Establishing Cut-off Scores for Embedded Performance Validity Measures among Collegiate Athletes

Samaritan Health Services

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BACKGROUND

Collegiate athletes undergo baseline as well as follow-up neuropsychological evaluation in order to objectively assess the presence and extent of concussion-related cognitive deficits, as well as inform treatment recommendations and the decision to return to competitive play (Harmon et al., 2013; Johnson, Kegal, & Collins, 2011; Moser et. al., 2007)

"Sandbagging" behaviors refers to intentional production of false or exaggerated cognitive and/or psychological impairments during baseline testing with the goal of appearing less impaired following a sports-related concussion and expediting their return to play (Echemendia et. al., 2013). Intentional poor performance on baseline testing complicates the interpretation of post-concussion testing and possibly place athletes at risk of experiencing more significant complications from subsequent concussions before fully recovering from prior injuries (Khurana & Kaye, 2012; Raab & Peak, 2018).

Despite public awareness of such behaviors, use of Performance Validity Tests (PVTs) in the field of sports neuropsychology is in its early stages. Although stand-alone PVTs have traditionally been used to assess credible performance, embedded PVTs may present a way to gauge performance validity throughout a test battery, without increasing the duration of the evaluation (Sawyer, Testa, & Dux, 2017).

The purpose of the present investigation is to determine the extent to which selected previously validated embedded PVTs can be used to determine valid performance during baseline neuropsychological evaluations among collegiate athletes.

METHODS

Study design: Retrospective analyses from an IRB approved repository

Inclusion criteria: (1) from the NCAA Division I athletes neuropsychological testing program; (2) complete at least 1 stand-alone PVT in the battery (i.e., TOMM); (3) must be at least 18 years of age and; (4) have the ability to consent and speak in English.

Scores were compared with Mann-Whitney U tests across embedded PVTs in the Hopkins Verbal Learning Test-Revised (HVLT-R), the Brief Visuospatial Memory Test-Revised (BVMT-R), the Trail Making Test (TMT), and FAS, along with Reliable Digit Span (RDS) and the Response Bias Scale (RBS). Valid performance was distinguished by performance on the Test of Memory Malingering (cut-off score of 45; powered at 80% at an alpha of 0.05 to detect medium effect size differences between groups; Cohen's d = 0.54).

RESULTS

The sample consisted of 205 participants who completed the TOMM, approximately 60% were female (n = 128) while the rest were male (n = 77). Participants' ages ranged from 18 to 24 years with a median age of 18. Majority of participants were White or Caucasian (61.9%) and most had at least 12 years of education (87.8%).

	Valid (N=177) TOMM ≥45	Invalid (N=28) TOMM <45	Effect Size (r)	FDR-corrected P-value[2]	AUC[3] (95% CI)
N	177	26			
Average HVLT Recog Raw (SD)	11.1 (1.0)	10.4 (1.7)	r= 0.16	0.07	0.37 (0.25-0.48)
N	174	28			
Average BVMT % Raw (SD)	97.0 (8.1)	92.3 (20.4)	r= 0.11	0.19	-
N	177	27			
Average TMT A (SD)	20.7 (5.8)	23.6 (9.4)	r= -0.08	0.36	-
N	176	27			
Average TMT B (SD)	54.0 (18.6)	56.0 (16.4)	r= -0.06	0.47	-
N	177	28			
Average FAS (SD)	40.7 (10.4)	34.8 (11.0)	r= 0.17	0.07	0.64 (0.53-0.75)
N	62	9			
Average RDS (SD)	9.4 (1.7)	10.3 (1.6)	r= -0.11	0.19	-
N	167	24			
Average RBS-t (SD)	52.4 (10.2)	53.1 (11.7)	r= 0.02	0.81	-

FAS Cutoff	Sensitivity	Specificity	PPV[1]	NPV[1]
≤25	0.07	0.95	0.18	0.87
≤26	0.11	0.94	0.23	0.87
≤27	0.21	0.92	0.30	0.88
≤28	**0.29**	**0.90**	**0.32**	**0.89**
≤29	0.29	0.88	0.27	0.89
≤30	0.29	0.84	0.22	0.88
≤31	0.39	0.79	0.22	0.89

Performance Validity Measures: (1) Test of Memory Malingering (TOMM; Tombaugh, 1996); (2) Advanced Clinical Solutions Word Choice Test (WCT; Pearson, Inc., 2009)

Executive Functioning Measures: (1) Trail Making Test, A&B (TMT; Schretlen, Testa, & Pearlson, 2010); (2) Controlled Oral Word Association Test, Phonemic Verbal Fluency (FAS; Tombaugh, Kozak, & Rees, 1999)

Learning and Memory Measures: (1) Brief Visuospatial Memory Test, Revised (BVMT-R; Schretlen, Testa, & Pearlson, 2010); (2) Hopkins Verbal Learning Test, Revised (HVLT-R; Schretlen, Testa, & Pearlson, 2010); (3) Reliable Digit Span for the Wechsler Adult Intelligence Scale (RDS; Wechsler, 1997a)

Symptom Validity Test: (1) Response Bias Scale for the Minnesota Multiphasic Personality Inventory (RBS; Gervais, Ben-Porath, Wygant, & Green, 2007)

CONCLUSIONS

- Validation efforts were positive and robust for the FAS embedded PVT to identify invalid performance across a collegiate athlete sample.
- By contrast, PVTs in the HVLT-R, BVMT-R, TMT, along with the RDS and RBS are not appropriate measures of valid performance among the college athlete population.
- Performance validity is not a static construct and should be captured by various validated tests across appropriately researched populations.

LIMITATIONS

- Retrospective study design and use of a non-normally distributed population
- Sample descriptors such as race, socioeconomic status, educational achievement was not included in statistical analysis
- We used a post-hoc subgrouping approach to only include valid performance on the TOMM and excluded a large number of individuals from the analyses where performance on the WCT was used to determine valid performance.

FUTURE IMPLICATIONS

- Further investigation of these embedded PVTs across populations is essential before use in clinical and nonclinical practice.
- More research is needed for identifying noncredible performance among a demographically diverse population, along with the use of stringent criterion for establishing validity groups.
- As there are limited tests developed to assess invalid test performance, there is an ongoing need to update and refine these measures to maintain the validity of these assessment techniques.

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