

Comparison Of The Children Neuropsychological And Behavior Scale And The Griffiths Mental Development Scales When Assessing The Development Of Children With Autism

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Background: The newly revised Children Neuropsychological and Behavior Scale (CNBS-R2016) is a diagnostic assessment tool widely used in China to assess the developmental level of children aged 0 to 6 years. The purpose of this study was to determine whether the effectiveness of developmental assessment in children with autism spectrum disorder (ASD) by the CNBS-R2016 was consistent with that of the Griffiths Mental Development Scales for China (GDS-C).

Methods: In total, 139 children with ASD were recruited in this study. The Autism Behavior Checklist (ABC) and the Childhood Autism Rating Scale (CARS) were used to measure ASD severity. All subjects were evaluated with both the CNBS-R2016 and GDS-C. To determine the consistency between the CNBS-R2016 and GDS-C, Pearson correlation coefficients and Bland-Altman plots were computed. The GDS-C was used as a reference assessment, and the performance of the CNBS-R2016 was analyzed with receiver operating curves.

Results: No significant difference was found between the proportions of developmental delays detected by the CNBS-R2016 subscales and the corresponding GDS-C subscales. The CNBS-R2016 Communication Warning Behavior subscale quotients and the total ABC and CARS scores were significantly and positively correlated. The general and subscale quotients of the CNBS-R2016 and the corresponding quotient of the GDS-C were also significantly and positively correlated. The area under all the curves of the CNBS-R2016 was above 0.8 according to the results of the GDS-C (general or subscale quotient <70 indicates a developmental delay), and Bland-Altman plots showed no systemic bias between the two scales.

Conclusion: The CNBS-R2016 and GDS-C tests showed good consistency in the developmental assessment of children with ASD. In addition, the CNBS-R2016 allows the simultaneous assessment of autism symptoms and the developmental level. Therefore, the CNBS-R2016 is worthy of clinical application in children aged 0–6 years.

Keywords: autism spectrum disorders, Children Neuropsychological and Behavior Scale, Griffiths Mental Development Scales, developmental assessment, children

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Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that presents in early childhood and is characterized by sociocommunicative dysfunction, restricted interests, and repetitive and stereotypical behaviors. The prevalence of ASD has increased dramatically in recent decades, from 1 in 5,000 children in 1975 to 1 in

59 children in 2014 in America;¹ the current worldwide prevalence is close to 1%.² ASD often coexists with a variety of other developmental disorders, and 31% of children with ASD demonstrate comorbid intellectual disabilities (IDs).¹ Speech and language problems are the main reasons that encourage caregivers of children with ASD to initially seek treatment.³ Gardner et al showed that the lower the adaption skills of children with ASD are, the higher the ASD severity and the greater the level of support required.⁴ The dual diagnosis of ASD and IDs can affect the services these children receive and ultimately their treatment outcomes.⁵ Children with ASD and missed diagnoses of comorbid ID may have worse developmental outcomes.⁶ Children with ASD and low developmental levels may need more intensive interventions to improve their developmental progress.⁷ Therefore, before children diagnosed with ASD receive treatment, intellectual and language development levels should be routinely evaluated to improve the multidimensional evaluation and diagnosis and to formulate a customized educational and behavioral intervention plan for these children. The goal is to reduce maladaptive behavior while developing life skills and normalizing functionality as much as possible.

A comprehensive psychological developmental assessment of children requires the evaluation of a broad range of behaviors, including motor, language, social, and cognitive traits. The Griffiths Mental Development Scales (GMDS) is a diagnostic measure that has been used extensively in many countries and has excellent psychometric properties.^{8,9} In 2006, the second edition of the GMDS was revised and renamed the Griffiths Mental Development Scales-Extended Revised (GMDS-ER).¹⁰ The GMDS-ER contains six separate subscales: Locomotor (A), Personal-Social (B), Language (C), Eye-Hand Coordination (D), Performance (E), and Practical Reasoning (F).¹⁰ Tso et al conducted a cross-cultural comparison of the Chinese version of the GMDS, and the results showed that the Griffiths Mental Development Scales for China (GDS-C) was adapted to the local Chinese culture and was suitable for the assessment of children aged 0–8 years in China.¹¹ However, the GDS-C scales are available only for evaluation by psychologists or clinicians with formal training. Furthermore, the GDS-C scales require at least one and a half hours for assessing a preschooler.

As an alternative to the GDS-C, the Children Neuropsychological and Behavior Scale (CNBS) is a diagnostic assessment tool developed by the Capital Institute of Pediatrics in China that is widely used in China to assess the

developmental level of children aged 0 to 4 years.¹² It includes five separate subscales: Gross Motor, Personal-Social, Language, Fine Motor, and Adaptive Behavior. The CNBS was restandardized in 2005 and completed in 2016 and was renamed the Children Neuropsychological and Behavior Scale-Revision 2016 (CNBS-R2016); the new version was shown to have adequate reliability.¹³ The age of assessment for the CNBS-R2016 was extended to 6 years, and an independent subscale, Communication Warning Behavior, was added to assess autism symptoms. After formal training, a psychologist can complete the CNBS-2016 in 30 to 50 mins.

Four of the subscales in the two tests correspond to one another. The Gross Motor, Personal-Social, Language and Fine Motor subscales of the CNBS-R2016 correspond to subscales A to D, respectively, of the GMDS. The Adaptive Behavior subscale of the CNBS-R2016 measures skills that are the forerunners of future “intelligence”. Therefore, it corresponds to subscales E and F in the GMDS. In addition, the classification of and statistics for the developmental level of children are similar in these two scales, which is another reason the two scales can be compared, as was done in the current study.

The GMDS has a wide range of clinical applications, such as the evaluation of the impact of epilepsy on cognitive competence,¹⁴ the impact of antiepileptic drugs on the cognitive development of offspring,¹⁵ the impact of congenital heart disease surgery on the outcome of infant neurodevelopment¹⁶ and the prediction of later developmental problems.^{17,18} In addition, previous research has proven that the Chinese version of the GMDS, which was renamed the GDS-C, is adapted to local Chinese culture.¹¹ Therefore, the GDS-C can be used as a reference assessment to evaluate the performance of new revisions of the CNBS.

To date, no study has compared the results of the CNBS-R2016 and the GDS-C tests in a given child with ASD. The purpose of this study was to determine whether the effectiveness of developmental assessment in children with ASD by the CNBS-R2016 was consistent with that of the GDS-C.

Methods

Study Design

This cross-sectional investigation was approved by the Ethics Committee of the First Hospital of Jilin University. Written informed consent was obtained from the parents or legal guardians of the children with ASD

prior to participation. This study was conducted in accordance with the Declaration of Helsinki.

Participants

The subjects were part of a research study in China entitled “Early diagnosis and nutritional intervention in children with autism spectrum disorders”, funded by the National Key Research and Development Program of China. After evaluation by at least 2 psychologists or developmental pediatricians in the First Hospital of Jilin University through a series of structured interviews conducted according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria, 139 children fulfilling the criteria for ASD were included in this study. These subjects also completed assessments of autism symptom severity and developmental level at the training center. The mean age of the children was 49.9 ± 12.3 months. The study group included 114 boys and 25 girls, and the age ranged from 25 months to 76 months. Subjects with Fragile X syndrome, Rett syndrome, genetic metabolic disorder, deficits in motor functioning (e.g., cerebral palsy) and other neurological disorders (e.g., epilepsy, tuberous sclerosis) were excluded from this study.

Measurements

Assessment Of Autism Symptoms

The symptoms of the children with ASD were assessed according to the Autism Behavior Checklist (ABC) and the Childhood Autism Rating Scale (CARS) by a developmental pediatrician.^{19,20} The ABC score for typically developing children should be < 53 , and the CARS score should be < 30 . The higher the scores on the two scales, the more severe the autism symptoms.

Assessment Of Mental Development

Two diagnostic mental development scales (CNBS-R2016 and GDS-C) were used in this study. Three psychologists who had undergone formal training in these two tests and had obtained evaluation qualification certificates participated in this study. Prior to the study, the evaluators conducted conformance tests using the GDS-C and CNBS-R2016, and the intragroup correlation coefficient was above 0.9. To reduce the impact of environmental factors on the test results, the test was conducted in a room in the training center that was familiar to the children. The GDS-C and CNBS-R2016 tests were performed in random sequences. The two tests for the same child with ASD were completed by the same evaluator within 1 week, and the original score was recorded.

The mean of the general quotient and the five subscale quotients of the CNBS-R2016 is 100. A general or subscale quotient less than 70 points [< 2 standard deviations (SDs)] indicates a developmental delay, a quotient between 70 and 79 points is slightly below the threshold for developmental delay, and a quotient greater than or equal to 80 points indicates no delay.¹³ For the new subscale of Communication Warning Behavior, a quotient less than 7 points indicates typical development, a quotient between 7 and 12 points indicates a need for follow-up, a quotient between 12 and 30 points indicates a risk of communication and interaction disorder, and a quotient greater than 30 points indicates a high suspicion of ASD.¹³ The mean of the general quotient and the six subscale quotients of the GDS-C is 100 points, and the SD is 15 points. A general or subscale quotient less than 2 SDs below the mean (< 70) indicates significant delay, a quotient between 1 SD and 2 SDs below the mean (70–85) indicates a mild delay, and a quotient equal to or greater than 85 points (≥ 85) indicates no delay.²¹ Each child with ASD was classified according to the SD as having significant delay (< -2 SDs) to mild or no delay (> -2 SDs).

Statistical Analyses

SPSS statistical software 22.0 (IBM Corp., Armonk, NY) was used to analyze the data. The Kolmogorov–Smirnov test was used to determine the distribution of the analyzed variable before analysis. Continuous variables are described as the means $\pm$ SDs, and categorical variables are described as frequencies and percentages. A chi-square test was performed to test for differences in the proportions of categorical variables between two groups. The Pearson correlation coefficient was calculated to evaluate the correlation between the two tests. The same statistical method was also used to test the correlation between the Communication Warning Behavior score of the CNBS-R2016 subscale and the total ABC and CARS scores. A Pearson correlation coefficient > 0.8 is considered an extremely strong correlation, a coefficient between 0.6 and 0.8 is considered a strong correlation, a coefficient between 0.4 and 0.6 is considered a moderate correlation, a coefficient between 0.2 and 0.4 is considered a weak correlation, and a coefficient between 0.0 and 0.2 is considered a very weak correlation.²² The performance of the CNBS-R2016 was determined using a receiver operating characteristic (ROC) curve by calculating the area under the ROC curve using the GDS-C general or a subscale quotient cut-off of 70 (mean -2 SDs) to identify a developmental delay. Bland-Altman plots were also drawn to analyze the agreement between the

two tests. All comparisons used 2-sided tests, and a p value <0.05 was considered statistically significant.

Results

Characteristics Of The Study Population

The characteristics of the study population are presented in Table 1. In total, 139 children were recruited for the current study. The mean age of the children with ASD was 49.9 ± 12.3 months, and the male-to-female ratio was 4.6:1.

Correlation Coefficients Of The Two Tests

Correlation coefficients were obtained between the general and subscale quotients of the CNBS-R2016 and their corresponding GDS-C quotients. The correlations between the general and subscale quotients of the Gross Motor, Personal-Social, Language and Fine Motor subscales were high and significant, with a Pearson correlation coefficient > 0.8 . The correlations of the quotient of the CNBS-R2016 Adaptive Behavior subscale to the corresponding quotient of the GDS-C Performance and Practical Reasoning subscale were significant, with a Pearson correlation coefficient between 0.5 and 0.8. These findings are presented in Table 2. There was a significant positive correlation between the CNBS-R2016 Communication

Warning Behavior subscale quotient and the total ABC score ($r = 0.821$, $p < 0.001$) and the total CARS score ($r = 0.734$, $p < 0.001$).

GDS-C And CNBS-R2016 Scores In Children With ASD

We evaluated the cognitive and behavioral development of children with ASD using both the GDS-C and CNBS-R2016 tests. The mean $\pm$ SD of the developmental quotients of the GDS-C and CNBS-R2016 are listed in Table 3. A general or subscale quotient -2 SDs below the mean was considered to indicate a developmental delay. The percentages of children exhibiting delays in different domains of the CNBS-R2016 and GDS-C are shown in Table 4. Due to their low developmental levels and limited language abilities, only 77 (55%) children has measurable scores in the Practical Reasoning area; the remaining 62 (45%) children scored zero in this area. The percentages of a developmental delay in two or more domains of the CNBS-R2016 and GDS-C were 68.3% and 67.6%, respectively. As shown in Table 4, the percentages of children with developmental delays in the Gross Motor, Personal-Social, Language, and Fine Motor subscales and in two or more domains of the scales did not differ significantly between the two tests. The percentage of a developmental delay according to the CNBS-R2016 general quotient was significantly lower than that determined by the GDS-C (55.4% vs 67.6%, respectively, $p < 0.05$).

The ROC Curve And Bland-Altman Plots

The area under the ROC curve for discriminating children with a developmental delay according to the general or subscale quotient of the CNBS-R2016 from those without

Table 1 Characteristics Of The Children With ASD Included In The Study (mean $\pm$ SD)

Item	ASD (n=139)
Age (mo)	49.9 $\pm$ 12.3
Gender (boys:girls)	114:25 (4.6:1)
Total ABC score	53.6 $\pm$ 18.5
Total CARS score	32.7 $\pm$ 5.2
Communication Warning Behavior score of the CNBS-R2016 subscale	40.8 $\pm$ 17.1

Table 2 Correlation Between The CNBS-R2016 And Its Corresponding GDS-C Scales

Variable (CNBS-R2016 Vs GDS-C)	r	p value
GQ	0.854**	<0.001
Gross Motor/Locomotor	0.873**	<0.001
Personal-Social	0.857**	<0.001
Language/Hearing-Speech	0.891**	<0.001
Fine Motor/Eye-Hand Coordination	0.808**	<0.001
Adaptive Behavior/Performance	0.766**	<0.001
Adaptive Behavior/Practical Reasoning	0.507**	<0.001

Note: ** $P < 0.001$.

Abbreviations: CNBS-R2016, The newly revised Children Neuropsychological and Behavior Scale; GDS-C, Griffiths Mental Development Scales for China; GQ, general quotient.

Table 3 General And Subscale Quotients Of The GDS-C And CNBS-R2016 (mean $\pm$ sd)

GDS-C		CNBS-R2016	
GQ	62.4 $\pm$ 19.9	GQ	66.8 $\pm$ 17.9
Subscale A	76.2 $\pm$ 19.3	Gross Motor	79.3 $\pm$ 18.8
Subscale B	62.4 $\pm$ 19.8	Personal-Social	65.4 $\pm$ 22.4
		Behavior	
Subscale C	54.7 $\pm$ 26.2	Language	58.0 $\pm$ 25.5
Subscale D	65.6 $\pm$ 21.8	Fine Motor	65.4 $\pm$ 19.2
Subscale E	69.1 $\pm$ 24.5	Adaptive Behavior	65.8 $\pm$ 20.6
Subscale F (n=77)	72.7 $\pm$ 23.1	-	-

Abbreviations: GDS-C, Griffiths Mental Development Scales for China; CNBS-R2016, The newly revised Children Neuropsychological and Behavior Scale; GQ, general quotient.

Table 4 Number Of Children With A Developmental Delay According To The General And Subscale Quotients Of The CNBS-R2016 And GDS-C (n, %)

Variable	CNBS-R2016	GDS-C	χ^2	p value
GQ	77 (55.4%)*	94 (67.6%)	4.391	0.036
Gross Motor/Locomotor	41 (29.5%)	55 (39.6%)	3.119	0.077
Personal-Social	80 (57.6%)	92 (66.2%)	2.196	0.138
Language/Hearing-Speech	105 (75.5%)	97 (69.8%)	1.159	0.282
Fine Motor/Eye-Hand Coordination	78 (56.1%)	80 (57.6%)	0.059	0.809
Adaptive Behavior/Performance	78 (56.1%)	75 (54.0%)	0.131	0.718
Practical Reasoning	–	41/77 (53.2%)	–	–
Delayed in ≥ 2 domains	95 (68.3%)	94 (67.6%)	0.017	0.898

Note: *Significantly different from the percentage of a delay by the GDS-C ($p < 0.05$).

Abbreviations: GDS-C, Griffiths Mental Development Scales for China; CNBS-R2016, The newly revised Children Neuropsychological and Behavior Scale; GQ, general quotient.

a developmental delay using the GDS-C general or subscale quotient cut-off of 70 (mean -2 SDs) as a standard is shown in Figure 1. The area under the curve (AUC) of all regions (Figure 1A–F) was approximately 0.9, which means that the CNBS-2016 could accurately detect the developmental delay in each area.

To examine the existence of systematic bias in the comparison between the CNBS-R2016 general or subscale quotients and the corresponding quotients of the GDS-C, Bland-Altman plots were created, as shown in Figure 2. These plots did not show any such bias in any area (Figure 2A–F).

Discussion

The objective of this study was to determine whether the effectiveness of developmental assessment in children with ASD using the CNBS-R2016 was consistent with that of the GDS-C. It is important to accurately measure and diagnose developmental delays in children with ASD given both the high comorbidity of these disorders and the influence of delays on a child's prognosis.^{23,24} In terms of describing the developmental level of children with ASD, our results showed that the proportion and distribution of the two tests for the detection of developmental delays in different domains in children with ASD are basically consistent. According to the assessment results of the CNBS-R2016 and GDS-C, nearly 70% of the children with ASD had developmental delays in two or more domains, consistent with Fombonne.²⁵ In addition, approximately 70% of the children showed developmental delays on the Hearing-Speech and Personal-Social subscales, while the proportion of children that manifested developmental delays on the Locomotor and Performance subscales was relatively small, indicating a characteristic cognitive profile of

children with ASD. The imbalance in the distribution of developmental delays across the five subscales of the CNBS-R2016 test also verified this cognitive profile. Sociocommunicative dysfunction is a core symptom of ASD and is often accompanied by impaired language ability. The relative strengths of individuals with ASD are gross motor and visual perception abilities. Visuospatial skills are tested in the Performance subscale of the GDS-C and in the Adaptive Behavior subscale of the CNBS-R2016, which may explain the low percentage of children in this study that showed developmental delays in these two subscales. Some research has also demonstrated this profile.^{26,27} In contrast, the proportion of children with developmental delays in all domains of the two tests was lower than that described by Guo et al (in which the proportion of children with a delay in each domain was above 70%),²⁸ possibly due to the sample size and age ranges of the subjects.

Although there was no difference in the ability of the CNBS-R2016 and GDS-C to identify developmental delays in the aspects of language, personal-social, adaptive behavior skills, gross and fine motor abilities in children with ASD, if the general quotients of the two tests were used to identify the proportion children with ASD with a general developmental delay, the CNBS-R2016 would have identified a lower proportion of the sample than the GDS-C. This finding may be because the CNBS-R2016 is a localized assessment tool, and some items more closely reflect the local culture; therefore, this tool may test the optimal ability of the children. This finding may also be related to the sample size; thus, further in-depth study is needed. One result that warrants attention is that there was a nearly trend-level difference in the percentage of children classified as having a delay in gross motor or

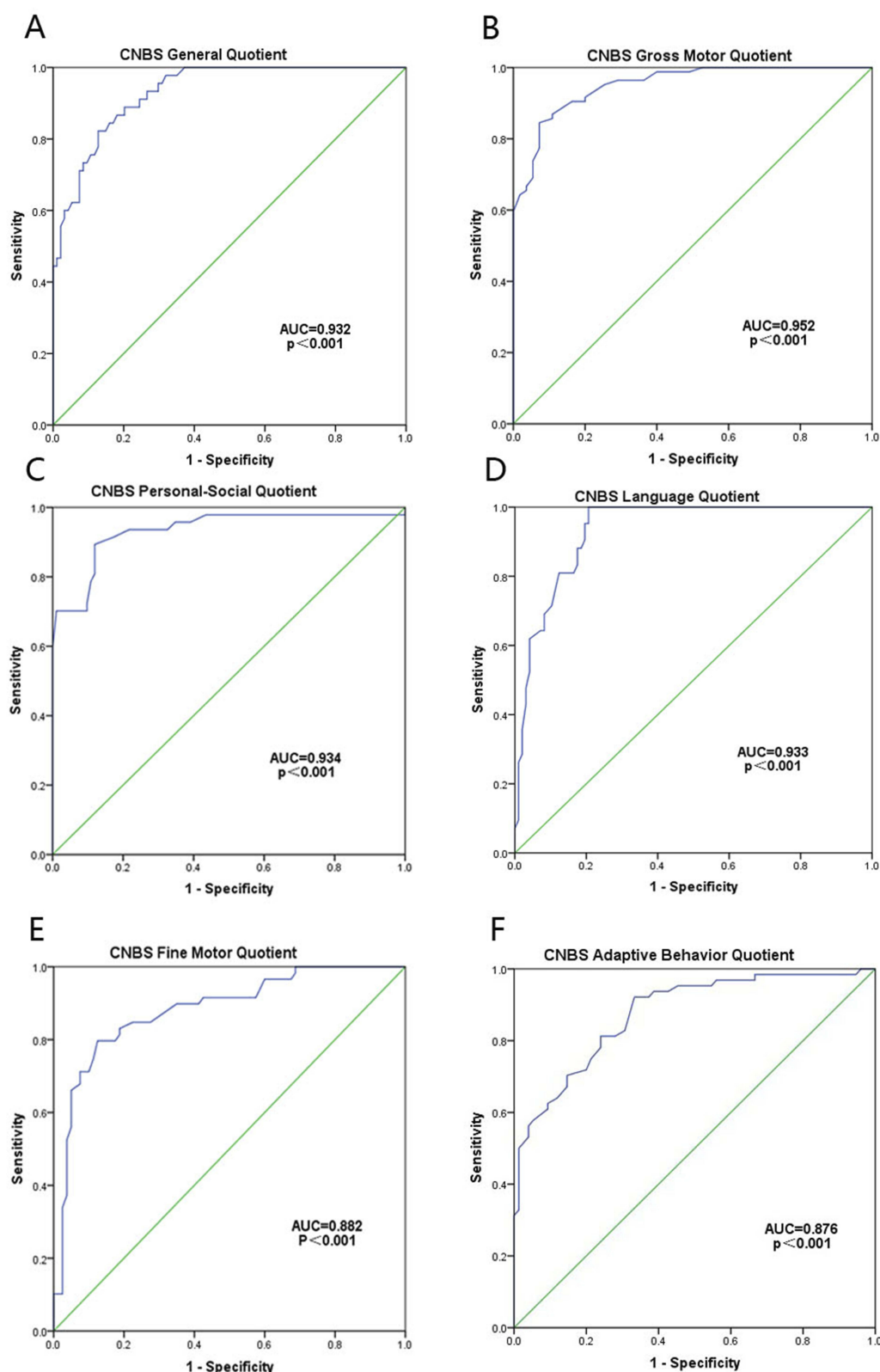


Figure 1 ROC curve for discriminating children with ASD and developmental delay according to the CNBS-R2016 general or subscale quotient from those without a developmental delay using the GDS-C general or subscale quotient cut-off of 70 (mean -2 SDs) as a standard. (A) ROC curve of the CNBS-R2016 general quotient using the GDS-C general quotient cut-off of 70 as a standard. (B) ROC curve of the CNBS-R2016 gross motor quotient using the GDS-C subscale A quotient cut-off of 70 as a standard. (C) ROC curve of the CNBS-R2016 Personal-Social quotient using the GDS-C subscale B quotient cut-off of 70 as a standard. (D) ROC curve of the CNBS-R2016 Language quotient using the GDS-C subscale C quotient cut-off of 70 as a standard. (E) ROC curve of the CNBS-R2016 Fine Motor quotient using the GDS-C subscale D quotient cut-off of 70 as a standard. (F) ROC curve of the CNBS-R2016 Adaptive Behavior quotient using the GDS-C subscale E quotient cut-off of 70 as a standard.

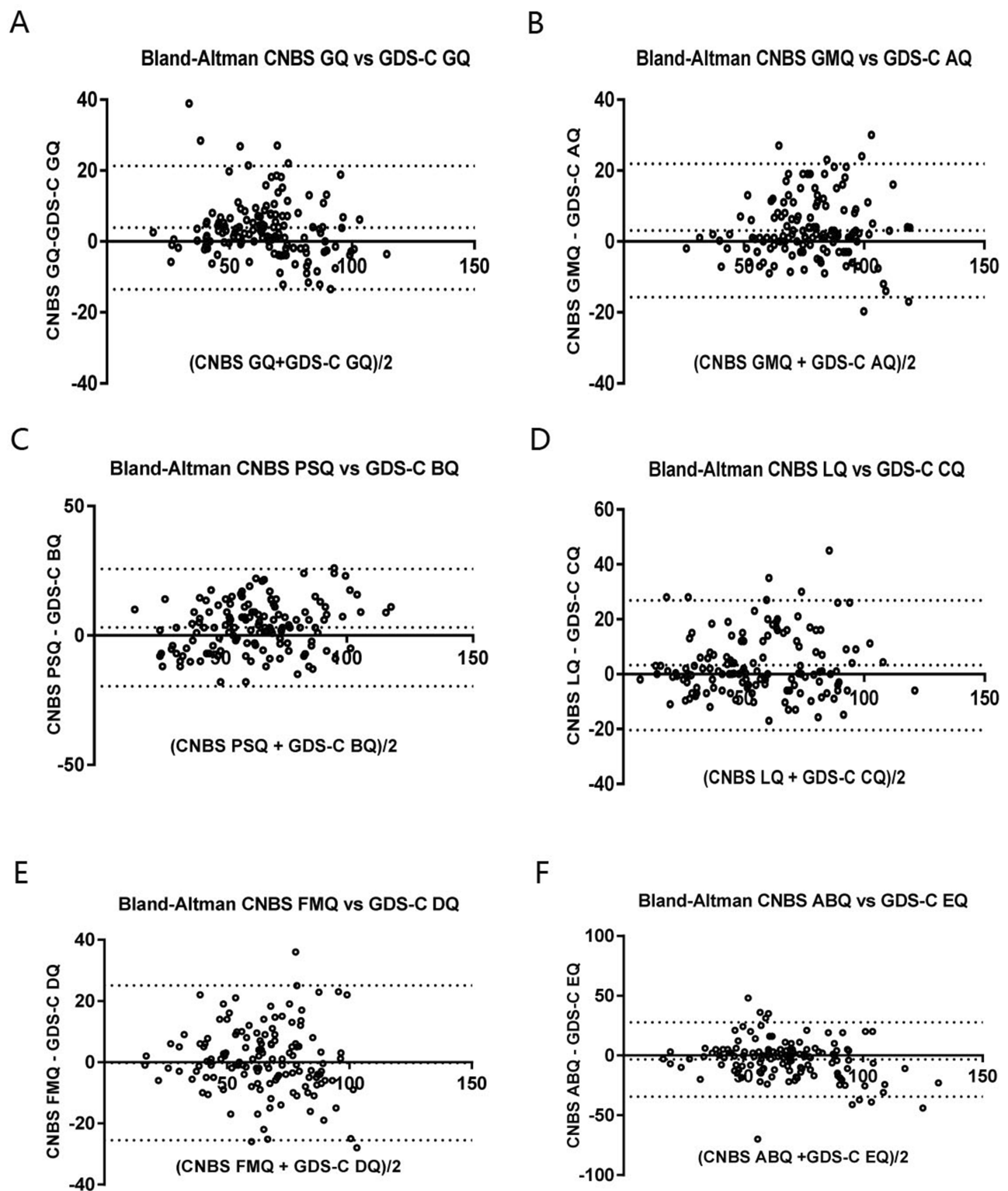


Figure 2 Bland-Altman plots generated to compare the average CNBS-R2016 and GDS-C quotients to their differences. The limits of agreement (95% CI, ie, mean $\pm$ 1.96 SDs) are shown by dotted lines. (A) Comparison of the CNBS-R2016 general quotient (GQ) and the GDS-C GQ. Mean difference: 3.9 (95% CI -13.5 to 21.3). (B) Comparison of the CNBS-R2016 Gross Motor quotient (GMQ) and the GDS-C subscale A quotient (AQ). Mean difference: 3.1 (95% CI -15.7 to 21.9). (C) Comparison of the CNBS-R2016 Personal-Social quotient (PSQ) and the GDS-C subscale B quotient (BQ). Mean difference: 3.1 (95% CI -19.6 to 25.7). (D) Comparison of the CNBS-R2016 Language quotient (LQ) and the GDS-C subscale C quotient (CQ). Mean difference: 3.3 (95% CI -20.4 to 26.9). (E) Comparison of the CNBS-R2016 Fine Motor quotient (FMQ) and the GDS-C subscale D quotient (DQ). Mean difference: -0.2 (95% CI -25.5 to 25.1). (F) Comparison of the CNBS-R2016 Adaptive Behavior quotient (ABQ) and the GDS-C subscale E quotient (EQ). Mean difference: -3.3 (95% CI -34.4 to 27.8).

locomotor skills by the two measures, with the GDS-C catching more of these types of delays. The reason for this result may be that the GDS-C is both more appropriate to the culture of the children tested (and thus potentially catching more true delays) and more sensitive to gross motor skills, and consequently, it does a better job of measuring motor functioning.

In addition, our results suggested that the two tests had the same significance for all subscales analyzed for a given child with ASD. There was a significant positive correlation between the general and subscale quotients of the CNBS-R2016 and the corresponding quotients of the GDS-C. The area under all the curves of the CNBS-R2016 was approximately 0.9 for discriminating children with a developmental delay from children without a delay using the GDS-C general or subscale quotient cut-off of 70 as a standard. Additionally, the Bland-Altman plots showed no systemic bias between the two scales. These results support good consistency between the CNBS-R2016 and GDS-C scales.

To date, we have not found any research on the consistency between the CNBS-R2016 and GDS-C. Some research has been performed on the value of the GMDS for predicting later developmental problems. Squarza et al conducted a study on early developmental level and cognitive outcomes in 99 children with an extremely low birth weight, and the results showed that the lower the GMDS score was at 1 year, the more severe the cognitive impairment was at school age, indicating a high predictive power of the GMDS.²⁹ This predictive power increased with increasing age at assessment.^{17,18} The results of the current study showed that the CNBS-R2016 and GDS-C have good consistency, indicating that the CNBS-R2016 may also have good value for predicting later developmental problems in children. More importantly, the CNBS-R2016 contains a Communication Warning Behavior subscale. Our results showed a significant positive correlation between the Communication Warning Behavior subscale quotient and the ABC and CARS total scores, indicating good consistency between the Communication Warning Behavior subscale, the ABC, and the CARS. Therefore, when the CNBS-R2016 is performed to evaluate the developmental level of children, it can also be used to assess autism symptoms. Moreover, CNBS-R2016 is a localized assessment tool, so it is easier to carry out formal training in China. Compared to GDS-C, it is a briefer measure of developmental assessment for young children, and thus demonstrates strong clinical practicability.

Although our results are promising, the study does have some limitations. First, the two tests were carried out only one week apart; because the evaluators were not blinded, they may be biased in their expectations of child performance at the second testing session. The children may also have recall bias for the two tests are similar. Second, while the sample size was reasonably large, due to the small number of females, it was not possible to examine differences by sex. Third, the age range of the sample was quite large, yet differences in measure performance by age were not able to be examined. It is possible that measures may perform slightly differently across the age span. Fourth, this study included only Chinese samples, so the results cannot be generalized beyond a Chinese sample. All are areas for future directions, in addition to exploration of the utility of the CNBS-R2016 in predicting future outcomes for young children.

Conclusion

The CNBS-R2016 and GDS-C tests show good consistency in the developmental assessment of children with ASD. In addition, the CNBS-R2016 can be used to assess autism symptoms while assessing the developmental level. Therefore, the CNBS-R2016 is worthy of clinical application in children aged 0–6 years in China.

Abbreviations

ASD, Autism spectrum disorder; IDs, Intellectual disabilities; GMDS, Griffiths Mental Development Scales; GMDS-ER, Griffiths Mental Development Scales-Extended Revised; GDS-C, Griffiths Mental Development Scales for China; CNBS, Children Neuropsychological and Behavior Scale; CNBS-R2016, Children Neuropsychological and Behavior Scale-Revision 2016; DSM-5, Diagnostic and Statistical Manual of Mental Disorders; ABC, Autism Behavior Checklist; CARS, Childhood Autism Rating Scale; SD, Standard deviation; ROC curves, Receiver operating characteristic curves; AUC, Area under curve.

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Disclosure

The authors report no conflicts of interest in this work.

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