A comparison of measures for assessing the level and nature of intelligence in verbal children and adults with autism spectrum disorder

Kimberly E. Bodner [a,1,*], Diane L. Williams [a,b,1,2], Christopher R. Engelhardt [c,3], Nancy J. Minshew [a,d,1]

[a] NIH Autism Center of Excellence, University of Pittsburgh School of Medicine, 3811 O'Hara Street, Suite 300, Webster Hall, Pittsburgh, PA 15213-2593, United States
[b] Speech-Language Pathology, Rangos School of Health Sciences, Fisher Hall 409, Duquesne University, 600 Forbes Avenue, Pittsburgh, PA 15282, United States
[c] Department of Health Psychology, Thompson Center for Autism & Neurodevelopmental Disorders, University of Missouri, 205 Portland Street, Columbia, MO 65211, United States
[d] University of Pittsburgh School of Medicine, Departments of Psychiatry & Neurology, 3811 O'Hara Street, Suite 300, Webster Hall, Pittsburgh, PA 15213-2593, United States

ARTICLE INFO

ABSTRACT

Previous work has suggested that the Raven's Progressive Matrices (RPM) are better suited for capturing the nature of intelligence for individuals with autism spectrum disorder (ASD) than the Wechsler scales. The RPM measures 'fluid intelligence', an area for which it has been argued that persons with ASD have a relative strength. Given that measures of intelligence are used for establishing clinical diagnoses, for making educational decisions, and for group-matching in research studies, continued examination of this contention is warranted. In the current study, verbal children with ASD performed moderately better on the RPM than on the Wechsler scales; children without ASD received higher percentile scores on the Wechsler than on the RPM. Adults with and without ASD received higher percentile scores on the Wechsler than the RPM. Results suggest that the RPM and Wechsler scales measure different aspects of cognitive abilities in verbal individuals with ASD. For the verbal children and adults with ASD in the current study, the RPM and Wechsler scales have unique contributions that must be considered in context when establishing a baseline of cognitive function. The results of this investigation highlight the importance of thoughtfully selecting appropriate measures of intelligence consistent with clinical, educational, and research purposes, especially for verbal children and adults with ASD.

* Corresponding author. Present address: Department of Psychological Sciences, University of Missouri, 3 McAlester Hall, Columbia, MO 65211, United States. Tel.: +1 573 884 8109; fax: +1 573 882 7710.
E-mail addresses: kimberly.bodner@mail.mizzou.edu, kimberly.bodner@gmail.com (K.E. Bodner), williamsd2139@duq.edu (D.L. Williams), engelhardtc@health.missouri.edu (C.R. Engelhardt), minshewnj@upmc.edu (N.J. Minshew).
[1] Tel.: +1 412 246 5460; fax: +1 412 246 5470.
[2] Tel.: +1 412 396 4217; fax: +1 412 396 4196.
[3] Tel.: +1 573 882 1923; fax: +1 573 884 1151.

1. Introduction

"Intelligence" has been more challenging to characterize in individuals with autism spectrum disorder (ASD) than in individuals with typical development (TD). ASD is a neurodevelopmental disorder characterized by impairments in social interactions and stereotyped and repetitive behaviors (American Psychiatric Association (APA), 2013). No IQ profile is representative of all individuals with ASD (Charman et al., 2011; Ghaziuddin & Mountain-Kimchi, 2004; Siegel, Minshew, & Goldstein, 1996; Williams, Goldstein, Kojkowski, & Minshew, 2008), and recent evidence suggests that the factor structure of intelligence and its relationship to adaptive functioning in this group is different from that found in individuals with TD (see Charman et al., 2011; Goldstein et al., 2008).

Measuring the intelligence of individuals with ASD is necessary for clinical assessment, educational service delivery, and research. The DSM-5 criteria for ASD include a specifier for cognitive abilities (APA, 2013), recognizing that affected individuals vary on this construct and that it may be important for identifying ASD subtypes (Grzadzinski, Huerta, & Lord, 2013). Establishment of an overall level of cognitive functioning is typically part of the process of qualifying a child for special education services (White, Scahill, Klin, Koenig, & Volkmar, 2007). Although not part of the diagnostic criteria, the related effect of ASD on cognitive functioning necessitates the consideration of the level of intelligence for most research in this area; the typical starting point for behavioral, neuroimaging, and neurofunctional studies is to individually- or group-match participants with ASD to controls on the basis of IQ, age, and gender or to use intellectual ability as a covariant in the statistical analyses. Important information about the cognitive and neurofunctional basis of ASD may be obscured if higher functioning individuals with ASD are compared to lower functioning individuals with TD (or vice versa). Therefore, the decision about what measure of intelligence to use in research is an important one (see Barbeau, Soulières, Dawson, Zeffiro, & Mottron, 2013; McGonigle-Chalmers & McSweeney, 2013).

Standardized measures of intelligence have generally been used to assess verbal individuals with ASD, including the various editions of the Stanford-Binet (e.g., SBV: Roid, 2003) and the Wechsler scales (Wechsler, 1981, 1991, 1999), a practice supported by some research (Filipek et al., 1999; Mottron, 2004). However, recent work has suggested that the Raven's Progressive Matrices (RPM; Raven, Raven, & Court, 1998) are better suited for capturing the nature of intelligence for individuals with ASD (Dawson, Soulières, Gernsbacher, & Mottron, 2007; Hayashi, Kato, Igarashi, & Kashima, 2008; Soulières, Dawson, Gernsbacher, & Mottron, 2011).

Dawson et al. (2007) were the first to suggest that the Wechsler scales may underestimate the intelligence of individuals with ASD and that the format of the RPM with its emphasis on fluid reasoning may be a more appropriate measure of intelligence for these individuals. They compared performance on the Wechsler assessments and the RPM in children and adults with and without ASD. Both the children and adults with ASD displayed dramatically higher RPM scores in comparison to age appropriate Wechsler assessments, while the TD groups exhibited no significant differences on these measures. The authors concluded that individuals with ASD are not impaired in fluid reasoning and suggested that conventional Wechsler IQ measures may underestimate the level of intelligence, which can lead to erroneous conclusions about the functioning level and cognitive profile of individuals with ASD (Dawson et al., 2007).

However, the IQ discrepancy (lower IQ abilities assessed in individuals with ASD in comparison to TD) across groups in the Dawson study makes a comparison of the differences on the RPM versus the Wechsler difficult to assess, as greater differences could occur in lower functioning individuals overall regardless of ASD diagnosis. That is, the RPM may be a more accurate assessment of nonverbal abilities for any group of individuals with low verbal skills. Indeed, results of a separate but related study suggest that the higher performance on the RPM as compared to the Wechsler measures primarily occurs for individuals with ASD with cognitive impairment (Bölte, Dziobek, & Poustka, 2009).

Soulières et al. (2011) also compared the performance of individuals with and without Asperger syndrome (ASP) (an ASD diagnosis characterized by relatively spared verbal abilities, lack of an early history of delayed language development, and IQ scores in the normal range, Klin, Volkmar, & Sparrow, 2000) on the RPM and the Wechsler scales to investigate whether the previously observed advantage on the RPM was also observed in more able individuals with ASD. Children and adults with and without ASP completed the RPM and the age appropriate Wechsler scale. Somewhat inconsistent with the findings by Dawson et al. (2007), both the adults with and without ASP had higher percentile performance on the RPM as compared to performance on the Wechsler IQ. However, this same pattern did not occur for the children, with both groups having similar performance on the RPM and Wechsler scales, though children with ASP had significantly higher RPM than Performance IQ scores.

Taken together, these previous studies suggest that individuals with ASD with low average and below average IQs obtain relatively higher scores on the RPM than on the Wechsler scales. The contention is, then, that the Wechsler scales are underestimating the cognitive abilities of individuals with ASD and leading to erroneous conclusions about their general intellectual abilities. However, the results for verbal, high-functioning children and adults with ASD (including those with ASP) have been mixed (Bölte et al., 2009; Chen, Planche, & Lemonnier, 2010; Dawson et al., 2007; Hayashi et al., 2008; Soulières et al., 2011; see Table 1), making it unclear how to proceed when selecting a measure for intelligence for these individuals. Given that measures of intelligence are used for establishing clinical diagnoses, for making educational decisions, and for group-matching in research studies of ASD, a continued investigation comparing the information provided by the RPM and the information provided by the Wechsler scales is warranted. Therefore, the objective of the current study was to further investigate the issue of intelligence measurement in individuals with ASD in a sample of verbal children and adults with high-functioning ASD and controls with TD to answer the question of to what extent, if any, their performance on the RPM differs from their performance on the Wechsler scales.