A Multisite Study of the Capacity of Acute Stress Disorder Diagnosis to Predict Posttraumatic Stress Disorder

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Objective: Previous studies investigating the relationship between acute stress disorder (ASD) and posttraumatic stress disorder (PTSD) have reported mixed findings and have been flawed by small sample sizes and single sites. This study addresses these limitations by conducting a large-scale and multisite study to evaluate the extent to which ASD predicts subsequent PTSD.

Method: Between April 2004 and April 2005, patients admitted consecutively to 4 major trauma hospitals across Australia (N = 597) were randomly selected and assessed for ASD (DSM-IV criteria) during hospital admission (within 1 month of trauma exposure) and were subsequently reassessed for PTSD 3 months after the initial assessment (N = 507).

Results: Thirty-three patients (6%) met criteria for ASD, and 49 patients (10%) met criteria for PTSD at the 3-month follow-up assessment. Fifteen patients (45%) diagnosed with ASD and 34 patients (7%) not diagnosed with ASD subsequently met criteria for PTSD. The positive predictive power of PTSD criteria in the acute phase (0.60) was a better predictor of chronic PTSD than the positive predictive power of ASD (0.46).

Conclusions: The majority of people who develop PTSD do not initially meet criteria for ASD. These data challenge the proposition that the ASD diagnosis is an adequate tool to predict chronic PTSD.

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The major change to the description of posttraumatic stress in the *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition (DSM-IV) was the introduction of acute stress disorder (ASD). One goal of this diagnosis is to describe stress reactions in the initial month after a trauma, after which time a diagnosis of posttraumatic stress disorder (PTSD) is possible. A second goal of the ASD diagnosis is to identify recently traumatized individuals who will subsequently develop PTSD.[1] The obstacle to achieving this goal has been that many people who display initial PTSD reactions subsequently adapt in the following 3 months.[2–6] Although initial PTSD symptoms are correlated with subsequent PTSD,[7] acute symptoms do not accurately predict chronic PTSD.

The DSM-IV[8] stipulates that ASD can occur after a fearful response to experiencing or witnessing a threatening event (Cluster A). The requisite symptoms to meet criteria for ASD include 3 dissociative symptoms (Cluster B), 1 reexperiencing symptom (Cluster C), marked avoidance (Cluster D), marked anxiety or increased arousal (Cluster E), and evidence of significant distress or impairment (Cluster F). The disturbance must last for a minimum of 2 days and a maximum of 4 weeks (Cluster G).[8] A major difference between the ASD and PTSD criteria is the former's emphasis on acute dissociation. Specifically, the diagnosis requires that people display at least 3 of the following dissociative symptoms: (1) a subjective sense of numbing or detachment, (2) reduced awareness of their surroundings, (3) derealization, (4) depersonalization, or (5) dissociative amnesia.[8] This requirement was introduced because of a proposition that acute dissociation impairs the encoding of memories and emotional responses at the time of trauma and that this, in turn, impedes subsequent processing of the traumatic memories and adaptation of traumatic stress.[9]

A dozen published studies have been reported that have assessed adult trauma survivors for ASD in the month after trauma exposure and subsequently assessed them for PTSD at a later date.[10–21] There has been considerable variability in the reported predictive rates of ASD. Some studies have found that the majority of trauma survivors who display ASD subsequently develop PTSD.[10–15]

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Other studies have found that only a minority of those with ASD subsequently develop PTSD.[16–18] A more convergent finding is that at least half of people who eventually develop PTSD do not initially display ASD.[10–14,16,17] There is some evidence that a major reason for people who are at high risk for PTSD not meeting ASD criteria is the requirement that dissociative symptoms be displayed.[22]

A major issue for the definition of PTSD in DSM-V is the extent to which ASD is an accurate predictor of PTSD, and whether ASD should be retained in the next edition. Although some commentators have argued that the available evidence suggests that ASD should be deleted from DSM-V because it does not adequately identify people who are at high risk for PTSD,[23,24] the current evidence is significantly flawed in several ways. First, previous studies that have employed clinical interview measures shortly after trauma exposure have been conducted in single sites[10–21]; multisite studies reduce the likelihood of local factors influencing the outcomes. This raises doubts about the representativeness of the findings because observations made in single-site studies may be particularly influenced by local factors. Second, sample sizes have been small, which limits the confidence in the reported predictive power of the ASD diagnosis.[10–16,18–21] Third, many studies have used unproven assessment tools to index ASD.[12,13,17,18,20] Numerous studies have used established measures of PTSD and added additional questions about dissociation to establish a diagnosis of ASD. This practice has resulted in ASD diagnoses being made with instruments that lack psychometric value. These methodological problems have resulted in variable results that provide little guidance for DSM-V regarding the predictive merits of the ASD diagnosis. There is an important need for larger-scale and multisite studies to properly test the extent to which ASD can predict PTSD. To this end, we conducted a longitudinal study of survivors of traumatic injury across 4 major hospitals. We assessed for ASD with a psychometrically sound clinical interview in the initial month and subsequently assessed for PTSD 3 months later.

METHOD

Participants

Patients admitted to 4 level 1 trauma centers across Australia were selected using a random assignment procedure and recruited into the study between April 2004 and April 2005. The study was approved by the Research and Ethics Committee at each hospital. Inclusion criteria included hospital admission following traumatic injury for persons aged 18 to 70 years who could understand and speak English proficiently and whose hospital visit lasted longer than 24 hours. This last inclusion criterion was adopted because of the difficulty in locating and recruiting patients who remained in the hospital for less than a day. Individuals were excluded from the study if they had moderate or severe head injury, were currently psychotic or suicidal, were non-Australian visitors, were cognitively impaired, or were under police guard. Individuals who met entry criteria were randomly selected using an automated, random assignment procedure, stratified by length of stay. This approach was adopted to ensure that we did not differentially recruit patients who had longer hospital stays because they may be more accessible. A total of 792 participants were approached, and 597 agreed to participate (75%). Participants comprised 427 men and 170 women with a mean age of 37.74 years (SD = 14.66 years). Two hundred fifty three participants experienced a mild traumatic brain injury (MTBI, defined as a loss of consciousness of approximately 30 minutes or less, a Glasgow Coma Scale score of 13–15 after 30 minutes, or posttraumatic amnesia not greater than 24 hours[25]), and the mean Injury Severity Score[26] was 10.75 (SD = 7.96). Participants spent a mean of 12.33 (SD = 12.82) days in the hospital. Seventy-five patients were admitted to intensive care units (ICUs). Types of injury included transport accidents (N = 370), falls (N = 96), assaults (N = 31), work-related accidents (N = 45), and other injuries (N = 55). Individuals who refused to participate in the current study did not differ from participants in terms of gender ($\chi^2 = 0.04$, df = 1, N = 590, p = .84), days in hospital (t = 0.07, df = 772, p = .86), injury severity score (t = 0.74, df = 666, p = .61), or presence of an ICU admission ($\chi^2 = 2.71$, df = 1, N = 562, p = .08). Refusers were younger than participants (t = 3.25, df = 781, p = .001).

At the 3-month follow-up assessment, 90 patients (11 with ASD and 79 without ASD) could not be contacted or declined to participate; subsequent analyses focused on the 507 patients who were interviewed by telephone, representing 85% of the initial sample. The mean time that had elapsed between the traumatic injury and the 3-month assessment was 104.32 days (SD = 25.97 days). Table 1 indicates that patients at the follow-up assessment did not differ from those who dropped out in terms of age, time between trauma and ASD assessment, length of hospital stay, or injury severity score. Participants who were assessed at follow-up had greater ASD severity than those who dropped out (t = 2.30, df = 591, p = .02).

Procedure

Following written informed consent, a trained clinician assessed for ASD on the basis of symptoms present at the time of the assessment utilizing the Acute Stress Disorder Interview (ASDI).[27] The ASDI is a structured clinical interview that is based on DSM-IV criteria and possesses sound test-retest reliability (r = 0.95), sensitivity (92%), and specificity (93%) relative to independent clinician diagnosis. A trained clinician also conducted the 3-month assessment, which assessed for PTSD using the Clinician Administered PTSD Scale-IV (CAPS-IV).[28] The CAPS-IV possesses good sensitivity (84%) and

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Table 1. Demographic and Clinical Characteristics of Trauma Patients at Time of Injury

Characteristic	Completed the Study (N = 507)	Dropped Out (N = 90)	p Value
Age, mean (SD), y	38.11 (14.63)	35.63 (14.73)	.14
Time between trauma and ASD assessment, mean (SD), d	7.39 (19.56)	6.72 (7.75)	.72
Length of hospital stay, mean (SD), d	12.74 (13.14)	9.99 (10.83)	.07
Injury severity score, mean (SD)	10.94 (8.04)	9.59 (7.40)	.17
ASD severity, mean (SD)[a]	5.21 (4.13)	6.40 (5.25)	.02
Type of injury, N (%)			.81
MVA	314 (62)	58 (64)	
Assault	25 (5)	4 (5)	
Fall	81 (16)	12 (13)	
Industrial	41 (8)	6 (7)	
Other	46 (9)	10 (11)	
Gender, N (%)			.83
Male	364 (72)	63 (70)	
Female	143 (28)	27 (30)	
Educational level, N (%)			.06
High school	216 (43)	48 (53)	
Technical	113 (22)	16 (18)	
College and above	178 (35)	26 (29)	

[a]ASD severity is based on total score of the Acute Stress Disorder Interview.
Abbreviations: ASD = acute stress disorder, MVA = motor vehicle accident.

specificity (95%) relative to the Structured Clinical Interview for DSM-IV PTSD diagnosis and also possesses sound test-retest reliability (0.90–0.80).[28] For comparative purposes, PTSD status was also assessed in the acute phase by supplementing the ASD assessment with additional questions from the CAPS-IV required for a PTSD diagnosis that are not addressed in the ASD diagnosis (i.e., the avoidance symptoms of C4, C5, C6, C7). These items were scored according to frequency alone to allow consistency with the ASDI scoring procedure.

RESULTS

Diagnostic Status

At the initial assessment, 33 patients (6%) met criteria for ASD and 50 (8%) met criteria for acute PTSD (i.e., PTSD without the duration criterion). At 3 months posttrauma, 49 patients (10%) met criteria for PTSD.

Relationship Between ASD and PTSD

In terms of those diagnosed with ASD, 15 (45%) met criteria for PTSD 3 months posttrauma and 18 (55%) did not meet criteria. In terms of those not diagnosed with ASD, 34 (7%) subsequently met criteria for PTSD and 440 (93%) did not meet criteria. To determine the influence of the amount of time between trauma exposure and assessment and the relationship between ASD and PTSD, we calculated the rates for patients assessed within 10

Table 2. Frequency, Sensitivity, Specificity, and Positive and Negative Predictive Powers of ASD Clusters for Predicting PTSD Diagnosis[a]

	Frequency, N (%)			Sensitivity			Specificity			Positive Predictive Power			Negative Predictive Power		
Variable	Total (N = 507)	No TBI (N = 291)	MTBI (N = 216)	Total	No TBI	MTBI	Total	No TBI	MTBI	Total	No TBI	MTBI	Total	No TBI	MTBI
A. Stressor	413 (81)	255 (88)	148 (69)	0.87	1.00	0.80	0.19	0.12	0.30	0.10	0.07	0.16	0.94	1.00	0.90
B. Dissociation	94 (19)	33 (11)	58 (27)	0.47	0.21	0.28	0.85	0.96	0.91	0.25	0.39	0.53	0.94	0.90	0.77
C. Reexperiencing	175 (35)	84 (29)	86 (40)	0.71	0.72	0.70	0.69	0.73	0.64	0.20	0.16	0.24	0.96	0.98	0.93
D. Avoidance	174 (34)	92 (32)	81 (38)	0.69	0.72	0.70	0.69	0.70	0.67	0.20	0.14	0.26	0.96	0.97	0.93
E. Arousal	308 (61)	173 (59)	130 (60)	0.88	0.89	0.87	0.41	0.40	0.42	0.14	0.09	0.20	0.97	0.98	0.95
F. Impairment	161 (32)	77 (26)	79 (37)	0.76	0.72	0.77	0.73	0.76	0.69	0.23	0.17	0.29	0.97	0.98	0.95
ASD	33 (7)	14 (5)	19 (9)	0.31	0.22	0.37	0.96	0.97	0.96	0.46	0.31	0.58	0.93	0.95	0.90
Subsyndromal ASD	65 (13)	31 (11)	33 (15)	0.40	0.22	0.40	0.90	0.97	0.88	0.31	0.31	0.36	0.93	0.95	0.89
PTSD (minus duration criterion)	25 (5)	7 (2)	17 (8)	0.31	0.28	0.33	0.98	0.91	0.96	0.60	0.71	0.59	0.93	0.95	0.90

[a]Sensitivity = probability that someone diagnosed with PTSD had a given acute diagnosis or cluster. Specificity = probability that someone not diagnosed with PTSD did not have a given acute diagnosis or cluster. Positive predictive power = probability that someone with a given acute diagnosis or cluster subsequently develops PTSD. Negative predictive power = probability that someone without a given acute diagnosis or cluster subsequently does not develop PTSD.
Abbreviations: ASD = acute stress disorder, MTBI = mild traumatic brain injury, PTSD = posttraumatic stress disorder, TBI = traumatic brain injury.

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Table 3. Frequency, Sensitivity, Specificity, Positive and Negative Predictive Powers, and Correct Identifications of PTSD Using Varying Numbers of Symptoms for ASD Diagnosis[a]

Predictor Variable	Frequency, N (%)	Sensitivity	Specificity	Positive Predictive Power	Negative Predictive Power	Correct Identifications, %
Dissociation						
At least 1 symptom	53 (10)	0.39	0.92	0.36	0.93	87
At least 2 symptoms	40 (8)	0.33	0.95	0.40	0.93	89
At least 3 symptoms	33 (7)	0.31	0.96	0.46	0.93	90
At least 4 symptoms	11 (2)	0.08	0.98	0.36	0.91	90
At least 5 symptoms	6 (1)	0.04	0.99	0.33	0.90	90
Reexperiencing						
At least 1 symptom	60 (12)	0.47	0.92	0.38	0.94	87
At least 2 symptoms	57 (11)	0.45	0.92	0.39	0.94	88
At least 3 symptoms	34 (7)	0.33	0.96	0.47	0.93	90
At least 4 symptoms	19 (4)	0.20	0.98	0.53	0.92	90
Avoidance						
At least 1 symptom	60 (12)	0.47	0.92	0.38	0.94	87
At least 2 symptoms	50 (10)	0.43	0.94	0.42	0.94	89
At least 3 symptoms	28 (6)	0.29	0.97	0.50	0.93	90
At least 4 symptoms	15 (3)	0.18	0.99	0.60	0.92	91
Arousal						
At least 1 symptom	60 (12)	0.47	0.92	0.38	0.94	87
At least 2 symptoms	57 (11)	0.47	0.93	0.40	0.94	89
At least 3 symptoms	53 (10)	0.45	0.93	0.42	0.94	89
At least 4 symptoms	41 (8)	0.41	0.95	0.49	0.94	91
At least 5 symptoms	23 (5)	0.27	0.98	0.57	0.92	92

[a]Sensitivity = probability that someone diagnosed with PTSD had a given acute diagnosis or cluster. Specificity = probability that someone not diagnosed with PTSD did not have a given acute diagnosis or cluster. Positive predictive power = probability that someone with a given acute diagnosis or cluster subsequently develops PTSD. Negative predictive power = probability that someone without a given acute diagnosis or cluster subsequently does not develop PTSD.
Abbreviations: ASD = acute stress disorder, PTSD = posttraumatic stress disorder.

days of trauma exposure and those assessed between 10 and 30 days after trauma exposure. For patients assessed within 10 days, 11 (42%) of those diagnosed with ASD subsequently developed PTSD and 15 (58%) did not, and 22 (6%) of those not diagnosed with ASD developed PTSD and 333 (94%) did not. For patients assessed beyond 10 days, 4 (57%) of those diagnosed with ASD subsequently developed PTSD and 3 (43%) did not, and 12 (10%) of those not diagnosed with ASD developed PTSD and 104 (90%) did not.

Predictive Power for ASD Clusters

Table 2 presents the sensitivity, specificity, positive and negative predictive power, and proportion of correct classifications of each ASD cluster to predict PTSD 3 months posttrauma. Sensitivity is defined as the probability that someone diagnosed with PTSD had a given acute diagnosis or cluster. Specificity is defined as the probability that someone not diagnosed with PTSD did not have a given acute diagnosis or cluster. Positive predictive power is the probability that someone with a given acute diagnosis or cluster subsequently develops PTSD. Negative predictive power is the probability that someone without a given acute diagnosis or cluster subsequently does not develop PTSD. Table 2 indicates that there was generally little difference in the overall diagnostic accuracy of the reexperiencing, avoidance, and arousal clusters. The dissociation symptoms generally have low sensitivity but high specificity. Consistent with this conclusion, removing dissociation from the ASD criteria improved the sensitivity, but reduced specificity and positive predictive power. Adopting the PTSD criteria in the acute phase produced stronger positive predictive power than the ASD diagnosis and comparable sensitivity, specificity, and negative predictive power.

Improving Predictive Ability

To provide more guidance for DSM-V concerning the optimal predictive value of ASD symptoms, we tested the prediction of ASD diagnosis using different numbers of symptoms for each cluster. Table 3 presents the predictive results of using an ASD diagnosis based on requiring 1 symptom from each cluster, and varying the number of symptoms required for each of the other clusters. Varying the requisite number of symptoms required for each cluster did not markedly vary the sensitivity, specificity, or predictive power of the ASD diagnosis. The best permutations only provided modest predictive power and still resulted in at least half of patients who developed PTSD not being identified in the acute phase.

DISCUSSION

Although the rates of ASD and PTSD are variable across studies, the rates observed in the current study are consistent with previously reported rates of ASD and

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PTSD in studies of traumatically injured populations.[29,30] This consistency suggests that the present population is representative of traumatically injured populations and that the findings can be generalized. The major finding of the study is that, although nearly half of patients who initially displayed ASD subsequently developed PTSD, over two thirds of patients who did develop PTSD did not initially meet ASD criteria. This pattern supports previous studies showing that a significant proportion of people with ASD will not recover and will subsequently suffer PTSD.[10–15] More compelling is that this finding provides strong supportive evidence that the majority of people who eventually develop PTSD do not initially meet criteria for an ASD diagnosis. This conclusion concurs with previous reports from smaller studies that suggest that the sensitivity of the ASD diagnosis is modest.[10–14,16–18]

Numerous commentators have suggested that the reason ASD does not identify more high risk individuals is the requirement that dissociative symptoms be present.[23,24] When we deleted this requirement, the diagnosis identified more people who did subsequently develop PTSD, although the positive predictive power was not as strong. This pattern of findings reinforces previous reports that the dissociative cluster does not provide significant additive benefit in identifying high risk individuals over and above other PTSD symptoms.[11,12] Consistent with this conclusion, we found that using the PTSD criteria (excluding the duration criterion) actually resulted in marginally better predictive ability than the ASD diagnosis. The PTSD diagnosis had better sensitivity than the ASD diagnosis, although the positive predictive power was marginally weaker. This pattern reinforces previous reports that the ASD diagnosis does not provide better prediction than the existing PTSD diagnosis.[12]

Analysis of the predictive capacity of specific clusters (see Table 2) reinforces the conclusion that acute dissociative reactions are not experienced by the significant majority of people who develop PTSD. Although reexperiencing, avoidance, and arousal symptoms were prevalent in the acute phase, these symptom clusters had poor positive predictive power because the majority of participants who experienced these symptoms in the acute phase did not develop PTSD. The finding that the majority of participants had transient reexperiencing, avoidance, and arousal reactions is consistent with many previous findings that these acute reactions are not strongly predictive of subsequent PTSD.[31–35]

In an attempt to determine better formulae for identifying high risk individuals after trauma, we experimented with various permutations. None of these attempts resulted in markedly better prediction than subsyndromal ASD or full ASD. It seems that the best permutation of symptoms resulted in approximate identification of 40% to 50% of people who eventually develop PTSD. This conclusion reinforces the finding across numerous studies that no specific constellation of symptoms has been found to robustly predict subsequent PTSD. Whereas different studies have reported acute dissociative,[36,37] reexperiencing,[3] avoidance,[36] or arousal[38,39] symptoms to be predictive of PTSD, these findings have not been replicated across studies. The current finding suggests that the variability of trauma response in the acute phase is too complex to accurately predict subsequent PTSD on the basis of acute symptoms.

Many variables may mediate the extent to which acute stress reactions translate into chronic PTSD. The finding that a proportion of people developed PTSD without initially displaying even subsyndromal ASD suggests that elevated acute stress reactions may not be apparent in people who subsequently develop PTSD. Subsequent stressors,[40–42] maladaptive appraisals,[43–45] and unhelpful coping responses[46] have all been associated with people recently exposed to trauma who are at high risk for PTSD development. It needs to be acknowledged that there will often not be a linear relationship between acute stress reactions and subsequent PTSD. Accordingly, the current data indicate that the capacity to predict PTSD on the basis of acute stress reactions appears limited.

One previous study has found that the predictive merits of the ASD diagnosis are greater if the assessment is made at 4 weeks rather than 1 week after trauma exposure.[20] When we considered the predictive values of assessments made before 10 days and after 10 days posttrauma, there were no substantial differences in either the rates of ASD or the predictive value of the diagnosis. This pattern suggests that the time frame of the diagnostic decision is not the critical factor because even assessments made later in the month after trauma exposure do not result in greater predictive accuracy.

It is noteworthy that the predictive capacity for acute symptoms tended to be stronger for patients who had sustained a MTBI than for those without TBI. More patients with MTBI (9%) met criteria for ASD than did those without TBI (5%), which is mainly attributable to the greater rates of MTBI patients to satisfy the dissociative criterion (28% vs. 12%). There are differential diagnosis problems in assessing ASD after MTBI because it is very difficult to disentangle dissociative symptoms that occur as a result of psychological factors from those that occur as a result of postconcussive factors.[47] Despite this potential problem, the MTBI patients displayed better sensitivity (0.37 vs. 0.22) and positive predictive power (0.58 vs. 0.31) than no TBI patients for ASD diagnosis predicting chronic PTSD. In light of evidence that early intervention for ASD after MTBI can prevent chronic PTSD,[48] providing treatment for MTBI patients who display ASD symptoms may be beneficial in their long-term adjustment.

We recognize several factors that may limit the conclusions of this study. First, all assessments were conducted while patients were inpatients. It is possible that different

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stress reactions may have been reported within the initial month if patients were assessed after hospital discharge. Factors more indicative of later adjustment may be apparent when patients are no longer in the artificial environment of the hospital.[49] The majority of our patients had suffered motor vehicle accidents and falls. It is possible that study of samples that comprise greater proportions of sexual or nonsexual assault may lead to different predictive results for the ASD diagnosis. Dissociative symptoms are more likely to occur following more severe, and often interpersonal, traumatic experiences; accordingly, it is possible that ASD may have stronger predictive power following more severe traumatic events.[50–52] All follow-up assessments were conducted via telephone to increase compliance. We note that the CAPS-IV has not been validated for telephone interviewing; however, several studies have indicated that telephone and face-to-face interviews result in comparable responses.[53,54] Finally, we recognize that a 3-month follow-up is a rather limited assessment of adjustment. There is a need to conduct longer-term assessments over several years to determine the relationship between ASD and subsequent PTSD. Longer periods between assessments may result in poorer predictive capacity of acute indices because there are more intervening influences that can alter the course of posttraumatic adjustment.

In summary, these results challenge the utility of the ASD diagnosis to identify the majority of people who will subsequently develop PTSD. On the basis of the available evidence, it is questionable whether ASD should be retained in DSM-V if its purpose is to identify those at high risk of developing PTSD. We qualify this conclusion, however, by noting that the ASD diagnosis may be more useful in other trauma populations. While it is recognized that acute stress reactions need to be described in DSM-V, this could be done by modifying the minimum time frame for a PTSD diagnosis or applying the V code, which is a DSM method for describing presentations that require clinical attention but are not necessarily a mental disorder.[24] The evidence that early intervention strategies are useful in preventing PTSD highlights the need to identify people who are likely to develop PTSD.[55,56] The current data indicate that research into acute predictors of chronic PTSD should investigate factors other than acute symptoms. Preliminary evidence that biological (e.g., resting heart rate),[57–59] cognitive (e.g., acute appraisals about the trauma),[43–45] and affective (e.g., depressed mood)[60] responses in the acute phase can be predictive of subsequent PTSD highlight that research should study a broader array of reactions rather than focusing on acute stress symptoms.

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