Diagnostic utility of the autism diagnostic observation schedule in a clinical sample of adolescents and adults

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ABSTRACT

Background: The Autism Diagnostic Observation Schedule (ADOS) Module 4 was investigated in an independent clinical sample of highfunctioning adolescent and adult males and females with suspected autism spectrum disorder. Special attention was paid to the performance of the ADOS in the subgroups autism spectrum disorders (ASD), personality disorders and disorders with onset usually occurring in childhood and adolescence.
Method: The recently revised algorithm and severity scores for Module 4 were used to analyze predictive values compared to the original algorithm in a sample of N = 356, 21% females, age range 12–68 yrs.
Results: Both algorithms have good sensitivity and specificity, with slightly better results for the revised algorithm. Diagnostic accuracy is lower for females, older individuals, and individuals with personality disorders or higher intellectual abilities.
Conclusion: The revised algorithm has good utility when used as part of a comprehensive assessment procedure conducted by an experienced examiner and including information on developmental history.

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1. Introduction

The Autism Diagnostic Observation Schedule (ADOS, Lord et al., 2000) Module 4 has recently been revised (ADOS-2, Second Edition, Hus & Lord, 2014; Lord et al., 2012), with the new two-domain algorithm (social affect, SA and restrictive and repetitive behavior, RRB) being consistent with DSM-5 criteria for autism spectrum disorder (ASD, American Psychiatric Association, 2013). Additionally, the authors offer calibrated severity scores (CSS) to provide metrics of symptom severity. The revised algorithm leads to a different constellation of the included items in terms of content and quantity. For modules 1 to 3, designed for the assessment of younger children and adolescents, the additional domain indicating restricted and repetitive behavior (RRB) has been shown to improve the diagnostic utility of the ADOS (Gotham et al., 2008; Kamp-Becker

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et al., 2013; Kim & Lord, 2010). In their original article on the Module 4 revised algorithm, Hus and Lord (2014) found increased sensitivity and specificity for the overall sample and showed that the RRB domain improved diagnostic utility. Aspects of diagnostic accuracy of the new Module 4 algorithm have recently been investigated in two studies. A multi-site study by Pugliese et al. (2015) compared the original and the revised algorithms in individuals with ASD without intellectual disability (n = 321, 77% male, age range 11–61, mean = 18.91, SD = 7.64). For the overall sample, the authors found increased sensitivity, but lower specificity for the revised algorithm, with highest sensitivity and/or specificity values for females, individuals with IQ below 85 or above 115 and ages 16 and older. De Bildt, Sytema, Meffert, & Bastiaansen (2016) investigated discriminative ability of the two algorithms in a sample of n = 93 Dutch males with ASD, schizophrenia, psychopathy or controls (sample used in a previous study by Bastiaansen et al., 2011). The authors found improved sensitivity for the revised algorithm over the original algorithm for the overall sample and a better balance between specificity and sensitivity for the revised algorithm when applied to the sub sample with schizophrenia. Additionally, they found high specificity in the psychopathy group that included 16 males from forensic psychiatric clinics.

Diagnosing ASD is a complex process, as there seems to be a considerable behavioral overlap with other disorders which is relevant for diagnostic evaluation of comorbidities as well as differential diagnoses (Matson, 2007; Simonoff et al., 2013; Verheij et al., 2015). Individuals with ASD show a high rate (up to 70%, Lai, Lombardo, & Baron-Cohen, 2014) of accompanying comorbid disorders, i. e. cognitive impairment, ADHD, personality disorders, tic disorders, obsessive-compulsive disorders as well as mood and anxiety disorders (Abdallah et al., 2011; Gjevik, Eldevik, Fjæran-Granum, & Sponheim, 2011; Joshi et al., 2013; Levy et al., 2010; Lugnegård, Hallerbäck, & Gillberg, 2012; Matson & Nebel-Schwalm, 2007; Mattila et al., 2010; Simonoff et al., 2008; Strunz, Westphal, Dziobek, & Roepke, 2015). In adolescents and adults, the diagnostic process is even more complicated due to increased comorbidities and a lack of valid developmental information; additionally, individuals are often unable to validly report deficits due to poor self-referential cognition (Lombardo and Baron-Cohen, 2011; Lombardo, Barnes, Wheelwright, & Baron-Cohen, 2007). Furthermore, many neurodevelopmental, mental and behavioral disorders may present behavioral overlap with ASD that suggest clinical suspicion of an ASD (for review see: Collin, Bindra, Raju, Gillberg, & Minnis, 2013; Thoma, Friedmann, & Suchan, 2013).

Gender disparity has been consistently reported (Lai et al., 2015). However, research has long focused on examining males with ASD, which may have led to biased diagnostic criteria and practice making it more likely for females to be un- or misdiagnosed (Dworzynski, Ronald, Bolton, & Happe, 2012; Lai et al., 2015; Mandy et al., 2012). Recent studies demonstrate that females without cognitive impairment are especially likely to be diagnosed at older ages, implying suboptimal treatment due to delayed start of specific therapeutic interventions (Begeer et al., 2013; Giarelli et al., 2010). In general, establishing an accurate diagnosis is crucial, as an invalid diagnosis of ASD is likely to result in the use of an inappropriate treatment strategy and may cause anxiety and distress to the participants and their families.

The aim of this retrospective study was to examine the diagnostic accuracy and utility of the Module 4 revised algorithm in a routine clinical sample of adolescents and adults with suspected ASD including relevant differential diagnoses such as personality disorders, ADHD and others. On the basis of recent findings we hypothesized that in our sample the new algorithm would outperform the original algorithm with regard to standard measures of diagnostic accuracy (sensitivity, specificity, AUC). We also expected that the RRB domain would improve diagnostic validity. In order to enlarge knowledge on

Table 1
Sample Description.

	Overall					ASD					non-ASD				
	male n = 282 (79%) female n = 74 (21%)					male n = 136 (82%) female n = 29 (18%)					male n = 146 (76%) female n = 45 (24%)				
	n	mean	SD	Min	Max	n	mean	SD	Min	Max	n	mean	SD	Min	Max
age (yrs)	356	23.0	10.3	12.8	68	165	20.8	6.97	13.3	54	191	24.9	12.12	12.4	68
IQ	205	100	17	59	145	124	99	17	59	145	81	102	18	81	145
Com + Soc	356	7.23	5.47	0	21	165	11.04	4.47	0	21	191	3.94	3.89	0	19
SA + RRB	356	8.52	6.20	0	27	165	12.88	5.04	0	27	191	4.75	4.39	0	21
CSS	365	4.56	3.08	1	10	165	6.77	2.42	1	10	191	2.65	2.18	1	10

	Pers Dis					Dis Child				
	male n = 70 (80%) female n = 17 (20%)					male n = 40 (85%) female n = 7 (15%)				
	n	mean	SD	Min	Max	n	mean	SD	Min	Max
age (yrs)	87	31.0	13.0	13.8	68.0	47	16.7	2.13	12.8	22.33
IQ	18	113	14.3	85	132	35	99.1	14.9	76	129
Com + Soc	87	4.22	4.11	0	19	47	3.49	2.92	0	14
SA + RRB	87	5.23	4.72	0	21	47	4.11	3.08	0	14
CSS	87	2.98	2.37	1	10	47	2.21	1.55	1	7

IQ full scale intelligence quotient, *Com + Soc* ADOS communication and social interaction domain, *SA + RRB* ADOS-2 social affect and restricted and repetitive behavior domain, *CSS* calibrated severity score, *SD* standard deviation, *Pers Dis* personality disorders, *Dis Child* disorders with onset usually occurring in childhood and adolescence; *SA + RRB* algorithm and *CSS* follow Hus and Lord (2014).