



ELSEVIER

Behaviour Research and Therapy 42 (2004) 315–328

---

---

**BEHAVIOUR  
RESEARCH AND  
THERAPY**

---

---

www.elsevier.com/locate/brat

## The relationship between acute stress disorder and posttraumatic stress disorder in severely injured trauma survivors

Mark Creamer<sup>a,b,\*</sup>, Meaghan L. O'Donnell<sup>a,c</sup>, Phillipa Pattison<sup>c</sup>

<sup>a</sup> Australian Centre for Posttraumatic Mental Health, ARMC Repat Campus, Waterdale Road, Heidelberg, Vic. 3081, Australia

<sup>b</sup> Department of Psychiatry, University of Melbourne, Melbourne, Vic. 3052, Australia

<sup>c</sup> Department of Psychology, University of Melbourne, Melbourne, Vic. 3052, Australia

Received 3 September 2002; received in revised form 27 March 2003; accepted 17 April 2003

---

### Abstract

This prospective longitudinal study was designed to investigate the relationship between acute stress disorder (ASD) and the subsequent development of posttraumatic stress disorder (PTSD) in a population of severely injured hospitalised trauma survivors. Symptoms of ASD were assessed just prior to discharge in 307 consecutive admissions to a Level 1 Trauma Centre, with PTSD assessments completed at 3 and 12 months post-injury. A well-established structured clinical interview was adopted for both assessments. Only 1% of the sample met criteria for an ASD diagnosis (at a mean of 8 days post-injury), while the incidence of PTSD was 9% at 3 months and 10% at 12 months. Although all ASD symptom clusters contributed to the prediction of subsequent PTSD severity, logistic regression indicated that only re-experiencing and arousal predicted a categorical PTSD diagnosis. The dissociative symptoms that form the core of ASD were rarely endorsed and showed high specificity but low sensitivity, resulting in a high proportion of false negative diagnoses. Reducing the number of dissociative symptoms required for a diagnosis ameliorated, but did not resolve, the problem. In this particular population, the low sensitivity of the ASD diagnosis renders it a poor screening test for use in identifying high risk individuals for early intervention and prevention strategies.

© 2003 Elsevier Ltd. All rights reserved.

*Keywords:* Acute stress disorder; ASD; PTSD; Dissociation; DSM-IV criteria

---

---

\* Corresponding author. Tel.: +61-3-9496-4329; fax: +61-3-9496-2830.  
E-mail address: markcc@unimelb.edu.au (M. Creamer).

## 1. Introduction

The diagnosis of acute stress disorder (ASD) was introduced in 1994 with the advent of DSM-IV (American Psychiatric Association, 1994) to describe abnormal traumatic stress reactions occurring within the first 30 days posttrauma. This new diagnosis aimed specifically to identify, within the first few weeks, those individuals who were likely to go on to develop a diagnosis of posttraumatic stress disorder (PTSD, Rothbaum & Foa, 1993). The diagnostic criteria for ASD comprise four clusters of symptoms. Intrusion, avoidance and arousal symptoms are similar to those required for a PTSD diagnosis, with ASD also requiring at least three of five possible dissociative symptoms (emotional numbing, reduction in awareness of surroundings, depersonalisation, derealization, or dissociative amnesia). As such, dissociation has been elevated to a core feature of ASD.

In recent years, doubts have been cast on the clinical utility and predictive validity of the ASD diagnosis (Bryant & Harvey, 1997; Marshall, Spitzer, & Liebowitz, 1999). Among the problems noted by Bryant and Harvey (1997) is the ambiguity of several criteria. For example, the requisite duration of dissociative symptoms is confusing; while instructions for the B (dissociative) Criteria begin “while experiencing or after experiencing the distressing event”, Criterion G requires that “the disturbance lasts for a minimum of 2 days”. This confusion between acute and prolonged dissociation may be important in the prediction of subsequent PTSD. There is also little empirical data to support the requirement for three (rather than one or two) dissociative symptoms. Unlike PTSD, the intrusion criteria in ASD do not specify that the re-experiencing must be involuntary or cause distress, despite the fact that it is reasonable to speculate that voluntary, low distress re-experiencing may be an adaptive part of recovery. The avoidance and arousal symptoms are poorly operationalised, with the requirement only that there be “marked” avoidance and arousal. These ambiguities and inconsistencies in the ASD criteria are likely to reduce the reliability of the diagnosis, making comparisons across studies difficult to interpret.

A few prospective empirical studies have addressed the predictive validity of the ASD diagnosis (e.g., Brewin, Andrews, Rose, & Kirk, 1999; Harvey & Bryant, 1999; Harvey & Bryant, 2000). A consistent finding has been that, although a high proportion of those with a diagnosis of ASD go on to develop PTSD, many who subsequently develop PTSD did not qualify for the acute diagnosis. In their review, Marshall and his colleagues (Marshall et al., 1999) note that the dissociative symptoms in ASD have high specificity (most people with high levels of dissociation will go on to develop PTSD) but unacceptably low sensitivity (many trauma survivors who go on to develop PTSD do not report peritraumatic dissociation). The authors go on to conclude that the ASD diagnosis does not adequately cover the clinical spectrum of acute posttraumatic stress, that the validity of making dissociation a core construct is questionable, and that the discontinuity (i.e. different criteria sets) between ASD and PTSD is problematic.

Despite these purported problems, ASD remains the only DSM diagnosis available to clinicians in the first month posttrauma and the only consensual way of identifying those at high risk for the subsequent development of PTSD. In order to inform developments for DSM-V, it is essential that a comprehensive body of data in the area of acute responses and their predictive validity be accumulated across a range of traumatised populations. The purpose of this study was to investigate the predictive utility of the ASD diagnosis in a highly specific population: severely injured, hospitalised survivors of trauma.

Interest in the psychological consequences of severe traumatic injury has increased over the past decade and the literature consistently identifies PTSD as a serious and persistent problem in this population (Mayou & Bryant, 2002; Michaels et al., 2000). Given the large number of hospital admissions following injury, early identification of those at risk for developing PTSD is an important component of health care management. Identification of variables that predict long-term morbidity has the potential to facilitate early intervention and prevention strategies. Recent evidence suggests that early psychological intervention is effective in reducing the incidence and severity of PTSD (Bryant, Sackville, Dang, Moulds, & Guthrie, 1999), and early pharmacological work also shows promise (Pitman et al., 2002). Ultimately, early intervention strategies may decrease the human and financial costs associated with the psychological sequelae of physical injury. Ideally, high risk individuals need to be identified while still in the acute hospital, since the provision of psychiatric monitoring and follow-up for all injured survivors after discharge is likely to prove impractical.

In the current study, severely injured trauma survivors were interviewed while still in hospital to assess the presence of individual ASD symptoms as well as an overall ASD diagnosis. Participants were followed up at 3 and 12 months post-injury to assess PTSD status, with the aim of examining the predictive validity of the ASD criteria for this specific population.

## 2. Method

### 2.1. Participants

Participants were consecutive admissions to a Level 1 Trauma Service at a large hospital. Individuals were included in the current study if they: (a) experienced a physical injury that required an admission to the trauma service of at least 24 h; (b) experienced either no brain injury or mild traumatic brain injury (MTBI, as defined by the American Congress of Rehabilitation Medicine, 1993); (c) were aged between 18–70 years; and (d) had a reasonable comprehension of English. Participants were excluded if the injury was a result of deliberate self-harm, if they were currently abusing intravenous drugs or had a current psychotic disorder.

Over an 18-month period, 412 individuals met entry criteria and were approached to participate in the study. A total of 363 agreed, representing an 88% participation rate. Following detailed explanation of the study, written informed consent was obtained from all participants. A total of 337 individuals completed the 3-month assessment and 307 completed the 12-month assessment, representing retention rates of 93% and 85%, respectively.

The majority (75%) of participants were male and the average age was 36 years ( $SD = 13.43$ ). The mean Injury Severity Score (ISS: Baker, O'Neil, Haddon, & Long, 1974) was 13.02 ( $SD = 9.39$ ) and 56% of participants met criteria for MTBI. Participants spent an average of 10.13 days in the Trauma Centre ( $SD = 9.64$ ) with 31% requiring an intensive care unit (ICU) admission. Motor vehicle accidents (MVAs) accounted for 74% of injury producing events. The gender ratio and proportion of injury caused by motor vehicle accidents were consistent with the larger trauma population for the same time period (Fishers exact test:  $p = 0.47$  and  $0.43$ , respectively).

## 2.2. Measures

The Clinician Administered PTSD Scale for DSM-IV (CAPS-IV; Blake et al., 1995) was used to diagnose 3- and 12-month PTSD. This structured clinical interview is one of the most reliable and widely used tools for diagnosing PTSD (Weathers, Keane, & Davidson, 2001). The diagnosis was derived using the “1:2 rule” (i.e. a score of 1 or more on frequency and 2 or more on intensity was required for an item to meet criterion). Frequency and intensity scores were summed to obtain an overall PTSD severity score.

Selecting an instrument to diagnose ASD is somewhat more complex, since few reliable structured clinical interviews are available. In order to provide maximum comparability across ASD and PTSD diagnoses in the current study, as well as to achieve optimum rigor and reliability in the ASD diagnosis, the CAPS-IV was selected for the ASD diagnostic assessment. This latest version of the interview specifically includes the necessary additional questions to allow for assessment of ASD although, given the ambiguity surrounding the ASD criteria, it is important to clarify exactly how the diagnosis was derived in this study. The following decisions were reached on the basis of precedent established by one of the few existing ASD interviews (Bryant, Harvey, Dang, & Sackville, 1998), as well as on the basis of close examination of the DSM-IV wording.

Each CAPS-IV item was grouped into one of the four ASD symptom clusters (i.e. dissociation, re-experiencing, avoidance, or arousal). For the dissociation symptoms, emotional numbing was taken from the existing PTSD CAPS question 11 (PTSD criteria C6). With regard to amnesia, there is increasing recognition of the difficulty in differentiating between psychogenic and organic amnesia in individuals who have experienced a traumatic brain injury (Bryant, 2001). Given the high percentage of MTBI in this population, and following the methodology utilised in similar research (Bryant, Marosszeky, Crooks, Baguley, & Gurka, 2001; Schnyder, Moergeli, Klaghofer, & Buddeberg, 2001), an a priori decision was made to exclude psychogenic amnesia (ASD criterion B5, PTSD criterion C3) in the assessment of both ASD and PTSD for all participants. The remaining three dissociative symptoms (reduced awareness, derealization, and depersonalisation) appear in the CAPS-IV under the heading of “Associated Features” (questions 28–30). The re-experiencing component of ASD was assessed using the first four PTSD re-experiencing questions (PTSD criteria B1–B4). The avoidance component of ASD was assessed using the first two PTSD avoidance questions (PTSD criteria C1 and C2), while ASD arousal was assessed using all five PTSD arousal questions (D1–D5) plus the PTSD symptom of physiological reactivity (B5). For a DSM-IV diagnosis of ASD, three dissociative, one re-experiencing, one avoidance, and one arousal symptom were required. As for PTSD, the “1:2 rule” was used to determine criterion for each item. Severity scores were computed for each symptom cluster by summing the frequency and intensity scores of the relevant questions.

## 2.3. Specific methodological issues

The assessment of a severely injured population in a hospital setting raises several complex methodological issues. In order to compare results across studies, it is important that authors clarify the manner in which these issues have been resolved. As noted above, in view of the high prevalence of head injury in the sample, the symptom of psychogenic amnesia was excluded for

all participants. Most participants received narcotic analgesia at the scene of the trauma and during their hospital admission. As there is considerable overlap between the effects of narcotics and certain psychological symptoms, the initial assessment was not conducted until participants had been free of narcotic medication for at least 24 h. Finally, particular effort was made to ensure that symptoms were psychogenic in origin and detector probes were used to identify other possible causes (i.e. was a given symptom best accounted for by a non-psychiatric explanation?). Symptoms that were better accounted for by, for example, pain, the hospital environment, or the injuries themselves were not scored as psychiatric symptoms. Thus, the current study adopted a conservative methodology in assessing the psychological profile of participants.

#### *2.4. Procedure*

Initial assessments were conducted in hospital shortly prior to discharge (a mean of 8 days post-injury and 2.5 days prior to discharge). This assessment was timed to minimise the potential confounding effects of issues such as hypovolaemia, pain, and analgesia use. At the time of assessment, patients were haemodynamically stable, were relatively pain free, and were a minimum of 24 h post-opioid analgesia.

Participants were followed up at 3 and 12 months post-injury. Follow-up assessments were conducted by means of a telephone interview. Two trained mental health clinicians conducted all interviews. Thirty percent of all interviews were audiotaped, with one third of these being randomly selected for interrater reliability. Agreement on the absence or presence of a CAPS diagnosis was 100% while severity score correlation was 0.99.

#### *2.5. Data analysis*

Several variables required transformation in order to meet criteria for normal distribution. Both 3- and 12-month CAPS PTSD severity scores were positively skewed and were transformed with a square-root transformation. Each of the ASD symptom severity clusters was also positively skewed. Re-experiencing and avoidance clusters required  $\log_{10}$  transformations while arousal required a square-root transformation. The dissociation cluster was so severely skewed that it failed to reach acceptable normal distribution criteria and was thus dichotomised. Scores greater than 0 on dissociation severity were coded positively on this variable.

Initial descriptive analyses were followed by computations of diagnostic accuracy for each ASD symptom cluster according to standard formulae (Baldessarini, Finklestein, & Arana, 1983). Logistic regression analyses were then used to examine the predictive utility of ASD symptom clusters, and individual ASD symptoms, on categorical PTSD status at 3 and 12 months post-injury. In order to examine the impact of those predictors when considered alone, as well as in the context of other non-redundant predictors, both adjusted and unadjusted odds ratios were computed. A large difference between the unadjusted and adjusted odds ratios suggests that the predictive power of the variable is reduced when the influence of other variables is taken into account. Finally, the relationship between the symptom severity of each ASD symptom and PTSD symptom severity, in a dimensional rather than categorical fashion, was examined using backward elimination multiple regression analyses.

### 3. Results

#### 3.1. Symptoms of ASD

Only 1% of participants ( $N = 3$ ) met full diagnostic criteria for ASD. Three times this number (3%;  $N = 9$ ) met the PTSD criteria (excluding duration). Only three people met ASD criteria for dissociation, and all qualified for the full diagnosis. Indeed, the dissociative symptoms were generally endorsed rarely, with only 8% ( $N = 30$ ) meeting criteria for one symptom and 2% ( $N = 8$ ) meeting criteria for two dissociative symptoms. Nearly 35% ( $N = 128$ ) met the re-experiencing criteria, 18% ( $N = 64$ ) met the avoidance criteria, and 44% ( $N = 158$ ) met the ASD criteria for arousal.

Females tended to score more highly than males on overall ASD severity (female mean = 3.60, SD = 2.10 vs male mean = 2.33, SD = 2.00;  $t(361) = 3.95$ ,  $p < 0.001$ ). There was a non-significant trend for those with MTBI to score higher on ASD severity than those without MTBI (MTBI mean = 3.04, SD = 2.11 vs non - MTBI mean = 2.67, SD = 2.00;  $t(361) = 1.70$ ,  $p = 0.09$ ).

#### 3.2. Prediction of a PTSD diagnosis

Overall, 9% ( $N = 29$ ) of the sample met criteria for a PTSD diagnosis at 3 months, and 10% ( $N = 32$ ) met criteria at 12 months. Thus, it is immediately clear that many of those who developed PTSD had not previously qualified for a diagnosis of ASD. Women were not more likely than men to have PTSD at 3 months (Fisher's Exact Test,  $p = 0.11$ ), but were significantly more likely to meet criteria for the diagnosis at 12 months (Fisher's Exact Test,  $p = 0.03$ ).

Individuals were deemed to have met criteria for an ASD symptom cluster if they met CAPS criteria (i.e. a score of at least 1 on frequency and 2 on intensity) for the requisite number of symptoms (i.e. 3 for dissociation, and 1 each from re-experiencing, avoidance, and arousal). The extent to which the ASD symptom clusters were associated with a PTSD diagnosis at 3 and 12 months is shown in Table 1. The sensitivity of each symptom cluster (i.e. the likelihood that someone with a later PTSD diagnosis will have reported that symptom cluster in the acute phase) and its specificity (i.e. the probability that someone without a later PTSD diagnosis will not have endorsed that cluster) are shown. Table 1 also shows the positive predictive power (i.e. the ratio of true positive results to all positive results) and the negative predictive power (i.e. the ratio of true negative results to all negative results).

It is clear from Table 1 that most people who meet the ASD dissociative criteria will go on to develop PTSD. On the other hand, a large proportion of those who go on to develop PTSD do not report dissociation in the acute stages. This is crucial if ASD is to serve its purpose in identifying those at high risk. For this kind of screening procedure, it is important to minimise the number of cases that are missed. Thus, the question of whether sensitivity could be improved by changing the number of symptoms required was investigated. The effect on prediction of 3-month PTSD of using one, two, or three symptoms in each cluster was investigated and the results are shown in Table 2. (Although not reported here, the pattern was repeated almost exactly for the prediction of 12-month PTSD.) For the dissociation cluster, reducing the number of symptoms required improved sensitivity, although it remained poor even at one symptom. For the remaining

Table 1

ASD symptom clusters—sensitivity, specificity, and power to predict PTSD at 3 ( $N = 337$ ) and 12 ( $N = 307$ ) months post-injury

	Sensitivity	Specificity	Positive predictive power	Negative predictive power	Correct classification (%)
<i>3 Months</i>					
B. Dissociation	0.03	0.99	0.50	0.92	91
C. Re-experiencing	0.79	0.69	0.20	0.97	70
D. Avoidance	0.48	0.86	0.24	0.95	82
E. Arousal	0.60	0.62	0.17	0.98	64
<i>12 Months</i>					
B. Dissociation	0.01	0.99	0.01	0.90	89
C. Re-experiencing	0.69	0.70	0.21	0.95	71
D. Avoidance	0.41	0.88	0.21	0.93	83
E. Arousal	0.75	0.64	0.19	0.96	65

Table 2

Effect on sensitivity, specificity, and power to predict 3-month PTSD of varying the number of symptoms required in each cluster ( $N = 337$ )

	Sensitivity	Specificity	Positive predictive power	Negative predictive power	Correct classification (%)
<i>Dissociation</i>					
At least 1 symptom	0.31	0.91	0.26	0.93	86
At least 2 symptoms	0.10	0.98	0.33	0.92	90
At least 3 symptoms	0.03	0.99	0.50	0.92	91
<i>Re-experiencing</i>					
At least 1 symptom	0.79	0.69	0.19	0.97	70
At least 2 symptoms	0.41	0.88	0.24	0.94	84
At least 3 symptoms	0.13	0.97	0.31	0.92	90
<i>Avoidance</i>					
At least 1 symptom	0.48	0.86	0.24	0.95	82
At least 2 symptoms	0.07	0.99	0.33	0.92	90
<i>Arousal</i>					
At least 1 symptom	0.90	0.61	0.17	0.98	64
At least 2 symptoms	0.55	0.87	0.28	0.95	84
At least 3 symptoms	0.28	0.95	0.35	0.93	89

clusters, increasing the number of symptoms required reduced the sensitivity to unacceptably low levels.

In order to determine the relative contribution of each ASD symptom cluster to the subsequent development of PTSD, a logistic regression was conducted with PTSD diagnosis as the dependent variable and all four DSM-IV symptom clusters entered as dichotomous variables (i.e. meeting

criteria for three dissociative symptoms, one symptom each from re-experiencing, avoidance, and arousal) simultaneously into the model. As shown in [Table 3](#), both the re-experiencing and arousal symptom clusters were significant predictors of a PTSD diagnosis at both 3 and 12 months post-injury. Comparison with the unadjusted odds ratios reveals that, considered in isolation, the avoidance cluster is also a predictor of subsequent PTSD but that this effect disappears when avoidance is considered in the context of the other symptom clusters.

In order to investigate the predictive utility of individual acute symptoms, four separate logistic regressions were conducted—one for each symptom cluster. All symptoms within that cluster were entered simultaneously. Results are shown in [Table 3](#). Of the dissociative symptoms, only numbing was a significant predictor of PTSD diagnosis (at both 3 and 12 months). Although this association was negative, observation of the unadjusted odds ratios suggests that this suppression effect is a statistical artefact and should not be taken to indicate that high levels of numbing in the first week or so post-injury are associated with a reduced risk of subsequent PTSD. Considered in isolation, reduced awareness was weakly predictive of 12-month PTSD, although this effect disappeared in the context of the other dissociative symptoms. Of the re-experiencing symptoms, both nightmares and distress at reminders of the trauma predicted PTSD, while in the avoidance cluster, a tendency to avoid thoughts, feelings and conversations associated with the trauma was a strong predictor of both 3 and 12-month diagnosis. Although avoidance of activities, places and people failed to predict subsequent PTSD, this may be a function of the time of assessment—while still in hospital, such avoidance may have been barely relevant. Of the arousal symptoms, irritability was a weak predictor of PTSD at both time points, poor concentration strongly predicted 3-month PTSD, and physiological reactivity in the first week or so post-injury weakly predicted 12-month PTSD. Interestingly, when each was considered in isolation, all the arousal symptoms except exaggerated startle response were predictors of a 3-month diagnosis and all were predictors of PTSD at 12 months.

### *3.3. Prediction of PTSD severity*

The ability of ASD symptom cluster severity to predict PTSD symptom severity at 3 and 12 months was investigated using a multiple regression analysis entering all four symptom clusters simultaneously. Results are shown in [Table 4](#). The severity of all four ASD symptom clusters predicted 3-month PTSD severity, while all except avoidance predicted 12-month PTSD severity. Acute arousal emerged as a particularly strong predictor of subsequent PTSD severity.

Finally, using symptom severity as the independent variables, all symptoms of ASD (regardless of cluster) were examined independently for their predictive value. Symptoms were entered into two backwards elimination multiple regressions with 3 and 12-month PTSD severity as the dependent variables. Backward elimination starts by including all independent variables in the model and then eliminating those variables not making a significant independent contribution. Variables with significance levels of less than 0.10 at either time point were selected for the final multiple regression analysis, the results of which are shown in [Table 5](#). Sleep difficulties, irritability, and distress at reminders were the most powerful predictors of both 3 and 12-month PTSD.



Table 3  
Logistic regression analyses with PTSD diagnosis as the dependent variable; (a) ASD symptom clusters entered simultaneously; (b) individual symptoms within each cluster entered simultaneously

Variable	3 Months PTSD					12 Months PTSD				
	$\beta$	SE	Odds ratio	Unadjusted odds ratio	95% CI adjusted	$\beta$	SE	Odds ratio	Unadjusted odds ratio	95% CI adjusted
<i>Clusters</i>										
Dissoctiation	$\chi^2(4) = 37.81, p < 0.001$ ; 78.6% correct	1.04	1.45	2.83	10.96	0.17–48.53				
Re-experiencing		1.41	0.56	4.08*	8.73***	1.37–12.22				–
Avoidant		0.23	0.49	1.26	5.60***	0.48–3.28				1.03–7.22
Arousal		1.60	0.60	4.96**	10.05***	1.52–16.20				0.63–4.37
<i>Dissoctiation symptoms</i>	$\chi^2(4) = 18.51, p < 0.001$ ; 90.2% correct									1.09–7.38
Numbing		–2.46	0.60	0.09***	11.93***	0.03–0.28				0.06–0.65
Reduced awareness		0.21	0.84	1.23	2.11	0.23–6.40				0.10–1.45
Derealisation		–0.20	1.24	0.82	4.49	0.07–9.26				0.09–16.32
Depersonalisation		–1.48	1.14	0.23	5.63	0.02–2.14				0.04–5.39
<i>Re-experiencing symptoms</i>	$\chi^2(4) = 25.47, p < 0.001$ ; 73.9% correct									
Intrusive memories		0.14	0.52	1.15	3.52**	0.42–3.16				0.33–2.77
Nightmares		1.15	0.52	3.17*	5.32***	1.13–8.84				2.36–16.21
Flashbacks		0.35	0.78	1.41	3.12	0.31–6.52				0.43–7.80
Distress at exposure		1.49	0.45	4.45***	5.78***	1.85–10.70				1.08–6.38
<i>Avoidant symptoms</i>	$\chi^2(2) = 17.36, p < 0.001$ ; 82.8% correct									
Avoid thoughts, etc.		1.70	0.42	5.49***	5.75***	2.41–12.53				1.95–0.55
Avoid activities, etc.		0.42	0.91	1.52	4.49	0.26–8.97				0.48–13.44
<i>Arousal symptoms</i>	$\chi^2(6) = 34.83, p < 0.001$ ; 81.9% correct									

(continued on next page)

Table 3 (continued)

Variable	3 Months PTSD				12 Months PTSD					
	$\beta$	SE	Odds ratio	Unadjusted odds ratio 95% CI adjusted	$\beta$	SE	Odds ratio	Unadjusted odds ratio 95% CI adjusted		
Sleep difficulties	0.63	0.50	1.87	3.39**	0.71–4.96	0.68	0.48	1.97	3.63***	0.77–5.08
Irritability	0.95	0.44	2.59*	2.92**	1.09–6.14	0.99	0.43	2.68*	3.32**	1.15–6.25
Poor concentration	1.70	0.46	5.46***	7.52***	2.20–13.53	0.76	0.52	2.13	4.56***	0.77–5.87
Hypervigilance	1.38	0.90	3.99	5.81*	0.68–23.29	1.19	0.91	3.28	5.59*	0.55–19.41
Exaggerated startle	-1.64	0.95	0.19	2.85	0.03–1.25	-0.48	0.85	0.62	6.18**	0.12–3.28
Physiologic reactivity	1.16	0.60	3.18	5.09***	0.99–10.24	1.41	0.56	4.11*	7.65***	1.38–12.25

\*  $p < 0.05$ .\*\*  $p < 0.01$ .\*\*\*  $p < 0.001$ .

Table 4

Unstandardised regression coefficients, standard error, and standardized regression coefficients for ASD symptom cluster severity in the prediction of 3-month ( $N = 337$ ) and 12-month ( $N = 307$ ) PTSD severity

	3-Month PTSD			12-Month PTSD		
	<i>B</i>	SEB	$\beta$	<i>B</i>	SEB	$\beta$
	Adj. $R^2 = 0.33$ , $F(4,332) = 42.94$ , $p < 0.001$			Adj. $R^2 = 0.34$ , $F(4,302) = 39.57$ , $p < 0.001$		
Dissociation	0.74	0.18	0.12*	0.95	0.35	0.15**
Re-experiencing	1.03	0.32	0.19***	1.05	0.34	0.19**
Avoidance	0.86	0.39	0.12*	0.65	0.43	0.09
Arousal	0.53	0.09	0.32***	0.56	0.10	0.33***

\*  $p < 0.05$ .

\*\*  $p < 0.01$ .

\*\*\*  $p < 0.001$ .

Table 5

Unstandardised regression coefficients, standard error, and standardized regression coefficients for ASD symptom severity variables retained in the model with 3-month ( $N = 337$ ) and 12-month ( $N = 307$ ) PTSD severity as dependent variables

	3-Month PTSD			12-Month PTSD		
	<i>B</i>	SEB	$\beta$	<i>B</i>	SEB	$\beta$
	Adj. $R^2 = 0.33$ , $F(7,336) = 24.48$ , $p < 0.001$			Adj. $R^2 = 0.34$ , $F(7,306) = 23.76$ , $p < 0.001$		
Distress at exposure	0.17	0.06	0.15***	0.24	0.07	0.21***
Avoid thoughts, etc.	0.19	0.06	0.16**	0.16	0.07	0.13*
Numbing	0.21	0.11	0.10**	0.20	0.12	0.09
Sleep difficulties	0.21	0.05	0.22***	0.22	0.05	0.22***
Irritability	0.20	0.06	0.16***	0.28	0.06	0.22***
Poor concentration	0.15	0.06	0.12*	-0.02	0.07	-0.02
Hypervigilance	0.23	0.09	0.11*	0.41	0.10	0.19***

\*  $p < 0.05$ .

\*\*  $p < 0.01$ .

\*\*\*  $p < 0.001$ .

#### 4. Discussion

The findings of this large prospective study of consecutive admissions to a specialist hospital trauma unit suggest that, for this population, the diagnosis of ASD is of limited benefit in predicting who will subsequently develop PTSD. This presents a major problem for the construct of ASD with this population. If the diagnosis is to be useful in targeting high risk individuals while still in hospital for early intervention and/or psychiatric monitoring, false positives are not a major

problem. At subsequent assessments, those who do not go on to develop a disorder can be removed from the follow-up register. False negatives, however, are to be avoided as far as possible. A failure to identify high risk individuals represents inadequate acute care and a failure of good clinical practice. Once patients are discharged from the acute hospital to their local community, follow-up becomes difficult unless mechanisms are established during the inpatient phase and this can only be achieved if vulnerable individuals are appropriately identified.

The dissociative symptoms, a core feature of the ASD diagnosis, were endorsed by only a small percentage of participants. This symptom cluster, however, showed high specificity. Individuals with high levels of acute dissociation were likely to develop PTSD and, as such, the current data add support to the suggestion that acute dissociation may represent one pathway to the development of longer term psychopathology following traumatic exposure (Koopman, Classen, Cardena, & Spiegel, 1995). However, a large majority of participants who developed chronic PTSD did not report the requisite number of dissociative symptoms in the acute phase. There was little to suggest that modifying the number of dissociative symptoms required for an ASD diagnosis would solve the problem. These data suggest that retaining a requirement for even one dissociative symptom would still lead to many false negatives.

The current data suggest that pathways to PTSD other than dissociation exist, with the findings pointing to the importance of acute re-experiencing and arousal symptoms as powerful predictors of subsequent adjustment. These two clusters of symptoms showed the highest sensitivity, were the strongest predictors of a categorical PTSD diagnosis, and were the best predictors in dimensional analyses of severity. These findings support those of Brewin and his colleagues (Brewin et al., 1999) who found that the presence of at least three re-experiencing or arousal symptoms provided equivalent predictive power to a full ASD diagnosis.

At the level of individual symptoms, it is clear that some within each cluster have stronger predictive power than others. Of the re-experiencing symptoms, the presence of nightmares and distress when reminded of the trauma at around 1 week post-injury predicted the development of PTSD 3 and 12 months later. Similarly, of the hyperarousal symptoms, acute levels of irritability, concentration, and physiological reactivity were predictors of subsequent PTSD pathology. The differential predictive value of two related constructs—numbing (often considered to be a “passive” avoidance symptom in the clinical picture of PTSD) and avoidance of thoughts, feelings and conversations (a more active, “phobic-like” PTSD symptom)—is particularly intriguing. Contrary to expectations the current data suggest that acute numbing may be protective against subsequent PTSD, assuming constant levels of the other symptoms (although not necessarily, it should be noted, against other psychopathology). It may be speculated that affective numbing functions as a defence against the acute re-experiencing and arousal symptoms that potentially constitute a pathway to the subsequent development of PTSD. On the other hand, active attempts at cognitive avoidance, far from being protective, were strongly predictive of later PTSD. It is possible that these two symptoms constitute effective and ineffective strategies to achieve the same end and that the latter interferes with the normal process of recovery.

Caution should be exercised in generalising the current findings to other traumatised populations. First, the majority of traumatic events in the current study did not involve human malevolence—most were MVAs or other types of accident. Epidemiological data (e.g., Creamer, Burgess, & McFarlane, 2001; Kessler, Sonnega, Hughes, & Nelson, 1995) suggest that, in general, traumatic events that involve interpersonal trauma (such as sexual and physical assault) result in

poorer levels of subsequent adjustment than those of non-human origin (such as accidents and natural disasters). Although no data are available on acute symptom profiles, it is reasonable to speculate that accidents may not result in the same acute clinical presentation as interpersonal traumas. Certainly, the ASD symptom profile of participants in the current study differed markedly from that of the victims of violent crime studied by Brewin and his colleagues (Brewin et al., 1999). Second, participants in the current study were assessed while they were still in hospital. This methodological approach is of particular relevance in informing clinical practice for specialist physical trauma units, but may not reflect acute traumatic stress profiles when the assessments are carried out in a more normal, day-to-day environment. Finally, despite the fact that this was one of the larger studies of its kind, and one of the very few to have focussed exclusively on a hospitalised injured population, the prevalence of PTSD is such that findings with regard to the predictive validity of ASD in terms of a categorical PTSD diagnosis must be interpreted cautiously. Only with very large subject numbers, probably only possible in the context of multi-site trials, can definitive statements be made about acute symptom predictors of a chronic diagnosis.

Despite these cautionary notes, the findings are sufficiently strong to raise serious questions about the utility of the ASD diagnosis among severely injured, hospitalised, trauma survivors. As proposed by Marshall and his colleagues (Marshall et al., 1999), it may be more parsimonious to eliminate the diagnosis of ASD altogether. Removal of the duration criteria for PTSD would allow for a diagnosis in the first few weeks posttrauma and overcome the incongruity of two separate and discontinuous diagnoses in the aftermath of trauma. In terms of identifying high risk individuals, it may prove better to focus on re-experiencing and arousal symptoms in combination with a broader approach that incorporates new knowledge regarding pre, peri, and posttrauma variables that have been found to predict subsequent adjustment (e.g., Ehlers, Mayou, & Bryant, 1998; Mayou, Bryant, & Ehlers, 2001; Zatzick et al., 2002).

## Acknowledgements

This study was supported by the Victorian Trauma Foundation, grant #V-11. The authors gratefully acknowledge the assistance provided by patients and staff at the Alfred Hospital Trauma Service.

## References

- American Congress of Rehabilitation Medicine (1993). Definition of mild traumatic brain injury. *Journal of Head Trauma Rehabilitation*, 8(3), 86–87.
- American Psychiatric Association (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: APA.
- Baker, S. P., O'Neil, B., Haddon, W. J. e. a., & Long, W. B. (1974). The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. *Journal of Trauma*, 14, 187–196.
- Baldessarini, R. J., Finklestein, S., & Arana, G. W. (1983). The predictive power of diagnostic tests and the effect of prevalence of illness. *Archives of General Psychiatry*, 40, 569–573.
- Blake, D. D., Weathers, F., Nagy, L. M., Kaloupek, D. G., Gusman, F. D., Charney, D. S., & Keane, T. M. (1995). The development of a clinician administered PTSD scale. *Journal of Traumatic Stress*, 8(1), 75–90.

- Brewin, C. R., Andrews, B., Rose, S., & Kirk, M. (1999). Acute stress disorder and posttraumatic stress disorder in victims of violent crime. *American Journal of Psychiatry*, *156*(3), 360–366.
- Bryant, R. A. (2001). Posttraumatic stress disorder and mild brain injury: controversies, causes and consequences. *Journal of Clinical and Experimental Neuropsychology*, *23*(6), 718–728.
- Bryant, R. A., & Harvey, A. G. (1997). Acute stress disorder—a critical review of diagnostic issues. *Clinical Psychology Review*, *17*(7), 757–773.
- Bryant, R. A., Harvey, A. G., Dang, S. T., & Sackville, T. (1998). Assessing acute stress disorder: psychometric properties of a structured clinical interview. *Psychological Assessment*, *10*(3), 215–220.
- Bryant, R. A., Marosszeky, J. E., Crooks, J., Baguley, I. J., & Gurka, J. A. (2001). Posttraumatic stress disorder and psychosocial functioning after severe traumatic brain injury. *Journal of Nervous and Mental Disease*, *189*(2), 109–113.
- Bryant, R. A., Sackville, T., Dang, S. T., Moulds, M., & Guthrie, R. (1999). Treating acute stress disorder: an evaluation of cognitive behavior therapy and supporting counseling techniques. *American Journal of Psychiatry*, *156*(11), 1780–1786.
- Creamer, M., Burgess, P., & McFarlane, A. C. (2001). Post-traumatic stress disorder: findings from the Australian National Survey of Mental Health and Well-being. *Psychological Medicine*, *31*(7), 1237–1247.
- Ehlers, A., Mayou, R. A., & Bryant, B. (1998). Psychological predictors of chronic posttraumatic stress disorder after motor vehicle accidents. *Journal of Abnormal Psychology*, *107*(3), 508–519.
- Harvey, A. G., & Bryant, R. A. (1999). The relationship between acute stress disorder and posttraumatic stress disorder: a 2-year prospective evaluation. *Journal of Consulting and Clinical Psychology*, *67*(6), 985–988.
- Harvey, A. G., & Bryant, R. A. (2000). Two-year prospective evaluation of the relationship between acute stress disorder and posttraumatic stress disorder following mild traumatic brain injury. *American Journal of Psychiatry*, *157*(4), 626–628.
- Kessler, R. C., Sonnega, A., Hughes, M., & Nelson, C. B. (1995). Posttraumatic stress disorder in the national comorbidity survey. *Archives of General Psychiatry*, *52*, 1048–1060.
- Koopman, C., Classen, C., Cardena, E., & Spiegel, D. (1995). When disaster strikes, acute stress disorder may follow. *Journal of Traumatic Stress*, *8*(1), 29–46.
- Marshall, R. D., Spitzer, R., & Liebowitz, M. R. (1999). Review and critique of the new DSM-IV diagnosis of acute stress disorder. *American Journal of Psychiatry*, *156*(11), 1677–1685.
- Mayou, R., & Bryant, B. (2002). Outcome 3 years after a road traffic accident. *Psychological Medicine*, *32*(4), 671–675.
- Mayou, R., Bryant, B., & Ehlers, A. (2001). Prediction of psychological outcomes one year after a motor vehicle accident. *American Journal of Psychiatry*, *158*(8), 1231–1238.
- Michaels, A. J., Michaels, C. E., Smith, J. S., Moon, C. H., Peterson, C., & Long, W. B. (2000). Outcome from injury: general health, work status, and satisfaction 12 months after trauma. *Journal of Trauma-Injury Infection and Critical Care*, *48*(5), 841–848 Discussion 848–850.
- Pitman, R. K., Sanders, K. M., Zusman, R. M., Healy, A. R., Cheema, F., Lasko, N. B., Cahill, L., & Orr, S. P. (2002). Pilot study of secondary prevention of posttraumatic stress disorder with propranolol. *Biological Psychiatry*, *51*(2), 189–192.
- Rothbaum, B. O., & Foa, E. B. (1993). Subtypes of posttraumatic stress disorder and duration of symptoms. In J. T. R. Davidson, & E. B. Foa (Eds.), (pp. 23–35). *Posttraumatic stress disorder: DSM-IV and beyond*, Washington, DC: American Psychiatric Press.
- Schnyder, U., Moergeli, H., Klaghofer, R., & Buddeberg, C. (2001). Incidence and prediction of posttraumatic stress disorder symptoms in severely injured accident victims. *American Journal of Psychiatry*, *158*(4), 594–599.
- Weathers, F. W., Keane, T. M., & Davidson, J. R. T. (2001). Clinician-administered PTSD scale: a review of the first ten years of research. *Depression and Anxiety*, *13*(3), 132–156.
- Zatzick, D. F., Kang, S. M., Muller, H. G., Russo, J. E., Rivara, F. P., Katon, W., Jurkovich, G. J., & Roy-Byrne, P. (2002). Predicting posttraumatic distress in hospitalized trauma survivors with acute injuries. *American Journal of Psychiatry*, *159*(6), 941–946.