The Clinical Neuropsychologist
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/ntcn20

Young Child With Severe Brain Volume Loss Easily Passes the Word Memory Test and Medical Symptom Validity Test: Implications for Mild TBI

Dominic A. Carone[a]
[a] SUNY Upstate Medical University, Syracuse, NY, USA
Published online: 25 Nov 2013.

To cite this article: Dominic A. Carone , The Clinical Neuropsychologist (2013): Young Child With Severe Brain Volume Loss Easily Passes the Word Memory Test and Medical Symptom Validity Test: Implications for Mild TBI, The Clinical Neuropsychologist, DOI: 10.1080/13854046.2013.861019

To link to this article: http://dx.doi.org/10.1080/13854046.2013.861019

The Clinical Neuropsychologist, 2013
http://dx.doi.org/10.1080/13854046.2013.861019

Young Child With Severe Brain Volume Loss Easily Passes the Word Memory Test and Medical Symptom Validity Test: Implications for Mild TBI

Dominic A. Carone
SUNY Upstate Medical University, Syracuse, NY, USA

The Word Memory Test (WMT) and Medical Symptom Validity Test (MSVT) are two commonly used free-standing measures of test-taking effort. The use of any test as a measure of effort is enhanced when evidence shows that it can be easily passed by patients with severe neurological conditions. The opportunity arose to administer the WMT and MSVT to a 9-year-old girl (referred to as CJ) with severe congenital bilateral brain tissue loss (shown via a compelling brain MRI image), chronic epilepsy, an extremely low Full Scale IQ, extremely low adaptive functioning, developmental delays, numerous severe cognitive impairments, and treatment with multiple high-dose benzodiazepines. She received extensive early intervention services and numerous academic accommodations. Despite this set of problems, CJ passed the WMT and MSVT at perfect to near perfect levels. Implications for failure on these tests among patients with known or alleged mild traumatic brain injury are discussed.

Keywords: Effort; Symptom validity testing; Malingering; Word Memory Test; Medical Symptom Validity Test.

INTRODUCTION

The Word Memory Test (WMT) (Green, 2003) and Medical Symptom Validity Test (MSVT) (Green, 2004) are two commonly used free-standing measures of test-taking effort (see the Materials section for a description). Both have undergone extensive validation as measures of performance validity in various samples such as children with moderate to severe brain damage/injury and/or developmental disabilities (Carone, 2008; Green, Flaro, & Courtney, 2009), normal children as young as age 6 (Blaskewitz, Merten, & Kathmann, 2008; Green & Flaro, 2003), adults with dementia (Green, Montijo, & Brockhaus, 2011; Howe, Anderson, Kaufman, Sachs, & Loring, 2007; Howe & Loring, 2009; Rienstra, Klein Twennaar, & Schmand, 2013), adolescents with severe learning or reading problems (Larochette & Harrison, 2012), adults with severe traumatic brain injury (Donders & Boonstra, 2007; Green, 2003, 2004), adults and children with hippocampal damage and/or partial removal (Carone, Green, & Drane, in press; Goodrich-Hunsaker & Hopkins, 2009), and normal adults (Rienstra, Spaan, & Schmand, 2009). These validation studies have found that the MSVT and WMT are easily passed by adults and children who are healthy normal controls and by

Address correspondence to: Dominic A. Carone, Ph.D., ABPP-CN, 505 Irving Avenue, Room 2012, Syracuse, NY, 13210, USA. E-mail: caroned@upstate.edu
(*Received 5 August 2013; accepted 25 October 2013*)

the vast majority of adults and children with moderate to severe neurological conditions.

Scores on the MSVT and WMT in adults are known to be negatively affected by compensation seeking (Armistead-Jehle, 2010; Armistead-Jehle & Buican, 2012; Carone, 2008; Flaro, Green, & Robertson, 2007; Gervais, Ben-Porath, Wygant, & Green, 2007; Green et al., 2009; Williamson, Green, Allen, & Rohling, 2003). However, one study found that compensation seeking was not predictive of poor WMT performance in adults with pseudoseizures (Williamson, Holsman, Chaytor, Miller, & Drane, 2012). Rather, the authors found that patients reporting abuse histories (physical, sexual, or emotional) were twice as likely to fail the WMT compared to patients not reporting abuse histories. The authors of that study speculated that dissociative tendencies related to abuse may contribute to verbal encoding deficits that can underlie WMT failure. Kirkwood and Kirk (2010) also did not find a strong linkage between compensation seeking (i.e., litigation) and MSVT failure in a pediatric mild traumatic brain injury sample. Thus, compensation seeking does not appear to be the sole factor associated with poor performance on the MSVT and WMT. In children other explanations for poor effort may include attempts to get out of schoolwork or to change a family/social situation (Kirwood & Kirk, 2010) in addition to not wanting to be at the evaluation.

Although the MSVT and WMT are well validated, some controversies regarding the WMT exist in the literature. For example, Bowden, Mathias, and Shores (2006) have argued that effort, as measured by the WMT, does not interact with injury severity to suppress cognition after brain injury. However, Rohling and Demakis (2010) statistically re-analyzed their data and rebutted their conclusion, showing that poor effort (as manifested by WMT failure) explained five times more variance in composite neuropsychological test scores than traumatic brain injury severity. Rohling and Demakis (2010) also confirmed this same finding by re-analyzing data from another study (Green, Rohling, Lees-Haley, & Allen, 2001) based on outpatients seeking workers compensation, medical disability, or personal injury litigation.

Despite the ease with which many severely impaired groups of patients pass the WMT, Willis, Farrer, and Bigler (2011) argued, based on two adult mild traumatic brain injury case studies, that genuine cognitive impairment (e.g., semantic interference, executive dysfunction, memory problems, attention/concentration lapses) can underlie WMT failure. Thus, these authors argued for the existence of a WMT false positive (i.e., that effort during the evaluation was actually good but defined as poor by the WMT). However, the two cases scoring below WMT cutoffs were undergoing medical disability proceedings and had a financial incentive to exaggerate deficits. This was a point that was also noted in a rebuttal by Graver (2012), who stated that the WMT data were misrepresented as a false positive and that proposing cognitive impairment from mild traumatic brain injury as a cause failure on such easy tasks was not neurologically plausible. Greve, Ord, Curtis, Bianchini, and Brennan (2008) also reported on WMT false positives for malingering in a study that included mild traumatic brain injury patients when using other effort tests as the gold standard for defining malingering. This has been interpreted by some as meaning that the WMT can lead to false positives for poor effort, although that was not what the study concluded. As Green et al. (2009) noted, the WMT was designed to measure effort and a false positive for malingering does not

equate to a false positive for poor effort. In other words, there are many reasons why effort can be poor, with malingering being only one of them.

Recently, Loring et al. (2011) reported that administration of an acute benzodiazepine (i.e., lorazepam) can impact multiple WMT measures in healthy controls with no prior exposure to this class of medication. At the time, the authors interpreted the findings to mean that poor WMT scores were unrelated to apparent intentional attempts at response distortion (Loring et al., 2011). The latter study was a randomized, double-blind, placebo-controlled crossover study (as part of a larger study) in which 28 participants were administered the WMT after using lorazepam or a placebo. All participants were financially compensated for taking part. Six participants failed the WMT after using lorazepam but subsequently performed normally when retested with a placebo. One participant failed the WMT after using a placebo but passed after using lorazepam.

The data from the aforementioned study was recently re-analyzed by Rohling (2013) along with additional data from the larger study upon which it was based. The re-analysis found that invalid test data from 40% the study participants was obtained not only during the lorazepam trial, but also during the baseline and placebo trials when evaluating their performance on other independent SVT measures. Because the WMT was not administered during the baseline trial, Rohling argued that Loring et al. (2011) had no way of knowing if a general poor effort effect unrelated to medication was present in their study. Rohling provided additional evidence for this alternative explanation by showing that participants who obtained the lowest neuropsychological test scores during the lorazepam trial obtained an equivalent amount of low scores during the baseline and placebo trials. Rohling stated that his overall findings supported the conclusion that the WMT failures in the lorazepam trial were actually true positives (caused by poor effort) as opposed to false positives (caused by lorazepam).

False positives may occur on SVTs (including the MSVT and WMT) in some cases of severe cognitive impairment such as advanced dementia, although this is minimized to a very low level on the MSVT and WMT by utilizing profile analysis (Green et al., 2011; Howe et al., 2007; Howe & Loring, 2009). In profile analysis, when patients with severe cognitive impairment score below the established cutoffs for poor effort, if a specific pattern is present between the easy subtests and the difficult subtests (see Materials section) this can be considered to reflect genuine cognitive impairment as opposed to poor effort. This is because all effort tests involve some form of cognitive ability, however minimal. The "severe impairment profile" as it was named by Carone (2009) can also be used to minimize potential false positives in some children with severe cognitive impairment, although the vast majority of such children have been found to pass these tests (Carone, 2008; Green, Flaro, Brockhaus, & Montijo, 2013). MacAllister et al. (2009) provided cautions about effort tests in pediatric epilepsy patients with very low IQ, behavioral problems, and ongoing inter-ictal epileptiform abnormalities, although this concern was raised with a different SVT—the Test of Memory Malingering (Tombaugh, 1996). On the MSVT and WMT, failures can also occur in children who have reading anomalies or who do not have at least a third grade reading level (Courtney, Dinkins, Allen, & Kuroski, 2003; Green & Flaro, 2003), which is why test modifications are suggested in such instances (see Materials section).

In light of this historical context of the WMT and MSVT, the opportunity arose to administer both tests to a 9-year-old, Caucasian girl (referred to as CJ) of middle

socioeconomic status with severe congenital bilateral brain tissue loss, chronic epilepsy, extremely low Full Scale IQ, extremely low adaptive functioning, treatment with multiple high-dose benzodiazapines, and numerous severe cognitive impairments. If a child with such severe multiple neurological problems were to pass the MSVT and WMT, it would run directly counter to the hypothesis of possible false positive results in these tests with mild traumatic brain injury patients. After the evaluation was completed and feedback was provided to CJ's parents, they provided written consent to submit her case details as a study to a scientific journal.

CASE PRESENTATION

Birth

In terms of early development there were no known gestational complications. CJ was born full-term (40 weeks) and delivered via an emergency C-section due to a small cervix. Delivery complications were denied. Birth weight was 7 pounds, 4 ounces (65% ile), birth length was 21.5 inches (>99%ile), and head circumference was 36.83 cm (97%ile). Apgar scores were 7 at 1 minute (due to decreased respiratory effort and muscle tone) and 9 at 5 minutes. She passed her newborn hearing exam. Birth records noted that her hips were lax. She was treated with phototherapy for jaundice but this quickly resolved as evidenced by a normal conjugated bilirubin level (0.24) on the third day of life. There were no other known medical problems at the time. There was no placental pathology report noted in the medical records. Newborn screening blood tests (e.g., for sickle cell disease, hypothyroidism, phenylketonuria) were all negative. She was discharged home from the hospital on the third day of life. She was not discharged with any medication or treatments but it was advised that she should eventually follow-up with an orthopedist due to her lax hips.

Early development

Since birth CJ was noted to have left-sided hand preference, right-sided stiffness, and head tilting to the right. Her pediatrician referred her to an orthopedist who also noticed hip laxness and right-sided weakness. He referred her to a neurologist who did not evaluate her until 9 months of age due to a pediatric neurologist shortage in the area. Her head circumference was 48 cm, which is greater than the 98th percentile (macrocephaly). She was diagnosed with cerebral palsy and right hemiparesis. A physiatrist diagnosed her with spastic hemiplegia. Prior to 1 year of age she began physical, occupational, and speech therapy. Speech therapy was discontinued after a year due to good progress. CJ did not walk until 20 months. There were no delays in speech or potty training. Occupational and physical therapy services transitioned to school when she entered Kindergarten.

Neuroimaging

Brain MRI at 10 months of age showed a chronic hemorrhage in the left basal ganglia with ventriculomegaly (especially the lateral ventricles), severe volume loss

Table 1. CJ's prior school psychological testing results

Test	Score	%ile
General		
WISC-IV Full Scale IQ	58	<1
WISC-IV Verbal Comprehension Index	75	5
Similarities	4	2
Vocabulary	7	16
Comprehension	6	9
WISC-IV Perceptual Reasoning Index	55	<1
Block Design	1	<1
Picture Concepts	5	5
Matrix Reasoning	2	<1
WISC-IV Working Memory Index	68	2
Digit Span	5	5
Letter-Number Sequencing	4	2
WISC-IV Processing Speed Index	65	2
Digit Symbol Coding	4	2
Symbol Search	3	1
Academic Achievement		
Reading/English Language Arts		
WJ-III Word Attack	93	32
WJ-III Letter Word Identification	92	30
WJ-III Basic Reading Skills Cluster	92	30
WJ-III Spelling	89	23
WJ-III Writing Samples	86	18
WJ-III Broad Reading	83	13
WJ-III Reading Fluency	77	6
Mathematics		
WJ-III Math Fluency	68	2
WJ-III Applied Problems	53	<1
WJ-III Broad Math	45	<1
WJ-III Calculation	45	<1

WISC-IV (Wechsler Intelligence Scale for Children-IV), WJ-III (Woodcock-Johnson-III Tests of Achievement).
All scores are standard scores except for WISC-IV subtest scores, which are scaled scores.

within the left frontoparietal white matter with cystic encephalomalacia changes, and more diffuse right-sided deep white matter volume loss within the cerebral hemisphere on that side. There were small amounts of blood in the left thalamus, internal capsule, and lentiform nucleus. Brain MRI at one year of age was stable. Figure 1 depicts compelling evidence on a brain MRI of severe bilateral brain volume loss at age 1. There has been no subsequent brain MRI.

Early educational history

An Individualized Educational Plan was implemented, which provided resource room support for math (her weakest subject), consultive in-class teaching support services for math and English (so she would not need to be removed from the class), help with organization, re-directing attention, repeating directions, and breaking down

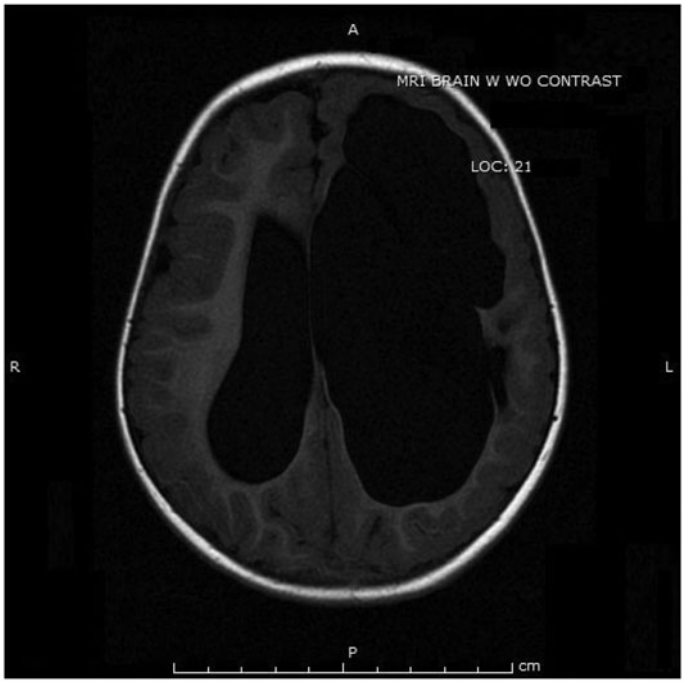

Figure 1. Brain magnetic resonance imaging at 1 year of age revealing severe bilateral volume loss.

multi-step tasks. She also received preferential seating on the right side of the class, use of a small table/bench when writing on the floor/carpet, use of a word processor, decreased visual information on paper with high contrast of materials, and small group instruction for math.

Seizure history

At 5.5 years of age CJ was diagnosed with her first seizure. The seizure was 3 minutes in duration and characterized by moaning, jerking movements of the right arm, pallor, spasming/twitching of the right face, and version of the head and eyes to the right. This was followed by 2 minutes of post-ictal confusion, fatigue, and vomiting. Brain CT revealed no acute findings. She was treated with oxcarbazepine and discharged home the same day. EEG was deferred until her regularly scheduled outpatient follow-up with the neurologist evaluating her in the hospital, who found her to be behaving normally and identifying family members when evaluated. About 1 month later her first EEG was abnormal due to frequent polyspike and wave activity with bilateral distribution with no clinical events, consistent with primary generalized epilepsy. Of note, 6 to 18 months before the diagnosed seizure she experienced two staring spells in which she was non-responsive for 4–5 minutes. This was followed by loss of postural tone and vomiting.

Six months after her first seizure, CJ experienced a suspected seizure which resulted in an oxcarbazepine dose increase. She continued to experience recurrent

Table 2. Presentation of CJ's performance on the neuropsychological assessment

Test	Score	%ile
General		
WASI-II Full Scale IQ	69	2
WASI-II Verbal Comprehension Index	79	8
WASI-II Perceptual Reasoning Index	64	1
WISC-IV Information subtest, scaled score (a)	8	25
Academic Achievement		
WRAT4 Word Reading	88	21
WRAT4 Spelling	92	30
WRAT4 Math Computation	59	<1
Gray Oral Reading Tests-5, Reading rate	85	16
Gray Oral Reading Tests-5, Reading accuracy	80	9
Gray Oral Reading Tests-5, Reading fluency	80	9
Gray Oral Reading Tests-5, Reading comprehension	65	1
Gray Oral Reading Tests-5, Oral Reading Quotient	70	2
Motor Functioning (a)		
WRAVMA Pegboard Test, dominant hand, # of pegs	17 (48)	<1
WRAVMA Pegboard Test, non-dominant hand, # of pegs	2 (<45)	<1
Language		
D-KEFS Letter Fluency (F,A,S)	7 (5)	5
D-KEFS Category Fluency (Animals, Boy's names)	11 (2)	2
Boston Naming Test-II	35/60 (78)	7
WASI-II Vocabulary, T score	35T	7
NEPSY Comprehension of Instructions	18/28 (4)	2
NEPSY Sentence Repetition	19/34 (6)	9
Visual-spatial		
Developmental Test of Visual-Motor Integration	14/30 (64)	1
Judgment of Line Orientation, form V (a)*	2/30 (37)	<1
Trail Making Test, part A (a)	71" (39)	<1
Rey-Osterrieth Complex Figure Test (a)	3/36 (<61)	<1
WASI-II Block Design, T score	29T	2
Learning and Memory		
• Verbal		
WRAML-2, Verbal Learning, Trial 1 (a)	1/16 (3)	1
WRAML-2, Verbal Learning, Trial 4 (a)	3/16 (3)	1
WRAML-2, Verbal Learning (Trials 1-4) (a)	10/64 (2)	<1
WRAML-2, Verbal Learning, Delayed Recall (a)	0/16 (3)	<1
WRAML-2, Verbal Learning, Delayed Recognition (a)	36/40 (9)	37
• Visual-spatial		
WRAML-2, Design Memory (5" exposure, 10"delay) (a)	14/60 (3)	1
WRAML-2, Design Memory, Delayed Recognition (a)	23/46 (5)	5
Rey-Osterrieth Complex Figure Test, Immediate recall (a)	3.5/36 (23T)	<1
Attention, Processing Speed, Executive Functioning		
WISC-IV Digit Span, longest forwards (a)	4 (80)	9
WISC-IV Digit Span, longest, backward (a)	2 (77)	6
WISC-IV Digit Span, scaled score (a)	5	5
WISC-IV Letter Number Sequencing (a)	10/30 (6)	9
WISC-IV Working Memory Index (a)	74	4
Trail Making Test, part B (a)	CNU	–
WISC-IV Digit Symbol Coding (a)	20 (4)	2
WISC-IV Symbol Search (a)	1 (1)	<1

(*Continued*)

Table 2. Continued

Test	Score	%ile
WISC-IV Processing Speed Index (a)	59	<1
WASI-II Similarities, T score	39T	14
WASI-II Matrix Reasoning, T score	28T	1
D-KEFS Category Switching, total correct	2 (2)	<1
D-KEFS Category Switching, switching accuracy	1 (4)	2
Adaptive Behavior (per parental report)		
ABAS-II Conceptual	67	1
ABAS-II Social	93	32
ABAS-II Practical	41	<1
ABAS-II General Adaptive Composite	58	<1

CNU = Could not understand task; D-KEFS (Delis-Kaplan Executive Function System); WASI-II (Wechsler Abbreviated Scale of Intelligence-II); WISC-IV (Wechsler Intelligence Scale for Children-IV), WRAML-2 (Wide Range Assessment of Memory and Learning-2nd edition), WRAT4 (Wide Range Achievement Test-4); WRAVMA (Wide Range Assessment of Visual-Motor Abilities).

*Denotes poor task understanding

(a) Denotes test administered on the first evaluation date.

When only one scores in listed, the score is a standard score, T scores, or scaled score, with the latter two labeled as such in the table. For some tests, raw scores are listed first because for some tests, this is sometimes more informative than the scaled score. In such instances a standard score scaled score is listed in parentheses. In this table all single-digit scores in parentheses are scaled scores and all double-digit scores in parentheses are standard scores.

seizures, with generally the same characteristics, although sometimes the seizure and post-ictal durations were longer. Oxcarbazepine dose was increased, later switched to levitiracetam, the dose of which was also increased, and then vitamin B6 was added. She was brought to the ER again for one of these seizures (lasting 5–8 minutes) but none of the others, because her parents knew how to manage them. At age 7 she was diagnosed with electrical status epilepticus of sleep after long-term video EEG monitoring showed left frontocentral slowing and left posterior temporal spike and slow wave activity. Her neurologist stated that the epilepsy was potentially multi-focal and/or generalized in onset and that there was diffuse profound cerebral cortical dysfunction/encephalopathy. She was treated with diazepam (15 mg, at night). Lamotrigine, divalproex sodium, and levocarnitine were also added. Follow-up EEGs were initially abnormal and consistent with left focal frontotemporal epilepsy (and sometimes right frontocentral parietal).

At age 8 CJ's neurologists noted a possible right visual field cut. The diazepam dose was decreased to 10 mg at night due to decreased memory and school performance. The divalproex sodium dose was increased but later decreased because of increased tremors. Clobazam was added and her parents believe she regressed further academically and became sleepier. EEG normalized at about 8.5 years of age but was abnormal 2 months before the neuropsychological evaluation due to bilateral frontal central spikes. Clobazam was increased and long-term video EEG monitoring results were normal in the month of the neuropsychological evaluation.

Status at evaluation date

At the time CJ was evaluated she was finishing the third grade and her chronological age was 9 years and 5 months. Her teachers reportedly noticed a brief staring episode that year for a minute or two followed by brief confusion, but her parents stated they had not noticed her experience staring episodes. Her parents' chief concerns at the time of the neuropsychological evaluation were academic regression, impulsivity, poor memory, poor frustration tolerance, and separation anxiety. There is no other relevant medical history besides what is noted above.

Family history

There is no family history of epilepsy, cerebral palsy, mental retardation, or psychiatric disorders. Family neurological history is significant for stroke and unspecified dementia in one distant relative and possible stroke and unspecified dementia in another distant relative. She is the youngest of three children (both half-siblings), neither of whom have medical problems. Her parents worked in administrative positions.

Medications

Medications at the time of the evaluation were as follows: lamotrigine (100 mg, bid), divalproex sodium (250 mg qam and qhs, 125 mg at lunch), clobazam (10 mg qam and lunch; 15 mg qhs), clonidine (0.5 mg, qhs), diazepam (10 mg, qhs), vitamin B6 (100 mg, bid), and levocarnitine (4 ml, bid). On the first day of testing she used lamotrigine, divalproex sodium, clobazam, vitamin B6, and levocarnitine between 8:15 and 9:00 am. At 12:30 pm she used clobazam and divalproex sodium. Testing began at about 12:20 pm. On the second day of testing she reportedly used these same morning medications at about 6:45 am. Testing began at about 8:00 am.

Prior psychological testing

CJ was tested by a school psychologist 6 months prior to the neuropsychological evaluation. She was administered the Wechsler Intelligence Scale for Children-IV (WISC-IV) (Wechsler, 2003) and the Woodcock-Johnson III Tests of Achievement (Woodcock, McGrew, & Mather, 2001), the results of which are summarized in Table 1. No mention was made of effort test administration in the school psychology report.

Behavioral observations

CJ was observed during a clinical interview with her parents and during 2 days of testing. These observations included but were not limited to:

- During a break on the first testing day she realized that her mother was waiting downstairs and not outside the office and she began to cry. She was inconsolable, refused to complete testing that day, and returned on another day.

- When she returned for testing she began crying when testing began but she was redirectable after a few minutes and showed no further signs of distress. Part of her crying also appeared related to her dislike of being tested for several hours.
- Right-sided visual neglect.
- Abnormal gait.
- Motor dysfunction in the right upper extremity.
- Severe impulsivity (e.g., responding before questions answered, careless errors).
- Requiring constant redirection to stay on task.
- Obsessive focus on when testing would be completed (e.g., looking at the clock, asking every few seconds to minutes about this topic).
- Whining and frequent negative comments about not wanting to be at the evaluation (which she stated was boring).
- Poor frustration tolerance (e.g., frequent loud expressions of exasperation, loud sighing).
- Inability to follow a five step command due to omission and sequencing errors.

MATERIALS

CJ was administered a comprehensive battery of neuropsychological tests over 2 days by a board certified neuropsychologist (the study author), including the MSVT (first testing date) and WMT (second testing date). The two testing dates were separated by 9 days. The WMT displays 20 common individual word pairs that reflect two concepts (e.g., rat, tail). Immediate Recognition (IR) and Delayed Recognition (DR) (after 30 minutes) are tested by presenting the patient with one of the original words along with a foil. The consistency (CNS) of responses between IR and DR is automatically computed. Together, IR, DR, and CNS (known as the "easy" subtests) are used to assess effort with cut-off scores specified in the test manual. The DR subtest is immediately followed by the following subtests: (a) Multiple Choice (MC): choosing the second part of each word pair out of eight options, (b) Paired Associates (PA): stating the second part of each word pair when told the first word, and (c) Free Recall (FR): stating as many words from the list as possible. These latter three subtests are known as the "hard" subtests and are used as supplements to profile analysis if any of the easy subtests are failed. If effort is good, they are actual memory tests in which verbal memory impairment may be assessed. The MSVT is similar to the WMT except that there are 10 word pairs instead of 20, the semantic pairings are stronger, the interval from IR to DR is 10 minutes, and there is no MC subtest.

Because the MSVT and WMT require a third grade reading level, these two tests were administered according to test manual instructions for patients in which there is concern that they might not yet be at that reading level. Specifically, CJ was asked to read each word aloud as it appeared and any reading errors were corrected immediately. This intervention was only required for a few items on the MSVT and WMT. Due to her extreme impulsivity, the examiner was concerned about the possibility of impulsive mouse clicking. Thus, CJ was informed to tell the examiner the correct answer for any subtests required mouse clicking (IR, DR, and MC) and the examiner clicked the mouse for her. This is consistent with the approach recommended by Chafetz and Biondolillo (2012) who noted that in low-functioning individuals it may be necessary to obviate the

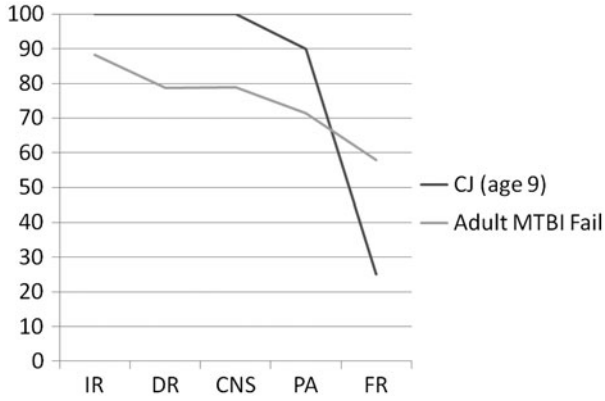

Figure 2. Medical Symptom Validity Test performance for CJ compared to adult mild traumatic brain injury patients who failed the Medical Symptom Validity Test. The graph shows perfect performance on the "easy" (effort) subtests (IR, DR, & CNS) for CJ with lower performance on the "hard" (ability) subtests (PA & FR) on the Medical Symptom Validity Test (MSVT). CJ outperformed a subset (N = 14) of adult mild traumatic brain injury (MTBI) participants administered the MSVT by Carone (2008) on all effort subtests and the PA subtest. Due to her severe cognitive impairment and the difficulty of free recall for someone with her severe neurological condition, her FR score was dramatically lower than the other scores and lower when compared to the MTBI group. It is noted that it is biologically implausible for adult MTBI patients to score worse on effort subtests but better on the most difficult subtest when compared to a child with severe neurological impairment. CNS (Consistency), DR (Delayed Recognition), FR (Free Recall), IR (Immediate Recognition), and PA (Paired Associates).

executive requirements of holding the mouse and that such modifications are considered important by the MSVT and WMT test author. This helps decrease the changes of accidental impulsive clicking mistakes. Such an approach has also been used for the MSVT with dementia patients (Howe & Loring, 2009).

Besides the MSVT and WMT, CJ was also administered selected subtests from the WISC-IV, Delis-Kaplan Executive Function System (Delis, Kaplan, & Kramer, 2001), Wide Range Assessment of Memory and Learning-2nd edition (WRAML-2) (Sheslow & Adams, 2003), Wide Range Achievement Test-4 (Wilkinson & Robertson, 2006), the Wide Range Assessment of Visual-Motor Abilities (Adams & Sheslow, 2005), and the NEPSY (Korkman, Kirk, & Kemp, 1998). She was also administered the Wechsler Abbreviated Scale of Intelligence-II (Wechsler, 2011), child's version of the Trail Making Test (A & B) (Reitan & Wolfson, 2000), Rey Complex Figure Test (Meyers & Meyers, 1996), Judgment of Line Orientation (Benton, Sivan, Hamsher, Varney, & Spreen, 1994), Boston Naming Test-II (Kaplan, Goodglass, & Weintraub, 2001), and the Developmental Test of Visual-Motor Integration-6 (Beery & Beery, 2010).

EXAMINATION RESULTS

Because the focus of this case study is on effort test performance, those results are emphasized first. On the MSVT (administered on the first testing day), CJ's scores were as follows: IR = 100%, DR = 100%, CNS = 100%, PA = 90%, and FR = 25%.

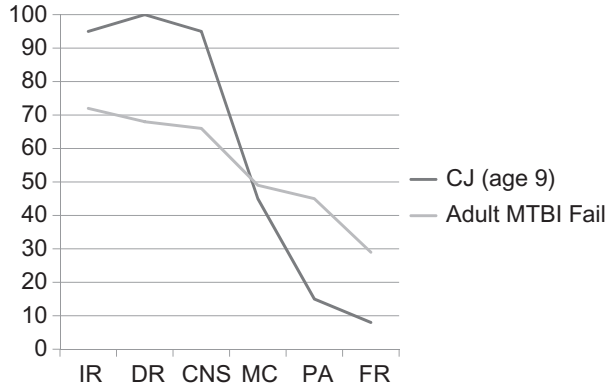

Figure 3. Word Memory Test performance for CJ compared to adult mild traumatic brain injury patients who failed the Word Memory Test. The graph shows perfect to near-perfect performance on the "easy" (effort) subtests (IR, DR, & CNS) for CJ with lower performance on the "hard" (ability) subtests (MC, PA, & FR) on the Word Memory Test. CJ outperformed a subset (N=149) of adult mild traumatic brain injury (MTBI) participants administered the WMT by Green et al. (2009) on all effort subtests and only slightly lower on the MC subtest. Due to her severe cognitive impairment, double the number of word pairs, and her severe neurological condition, her PA and FR scores were dramatically lower than the other scores and lower when compared to the adult MTBI group. Despite double the number of word pairs, the effort subtest scores did not decline for CJ in any meaningful way compared to the Medical Symptom Validity Test (MSVT) whereas the hard subtest scores did decline significantly compared to the MSVT. The graph also highlights the biologically implausible finding of MTBI patients performing worse than a severely impaired child on easy subtests but better on more difficult subtests. CNS (Consistency), DR (Delayed Recognition), FR (Free Recall), IR (Immediate Recognition), MC (Multiple Choice), and PA (Paired Associates).

On the WMT (administered on the second testing day), her scores were as follows: IR = 95%, DR = 100%, CNS = 95%, MC = 45%, PA= 15%, and FR = 8%. Thus, she passed all effort measures (IR, DR, & CNS) on the MSVT and WMT, with perfect performance on the former and perfect to near perfect performance on the latter. Although not valid for clinical use with children using adult cutoffs, if Reliable Digit Span (Greiffenstein, Baker, & Gola, 1994) was calculated based on the WISC-IV Digit Span subtest, the score would have been 5 (below adult cutoffs for good effort). The low RDS score highlights the problem inherent in using ability-based embedded effort measures based on adult cutoffs with significantly neurologically impaired children, as opposed to using free standing measures of effort. For example, even in healthy children (ages 6 to 11), although 99% passed the MSVT (with none failing the DR subtest), 59% failed RDS using adult cutoffs because the Digit Span subtest is closely linked with cognitive abilities in young children (Blaskewitz et al., 2008). The use of RDS in the aforementioned study was included for experimental purposes to explore its validity in young children.

Based on normative data (Green & Flaro, 2003) for children ages 7 to 9 on the WMT (n = 22), the MC score is low average (21%ile), PA is borderline (3%ile), and FR is low average (10%ile). Based on normative data (Blaskewitz et al., 2008) for third graders on the MSVT (n = 16), the PA score is high average (79%ile) and the FR score is extremely low (<1%ile). The significant verbal recall deficits on the WMT are

consistent with extremely low learning and recall scores on the WRAML-2 Verbal Learning subtest, the scores of which were all at the 1%ile or below for trial 1 recall (1/16), trial 4 recall (3/16), trial 1 through 4 recall (10/64), and delayed recall (0/16). In addition, her preserved verbal recognition memory on the WMT is consistent with her preserved recognition memory on the WRAML-2 Verbal Learning Subtest (36/40). She also had satisfactory single word reading abilities (WRAT-4 Word Reading standard score = 88) which is at the upper second grade level.

Other neuropsychological test data confirmed that this is a child with significant cognitive impairments. A summary of her test scores across both evaluation dates are reported in Table 2. In addition to these scores, her parents completed the Adaptive Behavior Assessment System-II (Harrison & Oakland, 2003) which resulted in an extremely low General Adaptive Composite scaled score of 58.

DISCUSSION

In this case study a 9-year-old child with severe congenital bilateral brain tissue loss, chronic epilepsy, use of multiple high dose benzodiazapines, extremely low Full Scale IQ scores over two evaluation dates (58 and 69), extremely low adaptive functioning, and numerous severe cognitive impairments was able to pass the MSVT and WMT with perfect to near perfect scores. While this child was extremely impulsive on exam and did not want to be there, she enjoyed reading, had an interest in words, and had preserved verbal recognition memory, all of which likely contributed to her motivation and performance on the MSVT and WMT. In this way CJ differs from some similarly globally impaired children. The results of this case study are consistent with other studies of patients with moderate to severe neurological conditions on the MSVT and/or WMT noted in the introduction. The results are also consistent with the results of a recent case study (Carone et al., in press) showing that the WMT was easily passed in a 15-year-old child with surgical removal of the left anterior hippocampus and left parahippocampal gyrus, chronic epilepsy, and a post-surgical stroke. The current case study is unique, however, due to the combinations of so many extreme findings and clinical features accompanying by a compelling visual image of severe brain tissue loss.

This case study has very important implications for clinicians doing forensic and non-forensic work with patients claiming persisting symptoms and/or disability after mild traumatic brain injury, mild head injury, or other objectively mild (or non-existent) neurological conditions who fail the MSVT and/or WMT. That is, if a child with such severe brain damage, severe cognitive/functional impairment, and polypharmacy can pass these tests at perfect to near-perfect levels, it is not reasonable to propose that patients with far more mild conditions (particularly adults in a chronic post-injury phase) can fail these tests for reasons other than poor effort. In fact, given the accumulation of data showing how easy these tests are for the vast majority of adults and children with severe neurological conditions and based on decades of research documenting that a single uncomplicated mild traumatic brain injury does not cause long-term objective cognitive impairment (Belanger & Vanderploeg, 2005; Binder, 1997; Binder & Rohling, 1996; Dikmen, Machamer, Winn, & Temkin, 1995; Frencham, Fox, & Maybery, 2005; Rohling et al., 2011; Schretlen & Shapiro, 2003) it is this

author's contention that a false positive for poor effort on the MSVT and WMT is impossible in chronic single mild traumatic brain injury cases provided that something obvious did not go wrong during test administration to invalidate the exam (e.g., the patient falling asleep; administering the computerized version to a patient who is legally blind or illiterate). Clinicians are strongly encouraged to compare the performance of adult mild traumatic brain injury patients failing the MSVT and WMT to this case and group data of children with severe neurological conditions to place their results in the proper context. Some group studies have specifically been published showing much higher failure rates for the MSVT and WMT in adults with mild traumatic brain injury compared to children with moderate to severe brain damage and developmental disabilities (Carone, 2008; Green et al., 2013). See Figures 2 and 3 for examples of charts comparing CJ to MTBI patients failing the MSVT and WMT, respectively.

The chronic use of benzodiazepines in this case differs from the first time use of benzodiazepines in healthy controls in the study by Loring et al. (2011). As noted earlier, the conclusion that acute lorazepam use can cause WMT failure was recently refuted during a re-analysis of the data by Rohling (2013). The findings from this case study are consistent with Rohling's conclusion. That is, if benzodiazepine use was sufficient to cause WMT failure, it would be rather remarkable for a young child with such severe cognitive impairment on multiple high-dose benzodiazepines and other medications to perform so well on the MSVT and WMT. Rohling's findings showed how the results of randomized controlled trials can be distorted by participants who are poorly motivated, despite being paid. For this reason, researchers are encouraged to pay participants for performance *to do well* rather than for merely participating. Financial compensation based on performance may also be needed in undergraduate research based on a recent study showing that 30.8% to 55.6% of healthy undergraduate students failed at least one of three effort tests when participating in research for extra credit (An, Zakzanis, & Joordens, 2012).

Case studies such as this one, along with group studies of children and adults with severe neurological conditions, are extremely helpful in validating that the SVT being studied is useful in measuring test-taking effort. That is, if a test is predominantly measuring effort as opposed to cognitive ability, then even patients with severe neurological impairments should be able to pass them. The same can be said for young healthy children. That being said, there are some patients with severe neurological conditions who will genuinely fall below an established SVT cutoff because once cognitive impairment crosses a certain threshold, even SVTs can become negatively impacted. This is because all SVTs require some level of cognitive ability, however miniscule. It will thus be important for future free-standing SVTs to incorporate cognitive ability subtests (e.g., free recall) so that a profile analysis procedure can be developed to reduce false positives for poor effort, analogous to the severe impairment profile/dementia profile analysis procedure for the MSVT and WMT (Green et al., 2011; Howe et al., 2007; Howe & Loring, 2009). Although such an analysis was not needed in this case, it will be needed in other cases to reduce false positives in other children with severe cognitive impairment, especially if these impairments involve word reading and verbal recognition memory. In this particular case, the cognitive ability subtests were still useful in documenting significant memory impairments (e.g., MSVT Free Recall at <1%ile and WMT Paired Associates at the 3%ile).

REFERENCES

Adams, W., & Sheslow, D. (2005). *Wide range assessment of visual-motor abilities*. Odessa, FL: Psychological Assessment Resources, Inc.

An, K. Y., Zakzanis, K. K., & Joordens, S. (2012). Conducting research with non-clinical healthy undergraduates: Does effort play a role in neuropsychological test performance? *Archives of Clinical Neuropsychology, 27*, 849–857.

Armistead-Jehle, P. (2010). Symptom validity test performance in U.S. veterans referred for evaluation of mild TBI. *Applied Neuropsychology, 17*, 52–59.

Armistead-Jehle, P., & Buican, B. (2012). Evaluation context and Symptom Validity Test performances in a U.S. military sample. *Archives of Clinical Neuropsychology, 27*, 828–839.

Beery, K. E., & Beery, N. A. (2010). *Beery-Buktenica Developmental Test of Visual-Motor Integration, sixth edition: Administration, scoring, and technical manual*. Bloomington, MN: Pearson.

Belanger, H. G., & Vanderploeg, R. D. (2005). The neuropsychological impact of sports-related concussion: A meta-analysis. *Journal of the International Neuropsychological Society, 11*, 345–357.

Benton, A. L., Sivan, A. B., Hamsher, K. S., Varney, N. R., & Spreen, O. (1994). *Contributions to neuropsychological assessment. A clinical manual* (2nd ed.). New York, NY: Oxford.

Binder, L. M. (1997). A review of mild head trauma. Part II: Clinical implications. *Journal of Clinical and Experimental Neuropsychology, 19*, 432–457.

Binder, L. M., & Rohling, M. L. (1996). Money matters: A meta-analytic review of the effects of financial incentives on recovery after closed-head injury. *American Journal of Psychiatry, 153*, 7–10.

Blaskewitz, N., Merten, T., & Kathmann, N. (2008). Performance of children on symptom validity tests: TOMM, MSVT, and FIT. *Archives of Clinical Neuropsychology, 23*, 379–391.

Bowden, S. C., Shores, E. A., & Mathias, J. L. (2006). Does effort suppress cognition after traumatic brain injury? A re-examination of the evidence for the Word Memory Test. *The Clinical Neuropsychologist, 20*, 858–872.

Carone, D. A. (2008). Children with moderate/severe brain damage/dysfunction outperform adults with mild-to-no brain damage on the Medical Symptom Validity Test. *Brain Injury, 22*, 960–971.

Carone, D. A. (2009). Test review of the Medical Symptom Validity Test. *Applied Neuropsychology, 16*.

Carone, D. A., Green, P., & Drane, D. L. (in press). Word Memory Test profiles in two cases with surgical removal of the left anterior hippocampus and parahippocampal gyrus. *Applied Neuropsychology: Adult*.

Chafetz, M. D., & Biondolillo, A. (2012). Validity issues in Atkins death cases. *The Clinical Neuropsychologist, 26*, 1358–1376.

Courtney, J. C., Dinkins, J. P., Allen, L. M., 3rd, & Kuroski, K. (2003). Age related effects in children taking the Computerized Assessment of Response Bias and Word Memory Test. *Child Neuropsychology, 9*, 109–116.

Delis, D., Kaplan, E. F., & Kramer, J. H. (2001). *The Delis-Kaplan Executive Function System: Technical manual*. San Antonio, TX: The Psychological Corporation.

Dikmen, S., Machamer, J., Winn, R., & Temkin, N. R. (1995). Neuropsychological outcome at one-year post head injury. *Neuropsychology, 9*, 80–90.

Donders, J., & Boonstra, T. (2007). Correlates of invalid neuropsychological test performance after traumatic brain injury. *Brain Injury, 21*, 319–326.

Flaro, L., Green, P., & Robertson, E. (2007). Word Memory Test failure 23 times higher in mild brain injury than in parents seeking custody: The power of external incentives. *Brain Injury, 21*, 373–383.

Frencham, K. A., Fox, A. M., & Maybery, M. T. (2005). Neuropsychological studies of mild traumatic brain injury: A meta-analytic review of research since 1995. *Journal of Clinical and Experimental Neuropsychology, 27*, 334–351.

Gervais, R. O., Ben-Porath, Y. S., Wygant, D. B., & Green, P. (2007). Development and validation of a Response Bias Scale (RBS) for the MMPI-2. *Assessment, 14*, 196–208.

Goodrich-Hunsaker, N. J., & Hopkins, R. O. (2009). Word memory test performance in amnesic patients with hippocampal damage. *Neuropsychology, 23*, 529–534.

Graver, C. J. (2012). In response to: "Are effort measures sensitive to cognitive impairment?" Published in the December issue [Mil Med 2011; 176(12): 1426–1431]. *Military Medicine, 177*, vii.

Green, P. (2003). *Green's Word Memory Test for Windows: User's manual*. Edmonton, Canada: Green's Publishing.

Green, P. (2004). *Green's Medical Symptom Validity Test (MSVT) for Microsoft Windows (user manual) Edmonton*. Canada: Green's Publishing.

Green, P., & Flaro, L. (2003). Word Memory Test performance in children. *Child Neuropsychology, 9*, 189–207.

Green, P., Flaro, L., Brockhaus, R., & Montijo, J. A. (2013). Performance on the WMT, MSVT, & NV-MSVT in children with developmental disabilities and in adults with mild traumatic brain injury. In C. R. Reynolds, & A. M. Horton (Eds.), *Detection of malingering during head injury litigation* (2nd ed.). (pp. 201–219). New York, NY: Plenum Press.

Green, P., Flaro, L., & Courtney, J. (2009). Examining false positives on the Word Memory Test in adults with mild traumatic brain injury. *Brain Injury, 23*, 741–750.

Green, P., Montijo, J., & Brockhaus, R. (2011). High specificity of the Word Memory Test and Medical Symptom Validity Test in groups with severe verbal memory impairment. *Applied Neuropsychology, 18*, 86–94.

Green, P., Rohling, M. L., Lees-Haley, P. R., & Allen, L. M., III (2001). Effort has a greater effect on test scores than severe brain injury in compensation claimants. *Brain Injury, 15*, 1045–1060.

Greiffenstein, M. F., Baker, W. J., & Gola, T. (1994). Validation of malingered amnesic measures in a large clinical sample. *Psychological Assessment, 6*, 218–224.

Greve, K. W., Ord, J., Curtis, K. L., Bianchini, K. J., & Brennan, A. (2008). Detecting malingering in traumatic brain injury and chronic pain: A comparison of three forced-choice symptom validity tests. *The Clinical Neuropsychologist, 22*, 896–918.

Harrison, P. L., & Oakland, T. (2003). *Adapative Behavior Assessment System* (2nd ed.). San Antonio, TX: Harcourt Assessment.

Howe, L. L., Anderson, A. M., Kaufman, D. A., Sachs, B. C., & Loring, D. W. (2007). Characterization of the Medical Symptom Validity Test in evaluation of clinically referred memory disorders clinic patients. *Archives of Clinical Neuropsychology, 22*, 753–761.

Howe, L. L., & Loring, D. W. (2009). Classification accuracy and predictive ability of the Medical Symptom Validity Test's dementia profile and general memory impairment profile. *The Clinical Neuropsychologist, 23*, 329–342.

Kaplan, E. F., Goodglass, H., & Weintraub, S. (2001). *The Boston Naming Test* - (2nd ed.). Philadelphia, PA: Lippincott, Williams, & Wilkins.

Kirkwood, M. W., & Kirk, J. W. (2010). The base rate of suboptimal effort in a pediatric mild TBI sample: Performance on the Medical Symptom Validity Test. *The Clinical Neuropsychologist, 24*, 860–872.

Korkman, M., Kirk, U., & Kemp, S. (1998). *NEPSY: A developmental neuropsychological assessment*. San Antonio, TX: The Psychological Corporation.

Larochette, A. C., & Harrison, A. G. (2012). Word Memory Test performance in Canadian adolescents with learning disabilities: A preliminary study. *Applied Neuropsychology: Child, 1*, 38–47.

Loring, D. W., Marino, S. E., Drane, D. L., Parfitt, D., Finney, G. R., & Meador, K. J. (2011). Lorazepam effects on Word Memory Test performance: A randomized, double-blind, placebo-controlled, crossover trial. *The Clinical Neuropsychologist, 25*, 799–811.

MacAllister, W. S., Nakhutina, L., Bender, H. A., Karantzoulis, S., & Carlson, C. (2009). Assessing effort during neuropsychological evaluation with the TOMM in children and adolescents with epilepsy. *Child Neuropsychology, 15*, 521–531.

Meyers, J., & Meyers, K. (1996). *Rey Complex Figure and the Recognition Trial: Professional manual. Supplemental norms for children and adolescents*. Odessa, FL: Psychological Assessment Resources.

Reitan, R. M., & Wolfson, D. (2000). The neuropsychological similarities of mild and more severe head injury. *Archives of Clinical Neuropsychology, 15*, 433–442.

Rienstra, A., Klein Twennaar, M., & Schmand, B. (2013). Neuropsychological characterization of patients with the WMT dementia profile. *Archives of Clinical Neuropsychology, 28*, 463–475.

Rienstra, A., Spaan, P. E., & Schmand, B. (2009). Reference data for the Word Memory Test. *Archives of Clinical Neuropsychology, 24*, 255–262.

Rohling, M. L. (2013). *When are your trial data real? Paper presented at the 53rd annual conference of the American Society for Clinical Psychopharmacology (NCDEU)*. Florida: Hollywood.

Rohling, M. L., Binder, L. M., Demakis, G. J., Larrabee, G. J., Ploetz, D. M., & Langhinrichsen-Rohling, J. (2011). A meta-analysis of neuropsychological outcome after mild traumatic brain injury: Re-analyses and reconsiderations of Binder et al. (1997), Frencham et al. (2005), and Pertab et al. (2009). *The Clinical Neuropsychologist, 25*, 1–16.

Rohling, M. L., & Demakis, G. J. (2010). Bowden, Shores, & Mathias (2006): Failure to replicate or just failure to notice. Does effort still account for more variance in neuropsychological test scores than TBI severity? *The Clinical Neuropsychologist, 24*, 119–136.

Schretlen, D. J., & Shapiro, A. M. (2003). A quantitative review of the effects of traumatic brain injury on cognitive functioning. *International Review of Psychiatry, 15*, 341–349.

Sheslow, D., & Adams, W. (2003). *Wide Range Assessment of Memory and Learning, Second edition administration and technical manual*. Wilmington, DE: Wide Range.

Tombaugh, T. (1996). *Test of Memory Malingering*. Los Angeles, CA: Western Psychological Services.

Wechsler, D. A. (2003). *The WISC-IV technical and interpretive manual*. San Antonio, TX: The Psychological Corp.

Wechsler, D. A. (2011). *Wechsler Abbreviated Scale of Intelligence–Second edition manual*. Bloomington, MN: Pearson.

Wilkinson, G. S., & Robertson, G. J. (2006). *WRAT4: Wide Range Achivement Test professional manual*. Lutz, FL: Psychological Assessment Resources.

Williamson, D. J., Green, P., Allen, L., & Rohling, M. L. (2003). Evaluating effort with the Word Memory Test or Category Test-Or Not: Inconsistencies in compensation-seeking samples. *Journal of Forensic Neuropsychology, 3*, 19–44.

Williamson, D. J., Holsman, M., Chaytor, N., Miller, J. W., & Drane, D. L. (2012). Abuse, not financial incentive, predicts non-credible cognitive performance in patients with psychogenic non-epileptic seizures. *The Clinical Neuropsychologist, 26*, 588–598.

Willis, P. F., Farrer, T. J., & Bigler, E. D. (2011). Are effort measures sensitive to cognitive impairment? *Military Medicine, 176*, 1426–1431.

Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson III Tests of Achievement*. Ithaca, IL: Riverside Publishing.