011), research on received social support has demonstrated mixed results (e.g., Morgan, Matthews, & Winton, 1995). Based on the single item administered, it is difficult to determine whether the question was pertaining to perceived or received social support.

Members of the high impact-recovery class also reported lower levels of experiential avoidance compared to those who fell within the chronic dysfunction class. Compared to the resilient class, individuals in the other classes also reported significantly higher levels on the DERS lack of clarity of emotional responses subscale and DERS limited access to emotion regulation strategies subscale. Results corroborate prior research indicating that inflexible emotional responses following traumatic events may be predictive of greater PTS (Marx & Sloan, 2005). Individuals who took steps to avoid negative internal experiences prior to the shooting may be more likely to continue utilizing this strategy post-shooting compared to individuals who report greater coping flexibility, potentially contributing to unremitting distress. With regard to interventions following mass shootings, it may be beneficial to emphasize flexible emotion regulation strategies as well as the likelihood of resilience.

Prototypical patterns of adjustment following trauma typically include a single recovery class (Bonanno, 2004), although more recent research has noted a distinction between marked and moderate recovery patterns (Steenkamp, Dickstein, Salters-Pedneault, Hofmann, & Litz, 2012). In the present sample, two classes characteristic of recovery emerged: high impact-recovery and moderate impact-moderate symptoms. While resilient classes are typically marked by low exposure to traumatic events, a pattern of gradual decrease in PTS for individuals grouped in moderate or elevated trauma exposure classes has been observed in prior research (Dickstein, Suvak, Litz, & Adler, 2010). Despite reporting similarly elevated levels of PTS immediately post-shooting, the high impact-recovery and moderate impact-moderate symptoms classes appear to differ in their relative speed of improvement. While participants in both classes returned to baseline levels by T3, the recovery class continued to evidence reduced PTS over time. As such, additional research is needed to determine factors (e.g., posttraumatic growth) distinguishing between recovery classes. Observed differences in reported PTS between the two classes also highlights the impact of pre-shooting functioning on recovery, as the moderate impact-moderate symptoms class had higher rates of PTS at baseline.

The current study has key strengths compared to extant research. Particularly, the use of LGMM with multi-wave PTS data, including pre-shooting measurement, allows for more encompassing, reliable, and valid exploration of longitudinal data. This is the first published research investigating the added role of pre-shooting functioning and coping style on symptom trajectories following exposure to mass violence, thus increasing confidence in determining the true nature of post-trauma adjustment.

The present study has several limitations. First, because conditional analyses with covariates cannot accommodate missing data, the sample size for the conditional model was slightly reduced. Second, we utilized a sample of undergraduate women, limiting generalizability to other samples. Additional research is needed as existing research investigating potential gender differences related to PTSD symptom trajectories in adult samples exposed to violence is mixed, with some authors reporting that women were more likely than men to fall into non-resilient or severe-chronic trajectories (Hobfoll et al., 2011), and others finding no significant effect of gender on trajectory class membership (Bonanno et al., 2005; Galatzer-Levy et al., 2011). Third, data were obtained exclusively through self-report measures, which can result in response and presentation biases. Fourth, because analyses were focused solely on PTS symptomatology, it is possible that we failed to capture other forms of post-shooting dysfunction. Fifth, several potentially meaningful predictors were not included in this study, most notably variables related to personality. Research has demonstrated that pre-trauma personality variables, such as low negative affectivity and trait self-enhancement, may play a predictive role in resilient outcomes (Bonanno & Diminich, 2013).

Despite these limitations, the current study reveals important data on prospective trajectories of resiliency and dysfunction in a sample of women exposed to a campus mass shooting. Consistent with previous research, the majority of women demonstrated resilient psychological functioning after exposure to targeted mass violence. While further research focused on a more generalizable sample utilizing varied predictors (e.g., personality variables) is needed, our findings suggest that pre-trauma functioning and coping styles are important factors in distinguishing between those who experience prolonged distress following trauma exposure and those who follow a course of recovery.

Acknowledgments

We express our gratitude to the research participants for their contributions to this work. This research was funded by grants from the Joyce Foundation, the National Institute for Child and Human Development (1R15HD049907-01A1), and the National Institute of Mental Health (5R21MH085436-02).

References

Bonanno GA. Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely adverse events? American Psychologist. 2004; 59:20–28. [PubMed: 14736317]

Bonanno GA, Brewin CR, Kaniasty K, La Greca AM. Weighing the cost of disaster consequences, risks, and resilience in individuals, families, and communities. Psychological Science in the Public Interest. 2010; 11:1–49.

Bonanno GA, Diminich ED. Positive adjustment to adversity: Trajectories of minimal-impact resilience and emergent resilience. Journal of Child Psychology and Psychiatry. 2013; 54:378–401. [PubMed: 23215790]

Bonanno GA, Kennedy P, Galatzer-Levy IR, Lude P, Elfström ML. Trajectories of resilience, depression, and anxiety following spinal cord injury. Rehabilitation Psychology. 2012a; 57:236–247. [PubMed: 22946611]

Bonanno GA, Mancini AD, Horton JL, Powell TM, LeardMann CA, Boyko EJ, Smith TC. Trajectories of trauma symptoms and resilience in deployed US military service members: Prospective cohort study. The British Journal of Psychiatry. 2012b; 200:317–323. [PubMed: 22361018]

Bonanno GA, Papa A, Lalande K, Westphal M, Coifman K. The importance of being flexible: The ability to both enhance and suppress emotional expression predicts long-term adjustment. Psychological Science. 2004; 15:482–487. [PubMed: 15200633]

Bonanno GA, Rennicke C, Dekel S. Self-enhancement among high-exposure survivors of the September 11th terrorist attack: Resilience or social maladjustment? Journal of Personality and Social Psychology. 2005; 88:984–998. [PubMed: 15982117]

Bonanno GA, Westphal M, Mancini AD. Resilience to loss and potential trauma. Annual Review of Clinical Psychology. 2011; 7:511–535.

Bond FW, Hayes SC, Baer RA, Carpenter KM, Guenole N, Orcutt HK, Zettle RD. Preliminary psychometric properties of the Acceptance and Action Questionnaire–II: A revised measure of psychological inflexibility and experiential avoidance. Behavior Therapy. 2011; 42:676–688. [PubMed: 22035996]

Cougle JR, Resnick H, Kilpatrick DG. A prospective examination of PTSD symptoms as risk factors for subsequent exposure to potentially traumatic events among women. Journal of Abnormal Psychology. 2009; 118:405–411. [PubMed: 19413414]

Dickstein BD, Suvak M, Litz BT, Adler AB. Heterogeneity in the course of posttraumatic stress disorder: trajectories of symptomatology. Journal of Traumatic Stress. 2010; 23:331–9. [PubMed: 20564365]

Drysdale, D.; Modzeleski, W.; Simons, A. Campus Attacks: Targeted Violence Affecting Institutions of Higher Education. Washington, DC: U.S. Secret Service, U.S. Department of Homeland

Security, Office of Safe and Drug-Free Schools, U.S. Department of Education, and Federal Bureau of Investigation, U.S. Department of Justice; 2010. 2010.

Galatzer-Levy IR, Burton CL, Bonanno GA. Coping flexibility, potentially traumatic life events, and resilience: A prospective study of college student adjustment. Journal of Social and Clinical Psychology. 2012; 31:542–567.

Galatzer-Lezy IR, Madan A, Neylan TC, Henn-Haase C, Marmar CR. Peritraumatic and trait dissociation differentiate police officers with resilient versus symptomatic trajectories of posttraumatic stress symptoms. Journal of Traumatic Stress. 2011; 24:557–565. [PubMed: 21898602]

Gratz KL, Roemer L. Multidimensional assessment of emotion regulation and dysregulation: Developmental, factor structure, and initial validation of the Difficulties in Emotion Regulation Scale. Journal of Psychopathology and Behavioral Assessment. 2004; 36:41–54.

Hayes SC, Wilson KG, Gilford EV, Follette VM, Strosahl K. Experiential avoidance and behavioral disorders: A functional dimensional approach to diagnosis and treatment. Journal of Consulting and Clinical Psychology. 1996; 64:1152–1168. [PubMed: 8991302]

Hobfoll SE, Mancini AD, Hall BJ, Canetti D, Bonanno GA. The limits of resilience: Distress following chronic political violence among Palestinians. Social Science and Medicine. 2011; 72:1400–1408. [PubMed: 21440348]

Kubany ES, Haynes SN, Leisen MB, Owens JA, Kaplan AS, Watson SB, Burns K. Development and preliminary validation of a brief broad-spectrum measure of trauma exposure: The Traumatic Life Events Questionnaire. Psychological Assessment. 2000a; 12:210–224. [PubMed: 10887767]

Kubany ES, Leisen MB, Kaplan AS, Kelly MP. Validation of a brief measure of posttraumatic stress disorder: The Distressing Event Questionnaire (DEQ). Psychological Assessment. 2000b; 12:197. [PubMed: 10887766]

Littleton HL, Grills-Taquechel AE, Axsom D. Resource loss as a predictor of posttrauma symptoms among college women following the mass shooting at Virginia Tech. Violence and Victims. 2009; 24:669–686. [PubMed: 19852406]

Lo Y, Mendell NR, Rubin DB. Testing the number of components in a normal mixture. Biometrika. 2001; 88:767–778.

Marx BP, Sloan DM. Peritraumatic dissociation and experiential avoidance as predictors of posttraumatic stress symptomatology. Behavior Research and Therapy. 2005; 43:569–583.

McArdle, JJ.; Nesselroade, JR. Growth curve analysis in contemporary research. In: Schnika, JA.; Velicer, WF.; Weiner, IB., editors. Handbook of Psychology: Research Methods in Psychology. Hoboken, NJ: Wiley; 2003. p. 447-480.

Morgan I, Matthews G, Winton M. Coping and personality as predictors of post-traumatic intrusions, numbing, avoidance, and general distress: A study of victims of the Perth flood. Behavioural and Cognitive Psychotherapy. 1995; 23:251–264.

Muthén, B. Latent variable analysis: Growth mixture modeling and related techniques for longitudinal data. In: Kaplen, D., editor. Handbook of quantitative methodology for the social sciences. Newbury Park, CA: Sage Publications; 2004. p. 345-368.

Nylund KL, Asparouhov T, Muthen B. Deciding on the number of classes in latent class analysis and growth mixture modeling. A Monte Carlo simulation study. Structural Equation Modeling. 2007; 14:535–569.

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; 25:469–74. [PubMed: 22807251]

Suliman S, Mkabile SG, Fincham DS, Ahmed R, Stein DJ, Seedat S. Cumulative effect of multiple trauma on symptoms of posttraumatic stress disorder, anxiety, and depression in adolescents. Comprehensive Psychiatry. 2009; 50:121–127. [PubMed: 19216888]

Westphal M, Seivert NH, Bonanno GA. Expressive flexibility. Emotion. 2010; 10:92–100. [PubMed: 20141306]

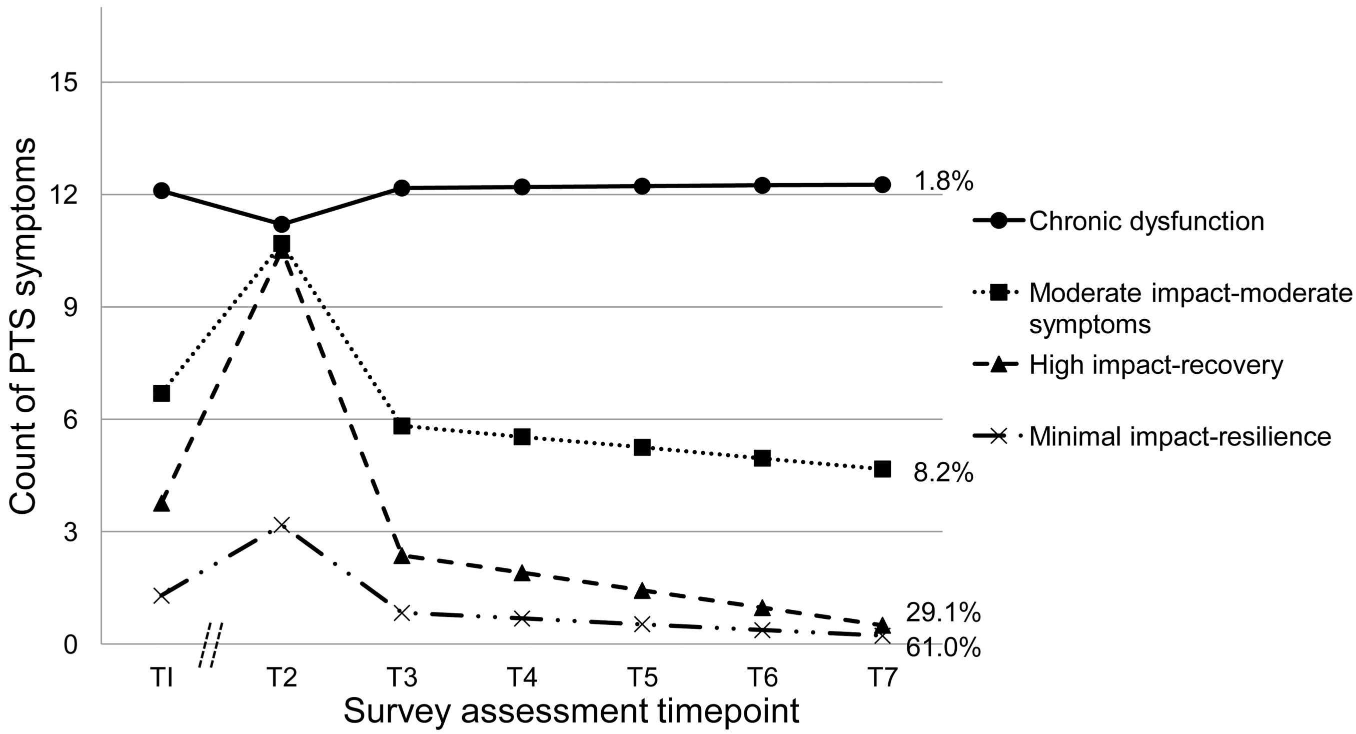

Figure 1.

Conditional four class model of posttraumatic stress (PTS) symptoms over seven time points in 660 undergraduate women exposed to a campus mass shooting. Break in x-axis to indicate variable time interval.

Table 1

Fit Indices for Two- to Five-Class Growth Mixture Models for PTSD Symptoms (Unconditional)

	Classes			
Index	**2**	**3**	**4**	**5**
AIC	19505.5	19290.5	19143.4	19028.8
BIC	19569.0	19367.6	19234.1	19133.1
SSBIC	19524.5	19313.6	19170.6	19060.1
BLRT *P*	<.001	<.001	<.001	<.001
Entropy	.97	.95	.84	.86
VLMR *P*	.06	.03	.02	.63
Adjusted LRT *P*	.07	.04	.02	.63

Note. *n* = 689. PTSD = posttraumatic stress disorder; AIC = Aikaike information criterion; BIC = Bayesian information criterion; SSBIC = sample size adjusted Bayesian information criterion; BLRT = parametric bootstrapped likelihood ratio test; VLMR = Vuong-Lo-Mendell-Rubin likelihood ratio test; adjusted LRT = adjusted Likelihood Ratio Test; *P* = probability.

Table 2

Results from the Multinomial Logistic Regressions Predicting Class Membership

	MI-R vs.						CD vs.				HI-R vs.	
	HI-R		MI-MS		CD		MI-MS		HI-R		MI-MS	
Variable	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***	**Est.**	***SE***
Race	0.54	0.39	−0.76	0.41	0.00	1.10	−0.77	1.11	0.53	1.08	−1.30	0.45*
Age	0.09	0.04*	−0.29	0.18	0.08	0.20	−0.37	0.27	0.01	0.20	−0.37	0.19*
Prior trauma	0.31	0.07***	0.35	0.09***	0.36	0.11**	−0.02	0.11	−0.06	0.10	0.04	0.08
T1 EA	0.13	0.20	0.48	0.24	1.23	0.46***	−0.75	0.49	−1.09	0.41**	0.34	0.22
Shooting exposure	1.82	0.60**	2.02	0.73**	3.92	0.99***	−1.90	1.03	−2.10	0.84*	0.21	0.58
T2 strategies	1.07	0.30***	0.91	0.33**	1.54	0.52**	−0.63	0.54	−0.47	0.45	−0.16	0.25
T2 clarity	1.21	0.23***	1.68	0.39***	1.84	0.43***	−0.16	0.41	−0.64	0.38	0.48	0.32

Note. $n = 660$. Model is estimated with shooting-to-T2 interval included as a time-varying covariate; Est = Estimate; *SE* = Standard error (Est divided by SE is equivalent to a *t* score and indicates the significance of the effect).

Race = White and Non-Hispanic versus all others; Prior trauma = count of prior exposure to potentially traumatic events reported at T1; MI-R = minimal impact-resilience; HIR = high impact-recovery; MI-MS = moderate impact-moderate symptoms; CD = chronic dysfunction; T1 = Time 1; T2 = Time 2; Age = age in weeks at T2; EA = experiential avoidance; strategies = T2 Difficulties in Emotion Regulation Scale - Limited Access to Strategies for Regulation subscale; clarity = T2 Difficulties in Emotion Regulation Scale - Lack of Emotional Clarity subscale

* $p < .05$.

** $p < .01$.

*** $p < .001$

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Table 3

ANOVA and Pairwise Comparisons of Main Study Variables by Trajectory Class

		Total sample		Trajectory Class: MI-R		HI-R		MI-MS		CD		
Variable	*n*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	η^2
Race	660	.69	.46	$.67_a$	.47	$.76_b$	.43	$.52_c$	.51	$.73_{abc}$	.47	$.02^{**}$
Age	660	20.02	2.59	19.98_a	2.65	20.26_a	2.81	19.46_a	0.93	19.92_a	1.12	.01
Prior trauma	660	2.92	2.51	2.22_a	2.12	3.98_b	2.70	4.16_b	2.68	5.36_{bc}	2.50	$.13^{***}$
T1 EA	660	2.49	1.09	2.19_a	0.95	2.87_b	1.08	3.18_b	1.16	4.21_c	1.23	$.15^{***}$
Shooting exposure	660	.08	.27	$.03_a$	.18	$.13_b$	.34	$.14_c$	.35	$.46_c$	.52	$.07^{***}$
Time interval	660	3.68	2.39	3.81_a	2.44	3.36_b	2.18	3.58_b	2.60	4.73_b	2.41	.01
T2 strategies	660	1.95	0.82	1.61_a	0.59	2.46_b	0.79	2.48_c	0.89	3.34_c	0.74	$.68^{***}$
T2 clarity	660	2.35	0.93	1.95_a	0.73	2.95_b	0.83	3.18_{bc}	0.88	3.44_c	0.72	$.32^{***}$
T1 PTS	620	2.72	3.67	1.44_a	2.51	4.07_b	3.74	6.41_c	4.77	10.18_d	5.14	$.26^{***}$
T2 PTS	654	6.14	4.81	3.23_a	2.72	10.98_{bc}	3.03	10.04_c	4.59	12.66_c	5.01	$.60^{***}$
T3 PTS	562	1.90	3.02	0.69_a	3.02	2.57_b	2.61	6.93_c	4.40	11.50_d	3.24	$.51^{***}$
T4 PTS	562	1.53	2.76	0.58_a	1.18	1.87_b	2.12	6.16_c	4.46	12.38_d	2.20	$.52^{***}$
T5 PTS	558	1.19	2.63	0.46_a	1.25	1.39_b	2.35	5.05_c	4.40	11.67_d	5.01	$.39^{***}$
T6 PTS	551	0.97	2.21	0.39_a	0.95	0.79_b	1.20	4.73_c	3.34	12.71_d	3.30	$.61^{***}$
T7 PTS	526	0.90	2.11	0.35_a	0.97	0.76_b	1.15	4.74_c	3.29	12.60_d	4.39	$.58^{***}$

Note. Race = White and Non-Hispanic versus all others; Prior trauma = count of prior exposure to potentially traumatic events reported at T1; Time interval = weeks elapsed between the mass shooting and T2; Means in the Trajectory Class columns with different subscripts differ significantly at $p < .05$.

MI-R = minimal impact-resilience; HIR = high impact-recovery; MI-MS = moderate impact-moderate symptoms; CD = chronic dysfunction T1 = Time 1; T2 = Time 2; T3 = Time 3; T4 = Time 4; T5 = Time 5; T6 = Time 6; T7 = Time 7; Age = age in weeks at T2; EA = experiential avoidance; strategies = T2 Difficulties in Emotion Regulation Scale - Limited Access to Strategies for Regulation subscale; clarity = T2 Difficulties in Emotion Regulation Scale - Lack of Emotional Clarity subscale; PTS = posttraumatic stress.

* $p < .05$.

** $p < .01$.

*** $p < .001$.