

# Systematic review of barriers and facilitators to hearing aid uptake in older adults

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## Introduction

A key element to success in the implementation of any screening for a health condition is that an effective treatment is available, accessible, and complied with. As the main treatment for adult-onset hearing loss is hearing aids, but only about 25% of those who could benefit from hearing aids actually use them (e.g., Kochkin, 2000; Meister, *et al.*, 2008), it is necessary to identify the factors that affect compliance with this treatment recommendation.

Several investigators have explored the barriers that may prevent those with hearing loss from choosing to purchase and use hearing aids to assist with their communication needs (e.g., Meister, *et al.*, 2008). Among some of the barriers to hearing aid use are stigmatization, underestimation of hearing loss by the individual, coping strategies, personality factors, low trust in hearing aid benefit, cognitive and functional restrictions, cost, false expectations (Meister, *et al.*, 2008), and communication styles (Helvik, *et al.*, 2008).

The goal of this study was to conduct a systematic review of the literature to identify the main barriers and facilitators to hearing aid (HA) uptake in healthy elderly (age 65+) non-users of hearing aids who have hearing loss (i.e., have been diagnosed as having hearing loss and had hearing aids recommended, but did not purchase aids).

## Methods

After an initial scoping of the literature, the specific search was

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planned, looking for research articles with the following characteristics. The research could focus on any potential barrier or facilitator, with a broad definition of these terms. Studies were not limited by type of data collection: for example, both self-report and objective data were considered. Only studies whose sample size exceeded 50 were included. Study sample characteristics were mainly adults over the age of 65 who had never used hearing aids, with participants having at least a mild to moderate sensorineural hearing loss but otherwise being relatively healthy.

## Search and retrieval process

The databases searched were CINAHL, PubMed, PsycINFO, Medline – OVID, and Google Scholar using the following keywords in many possible combinations: hearing aids, rejection, personality, cost, financial, barriers, expectation, reasons, reluctance, accessibility, amplification, older adults, elderly, utilization, willingness, hearing impairment. The publication date range was limited to January 1990 to May 2010. Reference lists of all relevant articles identified were checked for other possible studies.

## Results

The search process identified 388 abstracts. After reviewing all of the studies, 374 articles either did not meet the inclusion criterion or they were not relevant to this systematic review. Step 1 of culling articles involved removing duplicates (i.e., the same article identified from multiple databases). In Step 2, based on title alone, we removed articles that were primarily about children, cochlear implants, or medical aspects of hearing loss. Next, again from title, we removed articles about hearing aid processing or about auditory processing. In Step 4, we used the abstract to remove any articles that were primarily about hearing aid outcomes. This left 50 full articles to be reviewed in entirety to determine whether each one met the specific inclusion criteria for this review, out of which 14 articles were retained. The main characteristics of the studies are given in Table 1.

From the table, it can be seen that all studies had older adults for participants; some of the studies focused solely on older adults, while others included a broad age range. Degree of hearing loss was defined differently in each of the studies, with details not provided in two articles. Across studies, the sampled degree of hearing loss ranged from mild to severe.

## Outcome measures

The definition of *hearing aid outcome* was generally whether or not a hearing aid was purchased, but sometimes measured as the participant's willingness to purchase. The other relevant measures generally depended upon the specific research question, and included measures such as self-reported hearing loss, personality, general health and well-being, use of communication strategies, dexterity, hearing aid

Table 1. Key characteristics of included articles.

	Degree of loss	Age	N	Research question	Sign rating	Relevant measures	Significant predictors
Chang <i>et al.</i> 2009	PTA .5, 1, 2, 4 kHz Range: better than 25 dB HL – 80+ dB HL.	65-80+	1220	Relationship between objective HI and self-perceived HI	3	HHIE  Self-report health status HA outcome: Use of HA, or whether they thought they needed HA (reported as % of respondents who reported having or requiring a HA)	<i>Degree of loss</i> PTA < 41 dB HL: 1.2% PTA ≥ 41 dB HL: 13.8% <i>Self-perceived HL</i> HHIE < 10: 2.7% HHIE ≥ 10: 39.0% <i>Self-perceived HL greater predictor than degree of loss:</i> PTA ≥ 41 dB HL & HHIE < 10: 5% PTA ≥ 41 dB HL & HHIE ≥ 10: 45.4%
Chao & Chen, 2008	Normal to severe based on 4 f PTA	50-79	96	Cost-benefit analysis of hearing aids	3	HA outcome: Probability of obtaining HA	Degree of loss Mild 50% Moderate 48% Severe 67%
Cox <i>et al.</i> 2005	Mild to moderate-severe, symmetrical, SNHL	41-95	230	Do personalities of HA seekers differ from general public?	3	NEO five factor inventory (NEO-FFI; Costa & McCrae, 1992) Locus of control (LOC; Levenson, 1981) Coping strategy indicator (CSI; Amirkhan, 1990) HA outcome: All participants were “seekers of hearing aids”. Group data were compared to normative data of general population	<i>Personality traits:</i> HA seekers = lower neuroticism F(1,1228) = 8.8, P=0.003 HA seekers = lower openness F(1,1228) = 51.1, P<0.001 HA seekers = higher agreeableness F(1,1077) = 5.86, P=0.016 <i>Locus of control:</i> HA seekers = higher internal control F(1,330) = 16.46, P<0.001 <i>Coping strategies:</i> HA seekers = lower problem solving F(1,327) = 5.9, P=0.015 HA seekers = lower social support F(1,327) = 23.3, p=0.001 HA seekers = lower avoidance F(1,327) = 4.29, P=0.039
Franks & Beckmann 1985	PTA (500, 1000, 2000 Hz) 30 dB HL or greater in the better ear.	65+	100	Reasons for reluctance to use HAs	3	HA outcome: Participants were in groups: never-worn, users and non-users of hearing aids Data show percent of participants who agree with a statement as a reason for not getting HA	Of the top survey items reported only the following were significantly different between those who got and those who did not get HAs: Inconvenient to wear (64% of non-users agree; 16% of users agree) Dealers use high pressure (42% of non-users agree; 24% of users agree)
Garstecki & Erler 1998	PTA (500, 1000, 2000, 4000 Hz) greater than 30 dB HL in the better ear.	65-90	131	Compared psychological, control tendencies hearing loss, and demographics variables among those who accepted or ignored advice to use hearing aids.	3	Communication profile for the Hearing Impaired (CHPI; Demorest & Erdman, 1987) The Hearing Aid Management Questionnaire (Garstecki, 1994) Rotter's Internal-External scale (Rotter, 1966) responsibility for control version (Klockers & Varnum, 1975) Minnesota Multiphasic Personality Inventory (MMPI-2) Depression Scale (Hathaway & McKinley, 1940) MMPI-2 Barron's Scale (Barron, 1953) HA outcome: accepted or ignored advice to HA. Male adherents (MA); male nonadherents (MN); female adherents (FA); female nonadherents (FN)	<i>Degree of loss:</i> FA had worse PTA than FN t(32) = 24.60, P<0.001 Mean thresholds between MA and MN differed at 2000 Hz t(24) = 5.02, P<0.0001 Mean word recog for FA poorer than FN t(32) = -3.30, P<0.01 <i>Stigma:</i> MN more concerned with public reaction than MA t(35) = -2.17, P<0.05 <i>Cost:</i> FA and MA less concerned with cost than FN and MN t(24) = -2.88, P<0.01 <i>Locus of control:</i> FN and MA less internally controlled than FA N: t(27) = -2.18, P<0.05) F MA: t(21) = -2.87, P<0.01)

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Table 1. Continued from previous page.

	Degree of loss	Age	N	Research question	Sign	Relevant measures	Significant predictors
							<p><i>Personality:</i>                      FN had lower ego strength than FA and MN FA: <math>t(32) = 2.16, P &lt; 0.05</math>                      MN: <math>t(32) = -2.56, P &lt; 0.01</math>  <i>Self-perceived hearing loss:</i>                      FA reported less difficulty than FN when communicating under avg conditions <math>t(32) = 2.43, P &lt; 0.05</math>                      FA reported greater likelihood than FN to use verbal strategies to facilitate communication <math>t(32) = 2.61, P &lt; 0.05</math>                      MN reported greater difficulty than MA admitting hearing loss to others <math>t(24) = 2.70, P &lt; 0.01</math>                      FN reported more stress associated with hearing loss than MN (i.e. feeling of tension) <math>t(24) = -2.37, P &lt; 0.05</math>  <i>Demographics:</i>                      FA and MA more satisfied with income level than FN and MN respectively                      Females: <math>t(31) = 2.77, P &lt; 0.01</math>                      Males: <math>t(24) = 2.68, P &lt; 0.05</math></p>
Helvik <i>et al.</i> 2008	Mean threshold (500, 1000, 2000, 4000 Hz) in better ear at = 34.6 dB.	30-94. mean	173	Whether or not use of coping strategies and life situations associated with the outcome of accepting or rejecting hearing aids.	3	Communication Strategies Scale (CSS; Demorest & Erdman, 1987) The Hearing Disability and Handicap Scale (HDHS; Hetu <i>et al.</i> 1994) The Psychological General Well-Being scale (PGWB; Dupuy, 1984) HA outcome: accepting or rejecting hearing aids	<p><i>Age:</i>                      Advanced age reduced odds for HA rejection (OR = 0.96; CI 0.93-0.99)  <i>Degree of loss</i>                      Hearing loss &gt; 25 dB in better ear reduced odds for HA rejection (OR = 0.17; CI 0.08 – 0.37)  <i>Communication strategies:</i>                      Low scores of maladaptive behaviours increased odds of HA rejection (OR = 2.43; CI 1.08-5.48)  <i>Self-perceived hearing loss:</i>                      High scores on activity limitation and participation restriction reduced odds for HA rejection activity limitation: (OR = 0.83; CI 0.76-0.91); participation restriction: (OR = 0.82; CI 0.74-0.92)</p>
Hidalgo <i>et al.</i> 2009	Presence/ absence of loss according to Ventry Weinstein criterion of 40 dB HL at 1&2 kHz in at least 1 ear	65+ mean 73.3	1162	Describe functional status of older adults with hearing loss	3	HHIE HA outcome: self-perceived need for HA. Odds ratio are the odds for reporting a self-perceived need for HA	<p>Age &gt; 75 yrs Odds ratio (OR) 3.2                      Dependence re: activities of daily living OR 2.7                      Cognitive impairment OR 2.0                      More than 3 health problems OR 1.8                      Male OR 1.6                      Single or widowed OR 1.5</p>
Humes <i>et al.</i> 2003	Mild sloping to mod-severe	Mean 73-76 yrs	76	Investigated potential factors influencing HA candidate's decision-making regarding amplification.	3	Auditory processing CPHI (Demorest & Erdman, 1987) Hearing Aid Expectation Questionnaire (Bentler, 1993) HHIE ; (Ventry & Weinstein, 1982) Health Locus of Control (HLC - Wallston <i>et al.</i> , 1976) Health Opinion Survey (HOS – Krantz <i>et al.</i> , 1980) Finger dexterity – 9 hole peg test (Mathiowetz <i>et al.</i> , 1985)	<p><i>Self-perceived hearing loss:</i>                      Non-adherents = lower HHIE vs HA accept                      Non-adherents = lower CPHI vs HA accept                      86.5% of the variance in outcome explained by degree of loss (thresholds at 1000 Hz), self-perceived hearing loss (CPHI – CP problem awareness, CPHI – PA- self acceptance) and AV</p>

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Table 1. Continued from previous page.

	Degree of loss	Age	N	Research question	Sign rating	Relevant measures	Significant predictors
						Speech reading – video version of CUNY sentences (Boothroyd <i>et al</i> , 1988) HA outcome: declined vs purchased hearing aids	
Kochkin 207	Relative degree of loss within the sample from 1-10	21-75+	2057 HA owners 2169 HA non-adopters	To quantify obstacles to hearing aid adoption.	3	Screening survey Gallaudet Scale (Schein <i>et al</i> , 1970) Unaided Abbreviated Profile of Hearing Aid Benefit (APHAB; Cox & Alexander, 1995) HA outcome: self-report of HA owner vs HA non-adopter. Data shown are percentages of times a reason was cited by a non-adopter for not accepting a hearing aid	Type of hearing loss (e.g., “nerve deafness”, loss too mild) 71% Financial (e.g., “can’t afford,” “not worth it”) 60% Minimization or lack of need (53%) Attitudes towards hearing aid (33%) Knowledge and experience (32%) Stigma (29%) Professional recommendations (27%) Social network recommendations (24%) Trust (13%)
Meister <i>et al.</i> 2008	Mild sloping to moderate-severe, symmetrical, sensori-neural hearing loss	Mean 68.6 yrs	100	Examined the relationship between different pre-fitting factors and the motivation to use hearing aids.	3	Expected Consequences of Hearing Aid Ownership (ECHO; Cox & Alexander, 2000) Hearing Attitudes in Rehabilitation Questionnaire (HARQ; Brooks & Hallam, 1998) Attitudes Towards Loss of Hearing Questionnaire (ALHQ; Saunders & Cienkowski, 1996) HA outcome: self-reported “willingness” and actual HA uptake	Expectation of improvement in quality of life (42% of variability in willingness explained) Stigma expectations (8% of variability explained) Self-rated hearing (7% of variability explained)
Palmer <i>et al.</i> 2009	PTA of 1,2,3,4 – all degrees of loss	18-95	840	Evaluation of a simple tool to predict readiness for amplification	3	Single question: on a scale from 1-10, how would you rate your overall hearing ability? HA outcome: HA purchase	OR: .47. I.e., as self-rating increased by 1 unit, the odds of purchasing a HA decreased by a factor of .47
Uchida <i>et al.</i> 2008 (abstract only)	PTA at 5, 1, 2, 4 of worse than 25 dB HL	40-84	1192 men 1163 women	Factors predicting HA use	3	HA outcome: HA possession	For men: age (possession decreased with age), PTA (increase?), education (?) Women: age (possession decreased with age), PTA in better ear (direction?), HL pointed out by others (direction?)
Wallhagen, 2010	Unknown	Mean age 73	91 dyads	Longitudinal, qualitative, interviews	3-4	Themes emerging from interviews HA outcome: not specified, but all participants were non-users at the beginning of the study	Main theme: Stigma
Yueh <i>et al.</i> 2010	Unspecified	50+ mean age 60.7	2305	Which of 3 screening strategies led to the most patients using Has?	1	Pure-tone HHIE Both Neither HA outcome: HA use at 1 yr data shown as percentage of group using HA as a function of screening type.	Control: 3.3% Pure-tone: 6.3% HHIE: 4.1% Both: 7.4%

expectations, or interviews. These, along with the definition of HA outcome, are all provided in the table. The final column of Table 1 lists the significant predictors of HA outcome for each study, along with any statistical results.

## Results and Discussion

### Level of evidence

The level of evidence of each study can be rated based on the Scottish Intercollegiate Guideline Network (SIGN) system (2007), which categorizes the highest to lowest level of evidence on a scale from 1 to 4 respectively. A study with a rating of 1 includes high quality meta-analysis or systematic review, or randomized control trials; 2 is quasi-experimental controlled trials that use nonrandomized, parallel group, or crossover designs; 3 is for well-designed non-experimental studies that may use pre-post test designs with adequate description; and 4 is patient testimonials or expert opinions (Chisolm, *et al.*, 2007). All of the relevant studies included in this review, except one, were non-experimental and based on self-report questionnaires, therefore the SIGN level of evidence is considered to be a 3 for all included studies except Yueh *et al* (2010) which is a randomized control trial (SIGN level 1).

### Predictors of HA uptake

Self-reported hearing loss, as reflected in hearing-related quality of life, activity limitation, and participation restriction factors, was significant in six studies (Chang, *et al.*, 2009; Garstecki & Erler, 1998; Helvik, *et al.*, 2008; Humes, *et al.*, 2003; Meister, *et al.*, 2008; Palmer, *et al.*, 2009). In general, as self-reported hearing loss increased, participants were more likely to obtain or be willing to obtain hearing aids.

Stigma was predictive of HA uptake in five studies (Franks & Beckmann, 1985; Garstecki & Erler, 1998; Kochkin, 2007; Meister, *et al.*, 2008; Wallhagen, 2010). However, stigma appears to be inconsistent in terms of its predictability power. For example, Franks and Beckmann (1985) reported stigma as the highest concern among those surveyed, but Meister and colleagues (2008) found that stigma only accounted for 8% of the variability. Garstecki and Erler (1998) showed that the stigma effect may be gender-dependent: it was of greatest concern to male nonadherents.

Degree of hearing loss was significant in five studies (Chang, *et al.*, 2009; Chao & Chen, 2008; Garstecki & Erler, 1998; Helvik, *et al.*, 2008; Humes, *et al.*, 2003). As degree of loss increased, participants were more likely to adhere to HA treatment. This effect may be modified by gender differences, as Garstecki and Erler (1998) found that better-ear four-frequency average threshold contributed most to accounting for the variability in adherence in the *female* group, but was not significant in the *male* group.

Personality or psychological factors were contributing factors in HA uptake in three studies (Cox, *et al.*, 2005; Garstecki & Erler, 1998; Helvik, *et al.*, 2008). According to Cox and colleagues (2005), individuals who seek hearing aids differ systematically in some personality characteristics when compared to the general population.

Other psychological variables that are predictive of HA uptake are locus of control (LOC) and coping strategies (Cox, *et al.*, 2005; Garstecki & Erler, 1998; Helvik, *et al.*, 2008). Cox and colleagues (2005) found that HA seekers have relatively strong internal control, but locus of control may be gender-specific, as found in Garstecki and Erler's study (1998): only females who accepted hearing aids had greater internal control than all other participants. Maladaptive coping strategies, such as dominating conversations or avoiding social interactions, interfere with effective communication. Helvik *et al* (2008) found that

individuals who report using fewer maladaptive behaviours were more likely to reject hearing aids, which may be due to an underlying denial of both hearing loss and the use of poor communication strategies.

Cost of hearing aids was reported as a barrier to use of amplification in two studies but it was not found to be a significant predictor in another study in which it was considered (Meister, *et al.*, 2008). One should take careful consideration when interpreting cost results. For example, Kochkin's survey (2007) showed that 64% of respondents reported they could not afford hearing aids, but 45% of respondents also indicated that they are not *worth* the expense.

Age was found to be a contradictory predictor of HA uptake in 3 studies: Helvik *et al* (2008) showed a slight increase in HA uptake with increasing age, Hidalgo *et al* (2009) showed a stronger increase in HA uptake with increasing age, but Uchida *et al* (2008) found that HA uptake decreased with age.

Gender was reported to be a modifying variable for several of the above factors: stigma, degree of loss, and locus of control. In addition, Hidalgo *et al* (2009) reported that the males in their study were more likely to report needing a HA than were the females.

## Conclusions

There are some emerging consistencies in the factors associated with HA uptake for older adults. Those that may be modifiable, possibly self-perceived loss and stigma, should be explored further to determine whether there are ways to work with these factors in individual clients to increase HA uptake. Other interesting areas for further studies are the possibility of using the hearing screening process to alter HA uptake (e.g. Yueh, *et al.*, 2010).

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