Consistency of Memory for Combat-Related Traumatic Events in Veterans of Operation Desert Storm

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Objective: The nature of traumatic memories is currently the subject of intense scientific investigation. While some researchers have described traumatic memory as fixed and indelible, others have found it to be malleable and subject to substantial alteration. The current study is a prospective investigation of memory for serious combat-related traumatic events in veterans of Operation Desert Storm. Method: Fifty-nine National Guard reservists from two separate units completed a 19-item trauma questionnaire about their combat experiences 1 month and 2 years after their return from the Gulf War. Responses were compared for consistency between the two time points and correlated with level of symptoms of posttraumatic stress disorder (PTSD). Results: There were many instances of inconsistent recall for events that were objective and highly traumatic in nature. Eighty-eight percent of subjects changed their responses on at least one of the 19 items, while 61% changed two or more items. There was a significant positive correlation between score on the Mississippi Scale for Combat-Related Posttraumatic Stress Disorder at 2 years and the number of responses on the trauma questionnaire changed from no at 1 month to yes at 2 years. Conclusions: These findings do not support the position that traumatic memories are fixed or indelible. Further, the data suggest that as PTSD symptoms increase, so does amplification of memory for traumatic events. This study raises questions about the accuracy of recall for traumatic events, as well as about the well-established but retrospectively determined relationship between level of exposure to trauma and degree of PTSD symptoms.

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In the current medical, legal, and popular literature, there rages a heated debate about the nature of memory for traumatic events. On the one hand, memory for trauma is viewed as fixed or indelible, remaining remarkably accurate over the lifetime of the individual (1–4). On the other hand, it is seen as malleable and subject to substantial distortion and alteration (5–11). This debate recently has entered the medical-legal arena in which expert "scientific" testimony about the nature of recovered traumatic memory has been highly influential in determining the outcome of assault suits against alleged abusers, as well as malpractice claims against physicians and nonphysician therapists (12–22).

Data supporting the indelible nature of traumatic memory come from a variety of sources. In a well-known study of children who were kidnapped and then buried alive in a bus, most children reported detailed, precise memories for the event even 10 years later (23–25). Such emotionally arousing, unexpected, and personally consequential events reportedly produce what Brown and Kulik (26) have termed "flashbulb memories" that resemble a "photographic print." Flashbulb memories have been described in a high percentage of individuals exposed to shocking national news, such as assassinations or assassination attempts (2, 4). McGaugh (27) and Pitman (28) have proposed that highly arousing events cause an overstimulation of endogenous stress hormones, resulting in an overconsolidation of memory.

The opposing notion that memory for trauma is malleable grows out of an experimental literature on the inaccuracies of normal memory and on the "misinformation effect." In misinformation research (29), subjects witness an event and are then misled with false postevent information that often becomes integrated into their subsequent accounts of that event. Through the use of suggestion, items or objects may be modified

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TABLE 1. Number of Responses Changed Per Subject on Desert Storm Trauma Questionnaire From 1 Month to 2 Years (N=59)

Number of Responses Changed Per Subject	Subjects With Any Changes				Subjects With Changes From No to Yes[a]				Subjects With Changes From Yes to No[a]			
			Cumulative				Cumulative				Cumulative	
	N	%	N	%	N	%	N	%	N	%	N	%
1	16	27.1	16	27.1	21	35.6	21	35.6	16	27.1	16	27.1
2	14	23.7	30	50.8	6	10.2	27	45.8	6	10.2	22	37.3
3	8	13.6	38	64.4	5	8.5	32	54.2	3	5.1	25	42.4
4	8	13.6	46	78.0	6	10.2	38	64.4	1	1.7	26	44.1
5	1	1.7	47	79.7	2	3.4	40	67.8	0	0.0	26	44.1
6	5	8.5	52	88.1	1	1.7	41	69.5	1	1.7	27	45.8

[a]A "yes" response indicated memory of a specific type of serious combat-related traumatic event.

or even incorporated into the memory of a previously observed scene. While elegant, such memory distortion research has been criticized for its focus on "trivial details" that are unrelated to trauma (30, 31). However, Loftus (32) has shown that entire scenes of stressful events can be fabricated and then inserted into memory. These scenes are often believed to be true, even after the subject has been informed that the memory is actually false. Further, several studies of real-life traumas, such as the Challenger disaster (8) and the Los Angeles elementary school sniper attack (6, 7), provide additional evidence for significant memory distortion in highly arousing and stressful situations.

The current study is a prospective investigation of memory for serious combat-related traumatic events in veterans of Operation Desert Storm. Over a period of approximately 4 months, National Guard reservists from two separate units were exposed to a variety of stressors, including subsonic cruise unarmed decoy missile attacks, the death of several unit members, and bizarre disfigurement of dead bodies. All subjects completed a questionnaire about their combat experiences 1 month after the war and again nearly 2 years later. Questionnaire responses were then compared for consistency between the two time points. It was proposed that a high degree of consistency would support the notion that memory for traumatic events is indelible, while inconsistency of responses would favor the opposing position. Consistency of recall has implications for the widely accepted belief that high level of combat exposure is a powerful predictor of subsequent posttraumatic stress disorder (PTSD). If memories of combat are inconsistent over time, then the relationship between PTSD and combat exposure would be a tenuous one.

METHOD

Of the 62 subjects who were evaluated over the course of 2 years, 59 completed the Desert Storm Trauma Questionnaire (33, 34) and the Mississippi Scale for Combat-Related Posttraumatic Stress Disorder (35) at both 1 month and 2 years. Forty-six (78%) of these subjects were men, and 13 (22%) were women. Thirty (51%) of the subjects were from a medical unit, while 29 (49%) were from a military police unit. The mean age was 29.9 years (SD=9.9). The current methodology is a continuation of that used in two reports of returning Desert Storm veterans (32, 33). That is, unit members completed self-administered questionnaires during routine monthly training sessions approximately 1 month and 2 years after returning from the Gulf. All subjects provided written informed consent before their participation in the study.

The Desert Storm Trauma Questionnaire (33) is composed of 19 items dealing with potential traumatic stressors experienced by Desert Storm personnel. The questionnaire referred specifically to their experiences in the Persian Gulf and included extreme threat to personal safety, seeing others killed or wounded, death of a close friend, sitting with the dying, being stationed close to enemy lines, and witnessing bizarre disfigurement of bodies as a result of wounds. The total score was composed of the number of positive responses, with a possible range from 0 to 19. The Mississippi Scale for Combat-Related Posttraumatic Stress Disorder (range=35–175) is a self-report inventory consisting of 35 items derived from DSM-III and associated features (35). It measures both symptom severity and the effects of symptoms on an individual's life.

A paired t test was used to analyze the difference in mean total score on the Desert Storm questionnaire between 1 month and 2 years. Frequencies of the difference in total score between the two time points, as well as number of individual items changed, were examined. The degree to which each of the 19 individual items on the Desert Storm Trauma Questionnaire changed was also examined. Pearson correlations were used to test the association between PTSD symptoms at 2 years, as measured by the Mississippi scale score, and number of Desert Storm questionnaire items changed over time.

RESULTS

The total score on the Desert Storm Trauma Questionnaire changed significantly from 1 month to 2 years. There was a mean increase of 0.69 (SD=2.18) ($t=2.44$, $df=58$, $p<0.02$). Fifty-two (88%) of the 59 subjects changed their response on at least one of the 19 items at 2 years (table 1), while 36 subjects (61%) changed their response to two or more items. Twenty-three subjects changed either one item or no items. Table 1 also shows the number of responses on the Desert Storm questionnaire that were changed from no at 1 month to yes at 2 years. Forty-one subjects (70%) recalled an event at 2 years that they had not reported at 1 month. On the other hand, 27 subjects (46%) did not report an event at 2 years that they had endorsed at 1 month (response changed from yes to no).

Table 2 lists the 19 individual items on the Desert Storm questionnaire in order of decreasing change in response. The five items for which responses were most commonly changed at 2 years were extreme threat to

TABLE 2. Frequency of Subjects' Responses to the 19 Items on the Desert Storm Trauma Questionnaire 1 Month and 2 Years After Return From Operation Desert Storm (N=59)

	Subjects' Responses					
					Change	
Event or Experience	No at Both Times	No at 1 Month, Yes at 2 Years	Yes at 1 Month, No at 2 Years	Yes at Both Times	N	%
Extreme threat to your personal safety	17	11	10	21	21	35.6
Bizarre disfigurement of bodies as a result of wounds	25	15	5	14	20	33.9
Seeing others killed or wounded	26	9	7	17	16	27.1
Being stationed close to enemy lines	18	7	3	31	10	16.9
Mines or booby traps	34	8	1	16	9	15.3
Passing through hostile airspace in a chopper, plane, or ship	47	5	3	4	8	13.6
Death of a friend, not observed	35	6	2	16	8	13.6
Observe anything you would consider excessively violent or brutal, even for wartime, such as mistreatment of prisoners or mutilation of bodies?	50	5	3	1	8	13.6
Sniper or sapper fire	48	5	2	4	7	11.9
Firefights	52	5	1	1	6	10.2
Unit ambushed	47	3	3	6	6	10.2
Death of a close friend, observed	50	5	0	4	5	8.5
Being pinned down or caught in a helpless situation	53	1	3	2	4	6.8
Sitting with the dying	53	1	2	3	3	5.1
Sustained injury to yourself	57	1	1	0	2	3.4
Being in an aircraft that takes hostile antiaircraft fire	58	1	0	0	1	1.7
Participate in anything you would consider excessively violent or brutal, even for wartime?	58	0	1	0	1	1.7
Being in an aircraft that is shot down	59	0	0	0	0	
Being responsible for someone else's death	59	0	0	0	0	

personal safety (36% of subjects), bizarre disfigurement of bodies as a result of wounds (34%), seeing others killed or wounded (27%), being stationed close to enemy lines (17%), and mines or booby traps (15%). Responses to only two items (being in an aircraft that is shot down, being responsible for someone else's death) were not changed by any subjects.

Positive and statistically significant Pearson correlations were found between Mississippi scale score at 2 years and total number of responses on the Desert Storm questionnaire changed from 1 month to 2 years ($r=0.41$, $df=57$, $p<0.002$) and between Mississippi scale score at 2 years and number of responses on the Desert Storm questionnaire changed from no at 1 month to yes at 2 years ($r=0.32$, $df=57$, $p<0.02$). The correlation between Mississippi scale score at 2 years and total number of responses on the Desert Storm questionnaire changed from yes at 1 month to no at 2 years was not statistically significant ($r=0.17$, $df=57$, $p<0.20$).

DISCUSSION

The present findings do not support the notion that memory for traumatic events is fixed, indelible, or stable over time. During this 2-year study, 52 (88%) of 59 National Guard reservists reported changes in memory for personally experienced traumatic events during Operation Desert Storm. One month after the war, 46% of subjects reported one or more traumatic events that they did not recall 2 years later. Further, 70% of subjects at the 2-year evaluation recalled traumatic events that they had not reported at 1 month. The number of inconsistent recollections per subject ranged from none (12% of subjects) to six (8% of subjects). Sixty-one percent changed at least two responses on the Desert Storm Trauma Questionnaire.

These changes in memory were observed for a wide variety of traumatic experiences. Seventeen of 19 items on the Desert Storm questionnaire were changed by at least one subject. While a few of the items on the Desert Storm questionnaire involve subjective judgments (e.g., extreme threat to personal safety, being responsible for someone else's death), most items refer to specific, nontrivial events (e.g., seeing others killed or wounded, being involved in firefights, observing the bizarre disfigurement of wounded bodies). Thus, in this group of Desert Storm veterans, there were many instances of inconsistent recall for events that were generally objective and highly traumatic in nature. These inconsistencies raise doubts about the reliability of memory for combat.

Numerous investigations, including two earlier studies on this same population of Gulf War veterans (33–37), repeatedly have shown that level of combat exposure is significantly correlated with level of PTSD symptoms. However, if memories of trauma are inconsistent, then statistical analyses, such as correlations, involving retrospective accounts of trauma are highly suspect. Further, most researchers have assumed that combat actually causes PTSD even though correlations do not address cause and effect.

There are a number of possible explanations for changes from yes to no on the Desert Storm questionnaire. First, the events simply may have been forgotten. Second, it is possible that events initially remembered

were either repressed or dissociated, making them no longer available for conscious recall. Third, postevent information may have modified recall. For example, media accounts that minimized the traumatic nature of Desert Storm may have influenced some subjects to similarly minimize memories of their own traumatic experiences. Fourth, subjects may have intentionally or unintentionally exaggerated Gulf War experiences at first but not later on.

There are also a number of possible explanations for changes from no to yes. First, material that had been forgotten, denied, suppressed, or repressed at 1 month may have become conscious by 2 years. Second, memories may have become exaggerated after exposure to media accounts, after conversations with other traumatized reservists, or after multiple retellings of the same events. Third, it is possible that individuals with intrusive memories, nightmares, and flashbacks gradually recalled traumatic memories as a result of their involuntary reexperiencing of symptoms. Fourth, it may be that individuals who became increasingly symptomatic over time unknowingly exaggerated their memory for traumatic events as a way to understand or explain their emerging psychopathology.

In the current study, level of PTSD symptoms was positively correlated with overall inconsistency of memory for combat exposure, as well as with number of responses on the Desert Storm questionnaire that were changed from no to yes. These findings suggest that subjects with higher Mississippi scale scores tend to amplify their memory of traumatic events over time. In search of a cause for their worsening symptoms, traumatized individuals may attribute their pathology to a level of combat exposure that they unknowingly have exaggerated. Alternatively, it is possible that individuals with more severe intrusive memories, nightmares, and flashbacks gradually recall traumatic events as a result of the involuntary reexperiencing of symptoms.

The major limitation of this study is its reliance on self-rated questionnaires. It is generally believed that such reports are less reliable and less valid than assessments made by clinicians. A second limitation is that reliability and validity have not yet been established for the Desert Storm questionnaire. However, since most of the items on this questionnaire refer to factual events, it is unlikely that our findings could be explained by the instrument itself. Finally, because military records were not available, we were not able to verify the actual occurrence of traumatic events. There is no way of knowing which, if either, of the two time points depicted a more accurate representation of the truth. However, this study concerns changes in memory regardless of what actually happened.

The findings of the present study have potential implications for treatment. That memory for traumatic events frequently changed over time suggests that the search for historical "truth" may be fraught with complexity. Memories described by trauma survivors in the present at times appear to be inconsistent with earlier memories for the same events. Thus, efforts by therapists to uncover the real "truth" may be misguided. It may make greater psychotherapeutic sense to work with the patient's current version of the past, since the "real" version may no longer exist. Further, it is possible that traumatic memories may change during the course of psychotherapy as level of symptoms changes.

Because level of combat is considered the most important determinant of PTSD, many treatment programs have focused on the reconstruction and processing of traumatic combat experiences. However, this study suggests that the relationship between development of PTSD and level of combat exposure is not as clear as previously believed. Factors other than combat, such as childhood trauma (38, 39) and preexisting personality (37, 40–42), may also play an important part in symptom development. Successful treatment of combat-related PTSD requires a clear understanding of the relative etiologic contributions of both combat and noncombat factors.

In summary, this study raises questions not only about the accuracy of memory for traumatic events, but also about the relationship between traumatic stressors and PTSD. Clearly, further research is needed to investigate the nature and to determine the accuracy and consistency of traumatic memories.

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