The role of post-traumatic stress disorder and depression in predicting disability after injury

Meaghan L O'Donnell, Alexander C Holmes, Mark C Creamer, Steven Ellen, Rodney Judson, Alexander C McFarlane, Derrick M Silove and Richard A Bryant

ABSTRACT

Objectives: To examine the relationship between psychological response to injury at 1 week and 3 months, and disability at 12 months.

Design: Multisite, longitudinal study.

Participants and setting: 802 adult patients admitted to trauma services at four Australian hospitals from 13 March 2004 to 21 February 2006 were assessed before discharge and followed up at 3 and 12 months.

Main outcome measure: Disability, measured with the 12-item version of the World Health Organization Disability Assessment Schedule II.

Results: Logistic regression identified the degree to which high levels of depression and post-traumatic stress disorder (PTSD) at 1 week and at 3 months predicted disability at 12 months. After controlling for demographic variables and characteristics of the injury, patients with PTSD or subsyndromal PTSD at 1 week were 2.4 times more likely, and those with depression at 1 week were 1.9 times more likely to have high disability levels at 12 months. PTSD at 3 months was associated with 3.7 times, and depression at 3 months with 3.4 times the risk of high disability at 12 months.

Conclusions: PTSD and depression at 1 week and at 3 months after injury significantly increased the risk of disability at 12 months. Routine assessment of symptoms of depression and PTSD in patients who have been physically injured may facilitate triage to evidence-based treatments, leading to improvement in both physical and psychological outcomes.

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Injury is a leading global cause of morbidity and mortality.[1] Each year over 350 000 Australians experience an injury severe enough to warrant hospital admission.[2] The aim of trauma health care services is to restore damaged body structures and functions, and to prevent or limit disability (defined as the difficulty an individual has performing activities and roles within the context of his or her environment[3]). The determinants of long-term disability are often complex, involving interaction between physical, psychological and social factors. Elucidating early markers of later disability provides an opportunity to identify at-risk patients, with the potential to modify treatment approaches to improve long-term function.

New episodes of psychiatric disorder occur in 10%–20% of patients after injury sufficiently serious to require hospitalisation.[4] Post-traumatic stress disorder (PTSD) and depression are among the main psychiatric disorders to develop after injury.[5] Although the rates of post-traumatic mental health problems after injury are relatively low (about 10% for PTSD), the high frequency with which injury occurs renders it a leading cause of post-traumatic mental health disorders.[6]

Disability after injury is strongly but not exclusively determined by characteristics of the injury. A body of literature has also shown a relationship between exposure to traumatic stressors (independent of injury) and poor physical health and functioning.[7] After injury, anxiety and depression contribute to lower levels of return to work and poorer quality of life.[8]

The degree to which PTSD and depression affect disability, relative to characteristics of the injury, has not been well described. In light of this, we conducted a large, multisite longitudinal study to examine the role of post-traumatic mental health on long-term disability following traumatic injury. Importantly, we sought to investigate the independent contributions that PTSD and depression made to later disability by controlling for demographic variables (sex, age, employment status, marital status), pre-injury disability, and characteristics of the injury (severity, intensive care unit admission, length of hospital stay, mild traumatic brain injury [MTBI], discharge destination).

METHODS

Participants were recruited from four hospitals in three states of Australia (Alfred and Royal Melbourne Hospitals in Victoria, Westmead Hospital in New South Wales, and Queen Elizabeth Hospital in South Australia). A random sample of patients admitted to trauma services on weekdays were recruited to the study over 23 months, from 13 March 2004 to 21 February 2006. We used an automated, random selection procedure, stratified by length of stay. Random selection was used rather than a consecutive design because the numbers of patients admitted to each trauma service was far greater than recruitment resources allowed.

Patients were included in the study if they had experienced a traumatic injury that required a hospital admission of longer than 24 hours; were aged 16–70 years; and had sufficient English comprehension to complete the assessment. Those with an MTBI (defined as a loss of consciousness of 30 minutes or less, or a Glasgow Coma Scale score of 13–15 after 30 minutes, or post-traumatic amnesia not longer than 24 hours[9]) were included in the study. Patients were excluded if they had moderate to severe traumatic brain injury, were suicidal or had psychosis.

The study procedures were fully explained to the patients who met our inclusion criteria and whose written informed consent was obtained. Initial assessments were conducted, on average, 7.2 days (SD, 9.6 days) after the initial admission for injury. The assessment consisted of a structured clinical interview that assessed the presence of PTSD or subsyndromal PTSD, and self-report questionnaires that assessed demographics, pre-injury disability, pre-injury alcohol use and acute depression. Injury-related information was derived from automated hospital-based registry systems. At 3 and 12 months, we used a structured clinical telephone interview to assess PTSD or subsyndromal PTSD. Participants were also sent self-report questionnaires at 3 and 12 months to assess current

depression and disability, and returned them in reply-paid envelopes.

The study was approved by the human research ethics committee at each hospital, and at the University of Melbourne.

Measures

- ***Disability:*** we measured pre-injury and 12-month disability with the 12-item version of the World Health Organization Disability Assessment Schedule II (WHODAS II). This is a general disability instrument developed to assess activity limitations and participation restrictions. The 12 items of the WHODAS II cover six domains: understanding and communicating; getting around; self-care; getting along with others; household and work activities; and participation in society. Items are rated on a five-point rating scale in which 1 indicates no difficulty and 5 indicates extreme difficulty or inability to perform the activity. The WHODAS II has been shown to be a reliable and valid measure of disability within a number of patient groups.[10] As there are currently no Australian norms for the WHODAS II 12-item version, we dichotomised the continuous score using one SD above the mean as the cut-off to create a high-disability and a low-disability group.
- ***Injury characteristics:*** the characteristics of the injury were assessed with a range of measures. The Injury Severity Score (ISS)[11] is a measure of injury severity derived from the scoring of individual injuries. Hospital length of stay, the presence of an MTBI, admission to an intensive care unit (ICU), and discharge to a rehabilitation facility provide additional practical information on injury severity.
- ***Depression:*** we used the Hospital Anxiety and Depression Scale (HADS)[12] to assess depression symptoms at 1 week and 3 months. The HADS is a particularly useful tool with injured populations, as it does not measure somatic symptoms. It has excellent discriminant validity and internal consistency, as well as a stable factor structure.[13] The HADS depression scores (1-week and 3-month) were dichotomised around a cut-off point of 8[13] to create a high-depression and a low-depression group.
- ***Alcohol use:*** we assessed pre-injury alcohol use with the Alcohol Use Disorders Identification Test (AUDIT), a WHO brief screening tool that identifies problematic alcohol use.[14] The AUDIT questionnaire consists of 10 items that measure alcohol consumption, dependence symptoms, and the personal and social harms reflective of drinking. The AUDIT shows good reliability and validity across a number of populations.[15]
- ***PTSD and subsyndromal PTSD:*** we assessed PTSD at 1 week and at 3 months using the Clinician-Administered PTSD Scale (CAPS) for the *Diagnostic and statistical manual of mental disorders,* fourth edition (DSM-IV).[16] This structured clinical interview is one of the most widely used tools for diagnosing PTSD, and has excellent reliability and validity.[17] PTSD at 1 week was assessed excluding the 1-month time criterion — a "since you were injured" time criterion was used. We used subsyndromal PTSD and PTSD as predictors of later disability. Subsyndromal PTSD was defined as the presence of: (i) at least one symptom from the re-experiencing cluster; (ii) at least three symptoms from the avoidance cluster or at least two symptoms from the arousal cluster; and (iii) a clinical level of impairment or distress.[18] We decided to include subsyndromal PTSD in recognition of the fluctuating course of PTSD symptoms,[19] and evidence that subsyndromal PTSD is associated with comparable levels of impairment to those of full PTSD.[20] All telephone assessments were digitally recorded to ensure ongoing adherence to the protocol. To test inter-rater reliability, 5% of all CAPS interviews were assessed by an independent assessor, blinded to the original scoring, who reviewed recordings of the original diagnostic interview. Overall, the diagnostic consistency between assessors on the CAPS was 1.00 at 3 months and 0.99 at 12 months.

Statistical analysis

Demographic characteristics (age, sex, employment status, marital status), injury characteristics (ISS, ICU status, length of stay, MTBI status, discharge destination), pre-injury disability and pre-injury alcohol use were compared between 12-month disability groups using χ^2 for dichotomous variables and t tests for continuous variables (Box 1). We used two logistic regressions to examine the relationship between PTSD/depression and 12-month disability. In the first logistic regression, demographic variables, injury characteristic variables, pre-injury disability and pre-injury alcohol use were entered with depression and PTSD/subsyndromal PTSD at 1 week. In the second logistic regression, all of the above variables were entered and PTSD and depression at 3 months was also included (Box 2). Thus, the second analysis shows how much PTSD and depression at 3 months contributes to disability at 12 months over and above PTSD and depression at 1 week. Adjusted odds ratios (AORs) with 95% confidence intervals are reported.

RESULTS

Of the 1593 patients randomly selected for the study, 1047 (66%) consented to participate and completed the initial assessment; 904 participants (86%) completed the 3-month assessment, and 802 (77%) completed the 12-month assessment.

Of those who completed the 12-month assessment (and adjusting for missing variable data), 573 (72%) were male, with an average age of 39 years (SD, 13.7). Half of the sample who completed the 12-month assessment (367; 50%) were married or in a de-facto relationship, and 68 (10%) were not employed. Sixty-two per cent of patients (448) had more than high-school education. Forty-four per cent of participants (342) experienced an MTBI, and the mean ISS was 11.4 (SD, 8.4), which is in the moderate range of severity. Participants spent an average of 12.4 days (SD, 12.3 days) in hospital, and 16% of participants (120) had an ICU admission.

Transport crashes were the principal mechanism of injury (518 participants; 65%); 131 participants (17%) had falls, 51 (6%) were assaulted, 38 (5%) had work-related accidents not specified in the above categories, and 55 (7%) were injured in other ways. Most participants were discharged home (605; 78%), and the remainder were discharged to a rehabilitation facility.

Individuals who refused to participate in our study did not differ from those who participated in terms of sex ($\chi^2 = 1.50$; df, 1; non-significant), length of hospital admission ($t[1571] = 0.92$; non-significant), or ISS ($t[1561] = 1.46$; non-significant). Those who refused to participate were younger than participants ($t[1433] = 3.44$; $P = 0.001$).

Individuals who failed to complete the 12-month assessment did not differ from those who completed it in terms of sex, days in hospital, or presence of an MTBI. Those who did not complete the 12-month assessment were younger (35.3 ± 13.1 v 39.0 ± 13.7 years; $t[1143] = 4.4$; $P < 0.001$) and had a lower ISS (10.2 ± 7.3 v 11.4 ± 8.4; $t[676.5] = 2.4$; $P = 0.02$).

A total of 18% of patients (144) fell into the 12-month high-disability group. Box 1 shows the between-group differences across all measured variables.

All variables (demographic, injury characteristics, pre-injury disability and alcohol use, and initial mental health characteristics) were entered into a logistic regression. PTSD (including subsyndromal PTSD) at 1 week significantly predicted high 12-month disability (AOR, 2.37; 95% CI, 1.28–4.41; $P = 0.006$), as did high levels of depression

1 Demographic details, pre-injury disability and alcohol use, injury characteristics, and post-injury mental health in a randomly selected sample of 802 Australian injury patients, grouped by 12-month disability status

	High-disability group	Low-disability group
No. of patients in disability group	144	658
Sex (female)	29%	28%
Mean age in years (SD)	40.67 (12.84)	39.69 (13.83)
Marital status (married or de facto)	48%	51%
Working before injury	80%*	93%
Mean pre-injury disability score (SD)	11.58 (15.39)*	6.24 (10.02)
Mean pre-injury alcohol use score (SD)	5.53 (5.39)	6.31 (5.32)
Mean injury severity score (SD)	11.43 (7.84)	11.38 (8.52)
Discharge to rehabilitation	32%*	20%
Intensive care unit admission	23%*	14%
Presence of mild traumatic brain injury	48%	43%
Mean no. of days of hospital admission (SD)	16.92 (16.84)*	11.42 (10.85)
Initial assessment		
Post-traumatic stress disorder (PTSD) and subsyndromal PTSD	29%*	10%
Depression	37%*	19%
3-Month assessment		
PTSD and subsyndromal PTSD	45%*	12%
Depression	53%*	17%

* Significant at $P < 0.001$.

2 Second logistic regression: adjusted odds ratios (95% CI) for demographic characteristics, pre-injury disability and alcohol use, injury characteristics, post-traumatic stress disorder (PTSD) and depression in the presence of disability at 12 months after injury

	Odds ratio	95% CI
Sex	0.51	0.27–0.95
Age	1.00	0.98–1.03
Working before injury	0.70	0.30–1.63
Marital status	1.05	0.59–1.87
Pre-injury alcohol use	0.98	0.93–1.20
Pre-injury disability	1.01	0.99–1.04
Mean injury severity score	0.96	0.91–1.00
Intensive care unit admission	1.23	0.57–2.66
Duration of hospital admission	1.03	1.01–1.05
Presence of mild traumatic brain injury	1.43	0.83–2.47
Discharge to rehabilitation	2.22	1.19–4.12
Initial assessment		
PTSD and subsyndromal PTSD	1.15	0.56–2.37
Depression	1.33	0.72–2.44
3-Month assessment		
PTSD and subsyndromal PTSD	3.67	2.02–6.67
Depression	3.36	1.85–6.11

(AOR, 1.87; 95% CI, 1.11–3.16; $P = 0.02$). In the second logistic regression (Box 2), after controlling for all variables, 3-month PTSD (including subsyndromal PTSD) significantly predicted 12-month disability (AOR, 3.67; 95% CI, 2.02–6.67; $P < 0.001$), as did 3-month depression (AOR, 3.36; 95% CI, 1.85–6.11; $P < 0.001$).

DISCUSSION

Our prospective study demonstrates the relationship between early mental health problems after injury and later disability. Specifically, PTSD/subsyndromal PTSD and depression in the first 3 months after injury significantly increased the risk of disability at 12 months, independent of other variables including pre-injury disability and injury severity. The finding that 3-month PTSD and depression predicted disability after controlling for 1-week symptoms suggests that PTSD and depression symptoms escalate over the first 3 months after injury, and it is this escalation of symptoms that is particularly associated with disability. PTSD and depression each made a unique contribution to later disability, despite often being comorbid. Our findings suggest these two diagnoses contribute to later disability in different ways.

The relationship between injury, early PTSD and depression, and later disability has important implications for the care of injured patients. Clinicians being aware of the potential comorbidity between physical ill health and mental health problems could improve the care of injured patients. Providing information,[21] empathic listening,[22] and maintaining continuity of care[23] may all improve the patient's experience of feeling supported. Feeling supported after a traumatic event is associated with decreased adverse psychological sequelae.[24] Likewise, acknowledging common stressors, such as uncertainty about recovery, ongoing physical symptoms, and financial pressures, is likely to improve patients' satisfaction with care.

Injured patients can be screened in the initial stage of their hospital admission to identify those who are at higher risk of developing mental health problems. Several screening tests are available for this purpose, including one specifically designed for identifying risk of PTSD and depression in injured patients.[25] Once patients are identified as being at high risk, they should receive regular follow-up through primary care, with early referral to mental health services if symptoms emerge or escalate. Early psychological interventions show promising results in preventing and/or treating post-traumatic mental health problems.[4]

In lieu of, or perhaps in addition to, early screening, injured patients with high levels of disability should be screened for current mental health problems. Short screens such

as the HADS for anxiety and depression, or the PTSD Checklist[26] are suited to this task. If mental health problems are identified, specialist assessment leading to trauma-focused cognitive behaviour therapy is the first-line treatment for PTSD,[27] and cognitive behaviour therapy and/or antidepressant medications are effective for major depression.[28]

This study is limited in a number of ways. First, the 12-item WHODAS II assessed premorbid disability retrospectively, and there may have been an interaction between being injured and reporting of prior disability. Second, the main mechanism of injury in this sample was motor vehicle accidents, with only a small proportion of patients experiencing assault. How well these findings generalise to other countries where interpersonal violence makes up a larger proportion of injury to patients is unknown, given that interpersonal violence is associated with higher levels of PTSD than other mechanisms of injury.[29] Similarly, because we selected weekday admissions, patients who were admitted and discharged on the weekend were not a part of this sample. They might represent a different group to the whole sample. Finally, there may be limitations to generalising these findings to young people, given that younger people were less likely to participate in the study and less likely to complete the 12-month assessment. We can only speculate why young, less severely injured participants were less likely to complete the study, but, anecdotally, we found that these young participants had reengaged in their lives and were "too busy" to complete the questionnaires.

Our finding that early psychological distress predicts disability at 1 year represents both a challenge and an opportunity. The challenge is to develop treatment models that acknowledge the close interaction between physical and psychological factors, in contrast to the fragmented discipline-specific approach currently taken. The opportunity is that, in doing so in the immediate aftermath of injury, long-term disability may be reduced.

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COMPETING INTERESTS

None identified.

AUTHOR DETAILS

Meaghan L O'Donnell, BSc (Hons), MA(Clin), PhD, Senior Research Fellow, Department of Psychiatry, Australian Centre for Posttraumatic Mental Health[1] and National Trauma Research Institute[2]
Alexander C Holmes, MMed(Psych), FRANZCP, PhD, Senior Lecturer, Department of Psychiatry,[1] and Head of Psychiatry Consultation Liaison[3]
Mark C Creamer, BA(Hons), MA(Clin), PhD, Professor, Department of Psychiatry, and Director of Australian Centre for Posttraumatic Mental Health[1]
Steven Ellen, MB BS, MD, FRANZCP, Associate Professor, Department of Psychiatry, Alfred Hospital and Alfred Psychiatric Research Centre[2]
Rodney Judson, MB BS, FRCS, FRACS, Associate Professor,[1] and Director of Trauma Surgery[3]
Alexander C McFarlane, MB BS(Hons), MD, FRANZCP, Professor, School of Psychiatry, and Head, Centre for Military and Veterans' Health[4]
Derrick M Silove, MD, FRANZCP, Professor, School of Psychiatry, and Head, Centre for Population Mental Health Research[5]
Richard A Bryant, BA(Hons), MA(Clin), PhD, Professor, School of Psychology[5]
1 University of Melbourne, Melbourne, VIC.
2 Alfred Health, Melbourne, VIC.
3 Royal Melbourne Hospital, Melbourne, VIC.
4 University of Adelaide, Adelaide, SA.
5 University of New South Wales, Sydney, NSW.
Correspondence: mod@unimelb.edu.au

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