European Portuguese EARS Test Battery Adaptation

Adaptação da Bateria de Testes EARS ao Português Europeu

Marisa ALVES[1], Daniela RAMOS[1], Graça OLIVEIRA[1], Helena ALVES[1], Ilona ANDERSON[2], Isabel MAGALHÃES[1], Jorge H. MARTINS[1], Margarida SIMÕES[1], Raquel FERREIRA[1], Rita FONSECA[1], Susana ANDRADE[1], Luís SILVA[1], Carlos RIBEIRO[1], Pedro Lopes FERREIRA[3]

ABSTRACT

Introduction: The use of adequate assessment tools in health care is crucial for the management of care. The lack of specific tools in Portugal for assessing the performance of children who use cochlear implants motivated the translation and adaptation of the EARS (Evaluation of Auditory Responses to Speech) test battery into European Portuguese. This test battery is today one of the most commonly used by (re)habilitation teams of deaf children who use cochlear implants worldwide. The goal to be achieved with the validation of EARS was to provide (re)habilitation teams an instrument that enables: (i) monitoring the progress of individual (re)habilitation, (ii) managing a (re)habilitation program according to objective results, comparable between different (re)habilitation teams, (iii) obtaining data that can be compared with the results of international teams, and (iv) improving engagement and motivation of the family and other professionals from local teams.
Material and Methods: For the test battery translation and adaptation process, the adopted procedures were the following: (i) translation of the English version into European Portuguese by a professional translator, (ii) revision of the translation performed by an expert panel, including doctors, speech-language pathologists and audiologists, (iii) adaptation of the test stimuli by the team's speech-language pathologist, and (iv) further review by the expert panel.
Results: For each of the tests that belong to the EARS battery, the introduced adaptations and adjustments are presented, combining the characteristics and objectives of the original tests with the linguistic and cultural specificities of the Portuguese population.
Discussion: The difficulties that have been encountered during the translation and adaptation process and the adopted solutions are discussed. Comparisons are made with other versions of the EARS battery.
Conclusion: We defend that the translation and the adaptation process followed for the EARS test battery into European Portuguese was correctly conducted, respecting the characteristics of the original instruments and adapting the test stimuli to the linguistic and cultural reality of the Portuguese population, thus meeting the goals that have been set.
Keywords: Portugal; Cochlear Implants; Correction of Hearing Impairment; Hearing Tests; Speech Perception.

RESUMO

Introdução: A utilização de instrumentos de avaliação em saúde adequados é fundamental na gestão da prestação de cuidados. A escassez, em Portugal, de instrumentos específicos para a avaliação do desempenho de crianças utilizadoras de implantes cocleares motivou o trabalho de tradução e de adaptação da bateria de testes EARS (Evaluation of Auditory Responses to Speech) para o português europeu. Esta bateria de testes é hoje um dos instrumentos mais comummente utilizados por equipas de (re)habilitação de crianças surdas com implantes cocleares em todo o mundo. O objetivo a atingir com a validação do EARS foi fornecer às equipas de (re)habilitação um instrumento que permita: (i) monitorizar a evolução individual da reabilitação; (ii) gerir um programa de (re)habilitação de acordo com resultados objetivos, comparáveis entre diferentes equipas de (re)habilitação; (iii) obter dados comparáveis com equipas internacionais; e (iv) melhorar a adesão e a motivação da família e restantes profissionais no ambulatório.
Material e Métodos: No processo de tradução e de adaptação da bateria de testes, os procedimentos adotados foram os seguintes: (i) tradução da versão inglesa para português europeu por um tradutor profissional; (ii) revisão dessa tradução realizada por um painel de especialistas constituído por otorrinolaringologistas, terapeutas da fala e técnicos de audiologia; (iii) adaptação dos estímulos de teste pela equipa de terapeutas da fala; e (iv) nova revisão por parte do painel de especialistas.
Resultados: São apresentados, para cada um dos instrumentos que compõem a bateria EARS, as adaptações introduzidas, conciliando as características e os objetivos originais dos instrumentos com as particularidades linguísticas e culturais da população portuguesa.
Discussão: São discutidas as dificuldades encontradas durante o processo de tradução e de adaptação e as soluções adotadas. São feitas comparações com outras versões da bateria EARS.
Conclusão: Considera-se que o processo de tradução e adaptação da bateria de testes EARS para o português europeu foi realizado de forma apropriada, respeitando as características dos instrumentos originais e adequando os estímulos de teste à realidade linguística e cultural da população portuguesa, cumprindo assim os objetivos propostos.
Palavras-chave: Portugal; Implantes Cocleares; Correcção de Deficiência Auditiva; Testes Auditivos; Percepção da Fala.

1. Serviço de Otorrinolaringologia. Centro Hospitalar e Universitário de Coimbra. Coimbra. Portugal.
2. MED-EL. Innsbruck. Áustria.
3. Centro de Estudos e Investigação em Saúde. Faculdade de Economia. Universidade de Coimbra. Coimbra. Portugal.

INTRODUCTION

The use of adequate assessment instruments in health-care is crucial for clinical and economic management. In Portugal, specific assessment tools for hearing-impaired children are scarce. Major worldwide assessment instruments are presented in Table 1, based on language and functional auditory performance of children provided with cochlear implants.[1]

Several cochlear implantation programs use batteries of tests for that purpose. The option for a battery of tests rather than for a single test is explained by the complexity involved in children´s developmental assessment. This is the case of the Nottingham Early Assessment Package (NEAP) and the Navarra Evaluation Protocol, the most widely used instruments. NEAP[2-3] is a battery of tests allowing for assessment and monitoring of language and communication skills development, included in Nottingham paediatric cochlear implantation programme, consisting of the instruments presented in Table 2. In addition, the ENT Department at the *Clinica Universitaria de Navarra* cochlear implantation programme developed a hearing and language assessment protocol[4] which consists of the instruments presented in Table 3.

In Portugal, the assessment of hearing and language evolution in hearing-impaired children is usually carried out using tests validated for normal-hearing children, some of which have not been validated for the Portuguese language and culture. The ENT Department of the *Centro Hospitalar e Universitário de Coimbra* cochlear implantation programme[10] uses a battery of assessment tests including several instruments, the most important of which are presented in Table 4.

Considering that the available instruments are scarce and poorly specific in order to assess the performance of Portuguese hearing-impaired children, we carried out a modification and national validation of the EARS (Evaluation of Auditory Responses to Speech) battery of tests.

EARS was designed in 1995 by Dianne J. Allum-Mecklenburg in association with audiologists, ENT specialists, psychologists and speech and language therapists, reflecting the effort involved in collecting, adapting, combining and designing several assessment tools. It is currently one of the most used in this area. Since it was presented, EARS was adapted to more than 20 languages, allowing for the comparison of performance between children from different languages and cultures.[11] This instrument tool is currently aimed to: (i) assess the development of hearing perception in children with severe to profound hearing loss, provided with cochlear implants; (ii) provide support in rehabilitation and (iii) be used as a long-term assessment tool for children provided with a cochlear implant. Its target population includes children with severe to profound hearing loss between 3 and 10 years of age.[11]

Since EARS appearance, this instrument has been used in several studies on the evolution of performance in children provided with cochlear implants, from the pre-operative stage until several years after cochlear implantation, some in children attending cochlear implantation centres and even in those from different countries and using different cochlear devices.[11-18] This tool has been also used for monitoring progress and beneficial effects in children with related impairments.[19] The referred studies enhance the importance of monitoring the development of hearing perception in children provided with cochlear implants, as well as its role in the prognosis of language and speech development. Adaptation processes of assessment tools to different languages and cultures are complex and thus the different adaptations of EARS tools were carried out very carefully, in order to allow for the international comparison of the results.[20-21]

Therefore, considering the insufficiency and lack of specificity of assessment tools used in Portugal in order to evaluate the development of children provided with a cochlear implant, the work of translation and adaptation of EARS tool into European Portuguese has been regarded as crucial. This tool was selected for two major reasons: the quality of the instruments and, due to the small number of Portuguese children provided with a cochlear implant, international comparison is a necessity, solely made possible through the use of a widely adapted instrument.

Taking into account that the use of foreign assessment tools in the absence of adequate language and cultural adaptation to the patients that we intend to evaluate, might jeopardise the validity and precision of the evaluation,[22] a careful translation and adaptation into European Portuguese and Portuguese culture was considered crucial. This process raised specific constraints, due to the need to keep the original concept of the tests while at the same time fitting them into Portuguese linguistic and cultural reality.

The two main objectives of this study were: (i) the translation and adaptation of EARS tool to European Portuguese, described in the present study; (ii) the assessment of the adequacy of selected verbal and visual stimuli for the Portuguese population, through a pilot study with normal-hearing children aged between 2 and 4 years and 11 months, to be performed in a future study. We considered as adequate to culturally validate this tool in normal-hearing children with a lower chronological age for which it has been designed as far as hearing age is concerned. In normal-hearing children, hearing age is the same as chronological age; in hearing-impaired children it corresponds to the time period between the first programming of the speech processor of the implant or the first adaptation of the hearing prosthesis. Therefore, hearing age in hearing-impaired children is lower than chronological age.

The translation and adaptation process of EARS tool for European Portuguese was the result of an agreement between MED-EL Elektromedizinische Geräte GmbH, the *Centro Hospitalar de Coimbra, EPE* and the *Centro de Estudos e Investigação em Coimbra* at the University of Coimbra and was carried out in 2010 and 2011.

Table 1 – Major assessment instruments used worldwide for impaired-hearing children

Assessment Instruments	Area of Measurement
Meaningful Auditory Integration Scale (MAIS)[30]	Hearing ability and its use in natural environments
Infant-Toddler Meaningful Auditory Integration Scale (IT-MAIS)[33]	Hearing ability and its use in natural environments
Visual Habituation (VH)[34]	Speech patterns perception
Test of Auditory Perception of Speech for Children (TAPS)	Hearing perception
Glendonald Auditory Screening Procedure (GASP)[28]	Ability to recognize familiar or everyday questions
Categories of Auditory Performance (CAP)[35]	Assesses hearing performance from the response to environmental sounds to the performance using the telephone
Auditory Speech Sound Evaluation (A§E)[36]	Discrimination of phoneme irrespective of lexical items
Mr. Potato Head Task[37]	Recognition of keywords and sentences
Reynell Developmental Language Scales[38]	Language development
MacArthur-Bates Communicative Development Inventories (CDI)[39]	Inventory of the first words used
Rossetti Infant-Toddler Language Scales[40]	Linguistic ability
Preferential Looking Paradigm (PLP)[41]	Learning of speech sounds and objects associations
Maternal Speech	Parent communicative style
Meaningful Use of Speech Scale (MUSS)[31]	Vocal control, use of speech and communicative strategies
Babbling onset	Presence of multiple speech articulatory movements
Babbling spurt	Moment in which babbling frequency significantly increases
Tait Video Analysis (TVA)[42]	Pre-verbal and linguistic Development
Common Phrases Test[43]	Everyday sentences comprehension
Lexical Neighborhood Test (LNT)[44]	Open-set of word recognition

Table 2 – Instruments in Nottingham Early Assessment Package

Assessment instruments	Area of measurement
Tait Video Analysis (TVA)[42]	Pre-verbal and linguistic development
Pragmatics Profile of Everyday Communication Skills: Preschool version (PPECS)[45]	Social, interaction and conversational ability
Stories/Narrative Assessment Procedure (SNAP)[46]	Narrative ability
Profile of Actual Linguistic Skills (PALS)[47]	Ability to use verbal oral language
Preschool Language Scale (PLS)[48]	Language development regarding understanding and expression
Listening Progress Profile (LiP)[23]	Monitoring of auditory development changes in hearing-impaired children
Categories of Auditory Performance (CAP)[35]	Hearing performance to perceive environmental sounds up to using the telephone
Meaningful Auditory Integration Scale (MAIS)[49]	Hearing ability and its use in natural environment
Profile of Actual Speech Skills (PASS)[50]	Spontaneous vocalizations and speech patterns
Speech Intelligibility Rating (SIR)[51]	Progress of speech intelligibility rating

Table 3 – Instruments used in the cochlear Implantation Program at the ENT Department of the *Clinica Universitaria de Navarra*

Assessment instruments	Area of measurement
Vowel identification test	Vowel identification; consonant-vowel-consonant or single vowel type stimuli
Consonant identification test	Identification of the 13 more common consonant phonemes in Spanish
Closed-set series of everyday words	Everyday word sets presented to the child in written lists or graphically represented
Early speech perception test	Closed-set test with increasingly difficult skills aimed to categorize speech perception
Disyllable test	Open-set test using disyllable words
Monosyllable test	Open-set test using monosyllable words
Sentence open-set test (aided)	Sentences to be repeated by the child aided by images related with listened sentences
Sentence open-set test (unaided)	Sentences to be repeated by the child, unaided
Lip-reading test	Sentence repetition with access to lip-reading; evaluation is obtained with and without prosthesis aid
Categories of Auditory Performance[35]	Hearing performance to perceive environmental sounds up to using the telephone
Voice analysis	Assessment of intensity, pitch, melody and rhythm, duration, intonation and pneumophonic coordination
Induced phonological register	Picture-naming children performance
Oral language test of Navarra	Phonology, morphosyntax, semantics and language use assessment
Peabody picture vocabulary test	Assessment of children vocabulary with simple words, identifying one of four possible pictures
Illinois psycholinguistic abilities test	Assessment of audiovisual comprehension, audiovisual association, verbal-motor expression, audio-visuo-grammatical integration and hearing sequential and visuo-motor memory
Gael-P	Language assessment regarding comprehension and expression

MATERIAL AND METHODS
EARS assessment tool

The EARS battery of tests consists of the following:
- *LiP* – Listening Progress Profile[23]

LiP test assesses hearing perception of several sounds, including speech, as well as hearing ability development in children provided with cochlear implants. The following skills and/or behaviours are observed with this test: reaction to environmental sounds, environmental sound identification; response to elicited drum; (elicited) response to other musical instruments; (elicited and spontaneous) response to human voice; discrimination between loud and quiet, single and repeated drum sound; reaction to /a, i, u, m, s, ʃ/ sounds; discrimination between loud/quiet verbal sounds, single and repeated verbal sounds, long and short verbal sounds, three of Ling's six sounds; discrimination between two family names with differing syllable numbers; identification of patient's own name in silence. Score for each item is 0, 1 or 2, with 0 meaning 'never/does not know', 1 meaning 'sometimes' and 2 meaning 'always'.

- *MTP* – Monosyllabic-Trochee-Polysyllabic [24]

MTP test assesses ability in recognizing speech syllabic patterns. There are three different word-sets, with 3, 6

Table 4 – Instruments used in the Post-Cochlear Implantation Assessment Protocol of the *Unidade de Implantes Cocleares* at the ENT Department of the *Centro Hospitalar e Universitário de Coimbra*

Instrumentos de Avaliação	Area of measurement
Monosyllable test	Open-set test using monosyllable words
Numbers test	Open-set test using numbers
Sentence repetition test unaided	Open-set test consisting in sentences to be repeated without any kind of support
Sentence repetition test unaided at the telephone	Similar but applied using the telephone
25-word test	Open-set test using everyday words, to be repeated
25-word test using the telephone	Similar, but applied using the telephone
100-word test	Open-set test using everyday words, to be repeated
100-word test using the telephone	Similar, but applied using the telephone
Complex structures comprehension test[52]	Complex syntax structures
Test of Abstract Language Comprehension (TALC)[53]	Semantics, morphosyntax and pragmatics
Grelha de Avaliação da Linguagem – Nível Escolar (GOL-E)[54]	Semantics, morphosyntax and phonology
Teste de articulação Verbal[55]	Production of consonant phoneme in Portuguese
Speech Intelligibility Rating[51]	Speech intelligibility progression range
Grelha de avaliação das características vocais (GACV)	Intensity, pitch, nasal resonance, intonation and pneumo-phono-articulatory coordination
Categories of Auditory Performance[35]	Auditory performance to perceive environmental sounds up to using the telephone
Ling sounds	Ling sounds identification
Meaningful Auditory Integration Scale (MAIS)[49]	Hearing ability and its use in natural environments
Consonant identification test	Identification of consonant phoneme in Portuguese
Inventário de Desenvolvimento da Comunicação de MacArthur (CDI)[39]	Inventory of first used words
Meaningful Use of Speech Scale (MUSS)[31]	Vocal control, speech use and communicative strategies
Interval recognition test	Auditory processing – temporal processing
Duration pattern test	Auditory processing – temporal processing
Frequency pattern test	Auditory processing – temporal processing
Filtered speech test	Auditory processing – monoaural low redundancy test
Speech-in-noise test	Auditory processing – monoaural low redundancy test
Dichotic listening test – Disyllable overlapping and alternate	Auditory processing – dichotic test

and 12 words. It is aimed to determine the child´s ability to recognize different speech syllable patterns varying between one, two and more than two syllable. The child is asked to indicate or to repeat the words, with the support of images or objects previously presented by the evaluator. This test is applied without the support of lip-reading (only with hearing stimulation). Each word is pronounced once and the child is asked to answer. Answers are scored regarding the syllabic pattern correctly identified, as well as the word correctly identified.

- Monosyllable Closed- Set Test[25]

This test assesses ability in recognizing familiar monosyllable words. There are two word-sets of 4 and 12 words. The child is asked to indicate or to repeat the words, with the support of images or objects previously shown by the evaluator. This test is applied without the support of lip-reading (only with hearing stimulation). Each word is pronounced once and the child is asked to answer; each correct answer scores one point.

- Closed-Set Sentence Test[26]

This test is aimed to show ability in recognizing familiar co-articulated words. It consists of matrices with images: level A has four 2 x 3 matrices (the child must select from two items); level B1 has two 3 x 3 matrices (the child must select from three items); level B2 has two 3 x 4 matrices (the child must select from three items) and level C has two 4 x 4 matrices (the child must select from four items). The matrix is shown to the child by the evaluator who asks for an indication of the words heard or for sentence repetition. This test is applied without the support of lip-reading (only with hearing stimulation). Each sentence is said once and the child is asked to answer; each correct word is scored with (+) and each incorrect word is scored with (-). The final score for each matrix is the total number of correct words.

- Monosyllable Open-Set Test[27]

This test assesses the ability in recognizing monosyllabic words. There are two word-sets of ten words and it is applied without the support of lip-reading (only with hearing stimulation). Each word is pronounced once and the child is asked to answer. Answers are scored regarding the correct phoneme and the correct word.

- GASP – Glendonald Auditory Screening Procedure[28]

This test assesses the ability in recognizing simple questions. There are 10 questions and it must be applied without the support of lip-reading (only with hearing stimulation). Each sentence is said once and the child is asked to answer. Each correct answer is scored 1 point and each incorrect answer is scored 0.

- COT – Common Objects Token Test[29]

This test assesses ability in understanding sentences following instructions. The following materials are used: 4 model cars, 4 helicopters, 4 planes and 4 boats in red, blue,

green, yellow, 1 train and 4 circles, each in red, blue, green and yellow. After making sure that the child recognizes all objects and colours, he is asked to listen to each instruction and to complete the task. Scoring regards the entire sentence; each answer scores 1 point and each incorrect answer scores 0.

- MAIS – Meaningful Auditory Integration Scale[30]

This test was designed to assess the child´s spontaneous reactions to sound in everyday situations. There are ten questions and the information for each sentence is obtained through indirect questions that the evaluator will adapt to personality, relationship and cultural characteristics. Each question score ranges from 0 (the lowest) to 4 (the highest) points. Final score refers to the total number of points up to a maximum of 40.

- MUSS – Meaningful Use of Speech Scale[31]

This test was designed to assess the use of language in everyday situations. There are 10 questions and the information regarding each question is collected in an open interview. Scoring for each question ranges from 0 (the lowest) to 4 (the highest) points. Final score refers to the total number of points out of 40.

Procedures

The translation and adaptation of the battery of tests adopted the following procedures: (i) translation of the English version into European Portuguese done by a professional translator; (ii) review of this translation performed by ENT specialists, speech therapists and audiologists; (iii) adaptation of the stimuli used in the tests, performed by the speech therapy team, keeping the original concept of each test, as well as cultural and language characteristics of the population; and (iv) final review performed by the entire professional team.

As a validated assessment tool in several languages, we studied the Spanish version of the same battery of tests during the translation and adaptation process of EARS battery of tests into European Portuguese, considering cultural and linguistic proximities between Portugal and Spain.

One of major constraints during this process was due to the fact that during the translation into European Portuguese, many of the stimuli used on some of the tests (words, sounds, onomatopeas) changed the original concept of the test, because the translated term had few application in Portuguese (and therefore the result of the test would be influenced by the ignorance of its meaning) or due to the change in the syllable number in those tests where this is a crucial aspect of the assessment. Therefore, we needed to select new stimuli for several tests in order to keep the original concept of the instrument while at the same time maintaining Portuguese linguistic and cultural characteristics.

On some of the tests, part of the stimuli need to be

represented by objects or miniatures. This fact meant another constraint, as these objects or miniatures were not available, forcing us to review the initial selection. In other situations, only slight adjustments were needed, such as the order of presentation of the images in the closed-set sentence test (Tyler-Holstad), in order to keep the sentence´s syntactic structure in European Portuguese.

Regarding MAIS and MUSS tests, an adaptation into European Portuguese made by Ferreira e Silva had already been developed.[21] Therefore, this adaptation was adopted, with the necessary changes, namely with the introduction of a teacher-oriented version.

RESULTS

The translation, involving approximately 300 thousand characters, was carried out by a professional translator, further reviewed, in order to ensure the accuracy of clinical terms. In addition, it proved necessary to make some changes in order to keep the original concept of the instruments and mainly the linguistic and cultural issues of Portuguese population. A description of the adaptations made in each of the instruments included in EARS test battery is set below.

- LiP – Listening Progress Profile

The *hop, hop hop hop* (English version) was changed in the discrimination between one single speech sound and repeated speech sounds by *ão, ão ão ão*, as it was considered that the kangaroo presented in the images used in the English version was not a strong reference in Portuguese culture, the dog being considered more adequate.

The sounds *maaa, maaaaaaaa* (represented by images of sheep in the English version) were changed in the discrimination between long and short speech sounds by *muu, muuuuuuuu* (represented by images of cows), as the sound used for sheep in European Portuguese does not correspond to the sound of the same animal in English.

Two charts (LiP-12 A and LiP-12 B) have been introduced in the discrimination between three and six Ling's sounds, allowing for the discrimination between the Ling´s six sounds. There is a card in the English version allowing for the discrimination between the Ling´s five sounds (with images representing the sounds /a, i, u, s, ʃ/); in the Portuguese version, the card allows for the discrimination between the Ling´s six sounds (with images representing the sounds /a, i, u, m, s, ʃ/). The discrimination between two family names with differing syllable number and the identification of child's own name were maintained in the Portuguese version.

- MTP – Monosyllabic-Trochee-Polysyllabic

The English three-word test version includes the words *fish* (monosyllable), *baby* (disyllable) and *elephant* (polysyllable). The straight translation of the test stimuli would change the original concept of the test and therefore other words have been selected. Considering that in this three-word version stimuli may be presented using objects,

it was necessary to select words that might be represented in that way, while ensuring that they were part of the vocabulary usually used by young children. We selected the words *pá* - "shovel" (monosyllable), *bebé* – "baby" (disyllable) and *cavalo* –"horse" (polysyllable), keeping only one of the words used in the English version.

The English six-word test version includes, beyond the three words of the previous test, the words *cow* (monosyllable), *monkey* (disyllable) and *banana* (polysyllable). It is not necessary for this test that stimuli may be presented using objects, but only through images. Beyond the words *pá*, *bebé* and *cavalo*, that were selected for the three-word version, the words *três* –"three" (monosyllable), *carro* –"car" (disyllable) and *sapato* – "shoe" (polysyllable) were selected.

The English twelve-word test version includes, beyond the six words used for the previous test, the words *ball* and *tree* (monosyllable), *pencil* and *flower* (disyllables), *butterfly* and *telephone* (polysyllable). Beyond the words *pá*, *três*, *bebé*, *carro*, *cavalo* and *sapato*, selected for the six-word version, the words *céu* –"sky" and *mar* –"sea" (monosyllable), *bola* –"ball" and *lápis* –"pencil" (disyllable) and *girafa* –"giraffe" and *banana* –"banana" (polysyllable) were selected.

- Monosyllable Closed-Set Test

The English four-word test version includes the words *spoon*, *ball*, *tree* and *cow*. A straight translation of the stimuli used for this test would change the original concept of the test; therefore, we selected other monosyllabic words included in children's vocabulary adapted to the age group that we are studying and that would be represented using objects. With this consideration in mind, we selected the words *flor* –"flower", *cão* –"dog", *pau* –"stick" and *rei* –"king".

The English twelve-word version includes, beyond the four words previously referred, the words *horse*, *book*, *shoe*, *doll*, *sun*, *cat*, *rock* and *ship*. For this test, beyond the words *flor*, *cão*, *pau* and *rei*, selected for the four-word version, the words *mão* –"hand", *sol* - "sun", *luz* – "light", *pé* –"foot", *mãe* –"mother", *pai* –"father", *ler* –"to read" and *dói* "it hurts" were selected.

- Closed-Set Sentence Test (Tyler-Holstad)

In the Portuguese version – level B1 matrix (matrix 5), the word *counts* (English version) was changed by the word *leva* "carries".

In the Portuguese version – level B2 matrix (matrix 7), the word *cowboy* (English version) was changed by the word *cantora* –"singer" and the word *carries* (English version) by the word *conta* –"counts" (Portuguese version).

In the level C matrix (matrix 10), the word *cowboy* (English version) was changed by the word *cantora* –"singer" (Portuguese version).

Each change in the used words was associated to a change of the corresponding image. Adjustments in the order of presentation of images were needed in all matrices, in order to adapt to the syntactic structure of sentences in

European Portuguese.

• Monosyllable Open-Set Test

The English version of the first list of monosyllable words open-set test includes the words *boat*, *house*, *bean*, *nut*, *man*, *lip*, *ring*, *leg*, *match* and *soap*. A straight translation of these stimuli would also change the original concept of the test and therefore we selected other monosyllable words included in the common vocabulary of young Portuguese children; we selected the words *pão –"bread"*, *ver –"look"*, *sal –"salt"*, *dor –"pain"*, *mil –"thousand"*, *bom –"good"*, *sim –"yes"*, *deu "gave"*, *sai –"get out"* and *eu –"me"*.

The English version of the second list of monosyllable words open-set test includes the words *goat*, *mouse*, *seal*, *bus*, *boot*, *ship*, *song*, *lake*, *watch* and *nose*. The Portuguese version included the words *mel –"honey"*, *não –"no"*, *tu –"you"*, *som –"sound"*, *cor – "colour"*, *Rui*, *fim – "end"*, *noz –"nut"*, *pôr –"to put on"* and *chão –"floor"*, according to the objectives of the test.

• GASP – Glendonald Auditory Screening Procedure

In this test, we translated the questions and no additional changes were required.

• COT – Common Objects Token Test

In this test, we translated the tasks and no additional changes were needed.

• MAIS – Meaningful Auditory Integration Scale

An adaptation into European Portuguese has already been established.[32] Therefore, we adopted this adaptation and questions 1c and 2b, used in a teacher-oriented version and not included in the original adapted version, were introduced.

• MUSS – Meaningful Use of a Speech Scale

Again, an adaptation for European Portuguese had already been established.[32] Therefore this adaptation was adopted in the present study. Nevertheless, the introduction of a teacher-oriented version was also necessary.

DISCUSSION

The translation, cultural and linguistic adaptation of health assessment tools are challenging.

As previously described, this is an assessment tool already validated for several languages; during the translation and adaptation process of EARS battery of tests into European Portuguese, the Spanish version was taken into account, justified by the cultural and linguistic proximities between both countries.

The authors of the Spanish version opted for using disyllable words in monosyllable words closed-set tests and monosyllable open-set tests. In fact, monosyllable words are more common in English language and are usually included in young children's vocabulary, being more easily represented by objects or images than in Portuguese

or Spanish languages. Nevertheless and despite the difficulties in the word selection of monosyllables for the Portuguese version, the maintenance of these two tests with monosyllable words has been considered as crucial, meeting one of the objectives of this study, regarding the original concept of the instruments. This issue may give the Portuguese version a higher complexity when comparing both with the English version, due to a more common use of monosyllable words in young children's vocabulary and with the Spanish version, due to the replacement by disyllable words, which nevertheless may be compensated by reinforcing the practice of those specific words.

The difficulties regarding word frequency discrepancies and sound acoustic characteristics between Portuguese and English languages were corrected by the validation team, based on the experience and in the practical application of alternative options obtained through regular work with children provided with cochlear implants.

In order to consider this study as complete, it was crucial to carry out a pilot study with normal-hearing children aged between 2 and 4 years and 11 months. The cultural validation of this battery of tests has been considered essential for normal-hearing children with lower chronological age than the age for which it has been developed, considering the above-mentioned concept of hearing age. This pilot study has been already carried out and will be described in a future study.

CONCLUSION

The process of translation and adaptation of EARS battery of tests into European Portuguese has been considered as appropriate, despite its complexity, keeping the original concept of the instruments and adapting the test stimuli to the Portuguese linguistic and cultural reality.

This work instrument has been made available for the rehabilitation teams of hearing-impaired children provided with cochlear implants, allowing for the assessment of children, the monitoring of procedures, the presentation of comparable data with foreign teams' results and to provide objective data. In addition, it allows for a systematic follow-up for parents, as well as for policy-makers, enhancing the capacity to undertake adequate management decisions regarding healthcare programs.

Through a pilot study in normal-hearing children, adequacy assessment of selected verbal and visual stimuli y for Portuguese children which will be described in a future study.

CONFLICTS OF INTEREST

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Marisa ALVES, Daniela RAMOS, Graça OLIVEIRA, Helena ALVES, Ilona ANDERSON, Isabel MAGALHÃES, Jorge H. MARTINS, Margarida SIMÕES, Raquel FERREIRA, Rita FONSECA, Susana ANDRADE, Luís SILVA, Carlos RIBEIRO, Pedro Lopes FERREIRA

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