National Academy of Neuropsychology
November 5, 2015

Performance Validity Testing in ‘At-Risk’ Populations

Kyle Brauer Boone, Ph.D.
California School of Forensic Studies
Alliant International University
Department of Psychiatry and Biobehavioral Sciences
UCLA

Financial Disclosure

Dr. Boone receives royalities from Western Psychological Services for the b Test and the Dot Counting Test

Detection of noncredible psychological test results is critical:

- The viability of psychological/neuropsychological assessment hinges on ability to verify that scores are true and accurate
  - If noncredible performance cannot be detected, then psychological assessments are essentially worthless

Strategies For Detection Of Feigned Cognitive Symptoms

- A. Noncredible pattern on dedicated measures of response bias
- B. Noncredible pattern on standard neurocognitive tests ("embedded")
- C. Elevations on personality test validity scales (e.g., MMPI-2-RF F-r, Fp-r, Fs, FBS-r, RBS scales)
- D. Inconsistency between test scores and ADLs
- E. Inconsistency between injury specifics and test scores (improbable outcome)
- F. Inconsistency in scores within/across evaluations

Neurocognitive Performance Validity Tests (PVTs)

- Rationale (i.e., how/why do they work?)
  - the general public holds faulty information regarding the effects of brain injury, specifically, that the following skills are typically impaired:
    - overlearned information (alphabet, simple calculations, sight reading)
    - recognition memory versus free recall
    - simple motor dexterity and sensory function
    - basic attention
- Effective PVTs are those that incorporate these skills

Detection of noncredibe performance from test data

- Low performance relative to credible patient groups
- Pathognomonic signs (i.e., found only in feigned presentations)

Neurocognitive domains in which symptoms can be feigned:

- Memory
- Attention
- Mental Speed
- Language (including reading)
- Math
- Visual Perceptual/Spatial
- Intelligence
- Motor dexterity/strength and sensory function
- Any combination of the above

PVTs by Domain

Memory - Verbal	Memory - Visual	Attention/ Vigilance
Validity Indicator Profile (VIP) –Verbal	Computerized Assessment of Response Bias (CARB)	Dot Counting Test
Word Memory Test (WMT)	Nonverbal-MSVT	b Test
Medical Symptom Validity Test (MSVT)	Portland Digit Recognition Test (PDRT)	Digit Span
Warrington Words	Rey-15 + Recognition	Connors CPT-II
Rey Word Recognition	Test of Memory Malingering (TOMM)	Seashore Rhythm Test
Rey Auditory Verbal Learning Test Equation	Victoria Symptom Validity Test (VSVT)	Test of Variables of Attention (TOVA)
WMS-III Logical Memory Equation	Rey-Osterrieth Effort Equation	WAIS-III WMI
California Verbal Learning Test-II Recognition	WAIS-III Digit Symbol recognition	

Motor/Sensory	Visual-Perceptual/Spatial	Language
Finger Tapping	VIP – Nonverbal	b Test
Finger Agnosia	WAIS-III Picture Completion Most Discrepant Index	VIP - Verbal
Grip Strength	Judgment of Line Orientation	Speech Sounds Perception Test
Grooved Pegboard	Visual Form Discrimination	Stroop Test
	RO Effort Equation	Sentence Repetition
	Benton Facial Recognition	Token Test
	WAIS-III PIQ/POI	WAIS-III VIQ/VCI

Processing Speed	Executive	Numbers/Counting
b Test	Wisconsin Card Sorting	Dot Counting Test
Dot Counting Test	Category Test	CARB
Warrington Words (time score)	Controlled Oral Word Association Test (COWAT)	PDRT
WAIS-III Digit Symbol recognition		Rey 15-item + Recognition
Trails A		VSVT
Digit Span (forward time)		Digit Span variables
WMS-III PSI		
Stroop A and B		
Color Trails		

Current Practice Guidelines

- indicate that formal measures of response bias are to be interspersed *throughout* neuropsychological exams
    - NAN (Bush et al., 2005)
  - Including use of *embedded* as well as *free-standing* measures
    - AACN (Heilbronner et al., 2009)

Reliance on a single PVT (incorrectly) assumes that

- Response bias is constant across an exam
- Response bias presents in the same manner in all individuals
  - i.e., that all patients use the same strategies when feigning

Response bias is typically selective:

- Not all individuals feign in the same manner (Boone, 2009)
  - Examination of archival data (n = 146) noncredible subjects
    - Compensation-seeking
    - Failure on 2 or more PVTs out of at least 4
  - Average percentage of tests failed = 64%
  - Only 16.4% of patients failed all PVTs
  - 36% of patients failed $\leq$ half of PVTs
- Shows that response bias is not static across exam

- Response bias typically fluctuates across an exam
- Even if effort is constant, individuals differ in the strategies they use when feigning cognitive symptoms
- Therefore, need *continuous sampling* of performance validity using various indicators
    - Boone (2009)

Recent Practice Survey

- Martin, Schroeder, and Odland (2015) surveyed North American neuropsychologists (n = 316) regarding use of PVTs
  - An average of 6 PVTs (embedded and dedicated) were used in forensic exams
  - An average of 5 PVTs (embedded and dedicated) were used in clinical exams

To summarize:

- Current recommendation and practice in the field of clinical neuropsychology is to
  - Administer multiple PVTs
  - Interspersed throughout the exam
  - Covering multiple cognitive domains (if not for every task administered)
  - so that performance validity is repeatedly sampled

Key Issue:

- Does use of multiple PVTs increase the likelihood of falsely concluding that a patient is non-credible?
  - If the answer is "yes", then the field of neuropsychology must make an abrupt course correction because current practice guidelines recommend use of multiple PVTs
  - Fortunately, available research indicates that the answer is "no"

Specificity rates with use of multiple PVTs:

Victor et al. (2009)

- Subjects
  - 32 noncredible
  - 57 credible
- Predictor Variables:
  - Rey 15-item + recognition, Dot Counting Test, Warrington Words, Rey Word Recognition
- Results of backward step-wise logistic regression:
  - Failure on 1 of 4 tests (DCT) = 93% sensitivity, 59.4% specificity, 80.9% overall accuracy
  - Failure on $\geq$2 tests (DCT, Warrington) = 68.8% sensitivity, 89.5% specificity, 82.0% overall accuracy
- Failure on two tests - most accurate and efficient for determining group membership (DCT and Warrington Words were the most efficient combination); failure on 3/4 or 4/4 did not increase predictive accuracy
- Specificity:
  - 41% of credible subjects failed 1, 5% failed 2, 1.5% failed 3, and 0 failed 4

Specificity rates with use of multiple PVTs:

- Vickery et al. (2004):
  - 3 of 3 indicators failed: 33% sensitivity, 100% specificity
- Sollman, Ranseen, and Berry (2010)
  - 1 of 4 indicators failed: 63% sensitivity, 83% specificity
  - 3 of 4 indicators failed: 47% sensitivity, 100% specificity
- Larrabee (2003):
  - 2 of 5 indicators (88% sensitivity and 94% specificity)
  - 3 of 5 indicators (51% sensitivity and 100% specificity)
- Giger et al. (2010):
  - 1 of 7 indicators failed: 95% specificity
  - 2 of 7 indicators failed: 100% specificity
- Meyers and Volbrecht (2003)
  - 2 of 9 indicators (83% sensitivity and 100% specificity)
- Chafetz (2011)
  - 3 of 4 indicators (100% specificity)

Specificity rates with use of multiple PVTs:

- Schroeder and Marshall (2011)
  - 2 of 7 indicators (93% to 95% specificity)
  - 3 of 7 indicators (100% specificity)
- Larrabee (2014)
  - 3 of 7 indicators (94% specificity)
  - 4 of 7 indicators (100% specificity)
- Davis and Millis (2014)
  - 2 of 7 indicators (85% specificity)
  - 3 of 7 indicators (97% specificity)
  - 4 of 7 indicators (100% specificity)
- Dean et al. (2008)
  - With IQ $\geq$80, failure on >1 PVTs (out of $\leq$ 8) is unusual

PVTs failed by IQ band in heterogeneous neuropsychological clinic patients with no incentive to feign:

FSIQ band	n	Mean failed	range	Mean %
50-59	3	4.0	1-6	60%
60-69	12	2.9	1-6	44%
70-79	48	1.1	0-4	17%
80-89	44	.5	0-4	8%
90-99	39	.3	0-2	7%
100-109	27	.2	0-1	4%
110-119	11	.4	0-2	6%
≥120	5	.2	0-1	5%

How to limit false positive identifications:

- Administer several PVTs
  - Failure on increasing number of indicators does not increase sensitivity, but does increase specificity
    - i.e., when tests are very easy, failures are not likely to occur even with increasing numbers of tests administered

- Larrabee (2008)
  - the likelihood of obtaining a false determination of malingering *decreases* with *each subsequently failed PVT*
    - Chaining of likelihood ratios showed increase in probability of malingering
      - .713 to .837 for 1 failed PVT
      - .936 to .973 for 2 failed PVTs
      - .989 to .995 for 3 failed PVTs
  - Subsequently corroborated by Meyers et al. (2014)

- Meyers et al. (2014)
  - as the average base rate of invalid performance increases,
    - the number of failed PVTs needed to detect invalid performance decreases:
      - For example, an invalid performance base rate of 0.10 would require three failures for the probability of having invalid data to be over .90,
      - but with an invalid performance base rate of 0.6 or higher, only one PVT failure would be needed for the probability of having invalid data to exceed .90, using a test with a sensitivity of 0.70 and specificity of 0.90

Is number of PVTs a concern? (i.e., are there ever "too many"?)

- Probably not
  - Davis and Millis (2014)
    - number of PVTs failed and the number administered showed a small non-significant correlation: rs = .13, p = .10
    - Number of PVTs administered was not a significant predictor of number of PVTs failed

Are some groups at risk for PVT failure despite best effort?

- As discussed above, multiple failures ($\geq$3) on PVTs virtually never occur in credible populations, however, there are two noteworthy exceptions:
  - individuals with dementia and individuals with very low intellectual scores (FSIQ <70)
    - Dean et al. (2009) reported that in individuals with diagnosed dementia
      - 36% of PVTs were failed in those patients with MMSE >20
      - 47% of PVTs were failed when MMSE scores were 15 to 20
      - 83% of PVTs were failed with MMSE <15

- Similarly, Dean et al. (2008) reported that in neuropsychology clinic patients
  - with an IQ range of 60-69, 44% of administered PVTs were failed
  - with an IQ range of 50-59, 60% of PVTs were failed
- Performance validity indicators are based on the premise that simple tasks which appear relatively difficult will be passed by actual patients with brain injury, but failed by noncredible test takers
  - However, in patients with dementia or low IQ, many "simple" tasks are in fact difficult
- The question then arises as to how to arrive at an accurate differential diagnosis of actual versus feigned dementia or intellectual disability

Approach for protecting low IQ groups from false identification as noncredible

- Smith et al. (2014)
  - Credible patients with IQ $\leq$75 (n = 55)
  - Noncredible patients (n = 383) and subset with IQ $\leq$75 (n = 74)
    - Entire noncredible group > low IQ credible group
      - on verbal crystallized intelligence/semantic memory
      - manipulation of overlearned information
    - Low IQ credible group > entire noncredible group
      - many processing speed and memory tests
    - Low IQ credible group > noncredible group with low IQ scores
      - virtually all domains (attention, visual perceptual/spatial tasks, processing speed, verbal learning/list learning, and visual memory)

- With cut-offs set to maintain approximately 90% specificity:
  - Sensitivity rates in identifying noncredible subjects with low IQ scores were highest for
    - verbal and visual memory (mainly recognition)
      - Test of Memory Malingering (Trials 1 and 2) = 58% to 73%
      - Warrington Words (correct and time) = 41% to 64%
      - Rey Word Recognition Test total = 63%
      - RAVLT (Effort Equation, Trial 5, total across learning trials, short delay, recognition, and RAVLT/RO discriminant function = 41%-53%)
      - WAIS-III Digit Symbol recognition = 49%
    - select attentional scores
      - b Test omissions = 43%
      - time to recite 4 digits forward (WAIS-III Digit Span) = 45%

Cut-offs for the most sensitive tests

- b test # of omissions ≥ 46
- Digit Span four-digit time ≥ 4”
- Digit Symbol Recognition score ≤ 4
- RAVLT trial 5 ≤ 6
- RAVLT Effort Equation ≤ 7
- Rey Word total correct ≤ 7
- Warrington total score ≤ 38

- When failure rates were tabulated across seven most sensitive scores (>40%),
  - $\geq$ 2 failures was associated with 85.4% specificity and 85.7% sensitivity
  - $\geq$ 3 failures resulted in 95.1% specificity and 66.0% sensitivity

Table 5. Frequency of failures on most sensitive scores (≥ 40%) in credible and non-credible (FSIQ ≤ 75) participants

Number of tests failed	Credible (n = 41)	Non-credible low IQ (n = 56)
0	26	2
1	9	6
2	4	11
3	1	15
4	0	10
5	1	9
6	0	2
7	0	1

Approach to protecting groups at risk for PVT failure

- 1) Adjust individual cut-offs to achieve approximately 90% specificity in the target group
- 2) Tabulate number of failures
  - Increasing numbers of failures most likely due to feigning

Case: Actual versus Feigned Low IQ

- *24-year-old patient sustained massive injuries 3 ½ years prior to exam when he ran in front of a car in an apparent suicide attempt during an acute psychotic episode*
  - *In the hospital ED the patient was noted to be awake and moaning with eyes open, and trying to sit up; Glasgow Coma Scale was rated at 10 (4-4-2). Neurologic exam was grossly non-focal with movement in all extremities. The patient was intubated and sedated with GCS of 3.*
  - *He was found to have sustained multiple fractures, including multiple facial fractures and a fracture at the base of the skull, as well as fractures of his pelvis, left hip, left leg, left arm, and lower spine and rib.*

Case: Actual versus Feigned Low IQ

- *Brain CT did not show intracranial lesions but did reveal a small amount of blood in the posterior horns of the lateral ventricles.*
- *During his hospitalization the patient was described as making "steady improvement" and that he had "recovered his mental status." He indicated that he did not recall running in front of the car, and his first recollection following the injury was of awakening in the hospital and thinking he was "dreaming."*
- *Six weeks after injury he was transferred to a subacute facility for ongoing physical therapy and occupational therapy; discharge diagnoses included paranoid schizophrenia and cerebral concussion.*

Case: Actual versus Feigned Low IQ

- *The family filed a lawsuit alleging that the patient exhibited reduced cognitive function secondary to a significant brain injury incurred at the time of injury.*
- *When asked whether he was experiencing problems in thinking skills related to the accident, the patient responded that he did not know.*
- *When asked as to psychiatric symptoms stemming from the accident, the patient indicated that he was "more cautious;" he denied depression or anxiety, and stated that he did not know if he was experiencing changes in sleep or appetite.*
- *When asked as to current physical problems he related to the accident, he initially only reported left leg pain/dysfunction and missing teeth, but when specifically queried, he admitted that he could not extend the fingers of his left hand, and that he had "a little bit of pain" in his back.*

Case: Actual versus Feigned Low IQ

- *Educational, Linguistic, and Psychosocial Background:*
  - *The patient spoke English as a second language; he learned English when he entered school at age 5. He spoke Spanish to his parents, and was spoke Spanish and English to his siblings.*
  - *He performed very poorly in school, began receiving special education services in the 4^{th} grade, and did not begin reading until 5^{th} or 6^{th} grade. He reportedly had difficulty playing sports because "he didn't understand the rules."*
  - *He had never lived independently from his family, and had never held employment, never obtained a drivers license, had never had a romantic relationship, and was described as socially isolated throughout his schooling.*

Case: Actual versus Feigned Low IQ

- *Psychiatric History:*
  - *His first psychotic episode began approximately four months prior to the injury, and was characterized by isolating himself and locking himself in his room, not communicating with family members, and attempting to run away.*
  - *He was psychiatrically hospitalized, during which time he was described as confused and disoriented, responding to internal stimuli, selectively mute, and aggressive toward staff and patients, and with numerous bizarre behaviors (holding his ears while screaming, taking off his clothes, banging his head and punching himself, displaying waxy flexibility and posturing, and urinating and defecating on himself).*
  - *With treatment his acute symptoms resolved, and he was released to home, during which time the suicide attempt occurred.*

Case: Actual versus Feigned Low IQ

- *Medical History:*
  - *Records indicated some substance use, including marijuana.*
  - *He had been born prematurely (36 weeks) and had suffered from jaundice.*
  - *At the age of 14 months he was observed to have episodes of briefly "passing out," and the differential diagnosis included absence seizures.*
  - *He had sustained a previous concussion at the age of 17/18.*
  - *Family medical history was noteworthy for seizures in two siblings, and possible psychosis in a brother.*

Neuropsychological Exam

- *Behavioral Observations:*
  - *He presented as "young" and immature, and he was friendly but socially awkward and shy, and he laughed nervously at times.*
  - *He did not appear to be acutely psychotic, however, on one task he stopped responding and appeared possibly to either have had an absence seizure or to be reacting to internal stimuli.*
  - *Responses were slowed.*
  - *Speech was noteworthy for softspokenness, mumbling, and articulation errors ("sloppy" s's); the latter appeared related to missing teeth rather than to dysarthria.*
  - *Thought processes were grossly within normal limits, but the patient displayed a knowledge deficit (e.g., for aspects of his medical history, symptoms, and treatment) which appeared to be related primarily to low intelligence. He counted on his fingers when solving math problems.*

Neuropsychological Exam

Intellectual Scores (WAIS-III)

FSIQ:	75; 5th %
VIQ:	80; 9th %
VCI:	80; 9th %
PIQ:	74; 4th %
POI:	80; 9th %
Individual subtests:	
Vocabulary:	6; 9th %
Picture Completion:	4; 2nd %
Similarities:	8; 25th %
Digit Symbol:	3; 1st %
Arithmetic:	5; 5th %
Block Design:	6; 9th %
Digit Span:	6; 9th %
Matrix Reasoning:	10; 50th %
Information:	8; 25th %

Neuropsychological Exam

Information Processing Speed		***PVT***	
b Test			Roberson et al. (2012)
E-score	70	passed	
Omissions	9	passed	
Commissions	0	passed	
Time	15'02"	***failed***	
Dot Counting Test			Boone et al. (2002)
E-score	20	***failed***	
Grouped dot time	7.5"	***failed***	
Ungrouped dot time	11.5"		
Errors	1	passed	
Trails A	64"; <1st %	***failed***	Iverson et al. (2002)
Stroop A			Arentsen et al. (2013)
Word Reading	76"; <1st %	***failed***	
Color Naming	126"; <1st %	***failed***	
Digit Symbol			Kim, N., et al. (2010)
ACSS	3; 1st %	***failed***	
Recognition equation	-98	***failed***	
Recognition total	5	***failed***	
Attention			
Digit Span			Babikian et al. (2006)
ACSS	6; 9th %	passed	
Reliable Digit Span	7	passed	
Mean 3-digit time	1"	passed	
Mean 4-digit time	2"	passed	

Neuropsychological Exam

Language			
Vocabulary (ACSS)	9; 9th%		
Visual Perceptual/Spatial Skills			
WAIS-III Picture Completion			Solomon et al. (2010)
ACSS	4; 2nd %	***failed***	
Most Discrepant Index	2	***failed***	
WAIS-III Block Design (ACSS)	6; 9th %		
WAIS-III Matrix Reasoning (ACSS)	10; 50th %		
Rey Complex Figure			Reedy et al. (2012)
Copy	26; <1st %	***failed***	

Executive	
Wisconsin Card Sorting Test	6 categories; WNL
Similarities (ACSS)	8; 25th %
Stroop Interference	174"; <1st percentile
Trails B	210"; <1st percentile
Academic Skills:	
WRAT-4 Word Reading (SS):	77; 6th %
WRAT-4 Spelling (SS):	82; 12th %
WRAT-4 Math (SS):	74; 4th %

Neuropsychological Exam

Memory – Verbal			
WMS-III Logical Memory			Bortnik et al. (2010)
I (raw)	34; 25th %	passed	
II (raw)	17; 9th %	passed	
Recognition	19	***failed***	
Effort equation	45.5	passed	
Rey Auditory Verbal Learning Test			Boone et al. (2005)
Total	27	***failed***	
Trial 1	4; <1st %		
Trial 2	5; <1st %		
Trial 3	5; <1st %		
Trial 4	6; <1st %		
Trial 5	7; 1st %	***failed***	
List B	4; 8th %		
Short delay	3; <1st %	***failed***	
Long delay	2; <1st %	***failed***	
Recognition	8(1 FP)<1st %	***failed***	
Effort equation	10	***failed***	
Rey Word Recognition	9	passed	Bell-Sprinkel et al. (2012)
Warrington Recognition Words			Kim, M., et al. (2010)
Total correct	49	passed	
Recognition time	173"	passed	
Memory - Visual			
Rey Complex Figure			Reedy et al. (2010)
3-minute delay	9.5; <1st %	***failed***	
Recognition correct	2.0; <1st %	***failed***	
Effort equation	32	***failed***	
Rey 15-item			Poynter et al. (2014)
Recall	12	passed	
Recognition correct	14	passed	
Combination score	26	passed	
Test of Memory Malingering			
Trial 1	48	passed	Denning (2012)

Neuropsychological Exam

- PVT Scores:
  - *The patient failed PVTs from 9 of 14 separate tests using published cut-offs,*
    - *which in most cases would suggest that he was not performing to true ability.*
  - *However, overall IQ score was low (FSIQ = 75), and judged accurate (rather than as reflecting negative response bias) because it was consistent with very poor premorbid academic and social function*

Neuropsychological Exam

- PVT Scores:
  - *When the cut-offs adjusted for low IQ were employed for the seven tests found to be most sensitive in the differential of actual versus feigned low IQ per Smith et al. (2014), the patient passed all measures:*

- *b test omissions (cut-off ≥46) = 9 (passed)*
- *Digit Span four-digit time (cut-off ≥4") = 2" (passed)*
- *Digit Symbol Recognition correct score (cut-off ≤4) = 5 (passed)*
- *RAVLT trial 5 (cut-off ≤6) = 7 (passed)*
- *RAVLT Effort Equation (cut-off ≤7) = 10 (passed)*
- *Rey Word total correct (cut-off ≤7) = 9 (passed)*
- *Warrington total score (cut-off ≤38) = 49 (passed*

Neuropsychological Exam

- Personality Testing:
  - *MMPI-2-RF was invalid*
    - *due to a true response bias (TRIN-r = 80T) and failure to consistently comprehend the meaning of test items (VRIN-r = 82T) (despite administration through an audio version),*
      - *both found in individuals of low intelligence*

Case Conceptualization

- *1) The patient was judged to have most likely performed to his true ability level , and scores on standard neurocognitive scores were considered to reflect true skill level.*
- *2) Neurocognitive scores were interpreted as showing*
  - *substantial impairments in processing speed and visual memory*
  - *impaired to average skills in visual perceptual/spatial skills, verbal memory, and executive functions*
  - *borderline to low average academic skills (word reading, spelling math)*
  - *low average vocabulary range and basic attention.*

Case Conceptualization

- *3) The cause of the lowered cognitive function was judged to be multi-determined:*
  - *The patient's very poor performance in school in all subjects starting in early grades suggested that he had a longstanding developmental intellectual disability.*
  - *Additionally, when patients with schizophrenia have their first psychotic episode, cognitive function typically drops and then stabilizes (Goldberg et al., 1993). Thus, the patient likely experienced a decline in cognitive ability at the onset of his psychotic disorder in the months before the accident.*
  - *The patient's English as a second language status probably contributed to a mild lowering of scores on language-related tasks administered in English (Boone et al., 2007; Razani et al., 2006).*

Case Conceptualization

- 4) The patient was considered not likely to have any current cognitive sequelae related to the injury 3½ years earlier.
  - The available data suggested that the patient most likely met criteria for a mild traumatic brain injury
    - Records from his hospitalization referred only to a "cerebral concussion," and brain imaging was normal.
    - It is unclear whether the patient was rendered unconscious; in the emergency department he was described as awake and moaning with eyes open, and was trying to sit up.
    - He initially had Glasgow Coma Scale of 10, which normally would fall within the moderate traumatic brain injury category, although it is unclear whether the patient's extensive orthopedic injuries contaminated the ratings. Further, he was described as "confused/disoriented" (score of 4 on verbal response section of the Glasgow Coma Scale), but this was also likely true prior to the suicide attempt due to his severe psychosis.
    - Anterograde amnesia could not be reliably assessed due to sedation after the injury.

Case Conceptualization

- 4) (cont'd) Reviews of the literature on neuropsychological function in mild traumatic brain injury (see Carroll et al., 2004, 120 studies; Dikmen et al., 2009, 33 studies), including 6 meta-analyses involving dozens of studies and thousands of patients in the aggregate (133 studies, n = 1463, Belanger et al., 2005; 21 studies, n = 790, Belanger & vanderploeg, 2005; 8 studies, Binder et al., 1997; 17 studies, n = 634, Frencham, Fox, & Maybery, 2005; 25 studies, n = 2828, Rohling et al., 2011; 39 studies, n = 1716, Schretlen & Shapiro, 2003)
  - show that patients who experience mild brain trauma have returned to baseline by weeks to months post-injury.

- At the time of testing the patient was more functional than prior to the suicide attempt; for example, the patient's sister reported that he was now responding verbally to the family member's questions, whereas prior to the injury he did not.

Case Conceptualization

- *Concluded that the patient had*
  - *a longstanding, developmental intellectual disability*
  - *as well as a chronic psychotic disorder*
- *that were unchanged by the suicide attempt and related injuries 3½ years prior to exam, and that the patient had no current cognitive or psychiatric conditions stemming from that event*

Future Directions

- A critical goal within clinical neuropsychology is to quickly develop methods that adequately protect credible patient subgroups who are at risk for being inaccurately determined to be malingering or otherwise not performing to true ability.
  - One such method for protecting patients with low IQ was described (i.e., adjusting cut-scores to maintain $\geq$90% specificity in low IQ populations, then tabulate the number of failures)
  - Memory (especially recognition) and attentional measures appear to be most robust to low intelligence (Smith et al., 2014), and these are likely to show the most promise in differentiating actual versus feigned low IQ

Future Directions

- Qualitative aspects of some memory recognition tasks may reveal error types not found in individuals with low IQ (thereby specific to noncredible performance)
  - E.g., Marshall and Happe (2007) indicated that it was rare for subjects with low IQ to produce "dyslexic" false positive errors on the Rey 15-item recognition trial
- Significantly below chance performance on forced choice measures would not be explainable on the basis of low IQ
- Novel techniques may be worth pursuing
  - E.g., developing measures that assess for a "yes" response bias (exhibited by individuals with IQ, but not necessarily adopted by noncredible individuals attempting to feign low IQ), such as on the Logical Memory recognition trial (Marshall & Happe, 2007).

Case: Actual versus Feigned Dementia

- *69-year-old patient with 8 years of education and subsequent attainment of a GED*
- *Sustained at most a mTBI in a motor vehicle accident 5 years prior to evaluation*
  - *self-extricated at the scene and was standing at the accident site upon arrival of emergency medical personnel*
  - *alert and oriented with no loss of consciousness (GCS was 15), although subsequently he displayed some mild confusion and was amnestic for the event*
  - *brain CT was normal, but brain MRI obtained two days later showed an area of acute infarction/ischemia in the left basal ganglia and left cerebral peduncle region, as well as mild atrophy with mild nonspecific periventricular and deep white matter changes judged likely related to chronic ischemic white matter disease*
  - *discharged to home after three days*

Case: Actual versus Feigned Dementia

- *The patient filed a lawsuit alleging reduced cognitive function secondary to*
  - *direct effects of traumatic brain injury*
  - *effect of stroke which was claimed as caused by the traumatic brain injury*

  and which precluded him from returning to work as a taxi driver
- *Claimed symptoms reported at the time of evaluation included*
  - *decline in memory*
  - *reduced balance*
  - *back and right leg pain and pain at hand fracture site*
  - *periodic headaches*
  - *insomnia*
  - *depression and anxiety*
- *He resided with his wife and adult daughter, and no concerns were expressed regarding his ability to function within the community; he had an active driver's license*

Previous Relevant History

- *Medical history was rather extensive, including*
  - *chronic hypertension (with associated borderline hypertrophy on echocardiogram and calcification of the aorta)*
  - *high cholesterol*
  - *elevated blood sugar levels*
  - *low testosterone*
  - *possible sleep apnea*
  - *lengthy smoking history*
  - *treatment for GI cancer in the year prior to the accident including six months of chemotherapy*
  - *chronic depression*
  - *thyroid and parathyroid dysfunction*
  - *possible excessive alcohol use (current use of 2 glasses of wine 3 to 4 nights per week)*
  - *had performed poorly in school due to difficulty "concentrating," but he stated that he did not know whether he had an actual learning disability or attention deficit disorder*

Neuropsychological Exam

- *Behavioral Observations:*
  - Speech characteristics were unremarkable
  - No cognitive abnormalities were noted in spontaneous interactions; the patient was able to provide a full history and thought processes were organized and relevant
  - He worked on tasks in a focused manner and efficient manner (he completed the MMPI-2-RF quickly), and he displayed no confusion regarding test instructions
  - He initially presented as irritable. Mood appeared to be depressed
  - He used his fingers in a dexterous manner
  - No signs of fatigue or physical discomfort were observed during the several hour exam

Neuropsychological Exam

			PVT	
Gross Cognitive Function				
Mini-Mental State Exam	19 (out of 29 possible)			
Information Processing Speed			***PVT***	
b Test				Roberson et al. (2012)
E-score	102		***failed***	
Omissions	55		***failed***	
Commissions	0		passed	
Time	11'47"		***failed***	
Dot Counting Test				Boone et al. (2002)
E-score	31		***failed***	
Grouped dot time	12.5"		***failed***	
Ungrouped dot time	13.0"			
Errors	5		***failed***	
Trails A	79"	$<1^{st}$ %	***failed***	Iverson et al. (2002)
Stroop A (Word Reading)	2'29"	$<1^{st}$ %	***failed***	Arentsen et al. (2013)
Digit Symbol				Kim, N., et al. (2010)
ACSS	5	5^{th} %	passed	
Recognition equation	8		***failed***	
Recognition total	4		***failed***	
Attention				
Digit Span				Babikian et al. (2006)
ACSS	6	9^{th} %	passed	
Reliable Digit Span	7		passed	
Mean 3-digit time	4"		***failed***	
Mean 4-digit time	16.5"		***failed***	
Language				
Boston Naming Test	32	impaired	***failed***	Whiteside et al. (under submission)
Visual Perceptual/Spatial Skills				
WAIS-III Picture Completion				Solomon et al. (2010)
ACSS	3	1^{st} %	***failed***	
Most Discrepant Index	0		***failed***	
Rey Complex Figure				Reedy et al. (2012)
Copy	12.5	$<1^{st}$ %	***failed***	

Neuropsychological Exam

Test	Score	Percentile	Result	Reference
Memory – Verbal				
WMS-III Logical Memory				Bortnik et al. (2010)
I (raw)	19	2nd %	***failed***	
II (raw)	9	9th %	***failed***	
Recognition	18	chance	***failed***	
Effort equation	36		***failed***	
Rey Auditory Verbal Learning Test				Boone et al. (2005)
Total	17		***failed***	
Trial 1	2	1st %		
Trial 2	4	2nd %		
Trial 3	3	1st %		
Trial 4	4	5th %		
Trial 5	4	1st %	***failed***	
List B	3	12th %		
Short delay	3	7th %	***failed***	
Long delay	3	22nd %	passed	
Recognition	3 (0 FP)	≤1st %	***failed***	
Effort equation	4		***failed***	
Rey Word Recognition	2		***failed***	Bell-Sprinkel et al. (2012)
Warrington Recognition Words				Kim, M., et al. (2010)
Total correct	19		***failed***	
Recognition time	399"		***failed***	
Memory - Visual				
Rey Complex Figure				Reedy et al. (2010)
3-minute delay	4.0	<1st %	***failed***	
Recognition correct	3.0	<1st %	***failed***	
Effort equation	21.5		***failed***	
Rey 15-item				Poynter et al. (2014)
Recall	6.0		***failed***	
Recognition correct	6.0		***failed***	
Combination score	12.0		***failed***	
Test of Memory Malingering				
Trial 1	21		***failed***	Denning (2012)
Motor Dexterity				
Tapping				Arnold et al. (2005)
Dominant	19.0	<1st %	***failed***	
Nondominant	16.3	<1st %	***failed***	

Neuropsychological Exam

Scale	Score	Interpretation
Personality Function		
MMPI-2-RF		
Validity Scale		
VRIN-r	39T	low
TRIN-r	73F	Within normal limits
F-r	65T	Within normal limits
Fp-r	59T	Within normal limits
Fs	66T	Within normal limits
FBS-r	67T	Within normal limits
RBS	67T	Within normal limits
L-r	62T	Within normal limits
K-r	48T	Within normal limits
Elevated Scales		
RC1	77T	
RC2	95T	
MLS	81T	
HPC	72T	
NUC	86T	
HLP	79T	
STW	65T	
MSF	65T	
IPP	68T	
SAV	75T	
INTR-r	93T	

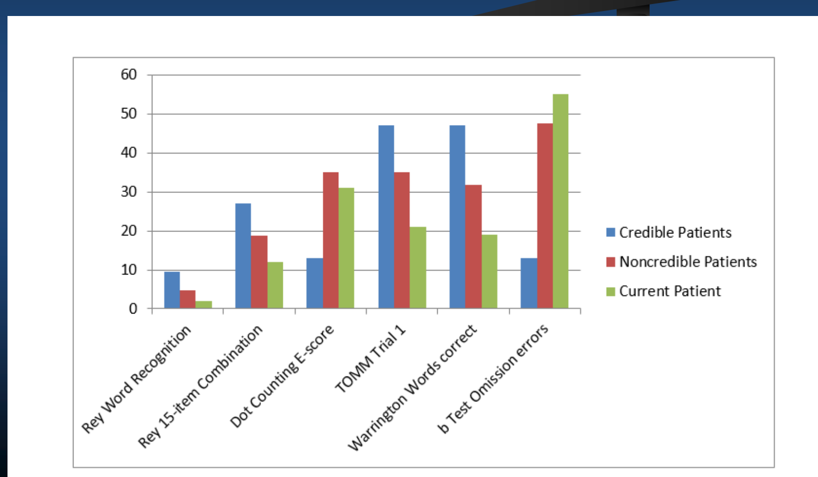
Neuropsychological Exam

The patient failed 100% of PVTs administered (15 of 15 separate tests)

- the graphs below contrast the patient's PVT scores against mean scores for credible and noncredible groups:

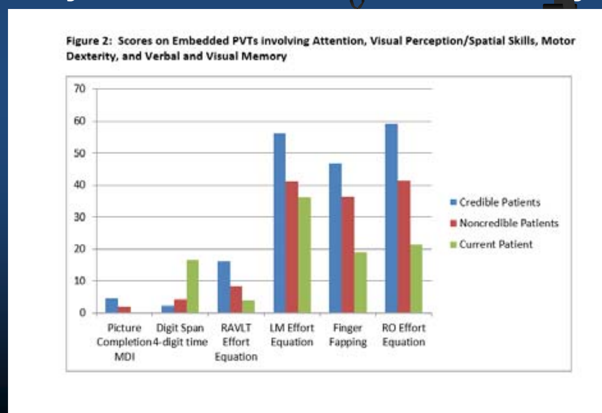
Neuropsychological Exam

- **Figure 1: Scores on Free-Standing PVTs**



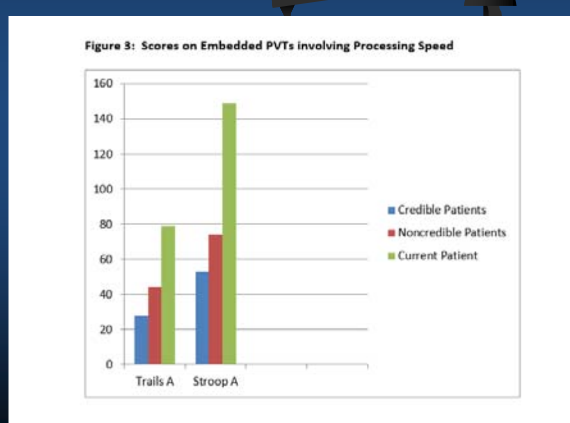
Neuropsychological Exam

- **Figure 2: Scores on Embedded PVTs involving Attention, Visual Perception/Spatial Skills, Motor Dexterity, and Verbal and Visual Memory**



Neuropsychological Exam

- **Figure 3: Scores on Embedded PVTs involving Processing Speed**



Neuropsychological Exam

- Personality Testing
  - Validity Scales:
    - No significant under- or over-report
  - Substantive Scales:
    - Elevated on Somatic Complaints (RC1, Somatic/Cognitive), Depression-related (EID, RC2, Helplessness/Hopelessness, Social Avoidance, Interpersonal Passivity, PSY-5 Introversion/Low Positive Emotionality – revised), and worry-related (Stress/worry, multiple specific fears) scales

Neuropsychological Exam

- Results of neurocognitive testing revealed
  - impaired scores in finger dexterity, visual perceptual/spatial skills, visual memory, and word retrieval
  - impaired to borderline scores in processing speed
  - impaired to low average scores in verbal memory
  - low average performance in basic attention
- In a test taker in the patient's age range who has documented evidence of small strokes and multiple medical illnesses, the question arises
  - as to whether he has developed cognitive deterioration to the level of a dementia
  - and if this accounts for the widespread PVT failures

Differential Diagnosis of Actual versus Feigned Dementia

The determination as to whether a patient's performance validity failures reflect noncredible performance versus the effects of an actual dementia is made by examining

- 1) the patient's functionality in activities of daily living (ADLs) to see if it is consistent with dementia
- 2) the patient's test scores versus spontaneously displayed skills for evidence of consistency of impairment
- 3) whether performance on PVTs matches that expected for dementia
- 4) whether the patient still fails PVTs when cutoffs are selected that adequately protect against false positive identifications of malingering in credible dementia patients

Differential Diagnosis of Actual versus Feigned Dementia

As outlined below, the evidence in the current case indicated that

- the patient did not in fact have a dementia
- his neuropsychological test performance was noncredible

Differential Diagnosis of Actual versus Feigned Dementia

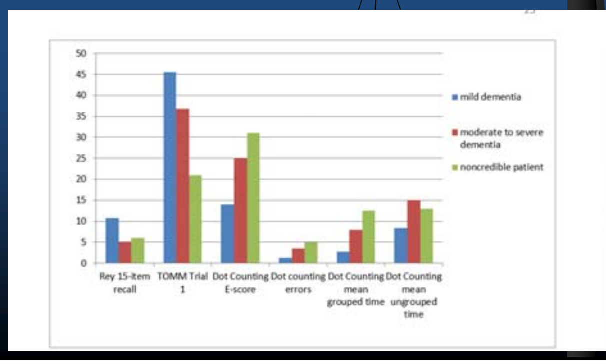
- **A. Evidence from PVT performance:**
  - 1) patient obtained a MMSE score of 19 (out of 29 possible points), which would suggest a mild/moderate dementia. Yet, he failed 100% of PVTs administered, which is markedly higher than that expected for this MMSE score
    - Dean et al. (2009) found that with a MMSE score of 15 to 20, an average of 47% of PVTs are failed (in contrast to 36% with MMSE score of >20, and 83% with MMSE scores <15)
  - 2) The only PVT employed in the Dean et al. (2009) study that maintained 90% specificity in dementia at published cut-offs was
    - mean time to recite 4 digits on forward Digit Span (cut-off $\geq$4”)
      - the patient’s score markedly exceeds this cut-off (16.5”)

Differential Diagnosis of Actual versus Feigned Dementia

- **A. Evidence from PVT performance:**
  - 3) When cut-offs were adjusted per the Dean et al. (2009) study to maintain a <10% false positive rate in dementia patients,
      - the patient still failed the Warrington Words (cut-off <26), finger tapping dominant hand (cut-off <21), and Rey Word Recognition (cut-off <5)
  - 4) On a forced choice measure (Warrington – Words), the patient obtained a score significantly below chance (19/50)
      - This performance would suggest that the patient knew correct answers that he did not provide
        - in contrast to patients with significant dementia (i.e., who have little to no ability to learn new information), and who would be expected to perform at worst at chance levels on the test

Differential Diagnosis of Actual versus Feigned Dementia

- **A. Evidence from PVT performance:**
  - 5) As shown below
    - scores on the Dot Counting Test, Rey 15-item total recall, and TOMM Trial 1 were worse than mean scores obtained by patients with mild dementia
    - most scores (with the exception of Rey 15-item recall and mean ungrouped dot counting time) were worse than mean scores obtained by patients with moderate to severe dementia who were residing in a locked residential facility



Differential Diagnosis of Actual versus Feigned Dementia

- **B. Mismatch between Test Scores and Demonstrated Functionality:**
  - 6) He was able to provide detailed information regarding the accident and his symptoms/treatment in his deposition and on interview, and showed no memory lapses in his interactions with the examiner (e.g., did not re-ask questions already asked, did not require test instructions be repeated, etc.),
    - behaviors which would be inconsistent with his dementia-level word recall scores on the RAVLT
  - 7) He scored below chance levels on one forced choice recognition memory test,
    - arguably performing worse than a blind person (who would be predicted to perform at chance levels)

Differential Diagnosis of Actual versus Feigned Dementia

- **B. Mismatch between Test Scores and Demonstrated Functionality:**
  - 8) His very low scores on measures of visual perceptual/constructional skills, visual memory, and processing speed would likely preclude ability to drive,
    - yet he was driving at the time of the exam
  - 9) His low confrontation naming score (Boston Naming = 32/60) would be indicative of a significant word-retrieval difficulty,
    - yet no such expressive language difficulties were observed in spontaneous speech
  - 10) He obtained very low finger tapping scores
    - yet used his fingers normally during the exam (to turn booklet pages, hold and use a pen, etc.), and did not report dysfunction of his fingers when asked regarding physical symptoms

Differential Diagnosis of Actual versus Feigned Dementia

- **B. Mismatch between Test Scores and Demonstrated Functionality:**
  - 11) He made excessive errors in counting, a pre-school level skill,
    - but in his deposition he was able to provide detailed information regarding the amount and source of his income
  - 12) He scored within the markedly impaired range in rapid word reading,
    - yet he was able to complete the 338-item MMPI-2-RF in under an hour (normal)
  - 13) No significant over-report was documented on MMPI-2-RF validity scales,
    - however, of note, he obtained a below average score on VRIN-r (39T), which measures consistency in answering similar sets of items. His low score, reflecting more carefulness and consistency in responses than the typical test taker, would not be likely in an individual with actual dementia

Differential Diagnosis of Actual versus Feigned Dementia

- **C. Marked Inconsistency in Test Scores Across Cognitive Exams**
  - 14) Three years prior to current testing the patient scored in the high average range on a visual spatial reasoning task,
    - in contrast to the impaired scores obtained on current testing
  - 15) Two years prior to current exam the patient scored in the average range in processing speed,
    - in contrast to the borderline to impaired scores obtained on current exam

Differential Diagnosis of Actual versus Feigned Dementia

- **C. Marked Inconsistency in Test Scores Across Cognitive Exams**
  - 16) Six months prior to current exam the patient scored in the average range on visual memory testing,
    - in contrast to the impaired visual memory scores observed on current testing
  - 17) MMSE scores were widely discrepant across evaluations by different neurologists: one to two years after the accident the patient was described as displaying intact memory and concentration;
    - the following year MMSE scores ranged from 15 to 18, but rose to 25 the year after that
  - 18) Particularly poor finger tapping performance was documented on current exam and two years previously,
    - but no neurologist or other physician had reported dysfunction of the patient's fingers

PVT cut-scores that do not require adjustment for dementia:

- In the Dean et al. (2009) study,
  - mean time to recite 4 digits in forward order on Digit Span maintained 90% specificity at established cut-offs in 48 dementia patients,
    - although sensitivity has been reported as low (28% to 37%; Babikian et al., 2006)
  - specificity for finger tapping cut-offs was low in the overall sample of 55 dementia patients, but was 100% in subgroups of patients with Alzheimer's disease and frontotemporal dementia (but only 43% in vascular dementia), although subgroup n's were small.
    - Sensitivity levels for dominant finger tapping cut-offs are at least moderate (50% to 61%; Arnold et al., 2005)

PVT cut-scores that do not require adjustment for dementia:

- In the Rudman et all. (2011) study,
  - 100% specificity in 42 patients with "working age" dementia (diagnosed prior to age 65) was observed for the discrepancy between grouped and ungrouped dot counting times on the Dot Counting Test
    - failure was defined as total ungrouped dot counting time < total grouped dot counting time
  - Although sensitivity rate is unknown (in current patient, mean grouped time was 12.5" and mean ungrouped time was 13.0")

Additional Techniques

- In addition to the performance validity scores employed in the above case (e.g., 4-digit forward span time, TOMM Trial 1, Dot Counting Test, Rey Word Recognition, Warrington Recognition Test - Words),
  - other techniques have been investigated and/or appear to have promise in discriminating actual versus feigned dementia:

- 1) A "severe impairment profile" on the Medical Symptom Validity Test (Green, 2004) can be used to flag patients with actual severe cognitive dysfunction and thereby reduce the test false positive rate in these patients
  - E.g., Howe and Loring (2009) reported a 94% specificity rate in 52 dementia patients using this algorithm
    - However, Chafetz and Biondolillo (2013) showed that noncredible patients can easily produce the severe impairment profile, and others have argued that the requirement that the severe impairment profile only be considered if there is a probability that the patient has true impairment is circular (Axelrod & Schutte, 2010)

- 2) Likewise, a "genuine memory impairment profile" (GMIP) has been developed to reduce false positive rates on the Word Memory Test (WMT) in patients with significant memory deficits
  - Martins and Martins (2010) showed a high false positive rate on the WMT in 21 patients diagnosed with Mild Cognitive Impairment (67%)
    - Which was reduced to 5% using the GMIP, while still maintaining 85% sensitivity in identifying simulators
  - However, little data are available regarding sensitivity rates in "real world" noncredible subjects when the GMIP is used
    - Of concern, the WMT was been found to have a 68.4% specificity rate in a criminal forensic population; use of the GMIP increased specificity to 94.7%, but sensitivity declined to 56.1% (Fazio, Sanders, & Denney, 2015)

- 3) Forced choice "Coin-in-the-Hand" Test (the examiner holds a coin in 1 hand. After showing the coin to patients for approximately 2 seconds, the examiner closes both hands and asks the patients to close their eyes. With eyes closed, the patients are asked to count backward from 10 to 1 out loud and then to open their eyes and point to the hand that holds the coin. Ten trials are given, with the examiner alternating the coin from hand to hand according to standardized instructions)
  - Schroeder et al. (2012) tested 45 hospitalized patients with moderate to severe cognitive deficits (mean RBANS Global score = 1st percentile; mean MMSE score = 21.47)
    - > 1 error = 89% specificity
    - > 2 errors = 96% specificity
    - > 4 errors = 100% specificity (Dementia subtype was not related to test performance)
  - Rudman et al. (2011) observed lower specificity for this measure in 42 patients of varying types of dementia
    - > 2 errors = 88.1% specificity
  - In contrast, in simulators of memory impairment
    - > 2 errors = 80% sensitivity (Cochrane et al., 1998)
    - Mean error rate = 5.9/10 and only 1 scored above chance (Hanley et al., 1999)
    - Mean error rate = 3.47 (Kelly et al., 2005)

- 4) Yes/no recognition task (presentation of 20 unfamiliar faces, followed by a recognition trial in which the 20 faces are interspersed with 20 new faces, with the test taker instructed to report whether each face was previously seen)
  - in a small sample of dementia patients (n = 13) and suspected malingerers (n = 11), the dementia patients exhibited an inflated "yes" response bias, while the suspected malingerers displayed an increased "no" response bias (Schindler et al., 2013)
  - At a cut-off of 9 false negative responses, sensitivity was 54% and specificity was 100%

- 5) Word Completion Test
  - Hilsabeck and colleagues (2001) reported data for a PVT involving priming that requires test takers to complete word stems with previously studied words (Inclusion subtest),
    - and then after exposure to a new list of words, test takers are asked to complete word stems *without* using these latter words (Exclusion subtest)
  - Normal controls and a small group of memory disordered patients (n = 14), including two patients with dementia, used more list words on the first task than on the second,
    - while simulators showed the opposite pattern, obtaining a mean difference score that was negative

- 6) Tasks that rely on old, overlearned information and implicit memory (which are relatively intact in patients with dementia)
  - For example, Cuddy and Duffin (2005) reported spared recognition for music in a woman with advanced dementia (MMSE = 8) as measured by recognition of familiar from unfamiliar melodies, and detection of "wrong" notes in known melodies as well as distinguishing distorted versus correctly played melodies
  - Horton and colleagues (1992) observed that normal individuals and amnestic patients both showed typical priming effects on word or fragment completion tasks, in contrast to an amnesia simulation condition in which word completion rates were substantially below baseline performances

- Taken as a whole, the available literature suggests that following appear to show the most potential as PVTs in dementia populations:
  - brief forced choice tasks (preferably involving actual items rather than words or pictures)
  - time scores for simple tasks (number repetition and counting)
  - finger speed (except in vascular dementia patients)
  - implicit memory measures and those involving overlearned information
  - recognition techniques that capitalize on the "yes" response bias (found in dementia patients) versus the "no" response bias (that appears to characterize performance on noncredible test takers)

Severity of dementia requires consideration in that patients with mild dementia are consistently found to outperform patients with more severe dementia on virtually all PVTs (see Dean et al., 2009)

Impact of Non-English language status on PVT performance

- Despite the fact that 13% of the US population speaks Spanish in the home (38 million; Ryan, 2013), relatively few studies have validated PVTs in participants tested in Spanish
  - ≤44 credible mild traumatic brain injury patients of lower educational level tested in Spain administered the Dot Counting Test, b Test, Rey-15 item, TOMM, and Victoria Symptom Validity Test (Vilar-Lopez et al., 2008a,b)
  - 29 Spanish-speaking medical clinic patients of lower educational level in North Carolina administered the Dot Counting Test and Rey 15-item (Burton et al., 2012)
  - 130 Spanish-speaking normal controls in Texas administered the Rey 15-item (Strutt et al., 2011)

Impact of Non-English language status on PVT performance

- Robles et al. (2015) obtained PVT data on 65 male, young to middle-aged (range of 18-49), monolingual Spanish-speaking, day laborers recruited in Los Angeles (n = 65) and Guadalajara, Mexico (n = 50)
  - Exclusionary criteria included history of head trauma, neurological disorders, significant psychiatric history, learning disorder, and alcohol or drug abuse/dependence per participant report. Participants were provided $10 per hour for their participation.
- Data were collected on 4 PVTs:
  - Dot Counting Test
  - B Test
  - Rey 15-item plus recognition
  - Rey Word Recognition Test (translated)

Impact of Non-English language status on PVT performance

- The sample was divided into those with 0–6 years of education (n = 56) versus those with 7 to 10 years of education (n = 59) to allow development of cutoffs specific to educational level
  - Groups did not differ on Dot Counting Test scores, but those with lower education performed more poorly on
    - b Test E-score
    - Rey Word total correct
    - 3 Rey 15-item scores (combination score, recall intrusion errors, and recognition false positives)

Impact of Non-English language status on PVT performance

Cutoff scores associated with ≥90% specificity in current and validation/cross-validation samples

	Current sample (Education subgroups)		
Test scores	*0–6 years*	*7–10 years*	*Validation/cross-validation samples*
Dot Counting Test	n = 56	n = 59	n^a = 228
E-score	≥16 (91)	≥14 (90)	≥17 (91%)
Ungrouped time (in s)	≥9.0 (93)	≥6.5 (90)	
Grouped time (in s)	≥4.90 (91)	≥4.90 (90)	≥6 (93%)
Total errors	≥5 (92)	≥5 (93)	≥4 (92%)
Ungrouped	≥4 (92)	≥4 (91)	
Grouped	≥2 (94)	≥2 (95)	
b Test	n = 25	n = 40	n^b = 103
E-score	≥204 (92)	≥142 (90%)	≥82 (90%)
Total time (in s)	≥588 (92)	≥542 (90%)	≥682 (90%)
Omissions	≥100 (92)	≥63 (90%)	≥32 (90%)
Commissions	≥7 (92)	≥4 (93%)	≥3 (92%)
"d" Commissions	≥3 (92)	≥3 (93%)	≥1 (92%)
Rey 15-Item	n = 54–56	n = 59	n^c = 168
Combination score	≤10 (91)	≤18 (91%)	≤21 (92%)
Total recall	≤5 (93)	≤8 (90%)	≤11 (91%)
Recall intrusions	≥3 (93)	≥1 (93%)	≥1 (90%)
Recognition correct	≤4 (93)	≤8 (93%)	≤11 (91%)
Recognition false positives	≥4 (94)	≥2 (95%)	≥3 (93%)
Rey Word Recognition	n = 31	n = 19	n^d = 122
Total correct	≤4 (94)	≤7 (89%)	≤6 (89%)
Total false positives	≥4 (97)	≥4 (89%)	≥4 (90%)

Note. ≥90% Specificity in parentheses, in percentages.

Impact of Non-English language status on PVT performance

- As can be seen from the table, a majority of cutoffs had to be made less stringent to limit false-positive identifications to ≤10% with the exception
  - Rey Word Recognition false positives
  - Dot Counting E-score and grouped dot counting time
  - b Test total time
- In the more educated subgroup, no changes to cutoffs were needed for
  - Rey 15-Item recall intrusions and recognition false-positive errors
  - Rey Word Recognition total correct

Conclusions/Recommedations:

- Some PVT cutoffs that maintained approximately 90% or higher specificity in the current sample match, or are even more stringent than, those recommended for use in US test takers who are primarily Caucasian, are tested in English, and have higher educational levels, i.e.,
  - Rey Word Recognition correct false-positive errors
  - Rey 15-Item recall intrusions and recognition false positive errors
  - b Test total time
  - Dot Counting E-score and grouped dot counting time
- Thus, performance on these PVT variables appears relatively robust to cultural/language/educational factors, and these measures are particularly recommended for use when evaluating primarily Spanish-speaking individuals of lower educational level in the US and Mexico

Conclusions/Recommendations:

- In contrast, most previously published cutoffs for the Rey 15-Item (with the exception of false-positive errors on recognition) and b Test (excluding time scores) were associated with inadequate specificity rates in the current sample and require adjustment before they can be used in patients matching the demographics of the current sample.

Conclusions/Recommedations:

- Moderating effect of education:
  - Participants with 0 to 6 years of education scored worse than participants with 7 to 10 years of education on some verbal/visual memory and letter identification PVT scores
  - In contrast, the two groups generally scored comparably on processing speed and simple calculation PVT scores, but all PVT cutoffs required some adjustment in the lowest education group with the exception of
    - Dot Counting Test errors and grouped dot counting time
    - b Test "d" commission errors
    - Rey Word Recognition false-positive errors

Conclusions/Recommedations:

- Moderating effect of education:
  - These findings suggest that gross letter discrimination, ability to count, and recognition of limited verbal information are relatively impervious to formal educational level, and very low educational level would not likely account for performance below cutoffs on these PVT variables
  - Further, despite the fact that PVT cut-scores required further additional adjustment in participants with 6 or fewer years of education, some of the adjusted cutoffs were still equivalent to (or more stringent than) those recommended for use with primary English-speakers in the US with an average of 12 years of education
    - Dot Counting E-score and grouped dot counting time score
    - b Test total time
    - Rey Word Recognition false-positive errors

In conclusion

- The field of neuropsychology has made considerable strides in developing methods to accurately identify noncredible neurocognitive test performance
  - However, an important research focus in on perfecting techniques to protect groups at risk for false positive identification as noncredible
    - Available data on individuals with low IQ or dementia, and who speak Spanish and are of lowered educational level suggest that use of PVT subcomponents may be of more use than overall equation scores


Questions?
Comments?