Validity and Reliability of the Indonesian Version of Brief Assessment of Cognition in Schizophrenia (BACS-I)

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Abstract

Approximately, 84%-94% patients with schizophrenia demonstrate cognitive impairment. Brief assessment of cognitive function for schizophrenia patients to be used in clinical practice is not available in Indonesia. This study aimed to assess the validity and reliability of the Indonesian version of the Brief Assessment of Cognition in Schizophrenia (BACS-I).

50 patients with schizophrenia who have been in remission phase, were assessed using BACS-I between April 2018 and September 2018 in two separate session at range interval of 14-90 days. Consistency in assessment score between the session was evaluated using test-retest reliability. The concurrent validity was assessed using standard battery.

The median of completion for the BACS-I was 22.08 min (16.13 min – 29.79 min) and show high test-retest reliability (ICC = 0.94). Correlation with standard test are very weak until moderate (0.09 – 0.59), but only significantly in verbal memory, working memory, and motor speed.

This study results indicates that BACS-I has satisfactory reliability to assess cognitive function in schizophrenia patients.

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Introduction

Cognitive impairment occurs in 84%-92 % of cases of schizophrenia[1] and it is a major determinant of general functioning of patients with schizophrenia.[2] Cognitive domains that show impairment in schizophrenia include attention, executive function, long-term and learning memory, working memory, and verbal fluency.[2] In Indonesia, neurocognitive test (NCT), we have performed to assess cognition in patients with schizophrenia requires two hours duration to complete. It is time-comsuming and technically difficult. The Brief Assessment of Cognition in Schizophrenia (BACS) is a portable pen-and-paper battery that requires approximately 30-40 minutes to complete.[3] Additionally, it is reliable to evaluate the main cognitive domains that are affected in schizophrenia, such as verbal memory, working memory, motor speed, verbal fluency, attention and executive function.[4]

The original version's composite score has a high test-retest reliability in patients with schizophrenia and healthy control (ICCs>.80).[5] The composite scores from the BACS and the standard battery were highly correlated in original, Brazilian, French, German, Spanish, Japanese, and Italian version.[4] The composite score is strongly correlated to functional measures such as independent living skills (r+.45), performance-based assessments of performance of everyday living skills (r=.56), and interview-based assessments of cognition in patients with schizophrenia (r=.48). Thus, it shows that BACS has a clear functional significance.[5] This data suggest that the BACS is a valid and reliable instrument for testing cognitive function in schizophrenia. This study will primarily assess validity and reliability of the Indonesian version of BACS (BACS-I) to assess cognition in schizophrenia patients.

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Materials and methods

The research was approved by Cipto Mangunkusumo National Hospital (LB.02 12.2 10399/2018) along with the ethical approval by

the Health Research Ethics Committee Faculty of Medicine, Universitas Indonesia (829/UN2.F1/ETIK/VII/2018).

Translation of BACS

In order to approve the version of BACS that was translated from English to Indonesian language, BACS was subjected to the following step-wise methodology: two independent forward translations, reconciliation, two independent back-translations, and panel testing with 10 people with schizophrenia and 10 residents of psychiatry of the Universitas Indonesia (UI) as controls. Subsequently, instructions and verbal memory test items were translated and adapted to suit the Indonesian language. For the verbal fluency test, "F" and "S" were changed to "N" and "S," which are used more often in the Indonesian language.[6] The author reviewed the back-translation for accuracy and sent to NeuroCog trial team which has BACS copyright for approval.

Subjects

This study design is cross sectional study. The tests were conducted between April 2018 and September 2018. The study included 50 patients who were diagnosed with schizophrenia based on the Structured Clinical Interview for DSM-IV Axis I Disorder exam. The patients were enrolled from three different locations: outpatients of the Psychiatry Clinic at the Cipto Mangunkusumo Hospital, Jakarta; Unit Informasi Layanan Sosial, Tebet-Jakarta; and Komunitas Peduli Skizofrenia Indonesia, Jakarta. All participants of the study have provided their written consent after being informed about the study.

The inclusion criteria included patients who met the DSM-IV criteria for schizophrenia, were in remission phase with Positive and Negative Symptom Scale remission score of <4 for each item, and had graduated from secondary high school. Patients with a history of epilepsy, brain trauma, or current substance use disorder were excluded. No specific medication criteria were set for inclusion. Demographic characteristics of the patients are indicated in Table 1.

Measure	Mean	S.D.
Age (years)	36.48	10.36
Illness duration (years)	13.98	9.09
Education (years)	14.17	0.34
Gender (N; %)		
Male	42 (84)	
Female	8 (16)	
Handedness (N; %):		
Right	50 (100)	
Left	0 (0)	

Tabel 1. Demographic of the sampel (N=50)

Assessment procedures

The patients were evaluated using BACS-I by trained residents in two separate sessions with an interval range from 14 to 90 days. The tests, procedures, and measures are listed below in the order that they were conducted and performed.

Verbal memory. The patients were presented verbally with 15 words and were then asked to recall as many words as possible. This procedure was repeated five times. In total, eight versions of verbal memory were determined. Verbal memory was assessed using the number of words recalled per trial in any order (range: 0–75 words).

Working memory. Digit sequencing task: The patients were presented with clusters of numbers in increasing quantity. They were asked to recall and tell the experimenter the quantity of numbers in the presented order. This task was assessed using the number of correct responses (range: 0–28).

Motor speed. Token motor task: The patients were provided 100 plastic tokens and were asked to place them in a container, two at a time, as quickly as possible. A 60-s time limit was imposed for this task, which was assessed using the number of tokens that were correctly placed in the container (range: 0–100).

Verbal fluency. Semantic or category fluency: The patients were given 60 s to name as many words as possible within a given category (e.g., names of animals). Phonetic or letter fluency: In two separate trials, the patients were asked to provide as many words as possible that began with a given letter (either N or S) in a 60-s period. Verbal fluency was assessed using the number of words generated per trial.

Attention and speed of information processing. Symbol coding: As quickly as possible, the patients were asked to write the numerals 1–9 corresponding to symbols presented on a response sheet. The patients

were provided maximum 90 s to complete the task, which was assessed using the number of correct numerals written (range: 0–110).

Reasoning and problem solving. Tower of London: The patients were simultaneously shown two pictures, each showing three balls of different colors arranged on three pegs. The balls were distinctly arranged in each picture. The patients were then asked to specify the total number of times the balls in one picture needed to be moved in order to arrange them in the manner depicted in the other picture. In total, there were 20 trials per patient. The test was discontinued if the patient provided five consecutive incorrect responses. If patients provided correct answers in all 20 trials, they were asked to complete two additional trials of greater difficulty. This task was assessed using the number of correct responses provided (range: 0–22).

Composite score

Composite score was calculated by averaging all z-scores of the six primary measures from BACS-I, using the first test patient means and the standard deviations.

Standard battery

Subjects were tested using BACS-I on first day followed by a standard battery on the next week. The standard battery was composed of widely used tests that are thought to assess the same constructs as the BACS. The tests and their respective constructs are listed below in the order administered: The Rey Auditory-Verbal Learning Test (RAVLT) for Verbal Memory,[3] Backward Digit Span (BDS) for Working Memory,[3] Finger Tapping Test (FTT) for Motor Speed,[7] Continuous Performance Task-Identical Pairs (CPT-IP) for A Attention,[8] and Trial Making Test B (TMT-B) for Executive Function.[9] The Category Fluency and Letter Fluency in BACS-I are included in NCT, and therefore we did not conduct a control test for verbal fluency. All of the test included in NCT had been previously validated in Indonesia.

Data analysis

Data was analyzed by using the Statistical Package for the Social Sciences (SPSS) version 20.0 (IBM Corp., Armonk, NY). Descriptive statistics were used to report demographic characteristics. Test–retest reliability was calculated using intraclass correlations for both the sessions. Relationships among BACS-I with standard battery were determined by calculating Pearson or Spearman correlations among the scores depends on normality of the data, $p < .05$ was considered statistically significant. A composite score was calculated by averaging all z-score of the six primary measures form the BACS-I.

Results

Administration time and completion rates

The median duration of BACS in first visit was 22.08 min (16.13 – 29.79 min) whereby median duration of BACS in second visit was slightly shorter 20.09 min (17.23 – 29.11 min).

Test-retest reliability

Table 2 lists the mean and standard deviation for all the measures from the BACS. The ICC and *Cronbach's Alpha* results between test retest for the entire sample were 0.94.

Measure	Test visit 1			Test visit 2			ICC	α
	N	Mean	S.D.	N	Mean	S.D.		
Verbal memory	50	31.78	8.11	50	33.74	8.71	0.80	0.81
Digit sequencing	50	15.64	3.61	50	17.30	4.29	0.79	0.82
Token motor task	50	58.72	15.68	50	61.84	16.11	0.90	0.91
Verbal fluency	50	34.22	8.80	50	37.08	9.67	0.83	0.85
Symbol coding task	50	39.68	11.76	50	41.22	11.81	0.93	0.93
Tower of London	50	13.04	4.92	50	13.94	4.55	0.86	0.87
BACS-I Composite Score	50	0.00	0.08	50	0.00	0.09	0.94	0.94

α = *Cronbach's Alpha*

Table 2. Mean, reliability coefficients (ICCs), and Cronbach's Alpha of BACS-I

Concurrent validity

Table 3 list the correlation between subtests BACS-I compare with standard battery. We use Pearson correlation for measuring correlation between RAVLT with Verbal Memory; FTT with Motor Speed; RAVLT with composite score; and FTT with composite score. Spearman correlation being use for measuring correlation between DBS with Working Memory; CPT-IP with Symbol Coding Task; TMT-B with Tower of London; DBS with composite score; CPT-IP with composite score; TMT-B with composite score.

Correlations are significantly in RAVLT with Verbal Memory ($p = .000$), DBS with

Working Memory (p = .001), FTT with Motor Speed (p = .000), composite score with RAVLT (p = .002), composite score with DBS (p = .007), composite score with FTT (p = .003), and composite score with TMT-B (p = .049). Correlations are not significantly in CPT-IP with Symbol Coding Task (p = .527), TMT-B with Tower of London (p = .15), and CPT-IP with composite score (p = .054).

	Verbal Memory	Working Memory	Motor Speed	Symbol Coding Task	Tower of London	BACS-I Composite Score
RAVLT	0.59**	0.39**	0.16	0.08	0.22	0.42**
BDS	0.10	0.47**	0.22	0.13	0.18	0.37**
FTT	0.13	-0.07	0.49**	0.40**	0.29*	0.40**
CPT-IP	0.10	0.16	0.35*	0.09	0.11	0.11
TMT B	0.01	0.26	0.07	0.01	0.20	0.27*

*$P < 0.05$, **$P < 0.01$
BACS-I, Brief Assessment of Cognition in Schizophrenia–Indonesian version; RAVLT, Rey Auditory-Verbal Learning Test; BDS, Backward Digit Span; FTT, Finger Tapping Test; CPT-IP, Continuous Performance Task-Identical Pair; TMT B, Trial Making Test B.

Tabel 3. Correlation for BACS-I measures and standard battery

Discussion

Results of the present study indicate that BACS-I is a reliable tool to evaluate cognitive function in schizophrenia. BACS-I required a median of 22.08 min to complete, whereas the original BACS was required less than 35 min to be completed.[3] Shorter processing time in BACS-I can be caused by the use of simplest Indonesian language in the test instruction.

The duration between first assessment and the second varies from 14 until 90 days. This duration could have reduced the practice effect amongst patients.[3] Unequal duration between test, may potential to produce a bias towards the patient's condition. In this study, 84% of the patients is male. Another studies in the Italian population of normal subjects stated that gender had no effect on the performance of the BACS test. In addition, the initial BACS study also stated that there were no significant differences between male and female sex in schizophrenic patients.[10] Another condition that need to be considered is all patients included in this test are right handed. This study needs to be reexamined if we want to generalize it for left handed population. There are no data on differences in outcomes when performed on left-handed populations in previous BACS studies, but there is consideration that left-handed link with genetic and brain lateralization in schizophrenic patients.[11] These conditions may be indirectly related to the cognitive function of schizophrenia patients.

BACS-I showed good test-retest reliability ICCs of 0.94 that indicate it is a reliable tool to evaluate cognitive function in schizophrenia in Indonesia. Compare to another version, BACS showed similar good test-retest reliability, *Brazilian Portuguese version of* BACS with ICCs of 0.68 – 0.84[3] and *Malay version of* BACS with ICCs of 0.76 – 0.85.[5] This data supported that BACS showed good reliability in different language and culture.

The correlation between subscales of BACS-I with standard battery were very weak to moderate (0.09 – 0.59), but only significant in Memory Verbal (r = 0.59, p= .000), Working Memory (r = 0.47, p = .001), and Motor Speed (r = 0.49, p = .000). Insignificant correlation between TMT-B and Tower of London may be caused by different part of executive function working at the test. The TMT-B more estimate quick visual search, visual space sorting and cognitive set transfer functions,[9] which differ with Tower of London, more estimate problem solving task.[12] Both symbol coding task and CPT-IP measure the attention and speed of information processing. The CPT-IP used for measuring sustained attention.[13] The insignificantly correlation between both tests may cause by symbol coding task performance relies predominantly on executive function, rather than processing speed or memory.[14] This results, showed there still need another standard test for measure concurrent validity between subscales, Symbol Coding task and Tower of London of BACS-I.

Conclusions

This study showed that BACS-I is a reliable and practical scale to evaluate cognitive function in schizophrenia patients. Compared to standard tests, Symbol Coding Task and Tower of London are not significant correlated.

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Declaration of Interest

The authors report no conflicts of interest.

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