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[mSP6P;June 14, 2025;14:11]







ORIGINAL ARTICLE

Psychometric characteristics of the mini-TEA scale: a screening instrument for autism spectrum disorder in children

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Received 5 December 2024; accepted 13 May 2025 Available online xxx

KEYWORDS

Autism; Screening; Mini-tea scale; Sensitivity; Specificity; Validation

Abstract

Objective: Early diagnosis of autism spectrum disorder (ASD) is advisable to promote better prognosis. The Mini-TEA scale was conceived as a sensitive screening for ASD among children. The authors aimed to confirm the diagnostic accuracy of the scale in a wider population. *Method:* 279 children from 2.5 to 12 yo were recruited, most of them under evaluation for possible ASD in the APAE of Passo Fundo/RS, as well as children with other diagnoses and normal children. Their parents/relatives answered the 48 binary questions (yes/no) of the Mini-TEA scale, divided into 15 items, which resulted in a score from 0 to 15. After that, the children were evaluated regarding the diagnostic criteria of ASD by experienced raters (gold standard) who had previously submitted to a concordance test and remained unaware of the children's scores. Sensitivity and specificity Figs. were obtained. Factor analysis and Item Response Theory approaches were used for validity evidence.

Results: 115 children were diagnosed with ASD. Scores \geq 9 had 98.3% of sensitivity and 62.2% of specificity for the diagnosis. Two cases with the typical presentation of Asperger's syndrome scored lower than 9. The mean time for screening was about 8.5 min. The validation model presented excellent coefficients of factorability. The analysis showed that the total variance of the scores of the scale through the 15 items was explained only by the set of ASD symptoms (unidimensionality).

Conclusion: The mini-TEA scale is a very sensitive tool to screen for ASD and has high internal consistency for assessing typical autistic symptoms.

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https://doi.org/10.1016/j.jped.2025.05.006

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Please cite this article in press as: C.M. Forcelini, R. Ampese, H.Y. de Melo et al., Psychometric characteristics of the mini-TEA scale: a screening instrument for autism spectrum disorder in children, Jornal de Pediatria (2025), https://doi.org/ 10.1016/j.jped.2025.05.006

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1 Introduction

Autism Spectrum Disorder (ASD) is characterized by per-2 sistent deficits in social communication and interaction 3 across multiple contexts, as well as restricted, repetitive 4 patterns of behavior, interests, or activities, all these 5 symptoms causing impairment in social, occupational, or 6 other important areas of current functioning.¹ Early diag-7 nosis of ASD is advisable because a better prognosis of 8 development emanates from several evidence-based 9 interventions that should begin as soon as possible.^{2,3} 10 However, there is a scarcity of services with trained pro-11 12 fessionals for the adequate diagnosis of ASD in Brazil,⁴ as well as in other developing countries.⁵ 13

The employment of screening tools could be an aid to 14 separate those infants and children who actually need fur-15 ther evaluation from those whose suspicion of ASD is not 16 appropriate, especially in the context of limited health 17 resources. In this setting, the widespread use of the revised 18 form of the Modified Checklist for Autism (M-CHAT-R/F) in 19 20 toddlers has been a recommendation for pediatricians.^{6,7} However, this instrument is devoted only to toddlers from 16 21 to 30 months of age, a population that often skips such eval-22 uation due to a lack of screening through adequate pediatric 23 care.⁸ 24

This scenario led the group to develop the Mini-TEA scale, 25 a screening tool for ASD in Brazilian Portuguese directed to 26 parents/relatives of children from 2.5 to 12 yo, because of 27 the lack of such a scale for this age group in Brazilian Portu-28 guese, Initial results of the present research suggested that 29 the scale has an excellent sensitivity (100%) and a reason-30 able specificity (68%),⁹ enabling the proposal of its use 31 32 among children not previously assessed with the M-CHAT-R/ F. This research has been extended to embrace a wider pop-33 ulation in order to confirm the diagnostic accuracy and to 34 ascertain other characteristics related to the validation pro-35 cess of the Mini-TEA scale. The purpose of this manuscript is 36 to report the results of this survey extension and reinforce 37 the helpfulness of the Mini-TEA scale to help in the screening 38 for ASD among children. 39

40 Methods

The local ethics committee approved this cross-sectional 41 study for evaluating the accuracy of the Mini-TEA scale in 42 July 2023 (approval number 6.175.425). The study was 43 accomplished from July 2023 to July 2024 in the Associação 44 de Pais e Amigos dos Excepcionais (APAE - Passo Fundo, RS, 45 Brazil). The APAE from Passo Fundo houses a Centro Regional 46 de Referência em Transtorno do Espectro Autista (Regional 47 48 Reference Center for ASD) of the Programa TEAcolhe, a pro-49 gram for improving diagnosis and management of ASD sup-50 ported by the Government of Rio Grande do Sul (RS), Brazil.

51 Children (and their parents/relatives) who were under 52 evaluation for possible ASD and other neurodevelopmental disorders in the APAE were recruited upon invitation. In par-53 allel, other parents/relatives brought normal children on 54 their own initiative attracted by local advertisements. This 55 convenience sample included children aged from 2.5 to 12 56 yo. The written consent was obtained from the child's legal 57 guardians and, whenever feasible, from the child. One child 58 declined participation. The only exclusion criterion was 59 guardians' illiteracy. 60

The first step was the obtainment of demographic and 61 clinical data from an interview with each child's parents/ 62 relatives. After that, they were asked by medical students 63 about the 48 binary questions ("yes" or "no") of the Mini- 64 TEA scale, divided into 15 items.⁹ Finally, the child was eval-65 uated by a rater (a pediatric neurologist or a psychologist, 66 both experienced in TEA) regarding the diagnostic criteria of 67 ASD from the DSM-V-RV.¹ The raters remained unaware of 68 the children's scores on the Mini-TEA scale until the end of 69 the study. They were previously submitted to a concordance 70 test (kappa statistics) to ascertain that they scored similarly 71 20 children in relation to the clinical diagnosis of ASD. 72

The authors estimated the sample size based on the study 73 of Kyriazos for a factorial exploratory analysis of binary 74 data,¹⁰ which suggested at least 200 participants, and the 75 study of Sahin & Anil that considered an adequate sample 76 size of 250 participants for the application of Item Response 77 Theory over unidimensional instruments.¹¹ The final sample 78 size was estimated to be circa 280 participants, adding 12% 79 to prevent losses due to missing data. 80

Ultimately, the results were assessed to define the pri-81 mary outcome: the cut-off score that could offer a high sen-82 sitivity for screening to ASD and an acceptable specificity 83 considering the diagnostic criteria according to DSM-V-RV as 84 the gold standard. To examine the mini-TEA scale as a test-85 criteria analysis with an external measure (gold standard), 86 the authors built a receiver operating characteristic (ROC) 87 curve to verify levels of specificity and sensitivity of the 88 scores in identifying cases of ASD established with the DSM-89 V-TR. Likewise, this analysis allowed an estimate of the 90 instrument cut-off point. The interview duration for apply- 91 ing the mini-TEA scale was recorded as a secondary outcome 92 to offer an estimate of the time spent screening for ASD. 93

Mean, standard deviation and frequency were used for 94 descriptive purposes of clinical data, according to the nature 95 of the variable. Shapiro-Wilk normality tests and visual 96 inspection of histograms were used to evaluate the distribution of the quantitative variables. 98

For validity evidence of the Mini-TEA scale, the authors 99 used factor analysis and item response theory (IRT) 100 approaches. First, the dimensionality of the scale was tested 101 with exploratory factor analysis (EFA) with unweighted least 102 squares (ULS) as the extraction method. Tetrachoric correla-103 tions for dichotomous data and parallel analysis as a method 104 to define the number of factors were used.¹² In addition, the 105 15 items of the Mini-TEA scale were submitted to an analysis 106 using the Rasch model for dichotomous unidimensional 107 instruments. Infit, outfit (raw and standardized), and signed 108

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chi-squared test $(S\chi^2)$ were used as fitting coefficients. Values from 0.7 to 1.3 are considered adequate (rule of thumb) for the infit and outfit indices.¹³ The significance level of $\alpha = 0.05$ and power of 0.8 were used. The statistical programs employed were R Studio (RStudio Team, 2020), using the packages psych (for EFA) and mirt (for Rasch analysis) and Microsoft Excel[®].

116 Results

The sample comprised 279 children whose parents/relatives answered the Mini-TEA scale. All participants completed the study and were assessed by one of the raters regarding the diagnosis of ASD. The result of the concordance test evidenced an extremely similar evaluation between raters, with Kappa coefficient = 1.0 (z = 4.47; p < 0.001), denoting that both agreed highly for the diagnosis of ASD.

124 Table 1 presents detailed information about the 279 participants. 115 had the diagnosis of ASD confirmed. Regarding 125 the severity of ASD, 74 were classified as level 1 ("requiring 126 support"), 30 as level 2 ("requiring substantial support"), 127 and 11 as level 3 ("requiring very substantial support"). 128 Most of them are currently under etiologic investigation. 129 The main alternative diagnoses of ASD were the following: 130 intellectual disabilities, communication disorders, atten-131 tion-deficit/hyperactivity disorder, and oppositional defiant 132 disorder. These children were referred to medical accompa-133 niment. Learning, behavior, and speech problems were the 134 leading symptoms that motivated the parents/relatives to 135 seek aid, both from the ASD group and the group with other 136 137 diagnoses. There were also volunteers without any com-138 plaints who contributed to the study sample.

The Mini-TEA scale, with 48 questions distributed along the 15 items (Figure 1), was performed with a mean time of about 8.5 min.

 Table 1
 Clinical characteristics of the sample.

The EFA model was applied to the scale and presented 142 excellent coefficients of factorability (Bartlett's $K^2 = 38.37$ 143 [df = 14; p < 0.001] and Kaiser-Meyer-Olkin [KMO] = 0.94). 144 The analysis based on the tetrachoric correlations matrix 145 showed that the total variance of the scores of the Mini-TEA 146 scale through the 15 items was explained by only one factor, 147 that is, the set of ASD symptoms, attesting to the unidimen-148 sionality of the instrument. Figure 2 shows the screen plot 149 with eigenvalues and the parallel analysis, revealing that 150 one-factor solution is the best for the present data. The vari-151 ance explained was 0.73 (ss loadings = 10.98). Table 2 illus-152 trates the loadings of each item for this factor, which are 153 high overall. This denotes that all items reflect the core 154 symptoms of ASD and contribute similarly to a singular 155 score. 156

Considering the unidimensionality of the Mini-TEA scale, 157 the authors implemented the Rasch model to investigate the 158 item's difficulty (b), that is, the percent subjects that 159 answered the item correctly (the percentage that was 160 attributed the ASD characteristic measured by the item) by 161 the percent of subjects that answered incorrect (did not 162 endorsed the item). B-values for the 15 items ranged from 163 -0.706 to 2.796 (mean = 1.61; SD = 0.94). In order to evalu-164 ate how well each item fitted accurately the unidimensional 165 model, the authors analyzed infit (how close observed values 166 are from expected values, considering the item's difficulty – 167 how probable it is to be endorsed - and person's ability - or 168 the level of symptoms of ASD) and outfit (a similar measure, 169 although not considering item's difficulty and person's abil-170 ity - a measure of unexpected errors). As observed, the 171 respondents' performance for Item 3 did not completely fit 172 the expected Rasch model when infit is considered. How-173 ever, when outfit is considered, items 1, 2, 3, 4, 6, 7, 9, 10, 174 and 15 had lower values of outfit, which means they overfit 175 the model and may be redundant or too predictable. Never-176 theless, considering the z-outfit, only items 2 and 3 can be 177

	ASD children (n = 115)		Non-ASD children (<i>n</i> = 164)	
Age (years) Mini-TEA score Sex	6.18±2.79 10.98±4.54 Male 98	Female 17	6.75 ± 3.07 9.84 ± 5.02 Male 110	Female 54
Learning problems Behavior problems Speaking problems	Yes 94 113 109	No 21 2 6	Yes 77 97 53	No 87 67 111

	Children with other diagnoses (<i>n</i> = 100)		Normal children (n = 64)	
Age (years) Mini-TEA score	$\begin{array}{c} 5.97 \pm 2.78 \\ 10.24 \pm 3.83 \end{array}$		$7.26\pm3.1\\4.12\pm3.4$	8 10
Sex	Male 70	Female 30	Male 42	Female 22

 $\label{eq:continuous} Continuous variables are expressed in mean \pm standard deviation, while categorical data are described with absolute number. \\ Note: ASD, autism spectrum disorder.$

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Data:

MINI - TEA

Entrevistado:

INSTRUÇÕES (leia antes de aplica): A - Essa escala se destina ao(s) responsável(is) de crianças entre 2 anos e meio de idade e 12 anos, devendo ser questionados presencialmente por um aplicador. B - A escala tem 15 itens, sendo cada item sobre um tema. C - Cada item de mem a e cinco perguntas. D - Cada item mem de uma a cinco perguntas. E - Responsa "SMP" para quaisquer das perguntas, não importa quantas (uma, duas, todas, etc.) leva à pontuação "1". F - Se TODAS as respontas das perguntas do item forem "NAO", a pontuação sera "0". G - Ou seja, como a escala tem 15 itens, a pontuação minima é o" e a máxima e "15". H - A escala pode ser aplicada sem a presença da criança. I - Caso se aplicue simultameamente a escala em mais de uma pessoa (ex: ambos o país) e houver discordância, levar em consideração a pontuação mais alta em cada item.

em consideração a pontulação mais alta em cada item. 1. Relações pessoais: [] O (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). A criança evita olhar diretamente nos olhos? Tem grande dificuldade em ter interação com adultos ou pessoas da mesma idade (timidez exagerada)? Chega a ficar muito zangado ou desesperado com alguma tentativa de interação com adultos ou pessoas da mesma idade?

Mostra-se distante, ausente, como se não percebesse ou não importasse a outra pessoa? É muito difícil conseguir a atenção da criança?

2. Imitação: [] 0 (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). A criança tem dificuldade para imitar gestos simples, como bater palmas? Tem dificuldade ou muita demora para imitar sons? Só com muito estímulo a criança imita gestos ou sons?

Resposta emocional: [] O (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). A criança às vezes tem reações emocionais aparentemente sem relação com o que o que está presente ou A criança às vezes tem reações emocionais aparentemente sem relação acontece à sua volta (ex: gritar, rir, sem motivo aparente)? Ou costuma ser indiferente a situações em que se esperaria um reação?

4. Movimentos corporais [] O (nenhuma resposta SIM). []1 (pelo menos uma resposta SIM).

A rionaninos corporationas (1) (temporative space and p. (1) (per of A criança é muito desajeitada (secorréenada)?
 Apresenta movimentos repetitivos?
 Tem novimentos estranhos corno os dedos das mãos ou com o corpo?
 Costuma caminhar mais na ponta dos pás?
 Corore de agrefar a si mesma (bater-se, met?)?

5. Uso de objetos: [] O (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). A criança brinca de forma estranha com objetos, diferente do que seria esperado (ex: sugando, batendo, arrastando, enfileirando)? Fixa a atenção somente em um aspecto ou parte do objeto ou brinquedo (ex: roda de carrinho)?

Tem interesse restrito, ou seja, somente em um ou dois objetos? Mostra pouco interesse em brinquedos e objetos?

6. Adaptação à mudança: [] 0 (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). endo para passar para outra atividade? de em aceitar mudar o qu Fica zangada ou triste por mudanças simples (ex: lugar dos móveis, trajeto para escola) Quando ocorrem mudanças bruscas mostra uma reação intensa (é difícil de acalmar)?



7. Resposta visual: [] 0 (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). A criança tem alguma forma estranha de olhar para alguns objetos (ex: de muito perto para . ra uma parte só do

objeto)? objeto)? Apresenta momentos de olhar parado, para o nada, como se estivesse ausente? Evita constantemente olhar para objetos apresentados?

8. Resposta ao som: [] 0 (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). Parece que a criança às vezes não ouve direito ou não atende quando chamada pelo nome? Tem reações inesperadas (ex: crise de irritabilidade, tapar os ouvidos) quando ouve alguns sons do ambiente?

9. Resposta ao paladar, olfato e tato: [] O (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). A criança segue levando à boca objetos, mesmo que outras crianças da sua idade já não Tonta cheirar ou experimentar o gosto de objetos não comestíveis, e até pessoas? Gosta de comer só alguns alimentos específicos, recusando-se a experimentar outros? ua idade já não facam mais isso? A reação a um estímulo doloroso é fora do normal: quase não reage ou reage muito mais intensamente que o esperado?

10. Medo ou nervosismo: [] 0 (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). M. Hedo du introvanto II. Parece que a criança muitas vezes tem medo ou nervosismo exagerado? Chega a ter medo de coiasa inofensivas? Ou parece não ter medo quando seria esperado que tivesse (ex: perto de um cachorro latindo, atravessar a rua)? Chega a ser difícil acalmar a criança nas crises de medo?

11. Comunicação verbal: [] O (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). A criança está atrasada para falar? Tem uma fala estranha, na escolha dos sons ou palavras, nem sempre fácil de entender? Fica repetindo muito só coisas que vê na TV (ex: números em inglês)?

12. Comunicação não verbal: [] 0 (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). 12. Comunicação não verbai: [] o (inennuma resposa arri); [] i (pero inense au A criança tem dificulada em se comunicar por gestos? Tem dificuladade de entender os gestos ou as expressões faciais que fazemos? Em vez de pegar algo ao seu alcance, puxa um adulto para pegar o objeto para ela?

13. Nível de atividade: [] O (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). Chega a não conseguir para quieta para fazer algo? Ou é muito parada, lenta, preguiçosa perto de outras crianças da idade?

14. Resposta intelectual: [] O (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). A criança parece ser menos esperta para aprender as coisas em relação às outras crianças? Tem dificuldade de aprende respecificamente só algumas coisas que outras da mesma idade já sabem? Parece ser muito mais esperta em uma coisa específica do que as demais crianças da idade?

15. Impressão dos pais/familiares: [] O (nenhuma resposta SIM). [] 1 (pelo menos uma resposta SIM). Você acha que sua criança tem algo de diferente do usual ou atrasado em relação ao desenvolvimento, comparado com outras crianças?

ESCORE FINAL

ATENÇÃO: Este é um instrumento de triagem, não de diagnóstico. Escore de 09 ou mais indica que a criança deve ser melhor avaliada quanto à possibilidade de TEA.



Figure 1 The mini-TEA scale.



Screen plot for the mini-TEA scale presenting eingenvalues (in blue) and parallel analysis (in red). The graph reveals that Figure 2 1 component adds enough information for the model, reinforcing the unidimensionality of the scale.

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Table 2	Loadings	for the	unifactorial	solution	of the I	Mini-
TEA scale.						

Table 3 Sensitivity and specificity of the Mini-TEA scale (n = 279).

Item	Loadings
ltem 1	0.891
Item 2	0.881
Item 3	0.952
Item 4	0.911
Item 5	0.906
Item 6	0.823
Item 7	0.888
Item 8	0.778
Item 9	0.815
Item 10	0.865
Item 11	0.810
Item 12	0.839
Item 13	0.831
Item 14	0.768
Item 15	0.856

Note: Loadings values range from 0 to 1.

really considered problematic (lower than 2 SD), which 178 means they present an overfit to the model and do not add 179 much information for the test. When one considers chi-180 square tests, items 4 and 14 seem to have significantly 181 higher residual values. After checking the item information 182 curves, the analysis revealed the peak of each item curve 183 ranged from -0.7 to 2.8, with a mean peak of 1.61 184 (SD = 0.95). Overall, these results indicate the Mini-TEA 185 scale provides more information when a person's ability (in 186 this case, symptoms of ASD) is higher [a test information 187 curve of 0 (zero) would be considered the test is maximally 188 informative on a medium level of ASD]. In other words, if 189 items are endorsed it may indicate a high probability of 190 being diagnosed with ASD. 191

Table 3 presents the sensitivity and specificity of the Mini-192 TEA scale to predict cases and non-cases of ASD. As a screen-193 ing test, when sensitivity was prioritized, the cut-off point 194 to identify suspected ASD was proposed: scores equal to 9 or 195 196 higher had 98.3% sensitivity and 62.2% specificity for the diagnosis. Figure 3 illustrates this through the ROC curve, 197 whereas the area under the curve (AUC) value was 0.88. 198 indicating a good discriminating quality. From the 115 ASD 199 children, 58 were scored 15 in the scale, 29 were scored 14, 200 13 were scored 13, three were scored 12, seven were scored 201 11, two were scored 10 and on child was scored 9. The only 202 two cases of ASD that were scored <9 on the Mini-TEA scale 203 (two boys, one with "5" and the other with "6") have the 204 typical presentation of Asperger's syndrome. On the other 205 hand, normal children were scored from 0 to 11, while those 206 with diagnoses other than that of ASD were scored from 2 to 207 15. 208

209 Discussion

Improvement in the early diagnosis of ASD is an aimed goal that led to recent worldwide research. Arun and Chavan developed a 37-item questionnaire in India, where the late

Cut-off Sensitivity Specificity 15 0.522 1 14 0.765 0.957 13 0.878 0.872 17 0.904 0.817 11 0.957 0.732 10 0.974 0.683 9 0.983 0.622 8 0.591 0.983 7 0.983 0.512 0.991 0.457 6 5 0.372 1 4 0.348 1 3 1 0.293 2 1 0.22 0.171 1 1 0 1 0.073

diagnosis is the rule, with dichotomous ves/no responses to 213 screen for ASD among children aged from 1.5 to 10 years.⁵ 214 They found the Figure of 89% of sensitivity and specificity. In 215 a different context, a group of researchers created a tool to 216 overcome the delay of more than one year for diagnosis of 217 ASD in the US.¹⁴ They developed a device to measure eye- 218 tracking-based social visual engagement and found the sen-219 sitivity of 70.7% and specificity of 85.4% for ASD among 16 220 to 30-month-old toddlers. Another example is the recently 221 published validation of the Social Communication Question-222 naire (SCQ) for the Portuguese population between 4 and 17 223 v.o.¹⁵ with values of sensitivity and specificity of 76 % and 224 93%, respectively. 225

In Brazil, despite the identification of ASD before 4 years 226 of age has improved, it still represents only 30% of the diag-227 noses made.¹⁶ In this setting, the authors created the Mini-228 TEA scale to fill the gap in screening for ASD from 2.5 to 12 y. 229 o. The results here presented confirmed the excellent sensi-230 tivity suggested by theprevious publication.⁹ 231

The M-CHAT-R/F has been recommended as mandatory to 232 pediatricians for ASD screening,^{6,7} but its employment is 233 actually far from the recommended widespread use due to a 234 series of reasons: lack of access to adequate pediatric care; 235 medical visits only when the child is ill; short period of con-236 sultation in many contexts. As a result, most children in Bra-237 zil were not screened for ASD at the time they could be with 238 the M-CHAT-R/F and became older than the age range for 239 which that guestionnaire was delineated. The Mini-TEA scale 240 was conceived as a simple tool that can be applied to these 241 children's parents or relatives not only by medical doctors 242 but also by other health professionals and even by teachers 243 and social agents. This can spread the screening of ASD. On 244 the other hand, almost 60% of the children without ASD 245 were adequately excluded by the Mini-TEA scale because 246 they scored less than "9". This is particularly important to 247 decrease the waiting lists of children with suspicion of ASD, 248 especially in the setting of scarcity of trained professionals 249 for adequate diagnosis. All this with a simple and 250

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Figure 3 Receiver operating characteristic (ROC) curve for the Mini-TEA scale.

comprehensible questionnaire with dichotomous yes/no
responses that take <10 min to be answered by the parents/
relatives of children, without the need for the latter's presence.

Two boys with the typical Asperger's syndrome skipped 255 the identification among 115 children with ASD. Apart from 256 them, only one child with ASD pointed "9" among the 257 remaining 113. Nevertheless, the authors adjudicate to 258 lower the cut-off point from the previously proposed "10",⁹ 259 with 97.4% of sensitivity, to "9" in order to enhance the sen-260 sitivity to 98.4% without prejudice to the reasonable figs. of 261 specificity. For screening purposes, sensitivity should be pri-262 oritized. 263

The failure of the Mini-TEA scale to detect two cases of 264 ASD with a characteristic presentation of Asperger's syn-265 drome is expected. People with this form of ASD show no 266 language problems and their cognitive development is not 267 marked by an overall delay but by specific impairments in 268 certain areas such as the executive functions, with hetero-269 geneous clinical presentations varying according to age.¹⁷ 270 Suspicion and screening of Asperger's syndrome is not easy 271 because of such diversity of clinical manifestations. Conse-272 quently, Asperger's syndrome is often diagnosed belatedly, 273 274 at 11 years of age on average and even in adulthood in some 275 cases.¹⁷ There were other children with Asperger's syn-276 drome in this series, but the possibility of skipping the identification of mild cases of this type of ASD presentation must 277 278 be kept in mind when employing the Mini-TEA scale for

screening purposes. This represents a limitation of the 279 instrument. 280

The present survey has some limitations to be addressed. 281 The convenience nature of the sample may include selection 282 bias whose impact was partly minimized by a wide number 283 of participants. The authors did not perform an etiologic 284 investigation of the ASD children, but this study was conceived to evaluate the accuracy of the Mini-TEA scale and 286 not to search for causative factors. 287

The Mini-TEA scale was not the first Brazilian attempt to a 288 screening tool for ASD. In 2008, Sato and cols, published a 289 preliminary study of translation and validation of the Autism 290 Screening Questionnaire (ASQ).¹⁸ The original research that 291 gave rise to the ASQ was undertaken in 1999 in London.¹⁹ 292 Both studies were performed in samples derived from a 293 series of pediatric patients with known neuropsychiatric dis-294 turbances in order to separate ASD from other diagnoses. 295 That is, ASQ was not designed to be a screening in the gen-296 eral population. Besides, the Brazilian version was tested in 297 children with a restricted mean age of about 10 to 11 yo. 298

Although ASD is universal, the behavioral manifestation 299 of autistic symptoms may vary according to different cultural contexts.²⁰ Taking this into account, a Brazilian group 301 undertook a survey that consisted of the translation of the 302 Childhood Autism Spectrum Test (CAST) to Brazilian Portuguese to investigate the factor structure of parent-reported 304 autistic symptoms in a large sample of children/adolescents 305 from the metropolitan area of São Paulo.,²¹ This provided 306 JID: JPED

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evidence of the cross-cultural validity of the classical autis-tic symptoms in the Brazilian urban population.

309 The authors demonstrated that the total variance of the scores of the Mini-TEA scale was explained by only one fac-310 tor, that is, the set of ASD symptoms. This was in line with 311 other studies with similar scales and unidimensional factor 312 solutions,²² although a number of factors for ASD screening 313 scales are particularly variable in the literature.²³ Consider-314 ing this unidimensionality of the Mini-TEA scale, the Rasch 315 model showed that overall the items are adequate to assess 316 ASD, and are more informative (less uncertainty) when indi-317 viduals present higher levels of symptoms. This should not 318 be mistaken by the cut-off point proposed, because the 319 Rasch model parameters are independent of the sensitivity/ 320 specificity analysis (which considers external criterium, i.e. 321 the clinical diagnosis of ASD). The analysis takes the various 322 presentations of the latent trait (informed by the different 323 items of the scale) and tests how probable this item is to be 324 endorsed in the sample. Despite some items could be 325 326 adjusted or restructured (one must consider they are 327 endorsed based on at least one affirmative answer to the set 328 of questions of that item, therefore questions could be reanalyzed in future analysis), most of the fit indices indicated 329 items were suitable for the one-factor solution. Besides, 330 based on this analysis, researchers and practitioners could 331 look at each item separately in order to use them as a more 332 precise guide to inform about the diagnosis and clinical 333 impact of decisions and interventions.²⁴ 334

In summary, the authors concluded that the Mini-TEA scale is a very sensitive tool to screen for ASD and has high internal consistency. The widespread use of this scale may be helpful for purposes of early identification of suspected cases of ASD and excluding non-ASD cases in several contexts.

341 Al declaration

342 Generative artificial intelligence was not employed to write343 this manuscript.

344 Conflicts of interest

345 The authors declare no conflicts of interest.

346 Funding

347 This research received no funding.

348 Acknowledgments

The authors thank the inclusion of this survey in the Programa TEAcolhe (for improving diagnosis and management of autism spectrum disorder) by the Government of Rio

352 Grande do Sul (RS), Brazil.

Editor

M.L. Nunes

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