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Determining the Different Trajectories of PTSD Symptoms During the Acute Post-Trauma Period

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DETERMINING THE DIFFERENT TRAJECTORIES OF PTSD SYMPTOMS DURING THE ACUTE POST-TRAUMA PERIOD

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ABSTRACT

The majority of adults in the United States will experience a potentially traumatic event (PTE) during their lifetime, yet only a small subset will develop posttraumatic stress disorder (PTSD). There is evidence to suggest that the period of time immediately following the trauma (the acute post-trauma period) may be particularly important in determining which individuals develop PTSD. The current study examined trajectories of PTSD symptom severity across the acute post-trauma period and if membership in these trajectories was predictive of PTSD symptom severity 1- and 3-months post-trauma. Utilizing Latent Class Growth Analysis (LCGA), four trajectories were identified: low and decreasing, moderate and decreasing, moderate-high and consistent, and high and consistent. Further, trajectory membership in the acute post-trauma period was found to predict differences in PTSD symptom severity at both 1- and 3- months post-trauma. Specifically, there were significant differences between 1-month PTSD symptoms for all trajectories, such that the "low and decreasing," "moderate and decreasing," "moderate-high and consistent," and "high and consistent" trajectories were associated with increasing severity of PTSD symptoms, respectively. There were significant differences between 3-month PTSD symptoms for all trajectories except the "moderate-high and consistent" and "high and consistent" trajectories. These findings highlight a relationship between PTSD symptoms during the acute post-trauma period and those that are observed at a later point.

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CHAPTER 1: INTRODUCTION

Posttraumatic Stress Disorder

The majority of adults in the United States (89.7%) have experienced a potentially traumatic event (PTE) in their lifetime (Kilpatrick et al., 2013). Although most individuals recover, a fraction (8.3%) develop Posttraumatic Stress Disorder (PTSD) (Kilpatrick et al., 2013). Despite considerable interest, it remains unclear why some who experience a PTE recover and others develop PTSD. PTSD is considered to be non-recovery following a PTE, and thus, the development of symptoms during the acute post-trauma period, defined as the 30 days post-trauma, may be indicative of this distinction. Determining if different trajectories are present *during this period* would provide insight into which individuals are at elevated risk for PTSD.

Longitudinal Trajectories of PTSD Symptoms. Evidence for the presence of different trajectories of PTSD symptoms following a PTE comes from longitudinal work that tracked symptom progression over months and years post-trauma. One study found that almost half (44.1%) of participants who met diagnostic criteria for PTSD 24 months post-trauma did not meet for full or subthreshold criteria three months following the trauma (Bryant, O'Donnell, Creamer, McFarlane, & Silove, 2013). Further, approximately half of the individuals in this study who met criteria for a PTSD diagnosis at assessments 3, 12, and 24 months post-trauma did not meet the symptom criteria for a diagnosis within days of the trauma (Bryant et al., 2013). These results suggest that symptoms fluctuate considerably over longer periods of time. It is unclear if such changes may be present shortly after a trauma.

Acute Stress Disorder. Initial conceptualizations of PTSD symptom development proposed a highly symptomatic trajectory and a resilient trajectory (Bryant, 2011). To capture these processes, the diagnosis of Acute Stress Disorder (ASD; American Psychiatric Association, 2013) was included in the DSM-IV (American Psychiatric Association, 1994). ASD was posited as a precursor for PTSD and represented the highly symptomatic trajectory (Bryant, 2006). Meeting criteria for ASD, however, does not adequately distinguish between those who do and do not develop PTSD. A review by Bryant (2011) examined the predictability of PTSD from an ASD diagnosis in 22 studies (19 of adults and 3 of children). The majority of the studies with adult participants had low sensitivity, implying that the individuals who met criteria for PTSD at least two months post-trauma did not meet for ASD. Specifically, 11 of the 19 studies of adults had less than 50% of participants who met for both ASD and subsequent PTSD. This finding indicates that persistently elevated symptoms during the acute post-trauma period does not consistently predict PTSD. As such, alternative models are needed.

A Fear Conditioning Model of PTSD

Pavlovian conditioning offers a model for the development and maintenance of PTSD symptoms following a PTE (VanElzakker, Dahlgren, Davis, Dubois, & Shin, 2014). In Pavlovian conditioning, a PTE acts as an unconditioned stimulus (US), and an individual experiences an unconditioned response (UR) (Rothbaum & Davis, 2003). Stimuli associated with the PTE become conditioned stimuli (CS) and thus elicit a conditioned response (CR). A CR may manifest as re-experiencing and hyperarousal symptoms, and sustained CS exposure and CR are posited to form the foundation of

PTSD symptoms (Zoellner, Rothbaum, & Feeny, 2011). For example, an individual who experiences a car accident (US) may exhibit fear responses during and soon after the event, such as hyperarousal symptoms (UR). Reminders of the event such as being in a car (CS) may also elicit these responses at a later time (CR). This individual may then avoid experiences associated with the PTE, thus continuing to have these fear responses when faced with stimuli associated with the PTE.

A review of fear conditioning and PTSD by Rothbaum and Davis (2003) conceptualized PTSD as an inability to extinguish a fear response following trauma. Within this model, those who recover after a PTE extinguish their response to trauma cues. However, individuals who go on to develop PTSD have a persistent response. A study by Norrholm et al. (2011) examined this model using a fear potentiated startle paradigm. Individuals who had PTSD demonstrated greater fear responses than trauma exposed individuals who did not have PTSD. There was considerable variability, however, in the rates of extinction. These differences were associated with the severity of PTSD symptoms in this sample. This association, and variability in the extinction of fear, suggests the process by which PTSD develops may not be uniform. Understanding how such different pathways present may be useful for identifying those at risk for long term PTSD or early intervention.

Symptom Development in the Acute Post-Trauma Period. Understanding symptom change during the acute post-trauma period is important to accurately determine PTSD risk. A meta-analysis of 22 studies conducted by Thomas et al. (2012) examined peritraumatic distress and its relation to the progression of PTSD over time. The authors found that peritraumatic distress and subsequent PTSD were associated

(r_{pooled} = .55), but the strength of correlations between these constructs decreased over time. Physiological acute stress responses can be predictive of future psychopathology. One study (Bryant, Harvey, Guthrie, & Moulds, 2000) was conducted with individuals who were admitted to the hospital following a motor vehicle accident. Increased heart rate at the time of discharge was predictive of PTSD symptoms six months later. These studies reveal that there are factors during the acute post-trauma period which are partially predictive of future PTSD. However, it highlights the need for more frequent assessment of symptoms, as it is unclear how symptoms develop during the acute post-trauma period and if this developmental process leads to symptoms post-trauma.

Research that has examined PTSD symptoms over longitudinal periods of months and years have found that individuals fall into trajectories based on symptom severity. A study conducted by deRoon-Cassini and colleagues (2010) assessed individuals who entered the Emergency Department for a traumatic injury, and followed participants for 1, 3, and 6 months post-trauma. Participants fell into four latent trajectory classes based on their PTSD symptom trajectories: chronic distress (high symptom severity throughout), delayed distress (initially moderate, and then high severity), recovering (initially moderate, and then decreased severity), and low distress (low severity throughout). This adds more evidence to the hypothesis that PTSD symptom severity is highly variable after a trauma. Further, it demonstrates that multiple symptom severity trajectories are present post-trauma. A limitation of the described study is the spacing of assessments, which occurred months after the PTE. Important smaller scale change may occur in the days and weeks post-trauma.

A key question is whether the trajectories observed in these longer-term studies also occur in the acute post-trauma period. One study assessed PTSD symptoms daily in individuals exposed to rocket fire related to the Israeli-Gaza conflict from 15 to 45 days following exposure (Greene et al., 2017). Similar latent classes of symptoms were present during this time. Participants had symptoms that were consistently low, decreasing, consistently moderate, or consistently high. These results provide preliminary evidence that trajectories of PTSD symptoms may be present soon after the PTE. However, this study first assessed symptoms two weeks after the trauma and extended for two weeks past 30 days. Thus, it may have missed important changes that take place shortly following the PTE. Additionally, the symptom progression was monitored during an ongoing conflict as opposed to an event that had ended. The ongoing conflict may have affected the presentation of certain symptoms.

Ecological Momentary Assessment and Measurement of PTSD Symptoms

Further research on the progression of PTSD symptoms after a PTE has been limited by barriers to data collection during this period. It is difficult to measure symptoms regularly after a trauma because of the numerous ongoing issues that individuals who experience trauma face in this period. *In vivo* and experience sampling methods such as Ecological Momentary Assessment (EMA; Shiffman, Stone, & Hufford, 2008) are a potential solution to this problem. Such methods can effectively monitor symptom progress during periods in which participants are difficult to reach. These methods also decrease the potential for retrospective bias and overgeneralization of symptomology. Additionally, daily assessments can capture important fluctuations in symptoms that may be missed by spacing assessments further apart. The use of mobile

technology to collect data is less burdensome than other assessment methods commonly used in psychological research. The majority of individuals in the United States (77% of adults) own a smartphone (Pew Research Center: Internet, Science & Tech, 2018), which can be used to collect EMA data. A recent study examined the feasibility of daily PTSD assessments via mobile phone during the acute post-trauma period (Price et al., 2018). Participants in this study had a response rate of 61.1% across 30 days of daily assessments, and almost a quarter of participants (22.2%) continued to respond to assessments after the 30-day period concluded. Qualitatively, participants reported these assessments to be "moderately helpful and minimally burdensome" (Price et al., 2018, p. 4). These results imply that EMA is an effective tool to assess PTSD symptoms during the acute post-trauma period, in that it is easily accessible, yields modest response rates, and is minimally burdensome. Therefore, mobile devices can be used to monitor symptom progression after a PTE and identify symptom trajectories.

Current Study

The reviewed literature identified latent trajectories of PTSD symptom severity in the months after a traumatic experience. Similar trajectories were found across studies: persistently elevated, persistently low, increasing in severity, or decreasing in severity. However, these studies have examined PTSD trajectories using a handful of assessment time points (< 5) that occurred over several months. To date, no study has examined trends of daily PTSD symptoms across the acute post-trauma period and assessed whether specific profiles are predictive of PTSD. The current study examined the latent trajectories of PTSD symptoms for 30 days following a trauma. This study also examined the relationship between trajectory membership and PTSD symptom severity 1- and 3-

months post-trauma. It was hypothesized that individuals would fall into four latent trajectories: consistently elevated, increasing in severity, consistently low, and decreasing in severity. It was hypothesized that one trajectory will be classified by curvilinear increases. This hypothesis is supported by recent post-trauma research, which demonstrates that trauma symptoms are temporally related. A study by Greene, Gelkopf, Fried, Robinaugh, & Lapid Pickman (2019) used multilevel vector auto-regression to examine PTSD symptoms daily soon after the PTE, and symptoms were associated with next-day symptoms. Thus, it is possible that there are higher order effects present in symptom trajectories. Further, it was hypothesized that trajectories of individuals who experienced consistently elevated or increasingly elevated symptoms will be most predictive of PTSD symptom severity 1- and 3-months post-trauma. Finally, the current study examined whether daily self-reported concerns differed by trajectory group. It was hypothesized that individuals in higher symptom severity trajectories would report more physical and psychological concerns than those in lower trajectories.

CHAPTER 2: METHOD

Participants

Participants were 90 individuals who experienced a criterion A traumatic event and were admitted to the Acute and Critical Care service at a large northeastern university medical center. Table 1 presents the types of trauma experienced. Participants were eligible for the study if they owned a smartphone that ran the iOS or Android operating systems and experienced a criterion A traumatic event. Exclusion criteria included current suicidal ideation, current or recent history of psychosis, being in police custody, non-English speaking, or being in an altered state of mind which prevented giving informed consent. Ages for participants ranged from 19-63 years (M = 35.00, SD = 10.41) and 36.7% of the sample identified as female. The majority of the sample identified as White (88.9%), 4.4% as African American, 1.1% as Asian American, 1.1% as Pacific Islander, 2.2% as American Indian, and 2.2% as Bi-racial. The majority of participants completed high school (95.4%) and 39.9% completed college, and 32.2% reported an annual income of $30,000 or less.

Measures

Standardized Trauma Interview (STI; Foa & Rothbaum, 2001). The STI is a 41-item interview administered by trained research assistants, which assesses details of a participant's traumatic experience. The STI was used in the present study to assess if participants' traumatic experience met Criterion A.

PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013). The original PCL-5 is a 20-item self-report measure which assesses severity of PTSD symptoms in which participants are asked to rate how much they were bothered by their symptoms on a

Likert scale (0 = not at all, 4 = extremely). An 8-item adapted version of the PCL-5 (Price, Szafranski, van Stolk-Cooke, & Gros, 2016) was used in the present study to assess daily PTSD symptom severity to reduce participant burden of the daily mobile assessments. The abbreviated version assesses each of the four PTSD symptom clusters, as well as generates a total severity score. Higher scores indicate greater severity of PTSD symptoms. PTSD symptoms were also assessed 1 and 3 months after the initial trauma using the full PCL-5. PCL-5 scores assessed at 1-month had an internal consistency of 0.93 and PCL-5 scores at 3-months had internal consistency of 0.95.

Daily Concerns. Participants were asked a daily question in their survey assessing their most impairing concern. The question was "What is your biggest concern at the moment?" These concerns were coded into seven domains as determined by Zatzick et al. (2001), which were concerns relating to physical health, psychological, work and finance, social, legal, medical, and uncodable. These concerns were blindly coded and verified by two trained research assistants.

Procedure

Recruitment: Participants were recruited from the Acute and Critical Care Service at a large northeast hospital. Trained research assistants approached participants at bedside $M = 4.88$ days ($SD = 5.22$ days) post-trauma. Participants were instructed to download the mobile application Metricwire (Waterloo, Ontario) for EMA data collection to their smartphone, which was available for free download from the app stores.

Mobile Assessments: Mobile assessments began within 1 week following the trauma and were examined for 34 days post-trauma in the current study. Participants

received one mobile assessment per day in the evening between 7:00 PM and 8:00 PM, which included the 8-item PCL-5 to assess PTSD symptomology for that day and a question regarding their concern for that day. Participants were able to complete the assessment for 10 hours following the initial assessment prompt.

Follow-up Assessments: Participants were contacted via phone by trained research assistants 1 and 3 months following the trauma to complete the full PCL-5, as well as other interviews and self-report measures.

Data Analytic Plan

Data preparation was conducted in R version 3.5.1 (2018). Thirty days of PCL-8 daily total scores were used in these analyses (days 5-34 post-trauma). Daily PTSD symptom severity was aggregated into three-day bins by taking the mean of three sequential days. Aggregation of EMA data is a widely used technique which reduces the amount of missingness that is common with this type of data collection (Shiffman, Stone, & Hufford, 2008). This method of aggregating EMA data over multiple days allowed the maximum number of time points to be utilized while minimizing missing data. In this dataset, daily mobile assessments aggregated over 3 days allowed 76.8% of the sample to contribute data to each bin on average. This resulted in the best trade off of number of measurements and sample representation. This method created 10 data points, which trajectories were derived from.

Latent Class Growth Analysis (LCGA) was used to create trajectories and conducted using Mplus version 7.4 (Muthén & Muthén, 1998-2012). LCGA is an analytic technique that identifies latent trajectories and the probability that individual participants belong to a given trajectory. First, a traditional Latent Class Growth Model

(LCGM) was estimated to examine the assumption of homogeneity in the sample. Thus, if it is violated, it indicates that there are heterogeneous trajectories in the sample. Then, models containing 2-5 classes of trajectories were estimated with linear models without covariates. The best fit model was then estimated with relevant covariates (i.e., age, gender, income). The optimal model was assessed using the Information Criteria (IC) statistics (i.e., Bayesian information criterion indices (BIC), sample-size adjusted Bayesian information criterion indices (SSABIC), Aikake information criterion indices (AIC)), entropy values, Lo-Mendell-Rubin likelihood ratio test (LMR-LRT), and bootstrapped likelihood ratio test (BLRT). Best fit was determined by lower IC statistics, entropy values above .80, and significant ($p < .05$) LMR-LRT and BLRT values. Three participants were not included in these analyses as they did not provide any mobile data. Thus, 87 participants were included in these analyses.

PTSD outcomes were assessed using PCL-5 scores 1- and 3-months post-trauma as distal outcomes. The BCH method was used to determine if there were significant differences in these PCL-5 mean scores between groups (Asparouhov & Muthén, 2014; Vermunt, 2010). The BCH method estimates omnibus differences between means of a continuous distal outcome of all trajectories, and significant differences between means of these individual classes. This method allows individual weights from each participant's class membership to predict these outcomes while preventing the effects of the distal outcome from influencing class memberships.

Daily concerns were examined using One-way ANOVA to assess the effect of category membership on count of concern for each category of concern. Seven ANOVA tests were performed to examine these differences.

CHAPTER 3: RESULTS

Latent Class Growth Model

A simple LCGM was estimated for the data in order to examine heterogeneity between distinct classes. This model did not provide a good fit for the data (χ^2(df) = 105.57(50), $p < .001$; RMSEA (90%) = .113 (.082, .143); CFI/TLI = .936, .943; SRMR = .069). Variances for intercept (28.97, $p < .001$) and slope (.127, $p < .004$) were also significant, implying that there was significant variability between individual participants in change over time.

Latent Class Growth Analysis Models

Linear and quadratic models of two, three, four, and five classes were then estimated. Quadratic terms were consistently not significant, and thus only linear change was examined (Table 2). A five-class model was rejected due to multiple trajectories with small sample sizes (e.g., n < 5) and a higher LMR-LRT than a four-class model. Models with covariates were estimated. Including age as a covariate prevented the model from converging and thus was removed. Fit statistics did not change meaningfully with gender included as a covariate. Though IC statistics were lower when income was included as a covariate, other fit statistics and trajectory membership did not meaningfully change. As a result, covariates were removed for parsimony (Table 3). A four-class model demonstrated the optimal fit for the data compared to a two and three class model. It had the lowest BIC, SSABIC, and AIC, high entropy (.949), a significant BLRT, and the lowest LMR-LRT. Further, models with two and three classes did not consistently converge. Though the LRM-LRT in the four-class model was not significant (.0995), a significant BLRT is a better indicator of goodness of fit that the LMR-LRT (Nylund et

al., 2007). The four-class model estimated a "low and decreasing" class (n = 43; 49.4%), a "moderate and decreasing" class (n = 23; 26.4%), a "consistently moderate-high" class (n = 17; 19.5%), and a "consistently high" class (n = 4; 4.6%) (Table 4, Figure 1).

Distal Outcomes

BCH weights were estimated with PCL-5 scores at 1-and 3-months post-trauma as a distal outcome (Table 5). Omnibus tests demonstrated significant differences between trajectory classes at both 1-month ($\chi^2 = 121.60$, $p < .001$) and 3-months ($\chi^2 = 72.30$, $p < .001$). Individual comparisons of trajectories reveal significant differences between PCL-5 1-month means for all trajectories ($M_{\text{Low/Decreasing}} = 5.77$, $M_{\text{Moderate/Decreasing}} = 21.53$, $M_{\text{Moderate-High/Consistent}} = 32.97$, $M_{\text{High/Consistent}} = 54.37$). Further, comparisons between trajectory classes for 3-month PCL-5 scores reveal significant differences between all trajectory pairs except the consistently moderate-high and consistently high classes ($M_{\text{Low/Decreasing}} = 4.78$, $M_{\text{Moderate/Decreasing}} = 15.34$, $M_{\text{Moderate-High/Consistent}} = 34.46$, $M_{\text{High/Consistent}} = 48.16$). See Table 6 for BCH outcomes.

Daily Concerns

ANOVAs were used to assess differences in number of concerns expressed between trajectory membership for each category of concern. For these analyses, the moderate-high/consistent and high/consistent trajectories were combined, as the high trajectory had a small sample (n = 4). Descriptive statistics of the number of days for each concern are reported in Table 7. Only psychological concerns varied across the groups ($F(2, 84) = 6.17$, $p = .003$). Post-hoc comparisons using the Tukey HSD test revealed that there were significant differences between count of psychological concern days for the low/decreasing ($M = .30$ days, $SD = .86$ days) and moderate/decreasing ($M =$

2.35 days, *SD* = 4.22 days) trajectories and the low/decreasing and combined moderate-high and high/consistent (*M* = 2.38 days, *SD* = 3.22 days) trajectories (Table 8).

CHAPTER 4: DISCUSSION

Summary of Main Findings

The present study examined trajectories of PTSD symptom severity during the first month post-trauma and the association between these trajectories on later PTSD symptoms. Four distinct trajectories of PTSD symptom severity emerged: 1) low and decreasing, 2) moderate and decreasing, 3) consistently moderate-high, and 4) consistently high. Further, these trajectories produced significantly different mean PCL-5 scores 1-month post trauma, such that the "low and decreasing" trajectory was associated with the lowest PCL-5 scores, the "moderate and decreasing" trajectory corresponded to moderate PCL-5 scores, the "moderate-high and consistent" trajectory produced high scores, and the "high and consistent" trajectory was associated with the highest PCL-5 scores. At 3-months post-trauma, there were significant differences between PCL-5 scores for all trajectories except the two highest classes (consistently moderate-high, and consistently high). Further, the "low and decreasing" trajectory was associated with the lowest 3-month PCL-5 scores, and the "moderate and decreasing" trajectory was associated with slightly higher scores than the low class, but still lower than the remaining two classes.

Current Study and Previous Literature. These findings were consistent with previous research examining trajectories of PTSD symptoms post-trauma. A study by deRoon Cassini and colleagues (2010) that was completed over a longer period of time following a trauma found four similar, but not identical, trajectories. When assessed at baseline, 1-, 3-, and 6-months post-trauma, a chronic elevated, delayed, recovering, and consistently low class were found. Thus, the current study may provide further

information to longer longitudinal studies about the acute-post trauma period, specifically. Further, research examining trajectories beginning two weeks after the traumatic experience and assessed daily (Greene et al., 2017) again found similar trajectory classes (e.g., low, reducing, moderate, high). The "low" group in this study may be comparable to the "low and decreasing" trajectory found in the current study. This would imply that the "low and decreasing" group becomes consistently low after a one to two weeks post-trauma, indicating that this low symptom class likely remains low longitudinally.

Implications

The association between trajectory membership and future symptomology suggested that this developmental process is indicative of future pathology. At the 1-month follow-up post-trauma, outcomes of PTSD symptoms were related to membership trajectory, such that the "low and decreasing" and "moderate and decreasing" trajectories predicted lower severity outcomes, and "moderate/high and consistent" and "high and consistent" trajectories were associated with higher outcomes. However, at a 3-month follow-up, lower trajectories remained associated with lower severity of PTSD outcomes, while higher trajectories were not significantly different from each other. This suggested that, as time from trauma increases, those with initially low and moderate symptoms remain lower, while individuals with initially elevated symptoms remain higher. Further, those with initially moderate-high or very high symptoms immediately post-trauma are unlikely to recover and appear to stay at their initial level of symptom severity at 1- and 3- month follow-ups, whereas those with initially low or moderate symptoms will experience some symptom reduction over time. Additionally, the daily concern

differences by trajectory demonstrate that participants who are in the moderate and high trajectories self-report psychological concerns more often than those in the low trajectory. This finding indicated that concerns about one's mental health may be an important indicator of long-term difficulty.

There is also an important distinction between the two middle trajectories. Though the highest and lowest trajectories differed consistently from the time of the trauma through follow-up, the "moderate and decreasing" and "moderate-high and consistent" trajectories were initially very similar. However, they diverged over time. These two trajectories explain why it may be difficult to rely on peritrauma distress alone to predict longer term PTSD. Careful classification of these groups may be necessary to accurately determine risk given their similarity at the initial assessment. Continuous early assessment may make it possible to distinguish these groups.

Research has suggested that post-traumatic stress reactions following a traumatic event are common (Bryant, 2003). One study found that only 23% of individuals who experienced a traumatic injury developed PTSD 12 months post-trauma (Zatzick et al., 2007). The present study had similar findings, in that 24.1% of the sample fell into the two consistently high trajectories. Therefore, it may be particularly important to target those who initially fall into these higher symptom severity ranges for repeated assessment or early intervention.

Limitations

This study had several notable limitations. The sample was recruited from an Acute Care setting. Thus, all participants had an index event that was a traumatic injury, and the majority experienced a motor vehicle accident. Many types of traumatic

experiences are not represented in the sample, such as interpersonal types of trauma (e.g., sexual assault). It is unclear if these results would generalize to other trauma types. Indeed, much of this literature has focused om victims of injury and this narrow focus may bias the field's understanding of symptom development. Further, though this study examined daily symptoms of PTSD using EMA, data was aggregated across multiple days. Though aggregation is a common practice in EMA data analyses, it reduces the amount of info used in the analysis, and thus researches do not obtain daily changes in symptoms. Additionally, the PCL-8 was used for daily assessments rather than the full PCL-5 to reduce burden for participants. However, this reduces the amount of information collected for daily assessments, in that all 20 symptoms of PTSD were not assessed.

Another limitation was the small sample size of the current study. Though the LCGA trajectories provide important information, LCGA assumes homogeneity within class variance, (Wickrama, Lee, O'Neal, & Lorenz, 2016), implying that all members of a class have the same slope. Though analyses such as Growth Mixture Modeling (GMM) do not make these assumptions, they require a large sample size (Wang & Bodner, 2007). Therefore, further study is necessary to confirm the trajectories found in the present study using a larger sample.

Future Directions

The results of the present study in conjunction with other work demonstrate the presence of trajectories of PTSD symptoms during the acute post-trauma period. Future work should extend the assessment period to integrate the acute post-trauma period and the following year. Though the current study provides information regarding outcomes of

acute post-trauma trajectories at 1- and 3- months post-trauma, it is unclear from the current study if trajectory membership predicts PTSD outcomes after this time point. This increased understanding would provide further information about the recovery versus non recovery of individuals after more time has passed post-trauma. Additionally, it would be important to assess the impact of pre-trauma factors, such as previous diagnoses and traumatic experiences, as these may contribute to current symptomology.

Conclusions

The current study provides important information regarding individual development of PTSD symptoms during the acute post-trauma period, and aids in the understanding of recovery versus non-recovery of PTSD symptoms following a traumatic experience. These findings have the potential to aid in the development of a targeted early intervention for PTSD.

Table 1: Type of trauma in the sample (N = 90)

Type of Trauma	Percentage of Sample
Motor vehicle crash or motorcycle crash	50.0%
Assault	1.1%
Recreational accident	12.2%
Work Accident	7.8%
Fall	14.4%
Crush Injury	2.2%
Burn	7.8%
Other	4.4%

Table 2: Fit indices for models with two to five classes

Fit Index	2 Classes	3 Classes	**4 Classes**	5 Classes
Group Size (%)	27 (32.11%)	5 (5.75%)	**4 (4.60%)**	3 (3.45%)
	60 (68.97%)	30 (34.48%)	**17 (19.54%)**	4 (4.60%)
	-	52 (59.77%)	**23 (26.44%)**	16 (18.39%)
	-	-	**43 (49.42%)**	21 (24.14%)
	-	-	**-**	43 (49.42%)
AIC	3572.80	3340.97	**3199.802**	3164.08
BIC	3609.79	33885.36	**3251.59**	3223.26
SSABIC	3562.46	3328.56	**3185.32**	3147.53
Entropy	.941	.959	**.949**	.955
LMR-LRT	.417	.1467	**.0995**	.3360
BLRT	<.001	<.001	**<.001**	<.001

Table 3: Fit indices of quadratic and covariate four class models

	Quadratic	Gender	Age	Income
Group Size (%)	4 (4.60%) 17 (19.54) 23 (26.44%) 43 (49.42%)	4 (4.60%) 19 (21.84) 21 (24.14%) 43 (49.43%)	4 (4.65%) 17 (19.77%) 23 (26.74%) 42 (48.84%)	4 (4.94%) 16 (19.75%) 22 (27.16%) 39 (48.15%)
AIC	3207.80	3192.81	3156.98	2979.03
BIC	3269.45	3251.99	3215.89	3036.49
SSABIC	3190.57	3176.26	3140.17	2960.80
Entropy	.949	.949	.948	.944
LMR-LRT	.0971	.0884	.0963	.0930
BLRT	<.001	<.001	<.001	<.001

Quadratic: Quadratic LCGA model; Gender: Gender as covariate model; Age: Age as covariate model; Income: Income as covariate model

Table 4: Growth Estimates for Trajectory Classes

Class	Intercept (*p*-value)	Slope (*p*-value)
Low/decreasing	2.44 (<.001)	-.213 (<.001)
Moderate/decreasing	8.12 (<.001)	-.295 (.013)
Moderate-High/Consistent	12.21 (<.001)	-.071 (.566)
High/Consistent	23.70 (<.001)	.020 (.955)

Table 5: Mean PCL-5 Scores at 1- and 3-Month Follow-ups

	M	SE
1-Month PCL		
Low/decreasing	5.77	.95
Moderate/decreasing	21.53	2.76
Moderate-High/consistent	32.97	4.25
High/consistent	54.37	5.99
3-Month PCL		
Low/decreasing	4.78	1.00
Moderate/decreasing	15.34	2.53
Moderate-High/consistent	34.46	5.37
High/consistent	48.16	7.51

Table 6: BCH Distal Outcomes for PCL-5 Scores 1- and 3- Month Follow-ups

	χ^2	*p*
1-Month PCL		
Overall	121.60	<.001
4 vs. 2	24.77	<.001
1 vs. 2	27.54	<.001
2 vs. 3	4.86	.027
4 vs. 1	64.11	<.001
4 vs. 3	8.39	.004
1 vs. 3	39.13	<.001
3-Month PCL		
Overall	72.30	<.001
4 vs. 2	17.17	<.001
1 vs. 2	14.16	<.001
2 vs. 3	9.95	.002
4 vs. 1	32.82	<.001
4 vs. 3	2.19	.139
1 vs. 3	29.62	<.001

Trajectories: 1) Low/decreasing, 2) Moderate/decreasing, 3) Moderate-High/consistent, 4) High/consistent

Table 7: Daily concern code descriptive statistics and One-way ANOVA results

Concern	**M**	**SD**	***F***	***p***
Physical Health	13.07	14.45	.611	.545
Psychological	1.34	2.90	6.17	.003
Work/Finance	4.20	6.87	2.44	.093
Social	1.2	3.25	2.14	.124
Legal	.01	.11	.506	.605
Medical	1.1	3.54	.080	.923
Uncodable	3.15	5.61	.200	.820

Table 8: Tukey HSD post-hoc tests for daily psychological concerns

	Mean Difference	*p*
Low/decreasing vs. Moderate/decreasing	2.04	.013
Low/decreasing vs. High/consistent	2.08	.015
Moderate/decreasing vs. High/consistent	.033	.999

Note: High/consistent trajectory combines the Moderate-high/consistent and High/consistent trajectories

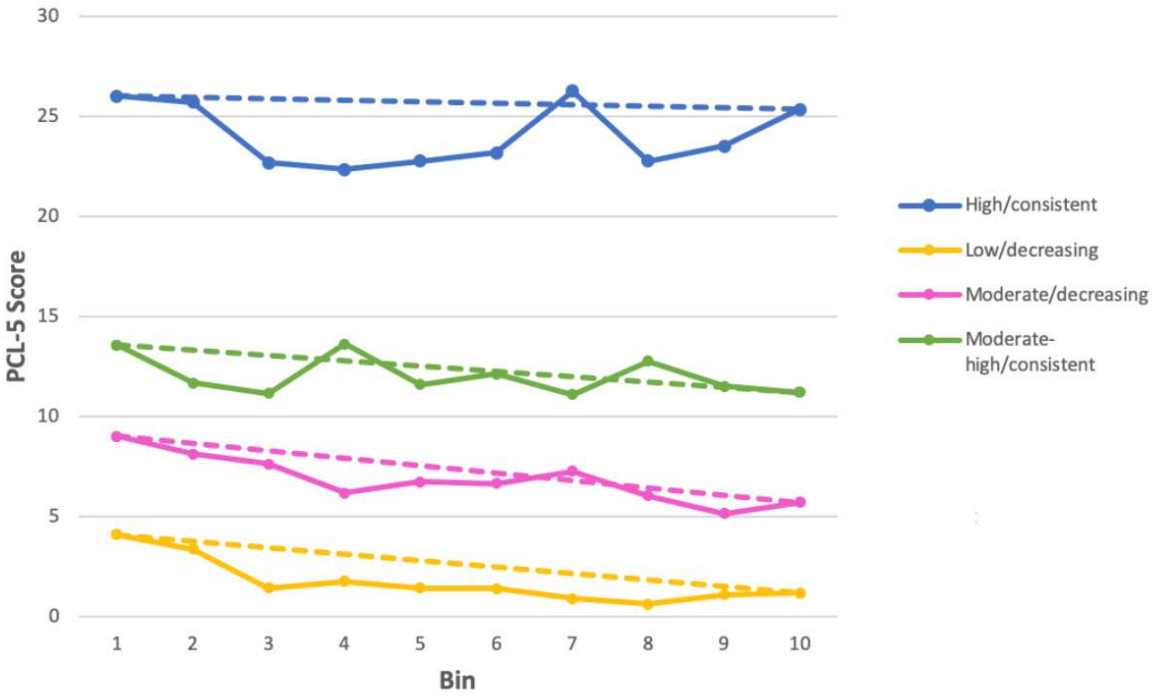

Figure 1: LCGA trajectories across the acute post-trauma period

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APPENDIX A

STI

Instructions to Administrator: Read each question to the participant and circle the response.

Briefly, in 1 or 2 sentences, describe the event that brought you into the hospital?

_____

_____

_____

_____

Did you lose consciousness? Yes No

Did the event occur at day time or night time? Day Night

How long ago did the event occur? (Hours and minutes) _____

How much have you slept since it ended? (Hours and minutes) _____

APPENDIX B

Item in PCL-8	Item in PCL-5	Question
1	**1**	Repeated, disturbing, and unwanted memories of the stressful experience?
2	**4**	Feeling very upset when something reminded you of the stressful experience?
3	**6**	Avoiding memories, thoughts, or feelings related to the stressful experience?
4	**7**	Avoiding external reminders of the stressful experience (for example, people, places, conversations, activities, objects, or situations)?
5	**9**	Having strong negative beliefs about yourself, other people, or the world (for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?
6	**12**	Loss of interest in activities that you used to enjoy?
7	**18**	Feeling jumpy or easily startled?
8	**19**	Having difficulty concentrating?

APPENDIX C

PCL 5

Part 3: Below is a list of problems that people sometimes have in response to a very stressful experience. Keeping the event that brought you to the hospital in mind, please tell me how much you have been bothered by each of the following since leaving the hospital. Please rate each on a scale of 0 to 4 with 0 meaning "Not at all" and 4 meaning "extremely."

Since leaving the hospital, how much were you bothered by:	*Not at all*	*A little bit*	*Moderately*	*Quite a bit*	*Extremely*
1. Repeated, disturbing, and unwanted memories of the stressful experience?	0	1	2	3	4
2. Repeated, disturbing dreams of the stressful experience?	0	1	2	3	4
3. Suddenly feeling or acting as if the stressful experience were actually happening again *(as if you were actually back there reliving it)*?	0	1	2	3	4
4. Feeling very upset when something reminded you of the stressful experience?	0	1	2	3	4
5. Having strong physical reactions when something reminded you of the stressful experience *(for example, heart pounding, trouble breathing, sweating)*?	0	1	2	3	4
6. Avoiding memories, thoughts, or feelings related to the stressful experience?	0	1	2	3	4
7. Avoiding external reminders of the stressful experience *(for example, people, places, conversations, activities, objects, or situations)*?	0	1	2	3	4
8. Trouble remembering important parts of the stressful experience?	0	1	2	3	4
9. Having strong negative beliefs about yourself, other people, or the world *(for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)*?	0	1	2	3	4
10. Blaming yourself or someone else for the stressful experience or what happened after it?	0	1	2	3	4
11. Having strong negative feelings such as fear, horror, anger, guilt, or shame?	0	1	2	3	4
12. Loss of interest in activities that you used to enjoy?	0	1	2	3	4
13. Feeling distant or cut off from other people?	0	1	2	3	4
14. Trouble experiencing positive feelings *(for example, being unable to feel happiness or have loving feelings for people close to you)*?	0	1	2	3	4
15. Irritable behavior, angry outbursts, or acting aggressively?	0	1	2	3	4
16. Taking too many risks or doing things that could cause you harm?	0	1	2	3	4
17. Being “superalert” or watchful or on guard?	0	1	2	3	4
18. Feeling jumpy or easily startled?	0	1	2	3	4
19. Having difficulty concentrating?	0	1	2	3	4
20. Trouble falling or staying asleep?	0	1	2	3	4