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Research paper

The influence of pre-deployment cognitive ability on post-traumatic stress disorder symptoms and trajectories: The Danish USPER follow-up study of Afghanistan veterans

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ABSTRACT

Objective: New trajectories of PTSD symptoms have recently been identified in war exposed army veterans. The aim of this army veterans study was to examine whether pre-deployment cognitive ability is associated with the risk of developing PTSD symptoms or non-resilient PTSD trajectories.
Method: Follow up study in 428 Danish soldiers, deployed to Afghanistan in 2009, who were assessed at six occasions from pre-deployment to three years post-deployment. Pre-deployment vulnerabilities, deployment and homecoming stressors were measured. Pre-deployment cognitive test scores on Børge Priens Prøve (based on logical, verbal, numerical and spatial reasoning) were converted to a mean of 100 and with a standard deviation of 15.
Results: Higher pre-deployment cognitive ability scores were associated with lower risk of PTSD symptoms as assessed by the Posttraumatic Stress Disorder Checklist–Civilian Version (PCL-C) 2.5 years post-deployment (OR=0.97; 95% CI 0.95–1.00) after adjustment for educational length, baseline PCL-C score and perceived war-zone stress. Compared to a resilient trajectory, a non-resilient relieved-worsening trajectory (high baseline mental symptoms, being symptom free during deployment and a drastic increase in PTSD symptoms at the final assessments of PTSD symptoms) had significantly lower cognitive scores by a mean difference of 14.5 (95% CI 4.7–24.3). This trajectory (n=9) comprised 26.5% of soldiers with moderate-severe PTSD symptoms 2.5 years post-deployment.
Conclusion: We confirmed an inverse association between pre-deployment cognitive ability and risk of PTSD symptoms, and observed significantly lower mean pre-deployment cognitive scores in one non-resilient PTSD trajectory. If replicated, this might inform relevant prevention efforts for soldiers at pre-deployment.

1. Introduction

Post-traumatic stress disorder (PTSD) is a severe disorder complicated by high comorbidity rates (Fear et al., 2010; O'Donnell et al., 2004). The disorder, which is precipitated by exposure to a major traumatic and psychologically distressing event, has a higher prevalence among certain subgroups including active duty military personnel and veterans (Gates et al., 2012). Far from all people suffering traumatic events develop the disorder and homogenous symptom response following potentially traumatic events cannot be assumed (Bonanno et al., 2012; Dickstein et al., 2010; Orcutt et al., 2004). General cognitive ability may, for instance, influence resilience status. On the basis of six early studies of military veterans, Brewin et al. found that low intelligence was a significant predictor of PTSD (Brewin et al., 2000). A role of cognitive ability has been further corroborated in follow-up studies in both military (Macklin et al., 1998; Kremen et al., 2007; Thompson and Gottesman, 2008) and non-military settings (Breslau et al., 2006). Furthermore, the association between cognitive ability and PTSD risk may be stronger at lower levels of trauma exposure (Thompson and Gottesman, 2008). Collectively, these findings support an inverse association between cognitive ability and risk of PTSD. However, more research is needed to examine the underpinnings of this relationship. Possible explanations for an inverse association include a potentially stronger role of cognitive ability in those in which the disorder has a strong comorbid behavioral component, such as alcohol abuse or dependence (Gale et al., 2008). Also, pre-trauma cognitive functioning may moderate trauma exposure on PTSD symptoms (Marx et al., 2009) or early-life traumatic events could correlate with lower cognitive ability as well as with mental vulnerability (Yates and Wekerle, 2009).

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A possibility for more in-depth examination of the relationship between cognitive ability and PTSD risk in soldiers involves the examination of trajectories of resilient and non-resilient PTSD status. The USPER study of Danish soldiers deployed in 2009 in Afghanistan has previously identified resilient/non-resilient trajectories of PTSD symptoms (Andersen et al., 2014). Thus, based on consecutive data collection before, during, and after the deployment and 2.5 years after homecoming (T6), this study identified six trajectories: A resilient trajectory (low stable) with low distress levels across six assessments (before, during, and after deployment to Afghanistan). Also a mild distress trajectory was identified with low pre-deployment symptom levels, followed by a moderate stress reaction during deployment and settling at a nonclinical yet elevated symptom level after homecoming. A third trajectory called the delayed-onset group showed low symptoms levels before, during, at return and up to 3 months after homecoming, after which symptom levels increased to clinical levels. The remaining three groups all had a moderate to high PTSD symptom level prior to deployment and displayed temporary benefits or relief from symptoms associated with deployment and homecoming, respectively. One of these classes, the relieved-worsening trajectory, had initial decreasing PTSD symptom levels followed by a steep increase in symptoms at post-deployment assessment. The relieved-worsening class was one of two trajectories which was significantly associated with suicidal ideation 2.5 years after homecoming (Madsen et al., 2014).

The current report examines whether pre-deployment cognitive ability was associated with the risk of developing PTSD symptoms 2.5 years post-deployment in Danish soldiers deployed in Afghanistan. We also wanted to examine if pre-deployment cognitive ability was associated with non-resilient PTSD trajectories. For instance, early exposure to traumatic events might influence normal development of cognitive and affective processing as well as influence non-resilient PTSD trajectories. To our knowledge, no previous prospective study has examined associations between pre-deployment cognitive ability and trajectories of PTSD symptoms.

2. Methods

The study was approved by The Danish Data Protection Agency. Written informed consent was obtained from all the participating soldiers during the pre-deployment assessment.

3. Study sample

The USPER study is based on the whole cohort (n=743) of Danish soldiers deployed to Afghanistan with the International Security Assistance Force to participate in Operation Enduring Freedom from February to August 2009. Data were collected at six time points from 6 weeks before deployment, during deployment, and at homecoming, as well as three months, seven months, and two and a half year after deployment. As part of the project, the soldiers responded to a comprehensive questionnaire including measures of PTSD and other mental and physical health issues, demographics, and social and combat-related factors. The sixth assessment (T 6) occurred three years after deployment (2.5 years post-deployment) on military locations across the country and consisted of several data collection methods including online questionnaires. At T6, 429 of the participants were assessed with the Structured Clinical interview for DSM IV Axis 1 disorders, Research Version, Patient Edition (SCID I/P) (First et al., 2002). It was shown that for 85% of those who reported an index trauma, it was deployment related. For individuals in the symptomatic classes, the proportion was 89%. In a previous study, a number of PTSD trajectories were estimated by latent growth mixture modeling (LGMM) (Andersen et al., 2014). We had pre-deployment cognitive scores (Børge Priens Prøve) on 606 persons (81.1%). Of these, 428 soldiers (70.6%) had completed assessment 2.5 years post-deployment and sufficient self-reported pre-, peri- and post-deployment symptom level measures to allow for allocation on whether or not PTSD symptoms were present at follow-up (data on trajectories of PTSD was available in 384 out of 428). The study sample consisted of these 428 (384) soldiers.

Table 1
Baseline characteristics of the study sample (n=428) and the non-participants (n=178) at the post-deployment assessment at T6.

Variable	Participants T6 (n=428)	Post-deployment non-participants T6 (n=178)	p-value
Mean age, years	24.0	22.8	0.001
% With longer education	71.4	52.4	0.0001
Number of years in military, mean	3.7	2.7	0.007
% Combat soldier	47.9	53.7	0.15
% Permanent employment	71.0	60.5	0.02
% On “first mission”	47.0	35.5	0.03
Mean pre-deployment PCL score	22.7	23.9	0.12

Table 1 reports characteristics of the study sample and those of the 178 (29%) with absent outcome data at T6. Non-participants were younger, a higher proportion had short education and shorter military experience, and fewer among the non-participants had the Afghanistan mission as their first mission. There was no difference with respect to pre-deployment cognitive ability or in proportion of combat soldiers between participants and non-participants.

4. Measures

4.1. PTSD symptoms

The PTSD checklist Posttraumatic Stress Disorder Checklist–Civilian Version (PCL-C) is a 17-item self-report measure that assesses posttraumatic stress symptom severity, providing a summary score of overall PTSD symptom severity (higher scores indicate greater symptom severity) (Blanchard et al., 1996). Respondents rate each item using a 5-point Likert scale, yielding a summary score (range 17–85) of symptom severity. The civilian version of the PCL includes military traumas and traumas endorsed outside of military settings. The scale items correspond directly to *DSM-IV* symptom criteria, measuring the (PTSD) symptoms clusters of re-experiencing, avoidance and emotional numbing, and hyperarousal. A validation study (Karstoft et al., 2014) in 415 out of the whole cohort (n=743) of soldiers found that the diagnostic accuracy of the PCL-C at T6 against interview data (Structured Clinical Interview for the *DSM–IV)* was satisfactory. The PCL was found to be a relevant and valid tool for screening for probable PTSD in active military samples. Specifically, high overall accuracy was found for cutoff scores ranging from 37 to 44. From the previous study of the diagnostic accuracy of the PCL-C, we used pre-established cutoff PCL-C scores to create dichotomous variables for PTSD symptoms at T6. We defined the outcome of the current study as moderate or severe PTSD symptoms (PCL-score $\geq$ 44). Based on previous papers examining trajectories of PTSD, we also used six previously defined trajectories to examine their relationship with general cognitive ability.