Volume **100** **e202604023** Received: **8/17/2025** Accepted: **3/16/2026** Published: **4/30/2026**
NARRATIVE REVIEW 16 pages **ONLINE VERSION**

Telemedicine and hearing impairment: communication challenges and tools for inclusive care

Telemedicina y discapacidad auditiva: retos comunicativos y herramientas para una atención inclusiva

AUTHORS

(1) María Paola Lubo López [ORCID: 0000-0003-2828-6883]
(1) Laura Andrea Rojas Arbelaez [ORCID: 0009-0001-2564-684X]
(1) Luisa Fernanda Cabezas Alvis [ORCID: 0000-0003-4683-4994]
(1) Mariana Arias Jiménez [ORCID: 0009-0002-5671-518X]
(2) Erwin Hernando Hernández Rincón [ORCID: 0000-0002-7189-5863]

AFFILIATIONS

(1) Primary Care Physician. Faculty of Medicine. University of La Sabana. CHÍA. COLOMBIA.
(2) Department of Family Medicine and Public Health. Faculty of Medicine. University of La Sabana. CHÍA. COLOMBIA.

FUNDING

Research derived from the MED-341-2023 project (Telehealth in Colombia) of the University of La Sabana, Colombia.

STATEMENT

This research is part of MP Lubo López's Master's thesis in Public Health.

CORRESPONDENCE

Erwin Hernando Hernández Rincón
erwinhr@unisabana.edu.co
Campus del Puente del Común, km. 7. Autopista Norte de Bogotá. Chía. Cundinamarca. Colombia.

Authors declare that there is no conflict of interests

AUTHORSHIP CONTRIBUTIONS

CONCEPTUALIZATION, RESEARCH PLANNING, RESULTS ANALYSIS, PRELIMINARY REPORT, MANUSCRIPT WRITING, FINAL VERSION APPROVAL: MP Lubo López, LA Rojas Arbelaez, LF Cabezas Alvis, M Arias Jiménez, EH Hernández Rincón.

DATA COLLECTION AND ORGANIZATION: MP Lubo López, LA Rojas Arbelaez, LF Cabezas Alvis, M Arias Jiménez.

INVESTIGATION SUPERVISION: EH Hernández Rincón.

SUGGESTED CITATION

Lubo López MP, Rojas Arbelaez LA, Cabezas Alvis LF, Arias Jiménez M, Hernández Rincón EH. Telemedicine and hearing impairment: communication challenges and tools for inclusive care. Rev Esp Salud Pública. 2026; 100: April 30th e202604023.

ABSTRACT

BACKGROUND // Hearing loss is a significant Public Health challenge, with an estimated annual economic impact of 750 billion dollars. It is more critical in low- and middle-income countries, where prevalence is higher and institutional support is limited. The objective of this review was to determine how telemedicine can address the challenges faced by people with hearing impairment and its role as a tool for more inclusive care.

METHODS // A narrative review was conducted in *Science Direct*, *PubMed*, and *Scopus*, including full-text articles published between 2015 and 2025 in English or Spanish, complemented with grey literature and the snowball technique. A total of twent-five studies were analyzed on individuals aged twelve years or older with mild to severe hearing impairment. The narrative synthesis was structured into four thematic categories. Methodological rigor was ensured through the application of *SANRA* criteria.

RESULTS // The main barriers identified were lack of infrastructure, insufficient healthcare personnel training, institutional unawareness, and communication difficulties. The development of mobile applications and digital platforms for assessment, auditory rehabilitation, and clinical interaction was reported. Tele-audiology proved useful in remote areas, conditioned on adequate connectivity, professional training, cultural sensitivity, and appropriate regulatory frameworks.

CONCLUSIONS // Digital technologies represent a promising approach to improve equity in access and quality of hearing care. Their effectiveness depends on inclusive policies, ethical standards, and active collaboration of multidisciplinary teams.

KEYWORDS // Telemedicine; Hearing loss; Accessibility to health services; Remote consultation.

RESUMEN

FUNDAMENTOS // La pérdida auditiva es un desafío importante de Salud Pública, con un impacto económico anual estimado en 750.000 millones de dólares estadounidenses. Es más crítica en países de ingresos bajos y medianos, donde la prevalencia es mayor y el apoyo institucional limitado. El objetivo de esta revisión fue conocer cómo la telemedicina puede responder a los desafíos de las personas con discapacidad auditiva y su papel como herramienta para una atención más inclusiva.

MÉTODOS // Se realizó una revisión narrativa en *Science Direct*, *PubMed* y *Scopus*, incluyendo artículos de texto completo publicados entre 2015 y 2025 en inglés o español, complementada con literatura gris y la técnica de bola de nieve. Se analizaron un total de veinticinco estudios sobre personas de doce años o más con discapacidad auditiva de leve a severa. La síntesis narrativa se estructuró en cuatro categorías temáticas. El rigor metodológico se aseguró mediante la aplicación de los criterios *SANRA*.

RESULTADOS // Se identificaron como principales barreras la falta de infraestructura, la capacitación insuficiente del personal sanitario, el desconocimiento institucional y las dificultades de comunicación. Se reportó el desarrollo de aplicaciones móviles y plataformas digitales para evaluación, rehabilitación auditiva e interacción clínica. La teleaudiología resultó útil en áreas remotas, condicionada a una conectividad adecuada, formación profesional, sensibilidad cultural y marcos regulatorios apropiados.

CONCLUSIONES // Las tecnologías digitales representan una vía prometedora para mejorar la equidad en el acceso y la calidad de la atención auditiva. Su efectividad depende de políticas inclusivas, estándares éticos y la colaboración activa de equipos multidisciplinarios.

PALABRAS CLAVE // Telemedicina; Pérdida auditiva; Accesibilidad a servicios de salud; Consulta remota.

RESP

INTRODUCTION

In recent decades, healthcare systems have advanced in providing inclusive care for people with disabilities, including those with hearing impairments. However, barriers that hinder access to health services still persist (1). Hearing loss, which has affected a considerable proportion of adults worldwide, has made it difficult to understand spoken language and communicate with medical staff. As a result, these individuals have had difficulties understanding medical information that has been conveyed solely verbally, which has been associated with poorer clinical outcomes and reduced well-being and quality of life (2,3).

Feelings of exclusion, frustration, and isolation have been common among people with hearing loss due to insufficiency of resources to meet their communication needs. Therefore, it has been essential to incorporate adaptations in the delivery of healthcare in order to achieve effective communication. Support strategies, defined as tools or adjustments that facilitate the exchange of information, have been recommended to prevent failures and promote accessibility in healthcare settings (2).

In this context, the limited preparation of healthcare professionals to address these communication needs has represented a significant challenge. In the United States, a nationally representative survey coordinated by Massachusetts General Hospital and the University of Massachusetts Boston showed that physicians from seven specialties recognized difficulties in adapting communication with deaf patients or those with significant hearing limitations, attributing them to logistical barriers, costs, and lack of knowledge about available strategies. Consequently, these limitations have favored inadequate practices in outpatient settings, affecting the understanding of diagnoses and treatments, especially among sign language users (4).

In this regard, telemedicine has become a valid alternative to strengthen healthcare delivery, particularly in remote or underserved areas (1,5). In the field of hearing care, it has enabled remote diagnosis, patient education, and follow-up, demonstrating effectiveness in the fitting and maintenance of hearing aids and cochlear implants, thereby supporting its growing role as a strategy within healthcare systems (5).

The objective was to analyze the current literature on the challenges faced by people with hearing disabilities in the context of telemedicine, as well as the communication barriers that have affected clinical practice, and to explore teleconsultation modalities and healthcare tools that have promoted more inclusive and equitable care for this population group.

MATERIAL & METHODS

A narrative review of the literature was conducted using *PubMed*, *ScienceDirect*, and *Scopus* databases. To ensure the replicability of the process, the search strategies used in each database are described below.

In *PubMed*, the following search strategy was used: *((Telemedicine) AND (Hearing Loss)) AND (Health Services Accessibility)*. Filters were applied for the publication period between 2015 and 2025, full-text availability, and English and Spanish language. This search yielded 30 results. In *ScienceDirect*, the following combination was used: *(Telemedicine) AND (Hearing Loss) AND (Health Services Accessibility)*. The search was limited to the period 2015–2025, open access articles, and document types corresponding to review articles and research articles. This strategy produced 198 results. In *Scopus*, the following equation was applied: *(telemedicine) AND (hearing loss) AND (health AND services AND accessibility)*. The search was filtered by the period 2015–2025 and open access documents, yielding 14 results.

To complement the database search, grey literature was identified through the *Google* search engine. Additionally, the snowball technique was applied, understood as the manual review of the reference lists of the articles selected at the end of the screening process, with the aim of identifying additional relevant studies. This secondary search was carried out using the references cited in the articles included after the final review.

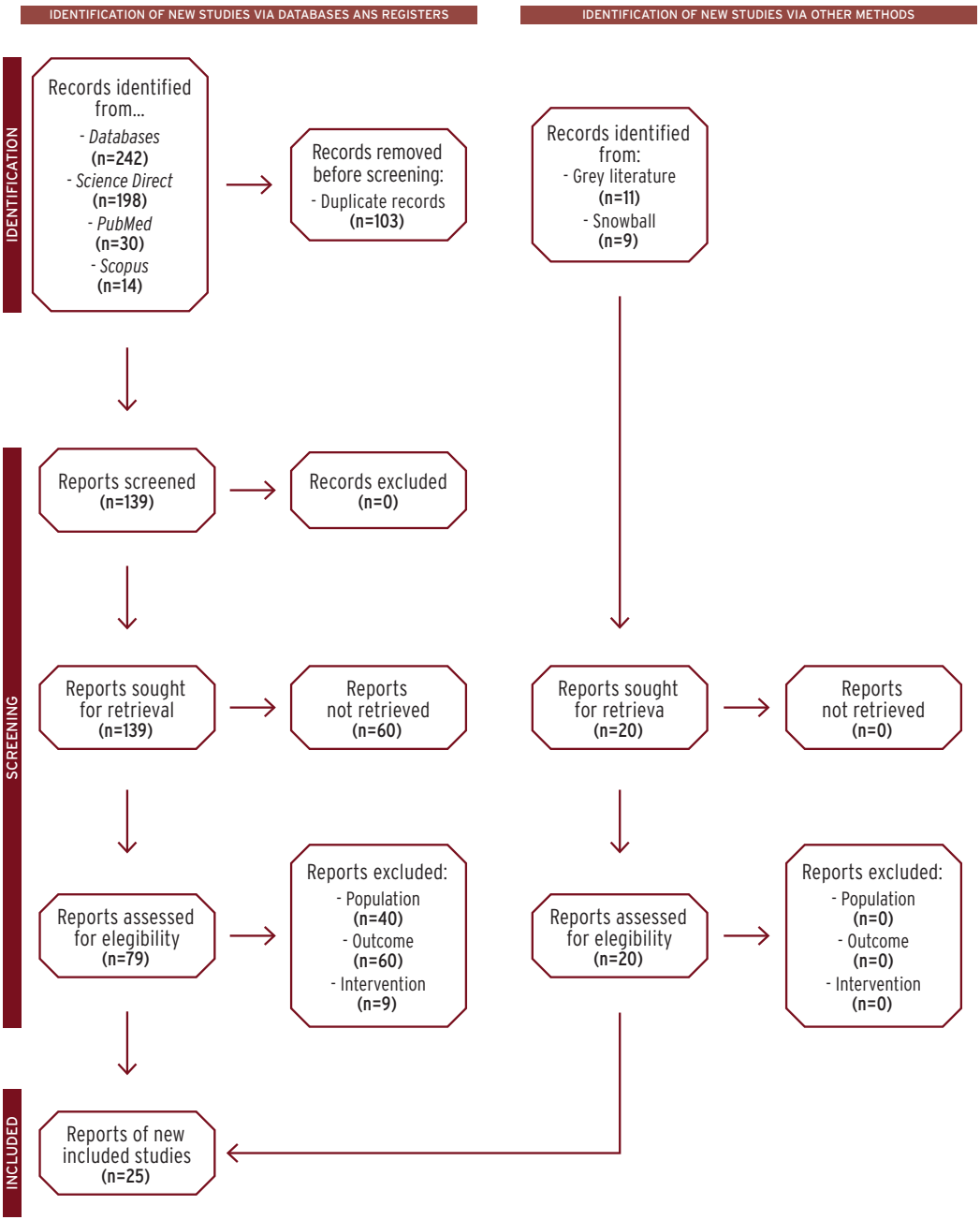
The retrieved records were consolidated in a *Microsoft Excel* spreadsheet, where the complete list of articles identified in the searches was organized. From this file, the selection process was carried out, in which two researchers independently reviewed the titles and abstracts to determine their relevance according to the established criteria. Subsequently, the full texts of potentially relevant studies were reviewed.

Eligible studies were identified from the search conducted between 2015 and 2025, including publications in English and Spanish. Research articles and review articles available in full text were considered. Regarding the population, studies focused on individuals aged 12 years or older with mild to severe hearing disabilities, including hearing loss and deafness, were included. Articles addressing other conditions, such as infectious etiologies, cerumen impaction, foreign bodies, or sudden hearing loss, as well as those limited exclusively to in-person care, were excluded.

A total of 25 studies met the eligibility criteria. The process was summarized in the *PRISMA* 2020 flow diagram **[Figure 1]**. Data were extracted and narratively synthesized according to four thematic categories: (1) Telemedicine and hearing disability: a call for inclusion, (2) Digital barriers and interaction challenges in the care of deaf and hard-of-hearing patients, (3) Technical standards to ensure access to telehealth platforms, and (4) Organization of teleconsultation.

To ensure methodological rigor, this review adhered to the *SANRA* (*Scale for the Assessment of Narrative Review Articles*) criteria **(7)**, which evaluates six fundamental elements: justification of the article's importance, ▶

Figure 1
PRISMA flow diagram illustrating the process of identification, screening, eligibility and inclusion of studies.



Source: Own elaboration.

clarity of the objectives or research questions, description of the literature search, references, scientific reasoning, and data presentation. *SANRA* scale was applied as a guiding tool to strengthen the methodological quality and transparency in the writing of this narrative review. In this regard, it was not used as a criterion for excluding identified studies, but rather as a framework to structure and critically evaluate the scientific consistency of the manuscript.

RESULTS

Before presenting the results in detail, a summary of the sources of the main concepts used in this section is provided in **Table 1.** This organization allows the bibliographic origin of the definitions and conceptual frameworks employed to be clearly identified, ensuring greater transparency and traceability in the construction of the narrative analysis.

Telemedicine and hearing disability: A call for inclusion. Disability refers to long-term physical, mental, intellectual or sensory impairments that, in interaction with various barriers, hinder full participation in society **(8)**. Hearing loss is a type of sensory disability that affects the ability to hear clearly and is defined by an auditory threshold of 20 decibels (dB) or more in both ears. This condition, whether congenital or acquired, affects more than 430 million people worldwide, including 34 million children **(9)**.

Hearing loss can be classified as mild, moderate, moderately severe, severe, profound or complete/deafness, depending on the hearing threshold in the better-hearing ear **[Table 2]**. Individuals with mild to moderate hearing loss may struggle to follow conversations, whereas those with severe or profound hearing loss may not perceive sound unless assistive devices are used. For this reason, clinical solutions must be tailored to the individual **(10,11)**.

Table 1
Sources of the key concepts used in the results.

Concepts	Source
Disability	Pan American Health Organization **(8)**
Hearing loss	World Health Organization **(9)**
Teleaudiology	Eikelboom R *et al.* **(12)**
Teleotoscopy	Thai-Van H *et al.* **(14)** & Coco L *et al.* **(15)**
Teleconsultation	Ministry of Health and Social Protection of Colombia **(28)**
Telesupport	Ministry of Health and Social Protection of Colombiaa **(28)**
eHealth	World Health Organization **(38)**

Source: Own elaboration.

Table 2
Classification of hearing loss.

Classification	Hearing threshold in decibels (dB) of the better-hearing ear	Hearing experience
Mild	20 dB to <35 dB	No difficulty is present when listening to conversational speech, although there may be challenges understanding what is said in noisy environments.
Moderate	35 dB to <50 dB	Difficulty may be present in understanding conversational speech, particularly in noisy environments.
Moderately severe	50 dB to <65 dB	Difficulty is present in understanding conversational speech and in participating in discussions, particularly in noisy environments; however, elevated voices can generally be heard without difficulty.
Severe	65 to <80 dB	Minimal conversational speech sounds are perceived, and difficulty may occur in hearing and understanding elevated voices.
Profound	80 dB to <95 dB	Extreme difficulty is present in hearing elevated voices.
Complete/deafness	≥95 dB	Speech sounds and most environmental noises are not perceived.

Fuente: Own elaboration, modified from information obtained from the World Health Organization and the Pan American Health Organization[10,11].

One of the most essential tools to reach this target population is teleaudiology, which uses digital technology to remotely deliver audiology services, including diagnosis, intervention, and education [12]. It is part of the broader field of telehealth and aims to expand access, particularly in low-resource settings [13]. This approach overcomes traditional barriers of time and location in healthcare delivery and can range from self-screening tools to direct professional interventions [14].

It also enables the use of technologies such as teleotoscopy, which allows the capture and transmission of ear images to remote physician. These images are typically obtained by a *facilitator*, a healthcare professional who provides technical support during the consultation. Their role has been vital in overcoming communication barriers in telehealth environments, especially in sensory care [14,15].

As a result, many countries have incorporated community health workers to support clinical professionals. This model, already implemented in telemedicine, has been extended to hearing screening. These workers perform scree-

nings, provide education, and coordinate care, thus reinforcing community-based preventive programs **(16)**.

One of the key responsibilities of organizations representing this population is to promote understanding of their characteristics, abilities, needs and preferences. This effort goes beyond removing barriers and also involves preventing new obstacles that could limit opportunities and development. In healthcare, accessibility and inclusion must be ensured across all stages of service delivery, from planning and design to implementation, operation and maintenance of healthcare environments **(17)**.

Given this context, healthcare professionals must recognize patients' diverse communication needs by identifying barriers, applying strategies suited to hearing levels, and using assistive technologies when appropriate. Equally important is improving communication, reducing cognitive decline risk, and ensuring equitable access to devices, rehabilitation, and inclusive tools. These measures must follow legal and ethical obligations, ensuring reasonable accommodations that support equitable, person-centered care **(18,19)**.

Digital barriers and interaction challenges in the care of deaf and hard-of-hearing patients. People with hearing disabilities face multiple challenges in accessing telemedicine. Studies show they use these technologies less than people without disabilities. Although barrier-free access is a right recognized by the *United Nations Convention on the Rights of Persons with Disabilities* (2006, ratified by Spain in 2008), significant limitations remain, especially regarding timely and high-quality access through telehealth platforms **(20)**.

As previously mentioned, in developing countries, the availability of resources for the detection and treatment of hearing loss remains limited. Many existing programs rely heavily on external financial and technical support. However, even in developed nations, ensuring effective and accessible healthcare for vulnerable groups, such as those living in rural areas, continues to be a major challenge **(21)**.

People in marginalized conditions, such as individuals with disabilities, older adults, indigenous communities, and those with low literacy, face obstacles accessing telemedicine despite its potential to improve equity. The absence of universal design in digital platforms, which often fail to comply with accessibility standards or information and communication technology (ICT) guidelines, contributes to these barriers. Additionally, the lack of features such as captions or adjustable volumes limits interaction with healthcare professionals, and studies show that prelingually deaf adults use healthcare services less than those who lose hearing later, highlighting cumulative communication barriers **(20,22-24)**.

Cost is another major limitation, particularly in relation to technological devices essential for remote care. Many individuals in these groups have reduced purchasing power, often due to limited access to educational and employment opportunities. Consequently, a significant number are unable to afford the tools needed to participate in virtual consultations **(22)**.

Another critical barrier is the limited number of healthcare professionals trained in accessible communication methods, such as sign language. Most receive little or no instruction on communicating effectively with deaf or hard-of-hearing patients or using interpretation services. To address these gaps, the European Digital Agenda 2020 has promoted broader internet access, digital literacy, and improved accessibility **(22)**.

Cultural and communicative differences can also lead to misunderstandings during remote consultations. For example, many deaf individuals follow distinct social norms, and being excluded from interaction during interpretation may be perceived as disrespectful. Furthermore, facial expressions, which are essential in sign language, are often not clearly visible on a camera and can distort meaning and lead to misinterpretation **(24)**.

Technical issues, such as unstable connections, interfere with both audio and video quality, affecting lip reading and sign interpretation. The absence of features such as real-time captioning, text-based messaging, or microphone enhancements further limits accessibility. Background noise, music, and small screens also compromise communication. Many platforms lack the ability to request accommodations, schedule appointments via text, or support assistive tools such as hearing loops and accurate subtitles **(22)**.

In addition to these individual-level issues, structural barriers across four dimensions have been identified: technological (poor coverage, lack of interoperability and complex digital solutions), organizational (outdated care models and unclear professional roles), human (resistance to change and lack of emotional engagement with telemedicine), and economic (insufficient funding and sustainability in small or middle-sized centers, as telehealth is often not officially included in service portfolios) **(25)**.

The challenges in implementing equitable telemedicine extend beyond technological limitations, encompassing privacy and security concerns, weaker patient–provider interactions, and unresolved ethical, cultural, and administrative issues. Negative perceptions of telehealth shared by patients, caregivers, and providers are often linked to connectivity problems, while additional barriers such as billing difficulties, reimbursement issues, and inconsistent labor and health policies further hinder effective access for people with hearing disabilities **(26)**.

Technical standards to ensure accessibility in telehealth platforms. Since the expansion of telehealth during the COVID-19 pandemic, various barriers have been identified that limit access for people with disabilities. In response, the World Health Organization (WHO) and the International Telecommunication Union (ITU) developed a global accessibility standard outlining technical requirements to ensure inclusion within these platforms. This standard may be adopted as an official or voluntary guideline by healthcare professionals and technology manufacturers, as shown in **Table 3** **(22)**.

When planning telehealth services, it is essential to implement strategies that promote the participation of this population, including access to scheduling, documentation of individual needs, information exchange, accessi-

Table 3
Accessibility requirements in telehealth platforms.

Accessibility requirements	Description
Subtitles and chat box	Video conferences should offer captions and a monitored chat box with volume control options in separate windows.
	There are closed captioning applications such as *Google Live*, which allows the sender's voice to be converted into direct text, as well as programs such as *Google Meet* and *Microsoft Teams* that allow captioning in the chat.
Text messaging	Must be available as an alternative when video or audio does not work properly.
	It is necessary to allow text communication between patients and providers.
Remote interpretation system	A remote sign language interpreting service or video remote interpreting (VRI) system should be implemented and offered.
Subtitles in videos	Videos on telehealth platforms should include clear captions, with a large font and no background music to improve comprehension.
Suitable screen	The screen used must be large enough to allow lip reading.

Source: Adapted by the authors based on the World Health Organization, the International Telecommunication Union and Abou-Abdallah M *et al.*[22,27]

ble communication, and professional training **[Table 4]**[22].

Organization of teleconsultation. Teleconsultation involves health-related activities conducted remotely through information and communication technologies. It encompasses telemedicine, tele-education (including health promotion, prevention, diagnosis, treatment, rehabilitation and palliative care) and tele-support, which refers to assistance provided by one healthcare professional to another via such technologies[28].

For effective teleconsultation, it is essential to consider several factors, including the patient's medical condition such as the degree of hearing loss (mild, moderate or severe), the use of assistive devices or the presence of deafblindness, as well as sociodemographic aspects like living in rural or urban areas which can affect internet connectivity. The type of device used (cell phone, computer or tablet) also plays a crucial role and assessing whether the patient will be accompanied during the consultation can further facilitate communication and support[27].

Communication between users and healthcare professionals through technological tools must meet specific requirements, starting with user autho- ▶

Table 4
Strategies for inclusion in Telehealth services.

Implementation strategies	Description
Access to programming	Enable accessible methods for scheduling appointments, such as e-mail, text messaging and online systems.
Duration of consultations	Ensure adequate time to meet the specific needs of this population group.
Requirements register	Design a clear process for identifying and documenting disability-related needs, highlighting them in administrative systems to facilitate their consideration.
Exchange of information	Share these requirements within the care team, with the patient's consent, respecting privacy regulations.
Accessible communication	Provide information tailored to patient preferences, ensuring patient understanding.
Professional training	Train staff in the use of telehealth technologies to communicate appropriately with people with disabilities.

Source: Adapted by the authors based on information from the World Health Organization and the International Telecommunication Union[22].

rization and the ability to identify the healthcare provider at the beginning of the interaction. If artificial intelligence is used this must be disclosed, and it is essential to safeguard the user's identity, ensure confidentiality and handle personal data securely[28]. The purpose of remote consultation is to provide diagnosis or treatment through electronic means[29].

To improve interaction during teleconsultation, healthcare professionals can use the *AEIOU* guide **[Table 5]**, a tool made up of five key elements that facilitate communication with patients experiencing hearing loss.

Moreover, to plan an effective teleconsultation providers must have basic technological knowledge, understand the limitations of the virtual format and recognize when an in-person consultation is preferable. It is also necessary to identify the methods and locations for connection, the institutions offering the service and the required hardware and software. Although many platforms are available most share similar functions and are user friendly[29].

Once the methods, institutions, and tools are defined, having the technical resources to ensure high-quality teleconsultation is essential. This includes fast and stable internet connections such as ADSL, fiber optics, or 4G, a computer with a good camera and microphone, and basic knowledge of platforms like *Zoom, Skype, Webex, MS*

Table 5
AEIOU guide for communicating with patients with hearing loss.

Letter	Objective	Key points
Ask	The health professional seeks to determine the type of communication that is most appropriate for the patient.	• General condition • Pathological history • Language • Preferred form of communication
Environment	Ensuring a suitable environment for consultation.	• Background noise • Correct identification of the health professional's face • Availability of assistive devices or displays
Interaction	Evaluating and adjusting the way information is communicated.	**Type of communication:** • Use of captioning • Interpreter or sign language **Clarity of speech:** • Avoiding speaking in a very high or low pitched voice as this can distort the sound • Vocalization speed should be neither too slow nor too fast
Outline	Define and present the support tool or resource.	• Applications or platforms that are correctly adapted to the patient's condition • Explain in a clear way how to use this tool
Understanding	Verify that the patient has understood and, if necessary, reinforce the information.	• Ask the patient to repeat or paraphrase what has been explained • Rephrase or expand the explanation if there are doubts

Source: Own elaboration based on Abou-Abdallah M *et al.*[27]

Teams or *FaceTime*. It is also advisable to select a reliable internet provider that ensures sufficient bandwidth and avoids interruptions [29].

To ensure continuity during the consultation it is recommended to have a backup device in case of technical failure and to close other applications that may consume bandwidth. Teleconsultation can help assess patients and prevent unnecessary emergency visits, which is especially useful for follow-up of those who do not require in-person care. However, depending on available infrastructure, some services cannot be adequately delivered via video calls. Therefore, current guidelines recom-

mend reserving face-to-face consultations for situations that truly require them [30,31].

In this context, it is essential to integrate in-person care with telemedicine, ensuring that technological advancements are applied safely and effectively. Proper use of these tools, particularly in the follow-up of chronic diseases, contributes to optimizing healthcare resources without compromising the quality, efficiency, or confidentiality of the service [32].

DISCUSSION

The results show that hearing loss constitutes a highly prevalent global public health problem, with varying degrees of severity that require individualized interventions. In this context, teleaudiology and teleconsultation have emerged as tools with the potential to expand access and reduce geographic and structural barriers; however, their implementation faces technological, economic, organizational, and communication limitations that particularly affect this population.

These difficulties not only have clinical and social implications but also large-scale economic consequences. Hearing loss generates an estimated global economic cost of 750 billion US dollars per year. Public health support remains limited, especially in low- and middle-income countries, where prevalence is high and resources are scarce and unevenly distributed [33]. Care for people with hearing disabilities is also affected by communication barriers, limited access, and lack of understanding, which negatively impacts the quality and continuity of care [34].

Given the burden of hearing loss on public health, exploring ways to reach underserved populations is essential. Its integration into public policy remains limited; in 2014, only 32 mostly high- or upper-middle-income countries had governmental strategies. Barriers such as limited awareness, few specialists, and scarce access to assistive technologies [35,36] reinforce stigma, limit resources, and discourage care seeking. Without interpreters, sign language tools, or strategies to address discrimination, patients risk exclusion from healthcare [34].

To reduce these inequities, a multidisciplinary approach with telemedicine as a key component is needed. Providing care in remote areas can be challenging, but increasing mobile phone and internet access offers new opportunities. Hearing screening tools via mobile devices can benefit populations in developing countries and isolated regions of high-income nations. Moreover, high-resolution video conferencing through phones, tablets, and other devices provides a viable option for hearing care [5].

A successful example is found in Alaska, where since 1968 a community-based model has improved access to hearing healthcare in remote areas. Trained health aides deliver care across over 250 rural clinics with support from specialists via telemedicine. These aides conduct hearing assessments and transmit results to audiologists, who determine management from local treatment to referrals to higher-complexity hospitals. Recently, a school-based hearing screening program using mobile technology was also incorporated [16].

Assessing the legal and regulatory challenges of these services, as well as infrastructure requirements, is equally important. Factors such as space, internet networks, equipment, software, human resources, and partnerships with remote community stakeholders are essential for proper implementation. Pilot projects may be needed to ensure feasibility and acceptability of remote hearing care to ensure high-quality care for the most vulnerable populations **(35)**.

Therefore, for telemedicine to be effective, it must meet a clear need and adopt a patient-centered approach with structured management and political commitment. National digital health strategies with key stakeholders should guide implementation. Collaboration with scientific and healthcare organizations is essential, considering cultural aspects and population needs. Technologies must be functional, accessible and interoperable, with proper reimbursement, quality standards and regulatory frameworks for ethics, privacy, and data security **(37)**.

Over time, technological advances have transformed healthcare, giving rise to *eHealth*, defined by the WHO as the safe and cost-effective use of information and communication technologies to support health services. Paglialonga *et al*. (2015) examined hearing health apps, classifying them into screening and assessment (17%), intervention and rehabilitation (52%), education and information (24%), and assistive tools (7%). These apps range from basic hearing tests to support services such as captioning and call transcription, used by both healthcare professionals and individuals with hearing loss **(38)**.

Renda *et al*. (2016) also assessed the accuracy of a smartphone-based hearing application for identifying hearing loss. The results showed a high level of agreement with standard pure-tone audiograms, indicating that hearing tests via smartphones could be a valid alternative for identifying hearing loss in rural or peripheral areas **(39)**.

Microsoft Teams is described by Cortés D *et al*. (2022) as a tool implemented during the COVID-19 pandemic that incorporates accessibility features useful for people with hearing disabilities, such as automatic captions, presentation translation, and mono audio **(40)**. Although it was not specifically designed for telemedicine and does not guarantee compliance with healthcare regulatory standards, it is included in this review as an example of how certain videoconferencing platforms, used circumstantially during the public health emergency, may facilitate communicative inclusion without replacing formal remote healthcare systems **(40)**.

Therefore, the integration of digital tools such as telemedicine, mobile applications, and inclusive platforms reduces inequalities in healthcare access for people with hearing loss, an important public health problem. Effective management requires government support, adequate infrastructure, and a patient-centered approach that addresses cultural, technological, and communication factors. Assistive technologies facilitate detection, diagnosis, and remote monitoring, if they are secure and adaptable **(38-40)**.

Based on the findings identified, this narrative review proposes projections for the development of public

health policies, programs, and research aimed at improving the accessibility of telemedicine for people with hearing disabilities. In this respect, the importance of strengthening social participation is highlighted through the inclusion of the deaf community, their families, and representative organizations in the design, implementation, and evaluation of these services. This involves promoting the co-design of accessible platforms, piloting teleconsultation services, and defining user-centered quality criteria, since the absence of these processes may lead to the underuse or failure of interventions. Likewise, it is essential to incorporate monitoring and evaluation mechanisms that allow the identification of communication barriers, the analysis of platform accessibility, and the strengthening of healthcare professionals' training in inclusive communication.

On the other hand, this review presents some limitations that should be considered when interpreting the results. The available evidence on telemedicine in populations with hearing disabilities remains limited and heterogeneous, which makes it difficult to establish direct comparisons between contexts, types of interventions, and reported outcomes. Additionally, several of the analyzed studies were conducted in specific settings or within healthcare systems with particular characteristics, which may limit the generalizability of the findings to other contexts. This situation is particularly relevant in low- and middle-income countries, where gaps in digital infrastructure, healthcare workforce training, and access to communication technologies persist and may influence the effective implementation of telemedicine.

In conclusion, technological advances have expanded telemedicine in hearing care, providing tools for intervention, rehabilitation and education. Mobile applications and platforms improve access, especially in rural areas, consolidating their clinical role. Sustainability requires inclusive policies, regulatory frameworks and professional training. Digital equity, accessibility, data security and community involvement are essential for patient-centered care addressing cultural and communicative needs.

REFERENCES

1. Swanepoel D, Clark JL. *Hearing healthcare in remote or resource-constrained environments.* J Laryngol Otol. 2019;133(1):11-7. *https://doi.org/10.1017/S0022215118001159*

2. Garcia AC, Arabi A, Croteau C, De Lacerda ABM. *Enhancing communication in healthcare: Supports for interactions between adults with hearing loss and healthcare providers.* PLoS One. 2025;20(2):e0308592. *https://doi.org/10.1371/journal.pone.0308592*

3. Stevens MN, Dubno JR, Wallhagen MI, Tucci DL. *Communication and healthcare: Self-reports of people with hearing loss in primary care settings.* Clin Gerontol. 2019;42(5):485-494. *https://doi.org/10.1080/07317115.2018.1453908*

4. Iezzoni LI, Rao SR, Ressalam J, Bolcic-Jankovic D. *Accommodating hearing loss in outpatient physician offices in the U.S.* Disabil Health J. 2023;16(1):101397. *https://doi.org/10.1016/j.dhjo.2022.101397*

5. Bush ML, Thompson R, Irungu C, Ayugi J. *The role of telemedicine in auditory rehabilitation: A systematic review.* Otol Neurotol. 2016;37(10):1466–74. *doi: https://doi.org/10.1097/MAO.0000000000001236*

6. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. *Rayyan-a web and mobile app for systematic reviews.* Syst Rev. 2016;5(1):210. *https://doi.org/10.1186/s13643-016-0384-4*

7. Baethge C, Goldbeck-Wood S, Mertens S. *SANRA-a scale for the quality assessment of narrative review articles.* Res Integr Peer Rev. 2019;4:5. *https://doi.org/10.1186/s41073-019-0064-8*

8. Organización Panamericana de la Salud. *Discapacidad*. Washington, D.C.: PAHO. *https://www.paho.org/es/temas/discapacidad*

9. Organización Mundial de la Salud. *Sordera y pérdida de la audición.* Ginebra: OMS. *https://www.who.int/es/news-room/fact-sheets/detail/deafness-and-hearing-loss*

10. Organización Mundial de la Salud. *Cuidado del oído y la audición en la atención primaria: manual de capacitación 2024*. Ginebra: OMS; 2024. *https://doi.org/10.37774/9789275328361*

11. Organización Mundial de la Salud. *Manual básico de cuidado del oído y la audición.* Ginebra: OMS; 2020. *https://apps.who.int/iris/bitstream/handle/10665/331279/9789240002258-spa.pdf*

12. Eikelboom R, Bennett R, Brennan M. *Tele-Audiology: An Opportunity For Expansion Of Hearing Healthcare Services In Australia.* Perth: Ear Science Institute Australia; 2021 Apr 8. *https://www.earscience.org.au/2021/04/08/tele-audiology-an-opportunity-for-expansion-of-hearing-healthcare-services-in-australia/*

13. Khoza-Shangase K, Moroe N. *South African hearing conservation programmes in the context of tele-audiology: A scoping review.* S Afr J Commun Disord. 2020;67(2):e1-10. *https://doi.org/10.4102/sajcdv6712.670*

14. Thai-Van H, Bakhos D, Bouccara D, Loundon N, Marx M, Mom T *et al. Telemedicine in audiology.* Eur Ann Otorhinolaryngol Head Neck Dis. 2021;138(5):363-375. *https://doi.org/10.1016/j.anorl.2020.10.007*

15. Coco L, Davidson A, Marrone N. *The role of patient-site facilitators in teleaudiology: A scoping review.* Am J Audiol. 2020;29(3S):661-675. *https://doi.org/10.1044/2020_AJA-19-00070*

16. Suen JJ, Bhatnagar K, Emmett SD, Marrone N, Kleindienst Robler S, Swanepoel DW *et al. Hearing care across the life course provided in the community.* Bull World Health Organ. 2019;97(10):681-690. *doi: https://doi.org/10.2471/BLT.18.227371*

17. International Federation of Hard of Hearing People. *Accessibility guidelines: IFHOH position paper.* Copenhagen: IFHOH; 2021. *https://www.efhoh.org/wp-content/uploads/2021/04/Accessibility-Guidelines-IFHOH-Position-Paper-1-1.pdf*

18. Organización Mundial de la Salud. *Prevención primaria y atención integrada de las deficiencias sensoriales.* Ginebra: OMS; 2025. *https://apps.who.int/gb/ebwha/pdf_files/WHA78/A78_R7-sp.pdf*

19. Yabe M. *Healthcare providers' and deaf patients' interpreting preferences for critical care and non-critical care: Video remote interpreting.* Disabil Health J. 2020;13(2):100870. *https://doi.org/10.1016/j.dhjo.2019.100870*

20. Kuenburg A, Fellinger P, Fellinger J. *Health Care Access Among Deaf People.* J Deaf Stud Deaf Educ. 2016;21(1):1-10. *https://doi.org/10.1093/deafed/env042*

21. García-Prieto V. *La alfabetización digital para personas con discapacidad: un enfoque mediático*. En: *Actas del I Congreso Internacio-*

nal Comunicación y Pensamiento. Comunicracia y desarrollo social. Sevilla: Egregius; 2016. p. 1223-1239. *http://hdl.handle.net/11441/51489*

22. World Health Organization, International Telecommunication Union. *WHO-ITU global standard for accessibility of telehealth services*. Geneva: WHO; 2022. *https://www.who.int/publications/i/item/9789240050464*

23. World Health Organization, International Telecommunication Union. *Implementation toolkit for accessible telehealth services*. Geneva: WHO; 2024. *https://iris.who.int/handle/10665/378483*

24. Pratt S. *Profound Hearing Loss: Addressing Barriers to Hearing Healthcare*. Semin Hear. 2018 Oct;39(4):428-436. *doi: https://doi.org/10.1055/s-0038-1670708*

25. Tao K, Brennan-Jones C, Capobianco-Fava D, Jayakody DMP, Bennett RJ, Eikelboom RH *et al. Teleaudiology services for rehabilitation with hearing aids in adults: a systematic review*. J Speech Lang Hear Res. 2018 Jul;61(7):1831-1849. *https://doi.org/10.1044/2018_JSLHR-H-16-0397*

26. Rettinger L, Kuhn S. *Barriers to Video Call-Based Telehealth in Allied Health Professions and Nursing: Scoping Review and Mapping Process*. J Med Internet Res. 2023 Feb 22;25:e45475. *http://dx.doi.org/10.2196/46715*

27. Abou-Abdallah M, Lamyman A. *Exploring Communication Difficulties with Deaf Patients*. Clin Med (Lond). 2021 Jul;21(4):e377-382. *https://doi.org/10.7861/clinmed.2021-011*

28. Ministerio de Salud y Protección Social. *Resolución 2654 de 2019*. Bogotá: Ministerio de Salud y Protección Social; 2019. *Disponible en: https://www.minsalud.gov.co/Normatividad_Nuevo/Resoluci%C3%B3n%20No.%202654%20del%202019.pdf*

29. McCarthy M, Leigh G, Arthur-Kelly M. *Telepractice delivery of family-centred early intervention for children who are deaf or hard of hearing: a scoping review*. J Telemed Telecare. 2019 May;25(4):249-260. *https://doi.org/10.1177/1357633X18755883*

30. Organización Panamericana de la Salud. *La COVID-19 y la prestación de servicios de salud esenciales en el primer nivel de atención*. Washington, D.C.: OPS; 2023. *Disponible en: https://iris.paho.org/handle/10665.2/57768*

31. World Health Organization. *Recommendations on digital interventions for health system strengthening*. Geneva: WHO; 2019. *Disponible en: https://www.who.int/publications/i/item/9789241550505*

32. Besio MR, Arriagada A, Bernier-Villarroel L, Bórquez-Estefó G, Micolich C, Misseroni-Raddatz A *et al. Teleconsulta médica. Análisis y recomendaciones del Departamento de Ética del Colegio Médico de Chile*. Rev Méd Chile. 2021 Nov;149(11):1614-1619. *https://doi.org/10.4067/S0034-98872021001101161*

33. Swanepoel DW, De Sousa KC, Smits C, Moore DR. *Mobile applications to detect hearing impairment: opportunities and challenges*. Bull World Health Organ. 2019 Oct 1;97(10):717-718. *https://doi.org/10.2471/blt.18.227728*

34. Fuentes Chiquito AR, Vázquez Velázquez N, Gutiérrez Velázquez AS, Flores Raygoza BF, Tenorio Martínez H, Vivero Acosta E *et al. Experiencia vivida de las personas con discapacidad auditiva durante la atención sanitaria*. Rev Cienc Salud. 2024 Sep 9;22(3):1.14. *https://doi.org/10.12804/revistas.urosario.edu.co/revsalud/a.13287*

35. Bush ML, Sprang R. *Management of hearing loss through telemedicine*. JAMA Otolaryngol Head Neck Surg. 2019 Feb 1;145(2):204. *doi: https://doi.org/10.1001/jamaoto.2018.3885*

36. World Health Organization. *Addressing the rising prevalence of hearing loss*. Geneva: WHO; 2018. *Disponible en: http://apps.who.int/iris/bitstream/handle/10665/260336/9789241550260-eng.pdf*

37. *Informe mundial sobre la audición*. Washington, D.C.: Organización Panamericana de la Salud; 2021. *https://doi.org/10.37774/9789275324677*

38. Paglialonga A, Tognola G, Pinciroli F. *Apps for hearing science and care*. American Journal of Audiology. 2015;24(3):293-298. *https://doi.org/10.1044/2015_AJA-14-009*

39. Renda L, Tarik O, Eyigör H, Osma U *et al. Smartphone based audiometric test for confirming the level of hearing; is it usable in underserved areas?* J Int Adv Otol. 2016 Jan;12(1):6-66. *https://doi.org/10.5152/iao.2016.1421*

40. Cortés Coss DE, Cortés Coss A. *Análisis y valoración de la plataforma MS Teams en atención a estudiantes universitarios con discapacidad auditiva: estrategia digital adoptada durante el confinamiento por la Covid-19*. IE Revista de Investigación Educativa de la REDIECH. 2022;13:e1419. *https://doi.org/10.33010/ie_rie_rediech.v13i0.1419*