Speech Perception Assessment Practices Among Audiologists in India: A Preliminary Survey

Aparna Nandurkar[1,*], Geetha Mukundan[1] and Geeta Gore[2]

[1]*Department of Audiology, Ali Yavar Jung National Institute for the Hearing Handicapped, Bandra, Mumbai, India*

[2]*Audiology and Speech Therapy Department, TN Medical College and BYL Nair Hospital, Mumbai, India*

Abstract: Assessment of speech perception is an important aspect of clinical audiology practice. The profession of audiology is about 50 years old in India. However, there is no published information available about speech perception assessment practices implemented by audiologists in the country. The present study is a small scale survey of audiologists involving 59 respondents working in various settings in India. The survey was conducted *via* e-mail and social networking website. Analysis indicates that about 70% respondents conduct speech testing routinely, though only about 50% test through audition-only and through the audiometer. The results indicate considerable variability in aspects such as presentation level, speech stimuli and tests used, setting used for testing, and Signal-to-Noise Ratio used for testing in noise. 85% respondents prefer presenting stimuli through monitored live voice for children. Word Recognition Score is the most commonly used measure, while HINT and SPIN are the tests commonly used for testing in noise. A majority of respondents feel the need for developing language-independent test material for both children and adults. Reportedly, the major impediments in conducting speech testing include non-availability of standard sound treated rooms, lack of access to sophisticated audiometers, lack of time and non-availability of standard test material in the various languages spoken in the country. The main limitation of the survey is that 73% of the respondents were from western India and hence the results cannot be generalized to the population of audiologists across the country. Despite its limitations, this study may be considered as a preliminary survey providing valuable information about speech perception assessment practices among audiologists in India.

Keywords: Speech perception, India, presentation level, monitored live voice, signal-to-noise ratio.

INTRODUCTION

Speech perception is a complex process that allows us to concentrate on our goal of making sense out of speech [1]. Gierut and Pisoni [2] simply described "Speech Perception" as the transformation of an acoustic signal transmitted from a speaker to an intended communicative message heard by a listener, for whom the perception of speech seems to be effortless and automatic. Speech perception is thus the basis of a communicative exchange and also plays an important role in the acquisition of language and speech. Assessment of speech perception forms a cornerstone in clinical audiological assessment. Traditionally, assessment of human auditory function has been primarily carried out using pure tone assessment, which does provide valuable information regarding audibility of the sounds, or, in other words, hearing sensitivity; but gives only limited information about the individual's receptive communication ability, the ability to understand speech stimuli. As speech is a more meaningful and relevant signal that relates closely to day-to-day functioning of the human being and also provides an understanding of the human's ability to understand everyday social communication, using speech as a stimulus for assessment of auditory function becomes important. A number of studies have demonstrated that development of speech and language skills in children with profound hearing impairment is not dependent only on pure tone average, but is related to the degree of residual hearing available and auditory speech perception ability [3]. If the goal is to measure and understand auditory speech perception abilities, speech must be used as the stimulus [4].

Speech perception assessment helps the clinician to estimate how well the listener understands speech in daily listening situations, thereby reflecting on the communication handicap created by the hearing loss. It further helps in establishing candidacy for the different types of medical and surgical treatments as well as hearing devices. Assessing the success of these various treatment options and monitoring subjects' performance throughout the aural re/habilitation process is also possible due to speech perception assessment procedures. Testing with speech stimuli also helps the clinician in confirming the audiogram and diagnosing retro-cochlear versus peripheral disorders [5, 6]. Further, speech perception testing offers an integrated look at the relationship between speech perception and production [7]. Assessment of speech perception encompasses procedures such as Speech

*Address correspondence to this author at the Department of Audiology, Ali Yavar Jung National Institute for the Hearing Handicapped, Bandra West, Mumbai 400050, India; Tel: +91 9820446304; Fax: +91 22 2640 4170;
E-mail: aparnanitinnandurkar@gmail.com

E-ISSN: 2311-1917/15

Awareness Threshold (SAT), Speech Reception Threshold (SRT), Word Recognition Score (WRS) or Speech Recognition Score (SRS) and other commonly used tests such as Ling six sound test [8], Early Speech Perception Test [9], Word Intelligibility by Picture Identification [10]. Testing speech perception in noise is also an important aspect of assessment in order to get a realistic estimate of the subject's speech perception in daily listening situations which are often noisy. Several tests are available for testing speech perception abilities in noise.

While recommending preferred practice patterns, ASHA [11] recommends inclusion of speech reception thresholds or speech detection/awareness thresholds with appropriate masking as well as word recognition measures with appropriate masking in the basic audiological evaluation for pediatric as well as adult population. Speech perception assessment using either objective or subjective measures in quiet as well as noise is also recommended during hearing aid validation. Evaluation of speech perception is included in the management of cochlear implant recipients and speech perception assessment forms an important component of outcome assessment too. The Indian Speech and Hearing Association (ISHA) [12] in its Scope of Practice document states that an audiologist is involved in clinical and/or instrumental screening, assessment, identification, diagnosis, and management of hearing disorders in infants, children, adults and geriatrics involving both peripheral and central pathways of hearing and may use behavioral, psychoacoustic and electroacoustic measures related to the peripheral and central auditory systems for this purpose. It is assumed that speech recognition procedures are included in behavioral measures. Guidelines for preferred practices have not been recommended by ISHA. Speech testing/Speech audiometry is included among the battery of tests for cochlear implant candidacy assessment according to the Clinical Practice Guidelines for Cochlear Implantation stated by the Cochlear Implant Group of India [13].

The field of audiology in India is almost 50 years old and has grown exponentially over the last few years. Audiologists are practicing in various settings including hospitals, regular and special schools, early intervention centers, cochlear implant clinics, AVT centers, hearing aid and cochlear implant companies and academic institutes [14]. Easwar and colleagues [15] conducted an Internet-based survey probing into current audiology practice patterns among 199 audiologists in India with the intention of identifying areas that warrant change. They reported findings about the audiological assessment practices, hearing aid fitting practices and clinical protocols adopted by the respondents. In the area of audiological assessments, they have reported on use of speech audiometry/testing by the respondents. In their survey, 24.12% of the respondents reported that they perform only speech recognition threshold (SRT) testing, while 53.27% of the respondents reported they performed SRT in combination with other speech measures such as speech identification scores (39.7%) and speech in noise (SIN) test (2.51%). None of the audiologists reported performing SIN in isolation; it was typically included in their test battery, often in combination with SRT and SIS (9.55%). 19.6% of the respondents reported that they do not perform any form of speech testing routinely. There was no mention of speech testing in any form among the procedures used for pediatric testing or for hearing aid selection and fitting in this survey. Most respondents were from the southern part of India and hence results cannot be generalized to the population of audiologists across the country. No other published study reports on the current audiological assessment practices in India and none have reported on speech perception assessment practices in particular.

The aim of the current study is to survey the speech perception assessment practices and protocols used by audiologists in the country.

METHOD

A questionnaire including a total of 24 questions on various aspects pertaining to speech perception assessment was developed by the authors. The questions were included based on the several years of clinical experience of the authors. Most questions had multiple choices out of which the respondents had to choose as many options that were relevant; while some questions had to be answered as yes, maybe, or no. Some questions were open-ended; for example, respondents were required to list out the test material that they used in few of the questions. The first question addressed the frequency of speech perception assessment in the respondent's practice and five options were given including always, often, sometimes, rarely and never. Respondents then had to choose the reasons for which they conducted speech perception assessment from a list of six different options and could also add any other reasons for which they conducted such assessment. Further, they had to

provide details about the patient population that they routinely dealt with and the languages which they encountered in their clinical practice. Information on any self-made test material and standard speech perception test material used for children and adults was obtained using open ended questions. Questions were also included to get information about the sensory modality preferred, the clinical setting used, the presentation level used, Signal-to-Noise Ratio employed and test material preferred for children and adults during assessment. Respondents were asked what they felt about the availability of speech perception test material to suit their clinical population and the kind of speech perception material that is urgently required for their clinical population. Lastly, space was provided for each respondent to provide any other suggestions relevant to speech perception assessment protocols and preferred practices. The questionnaire is given in the Appendix.

The survey was prepared as a Microsoft Word document and electronically mailed to 110 audiologists from a mailing list of audiologists at the National Institute for Hearing Handicapped, Mumbai. Only speech and hearing professionals actively engaged in audiology practice were included in the survey. The survey was also posted on a social networking forum (Facebook Inc., Menlo Park, CA, USA) to make it available to audiologists all over India. Audiologists working in the hearing aid and cochlear implant industry were not included in this survey.

RESULTS

Of the 110 audiologists who were electronically mailed the survey, seven replied stating that they do not perform speech perception assessment routinely and would not be able to complete the survey, while 53 returned the completed survey. All of these are included in the analysis. For the post on the social networking forum, 26 respondents started to fill up the questionnaire, but 20 did not complete it; answering only about three to four of the total 24 questions. Six completely filled questionnaires were included in the analysis. Thus responses obtained from a total of 59 audiologists are included in the analysis. The audiologists were asked to fill up information about the number of years of clinical experience they have, the kind of clinical population they commonly encounter and also the kind of setting that they worked in. Based on the responses to these questions, following are the details about the respondents.

With reference to the geographical distribution across the country, 72.88% of the respondents were from the Western region, 22.039% from the Southern region, and 5.09% from the Northern region. Audiologists from Eastern and Central regions of the country were invited to participate in the survey; however, no responses were received from audiologists belonging to these regions. The distribution of respondents is thus not balanced across the different regions and was skewed as larger number of participants from the Western region completed the survey.

Respondents were employed in different settings. Some of the respondents worked in two or three different types of settings. The number of respondents placed in the different types of work settings is shown in Figure **1**.

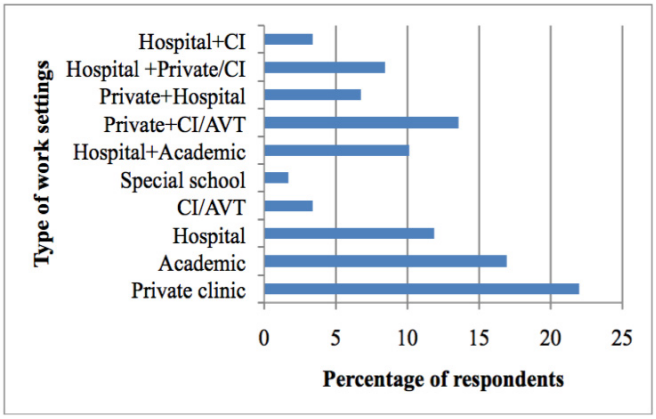

Figure 1: Type of work settings of respondents.

Respondents were also asked whether they mainly worked with children, adolescents and adults, or both. In response to this question, majority of the respondents (84.75%) stated that they worked with both client groups, 10.17% reported that they worked with children only, while 5.08% reportedly worked only with adolescents and adults. Respondents also varied in terms of the number of years of clinical experience they had. The distribution of the respondents (in percentage) according to number of years of clinical experience is shown in Figure **2**.

At the outset, respondents were asked whether they conduct speech perception assessment as a part of their routine clinical work. Responses reveal that 35.59% of the audiologists perform speech perception assessment sometimes, followed by 33.89% who conduct it often and then 22.05% who perform it always. A small percentage reported that they rarely (5.08%) or never (3.39%) conduct speech perception assessment. This is shown in Figure **3**.

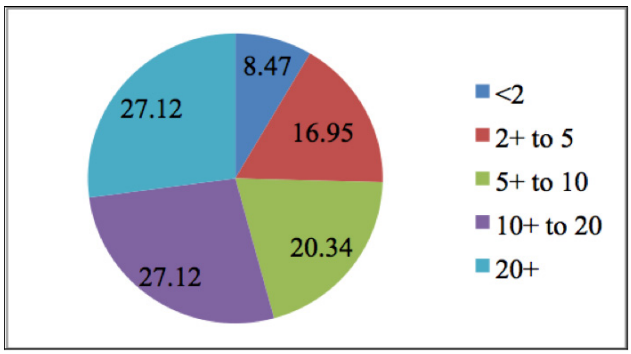

Figure 2: Number of years of clinical experience of respondents.

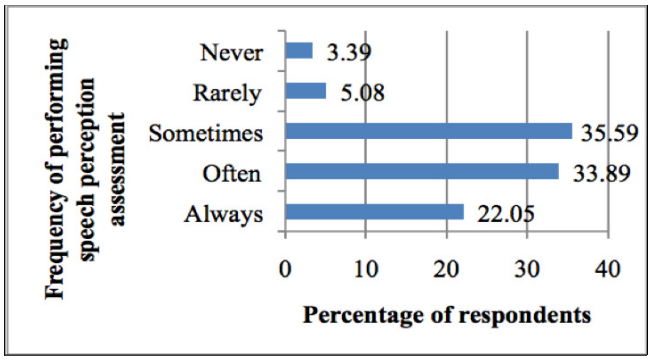

Figure 3: Percentage of respondents according to frequency of performing speech perception assessment.

Respondents were next asked to select reasons for which they conduct speech perception assessment. Seven options were given and respondents had to select all the possible reasons for which they perform speech perception assessment. They were also provided space to list any reasons other than that provided in the questionnaire. 18.64% of the respondents selected all the reasons provided. Most respondents (76.27%) reportedly perform speech perception assessment to assess the efficacy of the listening device used by the client. Establishing hearing aid and cochlear implant candidacy is another important reason for which respondents conduct speech perception assessment (62.71%), followed by monitoring of listening skills through the intervention process (59.32%). 54.24% of the respondents reported using data from speech perception assessment for getting information about the problems faced by clients in everyday communicative situations and almost a similar number (52.54%) responded that it helps in planning goals for listening training. Determining site of lesion and research were stated as reasons by 38.98 and 28.81% of the respondents, respectively. This is displayed in Figure **4**.

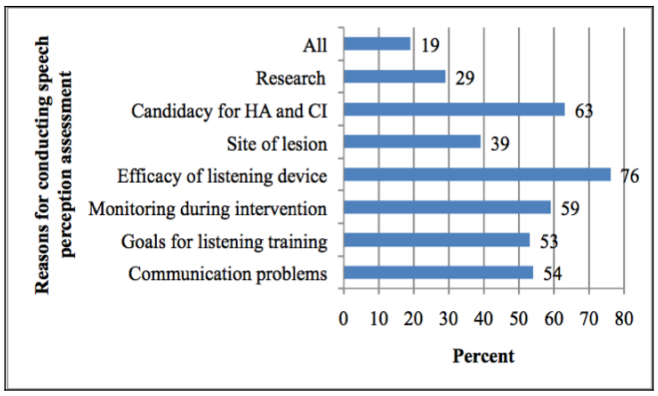

Figure 4: Reasons for conducting speech perception assessment.

Some of the respondents added other reasons for conducting speech perception assessment. These include ruling out Central Auditory Processing Disorders, selecting hearing aids in adult clients, medico-legal cases, deciding on the electrodes that need to be mapped in case of cochlear implant recipients, ascertaining need for FM system and for counseling.

Respondents were asked about the populations in which they commonly perform speech perception assessment and they were provided with options in terms of the age groups and post-lingual versus pre-lingual clients. Here again, the respondents had to choose all the relevant client groups that they worked with. 16.95% of the respondents reported that they conduct speech perception assessment in all client groups listed i.e. children with pre-lingual hearing loss of all age groups, children with post-lingual hearing loss, adults with pre-lingual hearing loss and adults with post-lingual hearing loss. Other respondents selected varying combinations of the options provided and the details that emerged from these responses are shown in Figure **5**.

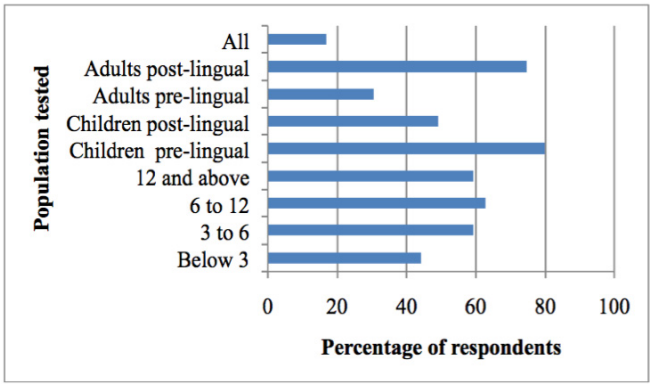

Figure 5: Percentage of respondents according to the populations tested by them for speech perception assessment.

When asked if they conduct speech perception assessment for every client that they encounter, 35.59% reported "yes", while 64.41% reported "no". Respondents were required to specify for which clients they choose to assess speech perception and the responses obtained were very varied. Respondents reported that they test speech perception only in clients with adequate verbal skills, those with sensori-neural hearing loss, clients reporting poor speech recognition skills, clients who are unhappy with their hearing aids, clients attending therapy, clients with cochlear implants and hearing aids, clients with post-lingual hearing loss and children suspected to have learning disability. When asked to provide the reasons for not performing speech perception assessment on every client, respondents cited several reasons such as time constraints, lack of adequate material in the language spoken by the client, lack of ideal setting to perform speech testing, inadequate verbal skills in clients, lack of proficiency in the client's first language, and affordability of the client.

Another question required respondents to state whether they use self-made material and/or standard test material for speech perception assessment and to state examples of such material for children and adults. Self-made or informal material is used by all the respondents, but only 36 of the 59 respondents provided examples of such material. Self-made or informal material used for speech perception assessment in children reportedly included words and sentences with differing lengths for assessing pattern perception, Learning to Listen sounds [16], monosyllabic words, bi-syllabic words and minimal pairs chosen from the child's vocabulary and used in a closed set, single and paired digits, nonsense syllables, rhymes, simple commands and questions and Ling six-sound test [8]. For adolescents and adults, respondents listed the following self-made material for speech perception assessment: monosyllabic and bi-syllabic words, sentence lists, questions and commands, reading material such as newspapers, paired digits and closed sets of minimal pairs.

Standard test material was listed by 25 of the 59 respondents. Other respondents stated that they did not have access to standard test material for assessment of speech perception. Among the standard material listed for children were tests and checklists such as the Early Speech Perception Test [9] (adapted versions in Tamil, Hindi and Marathi), Common Objects Token Test [17], Meaningful Auditory Integration Scale [18] and Infant-Toddler- Meaningful Auditory Integration Scale [19], The Parents' Evaluation of Aural/Oral Performance of Children [20], Categories of Auditory Perception [21], Word Intelligibility by Picture Identification [10], Northwestern University-Children's Perception of Speech [22], Lexical Neighborhood Test (LNT) and Multi-syllabic Lexical Neighborhood Test (MLNT) [23], CID Everyday Sentence Test [24], Learning to listen sounds, Listening Skills Scale for AVT (LSSAVT), and Marathi Speech Recognition Test [25]. Standard material listed for adults included word lists developed by Indian Speech and Hearing Association [26] for obtaining Speech Reception Threshold (SRT) and Word Recognition Score (WRS) in various Indian languages, Hearing In Noise Test (HINT) [27], SPIN [28], LNT [23], City University of New York (CUNY) Sentences [29], Dichotic Digit Test [30], and CID Everyday Sentence Test [24]. Respondents who were placed in academic institutions stated that they used standard material developed at their own centers.

When asked about the modality through which they administer the speech perception tests, 28 (47.46%) reported that they administer tests through auditory modality only, while 29 (49.15%) reported use of both – only auditory modality and combined auditory+visual modality. Only one respondent stated use of auditory+visual modality and one respondent did not answer the question. Respondents were then asked whether they administered the tests through the audiometer when they tested speech perception through the auditory modality only. Responses indicate that 45.76% of the respondents "always" conduct testing through the audiometer, 18.97% do it only "sometimes", 18.65% test using the audiometer "often", while the same percentage "never" conduct speech perception testing through the audiometer. 1.69% responded that they "rarely" use the audiometer for speech perception testing, while 3.39% did not provide any response.

The question on intensity level at which speech perception testing was performed received varied responses from the respondents. The main points that emerged from these responses are as follows: a) presentation level varies depending on the aim of testing, b) it varies according to the specific test used and its protocol, and c) some research protocols require test administration over a range of intensity levels. No response was obtained from 22.03% of the 59 respondents. Of the remaining, 40.68% stated that the presentation level is definitely supra-threshold and the specific levels reported by these respondents

varied from 20 dB SL to 60 dB SL. Some respondents administer at 20 dB above Pure Tone Average (PTA), while some reported the reference to be either Speech Reception Threshold (SRT) or Speech Awareness Threshold. Few respondents also stated level of administration to be PTA+40 or SRT+40 dB. 20.34% of the respondents reported to be administering speech perception tests at a fixed level and this level ranged between 30 dB HL to 65 dB HL. Few respondents among these stated level of administration to be 50 dBA or 60 dBA. Of the 59 respondents, 16.95% reported the presentation level to be the Most Comfortable Loudness Level (MCL).

With reference to the ear/s tested during speech perception assessment, 44.07% of the 59 respondents stated that they test both the ears independently (monaural), while 13.56% reportedly test both ears together (binaural). 8.47% stated they test the better ear only while 3.39% did not respond to the question. 30.51% respondents reported testing under both monaural and binaural conditions.

The setting in which speech perception assessment is done was asked in the questionnaire and options given were quiet room, sound field, and under headphones. Analysis indicates that 16.95% of the 59 respondents reportedly use all the three settings depending on the reason for which testing is being done e.g. if testing is being done to assess efficacy of the hearing device, testing is done in the sound field in a two room setup with the device in place; if testing is done to ascertain site of lesion, then it is done under headphones. The percentage of respondents using different combinations of the three types of settings is shown in Figure **6**.

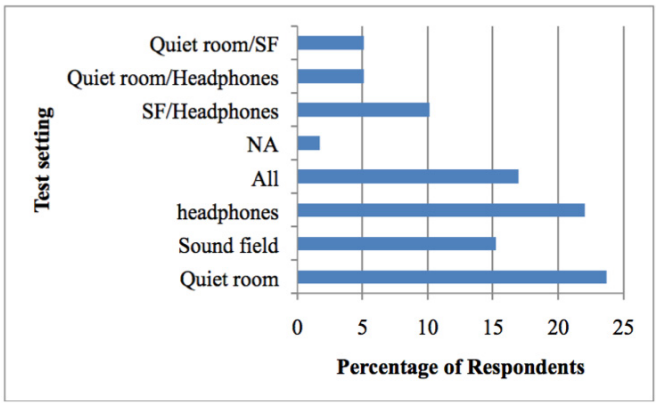

Figure 6: Percentage of respondents using the different test settings.

Respondents were specifically asked about the mode of presentation of speech stimuli when testing children. Two of the respondents (3.39%) answered "not applicable" to this question as they were not conducting speech perception testing on children. Majority of the respondents reported presenting speech stimuli using Monitored Live voice (MLV) (83.06%), while only one respondent (1.69%) reported using recorded stimuli presented through CD or tape. Both MLV and recorded stimuli were reportedly used by 10.17% of the respondents while one respondent (1.69%) did not answer the question.

With reference to the material that respondents preferred to use for their client population, 16.95% reported that they use all of the material suggested in the options i.e. words, sentences, closed-set tests and open-set tests, choosing according to the level of the clients being tested. A majority of the respondents (28.81%) prefer to use words, while 11.86% reportedly prefer closed-set tests as stimuli. None of the respondents prefer to use only open-set stimuli, while only one respondent (1.69%) reportedly preferred sentence stimuli. The number of respondents preferring the various types of stimuli and their combinations is shown in Figure **7**.

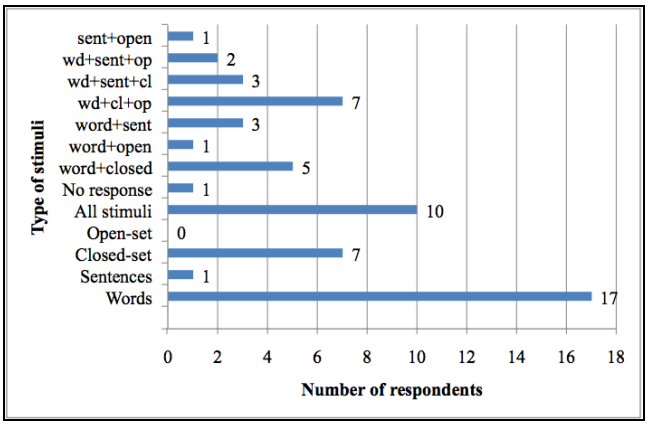

Figure 7: Number of respondents preferring different type of stimuli.

Analysis indicates that 5.08% of the 59 respondents "always" assess speech perception in noise, 33.89% do it only "sometimes", 15.27% test in noise "often", while 28.81% "never" conduct speech perception testing in noise. 16.95% responded that they "rarely" test in noise. Further, with reference to the tests used and the Signal-to-Noise Ratio (SNR) employed for testing in noise, 61.01% respondents stated that they test informally in a noisy room such as a cafeteria or a waiting hall and do not test through the audiometer; hence the question is not applicable. Most respondents (32.2%) who answered the question reportedly test at positive SNRs ranging between 0 to 20 dB; while

3.39% reportedly include both positive and negative SNRs ranging between -10 to +20 dB. Two respondents (3.39%) reported use of a variable SNR during research protocols.

Focusing on assessment in children, respondents were asked if they have adequate speech perception material that is equally difficult for use during repeated or periodic assessments. Majority (72.88%) of the respondents did not think adequate speech material with equal difficulty was available for periodic assessments in children. Only (5.09%) answered 'yes', while 20.34% answered "may be" to this question. One respondent (1.69%) did not answer the question.

Majority (74.58%) of the respondents felt there is a need for a screening test of speech perception. Most of the respondents also felt a strong need for standardized test material for speech perception assessment in children (93.22%) and adolescents and adults (84.76%). The same responses are shown in Table **1**.

Finally, respondents were asked what type of speech perception material is urgently needed for speech perception assessment in children and adolescent and adults. For both children and adolescents/adults, majority respondents (30.51 and 18.64% respectively) felt the need for closed-set word tests. Percentage of responses for other type of stimuli and the combinations as preferred by respondents are shown in Table **2**.

When asked if respondents would be able to use newly developed recorded tests in routine clinical practice, 52.56% responded affirmatively, while 33.89% responded with "May be". 11.86% of the 59 respondents did not think they would be able to put recorded tests to use and one respondent (1.69%) did not provide an answer.

When asked to add any suggestions that they might like to provide, following were some points included by the respondents:

a) There is a strong need to set a uniform, nation-wide protocol for materials, methods and presentation levels for speech perception testing in quiet and in noise.

Table 1: Percentage of Respondents for Questions About need for Standard Test Material

Question	Yes (%)	No (%)	May be (%)	No response (%)
Do you think there is a need for screening test of speech perception?	74.58	8.47	15.26	1.69
Do you feel the need for standardized test material for assessment of speech perception in children?	93.22	0	6.78	0
Do you feel the need for standardized test material for assessment of speech perception in adolescents and adults?	84.76	6.78	6.78	1.69

Table 2: Number of Respondents Preferring the Different Type of Material for Children and Adolescents/Adults

Type of material	For Children		For Adolescents/adults	
	No.	Percent	No.	Percent
Closed-set word tests	18	30.51	11	18.66
Closed-set sentence tests	4	6.78	3	5.08
Open-set word lists	2	3.39	7	11.86
Open-set sentence lists	1	1.69	7	11.86
All types of stimuli	4	6.78	7	11.86
Not answered	1	1.69	5	8.47
Closed-set word and sentence tests	7	11.86	1	1.69
Open-set word and sentence tests	2	3.39	7	11.86
Closed and open set word tests	7	11.86	2	3.39
Closed and open set sentence tests	2	3.39	3	5.08
Other combinations	11	18.66	6	10.19

b) Speech perception testing needs to be made mandatory and tests should be made available in recorded mode in all Indian languages.

c) Language-independent tests such as the Auditory Speech Sounds Evaluation Test [31] or low-verbal versions of test material need to be developed and made available to not only the academic institutions, but also to private practitioners across the country.

d) Less time consuming and low cost test material is the need of the hour.

e) Considering the multi-lingual environment in the country, there is a need for bilingual tests rather than tests in a single language.

f) Culture-specific test material needs to be developed instead of adapting already existing test material from the western countries.

DISCUSSION

Speech perception assessment forms an important component in the repertoire of tools available to audiologists. It is recommended as an important aspect of a diagnostic test battery and also for outcome assessment [11, 12]. The present study is a small scale survey of the speech perception assessment practices employed by audiologists in India. Most audiologists who responded to the survey were placed in private clinics, some of which offered cochlear implant services; followed by academic institutions. Results reveal that most audiologists include speech perception assessment in their clinical practice routinely, but not always. Some of the audiologists in private practice provided following reasons for their inability to conduct speech perception testing routinely: limited time with each client, non-availability of two-room set up, non-availability of sophisticated audiometers and more time taken for administration of speech tests. World Health Organization [32] reviewed the situation on deafness, hearing loss and available intervention programs in the South-East Asian countries in order to propose plans of action for alleviating hearing impairment in the countries in this region. It is stated that in India the ratio of audiologists per total population is 1:9216854, indicating severe imbalance in clinician:client ratio. This could be one of the main reasons why audiologists do not find sufficient time to perform speech tests on all clients that they assess. Further, in India, several audiologists also practice as speech-language pathologists as they possess educational qualifications in both these streams. Of the 59 respondents in this survey, 36 also practice as speech-language pathologists and are actively involved in providing intervention to children and adults with hearing impairment and other speech-language problems. This divides the time available to the clinician and may compromise on some of the clinical activities. Further, considering that most respondents do not have access to standard speech test material, informal testing may not provide adequate value for the time spent on testing.

One important reason that was consistently stated by respondents was the non-availability of test material in the language used by the client. India is a diverse country with a number of languages spoken across its length and breadth. According to Ethnologue, the number of individual languages listed for India is 461 of which 447 are living. The constitution of India has recognized 22 languages as official languages of the country; however, these are not the only languages spoken by large masses in the country. The 2001 Census of India [33] recorded 29 individual languages as having more than 1 million native speakers. The audiologists participating in the survey listed at least ten languages as languages spoken by clients they encountered in their clinical practice. Further, each of the respondents listed at least three languages commonly used by their clientele. Most respondents stated non-availability of speech perception test material even in the commonly used languages and recommended development of tests in different Indian languages. However, considering that this is a humungous task, a better option might be to develop language-independent tests as recommended by some respondents. Test material is commonly developed by training institutions as a part of dissertations, doctoral studies and research projects. However, these are rarely commercially available, rendering them unavailable to most clinicians working outside of the institutions where the tests have been developed. Some respondents stated that commercially available test material is expensive and unaffordable to most clinics.

Responses suggest that speech perception testing is more commonly carried out for the purpose of assessing the efficacy of the hearing device and not so much as a part of diagnostic test battery to ascertain site of lesion. This could be mainly due to availability of electrophysiological tests that have better sensitivity and specificity in determining site of lesion. Further,

respondents do not conduct speech perception testing in young children (0 to 3 years) as much as they do in older children and adults. Most respondents stated that they conduct speech tests if the clients are verbal. This could be because the tests commonly employed by most respondents include SRT and WRS, which are also reported to be commonly employed in adults and older children who have intelligible speech. For younger children, most respondents commonly use speech awareness threshold, Ling six sound test or various scales such as PEACH and IT-MAIS that can be used by parents to monitor the children's listening to speech stimuli. Less than 50% of the respondents confirmed use of standard test material such as the ESP (adapted), Word lists recommended by ISHA [26], and standard test material developed at academic institutions such as the Marathi Speech Recognition Test [25].

Results reveal considerable variability among respondents with reference to the different aspects of speech testing (e.g. modality used, presentation level, test setting). The preferred practice guidelines do not provide specific recommendation about these aspects. Audiologists conduct testing in the audition only mode, but also use AV mode, commonly for children. Further, not all audiologists present speech stimuli through the audiometer. Informal testing in a quiet room or a sound booth is commonly employed by audiologists, again commonly with children. Presentation level also varies according to the test employed and few audiologists test for normal conversational level as well as soft speech. Presentation level varies between 30 dB HL to 65 dB HL. Most respondents employ a supra-threshold presentation level as they are commonly obtaining Word Recognition Scores using PB word lists. There is also a trend among audiologists to administer speech tests at MCL, commonly with adult clients, as establishing MCL might be difficult with children. Scores obtained by testing at a single level do not generally provide a valid estimate of the client's maximum perceptual abilities. Hence many researchers and clinicians recommend plotting a performance-intensity (PI) function which records performance scores as a function of increasing presentation level [34, 35]. However, none of the respondents in the present survey mentioned use of PI function. Some of the respondents who do not present speech stimuli through the audiometer, test in a sound booth using live voice monitored using a sound level meter. Use of MLV is preferred by 83% of the respondents when testing children, as it provides more flexibility and is less time consuming. Also live voice is more familiar to children than recorded voice. Use of recorded voice is recommended by several authors [6, 36], but MLV has been more popular, especially with children [37].

About 45% of the respondents test the two ears separately and assess ear-specific performance. It is important to ascertain speech perception in each of the ears separately in both, the unaided as well as aided conditions, as it helps in decision making regarding site of lesion, ear to be selected for hearing aid or cochlear implant, ear to be selected for surgery and selection of assistive devices. Most audiologists in the survey reportedly prefer words or closed-set tests as stimuli as opposed to sentences and open-set tests. Closed-set tests have several advantages over open-set tests, shorter administration and recording time being one of the important advantages. This could be the reason why it is preferred by most respondents as more time consumption is one of the reasons cited by the respondents for not conducting speech testing.

Use of competing stimuli or background noise is recommended while testing speech perception in order to simulate daily listening situations and estimate real-life performance more accurately. The survey results indicate that about 45% of the respondents do not conduct speech tests in noise or do it rarely. Several of the respondents test in noise only informally e.g. in a noisy place such as a cafeteria or waiting area, rendering it difficult to ascertain the signal-to-noise ratio during the test. Of the limited respondents who test speech performance in noise using the audiometer, most generally test at 0 dB SNR or positive SNRs up to 20 dB, while few test at negative SNR of -5 dB. Respondents commonly use adapted versions of HINT or SPIN tests for testing performance in noise.

Approximately 75% of the respondents did not feel there is adequate speech perception material for testing children and also felt a strong need for a screening test of speech perception, which will be quick and easy to administer. Respondents also generally find an urgent need for closed-set test material for both children and adults. Approximately 50% of the respondents did not think they will be able to use recorded speech tests, if such tests were developed. The reasons cited were lack of time, unavailability of provision for external input in the audiometer, unavailability of standard sound treated rooms and inability of the clients to pay for the tests.

IMPLICATIONS OF THE STUDY

It is important to evaluate our clinical practices in order to ascertain if they conform to the preferred practice patterns and to thereby identify any gaps in service delivery. The present study is an attempt at understanding the status of current speech perception assessment practices in India. The results of the survey indicate that there are gaps in the clinical practices employed in speech perception assessment. The responses obtained in this survey emphasize the need for a nation-wide clinical protocol for speech perception assessment and also for language independent test material to suit the population across this multi-lingual country. Results of this study may serve as a guideline in developing such a nation-wide protocol.

LIMITATIONS OF THE STUDY

There were several limitations to this survey; the major one being a limited and skewed sample, making it difficult to generalize the results to audiologists across the country. The survey was completed electronically and the audiologists were sent reminder mails and contacted telephonically wherever possible to send in their responses. Those who did not respond after three reminders were not contacted again, due to which the number of respondents is limited. Some questions were left unanswered by the respondents and no effort was made to seek clarification on the unanswered questions. Though the survey sought specific information on the test material used for children and adolescents/adults separately, most respondents did not list material separately. Specific information was also not sought on unaided versus aided speech testing. Efforts also need to be made to obtain information specific to the different work settings in which audiologists practice e.g. private practice versus academic institutions, hospitals versus habilitation centers. On a positive note, this survey can be considered to be the first small scale or pilot survey about speech perception assessment practices employed by audiologists in India.

CONCLUSIONS

The current study provides useful information about the diversity in clinical speech perception assessment among Indian audiologists. Preferred practice patterns are adhered to by respondents placed in academic institutions and established private clinics; however, newer clinics grapple with lack of requisite infrastructure and unavailability of standard test material in the different languages spoken in the country. A common nation-wide protocol may help in improving clinical practices and service delivery.

ACKNOWLEDGEMENTS

The authors would like to thank the Director of AYJNIHH and all the audiologists who participated in the survey.

APPENDIX:

Questionnaire about Speech Perception Assessment

1. Do you conduct speech perception assessment as a part of your routine clinical work?

Always Often Sometimes Rarely Never

2. Which of the following are the reasons for which you employ speech perception testing in your clinic?

- To get information about the problems faced by the listener in everyday communication
- To help in planning goals for listening training
- For monitoring listening skills through the intervention process
- To assess efficacy of the listening device used by the client
- For determining site of lesion
- For establishing hearing aid and cochlear implant candidacy
- For research purposes
- For reasons other than the above (please state)

3. In which of the following populations do you assess speech perception in your clinic?

   - o Children below 3 years of age
   - o Children between 3 and 6 years of age
   - o Children between 6 and 12 years of age
   - o Children above 12 years of age
   - o Children with congenital/pre-lingual hearing impairment
   - o Children with post-lingual hearing impairment
   - o Adults with pre-lingual hearing impairment
   - o Adults with post-lingual hearing impairment

4. Do you conduct speech perception assessment for every client that you see for audiological assessment?

   Yes No (If no, specify for which clients you choose to do it.)

5. What are the languages commonly used by your clients?

6. Which of the following material do you commonly use for speech perception assessment?

   - o Self-made test material for informal assessment (Give examples):
   - o Standard tests for formal assessment (Name few):

7. List the speech perception tests that you use

   a) For children:

   b) For adolescents and adults:

8. How do you normally administer speech perception tests?

   - o Through auditory modality only
   - o Through auditory and visual modality combined
   - o Both of the above

9. When administered through audition only, do you administer speech perception tests through the audiometer?

   Always Often Sometimes Rarely Never

10. At what intensity level do you present speech stimuli if assessing through the audiometer?

11. How do you decide at what intensity level to administer the test?

12. Which ear do you test for speech perception assessment?

   - o Better ear
   - o Poorer ear
   - o Both ears independently (monaural)
   - o Both ears together (binaural)

13. In what setting do you administer the speech perception tests?

Quiet room Sound field Under Headphones

14. How do you present the assessment stimuli for children?

Monitored Live voice Recorded stimuli through CD or tape

15. For your clinical population, what kind of test material do you prefer?

- Words
- Sentences
- Closed-set tests
- Open-set tests

16. Do you assess speech perception in noise?

Always Often Sometimes Rarely Never

17. For assessment in noise what tests and signal-to-noise ratio do you employ?

18. If you have to repeatedly or periodically assess speech perception in children, do you have adequate number of equally difficult tests to use?

Yes May be No

19. Do you think there is a need for screening test of speech perception?

Yes May be No

20. Do you feel the need for standardized test material for assessment of speech perception in children?

Yes May be No

21. Do you feel the need for standardized test material for assessment of speech perception in adolescents and adults?

Yes May be No

22. What test material do you urgently need for speech perception assessment in children?

- Nonsense stimuli
- Closed-set word tests
- Open-set word lists
- Closed-set sentence tests
- Open-set sentence lists

23. What test material do you urgently need for speech perception assessment in adolescents and adults?

- Closed-set word tests
- Open-set word lists
- Closed-set sentence tests
- Open-set sentence lists

24. If recorded tests are developed, will you be able to use them in your routine clinical practice?

Yes May be No

25. Please add any suggestions you may like to provide.

Please provide the following information:

a) Name:

b) Number of years of clinical experience:

c) What kind of setting do you work in?

- Hospital
- Private clinic
- Academic institution
- Cochlear Implant clinic
- Auditory verbal therapy center
- Any other

d) What kind of population do you work with?

- Children
- Adolescents and adults
- Both

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Received on 23-03-2015 Accepted on 04-05-2015 Published on 17-09-2015

DOI: http://dx.doi.org/10.12970/2311-1917.2015.03.02.2