

Long-Term Outcomes Literature Review

1. Beyond morbidity and mortality: The practicality of measuring patient-reported outcomes in trauma. Hatchimonji JS, et al. *Injury*. 2021 Feb;52(2):127-133. doi: 10.1016/j.injury.2020.11.034.

PDF: [Read PDF Here](#)

URL: <https://pubmed.ncbi.nlm.nih.gov/33223252/>

Background: The 2016 Zero Preventable Deaths report highlighted the need for comprehensive injury data to include long term outcomes such as societal and workforce re-entry. Currently, postinjury quality of life is poorly understood. We hypothesized that routine measurement of patient-reported outcomes is feasible as a part of post-discharge follow-up, and that trauma patients would report that their injury had a detrimental impact on health-related quality of life (HRQoL) after discharge.

Methods: After instruction, patients self-administered the PROMIS-29 instrument in our outpatient office (11/2019-4/2020). We surveyed 7 domains: Participation in Social Roles/Activities, Anxiety, Depression, Fatigue, Pain Interference, Physical Function, and Sleep Disturbance. Results are reported as means (SD) and compared to the U.S population by t-score (mean score = 50). Higher scores in negatively-worded domains (e.g. "Depression") are worse; vice versa for positively-worded domains (e.g. "Physical Function"). Repeated scores among patients returning for a second visit were analyzed using paired t-tests.

Results: 103 patients completed the PROMIS-29. Mean (SD) age was 42.3 (17.3) years, 75% were male, and 42% suffered a penetrating injury. Median length of stay was 3 days and median time from injury to clinic visit was 18 days. Mean scores were worse than population means in every domain. Pain Interference (mean 63.5, 95%CI [61.8-65.3]) and Physical Function (38.0 [36.2-39.8]) were particularly affected. Among patients returning for a second visit (n = 10; median time between clinic visits: 17.5 days), there were no significant differences in domain scores over time.

Conclusion: Trauma patients are at high risk for poor quality of life outcomes in the short term following injury. Our results highlight the need for early recognition and multidisciplinary treatment following injury

2. The Center for Trauma Survivorship: Addressing the great unmet need for posttrauma center care. Livingston DH, et al. *J Trauma Acute Care Surg*. 2020 Nov;89(5):940-946. doi: 10.1097/TA.0000000000002775.

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Background: Returning patients to preinjury status is the goal of a trauma system. Trauma centers (TCs) provide inpatient care, but postdischarge treatment is fragmented with clinic follow-up rates of <30%. Posttraumatic stress disorder (PTSD) and depression are common, but few patients ever obtain necessary behavioral health services. We postulated that a multidisciplinary Center for Trauma Survivorship (CTS) providing comprehensive care would meet patient's needs, improve post discharge compliance,

deliver behavioral health, and decrease unplanned emergency department (ED) visits and readmissions.

Methods: Focus groups of trauma survivors were conducted to identify issues following TC discharge. Center for Trauma Survivorship eligible patients are aged 18 to 80 years and have intensive care unit stay of >2 days or have a New Injury Severity Score of ≥ 16 . Center for Trauma Survivorship visits were scheduled by a dedicated navigator and included physical and behavioral health care. Patients were screened for PTSD and depression. Patients screening positive were referred for behavioral health services. Patients were provided 24/7 access to the CTS team. Outcomes include compliance with appointments, mental health visits, unplanned ED visits, and readmissions in the year following discharge from the TC.

Results: Patients universally felt abandoned by the TC after discharge. Over 1 year, 107 patients had 386 CTS visits. Average time for each appointment was >1 hour. Center for Trauma Survivorship "no show" rate was 17%. Eighty-six percent screening positive for PTSD/depression successfully received behavioral health services. Postdischarge ED and hospital admissions were most often for infections or unrelated conditions. Emergency department utilization was significantly lower than a similarly injured group of patients 1 year before the inception of the CTS.

Conclusion: ACTS fills the vast gaps in care following TC discharge leading to improved compliance with appointments and delivery of physical and behavioral health services. Center for Trauma Survivorship also appears to decrease ED visits in the year following discharge. To achieve optimal long-term recovery from injury, trauma care must continue long after patients leave the TC.

3. Feasibility of a trauma quality-of-life follow-up clinic. Trevino C et al. J Trauma Acute Care Surg. 2020 Jul;89(1):226-229. doi: 10.1097/TA.0000000000002672.

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Background: Little effort has been made to address long-term quality of life, chronic pain (CP), posttraumatic stress disorder (PTSD), and functional disability in trauma survivors. This quality initiative was developed to determine feasibility of a coordinated, comprehensive, patient-centered follow-up clinic for those at risk for poor long-term outcomes.

Methods: A convenience sample from 649 hospitalized trauma patients at a Midwestern level 1 trauma center between February 2018 and August 2018 was screened for risk of PTSD and CP. Thirty-six patients were randomized into a standard follow-up clinic (standard of care [SOC]) (2-week post-discharge surgical clinic) or a new trauma quality of life clinic (TQOL). The TQOL was developed to provide comprehensive care to patients at high risk for PTSD (Injured Trauma Survivor Score, ≥ 2) and/or CP (discharge pain score, ≥ 4). Trauma quality of life clinic included a nurse practitioner or surgeon (physician), psychologist, social worker, and physical therapist at 1-week post discharge. All providers saw the patient independently, developed a care plan collaboratively, and communicated the plan to the patient. The SOC involved a visit only with a nurse practitioner or surgeon (medical doctor). Measures of pain, PTSD, depression, quality of

life, physical functioning, and life satisfaction were completed at time of the TQOL/SOC or over the phone.

Results: There were no differences in demographics, readmissions, or emergency department visits after discharge between groups. However, no show rates were almost twice as high in SOC (40%) compared with TQOL (22%) and those in TQOL completed 23 additional psychology visits versus one psychology visit in SOC. This clinic structure is feasible for high-risk patients, and TQOL patients demonstrated improved engagement in their care.

Conclusions: A comprehensive multidisciplinary TQOL addressing issues affecting convalescence for trauma patients at high risk for developing PTSD and CP can improve follow-up rates to ensure patients are recovering successfully.

4. Mental Health Burden After Injury: It's About More than Just Posttraumatic Stress

Disorder. Herrera-Escobar JP, et al. Ann Surg. 2020 Jun 4. doi:

10.1097/SLA.0000000000003780. Epub ahead of print. PMID: 32511129

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URL: <https://pubmed.ncbi.nlm.nih.gov/32511129/>

Introduction: Mental health disorders (MHD) after injury have been associated with worse long-term functional outcomes. However, earlier studies have focused almost exclusively on posttraumatic stress disorder (PTSD). In this pilot study, we assessed the prevalence of anxiety, depression, and PTSD after injury and their association with long-term physical outcomes.

Methods: Trauma patients with an Injury Severity Score (ISS)₉ treated at 3 Level I trauma centers were contacted 6 to 12 months after injury to screen for anxiety (GAD-7), depression (PHQ-8), PTSD (8Q-PCL-5), as well as pain and functional outcomes (T-QoL/SF-12). Associations between mental and physical outcomes were established using multivariable logistic regression models adjusting for confounders.

Results: Of the 303 patients followed, 65 (21%) screened positive for any MHD. Of those who screened positive for PTSD (8%, n = 24), all had comorbid depression and/or anxiety. In contrast, 41 (14%) patients screened negative for PTSD but positive for depression and/or anxiety. Adjusting for confounders, we found that compared with patients with no MHD, patients who screened positive for PTSD were more likely to have chronic pain (odds ratio [OR] 6.07; 95% CI 1.95 to 18.91), functional limitations (OR 9.46; 95% CI 3.41 to 26.26), and reduced physical health (b -8.4; 95% CI -12.4 to -4.4). Similarly, patients who screened positive for depression/anxiety (without PTSD) were more likely to have chronic pain (OR 15.24; 95% CI 4.48 to 51.91), functional limitations (OR 3.33; 95% CI 1.57 to 7.03), and reduced physical health (b -10.4; 95% CI -15.5 to -5.3) compared with those with no MHD (Table).

Conclusions: Mental health burden after injury is more significant than expected and not limited to PTSD. Distinguishing among MHD can help stratify risk of poor outcomes, providing more focused opportunities to optimize outcomes after injury.

5. Long-Term Social Reintegration Outcomes for Burn Survivors With and Without Peer Support Attendance: A Life Impact Burn Recovery Evaluation (LIBRE) Study. Grieve B,

et al. Arch Phys Med Rehabil. 2020 Jan;101(1S):S92-S98. doi: 10.1016/j.apmr.2017.10.007.

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URL: <https://pubmed.ncbi.nlm.nih.gov/29097179/>

Objective: To examine differences in long-term social reintegration outcomes for burn survivors with and without peer support attendance.

Design: Cross-sectional survey.

Setting: Community-dwelling burn survivors.

Participants: Burn survivors (NZ601) aged ≥ 18 years with injuries to $\geq 5\%$ total body surface area (TBSA) or burns to critical areas (hands, feet, face, or genitals).

Interventions: Not applicable.

Main Outcome Measures: The Life Impact Burn Recovery Evaluation Profile was used to examine the following previously validated 6 scale scores of social participation: Family and Friends, Social Interactions, Social Activities, Work and Employment, Romantic Relationships, and Sexual Relationships.

Results: Burn support group attendance was reported by 330 (55%) of 596 respondents who responded to this item. Attendees had larger burn size (43.4% \pm 23.6% vs 36.8% \pm 23.4% TBSA burned, $P < .01$) and were more likely to be >10 years from injury (50% vs 42.5%, $P < .01$). Survivors who attended at least 1 support group scored significantly higher on 3 of the scales: Social Interactions (PZ.01), Social Activities (PZ.04), and Work and Employment (PZ.05). In adjusted analyses, peer support attendance was associated with increased scores on the Social Interactions scale, increasing scores by 17% of an SD (95% confidence interval, 1%-33%; PZ.04).

Conclusions: Burn survivors who reported peer support attendance had better social interaction scores than those who did not. This is the first reported association between peer support group attendance and improvements in community reintegration in burn survivors. This cross-sectional study prompts further exploration into the potential benefits of peer support groups on burn recovery with future intervention studies.

6. Long-term Functional, Psychological, Emotional, and Social Outcomes in Survivors of Firearm Injuries. Vella MA, et al. JAMA Surg. 2019 Nov 20;155(1):1–9. doi:

10.1001/jamasurg.2019.4533.

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Importance: The outcomes of firearm injuries in the United States are devastating. Although firearm mortality and costs have been investigated, the long-term outcomes after surviving a gunshot wound (GSW) remain unstudied.

Objective: To determine the long-term functional, psychological, emotional, and social outcomes among survivors of firearm injuries.

Design, Setting, and Participants: This prospective cohort study assessed patient-reported outcomes among GSW survivors from January 1, 2008, through December 31, 2017, at a single urban level I trauma center. Attempts were made to contact all adult patients (aged ≥ 18 years) discharged alive during the study period. A total of 3088 patients were identified; 516 (16.7%) who died during hospitalization and 45 (1.5%) who

died after discharge were excluded. Telephone contact was made with 263 (10.4%) of the remaining patients, and 80 (30.4%) declined study participation. The final study sample consisted of 183 participants. Data were analyzed from June 1, 2018, through June 20, 2019.

Exposures: A GSW sustained from January 1, 2008, through December 31, 2017.

Main Outcomes and Measures: Scores on 8 Patient-Reported Outcomes Measurement Information System (PROMIS) instruments (Global Physical Health, Global Mental Health, Physical Function, Emotional Support, Ability to Participate in Social Roles and Activities, Pain Intensity, Alcohol Use, and Severity of Substance Use) and the Primary Care PTSD (posttraumatic stress disorder) Screen for the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition.

Results: Of the 263 patients who survived a GSW and were contacted, 183 (69.6%) participated. Participants were more likely to be admitted to the hospital compared with those who declined (150 [82.0%] vs 54 [67.5%]; $P = .01$). Participants had a median time from GSW of 5.9 years (range, 4.7-8.1 years) and were primarily young (median age, 27 years [range, 21-36 years]), black (168 [91.8%]), male (169 [92.3%]), and employed before GSW (pre-GSW, 139 [76.0%]; post-GSW, 113 [62.1%]; decrease, 14.3%; $P = .004$). Combined alcohol and substance use increased by 13.2% (pre-GSW use, 56 [30.8%]; post-GSW use, 80 [44.0%]). Participants had mean (SD) scores below population norms (50 [10]) for Global Physical Health (45 [11]; $P < .001$), Global Mental Health (48 [11]; $P = .03$), and Physical Function (45 [12]; $P < .001$) PROMIS metrics. Eighty-nine participants (48.6%) had a positive screen for probable PTSD. Patients who required intensive care unit admission ($n = 64$) had worse mean (SD) Physical Function scores (42 [13] vs 46 [11]; $P = .045$) than those not requiring the intensive care unit. Survivors no more than 5 years after injury had greater PTSD risk (38 of 63 [60.3%] vs 51 of 119 [42.9%]; $P = .03$) but better mean (SD) Global Physical Health scores (47 [11] vs 43 [11]; $P = .04$) than those more than 5 years after injury.

Conclusions and Relevance: This study's results suggest that the lasting effects of firearm injury reach far beyond mortality and economic burden. Survivors of GSWs may have negative outcomes for years after injury. These findings suggest that early identification and initiation of long-term longitudinal care is paramount.

- 7. Financial toxicity is associated with worse physical and emotional long-term outcomes after traumatic injury.** Murphy PB, et al. *J Trauma Acute Care Surg.* 2019 Nov;87(5):1189-1196. doi: 10.1097/TA.0000000000002409.

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Background: Increasing health care costs and high deductible insurance plans have shifted more responsibility for medical costs to patients. After serious illnesses, financial responsibilities may result in lost wages, forced unemployment, and other financial burdens, collectively described as financial toxicity. Following cancer treatments, financial toxicity is associated with worse long-term health-related quality of life (HRQoL) outcomes. The purpose of this study was to determine the incidence of

financial toxicity following injury, factors associated with financial toxicity, and the impact of financial toxicity on long-term HRQoL.

Methods: Adult patients with an Injury Severity Score of 10 or greater and without head or spinal cord injury were prospectively followed for 1 year. The Short-Form-36 was used to determine overall quality of life at 1 month, 2 months, 4 months, and 12 months. Screens for depression and posttraumatic stress syndrome were administered. The primary outcome was any financial toxicity. A multivariable generalized estimating equation was used to account for variability over time

Results: Five hundred patients were enrolled, and 88% suffered financial toxicity during the year following injury (64% reduced income, 58% unemployment, 85% experienced stress due to financial burden). Financial toxicity remained stable over follow-up (80-85%). Factors independently associated with financial toxicity were lower age (odds ratio [OR], 0.96 [0.94-0.98]), lack of health insurance (OR, 0.28 [0.14-0.56]), and larger household size (OR, 1.37 [1.06-1.77]). After risk adjustment, patients with financial toxicity had worse HRQoL, and more depression and posttraumatic stress syndrome in a stepwise fashion based on severity of financial toxicity.

Conclusion: Financial toxicity following injury is extremely common and is associated with worse psychological and physical outcomes. Age, lack of insurance, and large household size are associated with financial toxicity. Patients at risk for financial toxicity can be identified, and interventions to counteract the negative effects should be developed to improve long-term outcomes.

- 8. Resilience and long-term outcomes after trauma: An opportunity for early intervention?** Nehra D, et al. J Trauma Acute Care Surg. 2019 Oct;87(4):782-789. doi: 10.1097/TA.0000000000002442.

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URL: <https://pubmed.ncbi.nlm.nih.gov/31589192/>

Background: Resilience, or the ability to cope with difficulties, influences an individual's response to life events including unexpected injury. We sought to assess the relationship between patient self-reported resilience traits and functional and psychosocial outcomes 6 months after traumatic injury.

Methods: Adult trauma patients 18 years to 64 years of age with moderate to severe injuries (Injury Severity Score, ≥ 9) admitted to one of three Level I trauma centers between 2015 and 2017 were contacted by phone at 6 months postinjury and asked to complete a validated Trauma Quality of Life (T-QoL) survey and PTSD screen. Patients were classified into "low" and "high" resilience categories. Long-term outcomes were compared between groups. Adjusted logistic regression models were built to determine the association between resilience and each of the long-term outcomes.

Results: A total of 305 patients completed the 6-month interview. Two hundred four (67%) of the 305 patients were classified as having low resilience. Mean age was 42 ± 14 years, 65% were male, 91% suffering a blunt injury, and average Injury Severity Score was 15.4 ± 7.9 . Patients in the low-resilience group had significantly higher odds of functional limitations in activities of daily living (odds ratio [OR], 4.81; 95% confidence interval [CI], 2.48-9.34). In addition, patients in the lower resilience group were less

likely to have returned to work/school (OR, 3.25; 95% CI, 1.71-6.19), more likely to report chronic pain (OR, 2.57; 95% CI, 1.54-4.30) and more likely to screen positive for PTSD (OR, 2.96; 95% CI, 1.58-5.54).

Conclusion: Patients with low resilience demonstrated worse functional and psychosocial outcomes 6 months after injury. These data suggest that screening for resilience and developing and deploying early interventions to improve resilience-associated traits as soon as possible after injury may hold promise for improving important long-term functional outcomes.

9. The Hidden Burden of Mental Health Outcomes Following Firearm-related Injuries.

Joseph B, et al. Ann Surg. 2019 Oct;270(4):593-601. doi:

10.1097/SLA.0000000000003473.

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URL: <https://pubmed.ncbi.nlm.nih.gov/31318795/>

Objectives: Examine the effect of different types of firearms on readmission due to acute stress disorder (ASD) and/or post-traumatic stress disorder (PTSD) in firearm-injury victims.

Background: Survivors of firearm-related injuries suffer long-term sequelae such as disability, work loss, and deterioration in the quality of life. There is a paucity of data describing the long-term mental health outcomes in these patients.

Methods: We performed a 5-year (2011-2015) analysis of the Nationwide Readmission Database. All adult patients with firearm injuries were stratified into 3 groups by firearm type: handgun, shotgun, and semiautomatic rifle. Outcome measures were the incidence and predictors of ASD/PTSD.

Results: A total of 100,704 victims of firearm-related injuries were identified, of which 13.3% (n = 13,393) were readmitted within 6 months of index hospitalization, 6.7% (n = 8970) of these due to ASD/PTSD. Mean age was 34 ± 14 years, 88% were men. Of those readmitted due to ASD/PTSD, 24% (n = 2153) sustained a handgun-related injury on index hospitalization, 12% (n = 1076) shotgun, and 64% (n = 5741) semiautomatic gun (P = 0.039). On regression analysis, semiautomatic gun and shotgun victims had higher odds of developing ASD/PTSD upon readmission [odds ratio (OR): 2.05 (1.10-4.12) and OR: 1.41 (1.08-2.11)] compared to handgun. Female sex [OR: 1.79 (1.05-3.05)] and younger age representing those younger than 25 years [OR: 4.66 (1.12-6.74)] were also independently associated with higher odds of ASD/PTSD.

Conclusions: Apart from the lives lost, survivors of semiautomatic rifle- and shotgun-related injuries suffer long-term mental health sequelae. These secondary and debilitating mental health outcomes are important considerations for capturing the overall burden of the disease.

10. Long-term social dysfunction after trauma: What is the prevalence, risk factors, and associated outcomes? Herrera-Escobar JP, et al. Surgery. 2019 Sep;166(3):392-397. doi:

10.1016/j.surg.2019.04.004.

PDF: [Read PDF Here](#)

URL: <https://pubmed.ncbi.nlm.nih.gov/31104807/>

Background: Social functioning-the ability to participate in organized or informal family, friend, or peer groups and communal activities-is intertwined with physical and emotional health. Although trauma can have a lasting effect on both the physical and emotional well-being of patients, little is known about the long-term impact of injury on social functioning. We sought to determine the prevalence of, risk factors for, and outcomes associated with long-term social dysfunction after trauma.

Methods: Adults with moderate-to-severe injuries managed at three Level I trauma centers were contacted at 6 to 12 months after injury to inquire about social dysfunction. Demographics, socioeconomic parameters, and injury-related and hospital course information were also obtained. A stepwise backward logistic regression model was fitted to determine independent risk factors of social dysfunction, and multiple logistic regression models were used to determine associations between social dysfunction and post-traumatic stress disorder, functional limitations, and return to work.

Results: Of the 805 screened patients, 45.2% reported social dysfunction. Patients with social dysfunction were more likely to be African American, be Medicaid beneficiaries, be of lower education, require mechanical ventilation, be discharged less often to home, have a lower mean age and had longer hospital stays. In multivariable analysis, low education, longer hospital stay, past psychiatric illness, and African-American race independently increased the risk for social dysfunction. Furthermore, patients with social dysfunction were more likely to screen positive for post-traumatic stress disorder (odds ratio: 16.25 [95% confidence interval: 9.49-27.85]), be experiencing functional limitations (odds ratio: 2.80 [95% confidence interval: 1.76-4.44]), and to not have returned to work (odds ratio: 5.65 [95% confidence interval: 3.92-8.14]).

Conclusion: Lower educational attainment, long hospital stay, past psychiatric illness, and African-American race appear to predispose to social dysfunction after trauma, which in turn is associated with a positive post-traumatic stress disorder screen, functional limitations, and delayed return to work.

- 11. Lower education and income predict worse long-term outcomes after injury.** Herrera-Escobar JP, et al. J Trauma Acute Care Surg. 2019 Jul;87(1):104-110. doi: 10.1097/TA.0000000000002329.

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URL: <https://pubmed.ncbi.nlm.nih.gov/31033884/>

Background: Lower socioeconomic status (SES) is known to be associated with higher morbidity and mortality following injury. However, the impact of individual SES on long-term outcomes after trauma is unknown. The objective of this study was to determine the impact of educational level and income on long-term outcomes after injury.

Methods: Trauma patients with moderate to severe injuries admitted to three Level-I trauma centers were contacted 6 months to 12 months after injury to evaluate functional status, return to work/school, chronic pain, and posttraumatic stress disorder (PTSD). Lower SES status was determined by educational level and income. Adjusted logistic regression models were built to determine the association between educational level and income (lowest vs. highest quartile determined by census-tract area) on each

of the long-term outcomes. A sensitivity analysis was performed using the national median household income (\$57,617) as threshold for defining low versus high income. *Results:* A total of 1,516 patients were followed during a 36-month period. Forty-nine percent had a low educational level, and 26% were categorized in the low-income group. Mean (SD) age and injury severity score were 60 (21.5) and 14.3 (7.3), respectively, with most patients (94%) having blunt injuries. After adjusting for confounders, low educational level was associated with poor long-term outcomes: functional limitation [odds ratio (OR), 1.78 (95% confidence interval (CI), 1.41–2.26)], has not yet returned to work/school [OR, 2.48 (95% CI, 1.70–3.62)], chronic pain [OR, 1.63 (95% CI, 1.27–2.10)], and PTSD [OR, 2.23 (95% CI, 1.60–3.11)]. Similarly, low-income level was associated with not yet return to work/school [OR, 1.97 (95% CI, 1.09–3.56)], chronic pain [OR, 1.70 (95% CI, 1.14–2.53)], and PTSD [OR, 2.20 (95% CI, 1.21–3.98)]. In sensitivity analyses, there were no significant differences in long-term outcomes between income levels.

Conclusion: Low educational level is strongly associated with worse long-term outcomes after injury. However, although household income is associated with long-term outcomes, it matters where the threshold is. The impact of different socioeconomic measures on long-term outcomes after trauma cannot be assumed to be interchangeable.

12. Recovery After Mild Traumatic Brain Injury in Patients Presenting to US Level I Trauma Centers: A Transforming Research and Clinical Knowledge in Traumatic Brain Injury (TRACK-TBI) Study. Nelson LD, et al. JAMA Neurol. 2019 Jun 3;76(9):1049–59. doi: 10.1001/jamaneurol.2019.1313.

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URL: <https://pubmed.ncbi.nlm.nih.gov/31157856/>

Importance: Most traumatic brain injuries (TBIs) are classified as mild (mTBI) based on admission Glasgow Coma Scale (GCS) scores of 13 to 15. The prevalence of persistent functional limitations for these patients is unclear.

Objectives: To characterize the natural history of recovery of daily function following mTBI vs peripheral orthopedic traumatic injury in the first 12 months postinjury using data from the Transforming Research and Clinical Knowledge in Traumatic Brain Injury (TRACK-TBI) study, and, using clinical computed tomographic (CT) scans, examine whether the presence (CT+) or absence (CT-) of acute intracranial findings in the mTBI group was associated with outcomes.

Design, setting, and participants: TRACK-TBI, a cohort study of patients with mTBI presenting to US level I trauma centers, enrolled patients from February 26, 2014, to August 8, 2018, and followed up for 12 months. A total of 1453 patients at 11 level I trauma center emergency departments or inpatient units met inclusion criteria (ie, mTBI [n = 1154] or peripheral orthopedic traumatic injury [n = 299]) and were enrolled within 24 hours of injury; mTBI participants had admission GCS scores of 13 to 15 and clinical head CT scans. Patients with peripheral orthopedic trauma injury served as the control (OTC) group.

Exposures: Participants with mTBI or OTC.

Main outcomes and measures: The Glasgow Outcome Scale Extended (GOSE) scale score, reflecting injury-related functional limitations across broad life domains at 2 weeks and 3, 6, and 12 months postinjury was the primary outcome. The possible score range of the GOSE score is 1 (dead) to 8 (upper good recovery), with a score less than 8 indicating some degree of functional impairment.

Results: Of the 1453 participants, 953 (65.6%) were men; mean (SD) age was 40.9 (17.1) years in the mTBI group and 40.9 (15.4) years in the OTC group. Most participants (mTBI, 87%; OTC, 93%) reported functional limitations (GOSE <8) at 2 weeks postinjury. At 12 months, the percentage of mTBI participants reporting functional limitations was 53% (95% CI, 49%-56%) vs 38% (95% CI, 30%-45%) for OTCs. A higher percentage of CT+ patients reported impairment (61%) compared with the mTBI CT- group (49%; relative risk [RR], 1.24; 95% CI, 1.08-1.43) and a higher percentage in the mTBI CT-group compared with the OTC group (RR, 1.28; 95% CI, 1.02-1.60).

Conclusions and relevance: Most patients with mTBI presenting to US level I trauma centers report persistent, injury-related life difficulties at 1 year postinjury, suggesting the need for more systematic follow-up of patients with mTBI to provide treatments and reduce the risk of chronic problems after mTBI.

13. Patterns and Predictors of Return to Work After Major Trauma: A Prospective, Population-based Registry Study. Collie A, et al. *Ann Surg.* 2019 May;269(5):972-978. doi: 10.1097/SLA.0000000000002666.

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URL: <https://pubmed.ncbi.nlm.nih.gov/29342014/>

Objective: To characterize patterns of engagement in work during the 4-year period after major traumatic injury, and to identify factors associated with those patterns.

Background: Employment is an important marker of functional recovery from injury. There are few population-based studies of long-term employment outcomes, and limited data on the patterns of return to work (RTW) after injury.

Methods: A population-based, prospective cohort study using the Victorian State Trauma Registry. A total of 1086 working age individuals, in paid employment or full-time education before injury, were followed-up through telephone interview at 6, 12, 24, 36, and 48 months post-injury. Responses to RTW questions were used to define 4 discrete patterns: early and sustained; delayed; failed; no RTW. Predictors of RTW patterns were assessed using multivariate multinomial logistic regression.

Results: Slightly more than half of respondents (51.6%) recorded early sustained RTW. A further 15.5% had delayed and 13.3% failed RTW. One in 5 (19.7%) did not RTW. Compared with early sustained RTW, predictors of delayed and no RTW included being in a manual occupation and injury in a motor vehicle accident. Older age and receiving compensation predicted both failed and no RTW patterns. Preinjury disability was an additional predictor of failed RTW. Presence of comorbidity was an additional predictor of no RTW.

Conclusions: A range of personal, occupational, injury, health, and compensation system factors influence RTW patterns after serious injury. Early identification of people at risk for delayed, failed, or no RTW is needed so that targeted interventions can be delivered.

14. Risk of Posttraumatic Stress Disorder and Major Depression in Civilian Patients After Mild Traumatic Brain Injury: A TRACK-TBI Study. Stein MB, et al. JAMA Psychiatry. 2019 Mar 1;76(3):249-258. doi: 10.1001/jamapsychiatry.2018.4288.

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URL: <https://pubmed.ncbi.nlm.nih.gov/30698636/>

Importance: Traumatic brain injury (TBI) has been associated with adverse mental health outcomes, such as posttraumatic stress disorder (PTSD) and major depressive disorder (MDD), but little is known about factors that modify risk for these psychiatric sequelae, particularly in the civilian sector.

Objective: To ascertain prevalence of and risk factors for PTSD and MDD among patients evaluated in the emergency department for mild TBI (mTBI).

Design, setting, and participants: Prospective longitudinal cohort study (February 2014 to May 2018). Posttraumatic stress disorder and MDD symptoms were assessed using the PTSD Checklist for DSM-5 and the Patient Health Questionnaire-9 Item. Risk factors evaluated included preinjury and injury characteristics. Propensity score weights-adjusted multivariable logistic regression models were performed to assess associations with PTSD and MDD. A total of 1155 patients with mTBI (Glasgow Coma Scale score, 13-15) and 230 patients with nonhead orthopedic trauma injuries 17 years and older seen in 11 US hospitals with level 1 trauma centers were included in this study.

Main outcomes and measures: Probable PTSD (PTSD Checklist for DSM-5 score, ≥ 33) and MDD (Patient Health Questionnaire-9 Item score, ≥ 15) at 3, 6, and 12 months postinjury.

Results: Participants were 1155 patients (752 men [65.1%]; mean [SD] age, 40.5 [17.2] years) with mTBI and 230 patients (155 men [67.4%]; mean [SD] age, 40.4 [15.6] years) with nonhead orthopedic trauma injuries. Weights-adjusted prevalence of PTSD and/or MDD in the mTBI vs orthopedic trauma comparison groups at 3 months was 20.0% (SE, 1.4%) vs 8.7% (SE, 2.2%) ($P < .001$) and at 6 months was 21.2% (SE, 1.5%) vs 12.1% (SE, 3.2%) ($P = .03$). Risk factors for probable PTSD at 6 months after mTBI included less education (adjusted odds ratio, 0.89; 95% CI, 0.82-0.97 per year), being black (adjusted odds ratio, 5.11; 95% CI, 2.89-9.05), self-reported psychiatric history (adjusted odds ratio, 3.57; 95% CI, 2.09-6.09), and injury resulting from assault or other violence (adjusted odds ratio, 3.43; 95% CI, 1.56-7.54). Risk factors for probable MDD after mTBI were similar with the exception that cause of injury was not associated with increased risk.

Conclusions and relevance: After mTBI, some individuals, on the basis of education, race/ethnicity, history of mental health problems, and cause of injury were at substantially increased risk of PTSD and/or MDD. These findings should influence recognition of at-risk individuals and inform efforts at surveillance, follow-up, and intervention.

15. Factors Associated with Long-term Outcomes After Injury: Results of the Functional Outcomes and Recovery After Trauma Emergencies (FORTE) Multicenter Cohort Study.

Haider AH, et al. Ann Surg. 2020 Jun;271(6):1165-1173. doi: 10.1097/SLA.0000000000003101.

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URL: <https://pubmed.ncbi.nlm.nih.gov/30550382/>

Objective: The aim of this study was to determine factors associated with patient-reported outcomes, 6 to 12 months after moderate to severe injury.

Summary of background data: Due to limitations of trauma registries, we have an incomplete understanding of factors that impact long-term patient-reported outcomes after injury. As 96% of patients survive their injuries, several entities including the National Academies of Science, Engineering and Medicine have called for a mechanism to routinely follow trauma patients and determine factors associated with survival, patient-reported outcomes, and reintegration into society after trauma.

Methods: Over 30 months, major trauma patients [Injury Severity Score (ISS) ≥ 9] admitted to 3 Level-I trauma centers in Boston were assessed via telephone between 6 and 12 months after injury. Outcome measures evaluated long-term functional, physical, and mental-health outcomes. Multiple regression models were utilized to identify patient and injury factors associated with outcomes.

Results: We successfully followed 1736 patients (65% of patients contacted). More than half (62%) reported current physical limitations, 37% needed help for at least 1 activity of daily living, 20% screened positive for posttraumatic stress disorder (PTSD), all SF-12 physical health subdomain scores were significantly below US norms, and 41% of patients who were working previously were unable to return to work. Age, sex, and education were associated with long-term outcomes, while almost none of the traditional measures of injury severity were.

Conclusion: The long-term sequelae of trauma are more significant than previously expected. Collection of post-discharge outcomes identified patient factors, such as female sex and low education, associated with worse recovery. This suggests that social support systems are potentially at the core of recovery rather than traditional measures of injury severity.

16. Trends 10 years after burn injury: A Burn Model System National Database study. Chin TL, et al. *Burns*. 2018 Dec;44(8):1882-1886. doi: 10.1016/j.burns.2018.09.033.

PDF: [Read PDF Here](#)

URL: <https://pubmed.ncbi.nlm.nih.gov/30385060/>

Background: The Burn Specific Health Scale-Brief (BSHS-B) evaluates 9 aspects of health and has been validated globally. Existing reports typically focus on outcomes shortly after injury. The purpose of this study is to determine whether quality of life remains a concern for burn survivors ten years after-injury.

Methods: Cross sectional data of survivors admitted from 1994 to 2006 to four US burn centers were collected in the Burn Model System National Database 10 years after injury. Responses to the items in the nine BSHS-B domains range from 0 to 4. Lower scores indicating poorer quality of life. Median scores are reported and differences were compared using Wilcoxon-Mann-Whitney test.

Results: Ten-year survivor injury characteristics suggest a moderate severity of injury. Survivors scored lower in heat sensitivity, affect, body image, and work (median=3.2, 3.6, 2.8, and 3.6, respectively). Affect, body image, and interpersonal scores were

significantly lower for females (median=3.1, 2.8, 3.8, respectively) than males [median=3.6, 3.3, 4, respectively ($p=0.008, 0.004, 0.022$, respectively)].

Conclusions: Our results suggest certain domains of burn specific health benefit from support at 10 years after injury, and select populations such as females may necessitate additional treatment to restore burn-specific health. These results support that burn injuries represent a chronic condition and long-term medical and psychosocial support may benefit burn survivor recovery.

17. Long-term health status and trajectories of seriously injured patients: A population-based longitudinal study. Gabbe BJ, et al. PLoS Med. 2017 Jul 5;14(7):e1002322. doi: 10.1371/journal.pmed.1002322.

PDF: [Read PDF Here](#)

URL: <https://dx.plos.org/10.1371/journal.pmed.1002322>

Background: Improved understanding of the quality of survival of patients is crucial in evaluating trauma care, understanding recovery patterns and timeframes, and informing healthcare, social, and disability service provision. We aimed to describe the longer-term health status of seriously injured patients, identify predictors of outcome, and establish recovery trajectories by population characteristics.

Methods and findings: A population-based, prospective cohort study using the Victorian State Trauma Registry (VSTR) was undertaken. We followed up 2,757 adult patients, injured between July 2011 and June 2012, through deaths registry linkage and telephone interview at 6-, 12-, 24-, and 36-months postinjury. The 3-level EuroQol 5 dimensions questionnaire (EQ-5D-3L) was collected, and mixed-effects regression modelling was used to identify predictors of outcome, and recovery trajectories, for the EQ-5D-3L items and summary score. Mean (SD) age of participants was 50.8 (21.6) years, and 72% were male. Twelve percent ($n = 333$) died during their hospital stay, 8.1% ($n = 222$) of patients died postdischarge, and 155 (7.0%) were known to have survived to 36-months postinjury but were lost to follow-up at all time points. The prevalence of reporting problems at 36-months postinjury was 37% for mobility, 21% for self-care, 47% for usual activities, 50% for pain/discomfort, and 41% for anxiety/depression. Continued improvement to 36-months postinjury was only present for the usual activities item; the adjusted relative risk (ARR) of reporting problems decreased from 6 to 12 (ARR 0.87, 95% CI: 0.83–0.90), 12 to 24 (ARR 0.94, 95% CI: 0.90–0.98), and 24 to 36 months (ARR 0.95, 95% CI: 0.95–0.99). The risk of reporting problems with pain or discomfort increased from 24- to 36-months postinjury (ARR 1.06, 95% CI: 1.01, 1.12). While loss to follow-up was low, there was responder bias with patients injured in intentional events, younger, and less seriously injured patients less likely to participate; therefore, these patient subgroups were underrepresented in the study findings.

Conclusions: The prevalence of ongoing problems at 3-years postinjury is high, confirming that serious injury is frequently a chronic disorder. These findings have implications for trauma system design. Investment in interventions to reduce the longer-term impact of injuries is needed, and greater investment in primary prevention is needed.

18. Acute Rehabilitation after Trauma: Does it Really Matter? Nehra D, et al. J Am Coll Surg. 2016 Dec;223(6):755-763. doi: 10.1016/j.jamcollsurg.2016.09.001.

PDF: [Read PDF Here](#)

URL: <https://pubmed.ncbi.nlm.nih.gov/28193321/>

Background: The impact of post-discharge rehabilitation care for the trauma patient remains poorly investigated. Here we describe the functional outcomes of trauma patients discharged to an inpatient rehabilitation facility (IRF), and compare the likelihood of discharge home, 1-year rehospitalization, and 1-year mortality between patients discharged to an IRF and a propensity score-matched cohort of patients not discharged to an IRF.

Study design: The Washington State Rehabilitation Registry was used to collect data for all trauma patients discharged to an IRF between 2011 and 2012. These charts were linked to the Washington State Trauma Registry and the Comprehensive Hospital Abstract Reporting System database to obtain detailed patient, injury, and mortality data. Propensity score matching was used to identify a control group of patients who were not discharged to an IRF. Primary outcomes measures were improvement in Functional Independence Measure score with inpatient rehabilitation and the likelihood of discharge home, 1-year rehospitalization, and 1-year mortality.

Results: Nine hundred and thirty-three trauma patients were discharged to an IRF between 2011 and 2012. Total functional independence measure scores improved from 63.7 (SD 20.3) to 92.2 (SD 20.9) ($p < 0.001$) with care at an IRF. When patients discharged to an IRF were compared with the propensity score-matched control patients, rehabilitation was found to significantly increase the likelihood of discharge to home (odds ratio = 9.41; 95% CI, 6.80-13.01) and to decrease 1-year mortality (odds ratio = 0.60; 95% CI, 0.39-0.92).

Conclusions: Acute trauma patients should be recognized as an underserved population that would benefit considerably from inpatient rehabilitation services after discharge from the hospital.

19. Return to Work and Functional Outcomes After Major Trauma: Who Recovers, When, and How Well? Gabbe BJ, et al. Ann Surg. 2016 Apr;263(4):623-32. doi: 10.1097/SLA.0000000000001564.

PDF: [Read PDF Here](#)

URL: <https://pubmed.ncbi.nlm.nih.gov/26779977/>

Objective: To describe the long-term outcomes of major trauma patients and factors associated with the rate of recovery.

Background: As injury-related mortality decreases, there is increased focus on improving the quality of survival and reducing nonfatal injury burden.

Methods: Adult major trauma survivors to discharge, injured between July 2007 and June 2012 in Victoria, Australia, were followed up at 6, 12, and 24 months after injury to measure function (Glasgow Outcome Scale-Extended) and return to work/study. Random-effects regression models were fitted to identify predictors of outcome and differences in the rate of change in each outcome between patient subgroups.

Results: Among the 8844 survivors, 8128 (92%) were followed up. Also, 23% had achieved a good functional recovery, and 70% had returned to work/study at 24 months. The adjusted odds of reporting better function at 12 months was 27% (adjusted odds ratio 1.27, 95% confidence interval [CI] 1.19-1.36) higher compared with 6 months, and 9% (adjusted odds ratio 1.09, 95% CI, 1.02-1.17) higher at 24 months compared with 12 months. The adjusted relative risk (RR) of returning to work was 14% higher at 12 months compared with 6 months (adjusted RR 1.14, 95% CI, 1.12-1.16) and 8% (adjusted RR 1.08, 95% CI, 1.06-1.10) higher at 24 months compared with 12 months. *Conclusions:* Improvement in outcomes over the study period was observed, although ongoing disability was common at 24 months. Recovery trajectories differed by patient characteristics, providing valuable information for informing prognostication and service planning, and improving our understanding of the burden of nonfatal injury.

20. Predictors of functional limitation trajectories after injury in a nationally representative U.S. older adult population. Bell TM, et al. *Ann Epidemiol.* 2015 Dec;25(12):894-900. doi: 10.1016/j.annepidem.2015.08.012.

PDF: [Read PDF Here](#)

URL: <https://pubmed.ncbi.nlm.nih.gov/26481503/>

Purpose: Studies examining postinjury functional status have demonstrated that individuals with severe injuries often do not return to baseline levels of physical functioning. We sought to investigate the impact injuries have on changes in physical functioning across the life course of older adults. The study's objectives were to (1) identify trajectories of long-term functional limitations after injury in the older adult population to better characterize the recovery process and (2) predict which individuals are most at risk for poor functional trajectories after injury.

Methods: A retrospective cohort study was conducted using six waves of data from the Health and Retirement Study, which surveys Americans older than 50 years every two years. A group-based trajectory model was used to identify trajectories of functional limitations in injured participants. Using multivariate regression, we identified significant predictors of each trajectory.

Results: Five distinct trajectories were identified: Trajectory 1--consistently low functional limitations scores (18.9%), Trajectory 2--increase in functional limitations after injury followed by a gradual, incomplete recovery (46.3%), Trajectory 3--increase in functional limitations followed by further decline in functioning (10.5%), Trajectory 4--increase in functional limitations after injury followed by a gradual, complete recovery (13.4%), and Trajectory 5--consistently high functional limitations scores (10.8%).

Gender, multiple health conditions, and insurance status predicted trajectory membership.

Conclusions: Functional limitations after injury follow distinct trajectories that can be predicted by baseline individual characteristics.

21. Physical and mental health 10 years after multiple trauma: A prospective cohort study. Soberg HL, et al. *J Trauma Acute Care Surg.* 2015 Mar;78(3):628-33. doi: 10.1097/TA.0000000000000541.

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URL: <https://pubmed.ncbi.nlm.nih.gov/25710437/>

Background: People who have sustained severe multiple injuries have reduced health and functioning years after the injury. For people who have sustained severe injuries, an optimal degree of predictability in future functioning and health-related quality of life is important. The main aim was to study the impacts of demographic- and injury-related factors as well as functioning at 1 year and 2 years after injury on physical and mental health 10 years after injury.

Methods: Fifty-eight participants completed a 10-year follow-up (55.2% of all included patients). Demographic and injury severity characteristics were collected, and assessments at 1, 2, 5, and 10 years after injury were performed. Patient-reported outcome measures were the Short Form 36 (SF-36), the Brief Approach/Avoidance Coping Questionnaire, and the cognitive function scale (COG). The SF-36 Physical and Mental Component Summaries (PCS and MCS, respectively) were the main outcome variables. We performed hierarchical multiple regression analyses to assess functioning on the PCS and MCS.

Results: Mean (SD) age at injury was 37.8 (14.7) years, 74% were male. Mean (SD) New Injury Severity Score (NISS) was 33.7 (13.0). Mean (SD) PCS score was 41.8 (11.7). Mean (SD) MCS was 48.8 (10.7). Predictors of the PCS were change in coping from 2 years to 10 years ($p = 0.032$), physical functioning ($p < 0.001$) and cognitive functioning at 1 year ($p = 0.011$), as well as bodily pain at 2 years ($p = 0.005$). Adjusted R was 0.57. Predictors of the MCS were change in coping ($p = 0.031$), vitality ($p = 0.008$) at 1 year, as well as social functioning ($p = 0.034$) and mental health ($p = 0.043$) at 2 years. Adjusted R was 0.64.

Conclusion: Physical health was reduced compared with the adjusted general population at 10 years after injury. The mental health did not differ from that of the general population. In addition to physical functioning, coping strategies, vitality, social functioning, and mental health should be considered in the long-term rehabilitation perspective. A more comprehensive approach should be used for rehabilitation after multiple injuries.

22. Collaborative care intervention targeting violence risk behaviors, substance use, and posttraumatic stress and depressive symptoms in injured adolescents: a randomized clinical trial. Zatzick D, et al. JAMA Pediatr. 2014 Jun;168(6):532-9. doi:

10.1001/jamapediatrics.2013.4784.

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URL: <https://pubmed.ncbi.nlm.nih.gov/24733515/>

Importance: Violence and injury risk behaviors, alcohol and drug use problems, and posttraumatic stress disorder (PTSD) and depressive symptoms occur frequently among adolescents presenting to acute care medical settings after traumatic physical injury.

Objective: To test the effectiveness of a stepped collaborative care intervention targeting this constellation of risk behaviors and symptoms in randomly sampled hospitalized adolescents with and without traumatic brain injury.

Design, setting, and participants: A pragmatic randomized clinical trial was conducted at

a single US level I trauma center. Participants included 120 adolescents aged 12 to 18 years randomized to intervention (n = 59) and control (n = 61) conditions.

Interventions: Stepped collaborative care intervention included motivational interviewing elements targeting risk behaviors and substance use as well as medication and cognitive behavioral therapy elements targeting PTSD and depressive symptoms.

Main outcomes and measures: Adolescents were assessed at baseline before randomization and 2, 5, and 12 months after injury hospitalization. Standardized instruments were used to assess violence risk behaviors, alcohol and drug use, and PTSD and depressive symptoms.

Results: The investigation attained more than 95% adolescent follow-up at each assessment point. At baseline, approximately one-third of the participants endorsed the violence risk behavior of carrying a weapon. Regression analyses demonstrated that intervention patients experienced significant reductions in weapon carrying compared with controls during the year after injury (group \times time effect, $F_{3,344} = 3.0$; $P = .03$). At 12 months after the injury, 4 (7.3%) intervention patients vs 13 (21.3%) control patients reported currently carrying a weapon (relative risk, 0.31; 95% CI, 0.11-0.90). The intervention was equally effective in reducing the risk of weapon carrying among injured adolescents with and without traumatic brain injury. Other treatment targets, including alcohol and drug use problems and high levels of PTSD and depressive symptoms, occurred less frequently in the cohort relative to weapon carrying and were not significantly affected by the intervention.

Conclusions and relevance: Collaborative care intervention reduced the risk of adolescent weapon carrying during the year after the injury hospitalization. Future investigation should replicate this preliminary observation. If the finding is replicated, orchestrated investigative and policy efforts could systematically implement and evaluate screening and intervention procedures targeting youth violence prevention at US trauma centers.

23. A randomized stepped care intervention trial targeting posttraumatic stress disorder for surgically hospitalized injury survivors. Zatzick D, et al. *Ann Surg.* 2013

Mar;257(3):390-9. doi: 10.1097/SLA.0b013e31826bc313.

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URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3582367/>

Objective: To test the effectiveness of a stepped care intervention model targeting posttraumatic stress disorder (PTSD) symptoms after injury.

Background: Few investigations have evaluated interventions for injured patients with PTSD and related impairments that can be feasibly implemented in trauma surgical settings.

Methods: The investigation was a pragmatic effectiveness trial in which 207 acutely injured hospitalized trauma survivors were screened for high PTSD symptom levels and then randomized to a stepped combined, care management, psychopharmacology, and cognitive behavioral psychotherapy intervention (n = 104) or usual care control (n = 103) conditions. The symptoms of PTSD and functional limitations were reassessed at one-, three-, six-, nine-, and twelve-months after the index injury admission.

Results: Regression analyses demonstrated that over the course of the year after injury, intervention patients had significantly reduced PTSD symptoms when compared to controls (group by time effect, CAPS, $F(2, 185) = 5.50, P < 0.01$; PCL-C, $F(4, 185) = 5.45, P < 0.001$). Clinically and statistically significant PTSD treatment effects were observed at the six-, nine-, and twelve-month post-injury assessments. Over the course of the year after injury, intervention patients also demonstrated significant improvements in physical function (MOS SF-36 PCS main effect, $F(1, 172) = 9.87, P < 0.01$).

Conclusion: Stepped care interventions can reduce PTSD symptoms and improve functioning over the course of the year after surgical injury hospitalization. Orchestrated investigative and policy efforts could systematically introduce and evaluate screening and intervention procedures for PTSD at United States trauma centers.

24. Improved functional outcomes for major trauma patients in a regionalized, inclusive trauma system. Gabbe BJ, et al. *Ann Surg.* 2012 Jun;255(6):1009-15. doi:

10.1097/SLA.0b013e31824c4b91.

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URL: <https://pubmed.ncbi.nlm.nih.gov/22584628/>

Objective: To describe outcomes of major trauma survivors managed in an organized trauma system, including the association between levels of care and outcomes over time.

Background: Trauma care systems aim to reduce deaths and disability. Studies have found that regionalization of trauma care reduces mortality but the impact on quality of survival is unknown. Evaluation of a trauma system should include mortality and morbidity.

Methods: Predictors of 12-month functional (Glasgow Outcome Scale-Extended) outcomes after blunt major trauma (Injury Severity Score >15) in an organized trauma system were explored using ordered logistic regression for the period October 2006 to June 2009. Data from the population-based Victorian State Trauma Registry were used.

Results: There were 4986 patients older than 18 years. In-hospital mortality decreased from 11.9% in 2006-2007 to 9.9% in 2008-2009. The follow-up rate at 12 months was 86% ($n = 3824$). Eighty percent reported functional limitations. Odds of better functional outcome increased in the 2007-2008 [adjusted odds ratio (AOR): 1.22; 95% CI: 1.05, 1.41] and 2008-2009 (AOR: 1.16; 95% CI: 1.01, 1.34) years compared with 2006-2007. Cases managed at major trauma services (MTS) achieved better functional outcome (AOR: 1.22; 95% CI: 1.03, 1.45). Female gender, older age, and lower levels of education demonstrated lower adjusted odds of better outcome.

Conclusions: Despite an annual decline in mortality, risk-adjusted functional outcomes improved over time, and cases managed at MTS (level-1 trauma centers) demonstrated better functional outcomes. The findings provide early evidence that this inclusive, regionalized trauma system is achieving its aims.

25. Functional and health-related quality of life outcomes after pediatric trauma. Gabbe BJ, et al. *J Trauma.* 2011 Jun;70(6):1532-8. doi: 10.1097/TA.0b013e31820e8546.

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URL: <https://pubmed.ncbi.nlm.nih.gov/21427613/>

Background: Pediatric trauma results in lower mortality than adults and a high potential for lifelong functional impairment and reduced health-related quality of life (HRQL). There is no consensus regarding the best approach to measuring outcomes in this group.

Methods: One hundred and fifty injured children admitted to a pediatric trauma center participated in this study. The Pediatric Quality of Life Inventory (PedsQL), Child Health Questionnaire (CHQ-PF28), King's Outcome Scale for Childhood Head Injury (KOSCHI), modified Glasgow Outcome Scale (mGOS), and the Functional Independence Measure (FIM) were administered at 1 month, 6 months, and 12 months after injury by telephone. Change in instrument scores was assessed using multilevel mixed effects models. Mean HRQL scores were compared with population norms for the CHQ-PF28 and with healthy children for the PedsQL.

Results: Follow-up at all time points was completed for 144 (96%) cases. The median injury severity score was 10, and 65% of the patients enrolled were men. At 12 months, the percentage of cases with ongoing disability was 14% for the FIM, 61% using the mGOS, and 58% for the KOSCHI. CHQ-PF28 physical and PedsQL psychosocial health scores were below healthy child norms at 12 months. Improvement across all time points was demonstrated for the KOSCHI, mGOS, CHQ-PF28 physical, and PedsQL psychosocial summary scores.

Conclusions: Seriously injured children showed ongoing disability and reduced HRQL 12 months after injury. The CHQ-PF28 and PedsQL, and the mGOS and KOSCHI, performed comparably. The FIM demonstrated considerable ceiling effects, and improvement over time was not shown. The results inform the methodology of pediatric outcomes studies and protocol development for the routine follow-up of pediatric trauma patients.

26. Population-based capture of long-term functional and quality of life outcomes after major trauma: the experiences of the Victorian State Trauma Registry. Gabbe BJ, et al.

J Trauma. 2010 Sep;69(3):532-6; discussion 536. doi: 10.1097/TA.0b013e3181e5125b.

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URL: <https://pubmed.ncbi.nlm.nih.gov/20838122/>

Improved survival rates for trauma patients has placed a greater emphasis on determining the morbidity associated with injury, including the degree of functional loss, ongoing disability, and lost quality of life experienced by survivors. Improvements in trauma care in advanced trauma systems have the potential to influence morbidity rather than mortality; however, there is no systematic approach to measuring morbidity after injury and, therefore, no possibility of meaningfully benchmarking improvements. Anecdotally, a major impediment in measuring injury-related morbidity has been a belief that it is not feasible. Collection of long-term outcomes data are necessary to establish the impact of the injury problem, evaluate treatment approaches, inform injury prevention research, and improve public health program planning. Despite acknowledgment that the greatest cost burden of injury is related to morbidity, routine

measurement of injury outcomes other than mortality is rare. Existing surveillance systems such as hospital admission datasets and trauma registries fail to include long-term outcome measures. Cost, institutional ethics approval, selection of instruments, and mode of administration are the barriers toward the collection of long-term outcomes data. These barriers are not insurmountable. This article outlines the approach taken by the Victorian State Trauma Registry (VSTR) in Australia to address these issues and implement routine, population-based follow-up of adult trauma survivors.

27. A national US study of posttraumatic stress disorder, depression, and work and functional outcomes after hospitalization for traumatic injury. Zatzick D, et al. *Ann Surg.* 2008 Sep;248(3):429-37. doi: 10.1097/SLA.0b013e318185a6b8.

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URL: <https://pubmed.ncbi.nlm.nih.gov/18791363/>

Objective: To examine factors other than injury severity that are likely to influence functional outcomes after hospitalization for injury.

Summary background data: This study used data from the National Study on the Costs and Outcomes of Trauma investigation to examine the association between posttraumatic stress disorder (PTSD), depression, and return to work and the development of functional impairments after injury.

Method: A total of 2707 surgical inpatients who were representative of 9374 injured patients were recruited from 69 hospitals across the US. PTSD and depression were assessed at 12 months postinjury, as were the following functional outcomes: activities of daily living, health status, and return to usual major activities and work. Regression analyses assessed the associations between PTSD and depression and functional outcomes while adjusting for clinical and demographic characteristics.

Results: At 12 months after injury, 20.7% of patients had PTSD and 6.6% had depression. Both disorders were independently associated with significant impairments across all functional outcomes. A dose-response relationship was observed, such that previously working patients with 1 disorder had a 3-fold increased odds of not returning to work 12 months after injury odds ratio = 3.20 95% (95% confidence interval = 2.46, 4.16), and patients with both disorders had a 5-6 fold increased odds of not returning to work after injury odds ratio = 5.57 (95% confidence interval = 2.51, 12.37) when compared with previously working patients without PTSD or depression.

Conclusions: PTSD and depression occur frequently and are independently associated with enduring impairments after injury hospitalization. Early acute care interventions targeting these disorders have the potential to improve functional recovery after injury.

28. Long-term persistence of disability following severe lower-limb trauma. Results of a seven-year follow-up. MacKenzie EJ, et al. *J Bone Joint Surg Am.* 2005 Aug;87(8):1801-9. doi: 10.2106/JBJS.E.00032.

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URL: <https://pubmed.ncbi.nlm.nih.gov/16085622/>

Background: A recent study demonstrated that patients treated with amputation and

those treated with reconstruction had comparable functional outcomes at two years following limb-threatening trauma. The present study was designed to determine whether those outcomes improved after two years, and whether differences according to the type of treatment emerged.

Methods: Three hundred and ninety-seven patients who had undergone amputation or reconstruction of the lower extremity were interviewed by telephone at an average of eighty-four months after the injury. Functional outcomes were assessed with use of the physical and psychosocial subscores of the Sickness Impact Profile (SIP) and were compared with similar scores obtained at twenty-four months.

Results: On the average, physical and psychosocial functioning deteriorated between twenty-four and eighty-four months after the injury. At eighty-four months, one-half of the patients had a physical SIP subscore of ≥ 10 points, which is indicative of substantial disability, and only 34.5% had a score typical of a general population of similar age and gender. There were few significant differences in the outcomes according to the type of treatment, with two exceptions. Compared with patients treated with reconstruction for a tibial shaft fracture, those with only a severe soft-tissue injury of the leg were 3.1 times more likely to have a physical SIP subscore of 5 points ($p < 0.05$) and those treated with a through-the-knee amputation were 11.5 times more likely to have a physical subscore of 5 points ($p < 0.05$). There were no significant differences in the psychosocial outcomes according to treatment group. Patient characteristics that were significantly associated with poorer outcomes included older age, female gender, nonwhite race, lower education level, living in a poor household, current or previous smoking, low self-efficacy, poor self-reported health status before the injury, and involvement with the legal system in an effort to obtain disability payments. Except for age, predictors of poor outcome were similar at twenty-four and eighty-four months after the injury.

Conclusions: The results confirm previous conclusions that reconstruction for the treatment of injuries below the distal part of the femur typically results in functional outcomes equivalent to those of amputation. Regardless of the treatment option, however, long-term functional outcomes are poor. Priority should be given to efforts to improve post-acute-care services that address secondary conditions that compromise optimal recovery.

29. Developing Australia's first statewide trauma registry: what are the lessons? Cameron PA, et al. ANZ J Surg. 2004 Jun;74(6):424-8. doi: 10.1111/j.1445-1433.2004.03029.x.

PDF: [Read PDF Here](#)

URL: <https://pubmed.ncbi.nlm.nih.gov/15191472/>

Trauma registries, like disease registries, provide an important analysis tool to assess the management of patient care. Trauma registries are well established and relatively common in the USA and have been used to change legislation, promote trauma prevention and to evaluate trauma system effectiveness. In Australia, the first truly statewide trauma registry was established in Victoria in 2001 with an estimated capture of 1700 major trauma cases annually. The Victorian State Trauma Registry, managed by the Victorian State Trauma Outcomes Registry and Monitoring (VSTORM) group, was

established in response to a ministerial review of trauma and emergency services undertaken in 1997 to advise the Victorian Government on a best practice model of trauma service provision that was responsive to the particular needs of critically ill trauma patients. This taskforce recommended the establishment of a new system of care for major trauma patients in Victoria and a statewide trauma registry to monitor this new system. The development of the Victorian state trauma registry has shown that there are certain issues that must be resolved for successful implementation of any system-wide registry. This paper describes the issues faced by VSTORM in developing, implementing and maintaining a statewide trauma registry.

30. The impact of major trauma: quality-of-life outcomes are worse in women than in men, independent of mechanism and injury severity. Holbrook TL, Hoyt DB. *J Trauma*. 2004 Feb;56(2):284-90. doi: 10.1097/01.TA.0000109758.75406.F8.

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URL: <https://pubmed.ncbi.nlm.nih.gov/14960969/>

Background: The importance of gender differences in quality of life and psychologic morbidity after major trauma is a newly recognized focus of trauma outcomes research. The Trauma Recovery Project is a large, prospective, epidemiologic study designed to examine multiple outcomes after major trauma, including quality of life (QoL), and psychologic sequelae such as depression and early symptoms of acute stress reaction (SASR). The specific objectives of the present report are to examine gender differences in QoL outcomes and the early incidence of combined depression and SASR after injury, controlling for injury severity, specific body area injured, and mechanism.

Methods: Between December 1, 1993, and September 1, 1996, 1,048 eligible trauma patients triaged to four participating trauma center hospitals in the San Diego Regionalized Trauma System were enrolled in the study. The enrollment criteria for the study included age 18 years and older, admission Glasgow Coma Scale score of 12 or greater, and length of stay greater than 24 hours. QoL outcome after trauma was measured after injury using the Quality of Well-being scale, a sensitive index to the well end of the functioning continuum (range, 0 = death to 1.000 = optimum functioning). Depression was assessed using the Center for Epidemiologic Studies scale. SASR was assessed using the Impact of Events scale. Patient outcomes were assessed at discharge and at 6, 12, and 18 months after discharge.

Results: Women (n = 313) were significantly more likely to have poor QoL outcomes at follow-up than men (n = 735) (women vs. men: 12-month follow-up odds ratio [OR] = 2.2, p < 0.001; 18-month follow-up OR = 2.0, p < 0.001). Quality of Well-being scores at each of the 6-, 12-, and 18-month follow-up time points were markedly and significantly lower in women compared with men, independent of injury severity, serious and moderate injury status, lower extremity injury, intentional or unintentional injury type, and blunt or penetrating injury. Women were also significantly more likely to develop early combined depression and SASR at discharge (OR = 1.7, p < 0.01) and to have continuous depression throughout the 18-month follow-up period (OR = 2.3, p < 0.001).

Conclusion: These analyses provide further important and more detailed evidence that women are at risk of worse QoL outcomes and early psychologic morbidity after major

trauma than men, independent of mechanism and injury severity. A better understanding of the impact of major trauma in men and women will be an important component of efforts to improve trauma care and long-term outcome in mature trauma systems.

Reviews and Proceedings

31. Long-term Patient-Reported Outcomes and Patient-Reported Outcome Measures after Injury: The National Trauma Research Action Plan (NTRAP) Scoping Review. Herrera-

Escobar, JP, et al. J Trauma Acute Care Surg 2021 Feb. Epub ahead of print. doi: 10.1097/TA.0000000000003108

PDF: [Read PDF Here](#)

URL: <https://pubmed.ncbi.nlm.nih.gov/33605698/>

Background: The aim of this scoping review is to identify and summarize patient-reported outcome measures (PROMs) that are being used to track long-term patient-reported outcomes (PROs) after injury and can potentially be included in trauma registries.

Methods: Online databases were used to identify studies published between 2013-2019, from which we selected 747 articles that involved survivors of acute physical traumatic injury aged 18 or older at time of injury and used PROMs to evaluate recovery between six months and 10 years post-injury. Data was extracted and summarized using descriptive statistics and a narrative synthesis of the results.

Results: Most studies were observational, with relatively small sample sizes, and predominantly on traumatic brain injury or orthopedic patients. The number of PROs assessed per study varied from one to 12, for a total of 2052 PROs extracted, yielding 74 unique constructs [physical health: 25 (34%), mental health: 27 (37%), social health: 12 (16%), cognitive health: 7 (10%), and quality of life: 3 (4%)]. These 74 constructs were assessed using 355 different PROMs. Mental health was the most frequently examined outcome domain followed by physical health. Health-related quality of life, which appeared in more than half of the studies (n=401), was the most common PRO evaluated, followed by depressive symptoms. Physical health was the domain with the highest number of PROMs used (N= 157), and lower extremity functionality was the PRO that contributed most PROMs (N=33).

Conclusion: We identified a wide variety of PROMs available to track long-term PROs after injury in five different health domains: physical, mental, social, cognitive, and quality of life. However, efforts to fully understand the health outcomes of trauma patients remain inconsistent and insufficient. Defining PROs that should be prioritized and standardizing the PROMs to measure them will facilitate the incorporation of long-term outcomes in national registries to improve research and quality of care.

32. Proceedings from the Consensus Conference on Trauma Patient-Reported Outcome Measures. Sakran JV, et al. J Am Coll Surg. 2020 May;230(5):819-835. doi:

10.1016/j.jamcollsurg.2020.01.032.

PDF: [Read PDF Here](#)

URL: <https://pubmed.ncbi.nlm.nih.gov/32201197/>

No abstract available.

33. An introduction to patient-reported outcome measures (PROMs) in trauma. Turner

GM, et al. J Trauma Acute Care Surg. 2019 Feb;86(2):314-320. doi:

10.1097/TA.0000000000002102. PMID: 30376536.

PDF: [Read PDF Here](#)

URL: <https://pubmed.ncbi.nlm.nih.gov/30376536/>

Increased survival rates from traumatic injury have resulted in more people living with disability and reduced quality of life. To understand how peoples' quality of life is affected following a traumatic injury and the effects of that injury on their health and well-being, it is important to capture patients' perspectives of their own health. Patient-reported outcome measures (PROMs) are questionnaires, completed by patients, which can be used to measure the symptom burden associated with trauma and its treatment, and impact on quality of life. Patient-reported outcome measures have a wide variety of uses that are relevant to trauma. In a research setting, PROMs can be used to assess the effectiveness of treatment and burden of disease. In a clinical setting, PROMs have the potential to inform and guide patient-centered care and clinical decision making. Collected as part of trauma registries, PROMs can be used at an aggregate level to inform improvements and uphold the quality of trauma care. This literature review explores and summarizes the key current and potential future uses of PROMs in trauma research, routine clinical practice, and registries.

34. Patient-reported outcomes in trauma: a scoping study of published research.

Rosenberg GM, et al. Trauma Surg Acute Care Open. 2018 Sep 4;3(1):e000202. doi:

10.1136/tsaco-2018-000202.

PDF: [Read PDF Here](#)

URL: <https://pubmed.ncbi.nlm.nih.gov/30234168/>

More people are surviving traumatic injury, but disability and reduced quality of life are frequent. Investigators are now focusing on patient-reported outcomes (PROs) to better understand this problem. We performed a scoping study of the literature to explore trends in the study of PROs after injury. The volume of published literature on PROs after injury has consistently increased, but use of measurement tool and categorization of publications are inconsistent. Journal keyword patterns are inconsistent and likely limit the effective dissemination of important findings. In studies of hospitalized trauma patients, more than 100 unique measurement tools were used, and trauma-specific measures were used in fewer than 5% of studies. International investigators are more consistent than those in the USA in the use of validated, classic measurement tools such as the Short-Form 36 and the EuroQoL Five-Dimension tools. Uniform use of measurement tools would help improve the quality and comparability of research on PROs, and trauma-specific measures would enhance the study of long-term injury outcomes.

35. Health outcome after major trauma: what are we measuring? Hoffman K, et al. PLoS One. 2014 Jul 22;9(7):e103082. doi: 10.1371/journal.pone.0103082.

PDF: [Read PDF Here](#)

URL: <https://pubmed.ncbi.nlm.nih.gov/25051353/>

Importance: Trauma is a global disease and is among the leading causes of disability in the world. The importance of outcome beyond trauma survival has been recognised over the last decade. Despite this there is no internationally agreed approach for assessment of health outcome and rehabilitation of trauma patients.

Objective: To systematically examine to what extent outcomes measures evaluate health outcomes in patients with major trauma.

Data sources: MEDLINE, EMBASE, and CINAHL (from 2006-2012) were searched for studies evaluating health outcome after traumatic injuries.

Study selection and data extraction: Studies of adult patients with injuries involving at least two body areas or organ systems were included. Information on study design, outcome measures used, sample size and outcomes were extracted. The World Health Organisation International Classification of Function, Disability and Health (ICF) were used to evaluate to what extent outcome measures captured health impacts.

Results: 34 studies from 755 studies were included in the review. 38 outcome measures were identified. 21 outcome measures were used only once and only five were used in three or more studies. Only 6% of all possible health impacts were captured. Concepts related to activity and participation were the most represented but still only captured 12% of all possible concepts in this domain. Measures performed very poorly in capturing concepts related to body function (5%), functional activities (11%) and environmental factors (2%).

Conclusion: Outcome measures used in major trauma capture only a small proportion of health impacts. There is no inclusive classification for measuring disability or health outcome following trauma. The ICF may provide a useful framework for the development of a comprehensive health outcome measure for trauma care.