

# Assessment of speech perception: A survey of speech-language-hearing therapists on their most frequent practices

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## ABSTRACT

**Purpose:** to characterize the practices of speech-language-hearing pathologists in Chile, regarding speech perception assessment in children and adolescents.

**Methods:** an exploratory cross-sectional study carried out using a self-administered online survey to investigate knowledge and quantify trends in the practice of speech perception assessment, based on six focus groups with speech-language-hearing pathologists. The instrument was disseminated through the researchers' social media and contact networks. Descriptive statistical analysis was performed.

**Results:** a total of 121 people responded to the survey, all of them being speech-language-hearing pathologists. These professionals, in Chile, highly value speech perception in child development, however, a large percentage of them do not assess it. Those who carry it out, reported a wide range of assessment practices.

**Conclusion:** the results highlight the need for standardizing certain speech-language-hearing methods and the importance of understanding the assessment strategies in use to point out opportunities to improve both the assessment and subsequent therapeutic processes.

**Keywords:** Speech Perception; Child Development; Professional Practice; Speech, Language and Hearing Sciences; Surveys and Questionnaires

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## INTRODUCTION

Speech perception is the process by which humans interpret and understand language sounds by recognizing speech sounds and using this information to understand spoken language. This involves mapping continuous acoustic waveforms into discrete phonological units (distinctive sounds) to store words in the mental vocabulary<sup>1</sup>. Speech perception has its sensory basis in the auditory system, in which central processes of secondary and tertiary cortical areas of the brain participate. These cortical regions are involved in recognizing and processing the auditory signal to identify and understand what is heard<sup>2</sup>.

Children and adolescents need to develop speech perception as it helps advance other cognitive skills and processes, such as the ability to discriminate speech against competing signals thanks to central auditory processing (CAP)<sup>3</sup>, the development of phonological awareness and literacy<sup>4,5</sup>, auditory feedback for articulatory modulation<sup>6,7</sup>, and general language acquisition<sup>8-10</sup>.

Speech perception is also closely related to children's and adolescents' speech production<sup>4,5,7,11</sup>. This relationship is evident in both typical (TD) and atypical development (AD). For instance, TD children change their vocalizations by auditorily perceiving cardinal vowels for a short time<sup>12,13</sup>. Other studies have shown how babies specialize in producing native language sounds to which they have been exposed from an early age<sup>12,14</sup>. On the other hand, children and adolescents with AD such as phonological disorders<sup>7,15</sup> or speech sound disorders (SSD)<sup>16</sup> have limited perceptual knowledge compared to their TD peers.

Given the relevance of speech perception to the development of cognitive skills and processes and speech production, specialized professionals must assess it as an important step in the characterization of children's and adolescents' cognitive-linguistic development<sup>11</sup>. Such specialists include speech-language-hearing (SLH) pathologists, who work in both the clinical and educational fields<sup>17</sup>, carrying out SLH assessments in TD and AD, particularly the latter<sup>11,18,19</sup>. Moreover, SLH pathologists must determine whether a patient has difficulties in cognitive processes<sup>3-5</sup> and speech production<sup>7,15,16,20</sup>. In all these situations, it is considered relevant for SLH assessments to address speech perception.

Despite the importance of assessing speech perception in different areas, developments, and difficulties, there is evidence that SLH pathologists are not assessing this skill. A survey conducted in Australia<sup>21</sup> reported that 75.8% of SLH pathologists focus on assessing productive (phonetic-phonological) difficulties, while a smaller percentage (15.8%) additionally assess speech perception in children and adolescents with SSD. Another example is a study carried out in Sweden<sup>22</sup>, which showed that although speech production is often assessed in children with SSD, aspects such as speech perception and phonological awareness are less attended to.

In Chile, there is no formal evidence that reflects whether SLH pathologists consider it relevant to assess speech perception, whether they are carrying it out, and, if so, what procedures or practices they use.

Given the importance of assessing speech perception and the absence of formal documentation that characterizes such practices among SLH pathologists in Chile, the following questions arise: How relevant is the speech perception assessment for these professionals? Do they really assess speech perception? If so, what procedures are they using to assess this skill? Thus, this research aimed to characterize the practices of SLH pathologists, in Chile, regarding speech perception assessment in children and adolescents. Hence, it sought to understand the relevance that these professionals assign to such assessments in their clinical and educational practices and identify the methodologies and tools used in these assessments to detect possible gaps and opportunities to improve the quality and effectiveness of these *assessments*.

## METHODS

This study's procedures and ethical considerations were approved by the Human Research Ethics Committee of the Medical School of the University of Chile, Chile, (code 264-2020), within the framework of the project "SLH pathologists' knowledge about the assessment of speech sound perception" of the University of Chile.

An exploratory cross-sectional study was carried out<sup>23,24</sup> through a self-administered online survey to investigate knowledge and quantify trends in speech perception assessment. In a preliminary stage to validate the approach and structure of the survey, six

focus groups with SLH pathologists were conducted online on the Zoom platform (the first one was a pilot). They had to meet the following inclusion criteria: being an SLH pathologist, having graduated from a Chilean institution, having at least 1 year of experience in a clinical or educational context for children, and working in that context at the time the focus group was carried out. Each group had three to six participants from different areas of Chile, plus the two lead researchers, who guided the dialogue and introduced the questions and basic notions about the knowledge and assessment of speech perception. All group instances were recorded on video and audio, enabling each professional's interventions to be transliterated for subsequent analysis. Thus, the data collected from the groups were used to identify the (sub)categories, which then guided the development of questions and their alternatives in the survey<sup>23,24</sup>.

In the present investigation, special attention is paid to the results of the questionnaire and its connection with the central objective of the research presented here. The survey data analysis enables the characterization of SLH practices regarding speech perception assessment by SLH pathologists dedicated to these procedures.

## Participants

Eligible participants for the survey had to meet the following inclusion criteria: 1) having the title of an SLH pathologist, speech therapist, speech-language pathologist, or SLH technician – this encompassing approach aimed to collect data from every professional linked to child communication, speech, and language assessment and intervention, regardless of their nationality; 2) having at least 1 year of experience in clinical or educational settings focused on children and adolescents; and 3) having worked or actively working in said context at the time of data collection. An informed consent procedure was used to ensure they met these criteria, also detailing the conditions, scope, and limitations associated with study participation. Anyone who did not meet these criteria was excluded from the research.

The survey was initially available to be answered by any SLH pathologist who met the said criteria, regardless of nationality. However, as the research problem addresses the Chilean reality, it was decided to filter them by nationality. Thus, the inclusion criteria were applied, removing duplicate records, incomplete demographic data, and responses without the

corresponding approved informed consent from the initial total of 232 people interested in participating. Therefore, the sample size was reduced to 121 participants, each of whom provided informed consent approval, full identification data, and at least one response in the survey.

## Survey

The survey was developed based on the thematic categories identified during the focus group phase, with a particular emphasis on knowledge and practices related to systems and procedures for speech perception assessment in children and adolescents. The instrument had 35 questions – 14 formulated on a Likert scale, 7 with a single right answer, 12 with various response options, and 2 classification questions by relevance or priority.

Before its application, the survey was piloted by two professionals participating in the focus groups to evaluate their understanding and response time. It was also reviewed by two expert judges, who evaluated the questions for relevance and wording.

The internal structure of the survey had two sections. The first one requested the participant's demographic data such as sex, nationality, profession, academic degree, work setting, and years of experience. The second section, based on the focus group findings, focused on questions specifically designed to discern between relevant theoretical knowledge and the practical application of speech perception assessment among SLH pathologists. The knowledge questions and practical application questions were divided by a so-called "key question", namely: "In your professional practice, as the person or situation requires, do you actually assess speech perception skills?". This is one of the most relevant questions for the research objective because it aims to distinguish participants who reported assessing speech perception from those who only stated knowing this skill. If they answered the latter, their survey was concluded, while the rest continued with the survey.

## Procedure

Study data were collected and managed using REDCap (Research Electronic Data Capture) hosted at the Medical School of the University of Chile<sup>25,26</sup>. REDCap is a secure, web-based software platform designed to support data capture for research studies. The questionnaire was open for 4 months to all people

who met the inclusion and exclusion criteria. It was disseminated via the researchers' social media and contact networks. Upon accessing the link, participants found an initial instruction that outlined the study objective, data processing, and contact information. Participants were required to provide informed consent before proceeding with the survey. They were also given the option of withdrawing from the instrument at any time. At the conclusion, participants were asked to provide an e-mail address if they wished to receive the study results and were provided with space for additional comments.

## Data analysis

Data were collected and analyzed using the REDCap platform, which provides descriptive statistical tools. Absolute frequencies and percentages were obtained for categorical variables. In the case of Likert scale questions, means and standard deviations were calculated. Additionally, the Python programming language was used to clean, organize, and corroborate the data and analysis generated in REDCap.

## RESULTS

### Demographic characterization of the sample

The study sample included 121 participants, all Chilean SLH pathologists, most of whom identified as females (88.4%). Santiago was the most reported current city of residence, with 52.9%. Most participants' highest academic or professional degrees (71.1%) were reported as "bachelor/certified", followed by master's degree (28.1%). Only a small percentage of participants (0.8%) reported having a PhD. The University of Chile was the most reported undergraduate training institution, to which 25.6% of participants were associated, followed by the Universidad Mayor and the University of Valparaíso respectively with 12.4% and 9.09%. Santiago was also reported as the city where they have practiced SLH therapy for the longest time, where 51.2% of participants worked. As for the predominant work setting during their years of professional practice, 40.5% of participants reported working in an educational context, 33.9% in both clinical and educational contexts, 23.9% in clinical contexts, and a small percentage of the participants (1.7%) selected the "Other" option.

A specific subset directly aligned with the research objective was selected from the 35 questions asked in the survey, which covered both knowledge and

practices regarding speech assessment in children and adolescents. Thus, it presents the results of nine questions that investigate the relevance, decision, and procedures of speech perception assessment.

### Relevance of the assessment

The first question of the survey, answered by the 121 respondents, was "According to your knowledge and professional experience, how important is speech perception assessment in the process of assessing the linguistic performance of a child or adolescent?" In response to this inquiry, participants were inclined to rate the speech perception assessment as "important" (39.7%) or "very important" (59.5%). None of the respondents considered it as "unimportant" or "not at all important".

For research purposes, it was essential to investigate whether SLH pathologists actually assessed speech perception. The "key question" with a yes/no answer was "In your professional practice, as the person or situation requires, do you actually assess speech perception skills?". It was answered by 90 people, of whom only 55.6% responded "Yes", while the remaining 44.4% responded "No". This "key question" allowed the first group to move toward questions about speech perception assessment practices, while the second group was led toward the end of the survey.

### Questions on assessment procedures

The results of the questions that investigate assessment procedures used by SLH pathologists when assessing speech perception are given below.

To understand the decision criteria behind the speech perception assessment, professionals were inquired with the question "According to your professional practice, what criteria do you use to decide whether to assess speech perception directly (with formal or informal tests)? Check a maximum of three options". The results (n = 50) show that the most used criterion is "Based on the patient's type, age, history, and/or previously reported diagnosis, problem, difficulty, etc.", selected in 84.0% of the answers. This was followed by observations focused on "the person's language and/or speech production", with 60.0%. A third criterion, focusing on the "desired level of specificity", was selected in 32.0% of the responses. Less frequent criteria include "the patient's disposition or conditions at the time of the evaluation" (16.0%) and "whether it is a barrier or impediment in the person's



education” (12.0%). Few responses leaned towards criteria that involve physical (6.0%) or cognitive (4.0%) problems or difficulties.

The professionals were asked, “How often do you decide to indirectly assess speech perception (general clinical observation through communicative interaction) while evaluating other aspects of the person?”, which aimed to verify the frequency with which they opt for indirect speech perception assessments. The results (n = 48) show a trend towards frequent performance of indirect assessments. Specifically, 45.8% of participants said they do it “Usually”, while 37.5% do it “Sometimes”. Fewer professionals choose to do it “Always”, with 14.6% of the responses, whereas only a small percentage (2.1%) never perform indirect speech perception assessments while evaluating other aspects of the person.

They were also asked, “How often do you decide to refer speech perception assessments?” to understand their propensity to refer such assessments to other professionals. The findings (n = 48) indicate that most professionals rarely choose to refer this type of assessment. Specifically, 50.0% of those surveyed reported “Never” referring the assessment, while 45.8% do so “Sometimes.” Only a small percentage (4.2%) indicated that they “Usually” refer speech perception assessments. None of the participants claimed to do it “Always”.

Concerning the types of assessments or instruments, they were asked, “In your professional practice, what types of speech perception instruments or assessment(s) do you use? You can check more than one option”. The results (n = 48) show a high prevalence of “Clinical observation”, selected in 75.0% of the responses, followed by “CRT (criterion-referenced test)/ Informal guidelines”, with 68.8%. “Formal testing” was also a common option, selected in 56.3% of responses. Moreover, 47.9% of the participants indicated that they choose to “Refer to audiometry”. None of the respondents selected the option “I don’t really assess it”. A small percentage (2.1%) indicated the use of other types of assessments not specified in the list.

Regarding the specific instruments used by professionals in their practice, the question was asked “In your professional practice, which of the following instrument(s) do you use to assess speech perception in children and adolescents without hearing difficulties? You can check more than one option. The findings (n = 48) indicate that “Clinical observation” and “Informal comparison guidelines” are the most used tools, with

rates of 56.3% and 52.1%, respectively. Among the specific tests, the “Ling Test” is the most used, with 43.8% of the answers, followed by the “Wepman Test” and “Name Alert”, both with 35.4%. On the opposite end, the “Assessment of Auditory and Phonological Discrimination” was the least used, indicated in only 4.2% of the responses. Only a small percentage of respondents (2.1%) stated that they did not use any instrument to assess speech perception.

They were also asked, “Which of the following procedures is similar to the one you use most frequently to assess speech perception?”, which aimed to investigate the most used procedures in speech perception assessment. The results (n = 43) show a diversity of approaches, with 34.9% of participants indicating that they assess using “minimal contrast pair images”, followed by 25.6% opting for “observation of the performance with (random) word lists with minimal contrast pairs (no images)”. Also, 14.0% of those surveyed indicated that they use “the children’s productive errors and see if they review or correct their errors”, while only a small percentage of professionals resort to observation with “use of musical instruments and/or environmental sounds” (4.7%) or “evaluate perception with stimuli based on productive errors” (4.7%). Interestingly, none of the participants selected the option “I did not perform any procedure regarding this content”.

To elucidate the professionals’ criteria for applying a speech perception assessment, they were asked, “When considering a speech perception assessment, which of the following statements would best express your criteria for using the procedure?”. The findings (n = 43) reflect that the majority would choose to assess it “at the beginning of the evaluation, to find the phonological system input status before verifying their expressive performance (speech)”, selected in 48.8% of the responses. Also, 39.5% would do so “at the end of the evaluation based on productive/articulatory errors”, whereas a small percentage would choose to apply the evaluation “in a re-evaluation process in case of an expressive disorder/SSD resistant to treatment” (7.0%) or “at the end of the evaluation in case the difficulties were consistent with hearing loss” (4.7%). No participant selected the “Other criteria” option.

The most important assessment procedure results selected by the SLH pathologists are summarized in Chart 1.

## DISCUSSION

The main objective of this study was to characterize the practices of SLH pathologists in Chile regarding speech perception assessment in children and adolescents. This purpose arises due to the relevance of speech perception in the development of children's and adolescents' cognitive and linguistic skills<sup>3-9</sup>. Furthermore, a close relationship between speech perception and production is recognized in both TD<sup>12-14,27</sup> and AD<sup>15,16</sup>. Hence, the speech perception assessment by SLH pathologists is essential for understanding and analyzing children's and adolescents' cognitive-linguistic development<sup>10,11,28</sup>.

Given that there is no formal history of similar studies in Chile, it is impossible to compare results in the same context. However, explorations similar to this study have investigated these professionals' usual practices in other countries<sup>21,22</sup>. Although the methodologies, questions, and alternatives are not completely comparable, the results of this research will be discussed with said reports among other references.

The results of this study reveal contrasting ideas on the part of SLH pathologists. On the one hand, the 121 initial respondents gave high importance to speech perception assessment, as suggested by studies that relate this ability to cognitive and linguistic development<sup>3-8</sup> and speech production<sup>4,5,7,11,15,16,20</sup>. However, despite this relevance and the recommendations of various authors<sup>11,18,19</sup>, only a little more than half of the respondents, who answered the "key question", actually included speech perception in their evaluative processes. This finding corresponds to the results presented in Sweden, where SLH pathologists tend

to assess speech production more often and speech perception less often<sup>22</sup>.

This discrepancy between the relevance given by SLH pathologists and their decision to assess speech perception could be due to the complexity of assessing this skill, the lack of resources, and the limited time they have in their professional practice<sup>22</sup>. Other aspects could be added to this explanation, such as their knowledge of speech perception and its assessment<sup>21,22</sup>.

Concerning procedures, specifically the use of speech perception assessment instruments, respondents indicated that informal tests are the most used. They did not rule out the use of formal or standardized tests such as the "Ling Test" or "Wepman Test". This practice generally corresponds to what has been indicated by research<sup>21,22</sup> which also indicates the use of these types of instruments. However, among informal tests, the results of the present investigation indicate that "clinical observation" appears as the most used by respondents, while the Swedish survey indicates that "minimal contrast pairs" are mainly used<sup>22</sup>.

These results may be explained by the existing literature<sup>9</sup>. It has been explained that few materials are available to sensitively assess speech perception in normal-hearing children, although different developmental conditions have been related to a greater or lesser extent to perceptual development difficulties – e.g., children with language disorders<sup>29</sup>, children and adolescents with dyslexia<sup>30</sup>, in fluctuating hearing loss<sup>31</sup>, auditory processing deficit<sup>32</sup>, and diagnoses of speech disorders<sup>33</sup>.

**Chart 1.** Summary of the responses with greater and lesser frequency of speech perception assessment procedures selected by speech-language-hearing pathologists in Chile

Question	TOTAL N	Most frequent response	%	Least frequent response	%
What criteria do you use to decide whether to assess speech perception directly (with formal or informal tests)?	50	Based on the patient's type, age, history, and/or previously reported diagnosis, problem, difficulty etc.	84%	Criteria that involve physical (6.0%) or cognitive problems (4.0%).	10%
How often do you decide to indirectly assess speech perception (general clinical observation through communicative interaction) while evaluating other aspects of the person?	48	Usually	45.8%	Never	2.1%
How often do you decide to refer speech perception assessments?	48	Never	50%	Usually	4.2%
In your professional practice, what types of speech perception instruments or assessment(s) do you use?	48	Clinical observation	75%	Refer to audiometry	47.9%
		CRT (criterion-referenced test)/Informal guidelines	68.8%	Other types of assessments not specified in the list	2.1%
Which of the following instrument(s) do you use to assess speech perception in children and adolescents without hearing difficulties?	48	Clinical observation	56.3%	Assessment of Auditory and Phonological Discrimination	4.2%
		Informal comparison guidelines	52.1%	Did not use any instrument to assess speech perception	2.1%
Which of the following procedures is similar to the one you use most frequently to assess speech perception?	43	Minimal contrast pair images	34.9%	Use of musical instruments and/or environmental sounds	4.7%
		Observation of the performance with (random) word lists with minimal contrast pairs (no images)	25.6%	Assess perception with stimuli based on productive errors	4.7%
When considering a speech perception assessment, which of the following statements would best express your criteria for using the procedure?	43	At the beginning of the evaluation, to find the phonological system input status before verifying their expressive performance (speech)	48.8%	At the end of the evaluation in case the difficulties were consistent with hearing loss	4.7%

Captions: N = Number of people who answered the question; % = frequency percentage obtained for the answer.

## Clinical and educational recommendations

Some authors point out that the most ideal way to assess speech perception is through stimuli with low semantic and working memory demand<sup>11,19</sup>, such as the use of pseudowords in AX or sound recognition test formats<sup>34</sup>. The evidence also indicates that speech perception should be assessed in those sounds where errors in pronunciation appear – therefore, the choice of stimuli that will be part of the speech perception assessment should be built based on the child's productive errors, aiming to replicate the same phonetic contexts<sup>19,20</sup>. Thus, it can be concluded that each child

will require a speech perception assessment highly individualized to their difficulties, whereas standardized tests with randomized lists of perceptual contrasts are not recommended. Moreover, the task should offer several opportunities to try the same item to counteract the effects of chance in the forced response<sup>19,20</sup>. It is important to take these recommendations into account since the results of this study show that most professionals consulted (48.8%) assess speech perception at the beginning of the diagnostic processes, without feedback on the children's and adolescents' productive speech errors.

As previously mentioned, studies on speech perception in our country are scarce despite the increase in reports worldwide indicating its relevance and implication in the therapeutic processes of children with different developmental difficulties. This study helped trigger the investigation of speech perception in Chile and contributed to the collection of data on the usual practices of SLH pathologists, which must be looked at critically and contrasted with the available evidence. Using a methodology that approached the SLH practice of different parts of Chile in focus groups to construct the widely applied survey allowed the development of an instrument with the professionals' needs and concerns. The results highlight the need for standardizing certain SLH methods and the importance of understanding the assessment strategies in use to point out opportunities to improve both the assessment and subsequent therapeutic processes.

### Limitations and perspectives

Professionals' experiences are a valuable input to provide feedback on SLH pathologists' clinical practices. However, the sample in this study was concentrated in the Santiago Metropolitan Region, with limited participation of professionals from other regions of the country. This may have generated an information bias, so it is crucial to consider it in future research. Encouraging the participation of people from various locations and schools of study would provide results more representative of the target population and analyze trends in assessment practices, contrasting them with professional practices in different regions of the country.

Another limitation of this research is the lack of investigation into the reasons why some professionals do not assess speech perception, despite recognizing its great relevance to speech and language development. Knowing these reasons is essential to identify the difficulties that professionals face in this assessment process and thus develop an improvement plan.

### CONCLUSION

This research reveals a discrepancy between the importance given to speech perception assessment in children and adolescents and its effective implementation in clinical practice. Most professionals surveyed do not consistently include this assessment in their evaluation processes.

Regarding assessment procedures, informal tests are the most used ones, highlighting clinical observation as the main tool.

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