Auditory and Vestibular Research

The Role of Sign Language in Service Delivery for Individuals who are deaf or hard of Hearing: Knowledge, Attitudes, and Practices of Audiologists and Speech Language Pathologists

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Highlights:

- Younger clinicians showed higher knowledge, attitudes, and practices on sign language
- Prior sign-language use strongly improved professional attitudes and practices
- Training gaps highlight need for targeted education in audiology and SLP programs

Abstract

Background and aims: Many parents rely on professionals for information to decide their children's initial communication mode. Although sign language is accessible to all children who are deaf, spoken language remains inaccessible to many. Therefore, providing evidence-based professional counseling is crucial to guiding parents in leveraging this golden window for language acquisition. This study aimed to assess the knowledge, attitudes, and practices (KAP) of professionals regarding sign language.

Method: This cross-sectional study involved 199 audiologists (49.2%) and speech-language pathologists (50.8%) who completed an online KAP questionnaire. The survey assessed three domains of sign language in Individuals who are deaf and hard-of-hearing . The data were analyzed using descriptive and inferential statistics, including multiple linear regression, to identify the factors influencing each domain.

Results: There was a strong positive correlation between KAP ($p<0.001$). Misconceptions, such as the belief that "sign language hinders the speech learning ," were common. Speech-language pathologists demonstrated better performance in using sign language than audiologists ($p<0.001$), and younger practitioners exhibited higher levels of knowledge and practice, suggesting the impact of recent training.

Conclusion: This study showed persistent professional beliefs that sign language may reduce children's motivation to learn speech, overlooking the critical importance of language acquisition during sensitive developmental periods. Since the unbiased attitude of the professional community is influenced by knowledge, enhancing this knowledge base is expected to lead to more effective outcomes regarding the preservation of the golden window for language learning among deaf children.

Keywords: Sign language, knowledge, attitudes, practices, audiologists, speech language pathologists

Introduction:

Hearing loss can significantly disrupt an individual's ability to communicate effectively, potentially leading to difficulties with spoken language as the primary means of communication [1]. These barriers can result in substantial academic, vocational, emotional, and psychosocial challenges [2]. Consequently, individuals who are Deaf or Hard of Hearing (DHH) may require alternative methods of communication to interact with their environment, express their thoughts and emotions, and access educational and vocational opportunities [3, 4]. Furthermore, developmental language disorders observed in Individuals who are DHH compared with their hearing peers can lead to incorrect labeling and subsequent misconceptions that they possess diminished cognitive abilities or exhibit slow cognitive processing [5, 6].

Communication options for Individuals who are DHH are diverse and multifaceted. Families and professionals may select from a spectrum of In recent years, reputable research has demonstrated the high efficacy of spoken language approaches, which aim to maximize residual hearing through technology such as cochlear implants and hearing aids to develop spoken language as the primary mode of communication.However, despite the success of auditory-based interventions for many, Sign language remains a vital and common choice among Individuals who are DHH, playing a critical role in communication and educational development for those for whom spoken language is not fully accessible or preferred [7]. The importance of teaching sign language either as a primary language or alongside spoken language has attracted substantial attention from experts in audiology and speech-language pathology [8]. Consequently, professional efforts are underway to facilitate acceptance and integration into service delivery.

In the prevailing paradigm, language was previously defined as a phenomenon exclusive to auditory and oral systems, with the assumption that real language can only be understood and produced through these modalities. However, Williams's linguistic analysis has critically revised this attitude by introducing visual and manual modalities for perception and production, thus redefining the essential characteristics of language [9]. The presence of all fundamental language components, including syntax, semantics, and pragmatics, within sign languages affirms their status as complete and legitimate languages. Sign language is characterized by a combination of hand shape, position, and movement, which together form a distinctive sign. Crucially, sign language is not a universal phenomenon, and different countries have developed unique sign languages that express different concepts, lexical items, and grammatical structures [9,10].

Research indicates that successful language acquisition whether spoken or signed is the primary facilitator of cognitive development. Sign language provides Individuals who are DHH with a visual-spatial communication modality that actively engages multiple brain regions for information processing. Consequently, early language access through this modality has been linked to enhancements in various cognitive functions including memory, visual processing, attentional control, and problem-solving capabilities [11]. Extensive research underscores the importance of early exposure to language for fostering psychosocial growth and enhanced cognitive abilities. Specifically, studies have indicated that timely sign language acquisition during the critical period can prevent language deprivation and support speech fluency, vocabulary size, and academic achievement in bilingual contexts [12, 13]. Choosing the best educational approach remains a subject of ongoing discussion among specialists in audiology and speech-language pathology. While advocates of Auditory-Verbal and Oral approaches emphasize the benefits of spoken language proficiency for integration into the hearing world, supporters of Sign Language and Bilingual-Bicultural models argue that sign language guarantees complete access to language input, mitigating the risks of incomplete acquisition that can occur with spoken language alone [14, 15]. Thus, key considerations regarding the holistic development of individuals who are deaf involve balancing these perspectives to prevent language deprivation.

Assessing the KAP of professionals involved in the field under study provides valuable information for health decision-makers and policymakers. The importance, rationale, and application of this type of research within the fields of audiology and speech-language pathology have been described in detail in our previous study [16]. KAP studies were originally utilized in the fields of family planning and population studies within healthcare settings. This research approach provides insight not only into the level of knowledge held by participants but also into underlying beliefs and potential misconceptions that may hinder behavioral change related to the topic [16].

Despite the critical role of sign language, research on audiologist and speech-language pathologist knowledge, attitudes, and practices regarding its integration into professional training and clinical practice is limited. For instance, Cripps et al. found that while over 90% of speech-language pathology graduate students recognized American Sign Language (ASL) as a human language, most felt inadequately trained to provide sign language services [17]. Sager investigated the attitudes of audiology students towards deaf culture using the Attitudes about Deafness scale and in-depth interviews. The study found that students who had taken ASL classes were more open to use, but many still preferred spoken language approaches. The findings highlight the need for audiology students to develop a deeper understanding of deaf culture and collaboration with the deaf community [18]. Similarly, Wolderufael revealed that while Ethiopian teachers held positive attitudes toward sign language in education, they faced significant challenges, including a lack of sign language skills, training, and knowledge about teaching students who are DHH [19].

The study of knowledge, attitudes, and practices of specialists in the use of sign language for Individuals who are DHH will enable the identification of existing knowledge and abilities, which will inform decision-making in

educational curricula, selected therapeutic approaches, and the design and provision of technology-based services. This study aimed to investigate the knowledge, attitudes, and practices of audiologists and speech therapists in using sign language for the rehabilitation and education of Individuals who are DHH.

Methods

This study was approved by the Research Ethics Committee of Iran University of Medical Sciences (IUMS), Tehran, Iran (Ethics approval code: IR.IUMS.REC.1402.1185). All participants were informed about the purpose of the study, and written informed consent was obtained prior to participation. Participation was voluntary, and confidentiality and anonymity of the collected data were strictly maintained throughout the study. The study was conducted in accordance with the principles of the Declaration of Helsinki.

This study aimed to assess the KAP of audiologists and speech-language professionals regarding the use of sign language in rehabilitation processes, utilizing the KAP study guidelines in audiology and speech-language pathology [16] and the ChecKAP checklist [20]. The primary objective was to identify barriers and facilitators related to the use of sign language and examine the relationship between knowledge and attitudes toward professional practices.

Population

The target population comprised audiologists and speech-language pathologists (SLP) with clinical experience in working with Individuals who are DHH.

Questionnaire design and development

The development of the questionnaire followed a multistage process. An initial item pool was generated through a targeted literature review of relevant studies complemented by a series of structured expert panel meetings. Item formulation was directly guided by the primary and secondary objectives of the study, and the questions were organized into three sections: knowledge, attitudes, and practices.

For each proposed item, an item specification sheet was prepared during the expert panel sessions, documenting its reference source, relevance to specific study objectives, and the rationale for inclusion. To maximize content coverage, approximately three times the anticipated final number of items was generated. Throughout item drafting, emphasis was placed on clarity, linguistic simplicity, avoidance of bias, and elimination of content that could potentially generate gender, cultural, or religious sensitivity. In this stage, the preliminary questions were evaluated by a panel of ten experts, comprising five audiologists and five speech and language pathologists. The assessment of face and content validity was conducted using the Content Validity Index (CVI) and Content Validity Ratio (CVR), both of which confirmed the adequacy and relevance of the items. At the item level, items with an I-CVI $\geq$0.78 were considered acceptable. Based on Lawshe's method, items with a CVR $\geq$0.62 (for 10 experts) were retained. The overall scale content validity (S-CVI) demonstrated excellent validity.

In the final research team meeting, a consensus was reached on the definitive set of items for each domain, and the response format was formally approved. The final version of the questionnaire consisted of three domains: knowledge (15 items), attitude (15 items), and practice (15 items), comprising a total of 45 items. These items were finalized following expert review and content validity assessment.

In the Knowledge section, a combination of multiple-choice and open-ended questions was employed to assess both general and domain-specific knowledge. The attitude section used a Likert scale, enabling participants to express varying degrees of agreement or disagreement with statements pertaining to sign language. The practice section included both multiple-choice and open-ended items, and focused on the practical application of sign language in the rehabilitation process. This rigorous design process was intended to ensure content validity, minimize measurement bias, and enhance the comprehensiveness of the final instrument. Scoring was conducted separately for the knowledge, attitude, and practice domains, with equal weighting of items within each domain. Closed-ended items were quantitatively scored, while open-ended responses were coded descriptively and analyzed qualitatively. Raw domain scores were used for statistical analyses. Content validity was established using CVI and CVR.

Data collection and analysis

The final version of the questionnaire was uploaded to an online *Porsline* survey platform. Respondents were first required to confirm that they had reviewed the study instructions, and then explicitly provided informed

consent to participate in the survey. After this step, the participants were presented with the demographic information section, followed by the main body of the questionnaire. Completion of all items was mandatory; submission could not be finalized if any field was left unanswered. Upon completion of the data collection, all responses were coded and anonymized to ensure participant confidentiality, and the dataset was subsequently analyzed using SPSS version 17.

Statistical analysis

In this study, continuous variables were expressed as mean ± standard deviation or median (interquartile range, IQR), and categorical variables as number (percentage). Differences in demographic categorical variables between SLPs and AUDs were tested using the chi-square test. Spearman's correlation coefficient was used to examine the relationships between the KAP scores. In the univariable analysis, the relationship of KAP scores with demographic/occupational characteristics was examined using the Mann-Whitney test and Kruskal–Wallis test. In the multivariate analysis, multiple linear regression analyses were used to investigate the factors associated with KAP scores. Data analysis was performed using IBM SPSS Statistics for Windows, version 17.0 (IBM Corp., Armonk, NY, USA), and plots were illustrated using GraphPad Prism, version 8.0.1 (GraphPad Prism Software Inc., San Diego, CA, USA). Statistical significance was set at $p< 0.05$.

Results

Participants' characteristics

A total of 199 participants (50.8% AUDs and 49.2% SLPs were included in the study. Demographic and occupational characteristics (Table 1) revealed significant differences between the two professional groups: SLPs were generally younger, had less overall working experience, less experience with hearing-impaired individuals, and a lower history of using sign language than AUDs ($p<0.001$ for all).

The relationship between KAP scores among all participants is presented in Table 2. Spearman's correlation coefficient was used to assess the associations, revealing strong and statistically significant positive correlations between knowledge and attitude ($r = 0.564$, $p < 0.001$), knowledge and practice ($r = 0.718$, $p < 0.001$), and attitude and practice ($r = 0.673$, $p < 0.001$). Similar significant correlations were found when AUDs and SLPs were analyzed separately (Table 2).

Descriptive statistics for the KAP scores are presented in Table 2. The overall mean knowledge score was 65.7±22.1, attitude score was 52.8±12.5, and practice score was 49.5±20.1. (Table 2).

The univariate analysis revealed several significant associations. Knowledge scores were highest in younger participants (20-30 years), males, and in those with less than 10 years of working experience. Attitude scores were highest in the youngest and oldest age groups (20-30 and >50 years), those with a BSc degree, and participants with experience working with the hearing-impaired or a history of sign language use. Practice scores were highest in the youngest age group, those with a BSc degree, individuals with a history of sign language use, and SLPs compared with AUDs ($p=0.018$) (Table 3).

Multivariable linear regression (Table 4) identified key independent predictors for each domain:

Knowledge: Participants with a PhD scored significantly higher than those with a BSc ($b=13.93$, $p=0.005$). The knowledge scores generally decreased with increasing work experience. Critically, a history of sign language use was a significant positive predictor of knowledge ($b=10.75$, $p=0.004$). The model explained 20.0% of the variance in the knowledge scores ($R^2=0.200$).

Attitude: Attitude scores were lower in participants aged 30-40 years compared to those under 30 years ($b=-5.45$, $p=0.014$), and lower for those with MSc degrees compared to BSc ($b=-3.43$, $p=0.026$). Experience working with hearing impairments significantly predicted higher attitude scores ($b=4.13$, $p=0.046$). Notably, a one-point increase in knowledge was associated with a 0.300 increase in the attitude score ($p<0.001$). This model accounted for 49.0% of the variance in the attitude scores ($R^2=0.490$).

Practice: Participants over 50 years of age showed lower practice scores than those under 30 ($b=-10.99$, $p=0.032$), and MSc degree holders scored lower than BSc degree holders ($b=-4.08$, $p=0.039$). Conversely, those with more than 20 years of experience exhibited higher practice scores ($b=10.03$, $p=0.024$). A history of sign language use was a strong positive predictor of practice ($b=10.95$, $p<0.001$). Importantly, SLPs demonstrated significantly higher practice scores than AUDs ($b=8.83$, $p<0.001$). Both knowledge ($b=0.38$, $p<0.001$) and

attitude (b=0.64, p<0.001) were significant positive predictors of practice scores. This model explained 68.1% of the variance in the practice scores (R^2=0.681).

Discussion

This study investigated the KAP regarding sign language use in Individuals who are DHH among AUDs and SLPs. Our findings enhance the understanding of how these professionals perceive and incorporate sign language into their clinical practice, highlighting significant correlations between KAP scores and various demographic characteristics, as well as clinical experience. The results revealed significant disparities and interrelationships within the KAP scores, providing valuable insights into the current state of professional preparedness in this crucial area. Several demographic factors significantly influenced the KAP scores. Younger professionals (aged 20-30) consistently demonstrated higher knowledge and practice scores, possibly reflecting exposure to more contemporary training methods and curricula emphasizing inclusive practices. The majority of individuals with an undergraduate degree who were under 30 years old reported having received training in sign language, whereas among those over 30, affirmative responses to the question "*Have you received training in sign language?*" were rare. This finding indicates that education has an impact on the attitudes of professionals in this field. Further research is required to confirm this unexpected result. Conversely, the lower attitude scores among 30–40-year-olds warrant further investigation, potentially hinting at the impact of evolving professional standards and the need for continuing education opportunities. More than 70% of individuals under the age of 30 consider sign language an effective means of communication, whereas this percentage is significantly lower in people over 30. This indicates that younger individuals possess more up-to-date knowledge, as recent studies confirm that sign language is indeed an effective communication tool for Individuals who are DHH [21]. Therefore, it is essential to incorporate these topics and the latest related knowledge into the training of professionals to provide optimal support for these clients. This pattern was particularly evident in responses to the question, '*What is the optimal time for receiving sign language training in individuals who are hard of hearing or deaf*?' Despite substantial evidence emphasizing that language acquisition in the early years of life is critical for achieving higher levels of linguistic proficiency, fostering cognitive development, and enhancing academic performance, a considerable proportion of respondents aged over 30 years identified the school-age period as the most appropriate stage for such training.

The significant impact of prior professional experience with the DHH populations, as well as the personal use of sign language in service delivery, on KAP scores is clinically relevant. Direct exposure to sign language and the DHH community fosters deeper understanding and more positive attitudes, ultimately translating into improved professional performance. Notably, these professionals considered the use of sign language to be more important than other specialists for enhancing professional competency and therapeutic skills. Higher knowledge scores and more positive attitudes among therapists with greater experience underscore that providing services to Individuals who are DHH in a language in which the practitioner is proficient combined with prior experience in conducting assessment, therapeutic, or educational sessions leads to better practice. Such experiences enrich the clinician's professional practice, an effect that is reflected in their deeper understanding and a more positive outlook toward this population.

From the perspective of the differences between professionals, although no statistically significant variations were observed between SLPs and AUDs in terms of knowledge and attitude scores, SLPs demonstrated higher practice scores. This tendency may be rooted in the prevailing perspective among SLPs that communication should be taught using any available means and that mastery of one language can facilitate the acquisition of subsequent languages. Such a viewpoint appears to shape their clinical approaches, leading to a greater likelihood of incorporating sign language into therapeutic interventions, actively pursuing sign language learning, and practically recommending its use to families and Individuals who are DHH and their families [22, 23]. The significant positive correlations between knowledge, attitude, and practice scores across both AUDs and SLPs strongly support the hypothesized link between theoretical understanding and practical application. Professionals with greater knowledge demonstrated more positive attitudes and better practices, highlighting the importance of robust training programs focused on sign language competency. This aligns with established educational theories suggesting that knowledge acquisition precedes positive attitudes and ultimately influences behavior [24, 25]. The high R^2 values in the multivariate analysis further emphasize the substantial explanatory power of these relationships, particularly for practice (68.1%), suggesting that interventions aimed at enhancing knowledge may significantly improve practice. These findings underscore the necessity of implementing educational programs

and continuous professional development initiatives aimed at enhancing sign language knowledge, fostering positive attitudes, and improving practices among AUDs and SLPs Integrating hands-on experiences with the deaf community and comprehensive sign language instruction into existing curricula is essential. The demonstrated influence of academic training on awareness and attitude among younger professionals further reinforces this imperative.

Despite the absence of evidence indicating that learning sign language is easier for children than acquiring spoken language and the lack of empirical support for concerns that sign language acquisition may reduce children's motivation to develop speech skills [21], more than half of the respondents strongly agreed with the statement that "*learning sign language makes speech training more difficult*." This apparent discrepancy between empirical evidence and prevailing attitudes highlights the need to examine underlying beliefs about language acquisition in children who are DHH. While bilingualism is considered a cognitive skill and social advantage among the hearing population [13, 21], the assumption that the use of sign language as a first language places Individuals who are DHH at a disadvantage warrants further reflection and understanding the statement that "*using sign language as a first language reduces a child's receptive language abilities*" was also endorsed by more than half of the respondents. This perception persists among professionals in the field, despite studies demonstrating that early acquisition of sign language is associated with enhanced language development, improved neural functioning in receptive brain regions, and the advancement of higher-order cognitive abilities, such as theory of mind and mind-reading, as evidenced by various methodologies, including fMRI [26].

Given that more than 90% of deaf infants are born to hearing parents [27], these parents typically have limited knowledge about sign language and the deaf community. Concerned about their child's perceived inability to communicate with society, they make communication method decisions under the influence of various factors [28]. In the absence of accurate evidence-based counseling, these parents predominantly choose speech-based approaches [21]. This choice is unsurprising when the only two options presented to them are oral communication and sign language ,without adequate explanation from professionals about the critical importance of early language acquisition, regardless of modality, and the consequences of language deprivation.

In response to the question, '*Whose opinion most strongly influences parents when choosing a communication method?"* Physicians ranked first, followed by hearing and speech specialists, with community members and relatives ranking lower. Accordingly, raising awareness among professionals about the option of simultaneous acquisition of both languages and their role in mitigating language deprivation enables them to provide accurate, timely counseling when parents are particularly vulnerable to societal attitudes, fear of social stigma, and unscientific advice from others. Therefore, professionals play a crucial role in correcting these misconceptions by informing parents that sign language is a fully developed natural language and that its use does not preclude spoken language development. Providing accurate, evidence-based information may help parents resist societal pressure and avoid making clinical decisions driven primarily by stigma rather than by the child's best linguistic and developmental interests.

Recognizing that a deaf child who becomes proficient in sign language and a child who develops strong speech, auditory comprehension, and lip-reading skills both experience satisfaction from these achievements underscores that there is no reason to assume that such children, especially those who make good progress, cannot achieve even greater satisfaction and success, as well as dual competence, when exposed to bimodal language input. The COVID-19 pandemic and the use of personal protective equipment such as face masks that obscured visual cues and made speech comprehension difficult even for individuals with typical hearing [29], further highlighted the critical importance of having multiple communication pathways.

The findings of this study confirmed the relationship between knowledge, attitudes, and their impact on professional practice. One of the most important practice-related outcomes is the provision of up-to-date evidence-based information to individuals and their families, which can play a critical role in shaping their decisions and, consequently, the psychological, social, educational, and occupational future of the individual. Encouragingly, within the professional community, knowledge and attitudes consistently demonstrated a strong correlation, suggesting that increasing awareness can directly lead to improved practice. Given that more than half of the respondents indicated their willingness to participate in skill-enhancement courses, if available, the establishment of academic-level training programs, along with professional development workshops, appears to be a necessary step. Such initiatives could substantially reduce the use of educational and therapeutic protocols that prohibit the use of sign language in the education of DHH individuals' practices that contribute to language deprivation and its associated cognitive and social consequences [21]. The difficulty of learning sign language

among clinicians is one of the barriers reported by professionals regarding its integration into clinical approaches. Researchers have sought strategies to address this issue. Numerous studies have examined the effectiveness of advanced technologies in areas related to sign language [30], further strengthening the prospects of overcoming this challenge.

Limitations

Despite the comprehensive efforts of the research team, the response rate was approximately 20% for the target population. Although the respondent group encompassed considerable heterogeneity in geographic distribution, age, and educational attainment, this limitation necessitates a cautious interpretation of the results. Furthermore, the self-reported nature of KAP scores introduces potential response bias. Future longitudinal studies are necessary to track changes in KAP scores over time, assess the effectiveness of interventions, and determine the direction of associations between knowledge, attitude, and practice, given the cross-sectional design limits causal inference. It is also recommended that future studies explore comparative opinions of experts on the use of sign language and other therapeutic approaches.

Conclusion

Children who do not acquire a language within the critical period for language acquisition are at risk of failing to achieve full linguistic competence. Although sign language is accessible to all deaf children spoken language remains unattainable for many deaf infants and children. Therefore, timely evidence-based professional counseling is of paramount importance in guiding parents to make well-informed decisions that capitalize on the critical period for language acquisition. Such professional counseling is highly dependent on the knowledge, attitudes, and experiences of professionals. Findings from this study highlight certain professional attitudes , particularly the perception that exposure to sign language might delay or diminish motivation and capacity for acquiring spoken language. The results also revealed that more than half of the participants expressed interest in attending professional training workshops. Moreover, the observed trend of younger professionals demonstrating higher levels of knowledge, more positive attitudes, and better performance underscores the need to address the educational gaps through targeted academic training and hands-on professional training workshops.

Data availability

The datasets produced in this study were obtained from the corresponding author upon reasonable request.

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Conflicts of interest

The authors declare no conflicts of interest.

Author Contributions: AB and ZM contributed to the design and implementation of the research, analysis of the results and to the writing of the manuscript. FJ conceived the original and supervised the project.

References:

1. Aggarwal K, Ravi R, Yerraguntla K. Impact of Hearing Loss on Social Participation in Children: A Scoping Review. Indian J Otolaryngol Head Neck Surg. 2024 Feb;76(1):804-810. [DOI: 10.1007/s12070-023-04284-1]
2. Gulati S. Language Deprivation Syndrome. In: Glickman NS, Hall WC, editors. Language Deprivation and Deaf Mental Health. 1st ed. New York: Routledge; 2018. p. 24–53.
3. Most T, Aram D, Andorn T . Early Literacy in Children with Hearing Loss: A Comparison Between Two Educational Systems. Volta Rev. 2006;106(1):5-28.
4. Kramer SE. Hearing impairment, work, and vocational enablement. Int J Audiol. 2008 Nov;47 Suppl 2:S124-30. DOI: 10.1080/14992020802310887
5. Wondwosen Mitiku, Bizuhan Balew. Attitude of School Community Towards the Use of Sign Language for Instructional Purpose. International Journal of Research in Social Sciences and Humanities. 2020;10(4):76-86. DOI: http://doi.org/10.37648/ijrssh.v10i04.008
6. Citation: Nazeri A, Mahmoodi-Bakhtiari B, Fathollahzadeh F, Borna A, Azizi M, Mirzakhani N, et al. Metaphor Skills in Deaf and Hard of Hearing Individuals: A Systematic Review. Aud Vestib Res. 2026;35(1):1-17. 10.18502/avr.v35i1.20574
7. Napoli DJ, Mellon NK, Niparko JK, Rathmann C, Mathur G, Humphries T, Handley T, Scambler S, Lantos JD. Should All Deaf Children Learn Sign Language? Pediatrics. 2015 Jul;136(1):170-6. doi: 10.1542/peds.2014-1632. Epub 2015 Jun 15. Erratum in: Pediatrics. 2015 Oct;136(4):781. DOI: 10.1542/peds.2014-1632

8. Bhavna Singh, Amit Kumar Dubey. Deaf Education and Sign Language: Strategies, Challenges, and Benefits. Naveen Int J Multidiscip Sci. 2025;1(3):75–82. DOI: https://doi.org/10.71126/nijms.v1i3.26
9. Alamri G. Teachers' Beliefs and Attitudes about Saudi Arabia Sign Language. [Doctoral Dissertation]. Beaumont, TX: Lamar University; 2017.
10. Bonvillian JD, Lee NK, Loncke FT, Dooley TT. Simplified Signs: A Manual Sign-Communication System for Special Populations, Volume 1. Open Book Publishers; 2020. https://doi.org/10.11647/OBP.0205
11. De Villiers PA. The role of language in theory-of-mind development: What deaf children tell us. In: Astington JW, Baird JA, editors. Why Language Matters for Theory of Mind. Oxford: Oxford University Press. 2005. p. 266-297.
12. Murray JJ, Hall WC, Snoddon K. The Importance of Signed Languages for Deaf Children and Their Families. Hear J. 2020;73(3):30, 32. DOI: 10.1097/01.HJ.0000657988.24659.f3
13. Kushalnagar P, Mathur G, Moreland CJ, Napoli DJ, Osterling W, Padden C, Rathmann C. Infants and children with hearing loss need early language access. J Clin Ethics. 2010 Summer;21(2):143-54.
14. Fitzpatrick EM, Stevens A, Garritty C, Moher D. The effects of sign language on spoken language acquisition in children with hearing loss: a systematic review protocol. Syst Rev. 2013 Dec 6;2:108. DOI: 10.1186/2046-4053-2-108
15. Fitzpatrick EM, Hamel C, Stevens A, Pratt M, Moher D, Doucet SP, Neuss D, Bernstein A, Na E. Sign Language and Spoken Language for Children With Hearing Loss: A Systematic Review. Pediatrics. 2016 Jan;137(1). DOI: 10.1542/peds.2015-1974
16. Mousavi SZ, Fathollahzadeh F, Mahmoodi-Bakhtiari B, Nazari A, Mahmoudian S, Asgari A, Nakhostin Ansari N, Borna A. A Practical Guide for Designing and Conducting Knowledge, Attitude, and Practice Studies Focusing on Audio-Speech Field. Journal of Iranian Medical Council. 2026;9(1):261-70. DOI: https://doi.org/10.18502/jimc.v9i1.20500
17. Cripps JH, Cooper SB, Supalla SJ, Evitts PM. Meeting the Needs of Signers in the Field of Speech and Language Pathology: Some Considerations for Action. Commun Disord Q. 2016;37(2):108–16. https://doi.org/10.1177/1525740115576955
18. Sager NG. Exploring the attitudes and beliefs of audiology students towards people who are deaf or hard of hearing [Dissertation]. University of the Pacific; 2019. ProQuest no. 13809016.
19. Wolderufael WM. Attitude of School Community towards the Use of Sign Language for Instructional Purpose in Bahir Dar, Ethiopia. Eur Online J Nat Soc Sci. 2022;11(4):973–83.
20. Zarei F, Dehghani A, Ratansiri A, Ghaffari M, Raina SK, Halimi A, Rakhshanderou S, Isamel SA, Amiri P, Aminafshar A, Mosavi Jarrahi A. ChecKAP: A Checklist for Reporting a Knowledge, Attitude, and Practice (KAP) Study. Asian Pac J Cancer Prev. 2024 Jul 1;25(7):2573-2577. DOI: 10.31557/APJCP.2024.25.7.2573
21. Humphries T, Kushalnagar P, Mathur G, Napoli DJ, Padden C, Rathmann C, Smith SR. Language acquisition for deaf children: Reducing the harms of zero tolerance to the use of alternative approaches. Harm Reduct J. 2012 Apr 2;9:16. DOI: 10.1186/1477-7517-9-16
22. Secora K, Lee B, Smith D, Coppola M. Expert Consensus on the Role of Speech-Language Pathologists in Working With Deaf Children Who Use American Sign Language in the United States: A Classical e-Delphi Study. Am J Speech Lang Pathol. 2025 May 6;34(3):1219-1255. DOI: 10.1044/2025_AJSLP-24-00298
23. Cottrell CE, Medwetsky L, Boudreault P, Easterling BA. Assessing Audiologists' Exposure, Knowledge, and Attitudes when Working with Individuals Within the Deaf Culture. J Am Acad Audiol. 2021 Jul;32(7):426-432. DOI: 10.1055/s-0041-1729221
24. Bettinghaus EP. Health promotion and the knowledge-attitude-behavior continuum. Prev Med. 1986 Sep;15(5):475-91. DOI: 10.1016/0091-7435(86)90025-3
25. Valente TW, Paredes P, Poppe PR. Matching the message to the process: the relative ordering of knowledge, attitudes, and practices in behavior change research. Hum Commun Res. 1998 Mar;24(3):366-85. DOI: 10.1111/j.1468-2958.1998.tb00421.x
26. Richardson H, Koster-Hale J, Caselli N, Magid R, Benedict R, Olson H, Pyers J, Saxe R. Reduced neural selectivity for mental states in deaf children with delayed exposure to sign language. Nat Commun. 2020 Jun 26;11(1):3246. DOI: 10.1038/s41467-020-17004-y
27. Moores DF. Educating the Deaf: Psychology, Principles, and Practices. Boston: Houghton Mifflin; 2001.
28. Kurtzer-White E, Luterman D. Families and children with hearing loss: grief and coping. Ment Retard Dev Disabil Res Rev. 2003;9(4):232-5. DOI: 10.1002/mrdd.10085
29. Mousavi SZ, Maleki M, Maarefvand M, Borna A. Investigating the Effects of Face Mask on Word Recognition Score Test During the COVID-19 Outbreak: Considerations and Limitations. Journal of Modern Rehabilitation. 2024;18(1):55-61. https://doi.org/10.18502/jmr.v18i1.14729
30. Borna A, Mousavi SZ, Fathollahzadeh F, Nazeri A, Harari RE. Applications of Augmented and Virtual Reality in Enhancing Communication for Individuals Who Are Hard of Hearing: A Systematic Review. Am J Audiol. 2024 Dec 2;33(4):1378-1394. DOI: 10.1044/2024_AJA-24-00056

Table 1. Demographic and occupational characteristics of the participants

	Total (n=199) (%)	Field of study		P
		AUD (n=98) (%)	SLP (n=101) (%)	
Age (y)				<0.001
< 30	62 (31.2)	24 (24.5)	38 (37.6)	
30-40	60 (30.1)	26 (26.5)	34 (33.7)	
40-50	50 (25.1)	24 (24.5)	26 (25.7)	
> 50	27 (13.6)	24 (24.5)	3 (3.0)	
Sex				0.250
Male	75 (37.7)	33 (33.7)	42 (41.6)	
Female	124 (62.3)	65 (66.3)	59 (58.4)	
Education				0.170
BSc	90 (45.2)	40 (40.8)	50 (49.5)	
MSc	83 (41.7)	41 (41.8)	42 (41.6)	
PhD	26 (13.1)	17 (17.3)	9 (8.9)	
Working experience (y)				<0.001
< 10	85 (42.7)	37 (37.8)	48 (47.5)	
20-30	68 (34.2)	24 (24.5)	44 (43.6)	
> 20	46 (23.1)	37 (37.8)	9 (8.9)	
Experience working with the hearing impaired				0.001
No	28 (14.1)	6 (6.1)	22 (21.8)	
Yes	171 (85.9)	92 (93.9)	79 (78.2)	
History of using sign language				<0.001
No	145 (72.9)	57 (58.2)	88 (87.1)	
Yes	54 (27.1)	41 (41.8)	13 (12.9)	
Field of study				
AUD	98 (49.2)			
SLP	101 (50.8)			

Abbreviation. BSc, Bachelor of Science; MSc: Master of Science; PhD: Doctor of Philosophy; SLP: Speech Language Pathology or Pathologist; AUD: Audiologist.
P-values are based on the Chi-square test

Table 2. Descriptive statistics and correlations among study variables in total and by field of study.

Field of study	Range	Mean (SD)	Median [IQR]	Knowledge(**r**)	Attitude (**r**)	Practice(**r**)
Total (n=199)						
Knowledge	5.9 – 100	65.7 (22.1)	70.6 [52.9 - 82.4]	1		
Attitude	11.9 – 76.2	52.8 (12.5)	54.8 [44.0 - 63.1]	0.564	1	
Practice	10.7 – 100	49.5 (20.1)	50.0 [32.1 - 64.3]	0.718	0.673	1
AUD (n=98)						
Knowledge	5.9 – 94.1	63.7 (20.5)	64.7 [52.9 - 76.5]	1		
Attitude	22.6 – 76.2	54.2 (12.6)	56.0 [47.0 - 64.3]	0.537	1	
Practice	10.7 – 100	46.7 (20.6)	46.4 [32.1 - 60.7]	0.641	0.766	1
SLP (n=101)						
Knowledge	5.9 – 100	67.7 (23.6)	70.6 [50.0 - 91.2]	1		
Attitude	11.9 – 75.0	51.5 (12.4)	53.6 [42.9 - 61.9]	0.630	1	
Practice	14.3 – 92.9	52.2 (19.2)	53.6 [39.3 - 67.9]	0.746	0.643	1

Abbreviation: SD, Standard Deviation; IQR: Interquartile Range; SLP: Speech Language Pathologist; AUD: Audiologist.
Correlations were calculated using Spearman's correlation coefficient.
All correlations were significant at 0.001 level ($p<0.001$).

Table 3. Univariable analysis of the relationship of knowledge, attitude, and practice with demographic and occupational characteristics of the participants.

	Knowledge Score		Attitude Score		Practice Score	
	Median (IQR)	**P**	**Median (IQR)**	**P**	**Median (IQR)**	**P**
Age (y)		<0.001		<0.001		0.001
< 30	76.5 [70.6 to 88.2]		58.3 [51.2 to 63.1]		60.7 [49.1 to 67.9]	
30-40	58.8 [42.6 to 76.5]		44.6 [38.1 to 56.0]		42.9 [28.6 to 52.7]	
40-50	64.7 [41.2 to 88.2]		51.2 [45.8 to 61.9]		48.2 [28.6 to 67.9]	
> 50	64.7 [47.1 to 76.5]		65.5 [52.4 to 67.9]		50.0 [39.3 to 64.3]	
Sex		0.036		0.171		0.203
Male	76.5 [52.9 to 88.2]		56.0 [45.2 to 64.3]		53.6 [35.7 to 67.9]	
Female	64.7 [52.9 to 80.9]		52.4 [43.2 to 62.8]		46.4 [29.5 to 64.3]	
Education		0.596		0.026		0.008
BSc	70.6 [52.9 to 82.4]		58.3 [47.3 to 63.4]		51.8 [42.9 to 67.9]	
MSc	64.7 [41.2 to 82.4]		53.6 [38.1 to 59.5]		39.3 [28.6 to 64.3]	
PhD	64.7 [52.9 to 88.2]		51.2 [42.9 to 63.4]		46.4 [25.0 to 64.3]	
Working experience (y)		<0.001		<0.001		0.001
< 10	76.5 [64.7 to 88.2]		58.3 [48.2 to 63.1]		57.1 [46.4 to 67.9]	
10-20	58.8 [42.6 to 76.5]		47.0 [42.0 to 56.0]		42.9 [28.6 to 53.6]	
> 20	64.7 [39.7 to 76.5]		61.9 [43.2 to 67.9]		50.0 [32.1 to 65.2]	
Experience working with the hearing impaired		0.436		0.021		0.803
No	64.7 [52.9 to 76.5]		50.0 [38.4 to 56.0]		48.2 [32.1 to 62.5]	
Yes	70.6 [52.9 to 82.4]		56.0 [45.2 to 63.1]		50.0 [32.1 to 64.3]	
History of using sign language		0.086		<0.001		<0.001
No	64.7 [41.2 to 82.4]		52.4 [41.1 to 59.5]		46.4 [28.6 to 60.7]	
Yes	70.6 [58.8 to 82.4]		63.1 [52.4 to 67.0]		60.7 [50.0 to 78.6]	
Field of study		0.130		0.106		0.018
AUD	64.7 [52.9 to 76.5]		56.0 [47.0 to 64.3]		46.4 [32.1 to 60.7]	
SLP	70.6 [50.0 to 91.2]		53.6 [42.9 to 61.9]		53.6 [39.3 to 67.9]	

Abbreviation. b, Regression Coefficient; CI, Confidence Interval; BSc, Bachelor of Science; MSc, Master of Science; PhD, Doctor of Philosophy; SLP, Speech Language Pathology or Pathologist; AUD, Audiologist

Table 4. Multivariable analysis of the relationship of knowledge, attitude, and practice with demographic and occupational characteristics of the participants.

	Knowledge Score		Attitude Score		Practice Score	
	b* (95% CI)	P	b (95% CI)	P	b (95% CI)	P
Age (y)						
< 30	Ref.		Ref.		Ref.	
30-40	-5.77 (-14.54 to 3.00)	0.196	-5.05 (-9.05 to -1.05)	0.014	2.85 (-2.31 to 8.00)	0.277
40-50	2.88 (-9.02 to 14.79)	0.633	-1.42 (-6.83 to 3.98)	0.605	0.24 (-6.62 to 7.09)	0.945
> 50	5.69 (-11.63 to 23.02)	0.518	5.99 (-1.88 to 13.86)	0.135	-10.99 (-21.03 to -0.96)	0.032
Sex						
Male	Ref.		Ref.		Ref.	
Female	-5.63 (-11.82 to 0.56)	0.074	0.89 (-1.94 to 3.72)	0.535	1.55 (-2.04 to 5.15)	0.395
Education						
BSc	Ref.		Ref.		Ref.	
MSc	2.03 (-4.60 to 8.66)	0.546	-3.43 (-6.44 to -0.42)	0.026	-4.08 (-7.95 to -0.21)	0.039
PhD	13.93 (4.16 to 23.70)	0.005	-3.64 (-8.17 to 0.89)	0.115	-2.42 (-8.19 to 3.36)	0.410
Working experience (y)						
< 10	Ref.		Ref.		Ref.	
20-30	-14.91 (-24.15 to -5.68)	0.002	-0.89 (-5.19 to 3.42)	0.685	-1.11 (-6.57 to 4.34)	0.687
> 20	-22.44 (-37.22 to -7.67)	0.003	-0.15 (-7.02 to 6.71)	0.965	10.03 (1.33 to 18.73)	0.024
Experience working with the hearing impaired						
No	Ref.		Ref.		Ref.	
Yes	3.61 (-5.30 to 12.52)	0.425	4.13 (0.08 to 8.18)	0.046	-3.35 (-8.54 to 1.84)	0.204
History of using sign language						
No	Ref.		Ref.		Ref.	
Yes	10.75 (3.48 to 18.02)	0.004	3.08 (-0.30 to 6.45)	0.074	10.95 (6.64 to 15.26)	<0.001
Field of study						
AUD	Ref.		Ref.		Ref.	
SLP	6.32 (-0.34 to 12.97)	0.063	-0.74 (-3.79 to 2.31)	0.632	8.83 (4.97 to 12.70)	<0.001
Knowledge score			0.30 (0.23 to 0.37)	<0.001	0.38 (0.28 to 0.48)	<0.001
Attitude score					0.64 (0.45 to 0.82)	<0.001
Model Characteristics						
R^2	20.0%		49.0%		68.1%	
Adjusted R^2	15.3%		45.7%		65.9%	

Abbreviation. IQR, Interquartile Range; BSc: Bachelor of Science; MSc: Master of Science; PhD: Doctor of Philosophy; SLP: Speech Language Pathologist; AUD: Audiologist ;Ref: Reference

* Regression coefficient