Susceptibility of the MMPI-2-RF Neurological Complaints and Cognitive Complaints Scales to Over-reporting in Simulated Head Injury

Elizabeth Bolinger1, Caitlin Reese1, Julie Suhr1,*, Glenn J. Larrabee2

1Department of Psychology, Ohio University, Athens, OH, USA
2Independent Practice, Independent Practice, Sarasota, FL, USA

*Corresponding author at: Department of Psychology, 200 Porter Hall, Ohio University, Athens, OH 45701, USA. Tel.: +1-740-593-1091; fax: +1-740-593-0579.
E-mail address: suhr@ohio.edu (J. Suhr).
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Abstract

We examined the effect of simulated head injury on scores on the Neurological Complaints (NUC) and Cognitive Complaints (COG) scales of the Minnesota Multiphasic Personality Inventory-2 Restructured Form (MMPI-2-RF). Young adults with a history of mild head injury were randomly assigned to simulate head injury or give their best effort on a battery of neuropsychological tests, including the MMPI-2-RF. Simulators who also showed poor effort on performance validity tests (PVTs) were compared with controls who showed valid performance on PVTs. Results showed that both scales, but especially NUC, are elevated in individuals simulating head injury, with medium to large effect sizes. Although both scales were highly correlated with all MMPI-2-RF over-reporting validity scales, the relationship of Response Bias Scale to both NUC and COG was much stronger in the simulators than controls. Even accounting for over-reporting on the MMPI-2-RF, NUC was related to general somatic complaints regardless of group membership, whereas COG was related to both psychological distress and somatic complaints in the control group only. Neither scale was related to actual neuropsychological performance, regardless of group membership. Overall, results provide further evidence that self-reported cognitive symptoms can be due to many causes, not necessarily cognitive impairment, and can be exaggerated in a non-credible manner.

Keywords: Assessment; Professional issues; Malingering; Traumatic brain injury

Introduction

It is well documented that self-reported cognitive impairment is not an accurate way to diagnose actual cognitive impairment or disorders associated with cognitive impairment (Gasquoine, 2000; Gouvier, Uddo-Crane, & Brown, 1988; Iverson & Lange, 2003; Iverson & McCracken, 1997; Mittenberg, DiGiulio, Perrin, & Bass, 1992; Trahan, Ross, & Trahan, 2001; Wang, Chan, & Deng, 2006). Self-reported cognitive symptoms are not only related to psychological distress (Iverson, 2006; Meares et al., 2011) but also to personality traits (Hibbard et al., 2000; Greiffenstein & Baker, 2001) and to general factors associated with having been injured, being overly focused on physical symptomatology, or in seeking treatment (Bootzin & Bailey, 2005; Ferguson, Mittenberg, Barone, & Schneider, 1999; Gunstad & Suhr, 2001, 2004; Hilsabeck, Gouvier, & Bolter, 1998; Mittenberg et al., 1992). Over-reporting on cognitive symptom report scales can also reflect deliberate attempts to exaggerate symptoms for the purpose of external compensation (malingering; Tsanadis et al., 2008). For example, Rohling and colleagues (2011) recently re-analyzed data presented in a study by Gervais, Ben-Porath, Wygant, and Green (2008) and demonstrated that, in a large sample of disability claimants who failed performance validity tests (PVTs), the correlation between self-reported memory problems and performance on a memory test was highly significant ($r = -.47$), whereas in a large sample of disability claimants who passed PVTs, the relationship between self-reported memory and actual memory performance was not significant ($r = -.07$).

Unfortunately, most self-report cognitive symptom scales do not include validity measures to assist in interpretations of scale elevations. Unlike many self-report measures, the Minnesota Multiphasic Personality Inventory (MMPI) is known for its
well-developed validity scales, which have been shown to be highly effective in identifying general symptom over-reporting (Ben-Porath & Tellegen, 2008; Rogers, Sewell, Martin, & Vitacco, 2003). However, until its most recent iteration, the MMPI has not included scales of self-reported neurological and neuropsychological complaints. With the release of the MMPI-2 Restructured Form (MMPI-2-RF; Ben-Porath & Tellegen, 2008), two new neuropsychological symptom measures were included. The Neurological Complaints (NUC) scale measures self-reported neurological complaints such as dizziness and weakness. The Cognitive Complaints (COG) scale measures self-reported cognitive complaints such as memory difficulties and concentration problems. Although COG has no symptom overlap with other somatic scales, NUC overlaps considerably with other scales assessing somatization tendencies. NUC has four items that overlap with the over-reporting validity scales. COG shares only one item with any of the traditional validity scales, but does share four items with the newly developed Response Bias Scale (RBS) validity scale (Ben-Porath & Tellegen, 2011), which was designed by identifying MMPI-2 items associated with failure on PVTs (Gervais, Ben-Porath, Wygant, & Green, 2007).

Given that NUC and COG are relatively new scales, there is not much empirical evidence for their interpretation. Data from the clinical manual (Ben-Porath & Tellegen, 2008) indicate that empirical correlates of NUC include presentation with complaints of dizziness, coordination difficulties, and sensory problems, whereas empirical correlates of COG include reports of concentration difficulties. Data from the technical manual (Tellegen & Ben-Porath, 2008) show that both scales correlate moderately with the validity scales (in particular, F, Fs, and FBS), but also correlate strongly with the substantive scales of demoralization, RC1, RC7, RC8, and MLS (Malaise). These same relationships held, and were even stronger, in male and female outpatient samples used to develop the MMPI-2-RF; in fact, there were additional moderately strong relationships with RC2 (especially COG) and with GIC (Gastrointestinal Complaints) and HPC (Head Pain Complaints) scales (Ben-Porath & Tellegen, 2008). These findings suggest that, similar to other self-report cognitive symptom scales, NUC and COG are not measures of cognitive or neurological impairment; rather, they reflect the presence of other psychological and somatic concerns. In fact, in a new interpretive guidebook for the MMPI-2-RF, Ben-Porath (2012) clarifies that COG cannot be interpreted as a measure of actual cognitive functioning. In addition, given the strong relationships with the MMPI validity scales, these findings raise concerns that high scores on NUC and COG may simply reflect invalid responding (in the form of symptom over-reporting), rather than reflecting cognitive, neurological, psychological, or somatic symptomatology.

There have been few independent studies examining the empirical correlates of NUC and COG. Gervais, Ben-Porath, and Wygant (2009) found that the COG scale correlated strongly with anxiety, depression, and memory complaints, as measured by other self-report scales, in a sample of non-brain-injured disability claimants. Furthermore, Locke and colleagues (2010) found that NUC was useful in discriminating patients with actual epilepsy from those with psychogenic non-epileptic seizures, suggesting that this scale is sensitive to non-credible symptom presentations as can be seen in somatoform disorders.

Whether scores on NUC and COG are affected by malingering of cognitive impairment is of particular importance. Malingering of cognitive impairment might be seen in over-reporting of cognitive symptoms, in addition to failure of PVTs. Some prior MMPI research has demonstrated that MMPI validity scales are associated with malingering as identified on PVTs (Greiffenstein, Gola, & Baker, 1995; Larrabee, 1998; Thomas & Youngjohn, 2009), with the FBS showing the most promise in this regard (Larrabee, 1998; Nelson, Hoelzle, Sweet, Arbisi, & Demakis, 2010; Nelson, Sweet, & Demakis, 2006; Wygant et al., 2007). However, in a recent paper, Youngjohn, Wershba, Stevenson, Sturgeon, and Thomas (2011) found that NUC and COG were better predictors of who fails PVTs than the MMPI-2-RF validity scales, including FBS, in their sample of head-injured litigants. Such findings indicate that elevated scores on NUC and COG can reflect inaccurate over-reporting of cognitive symptoms (malingering), perhaps even in the context of valid performance on other MMPI validity indicators. However, Youngjohn and colleagues did not utilize the newly developed RBS (Gervais et al., 2007, 2008), which was designed specifically to capture those MMPI-2 items endorsed by persons failing PVTs and has been shown to discriminate those who pass and fail PVTs, sometimes even more accurately than the other MMPI-2-RF over-reporting validity scales (Rogers, Gillard, Berry, & Granacher, 2011; Schroeder et al., 2012; Whitney, Davis, Shepard, & Herman, 2008; Wygant et al., 2011).

In the present study, we examined the influence of simulated closed head injury on the NUC and COG scales. We hypothesized that NUC and COG scores would be significantly higher in individuals simulating head injury than in those asked to perform their best, even after controlling for invalid reporting based on MMPI validity scales, including the RBS. In addition, we examined the correlates of NUC and COG to both the validity scales and other substantive scales of the MMPI-2-RF, separately for the simulator and the control group. Given Gervais and colleagues (2010) findings that self-reported cognitive symptoms were strongly related to RBS, we wanted to examine whether COG would be more related to this validity scale in simulators than in controls. Given findings reported above, we also hypothesized that high scores on NUC and COG would be related to both physical and psychological complaints, although we did not have any a priori expectations for whether these relationships would be stronger in the simulator or the control sample. Finally, we examined the correlates of NUC and COG with actual cognitive performance in the two groups. Given prior findings suggesting that self-report cognitive performance is more strongly related to actual test performance in malingerers than in non-malingerers (Rohling et al., 2011), we expected to see a similar pattern of findings in our samples.
Method

Participants

All participants ($N = 87$) were recruited from introductory psychology courses at a medium-sized Midwestern university and were participants in a larger study examining neuropsychological performance in individuals asked to simulate effects of traumatic brain injury. Based on responses to a pre-experiment questionnaire, individuals who reported a history of a mild traumatic brain injury/concussion that involved loss of consciousness lasting between a few seconds to 20 min and who denied a history of psychological, neurological, or learning disorder or significant substance abuse were invited to participate in the study. The mean age for the sample was 19.04 ($SD = 1.11$). Of the total sample, 52% were women, 71.1% were freshman, and 94% identified as Caucasian.

Procedure

After completing informed consent, participants were randomly assigned to simulate symptoms of traumatic brain injury or to give their best effort. As part of the larger study, individuals were also randomly assigned to be observed (videotaped) or not during their evaluation; for the present analyses, this manipulation was not related to results and thus participant data were collapsed across those conditions. The 40 participants who were randomly assigned to simulate traumatic brain injury were given the following instructions:

“Today you will take a series of neuropsychological tests that assess motor speed, attention, memory, and thinking skills. You are being asked to believably pretend that you have significant problems (e.g., representative of brain damage) with motor speed, attention, memory, and thinking skills tests. In other words, pretend that you are someone involved in a lawsuit, and you want to pretend to have brain damage in order to win a financial settlement. What might you do to indicate (even though you do not) that you have permanent and significant problems with motor speed, attention, memory, and thinking skills while taking neuropsychological tests? There is no wrong answer. Supplemental materials have also been provided for you to read and give you additional ideas regarding how to pretend to have significant problems with motor speed, attention, memory, and thinking skills. The examiner who gives you the tests does not know that you will be pretending to have significant problems representative of brain damage, and of course, you would not want to be caught pretending; therefore, it is important to remind you to believably pretend to have such problems however you see fit. Please take a few moments to review the supplemental materials that you’ve received . . . You will be taken to the testing environment in which you will take the tests in a moment.” The supplemental materials were a handout from a website describing symptoms of brain injury (http://www.braininjury.com/symptoms.html).

The 47 participants who were randomly assigned to give their best effort were given the following instructions: “Today you will take a series of neuropsychological tests that assess motor speed, attention, memory, and thinking skills. You are asked to give your best effort on all of these tests . . . You will be taken to the testing environment in which you will take the tests in a moment.”

All participants completed a neuropsychological battery, which lasted approximately 2 h and were then administered the MMPI-2-RF.

Measures

The MMPI-2-RF (Ben-Porath & Tellegen, 2008, 2011) is a true/false self-report inventory of psychopathology with well-established validity data. The MMPI-2-RF validity scales (Variable Response Inconsistency, VRIN; True Response Inconsistency, TRIN; Infrequent Responses, F-r; Infrequent Psychopathology Responses, Fp-r; Infrequent Somatic Responses, Fs; Symptom Validity, FBS-r; Response Bias Scale, RBS), the nine revised clinical scales, and the Somatic/Cognitive scales (MLS, GIC, HPC, NUC, and COG) were used in the present analyses.

Participants were further defined as simulators or controls based on whether or not they failed or passed freestanding and embedded/derived PVTs. Specifically, the PVTs included the Word Memory Test (WMT; Green, 2005), as well as cutoffs for invalid performance on several standard neuropsychological measures, including finger tapping, Reliable Digit Span, embedded indices on the Auditory Verbal Learning Test, Continuous Visual Memory Test, and the Trail-making Test. Cutoffs were based on the WMT manual, plus integrative summaries regarding appropriate cutoffs for embedded malingering measures on the respective neuropsychological measures (Greiffenstein, 2007; Larrabee, 2009; Suhr & Barrash, 2007).
Results

From the initial sample of 87 participants, 3 simulator and 5 control MMPI-2-RF profiles were excluded due to inconsistent responding (Vrin-r and/or Trin-r T score >79), leaving a sample of 79 participants who ranged in age from 18 to 22 (mean 18.97, SD 1.06), and ranged in education from 12 to 15 years. In addition, 50.6% of the sample was women, and 93.7% reported that they were Caucasian (1.3% African American, 2.5% Asian, 2.5% biracial).

We divided the sample of 79 participants into two groups: Those randomly assigned to simulate head injury and who showed evidence of following simulator directions by failing at least one PVT, as described above (N = 32), and those randomly assigned to perform with their best effort and who showed no evidence of poor performance on any PVTs (N = 46). These two groups were used in all subsequent analyses. The two groups were not significantly different in age, t(76) = 1.66, p = .143, or education, t(76) = 1.97, p = .052. The two groups were not different in self-reported race/ethnicity, χ²(2) = 0.22, p = .642, but a slightly higher percentage of men were in the simulator group, χ²(1) = 4.85, p = .028. The two groups differed on several neuropsychological tests, which would be expected given the way in which the groups were defined (Table 1). The average Cohen’s d for the 12 tests in Table 1 was −1.385 (SD = 0.297), with the largest effect sizes for test scores directly related to performance validity (Digit Span Age-Corrected Scaled score, d = −1.71; AVLT Recognition, d = −1.72; Finger Tapping d = −1.55). These values are comparable with the mean Cohen d of −1.55 reported by Sollman and Berry (2011) in their meta-analysis of PVTs. Thus, the data in Table 1 support the external validity of our experimental manipulation.

Relation of NUC and COG to Simulated Head Injury

Consistent with our first hypothesis, simulators scored significantly higher than controls on both NUC, t = 3.82, p < .001, d = 0.87, and COG, t = 2.34, p = .022, d = 0.53. With regard to effect sizes relative to other MMPI-2-RF validity scales, Fp-r and FBS-r showed small effect sizes, Fs, RBS, and COG showed medium effect sizes, and F-r and NUC showed large effect sizes (Table 2).

In order to test whether the groups would still perform differently on the two scales after controlling for over-responding invalidity using the traditional MMPI-2-RF scales, we conducted two hierarchical logistic regression analyses. For each of the two regressions, the first step included F-r (which showed the largest effect size of the MMPI-2-RF validity scales) and RBS (due to its conceptual link to malingering of cognitive symptoms). For the second step, NUC or COG was entered. The traditional MMPI-2-RF validity scales led to an overall group classification accuracy of 69.6%; the overall model was significant, χ²(22, N = 76) = 85.89, p < .0001. With the addition of NUC to the model, the overall model accounted for 73.9% in classification accuracy, χ²(32, N = 76) = 131.01, p < .0001. The only significant variable in the final model was NUC; for every one point increase in symptom report on NUC, the likelihood that the individual was in the simulator group increased by 7% (Table 3). For the second regression, which added COG on the second step, the model accounted for 68.1% of the classification accuracy, χ²(32, N = 76) = 70.41, p = .071. When all the variables were in the final model, none was significant (Table 3).

In order to examine the clinical significance of these findings, we divided participants into those who scored within the clinical range on NUC and/or COG (T score > 64) and those who did not. For NUC, a higher percentage of simulators (75%) than controls (30%) scored in the clinical range, χ²(1) = 6.66, p < .01. For COG, 50% of simulators and 30% of controls scored in the clinical range, χ²(1) = 2.34, p = .143, as expected given the way in which the groups were defined (Table 1).

Table 1. Performance on neuropsychological variables in the two groups

<table>
<thead>
<tr>
<th>Test</th>
<th>Simulated head injury (N = 32)</th>
<th>Controls (N = 46)</th>
<th>Effect size (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled Oral Word Association</td>
<td>28.54 (7.74)</td>
<td>37.15 (10.41)</td>
<td>−0.91</td>
</tr>
<tr>
<td>Digit Span Age Corrected Score</td>
<td>5.70 (2.79)</td>
<td>10.30 (2.62)</td>
<td>−1.71</td>
</tr>
<tr>
<td>Complex Figure Test Copy</td>
<td>29.71 (6.79)</td>
<td>34.16 (2.60)</td>
<td>−0.93</td>
</tr>
<tr>
<td>Complex Figure Test Delayed Recall</td>
<td>18.56 (5.24)</td>
<td>23.97 (6.08)</td>
<td>−0.94</td>
</tr>
<tr>
<td>AVLT Immediate Recall</td>
<td>6.92 (4.07)</td>
<td>11.89 (2.29)</td>
<td>−1.58</td>
</tr>
<tr>
<td>AVLT Delayed Recall</td>
<td>7.00 (3.84)</td>
<td>11.67 (2.43)</td>
<td>−1.51</td>
</tr>
<tr>
<td>AVLT Recognition</td>
<td>10.46 (3.13)</td>
<td>14.18 (1.07)</td>
<td>−1.72</td>
</tr>
<tr>
<td>Trail-making Test A Time</td>
<td>43.32 (22.45)</td>
<td>21.22 (6.71)</td>
<td>1.45</td>
</tr>
<tr>
<td>Trail-making Test B Time</td>
<td>92.86 (49.36)</td>
<td>49.00 (14.77)</td>
<td>1.31</td>
</tr>
<tr>
<td>Finger Tapping Dominant Time</td>
<td>38.88 (18.74)</td>
<td>59.40 (7.29)</td>
<td>−1.55</td>
</tr>
<tr>
<td>Finger Tapping Non-dominant Time</td>
<td>37.75 (18.08)</td>
<td>55.73 (6.65)</td>
<td>−1.42</td>
</tr>
<tr>
<td>CVMT Total Correct</td>
<td>63.63 (10.96)</td>
<td>77.00 (6.58)</td>
<td>−1.55</td>
</tr>
</tbody>
</table>

Notes: AVLT = Auditory Verbal Learning Test; CVMT = Continuous Visual Memory Test. All variables were significantly different in the two groups at p < .001.
range, $x_2^2(1) = 3.05$, $p = .081$. Additionally, 50% of simulators, but only 17% of controls, scored clinically high on both scales, $x_2^2(1) = 9.42$, $p = .002$. After removing those with invalid over-reporting (any of F-r, Fp-r, Fs, FBS-r, or RBS at 100 or above, which removed 6 controls and 12 simulators from the analyses), 60% of simulators and 37% of controls had clinically high scores on NUC, $x_2^2(1) = 2.72$, $p = .099$, whereas 30% of simulators and 22% of controls had clinically high scores on COG, $x_2^2(1) = 0.40$, $p = .52$. Even after removing individuals with invalid over-reporting, there remained significant differences between the two groups in the number of individuals scoring clinically high on both scales (30% simulators, 7.5% controls, $x_2^2(1) = 5.29$, $p = .021$). Moreover, using a more liberal cutoff for potentially invalid over-reporting (any of F-r, Fs, FBS-r, or RBS as 80 or above, or Fp = 4 at 70 or above, which removed 13 controls and 19 simulators from the analyses), 23% of simulators and none of the controls still had clinically high scores on both NUC and COG, $x_2^2(1) = 8.15$, $p = .004$.

**Relation of NUC and COG to MMPI-2-RF Over-reporting Scales as a Function of Simulated Head Injury**

In order to examine the general relationship of NUC and COG with the over-reporting validity scales, we examined the correlations separately for each group (Table 4). Regardless of group membership, both NUC and COG were highly correlated with all validity scales. Given that FBS-r and RBS are validity scales with particular importance to non-credible report of cognitive impairment, we examined whether the correlations of RBS and FBS with NUC and COG were stronger in the simulator group than the controls. For NUC, the correlation with RBS was stronger in simulators than controls, $Z = 1.99$, $p = .046$. However, the correlation with FBS-r was not stronger in simulators than controls, $Z = 0.78$, $p = .21$. For COG, the correlation with RBS was significantly stronger in the simulators than in the controls, $Z = 2.25$, $p < .024$. However, the correlations of FBS-r with COG were not different in the two groups, $Z = 0.91$, $p = .36$.

**Relation of NUC and COG to MMPI-2-RF Substantive Scales as a Function of Simulated Head Injury**

Given prior data suggesting high correlations between self-report cognitive scales and clinical and somatic self-report scales, we calculated simple correlations between NUC and COG and the revised clinical and somaticizing scales of the MMPI-2-RF separately for each group (Table 4), after controlling for invalid over-reporting (partial correlations controlling for F-r). For simulators, NUC was related to somatic scales (RC1, MLS) but also RC3, whereas for controls, NUC was positively related to RC1 and
negatively to RC9. In simulators, COG was only related to RC3 and RC4, but in controls, COG was related to RC3, RC7, RC8, and MLS.

Relation of NUC and COG to Cognitive Performance as a Function of Simulated Head Injury

Finally, given prior studies showing stronger correlations between self-report cognitive performance and actual cognitive performance in malingerers, but not in the general population, we examined these relationships in both samples separately, after controlling for over-reporting (Table 5). Overall, there were no correlations of NUC and COG with actual neuropsychological performance in either group.

Discussion

Results indicate that scores on both NUC and COG were affected by simulation of closed head injury. Individuals asked to simulate head injury, and who failed at least one PVT, scored significantly higher on both scales, and the differences between the groups were of medium (COG) and large (NUC) effect size. Even after removing MMPI-2-RF protocols with evidence of over-reporting, simulators continued to score significantly higher on NUC than controls. Consistent with recent findings from Youngjohn and colleagues (2011), but expanded to include consideration of RBS, our results suggest that high scores NUC and COG (but especially NUC) may reflect non-credible over-reporting of cognitive and neurological dysfunction. Of note, our effect sizes were similar to those reported by other researchers for some of the MMPI-2-RF over-reporting validity scales, but lower on others (Tarescavage, Wygant, Gervais, & Ben-Porath, 2013; Wygant et al., 2009). This may be a function of differences in study samples (clinical patients receiving evaluation for disability who met clinical criteria for Malingered Neurocognitive Dysfunction vs. simulated head injury in the present study).

With regard to clinical significance, substantially more simulators than controls fell into the clinical range on both scales, even after removing protocols with evidence of over-reporting. Even when using liberal cutoffs for suspected over-reporting, more simulators than controls fell into the clinical range on both scales. Thus, our results imply that elevated T scores on NUC and
COG warrant careful consideration and cautious interpretation, even when the validity indices do not indicate that exaggeration of symptoms has occurred.

The correlations between NUC and COG and over-reporting validity scales of the MMPI-2-RF were higher than those reported by Gervais and colleagues (2010), but this is not surprising given that these were all subscales from the same measure that include some item overlap, while Gervais and colleagues utilized an independent measure of self-reported cognitive symptoms. However, the observation of a significantly stronger correlation between RBS and NUC/COG scales in the simulators relative to the controls suggests that RBS is an important validity indicator for the interpretation of both COG and NUC. As RBS was an addition to the MMPI-2-RF a couple of years after its initial publication, some users of the MMPI-2-RF may not be aware of the existence and importance of this scale; our data, together with other data reported on the scale, suggest that RBS is particularly important to use in interpretation of the validity of cognitive symptom report.

Even out of the context of both invalid test performance and invalid self-report, however, our results show that high scores on NUC and COG are related to reports of general physical symptoms, and high scores on COG, are related to high negative affectivity and other psychological distress. Overall, these findings are consistent with studies examining the correlates of other self-report cognitive measures, although expanded to control for symptom over-report, and provide further evidence that caution must be used when interpreting self-reported cognitive symptoms as bona fide indicators of actual neuropsychological impairment, even in the context of normal scores on MMPI-2-RF validity scales.

Finally, although simulators scored significantly higher on both NUC and COG and performed significantly worse on many neuropsychological measures compared with controls, it is interesting that there were no correlations between self-reported neuropsychological concerns (NUC, COG) and performance on neuropsychological tests within either group after statistical control for symptom over-reporting. Of note, this finding was not consistent with the recent report of Rohling and colleagues (2011), who showed that, in malingerers, there was a strong relationship between self-reported memory problems and poor memory performance, which was not seen in non-malingerers. It should be noted, however, that our sample was likely higher functioning than the individuals assessed in their study, and we utilized a simulated head injury design (although invalid performance consistent with malingering was confirmed on both free-standing and embedded PVTs).

In addition to the above noted weaknesses in the present study, the history of mild traumatic brain injury (TBI) in all participants was only confirmed via self-report (although it should be noted that many individuals with claims of mild TBI have no other evidence beyond self-report for their injury). In addition, the confirmation of simulator status was based on failing only one PVT. Importantly, none of the current sample was involved in litigation wherein they stood to gain substantial financial benefit as a consequence of exaggerated symptom report and demonstration of performance decrement. Given the use of a simulated head injury paradigm, which could have influenced the size of the effects for NUC, COG, and any of the validity scales on the MMPI-2-RF, the current results require independent confirmation in additional research. Future studies should specifically examine the performance of NUC and COG in clinical samples in which there are participants meeting criteria for Malingered Neurocognitive Dysfunction, after controlling for over-reporting invalidity across all validity scales, including RBS.

The present results support the need for further examination of self-reported cognitive and neuropsychological complaints using objective cognitive tests (including PVTs). Clinicians need to remember that self-reported cognitive symptoms can be

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**Table 5.** Partial correlations of NUC and COG scales with neuropsychological test performance in both study groups, controlling for over-reporting invalidity

<table>
<thead>
<tr>
<th></th>
<th>NUC (Controls N = 46)</th>
<th>NUC (Simulated head injury N = 32)</th>
<th>COG (Controls N = 46)</th>
<th>COG (Simulated head injury N = 32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COWA</td>
<td>.07</td>
<td>.01</td>
<td>.25</td>
<td>-.25</td>
</tr>
<tr>
<td>Digit Span ACSS</td>
<td>-.01</td>
<td>-.24</td>
<td>.17</td>
<td>-.15</td>
</tr>
<tr>
<td>CFT Copy</td>
<td>.29</td>
<td>-.06</td>
<td>.05</td>
<td>-.10</td>
</tr>
<tr>
<td>CFT Recall</td>
<td>-.15</td>
<td>-.19</td>
<td>.18</td>
<td>-.11</td>
</tr>
<tr>
<td>AVLT Immediate Recall</td>
<td>-.05</td>
<td>.11</td>
<td>.06</td>
<td>.05</td>
</tr>
<tr>
<td>AVLT Delay Recall</td>
<td>.01</td>
<td>.16</td>
<td>.01</td>
<td>-.01</td>
</tr>
<tr>
<td>AVLT Recognition</td>
<td>-.08</td>
<td>.18</td>
<td>.10</td>
<td>.09</td>
</tr>
<tr>
<td>TMT part A time</td>
<td>.09</td>
<td>-.05</td>
<td>.08</td>
<td>.23</td>
</tr>
<tr>
<td>TMT part B time</td>
<td>-.24</td>
<td>-.01</td>
<td>.15</td>
<td>.32</td>
</tr>
<tr>
<td>Tapping dominant</td>
<td>-.09</td>
<td>-.07</td>
<td>.29</td>
<td>-.31</td>
</tr>
<tr>
<td>Tapping non-dominant</td>
<td>.27</td>
<td>-.10</td>
<td>-.28</td>
<td>.12</td>
</tr>
<tr>
<td>CVMT total score</td>
<td>.14</td>
<td>.08</td>
<td>.02</td>
<td>-.05</td>
</tr>
</tbody>
</table>

**Notes:** NUC = Neurological Complaints scale; COG = Cognitive Complaints scale; COWA = Controlled Oral Word Association Test; Digit Span ACSS = Digit Span Scaled Score; CFT Copy = Complex Figure Test Copy Trial; CFT Recall = Complex Figure Test Recall Trial; AVLT Immediate Recall = Auditory Verbal Learning Test Immediate Recall; AVLT Delay Recall = Auditory Verbal Learning Test 30 minute Delayed Recall; AVLT Recognition = Auditory Verbal Learning Test 30 minute Delayed Recognition; TMT = Trail-making Test; CVMT = Continuous Visual Memory Test.
due to many causes, not necessarily cognitive impairment, or can be exaggerated in a non-credible manner. It remains imperative that clinicians interpret high scores on cognitive symptom scales in light of measures of non-credible symptom report, PVT performance, actual cognitive test performance, evidence of everyday functioning, and overall psychological distress.

**Conflict of Interest**

None declared.

**References**


