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An abbreviated version of the brief assessment of cognition in schizophrenia (BACS)

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ABSTRACT – *Background and Objectives:* A short version of the Brief Assessment of Cognition in Schizophrenia (BACS) was derived.

Methods: We calculated the corrected item-total correlation (CITC) for each test score relative to the composite score, and then computed the proportion of variance that each test shares with the global score excluding that test ($R_t^2 = CITC_t^2$) and the variance explained per minute of administration time for each test (R_t^2/mint).

Results and Conclusions: The 3 tests with the highest R_t^2/mint, Symbol Coding, Digit Sequencing, and Token Motor, were selected for the Abbreviated BACS.

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Introduction

The assessment of cognitive function is an important step in evaluating patients with schizophrenia because of the extensive evidence that cognitive impairment is a core feature of schizophrenia[1], as well as a key determinant of functional outcome[2]. The Brief Assessment of Cognition in Schizophrenia (BACS) has been developed as a quick and efficient tool for measuring cognition in patients with schizophrenia[3]. The time required for the testing with the BACS is approximately 30 min with minimal extra time for scoring and training demands. The author tried to derive an abbreviated version of the BACS (Abbreviated BACS, A-BACS) to make it more useful for clinical work, using the Japanese BACS recently developed by the authors upon permission[4].

Methods

Data from a previous study were utilized, and the subjects consisted of 472 stable patients with a DSM-IV[5] diagnosis of chronic schizophrenia or schizoaffective disorder. Among the patients, 213 (45%) were women; the patients had a mean age of 38.8 (SD = 13.3), and a mean age at onset of 24.7 years (SD = 7.9).

The BACS takes approximately 30 min, and is devised for easy administration and scoring by non-psychologists. It is specifically designed to measure treatment-related improvements. The BACS has high test-retest reliability[3], and is as sensitive to cognitive dysfunction in schizophrenia as standard 2.5-h batteries[6]. The BACS includes brief assessments of verbal memory (Verbal Memory), working memory (Digit Sequencing), motor speed (Token Motor), verbal fluency (Verbal Fluency), attention and processing speed (Symbol Coding), and executive function (Tower of London). The 18-item Brief Psychiatric Rating Scale (BPRS[7], 1-7 score) was completed by a trained psychiatrist along with the BACS, and the patients had a mean total BPRS score of 42.0 (SD = 13.6).

The data analyses were conducted using JMP-8.0.2.J for Mac software (SAS Institute Inc., Cary, NC, US). Descriptive statistics were used to report the patients in terms of socio-demographic and clinical data. The relationships among measures were determined by calculating Pearson correlations (r) among the scores. The level of significance was set at $P < 0.05$ (two-tailed).

Results

Based on the previous study[8], we calculated the corrected item-total correlation (CITC) for each test score relative to the composite score (Table). The CITC is the correlation between each standardized test score in the BACS with the standardized BACS total score excluding the test score itself, thereby controlling for part-whole correlation. We computed the proportion of variance that each test shares with the global score excluding that test ($R_t^2 = CITC_t^2$) and the variance explained per minute of administration time for each test (R_t^2/min_t). The 3 tests with the highest R_t^2/min_t were selected for the A-BACS. The composite score from the Symbol Coding, Digit Sequencing, and Token Motor tasks correlated 0.93 with the composite score of the whole BACS ($R^2 = 0.86$, $P < 0.0001$) and correlated 0.74 with the total battery score excluding these 3 tests ($R^2 = 0.55$, $P < 0.0001$).

Table
BACS Item; Tests Sortied by Variance Explained Per Minute of Administration Time.

Condition	CITC	Variance	Estimated Admin Time (min)*	VPM
Symbol Coding	0.74	0.55	3	0.18
Digit Sequencing	0.68	0.46	5	0.09
Token Motor	0.53	0.28	3	0.09
Verbal Memory	0.68	0.46	7	0.07
Verbal Fluency	0.61	0.37	5	0.07
Tower of London	0.59	0.34	7	0.05

*Administration times were derived from the administration records from the previous study[11].

VPM = variance explained per minute of administration time.

CITC = corrected item-total correlation.

BACS = Brief Assessment of Cognition in Schizophrenia.

Discussion

The A-BACS is also composed of two speed of processing measures and one working memory measure. The finding is consistent with the results in the previous reports: in their report, Hurford *et al*.[8] proposed a group of tests composed of trail making B, category fluency, and digit symbol. Verbal fluency was not chosen for this A-BACS, mainly because verbal fluency in the BACS is composed of Semantic Fluency and two trials of Letter Fluency, and thus it takes three times as long as Semantic Fluency alone takes. The findings in this study therefore suggested that the A-BACS could provide a valid estimate of general cognitive ability.

For assessing cognitive function in schizophrenia, a neuropsychological test battery (NTB), usually consisting of 8-12 tests tapping each of several for the putative neurocognitive domains, is employed. These NTBs are, however, time consuming, technically difficult, and costly. The availability of a quick and efficient tool for measuring cognition in patients with schizophrenia could be an extremely useful guide for clinicians making decisions about potential rehabilitation, and thus BACS has been developed. Still, a typical outpatient psychiatric practice allots about 15min for medication management appointments[8]. The 3 tests with the highest R_t^2/min_t were selected for the A-BACS, because, as Hurford *et al*.[8] described, a brief battery should be very brief and account for a large proportion of the variance of the global cognitive score of the battery.

Since a single generalized cognitive deficit has been suggested to best characterizes schizophrenia[9] and A-BACS could be administered approximately in 11 min, it may be a good choice to use an A-BACS to assess cognitive function in patients with schizophrenia in clinical settings. For broader dissemination of brief neuropsychological assessments such as A-BACS, further studies should be necessary to test their sensitivity to treatments. In addition, we should be aware that, for prediction of different aspects of outcome, another A-BACS composed of a different subset may be necessary[10].

Conflict of interest

Dr. Kaneda is responsible for developing the Japanese version of the BACS. Dr. Keefe receives royalties from the BACS testing battery and the MATRICS Battery (BACS Symbol Coding). He is also a shareholder in NeuroCog Trials, Durham, NC, USA.

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