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Original Article

# Chilean Spanish transcultural adaptation of CAP-II and SIR scales in an online format for parents of children with hearing aids or cochlear implants

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## ABSTRACT

Spoken language acquisition is challenging for very young deaf or hard-of-hearing children (DHH) who wear hearing aids or cochlear implants (CI). Timely decision-making for treatment is essential for these children and requires suitable assessments. Two such assessments are the Categories of Auditory Performance Index II (CAP-II) and the Speech Intelligibility Rating Scale (SIR). These have been shown to be helpful for the ongoing evaluation of developing speech perception and spoken language skills in various languages, but they are not available in Chilean Spanish. This study aimed to create a Chilean Spanish translation of the CAP-II and SIR appropriate for online self-administration by parents-caregivers in Chile to assist professionals in monitoring DHH children's progress, considering the COVID-19 restrictions. The methods used in the process started with translating a self-report proposal from the original English versions of the CAP-II and SIR scales. Finally, the Chilean Spanish versions were tested in 107 Chilean parents-caregivers of DHH children with CIs. The results suggest these instruments are suitable for use in a Chilean context.

## Keywords:

Deafness; Children;  
Cochlear Implant;  
Evaluation

## Adaptación transcultural al español chileno de las escalas CAP-II y SIR en formato online para padres de niños(as) con audífonos o implantes cocleares

## RESUMEN

La adquisición de lengua oral representa un desafío para niñas/os sordas/os o con pérdida auditiva (NSPA) que utilizan audífonos o implante coclear (CI). Tomar decisiones a tiempo durante el tratamiento con dispositivos es esencial y requiere de evaluaciones adecuadas. Dos instrumentos usados en la toma de decisiones son las escalas "Categories of Auditory Performance Index II" (CAP-II) y "Speech Intelligibility Rating Scale" (SIR). Estas escalas han mostrado ser útiles para la evaluación continua del desarrollo de habilidades auditivas y de la lengua oral en variados idiomas, pero estas no están disponibles para el español chileno. El objetivo de este estudio es crear traducciones en español chileno de las escalas CAP-II y SIR, las que puedan ser usadas como auto-reporte online por padres y cuidadores con el fin de asistir a profesionales en el monitoreo del progreso de niños/as NSPA, considerando las restricciones impuestas por el COVID-19. El método usado en el proceso comienza con la traducción de una propuesta de auto-reporte de las versiones originales en inglés de las escalas CAP-II y SIR. Finalmente, las versiones en español chileno fueron testeadas en 107 padres-cuidadores de niñas/os NSPA con CI. Los resultados sugieren que estos instrumentos serían adecuados para su uso en el contexto chileno.

## Palabras clave:

Sordera; Niños; Implante  
Coclear; Evaluación

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INTRODUCTION

Approximately 6.2% of the general population in the Americas Region are deaf or hard-of-hearing (DHH) (World Health Organization [WHO], 2021). The World Health Organization [WHO] (2017) estimates that there are 16 million DHH children in the region. Language acquisition is often challenging for these children who can use sign language, spoken language and/or mixed modalities to communicate (Humphries et al., 2016; Knoors & Marschark, 2018; Lieven & Tomasello, 2008) Lieven & Tomasello, 2020). Early diagnosis and amplification with hearing aids or cochlear implants (CI) are paramount for spoken language development (Peterson et al., 2010). Many DHH children in Chile receive hearing aids and CIs, which, when implanted at an early age, improve auditory stimulation and can lead to better spoken language outcomes (Contrera et al., 2014; Niparko et al., 2010).

However, there are considerable differences in the developmental trajectories of spoken language between DHH and typically-developing hearing children (Lederberg et al., 2013). While typically-developing hearing children show consistent milestones in spoken language development during their first years, DHH children, even when using amplification systems, will face challenges in language development and show varying outcomes (Yoshinaga-Itano et al., 2018). Thus, after amplification is provided - either switching on the CI or receiving hearing aids - it is crucial to continuously evaluate outcomes in order to make timely decisions about ongoing treatment (O'Neill et al., 2004). Auditory skills, such as sound awareness and speech sound discrimination, and spoken language development have been proposed as the most important milestones to be tracked during the early years (Albalawi et al., 2019).

There are many instruments for assessing language outcomes in DHH children, but they are not always available in Spanish, and very few are available in the Chilean Spanish dialect. In general, the cultural and social particularities for varieties of Spanish spoken in different regions influence language comprehension and/or production, making their common use difficult (Dumitrescu, 2005) and necessitating a Chilean-Spanish version of such instruments. The instruments adapted in this paper were initially formulated to be completed by clinicians and parents-caregivers of DHH children with CI (Allen et al., 1998), but their use has been extended to hearing aid users as well (e.g. Herman et al., 2019).

Various evaluation methods can be used to measure specific outcomes in DHH children using CI (Lund, 2020). Questionnaires

or rating scales about speech perception, language or communication are frequently used and are valuable instruments for monitoring auditory skills in CI children (Huttunen et al., 2009). These tools, which parents or therapists can complete, are more convenient in the assessment of a child's progress than structured behavioural tests (O'Neill et al., 2004). In this context, the Categories of Auditory Performance Index (CAP-II) and The Speech Intelligibility Rating Scale (SIR) represent two practical instruments for parents, caregivers and therapists (Albalawi et al., 2019) which can be used in monitoring CI children (Nunes et al., 2005). The scales are available in their original version in English (Allen et al., 1998; Nikolopoulos et al., 2005). Both instruments are also available in Mandarin (Wang et al., 2020), Arabic (Al-shawi et al., 2020) and Tamil (Arumugam et al., 2021), but not in Spanish or Chilean Spanish.

The CAP- rating scale evaluates auditory skills such as sound awareness, voice recognition and spoken language understanding in CI children during everyday situations. The original instrument created by Archbold et al. (1998) comprised eight categories from "No awareness of environmental sounds" to "Use of telephone with a known listener". In 2005, two new categories were added to the CAP-II Scale by Nikolopoulos et al. (2005), following their research findings with children who had a longer duration of CI use (See Table 1). These new categories are numbers 8 and 9 on the scale.

**Table 1.** Categories of Auditory Performance Index (CAP-II) (Nikolopoulos et al., 2005).

Categories of Auditory Performance Index (CAP-II)	
1.	No awareness of environmental sounds
2.	Awareness of environmental sounds
3.	Response to speech sounds
4.	Recognition of environmental sounds
5.	Discrimination of at least two speech sounds
6.	Understanding of common phrases without lip-reading
7.	Understanding of conversation without lip-reading with a familiar talker
8.	Use of a telephone with a familiar talker
9.	Understanding/Following group conversations.
10.	Use the telephone with an unknown speaker in an unpredictable context.

The original CAP-II scale in English is considered valid for measuring progress in auditory skills (Beadle et al., 2005). Performance on the rating scale is related to the duration of device use by children with CI, with improved ratings after more years of use (Gilmour, 2010). It can be completed by various professionals, including clinicians, therapists, and teachers. Additionally, the scale can be completed by parents or caregivers (Nikolopoulos et al., 2005).

The SIR scale, created by Allen et al. (1998), rates everyday spoken language production. This scale includes 5 categories, starting from unintelligible in category 1 to fully intelligible in category 5. Table 2 shows each category in the SIR scale. Higher ratings have been associated with chronological age and the length of device use in children (Gilmour, 2010). Despite these instruments being recommended for use with children up to 5 years of age, current evidence suggests that SIR and CAP-II can be used in long-term evaluations up to ten years of age (Beadle et al., 2005).

**Table 2.** Speech Intelligibility Rating Scale (SIR) (Allen et al., 1998).

<b>Speech Intelligibility Rating Scale (SIR)</b>	
1.	Connected speech is unintelligible. Pre-recognisable words in spoken language, the child's primary mode of everyday communication may be manual.
2.	Connected speech is unintelligible; intelligible speech is developing in single words when context and lip-reading cues are available
3.	Connected speech is intelligible to a listener who concentrates and lip-reads within a known context.
4.	Connected speech is intelligible to a listener who has little experience of a deaf person's speech.
5.	Connected speech is intelligible to all listeners. The child is understood easily in everyday contexts.

The English versions of the SIR and the CAP-II are standard assessments used in audiology clinics. Hence, this study aimed to create a Chilean Spanish adaptation of the CAP-II and SIR. Furthermore, considering the COVID-19 restrictions in 2020 and 2021, this version was adapted for online self-administration by parents-caregivers in Chile in order to assist professionals in monitoring DHH children's progress. To accomplish this, a transcultural adaptation was conducted. This ensured semantic, linguistic, and cultural equivalence with items on the English scales. Additional information was provided to allow for parental

completion. This article will report the transcultural adaptation process of the self-administration versions from the Chilean Spanish Version of the Categories of Auditory Performance Index II (CAP-II) and a Chilean Spanish Version of the Speech Intelligibility Rating Scale (SIR).

## MATERIALS AND METHODS

This study is part of a national audit to characterise DHH adults and children with CI sponsored by the Public Health Ministry in Chile through the national Public Tender 757-89-1120. Two Research Ethics Committees approved the research project: The Faculty of Medicine, University of Chile and University College London (UCL) in the UK. Each participating family provided informed consent before being included in the study.

Considering the restrictions imposed by the COVID-19 pandemic for face-to-face outpatient evaluation, extra information was added to facilitate online versions of each scale. Tele-practice and tele-rehabilitation procedures have become more valid due to necessity during the COVID-19 pandemic (Claridge & Kroll, 2021). Moreover, outcome assessments via telephone or online platforms are a well-established and valid format for use with parents-caregivers (Contrera et al., 2014; Spencer, 2004). In this study, we used the Opinion platform provided by UCL. This online tool has the capability to add a heading before each question. Thus, we presented each sentence of the scales as a heading, and the extra information or the examples were added to assist parents in self-administration. For this reason, the Chilean Spanish versions have some repeated sentences in certain sections of the scales (see Sentences in Supplements 1 and 2).

In order to develop an online self-administered version of CAPII and SIR in Chilean Spanish, the researchers completed a two-step process: 1) Online and parent-report versions of CAPII and SIR were created in English, including extra information in each scale to help administration for non-expert respondents such as parents-caregivers; and 2) a transcultural adaptation process of each scale into Chilean Spanish (Beaton et al., 2000).

### Online parent-report version

Although the original instruments (i.e. CAPII and SIR) could be used by professionals working with deaf children without any additional guidelines, additional examples and extra information was provided for both scales in order to facilitate self-administration by non-expert respondents such as parents-caregivers of DHH children. While this extra information was

provided to reduce possible misunderstandings, it is important to note that this might limit the possible uses of the new version compared to the original instruments. Thus, the researchers worked with an expert “English Language Committee” (ELC: Composed of 4 members: two researchers in language and cognition, one researcher in audiology and one researcher and speech and language therapist.) at UCL and an expert “Chilean Spanish Language Committee” (CSLC: Composed of two speech and language therapists, one linguist, and one audiologist) in Chile, to create instruments with extra information suitable for non-expert respondents.

Considering the risk of bias in parent-report versions of scales (Furnham & Henderson, 1982), we acknowledge these versions need to be further assessed to ensure that they are suitable to be used as monitoring and evaluation tools. We completed these proposed online parent-report versions considering the professional experience from those who commonly use these scales with parents-caregivers in the UK. Figure 1 shows the systematic process for including additional examples and extra information to facilitate parent-reporting.

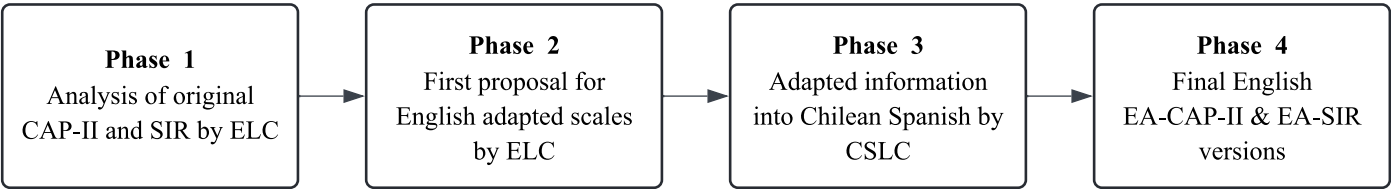


Fig 1. Adaptation of the online and parent-report versions of the CAP-II and SIR scales in English.

In phase 1, SIR and CAP-II scales were analysed by an expert ELC. The committee clarified the wording on each of the categories in both CAP-II and SIR, and then in phase 2, questions and examples were added to each category for the first proposals for both scales. The additional information was common questions and examples used with parents-caregivers when they complete both scales. For instance, Does your child react to sounds in the house or outside? For example, the doorbell, the dump truck, or the sound from the TV?. Later in phase 3, the CSLC reviewed each added information and example. They considered the knowledge and common examples used in the Chilean context by parents-caregivers. For instance, a compulsory

assessment tool used in Chilean DHH children with CI is the Ling Test (Test de ling) (Ministerio de Salud de Chile [MINSAL], 2019). The tool uses an adapted version of speech sounds in Spanish. Thus, the CSLC suggested one sentence as follows: Does your child show a response to speech sounds such as /a/, /m/, /s/, /sh/ /e/ /o/ in the speech and language therapy (SLT) session or with you at home?. In Stage 4, after consensus between the ELC, the CSLC and the researchers was reached, English-adapted versions of the CAP-II (EA-CAP-II), and the SIR (EA-SIR) were completed. They are presented in Table 3 and Table 4, respectively.

Table 3. English Adapted Version EA-CAP-II.

English Adapted Categories of Auditory Performance Index (EA-CAP-II)
<b>0 = No awareness of environmental sounds</b>
<b>1 = Awareness of environmental sounds</b> (Does your child react to sounds in the house or outside? For example, the doorbell, the dump truck, the sound from the TV?)
<b>2 = Response to speech sounds</b> (Does your child show a response to speech sounds such as /a/, /m/, /s/, /sh/ /e/ /o/ in the SLT session or with you at home?)
<b>3 = Recognition of environmental sounds</b> (Can your child identify some sounds from the house, pointing for example; the Doorbell, the door closing, the telephone ringing, animals such as a dog or cat?)

**4 = Discrimination of at least two speech sounds**

(Can your child discriminate between two sounds (such as hearing the sound 'woof woof' and pointing to/looking at the dog vs hearing the sound 'quack quack' and pointing to the duck, or his/her name vs some other word? sound?)

**5 = Understanding of common phrases without lip-reading**

(Can your child follow a short instruction using only their hearing? For example, sit here, where is papa? collect your toys).

**6 = Understanding of conversation without lip-reading with a familiar talker**

(Can your child maintain a conversation with some familiar people without the use of lip-reading? For example, with some uncle or aunt, or his/her teacher?).

**7 = Use of a telephone with a familiar talker.**

Can your child use the telephone with a familiar speaker?

**8 = Understanding/Following group conversations.**

Can you understand/follow group conversations? For example, in school? Or family meetings?

**9 = Use the telephone with an unknown speaker in an unpredictable context.**

Can the child use the telephone with an unfamiliar person or on an unfamiliar topic/context?

**Table 4.** SIR Adapted English Version.

**Adapted Speech Intelligibility Rating Scale (EA- SIR)**

1. Connected speech is unintelligible. Pre-recognisable words in spoken language, the child's primary mode of everyday communication may be manual.  
(Your child is communicating using gestures/pointing and some vocalisations).
2. Connected speech is unintelligible; intelligible speech is developing in single words when context and lip-reading cues are available  
(Your child is using any words that you recognise).
3. Connected speech is intelligible to a listener who concentrates and lip-reads within a known context.  
(You can understand your child's spoken phrases/sentences when you are focused, you know the background about, and you can lip-read).
4. Connected speech is intelligible to a listener who has little experience of a deaf person's speech.  
(Others who do not know your child can understand what she/he says).
5. Connected speech is intelligible to all listeners. The child is understood easily in everyday contexts.  
(Your child's speech is understood easily in everyday contexts).

**Transcultural adaptation of EA-CAP-II and EA-SIR**

Our transcultural adaptation process followed the guidelines suggested by Beaton et al. (2000). This methodology has been used in the adaptation of self-administered health scales from English into Spanish (Yuste et al., 2013). We aimed to adapt these instruments into Chilean Spanish, but the validation of the newly adapted instruments was not within the scope of this initial study. According to published studies, psychometric and other validations are separated from the transcultural adaptation process

(Ortega-Avila et al., 2020; Prosen et al., 2021). Thus, our methodology considers specific stages in the transcultural adaptation process and these are detailed in Figure 2. Additionally, at the end of the 6th stage, our study included an extra evaluation of the scales with a large sample of parents of DHH children with CI (N=107). This 7th Stage was called the "Testing Final Version Stage". The aim was to evaluate the parent-reporting process in a large group of parents/caregivers, whilst providing remote support throughout.



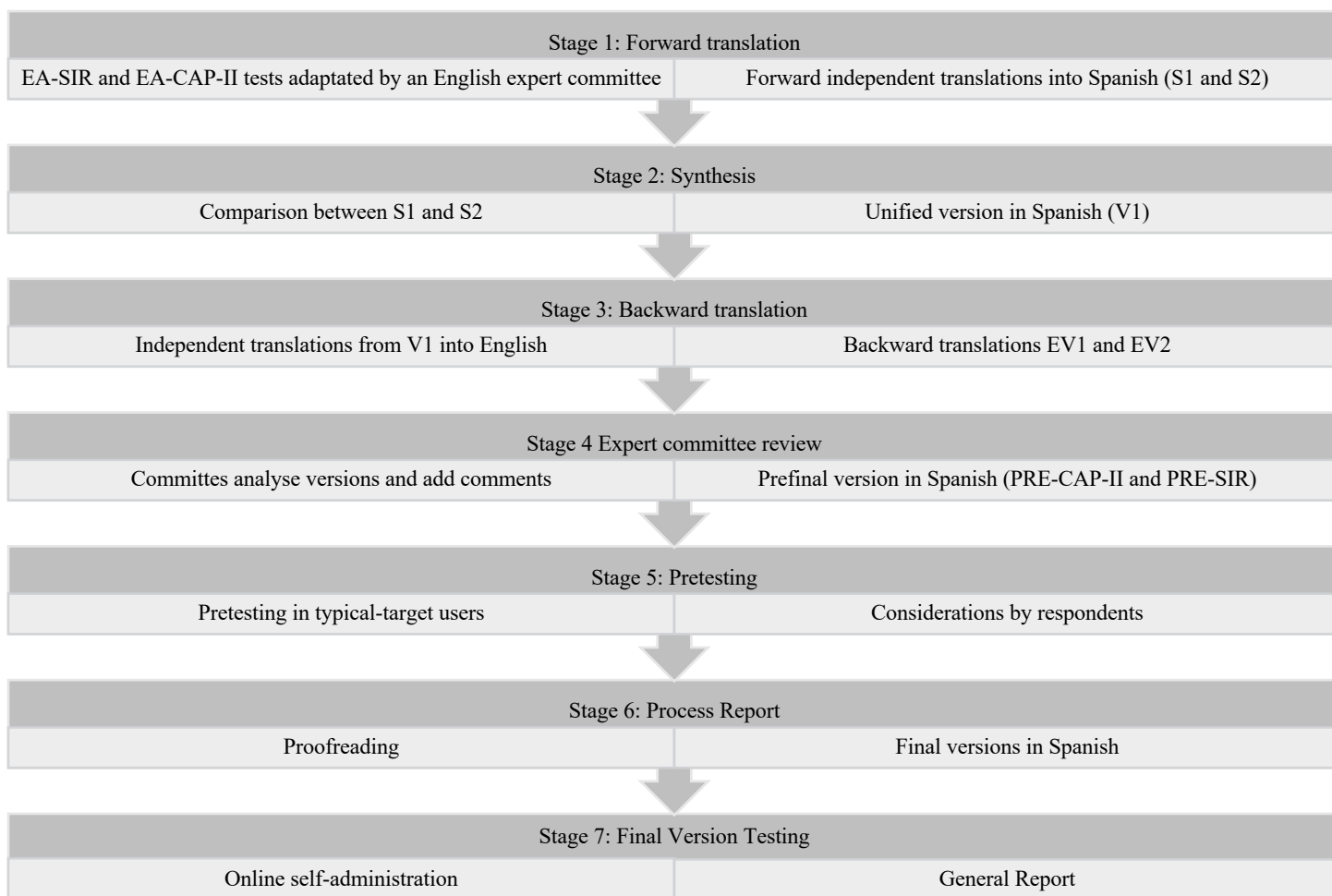


Fig 2. Transcultural adaptation process used in CAP-II and SIR (Adapted from Yuste et al. (2013).

### Stage 1

After the EA-CAP-II and EA-SIR were completed, Stage 1 of the transcultural adaption was undertaken. Two bilingual translators (native Chilean Spanish speakers) completed two forward translations of the EA-CAP-II and the EA-SIR scales. These were named S1 (EA-CAP-II S1 and EA-SIR S1) and S2 (EA-CAP-II S2 and EA-SIR S2) versions.

### Stage 2

In Stage 2, the translators and researchers agreed on a consensus between version S1 and S2 of each scale. Both versions in Chilean Spanish from each scale were evaluated considering translation discrepancies concerning semantic and concept particularities. The synthesised Chilean Spanish versions of each scale were then named V1 (V1-CAP-II and V1-SIR).

### Stage 3

In Stage 3, a backward translation of both scales was undertaken to check the quality of the Chilean Spanish original translation made in Stage 2. This procedure was made by two bilingual Chilean Spanish-English speakers who were blinded to the purpose of the study. Thus, two backwards-translated versions EV1 and EV2 of each scale in English were obtained.

### Stage 4

In Stage 4, versions EV1 and EV2 were compared with the original EA-CAP-II and EA-SIR scales by the original ELC to ensure semantic and conceptual equivalence between each EV1-EV2 version and the original adapted versions EA-CAP-II and EA-SIR. In this way, two scales were obtained (PRE-CAP-II and PRE-SIR) and used in a pretesting stage with parents of DHH children with CI in Chile.



### **Stage 5: Pretesting with Chilean Parents-Caregivers**

Pretesting with Chilean Parents-Caregivers: As a result of the COVID-19 restrictions during 2020-21, the pretesting and testing stages were carried out in an online format. An online survey platform (<https://opinio.ucl.ac.uk/>) was used. This platform enabled the participant to be provided with the study information sheet in order to obtain informed consent and the researcher could track participants through the stages of the study. The researcher started the call by explaining the project aims and the survey content. Thereafter, a personalised link through both WhatsApp mobile application and an email were sent to parents-caregivers who had agreed to participate.

At the pretesting stage, a pilot test was completed with parents-caregivers. The inclusion criteria were parents-caregivers of Chilean Spanish DHH children with CIs aged between 2 and 12 years. The parents-caregivers were randomly selected from a pool of possible participants from the database of the Speech Pathology and Audiology Department at the University of Chile. Five participants took part in the pilot study and completed the PRE-CAP-II and PRE-SIR versions. In order to achieve this task, instructions were added at the beginning of each Scale. In the PRE-CAP-II, the sentence was; "Please answer with YES or NO if your child can do the following actions at home with their CI". In the PRE-SIR, the question was; "Please select which one of the following options best represents the current intelligibility of your child with CI".

After completing the PRE-CAP-II and PRE-SIR, the participants were asked a Yes/No question as to whether each sentence from each scale was easily understood. Participants were invited to comment on any confusing sentences or words. All the suggestions were gathered in a single document, which was sent to the CSLC to complete the final version.

### **Stage 6: Process Report**

The suggestions made at all previous stages were considered by the CSLC and the final versions of the scales were confirmed. Although the ELC were not all bilingual speakers, the final versions were sent to them for any final comments or suggestions for improvement. At the end of this process, a "Final Report" was compiled to register all details about the process. Finally, the CAP-II and SIR in Chilean Spanish were ready for use in the testing stage.

### **Stage 7: Testing Stage**

One hundred and seven parents-caregivers of DHH children with CIs recruited from 7 public hospitals across Chile consented to participate in the survey. Participants were parents or caregivers of DHH children between three and 16 years who had been using a uni- or bilateral CIs for at least one year; and whose CI management was within the Public Health System in Chile. The final versions of the Chilean Spanish CAP-II and SIR were completed by participating parents-caregivers using the same procedure as in Stage 5 Pretesting. When filling in the survey, they were advised they could request support via telephone, WhatsApp, or video call for sign language speakers.

## **RESULTS**

### **Stage 1 and Stage 2: Forward Translation and Synthesis**

After the first translations into Chilean Spanish (S1 and S2) were completed, the researchers found a few differences between them. In both CAP-II and SIR, it was necessary to add gender terms for referring to CI children in Chilean Spanish and find equivalent synonyms for these words: "Sound/Sonido" and "Noise/Ruido". Specifically, in the case of S1 and S2 from CAP-II, the adapted version in English had examples not appropriate for the Chilean Spanish context. For example, words and onomatopoeias in English such as "dog" with "woof-woof!" or "duck" with "quack-quack!" are not common in the Chilean Spanish language. For this reason, the examples were changed to reflect the different written onomatopoeias and speech sounds used in Chilean Spanish. The researchers replaced common English sounds with appropriate Spanish sounds (Giraud et al., 2019). Finally, the Chilean Spanish versions of the EA-CAP-II and EA-SIR were completed: V1-CAP-II and V1-SIR.

### **Stages 3 and 4: Backward translation and Expert ELC review**

Backward translations (EV1-CAP-II, EV1-SIR, EV2-CAP-II and EV2-SIR) from V1 in Spanish were compared with the original English versions of EA-CAP-II and EA-SIR. For CAP-II, there was only one relevant difference: The clarifying examples given in categories 2 and 3 of the scale regarding the examples of speech and environmental sounds differed from the version in English. Therefore, examples in the Chilean Spanish version used embodiments of the Ling speech sounds, e.g., /s/ for a snake, /a/ for car, and /u/ for a ghost. However, this change did not modify the meaning of the category. In the SIR, the grammar of the sentences was modified, and some words were changed for

synonyms (for example, “manual” instead of “signed”). In these cases, the differences did not affect the content and aim of the SIR.

### Stage 5 and 6: Pretesting in a pilot test and evaluation report

The PRE-CAP-II and PRE-SIR were evaluated in five parents-caregivers, four women and one man, age range of 24–45 years. Their DHH children with CIs ranged in age from 3 to 14 years, and their age at implantation ranged from 18 months to 12 years.

For the PRE-CAP-II, all participants completed each sentence of the scale with YES or NO. Two participants appeared to misunderstand the ranking of the questions and responded with YES to a ‘more difficult’ category, having responded with NO to prior, ‘easier’ categories. Participants were asked about their decisions, and in both cases, it was clear that they had misunderstood the meaning of those two questions. To resolve this issue, the CSLC decided to enhance the “conversational” aspect of the questions in categories 7 and 8 by including an emphasis on ‘comprehension’ rather than on ‘only participating in a chat’. This was accomplished by using words such as “seguir” (to follow) and “entender” (to understand).

In the evaluation of how easy it was to understand each sentence in the scale, the majority of participants answered “YES”, with some exceptions:

- Two participants declared “NOT” in the category 4; “Puede el niño discriminar entre dos sonidos distintos? (Can the child discriminate between two different sounds?). They described the word “discriminar” (to discriminate) as being difficult to understand. To resolve this, the SCLC decided to change the word “discriminar” (to discriminate) for “diferenciar” (to differentiate) and add an extra action to give a better example of the child’s skills expected in the stage – “Por ejemplo; diferenciar el sonido del perro “guau guau” e indicarlo/mirarlo y el sonido del pato “cuác cuác” e indicarlo/mirarlo, o distinguir su nombre?” (such as hearing the sound ‘woof woof’ and pointing to/looking at the dog vs hearing the sound ‘quack quack’ and pointing to the duck, or his/her name?).
- One participant declared “NOT” in the Category 8; “Puede el niño/a seguir conversaciones grupales?”. They described the word “seguir”(to follow) as not clear about hearing, speaking or participating in the conversation. The CSLC decided to put the additional word “entender” (to understand) in order to clarify this.

Regarding to PRE-SIR pretesting results, all participants completed the task by choosing one option from the available options. There were no questions or comments from respondents

about completing the PRE-SIR. In the evaluation of how easy it was to understand each sentence, the participants answered “YES” in many cases. In one exception, three participants asked if they needed to complete all the elements in the sentence; “Usted puede comprender el habla del niño/a al concentrarse, entendiendo el contexto o usando lectura labio facial” (“You can understand your child’s spoken phrases/sentences when you are focused, you know the background, and you can lip-read”). The CSLC assessed this sentence and simplified it as follows; “Usted puede comprender el habla del niño/a al concentrarse, adivinando lo dicho o con lectura labio facial” (“You can understand your child’s spoken language when you are focused in the child’s speech by guessing or lip-reading”).

As the penultimate step before the final testing stage, the final versions of the instruments were sent with the evaluation report to the ELC. In this last stage, no further changes were suggested, and both instruments were adapted to be used in an online format. The final versions are available in Supplement 1: Categories of Auditory Performance Index CAP-II Chilean Spanish Version, and Supplement 2: Speech Intelligibility Rating Scale SIR Chilean Spanish Version.

### Testing the final version of the scales

The Chilean Spanish CAP-II and SIR versions were completed by 107 parents-caregivers of CI children. Children with CIs ranged in age between 2.8 to 15.1 years (mean age 7.2 years; SD = 2.9 years). Twelve participants required assistance in using the Opinio Platform, and help was provided by the researchers. Assistance was provided via telephone and WhatsApp, giving specific directions for use of the online platform and answering any questions. Assistance was not requested concerning the content of each question or sentence. There were no questions during or after the survey about any section of either the Chilean Spanish CAP-II or SIR versions.

Considering each scale’s final ranking, researchers evaluated answers provided by participating parents-caregivers. Chilean Spanish SIR answers were ranked directly from the instrument’s unique response given by parents-caregivers. Regarding the version of the Chilean Spanish CAP-II, there was an anomaly in the data concerning participants who appeared to misunderstand the ranking of the questions and responded with YES to a ‘more difficult’ category, having responded with NO to prior, ‘easier’ categories. This occurred in 30 cases (28%). Specifically, in three of those aforementioned cases, respondents were inconsistently selecting “YES” to very basic and very hard stages of the scale but selecting NO to some of the categories in between. In all these

cases, the researchers decided to apply the accepted rule for scoring the CAP-II, that is, to allow the highest ranking given by parents as the final outcome.

## DISCUSSION

It is essential to monitor the expected outcomes for auditory skills and spoken language development following cochlear implantation for DHH children. Rating scales such as the CAP-II and SIR are helpful tools for ongoing evaluation. The purpose of this study was to complete a transcultural adaptation process resulting in a Chilean Spanish self-report version of the CAP-II and SIR, which could be administered online by parents-caregivers of DHH children. The reason for online administration was in consideration of the COVID-19 restrictions.

The systematic process followed during the transcultural adaptation has been described in detail. It is necessary to acknowledge the differences in procedures between the current adaptation and the guidelines proposed by Beaton et al. (2000). The differences include an additional step of adding extra information (the examples) to each sentence of the scales to facilitate parents completing the surveys via an online platform. The transcultural adaptation required the existence of two language committees, an English and a Spanish committee. In addition, testing the final versions of the newly adapted instruments in a large sample of participants was accomplished. This served as an additional step in evaluating the support given to the parents during the survey process. Apart from including additional information, Beaton et al. (2000) guidelines for transcultural adaptation were followed. However, having added the extra information means that it is not possible to determine whether the new versions have exactly the same properties as the original scales, and this is a limitation of the study, necessitating future research to prove the scales' validity.

Adapting the scales into a format suitable for administration by parents by including both questions and examples, allows them to be directly involved in monitoring their child's auditory skill development. The simple administration by parents-caregivers in an online short format required no support during Stage 7 of the survey. This work provides evidence that the versions of the CAP-II and SIR in Chilean Spanish have the potential as useful parent-administered instruments without requiring direct supervision by professionals, thus saving time and expense for both professionals and families. These considerations are essential given the burgeoning role of tele-rehabilitation and are especially pertinent considering the necessary changes to delivering rehabilitation

services following the COVID-19 pandemic (Claridge & Kroll, 2021).

The transcultural adaptation process was completed successfully. Some minor changes to the content of a few questions and examples (e.g., sounds, onomatopoeias and words) were necessary for the Chilean Spanish version. However, according to the CSLC and the researchers, none of the changes modified the content and aim of each scale. In this way, we achieved semantic, idiomatic, experiential and conceptual equivalence as proposed by the recommended method (Beaton et al., 2000). Additionally, the apparent ease of use of these new instruments by parents-caregivers might enable further use of the scales as possible tools during monitoring DHH children who use hearing aids or CI (Hyde, 2000).

With respect to scoring the scales, the rule given by the researchers for the outcome of the CAP-II Chilean Spanish version – i.e., choosing the highest category given in the answers – seems helpful in a practical context. However, it is necessary to address inconsistencies where they arise in parents-caregivers' responses. For example, if a response of category 1 is given as representative of a child's abilities, but then category 9 is also given, this inconsistency should be addressed by interview or discussion with the parent in case there had been a misunderstanding. This challenge could be expected in instruments completed by parents-caregivers who may not have enough experience with DHH children. Support from professionals for respondents during the completion of the CAP-II could help reduce inconsistencies.

The CAP-II Chilean Spanish version results showed that participants used the full range of categories without requiring help to complete the scale. Similarly, the SIR Chilean Spanish results indicate that it might be a potential instrument for monitoring speech intelligibility. However, although the transcultural adaptation was fully completed, it is necessary to conduct further reliability studies on these versions.

## CONCLUSION

The Chilean Spanish parent-report versions of the CAP-II and SIR scales proved to be accessible for parents/caregivers to complete online, and the language used in the scales was appropriate. Therefore, these simple instruments could be suitable for evaluating DHH children's auditory skills and spoken language abilities during their treatment following the initial fitting of either hearing aids or CIs. It is acknowledged that further validation

research is needed and that such research should follow recognized validation steps for non-psychometric instruments.

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## APPENDIX

### Appendix 1. Acronyms used in the manuscript

**ELC:** English Language Committee.

**CSLC:** Chilean Spanish Language Committee

**CAP-II:** Original versions in English of the Categories of Auditory Performance Index

**SIR:** Original versions in English of the Speech Intelligibility Rating Scale.

**EA-CAP-II:** English Adapted version by the English Language Committee in Stage 1.

**EA-SIR:** English Adapted versions by the English Language Committee in Stage 1.

**S1-CAP-II:** Version 1 of the EA-CAP-II translated from English into Chilean Spanish in Stage 1.

**S1-SIR:** Version 1 of the EA-SIR translated from English into Chilean Spanish in Stage 1.

**S2-CAP-II:** Version 2 of the EA-CAP-II translated from English into Chilean Spanish.

**S2-SIR:** Version 2 of the EA-SIR translated from English into Chilean Spanish.

**V1-CAP-II:** Unified version in Chilean Spanish from the S1-CAP-II and S2-CAP-II in Stage 2.

**V1-SIR:** Unified versions in Chilean Spanish from the S1-SIR and S2 -SIR in Stage 2.

**EV1-CAP-II:** First backward translation of V1-CAP-II for comparison with the original CAP-II in Stage 3.

**EV1-SIR:** first backward translation of V1-SIR for comparison with the original SIR in Stage 3.

**EV2-CAP-II:** second backward translation of V1-CAP-II for comparison with the original CAP-II in Stage 3.

**EV2-SIR:** second backward translation of V1-SIR for comparison with the original SIR in Stage 3.

**PRE-CAP-II:** Combined Chilean Spanish version of CAP-II for pretesting in Stage 4.

**PRE-SIR:** Combined Chilean Spanish version of CAP-II for pretesting in Stage 4.

**CAP-II Chilean Spanish version:** Finalised version in Chilean Spanish for Final Testing in Stage 7.

**SIR Chilean Spanish version:** Finalised version in Chilean Spanish for Final Testing in Stage 7.

## Appendix 2. Categories of Auditory Performance Index CAP-II Chilean Spanish Version.

### Categorías de desempeño auditivo II (CAP-II) (Versión de Auto-reporte)

*Por favor responda sí o no a las siguientes preguntas en relación con el niño/a y su audífono/implante coclear*

**0 = No hay percepción de sonidos ambientales**

**1 = Percepción de sonidos ambientales**

*(¿El niño/a usando su audífono/implante coclear reacciona a sonidos dentro o fuera de la casa? Por ejemplo; El timbre, el camión de la basura, el sonido del teléfono o de la televisión)*

**2 = Respuesta a sonidos de habla**

*(El niño/a usando su audífono/implante coclear reacciona a sonidos de habla? Por ejemplo “aaa” de auto, “uuu” de fantasma, “sss” de serpiente)*

**3 = Reconocimiento de sonidos ambientales**

*(El niño/a usando su audífono/implante coclear puede identificar algunos sonidos de la casa, indicándolos o sabiendo de donde provienen? Por ejemplo; el timbre, la puerta al cerrarse, el sonido del teléfono, animales como perros-gatos, o sonidos del patio)*

**4 = Discriminación de al menos dos sonidos de habla**

*(El niño/a usando su audífono/implante coclear puede diferenciar entre dos sonidos? Por ejemplo; diferenciar el sonido del perro “guau guau” e indicarlo/mirarlo y el sonido del pato “cuác cuác” e indicarlo/mirarlo, o distinguir su nombre?)*

**5 = Comprender frases comunes sin lectura labio facial**

*(El niño/a usando su audífono/implante coclear logra seguir una instrucción breve usando solo su audición? Por ejemplo; Siéntate, ¿Dónde está el papá?, guarda tus juguetes).*

**6 = Comprender una conversación sin lectura labio facial con un hablante familiar/conocido**

*(El niño/a usando su audífono/implante coclear puede seguir/entender una conversación con personas conocidas sin usar lectura labial? Por ejemplo; con un tío/tía, o su profesor/profesora?, el fonoaudiólogo/a).*

**7 = Usar el teléfono con un hablante familiar/conocido.**

*(El niño/a usando su audífono/implante coclear puede seguir una conversación por teléfono con una persona conocida?)*

**8 = Comprender/seguir conversaciones grupales.**

*(El niño/a usando su audífono/implante coclear puede comprender/seguir conversaciones grupales? Por ejemplo; En el colegio, en reuniones familiares).*

**9 = Usar el teléfono con un hablante desconocido en un contexto impredecible.**

*(El niño/a puede hablar por teléfono con una persona desconocida o sobre un tema desconocido?)*



### Appendix 3. Speech Intelligibility Rating Scale SIR Chilean Spanish Version.

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#### Escala Inteligibilidad del Habla (SIR) (Versión de Auto-reporte)

*Por favor seleccione cuál de estas opciones representa mejor la comunicación actual del niño/a:*

1. ***El habla conectada es ininteligible. Palabras no identificables en lengua oral. El lenguaje diario del niño/a puede ser manual (gestual).***  
*(El niño/a se comunica principalmente mediante gestos/ lengua de señas, vocalizaciones/balbuceos o señalando/apuntando lo que quiere)*
  2. ***El habla conectada es ininteligible; el habla es inteligible en palabras cuando hay un contexto y pistas de lectura labio facial disponibles.***  
*(Solamente las personas que conocen al niño/a pueden entender algunas palabras que dice)*
  3. ***El habla conectada es inteligible para un oyente concentrado que puede leer los labios y se encuentra en un contexto conocido.***  
*(Usted puede comprender el habla del niño/a al concentrarse, adivinando lo dicho o con lectura labio facial)*
  4. ***El habla conectada es inteligible para un oyente que tiene poca experiencia con el habla de una persona sorda.***  
*(Puede usted y otras personas, que no conozcan al niño/a, comprender lo que él dice/habla).*
  5. ***El habla conectada es inteligible para todos los oyentes. El niño/a es comprendido fácilmente en contextos cotidianos.***  
*(Todos pueden entender fácilmente el habla del niño/a en contextos cotidianos)*
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