



Accuracy of Screening Tests for Autism Spectrum Disorder in Primary Care Settings

Marjolaine M. Limbos¹, PhD & David P. Joyce², MD, Karen Deng, BA³

¹Department of Psychology, B.C. Children's Hospital, Vancouver, BC, ²Department of Family Practice, University of British Columbia, ³Queen's University



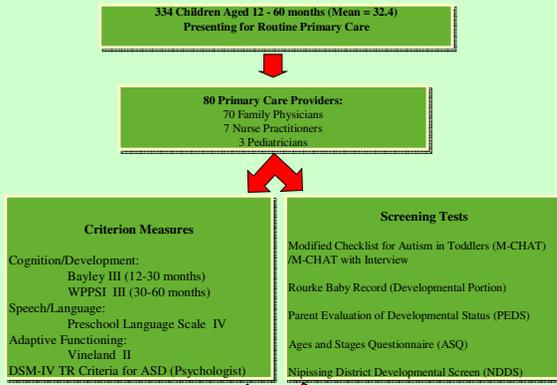
INTRODUCTION

- The prevalence of autism spectrum disorders (ASD) is much higher than previously estimated, affecting as many as 1 in 400 children.
 - Guidelines of the AAP recommend routine screening for developmental disabilities and ASD in preschool children.
 - There is mounting evidence that early intervention improves outcomes for children and their families in terms of behavioral, social and cognitive competence.
 - However, national surveys have indicated that few physicians use standardized screening tools and, of these, the majority do not use autism-specific screening tools such as the MCHAT.
 - While the MCHAT has excellent sensitivity and specificity, little is known about the accuracy of other more general screening measures in identifying ASD.
 - The advantage of using broad-band screening tools is that physicians are more familiar with them, overcoming the barrier of having to introduce a new testing method.
 - However, before these tests can be recommended, it is important to determine their accuracy in correctly classifying children with autism.
- The purpose of this study was to :
- Evaluate the clinical utility of this brief parent-administered screening tool in primary care settings.

ABSTRACT

Objective: To compare the sensitivity and specificity of four more commonly used broad-band developmental screening tests: The Nipissing District Developmental Screen (NDDS), Rourke Baby Record (Rourke), Parents' Evaluation of Developmental Status (PEDS) and the Ages and Stages Questionnaire (ASQ) to an autism-specific screening tool with established accuracy, the Modified Checklist for Autism in Toddlers (MCHAT). A secondary objective will be to study the accuracy of the MCHAT in a primary care setting. **Background:** Developmental disabilities are common and there is evidence that the prevalence of autism spectrum disorders (ASD) is much higher than previously estimated (Boyle, 1994). Guidelines of the American Academy of Pediatrics recommend routine screening for developmental disabilities and ASD in preschool children (AAP, 2006). However, national surveys have indicated that as few as half of physicians use standardized screening tools and, of these, the majority use broad-band developmental screening tools as opposed to autism-specific screening tools such as the MCHAT (Sices et al, 2003; Sand et al, 2005). While the MCHAT has excellent sensitivity and specificity, little is known about the accuracy of other more general developmental screening measures in identifying ASD. The advantage of using broad-band screening tools (e.g., ASQ, PEDS, NDDS and Rourke) is that physicians are more familiar with them, overcoming the barrier of having to introduce a new testing method. However, before these tests can be recommended, it is important to determine their accuracy in correctly classifying children with autism. This poster will attempt to answer the practice gap of limited data on the accuracy of general screening tests for identifying children with autism spectrum disorders. **Methods:** 334 children aged 12-60 months were recruited from the offices of 80 primary care providers in Canada. Parents completed all five screening tests: the NDDS, Rourke, PEDS and ASQ and MCHAT. A research assistant administered the MCHAT with follow up interview (MCHAT-I) if the MCHAT screen was positive. On the same day, children underwent a detailed assessment by a clinical psychologist which included a diagnostic interview and observations for signs and symptoms of ASD, using the criteria set out in DSM-IV. Children were also administered tests of: Cognition (Wechsler Preschool and Primary Scales of Intelligence or Bayley Scales of Infant Development), Speech and Language (Preschool Language Scale) and Adaptive Behaviour (Vineland Adaptive Behaviour Scales). The psychologist's assessment served as the gold standard for identifying ASD. The sensitivity, specificity and likelihood ratios were calculated for each screening test. McNemar's test with Yates correction was used to compare the accuracy of the screening tests. **Results:** The mean age of children was 32 months. Thirty four children met criteria for a developmental delay. Of these, five children (15%) were identified as having ASD. Consistent with past research, the MCHAT had a sensitivity of 100% and specificity of 88%. The MCHAT with follow up interview improved specificity to 98%. All of the broad-band tests had excellent (100%) sensitivity for identifying ASD. Specificity, however, was more variable, and in all cases was below (80%): NDDS (67%), Rourke (76%), PEDS (61%), ASQ (66%). There was no significant difference between the sensitivity and specificity of any of the broad-band screen tests (p>0.05). The MCHAT and MCHAT-I had significantly higher specificity than all of the other screening tests (p<0.05). **Conclusions:** This study is consistent with past research, demonstrating that the MCHAT has the ideal combination of sensitivity and specificity for screening for ASD in primary care settings. When the MCHAT is abnormal, the MCHAT-I increases the specificity of the MCHAT significantly. The study also offers some promise and reassurance regarding the use of broad-band screening tests in screening for ASD. All of the broad-band screening tests had excellent sensitivity for screening, indicating that a negative result successfully rules out ASD, in most cases. However, the ASQ, PEDS and NDDS have low specificity, indicating that there will be a significant number of false positives if these tests are widely used in clinical practice. Although the Rourke had moderate specificity, the study did not have sufficient power to find significant differences between this and the other tests, suggesting that further study on this tool is needed. The findings suggest that increasing physician familiarity with and use of the MCHAT would be ideal for screening for ASD. However, given that physician uptake of new developmental screening tests is low, it is suggested that existing broad-band screening tests may successfully rule out ASD when they are negative. Given the low specificity of these tests, a positive screen should be followed up with administration of the MCHAT, MCHAT-I, or more detailed assessment to confirm the findings.

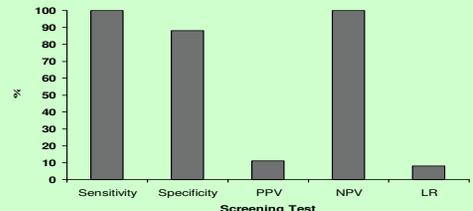
METHODS



Accuracy:
Sensitivity = TP/TP+FN
Specificity = TN/TN+FP

RESULTS

Figure 1. Accuracy of the MCHAT in Detecting Autism in Children



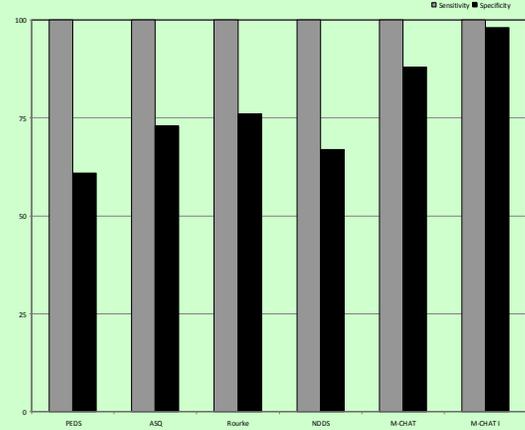
Notes: The gold standard for the clinical diagnosis of autism was the assessment of the clinical psychologist. However, all children diagnosed with autism also met criteria for a developmental delay (i.e. <= 10% percentile on either the cognitive or speech language criterion measures ASD <= 10th percentile on the measure of adaptive functioning). NPV = Negative Predictive Value; PPV = Positive Predictive Value; LR= Likelihood Ratio (3.7 on this graph)

Table 1. Characteristics of All Participating Children with and without Autism Spectrum Disorder*

	All Children	Children Diagnosed non-ASD	Children Diagnosed with ASD*	Comparison, χ^2 , p-value
	n (%)	n (%)	n (%)	
Child Age (mo)	334	329	5	
12 - 18	90 (27)	89 (27)	1 (20)	
19 - 24	47 (14)	46 (14)	1 (20)	
25 - 36	75 (23)	72 (22)	3 (60)	0.15
> 36	122 (37)	122 (37)	0 (0)	
Gender				
Male	187 (56)	182 (55)	5 (100)	
Female	147 (44)	147 (45)	0 (0)	0.05
Language				
French	254 (76)	239 (73)	5 (100)	
English	80 (24)	80 (24)	0 (0)	0.24
Mother's Race/ Ethnicity				
Caucasian	284 (85)	280 (85)	4 (80)	
Black	1 (1)	1 (1)	0 (0)	
Aboriginal	42 (12)	41 (13)	1 (20)	0.95
Other	7 (2)	7 (2)	0 (0)	
Maternal Age (y)				
<20	27 (8)	27 (8)	0 (0)	
21-29	147 (44)	144 (44)	3 (60)	
30-39	138 (41)	137 (42)	1 (20)	0.45
>40	22 (7)	21 (6)	1 (20)	

*Autism Spectrum Disorder refers to children meeting DSM-IV TR criteria for Autism Spectrum Disorder, assessed by structured interview with a registered psychologist. *Comparisons were made using the Pearson Chi-square test. †Aboriginal refers to Canadian descendants of the original inhabitants of North America. ‡Household income is expressed in Canadian dollars. ‡Urban location refers to cities in northern Ontario. Non-urban locations were areas within 1.5 hours of the urban locations.

Figure 2. Sensitivity and Specificity of the Screening Measures for Detection of Autism Spectrum Disorder



Note: The total number of participants was 334. A total of 5 children received a diagnosis of autism and 34 children received a diagnosis of a developmental delay using the criterion measures.

Table 2. Characteristics of Children Diagnosed with Autism Spectrum Disorder*

	Child 1	Child 2	Child 3	Child 4	Child 5
	Male	Male	Male	Male	Male
Child's Age (mo)	30	21	26	18	29
Gender					
Male					
Female					
Criterion Measures					
Bayley III					
Cognitive SS (PR)	75 (5)	80 (9)	80 (9)	55 (<0.1)	95 (37)
Language SS (PR)	N/A	N/A	N/A	N/A	N/A
Motor SS (PR)	79 (8)	85 (16)	85 (16)	67 (1)	94 (34)
Social Emotional SS (PR)	80 (9)	85 (16)	75 (5)	90 (25)	70 (2)
Preschool Language Scale 4th Edition					
Auditory Comprehension SS (PR)	50 (<0.1)	59 (<1)	50 (<0.1)	N/A	91 (27)
Expressive Communication SS (PR)	56 (<1)	50 (<0.1)	61 (1)	N/A	103 (58)
Total Language Score	50 (<0.1)	50 (<0.1)	51 (<0.1)	N/A	97 (42)
Vineland-II Adaptive Behavior Scales					
Communication SS (PR)	66 (1)	71 (3)	79 (8)	77 (6)	91 (27)
Daily Living Skills SS (PR)	73 (4)	109 (73)	87 (19)	100 (50)	80 (9)
Socialization SS (PR)	56 (<1)	78 (7)	68 (2)	84 (14)	82 (12)
Motor Skills SS (PR)	72 (3)	104 (61)	96 (19)	84 (14)	88 (21)
Adaptive Behavior Composite SS (PR)	64 (1)	88 (21)	79 (8)	83 (13)	82 (12)

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CONCLUSION

- Approximately 1.1% of individuals presenting for routine primary care were identified as having autism spectrum disorder.
- The MCHAT had 100% sensitivity and 88% specificity for the detection of autism spectrum disorder.
- The MCHAT follow up interview increased specificity to 98%.
- All of the broadband screening measures had high sensitivity (100%).
- However, most of the general developmental screening measures - the ASQ, PEDS and NDDS, had low specificity, indicating that there will be a significant number of false positives if these tests are widely used in clinical practice.
- Although the Rourke had moderate specificity, the study did not have sufficient power to find significant differences between this and the other tests, suggesting that further study on this tool is needed.
- Given the low specificity of the broadband screening tests, a positive screen should be followed up with administration of the MCHAT, MCHAT -I, or more detailed assessment to confirm the findings.
- These findings support current recommendations for routine use of broadband developmental screening tests in all children, with targeted screening using autism specific screening (MCHAT) for those with abnormal results.