

# WORKING P A P E R

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## Quality Indicators for the Management of Hearing Loss in Vulnerable Elder Persons

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**QUALITY INDICATORS FOR THE MANAGEMENT OF HEARING LOSS IN  
VULNERABLE ELDER PERSONS**

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## **INTRODUCTION**

Hearing loss is one of the most prevalent chronic conditions among the elderly population, and its prevalence increases progressively with age. An estimated 30% to 60% of the population over the age of 65 experiences some degree of hearing impairment. (1) At least 13 million people in the United States, more than half over 65, suffer from a hearing loss. Thus, the prevalence of hearing impairment is increasing as the elderly population grows.

The impact of hearing loss on older adults is significant. Hearing loss is associated with depression, social isolation, poor self-esteem, and functional disability (2) particularly for older patients who are suffering from hearing impairment, but have not yet been evaluated or treated for hearing loss. Use of hearing aids or surgical intervention to improve hearing loss has a positive impact on quality of life, (3,4,5) while hearing impairment without intervention has a negative impact on quality of life. (6)

As the general population continues to age, the prevalence of hearing impairment will increase. Without early diagnosis and treatment of hearing impairment, quality of life and functional status are likely to decline in the aging population. However, screening programs for elderly patients can be established, followed by appropriate referral to audiologic specialists based on the individual's needs.

## **METHODS**

The methods for developing these quality indicators, including literature review and expert panel consideration, are detailed in a preceding paper.(7) For hearing impairment,

the structured literature review identified 1,595 titles, from which abstracts and articles were identified that were relevant to this report. Based on the literature and the authors' expertise, 11 potential quality indicators were proposed.

## **RESULTS**

Of the 11 potential quality indicators, 6 were judged valid by the expert panel. (Table 1), 1 was merged with an accepted indicator and 4 were not accepted. The evidence that supports each of the indicators judged to be valid by the expert panel are described below.

### **Quality Indicator #1**

#### **Screening For Hearing Loss**

**ALL** vulnerable elders should have a hearing screening examination as part of the initial evaluation **BECAUSE** hearing loss is prevalent in the elderly population, and its prevalence increases with age.

**Supporting evidence:** Hearing loss is the third most prevalent chronic condition in elderly people, after hypertension and arthritis (1), and its prevalence and severity increase with age.(1) Among those age 65 to 75, the prevalence of hearing loss ranges from 20 to 40%, (1,8,9,10,11), while among those over age 75, its prevalence ranges from 40% to 66%.(9,12,13) Up to 83% of elderly people are estimated to have some degree of hearing loss.(14) These wide ranges in prevalence may reflect differing measurement criteria to determine hearing loss, different measurement techniques to

determine hearing loss, and different elderly populations measured.(15,16) In addition, since no universal screening protocol exists for hearing loss in persons over age 65, the actual prevalence of hearing loss is difficult to determine, but it appears likely to be underestimated.(17,18)

Thus, although hearing impairment is highly prevalent in the elderly population, this condition is frequently overlooked.(19) Several large population study samples have evaluated both subjective and objective hearing loss using interview formats and audiometric testing.(20, 21, 22) Current estimates indicate that more than 11 million people over age 75 will experience some degree of hearing impairment.(23, 24) Several methods of screening for hearing loss are practical.

The Audioscope is one screening tool for detecting hearing impairment. This hand-held instrument functions as both an otoscope and an audiometer and can be used to visualize the ear canal and ear drum and remove cerumen if necessary. The Audioscope emits tones at 25 db and 40 db, at frequencies of 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz. The patient being tested responds by raising a hand or fingers when a tone is heard. (9). It can be utilized by a primary care physician or a nurse trained in otoscopic examination.

A review of 100 sources that evaluated screening for hearing loss among the elderly revealed that the best objective screening tool is the portable Audioscope (sensitivity ranges from 87 to 96%; specificity ranges from 70 to 90%).(25) A more recent study determined that the Audioscope has an overall sensitivity of 94% and an overall specificity of 72%.(26)

Frequency testing with an Audioscope may be limited to 1000 Hz and 2000 Hz, since a study of 117 elderly veterans demonstrated that these two frequencies have the highest correlation with formal audiologic testing, the “gold standard” of hearing assessment.

(13). At 1000 Hz, the sensitivity of the Audioscope is 98.5%, and its specificity is 24%; at 2000 Hz, its sensitivity is 97% and its specificity is 69%.(13)

The Hearing Handicap Inventory for the Elderly-Short version (HHIE-S) is a subjective screening tool with a high accuracy in identifying hearing loss (overall accuracy = 75%).(25,27) This ten-item, five-minute questionnaire assesses the emotional and social impacts of hearing loss on the patient. The patient responds “yes” (4 points), “no” (0 points), or “sometimes” (2 points) to each question. A total score of 0 to 8 indicates a 13 % probability of hearing impairment; a score of 10 to 24 indicates a 50% probability of impairment; and a score of 26 to 40 indicates an 84% probability of impairment. (28). The questions for the HHIE-S are reproduced in Table 2.

Although there is no direct evidence that screening leads to better health outcomes, hearing loss is prevalent and can be effectively screened for using an audioscope or the HHIE-S. As will be shown below, hearing impairment is associated with poorer health and hearing rehabilitation results in health improvements.

## **Quality Indicator #2**

### **Formal Audiologic Examination**

**IF** a vulnerable elder fails a hearing screening, **THEN** he or she should be offered a formal audiologic evaluation within 3 months **BECAUSE** this will determine the need

for further testing or medical/surgical management, including hearing aid, medical intervention, or surgical intervention.

**Supporting evidence:** While no direct evidence indicates that formal audiologic evaluation improves patient outcomes, this testing method is considered to be the “gold standard” for assessing the nature and severity of hearing loss. Formal audiologic evaluation consists of several components:

1. Pure tone audiometry
2. Speech reception threshold
3. Bone conduction testing
4. Evaluation of acoustic reflexes
5. Tympanometry

Audiometric evaluation provides necessary information regarding hearing aid candidacy. Data such as monaural vs. binaural hearing loss, degree of hearing loss, and frequencies at which hearing loss occurs give information as to whether or not an individual is a hearing aid candidate, and, if so, which type of hearing aid would best suit his or her needs.

A trained audiologist usually performs audiologic evaluation in a sound protected setting. The sound-protected setting allays concerns about ambient noise, which can interfere with determining the responder’s actual hearing acuity.(13) A more detailed description of each component of the evaluation is presented below.

*Pure tone audiometry* assesses threshold of response to tones from low frequency (500 Hz) to high frequency (8000 Hz). The audiometer is calibrated to ensure accuracy of the signal against standard reference levels established by the American National

Standards Institute (ANSI).(29) Hearing level is measured in “decibel hearing level” (db HL) based on ANSI standardization measures. The decibel scale is logarithmic, and it ranges from 0 db HL (normal hearing ) to 110 db HL (profound hearing loss). Hearing thresholds for all frequencies can be measured for each ear in the audiometry setting.(30)

The *speech reception threshold* (SRT) measures the lowest intensity level at which a patient can understand spondaic words (i.e., two-syllable words with equal emphasis on each syllable, such as baseball, cowboy, and pancake). Speech recognition tests measure speech intelligibility (in percent correct). These measurements, in turn, indicate whether the patient is a candidate for amplification. (30).

*Bone conduction testing, acoustic reflexes, and tympanometry* identify presence or absence of concomitant middle ear pathology, which may include otitis media, otosclerosis, middle ear tumors, or tympanic membrane perforation. Identification of these disorders may indicate the need for medical and/or surgical intervention prior to hearing aid evaluation. (30).

### **Quality Indicator #3**

#### **Ear Examination**

**IF** a vulnerable elder has a hearing problem or fails an audiologic screening, **THEN** he or she should have an ear examination within 3 months **BECAUSE** this will facilitate assessment of the nature of the hearing loss, identify contraindications to hearing aid candidacy, and determine the need for further medical or surgical management.

**Supporting evidence:** Although presbycusis (a bilateral, symmetric, high-frequency sensorineural hearing loss) is the most common pattern of hearing loss in the elderly



population, other conditions affect hearing and warrant an ear examination. While no direct evidence exists that an ear examination will improve health outcomes, without such an exam, several potentially treatable causes of hearing loss may be missed. These conditions include cerumen impaction, otosclerosis, otitis media, Meniere's disease, and tumors of the auricle, middle ear, and acoustic nerve.

Cerumen impaction (one of the most common causes of hearing loss in older persons), otitis media, tympanic membrane perforation, and middle ear tumors can all be diagnosed by otoscopy. Cerumen impaction may result in a hearing loss up to 40 decibel and can be found in up to 30% of elderly people with hearing loss.(31,32) Complete cerumen impaction that has obliterated visualization of the tympanic membrane may be treated easily by the primary care provider. (32).

Acoustic neuromas have an incidence of approximately 2.4% in the general population and often present after the fifth decade.(34) Symptom onset is usually insidious: acoustic neuroma most commonly presents with asymmetric sensorineural hearing loss, vertigo, and tinnitus.(35) In older patients, the audiogram may demonstrate bilateral sensorineural hearing loss, with one ear worse than the other. The affected ear may also have poor speech discrimination that is disproportionate to the decibel hearing loss. Ear examination of a patient with such an audiogram and the associated symptoms may lead to further evaluation to rule out the presence of an acoustic neuroma. A patient with an acoustic neuroma may have a normal otoscopic examination, despite an audiogram demonstrating an asymmetric hearing loss. This may lead to further diagnostic evaluation, including more sophisticated audiologic testing and radiologic

work-up. Surgical removal may be indicated in older patients, especially those with significant symptoms secondary to tumor enlargement.(36)

Vertigo (dizziness secondary to an abnormality in the vestibular, or balance, system) may be associated with multiple otologic problems. It may be the presenting symptom of sensorineural hearing loss, Meniere's disease, or an acoustic neuroma. Since the vestibular nerve and vestibular system are proximal to the acoustic nerve and inner ear structures, signs and symptoms of vertigo may occur in parallel to those of hearing loss.

#### **Quality Indicator #4**

##### **Referral to an audiologist**

**IF** a vulnerable elder is a hearing aid candidate, **THEN** he or she should be offered referral to an audiologist within 3 months after audiologic exam **BECAUSE** such a referral is a necessary component of hearing rehabilitation.

**Supporting evidence:** There is no direct evidence linking referral to an audiologist and improved health status among patients who use hearing aids. However, increased hearing aid utilization is associated with patient education about the use and maintenance of hearing aids, which an audiologist can provide. An audiologist can interpret results of an audiogram and help determine hearing aid candidacy. In addition, the type of hearing aid prescribed (in-the-canal, in-the-ear, or behind-the-ear) depends on several factors, including nature and severity of the hearing loss and exacerbating chronic conditions in the hearing aid user. An audiologist is able to take these and other conditions (such as manual dexterity, cognitive function, vision, and ambulatory status) into account when selecting an appropriate hearing aid.

Cross-sectional studies have documented that elderly people with known hearing loss have a relatively low incidence of hearing aid use, because either they do not obtain hearing aids or they underutilize their hearing aids.(37) Other studies have shown that rates of hearing aid use are not necessarily correlated with subjective hearing aid performance levels.(38-40)

Various studies have reported different effects of counseling on hearing aid use. Norman and colleagues found that proper hearing aid earmold fitting affected the success of hearing aid use, whereas counseling sessions offered no specific benefit.(41) However, Andersson and colleagues found substantial long term (>15 month) benefits from counseling sessions regarding hearing aid use and communication strategies. (42)

As patients age, hearing aid handling becomes increasingly difficult: they experience more problems with inserting the earmold into the ear, switching on and off the hearing aid, changing the battery, cleaning the earmold, and changing the volume. (43,44) Among a group of 138 hearing aid users over age 90, 33% to 79% experienced difficulty with any or all of these tasks. (45). However, age (or any other predetermined variable) may not accurately predict hearing aid candidacy. In another study of a group of 87 elderly male veterans, variables such as subjective functional handicap, age, education, and number of medications had no consistent correlation with success of hearing aid use. (46).

## **Quality Indicator #5**

### **Hearing Rehabilitation**

**IF** a vulnerable elder is a hearing aid candidate, **THEN** he or she should be offered hearing rehabilitation **BECAUSE** hearing rehabilitation will affect independent living and improve quality of life.

**Supporting evidence:** Hearing rehabilitation includes not only the utilization of hearing aids, but also education and follow-up regarding proper maintenance of hearing aids by trained audiologists. It also includes potential use of additional instruments such as assistive listening devices (*eg.*, television amplifiers and telephone amplifiers). Evidence from a clinical trial and observational studies show that hearing aid use and hearing rehabilitation (including assistive listening devices and work with an audiologist) can improve quality of life in older adults.

Quality-of-life, as measured by emotional and social function, communication, cognitive function, and decline in depression, has been shown to be improved in patients receiving hearing aids as compared to those who did not. (5) Hearing aid use could potentially stave off declines in functional status due to sensory impairment, according to indirect evidence.(6) Obtaining and using hearing aids has also been directly associated with improvement in quality of life.(3,4,47,48)

Conversely, global dysfunction, as measured by the Sickness Impact Profile (SIP), a 136-item questionnaire that assesses physical, psychosocial, and overall levels of global function, is increased with increased subjective hearing loss.(49,50)

A longitudinal analysis of quality of life and sensory impairment among 1192 elderly community-dwelling people (age 70 to 75) over a six-year follow-up period demonstrated an association between uncorrected sensory deprivation (hearing and/or visual impairment) and low quality of life.(51) However, no association was found between

corrected sensory impairment (i.e., use of hearing aids or eyeglasses) and low quality of life. Quality of life was evaluated using Beck's Depression Inventory,(52) the Anxiety and Personal Well-being Scale,(52) instrumental activities of daily living (IADL) scores, and an assessment of physical health status based on health services utilized in the month prior to the interview.(53) Subjects who had either no sensory impairment or aided sensory impairment demonstrated higher mood levels, richer socialization, and better performance in IADLs than did those with unaided sensory impairments.

### **Quality Indicator #6**

#### **Conductive Hearing Loss**

**IF** a vulnerable elder has conductive hearing loss, **THEN** he or she should be offered a referral to an otolaryngologist **BECAUSE** this will facilitate assessment of the nature of the hearing loss, identify contraindications to hearing aid candidacy, and determine the need for further medical or surgical management.

**Supporting evidence:** Conductive hearing loss cannot be distinguished from sensorineural hearing loss based on subjective complaints or physical examination. The distinction must be made by formal audiologic testing. Potential etiologies of conductive hearing loss include cerumen impaction,(31-33) otitis media, tympanic membrane perforations, middle ear tumors, and otosclerosis. Prior to hearing aid evaluation, the etiology of the hearing loss should be determined.

Approximately 10% of the Caucasian population (54) and 1% of the African-American population (55) have otosclerosis, which results primarily in conductive

hearing loss. The average age of clinical onset of otosclerosis is 33.5 years.(56) Some patients with otosclerosis may experience minimal symptoms until concomitant sensorineural hearing loss from presbycusis becomes evident. Otosclerosis alone, or in combination with presbycusis, may be treated with hearing aids or surgery, depending on the severity of the hearing loss and the health and functional status of the patient.(57) Otoscopic examination of a patient with otosclerosis is most often normal. However, the audiogram will reveal a conductive hearing loss and may reveal a sensorineural hearing loss as well.

Although otosclerosis predominantly presents in younger adulthood , hearing evaluation may reveal the condition in elderly patients. Treatment options for otosclerosis include hearing aids and/or stapedectomy in one or both ears.(58-60)

## **DISCUSSION**

Hearing impairment is prevalent in the older adult population. As the general population ages, the prevalence of hearing impairment will increase. Early diagnosis and treatment of hearing impairment is likely to improve quality of life and functional status in the aging population. We identified six quality indicators for which the process to outcome link was judged to be sufficiently valid for use as measures of quality of care for vulnerable elders with respect to hearing evaluation and treatment of impairment. These indicators can potentially serve as a basis to compare the care provided by various health care delivery systems as well as to measure the change in care over time.

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**Table 1**

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**Quality Indicators Judged by the Expert panel as Valid  
for the Assessment of Care for Hearing Loss in Vulnerable Elders**

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<b>Quality Indicator #1</b> ALL vulnerable elders should have a hearing screening examination as part of the initial evaluation.
<b>Quality Indicator #2</b> IF a vulnerable elder fails a hearing screening, THEN he or she should be offered a formal audiologic evaluation within 3 months.
<b>Quality Indicator #3</b> IF a vulnerable elder has a hearing problem or fails an audiologic screening, THEN he or she should have an ear examination within 3 months.
<b>Quality Indicator #4</b> IF a vulnerable elder is a hearing aid candidate, THEN he or she should be offered referral to an audiologist within 3 months after audiologic exam.
<b>Quality Indicator #5</b> IF a vulnerable elder is a hearing aid candidate, THEN he or she should be offered hearing rehabilitation.
<b>Quality Indicator #6</b> IF a vulnerable elder has conductive hearing loss, THEN he or she should be offered a referral to an otolaryngologist.

**Related Quality Indicators for Hearing Loss**

Interpreter for hearing impaired patient (Continuity #13)
Evaluate hearing at initial exam (S&P #1, #2)

**Table 2**

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**Hearing Handicap Inventory for the Elderly-Short Version\***

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E-1 Does a hearing problem cause you to feel embarrassed when you meet new people?

E-2 Does a hearing problem cause you to feel frustrated when talking to members of your family?

S-3 Do you have a difficulty hearing when someone speaks in a whisper?

E-4 Do you feel handicapped by a hearing impairment?

S-5 Does a hearing problem cause you difficulty when visiting friends, relatives, or neighbors?

S-6 Does a hearing problem cause you to attend religious services less often than you would like?

E-7 Does a hearing problem cause you to have arguments with family members?

S-8 Does a hearing problem cause you difficulty when listening to TV or radio?

E-9 Do you feel that any difficulty with your hearing limits or hampers your personal or social life?

S-10 Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?

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Note: "E" denotes emotional items, "S" denotes social/situational items.

\*Ventry IM, Weinstein BE. Identification of Elderly People with Hearing Problems. American Speech-Language-Hearing Association 1983;25:37-42.