

Memory Consistency for Traumatic Events in Dutch Soldiers Deployed to Iraq

Iris M. Engelhard, Ph.D.

Utrecht University, Utrecht, The Netherlands •

Marcel A. van den Hout, Ph.D.

Utrecht University, Utrecht, The Netherlands

Richard J. McNally, Ph.D.

Harvard University, Cambridge, MA, USA

IN PRESS (MEMORY)

Short title: Memory consistency

• Correspondence to: Dr. Iris M. Engelhard. Clinical and Health Psychology, Utrecht University,
PO Box 80140, 3508 TC Utrecht, The Netherlands. i.m.engelhard@fss.uu.nl. Tel: +31 30
2531470; FAX: +31 30 2534718.

Abstract

Retrospective accounts of traumatic events are consistently associated with symptoms of posttraumatic stress disorder (PTSD). This has often been interpreted as *causal* impact of such events on psychological functioning, but recent studies suggest that the causal direction is (partly) reversed: high levels of PTSD symptoms may be associated with amplified recollections of precipitating traumatic events. The aim of this prospective study was to index the consistency with which Dutch Army soldiers reported traumatic stressors and nontraumatic stressors on their deployment to Iraq, and to examine to what extent PTSD symptoms and pre-existing reporting biases, such as that arising from neuroticism, affect memory inconsistency. Retrospective accounts of stressors were highly variable over time. Individuals with higher levels of PTSD symptoms and neuroticism and lower levels of extraversion and prior missions were more prone to increased reporting over time.

Acknowledgements

This study was supported by a grant from the Veterans Institute (Doorn, The Netherlands) and an Innovational Research Incentive VENI Scheme (016.045.106) by the Netherlands Organisation for Scientific Research awarded to Iris M. Engelhard. We thank representatives of the Netherlands Ministry of Defense for their cooperation, and the commanders and soldiers who participated in this study for their service. We also thank Ron M. Rapee for helpful comments on a presentation of an earlier draft of this paper.

The frequency and severity of posttraumatic stress disorder (PTSD) symptoms usually varies as a function of stressor severity (e.g., Dohrenwend et al., 2006; Hoge et al., 2004; Hotopf et al., 2006). Despite exceptions to this dose-response rule (McNally, 2003, pp. 79-100), in general, the more severe the trauma, the more severe the posttraumatic morbidity. Although this association is often interpreted as confirming the casual impact of stressor severity on functioning, one cannot infer causation from correlation. In fact, most studies documenting the dose-response effect are based on retrospective recollection of trauma severity among individuals with PTSD. This is problematic because clinical status can affect how one remembers one's traumatic experiences (e.g., King et al., 2000; Roemer, Litz, Orsillo, Ehlich, & Friedman, 1998; Schwarz, Kowalski, & McNally, 1993; Southwick, Morgan, Nicolaou, & Charney, 1997; Wessely et al., 2003).

The worse the current symptoms, the more severe individuals remember their trauma to have been. For example, school workers were asked to complete a questionnaire about their memory for a fatal shooting at an elementary school six months earlier (Schwarz et al., 1993). The questionnaire was re-administered 18 months after the shooting. Severity of PTSD symptoms at 18 months predicted participants' remembering the event as worse than they did at 6 months. Those doing better at follow-up tended to remember the event as less disturbing than they had earlier. Likewise, Gulf War veterans were asked to complete questionnaires concerning their exposure to war-related stressors one month and two years after their deployment (Southwick et al, 1997). Severity of PTSD symptoms at two years predicted the number of traumatic events reported at two years that were not reported at one month.

These studies have methodological limitations. First, participants had already been traumatized when they enrolled in the study. The most serious problem with this is that it is possible that those who most strongly attribute symptoms to traumatic events will be most likely to participate in a study that asks about both (Hotopf & Wessely, 2005). The result could

be an overestimation of the extent of retrospective recall bias. To avoid selective sampling, researchers should recruit individuals at risk for exposure to trauma (such as soldiers) and then follow them over time. But such prospective studies are rarely feasible. Second, earlier studies focused on the frequency of traumatic events, but few studies tested to what extent PTSD symptoms are related to inconsistent recall of the emotional *impact* of the event at the time. This is an important issue because subjective appraisal of stressor severity is often more predictive of PTSD than are objective measures of stressor severity (Bowman, 1999). It is also unclear whether memory for nontraumatic stressors, such as daily difficulties (e.g., for soldiers on deployment, this could be irritations and pressures within a malevolent or harsh war zone, such as lack of privacy, having to endure the climate, etc), is also vulnerable to distortion as a function of current clinical state. Finally, due to the retrospective nature of prior studies, little is known about pre-trauma predictors for memory distortions. Some of these variables may be assessed post-trauma, like the number of earlier missions that may act either as a vulnerability factor or may make soldiers resilient. Other pre-trauma variables, such as prior life events, neuroticism, and extraversion, would have to be assessed before trauma as post-trauma assessments may affect scores. For example, the presence of PTSD symptoms may inflate neuroticism scores due to item-overlap (Engelhard, van den Hout, & Kindt, 2003)

In this study, we administered self-report measures of traumatic stressors and nontraumatic stressors to Dutch soldiers who were deployed to Iraq. They completed these measures 5 months and 15 months after their deployment. The participants were recruited prior to deployment. The aims of this study were to investigate: (1) the stability of memories for stressors and their emotional impact over time, (2) the association between variability in these reports and symptoms of PTSD, and (3) pre-trauma predictors of variability. This report is part of a larger project on experimental approaches to PTSD (e.g., Engelhard, Huijding, van den Hout, & de Jong, 2006; Engelhard & van den Hout, 2006).

Method

Participants. Two hundred and sixteen infantry troops of the Royal Netherlands Army were asked to participate in this study prior to their four-month tour in the peacekeeping mission in Iraq in 2004. They were recruited on the basis of availability during preparations for Iraq, from one rotation and several units. Participation was voluntary. After the research team gave the participants a complete oral and written description of the study, written informed consent was obtained. This was done both before and after deployment. Two soldiers refused, and 214 (5% female) agreed to participate, and completed questionnaires assessing prior missions, prior life events, neuroticism, and extraversion about six weeks before their deployment. Their mean age was 23.1 ($SD=4.5$). Most were single, and 22% was married or cohabiting. The majority had finished high school, 7% only finished elementary school, and 2% was college-educated. For nearly two-thirds, this was the first peacekeeping mission, 24% had completed one prior mission, and 15% had completed two or three prior missions. About 5 months after their deployment, 171 (80%) of the participants completed questionnaires about traumatic stressors and nontraumatic stressors in Iraq and PTSD symptoms. At about 15 months, 152 soldiers (response rate: $152/214=71\%$) completed these same questionnaires; 133 of them completed all questionnaires at 5 months and at 15 months. Most of the assessments took place at the base, but at 15 months about a third of the participants was tested via mail. The university Institutional Review Board approved this study.

Measures. Prior life events were measured with a 17-item checklist that included road accidents, sudden death of a loved one, fire, being robbed, or threatened with a weapon. A count was used of all endorsed items. Neuroticism and extraversion were assessed with the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975). The Potentially Traumatizing Events Scale (PTES; Maguen, Litz, Wang, & Cook, 2004) includes 21

potentially traumatic war zone stressors (e.g., going on patrols, disarming civilians, being shot at), and the General Overseas Mission Stressors and Negative Peacekeeping Experiences Scale (Maguen et al., 2004) includes 30 nontraumatic stressors (e.g., feeling bored, being unable to identify a clear enemy, feeling unclear about what to do in threatening situations, difficulties getting mail, bad weather conditions). We omitted one item from the PTES because it was already included in the nontraumatic stressors scale (i.e., patrolling areas where there were land mines), added two items for the Iraq-mission (item 1 and 21, Table 1), and rewrote two nontraumatic stressors in general terms (in the original scale, these referred to civilians in Kosovo, which we rephrased as “civilians”). For each item, participants indicated whether they had experienced it, and if so, how much of a negative impact it had on them at the time of the event (1=no impact, 2=little negative, 3=moderately negative, 4=extremely negative). For both types of stressors, we calculated the number of endorsed items and the number of items rated as “moderately” or “extremely” negative. PTSD symptoms were measured with the PTSD Symptom Scale (PSS-SR; Foa, Riggs, Dancu, & Rothbaum, 1993), which includes the 17 PTSD symptoms that are rated on a 4-point severity scale (0=not at all, 3=almost always). Ratings were summed to yield a PTSD symptom severity score.

Results

Stability. The correlation between the number of potentially traumatic stressors recalled at 5 and 15 months was $r(133) = 0.64, p < 0.001$. The mean number of events did not change significantly over time, $t(132)=0.26, NS$. Following Southwick et al. (1997), we created variables indicating whether the event was either endorsed at both times (YY); at 5 months, but not at 15 months (YN); not endorsed at 5 months, but endorsed at 15 months (NY); or never endorsed (NN; see Table 1). A total of 80% reported at least one YN change,

and 47% reported two or more changes. Similarly, 70% reported at least one NY change, and 45% reported two or more. Interestingly, the NY category contained not only new recollections of subjective experiences, such as “fear that you might be taken hostage” (see Table 1, item 3), but also relatively objective events like “seeing dead or injured civilians” (item 5) or “being shot at” (item 11).

-- Please insert Table 1 about here --

The correlation between the number of events recalled as negative at 5 and 15 months was $r(133) = 0.55, p < 0.001$. The mean number of negative events did not change over time either, $t(132)=0.55, NS$. About 52% reported at least one change from “not negative” to “negative”, and 47% reported at least one change in the opposite direction. Items that changed most often from “not negative” to “negative” were: being told about a colleague who got killed (22%), fear of being ambushed (15%), witnessing an explosion (11%), and being shot at (11%). The former three items also changed most often the other way around (8-16%).

The correlation between the number of nontraumatic stressors recalled at 5 and 15 months was $r(135) = 0.65, p < 0.001$, and the mean scores decreased over time, $t(134)=3.59, p < 0.001$. Seventy-nine percent reported at least one YN change, and 67% reported at least one NY change. The most common YN items were: seeing kids who had been victims of violence (25%), not understanding the unit’s mission (21%), and having to remain neutral in the face of conflicts between civilians (20%). The most common NY items were: frustration about not knowing what to do with captured insurgents (15%), patrolling areas where there were land mines (13%), and lack of clarity about what to do in threatening situations (13%).

The correlation between the number of nontraumatic events recalled as moderately or extremely negative at 5 and 15 months was $r(135) = 0.67, p < 0.001$. Again, the mean scores

dropped over time, $t(134)=2.34, p = 0.02$. The items most often changed from “negative” to “not negative” included frustration with terrorist activity (16%), civilians having hostile reactions while you were trying to help (16%), being unable to identify a clear enemy (15%), and knowing that many war criminals were not arrested (14%). These were equally changed the other way around (14-16%).

Associations with PTSD symptoms and pre-trauma variables. The PSS and change scores were non-normally distributed and were transformed with square root to increase normality. Change in PTSD symptoms (15 months minus 5 months) was used to test for associations with variations in self-reported experiences. To obtain a graphical representation of the data, we divided participants into a PTSD-positive group ($n=21$) and a PTSD-negative group ($n=112$), defined by PSS criteria for PTSD at 15 months¹ (see Figure 1-2). Figure 1 suggests that the PTSD group shows increases in their reporting of traumatic stressors, whereas the other group did not. In fact, worsening of PTSD symptoms at 15 months was significantly related to more NY changes in traumatic events, $r(133) = 0.18, p = 0.04$, but it was unrelated to YN changes, $r(133) = -0.07$. It was also related to more NY changes in events with a negative impact at the time, $r(133) = 0.23, p = 0.01$, and to less YN changes in such events, $r(133) = -0.24, p = 0.01$ (Figure 2). Worsening of PTSD symptoms was related to more NY changes in *non-traumatic* events with a negative impact, $r(133) = 0.24, p = 0.01$, but it was not significantly related to any other change in recall of non-traumatic events (largest $r = -0.13$ for forgetting of difficulties), although the correlations were in the same direction (i.e., positive for NY changes and negative for YN changes).

¹ This is a symptom-based PTSD definition that follows DSM-IV criteria but does not include impairment (i.e., at least one reexperiencing symptom, three avoidance symptoms, and two hyperarousal symptoms had to be rated at least “some of the time”; Foa et al., 1993).

-- Please insert Figure 1-2 about here --

Prior missions, prior life events, neuroticism, and extraversion were correlated with the inconsistency variables that were significantly linked to PTSD symptoms. The only significant correlation for traumatic events was between NY changes in events recalled as negative and neuroticism, $r(132)=0.19, p=0.03$. A regression analysis showed that worsening of PTSD symptoms, $\beta=0.22, t=2.64, p<0.01$, and higher neuroticism $\beta=0.16, t=1.90, p=0.06$, predicted the number of NY changes, $F(2, 129)=6.11, p<0.01, R^2=0.09$. NY changes in non-traumatic events recalled as negative were related to neuroticism, $r(134)=0.25, p < 0.01$, extraversion, $r(134)=-0.22, p=0.01$, and prior missions, $r(135)=-0.19, p=0.03$. A regression analysis showed that worsening of PTSD symptoms, $\beta=0.21, t=2.54, p=0.01$, lower extraversion, $\beta=-0.25, t=3.01, p<0.01$, and fewer prior missions, $\beta=-0.18, t=2.19, p=0.03$, predicted more NY changes in non-traumatic events recalled as negative, $F(3, 128)=7.13, p<0.001, R^2=0.14$, but neuroticism was no longer significant, $\beta=0.14, t=1.54, p=0.13$.

Discussion

In line with other studies, retrospective accounts of trauma exposure were variable over time. This inconsistency occurred for a wide variety of events, but most referred to specific, nontrivial events, such as seeing human remains, being injured because of an attack, and being shot at. Similar inconsistencies occurred for lower magnitude stressors (e.g., having difficulty getting mail; lack of clarity about what to do in threatening situations). Furthermore, the more a participant reported PTSD symptoms, the more he or she retrospectively increased reporting of both traumatic stressors and nontraumatic stressors occurring during their deployment in Iraq. If psychiatrically ill traumatized individuals remember traumatic events

as worse than they originally did, this will inflate posttrauma estimates of the dose-response relationship between trauma and symptoms. We also found that those who are well were more inclined to forget the negative *impact* of such events. We did not verify the actual occurrences of traumatic events and therefore do not know which of the two time points depicts a more accurate representation of the truth. However, the focus of this study was on changes in reporting of memories.

Inconsistencies in reporting autobiographical memory are not uncommon. The question is why a specific memory change (NY changes) is associated with particular psychological problems (PTSD symptoms). The most likely explanation is that increased reports may result from a reappraisal process: those who suffer from more problems may most strongly try to make sense of their problems and attribute them to deployment-related stressors. Events previously seen as irrelevant and not endorsed may have increased in importance over time, and may be labeled differently (i.e., a person calling the sight of blood “seeing human remains”). It is also possible that individuals with more symptoms are more unwilling or unable to make efforts that are necessary to figure out exactly whether experiences occurred to them. They may retrieve less specific representations of what occurred during their deployment and may rely more on gist. Vague impressions of similarity between an item and a past event may result in false recognition. At least among war veterans, PTSD is related to deficits in retrieving specific memories (McNally, Litz, Prassas, Shin, & Weathers, 1994). Finally, increases in item endorsement may be explained by new information and source memory errors. New knowledge about deployment to Iraq from whatever source (e.g., unit meetings, media) may get inadvertently incorporated into one’s autobiographical memories of deployment. Possibly, post-mission information is more salient for PTSD sufferers making it likely that the new information gets integrated in autobiographical memory. If memory about new information contains perceptual details about

the context or setting, individuals are inclined to believe it is a real memory for an actual event (Johnson, Hashtroudi, & Lindsay, 1993).

The findings are consistent with other studies (e.g., Southwick et al., 1997) showing that retrospective accounts of traumatic events are not necessarily veridical. The magnitude of the link between PTSD symptoms and changes in reports of stressors is small, but noteworthy: individuals with more symptoms tend to amplify their memories of major and more minor stressors over time. With regard to clinical care, clinicians often conclude that the trauma reported to them by the patient is accurate and genuine. It is important for clinicians to understand that memory for a potentially traumatic event is not immutable. The very notion that PTSD is strongly related to stressor exposure is mainly based on correlations between self-reports about current symptoms and earlier events. The fact that self-reports about earlier events are influenced by symptoms seems relevant to the validity of the PTSD concept: when retrospective self-reports are used, the phenomenon of state-dependent memory retrieval will serve to overestimate the relationship between aversive events and PTSD symptoms. As Young (2004) has emphasized, the concept of PTSD has an “inner logic” (p. 128) whereby the memory of an event is the source of subsequent symptoms. According to this received view of PTSD, the symptoms themselves should not work backward, so to speak, and alter the memory. Yet this clearly does happen, underscoring the dynamic and malleable character of traumatic memory.

References

- Bowman, M.L. (1999). Individual differences in posttraumatic distress: Problems with the DSM-IV model. *Canadian Journal of Psychiatry, 44*, 21-33.
- Dohrenwend, B.P., Turner, J.B., Turse, N.A., Adams, B.G., Koenen, K.C., & Marshall, R. (2006). The psychological risks of Vietnam for U.S. Veterans: A revisit with new data and methods. *Science, 313*, 979-982.
- Engelhard, I.M., Huijding, J., van den Hout, M.A., & de Jong, P.J. (2006). *Vulnerability associations and symptoms of posttraumatic stress disorder after peacekeeping duties in Iraq*. Paper submitted for publication.
- Engelhard, I.M., & van den Hout, M.A. (2006). *Pre-existing neuroticism, stressor severity, and PTSD symptoms in Iraq peacekeepers*. Paper submitted for publication.
- Engelhard I.M., van den Hout M.A., & Kindt, M. (2003). The relationship between neuroticism, pre-traumatic stress, and post-traumatic stress: A prospective study. *Personality and Individual Differences, 35*, 381-388.
- Eysenck, H.J., & Eysenck, S.B.G. (1975). *Manual of the Eysenck Personality Questionnaire*. San Diego, CA: Educational and Industrial Testing Service.
- Foa, E.B., Riggs, D.S., Dancu, C.V. & Rothbaum, B.O. (1993). Reliability and validity of a brief instrument for assessing post-traumatic stress disorder. *Journal of Traumatic Stress, 6*, 459-473.
- Hoge, C.W., Castro, C.A., Messer, S.C., et al. (2004). Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *New England Journal of Medicine, 351*, 13-22.
- Hotopf, M., Hull, L., Fear, N.T., et al. (2006). The health of UK military personnel who deployed to the 2003 Iraq war: a cohort study. *The Lancet, 367*, 1731-41.
- Hotopf, M., & Wessely, S. (2005). Can epidemiology clear the fog of war? Lessons from the

- 1990-91 Gulf War. *International Journal of Epidemiology*, *34*, 791-800.
- Johnson, M.K., Hashtroudi, S., & Lindsay, D.S. (1993). Source monitoring. *Psychological Bulletin*, *114*, 3-28.
- King, D.W., King, L.A., Erickson, D.J., Huang, M.T., Sharkansky, E.J., & Wolfe, J. (2000). Posttraumatic Stress Disorder and retrospectively reported stressor exposure: A longitudinal prediction model. *Journal of Abnormal Psychology*, *109*, 624-633.
- Maguen, S., Litz, B.T., Wang, J.L., & Cook, M. (2004). The stressors and demands of peacekeeping in Kosovo: Predictors of mental health response. *Military Medicine*, *169*, 198-206.
- McNally, R.J. (2003). *Remembering trauma*. Cambridge, MA: Harvard University Press.
- McNally, R. J., Litz, B. T., Prassas, A., Shin, L. M., & Weathers, F. W. (1994). Emotional priming of autobiographical memory in post-traumatic stress disorder. *Cognition and Emotion*, *8*, 351-367.
- Roemer, L., Litz, B.T., Orsillo, S.M., Ehlich, P.J., & Friedman, M.J. (1998). Increases in retrospective accounts of war-zone exposure over time: The role of PTSD symptom severity. *Journal of Traumatic Stress*, *11*, 597-605.
- Schwarz, E.D., Kowalski, J.M., & McNally, R.J. (1993). Malignant memories: Post-traumatic changes in memory in adults after a school shooting. *Journal of Traumatic Stress*, *6*, 545-553.
- Southwick, S.M., Morgan, C.A. III, Nicolaou, A.L., & Charney, D.S. (1997). Consistency of memory for combat-related traumatic events in veterans of Operation Desert Storm. *American Journal of Psychiatry*, *154*, 173-177.
- Wessely, S., Unwin, C., Hotopf, M., Hull, L., Ismail, K., Nicolaou, V., & David, A. (2003). Stability of recall of military hazards over time. *British Journal of Psychiatry*, *183*, 314-322.

Young, A. (2004). When traumatic memory was a problem: On the historical antecedents of PTSD. In G. M. Rosen (Ed.), *Posttraumatic stress disorder: Issues and controversies* (pp. 127-146). Chichester, UK: Wiley.

Table 1. Potentially traumatic stressors in Iraq organized by the highest change in responses.

	Participants' responses					
	YY	YN	NY	NN	Change	
					<i>n</i>	%
1. Having injured civilians due to own action	16	29	20	68	49	37
2. Seeing dead or injured NATO (non-Dutch) soldiers	16	22	16	79	38	29
3. Fear that you might be taken hostage	81	18	18	16	36	27
4. Seeing human remains	21	16	18	78	34	26
5. Seeing dead or injured civilians	48	7	25	53	32	24
6. Having to aid in the removal of unexploded ordnance	10	16	16	91	32	24
7. Needing to manage civilians in chaotic conditions	74	13	16	30	29	22
8. Patrolling through the zone of separation	56	17	10	50	27	20
9. Seeing dead or injured Dutch soldiers	52	13	13	55	26	20
10. Having to aid in the removal of human remains	3	15	11	104	26	20
11. Being shot at	75	6	19	33	25	19
12. Locating unexploded land mines	12	9	15	97	24	18
13. Witnessing an explosion	90	14	9	20	23	17
14. Being injured because of an assault/attack	5	14	5	109	19	14
15. Witnessing violence	100	13	5	15	18	14
16. Experienced sexual harassment during deployment	3	11	3	116	14	11
17. Being injured because of an accident	9	8	6	110	14	11
18. Disarming civilians	86	4	8	36	12	9
19. Fear of having your unit fired on	120	7	4	2	11	8
20. Fear of being ambushed or attacked	127	3	4	0	7	5
21. Being informed of a Dutch soldier who got killed	126	0	6	1	6	5
22. Going on patrols or performing other dangerous duties	116	4	2	12	6	5

Note: YY=endorsed at both time points, YN=no longer endorsed, NY=newly endorsed,

NN=not endorsed at either time point.

Figure 1: The number of potentially traumatic stressors recalled at 5 and 15 months.

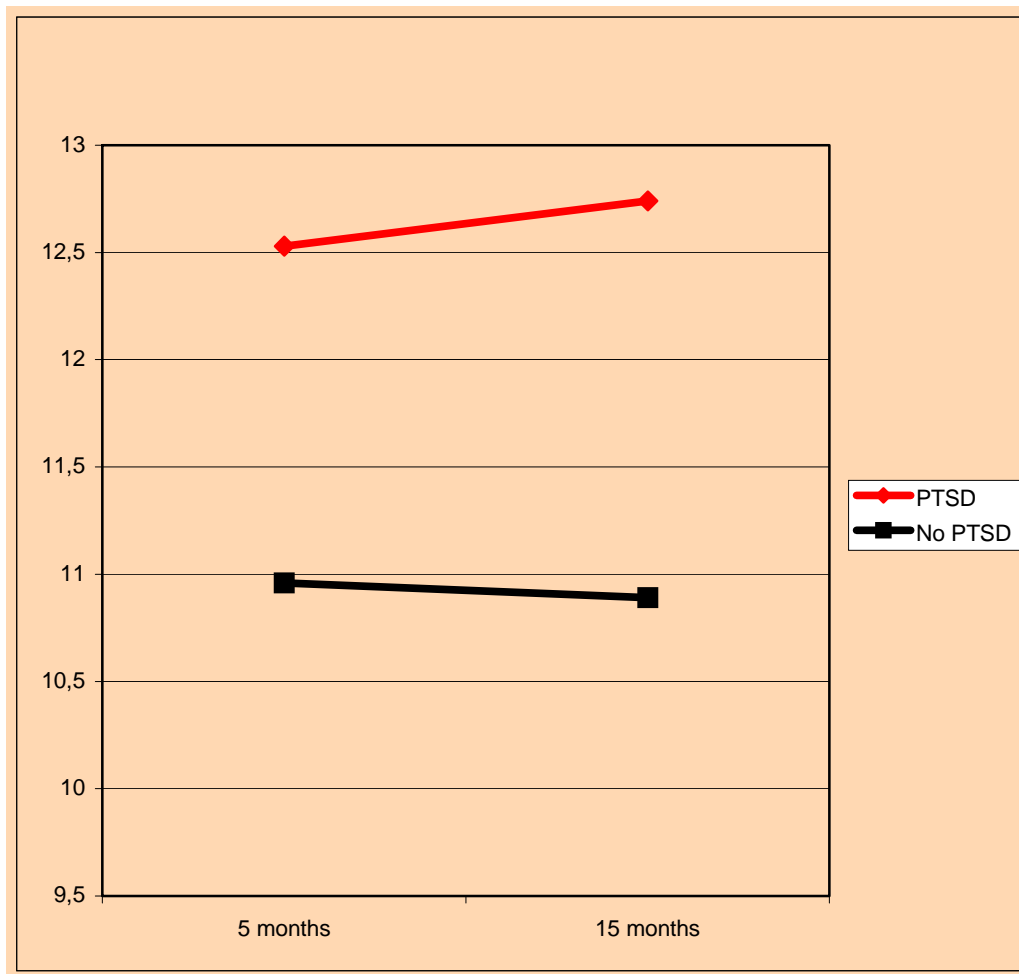


Figure 2: The number of potentially traumatic stressors recalled as negative.

