



A prospective study of the relation between posttraumatic stress and physical health symptoms¹

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ABSTRACT. This *ex post facto* prospective study investigated whether symptoms of posttraumatic stress disorder (PTSD) are associated with increased physical health problems, while controlling for base-rates of symptoms and individual differences in neuroticism. Dutch army soldiers completed standardized questionnaires before they were deployed to Iraq ($n = 479$), and about 5 months ($n = 382$; 80%) and 15 months ($n = 331$; 69%) after their return home. PTSD-symptoms were evaluated by questionnaires and clinical interviews. The results showed that, on average, participants with PTSD at 5 months reported increased physical problems after deployment. PTSD-symptoms at 5 months predicted coexisting physical symptoms, after controlling for demographic variables, military factors, injury sustained on deployment, war-zone exposure on deployment, baseline physical problems, baseline PTSD-symptoms, and neuroticism. PTSD-symptoms at 5 months also predicted physical problems at 15 months, while controlling for physical symptoms at 5 months. The results suggest that posttraumatic stress contributes to physical symptoms. Clinicians are advised to be attentive to PTSD when individuals present with physical symptoms, and to pay attention to physical symptoms in patients diagnosed with PTSD.

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KEYWORDS. PTSD. Physical health. Neuroticism. Soldiers. Prospective *ex post facto* study.

RESUMEN. En este estudio prospectivo *ex post facto* se investigó si los síntomas del Trastorno por Estrés Postraumático (TEPT) se asocian a un mayor número de problemas de salud física, partiendo de los porcentajes iniciales de síntomas y diferencias individuales en neuroticismo. Militares del ejército holandés rellenaron cuestionarios estándar antes de ir a Irak ($n = 479$), a los 5 ($n = 382$; 80%) y 15 meses ($n = 331$; 69%) tras su regreso. Los síntomas se evaluaron mediante cuestionarios y entrevistas clínicas. Los participantes con TEPT a los 5 meses tras su regreso, refirieron más problemas físicos. Los síntomas de TEPT a los 5 meses predecían los síntomas físicos coexistentes, considerándose las variables demográficas, los factores militares, las lesiones sufridas, la exposición a zona de guerra, los problemas físicos iniciales, los síntomas de TEPT iniciales y el neuroticismo. Los síntomas de TEPT a los 5 meses predecían también los problemas físicos a los 15 meses, considerándose los síntomas físicos a los 5 meses. Los resultados sugieren que el estrés postraumático contribuye a los síntomas físicos. Se recomienda a los clínicos alerta ante el TEPT cuando un individuo presente síntomas físicos y prestar atención a los síntomas físicos en pacientes con TEPT.

PALABRAS CLAVE. TEPT. Salud física. Neuroticismo. Militares. Estudio prospectivo *ex post facto*.

Trauma exposure and posttraumatic stress disorder (PTSD) have consistently been associated with adverse physical health outcomes in civilian and military samples, such as increased physical symptoms, utilization of medical services, and cardiovascular morbidity (see Friedman and Schnurr, 1995; Schnurr and Jankowski, 1999). For example, soldiers who screened positive for PTSD after deployment to Iraq reported more physical symptoms and sick call visits than soldiers who screened negative (Hoge, Terhakopian, Castro, Messer, and Engel, 2007). The primary mediator of the link between trauma exposure and physical health outcomes seems to be PTSD, not stressor severity or injury (Friedman and Schnurr, 1995; Schnurr and Jankowski, 1999). Most studies of the relationship between PTSD-symptoms and physical problems have been cross-sectional, but one of the rare longitudinal studies (Wagner, Wolfe, Rotnitsky, Proctor, and Erickson, 2000) observed among 1991 Gulf War veterans that PTSD-symptoms shortly after deployment predicted physical problems 18 to 24 months later, after controlling for initial physical symptoms. PTSD-symptoms partly explained the association between combat exposure and later physical symptoms.

Although these findings suggest that PTSD-symptoms lead to poor physical health, the interpretation of this association is unclear. Previous research took place *after* the traumatic event, and did not take into account pre-trauma health problems. Increased physical symptoms reported by individuals with PTSD might reflect pre-existing symptoms, which may even render them sensitive to develop PTSD. Prospective, longitudinal research, in which baseline symptom-levels are assessed, would help to define the temporal sequence of changes with regard to physical health and PTSD. However, such

studies are seldom feasible. Another causality-related issue is that prior studies did not control for stable individual differences in “negative affectivity” or neuroticism, which is linked to self-reported health problems (Watson and Pennebaker, 1989) and posttraumatic stress (Engelhard, van den Hout, and Kindt, 2003). To examine whether neuroticism accounts for the relationship between the latter two, neuroticism ought to be measured prior to trauma, because post-trauma assessments may be influenced by PTSD-symptoms (Engelhard *et al.*, 2003).

The aim of this *ex post facto* study (Montero and León, 2007) was to examine whether PTSD-symptoms predict physical symptoms by using a prospective, longitudinal design, and controlling for pre-trauma symptoms and neuroticism, stressor severity, and background variables. This report is part of a larger project on experimental approaches to PTSD (see Engelhard *et al.*, 2007a), and follows the norms suggested by Ramos-Álvarez, Moreno-Fernández, Valdés-Conroy, and Catena (2008).

Method

Participants and procedure

Dutch Army infantry troops were invited to participate in this study about six weeks before a four-month deployment to Iraq between March 2004 and March 2005. They were from three battalions that rotated in three subsequent deployment phases called Stabilization Force Iraq (SFIR) 3, 4, and 5. They sustained two combat-related deaths. At various sites, troops available during their preparation program were told about the aim and general procedure of the study by their commanding officers. A few days later, they met the principal investigator (IME) or research assistant who gave full information about the study. Participation was voluntary without financial compensation. Two soldiers refused, and 479 (3% female) enrolled in the study. They completed the Symptom Checklist-90 (SCL-90), PTSD Symptom Scale (PSS)³, and Eysenck Personality Questionnaire (EPQ; see measures below). Their mean age was 22.5 (SD 4.1). Most were single, and 22% was married or cohabiting. The majority had finished high school, and nearly two-thirds had not been deployed before. About five months after returning home, the Potentially Traumatizing Events Scale (PTES), SCL-90, PSS, and Structural Clinical Interview for DSM-IV (SCID-I) were administered. At 15 months, the SCL-90 and PSS were re-administered. Post-deployment testing generally took place at the base, but some questionnaires were sent by mail. Written informed consent was obtained from the participants. The institutional ethics committee approved the study.

Measures

The severity of 12 common physical symptoms was measured with the somatization scale of the SCL-90 (Arrindell and Ettema, 2004), which has established reliability and validity (Arrindell and Ettema, 2004). The participants were asked to rate to how much each symptom had bothered them during the past week on a 1 (*not at all*) to 5 (*very*

³ The SFIR 3 sample ($N = 214$) did not complete the baseline PSS.

often) scale. A total score was used. The coefficient alphas were .78 before deployment, .75 about 5 months after deployment, and .84 at 15 months. Neuroticism was measured with the EPQ (Eysenck and Eysenck, 1975). The psychometric properties of this scale are good (Sanderman, Arrindell, Ranchor, Eysenck, and Eysenck, 1991). The coefficient alpha of this study was .80. The PTES (Engelhard and van den Hout, 2007; Maguen, Litz, Wang, and Cook, 2004) was used to measure exposure to 22 war-zone events (e.g., going on patrols, disarming civilians, being shot at, being wounded or injured during deployment). For each event that had happened in Iraq, the participant rated its impact at the time from 1 (*no impact*) to 4 (*extremely negative*). The number of events rated ≥ 3 (*moderately negative*) was computed. PTSD was measured with the SCID for DSM-IV (First, Spitzer, Gibbon, and Williams, 1996). PTSD symptom severity was measured with the PSS (Foa, Riggs, Dancu, and Rothbaum, 1993), which includes the DSM-IV PTSD-symptoms that were rated for the prior month. Ratings were summed (range = 0-51). The scale has shown good psychometric properties (Engelhard, Arntz, and van den Hout, 2007b; Foa *et al.*, 1993). The coefficient alpha was .82 before deployment, and .89 5 months after deployment.

Statistical analysis

Frequencies of physical symptoms rated *moderately* or (*very*) *often* were tabulated. HLM version 6 was used to test whether physical symptom scores varied over time for groups with and without PTSD at 5 months. Hierarchical linear modeling (HLM), also known as multi-level analysis, is an advanced form of linear regression that can be used for nested structures like repeated measures. As HLM keeps incomplete case in the analyses, it is less sensitive to dropout (Hox, 2002). SCL-90 scores were not normally distributed; so robust standard errors were used (Maas and Hox, 2004). Regression analysis was used to test whether PTSD symptom scores predicted physical symptom scores, while controlling for the following potential confounders: age, partner status, rank, fixed/temporary contract, pre-deployment (baseline) symptoms, neuroticism, injury on deployment (rated > 3 on impact scale), and war-zone events. The model was rerun without non-significant predictors to reduce error. Tests were two-tailed using $\alpha = .05$.

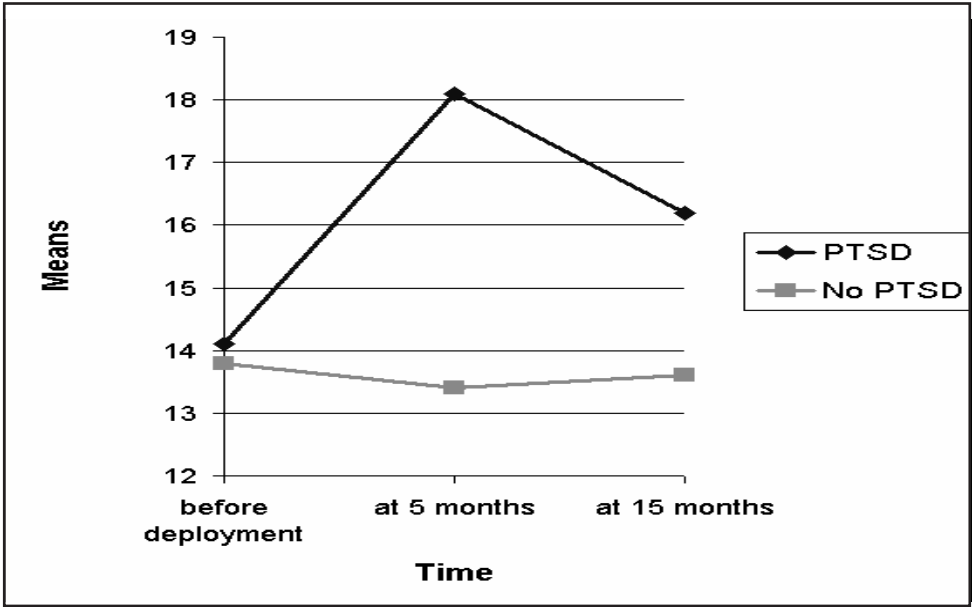
Results

The response rates were 80% ($n = 382$) at 5 months (71%; $n = 339$ also completed the SCID) and 69% ($n = 331$) at 15 months. Non-response was partly due to soldiers being on leave, attending a course, or being posted to new units. Non-responders at 5 months had slightly more prior missions than responders. No differences were found between non-responders and responders at 15 months. The most prevalent events in Iraq were going on patrols or other dangerous duties (94%), being told that a colleague got killed (79%), witnessing violence (79%), witnessing an explosion (70%), and being shot at (58%). The prevalence of deployment-related PTSD (see Engelhard *et al.*, 2007a) was 3.5% ($n = 12/339$). One individual with PTSD (8.3%) and 11 individuals without PTSD (3.4%) reported injury due to an accident, attack, or ambush in Iraq.

TABLE 1. Prevalence of physical symptoms that bothered the participants moderately or (very) often.

	<i>Time</i>		
	<i>Before deployment (%)</i>	<i>5 months after returning home (%)</i>	<i>15 months after returning home (%)</i>
Lower back pain	42/466 (9%)	45/370 (12.2%)	29/330 (8.8%)
Painful muscles	20/466 (4.3%)	20/370 (5.4%)	17/330 (5.1%)
Headache	21/467 (4.5%)	13/370 (3.5%)	9/330 (2.7%)
Pain in chest or heart	10/467 (2.1%)	6/371 (1.7%)	5/330 (1.5%)
Hot or cold spells	10/467 (2.1%)	4/371 (1%)	9/330 (2.7%)
Sickness or upset stomach	9/466 (1.9%)	10/370 (2.7%)	8/330 (2.4%)
Lump in throat	9/467 (1.9%)	5/371 (1.4%)	3/330 (0.9%)
Feeling weak in parts of body	7/467 (1.5%)	9/371 (2.4%)	14/330 (3.2%)
Numbness or tingling in parts of body	6/467 (1.3%)	2/371 (.6%)	4/330 (1.2%)
Faintness or dizziness	6/468 (1.3%)	3/271 (.8%)	1/330 (.3%)
Heavy feeling in arms or legs	4/465 (.8%)	3/371 (.8%)	8/330 (2.4%)
Trouble getting your breath	0/466 (0%)	1/371 (.3%)	4/330 (1.2%)

FIGURE 1. Estimated means of physical symptom scale for participants with and without Posttraumatic Stress Disorder (PTSD) at 5 months ($N = 12$, $N = 327$, respectively).



Physical symptom scores did not *generally* change over time (Table 1 shows prevalence rates), but soldiers with PTSD after deployment had higher scores at 5 months than soldiers without PTSD (see Figure 1). At 15 months, these scores tended to remain elevated, but HLM showed that only the group difference at 5 months was statistically significant ($t_{337} = 3.07$; $p = .003$). The PTSD-group did not report more severe physical symptoms before deployment ($U = 1626$; $p = .69$).

As expected, physical symptoms at 5 months significantly correlated with baseline physical symptoms, baseline PTSD-symptoms, neuroticism, war-zone events, and PTSD-symptoms at 5 months (smallest $r_s = .17$; $p < .01$), but not with demographic factors, military variables, and injury on deployment (largest $r_s = .097$; $p = .06$). Physical symptoms at 5 months were predicted by concurrent PTSD-symptoms ($\beta = .46$; $t = 10.72$; $p < .01$; 95% CI, .42 to .50), and baseline physical symptoms ($\beta = .34$, $t = 7.87$, $p < .01$; 95% CI, .26 to .41), $F_{(2, 353)} = 111.85$; $p < .01$; $R^2 = .39$. Baseline PTSD-symptoms, neuroticism, and war-zone events were no longer significant in this model. Similarly, physical symptoms at 15 months were predicted by both PTSD-symptoms at 5 months ($\beta = .21$; $t = 3.97$; $p < .01$; 95% CI, .15 to .27) and physical symptoms at 5 months ($\beta = .53$; $t = 10.19$; $p < .01$; 95% CI, .40 to .65); $F_{(2, 285)} = 105.22$; $p < .01$; $R^2 = .43$.

Discussion

Soldiers with PTSD after deployment had more severe physical symptoms than soldiers without PTSD. PTSD-symptoms at 5 months were related to concurrent physical symptoms, which was not accounted for by demographic variables, military factors, baseline symptoms, neuroticism, injury on deployment, and the number of war-zone events. PTSD-symptoms at 5 months predicted physical symptoms at 15 months, even after control for physical symptoms at 5 months. These results are consistent with previous cross-sectional and longitudinal research that reported a link between PTSD-symptoms and ill health, and suggest that posttraumatic stress predict physical symptoms.

How might PTSD-symptoms lead to physical problems? It is unlikely that a negative response style is involved, as neuroticism was controlled for. Apparently, the stress-overload in PTSD involves mental and physical aspects. PTSD reflects a state of dysregulation of (stress) physiological regulatory mechanisms (Boscarino, 2004; Friedman and Schnurr, 1995; Schnurr and Jankowski, 1999). In the long run, this may result in organic pathology, such as cardiovascular disease or autoimmune diseases. Health behavior, such as smoking and alcohol use, could also pose a risk to health (Pettit, Grover, and Lewinsohn, 2007). A recent meta-analysis (Meewisse, Reitsma, De Vries, Gersons, and Olff, 2007) casts doubt on the linkage between PTSD and HPA-axis hypofunction as biological plausibility of the findings.

Limitations of this study are the inclusion of young, fit participants, which may limit generalizability, the assessment of exposure to stressors by self-report, which is subject to memory distortions (Engelhard, van den Hout, and McNally, 2008), and the lack of power at 15 months to detect statistical significance for the group difference in physical symptoms. Strengths are the control for several key factors that could produce spurious results, the prospective design, high response rates, and use of clinical interviews for PTSD.

In sum, the findings suggest that posttraumatic stress predicts physical symptoms. Physical symptoms reported by traumatized individuals are often considered to be 'medically unexplained' (Van den Berg, Grievink, Yzermans, and Lebet, 2005), just like pain in depression (Peveler, Katona, Wessely, and Dowrick, 2006). Treatment of patients with such symptoms is frequently inadequate, and patients may resent the emphasis given to lack of a physical cause (Peveler *et al.*, 2006). Even if health complaints are not confirmed by a medical diagnosis, they may still be a source of discomfort, disability, and health care utilization (Barsky and Borus, 1995; Verbrugge and Ascione, 1987). Furthermore, PTSD may be associated with poor adherence to medical treatment (see Tedstone and Tarrier, 2003), which underscores the importance of assessing PTSD-symptoms. Clinicians are advised to be attentive to PTSD when individuals present with physical symptoms, and to pay attention to physical symptoms in patients diagnosed with PTSD.

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