

Self-Reported Hearing Difficulty and Audiometric Thresholds in Nursing Home Residents

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Background. Nursing home practitioners usually assess the general health and functional abilities of each resident at the time of admission. If audiometric screening is not routinely available, assessment of the resident's hearing status will probably consist only of asking questions about hearing difficulty. In this study we explored which questions, when answered positively, were most strongly associated with moderate or severe hearing impairment.

Methods. A total of 198 newly admitted nursing home residents answered questions regarding their hearing in common listening situations, and then underwent audiometric assessment.

Results. Fifty-four percent of the residents had a pure tone average hearing level of >25 dB at 500, 1000,

and 2000 Hz and were therefore considered impaired. A single general question regarding hearing had a sensitivity of 69% in determining the presence of such impairment. Three specific questions which assessed hearing—in a group, while watching television, and while on the telephone—had a collective sensitivity of 83%. Asking the three questions was significantly ($P = .003$) more effective than asking only the general question.

Conclusions. A set of specific questions significantly improved the identification of residents whose hearing loss affected their daily living activities compared with the use of a single hearing loss question.

Key words. Hearing loss, partial; aged; nursing homes, hearing tests.

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Hearing loss among the elderly has been documented in several studies using objective audiometric assessments. Prevalence rates of hearing loss among the well elderly have been reported to be from 31% to 87%.¹⁻⁴ Data from nursing homes indicate that 67% to 100% of the residents have impaired hearing.⁵⁻⁹ A number of these studies were one-time mass screenings of volunteers including only 50% to 75% of eligible residents.⁶⁻⁹

Although previous research indicates that the overall rate of hearing impairment in any nursing home is high, the precise hearing status of an individual resident cannot be known unless that person has been assessed. Information regarding the hearing level of a specific resident is important, as reduced auditory acuity has been implicated in other problems. Hearing impairment has been associated with social isolation independent of age, phys-

ical health, and socioeconomic status.³ In the early stages of a progressive hearing loss, an individual may appear preoccupied, inattentive, irritable, unsociable, absent-minded, or even paranoid.¹⁰⁻¹² Poor hearing has also been related to decreased performance on certain cognitive tests.¹³⁻¹⁵ Verbal tests and those administered during face-to-face interviews are particularly vulnerable, whereas nonverbal measures appear less susceptible.^{4,16,17}

In the absence of a systematic audiologic screening program, identification of hearing impaired residents in need of further assessment is left to physicians or nurses. These assessments are only a small part of a comprehensive evaluation of multiple systems at the time the resident is admitted to the nursing home. With time at a premium, the attention given to any single system with no obvious dysfunction may be limited. Medical personnel often base their assessment on the patient's report or the response to a single general question regarding hearing.

The present project was initiated to examine the hearing of our nursing home population including residents' perceptions of their hearing ability. As part of the project, responses to interview questions and the results

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of audiometric screening were compared to determine which questions most accurately identified residents with significant hearing loss.

Methods

Data were collected during a hearing screening program of new admissions to a 680-bed skilled nursing facility providing care for veterans and their spouses. This report is based on 296 consecutive admissions during a 2-year period. Thirty-four of these residents could not be tested because they died ($n = 18$) or were discharged ($n = 16$) before testing could be completed. Twenty-three refused or were too ill or unresponsive to participate. Residents who may have been identified previously as having a hearing loss were included to more accurately test the interview questions. Screening results were available for 239 residents (191 men and 48 women) having a mean age of 72.4 ± 11.4 years.

An interview was conducted with each resident before the audiometric assessment. The interview included several yes or no questions regarding the person's perception of his or her hearing status and ability to hear in common listening situations.

Test equipment consisted of a Maico 40-A portable audiometer (Maico Hearing Instruments, Inc, Minneapolis, Minn) calibrated to the standards of the American National Standards Institute (ANSI). Audiocup circumaural cushions were used to reduce ambient noise and the possibility of collapsed ear canals in geriatric patients. Ambulatory residents were tested in a soundproof booth located in a speech therapy room in a low-traffic area of the building. Since the booth did not accommodate wheelchairs, nonambulatory residents were tested in the room environment. Measures of ambient room noise were within acceptable limits.¹⁸

The assessment included an otoscopic examination. Residents with impacted cerumen were referred for ear lavage before audiometric assessment. Pure tone air-conduction thresholds were established at 500, 1000, 2000, and 4000 Hz using the procedure for threshold determination recommended by the American Speech-Language-Hearing Association.¹⁸ Reliability of response was determined by a repeated measurement at 1000 Hz after all other frequencies were tested. If the second threshold was within ± 5 dB of the first, reliability was considered good.

Functional hearing status was determined on the basis of the pure tone average across 500, 1000, and 2000 Hz in the better ear. This is considered a good estimate of an individual's hearing through the range of frequencies of speech, and has been associated with a

Table 1. Distribution of Residents by Hearing Status Based on Pure Tone Averages ($n = 198$)

Hearing Level	Pure Tone Average (dB)	Residents (%)
Normal	0-25	46.0
Impairment		
Mild	26-40	31.8
Moderate	41-55	14.1
Moderately severe	56-70	5.0
Severe	71-90	2.5
Profound	90+	0.5

global measure of functional health status.^{19,20} For purposes of data analysis, a resident's hearing was considered normal if the pure tone average was ≤ 25 dB or impaired if the pure tone average was > 25 dB.

The data were analyzed by calculating the sensitivity values for the interview questions according to standard practice. The chi-square was used to test all comparisons.²¹

Results

Of the 239 eligible admissions, 198 residents (83%), including 162 men and 36 women, demonstrated good audiometric response reliability and were included in the analysis. The distribution of pure tone averages in the sample is presented in Table 1. Approximately one half of the sample had normal hearing and one half were impaired on the basis of audiometric results.

The purpose of the interview questions was to identify situations in which the resident reported hearing difficulty. An affirmative or equivocal response to any question was considered a positive indicator of a hearing problem. This approach provided maximum sensitivity of the questions.

Residents were asked, "Do you have trouble hearing?" The distribution of responses to this general question according to audiometric status is presented in Table 2. Fifty-one percent of the normal group answered no. Among the impaired listeners, only one half answered yes. Twenty-four percent of the normal group and 18% of the impaired group gave equivocal responses in the

Table 2. Residents' Responses to the Question "Do You Have Trouble Hearing?"

Responses	Hearing Status Based on Audiometry	
	Normal, % ($n = 91$)	Impaired, % ($n = 107$)
No	51	31
Equivocal	24	18
Yes	25	51

Table 3. Residents' Responses to Questions Regarding Difficulty in Specific Listening Situations According to Hearing Status and Sensitivity for Each Question

"Do You Have Difficulty Hearing When . . ."	Answer	Hearing Status Based on Audiometry		Sensitivity*
		Normal, % (n = 91)	Impaired, % (n = 107)	
Talking with several people	No	64	26	73.8
	Equivocal	7	16	
	Yes	30	58	
Watching TV	No	64	38	61.7
	Equivocal	27	31	
	Yes	9	31	
On the telephone	No	64	40	59.8
	Equivocal	27	32	
	Yes	9	28	
No facial cues	No	75	42	57.9
	Equivocal	7	8	
	Yes	19	50	
In the dining room	No	64	50	49.5
	Equivocal	30	31	
	Yes	7	19	
Talking one-to-one	No	92	78	21.5
	Equivocal	3	7	
	Yes	4	15	
With facial cues	No	96	78	21.5
	Equivocal	3	10	
	Yes	1	11	

*Equivocal and "Yes" responses were both considered positive indicators. "No" responses were considered negative indicators.

form of a shrug or "I don't know." Thirty-three residents with abnormal audiograms denied difficulty hearing. Of these, 25 had mild losses (pure tone average range 26.67 to 40.00 dB, mean = 32.60), 6 had moderate losses (range 41.67 to 55.00 dB), and 2 had moderately severe losses (58.33, 60.00 dB).

The resident interview also included seven specific questions regarding the resident's ability to hear in common listening situations. The distribution of residents' responses according to hearing status and the sensitivity of the questions are shown in Table 3. Sensitivity is the proportion of persons with impaired hearing who gave a yes or equivocal answer to the question. The impaired group consistently had more equivocal answers than the normal group.

To discover an optimal set of questions to identify hearing loss, the two most sensitive questions were combined and analyzed as a set. A set was considered a positive indicator if one or more questions were answered yes or equivocally. Successive sets were developed by adding the next most sensitive question. The sets were compared with the single general question for differences in sensitivity. The results are presented in Table 4.

The sensitivity of the sets was compared with that of

the general question using a chi-square. Sensitivity increased with increasing numbers of questions. Sets of two or more were significantly more sensitive (more likely to identify hearing impairment) than the general question ($P < .05$). Among the 33 residents with abnormal audiograms who denied trouble with their hearing, 10 answered yes to at least one of the three most sensitive questions, indicating an awareness of a problem in rela-

Table 4. Sensitivity Values (%) for the General Hearing Question and Cumulative Sets of Specific Questions, and the Probability of a Significant Difference Between the General Hearing Question and Each Set

Question(s)	Sensitivity	Probability
General		
"Do you have trouble hearing?"	69.2	
Sets of specific questions (cumulative)		
"Talking with several people"	73.8	.4731
Plus "Watching TV"	80.4	.0290
Plus "On the telephone"	83.2	.0032
Plus "Absence of facial cues"	86.9	.0002
Plus "In the dining room"	87.8	.0001
Plus "Talking one-to-one"	88.8	<.0001
Plus "With facial cues"	88.8	<.0001

tion to a specific listening situation. Nine other residents gave equivocal answers to at least one question. The equivocal answers were much more common in those with moderate or greater losses (17 of 24).

The data from the 41 residents who did not demonstrate good audiometric reliability were reviewed for general trends. Six individuals were essentially unresponsive to both audiometric testing and interview. Another 6 had fair reliability with measured pure tone averages in the normal range. Their interview responses were consistent with relatively normal hearing in that 4 of the 6 denied both general and specific hearing difficulties. Of the remaining 28 with unreliable pure tone averages, 9 answered yes to the general question and to at least one of the questions regarding hearing in a group, while watching television, or on the phone. Seventeen of those with unreliable pure tone averages answered no to the general question, but 6 answered yes to at least one of the three most sensitive questions. Thus, more than half of those with unreliable audiometric results gave firm verbal indications of hearing dysfunction in some daily living situation.

Discussion

In most nursing homes, practitioners must assess hearing status without routine audiologic screening. The decision to refer a resident for further evaluation is made by a busy physician or nurse during a comprehensive assessment of multiple problems. In standard practice, even cognitively impaired residents who are capable of being interviewed are asked about their hearing, and their responses are often given consideration. We included all residents so that our sample would constitute a typical sample of nursing home patients. We decided to retain the data from individuals based on a specific functional assessment. They were required to be sufficiently attentive to an abstract and novel stimulus (the pure tone) and demonstrated good response reliability.

Our results suggest that residents' responses to questions regarding their hearing were not particularly sensitive indicators of measurable hearing loss. A single general question regarding hearing difficulty identified only 69% of the residents with hearing impairment. Even the three most sensitive questions identified only 83% of those with abnormal thresholds. Of the 107 hearing-impaired residents, 33 (31%) answered the general question with a negative response. Thirteen residents of this latter group also denied having hearing problems in the three most subjectively difficult listening situations, ie, hearing in a group of people, while watching television, or on the telephone. These residents may have been

unaware of their hearing impairment or were denying it. It is also possible that they were using compensatory strategies effectively.

Interviewing also failed to reliably indicate residents with normal audiograms. Using the most effective set of three questions, 54 of 198 (27%) patients reported difficulty despite normal speech-frequency thresholds. It is important to note that 54% of this group (29 of 54) had moderate or worse (>40 dB) bilateral high-frequency losses. An audiometric pass-fail criterion that does not consider high-frequency thresholds will miss persons who are hearing handicapped in some situations.¹⁹ Those residents who reported hearing difficulty but had only mild losses at all frequencies may have been reacting to a central auditory processing disorder, cognitive impairment, or some other disorder.

Despite the inadequacy of self-report in identifying hearing loss, the use of small sets of specific questions was beneficial. They functioned as a kind of "stress test" of the auditory system, and improved the identification rate of impaired residents. While only 69% of those with audiometric losses responded positively to the single general question, 83% ($P = .003$) responded positively to the three stress-situation questions. At the same time, the numbers of residents with normal pure tone averages who answered yes to the general question and to the three specific questions were 45 (49%) and 54 (59%), respectively. Since one third (30) of the 91 residents with normal hearing had bilateral losses of >40 dB at 4000 Hz, many of these positive responses may signal real dysfunction in the presence of a normal pure tone average. In summary, the use of specific questions increased the identification of hearing impairment without including significantly greater numbers of normal-hearing residents for whom additional evaluation would not be beneficial.

Affirmative responses were strong indicators of abnormality. A yes response meant that we could be quite certain that the resident would demonstrate abnormal hearing thresholds. Equivocal responses to the specific questions tended to be associated with hearing impairment slightly more than half the time. A no response was not as powerful an indicator. Our data indicate that, among residents who denied that they had trouble hearing in all three specific situations, one in six had hearing that was abnormal. Screening residents for hearing problems using the three questions failed to identify approximately 17% of those with losses. In light of these findings, questions regarding stressful listening situations are not a substitute for audiometric assessment, nor are they a solid basis for judgments of auditory rehabilitation potential. In the absence of systematic audiometric testing, however, the use of questions regarding hearing

difficulty in group conversation, in watching television, or in talking on the telephone will identify hearing impairment better than a single, nonspecific question. When audiometric testing is limited to screening at 1000 and 2000 Hz only, specific questions can suggest the presence of high-frequency loss and associated speech discrimination deficits in the presence of normal low- and mid-frequency acuity.

Affirmative responses should always be followed by pure tone threshold testing to determine the extent of the problem. It has been our experience that nursing home residents do not appreciate repeated audiometric testing. If screening is not routinely performed (or the resident responds unreliably to audiometric testing) and close questioning suggests a functional problem, a thorough audiologic assessment rather than preliminary acuity testing is advised. Just a few questions can alert the practitioner to a frequently undetected handicap.

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