

# Neuropsychological Changes Following Military Service in Iraq

## Case Proven, But What Is the Significance?

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SINCE THE 1990-1991 PERSIAN GULF WAR, THE IDEA that the health of military personnel returning from major deployments should be monitored proactively has been established. Major studies are under way on both sides of the Atlantic on the health of personnel deployed to Iraq. The research that has emerged so far on US veterans of Operation Iraqi Freedom indicates that there have indeed been many psychiatric casualties, with high prevalence rates of symptoms of posttraumatic stress disorder (PTSD), depression, and anxiety. Up to 20% of soldiers and marines returning from deployment to Iraq and Afghanistan met criteria for PTSD.<sup>1</sup> Similar findings have been documented by routine screening performed by the US Army.<sup>2</sup> The situation for UK personnel returning from Operation TELIC in the 2003 Iraq War is—with the exception of reservists—rather different, with a prevalence of PTSD (measured using identical measures to the US studies) and depressive symptoms similar to those of nondeployed personnel.<sup>3</sup> These international differences may in part be explained by the nature of deployments, with US personnel on longer tours of duty in more dangerous parts of Iraq. It also may relate to the populations deployed—the deployed US military personnel are younger and have considerably less experience of active deployment than their British counterparts.<sup>3</sup> Whatever the reasons, some of the most significant health effects for returning personnel seem to have been on mental health, and, thus far, there is no evidence of a repeat of the multiple physical symptoms that characterized Persian Gulf War illness.<sup>4</sup>

Most studies on military personnel have not been able to study changes in health before and after deployment. The nature of military operations means that making prior ratings of health is logistically difficult.<sup>5</sup> The study by Vasterling and colleagues<sup>6</sup> in this issue of *JAMA* is a noteworthy exception. The authors measured neuropsychological function in a cohort of military personnel prior to and following deployment to Operation Iraqi Freedom, and com-

pared these findings with those of a cohort of nondeployed soldiers. The authors report that significant neurocognitive changes occurred after deployment, with a worsening of performance on tasks requiring sustained attention, verbal learning, and visual-spatial memory but an improvement in reaction time. Vasterling et al conclude that these results are not explained by the most likely possibilities: head injury, PTSD, and depression.

One of the most consistent groups of symptoms reported following the 1991 Persian Gulf War were what might broadly be described as cognitive.<sup>7</sup> Many veterans of that conflict continue to complain of difficulties in memory, word finding, concentration, and other cognitive impairments. This led to speculation that these symptoms were the result of exposure to neurotoxic agents such as organophosphate pesticides and even sarin nerve gas. As a result, a series of neuropsychological studies of Gulf War veterans was undertaken some considerable time after deployment.<sup>8-10</sup> A review<sup>11</sup> of the results of these studies did not find a consistent pattern of significant deficits, and although certain subgroups (those who reported multiple symptoms and those who self-reported greater exposure to pesticides) had more deficits, again, there was no consistent pattern. Instead, the authors of the review concluded that these deficits were only mild and that “performance on objective tasks of neuropsychological function showed little correspondence to subjective perceptions of cognitive functioning.”<sup>8</sup> Nevertheless, the rationale for the present study by Vasterling et al<sup>6</sup> was to use neuropsychological testing as a means of assessing possible neural dysfunction, but this time to do so before so many years had elapsed. This study is the first of its kind to follow and reassess representative samples of deployed personnel 2 to 3 months following their return home from war.

Whether veterans should be concerned about the findings of Vasterling et al<sup>6</sup> depends on the answers to several other questions. First, are the reported effects clinically significant? The authors emphasize that the neuropsychological changes are “mild” and “subtle.” Although data on the dis-

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tribution of test performances are not presented, the implication is that the effect represents a minor change for the population as a whole rather than significant impairments in a few. Such shifts in a population's neuropsychological functioning may not be discernable to the individual but may affect other health outcomes. For example, following the Gulf War, there was an increase in accidental deaths<sup>12</sup>; it is conceivable that the changes reported by Vasterling et al<sup>6</sup> will translate into an excess of such rare but disastrous outcomes.

Second, what has caused the neurocognitive changes? The authors used analyses that controlled for mental disorders (PTSD and depression symptoms), which are incontrovertibly associated with neuropsychological impairment of the pattern described, but these adjustments did not have any appreciable impact on effect sizes. It is therefore unlikely that the observed effects can be explained by mental disorder, and the changes in effect sizes are too small to make residual confounding a likely explanation. Before excluding this possibility, however, it is important to note that there was only a very modest increase in symptoms of PTSD in this cohort. This observation is in contrast with the previous US studies of participants in combat duty in Iraq and Afghanistan,<sup>1,2</sup> and is rather surprising given the high degrees of combat exposure reported in the cohort.

Head injuries also were considered in the analyses, but controlling for these did not impact the effect sizes reported. The authors also considered environmental hazards but suggest that most reported exposures were "consistent with modern life" and that measures typically associated with neurotoxicants were not affected. Another neurotoxicant, alcohol, is an important candidate. Although current alcohol consumption was reported to be similar for the deployed and nondeployed groups, military personnel as a whole are inclined to drink more alcohol than civilian populations,<sup>13</sup> and it is likely that deployments are followed by considerable binge drinking, which may not be reported accurately.

Another possibility is that the effect is due to the persistence on return home of some of the psychological adaptations required during deployment. The term *battlemind* captures the way in which deployed military personnel develop ways of adapting that are appropriate and helpful when vigilance is required, decisions have to be taken quickly, targeted aggression is appropriate, and emotional control is essential.<sup>14</sup> Many returning veterans report difficulties switching from these normal responses to the responses required at home.<sup>15</sup> The finding that veterans had improved reaction times provides a clue: it would be unlikely for a pathological process caused by neurotoxins to improve reaction time. Continued hypervigilance provides a more plausible expla-

nation. The nature of the scores that changed on the Profile of Mood States<sup>16</sup> is another clue in that veterans experienced an increase in anxiety symptoms (feeling "tense" or "on edge") as well as confusion (feeling "bewildered" or "muddled"). Although these phenomena may have some similarities to PTSD, they are perhaps better considered as essentially normal coping experiences, which may perhaps influence neuropsychological function.

The final question for concerned veterans is whether the changes will persist. Given the lack of prior literature on neuropsychological functioning in populations of returning veterans, the planned follow-up of this cohort, with further rigorous neuropsychological testing and clinical monitoring, will be most welcome and certainly most important.

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