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Montreal Cognitive Assessment as a screening instrument for cognitive impairments in schizophrenia

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ABSTRACT

Background: Cognitive impairment is one of the core features of schizophrenia. For its evaluation, current clinical practice relies on detailed neuropsychological batteries which require trained testers and considerable amount of time to administer. Therefore, a brief and reliable screening tool for identification of overall cognitive impairment prior to a detailed comprehensive neurocognitive assessment is needed in a busy clinical setting. This study evaluates the clinical utility of the Montreal Cognitive Assessment (MoCA) in detecting cognitive impairments in schizophrenia and its relationship with functional outcome and demographic characters.
Methods: The MoCA, the Brief Assessment of Cognition in Schizophrenia (BACS), and the Brief UCSD Performance-based Skills Assessment (UPSA-B) were administered to 64 patients with schizophrenia. Mild and severe cognitive impairments were defined as BACS Z-score (calculated with the age and gender adjustments using previously published local norm data) of one or two standard deviations below the mean, respectively.
Results: The results showed that the MoCA was significantly correlated with BACS ($r = .61$, $p < .001$) and sensitive to detect both mild (AUC = 0.82, $p < .001$) and severe (AUC = 0.81, $p < .001$) cognitive impairments in schizophrenia. The MoCA was significantly correlated with UPSA-B score ($r = .51$, $p < .001$), and accounted for significant additional variance in UPSA-B score beyond the BACS.
Conclusion: These findings indicate that MoCA is a useful bedside cognitive screening instrument for people with schizophrenia.

1. Introduction

Schizophrenia is associated with enduring cognitive impairments in domains such as executive functioning, attention and memory (Bowie and Harvey, 2006; Halder and Mahato, 2015). These deficits affect at least 80% of people with schizophrenia and are clinically significant in predicting patients' treatment and functional outcomes (Bora et al., 2010; O'Carroll, 2000). Due to its clinical importance, clinicians who in their daily practice incorporate brief cognitive evaluations to detect cognitive impairments, can enhance treatment plan by making adjustments to patients' medication dose, or refer appropriate patients for further neurocognitive assessments or rehabilitation programs.

At present, there are various well-validated and comprehensive neuropsychological batteries such as the MATRICS Consensus Cognitive Battery (MCCB) (Nuechterlein et al., 2008) and the Brief Assessment of Cognition in Schizophrenia (BACS) (Keefe et al., 2004) that have been developed to measure cognitive abilities (Schulz and Murray, 2016). Indeed, these comprehensive batteries provide health practitioners with detailed understanding of the subject's specific cognitive abilities. However, in routine clinical consultations, administration of such batteries may not be particularly feasible, where completing the MCCB takes about 60 min and at least 30 min for the BACS. Furthermore, these assessments can only be conducted by fully trained testers or neuropsychologists, and require added time for scoring and interpretation of scores. Echoing this point, a previous survey found that clinicians prefer

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brief cognitive assessments (Keefe et al., 2016). Thus, in light of these issues, there is a need to evaluate the clinical utility of bedside cognitive screening instruments to screen for overall cognitive deficits in individuals with schizophrenia. Identified individuals can then be referred for comprehensive cognitive assessments.

One such bedside cognitive instrument is the Montreal Cognitive Assessment (MoCA), a 30-item screener that assesses a broad area of cognitive functions (Nasreddine et al., 2005). Originally designed to detect mild cognitive impairment in older adults with dementia, the MoCA has also been found to be applicable in assessing other clinical populations such as patients with stroke (Cumming et al., 2011), learning disability (Edge et al., 2016), sleep disorder (Gagnon et al., 2010), substance use disorders (Copersino et al., 2009), and in patients attending psychiatry inpatient/outpatient service (Gierus et al., 2015; Helmi et al., 2016). In another study on patients with severe mental illness (18 patients with schizophrenia and 10 with mood disorders), Musso et al. (2014) explored the relationship between MoCA total scores (with the 1 point education correction for those with <12 years of education), BACS composite score and functioning outcome on the UPSA-2. They reported a favorable sensitivity of 89% on the MoCA in differentiating patients from healthy controls. They also reported a stronger association between the MoCA ($r_s = .66$, $p < .001$) and the functional measures than that between the BACS ($r_s = .27$, n.s.) and the functional measures.

There were two published studies that were intended to validate the use of MoCA in people with schizophrenia. Ramírez et al. (2014) tested the concurrent validity of MoCA and reported a moderate correlation between the MoCA and the Mini-Mental State Examination (MMSE) ($r = .62$, $p < .001$), as well as the cognitive subscale of the PANSS ($r = .55$, $p < .001$). Similarly, Fisekovic et al. (2012) conducted a study with 30 patients where they reported a moderate positive correlation ($r = .40$, $p = .027$) between the MoCA and the MMSE. The authors opined that the MoCA is more sensitive in detecting milder cognitive deficits as the MoCA was able to detect more cases with mild cognitive impairments as compared to the MMSE. The common limitation of these two studies is that both the MoCA and the MMSE are cognitive screening tools. Previous studies have shown that MMSE is unsatisfactory in detecting mild cognitive impairments (Hoops et al., 2009) and insensitive to the cognitive impairments typically found in schizophrenia (Pendlebury et al., 2010; Popovic et al., 2007); therefore, it might not be appropriate to adopt MMSE as the reference cognitive assessment in schizophrenia (Manning et al., 2007). Two other studies have also highlighted the need of validating the MoCA against standard neurocognitive test batteries (Fisekovic et al., 2012; Wu et al., 2014). Taken together, despite some results supporting the utility of the MoCA in schizophrenia, evidence in this area is still limited. To date, there are no studies that have conclusively studied the clinical utility of the MoCA in detecting cognitive impairments in schizophrenia.

The aim of this study is to examine the ability of the MoCA as a bedside cognitive screening tool in detecting cognitive impairments in people with schizophrenia. In this study, MoCA was compared against the BACS; the diagnostic accuracy of the MoCA in detecting mild and severe cognitive impairments and its relation to functioning were evaluated. The effects of demographic characteristics, e.g., age, gender, education on MoCA performance were also tested.

2. Material and methods

2.1. Participants

Sixty-four outpatients diagnosed with schizophrenia were recruited from the Institute of Mental Health, Singapore. All patients' diagnoses were ascertained on the Structured Clinical Interview for DSM-IV (SCID) by trained research psychologists. The inclusion criteria of the study include diagnosis of schizophrenia, aged 16–65, English speaking and fit to provide informed consent. The exclusion criteria include history of strokes, traumatic brain injuries and neurological disorders such as epilepsy. Ethics approval for the study was provided by the National Healthcare Group Domain Specific Review Board. Written informed consent was obtained from all participants after the study procedures were fully explained.

2.2. Measures

The Montreal Cognitive Assessment (MoCA) (Nasreddine et al., 2005) is a brief screening instrument used to detect mild cognitive impairments with a reported administration time of about 10 min. Cognitive domains assessed by the MoCA include visuospatial skills, language, attention, memory, executive functions, abstraction, calculation and orientation. The total score ranges from 0 to 30, with a score of 26 or greater indicating "normal" cognitive functioning. This MoCA total score takes into account years of education where the total score of individuals who completed 12 years or less are adjusted by adding 1 point, as suggested in the MoCA manual.

The Brief Assessment of Cognition in Schizophrenia (BACS) (Keefe et al., 2004) is a well-established neuropsychological battery used to evaluate cognitive functioning in patients with schizophrenia. It consists of six subscales, namely Verbal Memory, Digit Sequencing, Token Motor Task, Semantic Fluency, Symbol Coding and Tower of London which measure verbal memory and learning, working memory, psychomotor function, verbal fluency and executive function. The BACS subscale and composite Z-scores were calculated with the age and gender adjustments using previously published local norm data (Eng et al., 2013). BACS Z-scores of one and two standard deviations below the mean were defined as mild and severe cognitive impairment, respectively.

The Brief UCSD Performance-based Skills Assessment (UPSA-B) (Mausbach et al., 2007) is a brief tool used to examine functional capacity in two areas of everyday functioning – communication and finances. Participants were assessed through role-play exercises, such as writing a cheque for the bill and calling to reschedule a doctor's appointment. The total score ranges from 0 to 100, with higher scores indicating better functional capacity.

2.3. Statistical analyses

In keeping with the suggestions of the MoCA manual, the MoCA total scores were adjusted for years of education in this study. The analyses with MoCA total scores without 1-point education correction are available in the supplementary material. Analyses were conducted in four steps. First, Pearson's correlations were employed to investigate relationships between MoCA performance, age and total years of education. Independent Samples *t*-Test was used to examine the effect of gender on the MoCA total score. Second, Receiver Operating Characteristic (ROC) curve analysis was performed to evaluate the diagnostic performance of MoCA in the detection of mild and severe cognitive impairments; AUC, sensitivity, specificity, positive and negative likelihood ratios and odds ratios were calculated on MoCA cut-off scores. A Stuart-Maxwell test (Everitt, 1997) was used to assess whether the classification rates of normal, mild and severe cognitive impairments differ by using BACS and MoCA. Third, we examined the relationships between MoCA and BACS and its subscales using Pearson's correlation as all variables were normally distributed. MoCA adjusted total score (i.e. residuals derived via linear regression after partialing out the effects of age and gender) was used in this and next step of analyses. Lastly, the relationships between cognitive tests (MoCA and BACS) and functioning (UPSA-B) were examined using Pearson's correlation. In addition, hierarchical regression modeling was employed to examine the additional variance MoCA or BACS had in predicting UPSA-B scores. For the first hierarchical regression, the BACS-Z score was entered into step 1 and MoCA adjusted score was entered into step 2. For the second hierarchical regression, the BACS-Z score and MoCA adjusted score were entered into the model in a reverse order. All analyses were performed with IBM SPSS Statistics 23.

Table 1
Demographic and descriptive data.

	N	Mean ± SD
Gender (male: female)	31:33	
Ethnicity (Chinese: others)	54:10	
Employment status (employed: unemployed)	28:36	
Age		31.56 ± 7.54
Years of education		13.58 ± 2.72
MoCA total score[a]		22.75 ± 3.21
Unadjusted MoCA total score[b]		22.44 ± 3.28
BACS composite z-score		−2.17 ± 1.34
UPSA-B total score		60.50 ± 14.93

[a] With 1-point education correction.
[b] Without 1-point education correction.

3. Results

3.1. Demographic data

Demographic data of participants and the means of the MoCA total score, BACS composite z-score and UPSA-B total score are presented in Table 1. The average duration required to administer the MoCA was 13 min (SD = ±2). This was based on 37 participants, where duration of administration was recorded. MoCA total score was not correlated with age ($r = -.03$, $p = .80$), gender ($t(62) = 1.19$, $p = .24$), and years of education ($r = .16$, $p = .22$). Information related to the illness is detailed in Table 2.

3.2. Diagnostic accuracy of MoCA

For the detection of mild cognitive impairments (BACS Z-score < −1), the AUC for MoCA was 0.816 (95% CI = 0.698–0.934, $p < .001$). Based on Youden's Index (Youden, 1950), the optimal MoCA cut-off score was <25. To detect severe cognitive impairments (BACS Z-score < −2), the AUC for MoCA was 0.814 (95% CI = 0.710–0.918, $p < .001$) and the optimal MoCA cut-off score was <23. The ROC curves are presented in Fig. 1a and b. Sensitivity, specificity, positive and negative likelihood ratios, and odds ratios for the MoCA cut-off scores are presented in Table 3. The percentage of the patients classified as normal, mild and severe cognitive impairments was 20%, 27% and 53% for BACS and 33%, 22%, 45% for MoCA. There was no statistically significant difference in classification of normal, mild and severe cognitive impairments between the MoCA and BACS (χ^2 (2) = 4.87, $p = .09$).

Table 2
Medications and treatment.

	N (%)	Mean ± SD
Duration of illness		9.10 ± 7.29
Duration of psychiatric treatment		12.86 ± 6.85
Current non-pharmacological treatment	44 (68.8)	
Antipsychotic medications	61 (95.3)	
Typicals		
Haloperidol	4	
Trifluoperazine	1	
Chlorpromazine	1	
Atypicals		
Amisulpride	3	
Aripiprazole	3	
Clozapine	9	
Olanzapine	17	
Quetiapine	5	
Risperidone	18	
Sulpiride	2	
Flupenthixol decanoate	19	
Paliperidone palmitate	1	
Pipothiazine palmitate	1	
Zuclopenthixol decanoate	7	
Not on any medication	3 (4.7)	
Chlorpromazine dose equivalents (mg/day)		393.57 ± 338.82

3.3. Relationship between MoCA and BACS

The MoCA adjusted total score was significantly correlated with the BACS composite Z-score ($r = .61$, $p < .001$) and Z-scores of five BACS subscales including Verbal Memory ($r = .44$, $p < .001$), Digit Sequencing ($r = .57$, $p < .001$), Semantic fluency ($r = .47$, $p < .001$), Symbol coding ($r = .35$, $p = .004$), and Tower of London ($r = .45$, $p < .001$), but not correlated with the Token Motor Task ($r = .15$, $p = .232$). Cronbach's alpha for MoCA and BACS were .518 and .703 respectively.

3.4. Relationship between the cognitive measures and UPSA-B

The UPSA-B score was significantly correlated with both the MoCA adjusted total score ($r(60) = .51$, $p < .001$) and BACS Z-score ($r(60) = .50$, $p < .001$) (See Fig. 2). Subsequently, two hierarchical regressions were used to predict UPSA-B score (See Table 4). In the first regression, the BACS Z-score was entered into step 1 and the model was found to be significant ($R^2 = 0.248$, $F(1, 58) = 19.10$, $p < .001$). Addition of MoCA adjusted total score to the model with BACS Z-score resulted in a significant increment in variance ($\Delta R^2 = 0.071$, $F(1, 57) = 5.93$, $p = .018$).

In the second regression model, there was a significant association between MoCA and UPSA-B ($R^2 = 0.259$, $F(1, 58) = 20.29$, $p < .001$). Addition of BACS Z-score resulted in a significant increment in variance ($\Delta R^2 = 0.059$, $F(1, 57) = 4.97$, $p = .030$).

4. Discussion

This study presents the results of the validation of the MoCA against the BACS in a sample of patients with schizophrenia. The MoCA demonstrated good ability in detecting mild and severe cognitive impairments in patients with schizophrenia. It is also moderately associated with functioning that is not inferior to the BACS.

The MoCA demonstrated adequate concurrent validity as a cognitive screening tool as our results showed a moderate agreement between the MoCA and the BACS composite and five of its subscales. These significant correlations could be attributed to the large overlap in the cognitive domains that are evaluated on both measures, such as verbal memory, executive function, verbal fluency and working memory. As for the insignificant finding between the Token Motor Task and the MoCA, it is understood that this BACS subscale mainly measures psychomotor functioning, a domain that is not evaluated by the MoCA. Thus, the lack of an overlap of cognitive skills might explain why the two scores are not correlated. Although these findings are consistent with what the authors predicted, they are, however, not consistent with Musso et al.'s (2014) study where no significant correlation between the MoCA raw score and BACS Z-score was found. The discrepancy might be due to differences in sample size and demographics of both studies as Musso et al.'s (2014) study sample only included 18 patients with schizophrenia and 10 with mood disorders.

The results of the present study also suggested that the MoCA can be a good screening instrument for both mild and severe cognitive impairments in schizophrenia. Further analyses revealed that the optimal MoCA cut-off score is <25 in detecting mild impairments and <23 in detecting severe impairments. This is consistent with findings of other studies that suggested using cut-off scores lower than the recommended cut-off score of <26 (Damian et al., 2011; Luis et al., 2009; Rossetti et al., 2011).

In the present study, both the MoCA and the BACS were significantly correlated with functional capacity as assessed on the UPSA-B. The finding of a significant correlation between the BACS and the UPSA was previously reported by Keefe et al. (2006). We also found that both the BACS and the MoCA contributed unique variance in predicting the UPSA-B. The additional unique variance could be a result of the cognitive skills that are exclusive to the individual tools. For example, unlike the MoCA, the BACS does not measure naming, calculation and

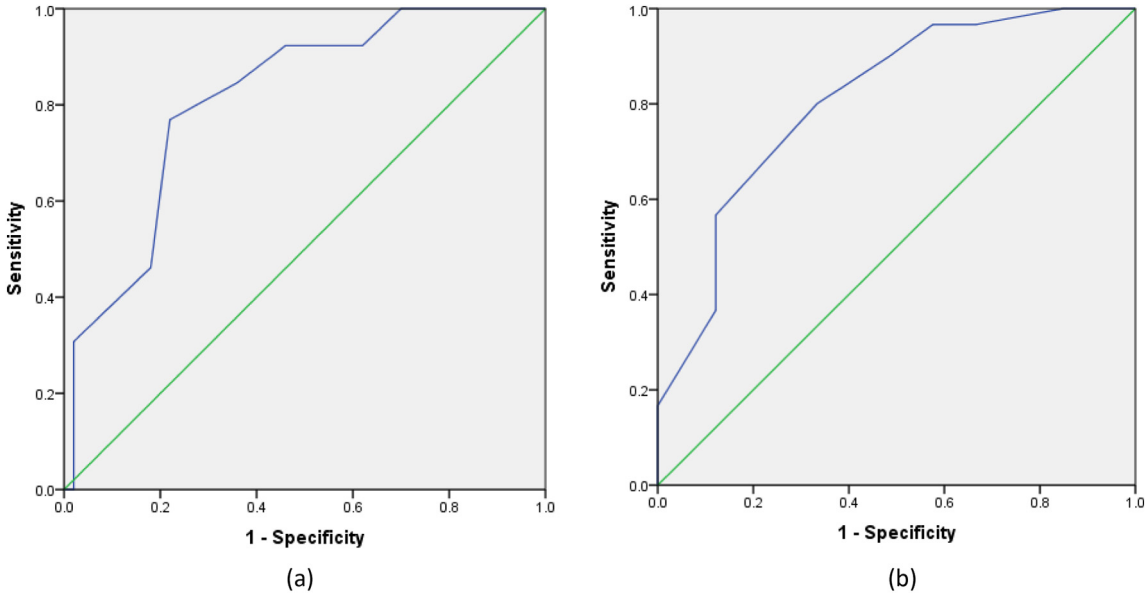

Fig. 1. Receiver operating characteristic curves demonstrating the accuracy of the MoCA in classifying patients with (a) mild cognitive impairments versus unimpaired and (b) severe cognitive impaired versus unimpaired.

abstraction; while unlike the BACS, the MoCA does not measure fine motor functioning.

In line with previous studies, age and gender did not have an effect on the MoCA score (Bernstein et al., 2011; Luis et al., 2009; Wu et al., 2014). As for the effects of education, a non-significant relationship with the MoCA total score was found which is consistent with Musso et al.'s (2014) study, but not the other studies (Bernstein et al., 2011; Rossetti et al., 2011; Wu et al., 2014). A possible explanation is that

Table 3
Diagnostic information of MoCA.

	Sensitivity (95% CI)	Specificity (95% CI)	LR+ (95% CI)	LR− (95% CI)	OR
Mild cognitive impairments					
MoCA < 14	0.000 (0.000–0.087)	1.000 (0.717–1.000)	–	1.000 (1.000–1.000)	–
MoCA < 15	0.020 (0.001–0.118)	1.000 (0.717–1.000)	Infinity	0.980 (0.943–1.019)	Infinity
MoCA < 16	0.020 (0.001–0.118)	1.000 (0.717–1.000)	Infinity	0.980 (0.943–1.019)	Infinity
MoCA < 17	0.039 (0.007–0.146)	1.000 (0.717–1.000)	Infinity	0.961 (0.909–1.016)	Infinity
MoCA < 18	0.059 (0.015–0.172)	1.000 (0.717–1.000)	Infinity	0.941 (0.879–1.008)	Infinity
MoCA < 19	0.098 (0.037–0.222)	1.000 (0.717–1.000)	Infinity	0.902 (0.824–0.987)	Infinity
MoCA < 20	0.255 (0.148–0.399)	1.000 (0.717–1.000)	Infinity	0.745 (0.635–0.875)	Infinity
MoCA < 21	0.314 (0.195–0.460)	1.000 (0.717–1.000)	Infinity	0.686 (0.570–0.826)	Infinity
MoCA < 22	0.392 (0.262–0.539)	0.923(0.621–0.996)	5.098 (0.752–34.559)	0.658 (0.522–0.831)	7.742 (5.702–9.782)
MoCA < 23	0.549 (0.405–0.686)	0.923 (0.621–0.996)	7.137 (1.068–47.692)	0.489 (0.356–0.670)	14.609 (12.496–16.722)
MoCA < 24	0.647 (0.500–0.772)	0.846 (0.537–0.973)	4.206 (1.157–15.292)	0.417 (0.280–0.622)	10.083 (8.471–11.696)
MoCA < 25	0.784 (0.643–0.882)	0.769 (0.460–0.938)	3.399 (1.247–9.265)	0.280 (0.159–0.495)	12.139 (10.686–13.592)
MoCA < 26	0.824 (0.686–0.911)	0.462 (0.204–0.739)	1.529 (0.910–2.570)	0.382 (0.177–0.825)	4.000 (2.693–5.307)
MoCA < 27	0.980 (0.882–0.999)	0.308 (0.104–0.611)	1.416 (0.984–2.039)	0.064 (0.007–0.623)	22.222 (19.919–24.526)
MoCA < 28	0.980 (0.882–0.999)	0.154 (0.027–0.463)	1.159 (0.916–1.466)	0.127 (0.008–2.034)	9.091 (6.603–11.579)
MoCA < 29	0.980 (0.882–0.999)	0.000 (0.000–0.283)	0.980 (0.943–1.019)	Infinity	–
MoCA < 30	0.980 (0.882–0.999)	0.000 (0.000–0.283)	0.980 (0.943–1.019)	Infinity	–
MoCA < 31	1.000 (0.913–1.000)	0.000 (0.000–0.283)	1.000 (1.000–1.000)	–	–
Severe cognitive impairments					
MoCA < 14	0.000 (0.000–0.126)	1.000 (0.859–1.000)	–	1.000 (1.000–1.000)	–
MoCA < 15	0.029 (0.002–0.171)	1.000 (0.859–1.000)	Infinity	0.971 (0.915–1.029)	Infinity
MoCA < 16	0.029 (0.002–0.171)	1.000 (0.859–1.000)	Infinity	0.971 (0.915–1.029)	Infinity
MoCA < 17	0.059 (0.010–0.211)	1.000 (0.859–1.000)	Infinity	0.941 (0.865–1.024)	Infinity
MoCA < 18	0.088 (0.023–0.248)	1.000 (0.859–1.000)	Infinity	0.912 (0.821–1.012)	Infinity
MoCA < 19	0.147 (0.055–0.318)	1.000 (0.859–1.000)	Infinity	0.853 (0.742–0.981)	Infinity
MoCA < 20	0.353 (0.203–0.535)	0.967 (0.809–0.998)	10.588 (1.462–76.690)	0.669 (0.521–0.860)	15.818 (13.704–17.932)
MoCA < 21	0.441 (0.276–0.619)	0.967 (0.809–0.998)	13.235 (1.857–94.319)	0.578 (0.428–0.781)	22.895 (20.789–25.000)
MoCA < 22	0.529 (0.354–0.698)	0.900 (0.723–0.974)	5.294 (1.729–16.215)	0.523 (0.363–0.752)	10.125 (8.755–11.495)
MoCA < 23	0.676 (0.494–0.820)	0.800 (0.609–0.916)	3.382 (1.594–7.178)	0.404 (0.245–0.668)	8.364 (7.216–9.511)
MoCA < 24	0.765 (0.584–0.886)	0.700 (0.504–0.846)	2.549 (1.431–4.541)	0.336 (0.178–0.634)	7.583 (6.471–8.696)
MoCA < 25	0.882 (0.716–0.962)	0.567 (0.377–0.740)	2.036 (1.328–3.121)	0.208 (0.079–0.548)	9.808 (8.539–11.077)
MoCA < 26	0.882 (0.716–0.962)	0.367 (0.205–0.561)	1.393 (1.033–1.878)	0.321 (0.114–0.902)	4.342 (3.061–5.623)
MoCA < 27	1.000 (0.874–1.000)	0.167 (0.065–0.355)	1.200 (1.023–1.408)	0.000 (0.000-)	–
MoCA < 28	1.000 (0.874–1.000)	0.100 (0.026–0.277)	1.111 (0.986–1.252)	0.000 (0.000-)	–
MoCA < 29	1.000 (0.874–1.000)	0.033 (0.002–0.191)	1.034 (0.968–1.106)	0.000 (0.000-)	–
MoCA < 30	1.000 (0.874–1.000)	0.033 (0.002–0.191)	1.034 (0.968–1.106)	0.000 (0.000-)	–
MoCA < 31	1.000 (0.874–1.000)	0.000 (0.000–0.141)	1.000 (1.000–1.000)	–	–

Note: CI = confidence interval; LR+ = positive likelihood ratio; LR−: negative likelihood ratio; OR: odds ratio.

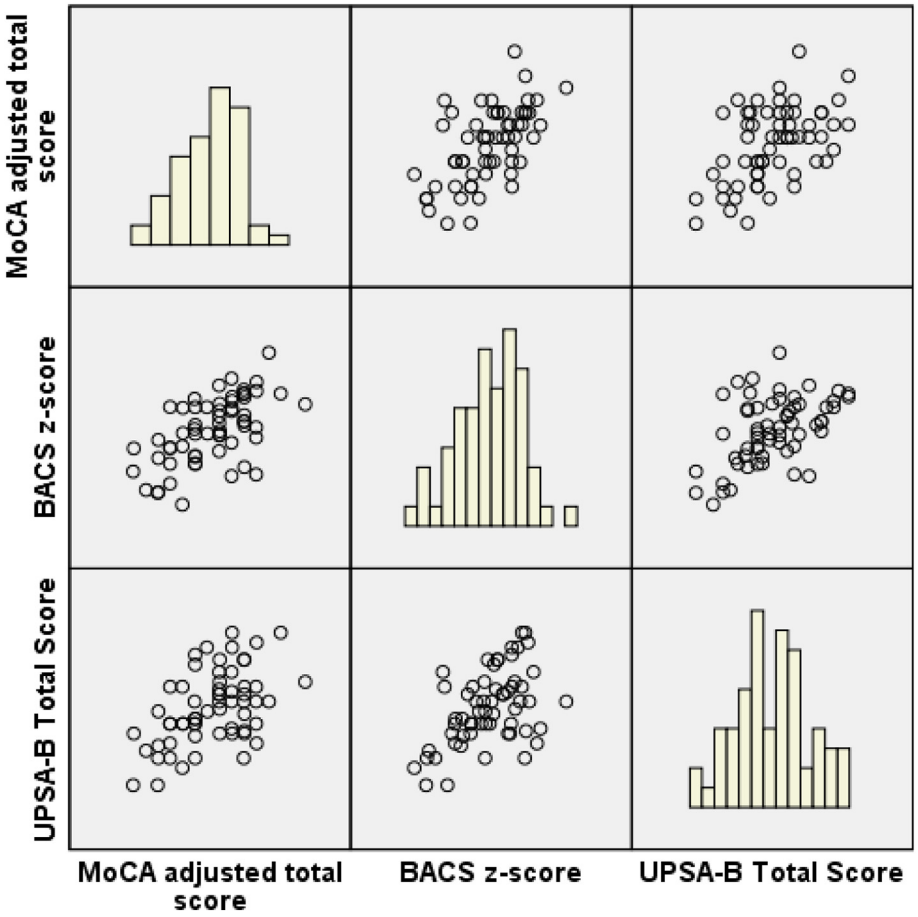

Fig. 2. Scatterplot matrix of the MoCA adjusted total score, BACS z-score and UPSA-B total score.

the MoCA scores in this and the study by Musso et al. (2014) were already corrected for patients with ≤12 years of education as suggested by the MoCA manual. The contrasting results could also be due to the involvement of different clinical population or sample characters in different studies; for example, the sample in Wu et al.'s study had a relatively lower education level (10.96 ± 1.92 year of education) as compared to the present study (13.58 ± 2.72 year of education) (Wu et al., 2014).

Implications of our results in clinical practice is the ability for clinicians or clinic staff providers to confidently classify individuals scoring 25 and above as likely normal due to the sensitivity of the test. Likewise, individuals who score below 25 but above 23 are most probably deemed to have mild cognitive impairments while those scoring below 23 are likely to have severe cognitive impairments. Further testing would likely be recommended for those with cognitive impairments.

This study has a relatively small sample size and future replication is necessary for validation and generalization. In addition, future studies might be directed at improving the suitability of the use of MoCA on the schizophrenia population. For example, minor adjustments could be made to the MoCA scale. Some of such adjustments might include increasing the weightage of scoring for tasks that assess cognition which are specifically impaired in schizophrenia, such as attention, verbal fluency, verbal learning and memory (Bowie and Harvey, 2006). On the other hand, tasks that appear lacking utility in detecting cognitive impairments in schizophrenia, such as task of naming could either be removed or have a reduced weightage in scoring. Apart from that, other studies might also examine the MoCA's sensitivity to cognitive change as well as the impact of clinical symptoms on its performance (Blair et al., 2016).

In summary, the results from this present study support the use of the MoCA as a bedside cognitive screening tool for patients with schizophrenia in the fast-paced clinical setting for various reasons - brief and simple administration, free usage for clinical purpose, and most importantly the scale's adequate sensitivity in identifying cognitive impairment. However, lower cut-off scores will need to be applied in patients with schizophrenia. It is important to note that the MoCA does not replace the use of a comprehensive neuropsychological battery in identifying specific areas of impairment.

Table 4
Prediction of functional capacity.

		B	*SE*	*β*	*t*	*VIF*	*p*
Model 1							
Model 1a	Intercept	72.11	3.15		22.92		<.001
	BACS Z-score	5.55	1.27	0.50	4.37	1.00	<.001
Model 1b	Intercept	67.29	3.61		18.62		<.001
	BACS Z-score	3.37	1.51	0.30	2.23	1.54	.030
	MoCA adjusted score	1.62	0.67	0.33	2.44	1.54	.018
Model 2							
Model 2a	Intercept	60.09	1.68		35.86		<.001
	MoCA adjusted score	2.50	0.56	0.51	4.50	1.00	<.001
Model 2b	Intercept	67.29	3.61		18.62		<.001
	MoCA adjusted score	1.62	0.67	0.33	2.44	1.54	.018
	BACS Z-score	3.37	1.51	0.30	2.23	1.54	.030

B: beta; *SE*: standard error; *β*: standardized beta weight; *t*: t-statistic; *VIF*: variance inflation factor; *p*: *p*-value.

Declaration of interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.schres.2018.03.008.

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