Investigations Into the Construct Validity of the Saint Louis University Mental Status Examination: Crystalized Versus Fluid Intelligence

Robert W. Wildman, II[1]. & William F. McDaniel[1]

General Abstract

Objective: The Saint Louis University Mental Status Examination (SLUMS) shows superior psychometric properties to other screening devices for dementia[4]. Since it is expected to be used for that purpose increasing in the future, it is important to investigate the construct validity of the SLUMS with respect to other more comprehensive psychological tests. The present investigations seek to present data relevant to both of these theoretical and clinical questions.

Study 1

Abstract

Objective: Examine the relationship between scores achieved on the SLUMS and the Wechsler Memory Scale – III (WMS-III)[5]. **Design and Participants:** 100 Social Security Administration (SSA)-disability adult claimants were administered both instruments. **Results:** The total score on the SLUMS correlated highly with the total score of the WMS-III, r (98) = .73, p < .001. All subtests of the WMS-III also correlated significantly with the SLUMS. **Conclusions: M**any questions concerning neurocognitive functions can be addressed via the SLUMS when determinations of such abilities are desired, but the time allotted for a thorough evaluation such as is typical of a detailed neuropsychological evaluation, has not been authorized or is not a possibility. Low scores on the SLUMS could serve as the rationale for a more detailed neuropsychological assessment. These results supplement another recent study showing that scores on the SLUMS correlate well with scores on other neuropsychological tests.

[1] PhD, Distinguished Professor of Psychology, Professor Emeritus of Psychology, Georgia College & State University, and Private Practice, Clayton, Georgia , RWW at 100 N. Arlington Ave., Ste. 240. Reno Nevada, 89501 or email: (rapidrobert813@yahoo.com); WFM at 1066 Screamer Drive, Clayton, GA 30525 (USA). Email: (bill.mcdaniel@gcsu.edu)

Study 2

Abstract

Objective: Investigate the possible clinical utility of a brief "mini-battery" for the early detection of dementia as proposed by Brown, Lawson, McDaniel and Wildman[2]. **Design and Participants:** 100 consecutive patients referred for SSA-disability evaluation that had graduated from regular educational programs and appeared to be putting forth a good-faith effort were given both the SLUMS and the Nevada Brief Cognitive Assessment Instrument (NBCAI). **Results:** The two screens correlated, r (98) = .61, p <.001. Importantly, while many cases were observed in which the patient scored in a lower category on the SLUMS than the NBCAI, no case in which the reverse direction of "cognitive slippage" was found. **Conclusion:** The SLUMS – NBCAI "mini-battery" appears to perform in the proposed manner, with cognitive deterioration observed first on the SLUMS, and with more advanced stages of neurocognitive impairment being characterized by lowered scores on both screens.

Study 1

Relationships between the St. Louis University Mental Status Examination and the Wechsler Memory Scale – III

Individuals aged 60+ years made up nearly 18% of the U.S. population in 2009, and this percentage is predicted to increase by almost 65% by the year 2030[1]. Cognitive impairment is a common complaint indicated by older persons[1] as well as applicants for Social Security disability benefits[2]. Cognitive and/or memory concerns present more often to general practitioners than to neurologists or neuropsychologists, and there is a need for sensitive screening instruments that can be used by general practitioners and other providers.

There are many cognitive screening tools used by professionals across a wide array of disciplines. One of the most commonly used screening devices is the Mini-Mental Status Exam (MMSE)[3], a 19 item, 30 point screen that takes roughly 6 to 10 minutes to administer. The MMSE screens orientation, immediate and 3-minute delayed free recall of 3 object-item words, calculation, concentration and attention, abstract thinking, construction and object identification. However, the MMSE has several problems.

These include ceiling effects when used with individuals with high educational attainment, poor specificity rates in identifying "minimal (or mild) cognitive impairment" (MCI), poor staging for questionable dementia, and limitations in its positive predictive values with MCI[1,4].

Noting problems with the MMSE when evaluating elderly veterans, many of whom may manifest symptoms of MCI, Tariq et al.[4] created the SLUMS. This is an 11-item, 30 point screening tool that assesses such cognitive domains as orientation, attention, concentration, calculation, immediate free and delayed free recall of 5 object-item words, answering questions about a short story read to the examinee, verbal fluency in an animal naming task, as well as constructional abilities and geometric shape discrimination. This screen also requires between 6 and 10 minutes for administration. Importantly, the authors reported that results with the SLUMS discriminated well between those with a high and low educational achievement, and score ranges were offered for consideration of normal, "Mild Neurocognitive Disorder" (MNCD), which is roughly equivalent to MCI, and performances suggestive of dementia for individuals with these levels of academic achievement.

The utility of the SLUMS as a screening tool for older adults who are not veterans has been demonstrated[1], and while SLUMS and MMSE total scores were found to correlate with one another (Pearson $r = .75$), SLUMS total scores were found to correlate more highly than MMSE scores with results obtained by administration of other neuropsychological tests. Examples include the Trail Making Test A ($r = -.54$, $p < .01$), Trail Making Test B ($r = -.56$, $p < .01$), Wisconsin Card Sorting Test Errors ($r = -.35$, $p < .01$), Wisconsin Card Sorting Test Correct Responses ($r = .33$, $p < .01$), Rey Auditory Verbal Learning Test Total Words Recalled ($r = .55$, $p < .01$) and Rey Auditory Verbal Learning Test Total Words Recalled after delay ($r = .54$, $p < .01$). The authors conclude, "Our findings support the view of the SLUMS as a useful screening measure for determining older adults' need for further neuropsychological assessment"[4] (p. 629).

We[2] have reported that SLUMS total scores correlate highly, $r = .76$, $p < .001$, with results obtained via the NBCAI when co-administered to individuals referred for mental status examinations by the Disability Adjudication Services SSA.

In the same article, it was reported that the NCBAI total scores correlated well with Verbal IQ obtained via the WAIS-III verbal IQs ($r = .83$) as well as the Vocabulary ($r = .73$), Similarities ($r = .69$) and Comprehension subtests ($r = .53$), all of which were statistically significant at the .001 level. It was concluded that the NBCAI might be useful in screening for general intelligence and the SLUMS in screening for neurocognitive abilities when conclusions concerning such functions are requested but formal neuropsychological testing has not been authorized. Both instruments were reprinted as appendices to this article and are therefore in the public domain. The SLUMS is also available on the internet at: http://medschool.slu.edu/agingsuccessfully/pdfsurveys/slumsexam_05.pdmt

The present study was conducted to examine the possible relationship between results obtained by administration of the SLUMS and WMS-III. The latter test or the more recent Wechsler Memory Scale – IV[6] are often used as neuropsychological tests to measure memory functions. It was predicted that a high correlation would be observed because both instruments address memory for recent information. However, the relationship was not expected to be perfect because some items on the SLUMS tap non-memorial abilities (e.g., verbal fluency in the animal naming task). Perhaps it should be noted that there are very few published studies concerning the SLUMS, and even fewer concerning the NBCAI. The studies presented here are intended to improve this situation, especially since the SLUMS is being presented in CE seminars as a viable instrument useful in the execution of mental status examinations (e.g., Webb, T., "Completing the Mental Status Exam," Cross Country Education, 2014).

Methods

Participants

The SLUMS and WMS-III was administered to 100 individuals who had applied for SSA disability benefits and were referred to one of the authors (RWW) in clinics in Reno and Las Vegas. All individuals had been referred for testing with the WMS-III because of complaints of problems with memory. A total of 108 consecutive individuals were assessed with both instruments, but malingering or lack of sufficient effort was suspected in 8 individuals because of inconsistencies observed during the interview or testing, and data from these individuals were not included in the analyses.

The first of these cases was seen on July 18, 2011 and the last on October 31, 2012. Fifty-five of the cases were males, and there were 45 females. Ages ranged from 18 to 65 years with a mean age of 44.18. Eighty-four claimants were Caucasians, four were of African-American descent, seven were Hispanic, three were of mixed and unclear racial descent and two were Native Americans. Eighty-one individuals were either high school graduates or had a graduation equivalency diploma (GED), with 71 reporting a history of special education at some point during their education. Nineteen individuals reported having less than a full high school education or its equivalent.

Procedures

The claimants completed standard intake forms. They were then interviewed for approximately 30 to 45 minutes as part of the mental status examination. Testing was administered following the interview, with the IQ test, when authorized, given before the WMS-III. The SLUMS was given as a "filler activity" during the required gap in time between the first and second halves of the WMS-III. As dementia and/or intellectual deterioration is always a question when the WMS-III is ordered, the SLUMS screen was considered to be an appropriate instrument to employ. Data were subsequently collected via a purely anonymous archival review of the resulting clinical files.

Results

The SLUMS scores ranged from 6 to 29 ($M = 20.29$, $SD = 4.80$). The mean composite scores for the WMS-III ranged from 50.63 to 119.63 ($M = 82.58$, $SD = 15.80$). The results from the two instruments produced a positive Pearson Product-Moment correlation, $r(98) = .73$, $p < .001$, which exceeds Cohen's criterion for a "large" magnitude. The coefficient of determination is 0.53 showing that the SLUMS and WMS-III share quantitatively 53% in common, but 47% as uncommon variance. The SLUMS also correlated with each subtest of the WMS-III as follows: Auditory Immediate Index, $r = .65$; Visual Immediate Index, $r = .57$; Immediate Memory, $r = 79$; Auditory Delayed Memory, $r = .63$; Visual Delayed Memory, $r = .58$; Auditory Recognition Delayed Index, $r = .63$; General Memory Index, $r = .69$; Working Memory Index, $r = .64$ (all p's $< .001$).

Conclusions

Results show that when administered to disability claimants, the SLUMS screen correlates well with results obtained by administration of the more thorough WMS-III. This is not to say that the SLUMS could be substituted for the WMS in neuropsychological testing. Rather, it can address many areas of neurocognitive functioning when a mental status examination is requested by an agency such as SSA, but testing with more time consuming neuropsychological instruments has not been authorized. The SLUMS provides information concerning neurocognitive functions that may need to be examined in greater detail. These results complement a recent article[1] demonstrating the utility of the SLUMS in the screening of neurocognitive functions.

Limitations

The current study used a sample of disability claimants in only two large cities in Nevada. Also 81% of the sample had a high school education or its equivalency, and 71% reported having had some form of special education at some point in their educational past. Thus, this sample may not be representative of the US population. Tarig et al.[4] demonstrated the utility, sensitivity and specificity of the SLUMS in distinguishing between normal cognitive ability, dementia and MNCD in elderly veterans, and Feliciano et al.[1] replicated and extended these findings to a sample of elderly non-veterans. Research with the SLUMS using samples from other populations and parts of the country is needed.

Study 2

A Demonstration of the Potential Clinical Utility of a Nevada Brief Cognitive Assessment Instrument and St Louis University Mental Status Examination Mini-Battey for the Detection of Dementia

Brown et al.[2] presented data showing that whereas the NBCAI possesses characteristics consistent with those of a psychometric instrument measuring "crystallized intelligence," the SLUMS appears to be more sensitive to "fluid intelligence."

As characterized by Catell[7], crystallized intelligence is acquired through the lifetime via education and experience, whereas fluid intelligence involves the ability to handle and solve novel situations or challenges demanding intellective properties. It would follow from these demonstrated psychometric characteristics that while the NBCAI would be expected to "hold" in the early stages of dementia, the SLUMS would detect cognitive processes more likely to "slip" in the early stages of dementia. The authors went on to recommend the use of both brief screens in cases where dementia is suspected or alleged, but more time consuming neuropsychological tests have not been authorized and will not be reimbursed. The present study is an informal and clinical demonstration of the utility of employing this "NBCAI – SLUMS Mini-Battery."

Methods

Participants

The data examined here were obtained from a review of records from 100 consecutive adult referrals to one of the authors (RWW) who met the criteria of having graduated from high school in a program in which they had not required special education services. Also, these individuals were ones not eliminated for motivational problems as discussed in the procedure section above. The disability claimants were evaluated in clinics by RWW in Reno and Las Vegas, Nevada. One of the cases had been referred by the Nevada Department of Vocational Rehabilitation, 10 by the US Department of Veterans Affairs, and the remaining 89 cases by Social Security disability adjudication offices in California and Nevada. Sixty-two of the participants were female, and 38 were male. Seventy-eight of the claimants were predominantly of European descent, eight of African descent, seven were Hispanics, two Native Americans, two of predominant Asian heritage, and three were of mixed racial descent. Their ages ranged from 23 to 83 ($M = 49.43$, $SD = 10.97$). The first claimant in this series was seen on May 15, 2013 and the last on September 20, 2013.

Procedures

When a claimant had been identified as meeting the educational requirements outlined above, she or he was informally evaluated for lack of effort/downplaying or ability.

Those appearing to be making a good-faith effort were given the SLUMS at the conclusion of the evaluation session. The SLUMS was scored and taken into account in offering diagnoses and other clinical summaries in these 100 cases. The data were collected via a review of the resulting clinical files in an anonymous archival manner.

Results

The NBCAI scores ranged from 8 to 50 (M = 40.35, SD = 8.67), and SLUMS scores ranged from 9 to 30 (M =22.70, SD = 4.80). The NBCAI failed to correlate with age, r (98) = .05, p > .05, and the same was true for the SLUMS, r(98) = - .07, p > .05. However, scores on the NBCAI and SLUMS correlated, r (98) = .61, p < .001.

SLUMS scores were categorized for persons at this educational level into three levels: Normal, 27-30; Mild Neurocognitive Disorder (MNCD), 21-26; and Dementia, 0-20 per recommendations that accompany the instrument[4]. An *a priori* decision was made to also classify NBCAI scores into three levels: 36-50 (a score of 40 predicts an IQ of 100 or above, which would be expected to reflect an average level of functioning for graduates from regular high school programs.); 21-35 (below average range); and 0-20 (well below average range; 17 corresponds to a predicted IQ of 70, or the borderline or mildly intellectually deficient range.) Table 1 presents the numbers of individuals performing within various ranges of the NBCAI and ranges of the SLUMS.

Table : Number of Individuals Scoring in Various Categories and Ultimate Diagnoses Slums Categories

	Normal	MDN	Dementia	R/O Dementia
NBCAI				
26-50	25	39	15	16 (20.2%)
21-25	00	06	11	07 (41.2%)
< 20	00	00	04	04 (100%)

A Chi Squared analysis of categorical data in the table above supported the association between SLUMS scores and NBCAI scores with this selected group of high school graduates, Chi-Squared = 12.30, p < .02.

Conclusions

The correlation between the NBCAI and the SLUMS of .61 suggests that the two instruments share approximately 37% of the variance. This finding is interesting when viewed in the context of the result of Study 1 of this report which demonstrated that the SLUMS and the WMS-III have a little over half of their variances in common. Putting these finding together appears to show that the SLUMS measures both the earlier-appearing "fluid intelligence" signs of dementia which are also seen on the WMS-III, as well as the late-stage deterioration of "crystallized intelligence" which is also measured by the NBCAI.

Table 1 supports the view of earlier "slippage" of "fluid intelligence" suggested by Brown *et al.*[2] in that none of the 100 examinees scored in a lower category on the NBCAI than on the SLUMS. The results shows that cognitive deterioration is seen first on the SLUMS. When "slippage" is seen on both instruments a diagnosis of dementia is likely more accurate. As an example, only 20% of the examinees scoring in the Dementia range on the SLUMS but in the 36-50 category of the NBCAI were diagnosed with dementia, while four of the examinees who scored in the lowest category on both devices were found to qualify for a diagnosis of dementia.

Limitations

It should be pointed out that while these diagnoses represent the clinical impressions of only one psychologist, the final reports are reviewed by other psychologists and psychiatrists, as well as, presumably, by other medical experts. Corrective feedback is given when these consultants disagree with an evaluator's opinion. Such corrections have not, to date, been received in regard to any of the reports from which data are included in this study.

The fact that so many examinees scored in the MNCD range of the SLUMS with so few of those displaying the clinical signs of dementia would suggest that the SLUMS might be overly sensitive in that regard. Alternately, this finding could be an artifact of patients being distracted by anxiety and depression brought to the surface in a just-concluded and often emotionally-arousing clinical interview.

General Conclusions

In general these findings support the Brown *et al* [2] recommendation that both the NBCAI and the SLUMS can be used validly in brief psychological evaluations. It would seem that not only can the NBCAI serve as a screen of general intelligence that tends to "hold" for comparisons with the SLUMS in the detection of the early stages of dementia, but it may later play a role in assessing the depth of dementias that have progressed or are progressing to advanced stages.

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