





The evolution of e-audiology in Brazil and in the world: an integrative review

A evolução da e-audiologia no Brasil
e no mundo: uma revisão integrativa

La evolución de la e-audiología en Brasil
y en el mundo: una revisión integrativa

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Abstract

Introduction: The terms ‘e-audiology’, ‘teleaudiology’, ‘telepractice in audiology’ and variations, have one feature in common: technological advances in audiology. **Objective:** The study seeks to evaluate the evolution and developments of audiology in a remote model in Brazil compared to other countries, as well as the advantages and adversities provided by this model. **Method:** An integrative review was carried out by searching and analyzing publications available in the databases: Taylor & Francis Online, PubMed, Scielo, Thieme, ASHAWire and Academia.edu, between November 2020 and February 2021, in Brazilian Portuguese and English. The search words were: *e-audiologia*, e-audiology, *teleaudiologia*, teleaudiology, *telessaúde em audiolgia*, telehealth in audiology, *teleprática em audiolgia*, telepractice in audiology. Articles published free of charge addressing audiology in a remote model were considered without limits to the year of publication. **Results:** 987 articles were found, but only 79 were selected for analysis in this review. The number of publications has increased over the past 5 years and Brazil, compared to other countries, has shown a good level of development in research in the field of teleaudiology. **Conclusion:** There is no doubt that teleaudiology already has a significant and positive impact as a model of audiological performance and, as in all evolution, e-audiology has been offering even greater opportunities for its users. Insecurity and uncertainty have been losing ground for research and updates in the field around the world and even with some barriers to be faced, their growth has enabled access, autonomy, financial savings and quality.

Keywords: eHealth; Telehealth; Audiology; Telemedicine.

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Authors’ contributions:

SVP: Study design; Methodology; Data gathering; Article Outline; Article writing; Critical review; Translation.

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Received: 17/10/2021

Accepted: 11/10/2022



Resumo

Introdução: Os termos ‘e-audiologia’, ‘teleaudiologia’, ‘teleprática em audiologia’ e variações, possuem uma característica em comum: avanços tecnológicos na audiologia. **Objetivo:** O estudo busca avaliar a evolução e desdobramentos da audiologia em modelo remoto no Brasil em comparação a outros países, assim como as vantagens e adversidades proporcionadas por este modelo. **Método:** Uma revisão integrativa foi realizada por meio de busca e análise de publicações disponíveis nas bases de dados *Taylor & Francis Online*, *PubMed*, *Scielo*, *Thieme*, *ASHAWire* e *Academia.edu*, entre novembro de 2020 e fevereiro de 2021, nos idiomas português brasileiro e inglês. Os termos de busca foram: e-audiologia, *e-audiology*, teleaudiologia, *teleaudiology*, telessaúde em audiologia, *telehealth in audiology*, teleprática em audiologia, *telepractice in audiology*. Foram considerados artigos publicados de forma gratuita abordando a audiologia em modelo remoto, sem limites ao ano de publicação. **Resultados:** Foram encontrados 987 artigos, mas apenas 79 foram selecionados para análise na presente revisão. O número de publicações apresentou um aumento nos últimos 5 anos e o Brasil, em comparação a outros países, mostrou bom nível de desenvolvimento em pesquisas na área da teleaudiologia. **Conclusão:** Não há dúvidas de que a teleaudiologia já possui um impacto significativo e positivo como modelo de atuação audiológica e, assim como em toda evolução, a e-audiologia vem oferecendo, ainda, maiores oportunidades para seus usuários. A insegurança e a incerteza vêm perdendo espaço para pesquisas e atualizações no campo ao redor do mundo, e, mesmo com algumas barreiras a serem enfrentadas, seu crescimento tem possibilitado acesso, autonomia, economia financeira e qualidade.

Palavras-chave: e-Saúde; Telessaúde; Audiologia; Telemedicina.

Resumen

Introducción: Los términos “e-audiología”, “teleaudiología”, “telepráctica en audiología” y variaciones tienen una característica en común: los avances tecnológicos en audiología. **Objetivo:** El estudio busca evaluar la evolución y desarrollos de la audiología en un modelo remoto en Brasil en comparación con otros países, así como las ventajas y adversidades que brinda este modelo. **Método:** Se realizó una revisión integradora mediante la búsqueda y análisis de publicaciones disponibles en las bases de datos *Taylor & Francis Online*, *PubMed*, *Scielo*, *Thieme*, *ASHAWire* y *Academia.edu*, entre noviembre de 2020 y febrero de 2021, en portugués brasileño e inglés. Los términos de búsqueda fueron: *e-audiologia*, *e-audiology*, *teleaudiologia*, *teleaudiology*, *telessaúde em audiology*, *telehealth in audiology*, *teleprática em audiology*, *telepractice in audiology*. Se consideraron los artículos publicados gratuitamente que abordan la audiología en un modelo remoto, sin límite de año de publicación. **Resultado:** Se encontraron 987 artículos, pero solo se seleccionaron 79 para el análisis en esta revisión. El número de publicaciones ha aumentado en los últimos 5 años y Brasil, en comparación con otros países, ha mostrado un buen nivel de desarrollo en la investigación en el campo de la teleaudiología. **Conclusión:** No cabe duda de que la teleaudiología ya tiene un impacto significativo y positivo como modelo de rendimiento audiológico y, como en toda evolución, la e-audiología viene ofreciendo aún mayores oportunidades para sus usuarios. La inseguridad y la incertidumbre han ido perdiendo terreno para las investigaciones y actualizaciones en el campo en todo el mundo, e incluso con algunas barreras que enfrentar, su crecimiento ha permitido el acceso, la autonomía, el ahorro financiero y la calidad.

Palabras clave: eSalud; Telesalud; Audiología; Telemedicina.

Introduction

Patient involvement in their healthcare has changed over time. The population has been increasingly prone to seek information, make informed decisions and have greater autonomy over their health conditions. Therefore, in recent years, there has also been an increase in the number of people using the Internet and social networks to obtain easy and free access to information, whenever and wherever they want, on various health issues, including hearing^{1,2}.

The terms ‘e-audiology’, ‘teleaudiology’, ‘telepractice in audiology’ and variations have one feature in common: technological advances in audiology. The focus of these innovations is to facilitate and expand access to everyone, everywhere, involving different types of telecommunications technology.

Despite their constant evolution and similarities, the terminologies have differences in definition that take into consideration the services and care provided. Telepractice, also considered as teleaudiology, is limited to remote assessments, training and adjustments, limiting audiology interfaces³.

The regulation of the use of telehealth in speech therapy and audiology in Brazil was published for the first time in 2009 by the Federal Council of Speech Therapy⁴. Currently, “telephonoaudiology” is regulated by the 580/20 resolution, which sets out synchronous, asynchronous, hybrid and automatic service delivery models, involving, but not limited to: interpretive service activities, second formative opinion, teleconsultations, teleinterconsultations and telemonitoring⁵.

The broader term that includes all information and communication technology in audiology is “e-audiology”, including screening, assessment, training, adjustments, monitoring, assistance, rehabilitation and aftercare². The itinerary and the multiplicity of choices in the patient’s experience are fundamental to the health service and must be part of telecare.

Therefore, the objective of this study was to evaluate the evolution and developments of audiology in a remote model in Brazil compared to other countries, in addition to the advantages and adversities arising from this model.

Description

Methodology

An integrative review was carried out based on the methodological structure of Souza, Silva and Carvalho (2010), due to its model of composition and objectivity. The model is composed of 6 phases, (I) definition of the guiding question; (II) database search and identification of relevant studies; (III) use of instrument for data collection; (IV) critical analysis and synthesis of studies; (V) discussion of results; and (VI) presentation of the review.

Following the steps, the focus of the review as a guiding question was “How has e-audiology evolved around the world compared to Brazil?”. As a search strategy, the following databases were used: Taylor & Francis Online, PubMed, Scielo, Thieme, ASHAWire and Academia.edu, between November 2020 and February 2021. In an attempt to capture articles compatible with the objective of the study, the following search terms were used: *e-audiologia*, *e-audiology*, *teleaudiologia*, *teleaudiology*, *telessaúde em audiology*, *telehealth in audiology*, *teleprática em audiology*, *telepractice in audiology*.

To be included, studies should be freely available with open access in Portuguese or English and address any aspect of audiology in a remote model. No limit was applied to the year of publications.

Researches that were not in the area of audiology and/or that did not address the distance model in any way were disregarded. Also not included: news; transcripts, notes or descriptions of events and workshops; comments; and studies, education guides, tutorials, training and/or qualification of professionals. These were not considered due to the low and/or non-existent relationship with the main theme and objective of the research in general.

The studies found in the databases were independently analyzed regarding the correspondence to the inclusion criteria. The search strategies generated 987 publications and references that were duplicated in the consulted databases were excluded. After removing the articles in copy, 930 articles were selected for the reading and screening of the abstract, and, later, the full reading of the publications, totaling 92 articles selected for full-text screening. In the end, 79 articles were included in the integrative review. (Figure 1)

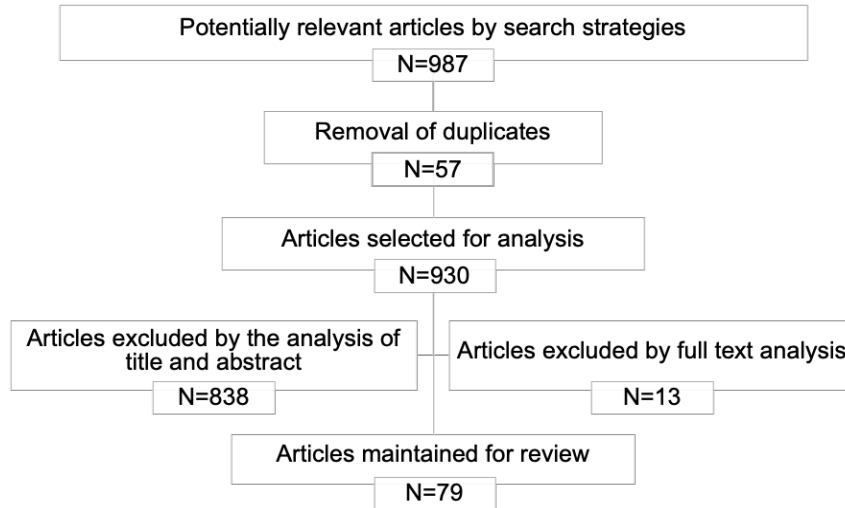


Figure 1. Literature search flowchart and inclusion of articles

Results

After reading 930 articles by analysis of title and abstract, all articles that were relevant to the review objective were selected. Publications with an indicative title from other areas of audiology or

speech therapy were automatically excluded. The filtering resulted in 92 studies kept for the final phase of selection, the full reading of the texts, providing a total of 79 articles that specifically addressed the use of digital technologies in remote audiology. (Chart 1)

Chart 1. Results and data from studies found in the review

TITLE	AUTHORS	YEAR	COUNTRY
A Browser-Server-Based Tele-audiology System That Supports Multiple Hearing Test Modalities	Yao JJ, Yao D, Givens G	2015	USA
A Comprehensive Evaluation of Tinnitus Apps	Deshpande AK, Shimunova T	2019	USA
A Hearing Screening Program for Children in Primary Schools in Tajikistan: A Telemedicine Model	Skarzyński PH, et al.	2016	Tajikistan
A Mobile Phone-Based Approach for Hearing Screening of School-Age Children: Cross-Sectional Validation Study	Chu YC, et al.	2019	Taiwan
A pilot study of telehealth and face-to-face consultations in diagnostic audiology	Petersen MS, Morris DJ, Nielsen MF	2016	Denmark
A Review of Contemporary Teleaudiology: Literature Review, Technology, and Considerations for Practicing	Kim J, et al.	2021	Korea
A scoping review of Australian allied health research in ehealth	Iacono T, et al.	2016	Australia
A self-fitting hearing aid: need and concept	Convery E, et al.	2011	Australia
A Store-and-Forward Tele-Audiology Solution to Promote Efficient Screenings for Ototoxicity during Cisplatin Cancer Treatment	Dille MF, et al.	2015	USA
A Survey of Telepractice in Speech-Language Pathology and Audiology in India	Mohan HS, Anjum A, Rao PKS	2017	India
Adaptação à distância de próteses auditivas acústicas: a teleaudiologia aplicada na melhoria da condução das Políticas Públicas no Brasil	Penteado SP, et al.	2012	Brazil
An examination of clinical uptake factors for remote hearing aid support: a concept mapping study with audiologists	Glista D, et al.	2020	Canada
Applied tele-audiology research in clinical practice during the past decade: a scoping review	Muñoz K, Nagaraj NK, Nichols N	2020	USA

TITLE	AUTHORS	YEAR	COUNTRY
Applying U.S. national guidelines for ototoxicity monitoring in adult patients: perspectives on patient populations, service gaps, barriers and solutions	Konrad-Martin D, et al.	2017	USA
Aspectos éticos e legais na prática da Telessaúde em Fonoaudiologia	Spinardi-Panes AC, Lopes-Herrera SA, Maximino LP	2013	Brazil
Asynchronous interpretation of manual and automated audiometry: Agreement and reliability	Brennan-Jones CG, et al.	2016	Australia
Audiology in the time of COVID-19: practices and opinions of audiologists in the UK	Saunders GH, Roughley A	2020	United Kingdom
Audiology Telemedicine Evaluations: Potential Expanded Applications	Fletcher KT, et al.	2019	USA
Babies' portal website hearing aid section: assessment by audiologists	Bastos BG, Ferrari DV	2014	Brazil
Biological calibration for web-based hearing tests: evaluation of the methods	Masalski M, Grysiński T, Kręcicki T	2014	Poland
Characteristics, behaviors and readiness of persons seeking hearing healthcare online	Ratanjee-Vanmali H, Swanepoel DW, Laplante-Lévesque A	2018	South Africa
Community-based hearing screening for young children using an mHealth service-delivery model	Hussein SY, et al.	2018	South Africa
Connected Audiological Rehabilitation: 21st Century Innovations	Saunders GH, Chisolm TH	2015	USA
Desenvolvimento e aplicação de instrumento administrativo para orientação das pesquisas em telefonaudiologia	Zanferrari PM, et al.	2016	Brazil
Development and validation of a smartphone- based digits-in-noise hearing test in South African English	Potgieter JM, et al.	2016	South Africa
Development of an educational tool on tinnitus in a website format	Carvalho RP, et al.	2020	Brazil
Diagnosis of hearing loss using automated audiometry in an asynchronous telehealth model: A pilot accuracy study	Brennan-Jones CG, Eikelboom RH, Swanepoel DW	2016	Australia
Digital Proficiency Is Not a Significant Barrier for Taking Up Hearing Services With a Hybrid Online and Face-to-Face Model	Ratanjee-Vanmali H, Swanepoel DW, Laplante-Lévesque A	2020	South Africa
eHealth and the hearing aid adult patient journey: a state-of-the-art review	Paglialonga A, et al.	2018	Italy
eHealth Technologies Enable more Accessible Hearing Care	Swanepoel DW	2020	South Africa
e-Health Technologies for Adult Hearing Screening	Stenfelt S, et al.	2011	Sweden
Enhancing Ear and Hearing Health Access for Children with Technology and Connectivity	Swanepoel DW	2017	South Africa
Feasibility of personalized remote long-term follow-up of people with cochlear implants: a randomized controlled trial	Cullington H, et al.	2018	United Kingdom
Features, Functionality, and Acceptability of Internet-Based Cognitive Behavioral Therapy for Tinnitus in the United States	Manchaiah V, et al.	2020	USA
Hearing and vision screening for preschool children using mobile technology, South Africa	Eksteen S, et al.	2019	South Africa
Hearing care across the life course provided in the community	Suen JJ, et al.	2019	USA
Hearing health-care delivery in sub-Saharan Africa – a role for tele-audiology	Swanepoel DW, Olusanya BO, Mars M	2010	Central African Republic
Home Hearing Test: Within-Subjects Threshold Variability	Margolis RH, et al.	2018	USA
Implementation and evaluation of a rural community-based pediatric hearing screening program integrating in-person and tele-diagnostic auditory brainstem response (ABR)	Ramkumar V, et al.	2019	India
Implementation of Image-Guided Cochlear Implant Programming at a Distant Site	McRackan TR, et al.	2017	USA
Intercontinental hearing assessment - a study in tele-audiology	Swanepoel DW, Koekemoer D, Clark J	2016	USA/South Africa
Internet e educação ao paciente	Bastos BG, Ferrari DV	2011	Brazil
Internet-Based Audiological Interventions: An Update for Clinicians	Beukes EW, Manchaiah V	2019	USA



TITLE	AUTHORS	YEAR	COUNTRY
Internet-based cognitive behavioral therapy for adults with tinnitus in the UK: study protocol for a randomized controlled trial	Beukes EW, et al.	2015	United Kingdom
Internet-based interventions for adults with hearing loss, tinnitus and vestibular disorders: a protocol for a systematic review	Beukes EW, et al.	2018	United Kingdom
Interregional Newborn Hearing Screening via Telehealth in Ghana	Ameyaw GA, Ribera J, Anim-Sampong S	2019	Ghana
Knowledge and Perceptions of Teleaudiology Among Audiologists: A Systematic Review	Ravi R, et al.	2018	India
Mobile applications to detect hearing impairment: opportunities and challenges	Swanepoel DW, et al.	2019	South Africa
Monitoring Hearing in an Infectious Disease Clinic with mHealth Technologies	Brittz M, et al.	2019	South Africa
New opportunities and challenges for teleaudiology within Department of Veterans Affairs	Jacobs PG, Saunders GH	2014	USA
Patient Uptake, Experience, and Satisfaction Using Web-Based and Face-to-Face Hearing Health Services: Process Evaluation Study	Ratanjee-Vanmali H, Swanepoel DW, Laplante-Lévesque A	2020	South Africa
Programação remota dos sistemas de implante coclear	Zumpano CE, et al.	2009	Brazil
Reliability of the Home Hearing Test: Implications for Public Health	Mosley CL, et al.	2019	USA
Remote speech-language-hearing follow-up: monitoring cochlear implant users in the immediate postoperative period	Vieira RGM, Ferraz LM, Cordeiro AAA	2020	Brazil
Self-Fitting Hearing Aids: Status Quo and Future Predictions	Keidser G, Convery E	2016	Australia
Self-test web-based pure-tone audiometry: validity evaluation and measurement error analysis	Masalski M, Kręcicki T	2013	Poland
South African hearing conservation programs in the context of teleaudiology: A scoping review	Khoza-Shangase K, Moroe N	2020	South Africa
Stories From the Webcams: Cincinnati Children's Hospital Medical Center Audiology Telehealth and Pediatric Auditory Device Services	Steuerwald W, et al.	2018	USA
Techniques for Remotely Programming Children With Cochlear Implants Using Pediatric Audiological Methods via Telepractice	Hughes ML, Sevier JD, Choi S	2018	USA
Teleaudiologia: comunicação profissional-paciente na programação e adaptação de aparelhos de amplificação sonora individuais via teleconsulta	Reginato TTP, Ferrari DV	2014	Brazil
Tele-Audiological Surveillance of Middle Ear Status among Individuals with Cleft Lip and/or Palate in Rural South India	Ravi P, et al.	2020	India
Teleaudiology hearing aid fitting follow-up consultations for adults: single blinded crossover randomised control trial and cohort studies	Tao KFM, et al.	2020	Australia
Teleaudiology Model Considerations	Krumm M	2014	USA
Teleaudiology Services for Rehabilitation with Hearing Aids in Adults: A Systematic Review	Tao KFM, et al.	2016	South Africa
Teleconsultorias de fonoaudiologia em um serviço público de telessaúde de larga escala	Lucena AM, et al.	2016	Brazil
Telehealth in audiology: The need and potential to reach underserved communities	Swanepoel DW, et al.	2010	South Africa
Telehealth tinnitus therapy during the COVID-19 outbreak in the UK: uptake and related factors	Aazh H, Swanepoel DW, Moore BCJ	2020	United Kingdom
Telemedicine in Audiology. Best practice recommendations from the French Society of Audiology (SFA) and the French Society of Otorhinolaryngology-Head and Neck Surgery (SFORL)	Thai-Van H, et al.	2020	France
Telessaúde em Audiologia: avaliação da eficácia de uma rede social on-line como apoio aos pais de crianças candidatas ao implante coclear	Aiello CP, Ferrari DV	2015	Brazil
Telessaúde em fonoaudiologia no Brasil: revisão sistemática	Fonsêca RO, Brazorotto JS, Balen SA	2015	Brazil
Telessaúde: avaliação da eficácia da teleconsulta na programação e adaptação de aparelho de amplificação sonora individual	Campos PD, Ferrari DV	2012	Brazil
The Role of Patient-Site Facilitators in Teleaudiology: A Scoping Review	Coco L, Davidson A, Marrone N	2020	EUA
	2020	USA	Quênia



TITLE	AUTHORS	YEAR	COUNTRY
The Role of Telemedicine in Auditory Rehabilitation: A Systematic Review	Bush ML, et al.	2016	Kenya
The use of telehealth services to facilitate audiological management for children: A scoping review and content analysis	Govender SM, Mars M	2016	South Africa
Tools for App- and Web-Based Self-Testing of Cognitive Impairment: Systematic Search and Evaluation	Charalambous AP, et al.	2020	United Kingdom
Use of telehealth for research and clinical measures in cochlear implant recipients: a validation study	Hughes ML, et al.	2012	USA
Use of the satisfaction with amplification in daily life questionnaire to assess patient satisfaction following remote hearing aid adjustments (telefitting)	Penteado SP, et al.	2012	Brazil
User-Innovated eHealth Solutions for Service Delivery to Older Persons With Hearing Impairment	Nielsen AC, et al.	2018	Denmark
Using tablet-based technology to deliver time-efficient ototoxicity monitoring	Brungart D, et al.	2017	USA

The available literature included reviews (n=21), experimental studies (n=39), observational studies (n=8), analysis/case reports (n=8), practice guideline, manuscript and editorial. The selected studies were published between 2009 and 2021, with a high concentration of research being carried out in North America, South America and Africa. The number of publications showed a significant

increase in the last 5 years and had a jump in the year 2020 (n=16), year of the beginning of the COVID-19 pandemic for most countries in the world. The year 2021 did not present relevant data - only one publication - due to the cut of research in the month of February 2021, not being included among the statistical data. (Figure 2)

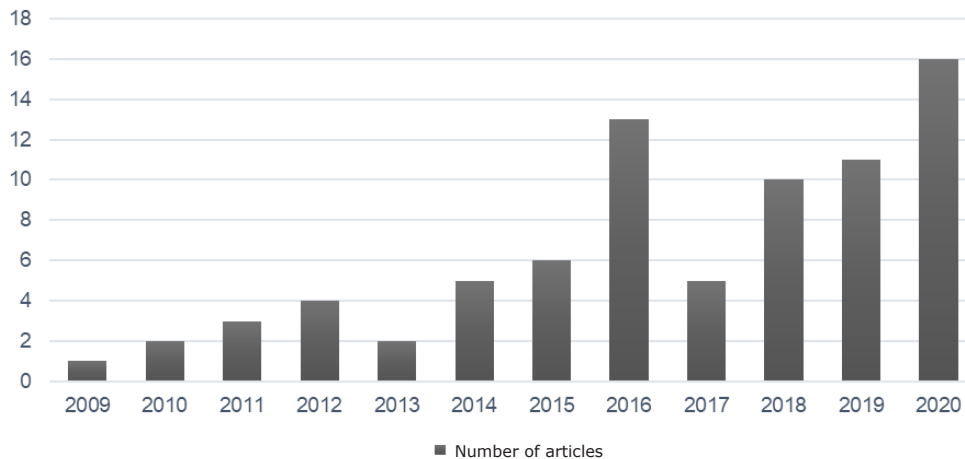


Figure 2. Distribution of studies published per year

In total, 18 countries took part in the survey: South Africa, Australia, Brazil, Canada, Korea, Denmark, United States, France, Ghana, India, Italy, Poland, Kenya, United Kingdom, Central African Republic, Sweden, Taiwan and Tajikistan. Literature reviews that reported global aspects were

referenced by the country of origin of the first author of the research and a single intercountry survey (United States and South Africa) accounted for data for both countries. (Table 1 – Figure 3)

Table 1. Geographic distribution of publications

Place	Total number
Africa	18 (22,50%)
South Africa	15
Ghana	1
Kenya	1
Central African Republic	1
America	36 (45,00%)
Brazil	14
Canada	1
United States	21
Asia	7 (8,75%)
Korea	1
India	4
Taiwan	1
Tajikistan	1
Europe	13 (16,25%)
Denmark	2
France	1
Italy	1
Poland	2
United Kingdom	6
Sweden	1
Oceania	6 (7,50%)
Australia	6

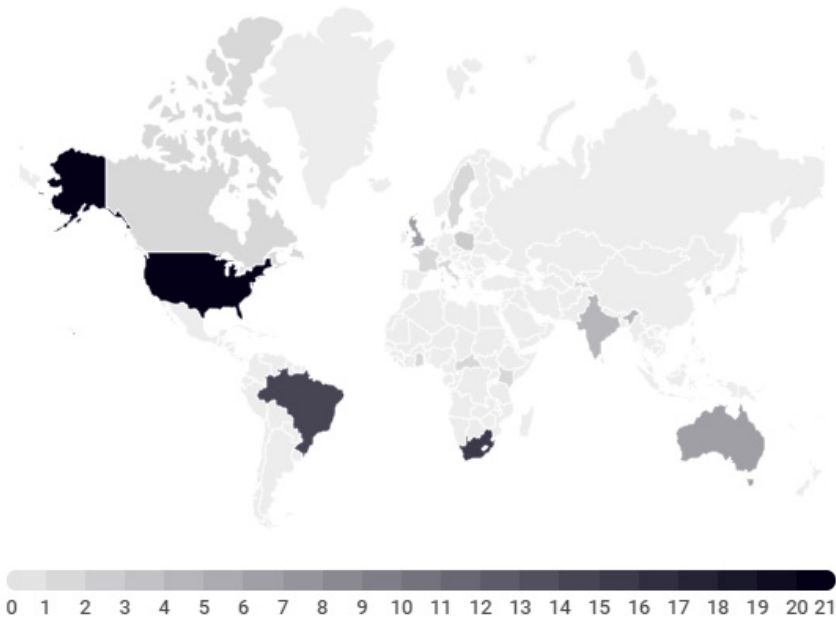


Figure 3. Geographic concentration of publications

Three countries stood out in terms of the number of surveys, namely the United States, South Africa and Brazil. However, while the number of publications from the United States and South

Africa gradually increased over the years, Brazil showed a reduction in the number of publications between 2017 and 2019. (Figure 4)

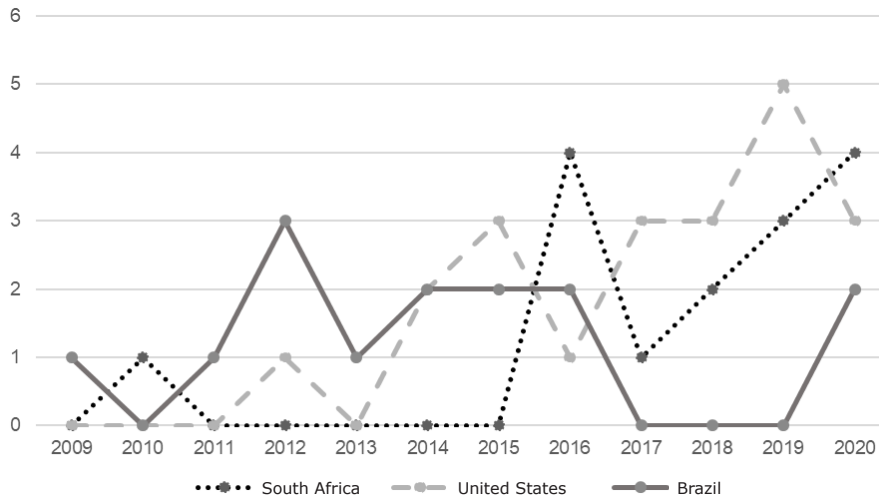


Figure 4. Annual comparison of the number of publications between the three countries with the larger number of selected studies

Regarding the time frame of publications, it can be considered that despite the large number of Brazilian publications, most researches do not include current data.

As for the topics covered, the articles studied in this work showed great variation. However, the themes hearing screening and/or remote audiometry (n=27), sound amplification devices (n=12) and cochlear implant (n=9) were the most recurrent foci of study. The objective of taking audiology to rural areas and away from metropolitan centers also proved to be a concern in most of the researches.

Discussion

Mapping the literature that addresses various topics related to digital technologies used in the development and improvement of audiology allowed us to know the needs, concerns and challenges that researchers and specialist professionals face in this area. Most studies dealt with teleassistance for performing audiometry and the use of hearing aids and/or cochlear implants, only a few studies

considered e-audiology, all of which were review or analysis.

All studies around the world have indicated the remote model as a competent and effective alternative in the approach to audiological care. The results show that the professional-patient relationship can be impacted, but is not harmed by physical distance, as well as clinical interventions are comparable to the face-to-face model and, in some cases, it is capable of improving service delivery^{7,8}.

Difficult access in rural areas limits the basic right to health, both due to infrastructure and the unavailability of professionals. The application of teleaudiology is an emerging field, and it already shows a promising path for the coverage of audiological care in more isolated areas, although there are still barriers to be faced^{9,10,11,12}.

One of the concerns regarding e-audiology is financial. However, studies indicate that the costs for the adoption of telepractice are lower than those of face-to-face assistance, which allows a greater reach and management of therapeutic actions^(13;14;10). The use of technologies that are already in the patient's domain, such as cell phones,



increases the cost-effectiveness not only for the professional but for the patient.

It is possible to observe through the studies that few audiologists offer any alternative of distance service, perhaps due to the need for research, infrastructure and reliability, to further increase their penetration in clinical practice^{15,16,17}. In Brazil, one of the studies also pointed out a high demand for teleconsultations by the speech therapists themselves to solve questions related to care¹⁸.

Opportunities for interprofessional collaboration expand even further with e-audiology, where multiprofessional contact becomes more accessible, including facilitators for patient assistance and follow-up¹⁹. E-audiology is designed considering the needs of patients and professionals; therefore, it is essential to accommodate all aspects involved in its application. From the first contact to post-care monitoring, there must be a prudent management so that patient-professional, patient-facilitator-professional or interprofessional contact does not fail.

The benefits of e-health are visible and have been the focus of many studies over the last few years. Audiology is a field that still needs to be developed a lot in this area, but it also already has several advantages for patients and professionals who are willing to adhere to the model, if there is feasibility. Better cost-benefit, greater access, better quality of care and individualization of patient demand needs are major incentives for the reassessment of the traditional service model¹³.

Despite not being recent, telepractice is still a new area, with barriers to be faced. Data security is one of the main issues related to the reliability of the remote model, as well as the lack of standardization²⁰. For that, it is necessary to regulate, test and validate competent bodies for the use of systems and applications that facilitate and ensure quality care.

Insecurity can also come from the patient, mainly due to the lack of aptitude with the technology, lack of adequate equipment and little knowledge of the model²¹. Facilitators can assist in the practical aspects of accessing and carrying out procedures²², health professionals and the patient's support network can play this role and make it possible to care for patients with low health literacy and/or technological skills.

It is worth mentioning that e-audiology services will not be appropriate and beneficial to all

cases, and there must be evaluations based on the unique needs of each patient, professional and service provided²³.

With the COVID-19 pandemic, the year 2020 presented a greater need to adapt to the remote model^{8,21}. However, teleaudiology and e-audiology should not be models imposed on the patient, but alternatives for audiological assistance that consider the patient's feasibility, need and preferences. Older patients may show greater resistance to change, and this must be respected, as well as rejection after an unsuccessful attempt. These models are not a replacement for face-to-face care, they are some of the branches of possibilities for advancing audiology.

Brazil, compared to other countries, showed a good level of development in research in the field of teleaudiology. However, very few studies were found mentioning the use of e-audiology around the world, all of them being reviews. The year 2020 was a milestone for remote audiology, mainly due to the global pandemic, but although there were Brazilian studies published in this period, only the United Kingdom published research aimed at the use of remote audiology at that time. Even with an accelerated growth, research in the area still needs to go a long way to reach the peak of available technological development.

Currently, the need for involvement, preparation and adaptation of health professionals is essential for the improvement of highly technological and well-structured audiological care. Precautions with quality and safety standards are the main focuses of attention when adapting to the remote model, therefore, it is important to emphasize the need for change from the education and training of professionals to the proper implementation of e-audiology.

Final considerations

Infrastructure and support are essential points for the delivery and accommodation of e-audiology services. A portion of the patient's motivation to participate and make decisions about health care comes from the individual's knowledge and skills to understand, acquire, evaluate and apply health information. For that, as part of the transition to the remote model, and in an attempt to reach the population that has a lower level of health literacy and technological skills, it is necessary for profes-



sionals to be careful to consider any and all issues that may become a barrier to communication and patient care.

There is no doubt that teleaudiology already has a significant and positive impact as a model of audiological performance and, as in all evolution, e-audiology has been offering even greater opportunities to its users. Insecurity and uncertainty have been losing ground for research and updates in the field around the world, and, even with some barriers to be faced, its growth has enabled access, autonomy, financial savings and quality.

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