Identification of Elderly People With Hearing Problems

Ira M. Ventry
Barbara E. Weinstein

For older persons generally, no guidelines exist for identifying hearing impairment. Some principles that need to be considered in developing an identification and screening program are discussed here. Authors are the late Ira M. Ventry, professor of audiology and coordinator of audiology programs, and Barbara E. Weinstein, adjunct assistant professor of audiology and coordinator of hearing services and practicum, both of Teachers College, Columbia University, New York, New York.

Considerable attention has been given to the early identification of people with hearing impairment but much of this attention has been directed towards infants or children. For example, the American Speech-Language-Hearing Association has a well-established and widely accepted protocol for pure-tone screening of school-age children (ASHA, 1975). Early identification of adult workers whose hearing may be affected by industrial noise has also received widespread attention over the years and, just recently, the Occupational Safety and Health Administration promulgated detailed guidelines describing the audiometric requirements of an industrial hearing conservation program (OSHA, 1981). This paper, on the other hand, addresses itself to a large population of people for whom there are no identification guidelines, protocols, or procedures. The people referred to here are the community-based, noninstitutionalized elderly. The purpose of this paper is to discuss some principles that need to be considered in developing an identification program for the elderly and to offer some suggestions about screening procedures. Our ultimate goal is to stimulate thought and action among those professionals who are interested in meeting the audiologic needs of older people with hearing problems.

The Need

There appears to be a consensus on the following points. First, elderly people, defined by convention, as individuals aged 65 or over, comprise about 10% of the American population and, more important, the percentage is increasing (Harris, 1978). Second, the prevalence of hearing impairment increases with age. As an illustration, the prevalence of hearing loss in 20-29 year olds is 4% whereas the prevalence of hearing impairment in 70-79 year olds is 70% (Harris, 1978). Third, relatively few elderly people avail themselves of audiologic services and many elderly people who could benefit from amplification do not use hearing aids (Maurer & Rupp, 1979; Freeman & Sinclair, 1981; Dodds & Harford, 1982). Finally, there are no guidelines that describe identification procedures that might be employed in large-scale screening programs of elderly persons.

Screening programs should constitute an important way of initiating hearing health care for community-based

0001-2475/83/25037-06 $01.00 © American Speech-Language-Hearing Association

elderly. Such screenings can and do take place in a variety of settings—health fairs, retirement communities, senior citizen centers, and the like. While screening for hearing loss in the elderly is probably rather commonplace, specific, well-defined and data-based guidelines are not so commonplace. For example, as far as we can determine, there is no consensus on what test frequencies should be employed, what hearing levels should be used, what fail criteria are most effective in limiting false-negative and false-positive identifications, and whether pure-tone screening per se represents the most efficient way to identify people with hearing problems. The remainder of this paper addresses these questions.

A Basic Concept

A fundamental distinction needs to be drawn at the outset between hearing impairment and hearing handicap. This distinction is central to our discussion and is at the heart of our identification procedure. Hearing impairment is "a change for the worse in either structure or function, outside the range of normal . . . " and " . . . is due to any anatomic or functional abnormality that produces hearing loss" (AAO-ACO, 1979; p. 2055). Hearing impairment and hearing loss are synonymous; audiometry, in all of its components, is used to quantify hearing impairment/hearing loss. Hearing handicap, on the other hand, is defined as "the disadvantage imposed by an impairment sufficient to affect a person's efficiency in the activities of daily living . . . " (AAO-ACO, 1979; p. 2055). There is increasing agreement that handicap is a complex phenomenon that involves far more than hearing impairment and that audiometry cannot be used to quantify hearing handicap (Noble, 1978; Clark, 1981; ASHA, 1981; Ventry and Weinstein, 1982). As will be documented below, there is an imperfect relationship between hearing handicap (however measured) and hearing impairment.

A variety of self-assessment techniques have been developed to measure hearing handicap ranging from the oldest, the Hearing Handicap Scale (HHS) (High, Fairbanks, and Glorig, 1964) to one of the newest, the Hearing Handicap Inventory for The Elderly (HHIE) (Ventry & Weinstein, 1982). Most of the self-assessment instruments focus on the situational difficulties imposed by a hearing impairment. Scales such as the HHIE and the Denver Scale of Communication Function (Alpiner et al., 1975) probe primarily the social and emotional effects of the hearing impairment. No matter what scale is employed to measure hearing handicap, only moderate correlations (about .60) have been reported between hearing impairment (usually defined by the pure-tone average in the better ear) and hearing handicap (Giolas, 1982). Squaring the average correlation of .6 produces an Index of Determination of 36%. This means that only 36% of the variability in handicap scores is explained by pure-tone thresholds in the better ear. When additional audiometric measures are included in an attempt to improve the prediction of hearing handicap, the percentage of the explained variance increases to about 40-50%, leaving more than 50% of the variability unexplained (Weinstein & Ventry, 1982).

This imperfect relationship between impairment and handicap indicates to us that there are people with minimal impairment but significant handicap as well as people with significant impairment but minimal handicap. More important, perhaps, is the principle that any identification program that relies solely on pure-tone testing must, per force, fail individuals who report no significant hearing handicap and pass individuals who perceive themselves as handicapped. The proportion of people in each of these two categories will vary depending on the pure-tone screening levels employed. The above-cited data and our line of reasoning suggest to us that a program designed to identify elderly individuals with hearing problems (not just hearing loss and not just hearing handicap) must have two basic components: a pure-tone screen and a hearing handicap assessment. The components of such a program are described below.

Procedure

The data underlying the suggested identification procedures were obtained on 162 subjects, aged 65 years or older. One hundred of these subjects were used to standardize the HHIE and are described in more detail elsewhere (Ventry & Weinstein, 1982). Sixty-two additional subjects (mean age = 73.3 years) were drawn from essentially the same clinic population used previously (Jupiter, 1982). There was an approximate equal distribution of males and females. Subjects were seen on consecutive referrals and only those subjects who had fluctuating hearing loss or significant psychological or neurological problems were eliminated from the study. All subjects were ambulatory and all lived in the New York City metropolitan area. Pure-tone thresholds were measured with the procedure recommended by ASHA (1978). The better-ear pure-tone average (500, 1000, and 2000 Hz) for the 62 subjects was 37 dBHL (SD = 17.7 dB). All testing took place in sound-treated test environments meeting ANSI 1977 standards using clinical audiometers calibrated to ANSI 1969 standards.

A short version of the HHIE was developed to screen for self-assessed hearing handicap. The reason the HHIE was selected for use is that it is the only handicap assessment inventory designed for and standardized on elderly people. The 25-item clinical version was reduced to a 10-item screening tool that included five social/situational items and five emotional response items (Appendix). The items were selected in such a way as to insure that the short form was of comparable reliability to the long form. The internal consistency (Chronbach's alpha) of the screening version is .87 compared to .95 for the full inventory. Scores on the HHIE-S (screening) can range from 0 to 40; a YES response is given 4 points, a NO response, zero points, and a SOMETIMES response is assigned 2 points. For screening purposes, HHIE scores were divided into three categories: 0 to 8 (no self-perceived handicap), 10 to 22 (mild to moderate handicap), and 24 to 40 (significant handicap)[1] The advantage of this scheme will be described below.

[1]The comparable categories for the full inventory are 0 to 16% (no handicap), 18 to 42% (mild to moderate handicap), and 44 to 100% (significant handicap) (Weinstein & Ventry, 1982.)

The Data Base

Table 1 shows the relationship between the three categories of hearing handicap and pure-tone average (500, 1000, and 2000 Hz) in the better ear. The reason for this table is that it emphasizes the point made earlier that pure-tone data cannot be used to estimate or predict the hearing handicap. There is an obvious relation between hearing sensitivity and hearing handicap; 83% of the subjects with no hearing impairment report no handicap while 70% of the subjects with significant hearing impairment (>55 dB PTA) report significant hearing handicap. However, six subjects with significant hearing loss report either no handicap (two) or a mild handicap (four) while seven subjects with no impairment report either mild (six) or significant (one) handicap. What is especially noteworthy is that the 52 subjects with 26-40 dB pure-tone averages are nearly equally divided between those who report no handicap (44%) and those who report mild or significant handicap (56%). This finding underscores the point made earlier that no matter what hearing levels are chosen for screening, they are destined to over-identify or under-identify people with hearing problems. It also illustrates the variability in self-assessed handicap in individuals with mild hearing impairment.

Another important point emerges from the data shown in Table 1. By omitting consideration of the mild (10-22) handicap category, it becomes rather clear that significant hearing handicap in the elderly often begins when the pure-tone average in the better ear exceeds 40 dB. Note the striking difference in the proportion of subjects who identified themselves as significantly handicapped and those who fell into the 26-40 dB and 41-55 dB hearing level categories. In the former category, more than three-quarters of the subjects (23/30) report no handicap while in the latter category, more than three-quarters of the subjects (21/27) report significant handicap. As would be expected, when the data are viewed in this dichotomous fashion, minimal hearing impairment produces minimal handicap while moderate hearing loss results in significant self-assessed hearing handicap.

Table 1

Distribution of 162 elderly subjects by hearing level/hearing handicap categories. Hearing level category is based on the three-frequency pure-tone average (500, 1000, and 2000 Hz) average in the better ear. Handicap scores reflect no handicap (0-8), mild to moderate handicap (10-22), and significant handicap (24-40) as measured by the screening version of the Hearing Handicap Inventory for the Elderly.

	Hearing Handicap Categories			
Hearing Level	0-8	10-22	24-40	Totals
0-25 dB	35	6	1	42
26-40 dB	23	22	7	52
41-55 dB	6	21	21	48
>55 dB	2	4	14	20
Totals	66	53	43	162

Screening Levels

The data shown in Table 1, however, are not directly applicable to the issue of screening levels to be employed in an identification program. The first reason for this is that pure-tone averages are not obtained in screening programs. The second reason is that there is not a one-to-one relationship between pure-tone average and pass/fail on a screen. Depending on the screening levels chosen, the frequencies tested, and the pass/fail criteria employed, it is possible for a person to have a pure-tone average within normal limits and yet fail the screen. (It is not possible for an individual to have a significantly elevated pure-tone average in the better ear and pass a screen unless, of course, screening levels are set at moderately high levels.) Despite these qualifications, the data presented in Table 1 suggest that a 40 dB average for the speech frequencies is a critical level and these data, combined with a careful inspection of our results, lead us to propose that screening levels be set at 40 dBHL at 1000 and 2000 Hz.

The fail/pass data in Table 2 were obtained by inspecting the individual audiograms of 100 subjects, 62 described earlier and 38 chosen at random from the larger sample of 100 subjects used to evaluate the HHIE. A fail on the pure-tone test was defined as a threshold of at least 45 dB in *each* ear at 1000 or 2000 Hz. This is analogous to the use of a 40 dB level for screening purposes. That is, a person who fails a 40 dB screen must have a threshold at the failed frequency of at least 45 dB. The HHIE-S data are subdivided into the same three categories used earlier.

Several aspects of these data need to be highlighted. First, of the people who passed the pure-tone screen (N = 49), 34 (69%) reported no handicap; only one person passed the screen and reported significant handicap. Of the people failing the pure-tone screen, 41 (80%) reported some degree of hearing handicap. Note, too, that of the individuals reporting significant handicap (N = 18), 17 (94%) failed the pure-tone screen. It is also noteworthy, but not unexpected, that 10 persons failed the pure-tone screen but reported no handicap. Overall, 44% of this sample of older persons reported no handicap and 49% passed the hearing screen.

Table 2

Pure-tone pass/fail data as a function of hearing handicap categories. Fail is defined as inability to hear a 40 dB tone at 1000 or 2000 Hz in each ear. The numbers in parentheses represent the change in results when 500 Hz is included as a test frequency. N = 100.

Hearing Handicap	Pure-tone Screen		
Categories	Fail	Pass	Total
0-8	10	34	44
10-22	24 (27)	14 (11)	38
24-40	17	1	18
Total	51 (54)	49 (46)	100

Although we were impressed with these findings, we explored other pass/fail criteria, other screening levels, and different frequency combinations. No modification was as effective as that which produced the results in Table 2. For example, lowering the screening levels produced a large increase in the pure-tone fail rate. As a result, more people failed the screen and reported no handicap than the 10% shown in Table 2. Including 500 Hz produced a minimal change in the pass/fail distribution and only in the 10-22 handicap category (see Table 2). Including 4000 Hz produced a dramatic increase in the pure-tone fail rate from the 51% rate shown in Table 2 to 74%. Using 2000 Hz alone produced results that were identical to the results shown in Table 2 for 1000 and 2000 Hz. The implication of these findings will be discussed below. The basic problem associated with any manipulation of audiometric parameters is the problem noted at the outset of this article, namely, the imperfect relationship between hearing sensitivity and hearing handicap. We suggest that the data shown in Table 2 are probably as close as one will get to producing a meaningful and efficient relationship, for screening purposes, between handicap and pure-tone screen data.

Table 3

Pure-tone pass/fail data as a function of hearing handicap categories for 104 community-based elderly who received the screening protocol.

	Pure-tone Screen		
Hearing Handicap Category	Fail	Pass	Total
0-8	12	40	52
10-22	27	17	44
24-40	4	4	8
Total	43	61	104

A Priority System

An important consideration in any screening program relates to the number of people who fail the screen and are then referred for further evaluation and/or intervention. A large number of referrals, especially including people who do not need follow-up care (i.e., false positives), overburdens the referral network, causes unnecessary expense, and may alienate community agencies. The priority system described here is designed to insure that people who probably need services receive them.

The priority system is as follows:

Priority One: Significant handicap (24-40) and fails pure-tone screen. This group represented 17% of the sample;

Priority Two: Significant handicap and passes pure-tone screen (1%);

Priority Three: Mild handicap (10-22) and fails pure-tone screen (24%);

Priority Four: Mild handicap (10-22) and passes pure-tone screen (14%);

Priority Five: No handicap (0-8) and fails pure-tone screen (10%).

The major advantage of this system is that rather than referring all people who fail a pure-tone screen or who report some degree of hearing handicap, it quickly identifies those elderly who are most in need of assistance and focuses attention on them. It should be noted that we have some preliminary data suggesting that a number of people who report mild handicap and fail the pure-tone screen (priority three) do, indeed, require audiologic follow-up. It appears, then, that elderly people who fall into the *first three categories* deserve essentially the *same priority*. Thus, 42% of the clinic sample would be referred while 34% of the community sample (see below and Table 4) would be referred for further audiologic evaluation of their rehabilitative needs.

Some Special Considerations

Unilateral Hearing Loss. Sixteen persons in our sample had either a unilateral (N=9) or a bilateral but asymmetrical hearing impairment. Although four subjects in this latter group fell into the Priority One category, eight of the nine unilaterals not only passed the pure-tone screen but also reported no handicap. The remaining subject with a unilateral loss did report some handicap and would have been placed in the Priority Four category. Since a unilateral loss may be a symptom of significant ear disease or represent a treatable ear condition, it appeared desirable to modify the fail criteria to reflect the importance of unilateral hearing impairment. To this end, a "unilateral fail" criterion is defined as an inability to hear a tone at both test frequenices in one ear combined with a pass for both frequencies in the other ear. All nine persons who originally passed the pure-tone screen would now fail while only two additional subjects out of the 100 subjects would be identified as "unilateral" when, in fact, they did not have a unilateral hearing loss. The referral priority given to these "unilats" needs to be decided by each screening agency although we would place them in the Priority One category.

Choice of Test Frequencies. It is recommended that 1000 and 2000 Hz be used as the test frequencies. The inclusion of 4000 Hz produces an unacceptably high fail rate and, in addition, will fail nearly 60% of those who report no handicap. If one wishes, 500 Hz can be included along with 1000 and 2000 Hz but it must be recognized that two frequencies produce essentially the same results

Table 4

Percentage of community-based and clinic subjects falling into five referral priority categories.

Referral Priority	Community (N=104)	Clinic (N=100)
1. Fail pure-tone, 24-40 on HHIE-S	04	17
2. Pass pure-tone, 24-40 on HHIE-S	04	01
3. Fail pure-tone, 10-22 on HHIE-S	26	24
4. Pass pure-tone, 10-22 on HHIE-S	16	14
5. Fail pure-tone, 0-8 on HHIE-S	12	10

as the three-frequency combination (Table 2). Further, the two-frequency screen is faster and is less subject to the masking effects of ambient noise. Finally, 2000 Hz could be used alone and would produce results identical to those obtained with the two-frequency screen. The professional community, however, may find it difficult to accept a single-frequency screen. (We have no wish to generate the same kind of confusion and controversy that surrounded the use of one- and two-frequency screening of school children in the late 1950s and early 1960s.) To recapitulate, the screening protocol calls for testing at 40 db HL at 1000 and 2000 Hz and the administration of the HHIE-S. A "fail" on the pure-tone screen is the inability to respond at any one frequency in each ear. The "unilateral" criterion is the failure to respond to both frequencies in one ear combined with a pass at both frequencies in the other ear. Referral priorities are based on the pure-tone screen results and scores on the HHIE-S.

Some Screening Data: As noted earlier, the screening protocol was based on audiometric data from elderly subjects referred to a hospital speech and hearing clinic for audiologic evaluation. In other words, the pass-fail distributions shown in Table 2 were not obtained from an actual screening program but from an inspection of audiograms. The data shown in Table 3, however, were obtained from 104 community-based elderly subjects who responded to announcements regarding the availability of hearing testing and who received the actual screening protocol. With the exception of the "fail pure-tone/24-40 HHIE score," there is remarkably good agreement between the two sets of data shown in Tables 2 and 3. This agreement is reflected more clearly in Table 4, which shows the proportion of subjects in the two samples falling into each of the five priority categories described previously. The difference in the Priority One category reflects the larger number of "clinic" subjects who failed the pure-tone screen and reported significant handicap as compared to the community subjects, a not unexpected finding. Otherwise, there is no more than a 3% difference for the other four referral categories.

Validation. Although the data in Table 4 demonstrate the consistency of screening results from one type of population to another and from one method of arriving at referral priorities (inspection of audiograms) to another (actual screening), the validity of the screening protocol and the referral priority system remains undetermined. This issue is best captured by the question: "How many people who receive the highest priority have no need for follow-up?" Conversely, "How many people with the lowest priorities actually require audiologic follow-up?" In other words, what are the false-negative (not sent for referral but actually in need) and false-positive (sent for referral but not in need) rates associated with the screening protocol? These questions are currently under study for a large group of people, all of whom are receiving the screening protocol and all of whom, irrespective of the results on the screen, are receiving a complete audiologic evaluation to determine their need for rehabilitative intervention. The results of this study should provide the definitive answer regarding the validity of the screening protocol and the referral priority system associated with the protocol.

Conclusions

The hearing health needs of elderly Americans have not received the attention given to other segments of the population. Although there are a variety of reasons for this, one likely reason is the lack of a meaningful, cohesive, organized identification program that can be used to initiate and implement a total rehabilitation program. To date, few guidelines exist that could be used to shape and direct efforts at large scale screening of elderly people. The proposal presented in this paper is designed to use pure-tone screening and hearing handicap assessment as the mainstays of an identification program to quickly and accurately identify people who require audiologic intervention. This combined approach appears to be a feasible approach that takes into account not only the needs of the elderly but the community resources available to provide follow-up services. Although there are still some unresolved issues with respect to the identification program outlined here (e.g., personnel, settings in which to perform testing, and so forth), the proposal should encourage concerned professionals to initiate identification programs and to think creatively about ways of implementing such programs. One caveat: problem identification is not the same as problem solution. No matter how sophisticated the identification program, it is destined to fail if those identified as having a problem do not receive the professional assistance they require and deserve. While identification is important indeed, it is only the first step in meeting the audiologic needs of the hearing-impaired elderly.

References

Alpiner, J., Chevrette, W., Glascoe, G., Metz, M., & Olsen, B. The Denver Scale of Communication Function. In M. Pollack (Ed.), *Amplification for the hearing impaired.* New York: Grune and Stratton, 1975.

American Academy of Otolaryngology and American Council of Otology. Guidelines for evaluation of hearing handicap. Journal of the American Medical Assocation, 1979, *241*, 2055-2059.

American Speech and Hearing Association. Guidelines for identification audiometry. *Asha*, 1975, *17*, 94-99.

American Speech and Hearing Association. Guidelines for manual pure-tone audiometry. *Asha*, 1978, *20*, 297-301.

American Speech-Language-Hearing Association. On the definition of hearing handicap. *Asha*, 1981, *23*, 293-297.

Clark J. Uses and abuses of hearing loss classification. *Asha*, 1981, *23*, 493-503.

Dodds, E., & Harford, E. R. A community hearing conservation program for senior citizens. *Ear and Hearing*, 1982, *3*, 160-166.

Freeman, B., & Sinclair, J. Hearing aids for the elderly. In D. Beasley & G. Davis (Eds.), *Aging: communication processes and disorders.* New York: Grune and Stratton, 1981.

Giolas, T. *Hearing handicapped adults.* Englewood Cliffs, NJ: Prentice-Hall, 1982.

Harris, C. *Fact book on aging: a profile of America's older population.* Washington, D.C.: National Council on Aging, 1978. In J. Maurer & R. Rupp (Eds.), *Hearing and aging.* New York: Grune and Stratton, 1979.

High, W., Fairbanks, G., & Glorig, A. Scale for self-assessment of hearing handicap. *Journal of Speech and Hearing Disorders.* 1964, *29*, 215-230.

Jupiter, T. *Audiometric and speechreading correlates of hearing handicap in the elderly.* (Unpublished doctoral dissertation, Teachers College, Columbia University, 1982).

Maurer, J. & Rupp, R. *Hearing and aging.* New York: Grune and Stratton, 1979.

Noble, W. *Assessment of impaired hearing: a critique and a new method.* New York: Academic Press, 1978.

Occupational Safety and Health Administration. Occupational Safety and Health Administration hearing conservation amendment. *Federal Register*, 1981 *46*, 42622-42639.

Ventry, I., & Weinstein, B. The hearing handicap inventory for the elderly: a new tool. *Ear and hearing*, 1982, *3*, 128-134.

Weinstein, B., & Ventry, I. The audiometric correlates of hearing handicap Inventory for the elderly. Paper presented at the 1982 ASHA Convention, Toronto, Canada, 1982.

Weinstein, B., & Ventry, I. The audiometric correlates of hearing handicap in the elderly. *Journal of Speech and Hearing Research*, 1983, *26*, 148-151.

Reprint requests should be addressed to Barbara E. Weinstein, Box 191, 525 West 120th Street, New York, New York 10027.

"Identification of Elderly People with Hearing Problems: A Proposal" was processed by Tina Bangs, former Associate Editor for Articles.

Guidelines for Submitting Articles to *Asha*

Authors should follow Publication Manual of the American Psychological Association, including style for references. Manual is available from Publication Sales, APA, 1200 Seventeenth Street, NW, Washington, DC 20036.

Send Articles to:
Mary J. Montesano
ASHA National Office
10801 Rockville Pike Rockville, MD 20852

Appendix
HHIE-S

		Yes (4)	Some times (2)	No (0)
E-1.	Does a hearing problem cause you to feel embarrassed when meeting new people?	—	—	—
E-2.	Does a hearing problem cause you to feel frustrated when talking to members of your family?	—	—	—
S-1.	Do you have difficulty hearing when someone speaks in a whisper?	—	—	—
E-3.	Do you feel handicapped by a hearing problem?	—	—	—
S-2.	Does a hearing problem cause you difficulty when visiting friends, relatives, or neighbors?	—	—	—
S-3.	Does a hearing problem cause you to attend religious services less often than you would like?	—	—	—
E-4.	Does a hearing problem cause you to have arguments with family members?	—	—	—
S-4.	Does a hearing problem cause you difficulty when listening to TV or radio?	—	—	—
E-5.	Do you feel that any difficulty with your hearing limits or hampers your personal or social life?	—	—	—
S-5.	Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?	—	—	—