Received: 30 October 2017 | Revised: 21 March 2018 | Accepted: 16 April 2018
DOI: 10.1002/smi.2815

RESEARCH ARTICLE

WILEY

The role of site and severity of injury as predictors of mental health outcomes following traumatic injury

Katharine Baecher[1] | Maria Kangas[1] | Alan Taylor[2] | Meaghan L. O'Donnell[3,4] | Richard A. Bryant[5] | Derrick Silove[6,7] | Alexander C. McFarlane[8] | Darryl Wade[3]

[1] Centre for Emotional Health, Department of Psychology, Macquarie University, Sydney, NSW, Australia
[2] Department of Psychology, Macquarie University, Sydney, NSW, Australia
[3] Phoenix Australia: Centre for Posttraumatic Mental Health, Carlton, VIC, Australia
[4] Department of Psychiatry, University of Melbourne, Parkville, VIC, Australia
[5] School of Psychology, University of New South Wales, Sydney, NSW, Australia
[6] Mental Health Centre, Liverpool, NSW, Australia
[7] School of Psychiatry, University of New South Wales, Sydney, NSW, Australia
[8] Centre for Traumatic Stress Studies, The University of Adelaide, Adelaide, SA, Australia

Correspondence Maria Kangas, Macquarie University Centre for Emotional Health Department of Psychology Building C3A 717 Ryde NSW 2109 Australia.
Email: maria.kangas@mq.edu.au

Funding information
National Health and Medical Research Council of Australia, Grant/Award Number: 1073041

Abstract

The aim of this study was to investigate the influence of injury site and severity as predictors of mental health outcomes in the initial 12 months following traumatic injury. Using a multisite, longitudinal study, participants with a traumatic physical injury (N = 1,098) were assessed during hospital admission and followed up at 3 months (N = 932, 86%) and at 12 months (N = 715, 71%). Injury site was measured using the Abbreviated Injury Scale 90, and objective injury severity was measured using the Injury Severity Score. Participants also completed the Hospital Anxiety and Depression Scale and the Clinician Administered Post-traumatic Stress Disorder (PTSD) Scale. A random intercept mixed modelling analysis was conducted to evaluate the effects of site and severity of injury in relation to anxiety, PTSD, and depressive symptoms. Injury severity, as well as head and facial injuries, was predictive of elevated PTSD symptoms, and external injuries were associated with both PTSD and depression severity. In contrast, lower extremity injuries were associated with depressive and anxiety symptoms. The findings suggest that visible injuries are predictive of reduced mental health, particularly PTSD following traumatic injury. This has clinical implications for further advancing the screening for vulnerable injured trauma survivors at risk of chronic psychopathology.

KEYWORDS

depression, injury severity, injury site, mental health, PTSD

1 | INTRODUCTION

Traumatic injury, defined as physical injury severe enough to require hospitalization (O'Donnell, Bryant, Creamer, & Carty, 2008; Quale & Schanke, 2010), is one of the leading precipitants of trauma-related psychiatric disorders (O'Donnell et al., 2008). Prevalence rates of psychological morbidity (including post-traumatic stress disorder [PTSD], anxiety, and depression) following traumatic injury have ranged from 17.5% to 42% at 6 months and 2% to 36% at 12 months (O'Donnell, Creamer, Bryant, Schnyder, & Shalev, 2003) post-injury. Positive associations have consistently been found between reduced mental health outcomes post-trauma and younger age, female gender, history of psychiatric disorder, and exposure to previous traumatic events (Steel, Dunlavy, Stillman, & Paper, 2011).

To date, studies that have examined the extent to which the objective severity of injury predicts PTSD and other psychiatric disorders have produced equivocal results. Several studies have reported no relationship between the objective severity of injury and mental health outcomes such as depression, PTSD, and quality of life (Mason, Turpin, Woods, Wardrope, & Rowlands, 2006; Quale & Schanke, 2010). In contrast, at least one study reported a negative relationship, where higher injury severity predicted lower PTSD (Delahanty, Raimonde, Spoonster, & Cullado, 2003); whereas other studies have found a strong positive correlation between injury severity and elevated levels of psychopathology symptoms (Frommberger et al., 1998; Jeavons, 2000).

This mixed pattern of findings between injury severity and mental health outcomes may in part be attributed to differences in the measures used to assess injury across studies, including the Injury Severity

Score (ISS; Baker & O'Neill, 1976), the Abbreviated Injury Scale 90 (AIS; Baker, O'Neill, Haddon, & Long, 1974), and the New ISS (Osler, Baker, & Long, 1997). Additionally, variable measures have been used to assess mental health outcomes ranging from global assessment of quality of life and functional distress to more symptom specific indices including diagnostic caseness (Holtslag, Post, Lindeman, & van der Werken, 2007).

The few studies which have investigated injury site as a predictor of mental health following traumatic injury have also reported mixed findings. A prospective cohort study by Haagsma et al. (2012) found that head and extremity injuries were significantly associated with PTSD symptom severity 2 years after injury, compared with other body sites. Similarly, other studies have also revealed that upper extremity and spinal cord injuries were associated with poorer functional health and lower quality of life (e.g., Haagsma et al., 2012; Holtslag et al., 2007; MacKenzie, Siegel, Shapiro, Moody, & Smith, 1988). Some studies have identified that it is the extent of disfigurement to the face, head, and neck that is positively correlated with PTSD severity rather than the site of injury itself (Fukunishi, 1999; Glynn, Shetty, & Dent, 2010; Madianos, Papaghelis, Ioannovich, & Dafni, 2001). A notable shortcoming of this body of research is that the effects of injury sites in predicting mental health outcomes have been limited for the most part to PTSD symptoms or more general distress or quality of life indicators.

Conceptually, Ehlers and Clark (2000) cognitive model of PTSD may serve as a useful heuristic framework to explain why traumatic injury may be related to poorer mental health outcomes. In accord with this theory, the appraisal of the activating event and an individual's initial emotional response will subsequently influence the development and maintenance of PTSD. In this way, studies have indicated that the beliefs that individuals hold post-trauma (inclusive of their capacity to cope or likelihood of physical and emotional recovery) will influence adjustment (Weaver, Griffin, & Mitchell, 2014). In particular, studies exploring body perceptions after injury (Weaver, Griffin, et al., 2014; Weaver, Walter, Chard, & Bosch, 2014) have revealed an association between elevated body image distress with depression and PTSD. Body image distress is conceptualized as an individual's subjective sense of their body based largely upon appearance and behavioural, perceptual, cognitive, and affective phenomena (Weaver, Griffin, et al., 2014). This concords with the aforementioned research by Fukunishi (1999) and Madianos et al. (2001), in which the authors posit disfigurement as a causal mechanism of PTSD following injury. Given that disfigurement and body image distress have been conceptualized as subjective perceptions (Weaver, Griffin, et al., 2014; Weaver, Walter, et al., 2014), this assertion concurs with cognitive theories that place the individual's negative interpretation of the injury as the prime influencer of reduced mental health (e.g., Ehlers & Clark, 2000). Accordingly, it would be expected that body sites which are more visible to the general public to be linked with poor adjustment, in particular depression and PTSD (Weaver, Griffin, et al., 2014; Weaver, Walter, et al., 2014) due to the individual's negative body image of the injury in that particular site.

In summary, methodological limitations have contributed to inconsistent findings regarding the impact of the site and severity of injury in relation to depression, anxiety, and PTSD symptom severity. There is also a paucity of studies that has examined these three mental health outcomes within the same injured population. The lack of within-study comparative mental health evaluations in this field limits our understanding of individual symptom profiles and any potential overlap between these three mental health outcomes post-traumatic injury. This line of inquiry has the scope to further advance screening assessments and early interventions for traumatic injury survivors. Accordingly, the primary objective of this study was to investigate whether site and severity of injury are predictive of depression, anxiety, and PTSD symptom severity over a 12-month period following a traumatic injury. It was expected that the injury sites which are most visible (notably, facial, head, upper and lower extremity injury, and external injury [the latter including lacerations, cuts, and burns]) would be associated with elevated mental health symptom severity post-trauma.

2 | METHOD

2.1 | Participants

Participants were recruited from four Level 1 trauma hospitals in three states of Australia (New South Wales, Victoria, and South Australia). A random sample of patients was recruited from weekday trauma admissions over 23 months (March 2004–February 2006). Inclusion criteria included proficiency in English, age between 16 and 70 years, and an injury serious enough to require hospitalization of more than 24 hours. Patients with mild traumatic brain injury (as defined by Harrington et al., (1993)) were eligible to participate; however, those with severe or moderate traumatic brain injury were excluded. Patients were further excluded if they were suicidal or psychotic, were non-Australian visitors/tourists, or had cognitive impairment. Throughout the 2-year period, 1,593 participants were randomly selected using an automated, random selection procedure, stratified by length of hospitalization. Random selection was used as the numbers of patients admitted exceeded the allocated recruitment processes. Of these 1,593 potential participants, 1,166 (73%) consented to be involved in the study (which was part of a larger trial; O'Donnell et al., 2013), with complete intake data being collected on 1,062 participants (91% of consenting participants) and 715 participants (67%) completing the 12-month follow-up assessment. Patients who did not complete the 12-month follow-up assessment did not differ from those who did in regard to gender, length of hospitalization, or injury severity. However, noncompleters were younger (M = 35.1 years, SD = 12.9 vs. M = 39.7 years, SD = 13.7, $t(1162) = -5.7$, $p < .001$). The sample was composed of 74% males (n = 811) and 26% females (n = 287). The mean age of participants at admission was 37.8 years (SD = 13.7).

2.2 | Measures

2.2.1 | Injury site

Injury site was measured using the AIS (Baker et al., 1974) and taken from each patient's hospital records. The AIS is an anatomically based classification system that categorizes individual injuries by body region and severity. Body regions are classified according to the following groups: (a) head or neck; (b) face; (c) chest/thorax; (d) abdomen; (e) spine; (f) upper and lower extremities (including pelvis); and (g) external injuries (which may include skin lacerations, cuts, and burns). Given that individuals with spinal cord injuries were not admitted to the hospital sites, spinal cord injuries were not included in the AIS for this study.

2.2.2 | Injury severity

An ISS was derived from the AIS which comprises a 6-point ordinal scale ranging from AIS 1 (minor) to AIS 6 (untreatable). For the purposes of the current study, injury severity was measured in two ways. First, it was assessed as a global measure using the ISS (Baker & O'Neill, 1976). The ISS is derived from the sum of the squares of the highest AIS scores in three different body regions. It was developed to provide a coding system with a better fit between overall severity and survival and allows for multiply-injured people (whereas the AIS does not). In subsequent analyses, injury severity was also assessed as a localized measure derived from the AIS severity rating. This second measure evaluated severity as the maximum AIS severity per person; that is, the rating of the most severe injury out of each participants' injuries, irrespective of the injury site.

2.2.3 | Psychiatric history

The Mini International Neuropsychiatric Interview version 5.5 (MINI; Sheehan et al., 1998) was used to measure lifetime history of psychiatric disorders prior to the injury event. The MINI variable was dichotomized such that the presence/absence of any psychiatric history was used as a predictor variable.

2.2.4 | PTSD symptoms

The Clinician Administered PTSD Scale (CAPS; Blake et al., 2000) was administered in the acute setting (1-week post-injury) and at 3- and 12-months post-injury. PTSD symptoms in the acute setting were assessed excluding the 1-month time criterion; rather, a “since you were injured” time criterion was incorporated. Telephone assessments (at 3- and 12-months post-injury) were recorded digitally to ensure consistency with the protocol. The CAPS was used as a continuous variable to measure PTSD symptom severity using the standardized scores.

2.2.5 | Anxiety and depression symptoms

The presence and severity of anxiety and depression symptoms were measured using the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983), which is a self-report questionnaire suitable for injury populations as it does not measure somatic symptoms. In the current study, the Anxiety and Depression subscales were used to assess anxiety and depression symptom severity as continuous variables.

2.3 | Procedure

Approval for the study was provided by the human research ethics committee at each hospital and at the University of Melbourne for the larger scale trial. Following written consent, baseline assessments were conducted on average 7 days (*SD* = 7.8) post-injury. The baseline assessment comprised a structured clinical interview in which the CAPS (current PTSD severity) and MINI (past psychiatric history) were administered and self-report questionnaires that also included the Hospital Anxiety and Depression Scale. Interviews were conducted just prior to discharge. Characteristics of injuries were obtained from medical records and included ISS, length of hospitalization, Intensive Care Unit admission, and discharge destination. Participants were subsequently assessed at 3- and 12-months post-admission, using the CAPS via telephone. They were also mailed and then returned self-report questionnaires.

2.4 | Statistical analyses

All analyses were conducted using SPSS Version 16 (SPSS Inc., 2007). The main analyses were based on a linear mixed, random intercept model (Singer, 1998) to evaluate the effects of site and severity of injury on the trajectory of psychopathology over time. The participant variable was treated as a random factor. This meant that the between-subject variability of the multiple observations for each participant was represented by random variation of their mean (or intercept scores) around a fixed intercept. Thus, the correlation amongst the values of the dependent variable (specifically depression, anxiety, and PTSD symptom scores) that came from the same person could be assessed and incorporated into the analysis. The other random term reflected the variation of each subject's score on a particular measure at a given time around the mean of all their scores.

Specifically, the random intercept multilevel model included:

- *Level 1*—multiple observations of the dependent variables: depression, anxiety, and PTSD symptom severity for each subject over time (Time 1 [T1] = baseline/admission; Time 2 [T2] = 3 months; and Time 3 [T3] = 12 months)
- *Level 2*—age, gender, injury site, injury severity (both ISS and AIS variants), and presence of psychiatric history.

The fixed terms for the intercept used in this model include the injury site (1 = *presence of injury in a given site*, 0 = *no injury in that site*), age (at baseline, centred around the mean), gender (0 = *male*, 1 = *female*), prior psychiatric history (0 = *no history*, 1 = *any history*), and the ISS (at baseline, centred around the mean), which had a range from 1 to 75. Time was treated as a categorical variable (T1, T2, and T3), as any changes over time were expected to be non-linear. Age, gender, and psychiatric history were selected as variables included in the model based on their known relationship with mental health outcomes following traumatic injury (e.g., O'Donnell et al., 2009; Ozer, Best, Lipsey, & Weiss, 2003). All outcomes of statistical tests were treated as significant below the .05 probability level.

3 | RESULTS

3.1 | Sample characteristics

Descriptive data for the sample are presented in Table 1. There were 54 individuals who did not have an identified injury and were excluded from the analyses. A further 14 individuals had missing data and were also excluded from analyses. The analyses were therefore based on 1,098 injury survivors who met inclusion criteria, with an age range from 16 to 71 years. The mean ISS score for the sample was 11.17 (*SD* = 8.07; range 1–73). The most common injury sites were lower extremity (57%), upper extremity (38%), and head injury (28%).

TABLE 1 Characteristics of the sample of injury patients

Variable	N	% of sample	M	SD
Gender				
Male	811	73.9	-	-
Female	287	26.1	-	-
Age				
Total sample	-	-	37.8	13.7
Female	-	-	39.1	14.3
Male	-	-	37.3	14.0
Psychiatric history				
MINI (y)	665	62.1	-	-
Injury severity				
ISS	-	-	11.2	8.1
Injury site				
Head (y)	312	28.4	-	-
Face (y)	202	18.4	-	-
Neck (y)	10	0.9	-	-
Thorax (y)	294	26.8	-	-
Abdomen (y)	149	13.6	-	-
Spine (y)	274	25.0	-	-
Upper extremity (y)	418	38.1	-	-
Lower extremity (y)	620	56.5	-	-
External injury (y)	19	10.8	-	-
Total injuries				
No. of injuries				
One injury	225	20.2		
Two injuries	237	21.3		
Three injuries	205	18.7		
Four to ten injuries	416	37.9		

Note. MINI = Mini International Neuropsychiatric Interview; "y" = presence of variable; % of participants with injuries in specific sites can be >100% due to multiple injuries.
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3.2 | Sociodemographics

Main effect analyses revealed a significant effect of gender and psychiatric history for each mental health outcome. Specifically, females reported more severe PTSD (M = 4.36 vs. M = 3.43), F(1, 1051) = 49.89, p < .001; anxiety (M = 2.32 vs. M = 2.03), F(1, 997) = 22.21, p < .001; and depression (M = 1.99 vs. M = 1.84), F(1, 1002) = 6.28, p = .01 compared with males. Participants with a psychiatric history had more severe PTSD (M = 4.42 vs. M = 3.37), F(1, 1041) = 76.67, p < .001; anxiety (M = 2.43 vs. M = 1.91), F(1, 996) = 83.09, p < .001; and depression (M = 2.13 vs. M = 1.71), F(1, 1002) = 58.63, p < .001, than those without a psychiatric history. Younger participants had more severe PTSD symptoms than older participants, F(1, 1081) = 13.98, p < .001. There was no significant main effect of age on anxiety or depression.

3.3 | Injury severity

ISS scores (derived from AIS) were reclassified into three categories: high severity (centred around one standard deviation above the mean), moderate severity (centred around the mean), and low severity (centred around one standard deviation below the mean). There was a significant main effect of injury severity for PTSD symptoms, F(1, 1033.91) = 6.83, p = .01, but not for depression, F(1, 986.17) = 0.55, p = .46, or anxiety, F(1, 978.83) = 1.62, p = .20. Specifically, individuals with high severity injury reported more severe PTSD symptoms than those with moderate and low severity injury.

Interaction analyses were conducted to evaluate the impact of injury severity on PTSD, depression, and anxiety symptoms over time. Results showed no significant interactions between sociodemographic variables and ISS scores for any of the mental health outcomes. Similar to the main effect results, a significant interaction was only identified between injury severity and time for PTSD symptoms, F(2, 1778.34) = 4.46, p = .01, indicating that the rate of change of PTSD symptoms differed between ISS categories (see Figure 1). Tests of simple effects of time were conducted to evaluate the effect of injury severity on changes in mental health outcomes over time. Results revealed a significant effect of time within the moderate severity, F(2, 1778.3) = 7.3, p < .001, and lower severity categories, F(2, 1787.3) = 11.1, p < .001. Specifically, pairwise comparisons indicated that for individuals with moderate severity injury, PTSD symptom levels were significantly higher at T2 than T1 (M difference = 0.181, SE = 0.08, p = .01) and significantly higher at T2 than T3 (M difference = 0.29, SE = 0.08, p < .001). Additionally, for individuals with low severity injury, PTSD symptoms were significantly higher at T2 than T1 (M difference = 2.22, SE = 0.09, p = .02); significantly higher at T1 than T3 (M difference = 0.27, SE = 0.10, p = .01); and significantly higher at T2 than T3 (M difference = 0.491, SE = 0.104, p < .001). There was no significant difference in PTSD symptoms between time points for individuals with high severity injury. Interaction analysis between ISS and time for anxiety and depression did not reach statistical significance.

3.4 | Injury site

Further analyses were conducted to test the effect of the presence of an injury in a specific site of the body for each of the three mental health outcomes (see Table 2). Results showed significant main effects for head injury and PTSD symptoms, F(1, 1049.38) = 20.33, p < .001, r^2 = .01, facial injury and PTSD symptoms, F(1, 1028.65) = 11.82,

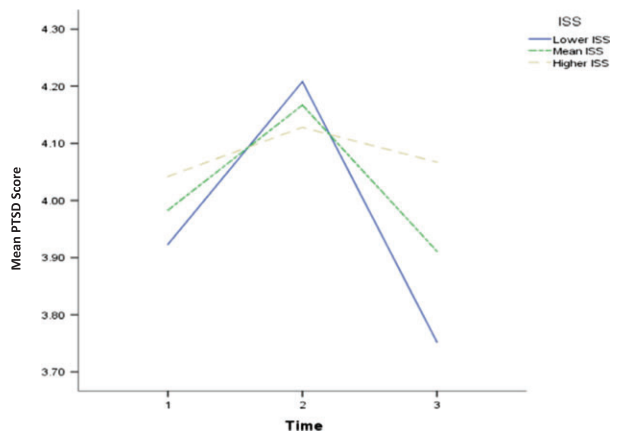

FIGURE 1 The significant interaction effect of Injury Severity Score (ISS) × time on Posttraumatic Stress Symptomatology. Mean ISS = mean of ISS; Lower ISS = 1 SD below the mean of ISS; Higher ISS = 1 SD above the mean; PTSD = post-traumatic stress disorder.

TABLE 2 Main Effects of injury site on post-traumatic stress disorder, anxiety, and depression symptom severity

	Posttraumatic Stress			Anxiety			Depression		
Variable	*F*	*df*	*p*	*F*	*df*	*p*	*F*	*df*	*p*
Head	20.327	1049	.000**	0.463	1012	.496	1.047	1021	.306
Face	11.817	1029	.001**	1.447	1638	.235	0.101	1011	.751
Neck	3.518	1042	.061	1.538	869	.215	1.526	866	.217
Thorax	0.023	1044	.880	0.180	996	.672	2.814	1004	.094
Abdomen	0.231	1044	.631	0.057	988	.811	1.337	993	.248
Spine	1.251	1027	.264	0.893	985	.345	0.296	994	.587
Upper	0.374	1027	.541	0.131	989	.718	0.588	998	.444
Lower	1.088	1030	.297	0.536	985	.464	7.189	992	.007**
External	8.551	1069	.004**	2.248	1025	.134	4.995	1039	.026*

Note. Upper = upper extremity injury; Lower = lower extremity injury.
$^{*}p < .05$ $^{**}p < .01$.

$p < .001$, $r^2 = .00$, external injury and PTSD symptoms, $F(1, 1068.66) = 8.55$, $p < .001$, external injury and depression symptoms, $F(1, 1038.75) = 4.99$, $p = .03$, $r^2 = .00$, and lower extremity injury and depression symptoms, $F(1, 991.95) = 7.19$, $p < .001$, $r^2 = .00$.

3.5 | Final model

A final model that included specific demographic variables (i.e., age, gender, and psychiatric history), injury severity, and injury site for the three mental health outcomes did not identify any notable differences in findings from those reported above (results available upon request from authors).

4 | DISCUSSION

The primary objective of this study was to investigate the relationship between both severity and site of traumatic injury with PTSD, anxiety, and depression symptoms over a 12-month period. Results indicated that participants with more severe injury reported higher PTSD symptom severity over time. This pattern was not replicated with anxiety nor depression, suggesting that objective injury severity is not a consistent predictor for each individual mental health outcome after traumatic injury. On the basis that injury severity was only found to be significantly related to PTSD, this outcome could in part be explained by the cognitive model of PTSD (Ehlers & Clark, 2000), in which the individual's appraisal of the event (including their physical injury/s) influences the development of PTSD symptoms.

Based on previous literature (Fukunishi, 1999; Madianos et al., 2001; Weaver, Griffin, et al., 2014; Weaver, Walter, et al., 2014), it was further investigated as to whether specific injury sites whose disfigurement would be more publically visible would be associated with increased symptom severity. The results did not demonstrate a uniform relationship between individual sites of injury and the three mental health outcomes; rather, a mixed pattern of findings emerged. Notably, sustaining a head or facial injury was associated with worse PTSD symptoms. The latter outcome is consistent with studies which have suggested that the underlying mechanism of disfigurement leading to body image distress influences the development of PTSD rather than the (facial) location of the injury itself (Fukunishi, 1999; Glynn et al., 2010). Participants with external injury (which included lacerations, cuts, and burns) also reported both significantly greater PTSD and depression symptom severity than participants without an external injury. It may be the case that head, face, and external injury are at greater risk of more visible disfigurement than other sites. This is also consistent with previous studies that have documented injuries such as burns, where there is a concern for scarring, and is predictive of PTSD than actual scarring per se (Bryant 1996). However, given disfigurement itself was not assessed in the current study, it would be useful in future research to explore the mediating effect of disfigurement on the impact of site of injury in predicting mental health outcomes post-trauma. This is important given previous research has indicated that perceived disfigurement related to burn injuries was predictive of adverse mental health outcomes overtime, indicating that perceived disfigurement may be a proxy marker for risk of adverse mental health (J. B. Brown et al., 2016).

Finally, lower (but not upper) extremity injury was associated with higher levels of depression and anxiety in participants when compared with individuals without that injury. This is likely to be partially reflective of the impact of lower extremity injuries (e.g., legs) on the functional capacity of the injured individual and the subsequent implications this has for their daily mobility post-trauma. In particular, lower extremity injuries can often prevent individuals making a swift return to work if their employment is contingent on being agile and which may further contribute to maintaining reduced mental health outcomes.

It is noteworthy that when all variables inclusive of age, gender, psychiatric history, injury severity, and site were entered into the final model to determine which variables predicted the three mental health outcomes, this model did not identify any new predictors or significant interactions from what was found in previous analyses. Independent of the samples psychiatric history, the findings that some specific sites are associated with poorer mental health outcomes may be explained by several possible yet compatible lines of reasoning. Indeed, injury can result in acute or long-term appearance changes. To that end, one explanation for the current findings is that individuals with injury-related appearance changes may form psychological meanings attached to the physical alterations or be influenced by previous belief systems regarding altered physical appearances. These meanings and appraisals may be related to the appearance change or the context in which the injury occurred (Weaver, Turner, Schwarze, Thayer, & Carter-Sand, 2007), resulting in body image distress. This proposition is supported by the findings of two previous studies (Weaver, Griffin, et al., 2014; Weaver, Walter, et al., 2014). In particular, in both Weaver, Griffin, et al.'s (2014) and Weaver, Walter, et al.'s (2014) studies based on women who experienced violence in interpersonal intimate relationships and soldiers who sustained injury in combat-related deployment, respectively, participants anchored their body image distress concerns to the injury-related appearance change. A second explanation could be in part attributed to neural circuitry and visceral responses which may be activated by sustaining and being subsequently confronted with visible injuries which may then invoke feelings of disgust and aversion (S. Brown, Gao, Tisdelle, Eickhoff, & Liotti, 2011). Indeed, research has indicated that facial injuries can evoke such sensory responses which pertain to the perception of beauty and familiarity (e.g., Bohrn, Altmann, Lubrich, Menninghaus, & Jacobs, 2013). Accordingly, exposure to visible injuries maybe a more direct sensory cue that triggers reflexive intrusions, reflecting a more primitive mechanism. A further explanation for the current findings may also be due to the impact these injuries have on functionality (in addition to appearance per se). Notably, lower extremity and external injuries (which the latter include cuts and burns to body parts) may have a detrimental impact to mobility and premorbid daily functioning (including self-care and occupational functioning), which may be an additional triggering cue to clinical distress post-traumatic injury. Taken together, these results attest to the impact that head, facial, and external and lower extremity injuries have on both visceral and sensory reactions and on functionality post-trauma. However, further research is needed to confirm this proposition given that the actual impact of functioning was not assessed in relation to specific injury site and severity in the current study.

The current findings have some important clinical implications. It is recommended that clinicians discuss injuries sustained with the clients who have PTSD post-injury. This is important to establish from the client's perspective whether the injury disfigurement and/or the impact the injury has on their functionality are important cues in triggering PTSD symptoms including intrusive memories and perceptions of ongoing threat. Moreover, physical injuries may also activate other emotional responses including anger and depression which may further stall or interfere with PTSD recovery. Accordingly, the clients' attributions pertaining to their injuries, whether it be due to appraisals of disfigurements and/or more visceral/ sensory reactions, need to be considered in the treatment planning to facilitate clients' mental health recovery.

We acknowledge several shortcomings of the current study need to be considered, as this may compromise the generalizability of findings. First, mental health symptoms were based upon a mixture of clinical interview (for PTSD symptoms) and self-report (for anxiety and depression). This difference in assessment may also in part account for differences in the pattern of results between PTSD, anxiety, and depression. Second, several variables not assessed in the current study, including disfigurement and body image concerns, may have influenced mental health symptom severity overtime. Additionally, a wide age range of participants (16 to 70 years) were included in this study. Although younger age was only found to be significantly related to elevated PTSD, given the wide age range of the sample, it is possible that other variables not assessed in the current study reflecting different life stage transitions and family responsibilities, including quality of social support and child, parent, and carer responsibilities, and whether participants were the primary income earner of their family at the time of the injury, may have also influenced mental health outcomes. Accordingly, the inclusion of indices assessing disfigurement, body image appraisals, social support, and socio-economic status is therefore warranted in future studies. A further consideration is the type of trauma or mechanism of injury that may have resulted in different injuries. For example, interpersonal violence has regularly been implicated in poor post-traumatic adjustment (Ozer et al., 2003). It is therefore possible that the inclusion of mechanism of injury may have influenced the pattern of results and, if included in future studies, could provide a more comprehensive model. Finally, testing comorbidity of symptom severity between anxiety and depression and/or PTSD was beyond the scope of the current study. Noting the concordance of psychological comorbidity between anxiety, depression, and PTSD, the evaluation of comorbid outcomes could be of clinical, conceptual, and theoretical interest in future research.

Notwithstanding these limitations, this study extends the traumatic injury literature in its investigation of both site and severity of injury as predictors of depression, anxiety, and PTSD symptom severity over a 12-month period following a traumatic injury, using a large heterogeneous sample. Overall, the results support the exclusion of the use of stand-alone objective severity measures as predictors of mental health outcome and highlight the importance of the type of injury (notably, head and visible facial and extremity injuries) in predicting poorer mental health outcomes within 1-year post-trauma.

ACKNOWLEDGMENT

This study was supported by a National Health and Medical Research Council of Australia program grant (#1073041).

CONFLICT OF INTEREST

The authors have declared that they have no conflict of interest.

ORCID

Maria Kangas http://orcid.org/0000-0001-8693-2949

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How to cite this article: Baecher K, Kangas M, Taylor A, et al. The role of site and severity of injury as predictors of mental health outcomes following traumatic injury. *Stress and Health*. 2018;1–7. https://doi.org/10.1002/smi.2815