

# Aural Rehabilitation for Older Adults with Hearing Loss: Impacts on Quality of Life—A Systematic Review of Randomized Controlled Trials

DOI: 10.3766/jaaa.15090

Helen N. Michaud\*

Louise Duchesne†

## Abstract

**Background:** Few systematic reviews have been conducted regarding aural rehabilitation for adults with hearing loss, with none specifically targeting the older adult population. With prevalence rates of hearing loss being highest in older adults, examining the effects of aural rehabilitation on this population is warranted.

**Purpose:** To evaluate the effects of aural rehabilitation on quality of life in an older adult population presenting with hearing loss.

**Eligibility Criteria:** Studies with adults presenting with hearing loss,  $\geq 50$  yr of age, with or without hearing aids, receiving interventions such as auditory training, speech-reading, communication strategies training, speech tracking, counseling, or a combination of approaches, and measuring outcomes related to quality of life, in an individual or group format, with or without significant others and with no limitations as to year of publication.

**Study Selection:** Searches in six databases, as well as results from hand-searching, gray literature, and cross-referencing of articles, yielded 386 articles. Of the 145 assessed as full-text articles for eligibility, 8 studies met inclusion criteria.

**Study Appraisal:** A component-based risk of bias assessment, as recommended by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.

**Results:** No effect sizes were found in group interventions measuring outcomes related to quality of life, such as mental and emotional functions, environmental factors, participation restrictions, and activity limitations. An intervention effect regarding participation was found for a self-administered home training program, but an effect size was unavailable. Small-to-medium effect sizes were found in one of two individual communication training programs, for which outcomes related to quality of life, such as emotional functions, activities, participation, and environmental factors were measured. The results of the component-based risk of bias assessment indicated that the quality of reporting was poor, thus compromising the internal validity of included primary studies.

**Conclusions:** Our results indicate that the combined body of evidence in support of aural rehabilitation for older adults with hearing loss is not sufficient to draw any firm conclusions. We identify a need for more rigorous research to guide clinical decision-making.

**Key Words:** activity limitations, attitudes, audiologic rehabilitation, aural rehabilitation, emotional functions, hearing impaired, hearing loss, older adult, participations restrictions, quality of life

---

\*Centre intégré universitaire de santé et de services sociaux de la Capitale-Nationale – Institut de réadaptation en déficience physique de Québec (CIUSSS-IRD PQ), QC, Canada; †Département d'orthophonie, Université du Québec à Trois-Rivières, QC, Canada

Corresponding author: Helen N. Michaud, CIUSSS-IRD PQ, QC, Canada G1M 2S8; E-mail: helen.michaud@irdpq.qc.ca

Funding was provided by the Centre intégré universitaire de santé et de services sociaux de la Capitale-Nationale – Institut de réadaptation en déficience physique de Québec (CIUSSS-IRD PQ), Quebec City, Canada.

Some of the data in the manuscript were presented at the ASHA Convention in Denver, CO, November 12, 2015.

The funders played no role in study design, collection, analysis, interpretation of data, writing of the report, or in the decision to submit the article for publication.

**Abbreviations:** ACE = Active Communication Education; CPHI = Communication Profile for the Hearing Impaired; GHABP = Glasgow Hearing Aid Benefit Profile; HCA = Hearing Coping Assessment; HHIE = Hearing Handicap Inventory for the Elderly; HHQ = Hearing Handicap Questionnaire; ICF = International Classification of Functioning, Disability, and Health; LOT = Life Orientation Test; PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses; QDS = Quantified Denver Scale; SAC = Self-Assessment of Communication; SESMQ = Self-Efficacy for Situational Communication Management Questionnaire; SF-36 = Short Form-36; SSQ = Speech, Spatial and Qualities of Hearing; WHODAS II = World Health Organization Disability Assessment Schedule II

## INTRODUCTION

On a global scale, the World Health Organization reports hearing loss prevalence rates to be higher among those aged  $\geq 65$  yr than in the younger adult population; approximately one-third of older adults are adversely affected by hearing loss (WHO, 2012). Although these figures show that older adults present with hearing loss in disproportionately large numbers compared to younger adults or children, prevalence estimates may be conservative because hearing loss is considered to be an underreported condition (Duthey, 2013).

Hearing loss has far-reaching implications that go above and beyond the misunderstanding of a word or not being able to follow a conversation: there are harmful consequences and costs to the individual (Duthey, 2013). Past research clearly established the many repercussions of hearing loss on a person's social, emotional, and psychological well-being. An untreated hearing loss may lead to frustration, feelings of loneliness, sadness, despair, and a sense of helplessness (Weinstein and Ventry, 1982; Knutson and Lansing, 1990; Monzani et al, 2008).

### Aural Rehabilitation: The Evidence Thus Far

Boothroyd (2007) holistically defines adult aural rehabilitation as “the reduction of hearing-loss-induced deficits of function, activity, participation, and quality of life through a combination of sensory management, instruction, perceptual training, and counseling” (p. 63).

Different means and methods can be used and offered, and these may vary according to the needs expressed by a given patient. These may include, but are not limited to hearing aid fitting, auditory training, speech-reading training, individual or group counseling, the inclusion of significant others in treatment, or a self-administered home training program. Although the benefits of using hearing aids or cochlear implants are well documented, these hearing devices are too costly for many people (Duthey, 2013). Moreover, despite the rapid evolution of technology, hearing aids do not compensate for all the difficulties associated with hearing loss. As most users will attest, hearing aids do make speech sounds louder, but they do not necessarily make speech clearer, especially in noisy environments

(McCarthy and Schau, 2008; Gifford and Revit, 2010). Therefore, demonstrating the short- and long-term benefits, as well as the time- and cost-effectiveness of aural rehabilitation options, other than the sole use of hearing aids, is of particular importance. Such is the case in countries where third-party payers are involved in covering health-care costs and may require proof thereof (McCarthy and Schau, 2008).

In a systematic review of 12 articles, Hawkins (2005) examined the effectiveness of counseling and communication strategy-based adult aural rehabilitation groups by measuring benefit or satisfaction with hearing aids, adjustment to hearing loss, or perceived hearing handicap. The author cited difficulties in drawing conclusions due to the lack of well-designed experiments, the lack of long-term follow-up assessment, and the small number of participants in the included studies. The author concluded that there were short-term benefits to adult aural rehabilitation groups, specifically, a reduction in self-perceived hearing handicap and a better use of communication strategies.

Sweetow and Palmer (2005) evaluated the efficacy and effectiveness of individual auditory training for adults in a systematic review of six primary studies. Included studies were clinically and methodologically heterogeneous: training paradigms were different, provision of feedback was variable, follow-up measures were lacking, and outcome measures varied from one study to another. The authors also noted large interindividual variability in results. They concluded that there was little evidence for the effectiveness of individual auditory training for the improvement of communication skills, such as consonant recognition, speech perception, or self-perception of ability. The authors did find, however, some evidence of efficacy in favor of a synthetic as opposed to an analytic approach to training: some of the studies using synthetic training measured improvements in speech recognition skills, particularly in noise.

Chisolm et al (2007) evaluated the health-related quality of life benefits of amplification in adults of all ages. In their systematic review, the authors identified 16 studies, of which only 2 used a randomized controlled trial design. Limitations of included studies consisted of a lack of control group, the absence of power analyses, and incomplete reporting as regard attrition. The qualitative findings demonstrated improvements in some of

the studies that used generic tests to measure health-related quality of life following hearing aid fitting. Examples of improvements included reduced anxiety and depression and greater mental and social functioning. In contrast to these results, most of the disease-specific health-related quality of life evaluations indicated important reductions in the emotional and social impacts of hearing loss. In quantitative terms, meta-analyses were conducted according to domain (results from either generic or disease-specific evaluation tools) and study design (either experimental or nonexperimental). The results of the experimental studies suggested that hearing aids had a robust, medium-to-large effect on disease-specific measures of health-related quality of life and a small, yet significant effect on the generic measures of health-related quality of life. Regarding the results of the nonexperimental studies using generic evaluation tools, the authors found that the impact of hearing aids on health-related quality of life was imperceptible. In comparison, the nonexperimental studies using disease-specific evaluations obtained a small-to-medium effect of hearing aids on health-related quality of life. The authors did caution in interpreting results because studies included participants of various age groups with variable degrees of hearing loss and hearing aid experience. Furthermore, study participants were drawn from different health-care systems.

Chisolm and Arnold (2012) updated Hawkins's (2005) systematic review of counseling-based group interventions and Sweetow and Palmer's (2005) systematic review of auditory training. Regarding the auditory training studies, the authors observed variations in training paradigms and reported several methodological limitations, such as mixed use of control groups, randomization, and lack of blinding. The results of their meta-analysis of auditory training data indicated a reliable yet small short-term effect on speech recognition performance in adults. As for the counseling-based group interventions, Chisolm and Arnold (2012) reported important differences in quality between studies with regard to blinding and dropout rates. The results of their meta-analysis also yielded a small, yet reliable effect in short-term results in the reduction of self-perception of hearing handicap.

Most recently, Henshaw and Ferguson (2013) examined the efficacy of individual computer-based auditory training on speech intelligibility, cognition, and self-reported hearing handicap in adults with hearing loss. In their systematic review of 13 primary studies, the authors found that no outcome measures were common to all training protocols. With the exception of one study, auditory training resulted in improved performance for trained tasks in studies that reported on-task outcomes. Generalization of learning was also observed to be significant for untrained measures of speech intelligibility, but improvements were found to be small and

not robust. The authors concluded that high-quality evidence was lacking and therefore, the results of the included studies could not be used to guide intervention.

In sum, previous research has not provided us with any definitive answers. For this reason, we conducted a systematic review to examine the effects of aural rehabilitation on quality of life in an older adult population presenting with hearing loss.

## METHODS

### Protocol

A proposal and then a protocol were produced and subsequently accepted for internal funding at our rehabilitation center, the Institut de réadaptation en déficience physique de Québec.

### Eligibility Criteria

#### *Population*

Participants in the included studies were adults aged  $\geq 50$  presenting acquired or professional hearing loss, from mild to profound in degree, stable or progressive, with or without hearing aids, cochlear, or other types of implants such as brainstem or bone-anchored hearing aid. We excluded studies where participants presented an associated visual impairment or other condition that might interfere with a treatment program such as cognitive impairment, dementia, stroke, or psychiatric disorders. Studies addressing intensive postcochlear implant rehabilitation were also excluded as were studies where participants with hearing loss were mixed with adults who did not present with hearing loss.

#### *Intervention*

In agreement with the definition of Boothroyd (2007), interventions included in the present review were the following: counseling, communication strategies training, auditory training, lip/speech-reading training, speech tracking, or a combination of approaches such as hearing aid fitting supplemented by auditory training. Interventions could be in an individual or a group format. Training could also take place in a laboratory or clinical setting or be a self-administered home training program. Studies reporting solely on hearing aid use or technical support without any other aural rehabilitation intervention were excluded.

#### *Outcomes*

We included studies, which measured self-perceived quality of life, using either a generic or disease-specific

evaluation tool. The World Health Organization defines quality of life as “Individuals’ perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns. It is a broad ranging concept affected in a complex way by the person’s physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of their environment” (WHO, 1997, p. 1). Due to its breadth and multifaceted nature, quality of life is considered here to be an umbrella term as presented in the modified International Classification of Functioning, Disability, and Health (ICF) Model by McDougall et al (2010). In this revised version, all of the components included in the ICF Model, such as body functions, activities/participation, and environmental factors are considered to affect and contribute to a person’s quality of life as their situation evolves over time. Accordingly, results of measures of quality of life examined in this systematic review include outcomes related to body functions, such as emotional response or reactions, acceptance, adjustment, optimism, well-being, awareness of difficulties, perceived hearing ability, or quality of hearing. Also included are activity limitations and participation restrictions, such as hearing handicap, coping, effective communication strategies, self-efficacy, and problem-solving; and environmental factors, such as attitudes of others, social support, and relationships.

Studies solely measuring speech recognition, speech perception, hearing thresholds, hearing aid use, hearing aid benefit, or hearing aid satisfaction were excluded. Some of the excluded outcomes were, however, evaluated in the included studies: speech perception (Kricos et al, 1992; Kricos and Holmes, 1996; Preminger and Ziegler, 2008; Ferguson et al, 2014) and cognitive measures (Ferguson et al, 2014).

All studies included in this review presented results from self-reported questionnaires. In some cases, questionnaires were constructed or questions were created for the study. Therefore, not all evaluation tools were of comparable internal consistency and test–retest reliability. On the basis of these considerations, results that were measured using unvalidated homemade tools and responses that were drawn from questions that were added to an existing evaluation tool were excluded. Moreover, results from evaluation tools used solely at postintervention or at follow-up were also excluded.

### **Study Type**

Included are randomized controlled trials only. However, studies of randomized controlled trials which assigned participants to either a control or treatment

group based on a nonrandom component, such as availability of participants, participants’ preferred meeting time, or eligibility of participants to receive hearing aids were excluded from the review.

### **Language and Publication Date**

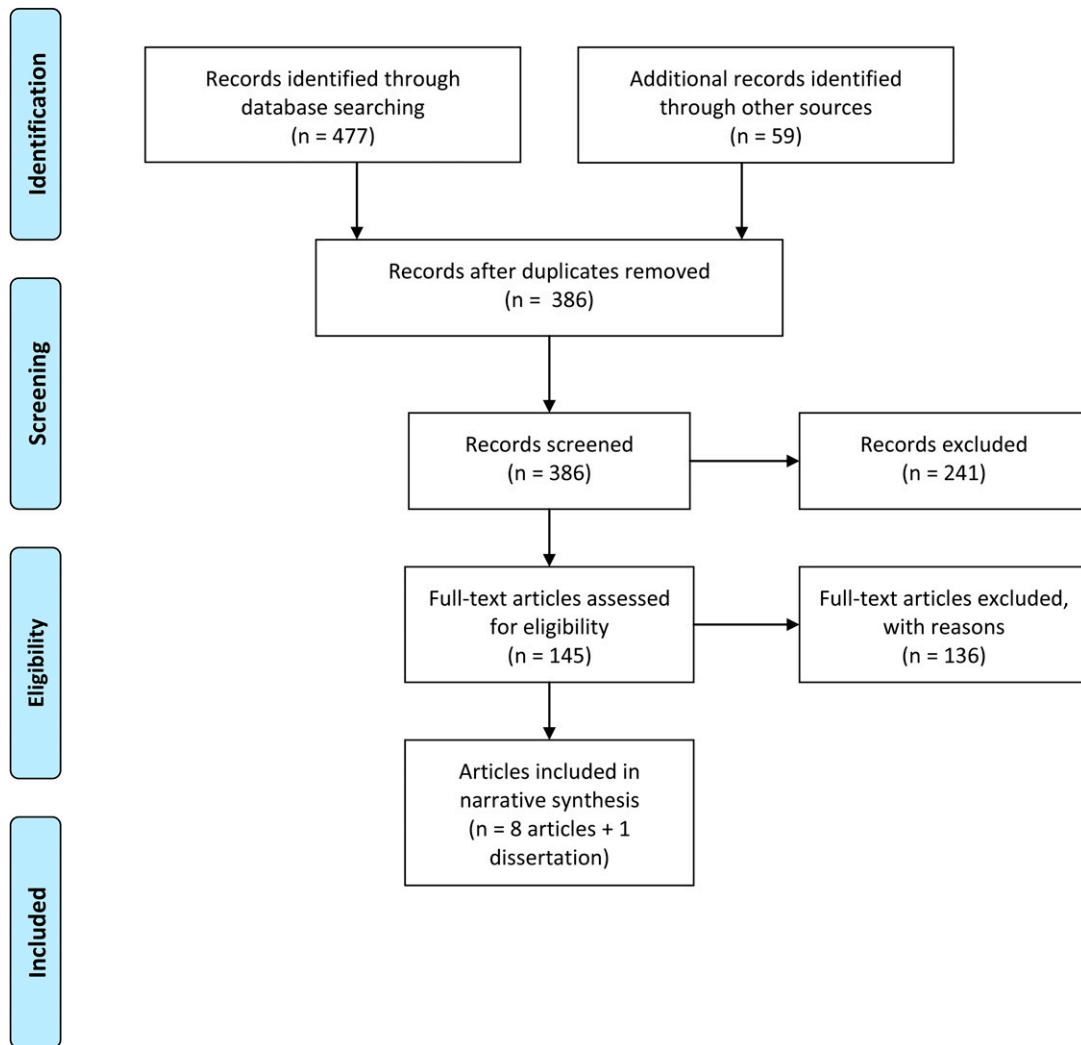
There were no restrictions regarding the language of study or publication date.

### **Search and Study Selection**

Searches conducted in PubMed (214 results), Excerpta Medica dataBASE (Embase; 107 results), Cochrane Library (1 result), Cumulative Index to Nursing and Allied Health Literature (47 results), Sociological Abstracts (search yielded no results), and PsycINFO (108 results) yielded a total of 477 results (for examples of terms, see Appendix). Results from hand-searching, searches in the gray literature, and cross-referencing source documents garnered a further 59 articles: 6 articles from hand-searching, 1 Ph.D. thesis from gray literature, and 52 articles from reference sections. Some authors were contacted to inquire about any forthcoming publication of results; they all responded. Articles published up until July 2015 were included in our search strategy.

After removing duplicate articles, we independently and in an unblinded manner screened the 386 records by title and abstract and then compared their results. Of these 241 were excluded because information in the abstracts clearly did not meet inclusion criteria. In the case of ten studies, titles or abstracts provided insufficient information as to decide whether to include or exclude them. Once obtained, we both read these articles. The interrater agreement rate was 95%. We settled any disagreements by consensus. An independent collaborator was available to settle any remaining questions. Once selected full-text articles were read, the same process was undertaken for the assessment of eligibility. For this stage, the interrater agreement rate was 95%. Of the 145 full-text articles assessed for eligibility, 136 were excluded for the following reasons: 54 for population (too young, cognitive impairment, not hearing impaired), 62 for study type (nonrandomized treatment study, case study, expert opinion, information article), 9 for intervention (use of hearing aids only), and 11 for outcome measures (greater use of hearing aids only, speech perception or speech recognition only).

As a result, the present systematic review includes eight studies reported in eight articles and one dissertation. One of the primary studies is reported in two different articles (follow-up results are published in a second article: Andersson et al [1995a,b]). See Figure 1 for results of search and study selection.



**Figure 1.** PRISMA flow diagram. From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med* 6(6):e1000097. doi:10.1371/journal.pmed1000097. For more information, visit [www.prisma-statement.org](http://www.prisma-statement.org). (This figure appears in color in the online version of this article.)

### Data Collection Process

The component-based risk of bias approach as recommended in the “Preferred Reporting Items for Systematic Reviews and Meta-Analyses” (PRISMA) statement and as described in the *Cochrane Handbook for Systematic Reviews of Interventions* guided us in our data collection and evaluation process. We both undertook this stage in an independent and unblinded manner. Overall, observed agreement on the evaluation of risk of bias was 90%. In the case of disagreement, discussions were held until consensus was reached.

We contacted 12 authors regarding missing information such as age range or participant characteristics, and 10 responded to our query. Two authors were unreachable because their article was published before the advent of the Internet. Therefore no e-mail address was provided. Attempts to reach them by contacting fellow

coauthors or place of employment were unsuccessful: they had either retired or passed away. Three authors were contacted and asked if their data had been published in more than one article. One other author was contacted and was asked if the same participants had been used in two separate studies. All four authors responded to our query.

### Data Items and Data Extraction

We extracted the following information from each study: (a) number of participants, (b) hearing aid or cochlear implant use, (c) age range, (d) intervention format: group, individual, or mixed, (e) type of intervention, (f) duration of intervention, (g) evaluation tools used, (h) outcomes measured, (i) follow-up, and (j) main findings. Where data were available, effect sizes (mean change in the variable of interest between two

assessment times/standard deviation of the first data set) were calculated for each study. Effect sizes were classified according to Cohen (1988) as either small ( $d = 0.20$ ), medium ( $d = 0.50$ ), or large ( $d \geq 0.80$ ). Study characteristics and results are presented in Table 1.

A meta-analysis of results was not conducted due to the heterogeneity between the included studies: the content and methods used in delivering interventions differed markedly between studies. Furthermore, no single outcome was common to all studies. For this reason, study findings and results of risk of bias of the eight studies were presented in a narrative synthesis.

### Risk of Bias

The purpose of assessing risk of bias is to evaluate the internal validity of included studies, which is an important step in determining whether to pool results. Ideally, only the data of studies with high internal validity should be pooled. Otherwise, meta-analyses could lead to drawing falsely positive conclusions (Higgins et al, 2011).

To verify the internal validity of randomized controlled trials, we assessed the following components: (a) sequence generation, (b) allocation concealment, (c) blinding, (d) incomplete outcome data, and (e) selective outcome reporting. Components were evaluated as being either of “low,” “high,” or “unclear” risk of bias and were judged based on what was reported in the article. When the components assessed were described sufficiently to allow appropriate evaluation, we marked “yes.” When such components were mentioned but not described, an evaluation of “unclear” risk of bias was given. Finally, when components were not mentioned or not assessed, we marked “no,” which indicates a high risk of bias. No study was excluded based on the results of risk of bias assessment. Table 2 presents the results of risk of bias.

## RESULTS

### Study Characteristics

All of the included studies were published in English between 1992 and 2014. The number of participants varied from 20 to 178 for a total of 488. In terms of age range, the youngest participant was 50 and the oldest was 94. Most studies had an equal balance of men and women participating. One study did not report on the gender of participants (Kricos et al, 1992). Two studies included significant others, but neither evaluated their participation (Jennings, 2005; Hickson et al, 2007). Duration and intensity of intervention varied across and within studies: the shortest intervention was administered over a 4-week period and the longest over a 10-week period. The total number of hours of intervention ranged from 4 to 20 hr.

### Effects of Interventions

In our examination of the generic and disease-specific evaluation tools used in the included studies, we discovered that the majority measured several outcomes which were often related to different components. For example, a single evaluation tool could examine outcomes related to body functions, participation restrictions, and activity limitations. Furthermore, due to the tool’s design, a numerical result would be given which was not component specific, but rather the sum of all the evaluated components. Aligning results according to a category of outcome or a component was therefore not feasible.

Similarly, we were not able to separate and classify interventions according to their content and methods used, that is, auditory training, speech-reading training, communication strategies training, or counseling/psychosocial exercises, because the majority of studies mixed several intervention types together. Each study was unique. To simplify the presentation of results and to facilitate comparisons between similar studies, we decided to present results according to the different modes of delivery: group interventions, self-administered home training programs, or individual communication training. The rationale for doing so is based on the fact that for many clinicians, deciding what to offer will depend on patient preference and on what is possible in their respective clinical settings or health-care systems. Table 3 provides a summary of the effects of intervention by mode of delivery.

### Group Interventions

Two studies, Andersson et al (1994) and Andersson et al (1995a,b), evaluated a behavioral counseling approach. In Andersson et al (1994), interventions were tailored to each participant according to the results of functional analyses and counseling, therefore, was individualized. Treatment took place either in a small group, individually, or in a combination of both. Participants with hearing aids were randomly assigned to either the treatment or control group. Treatment included learning and practicing hearing tactics and coping strategies, individualized behavioral counseling, identification of individual problem areas, and completing homework during the week. The results of the Life Orientation Test (LOT), which measures optimism, an outcome related to body functions, did not show a treatment effect (treatment group: change score = 0.1, effect size = 0.02; control group: change score = -2.1, effect size = -0.46).

In a subsequent study, Andersson et al (1995a,b) evaluated a similar behavioral treatment approach that included information, applied relaxation, coping with loud noises, goal setting, video self-modeling, role-play using hearing tactics and repair strategies, cognitive skills, and motivation needed to engage in

**Table 1. Study Characteristics**

Study	Number of Participants	Age	Group/Individual	Intervention	Duration	Evaluation Tools	Outcomes	Follow-up	Results
Andersson et al (1994)	20 HA owners	64-72	Group, individual, or both. Varied for each participant	Tx group: behavioral counseling Control group	4 hr over 4-week period	LOT	Optimism	15 mo	Effect of intervention? No for LOT
Andersson et al (1995a,b)	24 HA owners	64-72	Group/individualized tx	Four groups: behavioral group tx Control group	8 hr over 4-week period	HCA	Hearing disability and handicap	2 yr (Andersson et al, 1995b)	Effect of intervention? No for HCA
Ferguson et al (2014)	44 No HAs	50-74	Individual	Immediate training Delayed training	6 hr over 4-week period	GHABP	Hearing disability and handicap	4 weeks	Effect of intervention? "Yes" (1/4 questions from GHABP), effect size: data not available
Hickson et al (2007)	178 (and some Soss) About half are HA owners	53-94	Group	Tx group: ACE (interactive education program) Control group: placebo social program + ACE (afterward)	10 hr over 5-week period 20 hr over 10-week period	HHQ QDS SAC Ryff SF-36	Hearing participation restrictions Communication activity limitations Well-being Health-related quality of life	6 mo	Effect of intervention? No for HHQ, QDS, SAC, Ryff, SF-36
Jennings (2005)	68 (and some Soss) HA owners with variable use	59-94	Group	Tx group 1: standard AR Tx group 2: perceived self-efficacy AR Control group	6-9 hr over 6-week period 12-15 hr over 6-week period	HHIE SESMQ	Self-perceived hearing handicap Perceived self-efficacy in various listening situations	5-7 mo	Effect of intervention? No for HHIE Effect of intervention? No for SESMQ
Kricos et al (1992)	26 HA users	61-83	Individual	Experimental group: communication training program Control group	8 hr over 4-week period	HHIE	Self-perceived hearing handicap	None	Effect of intervention? No

**Table 1. Continued**

Study	Number of Participants	Age	Group/Individual	Intervention	Duration	Evaluation Tools		Outcomes	Follow-up	Results
						Duration	Tools			
Kricos and Holmes (1996)	78	52-85	Individual	Analytic auditory training	8 hr over 4-week period	HHIE	HHIE	Self-perceived hearing handicap	None	Effect of intervention? No for HHIE
Preminger and Ziegler (2008)	50	55-75	Group	Active listening training	5-6 hr over 6-week period	HHIE	HHIE	Psychosocial status	6 mo	Effect of intervention? No for HHIE and WHODAS II
				Control group				Self-perceived hearing handicap		
				A-only + AV training + psychosocial				Disability and level of difficulty encountered when carrying out specific activities		

Note: A-only + AV = auditory-only and audio-visual; AR = aural rehabilitation; HA = hearing aid; HHDI = Hearing Handicap and Disability Inventory; HQ = hearing questions; Sos = significant others; tx = treatment.

**Table 2. Risk of Bias**

Study	Sequence Generation	Allocation Concealment	Participants Blinded	Initial		Incomplete		Selective Outcome Reporting
				Assessors Blinded	Assessors Blinded	Outcome Data	Outcome Data	
Andersson et al (1994)	Unclear	No	No	Unclear	Unclear	Yes	Unclear	Unclear
Andersson et al (1995a,b)	Unclear	No	No	Unclear	Yes	No	Unclear	Unclear
Ferguson et al (2014)	Yes	No	No	No	No	Yes	Yes	Yes
Hickson et al (2007)	Unclear	No	Yes	Yes	Yes	Yes	Unclear	Unclear
Jennings (2005)	Unclear	No	No	No	No	Yes	Unclear	Unclear
Kricos et al (1992)	Unclear	No	No	No	No	Yes	Unclear	Unclear
Kricos and Holmes (1996)	Unclear	No	No	Unclear	Unclear	Yes	Unclear	Unclear
Preminger and Ziegler (2008)	Unclear	No	No	No	No	Yes	Unclear	Unclear

Note: No = high risk of bias; unclear = unclear or unknown risk of bias; yes = low risk of bias.



activities. The Hearing Coping Assessment (HCA), which evaluates emotional reactions, attitudes, activity limitations, and participation restrictions, did not indicate a treatment effect. The total score reflects how well a person can cope with their hearing loss.

Hickson et al (2007) assessed the Active Communication Education (ACE) program. Participants decide which hearing-loss-related issues they wish to address and are encouraged to develop problem-solving skills. The ACE group was compared to a control group receiving a placebo social program. Several self-administered questionnaires were used: the Hearing Handicap Questionnaire (HHQ), the Quantified Denver Scale (QDS), the Self-Assessment of Communication (SAC), the Ryff Psychological Well-Being Scale, and Short Form-36 (SF-36). Significant improvements were measured for both treatment groups: results of the QDS, which evaluates participation restrictions and attitudes of family members, and the Mental Component of the SF-36, which evaluates general mental health and emotional and social functioning, improved for participants of the placebo social program. Results of the HHQ, which measures emotional distress and discomfort, social withdrawal, and participation restrictions, the QDS, the SAC, which measures communication activity limitations, and the Ryff, which measures general well-being, improved for participants in the ACE group. Although both groups improved postintervention, between-group comparisons of change were not significant on any of the outcome measures (effect size range = 0.09–0.36).

Jennings (2005) compared two treatment groups and a control group. Both the standard aural rehabilitation group and the perceived self-efficacy aural rehabilitation group received information regarding the effects of hearing loss on communication, orientation to successful hearing aid use, improving communication, assistive devices, and using effective communication strategies. The difference between the two treatment groups was that discussions or group interactions were not encouraged by group facilitators in the standard aural rehabilitation group, whereas the participants in the perceived self-efficacy group were encouraged to partake in discussions and interact with each other. The Self-Efficacy for Situational Communication Management Questionnaire (SESMQ), which evaluates a person’s belief regarding their hearing and problem-solving ability in various listening situations, did not measure an intervention effect. The Hearing Handicap Inventory for the Elderly (HHIE), which evaluates the effects of hearing loss on emotional response and on social/situational participation, also did not result in an intervention effect. The data reported in this thesis did not allow for the calculation of effect sizes.

Preminger and Ziegler (2008) compared two treatment groups, (a) auditory-only and auditory-visual training, (b) auditory-only and auditory-visual plus psychosocial exercise training, and (c) a control group. Speech perception training was conducted in noise and consisted of analytic material, syllable drills, and synthetic exercises of sentence and paragraph length.

**Table 3. Effects of Intervention**

Study	Group Interventions	Self-Administered Home	
		Training Program	Individual Communication Training
Andersson et al (1994)	Effect of intervention: No (LOT)		
Andersson et al (1995a,b)	Effect of intervention: No (HCA)		
Jennings (2005)	Effect of intervention: No (SESMQ, HHIE)		
Hickson et al (2007)	Effect of intervention: No (HHQ, QDS, SAC, Ryff, SF-36)		
Preminger and Ziegler (2008)	Effect of intervention: No (HHIE, WHODAS II)		
Ferguson et al (2014)		Effect of intervention: No (SSQ); “Yes” (for 1/4 questions of the GHABP); effect size: data unavailable	
Kricos et al (1992)			Effect of intervention: No (HHIE)
Kricos and Holmes (1996)			Effect of intervention: No (HHIE); “Yes” (7/25 subscales of CPHI); effect size: small to medium
Summary	Effects found in zero of five studies	Effects found in one of one study	Effects found in one of two studies

The psychosocial exercises focused on discussing problems, feelings, attitudes, and emotions associated with hearing loss, as well as the impact of hearing loss on personal and professional relationships. The results of the 6-week training period indicated that all three groups showed a reduction in hearing handicap ( $p = 0.001$ ) as measured by the HHIE; the effect was maintained at the 6-mo follow-up measure. No time  $\times$  group interaction was found, indicating that the reduction in activity limitations and participation restrictions could not be attributed to the intervention. There was also no improvement for any of the groups as measured by the World Health Organization Disability Assessment Schedule II (WHODAS II), a generic evaluation tool of quality of life. Only four subscales of the WHODAS II were used: Understanding and Communicating, Getting Along with People, Life Activities (related to household tasks/work/school), and Participation in Society.

### ***Self-Administered Home Training Program***

Ferguson et al (2014) assessed phoneme discrimination training based on “Phonomena” (Moore et al, 2005), in a home-delivered computer game format. An immediate training group and a delayed training group were compared. Participants completed two questionnaires: the Glasgow Hearing Aid Benefit Profile (GHABP) and the Speech, Spatial and Qualities of Hearing (SSQ). Although there was a significant improvement ( $p = 0.03$ ) in both the GHABP, which assesses hearing disability and handicap using four predefined situations (Disability subscale: change score = 6.7%, effect size = 0.45,  $p = 0.004$ ; Handicap subscale: change score = 7%, effect size = 0.37,  $p = 0.03$ ), and the SSQ, which evaluates a person’s ability to participate in different listening situations, there was neither a between-group difference nor an interaction that might suggest a treatment effect. In a second analysis of the four individual GHABP Disability situations, the authors found a between-group effect ( $p = 0.03$ ) for the “having a group conversation” situation only, which is a measure of participation.

### ***Individual Communication Training***

Kricos et al (1992) compared a control group to a group of hearing aid users who participated in an individual communication training program. The content of the treatment group consisted of information presentations, listening activities (in quiet and noise), coping strategies, confidence building through the development of good listening habits, and conversational strategies. At the end of the 4-week program, results indicated a decrease in self-perception of hearing handicap (communication training group: change

score =  $-11.8\%$ , control group: change score =  $-8\%$ ;  $p < 0.05$ ) as measured by the HHIE, which was statistically similar in magnitude for both groups. In ICF terms, results of the HHIE relate to participation restrictions/activity limitations and to body functions (emotional functions). The data presented did not allow for the calculation of effect sizes.

In a subsequent study by Kricos and Holmes (1996), two treatment groups of hearing aid users received either analytic auditory training, consisting of structured syllable drills aimed at improving recognition of individual consonants and vowels, or active listening training, which emphasized comprehension of the general meaning of spoken messages. These two treatment groups were compared with a control group. The results showed no significant change at the end of the 4-week intervention and no treatment effect in terms of self-perceived hearing handicap as measured with the HHIE (analytic auditory training: change score = 7.6%, effect size =  $-0.29$ ; active listening training: change score = 7%, effect size =  $-0.38$ ; control: change score = 7%, effect size =  $-0.28$ ). However, a treatment effect was observed in the psychosocial status of participants who completed the active listening training, as measured by the Communication Profile for the Hearing Impaired (CPHI). The CPHI explores several areas related to hearing loss: communication effectiveness in a variety of situations, awareness of communication difficulties, physical and personal aspects (attitudes and behaviors of others), effective and ineffective communication strategies used, and acceptance and adjustment to hearing loss. The increase in the active listening group’s posttraining score relative to the control group was statistically significant ( $p = 0.037$ – $0.0001$ ) for 7 of the 25 subscales. Significant results from the Attitude of others subscale (reported estimated effect = 0.44) and the Behaviors of others subscale (reported estimated effect = 0.40) pertain to environmental factors. Significant results from the Verbal strategies subscale (reported estimated effect = 0.49), the Nonverbal strategies subscale (reported estimated effect = 0.57), and the Withdrawal subscale (reported estimated effect = 0.49) relate to activity and participation, whereas the Problem awareness subscale (reported estimated effect = 0.44) and the Acceptance of loss subscale (reported estimated effect = 0.44) pertain to body functions (mental functions).

In sum, no effects of intervention were found for any of the group training programs. Although an effect of intervention was found for the self-administered home training program, the effect size was unavailable. Small-to-medium effect sizes were found in one of two individual communication training programs. These effects were detected by two disease-specific evaluation tools, namely the CPHI and the GHABP. Although some of the generic evaluation tools such as the Ryff and the

SF-36 both measured improvements, between-group comparisons of change were not significant.

### Risk of Bias and Heterogeneity

Sequence generation and allocation concealment are hallmarks of the randomized controlled trial (Schulz and Grimes, 2002). Ideally, authors should describe which random component, for example, the use of a computer random number generator or the drawing of lots, was used in the sequence generation process. Although all the included studies indicate having randomly assigned participants to a group, only Ferguson et al (2014) clearly stated which random component was used: method of minimization. Allocation concealment was not described in the included studies; none of the authors explained what means were taken to prevent participants and investigators from foreseeing assignment.

Although blinding of participants to group membership may seem difficult to achieve, Hickson et al (2007) demonstrated that it is possible. None of the participants in the other studies were blinded. In six of eight studies, blinding of initial and outcome assessors was either unclear or not mentioned. In Andersson et al (1995a, b), outcome assessors conducting telephone interviews were blinded to group membership. Initial and outcome assessors were blinded in Hickson et al (2007).

Several of the included studies reported attrition, but in most cases, this was not to an extent that would compromise the study. Andersson et al (1995a,b) did find, however, that both experimental and control groups were significantly different when four participants did not take part in the follow-up measure 2 yr later. With the exception of Kricos et al (1992) and Kricos and Holmes (1996), which had no follow-up measure, studies had a follow-up measure that varied from 4 weeks to 2 yr.

With the exception of Ferguson et al (2014), which reported their study according to the Consolidated Standards of Reporting Trials statement, none of the studies provided sufficient information regarding selective outcome reporting (Higgins et al, 2011). In such cases, we made a judgment of “unclear.” Ideally, studies should state that a study protocol was available and that all prespecified outcomes had been reported.

The results of the component-based risk of bias assessment indicated that the quality of reporting was poor, in that most of the studies (six of eight) only addressed one of the five individual components used in assessing a study’s potential risk of bias. Only two studies (Hickson et al, 2007; Ferguson et al, 2014) clearly reported on two individual components. As a result, we cannot rule out a biasing influence on reported estimates of intervention effectiveness (Liberati et al, 2009), thus undermining the robustness of results in the included studies.

## DISCUSSION

The purpose of this systematic review was to examine the effects of aural rehabilitation on quality of life in an older adult population presenting with hearing loss.

Of the two studies reporting treatment effects, results were detected by disease-specific evaluation tools. In the first case, results were based on a few subscales, which evaluated body functions, activities and participation, and environmental factors. In the second case, a result was drawn from a single question pertaining to participation. Unfortunately, no single outcome emerges from the results. In addition, several authors discussed the possible lack of sensitivity in the evaluation tools used: although participants had reported greater well-being as a result of participating in their respective studies, these improvements were not detected by the various evaluation tools used (Kricos et al, 1992; Andersson et al, 1995a,b; Jennings, 2005). For these reasons, there are no overarching trends which may be discerned from the evidence. The clinical applicability of these results to an older adult population with hearing loss is, therefore, very limited.

The included studies proved to be clinically and methodologically heterogeneous: the content and methods used in delivering interventions varied greatly between studies. Overall, the results of the component-based risk of bias assessment indicated that the reporting of validity markers in the included studies was incomplete. In addition, most studies did not correct for multiple post hoc comparisons. We, therefore, could not rule out biasing influences on reported estimates of intervention effectiveness.

By following PRISMA guidelines and carefully detailing each stage in the Methods section, we aimed to conduct a rigorous systematic review to safeguard against potential reporting biases. Notwithstanding these measures, limitations are present at the review level: we did not register our review protocol; our evaluation of the included studies could have been more rigorously pursued by considering aspects such as power calculation and ecological validity. Despite our attempts to contact authors for missing information, 2 of the 12 we had communicated with did not respond, and we, therefore, did not include their studies in our review. As a result, we cannot exclude the possibility of publication bias.

### Recommendations for Further Research

The findings of our systematic review reveal a need for more rigorous research to guide clinical decision-making in the field of aural rehabilitation: using a randomized controlled trial study design with clear descriptions of the sequence generation process and allocation concealment procedures as well as ensuring blinding of participants and assessors. Hawkins (2005), Sweetow and Palmer (2005), and Henshaw and Ferguson

(2013) also came to this conclusion in their respective systematic reviews. Furthermore, a concerted effort to establish common outcome measures and comparable interventions regarding content and methods used would facilitate future systematic reviews. As to the duration of interventions, the majority of included studies lasted, on average, 4–6 weeks. In such cases, it may be argued, that the duration of treatment is not long enough for any measurable change to occur (Kricos et al, 1992); the insidious nature of hearing loss and its often detrimental effect on an individual's relationships, social participation, and mental health make for what may often be a long process of adjustment and acceptance. It may, therefore, be worthwhile to investigate the effects of offering intervention over a longer period, for example two to three blocks of 6 weeks over the period of a year. Most of the included studies relied solely on data drawn from self-report questionnaires. Although relatively quick to complete and inexpensive, self-report questionnaires are prey to recall and social desirability bias. They have also been found to overestimate adherence in participants. According to Kiessling et al (2003), the effectiveness of audiological rehabilitation would be better demonstrated with the development of robust behavioral or functional measures. Data drawn from both self-report questionnaires and functional measures would, therefore, be ideal.

## CONCLUSIONS

Our examination of the effects of aural rehabilitation on quality of life of older adults presenting with hearing loss is inconclusive. Our findings demonstrate that the clinical applicability of results to this population is limited. For this reason, we are not able to draw any evidence-based conclusions for clinicians working with hearing-impaired older adults.

**Acknowledgments.** The authors acknowledge the financial support provided by the CIUSSS-IRDPQ and the document support given by Ann Murchison and Chantal Dufour at the Centre intégré de gestion de l'information (CIGI). They also acknowledge the contribution of the following persons who commented on previous versions of their article: Alice Bennett, Mélanie Couture, Jean-Sébastien Roy, Ph.D., Francis Tousignant, and Donna Yavorska, Ph.D. The authors additionally acknowledge their colleague, Marc Perron, for his help and support with the revision of this article.

## REFERENCES

- Andersson G, Melin L, Scott B, Lindberg P. (1994) Behavioral counselling for subjects with acquired hearing loss. A new approach to hearing tactics. *Scand Audiol* 23(4):249–256.
- Andersson G, Melin L, Scott B, Lindberg P. (1995a) An evaluation of a behavioural treatment approach to hearing impairment. *Behav Res Ther* 33(3):283–292.
- Andersson G, Melin L, Scott B, Lindberg P. (1995b) A two-year follow-up examination of a behavioural treatment approach to hearing tactics. *Br J Audiol* 29(6):347–354.
- Boothroyd A. (2007) Adult aural rehabilitation: what is it and does it work? *Trends Amplif* 11(2):63–71.
- Chisolm T, Arnold M. (2012) Evidence about the effectiveness of aural rehabilitation programs for adults. In: Wong L, Hickson L, eds. *Evidence-Based Practice in Audiology: Evaluating Interventions for Children and Adults with Hearing Impairment*. San Diego, CA: Plural Publishing, 237–266.
- Chisolm TH, Johnson CE, Danhauer JL, Portz LJ, Abrams HB, Lesner S, McCarthy PA, Newman CW. (2007) A systematic review of health-related quality of life and hearing aids: final report of the American Academy of Audiology Task Force on the Health-Related Quality of Life Benefits of Amplification in Adults. *J Am Acad Audiol* 18(2):151–183.
- Cohen J. (1988) *Statistical Power Analysis for the Behavioral Sciences*. 2nd ed. Mahwah, NJ: Erlbaum.
- Duthey B. (2013) World Health Organization: priority diseases and reasons for inclusion. Background Paper 6.21: Hearing Loss. [http://www.who.int/medicines/areas/priority\\_medicines/BP6\\_21Hearing.pdf](http://www.who.int/medicines/areas/priority_medicines/BP6_21Hearing.pdf). Accessed February 9, 2016.
- Ferguson MA, Henshaw H, Clark DPA, Moore DR. (2014) Benefits of phoneme discrimination training in a randomized controlled trial of 50- to 74-year-olds with mild hearing loss. *Ear Hear* 35(4): e110–e121.
- Gifford RH, Revit LJ. (2010) Speech perception for adult cochlear implant recipients in a realistic background noise: effectiveness of preprocessing strategies and external options for improving speech recognition in noise. *J Am Acad Audiol* 21(7):441–451, quiz 487–488.
- Hawkins DB. (2005) Effectiveness of counseling-based adult group aural rehabilitation programs: a systematic review of the evidence. *J Am Acad Audiol* 16(7):485–493.
- Henshaw H, Ferguson MA. (2013) Efficacy of individual computer-based auditory training for people with hearing loss: a systematic review of the evidence. *PLoS One* 8(5):e62836.
- Hickson L, Worrall L, Scarinci N. (2007) A randomized controlled trial evaluating the active communication education program for older people with hearing impairment. *Ear Hear* 28(2):212–230.
- Higgins JPT, Altman DG, Sterne JAC, eds. (2011) Chapter 8: Assessing risk of bias in included studies. In: Higgins JPT, Green S, eds. *Cochrane Handbook for Systematic Reviews of Interventions*. Version 5.1.0 (updated March 2011). [www.cochrane-handbook.org](http://www.cochrane-handbook.org). Accessed May 2014.
- Jennings MB. (2005) Factors that influence outcomes from aural rehabilitation of older adults: the role of perceived self-efficacy. Doctoral dissertation. London, Canada: University of Western Ontario.
- Kiessling J, Pichora-Fuller MK, Gatehouse S, Stephens D, Arlinger S, Chisolm T, Davis AC, Erber NP, Hickson L, Holmes A, Rosenhall U, von Wedel H. (2003) Candidature for and delivery of audiological services: special needs of older people. *Int J Audiol* 42:2S92–2S101.
- Knutson JF, Lansing CR. (1990) The relationship between communication problems and psychological difficulties in persons with profound acquired hearing loss. *J Speech Hear Disord* 55:656–664. <http://jshd.pubs.asha.org/article.aspx?articleid=1775642> doi:10.1044/jshd.5504.656

- Kricos PB, Holmes AE, Doyle DA. (1992) Efficacy of a communication training program for hearing-impaired elderly adults. *J Acad Rehabil Audiol* 25:69–80.
- Kricos PB, Holmes AE. (1996) Efficacy of audiologic rehabilitation for older adults. *J Am Acad Audiol* 7(4):219–229.
- Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JPA, Clarke M, Devereaux PJ, Kleijnen J, Moher D. (2009) The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLoS Med* 6(7):e1000100. <http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1000100>. Accessed May, 2014.
- McCarthy P, Schau N. (2008) Adult audiologic rehabilitation: a review of contemporary practices. *Contemp Issues Commun Sci Disord* 35:168–177.
- McDougall J, Wright V, Rosenbaum P. (2010) The ICF model of functioning and disability: incorporating quality of life and human development. *Dev Neurorehabil* 13(3):204–211.
- Monzani D, Galeazzi GM, Genovese E, Marrara A, Martini A. (2008) Psychological profile and social behaviour of working adults with mild or moderate hearing loss. *Acta Otorhinolaryngol Ital* 28(2):61–66. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2644978/pdf/0392-100X.28.061.pdf>. Accessed April 13, 2015.
- Moore DR, Rosenberg JF, Coleman JS. (2005) Discrimination training of phonemic contrasts enhances phonological processing in mainstream school children. *Brain Lang* 94(1):72–85.
- Preminger JE, Ziegler CH. (2008) Can auditory and visual speech perception be trained within a group setting? *Am J Audiol* 17(1):80–97.
- Schulz KF, Grimes DA. (2002) Generation of allocation sequences in randomised trials: chance, not choice. *Lancet* 359(9305):515–519.
- Sweetow R, Palmer CV. (2005) Efficacy of individual auditory training in adults: a systematic review of the evidence. *J Am Acad Audiol* 16(7):494–504.
- Weinstein BE, Ventry IM. (1982) Hearing impairment and social isolation in the elderly. *J Speech Hear Res* 25(4):593–599. <http://jslhr.pubs.asha.org/article.aspx?articleid=1777651>. Accessed April 13, 2015.
- World Health Organization (WHO). (1997) WHOQOL measuring quality of life. [http://www.who.int/mental\\_health/media/68.pdf](http://www.who.int/mental_health/media/68.pdf). Accessed July 5, 2016.
- World Health Organization (WHO). (2012) Prevention of blindness and deafness: estimates. <http://www.who.int/pbd/deafness/estimates/en/>. Accessed February 9, 2016.

## APPENDIX

### Example Search Terms

Example terms used to search the PsycInfo database.

((Index Terms: ("Rehabilitation")) AND (Age Group: ("Middle Age (40 to 64 yrs)") OR Age Group: ("Aged (65 yrs & older)")) AND ((Index Terms: ("Hearing Disorders") OR Index Terms: ("Partially Hearing Impaired")) AND (Age Group: ("Middle Age (40 to 64 yrs)") OR Age Group: ("Aged (65 yrs & older)"))))

Index Terms: {Rehabilitation} AND Age Group: Middle Age (40 to 64 yrs) OR Aged (65 yrs & older)

Index Terms: {Audiology} AND {Rehabilitation} AND Age Group: Middle Age (40 to 64 yrs) OR Aged (65 yrs & older)

Any Field: "AURAL REHABILITATION" OR "AURAL TRAINING" AND Age Group: Middle Age (40 to 64 yrs) OR Aged (65 yrs & older)

Any Field: "AUDITORY REHABILITATION" OR "AUDITORY TRAINING" OR "AUDIOLOGIC\* REHABILITATION" OR "AUDIOLOGIC\* TRAINING" AND Age Group: Middle Age (40 to 64 yrs) OR Aged (65 yrs & older)

Index Terms: {Hearing Disorders} OR {Partially Hearing Impaired} AND Age Group: Middle Age (40 to 64 yrs) OR Aged (65 yrs & older)