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Main Articles

Hearing loss in over-65s: is routine questionnaire screening worthwhile?

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Abstract
It has been suggested that there is considerable unmet need in respect of hearing loss amongst the elderly population, but no routine screening test is currently used in general practice to identify these patients. The aim of this study was to determine whether routine questionnaire screening of the over-65s is a feasible way to identify elderly patients with hearing loss in primary care and whether patients so identified would benefit from hearing aid fitting. A cohort of patients consisting of a sample of 234 individuals aged between 65 and 74, attending a doctor's surgery over a specified period, received a scored questionnaire to complete based on the Hearing Handicap Inventory for the Elderly Screening test. Hearing aid owners and those with a hearing handicap were identified, and non-aid wearers with handicap offered examination and referral. Those patients who were fitted with aids were assessed after six months for aid usage and persisting handicap. Twenty-five per cent of the patient sample reported a previously undiagnosed hearing handicap. Six months after aid fitting, a reduction in hearing handicap was reported in 79 per cent of these cases and overall aid usage in the population sample had increased from nine per cent to 20 per cent. Routine questionnaire screening in general practice may be worthwhile since it is easy to carry out and the resulting intervention significantly reduces reported hearing handicap.

Key words: Hearing Impaired Persons; Hearing Aids; Questionnaires; Audiometry

Introduction

With an ageing population there will be a corresponding increase in the number of people with age-related hearing loss (presbyacusis). Parving and Ostri[1] found that hearing deteriorates most rapidly between the ages of 60 and 65. Stein and Theinhaus,[2] Kalayam *et al.*[3] and Apollonio *et al.*[4] showed that hearing loss has important adverse effects on the individual socially, psychologically and physically. Mulrow *et al.*[5–7] and Lamden *et al.*[8] have shown that in the majority of cases such hearing loss would be amenable to correction with a hearing aid. Brooks[9] comments that, in the UK, hearing aids are usually fitted when the average hearing loss is 35 dB or greater in the better hearing ear. Studies carried out by Herbst and Humphrey,[10] Lichtenstein *et al.*[11] and Wilson *et al.*[12] have shown that as many as 50 per cent of the population above the age of retirement will have this degree of hearing loss, but fewer than half of these will have been fitted with a hearing aid.

No standard procedure exists for the screening and referral of elderly patients with hearing loss in general practice. By relying on patient self-referral,[13,14] and together with the over-75 health check,[15] it is likely that hearing losses are being missed. According to a Public Health document[16] and a report from the Royal National Institute for the Deaf,[17] the absence of objective evidence of hearing impairment may lead to general practitioners failing to refer patients who might potentially benefit. However, pure tone audiometry would be unsuitable for routine screening in general practice as it requires specialized equipment and trained operators, and Wilson[12] found that it identifies a high proportion of individuals who do not wish to receive treatment.

Schow and colleagues[18] found that self-assessment measures were useful in screening the elderly for hearing handicap. Since they are more likely to identify those patients who want help, such tests should improve the detection rate of hearing loss amongst the elderly population and thus increase

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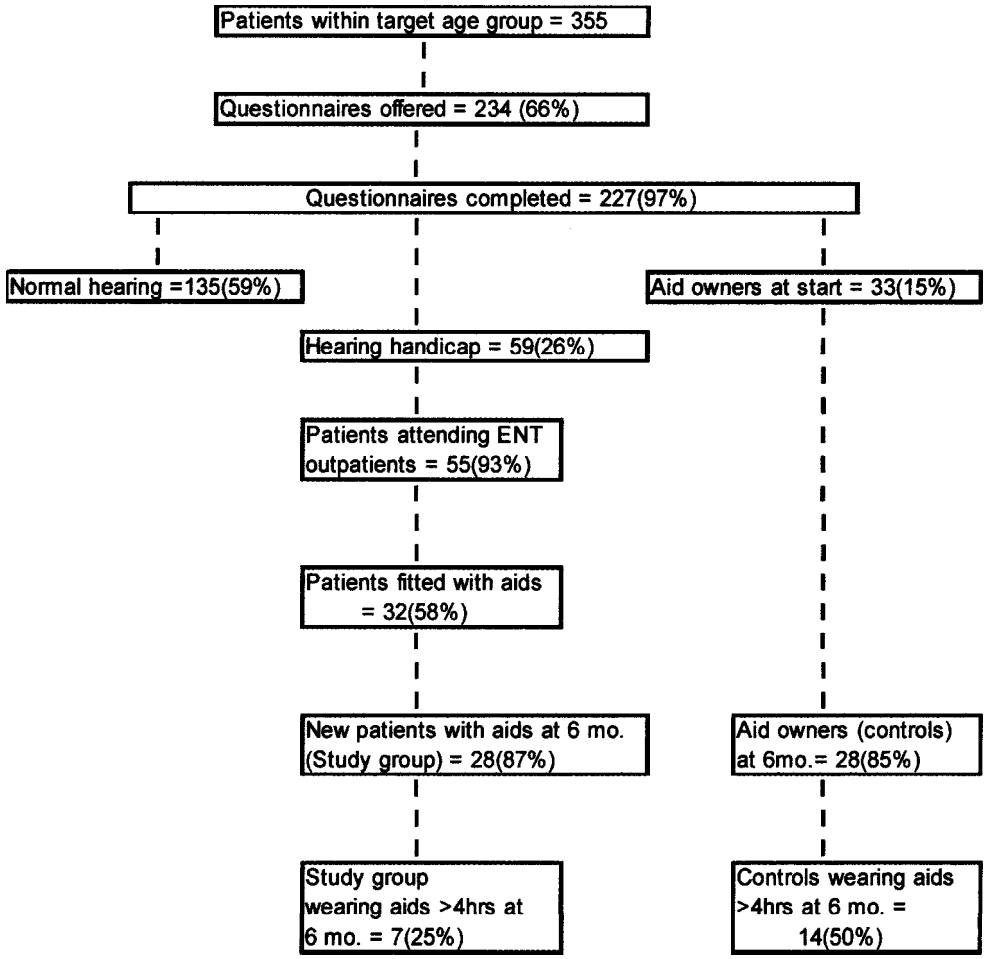

FIG. 1
Flow chart demonstrating the outcomes of patients entered into the study

numbers receiving assistance. A specialized questionnaire has been designed by Ventry and Weinstein,[19] known as the Hearing Handicap Inventory for the Elderly Screening questionnaire. It consists of 10 scored questions which were specifically designed for use in screening of the elderly for hearing loss. For each 'yes' response 4 points are scored, for each 'sometimes' response 2 points and for each 'no' 0 points.

The Hearing Handicap Inventory questionnaire has been well validated for use as a screening tool in American general practice.[11,20] When it was compared against the gold standard of pure tone audiometry, it was found to have a sensitivity of 76 per cent and a specificity of 71 per cent for scores of greater than eight. For scores of greater than 24 the specificity increased to 96 per cent but the sensitivity dropped to 30 per cent. The test has also been found to be useful in the assessment of change in hearing handicap before and after elderly individuals have been supplied with hearing aids.[5]

The principal aim of this study was to determine whether routine questionnaire screening of people over 65 for hearing loss in primary care would be feasible. In order to do this, the study was divided into two parts. The first part looked at whether the test would successfully identify patients with a previously undiagnosed hearing loss and the second part looked at whether patients identified in this way would go on to be successful hearing aid users and benefit from their hearing aids by an improved quality of life.

Methods

The setting of this study was a three-partner general practice in the Midlands. The subjects were all patients aged between 65 and 74 (mean age 69) who attended the surgery over a 17-week period. The total list size was 4100, with 355 patients in the target age range. The first two weeks of the study were used to pilot the intervention and analysis was on the basis of intention to treat. The percentage of hearing aid wearers in the sample population was compared before and after the intervention. Hearing Handicap Scores at baseline and at six months, were compared using a paired *t*-test.

The first part of the study examined the feasibility of using the questionnaire for screening. Patients were asked to complete the specialized self-report questionnaire (see Appendix 1) which was based on the Hearing Handicap Inventory for the Elderly Screening test and comprised 11 questions. An initial

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TABLE I
RELATIONSHIP BETWEEN OUTCOMES OF PATIENTS ATTENDING THE ENT CLINIC AND AGE AND SEX CHARACTERISTICS

	Patient characteristics				
	Age of patient		Sex of patient		
Outcome	Age < 69 years	Age > 70 years	Male	Female	Totals
Aid offered and supplied	15 (47%)	17 (53%)	25 (78%)	7 (22%)	32
Aid offered and refused	4 (50%)	4 (50%)	2 (25%)	6 (75%)	8
Aid not offered or supplied	12 (80%)	3 (20%)	8 (53%)	7 (47%)	15
					55

question concerned aid ownership and usage and the 10 remaining questions were scored as in the original screening test: Yes – 4, Sometimes – 2, No – 0.

The second part of the study examined whether the wearing of hearing aids was increased in the sample population. All patients identified as hearing aid owners, and all patients with questionnaire scores of eight or more, without aids and who agreed to ENT clinic referral, received a second copy of the questionnaire. Patients with apparent 'normal' hearing, i.e. with scores of lower than eight, did not receive a second questionnaire. All patients who had been referred and who had received hearing aids, became the study group in the second part of the study. All existing hearing aid wearers were used as the control group. Aid owners received their questionnaire six months after completing the original questionnaire and the newly referred patients received their questionnaire six months after hearing aid fitting.

Results

First part of the study

The outcomes of patients entered into the study, are shown in Figure 1. The percentages indicate the relationship of each figure to the figure above. There were 234 patients in the sample (66 per cent of target group) and 227 (97 per cent) of these agreed to complete a questionnaire. Hearing aid ownership in the sample was found to be 33 (14.5 per cent). This group was identified by asking patients whether they had ever owned an aid, rather than whether they had ever been offered one. If patients rated themselves as significantly handicapped, then such patients would be picked up by their answers to the remaining questions in the questionnaire.

Aid owners were more likely to be male (22) than female (11), taking more than five medications and to be over the average age of 70 when compared with patients with apparent normal hearing. Fifty-nine (26 per cent) of the patients who completed the questionnaire were found to have a previously undiscovered hearing handicap. The overall apparent prevalence of hearing loss in the sample, based on completed questionnaires, was therefore 40.5 per cent. Fifty-five (93 per cent) of the 59 patients with newly discovered hearing handicap agreed to outpatient referral.

Table I shows the relationship between outcomes of patients attending the ENT clinic and age and sex characteristics. Hospital audiometry results are shown as pass or fail in Table II and refers to audiometric testing at 1, 2 and 4 kHz. An average hearing loss of greater than 35 dB across these frequencies constitutes a fail. Both Tables I and II show that 40 of the 55 patients were offered aids but only 32 agreed to be fitted with one. Using Chi-squared analyses, there are statistically significant differences between the three groups (patients who were offered aids, those who refused and those who were not offered an aid) with respect to the proportions of males and females. Perhaps not unsurprisingly there are differences in the proportions who passed or failed audiometry although numbers are small. Since the gold standard measurement of outcome for this study was the fitting of a hearing aid, the positive predictive value of the Hearing Handicap Inventory questionnaire test was found in this study to be 58 per cent.

Second part of the study

Sixty-five patients were entered into the second part of the study, which included all patients newly fitted with hearing aids (study group) and all existing hearing aid owners (control group). However, after deaths and exclusions including illegible and non-returned questionnaires, the final number of patients in each of the study and control groups was 28, which meant a total of 56 patients were entered into the second part of the study. There were no significant differences in characteristics between the study and control groups.

TABLE II
RELATIONSHIP BETWEEN OUTCOMES OF PATIENTS ATTENDING THE ENT CLINIC AND HEARING HANDICAP SCORES AND AUDIOMETRY RESULTS

	Patient characteristics				
	Hearing handicap scores		Hospital audiometry results		
Outcome	Score < 24/40	Score > 26/40	Pass	Fail	Totals
Aid offered and supplied	22 (69%)	10 (31%)	3 (9%)	29 (91%)	32
Aid offered and refused	5 (62%)	3 (38%)	0 (0%)	8 (100%)	8
Aid not offered or supplied	12 (80%)	3 (20%)	12 (80%)	3 (20%)	15
					55

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TABLE III
AID USAGE AT THE OUTSET AND AT SIX MONTHS COMPARING STUDY AND CONTROL GROUPS

	At outset			At six months		
Aid use	Study group	Controls	Totals	Study group	Controls	Totals
Not wearing	28 (100%)	7 (25%)	35 (62%)	6 (21%)	8 (29%)	14 (25%)
Wearing:	0	21 (75%)	21 (38%)	22 (79%)	20 (71%)	42 (75%)
< 4 hrs		7 (25%)	7 (14%)	15 (54%)	6 (21%)	21 (37%)
> 4 hrs		14 (50%)	14 (24%)	7 (25%)	14 (50%)	21 (38%)
Totals	28	28	56	28	28	56

Clearly at the outset, 0 per cent of study group patients were wearing aids (Table III). This figure rose to 79 per cent at six months following the intervention. The percentage of patients in the combined study and control group populations who were wearing aids at the outset was 38 per cent. This figure approximately doubled to 75 per cent at six months. Overall, this represents a change in the percentage of hearing aid wearers in the whole sample population from nine per cent (21/227) at the outset to 20 per cent (42/214) at six months after intervention.

There was no statistically significant difference in mean handicap score at the outset and after six months for the control group alone (paired *t*-test: $t = 1.2$, $p = 0.24$) (Table IV). However, for the study group alone the mean handicap score at six months after aid fitting was significantly lower than the mean handicap score at the outset (paired *t*-test: $t = -3.95$, $p = 0.0005$).

At the outset there was no statistically significant difference between the mean handicap score of the control and study groups. However, six months after intervention the mean handicap score for the study group was significantly lower than for the control group (unpaired *t*-test: $t = 3.73$, $p = 0.0005$, d.f. = 53).

Discussion

It has been argued in particular by the RNID[17] that there is a large area of unmet need in respect of hearing handicap amongst the elderly population, and this study supports this view. Wilson and colleagues[11] have suggested that the way to approach the problem might be some form of generalised screening of people over the age of 65. This study has demonstrated the feasibility of identifying patients who want help by using a simple test within the general practice setting. It has also shown that intervention after screening results in significant benefit to patients.

The self-report questionnaire used in this investigation was designed by Ventry and Weinstein[19] and trialed extensively by Lichtenstein.[17] Using the same cut-off score of eight used in this study, Lichtenstein[1] found that 30 per cent of previously undiagnosed patients screened positive for hearing handicap. This is comparable to the 26 per cent found in this study. When he changed the score threshold to 24, Lichtenstein found that the positive predictive value (PPV) rose from 71 per cent to 92 per cent.[11] A total of 40 out of 55 patients referred in this study, were offered a hearing aid, which gives a PPV of 73 per cent. Changing the score threshold changes the PPV from 73 per cent to 81 per cent but in both studies the sensitivity drops dramatically.

TABLE IV
MEAN HANDICAP SCORES AT THE OUTSET AND AT SIX MONTHS WITH HEARING AID IN WHERE OWNED

Times	Study group	Control group
Outset	21.14 (s.d. 6.73)	17.8 (s.d. 5.66)
Six months	14.14 (s.d. 4.50)	19.73 (s.d. 6.27)

If the PPV in this investigation is viewed in terms of actual numbers of aids fitted, then the sensitivity drops to 58 per cent. This is due to the number of patients who refused aids offered by the hospital. Using in-house audiometry was found to improve the predictive value of the questionnaire from 58 per cent to 72 per cent. However, the environment for general practice audiometric screening is far from ideal and the majority of general practitioners do not possess audiometers.

The questionnaire has two main advantages when compared with the use of audiometric screening. These are its relative effectiveness in identifying patients who are willing to accept help, as demonstrated by Schow,[18] and its low cost since there is no need for special equipment or personnel. The disadvantage of such a questionnaire, however, is that responses may be affected by the composition of a particular target population, i.e. the mood, age, IQ and social-situational problems of the participants. Gatehouse,[21] Andersson *et al.*[22] and Newman *et al.*[23] reported on these various confounding factors in their respective studies.

The methodology used in this study may have meant that the sample was not representative of the target population as a whole, as it was taken from surgery attenders only. The higher level of pathology noted in the past in association with increased incidence of hearing disorder may therefore have resulted in an over-representation of patients with hearing loss in the sample. However, the sample represented 66 per cent of the studied age group and it is still of notable significance that a large number of patients with previously unreported handicap were detected using this method.

Although the majority of patients (58 per cent) who were referred having been identified as having a hearing handicap, were fitted with aids, a small but not insignificant number were not found to have a large enough hearing loss on hospital audiometric testing to warrant the fitting of an aid. A smaller number still refused an aid despite objective evidence of hearing loss. An extra question added

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into the questionnaire to find out whether patients would be interested in trying a hearing aid should they be offered one by the hospital, might have helped to reduce unnecessary referral in respect of this latter group.

The decision to fit patients with aids was made by the hospital according to a common agreed threshold and was irrespective of age. It can be seen from this study that a disproportionate number of younger patients were complaining of hearing handicap but did not have sufficient hearing loss on audiometric testing to warrant aid fitting. Work done by Gordon-Salantz and Fitzgibbons[24] has shown that younger subjects experience a greater handicapping effect from smaller hearing losses. It could therefore be argued that patients who felt handicapped by smaller hearing losses would also benefit from hearing aid fitting.

It is of note that patients refusing aids tended to be female, which according to work done by Bartkiw[25] on the visual appeal of hearing aids, might suggest a cosmetic consideration. However, the number is too small to allow valid conclusions to be drawn and more research is needed in this area. In addition, no explanation was given as to why three patients who passed hospital audiometry screening still went on to receive an aid.

In the second part of the study, 79 per cent of patients stated that they were still wearing their hearing aids at six months after fitting. The figure is pleasingly high but might have been an over-estimate in view of the fact that the questionnaires were not anonymized. Many patients were also not wearing their aids for the suggested minimum length of time of four hours per day. This study suggests that it is not appropriate to apply a minimum figure for daily hearing aid wear to patients with milder hearing losses. It appears that such patients may choose to wear hearing aids for certain tasks only and seem to derive significant benefit from doing so.

A statistically significant decrease in reported handicap was found after six months in the study group which was not observed in the control group. In addition there was also a statistically significant difference between the two groups in their level of reported hearing handicap at six months which was not present at the outset. It is not possible to be certain which part of the intervention resulted in these findings. They could primarily be due to hearing aid fitting but other explanations include a Hawthorn effect of the hospital referral itself, which has been looked at by Campbell and colleagues,[26] or the placebo effect of the hearing aid.

It is also possible that patients who are found on screening to have a handicap differ in a particular way from the control group of aid owners. This latter group are likely to have presented themselves spontaneously for help with a hearing difficulty and had their aids fitted in consequence. The control group demonstrated a slight but not statistically significant worsening of their handicap scores after six months which might have represented an inverse Hawthorn-type effect. The study may have resulted in a heightened awareness of hearing problems within this group. A randomized controlled trial using larger numbers of patients is needed to provide robust answers to these questions.

Interestingly, a quarter of all patients who owned aids both at the outset and at six months after intervention were not able to wear their aids at all. Although this resulted in wasted resources, new aid owners were no more likely to be unsuccessful aid wearers than existing aid owners. A lack of specialized counselling and after-care services might contribute to such an observation since the availability of these has been found by Upfold *et al.*[27] and Gordon-Salantz and Fitzgibbons[24] to contribute to successful hearing aid use.

Conclusion

In conclusion, routine questionnaire screening for deafness amongst the elderly is worthwhile in the general practice setting, but in view of the cost implications of setting up a nationwide screening programme, a larger study and a detailed cost–benefit analysis would be needed before such a programme could be implemented.

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Appendix 1: Questionnaire

Name _____

1. Do you have or have you ever had a hearing aid?

Yes _____ **No** _____

If the answer to this question is yes, please indicate how much you wear it:

Unable to wear it _____ **1–4 hours per day** _____

4–8 hours per day _____

More than 8 hours per day _____

2. Does a hearing problem cause you to feel embarrassed when you meet new people?

Yes _____ **No** _____ **Sometimes** _____

3. Does a hearing problem cause you to feel frustrated when talking to members of your family?

Yes _____ **No** _____ **Sometimes** _____

4. Do you have difficulty when someone speaks in a whisper?

Yes _____ **No** _____ **Sometimes** _____

5. Do you feel handicapped by a hearing problem?

Yes _____ **No** _____ **Sometimes** _____

6. Does a hearing problem cause you difficulty when visiting friends, relatives or neighbours?

Yes _____ **No** _____ **Sometimes** _____

7. Does a hearing problem cause you to attend religious services less often than you would like?

Yes _____ **No** _____ **Sometimes** _____

8. Does a hearing problem cause you to have arguments with family members?

Yes _____ **No** _____ **Sometimes** _____

9. Does a hearing problem cause you to have difficulty when listening to television or radio?

Yes _____ **No** _____ **Sometimes** _____

10. Do you feel that any difficulty with your hearing limits or hampers your personal or social life?

Yes _____ **No** _____ **Sometimes** _____

11. Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?