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Assistive Devices for Communication Use with the Elderly

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ASSISTIVE DEVICES FOR COMMUNICATION USE WITH THE ELDERLY IN RESIDENTIAL LIVING FACILITIES: A PILOT STUDY

Capstone Document

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ABSTRACT

Hearing loss is one of the prevalent medical conditions in older adults. Although it has been documented that hearing loss is associated with various aspects of social and physical health, hearing assistive technologies and audiologic rehabilitation have been infrequently tapped clinical solutions. Cost and user problems in background noise are two common reasons why hearing aids are underutilized by seniors, and by younger age groups as well. Alternative tools, such as assistive listening devices, may be helpful for older listeners, even though they are used less frequently than hearing aids. To identify if assistive listening devices are satisfactory, a pilot study was conducted involving older subjects residing in an assisted-living community.

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CHAPTER 1

Introduction

Age related hearing loss (ARHL) has been classified as the most common hearing loss etiology (Monahan, 2014). Also called presbycusis, ARHL progresses slowly, typically involving the high frequencies. Most notably, it is the third most common chronic condition found in the elderly (Nichols, 2006). It has been estimated that 50% of those over 75 years have some degree of hearing loss (Cohen-Mansfield, 2004a). For seniors who live in residential communities, 70% have a significant hearing loss, and up to 90% have some form of hearing impairment.

The negative impact of hearing loss, particularly in the elderly population, has been well documented. The impact of hearing loss is not just limited to communication difficulties but may impact everyday lifestyles. Hearing impairment may lead to social withdrawal, enabling depression. It can result in balance issues that can lead to falls and facilitate misdiagnosis, such as dementia. Although the prevalence of hearing loss is higher in elderly populations, about one-fifth of elderly persons who can afford hearing aids possess them (Nichols, 2006). For the older population, barriers to hearing aid uptake include accessibility, affordability, care, and maintenance. A representative number of older adults are on fixed incomes, so a substantial investment in hearing aids is impractical.

Group and individual audiological rehabilitation (AR) have been an underutilized treatment option for seniors. Use of education programs such as AR might serve to increase assistive listening device (ALD) awareness as well as improve communication strategies. Personal listening systems, which are a form of ALD technology, might be useful tools for individuals in low motivation and low-budget positions. A variety of ALDs are less expensive,

and, because they are usually larger in size, may be easier to care for. Typically, ALDs have a microphone that is hard-wired to an amplifier component that is coupled with headphones. Even basic ALD technology may be suitable when watching television, for one-on-one conversations, and in a range of conditions where background noise or speaker distance is a concern. Unfortunately, the benefits of ALD use are not being delivered to elderly people, especially those who live in residential communities.

Literature Review

Impact of hearing loss in the elderly

Hearing impairment negatively affects communication and, for older citizens in residential communities, this can impact their ability to interact and communicate with caregivers, visitors, and fellow residents. A potential outcome of this negative effect on interaction and communication is social isolation, in some cases, leading to depression (Linessen et al. 2013). There may be an association between hearing loss and an increased the risk of falls and cognitive decline.

Quality of life

Listening and communication are an important element of daily life. As adults age, hearing may begin to perform poorly, and this may have a direct impact on quality of life. Research has been conducted to examine the status of the quality of life in the elderly populations using a self-assessment questionnaire with three subscales: physiological, sociability, and communication (Tsuruoka et al. 2001). This study recruited 60 elderly people from residential facilities and determined that hearing loss not only affects communication, but social and emotional status as well. This provided evidence that hearing loss can affect social life

and emotional wellbeing. Subjects with bilaterally-impaired hearing demonstrated significantly poorer health related quality of life (HRQOL) when compared to individuals without hearing impairment (Chia et al., 2007). This report identified that as severity of impairment worsened, HRQOL increased as well. In other words, as hearing loss severity increases for our patients, we should expect to observe their quality of life decline incrementally. Using the Hearing Handicap Inventory for the Elderly (HHIE), a study by Midha and Malik (2015) compared the quality of life of older adults with normal hearing or hearing impairment to older hearing-impaired adults using hearing aids. The authors reported that older adults with hearing loss, even if using amplification, scored poorer on the HHIE social and emotional domains than adults with normal hearing. They concluded that hearing impairment in the older adults affects psychosocial wellbeing and quality of life (Midha and Malik, 2015).

Depression

Hearing impairment may produce social isolation, which can lead to depression. The rate of depression for the older people who live in residential communities was 40% (Mann et al., 2000). This investigation assessed 194 residents using the SHORT-CARE Brief Assessment Schedule. In a report from Monteso et al. (2012), the depression rate for elderly persons living in residential facilities was three times higher than elderly persons who did not reside in these communities. The report indicated that when a person's ability to perform activities of daily living were absent, the depression effect was greater, and this observation was far greater in males. Conducted by Saito and colleagues (2010), the Karabuchi Longitudinal Study found a depression rate of 19.6% for adults with hearing loss, versus 8% for adults without hearing loss after a three-year follow-up. High scores on the HHIE have been identified as a risk factor for development of depression in older adults (Mizutari, 2013), and it has been suggested that the

HHIE be used as a screening tool for depression in older adults.

Hearing aid use has been shown to alleviate depressive symptoms. For example, Boi and associates (2012) accessed the effects of digital hearing aids on the symptoms of depression in elderly with hearing loss. They discovered that the Center for Epidemiological Studies-Depression Scale (CESD) scores decreased one-month after the hearing aid fitting and this was sustained at the 6-month follow-up. Adults with hearing loss showed depressive symptom levels that were two times greater than the general population, so the authors concluded that hearing loss was a predictor of future depression (OR >2.0). After use of hearing aids, subjects demonstrated improvement of general health perception, social life, mental health, and perception of emotional health (Boi et al., 2012).

Balance and fall risk

Falls are a life-threatening issue in older adults. According to the Center for Disease Control (CDC), approximately 58 of every 100,000 adult deaths for persons over age 65 years are caused by falls (CDC, 2016). Hearing loss has been associated with an increased risk of falls (Lin and Ferrucci, 2012). Investigators discovered that for every 10-dB increase in hearing severity there was a 1.4-fold increase of a reported fall for the preceding year, examining 2,017 participants age 40 to 69 years from 2001 through 2004 (Lin and Ferrucci, 2012). Even after excluding subjects with moderate and severe hearing loss, group differences were statistically significant. Lin and Ferrucci (2012) reported that hearing greater than 25 dBHL was associated with a 3-fold increase of a fall occurring over the preceding year, and they deduced that physical proximity of the inner-ear balance and hearing mechanisms support plausibility of the association. Viljanen et al. (2009) examined the relationship between hearing loss and mobility in older females. Their data indicated that hearing loss was correlated with poor mobility, and

hearing loss appears to precede the decline of mobility in older women. These investigators reported that hearing loss was correlated with impaired postural balance and increased risk of falls. Although these studies are not suggesting causality, they identify important associations between hearing, balance, mobility, and falls.

Cognitive

Tsuruoka et al. (2001) evaluated the mental status in elderly in the residential facilities using the Hasegawa Dementia Rating Scale (HDRS) but a relationship between hearing loss and cognitive decline was not found. Chia et al. (2007) discovered that elderly subjects with bilateral hearing loss, living in residential communities, had lower Short-Form Health Survey (SF-36) scores in the physical and mental health subscales when compared to residents without hearing loss. Weinstein (1986) identified that elderly people with dementia living in residential communities have a higher rate of hearing loss than their normal-hearing counterparts. Palmer et al. (1999) reported that the incidence of hearing loss among those with cognitive impairment is approximately two times greater than individuals without it. These investigators suggested that hearing is correlated with severity of cognitive dysfunction, and, more importantly, when hearing loss is unmanaged it may actually contribute to cognitive decline. It is possible that hearing loss is associated with dementia because of deprivation of sound, decreased interaction, and the lack of social stimulation.

Lin et al. (2011) used the Baltimore Longitudinal Study of Aging (BLAS) to examine the relationship between hearing loss and incident dementia. Their data indicated that hearing loss was independently associated with incident all-cause dementia because the risk for dementia increased commensurate with hearing loss severity. For subjects older than 60 years, more than one-third of them that were diagnosed with dementia also had hearing loss (Lin et al. 2011).

Hearing loss can magnify dementia-related symptoms, which can lead to more distress for patients and their caregivers. Research has identified that people with dementia may experience benefit from use of hearing aids. For example, when monaural hearing aids were prescribed to individuals with Alzheimer's disease, a significant decrease in several communication-related problem behaviors was observed (Cohen-Mansfield and Taylor, 2004b). When hearing aids are used by patients, caregivers have reported several positive outcomes such as increased alertness and more engaging conservation. After three months, an increase in cognitive function was observed when subjects with dementia used hearing aids (Cohen-Mansfield and Taylor, 2004b).

Hearing loss for elderly living in residential facilities

Research has suggested that older people living in residential facilities are more adversely affected by hearing loss because it interferes with relationships and distorts interactions between caregivers and residents (Tsuruoka et al., 2001). The prevalence rate of hearing loss in residential communities is 80-86% and social-environmental factors limit the communication choices of older individuals more than their hearing losses (Pryce and Gooberman-Hill, 2011). Hence, modifying these contextual factors might serve to improve social-emotional health and quality of life for this population. The Americans with Disabilities Act of 1990 included hearing loss as a physical or mental disability (Cohen-Mansfield and Infeld, 2006), so public health entities should provide optional assistance for eligible persons with hearing impairment at no cost. Cohen-Mansfield and Infeld (2006) reported political pressure should be applied to lawmakers to advocate for the benefit of hearing aids and ALDs when made available for older people.

Hearing screenings

Audiometric-threshold screenings may be used to monitor hearing loss and identify

individuals that need assistance. Research has demonstrated that when hearing screenings are provided in residential communities, an increase of hearing aid uptake is more likely. Linssen et al. (2013), screened 234 residents, and 222 (91%) were identified with a hearing loss. At the beginning of the study, 28% of the residents owned hearing aids. Investigators reported a 5% increase to 33% at the conclusion of the study. Miztuari (2013) reported that hearing aid ownership increased from 7% to 11% for the entire study group but increased from 12% to 18% for participants over age 75 years. For this study, hearing aids were provided to subjects at no cost. A direct approach to screening is effective for identification of hearing impairment in seniors. Direct screening is also a simple and efficient way to refer residents for definitive care and services. Cost is reduced because hearing-screening tests provide important information about the patient in a short amount of time (Miztuari, 2013). Cohen-Mansfield and Taylor (2004a) found inconsistency in reported hearing impairment and hearing aid use, as well as an underuse of hearing aids, suggesting that regular hearing screenings and assessments should be provided in residential communities, and hearing aids should be checked as well.

Care professionals

Care professionals play an important role in the daily living of older people residing in assistive- and independent-living environments. Often overlooked, the staff in these communities face a number of problems when providing support for seniors who use ALD technology (Saborowski and Kollak, 2014). Staff have reported that assistive devices are difficult to care for and investigators discovered that negative thoughts prevailed over positive ones (Saborowski and Kollak, 2014). Furthermore, staff viewed technology to be in competition with the integral aspects of care such as feeding, wound care, and medications. Personnel who provide care for senior residents typically have not received training on the use and care of ALDs. Mann et al.

(2000) looked at the quality of responsiveness to health-care issues, including hearing loss, and determined that 7% of residential settings achieved a response rating of *good*, suggesting that seniors in residential settings do not receive the support and assistance they need on a consistent basis. It appears that training and improvement programs are necessary in these facilities, particularly hearing, communication, and ALD hearing-service support.

To alleviate burden on personnel, a comprehensive technology overview of products used in residential facilities should be administered at a specified periodicity. Such a technology review program might strengthen the comfort and confidence level of caregivers with respect to amplification- and ALD-technology service support. Clinical practice guidelines (CPGs) could be developed to homogenize support procedures, and this could be further enhanced if accompanied by standard operating procedures. By formulating clinical guidelines and standard procedures for caregivers, minimally-sufficient actions would be identified. To increase access to sound for older citizens living in residential communities, caregivers must know which actions to take. Roelands et al. (2004) discovered that CPGs improved shared decision-making of caregivers and older adults in residential settings. Specifically, caregivers used a wider range of intervention methods with increasing intensity. When amplification products were properly managed by staff, the quality of life of residents improved.

Boi et al. (2012) accessed the quality of life of hearing-impaired adults after they were fit with hearing aids. The study identified that the quality of life of residents increased and, in turn, caregivers demonstrated less stress and improved confidence. The Caregiver Burden Inventory (CBI) showed a significant decrease in anxiety and behavioral discord (Boi et al. 2012). Caregivers are capable of serving a critical and routine role in the lives of older citizens that reside in retirement communities. The role of caregivers, as it pertains to amplification, ALDs,

and communication health, should not be disregarded. This is a ripe area for improvement which, when properly managed, might lead to better health outcomes for communities of older citizens.

Hearing aids and usage in the elderly population

As above, hearing aid uptake and usage in the elderly population is low (Chia et al., 2007; Linssen et al., 2013; Perez and Edmonds, 2012). A report by Chia et al. (2007) indicated that only 25.5% of those with hearing loss possessed hearing aids in a residential facility. Correspondingly, Linssen et al. (2013) found 12-17% of individuals in this community own hearing aids. There are similar problems with lack of hearing aid usage in other countries. For instance, it is estimated that about 6 million could benefit from use of hearing aids in the United Kingdom (UK) but only 1.4 million people possess them (Perez and Edmonds, 2012). An important discerning factor about hearing aid usage pertains to the method in which the data are reported. A review, conducted by Perez and Edmonds (2012), produced fifteen different methods for measuring hearing aid usage, which raised a concern that there is a lack of consistency regarding hearing-aid usage metrics. While it has been reported that there is a positive relationship between hearing aid usage and hearing aid benefit/satisfaction, the relationship is multifaceted and must be more clearly understood (Perez and Edmonds, 2012). Overall, the non-use of hearing aids by older hearing-impaired individuals living in residential communities is not exclusive to owning and wearing these products but involves other factors such as barriers and support.

Barriers to hearing aid usage

Barriers to hearing aid usage can be especially multifarious for this population. Cohen-Mansfield and Taylor (2004b) conducted a study about barriers to hearing aid use in residential facilities. Specifically, they investigated hearing aid usage for individuals with hearing difficulties who did

and did not possess hearing aids. They determined that the overarching issue for individuals with hearing difficulties, but without a hearing aid, was communication problem neglect. The majority (69%) of seniors who possessed hearing aids reported having problems using them. The most common problem was difficulty with hearing aid use, including poor fitting and discomfort and problems with proper function. Cohen-Mansfield and Taylor (2004b) discovered that 86% of this population required assistance with taking care of hearing aids while nearly half of the staff had received no training about hearing aid support. Clearly, care professionals lack the knowledge, skills, and experience to help older residential populations. Other barriers have been identified: hearing aids are too expensive, residents are embarrassed to wear them, products lacked user information, and minimal guidance and instructions about the device was provided (Mizutari, 2013). Another common barrier for this population is the difficulty with transportation for scheduled appointments.

Regular follow up appointments are necessary and highly recommended for successful hearing aid outcomes and timely adjustment. Pryce and Gooberman-Hill (2011) cited hearing aid adjustment as an additional barrier to hearing aids for seniors. However, for the elderly population, hearing aid adjustment may be difficult to achieve (Perez and Edmonds, 2012). Many older citizens are unable to drive and rely on public, private, or government transportation to make medical appointments, making it difficult to show on time for scheduled appointments.

Hearing aid cost has been cited as a barrier to product acceptance. Cohen-Mansfield, J., and Infeld, D. L. (2006) investigated factors related to financial coverage for hearing aids. The elderly population is often on a fixed income and frequently must rely on caregivers or family to pay for hearing aids and ALDs. The cost burden associated with repair or replacement of broken hearing aid products may decrease the incentive for seniors and their financial supporters to

invest in hearing health care. In the United States, insurance coverage for hearing aids and assistive devices is limited. Most adults in the older population receive medical insurance from Medicare, which does not cover hearing aids. The benefits of hearing aids for individuals with dementia have been reported and hearing aid usage is significantly poorer for this subgroup of the population. Other common reasons for non-use of hearing aids by older populations are background noise, manipulation difficulties, social stigma, lack of awareness, comfort, perception of performance, feedback issues, poor understanding of how to use them, and general dissatisfaction with sound quality (Cohen-Mansfield and Taylor, 2004b).

Hearing aids and benefit

Most studies about hearing aid use and the elderly population have been conducted with individuals that do not have dementia and do not live in assistive-living environments. Although hearing aid usage may be rated as low in the older community, numerous benefits regarding use of amplification have been documented. Chia et al. (2007) revealed that habitual use of hearing aids may be associated with slightly better physical functioning, although this observation was not statistically significant. Palmer et al. (1999) reported that most caregivers revealed significantly lower perceived hearing handicap (i.e., HHIE scores) subsequent to hearing aid use. Humes et al. (2001) found similar results, reporting that hearing aid users had significantly better HHIE scores than non-users. Niemensivu et al. (2015) indicated that use of a monaural hearing aid improves hearing and has a marginal improvement in HRQoL for adults. Although use of binaural amplification is preferred, even for monaural hearing aid use, satisfactory outcomes were produced and quality of life was enhanced as well (Mizutari, 2013). Alternatively, if the barrier to hearing aid access is related to cost, use of a monaural device will likely improve communication ability and quality of life.

Audiologic Rehabilitation

Hearing aids and ALDs have been regularly characterized as treatment options for hearing-impaired older adults. Often overlooked, and frequently underutilized, audiological rehabilitation (AR) is a viable treatment program that may be designed for use with an individual or for a group of listeners. Audiological rehabilitation can target listening strategies, communication repair, auditory therapy, assistive technology, and other relevant issues pertaining to communication and may be driven by the needs of hearing-impaired participants. The delivery method can be facilitator or self-directed (Laplante-Lévesque, Hickson, and Worrall 2010). Group AR can be an effective auxiliary treatment option for hearing aid users.

Laplante-Lévesque, Hickson, and Worrall (2010) evaluated the effectiveness of AR programs for older adults in a comprehensive literature review. They determined that AR programs increased participation in activities associated with hearing, as well as quality of life according to the International Outcome Inventory-Alternative Interventions. The authors caution readers about interpretation of findings because cited reports had an assortment of participant characteristics, lacking uniformity. Linssen et al. (2013) discovered that 55% of 91 AR participants had a successful AR experience, which is evidence that AR can be a useful tool for older adults.

Prendergast and Kelley (2002) reported that only 5% of audiologists offer group AR and less than 1% offer individual AR. Adherence to AR is a common barrier. Programs vary widely regarding frequency and duration of clinical sessions. As with hearing aids, transportation can be a hindrance to compliance since many older adults require assistance getting to locations. Hickson, Worrall, and Scarinci (2007) indicated that 44% of participants did not attend all of their five group meetings held weekly. Similarly, 32% of participants in an individual AR

program did not show for five sessions held over five weeks (Sweetow, Henderson and Sabes, 2006). Delivery of and adherence to AR programs must be improved by clinicians if patients stand to maximize residual hearing and communication ability.

Assisted Listening Devices (ALDs)

ALDs have been classified as any device that aids in listening. Generally, ALDs are less sophisticated than hearing aids and, therefore, less expensive. Additionally, ALDs are larger and easier to manipulate than hearing aids. Candidacy and ALD-device considerations are not the same as hearing aids. Usually, hearing aids require a measurable loss of hearing and are dispensed by a licensed professional; whereas, ALDs may be obtained independently.

Barriers/limitations to ALDs

A limited number of studies are available about ALD effectiveness, so it is difficult to know the effectiveness of these devices. In order for ALDs to be effective, there needs to be an awareness and positive attitude towards them, including self-efficacy, realistic expectations, and support from family and caregivers (Roelands et al. 2004). Southall, Gagne, and Leroux (2006) reported that in order to be a successful ALD user, hearing difficulties must be recognized, which includes an awareness of available technologies, consultation for the device, obtaining it, behavior modification, and use of the device. Notably, ALDs are less sophisticated than hearing aids in their method of sound amplification.

Hearing aids use complex algorithms that may be prescribed to address a specific hearing loss, but ALDs are not customized and commonly amplify all frequencies in a uniform manner. Given that, sound quality has been a commonly-reported issue for ALDs, which negatively affects usage rates. Furthermore, variability has been reported with the quality control of ALDs. This has been observed in electroacoustic measurements of ALDs, which can vary significantly

between devices (Lesner 2003). At this time, there are no FDA regulations on ALDs, so customers can purchase them independently, without a professional. Due to this fact, ALD users may improperly use such devices and might not obtain an over-the-counter device suitable for their hearing needs. Audiologists should market ALDs as part of their clinic product lines. When doing so, clinicians must engage their patients in the ALD decision-making process and offer a trial period (Lesner 2003).

Benefits of ALDs

When utilized properly, ALDs can improve communication for older adult listeners. McInerney and Walden (2013) reported that individuals with hearing loss using an ALD performed similar to normal listeners regarding communication efficiency. Furthermore, they determined that ALD use resulted in improved communication efficiency irrespective of hearing loss severity or perceived hearing handicap. Aberdeen and Fereiro (2014) investigated 20 older adults at a residential facility by creating their own ALD (later produced commercially as the Pocketalker Ultra). Overall, their results identified that conversation and quality of life was rated high regardless of age and hearing health after using the device. Most subjects (90%) rated speech understanding and quality of sound at ‘4’ or ‘5’ (on a five-point scale where ‘5’ was the most favorable rating).

Mann et al. (1994) investigated the use of assisted devices in older adults, conducting face-to-face interviews with 35 participants at their residences. They discovered a general lack of awareness of ALD available in these individuals. Assistive device dissatisfaction was 22%, which was lower than dissatisfaction with hearing aids (60%). Mann et al. (1994) discovered that availability of social resources was the best predictor for success with ALDs and concluded that follow-up audiologic care and sufficient information about ALDs is beneficial for this

population. Assistive listening devices with a remote or tethered microphone can be placed closer to the desired source to improve the signal-to-noise ratio (SNR). A major complaint of hearing aids users is product performance in the presence of noise, so, ALDs present an advantage in this context. Furthermore, ALDs may benefit older residents of long-term care facilities because they are less costly, offer simplified maintenance and usage, and allow staff to be easily trained on their use (Lesner 2003).

ALD Device Considerations and Candidacy

Lesner (2003) characterized ALD candidacy for older adults, citing several features of the devices that should be considered. The first feature pertains to the ALD's physical design, microphone size, and microphone type. A microphone polar pattern should be compared to the user's listening conditions. The second feature is the ALD signal-transfer method. This pertains to whether, or not, the microphone connection is hardwired or wireless. Hardwired connections are usually less costly, but still useful in a variety of listening environments. Wireless connections may be beneficial but cost more and need to be paired to the primary ALD unit. Multichannel instruments tend to provide the most beneficial results and improve the SNR.

Individuals with profound hearing loss may have difficulty using most ALDs due to lack of adequate power (gain). Dexterity and ability to manipulate the device is an important candidacy consideration as well. Due to their size, ALDs are easier to use than their smaller hearing aid counterparts; however, they still require user ability to place the headphones and power-on the device. Lesner (2003) suggests that older adults, regardless of hearing status, are candidates for ALDs because they can improve SNR, which may improve intelligibility. It may be more appropriate for bedridden patients to use ALDs (Lesner 2003), given their ease of application in that setting.

Research Questions

1. Do assistive listening devices reduce the Geriatric Depression Scale (GDS) short form score for the elderly in residential living facilities?
2. Do assistive listening devices reduce the Hearing Handicap Inventory for the Elderly Screening (HHIE-S) version score for the elderly in residential living facilities?

CHAPTER 2

Methodology

Subjects

A total of 21 screenings were conducted on residents at an independent living facility within reasonable driving distance of the campus. Of the 21 residents screened, 15 were found qualified for inclusion in the study. Altogether, five residents consented to participate (**Figure 1**), which resulted in a 71% rate of qualification for the study and a 33% rate of consent. The mean age of the participants was 93.4 years and four out of the five (80%) were female. Two of the participants were previously fit or current hearing aid users. One of the participants had a fall that required a hospital stay; hence, a post-intervention questionnaire could not be completed by this individual.

Instrumentation and Equipment

Pure tone threshold tests were conducted using a MAICO 25 portable pure-tone air-conduction screening audiometer. Otoscopy was administered with a standard hand-held otoscope. Survey instruments included the Geriatric Depression Scale (GDS) short form, which is 15-item self-assessment used commonly in clinics to screen for depression in older people (Yesavage and Sheikh, 1986), and the Hearing Handicap Inventory for the Elderly - Screening version (HHIE-S), a common scale used for screening older adults (Weinstein and Ventry, 1983). The GDS short form and HHIE-S version have been provided in **Appendix A and B**, respectively.

Assistive listening devices resemble a portable music player: conventional headphones that plug into a small battery-operated amplifier component with a microphone. The amplifier-microphone component may be placed on a table or clipped to the participant’s clothing. A

typical ALD ranges in price from $30-$300, which is considerably more affordable than a $1,500-$5,000 hearing aid.

For the purposes of this study, four ALDs were utilized that ranged in price from $30 to $136 were used. Specifications for each of these products may be found in **Table 1**, and the appearance of the product has been displayed in **Figure 2**. Each participant was randomly assigned to a device for the trial period. Most companies that produce personal amplification systems (e.g., ALDs) do not publish their output and gain specifications. To verify the safety and performance of each of the manufactured products, electroacoustic measurements were administered in the laboratory.

Environment

This pilot study was conducted at an assisted living residential facility that has 60 residents. Hearing screenings were conducted in the residential theater room, which was centrally located. The ambient noise level was measured at 32-40 dBA. The principal investigator administered informed consent and questionnaires in the library room, which was adjacent to the room where hearing tests were conducted. Follow up checks took place every two weeks and were conducted with residents in their apartments.

Procedures

A visual inspection of both ears was administered. Residents were offered a routine pure-tone audiometric hearing screening test on site at the residential facility. The pure-tone air conduction audiometric test was administered by a graduate clinician to obtain hearing threshold levels (in dBHL) for 500-4000 Hz, to determine if any thresholds are worse than a *severe* degree of hearing loss (>85dBHL). When hearing threshold is classified as *profound,* a user would not be expected to benefit from an ALD, so that subject would not be invited to participate in the 8-

week trial use of the assistive listening device. If hearing did not exceed severe, an invitation to participate in the 8-week trial, using the assigned assistive listening device, was offered. Informed consent was obtained from all participants. Two questionnaires were used to determine baseline disposition of depression and hearing handicap: (1) GDS short form, and (2) HHIE-S version. Residents were educated about the use and care of the assigned ALD and encouraged to use it for 8 weeks. Upon completion of the usage period, all participants were asked to return the ALD and the GDS and HHIE/S were re-administered for comparison with baseline. Residents were asked to respond to five questions from a supplemental questionnaire (**Table 2**).

CHAPTER 3

Results

Electroacoustic data for each of the four ALDs was measured prior to the beginning of the investigation. The analyses were conducted by using the electro-acoustic chamber of the Audioscan Verifit 1. Output sound pressure level for a 90-dB input (OSPL-90) was measured for each device with amplification gain at the full-on setting. Due to issues of feedback with some of the ALDs, the volume had to be reduced in order for the measurement to be administered. **Figure 3** is a display of the OSPL-90 measurements for each of the four devices. There was wide variability between the various ALD products Differences were substantial even between the same devices. These electro-acoustic observations support results reported by Lesner (2003) who described variable electro-acoustic ALD data as well.

The results of the pre- and post-intervention GDS short form have been displayed in **Figure 4**. The mean pre-intervention score was 2.6 for the study group. Scores of five and above indicate depression and require a referral to a Mental Health professional for definitive evaluation. The post-intervention GDS short form score of 1.0 indicates a 62% reduction of the pre-intervention depression score. According to Smarr and Keefer (2011), a significant change of the GDS short form would be represented in a 6 to 11-point difference between pre- and post-intervention scores. The difference observed in this study group (1.6) was not considered clinically significant improvement and might be regarded as *no difference*. Due to the small size of the study sample, parametric statistics will not be reported.

The results of the pre- and post-intervention for the HHIE-S have been shown in **Figure 5**. A pre-intervention score of 18.8 classified the study group within the *mild-to-moderate* handicap category. A score of 18.0 is the cut-off between *no handicap* and the *mild-to-moderate* handicap. The post-intervention HHIE-S score was 16, which classified the study group as *no*

handicap. The HHIE-S difference was 2.8 between the pre- and post-intervention scores, which indicates a 15% reduction in hearing handicap. This difference would not be considered clinically significant according to Newman et al. (1991), which defines a clinically important change as 10-points or more.

There were five questions in the supplemental questionnaire, and the responses of each of the residents have been displayed in **Table 2**. Two of five (40%) of the participants used the ALDs. This utilization was too low which precluded the ability to assess the impact of the products. According to responses for question #4, residents estimated the mean cost of the ALDs to be about $67, which approximated the mean cost of the devices sampled. Surprisingly, none of the residents indicated that they would accept the device if it was offered to them at no cost.

With respect to the first research question of "Do assistive listening devices reduce the Geriatric Depression Scale (GDS) short form score for the elderly in residential living facilities?" we were unable to collect enough data to conduct statistical analysis (e.g., small sample size). Factors contributing to the small sample size will be discussed below. The other research question was "Do assistive listening devices reduce the Hearing Handicap Inventory for the Elderly Screening (HHIE-S) version score for the elderly in residential living facilities?" A small sample size precluded any discernible statistical analysis for this research question as well.

CHAPTER 4

Discussion

There were 21 residents who received audiometric hearing screenings, but only five of the 15 that qualified consented to the study. This was lower than expected, possibly because the residents were apprehensive about participating in the study for a variety of reasons. Some of the residents appeared skeptical about the research team and our true intentions. Consent to participate may have been low due to unfamiliarity with ALDs. Residents were unmotivated about improving their communication abilities. Of those who qualified, several residents admitted that they had difficulty hearing and communicating yet did not feel that the ALD was worth the time.

After the hearing screenings and questionnaires were completed, our research team returned to the residence to deliver the ALDs. Each participant was educated about their assigned ALD, which included a demonstration and orientation on ways to use the ALD in different listening situations, such as watching television, visiting with family, and participating in social activities within the community. Two of the five participants owned bilateral hearing aids and were encouraged to compare the assigned ALD to their prescribed amplification.

Lab students visited the participants every two weeks to survey the ALD, provide new batteries, and address any questions or concerns. During these checks, we discovered that most of the participants were not using the ALDs consistently. One subject complained about distortion and another claimed that the device was too loud. It appeared that users were embarrassed and felt stigmatized when attempting to use the ALD. Participants were concerned about how other residents viewed them when wearing the device. Participants did not appear to acknowledge their listening and communication difficulties, which, when coupled with concerns

about social stigma, served as a barrier to ALD use.

The GDS short form and HHIE-S demonstrated a reduction after the ALD experience but because use of the ALDs was limited to two residents, the pre-post difference did not achieve clinical significance. Due to the lack of awareness and concern about social stigma, a group AR course should be provided before delivery of the ALD. It is possible that a group experience might help to reduce social stigma and increase awareness that others are experiencing similar communication problems. It is possible that a group rehabilitation or educational approach might form partnerships of support for residents to experience the ALD together and reduce the stress of using the ALD alone. Additionally, the group AR classes could be specifically designed to demonstrate the benefit of improved communication and quality of life for older adults through use of an ALD. Unfortunately, very few (5%) of audiologists offer group AR (Prendergast and Kelley, 2002). Nevertheless, our final assessment was that the participants were not interested or motivated to improve their communication when this study was administered.

Boi et al., (2012) concluded that seniors with hearing loss were twice as likely to be diagnosed with depression in the future, but following hearing aid prescription, seniors demonstrated improvements in general health perception, social life, mental health, and perception of emotional health. Furthermore, as hearing loss severity increases, clinicians should expect the quality of life of their patients to decline incrementally. Hearing loss has been associated with dementia and the risk for dementia increases commensurate with hearing loss severity; however, when amplification is used (e.g., ALDs), caregivers have reported increased alertness and more conversant older adults.

Training programs for hearing, communication, and ALD hearing-service support are needed in senior residential facilities. When amplification products have been properly managed

by staff, the quality of life of residents may be expected to improve. In turn, caregivers may be expected to demonstrate less stress and even improved confidence. The role of caregivers, as it pertains to amplification, ALDs, and communication health, is critical and should be improved through training. Presently, care professionals lack the knowledge, skills, and experience to help older adult residents. For ALDs to become more accepted, there should be increased awareness. Increased self-efficacy, realistic expectations, and support from family and caregivers would serve to improve ALD acceptance. For example, the communication efficiency of individuals with hearing loss that used an ALD was as good as normal listeners. It has been demonstrated that ALD use improves conversation and quality of life and has been rated high regardless of age and hearing health, irrespective of hearing loss severity or perceived hearing handicap.

Conclusion

Although most of the residents that were screened qualified for the study (71%), merely 33% agreed to participate, resulting in a limited number of study participants. The residents who consented for this study may not have been a representative sample of the general population of older adults living in residential communities. Within our study group, there was an overall lack of motivation to sample the new ALD and attempt to improve communication. Cohen-Mansfield and Taylor (2004b) highlighted the pervasive social stigma and neglect of communication problems within older adult populations. While cost of hearing aids is continually cited as a major barrier for the usage, this pilot study may suggest that cost is not a significant barrier. Perhaps, awareness, education, social stigma and neglect of communication problems must be addressed before ALDs may be accepted and used by this population.

TABLES AND FIGURES

Table 1. Assistive listening device product specifications.

MANUFACTURER	DESCRIPTION	COST	HEADPHONES
RadioShack	3-band Amped Stereo Listener	$39.99	Panasonic Best in Class On-Ear Stereo Headphones
Williams Sound	Pocketalker Ultra Duo; 40 dB gain; most expensive option	$136.21	Included with device
Sound Assistant	Personal sound amplifier; cheapest option	$29.95	Included with device
Radioshack	Pocket-sized stereo amplified listener	$64.99	Panasonic Best in Class On-Ear Stereo Headphones

Table 2. Post-experience supplemental survey and results (n=5).

SQ1. Do you use a hearing aid?	**SQ2. When did you use the ALD?**	**SQ3. When used, which situation did you benefit from?**	**SQ4. What do you think it's worth? $30/$50/$100/or $135**	**SQ5. Would you use it if provided at no cost?**
yes	not used	not used	-----	no
yes	1st week	in room	$50	no
no	tv	too loud	$50	no
no	not used	not used	$100	no
no	fall/hospitalized	not used	-----	-----
Estimates		*40% use rate*	*Valued at $67*	*100% "No"*

Figure 1. Assistive listening device recruitment and inclusion.

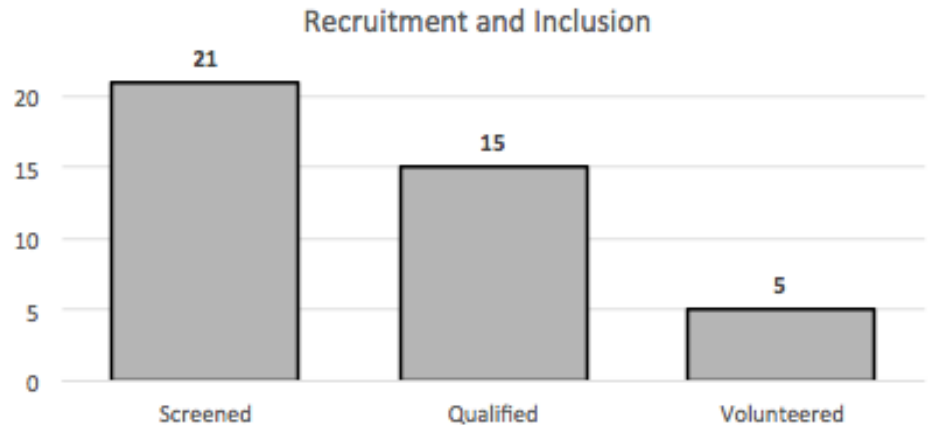


Figure 2: Assistive listening device product packets.

Option #1: RadioShack 3-band Amped Stereo Listener with Panasonic Best in Class On-Ear Stereo Headphones

Option #3: Sound Assistant – Personal Sound Amplifier with headphones

Option #2: Williams Sound Pockettalker Ultra Duo Pack Amplifier with folding headphones

Option #4: Radioshack Pocket-Size Stereo Amplified Listener with Panasonic Best in Class On-Ear Stereo Headphones

Figure 3: Assistive listening devices OSPL-90 measurements.

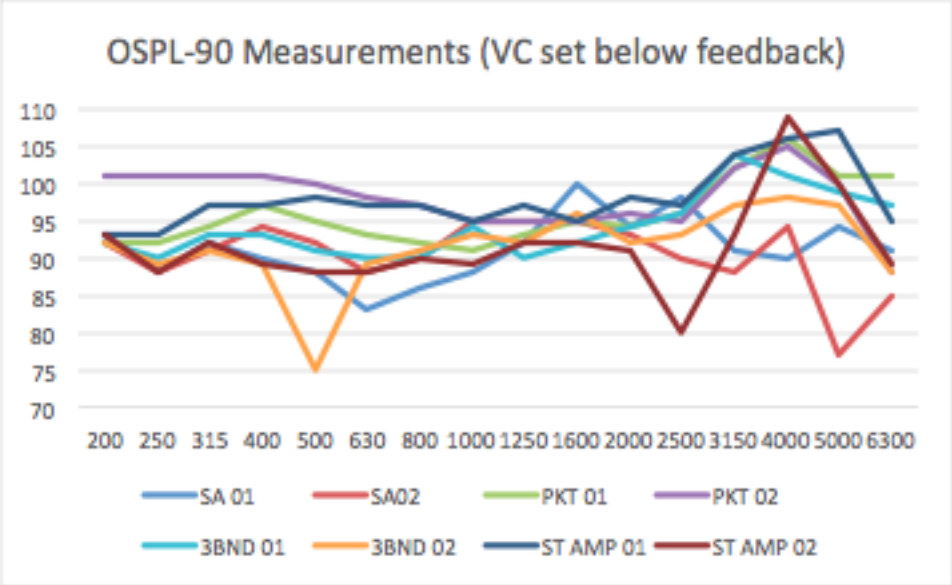


Figure 4: Geriatric Depression Scale screening results.

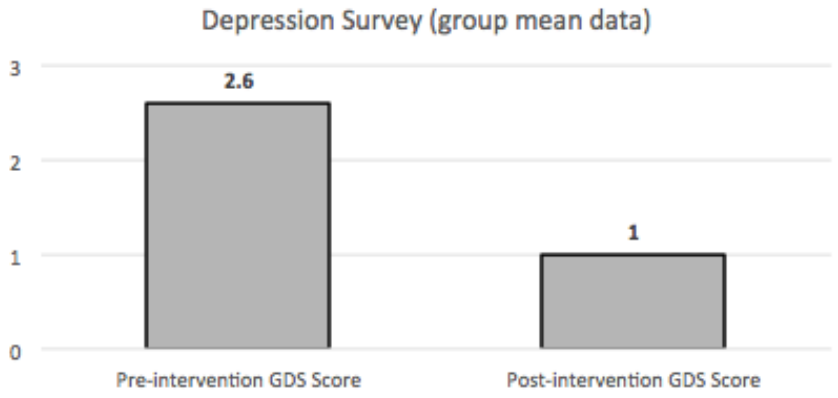
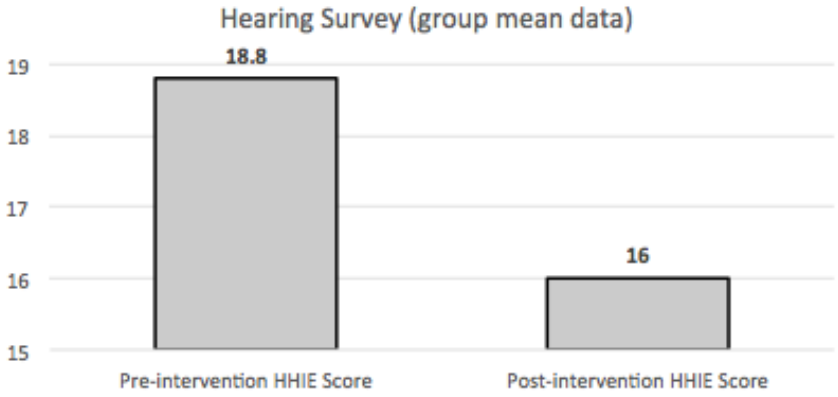


Figure 5. Hearing Handicap Inventory Elderly screening results.



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APPENDIX (A)

Geriatric Depression Scale

GDS -15, choose the best answer for *how you felt over the past week*

1. Are you basically satisfied with your life?
    a. Yes (+0) or No (+1)
2. Have you dropped many of your activities and interests?
    a. Yes (+1) or No (+0)
3. Do you feel your life is empty?
    a. Yes (+1) or No (+0)
4. Do you often get bored?
    a. Yes (+1) or No (+0)
5. Are you in good spirits most of the time?
    a. Yes (+0) or No (+1)
6. Are you afraid something bad is going to happen to you?
    a. Yes (+1) or No (+0)
7. Do you feeling happy most of the time?
    a. Yes (+0) or No (+1)
8. Do you often feel helpless?
    a. Yes (+1) or No (+0)
9. Do you prefer to stay at home, rather than going out and doing new things?
    a. Yes (+1) or No (+0)
10. Do you feel you have more problems with memory than most?
    a. Yes (+1) or No (+0)
11. Do you think it's wonderful to be alive now?
    a. Yes (+0) or No (+1)
12. Do you feel pretty worthless the way you are now?
    a. Yes (+1) or No (+0)
13. Do you feel full of energy?
    a. Yes (+0) or No (+1)
14. Do you feel your situation is hopeless?
    a. Yes (+1) or No (+0)
15. Do you think that most people are better off than you?
    a. Yes (+1) or No (+0)

Score: _____

**Scores greater than 5 should be further evaluated clinically; if this is your first time taking the GDS and your score is greater than 5, please seek care from your medical facility.*

APPENDIX (B)

Hearing Handicap Inventory for the Elderly – Screening Version (HHIE-S)

Name: _____ Date: _____

Introduction: We have some questions about how you feel about your hearing. For each statement, please tell me whether the statement does describe you, does not describe you, or describes you sometimes."

For each question, circle appropriate response:	Does the question describe you?		
Item	**No**	**Sometimes**	**Yes**
1. Does a hearing problem cause you to feel embarrassed when you meet new people?	0	2	4
2. Does a hearing problem cause you to feel frustrated when talking to members of your family?	0	2	4
3. Do you have difficulty hearing when someone speaks in a whisper?	0	2	4
4. Do you feel handicapped by a hearing problem?	0	2	4
5. Does a hearing problem cause you difficulty when visiting friends, relatives, or neighbors?	0	2	4
6. Does a hearing problem cause you to attend religious services less often than you would like?	0	2	4
7. Does a hearing problem cause you to have arguments with family members?	0	2	4
8. Does a hearing problem cause you to have difficulty when listening to television or radio?	0	2	4
9. Do you feel that any difficulty with your hearing limits/hampers your personal or social life?	0	2	4
10. Does a hearing problem cause you difficulty in a restaurant with relatives or friends?	0	2	4
Column scores:	**( )**	**( )**	**( )**

Total HHIE/S Score: _____

HHIE-S: *Scores >8 indicate hearing impairment that would benefit from further audiologic evaluation.*