



# Severity of traumatic injuries predicting psychological outcomes: A surprising lack of empirical evidence



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## ARTICLE INFO

### Keywords:

PTSD  
Trauma  
Severity  
Depression  
Injury

## ABSTRACT

Despite widespread beliefs that trauma severity is related to levels of posttraumatic stress symptoms (PTSS), the empirical evidence to support such beliefs is lacking. In the current study we examined Injury Severity Score (ISS), a medical measure of event severity for physical injuries, in a sample of 460 patients admitted to a Level 1 Trauma Center. Results revealed no significant relationship between ISS and PTSS, depression, pain, and general physical and mental health at baseline, three months, and six months post-injury. However, at 12 months post-injury, ISS significantly predicted depression, pain, and physical health, but was unrelated to PTSS. The effect sizes of these relationships were small and would not remain significant if any adjustments for multiple comparisons were employed. We conclude that the relationship between ISS and PTSS is, at best, weak and inconsistent. The results are discussed in the broader picture of event severity and psychological outcomes.

## 1. Introduction

A central question in the area of trauma research is whether the severity of a stressful event affects subsequent levels of posttraumatic stress symptoms (PTSS). Common sense suggests that a teenager who goes through a stressful romantic breakup may experience some psychological difficulties in the short term aftermath, but this adverse response should be markedly blunted when compared to someone who experiences a life-threatening traumatic event such as a violent sexual assault or serious physical injury. Surprisingly, the empirical evidence to support this notion has been mixed. Although some studies have found that traumatic events are associated with higher levels of PTSS than stressful, but non-traumatic events, a number of these studies find that this difference disappears when controlling for factors such as psychological distress (Lancaster, Melka, & Rodriguez, 2009) or emotional reactions (Boals & Schuettler, 2009). Further, some studies that have found no differences in levels of PTSS between non-traumatic and traumatic events (Bodkin, Pope, Detke, & Hudson, 2007; Rubin & Feeling, 2013). Some studies have even found that non-traumatic events elicited *higher* levels of PTSS than traumatic events (Gold, Marx, Soler-Baillo, & Sloan, 2005). The lack of a difference in PTSS between traumatic and non-traumatic events has also been found when controlling for the type of trauma. One study examined PTSS in victims of childhood sexual abuse and classified the abuse as either low, medium, or high severity, based on who the perpetrator was

and number of occurrences of abuse (McNally & Robinaugh, 2011). The results revealed no significant differences in mean levels of PTSS based on severity of the abuse. In summary, the empirical evidence suggests stressful, but non-traumatic events result in levels of PTSS similar to the levels produced by traumatic events.

At the heart of this issue is event severity. Some studies have made reasonable assumptions that some events (e.g. violent sexual assaults) are more severe than others (e.g., motor vehicle collisions; Breslau, Troost, Bohnert, & Luo, 2013). Some researchers have attempted to measure event severity by having neutral observers rate the severity of the event. Rubin and Feeling (2013) used three different measures in which neutral observers rated the severity of stressful events experienced by others. All three measures of severity were highly correlated with each other, suggesting that perceptions of severity by outside observers is a unitary concept. However, none of the neutral observers' ratings significantly correlated with PTSS. This result was found in both undergraduate and clinical samples. An alternative method for measuring event severity is to use some objective criterion. Attempts to use a more objective measurement include distance from the epicenter of an earthquake (Berntsen & Rubin, 2008), amount of damage experienced by a natural disaster (Fivush, Sales, Goldberg, Bahrack, & Parker, 2004), and level of combat exposure (Jordan et al., 2009). These studies typically find significant positive relationships between severity of the event and PTSS. This differential pattern of results depending on how

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event severity was measured raises interesting questions about the role event severity plays (or does not play) in subsequent PTSS. As an extreme example, having to deal with a rude customer is less likely to result in PTSS than a violent sexual assault.

One method for more objectively assessing event severity is to examine individuals who have sustained a traumatic physical injury. The severity of a physical injury is similar to the aforementioned more objective attempts at measuring severity, such as distance from the epicenter of an earthquake. Psychological traumas such as assaults likely vary greatly in severity due to individual differences in psychological reactions to the event. Examining physical injuries has an advantage in that there is a medically validated measure of event severity, the Injury Severity Score (ISS; [Association for the Advancement of Automotive Medicine, 1990](#)). ISSs are associated with increased risk for mortality and length of hospitalization ([Baker, O'Neill, & Long, 1974](#)). Subjective ratings of event severity are generally uncorrelated with ISS ([Delahanty, Raimonde, Spoonster, & Cullado, 2003](#); [Bryant & Harvey, 1995](#)).

Despite the standardized nature of the ISS as a measure of event severity, and its ability to predict mortality and physical recovery, studies that have examined the relationship between ISS and PTSS have produced somewhat mixed findings. The majority of such studies have found no relationship between these two variables ([Fujita & Nishida, 2008](#); [Haagsma et al., 2012](#); [Quale, Schanke, Frøslie, & Røise, 2009](#); [Bryant & Harvey, 1995](#); [Richmond, Kauder, Hinkle, & Shults, 2003](#)). However, two known studies found a positive relationship ([Blanchard, Jones-Alexander, Buckley, & Forneris, 1996](#); [Sandweiss et al., 2013](#)) and two known studies actually found a negative relationship between ISS and PTSS ([French et al., 2012](#); [Delahanty et al., 2003](#)). One limitation of these studies is most were cross-sectional. Only four known studies employed a longitudinal design, underscoring a need for more longitudinal studies in this area.

In the current paper we examined the relationship between ISS and PTSS in a sample of patients who were admitted to a Level 1 Trauma Center for a traumatic physical injury. Of the four known longitudinal studies of ISS and PTSS, two studies did not include a follow-up until one or more years post-injury ([Sandweiss et al., 2013](#); [Haagsma et al., 2012](#)) and the other two only included one follow-up during the first year post-injury ([Fujita & Nishida, 2008](#); [Richmond et al., 2003](#)). Part of the reason for the mixed results involving the relationship between ISS and PTSS may be due to timing. Traumatic events may have a strong effect on psychological outcomes in the short-term, regardless of event severity, leading to no relationship between event severity and psychological outcomes. But only the more severe events continue to affect psychological outcomes in the longer-term, leading to positive relationships between event severity and psychological outcomes. The very small number of existing longitudinal studies has produced mixed findings for this possible timing effect. We employed a longitudinal design in which participants were assessed four times in the year following injury – after 24 h of hospital admission (baseline), and at three, six, and 12 months post-injury. In addition to PTSS, we included multiple outcome measures, including depression, pain, general physical health, and general mental health. We hypothesized that ISS would be related to psychological outcomes when measured in the longer-term (12 months post-injury), but not in the shorter-term (baseline, three, and six months post-injury).

## 2. Methods

### 2.1. Participants

The data for this study is from the Baylor Trauma Outcome Project (BTOP), an ongoing longitudinal study of patients admitted to a large, urban Level 1 Trauma Center in the Southwest United States that admits approximately 2500 patients annually. Approval from the hospital's Institutional Review Board was obtained prior to enrolling subjects. Potential participants were 18 years and older, admitted to the

trauma service for  $\geq 24$  h, spoke either English or Spanish, and could provide at least one contact number for followup. Patients with traumatic brain injury and/or premonitory cognitive deficits (e.g., dementia, Alzheimer's disease) that impaired their ability to provide informed consent were excluded from the study. These individuals were identified through the trauma service admission list and twice-weekly trauma rounds as well as review of the medical record. Patients who met criteria to be included were approached 24 h after admission and before hospital discharge by trained clinical research assistants for consent and data collection.

Participants were included if they completed all measures included in this study at baseline (see Measures section below). Demographic and injury-related information was obtained from the hospital's trauma registry and self-report during baseline enrollment. A total of 460 (302 male) participants completed all required measures at baseline. The mean age was 43.89 ( $SD = 16.83$ ) with a range of 18–92. The racial composition was 311 Non-Hispanic White (68%), 112 Non-Hispanic Black (26%), 19 Hispanic White (4%), 3 Hispanic Black (1%), 2 Hispanic Other (1%), and 6 unobtainable (1%). Participation was voluntary and participants received no monetary compensation.

### 2.2. Measures

#### 2.2.1. Severity of injury

The severity of the traumatic injury was measured using the Injury Severity Scale (ISS; [Association for the Advancement of Automotive Medicine, 1990](#)). The ISS is an established medical score of anatomic injury severity and is used to assess physical trauma severity. To calculate ISS, you first calculate an AIS (Abbreviated Injury Scale) score for six regions of the body, which include the head or neck (including spine), face, chest, abdomen or pelvic contents, extremities, and external. AIS scores vary from 1 (minor) to 6 (currently unsurvivable). You then identify the three highest AIS scores from the single highest AIS score from each region (i.e., multiple AIS scores from the same region are not used, only the highest one), square them, and sum them together. The possible range of scores is 0–75. If any AIS score is 6 (unsurvivable), the score is automatically set to 75. Any score on the ISS over 0 indicates trauma but a score of 16 or higher indicates “major trauma”.

#### 2.2.2. Posttraumatic stress disorder symptoms (PTSS)

We included two measures of PTSS. The first measure was the Primary Care PTSD (PC-PTSD) and it was used to screen for PTSD ([Prins et al., 2003](#)). Designed for use in medical settings, the PC-PTSD is currently used as a screening instrument at Veterans Affairs (VA) centers. It has been used specifically in trauma patients ([Reese et al., 2012](#)) and has been shown to be comparable with longer assessments of PTSD in the trauma center setting, with a sensitivity of 72.4% and specificity of 93.4% when compared with the PTSD Checklist – Civilian version 17 item screen ([Hanley, deRoon-Cassini, & Brasel, 2013](#)). The PC-PTSD consists of four Yes or No items, with scores ranging from 0 to 4. The internal reliability in the current sample was  $\alpha = 0.78$  at baseline,  $\alpha = 0.78$  at three months post-injury,  $\alpha = 0.77$  at six months post-injury, and  $\alpha = 0.76$  at 12 months post-injury.

The second measure of PTSS was the PTSD Checklist (PCL-C; [Weathers, Litz, Herman, Huska, & Keane, 1993](#)). Participants who scored 3 or higher on the Primary Care PTSD screener (considered indicative of PTSD) subsequently completed the PCL-C. The PCL-C consists of 17 questions that correspond with the DSM-IV-TR criteria for PTSD. On a 5-point severity scale, respondents are asked how often they have been bothered by each symptom of PTSD in the past month, with questions are worded generically to refer to “stressful experiences in the past”. The PCL-C was not administered at baseline. The internal reliability in the current sample was  $\alpha = 0.95$  at three months post-injury,  $\alpha = 0.94$  at six months post-injury, and  $\alpha = 0.92$  at 12 months post-injury.

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