

International Survey of Audiologists during the COVID-19 pandemic: Use of and attitudes to telehealth

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Abstract

Objective: To determine the attitudes of audiologists towards telehealth and use of telehealth for the delivery of ear and hearing services pre-, during- and post- the COVID-19 pandemic, and to identify the perceived effects of telehealth on services and barriers to telehealth.

Design: An online survey distributed through the International Society of Audiology and member societies.

Study sample: 337 audiologists completing the survey between 23 June and 13 August 2020.

Results: There was a significant increase in the perceived importance of telehealth from before (44.3%) to during COVID-19 (87.1%), and the use of telehealth previous (41.3%), current (61.9%) and expected use of telehealth (80.4%). Telehealth was considered adequate for many audiology services, although hearing assessment and device fitting by telehealth received least support. Matters related to timeliness of services and reduction of travel were reported as the main advantages, but relationships between practitioners and clients may suffer with telehealth. Important barriers were technologies related to the client or remote site; clinic-related items were moderate barriers, although more clinician training was a common theme provided through open-ended responses.

Conclusion: The COVID-19 pandemic has resulted in audiologists having a more positive attitude towards and greater use of telehealth, but with some reservations.

Keywords: telehealth, tele-audiology, audiology services, COVID-19

Introduction

Major events such as earthquakes, storms, fire, floods and outbreaks of disease usually result in short to medium term disruption to communities on a local or regional level. Yet a country level response is often required before life goes back to normal for the majority of the affected population. The COVID-19 pandemic is different in that it has affected almost everyone indiscriminately across the globe to different degrees with emerging evidence that there will be long-lasting shifts in behaviour and practices. Hygiene practices, travel, work practices, personal interactions and access to services have all changed for most of the global population.

Not least of these changes has been access to health services, including to audiological care (Blumenthal et al., 2020). As governments enforced lockdowns of varying degrees (Our World in Data, n.d.), audiologists were faced with dilemmas on how to continue to care for clients under the fluctuating restrictions on business practice (Saunders and Roughley, 2020, Swanepoel and Hall, 2020, Ballachanda et al., 2020). Professional associations have provided support and advice (British Academy of Audiology, 2020, British Society of Hearing Aid Audiologists, 2020) and have interacted with governments to make the case for hearing services to be considered an essential service. Some governments put in place temporary allowances for hearing services to be delivered remotely, when funding had previously only been provided for in-person services (Department of Health, 2020, U.S. Department of Health & Human Services, 2020, National Center for Immunization and Respiratory Diseases (NCIRD)-Division of Viral Diseases, 2020).

To date, the evidence of how and to what degree the COVID-19 pandemic has affected audiology services has only been documented by a few (Saunders and Roughley, 2020, Aazh et al., 2020, Zaitoun et al., 2021). A survey of 120 audiologists in the United Kingdom (Saunders and Roughley, 2020) reported an almost universal use of telehealth for audiology service delivery during restrictions, alongside a range of concerns (e.g. impact on personal interactions, capacity of technology for certain tasks) and benefits of telehealth (e.g. reduced travel, convenience). A study of people undergoing CBT for tinnitus, found that 80% accepted telehealth-delivered therapy during the COVID-19 lockdown in the UK, but those with poorer hearing and greater distress from their tinnitus were less likely to use this service (Aazh et al., 2020). As an alternative to in-person consultations, the use of telehealth

for delivering health services has been promoted across many sectors (Garcia-Huidobro et al., 2020, Lin et al., 2020).

Although telehealth delivery of audiology services has been the subject of much discussion in recent years, clinical uptake has been slow, despite a growing body of evidence supporting the use of telehealth for audiology services (Munoz et al., 2020). Although many aspects of audiology have been validated for use in telehealth (Swanepoel and Hall, 2010, Tao et al., 2018) reports of it being used in routine clinical practice are still limited (Ratanjee-Vanmali et al., 2020b). Others studies have shown mixed attitudes of audiologists towards telehealth (Singh et al., 2014, Eikelboom and Swanepoel, 2016). The COVID-19 pandemic has escalated telehealth in audiology from a matter of convenience and preference to a service-delivery option that puts safety as paramount (Swanepoel & Hall, 2020). This study aimed to capture a global perspective of telehealth use by audiologists before and during the COVID-19 pandemic, and what they anticipate its role to be after COVID-19. We report on the effect of the pandemic on the workforce (Manchaiah et al., Submitted), and on the mental wellbeing of audiologists (Bennett et al., Submitted) in separate reports.

Methods

Study Design and Data Collection

The study used a cross-sectional survey design. Ethics approval for the study was received (HUM023/0420) from the Faculty of Humanities, University of Pretoria, South Africa.

A survey was developed to capture the following information pertinent to this report:

- Demographics: country of residence, sex, age (years), education level, scope of work, years of clinical experience.
- Opinions on telehealth for audiology services: importance of telehealth (before and current), use of telehealth, effects of telehealth on quality of service, scope of practice for telehealth services, barriers, and priorities of patient needs.

The survey was administered online using Qualtrics (Provo, Utah and Seattle, Washington, USA), and distributed through the International Society of Audiology (ISA) to all affiliated regional societies with a request for them to distribute it to their members. The survey was available only in English. Invitations were also distributed through professional and personal networks, and via social media platforms.

Data Analysis

Quantitative data analysis: Data were analysed and plotted using summary or descriptive methods using Microsoft Excel and SPSS (v26, IBM Corporation). The reported importance of telehealth either before COVID-19 or during COVID-19 analysed for the relationships with gender and previous use of telehealth at the workplace (yes or no) by calculating the Fisher's Exact Test Chi-squared coefficient. The relationships between the importance of telehealth before and during COVID-19, and age and experience (as continuous variables) were examined using univariate ordinal regression. The responses to the questions on the importance of telehealth were summarised to Not Important (for Not important at all, and Not important), Neutral, or Important (for Important and Very Important) because of low expected cell counts in the cross-tabulation. A $p < 0.01$ was used to determine statistical significance. Some of the questions in the survey were related to the use of telehealth in the clinic; as these would be relevant to practising clinicians only, respondents whose scope was only in research or industry were excluded for the analyses of these data viz. attitudes to telehealth, and the modes and utilisation of telehealth.

Qualitative data analysis: Free text provided by audiologists' in response to the question "What could be done to overcome these barriers?" were analysed using content analysis (Graneheim and Lundman, 2004). This qualitative analysis involved: (1) reading participants' answers to survey questions; (2) identifying meaning units within the data (identifying individual words/phrases within the data, yet still retaining their original meaning and context; (3) coding meaning units by grouping together those most closely related; and (4) grouping coded meaning units into categories. Peer debriefing was used to improve the rigour of the qualitative content analysis. One research assistant completed the initial content analysis and two members of the research team (RJB & RE) then crosschecked all of the analysed data to strengthen the accuracy of the coding, with discrepancies resolved through group discussion. Categories and meaning units were tabulated, with the number of participants contributing to each category provided.

Results

Demographics

A total of 337 people from 44 countries responded to the survey between 23 June and 13 August 2020. Of these, 298 people from 41 countries completed questions related to

telehealth. Approximately 60% of the responses came from three countries (Australia, South Africa, and USA), and at least 10 responses were received from a further three countries (Canada, India, Singapore) (Table 1, Supplementary material]. According to the World Bank Atlas (The World Bank, n.d.) method of classifying the economy of countries 222 (66%) responses were from High Income countries, 94 (28%) from Upper-Middle Income countries, 21 (6%) from Lower-middle Income countries, and none from Low Income countries.

Table 1: Respondents per country; see supplementary information for full list of respondents by country.

Country	Number (%)
Australia	76 (25.5)
United States of America	53 (17.8)
South Africa	50 (16.8)
Canada	13 (4.4)
India	10 (3.4)
Others with less than 10 respondents	119 (39.9)
Total	298

The respondents consisted of 214 females (78%) and 61 males (22%), with a mean age of 44.7 years (SD 12.7; Range: 22 to 81) and mean years of clinical experience of 18.9 (SD 12.4; Range 1 to 53). There was no significant difference in age and clinical experience between males and females.

Scope of services offered

Responses were received from audiologists working in a wide range of clinical fields, with at least 20% involved in adult hearing aids, adult implants, other adult related work, paediatric hearing aids, other paediatric work, aged-care residents, and research/academia. They were also active in industry (18.7%) and paediatric implantation (14.5%).

The survey provided eight types of services that may be offered in their clinics: hearing screening, hearing assessments, discussion on hearing loss interventions, device fitting, device fitting follow-up/fine-tuning, review appointments, communication training, and psychosocial support; all were offered by at least 30% of the respondents, with a range of other services reported, including tinnitus, vestibular assessment. Some respondents were also involved in non-clinical duties, e.g. training, reviewing policies, and so forth.

Use and perception of telehealth

There was a significant increase in audiologists' perception of the importance of telehealth during the COVID pandemic, compared to their reflections of the importance of telehealth before the pandemic (Fisher's $\chi^2=40.74$, $p<0.001$; Figure 1). The reported importance of telehealth at both time points was not significantly related to gender, experience or age (Table 2).

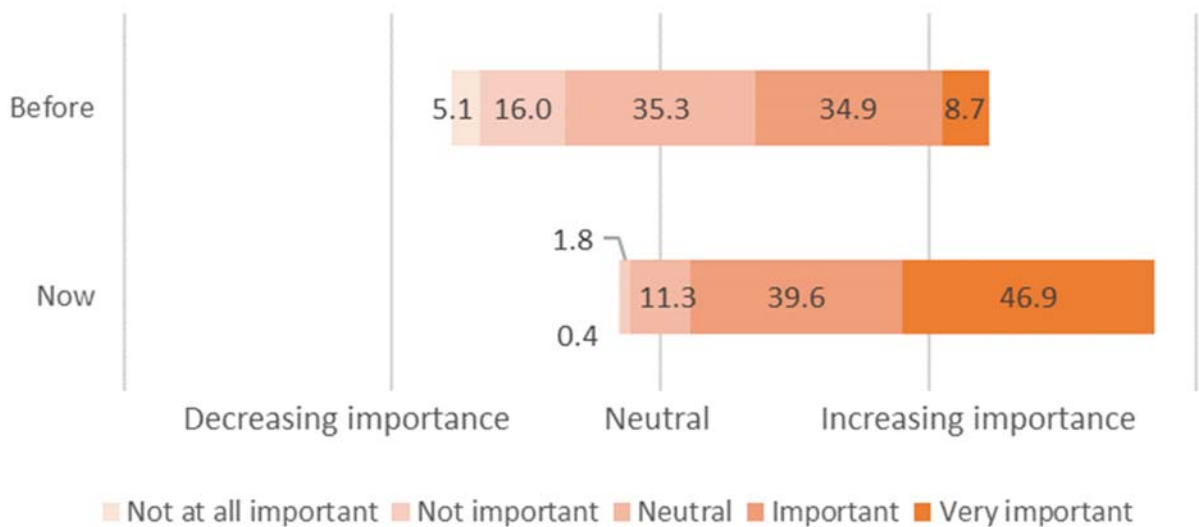
Table 2: The importance of telehealth before and during COVID-19, and associations with gender, age, experience and previous use of telehealth in the workplace (n=275).

Importance of telehealth		Not important (%)	Neutral (%)	Important (%)	Fisher χ^2	Wald χ^2 (95%CI)	Significance (p)
Before COVID-19							
Gender	Females	19.2	37.4	43.5	2.93		0.232
	Males	27.9	27.9	44.3			
Age (continuous)						3.52 (-0.001 - 0.034)	0.610
Experience (continuous)						2.75 (-0.003 – 0.032)	0.097
Previous use of telehealth	Yes	6.00	35.0	59.0	35.78		<0.001
	No	32.3	35.4	32.3			
After COVID-19							
Gender	Females	0.9	11.3	87.8	5.92		0.048
	Males	6.6	11.5	82.0			
Age (continuous)						2.169 (-0.004 – 0.031)	0.141
Experience (continuous)						0.876 (-0.01 – 0.026)	0.372
Previous use of telehealth	Yes	1.7	12.1	86.2	0.34		0.909
	No	2.5	10.8	86.7			

There was a marked increase in the use of telehealth in the audiology workplace from reflections before COVID-19 (n=117, 42.5%) to the use of telehealth at the time of the survey (n=169, 61.5%), and again to the expectation of the use of telehealth after COVID-19 (n=205, 74.5%).

There was a significant positive association between use of telehealth in the workplace before COVID-19 and the reported importance of telehealth before COVID-19 (Fisher’s $\chi^2=35.78, p<0.001$).

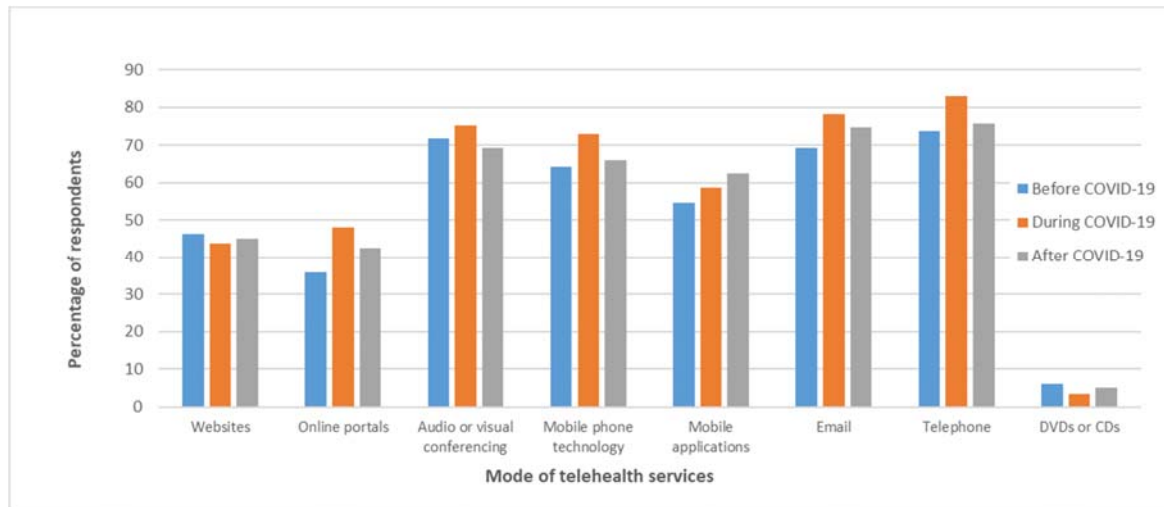
Figure 1: The importance of telehealth before and during the COVID-19 pandemic. The neutral responses are shown centred on the horizontal midline of the plot to demonstrate the change in the distribution of the responses towards more importance being placed on telehealth. The values represent the percentage of respondents (n=275).



Modes of telehealth and application to various consultations

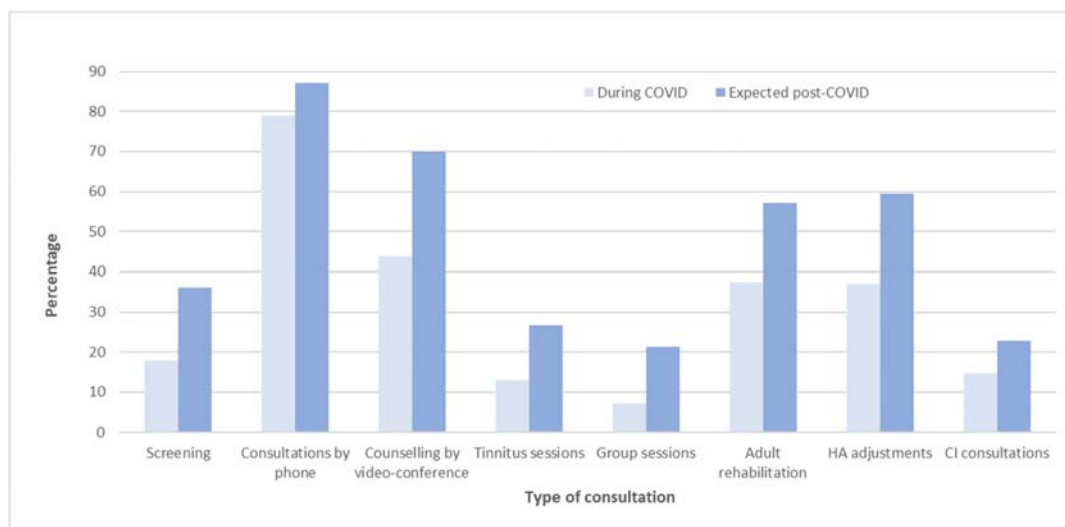
The use of various modes or tools for telehealth consultations used pre- and during-COVID-19, as well as expectation for their use after COVID-19 (Yes or No), did not vary much amongst those who reported using or expecting to use telehealth (Figure 2). Audio-video conferencing, mobile phone technology, email and the telephone are the most common modes of telehealth, all being used in over 60% of the workplaces that reported using telehealth before and during COVID-19, or expecting to use telehealth after COVID-19. In most instances, audiologists indicated that after COVID-19 they would likely reduce their use of the majority of modes of telehealth to some extent, with the exception of mobile phone technology, which participants indicated will increase beyond the pandemic.

Figure 2: Modes of telehealth as a percentage of respondents who use telehealth in their workplaces before COVID-19 (n=117) and during COVID-19 (n=169), or expected to use after COVID-19 (n=205).



Survey participants were asked what types of audiology consultations they performed by telehealth as a consequence of not being able to see patients in-person during COVID-19, and which they expect to be doing after COVID-19. Telephone consultations was the most commonly reported practice, conducted by 82% (177 of 224) of respondents (Figure 3), which was expected to increase to 90% post-COVID-19 (195 of 224). All other types of consultations are also expected to increase, and all from a lower baseline than telephone consultations.

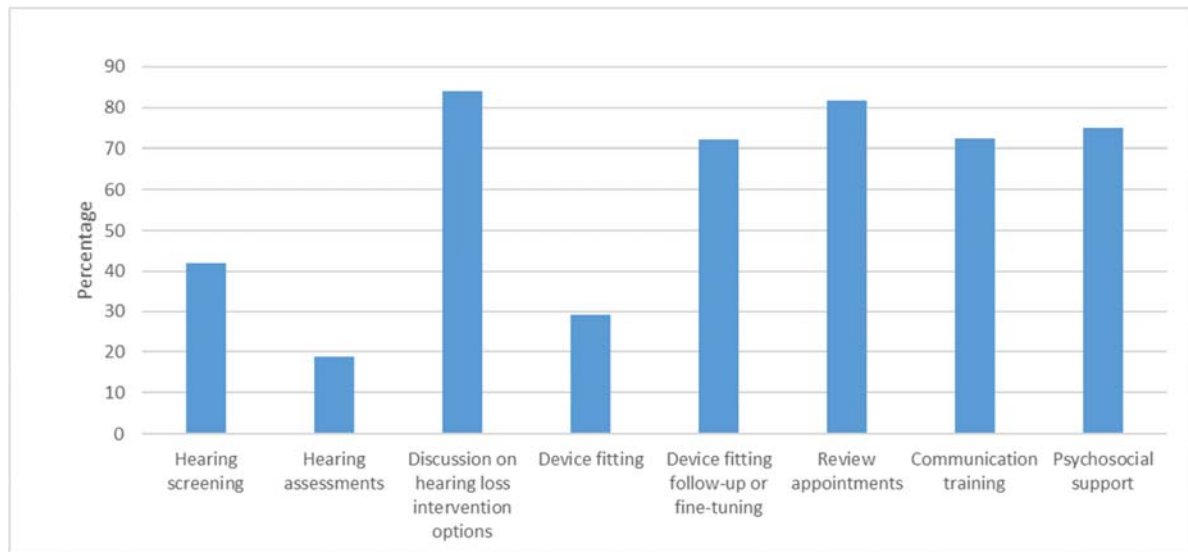
Figure 3: Utilisation of telehealth for consultation types during COVID-19 and expected use after COVID-19, by percentage of those who responded to both questions (Yes, No or Not applicable; n=224).



Considerations of telehealth and barriers

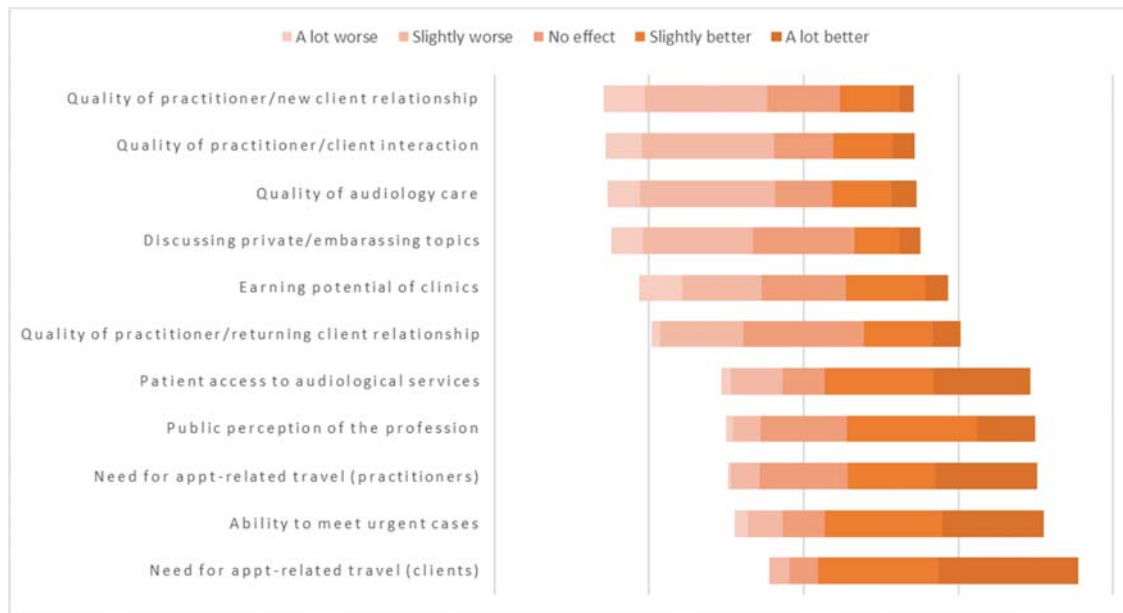
Participants were provided with a list of audiology-related services, and asked to indicate those that could be adequately delivered by telehealth. A 70% to >80% positive response was provided for five of the eight options (Figure 4). Telehealth was considered adequate for hearing screening by 42% of respondents. Hearing assessment and device fitting were the two services that respondents felt could least adequately be delivered via telehealth.

Figure 4: Adequacy of telehealth for various audiology services; percentage of positive responses of the total of respondents who completed this question (n=240).



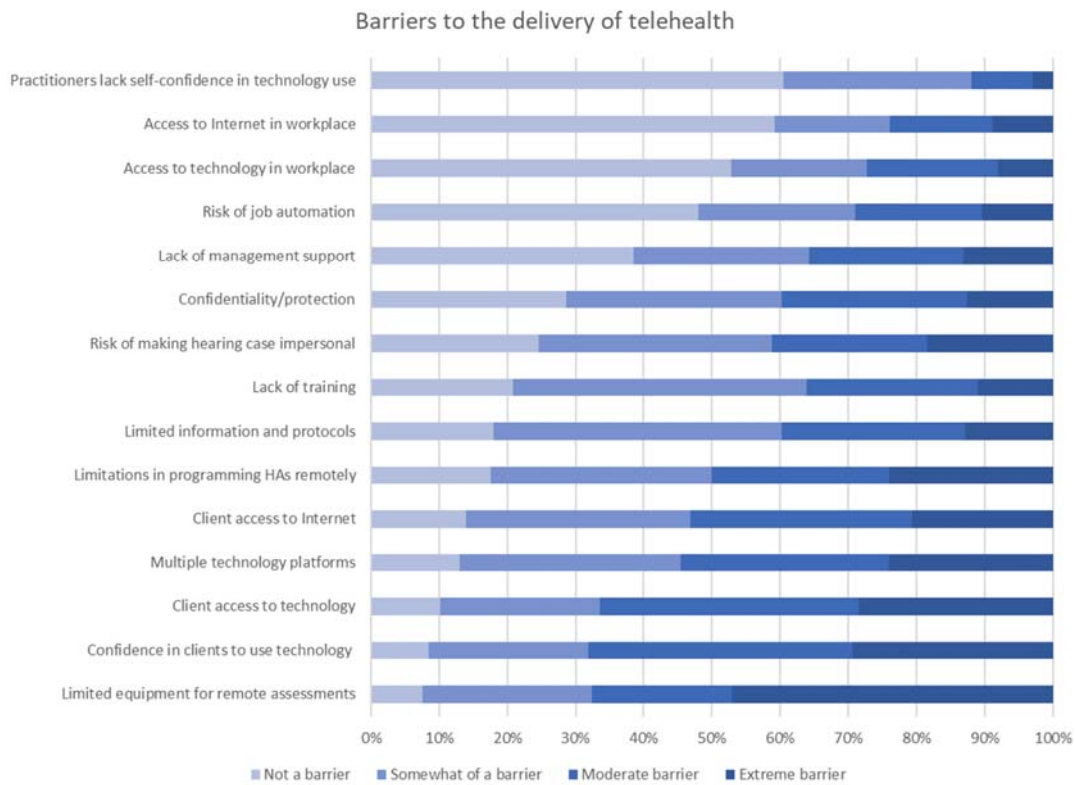
Participants in the survey were asked how using telehealth as a mode of delivery of audiology services may affect a range of factors, providing their responses on a scale from “A lot worse” to “A lot better” (Figure 5). The expectation of more positive effects was related to practical aspects (e.g., allowing for urgent appointments, improved access, and demand on travel for both clinicians and patients) and also how the public perceives the profession. The tendency to expecting more negative effects was reported for personal factors (e.g., the quality of relationship between practitioners and *new* clients, the quality of the interaction between practitioners and clients, the quality of care in audiology, and discussing personal matters). There was a relatively even spread of negative and positive expectations for two other factors: the earning potential of clinics, and the quality of the relationship between practitioners and *returning* clients).

Figure 5: Effect of telehealth on the delivery of audiological services. Percentage of responds on the scale *A lot worse* to *A lot better*. Items shown are slightly abbreviated from the phrases used in the survey; see supplementary information for full text of survey questions and answers (n=240).



A list of potential barriers to telehealth for audiology services was presented to the participants, asking them to respond with the degree to which they thought these were a barrier. Those factors that were considered the greatest barriers were related to clinical equipment (e.g., to conduct assessments remotely, multiple technologies across manufacturers, inability to access hearing aids remotely) and patient related (e.g., lack of confidence, access to the internet) (Figure 6). Factors considered to be the lowest barriers were technology infrastructure related (e.g., internet access, communications technology in the workplace), and personal factors (e.g., lack of confidence, risk of job redundancy, lack of support).

Figure 6. The degree to which potential barriers to the delivery telehealth are considered a barrier. Items shown are slightly abbreviated from the phrases used in the survey; see supplementary information for full text of survey questions and answers (n=240).



Suggested tools and innovations

An open field invited participants to answer “What could be done to overcome these barriers?” A total of 131 participants provided 235 suggestions (Table 3). Qualitative analysis showed that these suggestions were in four primary categories: Protocols & training, Access, Support and Research.

A further open field invited participants to make suggestions for tools or innovations that would be useful for delivering services during the COVID-19 pandemic; 108 participants provided a response to this question (Table 4). Qualitative analysis revealed four major Categories: Video-conferencing and sub-titling, Access to technology (for remote testing and programming, and internet capacity), Training, and Governance (legislative and financial support, security).

Table 3: Qualitative themes and suggestions for overcoming barriers to telehealth for audiology services.

Categories	Sub-categories	Sub-category description	Number of meaning units
Protocols & training	Training and education	Clinician/student/admin staff training, as well as ongoing training to reinforce clinical behaviours. Practice and experience to build skills and confidence.	107
	Clinical practice guidelines and support	Development of standardised clinical protocols/ guidelines. Acknowledgment and funding for tele-audiology services in government hearing services program. Development of government legislations/ regulations/ guidelines.	32
	Time	With time, practice and perseverance	7
Access	Access to technology and internet	Improved access to stable, high-speed internet, technology, and equipment required for tele-audiology services. Development of reliable remote access technology/ devices that enable tele-audiology programs. Address issues concerning data privacy and security. Overcome limitations relating to client's abilities to use technology prior to using tele-audiology (such as through training sessions).	50
	Financial consideration	Access to funds/ affordable costs for setting up tele-audiology services (such as software and equipment costs). Reduce data/internet usage cost, possibly through government funding or partnerships with telecommunications companies. Availability of affordable (or government funded) hearing aids that enable remote programming.	18
	Access to space/ infrastructure	Access to improved infrastructure. Access to space to provide tele-services (hospital-based model). Establishment of community health centre for tele-audiology set up.	6
Support	Support from management and colleagues	Supportive management (organisational buy-in). Relax organisational permissions to enable use of digital technologies (such as permission to use video-conferencing software). Peer support (forums for clinicians to share experiences, hands on practice, success stories)	9
	Emotional connection	Develop a therapeutic/ client-clinician relationship that can be maintained when providing remote care.	3
Research	Research	Research to confirm validity of tele-health services.	3

Table 4: Tabulation of themes and suggestions of tool or innovation to audiology service delivery during COVID-19.

Categories	Sub-categories	Sub-category description	Number of meaning units
Video-conferencing and sub-titling	Video-conferencing	Suggested improvements to current video-conferencing platforms included improved sound/video quality, live subtitling, live sign-language translation services, audiology-specific clinical platforms designed to facilitate audiological service delivery (such as embedding hearing assessment tools into video-conferencing platforms), and on the spot technological backup for troubleshooting video-conferencing issues as they arise.	32
	Subtitles	Improved accuracy of live subtitles in video-conferencing software, Subtitles in clients' languages with the possibility of automatic saving and sending of the final transcript of live subtitles to clients.	30
Access to technology	Remote testing	Remote otoscopy, screening, audiology tests by apps and software or by inexpensive equipment to be sent to clients' home.	29
	Remote programming and management programs	Remote fitting and programming hearing devices with a global integrated programming software. Tinnitus management programs as well as better compatibility of hearing devices with mobile phones with the possibility of self-made ear impressions.	24
	Access to technology and services	Access to stable internet and appropriate technology at low cost for all clients as well as access to open resources. Video-conferencing via TV.	23

Training	Information, education, and training for services during pandemic	Guidelines, simple instructions, videos, and written information (in clients' own language) as well as training on using technology for both clients and clinicians.	29
	Support	IT and financial support, legislative support, isolated clients' peer support, and alternative methods for supporting clients who cannot use technology for services.	8
Governance	Secure and confidential tools and apps	Information protection, security, and confidentiality of video-conferencing and apps.	5
	COVID-safe clinics	COVID regulated clinics with acoustic and visually transparent masks for in-person consultations.	2

Discussion

The purpose of this study was to gauge the response of the international audiology community to the COVID-19 pandemic, particularly the perceived importance and role of telehealth to deliver services including barriers to its use.

Responses came from audiologists across 44 countries (low, middle and high-income countries) that have experienced severe 'lockdowns' at some stage throughout the pandemic such that only key workers were able to carry out their normal activities. Updates from the websites of professional organisations and governments (Audiology Australia, 2020, British Society of Hearing Aid Audiologists, 2020, American Academy of Audiology, 2020, Government of Ontario, 2020) suggest that audiologists have been considered as essential health workers in many countries, but that there have been restrictions to the services offered in-person with recommendations to offer remote services where possible. This study has shown that audiologists recognise the potential for telehealth as a means to improve the way they can deliver audiological services, both during this pandemic and beyond it when not driven by the need for social/physical distancing. This is in line with the previous findings of others (Singh et al., 2014, Eikelboom and Swanepoel, 2016). In this study we have shown that previous exposure to telehealth has helped to shape audiologists'

attitude to telehealth, but that the current pandemic has resulted in a strong shift to a large majority perceiving telehealth to be of primary importance, even beyond the pandemic situation. The fact that the attitude to telehealth was significantly associated to previous use of telehealth prior to COVID-19, but not to the attitude during COVID-19 demonstrates that the pandemic has resulted in a change of attitude. The desire to continue to deliver audiology services, and the large amount of publicity that telehealth has received since the onset of the pandemic, not only in audiology but in health in general, is likely to have contributed to that change. The actual use of telehealth reported in this study was lower than that reported in the UK (Saunders and Roughley, 2020), probably reflecting the fact that this survey included respondents from low- and middle-income countries where facilities and infrastructure may not be in place, as indicated by participants in their free field responses.

The use of the different modes to deliver audiology services remotely appeared to increase slightly as a result of the pandemic. Of note, is that modes that promote self-management of the health condition (websites and online portals, and especially DVDs/CD) appear less utilised. Whilst the modes of delivery may not have changed much, participants expected a large increase in the number of services, especially for screening, tinnitus sessions and group sessions. The small amount of change is likely to have been because lockdowns during the COVID-19 pandemic have restricted accessibility to additional equipment, its purchase, installation and training. In addition, there have been considerable supply chain problems as the demand for video-conferencing equipment and home computers exceeded availability during the pandemic (Dave, 2020). There are a number of validated tools for remote hearing screening that includes an assessment of overall hearing sensitivity (Potgieter et al., 2016, Smits et al., 2016), conductive hearing loss (De Sousa et al., 2020) and speech recognition (Smits et al., 2013), as well as screening focused on hearing implants recipients (Kaandorp et al., 2015, Cullington and Aidi, 2017). Rehabilitation services for people with tinnitus can be delivered by telehealth and has been widely accepted (Aazh et al., 2020). While remote rehabilitation in audiology has been shown to be effective in one-on-one sessions with a clinician (Thoren et al., 2014, Malmberg et al., 2017, Meyer et al., 2019), the effective remote delivery of group audiological rehabilitation has yet to be demonstrated, even though it is technically feasible.

Respondents appeared to take a pragmatic approach, based on their available knowledge, technology and skills, to identifying those audiology services that could be adequately delivered remotely. Most of the services received an endorsement over 70%, which is quite high in light of the lack of strong evidence of the effectiveness of tele-audiology services (Tao et al., 2018), and therefore support implementation of tele-audiology services in a clinical setting. This endorsement is also similar to the percentage of audiologists who indicated that they would be using telehealth. This may reflect the pragmatic approach of audiologist to continue to provide services, despite the limitations that they may or may not recognise. Changing audiological practices to be more reliant on technologies, including remote care, has also raised fears that some services may become entirely automated leaving audiologists with a smaller scope of practice (Swanepoel et al., 2010). Few audiologists were in favour of providing hearing assessments and device fittings via tele-audiology. These aspects are essential elements of initial patient engagement, both of assessment and fitting of a hearing device, and also the most challenging to telehealth service delivery. This may be influenced by current limitations regarding access to equipment at remote sites. Hearing assessment usually includes obtaining air and bone conduction, and speech hearing thresholds which require specific equipment and a sound treated space (Swanepoel et al., 2010, Swanepoel and Hall, 2020, De Sousa et al., 2020). There may be some scope to utilise automated audiometers away from a clinic (e.g. Brennan-Jones et al., 2018), but a facilitator is likely still required. Alternatively, mobile technologies may provide increasingly sophisticated self-test solutions as recently demonstrated using air conduction tests, including digits-in-noise and pure tone audiometry, to accurately differentiate conductive from sensorineural hearing loss (Swanepoel and Hall, 2020, De Sousa et al., 2020). This type of approach can enable hearing assessments in unconventional settings because cases of conductive hearing loss or ear disease can be escalated to clinics (Swanepoel and Hall 2020).

Device fitting is a task with many physical aspects that usually requires the audiologist to be with the client. Previous research in this area highlighted limitations in self-fitting of hearing aids (Convery et al., 2013) but have more recently supported the potential of self-fitting with advances in technology and patient-support (Keidser and Convery, 2018). Some elements of audiology practice (e.g., discussion of hearing loss intervention options, communication training, psychological support) have been demonstrated to be effective

(Beukes et al., 2018, Malmberg et al., 2017, Thoren et al., 2014). However, not all respondents appear to be aware of this, or remained unconvinced of the evidence. This highlights a need for training of audiologists on various telehealth models and technologies, and further validation studies.

Respondents to the survey indicated that audiology services by telehealth are most likely to affect the relationship between the clinician and the clients, and included aspects of confidentiality, discussing sensitive matters, and quality of care. However, it should be noted that this view was not universal, and over 50% in each case said that telehealth would have no effect, or potentially improve these aspects of the services. On the other hand, there appears to be a need for these aspects to receive attention when implementing services and educating audiologists. These findings are largely in line with those of recent studies during the COVID-19 pandemic (Saunders and Roughley, 2020, Zaitoun et al., 2021). It remains to be seen whether audiology patients in general have the same concerns. One fifth of patients in a tinnitus treatment programme declined it being delivered remotely for reasons that included lack of access to devices, and lack of confidence of usefulness (Aazh et al., 2020). Others report that patients are open to telehealth consultations, but retain a preference for face-to-face services (Eikelboom et al., 2014, Eikelboom and Atlas, 2005, Tao et al., 2020). There was a strong recognition amongst audiologists that telehealth services can lead to better efficiency: less travel for clients or clinicians, more timely attention, and better overall access, as evidenced in the audiology (Saunders and Roughley, 2020, Reginato and Ferrari, 2014) and broader literature (Caffery et al., 2016, Taylor et al., 2018, Kokesh et al., 2011).

Audiologists' perceived barriers to telehealth may partly explain their restricting attitude towards telehealth practices. The least prominent barriers were related to the audiologists themselves (confidence, support from management, and job security) and communications technology available to them. More moderate barriers were protocols, training, the risk of making hearing care impersonal, and confidentiality. The most prominent barriers were aspects external to the audiologists: unavailability of suitable equipment either in the clinic or at the client's site, and uncertainty whether their clients could cope with the technology. These barriers were also captured recently in a thematic report of non-use of telehealth and the effects of telehealth on personal interactions, quality of service and confidence in delivering services (Saunders and Roughley, 2020), and survey of audiologists in Jordan and

Arab countries (Zaitoun et al., 2021). This reflects a lack of confidence in their clients, something that may be misplaced. It has been shown that people utilising hearing health services are proficient in using devices like mobile phones or computers (Ratanjee-Vanmali et al., 2020a). What clinicians may be reporting are their own barriers to acquiring, installing and managing telehealth tools for their clients, reflective of the fact that there is no common platform for tele-audiology. It is also known that patient preference was typically for in-person service over telehealth services pre-COVID-19 (Donelan et al., 2019, Eikelboom and Atlas, 2005, Tao et al., 2020).

The findings from these questions were reinforced by responses to an open-ended question on what innovations and improvements audiologists would like to see, and confirm the findings of others (Saunders and Roughley, 2020). Responses covered ten major themes relating to digital resources for communicating and remote services, and increased support from managers or government facilitation of improved access to technology and services, training and education. In order to provide an effective telehealth service, it is important that the focus be on optimising the communication between the clinician and the client, not only through the use of technology e.g. live captioning, but also conscious of the limitations and the need to compensate for these.

Results suggest that whilst audiologists have responded to the COVID-19 pandemic with a greater appreciation of telehealth, they are mindful that they need to discriminate about the appropriate services it can be used for. In some cases, they require their managers and organisations to empower and better support them, and in other cases investment is needed by industry or government to develop new technologies and products. Unless these are in place, audiologists will continue to struggle to provide services to vulnerable people, especially in terms of future emergencies such as the COVID-19 pandemic.

Study Limitations

This study has involved a sample of 337 audiologists from 44 countries which, while representing the views from a wide cross-section of ages, clinical experience and scope of practice, as well as industry, research and academia, is too small to represent the global population of audiologists. Responses were also representative of those working in high as well as upper- and lower-middle income countries; there were no responses from 29 (of 218) countries classified by the World Bank as having Low Income economies, but where

there are very few audiologists (Goulios and Patuzzi, 2008, World Health Organization, 2013, Mulwafu et al., 2017). It is possible that there was a sampling bias, with the high numbers from the countries of the authors already noted, and greater uptake from predominantly English-speaking countries. We were unable to estimate the response rate. Responses were also likely to be affected by the current lockdown situation faced by the respondent.

Conclusions

A wide cross-section of the international audiology community provide insights into how telehealth plays a role in delivering audiology services in response to the COVID-19 pandemic. There is an overwhelming acceptance that telehealth is important and necessary in the COVID-19 situation and also in the future when lockdowns may still be a risk. Some barriers were identified, mostly relating to limitations in technology and a lack of confidence that clients are well-placed to receive telehealth services. More innovation and validation is needed in technology to enable safe and reliable methods of assessment and device fitting.

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