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HUMANITARIAN AUDIOLOGY IN NICARAGUA:

A QUALITY OF LIFE STUDY

By

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APPROVAL PAGE

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This is to certify that the thesis prepared by Kelsey Ambrose, B.A., Au.D. Candidate, entitled Humanitarian Audiology in Nicaragua: A Quality of Life Study has been approved by the thesis committee as satisfactorily completing the thesis requirements for the degree Doctor of Audiology.

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ABSTRACT

Humanitarian Audiology in Nicaragua: A Quality of Life Study

Kelsey Ambrose

Access to healthcare in third world countries is a challenge that is often addressed through medical mission trips (MMTs). When utilizing MMTs to fill a void in healthcare services, it is important to ensure that the patients receiving services on these mission trips perceive the benefits that are intended by the program (Suchdev et al., 2007). This study examined the impact of the services provided by Mayflower Medical Outreach (MMO) MMT program, an organization that provides hearing healthcare to residents in Jinotega, Nicaragua.

A seven-question survey was administered to 53 participants. The survey asked questions to obtain information regarding the patients' perception of the hearing aids and services provided by MMO. The surveys were administered to both pediatric and adult patients by MMO volunteers and audiologists.

Results of the survey responses revealed a very positive perception of the services provided by the organization. Overall, the majority of the patients reported that the hearing aids provided by the organization are easy to use and promote a change in quality of life. Additionally, positive responses were reported regarding the overall benefit and satisfaction from using the hearing aids and that patients would recommend hearing aids

to their friends and family. The most variable response was the question requesting information about the comfort of the hearing aids.

The results of this study indicate that MMO has an overall positive impact on the patients they serve in Jinotega, Nicaragua. Additionally, the survey responses collected from this study support the need for mission trips to underserved populations in third world countries.

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CHAPTER 1

INTRODUCTION

Hearing loss is a condition that affects thousands of people worldwide (WHO, 2015). Access to sound, either with normal hearing thresholds or with amplification is necessary for oral communication, which is the primary way humans communicate. Therefore hearing health services should be available to everyone. In the United States, and other developed countries, there are audiology and/or ear, nose and throat (ENT) services. However, in developing countries, even general practitioners can be difficult to access (Swanepoel et al., 2010). There are two ways that this absence in the quality of hearing healthcare can be addressed: telehealth and medical mission trips.

Telehealth refers to the use of telecommunications to provide health services from a distance (Kleinpell & Avitall, 2005). It was created to give patients access to services and/or physicians/specialists that were not available in their country/region. Telehealth can be implemented in three different ways: synchronously, asynchronously or a hybrid (Swanepoel et al., 2010). Although the concept of telehealth is relatively new, several studies have found that telehealth is a successful way to provide services in these remote areas (Grant, Rockwood & Stennes, 2014; Swanepoel et al., 2010; Wynn & Sherrod, 2012). There are many different types of healthcare disciplines, which are expanding their practices to utilize telehealth services, including the profession of audiology (Swanepoel et al., 2010).

Teleaudiology is the use of telehealth to provide hearing health services to patients at a distance. Although there are studies, which show the feasibility of administering teleaudiology services, more research is needed to address the challenges,

associated with setting up this type of practice (Jacobs & Saunders, 2014; Krumm, Huffman, Dick & Klich, 2008; Swanepoel, Koekemoer & Clark, 2010). Some of these challenges include Internet connectivity, health insurance/reimbursement policies, and state licensure policies (Hughes et al., 2012). Additionally, the cost of equipment and expenses may outweigh the potential financial benefits for the audiologist (Scharpe, Froelich, & Peterson, 2010). All of these obstacles may affect the patient and the audiologist's willingness to receive/administer these services. While teleaudiology is one possible solution to the lack of hearing healthcare services, another strategy to reach these remote areas is medical mission trips (MMT).

Medical mission trips to developing countries bring healthcare professionals to underserved populations in need. According to Vu, Johnson, Francois, and Simms-Cendan (2014), the benefit of MMTs extends beyond the recipients. This study found that the volunteers of a MMT felt an increased sense of gratification and worth following the experience (Vu et al., 2014). However, more studies are still needed to identify the benefit (or lack thereof) in quality of life of the *patients* receiving services from this non-traditional healthcare model.

CHAPTER 2

LITERATURE REVIEW

Hearing Loss

There are three types of hearing loss, all of which are prevalent worldwide. A conductive hearing loss (CHL) is characterized by damage to the outer and/or middle ear. An impaired outer and/or middle ear will obstruct or impede the sound traveling to the inner ear and the VIIIth nerve (Sneed & Joss, 1999). On the other hand, the term sensorineural hearing loss (SNHL) is used when the damage is localized to the inner ear and/or VIIIth nerve. SNHL affects the transmission of the auditory signal to the brain (Sneed & Joss, 1999). Lastly, a mixed hearing loss occurs when both the conductive and sensorineural components are affected.

There are numerous physical, emotional and environmental factors that may affect how a person adapts to hearing loss (Preminger, 2007). The type and degree of hearing loss will affect how a patient adapts to the disability. Additionally, age of diagnosis and rehabilitation choice (i.e., amplification and/or aural rehabilitation) will impact the person's adjustment to the hearing loss (Preminger, 2007). There are many other factors that affect how a person copes with their hearing loss, which include: personality, interpersonal relationships, outside support systems, education, socioeconomic status, etc. (Sneed & Joss, 1999). Since hearing loss explicitly affects our ability to communicate with others, it can be a very isolating condition. Because of the variability in the etiology of hearing loss, its prevalence varies between countries around the world.

Prevalence

According to the World Health Organization (WHO; 2015), there are currently about 360 million people who suffer from a disabling hearing loss worldwide. Among this large estimate, approximately 328 million are adults and the remaining 32 million are children (WHO, 2015). WHO defines a "disabling" hearing loss for adults (15 years and older) as pure tone thresholds worse than 40 dB HL in the better ear. For children, a disabling loss is thresholds greater than 30 dB HL in the better ear (WHO, 2015). Unfortunately, the majority of people living with a disabling hearing loss reside in second and third world countries. This is important because healthcare in these countries is typically underserved (Rule et al., 2014). In countries where healthcare is difficult to access, there is often a lack of personnel who can provide appropriate services to the residents for even minor ailments and medicine to treat the ailments (Rule et al., 2014). To address some of these challenges, telehealth, also commonly referred to as telemedicine, was created.

What is Telehealth?

Telehealth is an umbrella term encompassing:

> The use of audio, video and other telecommunications and electronic information processing technologies for the transmission of information and data relevant to the diagnosis and treatment of medical conditions, or to provide health services or aid healthcare personnel at distant sites. (Koch, 2005, p. 566)

There are two types of telehealth: synchronous (real-time) and asynchronous (cloud-based) (Swanepoel et al., 2010). Synchronous telehealth means the delivery of the services is done live, typically through videoconferencing or telephone communication.

Some examples of synchronous telehealth could be videoconferencing to provide counseling services or to view test results as a technician obtains them at a different location (Swanepoel et al., 2010). The asynchronous model of telehealth can also be thought of as the store and forward approach (Swanepoel et al., 2010). This method allows a trained technician to obtain results, which are then sent to a physician or other medical professional to interpret. Asynchronous telehealth could be used when there are technicians available to obtain test results or to perform an assessment independently but they are not able to analyze or make recommendations without a medical professional's expertise. This type of telehealth may also work best when real-time communication is not possible (e.g., patient is in a remote village without access to phone or internet). The availability of both synchronous and asynchronous delivery models can help healthcare workers identify which approach is best for the population in need and/or the service(s) administered (e.g., counseling by a professional is best done synchronously).

In the event that both types of telehealth are necessary, a hybrid approach may be utilized. A hybrid approach is a combination of the synchronous and asynchronous models (Krumm & Syms, 2011). For some specialties, a test battery will have different components, some of which are better performed synchronously and others asynchronously. A study by Lancaster, Krumm & Ribera (2008), used a hybrid approach to test hearing sensitivity in school-aged children. Otoscopy and pure tones were obtained synchronously through video conferencing and the tympanometry results were obtained from a technician who emailed the results to the researchers (Lancaster, Krumm & Ribera, 2008). Any form of telehealth can benefit a variety of patient populations who are

unable to access traditional health services for a variety of reasons (Swanepoel et al., 2010).

Populations that would benefit.

The concept of telehealth was developed to increase quality healthcare accessibility despite remote physical location and/or access barriers. Additionally, patients who have impaired mobility can benefit from telehealth (Edwards, Stredler-Brown & Houston, 2012). If a patient in a remote area needs to see a specialist, then telehealth services may allow the patient to be evaluated by a qualified expert without lengthy travel. An example of a specialist that often is not available in rural areas is a neurologist. Neurologists tend to reside in denser populated urban areas thus leaving patients who live elsewhere at a disadvantage when this type of specialty consult, or long term care, is needed (Timpano et al., 2013). Research suggests telehealth may help decrease the number of emergency room visits or re-hospitalization (Myers, Grant, Lugn, Holbert & Kvedar, 2015), mortality rates and/or improve quality of life by providing access to medical professionals which would otherwise be inaccessible (Gorst, Armitage, Brownsell & Hawley, 2014).

Since telehealth emerged, several disciplines have modified their practices to be able to deliver this type of care. Audiology, radiology, dermatology, otology, psychiatry, nursing and even pediatrics are just a few of the healthcare specialties finding success in providing services via telehealth (Swanepoel et al., 2010). Nursing, specifically, has proven to be extremely advantageous in delivering telehealth services to a variety of patients. Recent advances have enabled nurses to monitor biometric parameters among patients who are well established in terms of their medical status, but considered high-

risk patients due to the presence of chronic illness. In addition to these patients, nurses are also able to monitor the geriatric population to determine if they are capable of living on their own through the use of sensor technologies (Grant, Rockwood & Stennes, 2014). The geriatric population is one of many who are benefitting from the telehealth model.

Veterans comprise a large number of patients who can also benefit from telehealth services. Since veterans receive health related services at designated Veterans Affairs Medical Centers (VAMC), those who live in remote areas are at a disadvantage in accessing these services (Northern, 2012; Wynn & Sherrod, 2012). This is especially detrimental to the veterans in need of continuous mental health care. Because veterans are at a greater risk for mental health issues after returning home from war, there is a higher demand for mental health care providers. The use of videoconferencing for counseling these patients is a convenient solution for both the patient and the clinician (Wynn & Sherrod, 2012).

People living with chronic diseases would also benefit from telehealth, as there is a frequent need to see specialists. A chronic disease by definition indicates the condition is long in duration with slow progression (Venes & Thomas, 2001). Some examples of chronic diseases include cardiovascular disease and diabetes. According to WHO (2015), there are approximately 38 million deaths due to different chronic illnesses each year. The management of chronic diseases requires more regular health monitoring, which increases the number of visits to doctors and specialists. Moreover, among the 600 million individuals living with chronic illness, 80% reside in developing countries where adequate health care is sparse (Olusanya, Ruben, & Parving, 2006). The possibilities for

telehealth are rapidly growing as technology evolves and the need to reach underserved communities in a cost effective manner expands (Timpano et al., 2013).

Delivery considerations.

There are several different aspects of healthcare delivery that need to be considered before implementing telehealth services. Among all of the caveats associated in the delivery of telehealth, the most important and most fundamental is the quality of care. The Institute of Medicine (IOM) defines six dimensions that should be addressed to attain adequate quality of care when utilizing telehealth services (Schwamm, 2014). The first dimension, safety, encompasses the telehealth model's ability to prevent further injury to the patient. Effectiveness, the second dimension, ensures the services provided are best practice and evidence based. In other words, the services provided should be scientifically proven to be clinically successful (Schwamm, 2014). The telehealth model should be patient centered; throughout the clinical decision making process the patient's needs and desires should be incorporated in a respectful manner, not ignored. The fourth dimension addresses the timeliness associated in the delivery of healthcare (Schwamm, 2014). Longer wait times can potentially affect a patient's health condition if he or she has to wait an extended amount of time before seeing a clinician. Telehealth services, in theory, should alleviate the issue of timeliness as accessibility is increased compared to traditional health care models. The fifth dimension covers the efficiency of the services in that they should reduce any waste, such as equipment and/or supplies. Lastly, services should be equitable and consistent in terms of quality across all patients regardless of demographics (Schwamm, 2014). Although more research is needed, Schwamm (2014) provides a good foundation to effective telehealth care without sacrificing quality.

Preservation of the doctor-patient relationship is another element to consider in delivering any form of health care. Sabesan et al. (2014) recommends a variety of techniques to maintain an effective communication style during a synchronous telehealth appointment. These recommendations include: ensuring all video equipment is functioning properly before a session starts and beginning the appointment with a formal introduction. Also proper webcam positioning, and maintenance of eye contact will help improve the overall experience for the patient (and the physician). The physician or specialist should be prepared with appropriate visual aids to effectively transfer pertinent information to the patient (Sabesan et al., 2014). In doing so, the patient may retain more regarding his/her diagnosis, treatment plan, prognosis etc. Patient concerns should be addressed at the end of the appointment along with a summary of everything that was discussed (Sabesan et al., 2014). Effective communication is important to maintain the doctor-patient relationship however, a cost-benefit analysis is also important to consider when providing telehealth services.

In theory, telehealth has the potential to significantly decrease healthcare costs as it eliminates or minimizes the need to travel long distances (either the practitioner to the patient or vice versa) (Kokesh, Ferguson, Patricoski & LeMaster, 2009). On the other hand, the billing and reimbursement policies remain a gray area in delivering telehealth services, especially when they cross national borders. Therefore, physicians should understand the current policies and then develop their own policies and procedures before implementing telehealth (Loh et al., 2013). Telehealth is still a relatively new advancement in healthcare and there are many obstacles to overcome, however, some specialties are developing their own model of delivery, such as audiology.

Teleaudiology

Teleaudiology refers to the use of telehealth, both synchronous and asynchronous methods, to reach patients in need of audiologic care. This allows audiologists to provide services to people in remote areas to ultimately decrease the global burden of communication disorders. Hearing loss is the most prevalent health condition on a global scale (Krumm, Ribera & Klich, 2007; Swanepoel et al., 2010; WHO, 2015). When teleaudiology first emerged, the use of services were limited to just hearing aid programming and video otoscopy (Swanepoel et al., 2010). However, as the technology continues to grow, the scope of teleaudiology has subsequently expanded. Currently, audiologists are able to use teleaudiology as a tool to facilitate education and training, for screening purposes, diagnostic evaluations and even for intervention and treatment. Table 1 from Swanepoel et al. (2010) highlights various examples of teleaudiology. Additionally, the various application possibilities can be utilized among a variety of patient populations.

Table 1. Scope of application possibilities for telehealth in audiology.

	Scope of telehealth applications	
Field of application	*Synchronous*	*Asynchronous*
Education/training		
Health care providers Paraprofessionals Parents	Real-time interactive videoconference presentations Telementoring and guidance during assessments or procedures Discussing difficult results/cases with experienced clinicians	Interactive online training modules Posting questions via email or online forums Requesting 2nd opinions from experienced clinicians
Screening		
Newborn hearing screening School-entry hearing screening Adult hearing screening (i.e. occupational health) Vestibular screening	Real-time screening directed via interactive videoconferencing and application sharing Quality control of screening via interactive videoconferencing	Automated OAE/ABR screening Automated auditory screening Internet-based hearing tests may be valuable screening options
Diagnosis		
Case history Otoscopy Immittance Otoacoustic Emissions (OAE) Auditory Evoked Potentials (AEP) Audiometry (pure tone & speech) Vestibular assessment Intra-operative monitoring	Case history via interactive videoconferencing Video-otoscopy via interactive videoconferencing and application sharing directed by audiologist Immittance, OAE, AEPs via interactive videoconferencing and application sharing Placement of probe/electrodes etc., guided by audiologist and testing conducted via application sharing PC-based audiometers facilitate remote testing via interactive videoconferencing and application sharing	A case-history can be taken electronically (store-and-forward or electronic patient file Video-otoscopy (store-and-forward or electronic patient file Automated test sequences of immittance and OAE completed beforehand and emailed (store-and-forward or electron patient file) Automated audiometry (store-and-forward or electronic patient file)
Intervention		
Counseling Ear canal management Hearing aid selection, fitting & verification Cochlear implant mapping Intervention	Counseling and troubleshooting conducted via interactive videoconferencing Ear canal management guided remotely by audiologist via videoconferencing Hearing aids fitting guided and programmed via interactive videoconferencing and application sharing Verification of hearing aid via application sharing and interactive videoconferencing Cochlear implant activation and mapping via application sharing and interactive videoconferencing Follow-up sessions via interactive videoconferencing Home-based early intervention services via interactive videoconferencing	Hearing aids may be pre-selected and pre-programmed based on audiological results Counseling sessions via interactive videoconferencing may be preceded by questions and complaints emailed Internet-based audiological counseling programs Internet-based audiological treatment programs (i.e. tinnitus) Internet-based auditory training programs Home-based intervention for infants may be provided by recorded play sessions at home sent through to interventionist for evaluation

Patients in need.

One example of a patient population that can benefit from teleaudiology services would be veterans. Veterans, in addition to receiving mental health services through telehealth, may also receive services to address hearing health through teleaudiology. Veterans are a high-risk population for hearing loss while they are in service. In fact, approximately 672,000 veterans suffer from hearing loss that was acquired during their time in service (Folmer et al., 2011). While veterans have access to healthcare professionals through the VA system, as referenced some of the VAMCs are not accessible (Jacobs & Saunders, 2014; Northern, 2012). Additionally, even when VAMCs are accessible sometimes the amount of appointments needed to follow-up (e.g., hearing aid fittings) make accessing the VAMC a burden.

Teleaudiology may also be used to reach infants who are born in remote areas. Universal Newborn Hearing Screening (UNHS) is successful in the early detection and intervention of children with hearing loss. But, there are rural hospitals that do not have the trained personnel to provide these services (Krumm, Huffman, Dick & Klich, 2008; Krumm & Syms, 2011; Scharpe, Froelich & Peterson, 2010). For this reason, the parents must then travel to a facility that is equipped to do the screening (Krumm et al., 2008). This can potentially delay the entire process of diagnosis and intervention (Scharpe, Froelich & Peterson, 2010). A study by Krumm et al. (2008) compared the results of auditory brainstem response (ABR) testing and evoked otoacoustic emissions (OAEs) obtained in traditional face-to-face screenings and those via synchronous telehealth methods. A total of 30 infants were tested by an audiologist face-to-face, while another audiologist used remote computing to obtain test results at a distance (Krumm et al.,

2008). Results indicated that there was no significant difference between the data collected in the two methods (face-to-face vs. telehealth). Although many more studies are needed, this leads us to believe that both methods are capable of yielding comparable results and teleaudiology can be feasibly applied to newborn hearing screenings (Krumm et al., 2008). Since the ability to successfully utilize teleaudiology within our country was established and in developed countries like the US, the next goal is to reach the remaining hard of hearing population intercontinentally.

Although it may seem implausible to provide teleaudiology services to patients in developing countries, research shows great potential to successfully serve these individuals. To demonstrate the viability of teleaudiology in developing countries, Swanepoel, Koekemoer and Clark (2010) conducted a study to assess the validity of teleaudiology on a global scale. Audiologists in Texas used a remote controlled audiometer to assess the pure tone thresholds of 30 participants in Pretoria, South Africa, a total distance of approximately 14,680 kilometers. These participants were tested once in a conventional face-to-face manner, in South Africa, and again through synchronous testing using the specialized remote audiometer set-up (Swanepoel, Koekemoer, & Clark, 2010). Thresholds were measured at octave intervals between 125 and 8000 Hz using the traditional 10 dB down, 5 dB up method. A data analysis of results indicated no significant difference between thresholds obtained via conventional face-to-face and remote audiometry (Swanepoel, Koekemoer, & Clark, 2010). Additionally, teleaudiology services can help with the hearing aid fitting process as well. Another method that falls under the telehealth umbrella but requires less professional presence than the methods previously discussed is the self-fitting hearing aid.

The concept of a self-fitting hearing aid gives the patient almost complete autonomy in the hearing aid fitting process. These devices could be extremely advantageous because only about 3% of the 186 million hard of hearing residing in developing countries are utilizing amplification and this would give them access to a device to help improve their ability to hear (Convery, Keidser, Dillon, & Hartley, 2011). According to Convery et al. (2011), there are some companies making these devices to specifically target patients in developing countries. These hearing aids use a solar powered battery charger and are adjusted, or programmed, using trim pots and a screwdriver. Another similar device contains a tone generator to administer the hearing test itself, then uses the thresholds obtained to program the hearing aid (Convery et al. 2011). A third device, referred to as a user-programmable hearing aid, is preprogrammed by the manufacturer after the patient sends in necessary paperwork including an audiogram, medical history, waiver form and a Health Insurance Portability and Accountability Act (HIPPA) privacy policy form. If the user wishes to make further adjustments, they can request software and cables to do so when ordering the hearing aid (Convery et al.. 2011). The idea of a self-fitting hearing aid appears to provide the wearer with a solution and autonomy at a reasonable price, but it certainly is not the safest or most successful rehabilitation option for someone with a hearing loss. Although these studies support the feasibility of teleaudiology, there are some caveats to implementing these services in developing countries.

Implications.

The primary benefit to each of these self-fitting hearing aids is undoubtedly the inexpensive price. Not just the price of the hearing aid itself but the reduction in travel

costs and number of doctors visits (Convery et al., 2011). However, a main concern remains in the quality of the hearing aids, the programming and their function. While leaving the entire hearing aid fitting up to the patient may provide the user with feelings of autonomy, there are a number potential risks involved such as improperly programming the device, providing too much gain, missing an asymmetry and/or conductive component to the hearing loss (Convery et al., 2011). These risks outweigh the temporary benefit that these self-fitting hearing aids can provide, even at such low costs (Convery et al., 2011). There are alternative ways to provide audiologic services to patients in developing countries in cost efficient manners through teleaudiology, however, there are several obstacles that must be considered.

While these studies promote the use of teleaudiology to increase healthcare accessibility in a cost effective manner, there are several drawbacks that will also affect an audiologist's willingness to participate. The startup costs to create a teleaudiology program are extremely variable. Depending on the level of technology desired, the equipment could range from about $1,000 for desktop computer based equipment to $20,000 for the higher end videoconferencing equipment (Scharpe, Froelich, & Peterson, 2010). Although a computer-based system is cheaper up front, the necessary software is not included and should be calculated into the initial budget. Additionally, the cost of bandwidth, or the amount of data, increases in the more remote geographical areas (Scharpe, Froelich, & Peterson, 2010). Aside from the initial startup costs, the monthly expenses required and profit margins should also be considered.

Health insurance and reimbursement policies for telehealth have not been established within every insurance company. Additionally, the insurance companies who

do reimburse for telehealth services typically have strict requirements in terms of what is covered and how the services should be delivered (Krumm & Syms, 2011; Hughes et al., 2012; Scharpe, Froelich & Peterson, 2010). State licensure is another obstacle that the world of telehealth has yet to overcome. Some states have restrictive licensure agreements, meaning if an audiologist wants to administer these services, he/she may need an additional license (Freeman, 2010; Hughes et al., 2012; Krumm & Syms, 2011; Scharpe, Froelich & Peterson, 2010). For these reasons, audiologists may be deterred from accepting the use of teleaudiology within their practices.

Technology limitations may also be an issue in successfully delivering teleaudiology services. In order to provide comprehensive audiologic evaluations via teleaudiology, the equipment required is different for each site. The audiologist, or person delivering telehealth services, will need a computer with appropriate software and a video system for the videoconferencing (Krumm & Syms, 2011). At the location of the patients, the trained technician will need a computer, web camera, audiometric equipment, video-otoscopy device, immittance bridge, and a local area network (LAN) connection (Krumm & Syms, 2011). Similar to traditional audiologic care, all of this equipment must be installed and calibrated ahead of time with regular equipment checks. Good Internet connectivity, video and audio quality are all required for videoconferencing (Hughes et al., 2012). Intermittent Internet connectivity will increase the time required to finish the appointments (Yao, Wan & Givens, 2010). Poor audio quality may affect word recognition scores, especially when a sound booth is unavailable (Hughes et al., 2012). Additionally, software upgrades may be required for hearing aid programming or cochlear implant mapping. If the upgrades are not completed ahead of time, this can also

affect the length of time required to complete the session (Hughes et al., 2012). If the scheduled session continually goes over due to technology issues, then the audiologists may prefer traditional methods where they have more control. In such instances where reimbursement, licensure, and/or technology issues are a hindrance to providing quality care, a mission trip may be necessary to reach these remote locations of the world.

Mission Trips

Over the years, many healthcare providers have become increasingly interested in global health and helping these developing countries. The interest has grown so much that in 2011, more than 30% of US medical student graduates have participated in health related mission trips (Vu, Johnson, Francois, & Simms-Cendan, 2014). These trips enable trained professionals to visit underserved populations who do not have the means to access health care. While there are barriers and ethical challenges to any program that deviates from the traditional healthcare model, the benefits will negate the potential risk factors associated with leaving these populations without any care. A study by Vu et al., (2014) evaluated the opinions of 379 medical students on the impact of short-term international medical mission trips (STIMMTs). Of the 379 residents, 131 of them had participated in at least one STIMMT. The restrictions identified by the residents who have not participated on a STIMMT included trip cost, schedule conflicts, lack of interest and their medical school not offering a program (Vu et al., 2014). Among the 131 who did participate on a STIMMT, the general consensus concluded that these trips enhance appreciation of the relation between a person's culture and his/her health, one's sense of social responsibility, increased the chances of participating on another STIMMT and enabled them to adapt to a new and different healthcare setting (Vu et al., 2014). It is

important to note, this study shows the perceived benefit of STIMMT for the volunteer resident however, it is also imperative to ensure that there is perceived benefit for the patients as well.

Quality of care is of the utmost importance among all of the caveats associated in delivering telehealth services. Although the medical residents from the study discussed their own perceived benefit from participating in these MMTs, it should be emphasized that the purpose of these trips is to benefit the patients (Vu et al., 2014). One of the more relevant questions that emerges when implementing one of these short term MMTs is whether the trip is providing a short-term fix or if the root problems are being addressed (Suchdev et al., 2007). If a group of medical professionals travel to a developing country to provide healthcare services for one week, there must be some form of follow up to ensure that the medical services are benefiting people in the long-term. For this reason, Suchdev et al., (2007) created a model to maximize the sustainability of short-term medical trips.

An Effective Model.

Children's Health International Medical Project of Seattle (CHIMPS) was used to develop a model to help improve sustainability of mission trips (Suchdev et al., 2007). This model incorporates seven guiding principles to enhance the stability of the project. CHIMPS is a program that organizes a weeklong trip to El Salvador each year for medical residents, faculty, nurses, medical students and other health professionals to provide health services. Although the annual trip is only one week in duration, they also have a one-month elective class for students to travel to El Salvador at another time of year. During this time, the students work alongside a local nongovernmental organization

(NGO) to maintain the relationship and collaboration (Suchdev et al., 2007). This additional month promotes sustainability of the program.

The first principle outlined by CHIMPS is a mission statement, which is used as a reference to keep the goals of their project on track. The mission statement is representative of the group's beliefs as a whole and remains static as the project continues to grow and change (Suchdev et al., 2007). The second principle includes collaborating with the community allowing the mission trip organization to maintain a partnership and work together to facilitate projects and work that needs to be done. The third principle is the education for themselves, the community and their peers. Before CHIMPS sends a group of people to El Salvador they ensure each volunteer is well informed about the community, the health problems they face, and the intervention strategies (Suchdev et al., 2007). They also educate the community using materials (i.e. lectures) they have created so that they are able to continue the process of improving health. Additionally, CHIMPS is continually providing lectures and presentations to peers in an attempt to spread awareness of various health issues on an international level. The fourth principle is to create infrastructure by providing services based on the community's needs using what supplies they are able to bring along (Suchdev et al., 2007). The fifth principle involves working as a team between all of the group members and their prospective specialties as well as with the local physicians. Since the individuals in the group will vary in terms of education level, the students must be supervised to the same extent they would be in the United States. The sixth principle identifies the need to create a sustainable project, which allows for growth in the future. An example from CHIMPS is to educate the locals so when they have their annual trip, they are working *with* the community and not just

treating them and leaving (Suchdev et al., 2007). The last principle is to carry out regular evaluations to ensure the goals are being met and that progress is being made. Collecting data from each trip allows them to make changes where certain interventions are more or less effective (Suchdev et al., 2007).

The model suggested by Suchdev et al., (2007) addresses the quality, effectiveness and benefit of a short-term medical trip to the patient, all of which are essential. However, the cost effectiveness of a short-term mission trip should also be taken into consideration. Although each trip differs in destination, services, duration etc., ensuring the trip is cost effective allows for reoccurring visits in the future. Egle, McKendrick, Mittal and Sosa (2014) evaluated the cost effectiveness of two-week long mission trips to the Dominican Republic. The Midwest Medical Missions Michigan Chapter holds annual visits to the Dominican Republic to provide a variety of surgical care needs. The cost of all surgeries were logged for the trips from 2010 and 2012, and then compared to what the cost of these surgeries would be in the United States. A total of 29 surgeries were performed on the 2010 trip and 42 on the 2012 trip (Egle et al., 2014). Egle et al., (2014) found that the surgeries in 2010 were relatively inexpensive for a total of $61,924 in comparison to the United States estimate of $255,187 for the same procedures. Furthermore, the surgeries in 2012 totaled $82,368, an impressively low number when compared to the United States' numbers at about $398,177 (Egle et al., 2014). Again it is important to note that each trip will differ in cost depending on the location, duration, number of participants etc., but this study provides promising evidence that costly procedures can be implemented in an economical manner. There are several audiology MMTs that consider cost effectiveness, quality of care and long term care of

recipients, the program that will be the focus of this paper is the Mayflower Medical Outreach.

Mayflower Medical Outreach

Since 1999, an organization called Mayflower Medical Outreach (MMO) has provided health services to a small city in Nicaragua (mmonicaragua.org/splash/). MMO originally traveled all over Nicaragua to smaller towns to reach more patients in need. They soon found that localizing to one densely populated area would optimize their ability to provide services and utilize resources (mmonicaragua.org/splash/). To better understand the incidence of hearing loss in this developing country, Saunders et al. (2007) studied the prevalence and etiology of hearing loss in rural Nicaraguan children. In this study, two groups were examined; a group of school age children who were screened for hearing loss by the Department of Jinotega, Nicaragua (Group A) and a group of children who had a known or suspected hearing loss and were seen at the Otolaryngology and Audiology Clinic in Jinotega, Nicaragua (Group B). The underlying objective of this study was to obtain information about the prevalence of hearing loss (from group A) and the etiologies of the hearing loss (from group B). This information would then, hopefully, help create an effective hearing loss prevention program for the Nicaraguan population (Saunders et al., 2007)

First, using a pass/fail system, Saunders et al. (2007) diagnosed those with hearing loss using a 30 dB HL cut off. Among the 274 children in group A, 18.4% were in the failed category. This is relatively high in comparison to previous research suggesting the range of SNHL prevalence is between 1 and 13.6% (Saunders et al., 2007). The 96 participants in group B had a variety of hearing loss etiologies. 32% of the

participants from group B had a history of neonatal distress, 30% were administered gentamicin (an ototoxic drug), and 12% had meningitis (Saunders et al., 2007). These numbers indicate a high prevalence of hearing loss in Jinotega, Nicaragua with a large incidence of risk factors. Some of these risk factors include low birth weight, prematurity, neonatal distress, maternal infections during pregnancy and gentamicin exposure (Saunders et al., 2007). This study provided good reason that Jinotega, Nicaragua is a sensible location for MMO to send their support and services.

After choosing the location of interest, MMO has since developed their program to address the hearing healthcare needs of Nicaraguans. The mission statement of the organization is "To provide ENT and Audiology services. To provide opportunities for Deaf students. To strengthen training in the fields of ENT medicine, Audiology and Deaf education." (mmonicaragua.org/splash/). The program is a 501 C.3 non-profit organization and is funded through private donations and grants. Members of the MMO board have created multiple programs within the organization to reach these goals. The programs include an otolaryngology, education/training, deaf research projects and audiology. The otolaryngology program provides services annually from volunteer ENTs participating on the mission trips. Not only do the visiting physicians perform surgeries but they also help train the local ENTs and residents practicing in Nicaragua.

A majority of the surgeries and medical care are performed at the Victoria Motta Hospital in Jinotega. The education and training aspect of the program is typically carried out at the Lenin Fonesca Hospital, located in the country's capital of Managua. Upon discovering the high incidence of deaf children in Nicaragua, MMO created the deaf education program. Similar to the concept of telehealth, this program provides these

children with access to the curriculum, which would otherwise be inaccessible in the local schools as they are not tailored to the needs of students with hearing loss. To address this education gap, MMO established a school for children with hearing loss in 2008 called the Albergue Mayflower. The Albergue Mayflower serves as a school and a home to these children during the academic year. Lastly, the audiology program provides audiologic care during three mission trips per year. Using predetermined criteria, MMO dispenses analog hearing aids based on the degree of hearing loss in exchange for a monetary donation if possible. Donated earmolds are provided to the patients and shaved down for the best fit. If a donated earmold does not fit comfortably or without causing feedback, then impressions are taken and sent to the lab in Managua. In the interim, a temporary comply tip is used. Afterwards they follow a fixed protocol in terms of counseling, auditory training, annual follow up appointments, etc. This ensures consistency in hearing healthcare. Almost all communication is carried out through a translator. Since there is a language barrier, the patients' perceived benefit of the devices can be difficult to determine.

Statement of Purpose

Although researchers have examined the perceived benefit of mission trips from the volunteers' point of view, the perception of the benefit of the MMTs should be obtained from the participants' perspective as well (Crump & Sugarman, 2008). While it is important for the volunteers to feel as though their time and skills are valuable on a mission trip, it is imperative that the participants of the program are also perceiving benefit. When patients' receive services through volunteer mission trips in developing countries, patient satisfaction can be more difficult to measure and track. The purpose of

this study is to evaluate quality of life benefits (or lack thereof) of the MMO program as perceived by the recipients of the hearing healthcare.

CHAPTER 3

METHODS

Participants

Thirty participants were recruited through the MMO program in Nicaragua. Participants ranged in age from 1 to 99 years. MMO provided the researchers a hearing aid database of patients who received devices through the organization from 2013 to present. Any recipient of an MMO hearing aid was eligible to participate in the survey, however, participants were required to have the hearing aids for a minimum of one month prior. The study was approved by the IRB at Towson University, see Appendix A for a copy of the approval.

Procedures

Participants received information inviting them to participate in the survey study in their native language (Spanish) when they were seen by the MMO Chief audiologist or the audio technician for the program. If they chose to participate, consent (and assent if a child) was obtained and the survey was administered (forms in Appendix B).

Survey.

The survey consisted of eight questions. The questions were modified or taken verbatim from a questionnaire in a similar study by Bertoli, Staehelin, Zemp, Schindler, Bodmer, and Probst (2009) to obtain information about the participants' perception of their quality of life after receiving a hearing aid(s) through MMO. The eight questions were:

1. How many hours a day do you use the hearing aid?
2. Is it comfortable?
3. Is the hearing aid easy to use?

4. Overall, are you satisfied with the hearing aid?
5. Do you benefit from using the hearing aid?
6. If you said yes you benefit from the hearing aid, give two examples of when you notice it helps you?
7. Has there been a change in the quality of life since receiving the hearing aid?
8. Would you recommend hearing aids to your family or friends?

The survey was translated into Spanish by a fluent Spanish speaker of Nicaraguan descent, specifically from Ometepe Island. See Appendix C for copies of the survey in English and Spanish.

Survey Administration.

The researchers sent a total of 25 pediatric surveys and 45 adult surveys to the Chief audiologist for MMO. The first round of surveys was sent before the June 2015 trip and the second round was sent before the February trip. The Chief audiologist brought one copy of the survey in English and 70 translated surveys (between the two separate trips) to Jinotega, Nicaragua. The Chief Audiologist also received specific instructions for administration (see Appendix D). She then provided the survey administration instructions to the audio technician, who works in the clinic year-round and is responsible for maintaining the audiologic care between mission trips. The pediatric assent forms were attached to the pediatric surveys, which were printed on purple paper. The informed consent forms were attached to the adult surveys, which were printed on blue paper to avoid confusion with the pediatric surveys. Participation in this study was voluntary and had no effect on their participation in the MMO program. Participants were able to abstain from answering any question.

The surveys were administered between June 2015 and March 2016. Participants received the invitation to participate when they came in for their clinic appointments or during one of the three MMTs. If the participants could not read, then the audiologist or audio technician administering the survey read the forms aloud and recorded the participant's responses. Completed surveys were then sent to the researchers from the Chief Audiologist or another volunteer from the program.

Participant demographics.

The hearing aid database provided by MMO contained the demographic information of 447 of their patients who were fitted with a hearing aid(s). This demographic information included patients' first and last names, date of birth, and the calculated age (at the time of the fitting). The database also included the fitting date, the ear(s) fitted with amplification, the pure tone average (PTA) of the ear(s), and the type of hearing loss (SNHL, CHL, or mixed). Lastly, the spreadsheet indicated if the patient received a new or replacement hearing aid, the model of the aid (ReSound Match 70 or 90), the serial number and the earmold type (donated or custom).

Data analysis.

Each survey was numbered and matched to the corresponding participant in the database. Responses to Q6b were categorized into themes; communication, social and emotional health (SEH), work, safety, church and music. Descriptive statistical analysis was completed. Chi-square analyses were conducted to assess any differences in perceived benefit between adults and pediatrics, males and females, and among the different degrees/types of hearing loss (SNHL, CHL or mixed).

CHAPTER 5

RESULTS

Participants

A total of 55 surveys were completed, eight pediatric and 47 adult. Participant numbers 18 and 37 were removed from the study because they were surveys that had already been completed by an MMO recipient. A total of 53 surveys were included in the data analysis. Twenty-three of the 53 participants (43.4%) were in the MMO hearing aid database. For these participants, information regarding age, gender, pure tone average (PTA), type of hearing loss, hearing aid, and earmold were also available. For the remaining 30 participants, age group was solely determined by the color of the survey he/she completed (blue (adult) vs. purple (pediatric)).

Survey Responses

The survey was only seven questions in length and required translation for some questions. Each question will be discussed below. The summary of answers for each question can be found in Appendix E.

Hours per day.

Across all 53 participants, the mean reported hearing aid use per day was 13.5 hours (*SD* = 3.18) (question 1). When comparing average use by age, the pediatric patients reported an average use of 11.5 hours (*SD* =3.78) per day and the adult participants reported an average of 13.8 hours (*SD* = 3.01) of use per day. The individual subjects' reported hearing aid use ranged from 4 to 24 hours. Figure 1 highlights the number of participants' responses recorded for each number of hours per day of use up to 24 hours.

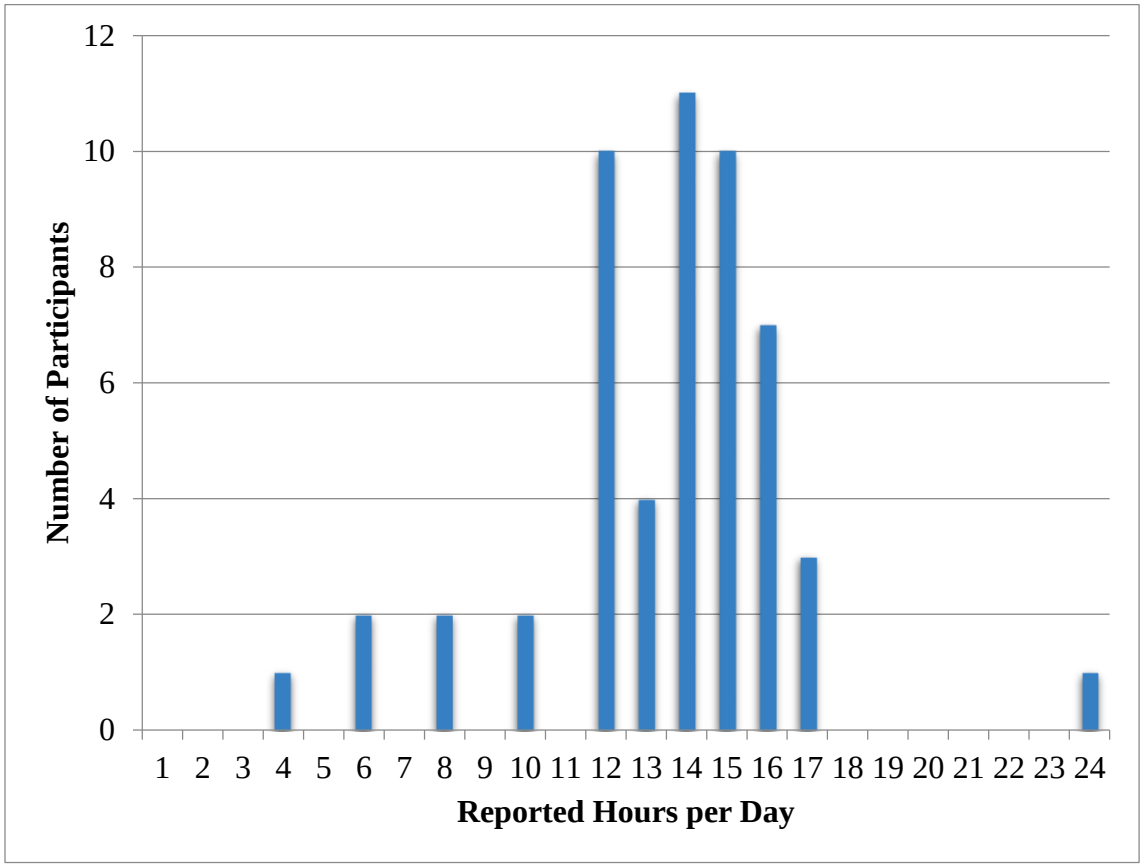

Figure 1. The participants' reported hearing aid usage per day, by total hours.

Comfort.

In response to question 2 of the survey, a majority of participants (*N* = 53, 86.8%) indicated that they found the hearing aid to be comfortable. The remainder of the participants (*N* = 53, 11.3%) reported that their devices were uncomfortable. One pediatric participant (age 2 years) did not respond to this question, his survey was completed by a parent/guardian. Survey respondents were divided into two groups, those who indicated that their hearing aid(s) were comfortable and those who reported that their hearing aid(s) were uncomfortable. As expected, individuals who reported their hearing aids to be comfortable wore their devices for greater lengths of time on average (*M* = 13.8 hours/day, *SD* = 2.3, range = 6-17 hours/day); in comparison to those participants who found their hearing aids to be uncomfortable (*M* = 12.3 hours/day, *SD* = 7.1, range = 4-24 hours/day).

Prior to evaluating whether hearing aid comfort affected the number of hours participants reported wearing their hearing aids, an exploratory data analysis was conducted to determine if the number of hours participants reported wearing the devices were normally distributed using IBM SPSS statistics software version 23. Review of the Lilliefors-corrected Kolmogorov-Smirnov (K-S) test of normality results indicate that the data significantly deviated from a normal distribution ($D(53) = 0.188$, $p < .05$). A further review of the Shapiro-Wilk (S-W) test of normality results further corroborate that the data significantly deviated from a normal distribution ($W(53) = 0.891$, $p < .05$). To determine homogeneity of variance, Levene's test of equality of variance was conducted. Variances in the number of hours the devices were worn between the two groups were significantly different, $F(1, 50) = 14.35$, $p < .05$. Because the model assumptions of

normality and equal variance were violated, a non-parametric Mann-Whitney test was conducted to explore whether differences in comfort would affect the number of hours participants spent wearing their hearing aid(s). Results of the Mann-Whitney test suggest that the two groups did not significantly differ from one another with respect to how much time they reported wearing the devices ($p = 0.265$). This suggests that the reported degree of comfort had little to no effect on hearing aid use.

Ease of use and satisfaction.

A majority of participants ($N = 53$, 98.1%) of the participants responded "yes" when asked about the ease of use of their hearing aid(s) (question 3). Of note, the participant that reported the hearing aid was not easy to use was a 6 year old. When asked if they were satisfied with their hearing aid, one participant said "no", one said "intermittently" and the remaining participants ($N = 53$, 96.2%) said they were satisfied (question 4). Of note, the person that responded that their satisfaction was intermittent was the parent/guardian of a 2 year old.

Benefit.

The participants' perception of benefit of the hearing aid(s) was evaluated in question 5. A majority of the participants ($N = 53$, 98.1%) reported they receive benefit from their hearing aid(s). If a participant reported benefit they were asked to provide two examples.

Subjective examples of perceived benefit

The 104 written responses were translated into English and grouped by common underlying themes including communication, safety, social and emotional health (SEH), music, work, and worship. The most common theme, seen in 42 responses, was in the

area of communication. The second most common reported them was SEH. Examples of SEH include an improvement in self-esteem, social life, and increased happiness. The third most common theme was noticed benefit in their work settings such as in meetings, talking to clients, and in helping fellow employees. The number of participant responses for each of the six categories can be seen in Figure 2. Individual responses in Spanish and English from each participant can be seen in Appendix F. Additionally, the translated responses grouped by theme can be seen in Appendix G.

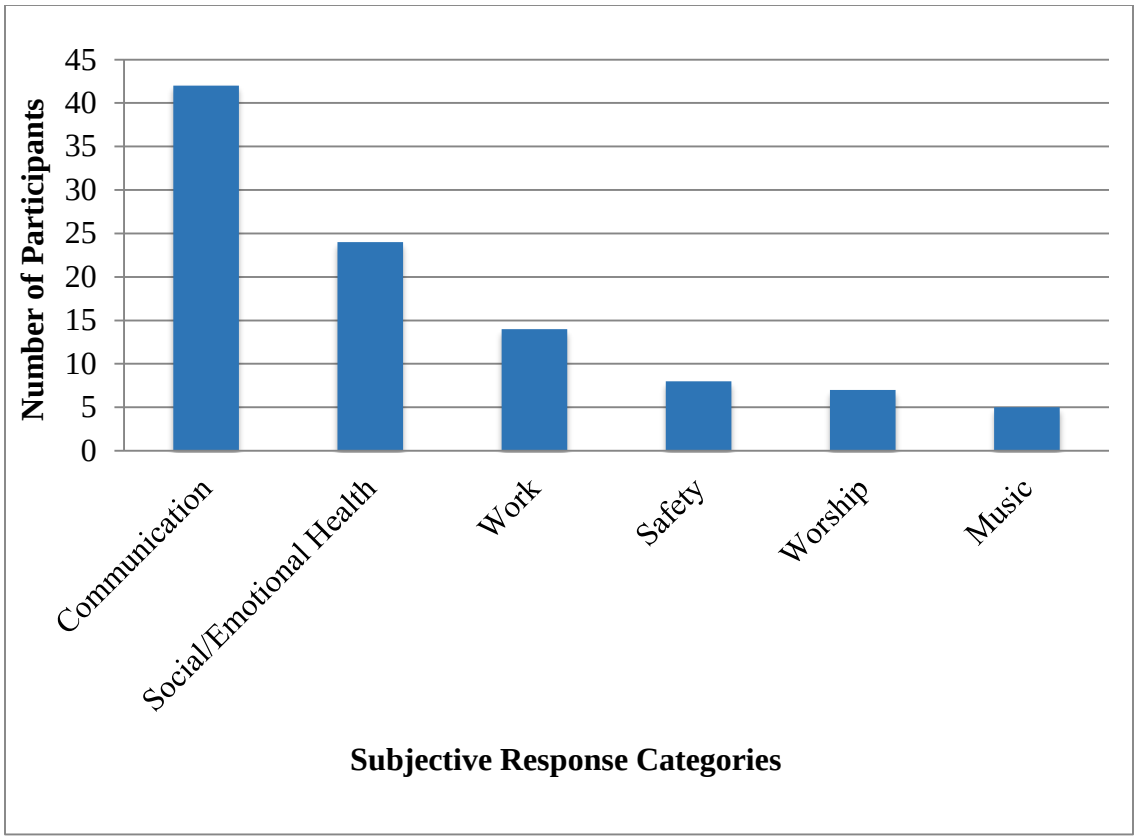

Figure 2. Subjective comments from participants that responded "yes" to Q5 (Do you benefit from using the hearing aid?). Each participant provided two examples.

Quality of life and recommendations.

In response to question 6 of the survey, a majority of participants (*N* = 53, 98.1%) of the participants responded "yes" when asked if there was a change in quality of life since receiving the hearing aids. Of note, a pediatric participant's guardian reported that the hearing aids did not promote a change in quality of life as the patient was 2 years old. Nearly all of the participants (*N* = 53, 98.1%) responded "yes" when asked if they would recommend hearing aids to their friends and family (question 7). One adult participant responded "no" they would not recommend hearing aids to their friends and family.

Chi-square analyses were performed to assess any associations between questions two through seven. Due to the limited number of opposing answers the Chi-square results were not valid and could not be generalized to the population.

Survey Responses and Demographic Information

Participants.

There were 23 participants with demographic information in the MMO database (7 pediatric, 15 adults). Mean age was 40 years (*SD* = 27). Age ranged from 20 months to 94 years of age.

Of the 23 with known demographic information, there were ten male participants (43%) and thirteen female participants (57%). The chief audiologist for MMO noted that one pediatric participant (age 2 years) is currently under observation for a cochlear implant.

Hearing loss.

The types of hearing loss were categorized into sensorineural, conductive, and mixed. Among the 23 participants whose demographic information was available, only

22 had hearing loss documented in the database. Eighteen had a sensorineural hearing loss, four a mixed loss, and zero conductive hearing losses. Pure tone averages were calculated using a four-frequency average of .5, 1, 2, and 4 kHz. Mean PTA for the fitted ear was 73.7 dB (*SD* = 16.7). The PTAs ranged from 45 to 106 dB HL for the aided ears.

A Pearson's Correlation coefficient test was run to assess if participants' reported hours of hearing aid use per day was associated to the PTA of the aided ear. Results indicated the number of hours reported is negatively correlated to the PTA (r = -.151). However, the effect size of this relationship is small and these results were not significant (p = .492) indicating that PTA did not predict the number of hours per day a participant will use their hearing aid.

Hearing aids.

Each MMO patient who meets the criteria for a hearing aid based on their hearing loss is eligible for one hearing aid. Nine participants were fitted in the left ear, eight were fitted in the right ear, two participants were fitted binaurally and ear fitted was unknown for four participants. Fifteen of these participants were fitted with Match 70 hearing aids, two with Match 90, one with a Eurion Lotus PP hearing aid and five had unknown models of the hearing aid(s). Seven participants reportedly had custom earmolds made through the clinic, four were given premade earmolds and the remaining 12 earmold types were not recorded.

Comfort and ease of use.

Five of the participants in the hearing aid database reported that their hearing aid was not comfortable. Two participants had custom earmolds, one had a donated (premade) earmold from the clinic, and earmolds were unknown for two. Among the total

23 complete entries, one pediatric participant reported the hearing aid was not easy to use. This participant is a 6-year-old female whose parent/guardian completed the survey for her. The remaining 22 participants claimed the hearing aid(s) were easy to use.

Satisfaction, perceived benefit and QOL.

Twenty-two participants in the database reported "yes" to the overall satisfaction, to a perceived benefit and to a change in quality of life with the hearing aid(s). One pediatric participant's parent/guardian reported "intermittent" satisfaction with the hearing aids. The same participant also reported "no" to perceived benefit and a change in quality of life with the hearing aids.

Recommendation.

All 23 participants reported they would recommend hearing aids to their family and friends.

CHAPTER 6

DISCUSSION

MMTs are designed to reach underserved populations in remote regions of the world. According to Suchdev et al. (2007), it is crucial to determine if an MMT is providing a short-term fix or if the program is addressing the root problems. For MMO, one of the aims of the program is to address the high incidence of untreated hearing loss in Nicaragua (Saunders et al., 2007). Therefore, in order to provide services that would address this aim for the long term, MMO established an audiology clinic and a free hearing aid program in Jinotega, Nicaragua. When developing this MMT, MMO wanted to make sure that the quality of care was similar to the services provided in more developed countries. For any MMT it is important to routinely evaluate if the patients being served by the program perceive the benefits intended by it (Suchdev et al., 2007). A program evaluation of an MMT will assist in evaluating the progress of the program. Program evaluations may also help with the development of new MMT programs because the evaluations will identify strengths and weaknesses. Knowledge of other MMT programs' strengths and weaknesses will aid in the development of new MMT programs by reducing the number of foreseeable challenges. The purpose of this study was to assess benefits (or lack thereof) of the MMO program for the recipients of the audiological services.

Survey Findings.

The current study included 53 surveys from a sample of patients who received hearing aids through the MMO program in Jinotega, Nicaragua. Any person who

received a hearing aid (or aids) from MMO was given the opportunity to participate in this study. There were three main areas investigated using a simple short survey.

Hours per day.

It is well documented that a patient with hearing loss who wears hearing aids has access to more acoustic information, which results in a change in performance called the acclimatization process (Kaplan-Neeman, Muchnik, Hildesheimer, & Henkin, 2012). The acclimatization process is described as "a systemic change in auditory performance with time, linked to a change in the acoustic information available to the listener" (Arlinger et al., 1996, p. 87S). According to Kaplan-Neeman et al. (2012), people who report higher amounts of daily hearing aid use are more likely to report higher satisfaction ratings in comparison to their counterparts. The current study found that the respondents of the survey reported wearing their hearing aids an average 13.5 hours per day, which is essentially a full day. Additionally, the majority of respondents reported being satisfied with their hearing aids. This may be due to consistent daily use, which would be consistent with Kaplan-Neeman et al. (2012).

The patients of the MMO program are often fitted with one hearing aid due to the financial constraints of the program. While we know that two hearing aids are better than one, there is some research that provides evidence that even one hearing aid is better than none (Noble & Gatehouse, 2006, Silman, Gelfand & Silverman, 1984). In this study these investigators compared speech recognition abilities in patients with bilateral SNHL who were fitted monaurally from those who were fitted binaurally (Silman et al., 1984). Comprehensive audiometric evaluations were obtained from the 44 participants three times throughout the study; once prior to the hearing aid evaluation, at the hearing aid

evaluation and then again 4-5 years after the hearing aid fitting (Silman et al., 1984). Results indicated that the aided benefits in speech recognition scores provided by both the binaural as well as monaural hearing aids were maintained after 4-5 years of hearing aid use. Conversely, the speech recognition scores for the unaided ear in the monaurally aided group decreased from the first assessment to the final one (Silman et al., 1984). Although binaural amplification is ideal for people with bilateral SNHL, it is more expensive because the patient needs to purchase two hearing aids and possibly two earmolds. Therefore it is not practical for MMT programs with limited resources (or a lower socioeconomic status (SES) patient population) to dispense two hearing aids per patient. Specifically, the MMO provides amplification for one ear, which allows them to fit a larger number of patients rather than providing two hearing aids to a smaller number of people.

Comfort.

Participant responses to the question about comfort were the most variable across respondents. Unfortunately, the way the question was worded it did not evaluate the type of comfort the patient was referring to (e.g., there was no differentiation between physical discomfort and loudness levels or sound quality). It can be suspected that the participants who indicated that their hearing aids were not comfortable were referring to the fit of the earmolds. For the MMO program, the earmolds are typically premade in the U.S. and then shaved down in Nicaragua until it can fit into the patient's ear without producing feedback, therefore these earmolds are not custom fit. A custom impression may be taken if the premade earmold does not fit well enough. This situation is rare but when it happens the impression of the ear is taken and sent to a lab two hours away. Even with

this custom type of earmold, the quality of the earmold is not the same as what is used in the U.S. (e.g., the edges are not smooth). Loudness levels and/or sound quality may also be an issue because the hearing aids used in the MMO program only allow for the manipulation of trim pots, which are adjusted based on patients' subjective perception of the sound quality. There are no ways to verify the hearing aid fitting nor are there "programs" in the hearing aids to assist with various complaints (e.g., noise reduction) (Fabry, 2003).

The number of participants reporting discomfort (n = 6) was minimal and there was no association between comfort and hours of hearing aid use per day. This contradicts the literature, which states that if the patient does not have a good fit of their hearing aid then they will not wear it (McCormack & Fortnum, 2013). This difference may be due to the fact that McCormack & Fortnum (2013) reported on the general populations' use of hearing aids and not just low SES or MMT programs. This contradiction highlights the fact that even though the earmolds are not custom fit in the MMO program, it appears that the physical fit of the earmold is not a barrier to use. This finding may be unique to this impoverished population fit by the MMO and similar third world communities (or low SES communities in developed countries).

Benefit.

Despite occasional reports of discomfort and other underlying factors with the hearing aids, 98.1% reported they are receiving benefit from their hearing aid(s). The only participant who reported no benefit with binaural hearing aids was a pediatric participant with profound sensorineural hearing loss who is currently under consideration for a CI. His four frequency pure tone average is 100 dB HL (ear not specified in

database). In the U.S., this reported lack of functional benefit with traditional amplification is actually a part of the candidacy criteria for a CI. Typically, the patient's report of functional use of the hearing aid is considered during the candidacy process (i.e. the ability to talk on the phone or attend social events) (Gifford, 2011). A PTA of 100 dB HL most likely results in a very reduced dynamic range and ultimately minimal benefit from hearing aids. Therefore, this patient's parental report that the child is receiving minimal/no benefit with hearing aids is not surprising (Gifford, 2011).

Impact of Services

A person's standards for a "good" quality of life, or well-being, are influenced by a variety of things (Abrams, Chisolm, & McArdle, 2005). For example, someone with a low socioeconomic status (SES) may have different values for their quality of life compared to someone with a high SES. Someone with a low SES may feel like they have a good quality of life if they have somewhere to live, a job and food to eat. Whereas someone with a high SES may want more things of a higher value to perceive a good quality of life (e.g., a vacation home, a better job and/or higher quality foods) (Abrams et al., 2005). Additionally, where you live may affect how you perceive your quality of life. People who live in the developed world may have different standards for what makes a good quality of life as compared to someone who is living in a third world country (Abrams et al., 2005). What defines "a good or bad quality of life" will differ between individuals, however, poor health will negatively affect quality of life for all people (Abrams et al., 2005).

As healthcare providers, it is our job to help patients improve their health related quality of life. An untreated hearing loss, regardless of the type, onset, or causal factors,

will affect an individual's quality of life. Hearing loss can affect our physical, social, emotional and mental health (Abrams et al., 2005). Providing hearing aids to people with hearing loss will help to reduce the impact on these domains and can ultimately improve their quality of life (Bess, 2000).

For patients in the U.S., audiologists are typically trained to provide a similar standard of care regardless of where they earned their audiology degree. Currently, hearing healthcare is based on a medical model, which includes a comprehensive audiologic evaluation and treatment with hearing aids (Lin, 2012). If a hearing loss is diagnosed at the evaluation, then the patient is fitted with hearing aids followed by multiple appointments for programming and counseling. This strategy employed in the U.S. is patient centered as opposed to a community-based approach (Lin, 2012). This clinic-based model also requires the presence of an audiologist or licensed professional to perform the testing and dispense the hearing aids, which is not possible in more remote regions of the world (Davis et al., 2016).

In developing countries, audiologists are rare if at all present. The U.S.'s gold standard process for diagnosis and treatment is not financially or in some cases physically possible in more remote or impoverished areas (WHO, 2004). The MMO uses a standard of care based on the WHO guidelines, which were created to define the minimum requirements for service delivery to underserved populations (WHO, 2004). The findings in this study provide reasonable support that MMO is beneficial to the population it was intended to serve even though it is not able to provide the gold standard of hearing health care delivered in the U.S.

Limitations

Survey administration.

This study relied on survey administration from volunteers traveling to or working in Nicaragua. If the volunteer worked in Nicaragua they would give the completed surveys to the next American volunteer that came on an MMO trip. The MMO U.S. volunteers were responsible for returning the surveys to the researchers once they were stateside. Accessing all of the MMO hearing aid recipients was not possible. Because there are only a few MMO trips each year the main focus of the audiologist(s) is on fitting new patients and following up with patients that are experiencing problems. During the data collection period (10 months) there were three MMTs to Nicaragua. Even if one of the researchers traveled to Nicaragua, access to all of MMO patients would have been challenging due to third world issues (e.g., transportation).

Survey content.

The survey questions were written in yes/no form, which was later recognized as a potential limitation because it provided limited information. Due to unknown education levels and reading levels and time constraints for administration the use of yes/no options was sufficient to preliminarily evaluate the participants' perceived benefit from their hearing aids.

Language.

Although a native Spanish-speaking individual from Nicaragua translated the survey from English to Spanish, there was still a language barrier between some of the audiologists administering the survey and the participants because not all volunteers speak Spanish fluently. The language barrier may have been perceived by the participant

as a negative for those individuals who wanted to ask further questions about the survey and/or for those individuals who could not read the questions themselves.

Demographic information.

In addition to the limited access to patients, the hearing aid database was not updated. The researchers found that it was missing some participants' demographic information. Different volunteers use the database. The record keeping skills related to the database clearly varies across volunteers. This was not anticipated, which is why there were no demographic questions in the survey. This missing material resulted in many completed surveys without identifying information to use for data analysis.

Future directions

The current study had several limitations, which should be addressed in future studies of the MMO program and/or other MMTs. Issues regarding access to more participants, time and accurate demographic information could be addressed if the researchers went to Nicaragua and administered the surveys themselves. If this were possible, this would allow participants the opportunity to expand on their survey responses in a more qualitative form. This qualitative data would help the researchers evaluate the perceived benefit of the devices and services offered by MMO. Additionally, an update to the survey to include demographic information would help the researchers obtain more complete information but would also help fill gaps in the database.

Finally, a longitudinal study on the quality of life of these hearing aid recipients would allow the researchers to evaluate the effect(s) over time and to monitor the sustainability of the mission trips. Currently, MMO is in the process of training seven healthcare professionals in Nicaragua to be audio technicians. They will be responsible

for audiologic evaluations and hearing aid dispensing between mission trips. While the directors are making structural changes to the program, a longitudinal study would assess the patients' perspective to ensure they continue to benefit from their hearing aids.

Appendix A

IRB Approval

TOWSON UNIVERSITY

EXEMPTION NUMBER: 15-X086

To: Jennifer Smart
From: Institutional Review Board for the Protection of Human Subjects, Debi Gartland,Chair (YS)
Date: Tuesday, June 16, 2015
RE: Application for Approval of Research Involving the Use of Human Participants

Office of Sponsored Programs
& Research

Towson University
8000 York Road
Towson, MD 21252-0001

t. 410 704-2236
f. 410 704-4494
www.towson.edu/ospr

Thank you for submitting an application for approval of the research *Humantarian Audiology in Nicaragua: A Quality of Life Study*

to the Institutional Review Board for the Protection of Human Participants (IRB) at Towson University.

Your research is exempt from general Human Participants requirements according to 45 CFR 46.101(b)(4). No further review of this project is required from year to year provided it does not deviate from the submitted research design.

If you substantially change your research project or your survey instrument, please notify the Board immediately.

We wish you every success in your research project.

CC: Kelsey Ambrose, Dr. Korczak, Dr. Robinson, Dr. Fried
File

Appendix B

Consent and Assent Forms (in English)

INFORMED CONSENT

Project Title: Humanitarian Audiology in Nicaragua: A Quality of Life Study

Principal Investigators:

Jennifer L. Smart, Ph.D.

Co-investigators: Kelsey Ambrose, B.A., Peggy Korczak, Ph.D., & Candace Robinson, Au.D.

Towson University

Dept. of ASLD

8000 York Road

Towson, MD 21252

Purpose of the Study:

The purpose of this study is to investigate the benefit or lack thereof among patients fitted with hearing aid(s) through the Mayflower Medical Outreach (MMO) program in Jinotega, Nicaragua.

Procedures:

You will receive a survey of 8 questions. You may ask questions at any time. You should complete all sections of the survey (to the best of your abilities), and provide additional information where applicable. If you would like someone to read the questions to you and record your answers please inform the technician.

Risks/Discomfort:

There are no risks for those participating in this study.

Benefits:

Data collected during this research study will help humanitarian programs, such as MMO, gain a better understanding about the impact that their study has on the population they were developed for. The results from this study may assist in the development of new programs or help current programs improve their outcomes.

Participation:

Participation in this study is voluntary. Participants can abstain from answering any survey question.

Compensation:

There is no compensation for participating in this study.

Confidentiality:

All obtained information will remain strictly confidential. Personal names and/or identifying information of participants will not be disclosed if descriptions and findings are published. If you agree to participate in this study, please indicate that you have read and understood information and sign your name below.

_____ I have read and understood the information on this form.

_____ I have had the opportunity to ask questions.

_____

Participant's Name (printed)

_____ _____

Participant's Signature Date

_____ _____

Principal Investigator Date

If you have any questions regarding this study please contact the Principal Investigator,

Dr. Jennifer L. Smart, phone: 001+ (410) 704-3105 or email: JSmart@towson.edu or the Institutional Review Board Chairperson, Dr. Debi Gartland, Office of University Research Services, 8000 York Road, Towson University, Towson, Maryland 21252; phone (410) 704-2236.

THIS PROJECT HAS BEEN REVIEWED BY THE INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN PARTICIPANTS AT TOWSON UNIVERSITY (PHONE: 410-704-2236).

INFORMED ASSENT FORM

Project title: Humanitarian Audiology in Nicaragua: A Quality of Life Study

Principal Investigators:

Jennifer L. Smart, Ph.D.
Towson University
Dept. of ASLD
8000 York Road
Towson, MD 21252

Information Sheet for Participants

(To be read aloud to each participant)

Purpose of study

We are asking you to participate in this study to help us better understand how you use and feel about your hearing aid. All of the people that received their hearing aid from the Medical Mayflower Outreach (MMO) program are being asked to participate in the study.

What tests does the study involve?

If you choose to participate in the study you will answer 8 questions about your hearing aid. It will take about 10 minutes to complete the survey. If you would like someone to read the survey to you and write down your answers please let the technician know.

Child Assent Form

(To be read aloud to the child and signed by researcher if child agrees to participate)

Title of Project: Humanitarian Audiology in Nicaragua: A Quality of Life Study

Primary Investigators: Jennifer Smart, Ph.D.

If you are happy to do this study, I will need you to write your name on this piece of paper.

First, I will ask you some questions, just to make sure that you are happy to do this. Say 'yes' if you agree with what I am saying. If you do not agree with the statement, tell me 'no.'

- I have had the information sheet read out loud to me.
- I understand that you want to find out about my hearing aid.
- I understand that I can decide to stop at any time.
- I understand that some of my answers will be used in a report, but that people reading the report will not know that the answers are mine, because my name will not be written on it.
- I understand that my answers will be kept for a long time in a safe place.

If you would like to participate in this study, please write your name and I will sign below.

……

……

Child's Name Researcher's Signature

Today's date:……

If you have any questions regarding this study please contact the Principal Investigator, Dr. Jennifer L. Smart, phone: (410) 704-3105 or email: JSmart@towson.edu or the Institutional Review Board Chairperson, Dr. Debi Gartland, Office of University Research Services, 8000 York Road, Towson University, Towson, Maryland 21252; phone: (410) 704-2236.

THIS PROJECT HAS BEEN REVIEWED BY THE INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN PARTICIPANTS AT TOWSON UNIVERSITY (PHONE: 410-704-2236).

Appendix C

Hearing Aid Benefit Survey in English and Spanish

Hearing Aid Benefit Survey (English Version)

Q1. How many hours a day do you use the hearing aid? _____ hours/day

Q2. Is it comfortable? Yes No

Q4. Is the hearing aid easy to use? Yes No

Q5. Overall, are you satisfied with the hearing aid? Yes No

Q6a. Do you benefit from using the hearing aid? Yes No

Q6b. If you said yes you benefit from the hearing aid, give two examples of when you notice it helps you.

1. _____
2. _____

Q7. Has there been a change in your quality of life since receiving the hearing aid? Yes No

Q8. Would you recommend hearing aids for your family or friends? Yes No

Encuesta de Beneficios Sobre el Uso de Audífonos

Q1. ¿Cuantas horas al día usa usted el audífono? _____horas por día

Q2. ¿El audífono es cómodo o no? Si No

Q4. ¿El audífono es fácil de usar? Si No

Q5. ¿En general, está usted satisfecho/a con el audífono? Si No

Q6a. ¿Percibe usted beneficio cuando usa el audífono? Si No

Q6b. ¿Si contestó si a la pregunta Q6a., favor de dar dos ejemplos en cuáles percibe beneficio?

1. _____
2. _____

Q7. ¿Ha habido algún cambio en la calidad de su vida desde que recibió el audífono? Si No

Q8. ¿Recomendarías el uso de audífonos a tu familia o a tus amigos? Si No

Appendix D

Survey Administration Directions

Hi Debra,

I cannot thank you enough for helping me on this project! From this project I hope to provide a better understanding of the perceived hearing aid benefit from the structure of MMO's program. The results from this study may help other programs on how to structure their own in a sustainable/positive manner. I have attached English copies of the survey and consent/assent forms for you. Here are the basics of the survey…

1. The surveys are all attached to either a blue or a purple form (front and back!)
    - Blue forms are for adult participants to read and sign.
    - Purple forms are for pediatric participants to sign along with their parent/guardian.
2. The forms can be read aloud if needed but it is not necessary.
3. Please keep the forms attached to the surveys so we can match the survey responses to the hearing aid database.
4. There is a line on both forms for you to sign, or whoever administered the survey.
5. When you return to the U.S., I will send you a pre-paid/addressed envelope for you to mail back the surveys.

Again, I cannot thank you enough! I'm looking forward to hearing about the trip and seeing what information we can gather!

Safe travels!

Kelsey Ambrose & Dr. Smart

Appendix E

Survey Responses

Q1. How many hours per day do you use the hearing aid?

	Average Hours /Day	n
Adults	13.9	45
Children	11.5	8

Total number of respondents=53

Q2. Is the hearing aid comfortable?

	Total (%)	Adults (%)	Pediatrics (%)
Yes	46 (86.8)	42 (93.3)	4 (50)
No	6 (11.3)	3 (6.7)	3 (37.5)
No Response	1 (1.9)	0	1 (12.5)

Total number of respondents=53, adults (n=45), pediatrics (n=8)

Q3. Is the hearing aid easy to use?

	Total (%)	Adults (%)	Pediatrics (%)
Yes	52 (98.1)	45 (100)	7 (87.5)
No	1 (1.9)	0	1 (12.5)

Total number of respondents=53, adults (n=45), pediatrics (n=8)

Q4. In general, are you satisfied with the hearing aid?

	Total (%)	Adults (%)	Pediatrics (%)
Yes	51 (96.2)	44 (97.8)	7 (87.5)
No	1 (1.9)	1 (2.2)	0
Intermittently	1 (1.9)	0	1 (12.5)

Total number of respondents=53, adults (n=45), pediatrics (n=8)

Q5a. Do you benefit from using the hearing aid?

	Total (%)	Adults (%)	Pediatrics (%)
Yes	52 (98.1)	45 (100)	7 (87.5)
No	1 (1.9)	0	1 (12.5)

Total number of respondents=53, adults (n=45), pediatrics (n=8)

Q6. Has there been a change in your quality of life since you received the hearing aid?

	Total (%)	Adults (%)	Pediatrics (%)
Yes	52 (98.1)	45 (100)	7 (87.5)
No	1 (1.9)	0	1 (12.5)

Total number of respondents=53, adults (n=45), pediatrics (n=8)

Q7. Would you recommend hearing aids to your family or friends?

	Total (%)	Adults (%)	Pediatrics (%)
Yes	52 (98.1)	44 (97.8)	8 (100)
No	1 (1.9)	1 (1.8)	0

Total number of respondents=53, adults (n=45), pediatrics (n=8)

Appendix F

Written Responses to Q6b. in Spanish and English by Participant

	Spanish	English	Theme
1	a. Me siento feliz de escuchar sonidos. b. Entiendo mejor las voces y lo que hablaban las personas.	a. I am happy to hear sounds. b. I understand voices better and can talk with people.	a. SEH b. Comm.
2	a. Cuando me hablan el escucha. b. El puede trabajar y ayudar a los otros empleados.	a. When others speak I can hear. b. I can work and help other employees.	a. Comm. b. Work
3	a. Escucho las voces. b. Escucho sonidos fuertes.	a. I can hear voices. b. I can hear loud voices.	a. Comm. b. Safety
4	a. Nos podemos comunicar mejor b. El percibe bien los sonidos.	a. We can communicate better. b. He perceives sounds better.	a. Comm. b. Safety
5	a. Escucha mejor la voz. b. Escucha el ruido de los vehículos en la calle.	a. He hears voices better. b. He hears vehicle sounds in the street.	a. Comm. b. Safety
6	a. Mayor facilidad para comunicarnos en familia. b. Es ahora mas fácil que ella aprenda y evite accidentes.	a. It's easier for her to communicate with our family. b. It's easier for her to learn and avoid accidents.	a. Comm. b. Safety
7	NR	a. NR	
8	a. Me ayuda con mi auto estima, puedo mantenerme activa/o con mi familia, al escuchar, a través del audífono, ha mejorado mi actitud. b. Cuando camino hacia la iglesia puedo escuchar la misa.	a. It helps with my self-esteem, I can be active with my family, to listen through the HA improved my attitude. b. When I walk to church I can hear the mass.	a. SEH b. Church
9	a. Oigo mas. b. Entiendo mucho mejor.	a. I hear more. b. I understand better.	a. SEH b. Comm.

10	a. Escucho mejor. B. Entiendo mas	a. I hear better. b. I understand more.	a. SEH b. Comm.
11	a. Me gusta usar el audífono porque escucho mejor. b. Entiendo mejor a la gente.	a. I like to use the hearing aid because I hear better. b. I understand people better.	a. SEH b. Comm.
12	a. Porque ella puede escuchar mejor. b. Porque ella puede comunicarse mejor.	a. Because she can hear better. b. Because she can communicate better.	a. SEH b. Comm.
13	a. (Mejor) Puedo escucha mejor. b. Puedo conversar mejor con las personas.	a. I can hear better. b. I converse with people better.	a. SEH b. Comm.
14	a. No toma tanto esfuerzo para poder escuchar b. Cuando ando gripe no escucho casi nada y con el audífono me ayudo a sentir bien mas cuando trabajo, cuando el cliente habla bajo.	a. It doesn't take effort to listen. b. When I have a cold, I hear almost nothing, but when I wear the hearing aid I can hear so much better and feel better talking to clients.	a. SEH b. Comm. & work
15	a. Escucha un poquito y entiendo mas. b. Para estudiar o cuando hay trafico.	a. I hear a little and understand more. b. To study or when there is traffic.	a. Comm. b. Safety
16	a. Entiendo mejor la palabra. b. Sin el me cuesta comunicarme.	a. I hear words better. b. Without the hearing aid I find it hard to communicate.	a. Comm. b. Comm.
17	a. Puedo platicar con las personas. b. Entiendo mas a las personas.	a. I can talk with people. b. I understand people more.	a. Comm. b. Comm.
19	a. Se puede movilizar. b. Conversar con las personas.	a. I can be mobile. b. I can converse with people.	a. SEH b. Comm.
20	a. Ver TV. b. Comunicarse con las personas.	a. I can watch TV. b. I can communicate with people.	a. SEH b. Comm.

21	a. Escuchar. b. Evita tener mareos.	a. I can listen. b. Avoid dizziness.	a. SEH b. Safety
22	a. Conversar con las personas. b. Ayuda en el trabajo. Sin el audífono se aísla.	a. I can converse with people. b. It helps at work. Without the HA, I isolate myself.	a. Comm. b. Work & SEH
23	a. Facilita comunicación. b. Ayuda en mi trabajar y para estudiar y cuidar a mi hija.	a. facilitates communication. b. It helps with work, study, and to care for my daughter.	a. Comm. b. Work & Safety
24	a. Conversar con las personas. b. Me hace sentir alegre.	a. I can communicate with people. b. It makes me happy.	a. Comm. b. SEH
25	a. Puede trabajar cómodamente. b. Escucha mejor.	a. I can work comfortably. b. I can listen better.	a. Work b. SEH
26	a. Para conversar. b. Acudir a la iglesia.	a. To converse. b. Going to church.	a. Comm. b. Church
27	a. En reuniones de trabajo escucho mejor. b. Escuchar radio.	a. In work meetings I can hear better. b. I can listen to the radio.	a. Work b. Music
28	a. Escucha para poder trabajar. a. Comunicación con la familia.	a. I can listen at work b. Communicate with my family.	a. Work b. Comm.
29	a. Conversaciones. b. Escucha radio.	a. Conversations. b. I can listen to the radio.	a. Comm. b. Music
30	a. Ayuda para conversar. b. Ayuda a escuchar para trabajar.	a. It helps to converse. b. It helps to listen at work.	a. Comm. b. Work
31	a. Escuchar mejor a los familiares. b. Escuchar misa.	a. I can hear my family better. b. I can hear mass.	a. Comm. b. Church
32	a. Mejora a la comunicación. b. Escuchar radio.	a. Improves communication. b. I can listen to the radio.	a. Comm. b. Music
33	a. Comunicación con familiares. b. Acude a misa y puede escuchar al sacerdote.	a. Communicate with my family. b. I can attend mass and hear the priest.	a. Comm. b. Church

34	a. Escuchar noticiero. b. Acude a la iglesia. Llanto di los niños.	a. I can hear the news. b. I can go to church and hear the kids crying.	a. Safety b. Church & Safety
35	a. Escuchar conversaciones. b. Comunicarse con los demás.	a. I can listen in conversation. b. I can communicate with others.	a. Comm. b. Comm.
36	a. Ayuda a pronunciar bien las palabras. b. Poder estudiar.	a. It helps me to pronounce words better. b. I can study.	a. Comm. b. Work
38	a. Oigo mas. b. Entiendo mejor.	a. I hear more. b. I understand better.	a. SEH b. Comm.
39	a. Me beneficia en escuchar mas. b. Me relaciono mejor con las personas.	a. it benefits me to hear better. b. I relate better with people.	a. SEH b. Comm. & SEH
40	a. Escucho mejor. b. Puedo comunicarme mejor con los demás.	a. I can hear better. b. I can communicate better with others.	a. Comm. b. Comm.
41	a. Telefono b. Culto (Carlos, predicador)	a. Telephone. B. Worship (Carlos, the preacher)	a. Comm. b. Church
42	a. Hablar con otras personas. b. Pájaros.	a. I can talk other people. b. Birds.	a. Comm. b. SEH
43	a. Hablar/Platicar mas con las personas. b. Ha mejorado mi comunicación en el trabajo.	a. I can talk with people more. b. Communication at work has improved.	a. Comm. b. Comm.
44	a. Mejor comunicación. b. Mi vida social ha mejorado	a. Communication improved. b. Social life improved.	a. Comm. b. SEH
45	a. Escuchar a las personas ha mejorado(comunicación). b. Puedo escuchar música.	a. Listening to people improved. b. I can listen to music.	a. Comm. b. Music
46	a. Gente hablando. b. Música.	a. People talking. b. Music.	a. Comm. b. Music

47	a. Comunicación con mi familia. b. Estudiar en la secundaria, aprender a leer.	a. Communication with my family. b. High school, learned to read.	a. Comm. b. Work
48	a. Escuchar mejor. b. Me relaciono mejor o con mi amigos y en el trabajo.	a. I can hear better. b. Relate better with friends and at work.	a. SEH b. Work & SEH
49	a. Mejor escucha. b. Relacionarse mejor (trabajo)	a. I can hear better. b. I can relate better (at work).	a. SEH b. Work
50	a. Mejor comunicación. b. Relacionarse en el trabajo.	a. Communication improved. b. I can relate at work.	a. Comm. b. Work
51	a. Ha mejorado mi comunicación en el trabajo. b. Convivencia familiar.	a. Communication at work improved. b. Family life.	a. Work b. SEH
52	a. Comunicación familiar. b. Aprender a hablar.	a. Communication with my family. b. I learned to talk.	a. Comm. b. SEH
53	a. Comunicación. b. Hablar susurrando	a. Communication. b. Talk in whispers	a. Comm. b. Comm.
54	a. Modula el sonido del TV. b. *Response not legible	a. He can modulate the sounds of the TV. b. *Response not legible	a. SEH b. N/A
55	a. Percibe mas sonidos. b. Ha mejorado mi lenguaje.	a. He perceives more sounds. b. His language improved.	a. SEH b. Comm.

Appendix G

Written Responses to Q6b. by Theme

Theme	Written Response
Communication	I understand voices better and can talk with people.
	When others speak I can hear.
	I can hear voices.
	We can communicate better.
	He hears voices better.
	It's easier for her to communicate with our family.
	I understand better.
	I understand more.
	I understand people better.
	Because she can communicate better.
	I can converse with people.
	I can communicate with people.
	I can converse with people.
	Facilitates communication.
	I can communicate with people.
	To converse.
	Communicate with my family.
	Conversations.
	It helps to converse.
	I can hear my family better.
	Improves communication.
	Communicate with my family.
	I can listen in conversation
	I can communicate with others.
	It helps me to pronounce words better.
	I understand better.
	I relate better with people.
	I can hear better.
	I can communicate better with others.
	Telephone.
	I can talk with other people.
	I can talk with people more.
	Communication at work has improved.
	Communication improved.
	Listening to people improved.
	People talking.
	Communication with my family.

	Communication improved.
	Communication with my family.
	Communication.
	Talk in whispers.
	His language improved.
Social and Emotional Health	I am happy to hear sounds.
	I hear more.
	I hear better.
	I like to use the hearing aid because I hear better.
	Because she can hear better.
	I can hear better.
	It doesn't take effort to listen.
	I can watch TV.
	I can listen.
	It helps with work. Without the HA I isolate myself.
	It makes me happy.
	I can listen better.
	I hear more.
	It benefits me to hear better.
	I relate better with people.
	Birds.
	Social life improved.
	I can hear better.
	Relate better with friends and at work.
	I can hear better.
	Family life.
	I learned to talk.
	He can modulate the sounds of the TV.
	He perceives more sounds.
Work	I can work and help other employees.
	When I have a cold, I hear almost nothing, but when I wear the hearing aid I can hear so much better and feel better talking to clients.
	It helps at work. Without the HA I isolate myself.
	It helps with work, study, and to care for my daughter.
	In work meetings I can hear better.
	I can listen at work.
	It helps to listen at work.
	I can study.
	High school, learned to read.
	I can relate better (at work.)
	I can relate at work.

	Communication at work improved.
Safety	I can hear loud voices. He perceives sounds better. He hears vehicle sounds in the street. It's easier for her to learn and avoid accidents. To study or when there is traffic. Avoid dizziness. It helps with work, study, and to care for my daughter. I can go to church and hear the kids crying.
Worship	When I walk to church I can hear the mass. Going to church. I can hear mass. I can attend mass and hear the priest. I can go to church and hear the kids crying. Worship (Carlos, the preacher).
Music	I can listen to the radio. I can listen to music. Music.

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