



## Validity and reliability analysis of the Chinese parent version of the Autism Spectrum Rating Scale (6–18 years)

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### ABSTRACT

This study aimed to investigate the validity and reliability of the Chinese parent version of the Autism Spectrum Rating Scale (ASRS, 6–18 years) for a general sample of Chinese children. The study involved assessing 1625 community-based subjects aged 6–12 years from four sites (Shanghai, Guangzhou, Changsha, and Harbin city) in China and 211 clinic-based participants aged 6–18 with a confirmed diagnosis of autism spectrum disorders (ASDs). The internal consistency (Cronbach's alpha) ranged from 0.585 to 0.929, and the test–retest reliability (interclass correlations) ranged from 0.542 to 0.749, indicating no significant difference between the two tests at an interval of 2–4 weeks. The construct validity was relatively excellent, and the concurrent validity with the Social Responsiveness Scale (SRS) (Pearson correlations) was 0.732 between the two total scores. Receiver operating characteristics (ROC) analyses showed excellent and comparable discriminant validity of the ASRS with respect to the SRS, with an area under the curve (AUC) of 0.9507 (95% CI: 0.93–0.97) versus 0.9703 (95% CI: 0.96–0.98), respectively. Our data suggested a cutoff  $\geq 60$  for the Chinese version of the ASRS, with good accuracy in screening autism symptoms (sensitivity = 94.2%, specificity = 77%). The Chinese parent version of the ASRS is therefore a reliable and valid tool for screening autistic symptoms in Chinese children in general.

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### 1. Introduction

Autism spectrum disorders (ASDs) are a group of neurodevelopment disorders characterized by diverse clinical phenotypes and varying levels of impairment in social interaction and reciprocal communication, as well as restricted and repetitive interests and behaviors (Wills, 2014). The term “ASDs” is an umbrella term in the DSM-V. Symptoms are typically notable before

the age of 3 years old, and numerous studies have indicated a high level of functional limitations and poor life quality in affected children (Eaves and Ho, 2008; Barneveld et al., 2014). The disease burden of ASD for families and society is remarkable (Horlin et al., 2014). ASD is one of the fastest-growing disorders worldwide, with many countries showing significantly increased incidence in recent decades (Williams et al., 2006; Elsabbagh et al., 2012; Blumberg et al., 2013). Increased public awareness of ASDs has recently resulted in more scientific epidemiological surveys of ASDs in many areas (Idring et al., 2014; Ouellette-Kuntz et al., 2014; Zahorodny et al., 2014).

To conduct a national epidemiology survey of ASDs in any population, the usual method is to screen a representative sample of children to identify those who may have ASDs and conduct further clinical assessment with more in-depth approaches to

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derive unbiased prevalence estimations. A questionnaire-based screening is an ideal approach for conducting ASD screening because of the easy administration and use. In recent decades, the epidemiology of autism in children has made great progress in the development of valid and reliable screening instruments for diverse participants, such as the Checklist for Autism in Toddlers (CHAT), the Modified Checklist for Autism in Toddlers (M-CHAT), and the Checklist for Autism in Toddler-23 (CHAT-23) recommended for use in very young children (Robins et al., 2014). The Pervasive Developmental Disorders Screening Test (PDDST) is a 40-item scale that can also be used for children from birth to 3 years old (Ferrerri, 2014). The Social Communication Questionnaire (SCQ) is a 40-item scale derived from a diagnostic tool (ADI-R) for use with children ages 4 years and older (Mulligan et al., 2009). The Social Responsiveness Scale (SRS) is a 65-item scale for children ages 4–18 years (Wigham et al., 2012). These screening instruments are usually completed within 10–20 min and are designed to estimate the risk of autistic condition. However, reviews of autism epidemiological studies have indicated that screening instruments have been very heterogeneous in population surveys (Matson et al., 2007). Such studies have rarely been based on the use of criterion instruments of known reliability and validity applied to representative samples in the general population. In a way, the variability in questionnaires reflects differences in the culture and representative samples of the surveyed areas. Besides, the lack of properly validated and reliable instruments to screen for autistic behaviors in the general population has been a significant barrier to epidemiologic studies of these conditions.

Research on ASDs has only recently begun in China, and the exact national prevalence of ASDs in China remains unknown (Li et al., 2011). One year ago, an important initiative program funded by the Ministry of Health was launched to boost autism awareness among clinical experts and researchers. As part of this program, a national epidemiological survey of ASD among the school-aged (6–12 years) population of China was designed. To conduct the screening phase of this survey, an instrument that is properly validated for the Chinese population is necessary.

Currently, there is no published autism screening tool that has been developed in Chinese. Several English versions of autism screening tools have been adapted to Chinese. For example, the Chinese version of the CHAT-23, which is designed for use in primary care settings at the 18-month visit, combines 23 items from parental reports with 2 items from the direct observation of the child. The CHAT-23 has excellent screening performance in representative Hong Kong samples (Wong et al., 2004). A Mandarin Chinese version of the CAST (M-CAST) was translated and developed by Dr. Sun Xiang, and it has good psychometric properties for Chinese children aged 4–11 years (Sun et al., 2014). Moreover, the Chinese version of the Social Responsiveness Scale (SRS) and the Social Communication Questionnaire (SCQ) were shown to have good reliability and validity in Taiwanese children (Gau et al., 2011, 2013). However, those existing Chinese versions of screening instruments were applied in populations that either lacked regional diversity or were not matched to the age range of our studied population. Therefore, it is necessary to develop a screening tool appropriate for the age range and population diversity of this national ASD prevalence survey.

Among recently developed instruments designed to detect autistic symptomatology in both clinical and nonclinical samples, we specially considered the Autism Spectrum Rating Scale (ASRS) (Goldstein and Naglieri, 2009) for evaluation. The ASRS was designed for both young children aged 2–5 years and children aged 6–18 years, and it has excellent reliability and validity in the U.S. population. This scale has both full-length and short versions, with the former comprising 70/71 items and the latter containing 15

items. Separate forms are completed by parents (ASRS Parent Rating) or teachers (ASRS Teacher Rating). Both have the same items and structure. The full-length ASRS was designed not only as a screening tool to guide diagnostic decisions but also as a tool for treatment planning based on ongoing monitoring of the response to intervention and evaluation; by contrast, the short version is suitable only for screening. Comparisons with other instruments are easy because of the availability of standard scores. Therefore, according to the task of the epidemiologic surveys and further ongoing monitoring for ASD children, we evaluated the full-length ASRS (6–18 years) as the candidate screening tool for the national epidemiological survey, with the following aims: (1) to examine the psychometric properties of the Chinese parent version of the ASRS in a Chinese sample aged 6–12 years and (2) to measure the discriminant validity of the Chinese parent version of the ASRS as a screening instrument for investigate the national prevalence of ASDs.

## 2. Methods

### 2.1. Study populations

#### 2.1.1. General sample

The ASRS was developed for the general population in the U.S. (Goldstein and Naglieri, 2009). Thus, we selected the community-based population (aged 6–12 years) as the general sample to ensure its representativeness by using convenient cluster sampling. Four community-based samples were selected in Shanghai, Harbin, Guangzhou, and Changsha. All children with local residency or children who have been living in the community for more than six months were eligible to participate in this study, with a total number of 2053.

#### 2.1.2. Clinically diagnosed ASD cases

To analyze concurrent and discriminant validity, children who had been clinically diagnosed with ASDs were recruited from the local autism rehabilitation center. The clinical diagnosis of ASD was made by senior child psychiatrists who have extensive clinical and research experience in the assessment and treatment of children with ASD according to DSM-V criteria, confirmed using the autism diagnostic interview-revised (ADI-R). In total, 211 ASD cases aged 6–18 years were recruited.

### 2.2. Measures

#### 2.2.1. ASRS Chinese parent version

The Chinese parent version of the full-length ASRS (6–18 years) was used in this study. The ASRS questionnaire evaluates the frequency of each behavior ('0' for never and '4' for Very Frequently) to quantify autistic features. According to different study purposes, the ASRS (for children 6–18 years old) can be referred to as the ASRS scales, DSM-IV-TR scales, and treatment scales. A three-factor solution was the most suitable parent version of the ASRS scales for the 6–18 age group. Three factors constituting 60 of the total 71 items are generated for screening: one factor related to Social/Communication (19 items); another factor with items related to Unusual behaviors (24 items); and the third factor Self-Regulation (17 items) that included items primarily related to attention problems, impulsivity, and compliance. These 3 scales are combined into a single composite score, the *T*-score, which was developed for screening purposes. High scores on the ASRS scales suggest that additional evaluation is required. The DSM-IV-TR scale is derived from 34 items based on experience from the total 71 items, some of which also contribute to the diagnosis scales. Finally, the treatment scales consist of 8 subscales that can be used

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