https://doi.org/10.23925/2176-2724.2024v36i4e66741

Assessment of auditory speech perception in children using electronic hearing aid devices: tests in Brazilian Portuguese

Avaliação da percepção auditiva da fala em crianças usuárias de dispositivos eletrônicos auxiliares de audição: testes no português brasileiro

Evaluación de la percepción auditiva del habla em niños que utilizan dispositivos electrónicos de asistencia auditiva: pruebas em português brasileño

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Abstract

Introduction: the evaluation of the results of the use of electronic assistive hearing devices (AHDs) is a fundamental part of evidence-based clinical practice. **Purpose:** to carry out a survey of the tests available in Brazilian Portuguese to evaluate auditory speech perception in children with hearing loss who use AHDs. **Methods:** This is an integrative literature review. The search was conducted in different databases and included studies that presented the development or translation and cultural adaptation of tests, scales and/or questionnaires in/to Brazilian Portuguese with the objective of evaluating the

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KCJ, ASC: methodology; data collection and analysis; writing of the article.
VLDF, LCV: study conception; methodology; data analysis; writing of the article; critical revision of the final version.

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Received: 05/23/2024
Accepted: 10/15/2024

auditory perception of speech of children using AHDs. **Results:** Fourteen instruments were identified. Only one clinical test and one questionnaire were developed in the Brazilian Portuguese, with the others being translated from English and adapted for the Brazilian target population. **Discussion:** Instruments with different levels of complexity were found, including 8 questionnaires that can be completed by the child's guardians by observing the auditory behavior. It is essential that each service develops an evaluation protocol considering the application time of each chosen instrument and the characteristics of the child and that the professionals who work with these children are familiar with the objectives, target age, composition/form of application and scoring of these instruments. **Conclusion:** It was possible to identify 14 instruments available in Brazilian Portuguese used to assess auditory speech perception in children with hearing loss who use AHDs.

Keywords: Child; Hearing Tests; Speech Perception; Hearing aids; Cochlear implantation.

Resumo

Introdução: a avaliação dos resultados do uso de dispositivos eletrônicos auxiliares de audição (DEEA) é parte fundamental da prática clínica baseada em evidências. **Objetivo:** realizar um levantamento dos testes disponíveis no Português Brasileiro para avaliação da percepção auditiva da fala em crianças com perda auditiva usuárias de DEAA. **Métodos:** trata-se de revisão integrativa da literatura. A busca foi realizada em diferentes bases de dados e foram incluídos estudos que apresentaram a elaboração ou tradução e adaptação cultural de testes, escalas e/ou questionários no/para o Português Brasileiro com o objetivo de avaliar a percepção auditiva da fala de crianças usuárias de DEAA. **Resultado:** 14 estudos foram incluídos nesta revisão, dos quais somente um teste clínico e um questionário foram desenvolvidos no próprio idioma, tendo sido os demais traduzidos da língua inglesa e adaptados para a população-alvo brasileira. **Discussão:** Foram encontrados instrumentos com diferentes níveis de complexidade, incluindo oito questionários que podem ser preenchidos pelos responsáveis pela criança mediante observação do comportamento auditivo. É primordial que cada serviço desenvolva um protocolo de avaliação considerando o tempo de aplicação de cada instrumento escolhido e as características da criança e que os profissionais que atuam com essas crianças estejam familiarizados com os objetivos, idade alvo, composição/forma de aplicação e pontuação desses instrumentos. **Conclusão:** Foi possível identificar 14 instrumentos disponíveis no Português Brasileiro utilizados para avaliar a percepção auditiva da fala em crianças com perda auditiva usuárias de DEAA.

Palavras-chave: Criança; Testes auditivos; Percepção da fala; Auxiliares de audição Implante coclear.

Resúmen

Introducción: Evaluar los resultados del uso de dispositivos electrónicos de asistencia auditiva (DEEA) es una parte fundamental de la práctica clínica basada en la evidencia. **Objetivo:** realizar un estudio de las pruebas disponibles en portugués brasileño para evaluar la percepción auditiva del habla en niños con pérdida auditiva que utilizan DEA. **Métodos:** se trata de una revisión integradora de la literatura. La búsqueda se realizó en diferentes bases de datos y se incluyeron estudios que presentaban la elaboración o traducción y adaptación cultural de pruebas, escalas y/o cuestionarios al portugués brasileño con el objetivo de evaluar la percepción auditiva del habla en niños utilizando DEAA. **Resultado:** Se identificaron 14 instrumentos. Sólo un ensayo clínico y un cuestionario fueron desarrollados en el propio idioma, siendo los demás traducidos del el idioma inglés y adaptado para la población objetivo brasileña. **Discusión:** Se encontraron instrumentos con diferentes niveles de complejidad, entre ellos 8 cuestionarios que pueden ser completados por los responsables del niño. Es fundamental que cada servicio desarrolle un protocolo de evaluación considerando el tiempo de aplicación de cada instrumento elegido y las características del niño y que los profesionales que trabajan con estos niños conozcan los objetivos, edad objetivo, composición/forma de aplicación y puntuación de estos instrumentos. instrumentos. **Conclusión:** Fue posible identificar 14 instrumentos disponibles en portugués brasileño utilizados para evaluar la percepción auditiva del habla en niños con pérdida auditiva que utilizan DEEA.

Palabras clave: Niño; Pruebas Auditivas; Percepción del Habla; Audífonos; Implantación Coclear.

Introduction

In view of the diagnosis of childhood hearing loss, the use of assistive hearing devices (AHDs), such as the hearing aids (HA), the Cochlear Implant (CI), and/or other implanted devices, are key components for auditory (re)habilitation[1]. When correctly adjusted, the device will enable children to maximize the use of their residual hearing or have, for the first time, auditory access to sounds[2].

If children have appropriate early intervention, their auditory language skills can be developed at a pace according to their chronological age, or close to it[2]. However, studies showed the variability of obtained results, regarding those skills in children with hearing loss that make use of AHDs[3-6]. The benefits obtained by the AHDs can be limited by social determinants in health, which hinder the access to proper treatment, medical commorbidities[7], degree of hearing loss, age of the diagnosis, and age when the speech therapy treatment began[8], among others.

The development of auditory skills occurs hierarchically, extending for several years after the adjustment of the AHDs. Thus, it is fundamental that the speech therapist knows the clinical markers of development, to identify and inform the family probable warning signs, apart from guiding the individual intervention planning[3].

Given the variability of the results presented by children with hearing loss regarding their auditory skills and individual planning, the speech therapist must conduct children's periodical assessment, not only for the adjustment of the hearing aids used, but also to follow up the pace of evolution of those skills[6].

The assessment of the results is an essential part in evidence-based clinical practice, in addition to the application of behavioral tests, speech perception tests, and assessing questionnaires with guardians are strategies used to document the benefits of the AHDs, verify the need of programming adjustment[9], and monitor the children's progress. Monitoring the development of auditory skills by means of formal tests and questionnaires before two years old is a significant predictive factor for the development of language at 3 and 5 years old[10].

For proper monitoring of children and reliable documentation of the intervention benefits, professionals must know formal protocols and be qualified for the application and interpretation of the results.

This study aims to carry out a survey of the tests available in Brazilian Portuguese to assess the auditory speech perception in children with hearing loss, users of AHDs.

Methods

Type of study

Construction steps for an integrative literature review were adopted, as follows: identification of the problem, search in literature, data assessment and presentation. When well conducted, an integrative literature review displays the status of a certain scientific area, with straightforward applicability to practice[11].

The following guiding question was adopted: What are the tests available in Brazilian Portuguese to assess the auditory speech perception in children with hearing loss, users of AHDs?"

Search strategy

The search was carried out in March 2021, and updated in May 2024 in the following databases: Scientific Electronic Library Online (SCIELO), Latin American and Caribbean Literature on Health and Science (LILACS), Virtual Health Library (Biblioteca Virtual em Saúde - BVS), CAPES Periodicals Portal (Portal de Periódicos CAPES) in Google Academics, and in databases of Higher Education institutions, which offer Postgraduation Programs in Speech-Language Therapy in Brazil[12].

The following descriptors were selected in the DeCS – Descriptors in Health Sciences (Descritores em Ciências da Saúde): "*criança", "testes auditivos", "inquéritos e questionários", "auxiliares de audição"*, *"implante coclear"* e *"percepção de fala"*. The descriptors were combined by means of three terms, resulting in six combinations: "*criança AND testes auditivos AND auxiliares de audição", "criança AND testes auditivos AND implante coclear", "criança AND questionários e inquéritos AND auxiliares de audição", "criança AND questionários e inquéritos AND implante coclear", "criança AND percepção da fala AND auxiliares de audição", "criança AND percepção da fala AND implante coclear"*.

Selection criteria

Articles, dissertations or thesis presenting the elaboration of clinical tests, scales and/or questionnaires in Brazilian Portuguese were included, or the translation, cultural adaptation and/or validation of these materials to that idiom objectifying to assess the auditory speech perception in children with hearing loss, users of AHDs. Studies, which did not answer the guiding question and duplicates, were excluded.

Selection process

Two independent reviewers (KCJ and ASC) blindly selected the studies. They were initially selected by their title, and, after the application of the selection criteria, the included studies were eligible for abstract reading and analysis. Subsequently, the studies were fully read. The articles, which were not available in full online, the authors contacted the corresponding author of the study and requested a digitalized copy. Aiming at expanding the search, the references of the selected studies were consulted, and the selection criteria were applied.

Data extraction

Two independent reviewers (KCJ and ASC) conducted the data extraction of the selected studies. To all the selected studies, after full reading, the following information was collected: name of the instrument, year of publication, target public and composition, and way of application.

Evaluation of the bias risk

The bias risk of the included studies was independently evaluated by two reviewers (LCV and VLDF), by means of the COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN)[13]. This tool was developed to assess the reliability and measurement error of result measuring instruments, which comprise all measurement procedures to reach the scoring.

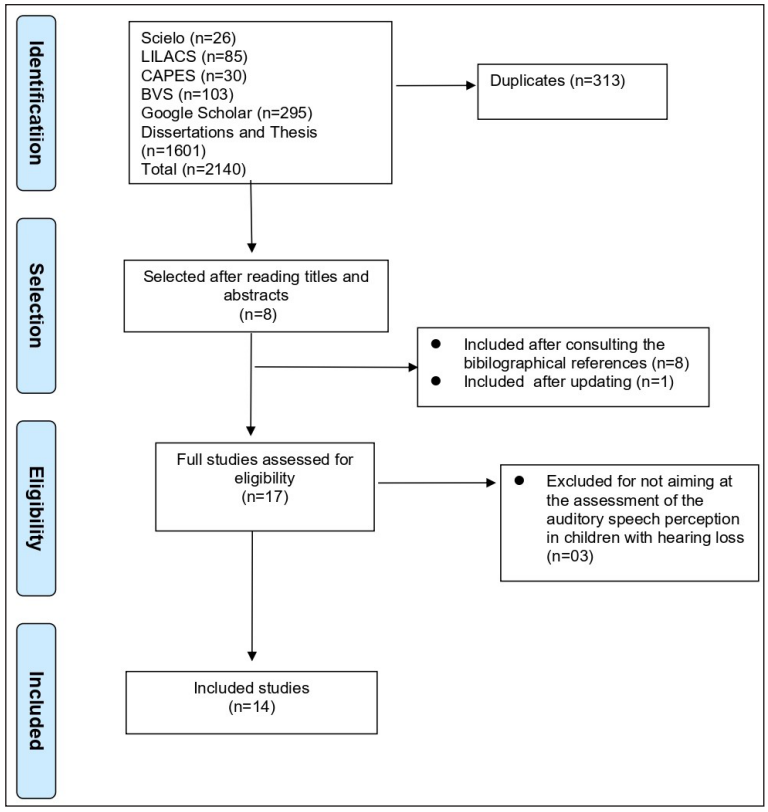
The reviewers assessed the study bias regarding its structural validity and internal consistency of the instruments, answering the following domains: (1) Was exploratory and confirmatory analysis carried out? (2) Does the selected model fit the research question? (3) Was the sample size included in the analysis adequate? (4) Was the internal consistency calculated for each scale or subscale separately? (5) Was Cronbach Alpha calculated? To the answers "yes", low risk of bias was attributed, and to each answer "no", high risk of bias was attributed. When the study was unclear about that, it was considered "unclear". The general risk of bias of each study was rated considering:

- Low risk of bias: all the domains considered as low risk of bias.
- High risk of bias: more than one domain considered as high risk of bias or multiple domains rated as undetermined.
- Unclear risk: a domain rated as undetermined, without others rated as high risk of bias.

In the end, for each study, the following symbols were attributed: low risk of bias (+), high risk of bias (X) or unclear (-).

Results

From 2,140 identified retrievals, 313 were excluded as duplicates. After that exclusion, 1,827 retrievals were kept from which 16 were selected by title and abstract for full reading, and 14 studies were included in this review.[14-27]. The summary of the process of identification, selection, eligibility and inclusion of the studies is displayed in Figure 1.



Source: the author

Figure 1. Descriptive flowchart of the search process

Therefore, 14 instruments used to assess auditory speech perception in children with hearing loss, users of AHDs were identified, available in Brazilian Portuguese, as follows: Glendonald Auditory Screening Procedure (GASP)[14], Test of Minimal Auditive Capacity (MAC) (*Teste de Avaliação da Capacidade Auditiva Mínima* - TACAM)[15], the Meaningful Auditory Integration Scale - MAIS)[16], the Infant-Toddler Meaningful Integration Scale (IT-MAIS)[17], *Lista de palavras como procedimento de avaliação da percepção dos sons da fala para crianças deficientes auditivas*[18], Parent's Evaluation of Aural/Oral Performance of Children (PEACH)[19], Auditory Behavior in Everyday Life (ABEL)[20], Early Listening Function (ELF)[21], FM Listening Evaluation for Children[22], LittlEars® Auditory Questionnaire[23], Phrases in Noise Test (PINT Brazil)[24], Functional Auditory Performance Indicators (FAPI)[25], *Escala de Desenvolvimento da Audição e Linguagem* (EDAL-1)[26], Brazilian Functional Audidory Performance Indicators – short version (FAPI-r)[27], which are briefly described in Table 1 in chronological order of the original version publication.

Table 1. Instruments available in Brazilian Portuguese to assess the auditory speech perception in children with hearing loss, users of electronic assistive hearing devices.

Instrument	Year	Target public	Composition	Application
Glendonald Auditory Screening Procedure (GASP)/ Procedure for the Assessment of Children with Profound Hearing Impairment	Developed in 1982[28]. Adapted to Brazilian Portuguese in 1996[14]	Children from 5 years of age with profound hearing loss	It comprises 6 tests: (1) Detection of speech sounds; (2) Discrimination of male and female voice; (3) Vowel discrimination; (4) Discrimination of the vowel length; (5) Recognition of words; (6) Sentence Comprehension.	The tests 1, 3, 4, 5 and 6 are applied by voice, at one meter distance between the child and the examiner, voice intensity around 70-75dB, in an illuminated room, with acoustic treatment, without the support of lip reading (LR). Only test 2 is applied by means of recorded sentences with female and male voices.
Test of Minimal Auditive Capacity (MAC) (*Teste de Avaliação da Capacidade Auditiva Mínima* - TACAM)	Developed in 1990[29] Adapted to Brazilian Portuguese in 1998[15]	Children until 05 years of age with profound bilateral neurosensory hearing loss.	Divided in two steps: (1) Pattern of perception (discrimination of the duration, discrimination between monosyllables and trisyllables, between disyllables and trisyllables, and between monosyllables and polysyllables); (2) Identification of words (identificarion of polysyllables and identification of monosyllables).	Step 1 – training with the presentation of 4 stimuli (monosylllable, disyllable, trisyllable and polysyllable) supported by the lip reading. After the child shows comprehension in this step, goes to Step 2. Step 2 – presentation of monosyllables and polysyllables without lip reading. The test must be conducted in acoustically treated room or acoustic booth; words are presented in free field, with the child at one-meter distance from the acoustic box; the examiner shows the word at the intensity of 70dB, and the child must point to the corresponding object.
Meaningful Auditory Integration Scale (MAIS)	Developed in 1991[30] Adapted to Brazilian Portuguese in 2000[16]	Children with profound hearing loss older than 4 years old.	Questionnaire with 10 questions related to three aspects of the auditory behavior (device connection, attention to the sound and ability to attribute meaning to the sounds) of the child in different daily situations. For each question, a five-point scale is used to determine the frequency of the behavior, ranging from "never" to "always".	It must be applied to parents or guardians in the form of an interview. The questions must "provoke" the dialogue between the professional and parents/guardians. The respondent must offer examples of the child's auditory behavior facing daily listening situations so that the professional may score the frequency of certain behavior.
Meaningful Auditory Integration Scale to Infant/Toddlers (IT-MAIS)	Developed in 1997[31] Adapted into Brazilian Portuguese in 1998[17]	Children with profound hearing loss younger than 4 years of age.	Consists of 10 questions, related to the spontaneous auditory behavior of the child in situations of his/her daily living by means of examples in three different areas: vocalization changes associated with the use of the device, alert to environmental sounds and attribution of meaning to the sound. For each question, a five-point scale is used to determine the behavior frequency , ranging from "never" to "always".	It must be applied to parents or guardians in the form of an interview. The questions must "provoke" the dialogue between the professional and parents/guardians. The respondent must offer examples of the child's auditory behavior facing daily listening situations so that the professional can score the frequency of a certain behavior.
Lista de palavras como procedimento de avaliação da percepção dos sons da fala para crianças deficientes auditivas.	Developed in Brazilian Portuguese in 1999[18] Updated to the recorded version in different S/R relations in 2020[3]	Hearing-impaired children aged between 05 and 10 years.	Consists of a list of 20 disyllable words, phonetically balanced, with consonant-vowel-consonant-vowel structure, recorded and acoustically treated. Recorded list in two conditions: silence (fixed intensity at 60dBNPS) and noise (signal/noise ratio of +10dB)	The test must be conducted in acoustic booth using an audiometer. The child must be sitting at one-meter distance from the acoustic box and repeat each listened word. In the noise situation, this must be presented in the same acoustic box as the speech signal, at 0º azimuth.
Parent's Evaluation of Aural/Oral Performance of Children (PEACH)	Developed in 2001[33] Adapted to Brazilian Portuguese in 2016[19]	Children until 05 years of age, users of AHDs.	Questionnaire with 12 items on the use of AHDs, auditory comfort, situations in silence, situations at a noise scenario, and attention/recognition of environmental and speech sounds. For each question, a 5-point scale is used to determine the behavior frequency, ranging from never (the child never shows certain behavior, no example is given) to always (the child presents the behavior over 75% of the time, more than 6 examples are given)	It must be applied to parents or guardians in the form of an interview. For each question, parents must think about their child's auditory behavior during the former week and estimate a percentage of time that their child displayed the described behavior.

Instrument	Year	Target public	Composition	Application
Auditory Behavior in Everyday Life (ABEL)	Developed in 2002[34] Adapted to Brazilian Portuguese in 2011[20]	Children with hearing loss aged between 04 and 14 years.	Questionnaire comprising 24 questions, divided in three factors: aural-oral aspect (auditory reception and verbal response to sounds); auditory and environmental awareness to sounds; and social, conversational skills and skills of functional independence. For each question, there are seven options of answers related to the behavior frequency, from never (0 points) to always (6 points).	It must be applied to parents and guardians in the form of an interview. For each question, the respondent must state the behavior frequency presented by the child.
Early Listening Function (ELF)	Developed in 2002[35] Adapted to Brazilian Portuguese in 2010[21]	Children with hearing loss aged 05 months to 03 years.	Comprises 12 activities of auditory detection to different listening conditions (low, middle, high intensity sounds, at different distances and situations of silence or noise).	Instrument to be applied by parents at home settings. Parents must observe and record their child's auditory behavior, assessing his/her hearing detection from different sounds in different positions.
FM Listening Evaluation for Children[20]	Developed in 2003[36] Adapted to Brazilian Portuguese in 2010[22]	Children with hearing loss, users of AHDs, with or without FM system.	Comprises five hearing situations with seven listening conditions each (different distances and situations of silence or noise)	The instrument can be filled in by parents, teachers or speech therapists. The answers are scored from 1 (hardly ever) to 5 (always) or N/A (does not apply).
LittlEars ® Auditory Questionnaire	Developed in 2003[37] Adapted to Brazilian Portuguese in 2016[23]	Babies and toddlers with auditory age until 02 years.	Questionnaire comprising 35 questions on the child's auditory behavior with alternative "yes" and "no" answers.	It must be applied to parents or guardians in the form of an interview.
Phrases in Noise Test (PINT)/ PINT Brazil	Developed between 2005[38] and 2006[39] Adapted to Brazilian Portuguese in 2017[24]	Children with hearing loss from 04 years of age, users of AHDs.	Clinical test, entailing 12 recorded sentences	Conducted in an acoustic booth, with a two-channel audiometer in free field. The child must be sitting at one-meter distance from each acoustic box. The speech signal is presented in the box located at 0º azimuth and the noise in the box located at 180º azimuth in order to simulate the classroom environment. The recorded sentences are simple commands which must be executed by the child with the help of a doll.
Functional Auditory Performance Indicators (FAPI)	Developed between 2001 and 2004[40] Adapted to Brazilian Portuguese in 2011[25]	Children with hearing loss until 05 years of age.	Comprising 61 items, organized in 33 sections, which assess seven categories of auditory skills: sound awareness and meaningful sounds; auditory feedback and integration; location of the sound source; auditory discrimination and recognition; auditory comprehension; short-term auditory memory; and linguistic auditory processing.	Each skill must be assessed by means of direct observation and/or parents' or guardians' report in the form of an interview. The respondent must report the child's auditory behavior, providing the largest possible number of examples. The indicators can be administered along the time and scored at any moment.
Escala de Desenvolvimento da Audição e Linguagem (EDAL-1)	Developed in Brazilian Portuguese in 2016[26]	Children users of cochlear implant until 02 years of auditory age	First test of the EDAL set of tests. Comprises 20 questions with "yes" or "no" answers.	Applied to parents/guardians in the form of an interview. Questions 1a, 2a, 3a, 4a and 6a are for listening children, and questions 1b, 2b, 3b, 4b, 5b and 6b are for children users of AHDs. The answer to the question can be positive (scoring 5 points) or negative (scoring 0 points), except for question 2a, which was inverted.
Brazilian Functional Auditory Performance Indidators – short version (FAPI-r)	Adapted to the short version in Brazilian Portuguese in 2021[27]	Children with hearing loss until 05 years of age.	Comprising two formularies: one to the speech therapist (25 items), and one to the family (15 items). Organized in 15 sections, divided in the same seven categories as the original FAPI.	Applied by means of direct assessment of the child by the speech therapist, and questions in the form of an interview to parents and/or guardians.

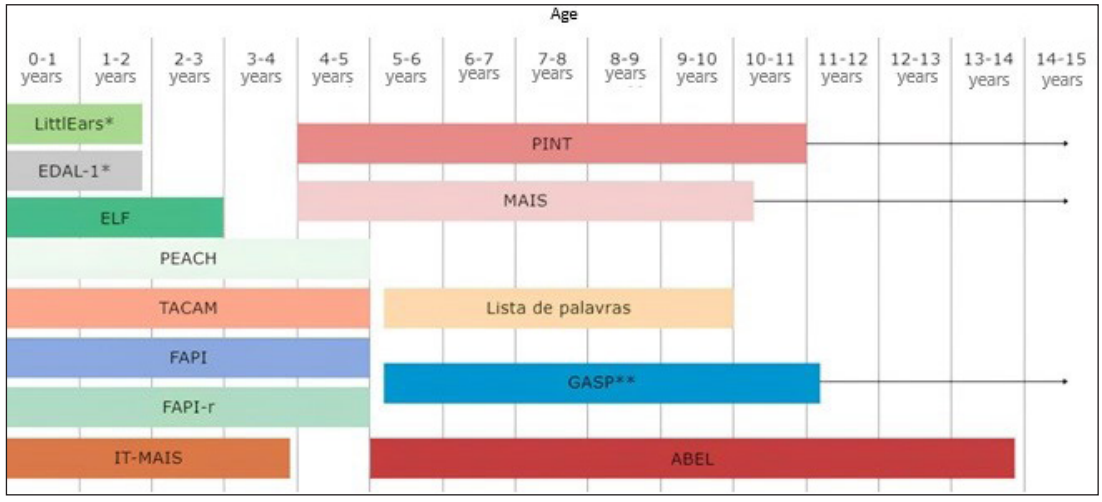
Caption: ABEL= Auditory Behavior in Everyday Life; AHDs = Assistive Hearing Devices; EDAL= Escala de Desenvolvimento da Audição e Linguagem/Hearing and Language Development Scale; ELF= Early Listening Function; FAPI Functional Auditory Performance Indicators; FM=Frequency Modulated; GASP=Glendonald Auditory Screening Procedure; IT-MAIS= Meaningful Auditory Integration Scale to Infant/Toddlers; L R= Lip Reading; MAIS= Meaningful Auditory Integration Scale; PEACH= Parent's Evaluation of Aural/Oral Performance of Children; PINT=Phrases in Noise Test; Test for the Assessment of the Minimum Auditory Capacity/ Teste de Avaliação da Capacidade Auditiva Mínima = TACAM

Figure 2 displays the instruments found by the age that they can be applied. Importantly, the FM Listening Evaluation Instrument for Children[22] is not in the figure because it does not indicate the specific age for evaluation. Instruments followed by an arrow indicate the age for applying them, but they do not refer to the maximum age of application.

Source: McGuinness, LA, Higgins, JPT. Risk-of-bias VISualization (robvis): An R package and Shiny web app for visualizing risk-of-bias assessments. Res Syn Meth. 2020; 1- 7. https://doi.org/10.1002/jrsm.1411. https://mcguinlu.shinyapps.io/robvis/

Figure 2. Assessment of the risk of bias of the included studies using the COSMIN tool.

Studies included in the current review uncovered high risk of bias, except for the study which adapted FAPI-r[27] of undetermined risk. This study was the only one that presented Cronbach Alpha statistical data, as well as the assessment of the instrumental internal consistency (Figure 3).



Source: the author.
Caption: * = consider hearing age; **designed for children aged 5 and over, but currently used for younger children (see reference 6 – Silva et al. 2019)

Figure 3. Application of instruments to assess auditory speech perception in children using Hearing Assistance Devices according to age.

Discussion

Neonatal hearing screening enables the early audiological diagnosis of hearing loss, which reduces the age for adapting HA, as well as for the CI surgery[41,42]. Thus, professionals involved in the process of (re)habilitation and family must make important choices based on the benefit for the child making use of HADs or the selected intervention since early months of life, and throughout the (re) habilitation process along their lives.

The tests used to verify the benefit of the AHDs must be adequate for the child's chronological and hearing age, as well as his/her level of development. In addition, they must be validated, enabling the follow-up of the child's evolution, comparison with his/her peers, users of AHDs, and with his/her listening peers.

In the current study, six clinical tests were used to assess hearing speech perception: GASP[14], TACAM[15], *Lista de palavras como procedimento de avaliação da percepção dos sons da fala para crianças deficientes auditivas*, as the procedure to assess the perception of speech sounds[18], PINT Brasil[24], FAPI[25] and FAPI-r[27]. For addressing early hearing skills, GASP[14], TACAM[15], and FAPI[25] can be applied with short time of hearing experience. However, FAPI presents the disadvantage of being a long test, an average application of one hour. In view of that, in a study published in 2020, the authors adapted its protocol for a reduced version (FAPI-r), facilitating its application. The proposed version considered the most representative hearing skills from the original version, and it was approved by professionals.

Despite GASP had been elaborated for hearing impaired children from the chronological age of 5 years, there is a guidance for this test to be applied to populations at younger ages, once the CI, in the present context, has enabled the development of hearing skills earlier. The application of the "Word list" test, as a procedure to assess the speech perception, involves the repetition activity, demanding from the child not only his/her skill of hearing recognition, but also his/her oral language[18]. This test enables the analysis of recognition at the phonemic level, and commonly used words in Brazilian children's everyday life. However, it should be applied with caution in cases when different listening situations are assessed (such as the use of AHDs in each ear isolatedly and in both ears), enabling children to memorize the words, as there is only one list, which may cause better performance in the last tested activity of stimulation. In a study[32] published in 2020, the authors recorded that test in silent conditions and signal/noise ratio of + 10 dB.

To assess the closed-set auditory recognition, in conditions of silence and noise in children with

hearing loss who have not acquired oral language or in the development phase of this skill, the PINT Brazil can be applied, which does not demand a verbal response. In this test, recorded lists are applied, comprising simple commands regarding the parts of the body that children must execute. Miniatures and a doll are provided. In PINT Brazil, the speech signal is presented at a fixed intensity of 60dB, and noise intensity ranges in an adaptive way[24]. The authors of this test released it free online in order to help speech therapists in the adaptation protocols and AHDs follow-up[43]. For its application, an acoustic booth, two-channel audiometer and a free-field system are necessary.

Despite presenting different levels of complexity, those tests very often may be hard to apply, considering the associated disabilities that some children may present[44]. In addition to these factors, some clinical tests are not enough for measuring the communication skill of the child in his/her everyday life[45]. Thus, the need to use instruments for better assessment of children's daily life, out of clinical settings, comes forth[46].

Family participation in diagnosis, adjustment and auditory (re)habilitation has been an essential requirement throughout the process[47]. In this perspective, some protocols aim to encourage the active participation of the family in the assessment process by means of systematic observation of the child's auditory behaviors. That is the case of the ELF, specifically created to be applied in home settings. This protocol was elaborated as a family-centered intervention model and enables parents to identify the ideal listening distance to different sounds for a child with or without the use of AHDs[21].

Regarding the questionnaires found, LittlEars® Hearing Questionnaire[23], ABEL[20], PEACH[19], MAIS[16], IT MAIS[17] and EDAL-1[26], only the *LittlEars*®[23] and the PEACH[19] Questionnaires can be filled in by the child's guardians as a formulary, not demanding an interview for their application. The application as an interview enables the guardians to have better interpretation of each question, offering a greater number of examples and quality of auditory responses for each situation. However, the time of application is longer, thus it may lead to exhaustion[48]. Therefore, the application format of these two questionnaires, when used, must consider the demand of each service.

MAIS and IT-MAIS must be informally presented to children's parents and/or legal guardians, in the interview format, which is mandatory. The speech therapist needs to use accessible language and guide the respondent before starting. In addition, a visual copy of each question for the respondent in the moment of its application is desirable. Only the spontaneous listening responses of the child must be considered. If the respondent reports exemplified situations, in which the child responds only in a structured environment, with previous notice from others, the response must be disregarded. Parents and/or guardians must provide the largest possible number of examples of the children's auditory behavior. Reports on behaviors not addressed by the questions must be taken down separately[16,17].

To Brazilian children, users of CI, results of the MAIS and IT-MAIS, in addition to the GASP clinical test can be compared with clinical markers published to that population[3,6]. Thus, speech therapists could identify if the results presented by their patients are under, within or beyond the expected according to the length of time that the device has been used.

Although parents' observation is highly relevant in the assessment process, the use of several tests for a complete evaluation is deemed necessary[44], once a single questionnaire or test cannot measure the benefits. Additionally, there may be discrepancy between parents' responses to the questionnaires and the hearing-impaired child's performance[27,49]. Thus, the assessment data during behavioral observation held by the speech therapist may provide more realistic and effective data, which should not be disregarded[49].

In the current review, high risk of bias in the studies was observed, when assessed the structural validity and internal consistency of the instruments to assess the auditory speech perception in children who make use of AHDs. Only one study[27] which aimed to validate a questionnaire, presented statistical data of reliability. Thus, the need of researchers who dedicate to the creation or validation of new instruments in the area is verified. However, they must be attentive to the methodological rigor, including the pertinent statistical analyses to attest the reliability of the instrument to the Brazilian population.

Despite the inclusion of many instruments in this study, which were validated or created many years ago, they have still been used in clinical

practice to assess hearing-impaired children, users of AHDs. Therefore, it is fundamental that each service develops an assessment protocol, considering the time of application of each selected instrument, as well as the children's characteristics regarding their chronological age, auditory age and auditory performance[50].

Tests and questionnaires are used for longitudinal measurement of children's skills, users of AHDs, and are extremely important in clinical practice. Therefore, professionals who deliver care for those children need to be familiar with the objectives, target age, composition/way of application and scoring of those instruments, so that they can use them according to the children's individual need, comparing them with themselves, with their peers with hearing loss, and with their listening peers. It is important to point out that the tests of auditory speech perception do not rule out the need of applying other instruments, which aim to assess the different aspects of development of the child with hearing loss, user of AHDs.

Conclusion

It was possible to identify 14 instruments available in Brazilian Portuguese, used to assess the auditory speech perception in children with hearing loss, users of AHDs. From those, only one clinical test and one questionnaire were developed in Brazilian Portuguese. The others were translated from the English language and adapted for the Brazilian target-population.

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