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The Current Perceptions of Practicing Audiologists Regarding the State of Teleaudiology Education and Training

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THE CURRENT PERCEPTIONS OF PRACTICING AUDIOLOGISTS
REGARDING TELEAUDIOLOGY EDUCATION
AND TRAINING

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has been approved as meeting the requirement for the Degree of Doctor of Audiology in the College of Natural and Health Sciences in the School of Human Sciences, Program of Audiology and Speech-Language Sciences.

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ABSTRACT

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Telemedicine is the practice of providing medical care remotely, when the patient and the clinician are not meeting face to face (Krumm & Syms, 2012). The practice of telemedicine in audiology is teleaudiology. The purpose of the current study was to determine the current perceptions and experiences audiologists have about teleaudiology practices, education, and training.

A 16-question survey was developed using Qualtrics and distributed to audiologists via various social media groups for audiologists online and it consisted of 16 questions. There were 352 respondents. Overall, a large percentage of audiologists do perform teleaudiology services, and most reported their training for teleaudiology was on the job or through workshops. The vast majority of participants (93%) reported that they felt there was a need for teleaudiology education and training, while only about 30% of respondents reported there was adequate teleaudiology education and training in their area. Results were further analyzed for the entire group as well as by various demographic factors such as years of experience, practice setting, etc. to see if those factors influenced responses. The results were highly consistent across subgroups such that the factors did not appear to influence the overall perceptions or practices of participants.

The respondents had a chance to make additional comments at the end of the survey and these comments provided some interesting feedback. In the comments, respondents identified barriers to teleaudiology such as lack of infrastructure, lack of institutional support, and a lack of training.

Based on the responses obtained in the current study, there does not seem to be a large number of audiologists who have received training in a formal education setting, i.e., graduate courses.

However, due to the high percentage of audiologists reporting active teleaudiology services, future studies might include a closer look at graduate curriculum, or a survey targeted to faculty, graduate students, and/or preceptors to determine the extent of teleaudiology content within graduate training programs.

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STATEMENT OF THE PROBLEM

Introduction

The use of telemedicine is becoming more common practice for many health care fields (Gilman & Stensland, 2013). The use and or practice of telemedicine within the field of audiology is known as teleaudiology. It is a useful tool for delivering services to individuals and or communities that might not get those services otherwise due to distance from the audiologist. The model of service delivery is set up in a way to ensure that the patient can get access to care either "in real time" or in a follow up visit after their case has been reviewed (Jacobs & Saunders, 2014). These models are referred to as synchronous and asynchronous. In the synchronous model the patient receives care from the provider either by video conferencing or teleconferencing. In an asynchronous model, data from the patient is collected and stored and the provider reviews it at a later time and then makes recommendations for follow up care (Jacobs & Saunders, 2014). Advances in teleaudiology have led to a more convenient service delivery model for rural places. In addition to being a convenient way to treat patients in rural areas where audiologists are few and far, between teleaudiology may benefit patients who are not able to travel to the nearest audiology clinic because of health reasons, financial reasons, transportion or other logistical reasons. One of the most prominent examples of teleaudiology is its use in the Veterans Administration system (VA; Jacobs & Saunders, 2014). The VA has used teleaudiology to do remote hearing tests and remote hearing aid fittings. The VA has to serve a large population, many of whom live in rural areas and may not have access to audiology

services. Teleaudiology is also used for remote fitting of hearing aids and remote programming of cochlear implants (Penteado et al., 2014).

There are many ways in which audiologists have utilized telemedicine including remote hearing screening, remote device programming, and the synchronous review of otoscopy and immittance testing (Bhutta, 2018; Krumm & Syms, 2012; Swanepoel & Clark, 2019). Benefits of teleaudiology include convenience, accuracy, and cost/time effectiveness. Despite potential patient benefits related to teleaudiology, when surveyed, only 31 out of 422 audiologists reported using it (Schonfeld, 2016). Audiologists surveyed identified several barriers to teleaudiology implementation including lack of education and training, lack of infrastructure and licensure, and reimbursement issues (Ravi et al., 2018). Most of the respondents, about 90%, reported that they would be interested in teleaudiology training through continuing education courses or through information presented at conferences.

Teleaudiology provides access to care for patients who may not be able to receive audiology services otherwise, due to distance from provider or other barriers to travel. Teleaudiology is a safe and reliable way to provide care. Practicing audiologist should be open to implementing teleaudiology as it can help them serve more of the population. When surveyed audiologists in general have a positive view to teleaudiology but they are not practicing it frequently (Schonfeld, 2016). There are several barriers that audiologists have identified as reasons they do not often practice teleaudiology, one of the barriers identified is a lack of education or training in the administration of teleaudiology. It is important to understand more about the education and training audiologists receive to determine if there are gaps in education and if audiologists are interested in training.

While lack of education and training has been identified as a barrier to implementation of teleaudiology services, there is little known about education and training for telehealth practices in the field of audiology. Therefore, the purpose of this study was to learn more about audiologists' perceptions about and experiences with education and or training opportunities that are available.

The research question for the current study was:

Q1   What are the current perceptions of practicing audiologists regarding the state of teleaudiology education and training?

The corresponding hypothesis is:

H1   Currently audiologists perceive there is very little formal training for teleaudiology services, even though there are increasing opportunities to incorporate teleaudiology into practice.

CHAPTER II

REVIEW OF THE LITERATURE

Overview of Telemedicine

Telemedicine, or telepractice, is the delivery of health services remotely using technology (Krumm & Syms, 2012). With the help of the internet, telemedicine has been able to grow and evolve to overcome barriers to healthcare delivery like distance and travel expenses that would prevent the patient from receiving certain medical services. People living in rural areas or small communities can benefit from the use of telemedicine because it increases the availability or opportunity to connect with health care specialists without the need to travel long distances (Krumm & Syms, 2012). Telemedicine can be used by health care professionals as an alternative to face to face delivery to evaluate and diagnose patients and to recommend treatment from a distance.

Telemedicine began as early as the 1950's when hospitals and medical centers started to find ways to share information over the telephone (Dorsey & Topol, 2016). In the beginning, telemedicine was simply the practice of connecting general practitioners with specialists to work with a patient. This was a benefit for people living in rural areas where specialist care was not readily available. With the use of the internet teleaudiology has evolved to a much more comprehensive service delivery model. As the internet began to develop and internet coverage became more reliable, telehealth broadened to become a viable option for diagnosis and treatment. Initially, telehealth was used for acute conditions such as trauma and stroke (Dorsey &

Topol, 2016). In 1999, there were "telestroke" programs where a remote neurologist would provide acute stroke care to patients in an emergency room (Dorsey & Topol, 2016).

The VA implements a home telehealth model for patients to monitor their conditions in their own homes (Jacobs & Saunders, 2014). Diagnostic tools have become more portable, so for patients with chronic medical conditions it is possible for them to monitor themselves in their homes (Jacobs & Saunders, 2014). One example of this would be a portable hearing testing device called OtoID which can be used to monitor hearing including ultrahigh frequencies for patients who have been undergoing chemotherapy treatments (Jacobs & Saunders, 2014). The patient can test their hearing after treatments and an audiologist can review those tests to see if there is a change in hearing when compared their baseline to see if the chemo is affecting their high frequency hearing.

There are two main ways that telepractice is carried out: synchronously and asynchronously (Krumm & Syms, 2012). The synchronous model of telehealth is when the clinician delivers services to clients in real time or "live". Examples of this would be a conference call or video calling. Interactive video is typically used with synchronous services to ensure the patient's needs are being met even though the physician is not in the physical room with them. This provides the patient with services that are essentially face to face, which can put patients' minds at ease. Synchronous telehealth requires a strong internet connection on both ends and sufficient bandwidth and video quality, at least 60 kbit/sec and 8 frames per second respectively (Schepers et al., 2019).

The asynchronous model of telehealth captures digital samples, such as still images, video, or audio and relevant data at the patient's location and then transmits these files for interpretation at a remote site by health professionals (Krumm & Syms, 2012). Asynchronous is

sometimes called a "store and forward" method. With this model there is no need for the patient

and the provider to be on the network simultaneously. For example, a patient can go to a remote

clinic and record their medical concerns (i.e., rashes or suspicious moles) and the doctor can

review the chart and make recommendations without having seen the patient in person

(Deshpande et al., 2009). This cuts down on travel time for the patient, wait time at a specialists

office, and the financial burden of taking time off work to see a specialist. Asynchronous

telehealth can reduce the number of in-person visits which many patients view as being

beneficial.

Depending on the service, telehealth can be provided in small community centers or even

in some cases in the comfort of a patient's own home. For a home health care model, a patient's

mobile device can be used to collect data that the health care practitioner can review later (Jacobs

& Saunders, 2014). For instance, current smartphones and smart watches use sensors to track the

number of steps taken, heartrate, blood oxygen levels and body temperature (Ballachanda, 2019).

These results can be tracked by the patient or the primary care physician to have a better idea of

the overall health of the patient.

**Teleaudiology Use in Low Socioeconomic
Status Environments**

Over 85 % of the world's population live in low to mid Socioeconomic Status (SES

environments (Swanepoel & Clark, 2019) and in those environments specialized care like

audiology can be very limited. In 2017, a study by Mulwafu et al. reported that in Africa there

was less than one otolaryngologist per million people, and even fewer audiologists per million

(Mulwafu et al., 2017). Children who live in these areas may not be able to get the specialized

care that they need. Teleaudiology is one way to get them care. In remote locations, otoscopy can

be done remotely to monitor ear infections (Bhutta, 2018). In Australia and South Africa, teleaudiology has been used successfully to diagnose and monitor ear infections.

In a study conducted by Ramkumar et al. (2018), telehealth was used to identify and manage middle ear disorders in a rural population of cleft palate patients. Patients with cleft lip and palate are very susceptible to middle ear disorders, so monitoring them is vital (Ramkumar et al., 2018). Middle ear disorders require early identification and treatment because if left untreated they can lead to hearing loss and delays in speech and literacy development (Ramkumar et al., 2018). Teleaudiology programs incorporating the use of video otoscopy and tympanometry testing allow remote determination of the middle ear function, and the appearance of the eardrum and the ear canal of the patient. This can be done in either an asynchronous or a synchronous method. The study by Ramkumar et al. (2018) used an asynchronous method. In this study, a trained facilitator interacted with the patients and performed the video otoscopy and immittance testing (Ramkumar et al., 2018). Eight community members were trained to perform video otoscopy and store the results. Those files were then reviewed by an otolaryngologist offsite. If the patient had cerumen or a middle ear disorder as determined by the immittance results, medication or surgical intervention was recommended (Ramkumar et al., 2018). The second step was for the patients to undergo pure tone audiometry testing if they were diagnosed with a middle ear disorder. The remote audiologist provided counseling based on the results of the pure tone audiometry and made appropriate recommendations such as referrals to otolaryngologists if necessary (Ramkumar et al., 2018).

Telehealth Applications in Audiology

The application of telehealth within the field of audiology is often referred to as "teleaudiology." Teleaudiology can be used for both screening and diagnostic purposes, though

there are limits to utilizing telehealth for diagnostic testing as specialized equipment is required

to administer various diagnostic tests. It can also be used as a means to remotely program

hearing aids. However, again, successful implementation of remote hearing aid programming

would also rely on availability of specialized software and equipment. One of the first major

organizations to use telehealth widely, specifically teleaudiology, was the Veterans

Administration (VA; Jacobs & Saunders, 2014). The VA began their teleaudiology services as a

way to address the growing population of veterans who needed audiology services. There was a

large number of veterans who were living in underserved communities who were not getting the

care they needed. The VA implemented their teleaudiology program in three phases. The first

phase was remote hearing aid fittings. The patient would have a computer cart with various

fitting software and programs at a local clinic and the audiologist would either video conference

in or call in to the patient to explain how to connect the hearing aids to the programming

software on the computer (Jacobs & Saunders, 2014). The audiologist would then take control of

the programming software from a distance to complete the programming. The fittings were

verified with probe mic measures at a follow up appointment which could also be completed

remotely with the help of a trained health care professional. For all appointments, onsite help

was needed there was a registered nurse or other trained health care professional available. The

VA then used a questionnaire to determine whether or not the patients were satisfied with the

telehealth model of service delivery. Overall, the patients rated the process as being very useful

and valuable. Phase two consisted of remote audiometry. There were several challenges with the

completion of remote audiometry (Jacobs & Saunders, 2014). One such challenge was the

concern with secure networks to protect patient information, especially when using third party

hosted services. A specific fire wall and security programs had to be put into place to ensure that

the data was protected. Another challenge was the testing location itself. The ambient noise in the rooms had to be at or below 76 dB SPL for the hearing tests to be accurate. In one study, Krumm et al. (2007) compared results for both hearing tests and otoacoustic emissions for face-to-face and remote visits. They found that the results were not significantly different between the face-to-face condition and the remote condition. Emerging uses of teleaudiology include remote cochlear implant programming (Slager et al., 2019) and the use of cell phone applications to program hearing aids (Munhoes dos Santos, 2019). Opportunities to implement teleaudiology will continue to grow as technology becomes more advanced and secure.

<div align="center">**Teleaudiology Use in School Screenings**</div>

Use of teleaudiology in school hearing screenings was investigated by Lancaster et al. in 2008. Otoscopy, immittance audiometry, and pure tone audiometry screenings were conducted on 32 children first on-site and then through teleaudiology practice. For the on-site screenings, an audiologist went to the school to perform the procedures. For the teleaudiology service an audiologist was stationed thirty miles away and a trained technician was a facilitator on site. The technician performed video otoscopy, tympanometry, and earphone placement while the audiologist remotely viewed the test as the technician performed it (Lancaster et al., 2008). The results for otoscopy and immittance audiometry were identical between both the on-site screening and the teleaudiology screening. The pure tone screening was conducted at 20 dB at 1000, 2000, and 3000 Hz. Pure tone audiometry results did not agree for five of the children, such that they passed onsite but referred following the in-person screening (Lancaster et al., 2008) in the remote screening and the onsite screening. The authors attributed the five referrals to either patient distraction, or the inconsistent internet coverage leading to the remote audiologist missing important visual cues from the children, marking a false response as

accurate. Overall, the authors determined that the outcomes for the two procedures were not statistically significant ($p = .37$; Lancaster et al., 2008). The authors concluded that teleaudiology screenings can be done accurately and reliably. They then determined the sensitivity and the specificity of the teleaudiology testing. There were some other challenges that went along with the teleaudiology delivery. First, the researchers had to set up a secure network between the school's internet and the remote audiologist. They established a VPN (virtual private network) between the two sites, so the information was protected. They also had to make sure that the school had a computer that could run the VPN software and broadcast a video. All the students were found to have normal hearing, which could be considered a limitation. If there were students with a hearing loss, it would show the ability of the remote screening to accurately refer those students for further testing.

Teleaudiology Used for Remote Cochlear Implant Programming

Remote programming of cochlear implants was approved by the FDA in 2017 (Slager et al., 2019). One group of researchers investigated the outcomes of remote cochlear implant programming (Kuzovkov et al., 2014). The authors were focused on if the technology could be used to reliably program a cochlear implant, and if the patients and the specialists programming the cochlear implants were pleased with the process. In this study, there were three groups that were interacting, the remote programming expert, the local audiologist host, and the cochlear implant user (Kuzovkov et al., 2014). The remote programming expert and the host set up a secure interface where the remote programmer could control the software and apply changes to the program. The cochlear implant user was at the host location connected to the programming software so they could receive those changes. The programmer and the patient were also connected via web cam video, or a telephone (Kuzovkov et al., 2014). There were 26 participants

who each received an average of three remote programming sessions. Telemetry was performed and electrically evoked stapedius reflex thresholds (ESRT) were also measured to assist in programming. The remote sessions took about an hour, which is comparable to the amount of time an in-person session would take, as reported by the local host (Kuzovkov et al., 2014). The implants were programmed using telemetry values (threshold and comfort levels). The participants and the programmers completed a questionnaire for each session to report on their feelings about the session. They were asked to rate how satisfied they were with the remote programming experience and how satisfied they were with the programming itself. About 48% percent of the cochlear implant users said that they were satisfied and 39% said they were very satisfied (Kuzovkov et al., 2014). Almost all of them would do remote programming again. The local hosts and the programming experts were asked to fill out the same questionnaires. They responded in a similar manner, with a majority of them being satisfied with the programming and a majority of them willing to do it again (Kuzovkov et al., 2014). It is unclear which modality the participants would prefer because the questionnaire did not ask respondents to rank or make any preference decisions. One reason people may prefer the teleaudiology service delivery may be attributed to the convenience and cut down on travel time. The participants in this study did not have a face-to-face programming session to compare their experience to. This is a limitation because it is possible that the patients would have preferred the face-to-face programming. Without a face-to-face condition it is difficult to tell which service delivery method would have been more beneficial to the patient.

Another group of researchers compared patients' cochlear implant performance when they had undergone remote programming to a patient that received programming in a face-to-face clinic (McElveen et al., 2010). In this retrospective study, the authors examined the hearing

in noise test (HINT) and the consonant/nucleus/consonant (CNC) test scores for seven patients with cochlear implants that had been programmed remotely and seven patients with cochlear implants that had be programmed in person. The length of the appointments was also compared in this study. The authors had a main clinic stationed in Raleigh, North Carolina and a remote clinic in Greenville, South Carolina. A virtual private network (VPN) was encrypted and established between the two sites to ensure patient privacy (McElveen et al., 2010). A cochlear implant audiologist from Raleigh trained a "noncochlear implant" audiologist in Greenville to do the initial assessment and to do the CNC and HINT testing at follow up programming appointments. The patients were seen for a 1 month, 3 month, 6 month, and 1 year follow-up. At each appointment, the HINT and CNC tests were performed by the audiologist on site and the programming was done by the audiologist in the main clinic taking over the computer at the remote site. The audiologist on site was able to take back control of the computer if the connection failed for some reason (McElveen et al., 2010). There were no statistically significant differences between the scores of the group programmed at the central clinic and the group who were programmed remotely. The authors also reported that there were no substantial differences in the amount of time the appointments took in Raleigh and Greenville (McElveen et al., 2010). In this case, Raleigh and Greenville are over 200 miles apart, and over 4 hours apart. Traveling all the way to Raleigh and back would take at least eight hours plus the amount of time the appointment takes, so an entire day would be spent traveling for one medical appointment. Traveling is an added expense for the patient. They would have to pay for transportation, perhaps lodging in the city, and they would be losing wages if they had to take off work. If they are unable to travel alone, they also must rely on the schedule of their travel companion matching up

with the clinic's schedule. Teleaudiology provides convenient and quality care for those who cannot afford to travel far distances to receive specialist care.

Remote programming has also been shown to be safe and effective for pediatric patients. Schepers et al. (2019) used remote cochlear implant programming to program pediatric and adult cochlear implant users. A local host was trained on setting up the programming software and establishing the internet connection between the remote computer and the local computer (Schepers et al., 2019). The participants for this study included 21 children and 25 adults that were each tested and had their CIs programmed remotely and in the main clinic. The tests that the subjects underwent at their fitting appointments were impedance field telemetry (IFT), maximum comfort levels (MCL), threshold levels, and speech testing. The authors chose speech tests that were appropriate for the patient's age and development. There were no significant differences between the results of the IFT, MCL, the threshold levels and the speech testing in the remote programming versus the in-person programming. The authors determined that both forms of programming were safe and effective for the pediatric population (Schepers et al., 2019). The authors also administered a questionnaire about the overall satisfaction to the patients and their parents and found that most reported high levels of satisfaction. With teleaudiology, the children can receive care without their parents having to take off work to travel to a potentially distant specialist. Children can be a difficult population to test and treat because of their shortened attention spans and lack of cooperation. As this study shows even with the added complexity of the pediatric population, teleaudiology can be used successfully.

Teleaudiology Used for Remote Hearing Aid Programming

Hearing aid programming has also been performed using teleaudiology service delivery model (Penteado et al., 2014). In a study conducted in Brazil, eight hearing aid users underwent

initial programming procedures in person with the audiologist. Then, in the follow up remote fittings, the patients had their hearing aids adjusted remotely and patient satisfaction was measured using the Satisfaction with Amplification in Daily Life (SADL) questionnaire (Penteado et al., 2014). The follow ups were conducted at an office with an audiologist present as a facilitator and an audiologist in a remote location who was conducting the appointment. The patients rated the remote fitting as being as effective as face-to-face fittings and the mean scores for the SADL of the remote fitting were above the mean scores of the SADL for the initial in person fitting, which indicates a high level of satisfaction (Penteado et al., 2014). Due to the complexity of the software and the amount of fine tuning that must be done to the programming, patients would best be served by going to the audiologist for an initial fitting. Follow-up fittings usually require fewer changes and would be easy to complete remotely. The authors suggested the patients come to an audiologist for the initial fitting, but the follow-up appointments could be conducted remotely. At least one major hearing aid manufacturer currently has the ability to provide remote fine tuning through a process called TeleCare (Munhoes dos Santos, 2019). The patient downloads an app to their phone and if they need changes made to their programming the audiologist makes the changes in their office. The patient then downloads the changes to their app, which then applies the changes to their hearing aids. This means that as long as the patient has cell phone service, they should be able to adjust their hearing aids. According to the white papers published in 2019 by Munhoes dos Santos, seven out of ten hearing care providers agree that Telecare can provide higher patient satisfaction. Further research needs to be done to determine if the patients are actually satisfied with the TeleCare service.

Teleaudiology used for Remote Auditory Brainstem
Response Testing

Early detection and intervention of hearing loss is key for making sure that children get the amplification they need in order to develop language and literacy skills at a normal pace (American Speech-Language Hearing Association, 2019). In many countries, newborns are screened for hearing loss following birth using an automatic brainstem response (ABR). The ABR is an objective test that can be used to diagnose a hearing loss in children and hard to test populations. ABRs are interpreted by comparing latencies and amplitudes of the waveform to established norms and for the purposes of threshold estimation. ABRs are further interpreted by looking for the lowest stimulation level that a response is present and repeatable and then estimating hearing thresholds by applying known correction factors. In a study conducted by Hatton et al. in 2019, telehealth-enabled ABRs (TH-ABRs) were administered to 102 infants in rural British Columbia. The authors reported that in rural British Columbia currently there are not adequate ABR resources. Either the audiologist or the patient has to travel to get the infant tested, in some cases up to 15 hours (Hatton et al., 2019). The purpose of the study was to determine if TH-ABRs were time/cost effective and accurate. The impacts of telehealth services on the caregivers of the children were also evaluated.

In order to provide TH-ABRs, a first technician underwent training for how to set up an ABR test, placing the electrodes and use of the equipment. The technician did the administrative duties such as scheduling appointments and follow ups if necessary, as well as setting up the ABR test and the video conferencing equipment (Hatton et al., 2019). The audiologist was monitoring the testing and interacting with the patients during testing through a video conferencing programming on a computer. Of the 102 infants tested, 50 were found to have a hearing loss based on the results of the TH-ABR matching the criteria for hearing loss according

to the British Columbia Early Hearing Program (Rennert et al., 2012). Of those 50 after further testing, 30 were found to have a conductive hearing loss due to temporary middle ear fluid or ear wax, 5 had permanent conductive hearing loss due to structural abnormalities, 8 had a sensorineural hearing loss, one was diagnosed with auditory neuropathy spectrum disorder, and 6 were false positives (Hatton et al., 2019). The TH-ABR was found to be accurate and efficient. Whether in person or by remote viewing the main factor that contributes to ABR test interpretation is the skill of the audiologist when viewing the waveforms. If the transmission of the data is clear, the audiologist should be able to accurately interpret the ABR. The results should be the same in person or at a distance. The technician will need to be trained to obtain clear and repeatable waveforms so the audiologist can accurately interpret the results.

In addition to the infant testing, 41 caregivers were asked to complete a survey regarding their experiences. Of the 40 caregivers that completed the survey, 90% said that the TH-ABR appointment meant that they could see a provider sooner, and saved them time and expense (Hatton et al., 2019). Six caregivers responded that they would not have traveled to get the service if the TH-ABR was not available. The authors also determined that it did not cost more to provide the TH-ABRs than the in-person ABRs. The authors reported there was a savings of about $91,000. The audiologists did not have to be compensated for travel, lodging, or per diems. They were also able to pay the technician much lower hourly rate than what they would pay the audiologist. In this case, teleaudiology allowed for the provision of care of infants in rural populations. This is a crucial service because early detection and identification of hearing loss is key to a child's success. Some parents may not know the importance of early identification, so they might not be motivated to travel to receive hearing screening services. Teleaudiology gives

them a convenient way to access hearing healthcare in a timely way so that children with a hearing loss can have the best chance of early diagnosis and treatment.

There are many ways to implement teleaudiology that are beneficial to patients. Almost any service that can be done in a traditional audiologist's office can be completed remotely, though some audiological procedures are easier to facilitate than others. The research reviewed within this chapter has shown that hearing screenings, diagnostics, and programming can be done successfully remotely. Most patients had a positive experience with the remote services, and they would use it again in the future. Teleaudiology can be used to provide essential services to rural communities. However, for teleaudiology to be successful, the communities would need access to specialized equipment, like sound treated rooms and diagnostic equipment such as auditory evoked potentials systems and audiometers. Additionally, most audiological services completed remotely via telehealth do require additional personnel to be available wherever the patient is located to facilitate, particularly in the case of diagnostic testing.

Current Clinicians' Opinions on Teleaudiology

Teleaudiology can provide many benefits for both patients and audiologists. Audiologists can use teleaudiology to reach more patients and bill those hours, increasing revenue and outreach (Ballachanda, 2019). In 2016, Eikelbloom and Swanepoel surveyed audiologists to determine the experiences and attitudes that audiologists had about telehealth. They also asked questions about how comfortable they were with using technologies like video conferencing systems and computers. A total of 269 people responded to the survey with respondents from Europe North America, and South America (Eikelbloom & Swanepoel, 2016). Out of the respondents, only 15% had experience with teleaudiology, which suggests it is not widely used. However, 90% of audiologists surveyed were familiar with telehealth and teleaudiology and they

were willing to use it, but less than a quarter reported having used it. The authors attribute the gap between the positive attitudes towards teleaudiology and the actual use of teleaudiology to the lack of infrastructure in some countries, and the high case load that many audiologists have (Eikelbloom & Swanepoel, 2016). Infrastructures like high-speed internet and various tools and technology need to be in place for an audiologist to be able to provide telehealth services. Also, because of the heavy case load that many audiologists have, it might not be possible for them to add telehealth services to their load.

The attitudes toward telehealth also need to be taken into account. In a systematic review performed by Ravi et al. in 2018, five studies regarding the attitudes and perceptions of teleaudiology by audiologists were examined. Studies included in this review were dated from 2004 to 2016. Across all the studies audiologists had a positive view of teleaudiology and stated that they would perform teleaudiology if they felt they were able to. According to the authors, most audiologists reported being trained for teleaudiology on the job, or through continuing education courses (Ravi et al., 2018). In some studies, the barriers to teleaudiology were addressed. The most common barriers were the lack of suitable infrastructure, the lack of training, difficulties with reimbursement and billing, licensure problems, and the lack of standardization of procedures (Ravi et al., 2018). Most of the respondents in the studies were interested in gaining more information about how to perform teleaudiology and they indicated that continuing education courses or sessions at conferences would be their preferred method of gaining this knowledge (Ravi et al., 2018). Providing teleaudiology services requires a commitment from the audiologists involved. They would have to pursue training and perhaps additional licensure if they wanted to practice teleaudiology over state lines, and they would also

have to stay up to date with the changes in reimbursement policies. These responsibilities all need to be taken into consideration if a practitioner wants to offer teleaudiology services.

Reimbursement

One potential barrier to the implementation of telehealth services is the ability for audiologists to be reimbursed for teleaudiology services (Dorsey & Topol, 2016). Dorsey and Topol reported on the status of reimbursement by collecting and reviewing the policies for telehealth for different insurance groups. There is limited reimbursement for teleaudiology, but it is becoming more common to see insurances cover teleaudiology. As of 2019, there were 36 states that required private insurance carriers to cover telehealth services to the extent that they cover in person care (American Telehealth Association, 2019). In 48 states, Medicaid programs will cover telehealth to some degree. Each state has their own restrictions on the reimbursement. Medicare programs will only reimburse when telehealth services are performed in a clinic setting in a community where there are few specialists (Dorsey & Topol, 2016). In 2012, Medicare spent $5 million on telehealth services which was less than .0001% of their spending that year (Dorsey & Topol, 2016). Many of the people living in the rural and isolated areas that would benefit from telehealth services are covered either by Medicaid or Medicare but depending on their state's unique restrictions, some clinics and practitioners are unable to bill insurances, which limits their ability to provide telehealth services (Dorsey & Topol, 2016). Telehealth can be a cost-effective model of providing health care. Countries with universal health care and organizations at risk for large health care spending would benefit from the low costs of telehealth services. The limitation of this model is that the telehealth providers have to target a large customer base. Many of the telehealth providers have marketed to employers and other large groups of consumers.

Models of Training

In Arizona there is a statewide telemedicine program, the Arizona Telemedicine Program (ATP), which receives state funding and grants to train practitioners in telehealth (Krupinski et al., 2011). The ATP is an umbrella organization for over 50 independent health care organizations such as community health centers, Indian Health Service facilities, and the Department of Corrections. They offer over 60 clinical subspecialties across the state. Due to the extensive number of places served and specialties offered, the ATP has created a bimonthly training program that focuses on an overview of telemedicine and its clinical applications (Krupinski et al., 2011). The training program gives an opportunity for the participants to get hands on experiences with various telemedicine technologies. The training is offered to people associated with the ATP and people from out of state. The ATP also offers follow up, onsite training to go over how the technology will be used in that specific office (Krupinski et al., 2011).

Many new health care professionals have grown up with technology and incorporate technology in their daily lives, like video calls, online classes and use of advanced diagnostic tools. Pathipati et al. (2016) addressed how to train this younger generation to perform telemedicine. The authors felt that telemedicine training should begin while students are in medical school so they can become comfortable with the skills required to practice telemedicine (Pathipati et al., 2016). By training the students early they will be more likely to consider telemedicine as a viable treatment option. The authors suggested that telemedicine should be introduced in the "preclinical" course work that all medical students must take, and then applied in the clinical course work (Pathipati et al., 2016). The authors cited several student training programs that have successfully incorporated telemedicine, including the Department of

Veterans Affairs Medical Center in Denver and Stanford University School of Medicine

(Pathipati et al., 2016).

As of right now, the most common way for an audiologist to be trained in telehealth is through hands on experience. The University of Texas has a "clinic on a cart" that they use to train their students (Moore, 2017). The cart contains an audiometer, tympanometer, and video otoscope. The audiologist can control the audiometer from a remote location to perform audiometry using a synchronous method of teleaudiology delivery. The students learn how to use the cart and then the cart is placed in a community health clinic where it can serve the community. The students get to use the cart under supervision from an audiologist. Not all universities offer these types of opportunities to learn how to utilize synchronous teleaudiology delivery. There are online resources for continuing education credits in teleaudiology, but one could argue that online experiences are not as helpful as hands on experience. Education and training has been suggested as one of the barriers to successful implementation of a teleaudiology program (Eikelbloom & Swanepoel, 2016). However, it is unclear what the current status of formal education and training is within the field of audiology.

Summary

Telehealth has been in use in many different fields of medicine for many years. There are ways to implement telehealth in audiology including remote screenings, remote hearing aid and cochlear implant programming. The attitude towards telehealth services are generally positive from both the audiologist and patient perspective. Teleaudiology practices have been found to be time and cost effective while still being accurate and reliable. In rural areas where specialist care, like audiology, may be far from the patient, teleaudiology provides a convenient way to get care. Teleaudiology has been used successfully in children and adults to program cochlear implants.

Children in rural areas can also receive newborn hearing screenings via teleaudiology, an essential component of early hearing loss identification. However, the lack of training and education programs for teleaudiology may be preventing audiologists from adding telepractice service delivery. The purpose of this study was to determine the current state of teleaudiology education and training. Current practicing audiologists were surveyed to obtain more information about any training or education they received in the area of telepractice, if they are currently offering teleaudiology services, and if they would be interested in additional training and education for teleaudiology.

CHAPTER III

METHODOLOGY

Purpose

The purpose of this study was to determine the current perceptions of practicing audiologists regarding teleaudiology education and training. A survey directed at practicing audiologists was developed to determine if/how audiologists are receiving teleaudiology education and training and their experiences with teleaudiology. By learning more about the attitudes and perceptions of audiologists regarding telehealth, in the future it may be possible to address barriers presented by audiologists so that teleaudiology services can be provided more frequently.

Procedure

Survey Development

Using Qualtrics Survey Software, one survey was developed for all participants. There were demographic questions and additional questions that focused on different aspects of teleaudiology including the use, training and education received, and the perceived importance of teleaudiology.

Survey Questions

At the beginning of the survey there was a page providing information on the survey, voluntary participation, possible risks, and how consent is obtained was presented. The participants are informed that pressing continue constitutes consent.

The survey consisted of 16 questions asking if they are currently practicing audiology, if they are currently seeing patients, what setting they are currently employed in, if they use teleaudiology, and what kind of training the participant has received in teleaudiology. There were questions at the end asking about how interested they are in receiving training in teleaudiology. These questions were meant to answer the research question about what kind of training and education they have or have not received in teleaudiology. The second question asked if the respondent are currently seeing patients, if they answered no the survey would end. This is because it is of most interest to determine whether the audiologists responding are currently using teleaudiology to treat patients. The participants will be asked if they received training or education in various aspects of teleaudiology and how often they offer their teleaudiology services. These questions were asked to determine if there is a lack of training for services offered. The last three questions asked about the opinions the audiologist had about teleaudiology and its importance, and the importance of teleaudiology training and education. Most questions required a single response, some used a Likert rating scale. See Appendix B for reference.

The materials for the survey included the statement of consent, the survey questions, and the Doctoral Scholarly Project proposal, all of which can be found in Appendix B. The materials were submitted to the Institutional Review Board (IRB) at the University of Northern Colorado. Approval was obtained from the IRB on April 14, 2020, approval can be found in Appendix A.

Survey Distribution

The link to the survey was provided online on social media sites including audiology Facebook groups. The Facebook groups included Audiology Antics and Anecdotes, and Audiology Happy Hour. Each of these groups contain members from around the globe who are

either students or professionals in the field of Audiology. Audiology Antics and Anecdotes currently has over 14,500 members and Audiology Happy Hour has around 10,000 members with some crossover The link to the survey was posted on each Facebook group once on June 3, 2020. The study had 336 respondents that consented to participate.

Participants

To obtain information about current audiologists' perceptions and experiences with telepractice, the population targeted in this survey included currently practicing and licensed audiologists. Inclusion criteria consisted of English as a primary language and being 18 years of age or older. To reach these professionals, a survey was developed and distributed via social media and email. The institutional review board (IRB) at the University of Northern Colorado approved this research. A statement was provided to the participants discussing the study and the consent process. Participants were informed that starting the survey constituted as their consent.

Data Analysis

Research Question

The research question evaluated what the status of education and training is for teleaudiology currently. The survey asked several questions about the audiologist to determine the demographic information of the person responding. These questions included how long they have been practicing, what setting they currently practice in, and how they received their education (i.e., in person or by distance). They were then asked if they have received training or education for certain teleaudiology services, then they were asked which, if any, teleaudiology services are offered in their current place of employment. Responses to these questions helped answer the research question regarding the current state of education and training. There were also questions at the end of the survey asking the respondents their opinion about teleaudiology

and their interest in receiving training in teleaudiology training and education. These questions will contribute to the conclusion drawn about the current state of teleaudiology. Survey questions can be found in Appendix B.

Trends were analyzed across the entire participant pool. The responses were then also separated based on demographic data such as the amount of time they have been practicing and what kind of education they have received to see if there were any demographic related factors that influenced participant responses. Responses to an open-ended question at the end of the survey was also analyzed qualitatively to look for common themes in the answers.

CHAPTER IV

RESULTS

With the research question "what are the current perceptions of practicing audiologists regarding the state of teleaudiology education and training?" in mind, a survey was developed to ask practicing audiologists their perceptions of teleaudiology education and training. The survey was posted to multiple Facebook. Overall, there were 352 respondents and 338 consented to participate in the study. The total number of members for the groups the survey was posted to is about 31,800 with the largest group having about 15,000 members. The groups have some overlap in members so out of the 15,000 the response rate is about 2.25% when using the largest group to calculate the response rate. All responses can be seen in Appendix C.

To get a sense of geographic distribution, respondents were asked which state they reside in. Based on participant responses, all states were represented except for Rhode Island and Delaware. Florida and Texas had the most representation with 7% and 8% of the respondents being from those states, respectively. The country was separated into four geographic regions: northeast, south, midwest and west to look at regional distribution of responses. The south had the most representation with 137 (39%) responses (see Figure 1).
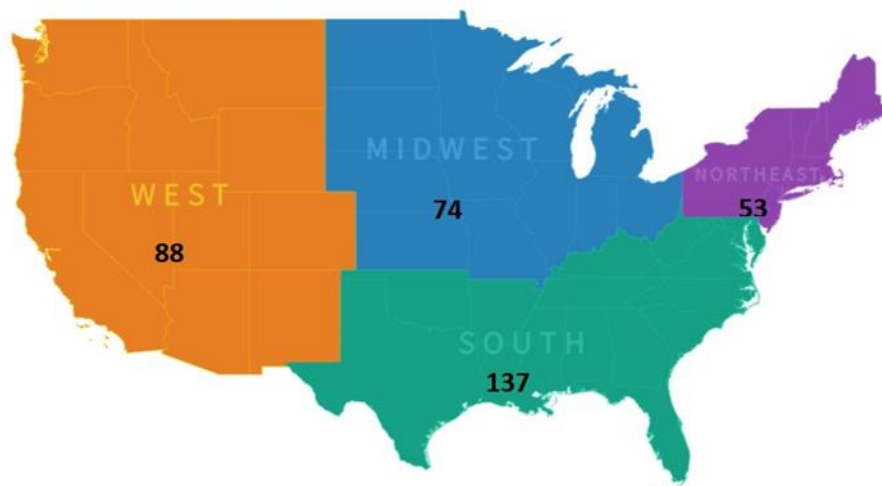
Figure 1. Number of participant responses by geographical region.

The majority of respondents (56%) reported their education was a residential four-year Au.D. program, 30% were in a distance Au.D. program, 11% attended a Master's degree program, 2% were in a Ph.D. program, and 1 person (.3%) answered "other" when asked about their education. Participants were asked if their primary workplace was urban, suburban, or rural. The majority, 45%, responded that they work in an urban setting, 42% reported working in a suburban setting, and 12% reported working in a rural setting. When asked where they primarily worked, participants answered hospital (57%), private practice (12%), other (21%), and ENT (5%). See Figure 2 for full breakdown of work setting demographics.
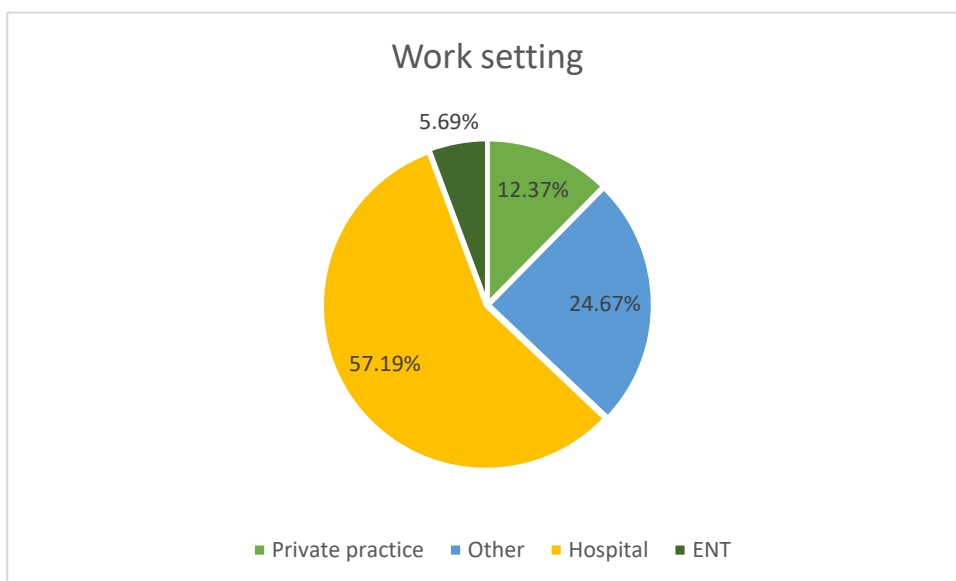
Figure 2. Breakdown of participant's work settings. The "other" category includes responses for industrial, manufacturer, educational audiologist, university, and other.

The next section of questions asked about their education and/or training and if/how they received teleaudiology education for various aspects of audiology clinical service delivery. The respondents were then asked about the various forms of teleaudiology and if/how they were educated on it. The responses of "no education or training" and "on the job training" were the most common response for each of the categories of teleaudiology services (see Table 1). When asked how often they provide various teleaudiology services, the most common answer was "never" for all the categories except for two, remote counseling and remote hearing aid fitting, which were most commonly offered "weekly".

Table 1

Relative Amount of Training for Different Teleaudiology Services Reported

Teleaudiology Services	No Education/ Training	Graduate Course(s)	Clinical Practicum/ 4th year	On the Job	Workshop/ CEU
Remote Screenings	55%	3.0%	4%	25%	11%
Remote pure tone threshold testing	56%	2.0%	4%	24%	13%
Remote otoscopy/tympanometry	55%	2.0%	4%	29%	9%
Remote hearing aid fitting/programming	9%	1.0%	4%	56%	28%
Remote cochlear implant programming	82%	0.6%	1%	7%	7%
Remote aural rehabilitation	40%	3.0%	4%	43%	7%
Remote counseling	17%	3.0%	5%	66%	7%

Note: CEU refers to continue education units.

The next section of questions focused on participants' perceptions regarding training for teleaudiology. When asked if they would be interested in receiving formal teleaudiology training, 92% answered they would be interested. When asked about which forms of training would be preferable, the categories that people were the most interested in were webinars (93%) and continuing education courses (94%). The category that participants were the least interested in was the university courses with 67% of participants reporting that they were not interested in receiving teleaudiology training through university courses (see Figure 3).
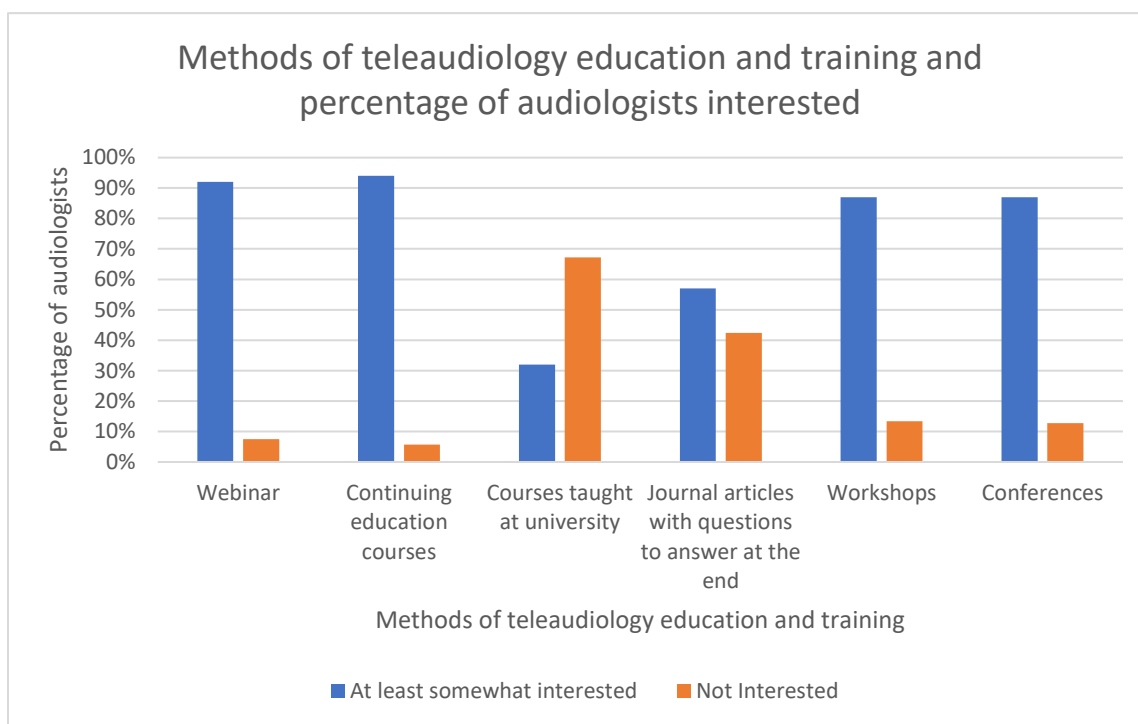
Figure 3. The percentage of audiologist who are interested in different teleaudiology education and training.

When asked if there was a need for teleaudiology training, 95% of respondents answered yes. In the next question, over half (71%) responded no when asked if they felt that there was enough teleaudiology training in their area. About 94% of participants answered yes when asked if graduate education should include teleaudiology training.

To further evaluate participant's responses, participants were broken up based on various demographics to determine if certain demographics had an impact on their perceptions regarding teleaudiology education and training. The first demographic that was looked at was work setting. Within the group of people who responded they work in a hospital, 95 % of them said there was a need for teleaudiology training and 33% answered yes when asked if there is enough training and education for teleaudiology. In this group, about 44% responded they would be very

interested in getting formal teleaudiology training and education and 45% said they would be somewhat interested in formal teleaudiology education and training. The most common teleaudiology service offered was remote hearing aid fitting. Of the people who responded they worked in a hospital, 47% reported they offered remote hearing aid fittings on a weekly basis, 18% offered remote fittings monthly, and 14% offered remote fittings on a quarterly basis. Remote counseling was the second most popular service offered with 63% of people who answered they worked in a hospital offering remote counseling on a weekly basis. In that same group, 14% offered remote counseling monthly and .8% offered counseling on a quarterly basis. To see the full breakdown of teleaudiology services offered by people in the hospital setting (see Table 2).

Table 2

Frequency of Various Teleaudiology Services

	Weekly	Monthly	Quarterly	Never
Remote Screening	10%	1%	5%	84%
Remote otoscopy/tympanometry	21%	4%	6%	69%
Remote hearing aid fitting	49%	18%	14%	18%
Remote aural rehabilitation	31%	17%	9%	43%
Remote counseling	62%	15%	9%	14%
Remote pure tone threshold testing	15%	3%	3%	78%
Remote cochlear implant Programming	1%	1%	2%	96%

Out of the respondents, there were 171 in the hospital setting and 173 in all other settings combined. It was found that the group in the hospital setting performed teleaudiology services

more frequently than the non-hospital group. The biggest difference between groups was with the amount of remote otoscopy done. In the hospital group, it was about 30% and in the non-hospital group it was 15%, which is just about half as often. The non-hospital group did report performing remote pure tone threshold testing more often than the hospital group. See Table 3 and Figure 4 for full break down.

Table 3

Frequency of Various Teleaudiology Services in the Hospital Group and Non-Hospital Group

	Hospital ($n = 171$)	Non-Hospital ($n = 173$)
Remote screening	17%	17%
Remote otoscopy/tympanometry	31%	15%
Remote hearing aid fitting/programming	82%	75%
Remote aural rehabilitation	57%	40%
Remote counseling	86%	73%
Remote pure tone threshold testing	21%	27%
Remote cochlear implant programming	4%	3%
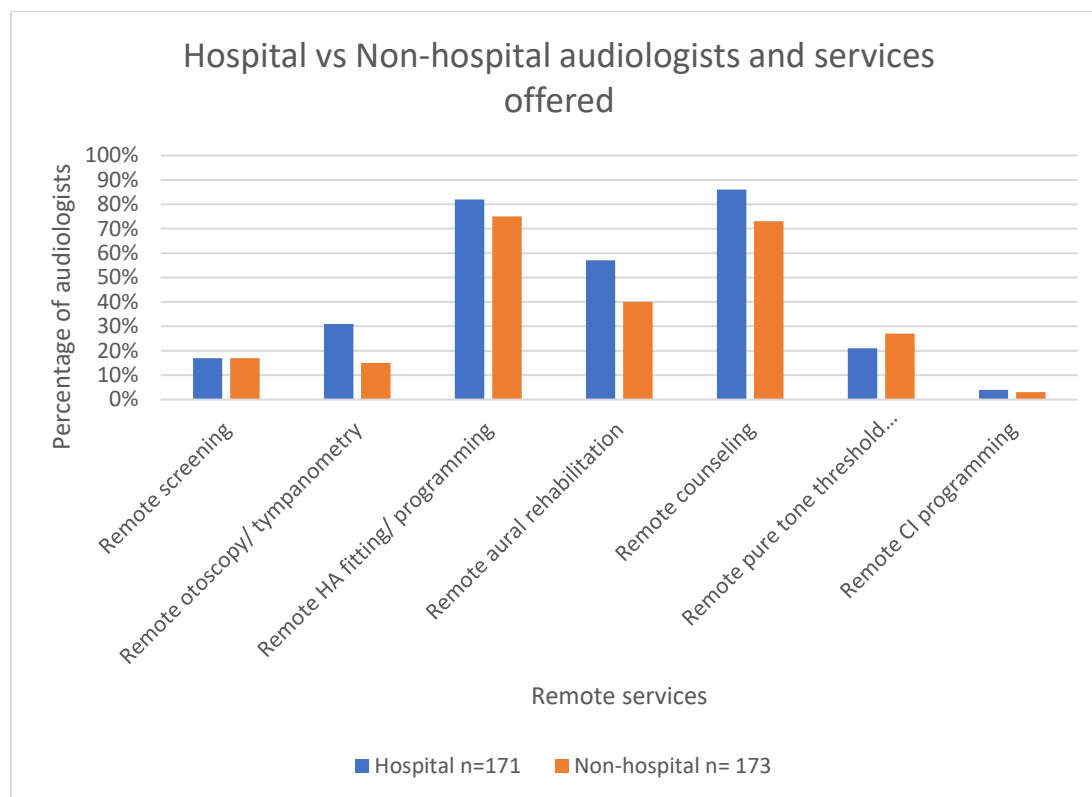
Figure 4. The services offered by hospital audiologists and non-hospital audiologists

Another demographic of the respondents was how long they had been practicing audiology. The choices were 0-5 years, 6-10 years, 11-20 years, and 20 or more years. Out of the group of audiologists that answered they had been practicing 0-5 years, 71% reported completing hearing aid fittings remotely and 71% reported they did remote counseling. To see what other services were offered see Table 4. In this group, 41% were very interested in receiving formal teleaudiology training and education and about 45% were somewhat interested in receiving formal teleaudiology training and education. When asked if there is a need for teleaudiology training and education, 92% answered yes.

Table 4

Length of Time Practicing and Remote Services Offered

	0-5 years ($n = 77$)	6-10 years ($n = 55$)	11-20 years ($n = 75$)	>20 years ($n = 92$)
Remote screening	10%	25%	13%	15%
Remote otoscopy/tympanometry	19%	31%	21%	21%
Remote hearing aid fitting/programming	71%	78%	84%	80%
Remote aural rehabilitation	40%	41%	60%	51%
Remote counseling	71%	75%	88%	83%
Remote pure tone threshold testing	18%	27%	21%	12%
Remote cochlear implant programming	1%	5%	2%	4%

The respondents were then separated based on what type of environment their employment was located: rural, suburban, or urban. There were 36 people who answered that their primary work setting is rural. Out of those 36, 83% reported providing remote hearing aid programming and 80% reported completing remote counseling. Almost all of these respondents (91%) reported there is a need for formalized teleaudiology education and training. In addition, 88% of these respondents answered that they would be interested in formal teleaudiology education and training.

In the suburban group, 81% reported having done a remote hearing aid fitting and 78% said that they have done a remote counseling session. When asked if there is a need for formalized teleaudiology education and training 92% reported yes. In this group, 87% said they

would be interested in formalized teleaudiology education and training and the majority of the group believes there is not enough teleaudiology education and training.

     The next group is the urban group. There were 135 respondents in the urban group. In this group, 94% report there is a need for formalized teleaudiology education and training and 93% said they would be interested in that training and education. Out of the 135 respondents in this group, 77% have done a remote fitting session and 80% have done a remote counseling session. Table 5 and Figure 5 show the remote services offered from the different work settings.

Table 5

Location of Workplace and How Often They Offer Telehealth Services

	Rural (*n* = 37)	Suburban (*n* = 127)	Urban (*n* = 135)
Remote screening	22%	15%	15%
Remote otoscopy/ tympanometry	25%	22%	25%
Remote hearing aid fitting/ programming	81%	78%	80%
Remote aural rehabilitation	47%	43%	54%
Remote counseling	80%	78%	80%
Remote pure tone threshold testing	19%	19%	17%
Remote cochlear implant programming	6%	2%	3%
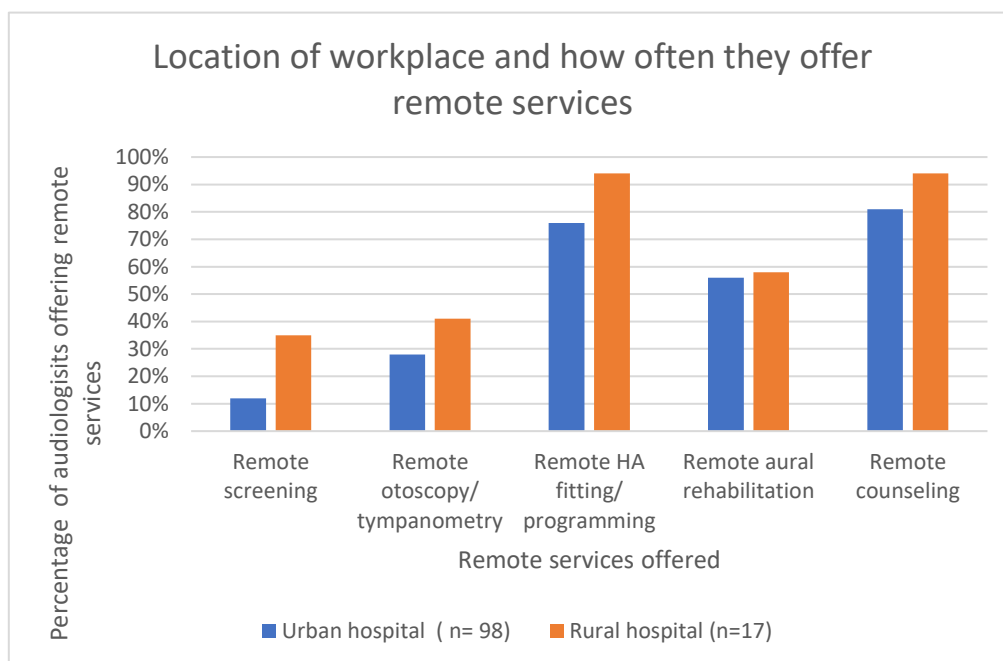
Figure 5. The percentage of urban and rural hospital audiologist performing telehealth services.

The next demographic that was evaluated was the different educational backgrounds of the participants. The participants reported; Master's degree, distance Au.D., residential Au.D., or Ph.D.

To look at the data, the distance Au.D. group and the Master's group were combined because it is assumed that most audiologists who obtained a distance learning Au.D.. were practicing audiologists who already held a Master's degree. The largest group in the education demographic is the residential Au.D. group with 181 respondents. In this group, 78% of people had provided a remote hearing aid fitting and 78% had provided a remote counseling session. Over 90% of this group reported they would be interested in getting teleaudiology education and training. Ninety four percent in this group reported there is a need for teleaudiology education and training and 69% answered that there is not adequate teleaudiology education and training.

The smallest group of respondents was the Ph.D. group with 8 respondents. In this group, 75% reported they had done a remote fitting session and 63% have done a remote counseling session. Seventy five percent agree that there is a need for teleaudiology training and education and 75% reported they would be interested in teleaudiology training and education. When asked if the teleaudiology education and training is adequate, 62% responded no. Regardless of educational background the response patterns were generally the same and the trends between the groups were very similar. See Figure 6 for a full break down of remote services offered.
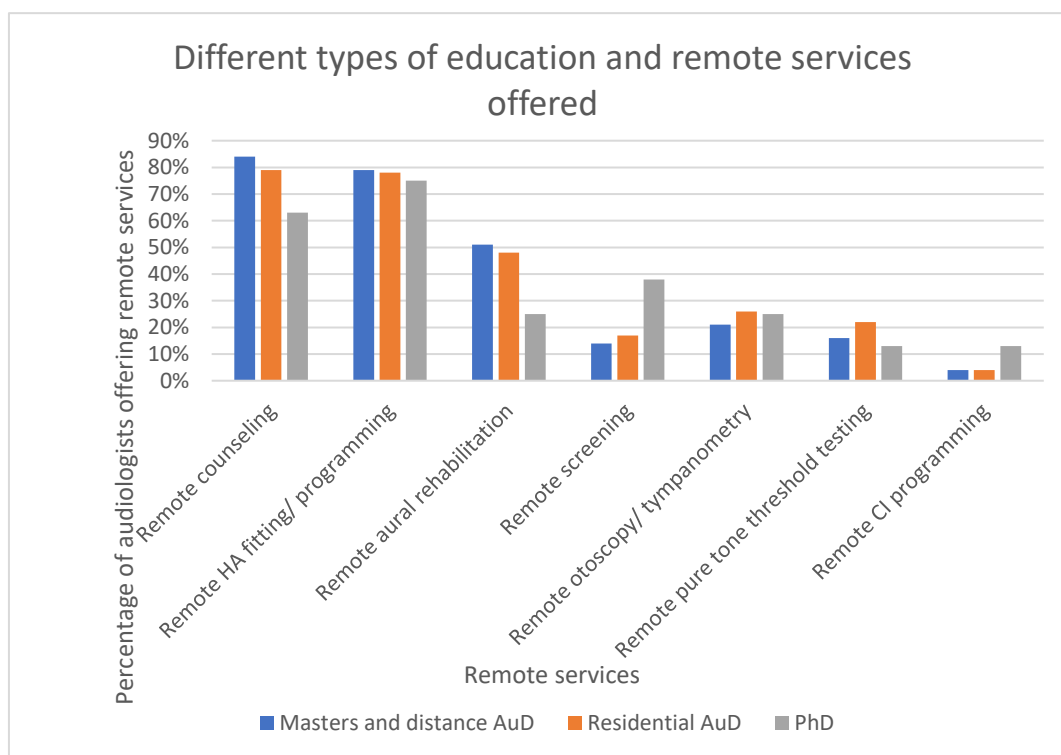

Figure 6. The percentage of audiologists who offer remote services across different educational backgrounds.

CHAPTER V

DISCUSSION AND CONCLUSIONS

The purpose of this study was to determine the experiences, attitudes, and perceptions of practicing audiologists regarding the state of teleaudiology education and training. The majority of participants answered that they had not received education or training for any forms of teleaudiology services. Those who have received teleaudiology training have mostly received it from on-the-job trainings or from workshops. There seems to be a lack in formalized classes or courses regarding teleaudiology training. This result is similar to what Ravi et al. (2018) reported on. Overall, the participants in this survey would be interested in getting teleaudiology training through workshops or CEU credits, not courses taught at a university. One reason for this trend might be that the people interviewed were practicing audiologists who are not currently enrolled in a college audiology program. They would not have a reason to take courses at a university. If the survey had been made for different groups such as current doctor of audiology students, responses may have been much different. Most of the participants did respond that they think teleaudiology education and training should be included in graduate education. When asked if there is adequate teleaudiology training in their area, the majority of people responded no. As technology keeps advancing, teleaudiology will become a more utilized form of service delivery.

Even though there seems to be a lack of teleaudiology training, many participants reported providing teleaudiology services. The services that were reported as being the most frequently offered were remote hearing aid fitting/programming and remote counseling. Remote hearing aid services have been available for the past few years. In 2014 Penteado et al. used

teleaudiology to remotely program hearing aids. As this technology has been available for a few years, it may be a more comfortable technology for audiologists to use. There is very little specialized technology that is needed for remote programming which could be another reason that it is one of the most common services to be offered.

The responses were broken down into different grouping abased on demographics. For the most part, the results between groups were very similar. When compared between work setting (i.e., rural, suburban, urban) about 80% of audiologist offer remote hearing aid fittings. When broken down by workplace (i.e., hospital, private practice, etc.), about 94% of the group of rural hospital audiologists reported offering remote hearing aid fittings and 81% of the group of urban hospital audiologists reported offering remote hearing aid fittings. The difference between these two groups could be because there was a large difference in the number of respondents for each group. The rural hospital audiologists had 17 respondents and the urban hospital audiologists had 98 respondents. In general, though, the groups of rural and urban audiologists report offering teleaudiology services at about the same percentage. This is interesting because teleaudiology services are a great way to serve rural communities, so it was anticipated that rural audiologists would have reported providing more remote services. When divided into hospital and non-hospital audiologists, the hospital group provided more teleaudiology services than the non-hospital group. This could be because with the larger organizations like a hospital, the infrastructure could already be in place for other remote services. The audiology department could use the same infrastructure to provide their remote services.

When divided into years practicing, the findings across groups were very similar also. It appears the length of time practicing does not affect the percentage of audiologists offering remote services. Across all groups, about 80% offered remote hearing aid fittings with the

newest audiologists (0-5 years practicing) offering the least amount of remote hearing aid fittings at 71%. It would not be unreasonable to think that the newest audiologist would be incorporating more remote care into their services because they would have had the chance to become familiar with the latest practices in their graduate courses and could then incorporate it into their practice. It was fairly surprising that the groups were so similar in the amount of teleaudiology offered. It was anticipated that the groups would differ based on work setting and primary population served (i.e., rural vs. urban) or the more recent the graduate.

The largest factor that could have impacted the results of the survey would be the COVID-19 pandemic. More specifically, participants may have been offering some more remote services during that time. During the pandemic, many businesses were ordered to shut down to help limit the spread of the virus. These closures affected many businesses, audiology included. Shutting down clinics and lessening the amount of face-to-face appointments helped lessen the potential risk of spreading the virus. Clinics that were not previously using remote services may have started to reevaluate and consider implementing teleaudiology as a way to continue to serve patients while clinics were shut down. An article by Ballachanda et al. (2020) described two business models for teleaudiology services and describe which services can be offered remotely. The authors suggest that hearing loss identification and subsequent hearing loss interventions can be done remotely for the most part. The authors created a chart walking the reader through different considerations for each part of remote care implementation. For example, if an audiologist is going to incorporate remote services, they may need to have trained staff or facilitators (Ballachanda et al., 2020). The authors propose that almost all services can be performed using teleaudiology and the pandemic has pushed more audiologists to include remote

services, the authors believe that teleaudiology will continue to evolve and it will be offered in the long term.

Teleaudiology During the COVID-19 Pandemic

The survey was developed before the pandemic and the IRB approved the survey at the time when many places had to shut down due to COVID-19 precautions. The survey was distributed after most clinics had reopened. The audiologists would have needed to incorporate remote services into their practice in order to provide care while they were shut down. Audiologists across the board had to adapt and find ways to provide care while maintaining the safety of their patients and staff. Some audiologists who may not have been providing remote care would have needed to. This could be why much of the data is so similar, because of the need for teleaudiology. In another article written during the pandemic, the author examined various aspects of how a clinician can transition to offering more remote care (Nalley, 2020). The author covered topics including reimbursement and insurance coverage. She points out that in the past teleaudiology was not reimbursed by insurances, but during the pandemic, Medicaid and Medicare started reimbursing for more telehealth services, including, teleaudiology. The author emphasized that teleaudiology is a useful tool because the clinician can provide care for the patient in the comfort of their own home. For example, in the case of the hearing aid programming, if the patient is struggling with certain ambient sounds in the house, the issue can be addressed right away instead of making adjustments in the office and then hoping it solves the issues when the patient returns home (Nalley, 2020). One audiologist interviewed in this article believes that teleaudiology can offer clinicians opportunities to grow and transform the audiology service delivery model. Hearing aid programming is one of the easiest remote services to offer.

Remote hearing aid programming was the most common service offered. Remote hearing aid programming has been an option from many of the major hearing aid manufacturers for some time now. It does not require very specialized equipment or training. The same is true for remote counseling and remote aural rehabilitation. Those services can be done as long as the patient and the audiologist have a secure video connection.

Some of the other services that were less frequently offered were remote cochlear implant programming and remote screenings. Remote cochlear implant programming is the least offered which could be because remote cochlear implant programming requires specialized equipment and an audiologist familiar with cochlear implant programming. It seems that the audiologists surveyed have a positive attitude towards teleaudiology, but there are some reasons as to why teleaudiology services are not being offered regularly.

In this study, the respondents were not specifically asked if they perceived any barriers to teleaudiology implementation but in the final open-ended question the respondents did identify some reasons as to why they did not incorporate teleaudiology more regularly. There were several themes in the responses including licensure, reimbursement, lack of infrastructure and rapidly changing technology. Some barriers that have been pointed out in a past study by Ravi et al. (2018) include reimbursement, technology limitations, and licensure issues.

One person stated that one deterrent to using teleaudiology was the licensing involved. In some states, the practitioner is required to be licensed in the state they are physically in and the state where the patient is located which can sometimes be in a different state. A few participants also brought up the issue of reimbursement. They mention that the reimbursement for teleaudiology services is not enough. Medicare usually does not reimburse for teleaudiology or speech pathology services (American Speech-Language-Hearing Association, 2021) and private

insurance reimbursement depends on the insurer and the state's policy. Due to the COVID-19 pandemic, Medicare has put policies in place to reimburse for telemedicine services provided during the pandemic (American Speech-Language-Hearing Association, 2021). Even if the state has policies in place for reimbursement, depending on the individual insurance company and policy teleaudiology services may not be reimbursed. One interesting result from the data is that audiologists did respond that they offered remote aural rehabilitation sessions. The reimbursement rate for face-to-face aural rehabilitation sessions is very low, if it is reimbursed at all, so it was surprising that audiologists reported they offered this service remotely. It is possible that remote counseling as part of remote hearing aid programming was being described as aural rehabilitation by the survey respondents. These responses are similar to responses found in the study conducted by Ravi et al. (2018).

Several other barriers were brought up by the participants within the final open-ended question. For example, one respondent mentioned that because technology is always changing having teleaudiology course work would not be useful because technology will have changed by the time they are practicing. On the other hand, one person replied that they were a recent graduate and they had wished there was more course work regarding teleaudiology because it was a difficult thing to adjust to. Many of the respondents also mentioned that teleaudiology is necessary for rural patients, though that need was not voiced by audiologists who worked in rural settings. One of the participants who worked in a rural setting stated that "needs to be incorporated in our daily practices". Open ended responses are summarized in Table 6.

Table 6

Barriers Identified by Participants

Barriers identified by participants	Comments
Support from their institution /workplace and infrastructure	"It's tricky. It takes a lot of set up and you need to have buy in from your institution. For example, we would love to offer remote services, but our hospital for some reason seems to really bar our ability to do it and doesn't want to move."
	"It's tricky. It takes a lot of set up and you need to have buy in from your institution. For example, we would love to offer remote services, but our hospital for some reason seems to really bar our ability to do it and doesn't want to move."
	"we have administration restrictions due to IT and large multi specialty clinic"
	"Adequate equipment for teleaudiology is needed as well."
	"We didn't have the infrastructure to see audio patients in this manner, so I'm a little worried we may have lost business due to the closure of the university for 3.5 months."
Billing	"Billing and licensing becomes and issue. In some state (Ohio) I am not legally allowed to remotely test or fit hearing aids so I don't think training is necessary until licensing catches up"
	"Teleaudiology billing"
	"Reimbursement first, then teleaudiology; otherwise, it is another way of giving it away or worse letting someone else do it instead of audiologists"
Patient's reluctance/comfort	"Since the pandemic I have been offering it to all new fits to have teleaudiology for follow ups. I've yet to have anyone choose this"
	"Its not difficult for Audiologists to use, the difficulty is often with patient use. Training needs to be for the elderly population on how to use devices, not so much the professional."
Provider's reluctance/comfort	" I do feel this is a tough area for those who have been practicing more than 10 yrs. The idea of doing things remotely takes time to feel comfortable."

Limitations

This survey was released during the COVID-19 pandemic, so that might have influenced some of the answers. Many practices had to be shut down or at least limit the number of in person appointments they had during this time. The survey was developed prior to the pandemic, though IRB approval happened while many clinics were shutting down. The survey was then posted after most clinics had reopened but in person visits were still limited. The survey was released in June 2020, and a majority of responses occurred at that time. Participants may have answered that they offer more teleaudiology services more frequently than what had been typical in the past (even just a couple of months prior). It is impossible to determine if this is the case as there were no specific instructions as to if they should answer the questions based on how they are practicing now or how they were practicing before the pandemic. Another limitation would be the number of people who answered the survey. Out of the 15,000 people the response rate was about 2.25%. With more responses the results would give a more accurate picture of the perceptions audiologists have of teleaudiology training and education.

The advances in technology have made it possible to serve a more diverse population. Teleaudiology could provide opportunities for increased care in rural populations and populations that cannot travel to get care. Even though teleaudiology is accessible for much of the population there are underserved communities within the United States that do not have access to even the basics needed for teleaudiology like reliable internet or smart phones. It is mportant to consider these disproportionately underserved populations when discussing telehealth

While teleaudiology is a viable service method, there seems to be a lack of audiologists providing certain teleaudiology services. One of the least provided services is the remote

cochlear implant programming. As cochlear implant programming has only been approved by the FDA since 2017 some audiologists may have been hesitant to add remote services to their practice. Due to the complexity and length of cochlear implant programming appointments, it might be more comfortable for the audiologist to see the patients in person so they can more easily troubleshoot issues that may come up. The most commonly provided remote services are ones that do not require specialized testing equipment. The most common services were remote programming and remote counseling which require the patient have access to a smart phone or computer, the provider needs a computer also and programming software. The lack of services provided could be due a lack of training, a lack of infrastructure, a lack of reimbursement, or a complicated licensure process. When asked if there is adequate training for teleaudiology, the majority of respondents answered no. According to this survey many practicing audiologists are using teleaudiology in their jobs. The use of teleaudiology is a skill that should be introduced in graduate training so the clinicians will be able to implement it in practice.

Summary and Future Directions

Overall, participants reported providing telehealth services at relatively high rates. Across all demographics, the percentage of audiologists offering remote services like remote hearing aid fittings were fairly even. This shows that most audiologists are willing to implement remote services in their practices. In the future more services may be provided on a more regular basis because of the COVID -19 pandemic. Remote care is a good way to limit the amount of people coming in and out of the office. Remote care would allow for patients to be seen in the safety of their own home and limit their potential for exposure. Audiologist may be forced to adapt more remote services in the future as patients may come to expect a more convenient way of receiving

care. Despite teleaudiology becoming more normalized, there are still some barriers to the implementation of teleaudiology.

The reasons respondents provided for not implementing services include lack of infrastructure, lack of reimbursement, and lack of training. There is a need for more formalized teleaudiology education and training. Clinicians that were surveyed did not feel that there is adequate training for teleaudiology, but they are already using teleaudiology services fairly often. For practicing audiologists, it is important to have training in the services that are offered at their workplace. The COVID -19 pandemic has changed the way that audiology services are offered. Services that were traditionally done face to face can now be done remotely. The lack of teleaudiology education and training has become a problem now more than ever because more audiologists need to use teleaudiology but they do not feel comfortable implementing it. As the service delivery model has changed, the education of audiologists needs to change to include teleaudiology because now it may be expected of recent graduates to be familiar with teleaudiology care. Most of the respondents reported that they had learned about performing teleaudiology on-the-job. One of the groups that offered the least amount of teleaudiology services was the group that has been practicing for the shortest amount of time. This is most likely because they have not had the opportunity to learn on-the-job like the other groups have. There should be more reliable ways of obtaining teleaudiology education and training than just on the job opportunities.

Currently the clinicians surveyed were not interested in taking graduate courses in teleaudiology, presumably because they have already graduated and do not want to take another course. There should be many options for audiologists to use to get the training they need. Formalized webinars or training sessions by the manufacturers may be a good way to change the

offer the education the clinicians are interested in. For the future, groups of audiologists might benefit from graduate courses covering teleaudiology services. If clinicians become comfortable with teleaudiology in graduate school, they might be more confident implementing teleaudiology once they graduate. By providing audiologists with a strong base for teleaudiology skills through formalized education and training newly graduated audiologists will be better prepared for their future jobs where they might be asked to perform teleaudiology.

As teleaudiology becomes more widely used it will be important for teleaudiology to be addressed in graduate courses as a way to provide care so clinicians can at least have an idea of how to perform remote services. As shown by the responses to this survey, audiologists do feel there is a need for education and training for teleaudiology services. If audiologists are introduced to teleaudiology early in their career, either through graduate courses or by learning from webinars they should be able to become more comfortable offering teleaudiology services for patients who would like those services. There are populations that could benefit from teleaudiology services and by have adequate training audiologists can provide care to those populations. Having a solid understanding of the different aspects of teleaudioloy can allow the audiologist the opportunity to work with populations who are in need but may not have readily accessible care. Quality telaudiology training and education are key for the implementation of remote services.

According to most respondents, they would be more interested in teleaudiology training in webinars or workshops at conferences and less interested in graduate courses. Training would be more easily accessible in the form of webinars or workshops, so, more audiologists would be able to complete it. More research should be done to learn what trainings are available to audiologists regarding teleaudiology. Professional organizations may benefit from inviting

presenters to give lectures or workshops on teleaudiology skills to their conferences. If teleaudiology presentations or trainings are offered at large conferences more audiologists would have the chance to take advantage of that training. Once they have completed training they might be more willing to expand their services to include more telehealth options. Professional organizations should be encouraging teleaudiology education and training as it is a valid way of providing care, and it appears that a large number of audiologists are already providing teleaudiology services.

One future study could be a national curriculum review to determine what the status of telepractice education is in graduate audiology programs. A survey could be developed and sent to graduate students to get a better idea of their perspectives of teleaudiology and what training or education they are receiving regarding teleaudiology services. It would also be interesting to develop a pre and post COVID survey to see if there is a difference between the amount of teleaudiology services offered before and after the pandemic began.

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APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL

UNIVERSITY OF NORTHERN COLORADO

Institutional Review Board

Date: 01/14/2021

Principal Investigator: Jessica Bishop

Committee Action: **IRB EXEMPT DETERMINATION – New Protocol**

Action Date: 04/14/2020

Protocol Number: 2005002355

Protocol Title: Current Perceptions of Practicing Audiologists Regarding Teleaudiology Education and Training

Expiration Date:

The University of Northern Colorado Institutional Review Board has reviewed your protocol and determined your project to be exempt under 45 CFR 46.104(d)(702) for research involving

Category 2 (2018): EDUCATIONAL TESTS, SURVEYS, INTERVIEWS, OR OBSERVATIONS OF PUBLIC BEHAVIOR. Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met: (i) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects; (ii) Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or (iii) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by 45 CFR 46.111(a)(7).

You may begin conducting your research as outlined in your protocol. Your study does not require further review from the IRB, unless changes need to be made to your approved protocol.

As the Principal Investigator (PI), you are still responsible for contacting the UNC IRB office if and when:

Institutional Review Board

- You wish to deviate from the described protocol and would like to formally submit a modification request. Prior IRB approval must be obtained before any changes can be implemented (except to eliminate an immediate hazard to research participants).

- You make changes to the research personnel working on this study (add or drop research staff on this protocol).

- At the end of the study or before you leave The University of Northern Colorado and are no longer a student or employee, to request your protocol be closed. *You cannot continue to reference UNC on any documents (including the informed consent form) or conduct the study under the auspices of UNC if you are no longer a student/employee of this university.

- You have received or have been made aware of any complaints, problems, or adverse events that are related or possibly related to participation in the research.

If you have any questions, please contact the Research Compliance Manager, Nicole Morse, at 970-351-1910 or via e-mail at nicole.morse@unco.edu. Additional information concerning the requirements for the protection of human subjects may be found at the Office of Human Research Protection website - http://hhs.gov/ohrp/ and https://www.unco.edu/research/research-integrity-and-compliance/institutional-review-board/.

Sincerely,

Nicole Morse
Research Compliance Manager

University of Northern Colorado: FWA00000784

APPENDIX B

SURVEY QUESTIONS

SURVEY QUESTIONS

Informed Consent Form for Participation in Research

Title of Research Study: Current Perceptions of Practicing Audiologists Regarding
                          Teleaudiology Education and Training

Researcher(s):   Jessica Bishop, Audiology and Speech Language Sciences

email: jessica.bishop@unco.edu

Research Advisor: Tina M. Stoody, PhD, CCC-A

Phone Number: (970) 351-2204

email: tina.stoody@unco.edu

Procedures: We would like to ask you to participate in a research study. If you participate you
will be asked to complete a survey that will take about 5 minutes to complete. This survey will
include questions about your current workplace, your training in teleaudiology, and your
perceptions about teleaudiology. Responses will be anonymous.

Questions: If you have any questions about this research project, please feel free to contact
Jessica Bishop at Jessica.bishop@unco.edu. If you have any concerns about your selection or
treatment as a research participant, please contact Nicole Morse, Research Compliance Manager,
University of Northern Colorado at nicole.morse@unco.edu or 970-351-1910.

Voluntary Participation: Thank you for agreeing to participate in our research. Before you begin,
please note that the data you provide may be collected and used by Amazon as per its privacy
agreement. Additionally, this research is for residents of the United States over the age of 18; if
you are not a resident of the United States and/or under the age of 18, please do not complete this
survey. (Note: Amazon Mechanical Turk, Qualtrics, and Inquisit have specific privacy policies
of their own. You should be aware that these web services may be able to link your responses to
your ID in ways that are not bound by this consent form and the data confidentiality procedures
used in this study. If you have concerns you should consult these services directly.) Please
understand that your participation is voluntary. You may decide not to participate in this study
and if you begin participation, you may still decide to stop and withdraw at any time. Your
decision will be respected and will not result in loss of benefits to which you are otherwise
entitled.

Please take all the time you need to read through this document and decide whether you would like to participate in this research study. If you decide to participate, your completion of the research procedures indicates your consent. Please keep this form for your records.

○ Yes, I consent to participate

○ No, I do not consent to participate

In which state do you currently reside?

○ Alabama

○ Alaska

○ Arizona

○ Arkansas

○ California

○ Colorado

○ Connecticut

○ Delaware

○ District of Columbia

○ Florida

○ Georgia

○ Hawaii

○ Idaho

○ Illinois

○ Indiana

○ Iowa

○ Kansas

○ Kentucky

○ Louisiana

○ Maine

○ Maryland

○ Massachusetts

○ Michigan

○ Minnesota

○ Mississippi

○ Missouri

○ Montana

○ Nebraska

○ Nevada

○ New Hampshire

○ New Jersey

○ New Mexico

○ New York

○ North Carolina

○ North Dakota

○ Ohio

○ Oklahoma

○ Oregon

○ Pennsylvania

○ Puerto Rico

○ Rhode Island

○ South Carolina

○ South Dakota

○ Tennessee

○ Texas

○ Utah

○ Vermont

○ Virginia

○ Washington

○ West Virginia

○ Wisconsin

○ Wyoming

○ I do not reside in the United States

Are you a licensed and or certified audiologist?

○ Yes

○ No

Do you currently see patients?

○ Yes

○ No

How long have you been practicing audiology?

○ 0-5 years

○ 6-10 years

○ 11- 20 years

○ more than 20

Which of the following would you consider your primary work setting?

○ Private practice

○ School audiologist

○ Hospital

○ Industrial

○ University Clinic

○ ENT

○ Manufacturer

○ Other

In what area is your primary work setting currently located?

○ Rural

○ Urban

○ Suburban

What best represents your graduate education experience? Please select all that apply.

☐ Masters Degree

☐ Distance AuD

☐ Residential AuD

☐ PhD

☐ other _____

Please describe your education/ training in the following areas

	No education/ training	Graduate Course(s)	Clinical Practicum/ 4th year	On the job	Workshops/ CEU
Remote screenings	○	○	○	○	○
Remote pure tone threshold testing	○	○	○	○	○
Remote otoscopy/ tympanometry	○	○	○	○	○
Remote hearing aid fitting/ programming	○	○	○	○	○
Remote cochlear implant programming	○	○	○	○	○
Remote aural rehabilitation	○	○	○	○	○
Remote counseling	○	○	○	○	○

Please describe how often you offer the following services.

	Weekly	Monthly	Quarterly	Never
Remote screening	○	○	○	○
Remote pure tone threshold testing	○	○	○	○
Remote otoscopy/ tympanometry	○	○	○	○
Remote hearing aid fitting/ programming	○	○	○	○
Remote cochlear implant programming	○	○	○	○
Remote aural rehabilitation	○	○	○	○

Remote counseling

○	○	○	○

How interested would you be in receiving formal teleaudiology training?

○ Very interested

○ Somewhat interested

○ Not interested

Please select how interested you would be in the following.

	Very Interested	Somewhat Interested	Not Interested
Webinar	○	○	○
Continuing education courses	○	○	○
Courses taught at university	○	○	○
Journal articles with questions to answer at the end	○	○	○
Workshops	○	○	○
Conferences	○	○	○

Do you feel like there is a need for training in teleaudiology?

○ Yes

○ No

Do you feel that there is adequate education and training for teleaudiology in your area?

○ Yes

○ No

Do you feel current graduate education should include teleaudiology training?

○ Yes

○ No

Is there anything else you would like to add regarding teleaudiology education, training, or practice?

_____

APPENDIX C

SURVEY RESPONSES

Informed Consent Form for Participation in Research

Title of Research Study: Current Perceptions of Practicing Audiologists Regarding
                           Teleaudiology Education and Training

Researcher(s):   Jessica Bishop, Audiology and Speech Language Sciences

email: jessica.bishop@unco.edu

Research Advisor: Tina M. Stoody, Ph.D., CCC-A

Phone Number: (970) 351-2204

email: tina.stoody@unco.edu

Procedures: We would like to ask you to participate in a research study. If you participate you will be asked to complete a survey that will take about 5 minutes to complete. This survey will include questions about your current workplace, your training in teleaudiology, and your perceptions about teleaudiology. Responses will be anonymous.

Questions: If you have any questions about this research project, please feel free to contact Jessica Bishop at Jessica.bishop@unco.edu. If you have any concerns about your selection or treatment as a research participant, please contact Nicole Morse, Research Compliance Manager, University of Northern Colorado at nicole.morse@unco.edu or 970-351-1910.

Voluntary Participation: Thank you for agreeing to participate in our research. Before you begin, please note that the data you provide may be collected and used by Amazon as per its privacy agreement. Additionally, this research is for residents of the United States over the age of 18; if you are not a resident of the United States and/or under the age of 18, please do not complete this survey. (**Note:** Amazon Mechanical Turk, Qualtrics, and Inquisit have specific privacy policies of their own. You should be aware that these web services may be able to link your responses to your ID in ways that are not bound by this consent form and the data confidentiality procedures used in this study. If you have concerns you should consult these services directly.) Please understand that your participation is voluntary. You may decide not to participate in this study and if you begin participation, you may still decide to stop and withdraw at any time. Your decision will be respected and will not result in loss of benefits to which you are otherwise entitled.

Please take all the time you need to read through this document and decide whether you would like to participate in this research study. If you decide to participate, your completion of the research procedures indicates your consent. Please keep this form for your records.

Answer	%	Count
Yes, I consent to participate	99.41%	336
No, I do not consent to participate	0.59%	2
Total	100.00%	338

0 States, D.C., and Puerto Rico
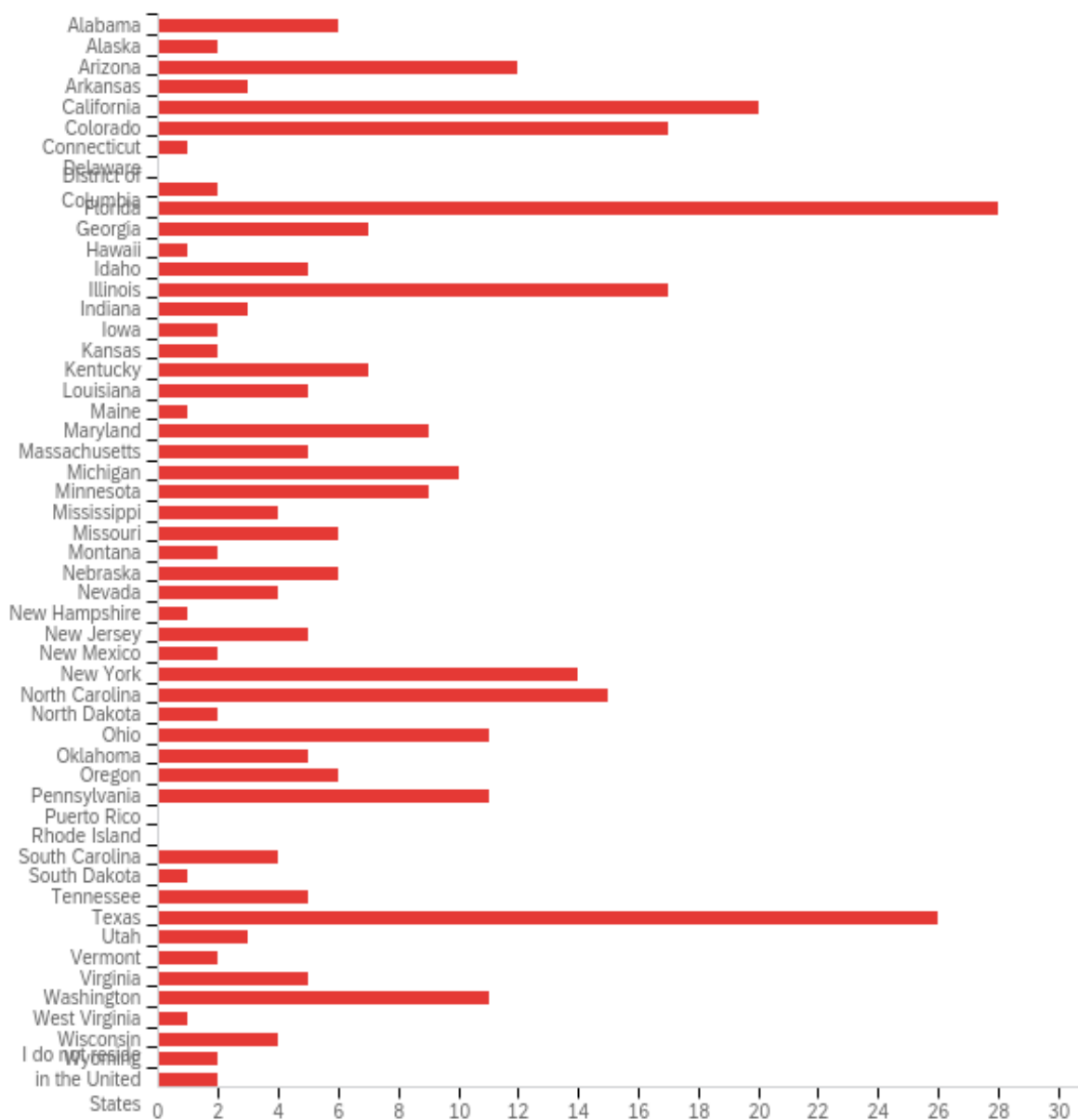
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	50 States, D.C., and Puerto Rico	1.00	53.00	24.71	15.27	233.12	334

#	Answer	%	Count
1	Alabama	1.80%	6
2	Alaska	0.60%	2
3	Arizona	3.59%	12
4	Arkansas	0.90%	3
5	California	5.99%	20
6	Colorado	5.09%	17
7	Connecticut	0.30%	1
8	Delaware	0.00%	0
9	District of Columbia	0.60%	2
10	Florida	8.38%	28
11	Georgia	2.10%	7
12	Hawaii	0.30%	1
13	Idaho	1.50%	5
14	Illinois	5.09%	17
15	Indiana	0.90%	3
16	Iowa	0.60%	2
17	Kansas	0.60%	2
18	Kentucky	2.10%	7
19	Louisiana	1.50%	5
20	Maine	0.30%	1
21	Maryland	2.69%	9
22	Massachusetts	1.50%	5
23	Michigan	2.99%	10
24	Minnesota	2.69%	9
25	Mississippi	1.20%	4
26	Missouri	1.80%	6

#	Answer	%	Count
27	Montana	0.60%	2
28	Nebraska	1.80%	6
29	Nevada	1.20%	4
30	New Hampshire	0.30%	1
31	New Jersey	1.50%	5
32	New Mexico	0.60%	2
33	New York	4.19%	14
34	North Carolina	4.49%	15
35	North Dakota	0.60%	2
36	Ohio	3.29%	11
37	Oklahoma	1.50%	5
38	Oregon	1.80%	6
39	Pennsylvania	3.29%	11
40	Puerto Rico	0.00%	0
41	Rhode Island	0.00%	0
42	South Carolina	1.20%	4
43	South Dakota	0.30%	1
44	Tennessee	1.50%	5
45	Texas	7.78%	26
46	Utah	0.90%	3
47	Vermont	0.60%	2
48	Virginia	1.50%	5
49	Washington	3.29%	11
50	West Virginia	0.30%	1
51	Wisconsin	1.20%	4
52	Wyoming	0.60%	2
53	I do not reside in the United States	0.60%	2
	Total	100.00%	334

Q1   Are you a licensed and or certified audiologist?
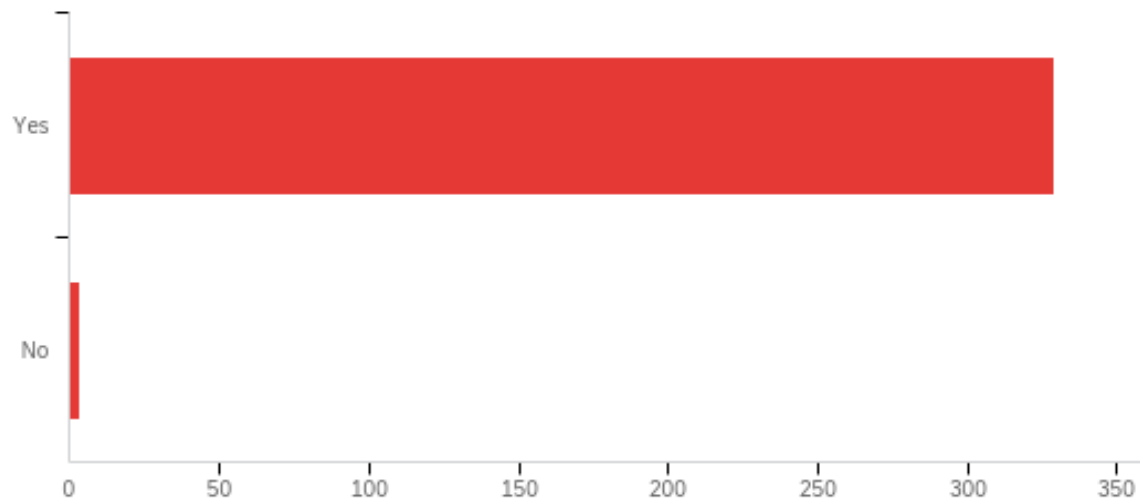
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Are you a licensed and or certified audiologist?	1.00	2.00	1.01	0.09	0.01	332

#	Answer	%	Count
1	Yes	99.10%	329
2	No	0.90%	3
	Total	100.00%	332

Q2   Do you currently see patients?
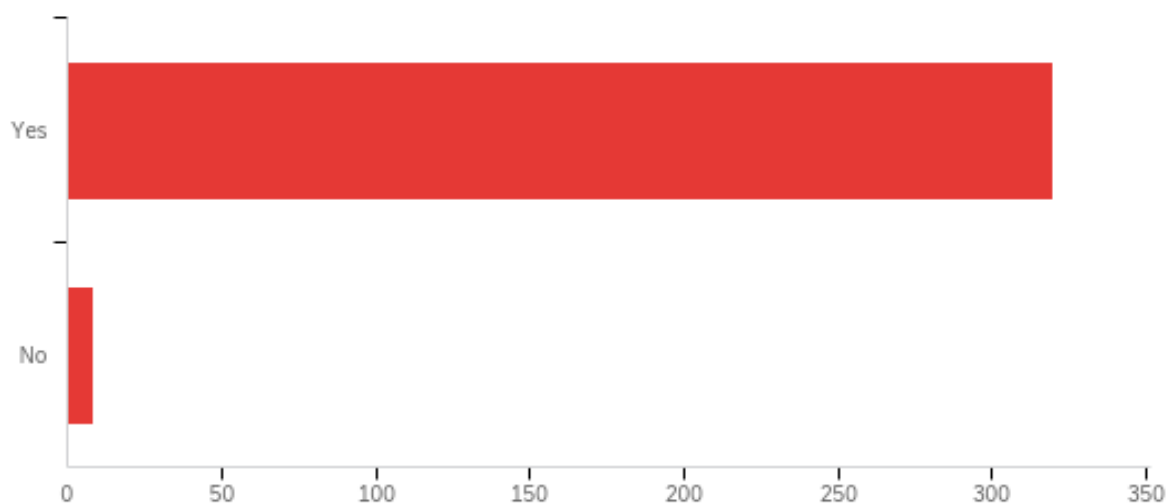
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Do you currently see patients?	1.00	2.00	1.02	0.15	0.02	328

#	Answer	%	Count
1	Yes	97.56%	320
2	No	2.44%	8
	Total	100.00%	328

Q3   How long have you been practicing audiology?
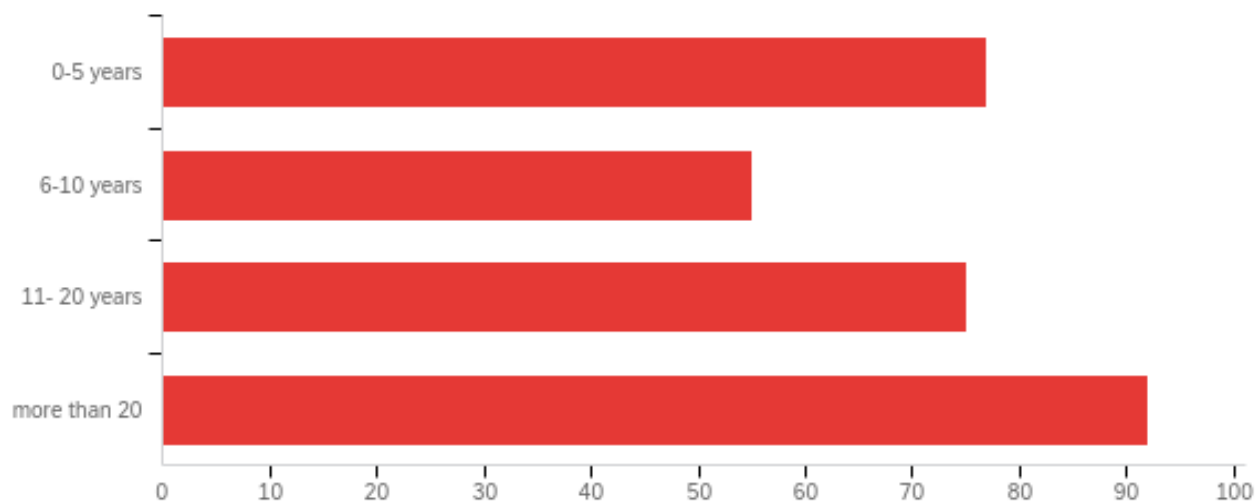
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How long have you been practicing audiology?	1.00	4.00	2.61	1.17	1.37	299

#	Answer	%	Count
1	0-5 years	25.75%	77
2	6-10 years	18.39%	55
3	11-20 years	25.08%	75
4	More than 20	30.77%	92
	Total	100.00%	299

Q4   Which of the following would you consider your primary work setting?
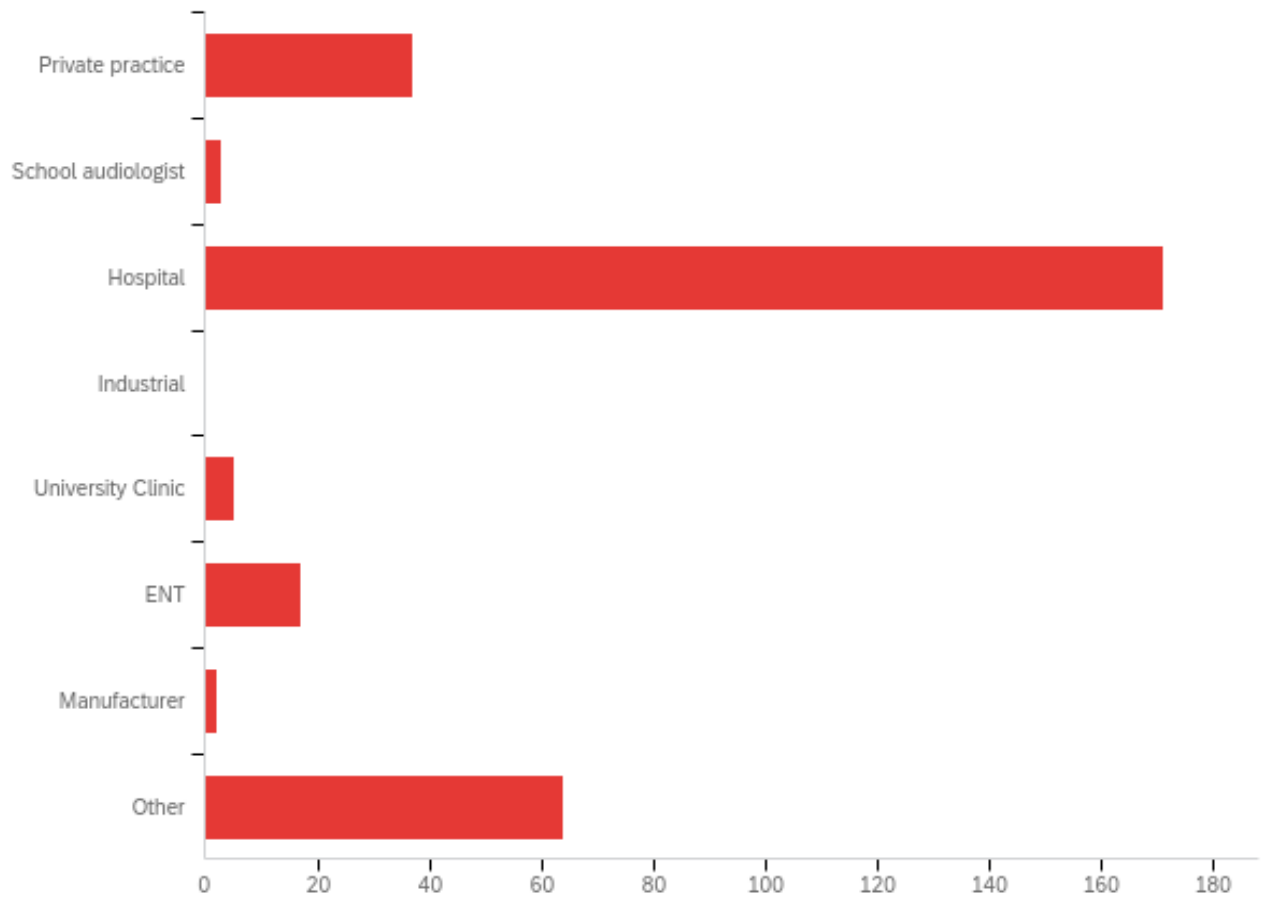
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Which of the following would you consider your primary	1.00	8.00	4.04	2.34	5.45	299

#	Answer	%	Count
1	University Clinic	1.67%	5
2	School audiologist	1.00%	3
3	Private practice	12.37%	37
4	Other	21.40%	64
5	Manufacturer	0.67%	2
6	Industrial	0.00%	0
7	Hospital	57.19%	171
8	Otolaryngologist	5.69%	17
	Total	100.00%	299

Q5   Please describe your education/ training in the following areas.
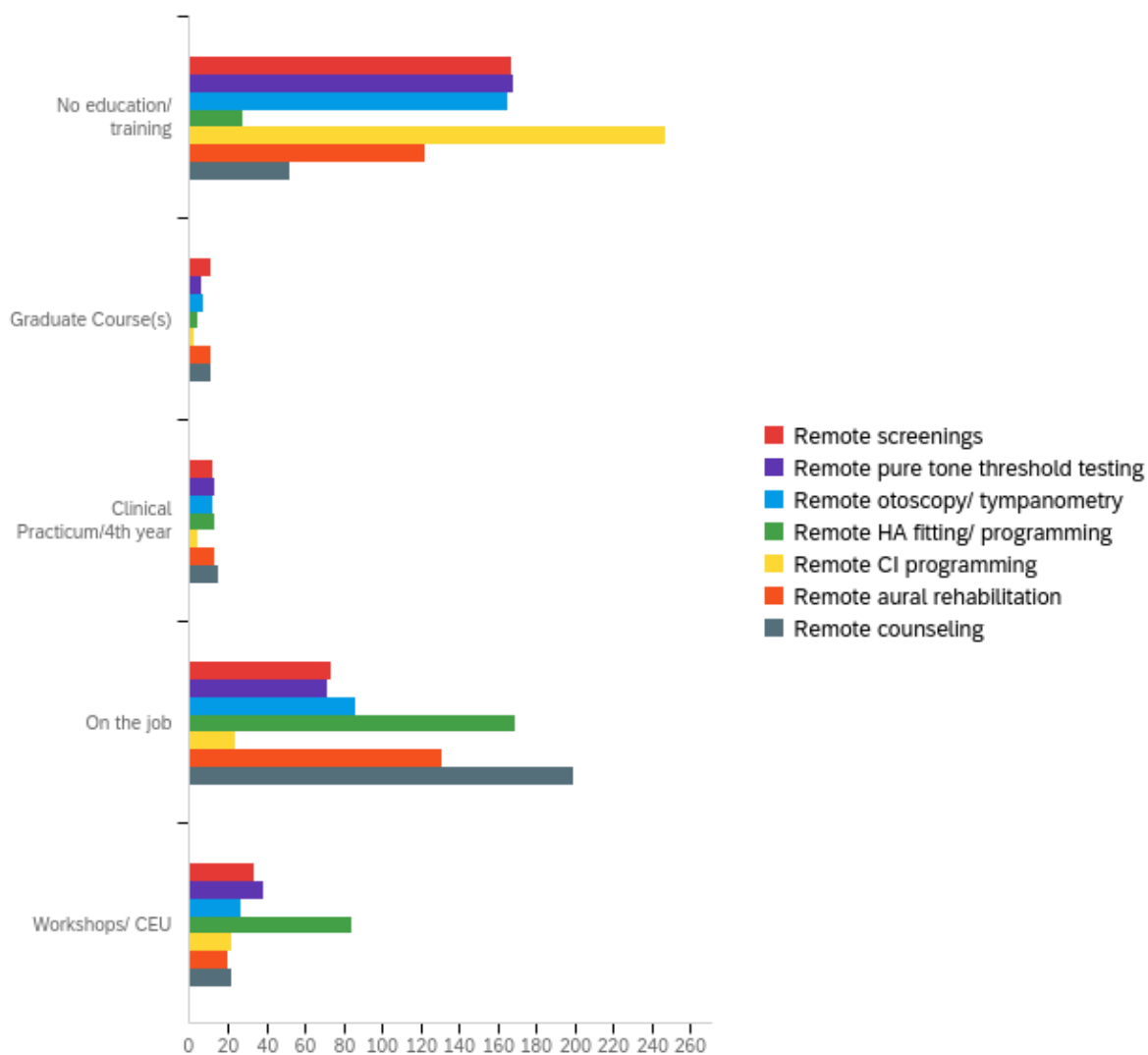
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Remote screening	1.00	5.00	2.32	1.59	2.52	298
2	Remote pure tone threshold testing	1.00	.00	2.36	1.62	2.63	298
3	Remote otoscopy/ tympanometry	1.00	5.00	2.34	1.57	2.46	297
4	Remote hearing aid fitting/ programming	1.00	5.00	3.93	1.10	1.22	298
5	Remote cochlear implant programming	1.00	5.00	1.57	1.28	1.64	299
6	Remote aural rehabilitation	1.00	5.00	2.72	1.52	2.31	297
7	Remote counseling	1.00	5.00	3.43	1.23	1.51	299

#	Question	No Education/ Training (% / n)	Graduate Course(s) (% / n)	Clinical Practicum/ 4th year (% / n)	On the Job (% / n)	Workshops/ CEU (% / n)	Total
1	Remote screening	56.04% 167	3.69% 11	4.03% 12	24.83% 74	11.41% 34	298
2	Remote pure tone threshold testing	56.38% 168	2.01% 6	4.36% 13	24.16% 72	13.09% 39	298
3	Remote otoscopy/ tympanometry	55.56% 165	2.35% 7	4.04$ 12	28.96% 86	9.09% 27	297
4	Remote hearing aid fitting/ programming	9.40% 28	1.34% 4	4.36% 13	56.71% 169	28.19% 84	298
5	Remote cochlear implant programming	82.61% 247	0.67% 2	1.34% 4	8.03% 24	7.36% 22	299
6	Remote aural rehabilitation	41.08% 122	3.70% 11	4.38% 13	44.11% 131	6.73% 20	297
7	Remote counseling	17.39% 52	3.68% 11	5.02% 15	66.56% 199	7.36% 22	299

Q6   In what area is your primary work setting currently located?
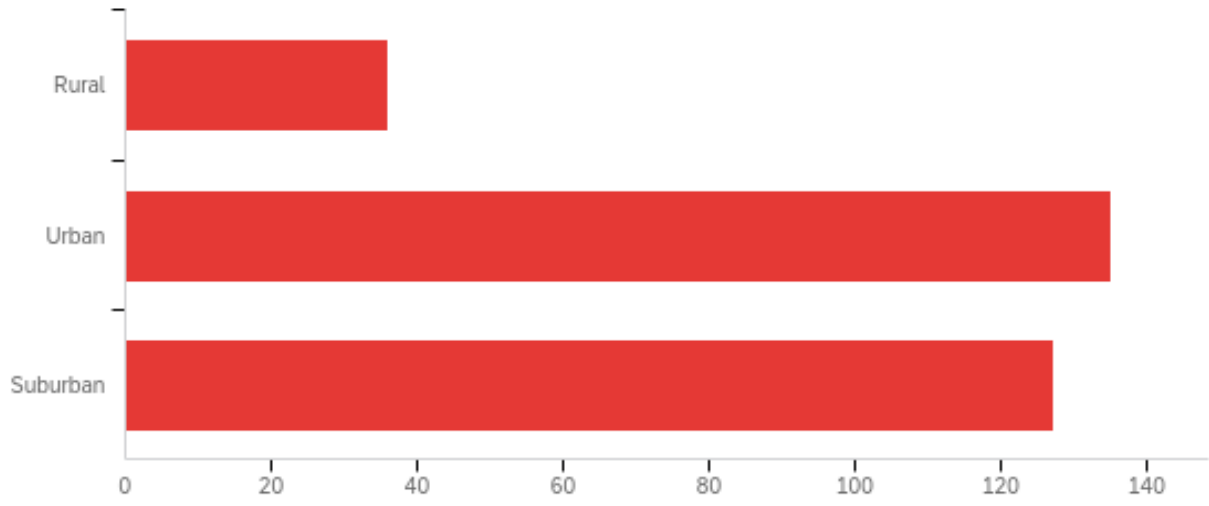
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	In what area is your primary work setting currently located?	1.00	3.00	2.31	0.67	0.45	298

#	Answer	%	Count
1	Rural	12.08%	36
2	Urban	45.30%	135
3	Suburban	42.62%	127
	Total	100.00%	298

Q7 What best represents your graduate education experience? Please select all that apply.
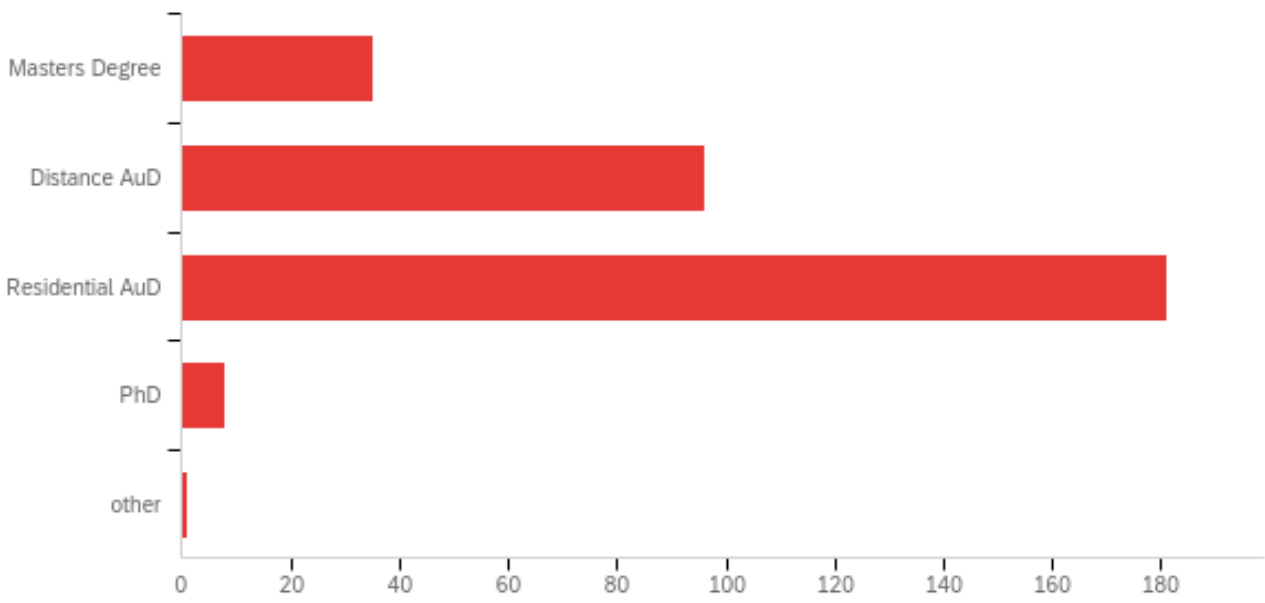
#	Answer	%	Count
1	Master's Degree	10.90%	35
2	Distance Au.D.	29.91%	96
3	Residential Au.D.	56.39%	181
4	Ph.D.	2.49%	8
5	Other	0.31%	1
	Total	100.00%	321

Q7_TEXT – other

Other – Text
Au.D./Ph.D.

Q8   Please describe how often you offer the following services.
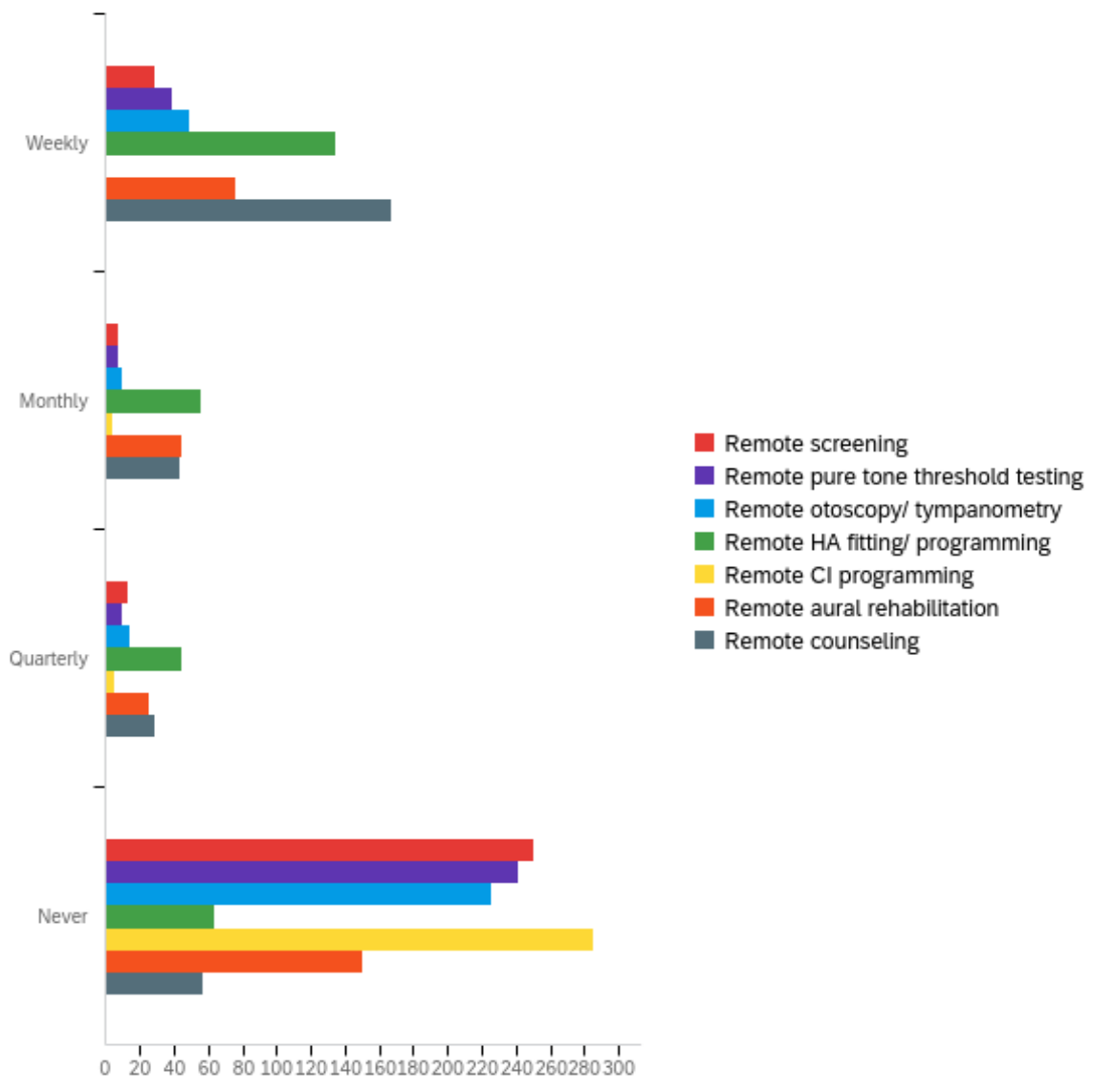
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Remote screening	1.00	4.00	3.62	0.93	0.86	299
2	Remote pure tone threshold testing	1.00	4.00	3.53	1.04	1.08	297
3	Remote otoscopy/ tympanometry	1.00	4.00	3.39	1.14	1.29	299
4	Remote hearing aid fitting/ programming	1.00	4.00	2.13	1.20	1.44	299
5	Remote cochlear implant programming	1.00	4.00	3.95	0.31	0.10	295
6	Remote aural rehabilitation	1.00	4.00	2.84	1.29	1.66	296
7	Remote counseling	1.00	4.00	1.92	1.19	1.43	296

#	Question	Weekly (% / n)	Monthly (% / n)	Quarterly (% / n)	Never (% / n)	Total
1	Remote screening	9.70% 29	2.34$ 7	4.35% 13	83.61% 250	299
3	Remote otoscopy/ tympanometry	16.39% 49	3.34% 10	4.68% 14	75.59% 226	299
4	Remote HA fitting/ programming	44.82% 134	18.73% 56	15.05% 45	21.40% 64	299
2	Remote pure tone threshold testing	13.13% 39	2.36% 7	3.37% 10	81.14% 241	297
6	Remote aural rehabilitation	25.68% 76	15.20% 45	8.45% 25	50.68% 150	296
7	Remote counseling	56.42% 167	14.53% 43	9.80% 29	19.26% 57	296
5	Remote cochlear implant programming	0.34% 1	1.36% 4	1.69% 5	96.61% 285	295

Q9   How interested would you be in receiving formal teleaudiology training?
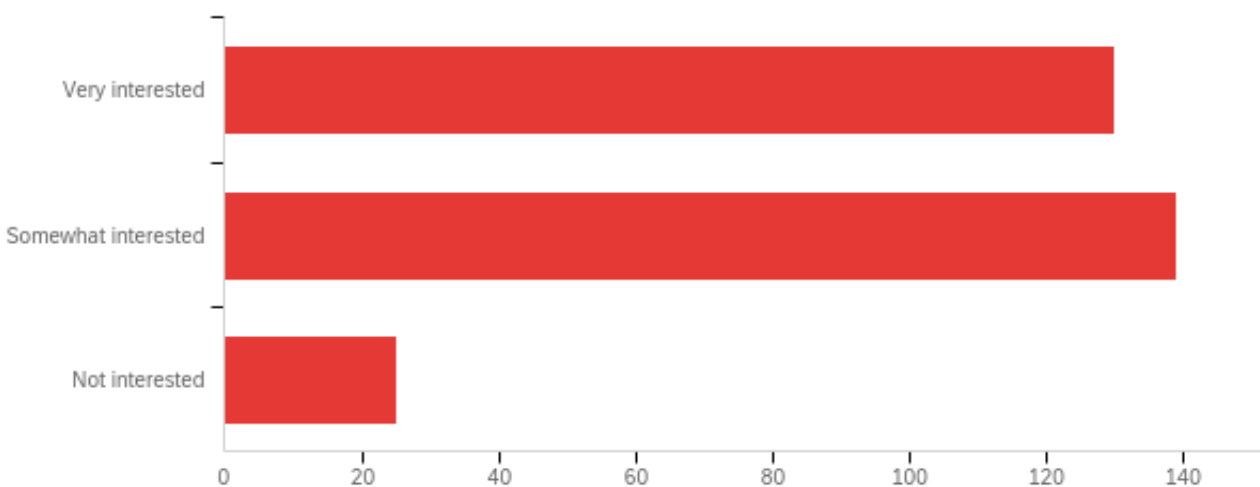
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How interested would you be in receiving formal teleaudiology training?	1.00	3.00	1.64	0.63	0.40	294

#	Answer	%	Count
1	Very interested	44.22%	130
2	Somewhat interested	47.28%	139
3	Not interested	8.50%	25
	Total	100.00%	294

Q10   Please select how interested you would be in the following.
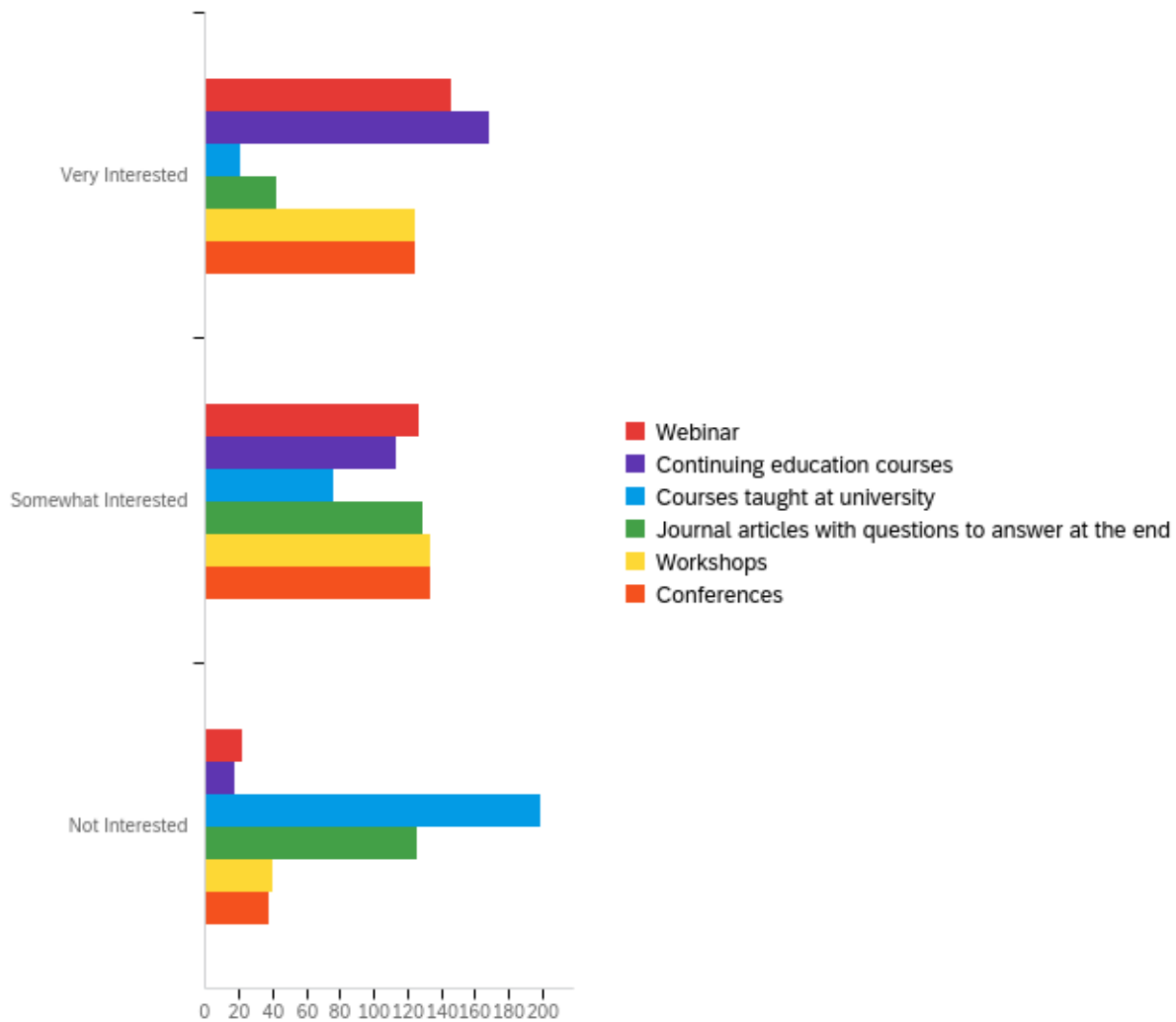
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Webinar	1.00	3.00	1.58	0.63	0.39	295
2	Continuing education courses	1.00	3.00	1.49	0.60	0.36	298
3	Courses taught at university	1.00	3.00	2.60	0.62	0.38	296
4	Journal articles with questions to answer at the end	1.00	3.00	2.28	0.70	0.49	297
5	Workshops	1.00	3.00	1.72	0.69	0.47	298
6	Conferences	1.00	3.00	1.71	0.68	0.46	297

| #	Question	Very Interested (% / n)	Somewhat Interested (% / n)	Not Interested (% / n)	Total
1	Webinar	49.49% 146	43.05% 127	7.46% 22	295
2	Continuing education courses	56.38% 168	37.92% 113	5.70% 17	298
3	Courses taught at university	7.09% 21	25.68% 76	67.23% 199	296
4	Journal articles with questions to answer at the end	14.14% 42	43.43% 129	42.42% 126	297
5	Workshops	41.61% 124	44.97% 134	13.42% 40	298
6	Conferences	42.09% 125	44.97% 134	13.42% 40	298

Q11   Do you feel like there is a need for training in teleaudiology?
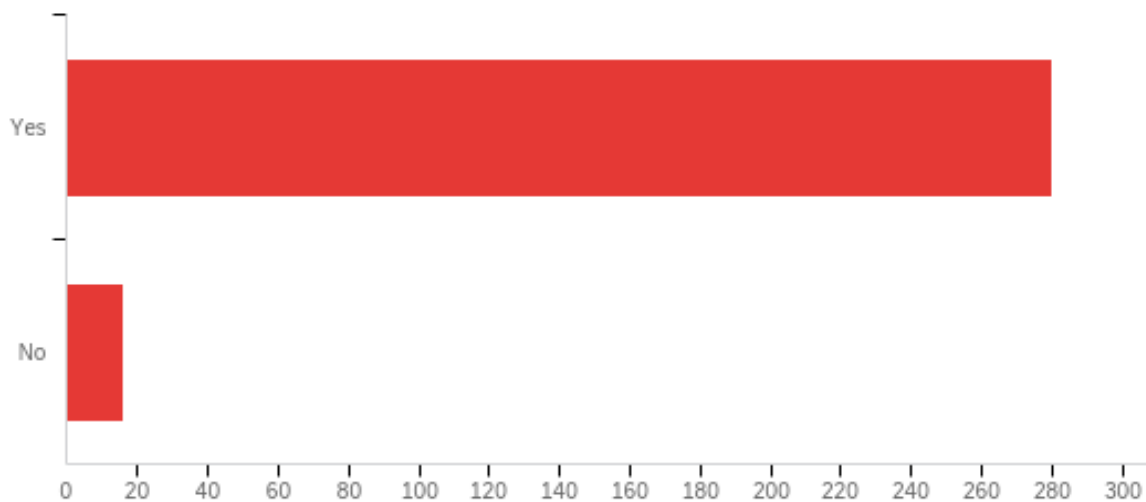
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Do you feel like there is a need for training in teleaudiology?	1.00	6.00	1.27	1.13	1.28	296

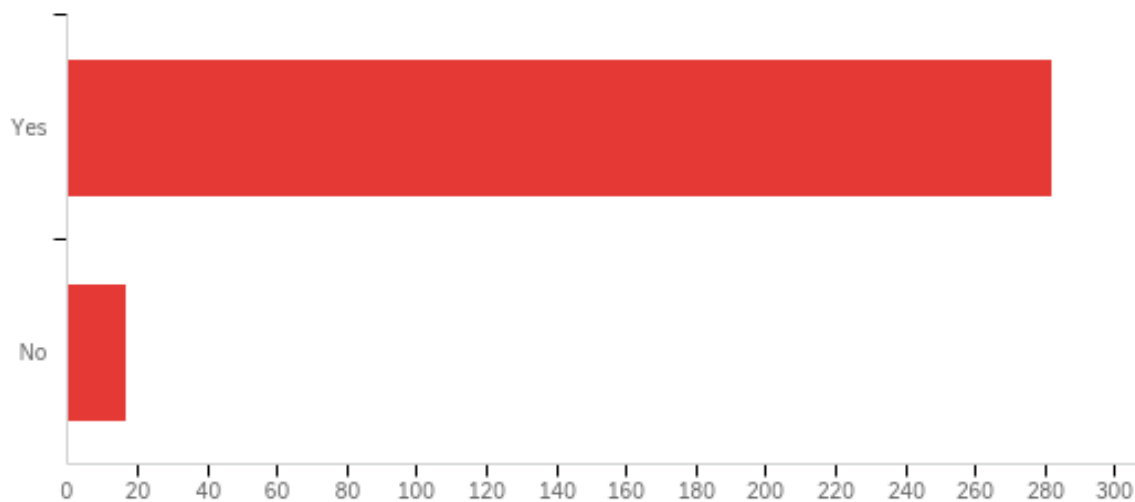| #	Answer	%	Count
1	Yes	94.59%	280
2	No	5.41%	16
	Total	100.00%	296

Q12   Do you feel that there is adequate education and training for teleaudiology in your area?
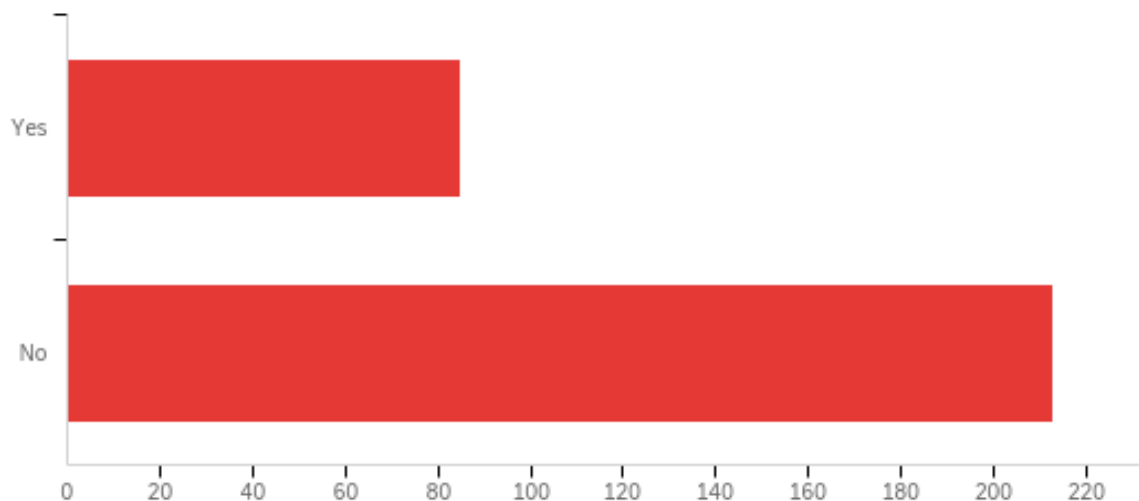
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Do you feel that there is adequate education and training for teleaudiology in your area?	1.00	2.00	1.71	0.45	0.20	298

#	Answer	%	Count
1	Yes	28.52%	85
2	No	71.48%	213
	Total	100.00%	298

Q13   Do you feel current graduate education should include teleaudiology training?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Do you feel current graduate education should include teleaudiology training?	1.00	2.00	1.06	0.23	0.05	299

#	Answer	%	Count
1	Yes	94.31%	282
2	No	5.69%	17
	Total	100.00%	299

Q14   Is there anything else you would like to add regarding teleaudiology education, training, or practice?

Is there anything else you would like to add regarding teleaudiology education, training, or practice?
n/a
The VA has been providing teleaudiology services consistently for 5-8 years, depending on the clinic.
Your info may be skewed depending on how people answer questions... pre-covid or currently.
Specific to VA audiology should be considered. Different programs are necissary
no
As a younger audiology, I feel very comfortable with teleaudiology however, due to COVID I have had to train all of my coworkers (20+) on teleaudiology such as VVC because it was not widely taught or discussed. Likely I am in the VA where it is easier to accomplish but I know a hiderence in the private sector is state laws and billing which cause a lot of audiologists to stay away from it, resulting in many providers having little knowledge. I think workshops would be a great way to give audiologists hands on training that they need as there is very little out there now.
Tinntius management
Will become a necessary part of audiology practice as time progresses
On the Workplace Question I work at a VA Clinic
n/a
n/a
While I don't do tele-audiology on the regular, our clinic does. We have a full-time tele-audiology clinic where audiologists from the mainland call in to our clinic to help us with our workload.
NA
It should be viewed as a viable way to practice since there is a shortage of audiologists in rural areas
no
no

done here, just not by me

None

Na

It's tricky. It takes a lot of set up and you need to have buy in from your institution. For example, we would love to offer remote services, but our hospital for some reason seems to really bar our ability to do it and doesn't want to move.

Billing and licensing becomes and issue. In some state (Ohio) I am not legally allowed to remotely test or fit hearing aids so I don't think training is necessary until licensing catches up

I am currently on furlough due to COVID but answered the questions based on prior to furlough.

Teleaudiology billing

My doctoral dissertation was focused on teleaudiology

we have administration restrictions due to IT and large multi specialty clinic

Since the pandemic I have been offering it to all new fits to have teleaudiology for follow ups. I've yet to have anyone choose this

No

No

There should be more research and some standardization as to best practice.

it is continuing process somewhat forced upon VA employees due to Covid19 but I see it as a postive

no

no

no

no

The future is in teleaudiology. Students should be exposed to it and have practice in how to establish rapport with patients via teleheatlh.

Promising area for growth in our profession; legislative efforts need to be aligned with emerging practice patterns for audiology.

I have received but was unable to include manufacture training/CEU/training, as well as on the job training. It would only allow for one selection.

Not so different than being with the patient. It's nice to have a well trained health technician to work with.

No

no

no

no

COVID-19 changed teleaudiology

I do feel this is a tough area for those who have been practicing more than 10 yrs. The idea of doing things remotely takes time to feel comfortable.

Teleaudiology programming and counseling has only been offered since March, 2020 as result of COVID-19.

More specific to question regarding "Are you seeing patients", is that face to face or Video Telehealth?

It's the wave of the future allowing us to connect ith rural areas and people who are not able to drive to clinic - it's necessary and we need to incorporate it in our daily practices (and reimbursement should reflect the work done)

no

The success of the session greatly depends on the patient and their ability to use technology.

You should add government clinic.

No

N/A

I think adding a chapter/section over telehealth would be useful, though not an entire course. The audiologisists who do most of our telehealth (and have for years) learned on the job and do great. Everything at this point is pretty straight forward and the major adjustment in my opinion is changing your communication strategy since they are not in the same room. Experience with telehealth during univeristy would be great, but I think an entire course is overkill. This is a great, relevant study! Good luck and cheers.

We have the capability at our facility, just haven't started using it yet.

I am currently a TeleAudiology Program Manager in the VA Eastern Colorado Health Care System. I complete TeleAudiology services on a daily basis so have significant experience but I do think it is important to start providing education on TeleAudiology for students and practicing clinicians. Thanks for the survey!

na

Working with the VA it is dealing with very specific info and what they do and don't allow.

I work at a VA and regularly practiced Tele-audiology as a 4th year. It is something that definitely takes practice and guidance about best ways to instruct your patient and/or technician to ensure they are doing what you ask.

I don't believe graduate level training is helpful for teleaudiology because technology changes so quickly, it's easier to have on-the-job training.

no

no

we are designing a remote CI programming partnership with MPLS VHA, to commence end 2020

Reimbursement first, then teleaudiology; otherwise, it is another way of giving it away or worse letting someone else do it instead of audiologists

no

no

I'm a new graduate that just started working and telehealth was a shock to me. I wish I had more training in school. I know it could be difficult, but there should be some portion of courses involving hearing aid programming dedicated to showing how telehealth can be done to program hearing aids remotely.

No

no

No

Its not difficult for Audiologists to use, the difficulty is often with patient use. Training needs to be for the elderly population on how to use devices, not so much the professional.

Our best trainings came from Counsel Ear our EMR, Widex, and Phonak.

Trainings should be diverse and inclusive of multiple manufacturers

I was trained and was part of research with teleaudiology in undergrad and grad school. My program taught us about it but it was not legal or wide spread beyond the VA which is where I gained on job training.

Adequate equipment for teleaudiology is needed as well. Our clinic is offering telehealth since the onset of COVID19 for hearing aid service and tinnitus counseling. There is nobway for us to perform diagnostics currently. The training i do have about Dx is from a conference i attended and the audiologists presenting practiced in rural Alaska.

No

At the university where I work, the speech side has started doing teletherapy due to COVID-19. We didn't have the infrastructure to see audio patients in this manner, so I'm a little worries we may have lost business due to the closure of the university for at least 3.5 months

Should be a part of all curriculum. Has significant and undervalued benefits!

it's a nice idea, but healthcare cannot be conducted using best practices without someone knowledgeable actually being with the patient. I've been on 3 manufacturer support teams to help develop teleprogramming and they all sorta suck.

Just starting remote hearin aid adjusting/programming/troubleshooting/counseling. Not sure if Diagnostic and fitting should be done remotely

It's the future. COVID-19 has proven that it's necessary. Living in a rural state, patients often have to drive 3-4 hours to get to my clinic for a 30 minute hearing aid adjustment. We need to be implementing more services remotely in order to provide the best care for our patients.

There has been a significant increase in telefittings since COVID.

I feel that it is important, but I would not be able to utilize it in my current setting. I am with the county health department, and many of my patients have multiple barriers to telehealth, including language barriers, homelessness, and other poverty-related issues.