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Access to Audiology Care in Rural and Urban Communities: A Methodology Paper

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ACCESS TO AUDIOLOGY CARE IN RURAL AND URBAN COMMUNITIES: A METHODOLOGY PAPER

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ABSTRACT

The ability of those affected by hearing loss to access audiology care is imperative as the effects of unmanaged hearing loss are deleterious, and the prevalence is high. Despite the abundance of individuals affected by hearing loss and the implications of the condition when untreated, barriers to access to care remain primarily unresolved, affecting groups disproportionately. These barriers include knowing when a hearing problem warrants intervention, transportation, geographical barriers, a lack of hearing health care providers, affordability, and insurance coverage. Rural and urban communities are each predisposed to a unique set of social determinants of health, which affect their ability to access hearing health care and health care in general, leading to worsened health outcomes. Implementing programs aimed toward health equity, including mobile audiology, tele-audiology, and community outreach services, breaks down these barriers by eliminating geographical and several other factors affecting the ability to access care. A methodology is outlined beginning with community outreach events that serve to aid community members in the identification of a hearing problem and provide hearing health education. Mobile audiology services allow in-person, hands-on care, including diagnostic assessment and hearing aid fitting. Remote tele-audiology services are suggested in the interim, offering care for issues that do not require patient contact.

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VITA

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TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

According to the World Health Organization, hearing loss affects one in five people globally. Approximately one-third of those affected require intervention, though only a fraction of those who could benefit from hearing health care receive the necessary services (D'Onofrio & Zeng, 2021). These individuals may have difficulty following conversations and listening to the television. They often rely on help from their friends and family to identify that they are not hearing as well as they once did (Warren & Grassley, 2017). The older adult population has the highest prevalence of difficulty, with 55.7% of those over age 85 reporting hearing problems (Joseph, 2022). Disturbingly, the risk of hearing loss is 100 times greater than the risk of cancer and 10-20 times greater than the risk of heart disease in the elderly population. Despite an overwhelming prevalence rate, only 14% of those with hearing loss utilize a hearing aid, which may be related to the lack of screening programs for older adults as well as social stigma and access to treatment (Warren & Grassley, 2017).

It is imperative for individuals with hearing difficulty to have access to audiology care because the effects of unmanaged hearing loss are deleterious. Untreated hearing problems can impose a preventable burden at the individual and community levels, producing problems with job performance, health and safety, and personal relationships. Additionally, those who experience hearing difficulties are three to four times more likely to experience tinnitus, cognitive difficulty, and balance problems, with an increased risk of falls compared to those reporting no hearing difficulty (Joseph, 2022). Overall quality of life may be at risk for those who face hearing loss without proper access to hearing health care (Hay-McCutcheon et al., 2020).

Despite the abundance of individuals affected by hearing loss and the consequences of this condition when untreated, access to care barriers remain unresolved, affecting various groups disproportionately. These barriers include (1) knowing when a hearing problem warrants intervention, (2) transportation and geographical obstacles, (3) a limited number of hearing health care providers, (4) affordability of hearing technology and services, and (5) inadequate insurance coverage (Powell et al., 2019 & Yu et al., 2017). Those living at or below the poverty level or in low-resource areas are least likely to access the services they need to manage a hearing-related problem (Frank, 2017 & Jayawardena et al., 2018). They may be isolated from audiologic care by their presence in a *hearing health desert*, a term presented by Joseph (2022). This term suggests that an individual resides at an increased geographical distance from the nearest audiology clinic or will encounter a transportation burden to access the closest clinic. Those living in rural communities must travel further for in-person care while experiencing higher hearing loss rates and associated characteristics (Powell et al., 2019). Conversely, those living in urban communities are less likely to reside in states with legislation mandating insurance coverage of audiology services (Amlani, 2023). These individuals are often reliant on public transportation for travel to medical appointments (Gimie et al., 2022). Though the specific barriers to health care differ across communities, the result is a hearing health care disparity between those who can and those who cannot easily access the necessary care. Resultantly, the adverse effects of untreated hearing loss become unequally distributed across groups depending upon the level of privilege they possess to obtain care.

Over the last two decades, due to technological advancements, the hearing aid industry has produced more sophisticated devices that include advanced signal processing, directional microphones, adaptive compression, and feedback canceling and noise reduction capabilities.

These features allow hearing instruments to restore the audibility of sounds, improve speech understanding, reduce the cognitive load of listening, and improve socialization (Amlani, 2023). This potentially life-changing technology comes at a cost that most health insurance companies do not cover. For a single hearing aid, the out-of-pocket cost can approach $2,000; however, most patients are prescribed two devices to address the extent of their impairment (Warren & Grassley, 2017). When costs are high and health insurance fails to provide coverage, accessibility is limited to only those who can privately afford these products. Those who do not have the financial means to pay for hearing aids may be left to manage their hearing difficulty without an adequate prescription for amplification.

According to the American Speech-Language and Hearing Association (ASHA), communication sciences and disorders professionals are responsible for using every resource, including referral or interprofessional collaboration, to ensure that quality care is available for all individuals (ASHA, 2023). This charge from ASHA calls for a precise characterization of the obstacles faced by patients who need screening, diagnostic, and rehabilitation services, particularly for at-risk and disadvantaged communities. This report explores the unique barriers experienced by individuals from rural and urban communities and offers solutions to facilitate hearing health care access groups.

Literature Review

Social Determinants of Health

The social determinants of health describe the impact of society's unequal distribution of finance, power, knowledge, and support structures on an individual's health status. These non-medical factors can exist at an individual or population level and create health care disparities, or

differences in access to health care for some groups (Ellis & Jacobs, 2021 & Joseph, 2022). On an individual level, race, gender, ethnicity, socioeconomic status, level of education, income, employment status, and ability are all determinants of health access and outcomes. By comparison, the population level accounts for a community experience of poverty, income inequality, limited educational opportunities, lack of affordable housing, inadequate health services, and poor transportation infrastructure. Low socioeconomic status is a primary determinant of many health indicators and is often related to insurance status. Further, those with the worst health outcomes are Americans with the lowest income levels and educational attainment (Ellis & Jacobs, 2021). These determinants, many of which may seem unrelated to health and wellness, have varying applications in rural versus urban environments.

When health care is inaccessible, disease and disability may become widespread and untreated, and quality of life may be impacted. Amlani (2023) defined determinants of health as a relationship between a person's health status and their quality of life, accounting for over 80% of modifiable health outcomes. In other words, limited access to health resources may produce deteriorating health outcomes. If the determinants of health are modifiable risk factors, providers must work collaboratively to mitigate risk. By focusing on the factors applicable to a given patient and working to understand their potential impact, providers across health care disciplines might assess how a patient's individual or environmental privilege may help or hinder the prevention, assessment, and treatment of disease. In turn, health care delivery models may be optimized to achieve improved health outcomes for the most vulnerable populations.

Rural Barriers to Care

Rural community members are more likely to experience low median income. Living in poverty can independently make an individual four times more likely to have insufficient

insurance coverage than those living 400% above the federal poverty line, placing a significant financial burden on health care accessibility (Ellis & Jacobs, 2021). To access health care, individuals in rural communities more often rely on state Medicaid coverage than their urban and suburban counterparts. In addition, those from rural communities often experience insurance-related delays in care. This applies only to those who reside within the 28 states in the U.S. that offer coverage of adult audiology services through Medicaid (Powell et al., 2019). Rural residents in the other 22 states must rely on private financial means and face additional geographic barriers.

Where audiology services are attainable, many rural counties lack adequate providers and facilities. Consequently, compared to those living in urban and suburban communities, those in rural communities must travel further and longer to receive in-person care. As such, Amlani (2023) indicated that those from remote and rural areas receive less frequent hearing tests and are offered hearing aids at a lower rate. Still, increased geographical distance should not be equated to reduced care utilization because other key underlying factors exist, including motivation to seek intervention, financial means to pay for care, and access to a vehicle (Coco et al., 2018). When an established public transportation system is lacking, access to a vehicle may be a more significant barrier for those residing in remote locations, which further restricts access to medical appointments (Pailaha, 2023).

A discussion about the audiology workforce is warranted because it appears to be a critical factor contributing to the rise of geographical barriers. According to Amlani (2023), the profession of audiology has grown by only 5% from 1999 to 2019, which may lead to an inadequate supply of audiologists charged with meeting the needs of those with hearing loss. An Arizona study showed that over a third of the counties in that state lacked the availability of a

single audiologist (Coco et al., 2018). There may be insufficient audiologists to provide care for those lost due to geographical distance. Joseph (2022) reported that the increased likelihood of inaccessibility is due to the lack of hearing health care providers and the increased geographical distance from points of care, which places individuals in a *hearing health desert*. When compounded with other factors, general audiology services can become increasingly inaccessible.

The challenge experienced by those living in more remote, rural areas is extraordinary concerning access to routine audiology care. For example, kin relationships are essential for individuals in rural communities. Because hearing loss leads to communication problems, this can produce devastating social consequences for kin relationships (Powell et al., 2019).

On an individual level, those residing in rural areas are more likely to be affected by other determinants of health, like obesity, sedentary lifestyle, and unhealthy dietary habits, compared to urban and suburban communities. These health determinants put people from rural communities at risk for poor health outcomes. Factors such as hypertension, diabetes, smoking, and noise exposure are more prevalent in rural communities and have been linked to the progression of hearing loss (Powell et al., 2019). Additionally, residents of rural communities tend to be older and, therefore, have an increased preponderance of hearing difficulties (Amlani, 2023). These individual-level health determinants make facilitating access to hearing health care crucial. To achieve this, solutions must be identified and implemented to address issues related to geographical distance from care, financial accessibility, and the supply of care providers.

People in rural communities are more likely to be exposed to the risk factors for hearing loss. They are also more likely to be impoverished, without public transportation infrastructure, and geographically detached from audiology care. This collection of barriers can render

individuals and families isolated from health care and more likely to experience poor health outcomes.

Urban Barriers to Care

Urban communities tend to have higher median household incomes and a younger population, with fewer older adults reporting hearing difficulties. Notwithstanding, urban communities are more likely to be in states that lack legislation that requires insurance coverage of audiology services (Amlani, 2023). Out-of-pocket expenses and a diminished likelihood of accessible state-government hearing aid benefits make obtaining audiological intervention a significant financial burden for urban residents.

Metropolitan regions command an increased number of audiologists, increasing the chance that a given district or neighborhood will likely have an audiologist nearby. For illustration, food deserts are classified by a lack of grocery stores with fresh and nutritional foods within ten miles of a rural population or one mile of one-third of an urban population (Dutko et a., 2012). However, when hearing health and hearing aid deserts are likened to food deserts (Joseph, 2022), they may be more widespread in urban areas than expected. Without access to an automobile or established public transportation system, presumably, a person would have to reside greater than one mile from the nearest hearing health care provider to be classified as a resident of a desert and without proper access to care.

Urban communities are more highly populated with racial, ethnic, gender, and sexual minorities (USDA, 2018; Doderer, 2011). Historically marginalized groups, stigmatized communities, and those at a higher risk of disease related to social determinants of health face barriers, including finances, transportation, and a perceived lack of patient-centered care (Yu et al., 2017). For example, people with more diverse sexual identities have been provided

insufficient legal privileges and are more prone to be uninsured. Decreased access to and utilization of health care has been reported among LGBTQ+ individuals who identify as women. Race can further reduce the likelihood of having health insurance. For example, Hispanic individuals are 2.5 times more likely to be without insurance coverage when compared to Caucasians. Overall, the cost of health care frequently incurs a significant financial burden for historically marginalized communities (Ellis & Jacobs, 2021), so access to audiology services is disproportionally low for these groups.

Homophily is the tendency of individuals to bond with others who are similar to themselves, including characteristics like race, ethnicity, socioeconomic status, education, and beliefs. It can significantly affect access to health care in various ways. For example, homophily may enhance communication between patients and health care providers when they share similar backgrounds. This may lead to better understanding and trust and, in turn, cause patients to seek care from professionals whom they resemble (Jouett & Joseph, 2022). However, suppose there is a lack of homophily. In that case, patients might feel less comfortable discussing their health concerns, potentially culminating in lower quality of care, poor outcomes, or avoidance of care altogether. Providers might unconsciously prefer patients who are more like themselves, potentially giving better care and more attention to those patients. In contrast, patients who do not share similarities with their providers may feel neglected or mistreated.

Patients are more likely to utilize health care services when they perceive their providers share similar backgrounds. In that capacity, ethnic or racial minorities might feel more confident about their care if their health care practitioner is from the same community, which can improve adherence to treatment, follow-up, and outcomes. Furthermore, homophily can contribute to the exclusion of human resources, where some communities might have ample healthcare providers

while others lack access. Homophily can exacerbate disparities in health care access, contribute to disparities in outcomes between different demographic groups, and strengthen social determinants that limit access to medical care. Addressing the effects of homophily in health care calls for fostering diversity and inclusivity in health care delivery to ensure that all communities have equitable access to health resources, including human resources and information.

The audiology workforce is homophilous and has a significant lack of diversity. The white population comprises only 75% of the U.S. population, while white audiologists comprise almost 92% of the audiology workforce (Joseph, 2022). This lack of workforce diversity could serve to deter historically marginalized groups from seeking hearing-health care, which could be compounded further by their difficulties obtaining insurance coverage. Hearing professionals must work to understand the complexities of inequity by becoming more educated about cultural diversity, civic responsibility, and social justice (Ellis & Jacobs, 2021). The audiology workforce should improve its diversity and cultural competence to promote patient-centered care.

Health Equity

Health equity describes improving the health of those at a social or economic disadvantage. This concept is based on the idea that resources should be distributed relatively to reduce and eliminate health disparities (Ellis & Jacobs, 2021). According to reports about the social determinants of health, some people have the wherewithal to obtain care and are likely to do so, while others face adversity. In an equitable scenario, those who need resources would be entitled to them. In this scenario, the allocation of resources would not be equally distributed, as this would reflect ‘equality;’ instead, the allocation should be proportional to the degree of distress experienced by a person. Adopting a health equity approach would provide people with mechanisms to access the required health services.

Health equity is not a goal attainable by individual care providers alone, as it aims to solve a systemic problem. Instead, the onus lies with both providers and the health care system. What is needed is intentional, comprehensive, system-oriented, and coordinated strategies at the national, state, and local government levels and efforts by nonprofit and philanthropic organizations (Ellis & Jacobs, 2021). This coordinated effort should break down financial and geographic barriers for those affected. To achieve this, health care professionals must participate in legislative advocacy, as change agents for designing and implementing patient outreach programs. Notably, the role of the clinician-advocate is to impact individuals during each patient encounter. Clinicians are positioned to empathetically assess patient needs, provide services within their professional scope and ability, and advocate for providing services and resources they may not be able to provide themselves, such as specialty care.

Health Literacy

Health literacy is how an individual can obtain, process, and understand information and services, allowing them to make appropriate decisions about their health and health care. Lower levels of health literacy correlate with poor health outcomes, especially for patients with financial and distance barriers (Pailaha, 2023). For example, providers often prepare a quality care plan by obtaining a case history or needs assessment. Based on reading and comprehension levels, patients with low levels of health literacy may be unintentionally excluded from the decision-making process. While completing patient outcome measures, they may report imprecise information about themselves or a family member, which could jeopardize the care plan (Douglas & Kelly-Campbell, 2018).

Information must be delivered to and obtained from patients so that providers can work with accurate case information to appropriately measure the impact of intervention and

rehabilitation. Using plain language, tools and measures should be created with health literacy in mind (Douglas & Kelly-Campbell, 2018). Additionally, community- and preventive-health education can inform and empower patients with lower health literacy. Through partnerships with trusted community organizations, programming can be facilitated to inform patients about health-risk factors, the importance of and where to seek treatment, and how to access quality care (Pailaha, 2023), including direct access. If implemented effectively, individuals in our communities may achieve a heightened health awareness and literacy level, become more empowered, and learn how to gain access to the health care system.

Proposed Care Solutions

Mobile Audiology Clinic

Mobile clinics can transport health care to a variety of people, including historically marginalized, stigmatized, and homeless groups, and those at high risk for disease. Mobile health clinics eliminate barriers such as time, cost, resources, and the motivation to travel to the nearest stationary care facility (Yu et al., 2017). When implemented by an audiology clinic, a mobile model can facilitate hearing care access for rural and urban populations. These communities may reside in a hearing health or hearing aid desert without sufficient health insurance, transportation, or financial support. Individuals must overcome several barriers to manage communication problems while living in a hearing health desert to ascertain the care needed.

An audiology clinic vehicle can extend most diagnostic and rehabilitative hearing care aspects to rural and urban communities. To obtain reliable audiometric hearing thresholds outside of a conventional, certified, sound-treated examination room, a vehicle equipped with a sound enclosure is a practical approach to achieving maximum permissible ambient noise levels for clinical testing (Lee et al., 1963). Pretest sound-level measures must be conducted to verify

that the test environment meets the standard for hearing threshold testing. A suitable mobile clinic should have a dedicated Health Insurance Portability and Accountability Act (HIPAA) compliant counseling area, a patient-waiting room, internal temperature adjustment capability for hot and cold climates, and adequate storage. Mobile clinics can allow patients to receive care without traveling to a fixed-facility clinic; however, a newer, spacious, fully equipped mobile unit will be costly.

To deliver audiology services to a rural community, providers might elect to serve a small population representing a large geographic area. This can be a costly operation that becomes an inefficient use of time. Alternatively, a mobile clinic model that does not require an expensive vehicle calls for collaboration with community partners. If providers can negotiate the use of facilities with their partners, such as examination rooms, waiting areas, and parking, a much lower financial investment will be required to deliver mobile care. Most likely, an attorney will be required to review lease agreements and other contracts legally. Diagnostic assessment may be performed if the ambient sound levels in a room are quiet enough, but this will be challenging because medical examination rooms are not acoustically treated.

An optimal room for hearing care delivery should be easy to find and accessible to seniors and persons with disabilities. Points of care should be selected in a hearing health or hearing aid desert. Facilities that may collaborate with mobile audiology providers are hospitals, outpatient clinics, community centers, high schools, junior colleges, specialty clinics, long-term care facilities, and nursing homes. Although the aim for services may be diagnostic care, some clinic locations may not provide a quiet space for diagnostic testing. Hearing aid fitting and counseling, audiologic rehabilitation, patient education, and follow-up services should be provided in these instances.

Tele-Audiology

Telehealth is a virtual care solution that eliminates the need for patients to travel to a fixed facility. Telehealth, also called telemedicine, is cost-effective (Lancaster et al., 2008) for both the patient and the provider. Due to the rising cost of medical care, the health care industry has implemented telemedicine and virtual technology because they have been classified as cost-effective, quality health care solutions (Manocchia, 2020). A user-friendly software system may reduce clinic operating costs with a HIPAA-compliant video conferencing system, webcam, and video conferencing software license (Steuerwald et al., 2018). After accessible software has been installed, one or two tele-audiology service models can be administered.

One tele-audiology model requires a trained health technician to facilitate on-site, in-person care. During this type of telehealth encounter, patient assessments are delivered by the technician. At the same time, a clinician directs each procedure, interprets the resultant clinical data, and renders a diagnosis from another location. This model is driven by remote computing technology, so patients do not need to be proficient with software use because the technician connects the patient to the clinician. For example, a technician might use a computer-based audiometer to obtain air- and bone-conduction audiometric thresholds for an audiologist who can observe the procedure in real time (Lancaster et al., 2008). The same can be done for video otoscopy, tympanometry, recorded speech audiometry, hearing aid fittings, and other diagnostic and rehabilitative audiology procedures. However, the cost of this tele-audiology model is substantial, given the expenses associated with a clinical audiologist, trained audiology technician, calibrated portable equipment, computer software and hardware, and travel. Although costly, this model makes complete diagnostic testing accessible to patients who cannot travel to

the clinic. This telehealth method permits audiologists to extend services to a wide range of patients and points of care because nurses or other skilled health care professionals may be trained to facilitate the delivery of services (Lancaster, et al., 2008).

An alternative tele-audiology model is more economical and does not provide direct physical patient contact. In most instances, telemedicine involves delivering virtual care through teleconferencing applications on a computer, tablet, or smartphone. This approach can effectively enable follow-up services for patients facing barriers to in-person care. It works reasonably well for hearing aid and cochlear implant programming, hearing aid checks, and troubleshooting of various hearing instruments. Used strategically, it may eliminate day-, week-, and month-long appointment wait times, increase patient satisfaction and follow-up compliance, and avoid unnecessary patient travel time. Follow-up audiology appointments for some patients and families may require time away from work or school and travel-related expenses (Steuerwald et al., 2018), which may be alleviated by a tele-audiology encounter. Tele-audiology functions well for audiologic rehabilitation and counseling because physical patient contact is unnecessary for these encounters.

In audiology, care is often delivered across multiple encounters with each patient; therefore, individuals who face hearing health-care barriers face them repeatedly. Three or more appointments may be needed to prescribe an amplification device, sometimes more for cochlear implant care. These procedures require follow-up appointments to ensure proper device acclimatization, make programming adjustments, review device care and maintenance, troubleshoot assistive listening devices, and discuss peripheral hearing technology and manufacturer repairs. Thus, tele-audiology is a viable appointment option for various hearing care procedures, mainly when in-person care is not imperative.

Community Outreach

Community-based health education can be a powerful tool that promotes health literacy. It also has the potential to empower community members and mitigate health disparities. This is particularly important in locations where health care access is limited by geographical distance, cost of services, availability of providers, and lack of clinical equipment (Pailaha, 2023). For example, in rural communities where exposure to hazardous noise is prevalent, hearing protection training and counseling on noise-induced hearing loss are essential (Powell et al., 2019). In these communities, the proper use of hearing protection can prevent hearing shift and progression of hearing loss for those with hearing impairment. Community-based occupational audiology should be accessible to workers exposed to hazardous noise.

Educational community outreach events can bridge the gap between those who can and cannot access health care by making them more aware of when, where, and how to seek care for a hearing problem. Before a person seeks help for hearing difficulty, awareness of a hearing problem is needed, which may occur after a community hearing screening that includes counseling (Warren & Grassley, 2017). Therefore, hearing screenings in conjunction with counseling and educational material can empower patients and promote health care utilization. Over-the-counter (OTC) hearing aids may be a suitable alternative for some patients. These hearing devices can address adult mild to moderate hearing loss and effectively address issues about access to care (Warren & Grassley, 2017). Patients who meet the criterion for OTC hearing aids may have success, eliminating the need for additional encounters and travel. User-fitted OTC hearing aids usually cost less than provider-prescribed technologies but are not an appropriate intervention for all persons with hearing difficulties.

Communication strategies encompass essential rehabilitative counseling and education for all individuals with hearing difficulties. According to the ASHA (2015), effective communication strategies include gaining a listener's attention before speaking, speaking clearly and face-to-face, reducing background noise, rephrasing the message when communication breaks down, and using captioning. Community outreach events can be designed for those who need to become more aware of when, where, and how to seek hearing care, individuals experiencing barriers to care, and those needing improved health literacy. Extending screening, counseling, and education through community outreach can help individuals become aware of auditory problems and, more importantly, know where to get definitive assistance. Easy access to reliable, low-cost transportation should help more community members attend outreach activities.

Transportation

Transportation is a primary health-care barrier and has long been a significant obstacle for those requiring access to audiology services. Wolfe and associates (2020) reported that, because of poor transportation availability, almost 2% of Americans have delayed non-emergent medical care. Groups that have been disproportionally affected by transportation include older adults, those experiencing homelessness, people with young children, individuals who are chronically ill, residents of public housing, and people with disabilities (Wolfe et al., 2020). Furthermore, individuals with age-related hearing loss may experience multiple barriers to care, given their age, chronic illnesses, and limited financial income. In urban communities, over 20% of older adults reported reliance on public transit as their only means of transportation, especially for attending medical appointments (Gimie et al., 2022).

This begs the question: *What means of transportation do older adults in suburban areas, small to mid-sized towns, and rural communities with poor, unreliable, or non-existent public transportation infrastructure use to access audiology care?* Presumably, given that transportation is inhomogeneous across the US, American patients are experiencing varied types of barriers to transportation for access to health services. Nevertheless, reliable transportation services should be provided for older citizens who may require consistent travel to care providers. Government or grant funding, non-profit organizational support, and philanthropic resources offer a feasible funding solution to serve communities with higher rates of hearing loss and transportation problems.

CHAPTER 2

METHODOLOGY

Service delivery solutions, including mobile audiology, tele-audiology, and community outreach, will be discussed to explicate access to audiologic care and promote hearing health education and wellness. The reviewed literature will be used to develop a methodology that focuses on implementing a non-traditional service delivery model in which the providers travel to the patient rather than patients traveling to the clinic. These solutions are designed to allay transportation and geographic distance barriers through mobile audiology, tele-audiology, and community outreach services. Community outreach services should eliminate financial and insurance-related barriers and educate and empower patients at no cost.

The ideal approach to providing solutions to hearing care accessibility may involve combining all three methods rather than relying on just one. First, a community outreach event should serve to aid individuals in identifying a hearing problem through hearing screening while informing patients where and how to seek care for a hearing problem, communication difficulties, and strategies for hearing loss prevention. Outreach services should lead to community awareness and result in referrals for audiology consultations. This would generate a greater need for in-person, hands-on Mobile audiology services, including diagnostic audiometry, rehabilitation, and prescription of amplification devices, as well as follow-up services. To address the need for follow-up, a virtual care program like tele-audiology could provide continuity of care without the expenses associated with travel. Tele-audiology would deliver care to patients who do not require in-person procedures.

Figure 1 illustrates the primary foundation of the solutions for an audiology service delivery developmental model. Outreach services could employ hearing and hearing-aid

screenings, hearing health education and counseling, community partnerships, and the development of interprofessional partnerships. Mobile audiology services could include diagnostic assessments, hearing aid services, in-person individual and family counseling, and person-centered follow-up services. Corresponding tele-audiology services could include hearing aid and cochlear implant programming, hearing aid checks and support, and various follow-up audiology services. In some urban communities, service provision might be less costly to deliver because larger populations may be situated in smaller geographic locations; however, Powell and colleagues (2019) indicated that significant barriers to care are more prevalent in rural communities, making rural services equally important. Hence, this audiology service delivery developmental model (**Figure 1**) would be adapted for its intended community.

Location of Care Delivery

Regarding geographic location, consumer demand may be examined using surveys and focus groups with current customers, including those unable to obtain services (Amlani, 2023). For example, if surveys and focus groups indicate that the most significant hearing health care barrier is obtaining time off from work, delivery of a weekend program may be necessary. Identifying and mapping regional hearing health practices should demonstrate hearing health deserts in the area. Additionally, it is essential to consider why individuals cannot obtain hearing health care. After conducting a community needs analysis, it may be possible to determine which services are necessary and which groups have the greatest need.

Community and Interprofessional Collaboration

Clinical services may be transitioned from a conventional clinical practice setting to a convenient remote location to facilitate patient access to hearing care. To do so, a clinical team

must establish a hearing health care access point in coordination with leaders at a hospital, health clinic, or community center. Because the community knows these settings, they can serve as convenient points of care and places for socialization and engagement. Nursing homes and independent living centers provide access for populations at risk for hearing loss.

Partnerships with community health clinics can develop interprofessional relationships between audiologists and other medical providers. These interprofessional relationships are valuable because they help increase referrals to audiology by educating providers on when a patient should be referred for diagnostic testing (Hinzmann, 2018). Audiology may be integrated into primary care, family practice, or public health by transporting and delivering hearing services to a conveniently located community facility, generating more significant access to care (Powell et al., 2019). Although hearing is critical to well-being, hearing loss is not a life-threatening issue. Therefore, patients are more likely to use their resources to visit their primary care provider when they have trouble hearing. Interprofessional partnerships enhance care coordination, improve access, and increase the utilization of audiology.

Equipment and Preparation

To determine the feasibility of delivering a new service model, such as providing audiology services at a location detached from a clinic's fixed facility, a needs assessment should be conducted, and a business plan should be written. New service models generally require additional clinic space, personnel, and equipment costs, including community partnerships and professional training, and these expenses should be realized. Early in the business planning cycle, financial projections should be made, including a balance sheet (assets and liabilities), an income statement (revenue, expenses, and profit), and a cash flow statement (inflows and outflows) because proper business planning helps determine which audiology services to offer.

Providing mobile audiology care requires considering the need for diagnostic equipment and ensuring that the space, whether a mobile unit or a quiet room, is suitable for diagnostic audiometric testing. An otoscope, portable or diagnostic audiometer, middle ear evaluation system, and otoacoustic emissions testing instrumentation would be necessary, as well as hearing aid programming modules, a laptop computer, and a secure HIPAA-compliant internet connection (Lancaster et al., 2008). For successful telehealth, a webcam, a HIPAA-compliant video conferencing system, and a software license are warranted (Steuerwald et al., 2018). A program to support community outreach services requires instrumentation as well. Those often included are an otoscope and portable audiometer for audiometric hearing screenings. Additional tools useful for community outreach activities are hearing handicap scales, tinnitus questionnaires, hearing-loss prevention handouts, and pertinent educational posters and materials.

Data from a community needs assessment may be used to identify locations that might benefit from mobile audiology and community outreach services. Once the data have been reviewed, analyzed, and summarized, partnerships can be developed with organizations aligned with those communities of interest identified by the needs assessment and business plan. During the initial stages of preparation for mobile services, protocols should be written for each segment of service delivery. For example, a scheduling system should be crafted for mobile- and tele-audiology; however, the onus may fall on the community partner or the care-providing clinic. Roles and responsibilities should be outlined in a written document or contract.

To encourage wellness in the community, outreach education should be designed to examine the needs of the community receiving services. Critical educational topics could include hearing screenings for early identification of hearing loss, noise-induced hearing loss, age-related

hearing loss, cerumen management, and over-the-counter hearing aids. A vital element of the education program should address where audiology services may be accessed, accounting for the specific barriers experienced by the community. When all necessary planning has been completed, services should be delivered and followed by an easily administered outcome measure to determine whether the program has improved accessibility. In addition, clinician outcomes should be examined to assess performance improvement for future planned activities.

Delivery of Follow-Up Care

Most individuals are unaware of when to obtain an examination for hearing difficulty, so community outreach programs in audiology can fill this void. After patients have been educated and empowered, mobile audiology services allow for hands-on care, including diagnostic services and hearing device fitting. These services can be delivered regularly or semi-regularly depending on community needs, with telehealth services being offered in the interim to address patient needs that do not require in-person care. The process repeats to facilitate new patients' education, screening, and diagnostics. The frequency of care should be determined by the need to avoid the waste of resources and billable time if there is no care utilization.

Patient Satisfaction Measurement

Patient outcome measurement is a valuable tool for promoting patient-centered care. It may be administered to probe the impact of care on a patient from their perspective, removing the need for guesswork about a patient’s experience. To obtain the most accurate assessment of outcomes, patient satisfaction measures should be designed with health literacy in mind by utilizing plain language and white space (Douglas & Kelly-Campbell, 2018). Appendix A is a compilation of all items that qualified for our patient satisfaction survey, including 5-point rating

scales. The complete survey questions complemented the following: *How would you rate your experience today? How beneficial do you feel today's appointment was? How well was your hearing problem addressed? If you had not attended today, how likely would you have been to seek help for a hearing problem? How often have you noticed a hearing problem, but not known where or how to seek help? If you do not currently see a hearing professional, what is the main reason? How much do you feel you have learned about how to get help for a hearing problem? How much did the convenience of today's care prompt you to seek help that you would not have otherwise? How long did you travel to get here today? Without today's services, how long would you have had to travel for help with your hearing problem? How well were your questions addressed today?* and, *Is there something we did not cover today that you hoped to get out of your experience?* Appendix B includes the final suggested patient satisfaction measurement written to assess the impact of services on the patient and their ability to access care. These items were: *How beneficial do you feel today's appointment was? How much do you feel you have learned about how to get help for a hearing problem? How much did the convenience of today's care prompt you to seek help that you would not have otherwise? If you do not currently see a hearing professional, what is the main reason? How long did you travel to get here today?* and, *Without today's services, how long would you have had to travel for help with your hearing problem?*

Clinician-Based Outcomes

Clinician-based outcome measures, conversely, measure the experience of the care provider. These measurements allow program coordinators to get a pulse for what improvements can be made to the program from the provider's perspective. Feedback may reveal that certain aspects of care require modification, augmentation, or removal. Appendix C shows a suggested

clinician-based outcome tool that includes, *How efficient was the delivery of mobile/tele-audiology/community outreach services compared to services delivered in the traditional clinic setting? Overall, how beneficial are the services provided to patients? What aspects of care delivery do you feel were most successful? What aspects of service delivery do you feel need improvement and how do you feel these may be improved?* and, *Do you have any questions or comments about service delivery?*

CHAPTER 3

DISCUSSION

Conclusions

Providing care to various populations by developing health care access points is an essential, moral, and ethical undertaking in audiology. Audiologists should educate themselves about the complex nature of health care inequity and its individual- and population-level contributing factors. They should refer to **Figure 2**, which contains some crude steps for creating an access-improvement program. First, a clinical team should be formed. This team should identify the ideal areas intended for delivering audiology services. A needs analysis of the community and its surrounding areas should be conducted to identify community residents with poor access to hearing health care. The social determinants of health can point to individuals at a higher risk for disease and poor health outcomes.

Figure 2 suggests that community partnerships should be formed. A business plan should be written that explains how the clinic team aims to overcome hearing health barriers and provide access to care. The team should create a protocol for each mode of care that tends to the community's demands. Following community partnerships, a community of patients should be formed. Hearing health care can be delivered through several service lines, including mobile audiology, tele-audiology, and community outreach services. When delivering these services, the clinical team should be mindful of measuring its performance using patient satisfaction and outcome surveys.

Capacity building for communities in hearing health deserts is essential to ensure access to vital audiology services. By developing mobile audiology care, expanding telehealth

capabilities, and fostering community outreach programs, the gaps in hearing healthcare for underserved populations may be resolved. These initiatives empower local communities with the tools and resources needed to address hearing loss, promote early detection, and provide timely interventions, ultimately improving health outcomes and quality of life for individuals without easy access to traditional audiology services. Health outcomes can be improved by focusing on the social determinants of health and specific factors that affect rural and urban populations.

Future Research and Considerations

Every person deserves the means to communicate and connect with others and the world; however, this privilege is not equally distributed across the population. It will take a coordinated effort across rural and urban communities to mitigate the disparities in hearing health care. The literature revealed significant findings about barriers to care in rural communities but did not offer the same findings for urban communities; therefore, more research about urban hearing health solutions is needed. A more precise explanation of the profitability of mobile audiology services is needed. A cost-effective method should be investigated when delivering care using a mobile clinic vehicle or providing transportation services for patients. Also, the efficacy of providing counseling, education, and hearing aid prescription through tele-audiology has not been researched, perhaps because patients who lack confidence with technology, software applications, and the Internet cannot correctly navigate telehealth platforms.

In closing, the audiology workforce's growth rate cannot supply the audiologists needed to resolve the hearing health deserts and an expanding older population. Recruiting more audiology students and diverse hearing care professionals is needed to meet the needs of underserved populations and culturally sensitive hearing health care.

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FIGURES

Figure 1. Service delivery developmental sequence.

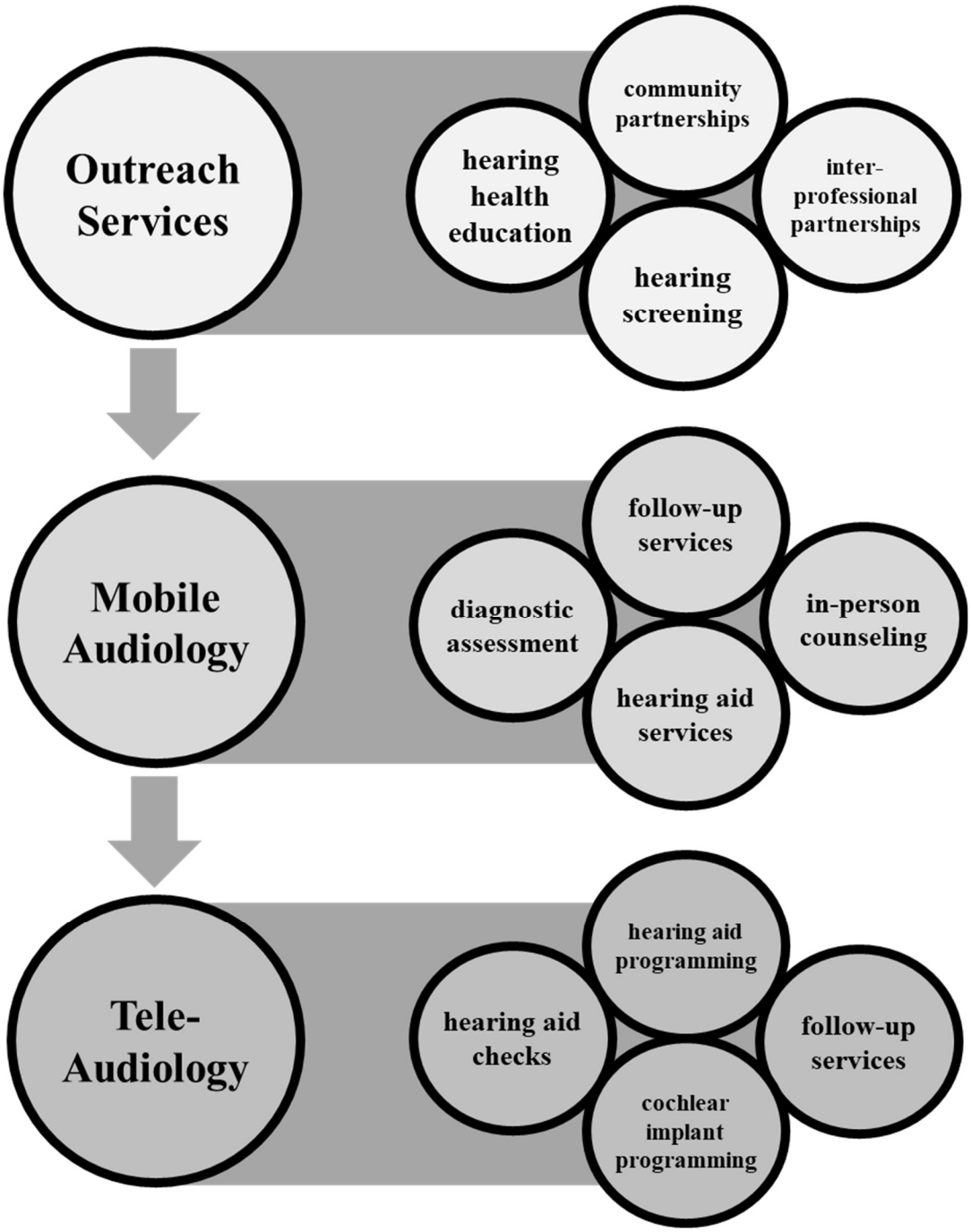
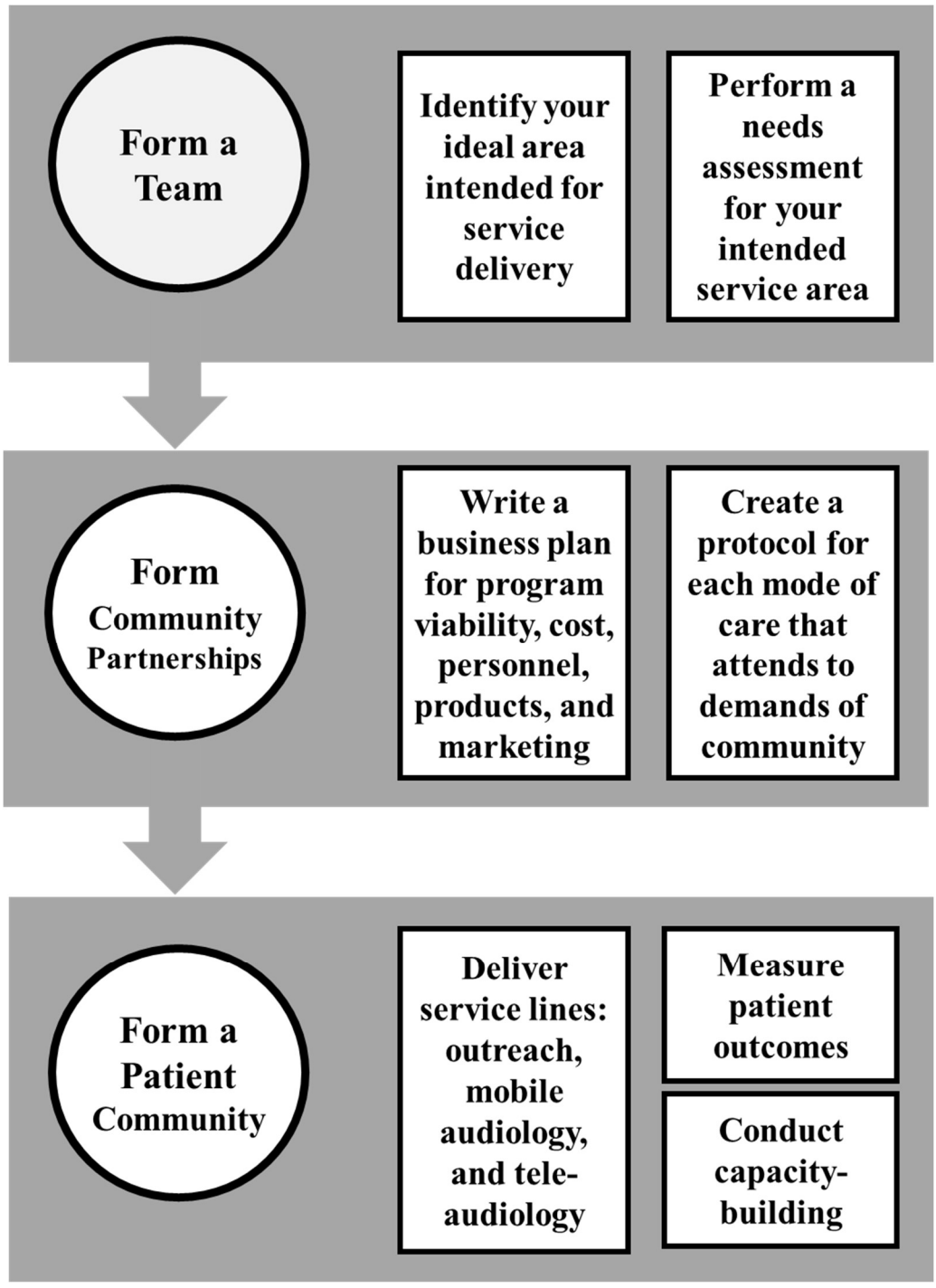


Figure 2. Crude steps for establishment of an access-improvement program



Appendix A

Items and response scales examined for the patient outcome tool

1) How would you rate your experience today?
   a) Very good
   b) Good
   c) Neutral
   d) Poor
   e) Very poor
2) How beneficial do you feel today's appointment was?
   a) Very beneficial
   b) Beneficial
   c) Neutral
   d) Not beneficial
   e) Very much not beneficial
3) How well was your hearing problem addressed?
   a) Very well
   b) Well
   c) Neutral
   d) Poorly
   e) Very poorly
4) If you had not attended today, how likely would you have been to seek help for a hearing problem?
   a) Very likely
   b) Likely
   c) Neutral
   d) Unlikely
   e) Very unlikely
5) How often have you noticed a hearing problem, but not known where or how to seek help?
   a) Very often
   b) Often
   c) Sometimes
   d) Not very often
   e) Never
6) If you do not currently see a hearing professional, what is the main reason?
   a) Distance/transportation
   b) Insurance coverage/cost
   c) Time off work
   d) I did not think I had a hearing problem, or I did not know how to find a hearing professional
   e) Other
7) How much do you feel you have learned about how to get help for a hearing problem?
   a) A lot
   b) Some
   c) Neutral

   d) Not very much
   e) Nothing
8) How much did the convenience of today's care prompt you to seek help that you would not have otherwise?
   a) A lot
   b) Some
   c) Neutral
   d) Not very much
   e) Nothing
9) How long did you travel to get here today?
   a) More than 2 hours
   b) 1 hour – 2 hours
   c) 30 minutes – 1 hour
   d) 15 – 30 minutes
   e) 0 – 15 minutes
10) Without today's services, how long would you have had to travel for help with your hearing problem?
   a) More than 2 hours
   b) 1 hour – 2 hours
   c) 30 minutes – 1 hour
   d) 15 – 30 minutes
   e) 0 – 15 minutes
11) How well were your questions addressed today?
   a) Very well
   b) Well
   c) Neutral
   d) Poorly
   e) Very poorly
12) Is there something we did not cover today that you hoped to get out of your experience?

   _____

Appendix B

Final patient outcome survey

1) How beneficial do you feel today's appointment was?
   a) Very beneficial
   b) Beneficial
   c) Neutral
   d) Not beneficial
   e) Very much not beneficial
2) How much do you feel you have learned about how to get help for a hearing problem?
   a) A lot
   b) Some
   c) Neutral
   d) Not very much
   e) Nothing
3) How much did the convenience of today's care prompt you to seek help that you would not have otherwise?
   a) A lot
   b) Some
   c) Neutral
   d) Not very much
   e) Nothing
4) If you do not currently see a hearing professional, what is the main reason?
   a) Distance/transportation
   b) Insurance coverage/cost
   c) Time off work
   d) I did not think I had a hearing problem, or I did not know how to find a hearing professional
   e) Other_____
5) How long did you travel to get here today?
   a) More than 2 hours
   b) 1 hour – 2 hours
   c) 30 minutes – 1 hour
   d) 15 – 30 minutes
   e) 0 – 15 minutes
6) Without today's services, how long would you have had to travel for help with your hearing problem?
   a) More than 2 hours
   b) 1 hour – 2 hours
   c) 30 minutes – 1 hour
   d) 15 – 30 minutes
   e) 0 – 15 minutes

Appendix C

Clinician-Based Outcome Measure

1) How efficient was the delivery of mobile/tele-audiology/community outreach services compared to services delivered in the traditional clinic setting?
   a) Significantly more efficient
   b) More efficient
   c) Neutral
   d) Less efficient
   e) Significantly less efficient
2) Overall, how beneficial are the services provided to patients?
   a) Very beneficial
   b) Beneficial
   c) Neutral
   d) Not beneficial
   e) Very much not beneficial
3) What aspects of care delivery do you feel were most successful? _____
   _____
4) What aspects of service delivery do you feel need improvement? How do you feel these may be improved? _____
   _____
5) Do you have any questions or comments about service delivery? _____
   _____