



# The association between posttraumatic stress symptoms, depression, and length of hospital stay following traumatic injury



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## ABSTRACT

**Objective:** The present study examined the relationship between posttraumatic stress symptoms (PTSS) and depression symptoms with hospital outcome measures to explore how psychiatric factors relate to hospital length of stay (LOS).

**Method:** Participants were adults admitted to a large Level I Trauma Center for longer than 24 h. Depression was assessed at hospitalization using the Patient Health Questionnaire (PHQ-8), and PTSS was measured by the Primary Care PTSD Screen (PC-PTSD). Hospital outcome information was collected from the hospital's trauma registry. Pearson correlations were performed.

**Results:** 460 participants (mean age = 44 years,  $SD = 16.8$ ; 65.4% male) completed the study. Baseline PTSS and depression were significantly correlated with longer hospital LOS while controlling for demographics and injury severity ( $p = 0.026$ ;  $p = 0.023$ ). Both PTSS-positive and depression-positive groups had an average increased hospital LOS of two days.

**Conclusions:** A significant proportion of individuals who are admitted to the hospital following trauma may be at risk for depression and PTSS, which may then increase hospital LOS. As national attention turns to reducing healthcare costs, early screenings and interventions may aid in minimizing psychiatric symptoms in trauma patients, in turn reducing the cost and outcomes associated with total hospital LOS.

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## 1. Introduction

Traumatic injuries, defined as severe physical injuries caused by external forces, will affect nearly 81% of Americans in their lifetime, and are thus a major source of both healthcare and financial concern [1,2]. Over 2.8 million people are hospitalized each year following traumatic injuries that lead to more deaths than both heart disease and cancer combined [1,2,3]. The economic impact of traumatic injuries is large, with initial and subsequent care following trauma accounting for over \$406 billion in healthcare costs and lost productivity annually [4].

In addition to the sizable impact traumatic injuries have on physical functioning, trauma may also significantly disrupt psychiatric outcomes

[5]. Indeed, traumatic injury patients show elevated rates of mood disorders, psychotic disorders, and anxiety disorders [6]. Of specific concern are depression and posttraumatic stress symptoms (PTSS), which may develop within the days and weeks following a traumatic injury [7,8,9]. Rates of depression in traumatic injury patients are significantly elevated when compared to the general population, with prevalence estimates ranging from 28% to 42% [3,10]. Additionally, traumatic injuries are one of many events that meet the DSM 5 Criterion A definition for a potentially traumatic event [11]; thus, traumatic injuries may increase likelihood of PTSS and PTSD diagnosis.

PTSS, which include re-experiencing symptoms (e.g. flashbacks, nightmares), avoidant behaviors, negative alterations in cognition and mood, and alterations in arousal and reactivity, may be present in up to 71% to 94% of patients immediately following a traumatic event [12], with 30% to 50% experiencing multiple elevated symptoms [13]. In the weeks and months following a traumatic injury, many patients initially experiencing PTSS may go on to be diagnosed with PTSD, with prevalence estimates suggesting 10 to 20% of injury patients meet full PTSD diagnostic criteria > 30 days after injury [7]. For some who initially present with PTSS in the emergency department [ED] following

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traumatic injury, a natural recovery process will occur, reducing symptoms and leading to adaptive mental health and functioning [14]. Differing hypotheses have predicted who will have the greatest long-term PTSS morbidity following traumatic injury, with initial PTSS symptoms of dissociation, avoidance, and derealization as well as other mood symptoms, such as feelings of worthlessness, elevated depression, and anger, expected to play a major role in outcomes [14,15,16]. Prior experience of potentially traumatic events, as well as a preexisting diagnoses of PTSD and other psychiatric disorders, may predict poorer outcome in those experiencing elevated PTSS following traumatic injury [16,17]. Conflicting evidence for each of these hypotheses, as well as need for further investigation at an early time-point within the ED of large trauma centers, make the study of the relationship between initial PTSS following injury and long-term mental and physical health outcome imperative.

Mental health outcomes associated with depression and PTSS following traumatic injury may be vast, and include increased risk for psychiatric comorbidities, lower quality of life, and poorer long-term psychiatric functioning [9,18,19]. Depression and PTSS not only impact a person's mental health and wellbeing, but may also increase medical complications, in part determining a patient's overall outcome [17–21]. Poor psychiatric functioning following traumatic injuries may lead to negative health outcomes such as re-hospitalization and increased healthcare costs [22,23]. Additionally, disorders such as posttraumatic stress disorder [PTSD] and depression may impair functional outcomes, and delay or prevent return to work [20]. Thus, psychiatric outcomes of traumatic injury should be examined not only in the realm of mental health, but also in relation to physical health and functioning.

While emerging research highlights the close relationship between psychiatric functioning and physical health, the association between specific psychiatric symptoms and hospitalization outcomes within a trauma setting remains an open area of investigation. Results from studies in various hospital settings suggest that psychiatric factors may be related to outcomes such as hospital LOS, ICU LOS, and mechanical ventilation [24–28]. For example, psychiatric symptoms have been found to predict hospital outcomes following cardiac surgery, trauma surgery, and acute lung surgery, and depression has been found to correlate with LOS within a cardiovascular ICU setting. The limitation of these studies is that few specifically examine depression and PTSS, and fewer do so in a large Level I Trauma Center.

Additionally, literature is varied on the exact relationship between early-presenting psychiatric factors and these hospitalization outcomes. As is typical for PTSD research, many studies investigate psychiatric factors at an advanced time point during hospital stay or following hospital discharge [26,28]. While assessing psychiatric symptoms at these time points may be appropriate to delineate the prevalence and effects of a formal PTSD diagnosis, they provide little information about early-onset PTSS and hospital course. Prospective studies initiated shortly after admission to large trauma hospital settings may provide information on the relationship between traumatic injuries, psychiatric symptoms, and hospital outcomes shortly after injury and ED admission. This may then, in turn, inform primary and tertiary care approaches.

The primary aim of the present study was to examine the relationship between psychiatric factors (PTSS and depression) following traumatic injury and subsequent hospital outcomes. We expected that PTSS and depression would each independently correlate with increased hospital LOS and ICU LOS, even when injury severity and prior psychiatric diagnoses were controlled for. Furthermore, we examined the relationship between psychiatric factors and use of mechanical ventilation.

## 2. Methods

Data were collected at a large, urban Level I Trauma Center in the Southwest United States that admits approximately 2500 patients annually. Approval from the hospital's institutional review board (IRB) was obtained before enrolling subjects into the present study. Potential

participants were adults 18 years of age and older who were admitted to the trauma service for a period of at least 24 h. Potential participants were identified through the trauma service admission list and twice weekly trauma rounds, as well as through a review of medical records. Patients who met inclusion criteria were approached at least 24 h after admission, and before hospital discharge, by trained clinical researchers for consent and data collection.

Patients were eligible for study participation if they were medically stable, spoke English or Spanish, were able to provide a least one contact number for follow-up, and met the trauma registry injury criteria conforming with the National Trauma Data Standard of the American College of Surgeons [29]. The following ICD-10-CM codes are included as part of the National Trauma Data Standard: S00–S99, T07, T20–28, T30–32, T79.A1–T79.A9. Additionally, to be included in the Standard, patients must have sustained at least one injury with a diagnostic code outside the following range of codes: S00, S10, S20, S30, S40, S50, S60, S70, S80, S90. Patients were excluded if they did not have the cognitive capacity, either because of premorbid or injury-related condition, to provide informed consent. Cognition was assessed through chart review and orientation questions from the Cognistat screening tool [30]. Demographic and injury-related data were obtained, and study measures were completed at the time of hospitalization (baseline).

In addition to exclusions due to the above criteria, reasons for not participating included change in mental status or inability to pass orientation questions, discharge before being approached for participation, experiencing too much pain or fatigue to participate, or patients requesting researchers to return at a more convenient time and then subsequently being discharged.

Patients who met inclusion criteria and chose to participate signed informed consent documents and were enrolled into the study. Once enrolled, patients completed the baseline measures.

### 2.1. Measures

Posttraumatic stress symptoms were assessed using the Primary Care PTSD (PC-PTSD) screen [31]. The PC-PTSD is a four-item questionnaire used to assess PTSS, and is currently utilized as a screening instrument at medical centers and Veterans Affairs hospitals. The PC-PTSD consists of four yes or no items, with scores ranging from 0 to 4. The PC-PTSD has been shown to be comparable with longer assessments of PTSS in trauma center settings. It has a sensitivity of 72.4% and specificity of 93.4% when compared with the PTSD Checklist-Civilian version (PCL-C) 17-item screen [32,33]. With a cutoff score of 3 for diagnosis, the PC-PTSD has shown 85% diagnostic efficiency, 78% sensitivity, and 87% specificity among Veterans Affairs clinic patients [31]. Thus, a score of 3 or higher on the PC-PTSD was considered a positive screen result for clinical levels of PTSS.

Depression was measured at baseline using The Patient Health Questionnaire (PHQ-8). The PHQ-8 is a brief self-report measure of major depressive disorder, derived from the PHQ-9 by removing the last question regarding suicide assessment [34]. The suicide assessment question has been removed in the PHQ-8 to reduce undue burden on subjects when the purpose of a study is not directly related to assessing suicidal ideation. It is considered to be a valid measure of depression for population-based studies and clinical populations, and has been used in studies of patients with physical injury [9,34]. Frequency of symptoms during the last 2 weeks is assessed on a 0 (not at all) to 3 (nearly every day) scale. A cutoff score of 10 or greater is considered to be diagnostic for current depression.

### 2.2. Variables

Patient demographic information, hospitalization characteristics, and injury-related information were obtained from the hospital trauma registry (TraumaBase – Clinical Data Management, Colorado Springs, CO). Demographic information included age, gender, ethnicity, marital

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