Subjective Cognitive Complaints, Affective Distress, and Objective Cognitive Performance in Persian Gulf War Veterans

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We examined subjective cognitive complaints, affective distress, and cognitive performance in Persian Gulf veterans who reported illness and cognitive complaints. We predicted a stronger relationship between subjective cognitive complaints and affective distress than between subjective cognitive complaints and objective cognitive performance. This prediction was confirmed in a sample of 100 veterans. The results suggest that cognitive impairment should not be diagnosed in this population without objective confirmation with cognitive testing. © 1999 National Academy of Neuropsychology. Published by Elsevier Science Ltd

Veterans have reported a variety of symptoms associated with their service in the Persian Gulf in 1990–1991. These symptoms include fatigue, headaches, muscle and joint pain, respiratory difficulty, skin rash, cognitive difficulties, emotional distress, and other complaints (Persian Gulf Veterans Coordinating Board, 1995). Complaints of emotional and cognitive difficulty have been common. Over 10% of ill or concerned veterans in the Persian Gulf Health Registry had spontaneous neuropsychological complaints, including cognitive difficulties (Persian Gulf Veterans Coordinating Board, 1995). Veterans tested an average of 9 months after their return from the Gulf had a prevalence of posttraumatic stress disorder of 13% and a prevalence of psychological distress of 38% (Sutker, Davis, Uddo, & Ditta, 1995).

Objective evidence of cognitive difficulties has been mixed, to date. In a preliminary clinical study (Axelrod & Milner, 1997) there was little difference between symptomatic Persian Gulf veterans and published normative data. Similarly, individual neuropsychological measures did not discriminate cases and controls, but a summary score was significantly impaired in veterans reporting illness (Goldstein, Beers, Morrow, Shemanski, & Steinhauer, 1996). In another clinical study there were differences between cases and controls on several measures including WAIS Verbal and Performance IQ scores, Halstead Reitan Battery (HRB) Impairment Index, and HRB Generalized Neuropsycho-
logical Deficit Scores (Hom, Haley, & Kurt, 1997). We have demonstrated a neuropsychological deficit in a subset of ill Gulf War veterans (Anger et al., in press).

The ability of patients to accurately report symptoms is of substantial clinical importance, and there is evidence that subjective cognitive difficulties and objective cognitive performance are not strongly related. Studies from a variety of populations show that cognitive symptoms are at least as strongly related to negative affect as they are related to objective cognitive problems (Gass & Apple, 1997; Larrabee & Levin, 1986; Seidenberg, Taylor, & Haltiner, 1994; Williams, Little, Scates, & Blockman, 1987). Conversely, patients with severe brain damage may display a striking lack of insight regarding their limitations (Bradshaw & Mattingley, 1995; Prigatano & Altman, 1990). The literature indicates that people with depression and anxiety often report more cognitive disruption than people with brain injuries or disease.

The present study examined self-ratings of cognitive ability or subjective cognitive complaints in Persian Gulf veterans. We predicted that there would be a stronger relationship between subjective cognitive complaints and affective distress than between subjective cognitive complaints and objective cognitive performance. This study focused on the relationship between cognitive complaints and cognitive performance in cases and not in controls because we were much more interested in relationships between these variables in people who had cognitive complaints than in people without cognitive complaints.

METHOD

The Portland Environmental Hazards Research Center obtained from the Department of Defense a list of names and addresses of military veterans deployed to the Persian Gulf between September 1, 1990, and August 31, 1991, from the states of Oregon and Washington. Questionnaires regarding symptoms and exposure to hazards were sent in 1995–1997 to 1,840 randomly selected veterans. Females and persons deployed only for selected phases of the Persian Gulf War operations were oversampled. Females were oversampled to obtain a sufficient number of females to allow us to study the effects of the war on females. Persons deployed only for selected phases of the War were oversampled because they could not have been exposed to certain potentially toxic substances. For example, veterans who arrived in the Gulf after the war ended did not consume pyridostigmine bromide as a nerve gas illness prophylactic agent and they were exposed to oil well fires. The oversampling methodology was employed to learn more about the effects of specific toxins in future studies. We were able to locate 53% of the veterans. Sixty-one percent of the sample responded to the initial questionnaire, although efforts to improve response rate are ongoing. Volunteers participating in the clinical case-control study provided informed consent and were paid $50 to complete an evaluation, including physical examination with emphasis on neurological and musculoskeletal systems, health history gathering, collection of blood and urine samples, and neurobehavioral and psychological testing.

Persons who responded to the questionnaire and who also volunteered for medical and psychological testing were classified by a multidisciplinary committee as cases or controls, or were excluded from the study. Participants reporting one or more symptoms were classified as a case unless the history or clinical or laboratory findings indicated a known medical explanation for the symptom(s). The primary bases for exclusion were the occurrence of diabetes mellitus, malignancy, autoimmune disease, neuromuscular disease, or other conditions associated with our major symptom categories, for example, head injury, bipolar affective disorder, or schizophrenia for cognitive or psychological
symptoms or current pain in an area of previous surgery for muscle or joint symptoms. In addition, Vietnam veterans were excluded from the study.

The case definition required that symptoms (a) began during or after deployment to the Persian Gulf, (b) persisted for 1 month or longer, and (c) occurred during the 3 months prior to recruitment into the study. Of the potential cases, 19% were eliminated because of the presence of an exclusionary illness or other reasons. All controls were asymptomatic. Cases reported at least one of the following symptoms: fatigue, muscle or joint pain, psychological or cognitive complaints, gastrointestinal symptoms, or skin lesions. We eliminated 26 people who had no psychological complaints on the initial questionnaire, leaving a sample for this study of 100 cases.

The mean age of the sample of cases was 32.7 years (SD = 7.4). The sample had a mean of 13.4 years of education (SD = 1.6) and it included 23 females. Armed Forces Qualification Test (AFQT; Sands, Waters, & McBride, 1997) data from the time of induction into the military were available for 54 subjects. The AFQT is a self-administered mental aptitude test. These 54 subjects were, on average, at the 59.6 percentile on the AFQT (SD = 19.9).

Psychological and cognitive testing was administered on Macintosh PowerBook computers by user-developed software (Anger, Rohlman, et al., 1996; Kovera et al., 1996). Responses were made on a nine-key DataSled response unit, an input apparatus which simplifies keyboard operation by placing the nine-key unit over a conventional PowerBook keyboard. The DataSled, pictured in Anger, Rohlman, et al. (1996), served to reduce any advantage associated with previous computer keyboard experience. The extensive test battery included measures of attention, memory, information processing speed, combat exposure, traumatic stress, anxiety, depression, and personality.

The SCL90-R was selected to provide a subjective measure of cognitive complaints which served to define our subjective cognitive complaints scale. Two board-certified neuropsychologists, Laurence Binder and Diane Howieson, reviewed the SCL-90-R items to select the items which assessed cognitive complaints, according to both raters: Items 9, 10, 38, 45, 46, 51, 55, and 90. These items address memory, decision-making ability, and concentration and form our subjective cognitive complaints scale. Responses to all SCL-90-R items range from 0 (no distress) to 4 (extreme distress). The subjective cognitive complaint scale had a 1-week test-retest reliability of .91 in a pilot study of 30 people who had not served in the military in the Persian Gulf (Campbell et al., in press). The 100 Persian Gulf veterans identified as cases for the present study had a mean score of 1.32 per item on the scale (SD = 0.83) compared with 69 Persian Gulf veterans identified as control subjects who had a mean of 0.34 (SD = 0.49). The difference between means was significant, F(1, 167) = 77.33, p < .0001.

Scores on the Beck Depression Inventory and the Beck Anxiety Inventory were selected as measures of affective distress. The Beck Anxiety Inventory correlated r = .59, p = .000, with the subjective cognitive complaints scale in our sample. The Beck Anxiety Inventory correlated r = .58, p = .000, with the subjective cognitive complaints scale. The Beck Anxiety Inventory and the Beck Depression Inventory scores also were related to each other (r = .62, p = .000). We used the correlational value of .58 as the measure of the relationship between subjective cognitive complaints and affective distress because each Beck Inventory correlated essentially to this degree with the subjective cognitive complaints scale.

We compared this correlation of .58 to the correlations of the subjective cognitive scale with our cognitive measures. Cohen’s q (Cohen, 1988) for each variable was computed from the r-to-z transformation of the correlations in Table 1 between the subjective cognitive complaints scale and each cognitive variable subtracted from the r-to-z transformation of .58. The q statistic is an effect size equivalent of the r-to-z transformation.
Our computerized battery of cognitive tests (Anger, Rohlman, et al., 1996; Anger et al., in press; Campbell et al., in press; Kovera et al., 1996) consisted of measures of digit span forward and backward, reaction time, a symbol-digit coding task, a supraspan digit learning task, a forced-choice measure of recognition memory (Oregon Dual Task Procedure) modeled after the Portland Digit Recognition Test (Binder, 1993), and a selective attention measure. We employed a computerized test battery in order to efficiently collect data and automatically enter them into a database.

Computerized test batteries are able to discriminate between workers who were or were not exposed to potential neurotoxins (Anger, 1990; Anger, Otto, & Letz, 1996). Our battery was modeled after the NES2, a computerized battery designed for neurotoxicologic research. The NES2 can discriminate between control subjects and patients with either Parkinson’s Disease or Multiple Sclerosis (Krengel et al., 1996; White, Diamond, Krengel, Lindem, & Feldman, 1996). Thus, there is growing evidence that computerized tests can accomplish some of the functions of traditional neuropsychological tests, and their efficiency supports their use in neuropsychological testing. Our battery includes several timed measures which generally are sensitive to neurotoxic-related deficits. We recently demonstrated with this computerized battery that some ill Gulf War veterans have neuropsychological deficits (Anger et al., in press).

RESULTS AND DISCUSSION

As shown in Table 1, the correlations between cognitive performance and the subjective cognitive complaints scale all were modest, with none greater than .28. Reaction time, ODTP Correct, and ODTP Latency were significantly related to the subjective

### TABLE 1

<table>
<thead>
<tr>
<th>Subjective Cognitive Complaints Scale With Cognitive Variables</th>
<th>r</th>
<th>q</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digit Span Forward</td>
<td>-.17</td>
<td>0.69</td>
</tr>
<tr>
<td>Digit Span Backward</td>
<td>.03</td>
<td>0.98</td>
</tr>
<tr>
<td>Reaction Time Latency</td>
<td>.23*</td>
<td>0.61</td>
</tr>
<tr>
<td>Symbol Digit Latency</td>
<td>.16</td>
<td>0.71</td>
</tr>
<tr>
<td>Serial Digit Learning</td>
<td>.06</td>
<td>1.02</td>
</tr>
<tr>
<td>ODTP Correct</td>
<td>-.27**</td>
<td>0.55</td>
</tr>
<tr>
<td>ODTP Latency</td>
<td>.28**</td>
<td>0.52</td>
</tr>
<tr>
<td>Selective Attention Correct</td>
<td>-.09</td>
<td>0.81</td>
</tr>
</tbody>
</table>

*ODTP = Oregon Dual Task Procedure. The Beck Depression Inventory and the Beck Anxiety Inventory had similar correlations of .58 and .59, respectively, with the subjective cognitive complaints scale. q for each variable was computed from the r-to-\(z\) transformation of the correlations in this table between the subjective cognitive complaints scale and each cognitive variable subtracted from the r-to-\(z\) transformation of .58.

\(\ast p < .05.\)

\(\ast\ast p < .01.\)
cognitive impairment scale, and the other five cognitive variables were not significantly related. We compared the r-to-z transformation of the correlation of affective distress and subjective cognitive complaints of .58 to the r-to-z transformation of correlations of the subjective cognitive complaints scale with the cognitive variables. Of the eight cognitive variables, three were timed latency measures. It was expected that subjective cognitive complaints scores should be directly related to latency measures (high cognitive complaints related to long latencies) and inversely related to the other cognitive variables which measured the number correct on various tasks. For Digit Span Backward and Serial Digit Learning the correlations, although small, were in the opposite direction than predicted. Hence, negative z scores were used for computation of q values for Digit Span Backward and Serial Digit Learning. The values of q shown in Table 1 are all significant (p < .01), indicating a stronger relationship between subjective cognitive complaints and affective distress than between subjective cognitive complaints and any of the cognitive variables. The q statistic is an index of effect size with values of .50 or more considered large (Cohen, 1988).

Correlations between the Beck scales and measures of cognition all were .29 or less. Of the total of 16 correlations between the eight cognitive measures and the two Beck scales, the only correlations that reached significance were ODTP Correct with Beck Anxiety (r = .29, p < .01) and Reaction Time with Beck Depression (r = .29, p < .05).

The Oregon Dual Task Procedure is a forced-choice (symptom validity) task. There was no evidence of motivation to perform poorly as measured by the Oregon Dual Task Procedure in this sample. On this test, all subjects were correct on at least 81% of the items, with a mean of 46.74 correct out of 48 items (SD = 2.13). The Portland Digit Recognition Test is the noncomputerized version of the Oregon Dual Task Procedure. The validation studies of the Portland Digit Recognition Test indicate that a score of 81% correct does not indicate poor motivation (Binder, 1993; Binder & Kelly, 1996).

Our data support the hypothesis that self-ratings of cognition in symptomatic veterans of the Persian Gulf War are more closely related to affective distress than to cognitive performance. There may be multiple explanations for our findings. Persons with affective distress may have cognitive complaints without having cognitive difficulties—they may not differentiate between cognitive and affective problems. Persons with affective distress may overestimate cognitive difficulties because they are self-deprecating and self-doubting (Williams et al., 1987). Persons with objective cognitive difficulties in our sample may lack insight about their impaired abilities. Our test battery may not be as sensitive to cognitive difficulties as to emotional distress in these veterans although other data suggest that the neurobehavioral tests are sensitive to objective cognitive problems in a subset of our cases (Anger et al., in press).

Our results confirm the need to distinguish between subjective and objective difficulties in cognition. Proposed and accepted diagnostic criteria for certain conditions (American Psychiatric Association, 1994; Mild Traumatic Brain Injury Committee, 1993) indicate that clinicians sometimes consider complaints of cognitive difficulty to be significant for diagnosis. Consistent with other literature (Larrabee & Levin, 1986; Seidenberg et al., 1994; Williams et al., 1987), our results suggest that discrepancies often exist between cognitive complaints and objective abnormalities and that these complaints appear to reflect affective distress, at least when objective cognitive measures are normal. In cases where cognitive complaints are coupled with objective abnormalities they signify intact insight into limitations (Gass & Apple, 1997). Our results suggest that cognitive impairment should not be diagnosed in Gulf War veterans based only on subjective complaints. Objective testing with measures of cognitive ability is necessary.
REFERENCES


