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A comparative study of telephone and face-to-face use of phone screening interview for autistic spectrum disorder symptoms (PSI-ASD)

Estudo comparativo da aplicação por telefone e presencial da entrevista de triagem por telefone de sintomas do espectro autista (PSI-TEA)

ABSTRACT

Objective: Describe reliabilities evidence of the Phone Screening Interview (PSI), a telephone screening interview for autism spectrum disorder (ASD) symptoms, capable of investigating mild to moderate ASD symptoms. Moreover, the PSI also works for verbal and non-verbal children and is consistent with the DSM-5 diagnostic criteria. **Methods:** An interview was performed with sixty-eight parents of children between 2 and 15 years old attended by the Psychiatry Ambulatory of *Santa Casa de Misericórdia do Rio de Janeiro* through the PSI in person and by telephone. **Results:** No significant differences in comparison between averages of the total score of the face-to-face and telephone applications were observed. The agreement analysis between the items indicated three items with lower values, leading to the modification of some questions, culminating in a new interview version for further studies. Given the disagreement in the values found, the order of application of the interviews seems to not impact the results, demonstrating strong correlations between both interviews, even with a different order of application. Aiming to facilitate the use of the scale by different examiners, the interobserver reliability was investigated, which did not show significant differences in the means. **Conclusion:** The study suggests that the telephone interview can be used similarly to the face-to-face interview, by different evaluators, with no impact on its efficiency in detecting ASD symptoms.

KEYWORDS
Autism spectrum disorder, phone screening, screening, warning signals, non-verbals.

RESUMO

Objetivo: Descrever evidências de confiabilidade da *Phone Screening Interview* (PSI), uma entrevista para rastreio telefônico de sintomas do Transtorno do Espectro Autista (TEA) de fácil aplicação, capaz de investigar sintomas de TEA leve a moderado, aplicável a crianças verbais e não verbais e consistente com os critérios diagnósticos do DSM-5. **Métodos:** Sessenta e oito pais de crianças com idade entre 2 e 15 anos atendidas pelo Ambulatório de Psiquiatria da Santa Casa de Misericórdia do Rio de Janeiro foram entrevistados por meio da PSI, tanto de maneira presencial quanto telefônica. **Resultados:** As médias da pontuação total da aplicação presencial e telefônica foram comparadas, não sendo obtidas diferenças significativas. A análise de concordância entre os itens apontou três itens com valores muito baixos, levando à modificação de algumas perguntas, culminando em uma nova versão, para estudos posteriores. Diante da discordância de valores encontrada, foi verificado que a ordem de aplicação das entrevistas não impactaria os resultados, demonstrando fortes correlações entre as entrevistas, mesmo com ordem de aplicação diferente. Para viabilizar o uso da escala por diferentes examinadores, investigou-se a confiabilidade interobservadores, que não mostrou diferenças significativas nas médias. **Conclusão:** O estudo sugere que a entrevista telefônica pode ser utilizada de forma semelhante à presencial, por diferentes avaliadores, sem impacto em sua eficiência na detecção de sintomas de TEA.

PALAVRAS-CHAVE
Transtorno do espectro autista, triagem telefônica, rastreio, sinais de alerta, não verbais.

INTRODUCTION

Autism spectrum disorder (ASD) is one of the most common neurodevelopmental disorders in childhood[1], which brings heterogeneity and variability in clinical presentation, making its diagnosis a complex process[2]. The principal behavioral signs observed include impairments in shared attention, language, and the presence of stereotyped behaviors[3]. Persistent deficits in communication, social interaction, and restricted or repetitive patterns of behavior, interests, and activities are also present since early childhood[4].

As it is a clinical diagnosis based on the criteria described in the *Statistical and Diagnostic Manual* of the American Psychiatric Association[4], the measurement of impacted domains relies on the report and observation of parents, caregivers, and health professionals, given the absence of biological markers[5]. Therefore, different methods are favorable to obtain information to help in this diagnostic design of ASD in Brazil[6] and other countries[7]. There is considerable interest from the scientific community in use of tests to investigate and evaluate this disorder[8].

As the number of children diagnosed with ASD has grown considerably[9], there has been an increase in demand for services in search of diagnosis and follow-up, generating long waiting lines[10]. To assist in the correct direction of waiting patients, considering the evidence of the earlier intervention importance[11,12], is notorious the relevance of instruments that allow screening patients with signs of risk for ASD[13] or another neurodevelopmental disorder, to subsequent transference to a complete multidisciplinary evaluation.

The use of screening instruments is pointed out as a relevant ally in this sense[14], constituting a quick way for health professionals to identify children who present some sign of risk for a disorder and who need a more in-depth assessment[14]. Therefore, screening should be a brief assessment, which identifies risky signs instead of providing a diagnosis[15], as well as enabling an easy and quick application, proving to be more comprehensive[16].

Accordingly, one of the widely used screening tools studied for the Brazilian population is the Modified Checklist for Autism in Toddlers (M-CHAT), adapted by Castro-Souza[17]. M-CHAT is a screening tool based on parents' responses to items mainly related to social interaction, communication, shared attention, and pretend-play[18] that identifies children with suspected ASD. It applies to children between 18 and 24 months. The M-CHAT[19,20] uses an interview with dichotomous yes and no answers. However, it focuses exclusively on screening for early symptoms.

Despite the development of some screening instruments, there is a limitation related to the age reached, with a gap between ages 30 and 48 months[10]. Seize and Borsa[20] reported a scarcity of instruments for screening early signs of ASD in Brazil, a result also found by Backes et al.[21], encouraging the development of new instruments.

The Autism Symptom Interview (ASI)[22] is an example of a screening interview conducted through the telephone application, intended to identify individuals whose behavior is consistent with the diagnosis of ASD, focusing their questions on current behaviors observed in the previous three months. It relies on the Autism Diagnostic Interview-Revised[23]. The authors describe the ASI as a helpful tool for identifying ASD in research contexts. But they also highlight some limitations, which include the difficulty in recruiting non-verbal participants without a diagnosis of ASD and over five years of age.

Telephone interviews have been appointed by several studies as correlated to face-to-face interviews[24-28]. An especially relevant aspect mentioned in the validations of telephone screenings is the possibility of reaching a greater number of people for participation in research and further medical follow-up.

Siegel et al.[16] applied the ABC-I (Aberrant Behavior Checklist – Irritability Subscale) through telephone to parents of 39 persons with intellectual disabilities, ASD, or both conditions. A written copy of the subscale also was sent to the same caregiver. The ABC-I is a checklist that aims to identify inappropriate behaviors in the population with developmental delay, helping in the evaluation and the response to treatment. Scores obtained by telephone and written administration were highly correlated.

Given the scarcity and limitations reported[10,20], the possibility of screening by telephone is a helpful alternative to traditional screening methods. Furthermore, in a pandemic context, Fichman et al.[29] realized the relevance of developing an instrument that, in addition to mapping signs of ASD, could have widespread uses, to reach a higher number of children without being restricted to face-to-face use. Those instruments have utility in research and possibilities increasing the rotation of access to outpatient services.

The Phone Screening Interview (PSI) was based on the diagnostic criteria established by the DSM-5, outlining the investigation mainly through information related to impairments in communication and social interaction (criterion A) and restricted and repetitive patterns of behavior, interests, or activities (Criterion B). It aims to investigate central warning symptoms of ASD, not only early signs. Therefore, it also considers developmental characteristics related to shared attention, social communication, and

stereotyped and inflexible patterns[29]. Studies show that the initial concerns commonly reported by the parents are delays in language skills, atypical social and emotional responses (such as not answering the name), and impairment in shared attention (initiative and responses). There is also a concern about the reduced sharing of positive emotions, restricted and repetitive behaviors and interests, and extreme behavioral reactions[1].

The instrument proved to have utility in outpatient clinical settings and clinical research; easy-to-apply; brief; broad (wide age group); able to investigate mild to moderate ASD symptoms; applicable to verbal and non-verbal children; and consistent with the DSM-5 diagnostic criteria[29].

The present study had the initial objective of developing evidence of the reliability of the PSI. For that purpose, the research compares the averages of the total score of the face-to-face and telephone applications. In addition, this study aimed to analyze the agreement between the total score and the scores of each interview item, which led to the elaboration of a new instrument version. Results indicated the need to verify the influence of the order of application of the interviews. To verify the instrument's reliability when applied by different interviewers the research realized a scores analysis of an inter-examiner application on a sample of children.

METHODS
Participants

The sample consisted of 68 parents of children aged between 2 and 15 years, from the Psychiatry Outpatient Clinic of *Santa Casa de Misericórdia do Rio de Janeiro*. Participants were selected from the waiting list for Neuropsychological Assessment at the clinics. The list included children without any specific diagnosis, referred by the service's physicians for neuropsychological evaluation.

Inclusion criteria were: 1) children with 2 to 15 years; 2) belonging to the waiting list for Neuropsychological Assessment at Santa Casa; 3) previous evaluation by the team psychiatrist. The psychiatric evaluation is clinical and relies on the diagnostic criteria of the DSM-5, including an anamnesis that seeks to investigate in-depth early aspects of development. 4) consent to participate in the research by the parents of the children and adolescents, according to the Consent Form.

Exclusion criteria were: 1) Non-participation in all necessary steps (telephone and face-to-face screening); 2) Non-authorization of those parents for the use of data in the research; 3) Screenings with vague answers (e.g., "I don't know" or "I don't remember");

Instruments

Phone Screening Interview (PSI)[19]: Phone screening interview for screening for ASD symptoms in children aged 2 to 15 years, which can be identified early or retroactively. It consists of 12 items, divided into four categories: Shared Attention (SA), Social Communication (SC), Shared Attention + Social Communication (SAs), and Stereotyped Patterns (SP). It also collects the child's sociodemographic and clinical identification data (age, sex, mother's name, contact, previous diagnosis, previous treatments, and referral). The full interview is in Annex 1.

Ethical aspects

The current study belongs to a broader project on the development of a Theory of Mind instrument for the assessment of ASD symptoms, in which the need arose to develop the screening of children diagnosed with ASD for research. The project was approved by the Research Ethics Committee (CEP) of *Hospital Universitário Clementino Fraga Filho* (HUCFF)/UFRJ, via Plataforma Brasil through CAAE:41590720.4.0000.5257. All participants signed an informed consent form, allowing the use of data for research.

Procedures

Evaluators of the team received training on the function and form of application of the interview in its face-to-face and telephone format. An explanation of each PSI item, possible causes of doubts, and what should be explained in each case (Appendix 1) was also provided. The team consisted of psychologists and psychology undergraduate students.

The instructions for all applicators was to follow what was written in each interview question, giving the explanation and the previously established examples for cases of doubts. (for example, question 4: "Does he or she is interested in children?" could be complemented with: "Does he play? Does he like to play with them?"). They were guided about the estimated time for the interview (from 5 to 15 minutes). For the telephone interviews, after the explanations, each new evaluator of the team performed a telephone screening with the rest of the research team to observe the performance and possible adjustments. After this training, the evaluator was able to carry out the interviews.

During the initial psychiatric evaluation, patients were referred for neuropsychological evaluation. After that, they were included in the research protocol and scheduled for neuropsychological testing. Telephone contact was made with those parents of the child to carry out the telephone interview, consisting only of the application of the PSI-TEA.

Initially, demographic and clinical data were collected through a semi-structured anamnesis when the parents were attending in person for the neuropsychological evaluation. We realized the importance of giving this space so that those parents could talk better about their perception of the child's development in a broadest way, before the PSI application, which is a structured interview. After that, the research consent terms were explained and given to those parents. Finally, after the initial reception of the parents and the explanations, the team psychologist applied the PSI in person. The evaluators did not know the result of the telephone application referring to the same participant. It was not possible to standardize the order of application of the interviews, given the difficulty found in some situations to obtain telephone contact at the time the researcher tried to call. Therefore, the order of application varied.

The interobserver reliability verify was considered important to investigate, since different interviewers carried out the interview. This investigation aimed to assure the effectiveness of the training, done more systematically in the telephone application. In addition, this examination also made it possible to check the feasibility of using the scale by different examiners, without impact on efficient detection of ASD symptoms. For this verification, two interviewers were assigned to carry out the telephone screening interview with the same parents at two different times, being applied to 31 parents.

Statistical analysis

After accounting for the PSI responses of all subjects, the results were analyzed using the Statistical Package for Social Sciences (SPSS) version 20.

A descriptive analysis of the demographic and clinical characteristics of the participants was performed, defining the frequency and percentage of the variables. The age group was divided into three groups: 2-3 years, 4-6 years, and 7-15 years. The children's schooling was divided into two groups: pre-scholar (Child Education) and school (1st to 9th grade), and the parents schooling, in four categories: incomplete 1st grade, 1st complete degree, complete 2nd degree, and complete 3rd degree.

In order to confirm the reliability of the interview application, the Student's T-Test was used to compare the means of the total score of the two groups (face-to-face and telephone application). Student's T-test and Cohen's kappa were performed to compare the means of each item in the face-to-face and telephone application. An analysis was also carried out to verify the correlation between the different application formats of the PSI, considering the p-value lower than .05 for statistical significance.

Objective to investigate whether the order of application of the interviews impacts the results, a correlation was carried out with a small sample of the study, to verify the data correspondence of the application with face-to-face/telephone and telephone/face-to-face order.

For the analysis of interobserver reliability, the Student's T-test was performed, comparing the averages of the applications made by two different interviewers to the same parent, at different times.

RESULTS

Table 1 presents the percentage variation for the age group, sex, and educational level of children and parents. This study had a sample size of 68 children, with a minimum age of 2 and a maximum of 15 years. The mean age obtained was 9.5. The results describe a higher number of individuals aged between 7 and 15 years (77.9%), with a prevalence of schoolchildren participants (91.2%) and males (72.1%). Parents' schooling was analyzed in a sample of 43 parents, most of whom had completed high school (53.48%).

The paired t-test was applied to compare the means between the applications. Results showed no significant difference between the means of telephone screening and face-to-face screening (t(59) = -0.52; p = .600), as shown in Table 2. Furthermore, the correlation between the screenings was significantly positive and strong, with a value of r= .798 and p < 0.01.

The lowest correlations were in items 5 (uses hand), 5.1 (points), 8 (responds to name), and 10 (likes the same thing), which showed correlations considered weak (between 0.3

Table 1. Demographic characteristics of children and parents

Demographic variables	N	Percentage
Age group		
2-3 years	1	1.5%
4-6 years	14	20.6%
7-15 years	53	77.9%
Children's schooling range		
Preschool	6	8.8%
School	62	91.2%
Sex		
Female	19	27.9%
Male	49	72.1%
Parent's education		
incomplete 1st grade	1	2.32%
1st grade complete	6	13.95%
2nd grade complete	23	53.48%
complete 3rd degree	13	30.25%

Table 2. Comparison of the averages of the total score and each item of the face-to-face and telephone application using T Test

	Telephone		Presential		
	Average	Standard deviation	Average	Standard deviation	Correlation _
Total score	3.95	1978	4.03	1,868	0.798
Speak	22.28	18,869	21.29	12,465	0.664
To walk	13.54	5,158	13.87	4,782	0.782
Interested in children	0.16	0.371	0.21	0.407	0.665
Hand use	0.41	0.496	0.60	0.493	0.313
Points	0.19	0.396	0.18	0.384	0.462
Visual contact	0.26	0.444	0.26	0.444	0.547
Annoying noise	0.62	0.490	0.63	0.486	0.718
Respond to name	0.10	0.306	0.10	0.306	0.363
Conversation at home	0.29	0.459	0.26	0.444	0.564
Likes the same thing	0.63	0.486	0.65	0.481	0.394
Repeat dialogs	0.43	0.498	0.49	0.503	0.531
Repeated movements	0.69	0.465	0.65	0.481	0.705

and 0.5). The highest correlations were in item 3 (how old were when start walking), item 7 (noise bothers), and item 12 (does or has already made movements with hands or fingers).

Table 3 shows the analysis using the Kappa Coefficient for items 4 to 12, which are dichotomous response items. Item 5 (uses hand) had the lowest level of agreement, with a kappa value of .290, considered low. Items 8 (responds to the name) and 10 (likes the same thing) also had low kappa coefficient values (.363 and .394, respectively). The highest values of kappa appeared in items 7 (noise bothers) and 12 (movements with hands or fingers).

Given the low reliability found in some items, some modifications were made to the questions, seeking to avoid dubious interpretations and reorganizing its structure to facilitate the follow-up of the application form by different applicators (Table 4). For example, item 5, which had the lowest kappa value, was changed to "Does he use your hand – of the adult/caregiver – to pick up things he wants? Does the children take the adults hand to the object he wants?".

The qualitative analysis of the answers showed that items in which the retroactive question was not asked, the parents answered that the child had already presented that behavior at some point, but were not presenting it anymore. That may have generated different interpretations for the interviewer, during the record. For this reason, some questions were modified to include retroactive analysis. Furthermore, in item 11 (repeat dialogues) the question was modified to include late (out of context) echolalia and immediate echolalia. The new PSI format is complete in Annex 2.

Table 3. Analysis of the reliability of the telephone and face-to-face applications of items 4 to 12 using the kappa test

	Kappa value
Item 4 – Interested in children	.658
Item 5 – Hand use	**.290**
Item 5.1 – Points	.461
Item 6 – Visual Contact	.547
Item 7 – Annoying Noise	.718
Item 8 – Responds to name	**.363**
Item 9 – Conversation at home	.562
Item 10 – Likes the same thing	**.394**
Item 11 – Repeat dialogs	.527
Item 12 – Repeated movements	.702

The analysis of the correlations in the applications made with different orders showed either in the order of face-to-face application first, and telephone application later, or in the reverse order, that the correlation was significantly positive and strong in both situations, with values of r = .822 (Telephone/Face-to-face) and r = .825 (Face-to-face/Telephone). Therefore, it concluded that there was no influence of the application order on the results.

Finally, the analysis of interobserver reliability through the T-Test comparing the averages of the total scores of the first and second telephone interview showed no significant difference between the averages of telephone screening 1 (M = 4.32) and telephone screening 2 (M = 4.19), with values of t(30) = .519 and p = .608. In addition, the correlation between the screenings was significantly positive and strong, with a value of r = .795 and p = .00.

Table 4. Modifications made to the PSI questions

Version 1	Version 2
How was the referral? From who?	Who made the referral for the assessment?
Interested in children (does he play? Does he like to play with them?)	Is he interested in interacting with other children? Does he like to play with them?
Does he use his hand to get things he wants?	Does he use your hand – of the adult/caregiver – to pick up things he wants? Do the children take the adults hand to the object he wants?
Does he maintain eye contact?	Does he maintain or did he used to maintain eye contact? (Does he look you in the eye while you or someone else is talking to him?) NOTE: answer "sometimes" – mark yes; answers saying that at some point in life he didn't keep it – mark no
Does he answer when called by name? Have you ever worried about his hearing?	Does he respond when someone calls him by name? Have you ever worried about his hearing?
Does he like something a lot? (Such as characters or cartoons and movies.)	Does he excessively like the same things? For example, does he watch the same movie or cartoon episodes several times? Or is he always playing with the same toy? (Characters or cartoons/films)
Does he repeat dialogues or phrases he hears from TV or other people out of context?	Does he repeat or used to repeat dialogues or phrases he hears on TV or from other people?

DISCUSSION

One way to potentially expand access to diagnosis, treatments and to deal with long waiting lists is through accessible and accurate screening tools that can help differentiate and triage children with signs suggestive of ASD from children suspected of having other diagnoses[10].

A crucial difficulty cited by Desideri *et al.*[30] in their systematic review is the implementation of screening for signs of ASD in the routine of clinical practice, due to the time spent with the administration and in the scoring of the instruments. The telephone investigations were utilized to complement the screening performed with the M-CHAT[31]. Hence, usefulness of this procedure has already been demonstrated.

Given this, the present article describes the development of evidence of the reliability of the PSI-TEA, to aid in the screening of autism warning signs, which can be applied in an outpatient context by trained employees.

This study demonstrated a good correlation between the face-to-face and telephone application of the PSI-TEA ($r = 0.798$ and $p = 0.00$). It showed no significant difference between the means of the screenings (3.95 in the telephone and 4.03 in the face-to-face). Those results are similar to those found in studies carried out in other countries, such as the study by Baggio *et al.*[32], who obtained identical results between telephone and face-to-face screening in 54% of the modified Rankin Scale (mRS) applications, with an average of 3.5 in the telephone application and 4 in the face-to-face application. No favorable results were found for either of the two application formats. Siegel *et al.*[16] also found a significant correlation between written (face-to-face) and telephone application of the ABC-I scale, with $r = 0.83$ and $p < 0.001$.

The mean scores compared using the paired T-test were not statistically significant ($p = 0.3$).

The analysis carried out showed that items 5 (uses the hand), 5.1 (points), 8 (answers when called), and 10 (likes the same thing) showed low levels of agreement when compared to face-to-face and telephone applications. Some aspects should be considered when using questionnaires answered by parents, such as the possibility of parents being influenced by diagnosis information, the memory of the facts may be compromised, and parents may not have their eyes directed by knowledge about ASD[33].

The statistical difference in evidence in item 5 ("Does he use your hand to pick up things he wants?") may be mainly related to two different aspects. The question refers to the parent's hand and aims to investigate the use of shared attention, investigating whether the child uses communicative gestures to show the other what he wants[34]. However, the ambiguity caused by the possessive pronoun "your" in Portuguese language, which could be interpreted as "the caregiver's" or "his/her" (the child's own), may cause a misinterpretation of the item (Check Annex 3 and 4 for the portuguese versions of the instrument). Another intervening aspect may be the parents' difficulty in identifying and discriminating this sign. The other items with a low level of agreement may be related to the parents' difficulty in knowing marks of social development[35] and in distinguishing behaviors considered warning signs. Sturner[36] says that successful referral begins with a shared understanding of how the child's behaviors related to a potentially serious, though sometimes subtle, condition.

The aspects investigated in questions 6 (maintains eye contact) and 11 (repeats dialogues or lines) that were not placed

retroactively, caused some doubts on the part of the parents, who answered based on the current moment. Some parents, nevertheless, indicated that when the child or adolescent was smaller, the behavior was different. On the other hand, the most valuable aspects of kappa (items 7 "does the noise bother or bothers?" and 12 "makes or has made different movements with the hands and fingers or with the body, for example: circling or swinging") were in questions asked concerning both the present and the past, already covering the retroactive analysis. According to Bosa[34], studies raise the hypothesis that questions with retrospective information may raise doubts because the impairment was not present or because it was not noticed by the parents, for reasons that may involve "denial" or "inexperience in living with babies".

Changes were made to the structure of some interview items, considering the perception of difficulties encountered in understanding some items of the instrument and the low degree of agreement. The purpose was to make them simpler and easier to understand, with a new format being proposed, not used in the current study (Appendix 2).

The order of application of the interviews (face-to-face or telephone first) showed no impact on the results, with similar averages in both applications (0.822 and 0.825). In their study also comparing different forms of application of the ADI-R (face-to-face and by telephone), Ward-King *et al.*[37] reported the possible influence of the application order on twice applying the same instrument within a reasonably short timeframe and by the same interviewer, but found no effect in this regard. Therefore, we consider that these facts did not impact the results.

The analysis of interobserver reliability showed that the application of the interview, when well trained, presents compatible results, proving to be reliable for use by different professionals, which is an expected result for an instrument to be widely used in outpatient and research contexts.

Despite the differences found, the statistical results of the screening remain reliable to those obtained in the face-to-face assessment, so the PSI-TEA presents high effectiveness and is similar to face-to-face screening methods[19].

The study sought to verify whether there were significant differences in the face-to-face and telephone application of the PSI-TEA. The analysis showed that the telephone interview could be used similarly to the face-to-face interview, by different examiners, with no impact on its efficiency in detecting ASD symptoms. This result is highly relevant in the current context of the COVID-19 pandemic, allowing an initial assessment remotely.

Telephone contact often is not feasible due to the incompatibility of the schedule of parents, or because they do not identify the number as known, many people do not answer. These factors ended up interfering with the order of application of the interviews or caused a long time between one application and another, which caused the lack of standardization of time between interviews. The lack of standardization in the training of the evaluators of the face-to-face application team proved to be a possible limiting factor. Results suggests the need of further studies to verify the effectiveness of the proposed new version for the PSI-TEA.

CONCLUSIONS

The present work aimed to develop evidence of the reliability of PSI-TEA. The study showed high efficiency in the telephone application of the screening interview. The telephone application is reliable to be used by different professionals, demonstrating its importance for the expansion of the screening of warning signs in children's development, in outpatient and research contexts, especially for families with difficulty in accessing these services face-to-face.

INDIVIDUAL CONTRIBUTIONS

We declare that the authors of this article are: Laryssa Siqueira Couto da Cunha Heckert Alves da Costa (Pontifical Catholic University of Rio de Janeiro – PUC-Rio), who collaborated with the conception, design of the study and in the execution of the research, in the collection and in the data analysis, in the interpretation of the findings and in the writing of the article and approval of the final version of the manuscript; Helenice Charchat-Fichman (PUC-Rio), who collaborated with the conception and design of the study, in the analysis and interpretation of the findings and in the critical review of the content and approval of the final version of the manuscript; Conceição Santos Fernandes (PUC-Rio), who collaborated with the conception and design of the study, in the analysis and interpretation of the findings, in the critical review of the content and approval of the final version of the manuscript; Fábio Mello Barbirato Nascimento Silva (*Santa Casa da Misericórdia do Rio de Janeiro*), who collaborated with the conception and design of the study, in the critical review of the content and approval of the final version of the manuscript; Gabriela Macedo Dias (*Santa Casa da Misericórdia do Rio de Janeiro*), who collaborated with the conception and design of the study, in the critical review of the content and approval of the final version of the manuscript; and Lucas Villar Magalhães da Cruz (PUC-Rio), who collaborated with the analysis and interpretation of data, in the elaboration of the article and approval of the final version of the manuscript.

CONFLICTS OF INTEREST

We declare that there was no conflict of interest in this research.

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Annex 1. PSI-TEA in English

Developmental items		
1 – Above 3 years old, ask: How old was he when he spoke? Between 2 and 3 years old, ask: Does he speak more than 2 words, besides *mommy and daddy*?		
2 – How old was he when he started walking?		
Specific ASD symptoms items	**In short**	**Category**
3 – Does he shows interest in children? (Does he play or likes to play with them?)	Social interest	JA
4 – Does he use your hand to pick up things he wants? (If older than 6 years, ask "Did he…")	Using the other's hand	JA
5 – Does he point to objects? (If older than 6 years, ask "Did he…")	Pointing	JA
6 – Does he keep visual contact?	Visual contact	SC
7 – Does or did he get disturbed by noise?	Sensitivity to noise	SP
8 – Does he answer when called by name? Have you ever worried about his hearing?	Response to the other	SC
9 – (Do not ask this of under-3-year-olds or non-verbals.) Does he talk to you at home?(Telling about his day.)	Talking	SC
10 – Does he like something a lot? (Such as characters or cartoons and movies.)	Specific interest	SP
11 – Does he repeat dialogs or phrases he hears from TV or other people out of context?	Decontextualized speech	SP
12 – Does or did he make unusual movements with hands or fingers, or with the body? (Like circling or rocking.)	Motor stereotypies	SP
Other questions included in the interview		
How was the referral? By whom?		
Has he been diagnosed?		
Is he or was he in some sort of treatment? (neurological, phonoaudiological, psychological)		

Annex 2. New Version of PSI-TEA in English

1 – Who made the referral for the assessment?	
Between 2 and 3 years old	***Over three years old***
2 – Does he speak more than two words besides mommy and daddy?	2 – How old were you talking?
	(If the mother says that understandable speech was, for example, only four years old, ask: when did you start speaking your first words?)
A:	A:
3 – How old was he when he started walking?	
4 – Is he interested in interacting with other children? Does he like to play with them?	
( ) Yes ( ) No	
Under six years old	***Over six years old***
5 – Does he use your hand – of the adult/caregiver – to pick up things he wants? Do the children take the adults hand to the object he wants?	5 – Did he used to use your hand to pick up things he wanted? Did the children used to take the adults hand to the object he wanted?
( ) Yes ( ) No	( ) Yes ( ) No
Under six years old	***Over six years**
5.1 – Does he points to objects?	5.1 – Did he used to point to objects?
( ) Yes ( ) No	( ) Yes ( ) No
6 – Does he maintain or did he used to maintain eye contact? (Does he look you in the eye while you or someone else is talking to him?)	
NOTE: answer "sometimes" – mark yes; answers saying that at some point in life he didn't keep it – mark no	
( ) Yes ( ) No	
7 – Does the noise bother or used to bother he?	
( ) Yes ( ) No	
8 – Does he respond when someone calls him by name?	
( ) Yes ( ) No	
Have you ever worried about his hearing? ( ) Yes ( ) No	
Below 3 years/non-verbal	***Over three years***
Skip to the next question	9 – Does he talk to you at home? Does he tell you about his day, for example?
	( ) Yes ( ) No
10 – Does he excessively like the same things? For example, does he watch the same movie or cartoon episodes several times? Or is he always playing with the same toy? (Characters or cartoons/films)	
( ) Yes ( ) No	
11 – Does he repeat or used to repeat dialogues or phrases he hears on TV or from other people?	
( ) Yes ( ) No	
12 – Makes or has made different movements with the hands and fingers or with the body (for example: circling or swinging)	
( ) Yes ( ) No	
13 – Does he already have a diagnosis? Which one?	
14 – Is he under treatment now, or has he already been under treatment before? (e.g., neurologist, speech therapist, psychologist)	

Annex 3. PSI-TEA in Portuguese

1 – Como foi o encaminhamento? De quem?	
2 – Acima de 3 anos, perguntar: Falou com quantos anos?	2 – Acima de 3 anos, perguntar: Falou com quantos anos?
2.1 – Entre 2 e 3 anos, perguntar: Ele fala mais de 2 palavras além de papai e mamãe	2.1 – Entre 2 e 3 anos, perguntar: Ele fala mais de 2 palavras além de papai e mamãe
3 – Andou com quantos anos?	
4 – Interessa-se pelas crianças (Ele brinca? Gosta de brincar com elas?)	
( ) Sim ( ) Não	
5 – Ele usa sua mão para pegar coisas que ele quer? (Se for maior de 6 anos, colocar no passado)	
( ) Sim ( ) Não	
5.1 – Ele aponta para os objetos? (Se for maior de 6 anos, colocar no passado)	
( ) Sim ( ) Não	
6 – Mantém contato visual?	
( ) Sim ( ) Não	
7 – O barulho o incomoda ou incomodava?	
( ) Sim ( ) Não	
8 – Responde quando chama pelo nome? Alguma vez você já se preocupou com sua audição?	
( ) Sim ( ) Não	
9 – (Caso seja menor de 3 anos ou não verbal, não fazer esta pergunta). Ele conversa em casa com você? Conta o dia, por exemplo?	
( ) Sim ( ) Não	
10 – Ele ou ela gosta muito de uma mesma coisa? (Personagens ou desenhos/filmes)	
( ) Sim ( ) Não	
11 – Repete diálogos ou falas que ele escuta na TV ou de outras pessoas fora de um contexto?	
( ) Sim ( ) Não	
12 – Faz ou já fez movimentos diferentes com as mãos e dedos ou com o corpo (por exemplo: circular ou balançar)	
( ) Sim ( ) Não	
13 – Já tem algum diagnóstico?	
14 – Faz algum tratamento ou já fez? (Exs.: neurologista, fonoaudiólogo, psicólogo)	

Annex 4. New Version of PSI-TEA in Portuguese

1 – Quem fez o encaminhamento para a avaliação?

Entre 2 e 3 anos	***Acima de 3 anos***
2 – Ele(a) fala mais de 2 palavras além de papai e mamãe?	2 – Falou com quantos anos?
	(Se a mãe disser que a fala compreensível foi só com 4 anos, por exemplo, perguntar: quando começou a falar as primeiras palavras?)
R:	R:

3 – Andou com quantos anos?

4 – Interessa-se por interagir com as outras crianças? Brinca? Gosta de brincar com elas?

( ) Sim ( ) Não

Abaixo de 6 anos	***Acima de 6 anos***
5 – Ele usa a mão – do adulto/cuidador – para pegar coisas que ele quer? Encosta a mão do cuidador/do adulto no objeto que ele quer?	5 – Ele usava a mão – do adulto/cuidador – para pegar coisas que ele queria? Encostava a mão do cuidador/do adulto no objeto que ele queria?
( ) Sim ( ) Não	( ) Sim ( ) Não

Abaixo de 6 anos	***Acima de 6 anos**
5.1 – Ele aponta para os objetos?	5.1 – Ele apontava para os objetos?
( ) Sim ( ) Não	( ) Sim ( ) Não

6 – Mantinha ou mantém contato visual? (olha nos olhos enquanto você ou outra pessoa fala com ele?)

Obs.: resposta "às vezes" – marcar sim; respostas dizendo que em algum momento da vida não mantinha – marcar não

( ) Sim ( ) Não

7 – O barulho o incomoda ou incomodava?

( ) Sim ( ) Não

8 – Responde quando alguém o chama pelo nome?

( ) Sim ( ) Não

Alguma vez você já se preocupou com sua audição? ( ) sim ( ) não

Abaixo de 3 anos/não verbal	***Acima 3 de anos***
Pular para a próxima pergunta	9 – Ele conversa em casa com você? Conta o dia, por exemplo?
	( ) Sim ( ) Não

10 – Ele ou ela gosta muito de uma mesma coisa? Por exemplo, assiste diversas vezes ao mesmo filme ou episódio de um desenho? Ou está sempre com o mesmo brinquedo? (Personagens ou desenhos/filmes)

( ) Sim ( ) Não

11 – Repete ou repetia diálogos ou falas que ele escuta na TV ou de outras pessoas? ( ) sim ( ) não

12 – Faz ou já fez movimentos diferentes com as mãos e dedos ou com o corpo (por exemplo: circular ou balançar)

( ) Sim ( ) Não

13 – Já tem algum diagnóstico? Qual?

14 – Faz algum tratamento ou já fez? (Exs.: neurologista, fonoaudiólogo, psicólogo)