

Three-subtest Short Form of the Wechsler Adult Intelligence Scale-III for Patients with Psychotic Disorders: a Preliminary Report

ELS Chan, EYH Chen, RCK Chan

Abstract

Objective: To evaluate the usefulness of a 3-subtest short form of the Wechsler Adult Intelligence Scale-III for estimating full-scale intelligence quotient scores by comparing it with an established 4-subtest short form.

Patients and Methods: Full-scale intelligence quotient scores were evaluated using the 4-subtest short form, which includes information, arithmetic, digit symbols, and block design, in a group of 49 patients with psychotic disorders and 49 healthy controls matched for age and educational status. Regression analysis was used to evaluate a model consisting of the 3 subtests, information, arithmetic, and digit symbols.

Results: Variables included in the 3-subtest short form accounted for 94% of the variance for patients with psychotic disorder and 88% of the variance for healthy controls. Correlation coefficients were 0.97 for patients with psychotic disorders and 0.94 for healthy controls. Both for patients and healthy controls, the 3-subtest estimates fell within 5 points of the 4-subtest scores (with a maximum of 76 points) in 98% of cases.

Conclusion: The data suggest that the proposed 3-subtest short form is almost as effective as the 4-subtest short form for providing an estimate of general intelligence of patients with psychotic disorders.

Key words: *Intelligence tests, Methodological study, Psychotic disorders, Schizophrenia, Wechsler scales*

Introduction

Intelligence impairment has been reported for patients with schizophrenia.^{1,2} Various standard tests of intelligence are used in clinical settings. One of these, the Wechsler Adult Intelligence Scale (WAIS), in its various revisions, has been widely used for the assessment of intelligence across different cultures.³ In various clinical and research settings, intelligence quotient (IQ) is a useful measure of general cognitive

ability and also provides an interpretive context for other test results.⁴

The WAIS-III Manual states that the average time required to carry out a full-scale IQ assessment is 60 to 90 minutes.³ Patients with psychiatric disorders may take even longer to complete the tests. This long assessment time may lead to fatigue and decreased motivation for patients.⁵ Abbreviated versions of intelligence tests have therefore been developed to allow more rapid estimation of intelligence for research and clinical purposes.

The 7-subtest short form of the WAIS-III devised by Axelrod et al, which includes the information, digit span, arithmetic, similarities, picture completion, block design, and digit symbol subtests, can be administered in 37 to 45 minutes.⁶ A correlation coefficient of 0.98 has been reported for the correlation between estimates obtained by the 7-subtest short form of the WAIS-III and full-scale IQ scores.⁷

The Satz-Mogel short form is based on select-item abbreviation.⁸ The total number of items within individual subtests was reduced by 50%, with a corresponding reduction in administration time compared with the full-scale version. The correlation coefficient for the relationship

Ms Elke LS Chan, Department of Psychiatry, The University of Hong Kong, Pokfulam, Hong Kong, China.

Dr Eric YH Chen, Department of Psychiatry, The University of Hong Kong, Pokfulam, Hong Kong, China.

Dr Raymond CK Chan, Department of Psychiatry, The University of Hong Kong, Pokfulam, Hong Kong, China, and Department of Psychology, Sun Yat-Sen University, Guangzhou, China.

Address for correspondence: Ms ELS Chan, Department of Psychiatry, The University of Hong Kong, Queen Mary Hospital, Pokfulam Road, Pokfulam, Hong Kong, China.
Tel: (852) 2855 3064; Fax: (852) 2855 1345;
E-mail: elke_chan@yahoo.com.hk

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between the short-form and full-scale IQ scores was 0.93 and the short-form estimate of IQ was within 6 points of the WAIS-III in 90% of cases.⁸ The 4-subtest short form of the WAIS-III devised by Blyler et al, which includes the information, block design, arithmetic, and digit symbol subtests, can be administered in 30 minutes.⁴ This combination, which comprises 1 subtest from each of the 4 WAIS index scores, has been shown to account for 90% of the variance for patients with schizophrenia and 86% of the variance for healthy controls when compared with the full-scale IQ scores.

Although the latter 4-subtest short form offers a substantially reduced administration time compared with the full-scale version, assessment of each patient still requires a minimum of 30 minutes. For some clinical and research purposes, a less time-consuming test would be advantageous. The aim of the present study was to develop a method for assessing general cognition background, suitable for use as a research tool, which could be completed within 15 minutes. The 4-subset short form of Blyler et al,⁴ which is based on information, arithmetic, digit symbol, and block design, was the starting point. The block design subtest was omitted in order to save time and increase flexibility; this was the most time-consuming of the 4 subtests and the remaining 3 tests could be completed in approximately 15 minutes. Furthermore, a set of 9 blocks, a booklet, and a timer were needed to conduct the block design test, whereas only a piece of paper and a timer were needed for the other 3 tests.

Patients and Methods

Patients were recruited from inpatient and outpatient populations at the Queen Mary Hospital, Hong Kong, which is a university teaching hospital. Patients fulfilled the criteria in the Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV for the diagnosis of schizophrenia. Other inclusion criteria were: age between 18 and 65 years; a level of understanding sufficient to communicate intelligently with the study coordinator and to participate in cognitive testing; and Cantonese-speaking Chinese ethnicity. Exclusion criteria were: DSM-IV-defined substance abuse or drug dependence in the past 3 months; attendance at a special school due to learning disability; or presence of organic disorder or serious physical illness.

A healthy control population was recruited from the general public by invitation during a public health education event. Their health status was screened by psychiatrists or trained research assistants using a semi-structured questionnaire. Any participants with a history of mental illness were excluded. The healthy control population was matched with the patient group for age, educational level, and ethnicity. Informed consent was obtained in accordance with the Declaration of Helsinki.

Assessment Methods

Selected WAIS-III subtests were administered and scores were determined in accordance with standard procedures.³

The 4-subtest short form administered included the information, block design, arithmetic, and digit symbol subtests.⁴ Scores were also estimated using a 3-subtest short form, which included the results of information, arithmetic, and digit symbol subtests only.

Data Analysis

The Statistical Package for Social Sciences, version 11.0, was used for all data analysis. Descriptive statistics for demographic data and WAIS subtests were generated first. The Chi squared test was then used to compare the demographic data of patients with schizophrenia and healthy controls. Due to the small sample size and skewed distribution, the non-parametric paired Wilcoxon signed rank test was used for between-group comparisons of scores. A regression model of the 3-subtest short form was developed to estimate 4-subtest short-form scores. The Pearson correlation coefficient was calculated for the 3-subtest short form.

Results

Forty nine patients were recruited, 32 men and 17 women. Their diagnoses were as follows: schizophrenia (32.7%), paranoid schizophrenia (30.6%), psychosis not otherwise specified (16.3%), delusional disorder (8.2%), acute and transient psychosis (4.1%), acute polymorphic psychosis (4.1%), undifferentiated schizophrenia (2.0%), and schizoaffective disorder (2.0%). Of the 49 healthy controls recruited, 12 were men and 37 were women. Data for age and educational status both for patients and healthy controls are summarised in Table 1. There was no significant difference between the 2 populations in these respects.

Table 2 summarises the subtest and total scores for the 4-subtest short form of the WAIS-III. Significantly lower values were obtained for patients than for healthy controls

Table 1. Demographic data for patients and healthy controls.

Characteristic	Patients Mean (SD)	Controls Mean (SD)
Age (years)	28.9 (10.9)	29.5 (11.0)
Education (years)	11.6 (3.6)	11.0 (1.4)
Number assessed	49	49

Table 2. Comparison of 4-subtest short-form WAIS-III scores for patients and healthy controls.

Subtest	Patients Mean (SD)	Controls Mean (SD)
Arithmetic	9.5 (2.9)	10.0 (2.7)
Digit symbol	8.6 (3.4)*	12.0 (3.3)
Information	9.0 (2.8)*	11.1 (2.7)
Block design	10.4 (3.2)	11.6 (2.9)
Total score	37.5 (9.6)*	44.7 (7.9)

* Significantly lower than value for controls, $p \leq 0.01$, Wilcoxon test.

Table 3. Comparison of estimated 3-subtest scores and 4-subtest short-form scores.

Difference between scores (points)	Patients		Controls	
	Frequency Number (%)	Cumulative frequency (%)	Frequency Number (%)	Cumulative frequency (%)
0	9 (18.4)	18.4	2 (4.1)	4.1
1	11 (22.4)	40.8	18 (36.7)	40.8
2	8 (16.4)	57.2	9 (18.4)	59.2
3	11 (22.4)	79.6	12 (24.5)	83.7
4	5 (10.2)	89.8	4 (8.2)	91.9
5	4 (8.2)	98.0	3 (6.1)	98.0
6	1 (2.0)	100	1 (2.0)	100

for total score ($z = -3.92$, $p < 0.001$), digit symbol ($z = 4.57$, $p < 0.001$), and information ($z = 3.43$, $p = 0.01$).

When estimates based on the 3-subtest short form were compared with 4-subtest short-form scores, Pearson correlation coefficients were 0.97 for patients with psychotic disorders and 0.94 for healthy controls. The percentage of patients with 3-subset short-form estimates falling within 5 points of 4-subset short-form scores (with a maximum of 76 points) was 98% both for patients with psychotic disorders and healthy controls (Table 3).

The regression model for the 3-subtest short form was estimated IQ score = $2.4 + 1.3^* \text{arithmetic} + 1.3^* \text{digit symbol} + 1.4^* \text{information}$ for patients and estimated IQ score = $0.5 + 1.1^* \text{arithmetic} + 1.2^* \text{digit symbol} + 1.3^* \text{information}$ for healthy controls. R^2 values were 0.93 for patients with psychotic disorders and 0.88 for healthy controls (Table 4).

Discussion

This study provides preliminary empirical data for a 15-minute short-form WAIS-III assessment for patients with psychotic disorders, including schizophrenia. When compared with the 4-subtest short-form scores, estimated 3-subtest short-form scores accounted for 93% of the variance for patients with psychotic disorder and 88% of the variance for healthy controls. In addition, the 3-subset short-form estimates correlated significantly with 4-subtest short-form scores and the estimated IQ agreed with 4-subtest short-form IQ within 5 points in 98% of cases. These results suggest that the 3-subtest short form may be useful clinically

and also for research when a reasonable estimate of background cognition among patients with psychotic disorders is required.

The present study suggests that the 3-subtest short form of the WAIS-III can provide an estimate of intelligence level of patients with psychotic disorders and healthy controls. Its usefulness for patients with other disorders remains to be determined. This short form can be completed in approximately 15 minutes, leading to a reduction in both administrative burden and patient fatigue. However, any short form of the WAIS-III increases measurement error relative to that of a full-scale assessment. Therefore, short forms are not recommended for diagnostic purposes, determination of programme placement, or eligibility for benefits. However, in many routine clinical and research settings, short-form estimates are adequate for establishing the general level of cognitive competence and serve as useful screening tools for identifying patients who need more detailed assessment.

There are several limitations to the present study. First, the small sample size necessitates caution when interpreting the findings. Second, slightly higher estimated IQ might be expected when using the 3-subtest short form because fatigability is reduced in this approach. Third, due to time constraints, estimates based on the 3-subset short form were compared with corresponding 4-subtest scores, not full-scale IQ scores. Nevertheless, the present data provide a preliminary indication that the 3-subtest short form described here provides a good estimate of intellectual functioning, at least in the populations sampled in the present study, and may serve as a general indicator of background

Table 4. Stepwise regression analysis of short-form scores.

Group	Step	Variable	R ²	R ² increment	F value	Degrees of freedom	p Value
Patients	1	Arithmetic	0.645	0.645	88.0	1, 47	0.000
	2	Digit symbol	0.795	0.15	94.2	1, 46	0.000
	3	Information	0.932	0.137	220.7	1, 45	0.000
Controls	1	Arithmetic	0.471	0.471	43.8	1, 47	0.000
	2	Digit symbol	0.725	0.254	64.3	1, 46	0.000
	3	Information	0.879	0.154	117.6	1, 45	0.000

cognitive ability for research purposes. To validate further the usefulness of the 3-subtest short form, additional research is required, involving larger study populations and direct comparison of 3-subtest short-form scores with full-scale IQ scores.

References

1. Goldberg TE, Ragland JD, Torrey EF, Gold JM, Bigelow LB, Weinberger DR. Neuropsychological assessment of monozygotic twins discordant for schizophrenia. *Arch Gen Psychiatry* 1990;47:1066-1072.
2. Goldberg TE, Torrey EF, Gold JM, Ragland JD, Bigelow LB, Weinberger DR. Learning and memory in monozygotic twins discordant for schizophrenia. *Psychol Med* 1993;23:71-85.
3. Wechsler, D. WAIS-III: Wechsler Adult Intelligence Scale. Administration and scoring manual. 3rd ed. San Antonio: Psychological Corporation/Harcourt Brace; 1997.
4. Blyler CR, Gold JM, Iannone VN, Buchanan RW. Short form of the WAIS-III for use with patients with schizophrenia. *Schizophr Res* 2000;46:209-215.
5. Wymer JH, Rayls K, Wagner MT. Utility of a clinically derived abbreviated form of the WAIS-III. *Arch Clin Neuropsychol* 2003;18:917-927.
6. Axelrod BN, Ryan JJ, Ward LC. Evaluation of seven-subtest short forms of the Wechsler Adult Intelligence Scale-III in a referred sample. *Arch Clin Neuropsychol* 2001;16:1-8.
7. Pilgrim BM, Meyers JE, Bayless J, Whetstone MM. Validity of the Ward seven-subtest WAIS-III short form in a neuropsychological population. *Appl Neuropsychol* 1999;6:243-246.
8. Ryan JJ, Lopez SJ, Werth TR. Development and preliminary validation of a Satz-Mogel short form of the WAIS-III in a sample of persons with substance abuse disorders. *Int J Neurosci* 1999;98:131-140.