Hearing impairment and mental state in the elderly living at home

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Summary and conclusions

Altogether 153 (60%) out of a sample of 253 people aged 70 years and over living in their own homes were found to have impaired hearing when tested by pure-tone audiometry. This is almost twice the prevalence found in all other studies, in which deafness was assessed clinically or by self-reporting. The prevalence of deafness increased with age. Evidence of organic brain syndrome (dementia), as determined by questionnaire, was present in 39 (16%) out of 245 respondents, and of depression in 82 (35%). Dementia and depression were both age related. An apparent association between deafness and dementia was shown to be due to age alone. A significant relation between deafness and depression was independent of age and socioeconomic state.

The use of audiometric techniques of assessment established that an association exists between deafness and depression that is not simply a function of differential reporting reflecting the emotional state of the respondent.

Introduction

No community studies have been conducted in Britain to assess the prevalence of hearing loss in the elderly by audiometric techniques. Instead various studies have relied on the self-assessment of respondents,^{1 2} or the judgment of the interviewer or clinician.^{3 4} Both these methods produce results consistently suggesting that between 30% and 40% of the population aged 70 years and over suffer from appreciable bilateral hearing loss. Estimates of this order appear to be used by the Department of Health and Social Security when considering the provision of social services for the elderly with impaired hearing.⁵ A relation between hearing loss and mental state in the elderly has been suggested since the seminal study of Kay *et al* on the possible social and medical causes of mental disorders in old age.⁶ Workers have suggested, firstly, that long-term sensory deficit may play some part in producing symptoms of dementia^{6 7} and, secondly, that deafness may contribute to the precipitation of depression in old age.^{8 9}

We report a study in which a sample of elderly people were examined audiometrically in their own homes and assessed for mental function.

Methods

The sample consisted of all 365 persons aged 70 years and over registered with a group practice in an inner London borough. Forty-eight refused to take part and 46 were in hospital, on holiday, or untraceable. Eighteen were subsequently excluded from analysis because of inadequate audiometry, poor English, or inebriation. Thus 253 subjects, representing 69% of the sample, were studied.

Table I shows the age and sex distributions. There were no significant differences between respondents and non-respondents in these distributions.

TABLE I—Age and sex distributions of sample

	Age (years)				Total
	70–74	75–79	80–84	85+	
No (%) of men	46 (41)	34 (46)	7 (20)	5 (16)	92 (36)
No (%) of women	66 (59)	40 (54)	28 (80)	27 (84)	161 (64)
Total (%)	112 (100)	74 (100)	35 (100)	32 (100)	253 (100)

The interview questionnaire, which took on average one and a half hours to complete, was administered during one home visit to each respondent.

Deafness—Hearing loss in each ear was measured using pure-tone audiometry (air conduction) over the speech frequencies 0.25 kHz, 0.5 kHz, 1 kHz, 2 kHz, and 4 kHz. Masking was considered to be unnecessary. Audiocups were fitted to the Amplivox 2150 portable diagnostic audiometer used. A history was taken of any hearing impairment, the experience of deafness, and use of aids (where applicable). The audiometry was validated by the hearing-aid centre at the Royal National Throat, Nose and Ear Hospital, London, to which 44 patients were referred for hearing aids (19 requiring domiciliary visits). A high level of agreement (overall mean difference 0.3 db) was found between the average decibel levels of respondents retested under clinical conditions and their average levels in the field.

Mental state—Scales for screening for organic brain syndrome (dementia) and depression were extracted from the Comprehensive Assessment and Referral Evaluation (CARE) schedule¹⁰ and applied for each respondent. In their revalidation of the CARE schedule Gurland *et al*¹¹ recommend that a score of three on the dementia scale is the cut-off point that differentiates those people who would probably be clinically assessed as having some degree of dementia from those who would not. Similarly, they suggest that a score of seven or more on the depression scale is the cut-off point that differentiates those who would probably be clinically assessed as suffering from some degree of depression from those who would not. An independent psychiatrist with experience in research and psychiatry in old age carried out 10 clinical interviews to validate the application of the scales by the research team. A high level of agreement was found.

Statistical analysis—Unless otherwise stated, all significance levels were derived using a χ^2 test.

Results

Deafness—Using as a measure of deafness the degree of impairment at which a hearing aid is normally considered to be necessary (an average loss of 35 db or more over the speech frequencies of 1 kHz, 2 kHz, and 4 kHz in the better ear), we established that 153 respondents (60%) were deaf (table II). Sixty-nine per cent of those aged 75 years and over, 82% of those aged 80 years and over, and 84% of those aged 85 years and over were deaf. Thus the proportion deaf and the severity of deafness increased significantly with age ($p < 0.001$). In keeping with all other studies in which no audiometry was performed, only 96 respondents (38%) gave a positive answer to the conventional question on hearing loss in the interview schedule.

Dementia—Of the 245 respondents in the sample who completed the questions on dementia, 39 (16%) scored three or more and were thus probably suffering from some degree of dementia (table III). Of these 39 people, 19 (8% of the whole sample) scored five or more.

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TABLE II—Relation between advanced age and degree of deafness. Figures are numbers (%) of respondents

Degree of deafness	Age (years)		Total
	70-79	80 +	
0-34 db: not deaf	88 (47)	12 (18)	100 (40)
35-44 db: moderately deaf	38 (20)	8 (12)	46 (18)
45-69 db: substantially deaf	47 (25)	34 (51)	81 (32)
70+ db: severely deaf	13 (7)	13 (19)	26 (10)
Total	186 (100)	67 (100)	253 (100)

$\chi^2 = 30.09$; $df = 3$; $p < 0.001$.

TABLE III—Relation between age and dementia. Figures are numbers (%) of respondents

Degree of dementia	Age (years)		Total
	70-79	80 +	
Not demented	163 (91)	43 (66)	206 (84)
Mild dementia	15 (8)	5 (8)	20 (8)
Pronounced dementia	2 (1)	17 (26)	19 (8)
Total	180 (100)	65 (100)	245 (100)

$\chi^2 = 42.02$; $df = 2$; $p < 0.001$.

All but one of these 19 were adjudged at interview to be giving unreliable responses because of mental frailty. This was regarded by the research team as justification for taking a score of five as an additional cut-off point denoting a division between mild and pronounced dementia. These figures for the prevalence of dementia are comparable with those of other studies reviewed by Gilmore.¹² As expected, a significant relation was found between increased age and the prevalence and severity of dementia ($p < 0.001$).

Deafness and dementia—Thirty-one (79%) of the 39 respondents with dementia were also deaf (table IV). A significant relation was found between deafness and dementia ($p < 0.01$). As people get more deaf they are significantly more likely to be demented ($p < 0.05$). These results, however, do not support the suggestion of Kay *et al*⁶ that the connection between deafness and dementia is "too strong to be wholly explicable by advanced age." Once age is controlled for the apparent relation is lost (table V). Deafness and dementia appear to be merely contiguous conditions; both are functions of age.

Depression—Of the 235 respondents who completed the full depression scale, 82 (35%) scored seven or more and thus may be taken as suffering from at least "limited" depression. Of these 82 respondents, 25 (11% of the sample) scored 14 or more and may be taken as suffering from "pervasive" depression. These figures for the

TABLE IV—Relation between severity of hearing loss and dementia. Figures are numbers (%) of respondents

	Degree of deafness			Total
	Not deaf (0-34 db)	Moderately and substantially deaf (35-69 db)	Severely deaf (70+ db)	
Not demented	87 (92)	101 (81)	18 (72)	206 (84)
Mild and pronounced dementia	8 (8)	24 (19)	7 (28)	39 (16)
Total	95 (100)	125 (100)	25 (100)	245 (100)

$\chi^2 = 7.72$; $df = 2$; $p < 0.05$.

TABLE V—Dementia by degree of deafness, controlling for age. Figures are numbers (%) of respondents

	Age (years)							
	70-79				80 +			
	Not deaf (0-34 db)	Moderately and substantially deaf (35-69 db)	Severely deaf (70+ db)	Total	Not deaf (0-34 db)	Moderately and substantially deaf (35-69 db)	Severely deaf (70+ db)	Total
Not demented	78 (94)	74 (88)	11 (85)	163 (91)	9 (75)	27 (66)	7 (58)	43 (66)
Mild and pronounced dementia	5 (6)	10 (12)	2 (15)	17 (9)	3 (25)	14 (34)	5 (42)	22 (34)
Total	83 (100)	84 (100)	13 (100)	180 (100)	12 (100)	41 (100)	12 (100)	65 (100)

Significance of difference between respondents with and without dementia—Those aged 70-79: $\chi^2 = 2.27$; $df = 2$; NS. Those aged 80 and over: $\chi^2 = 0.75$; $df = 2$; NS.

prevalence of depression are higher than those found in other community studies,^{13,14} but this may be partly explained by the greater age of the respondents in the present study and the consequently higher proportion of women, among whom depression is apparently more common.¹³ When the two categories of depression were combined a significant relation was found between age and depression (table VI), but there was no association between age and the severity of depression. The 19 respondents assessed as suffering from pronounced dementia were excluded from all further analysis of depression since their responses at interview were judged to be unreliable.

TABLE VI—Relation between age and depression. Figures are numbers (%) of respondents

	Age (years)		Total
	70-79	80 +	
Not depressed	120 (69)	33 (54)	153 (65)
Limited and pervasive depression	54 (31)	28 (46)	82 (35)
Total	174 (100)	61 (100)	235 (100)

$\chi^2 = 4.39$; $df = 1$; $p < 0.05$.

Deafness and depression—Fifty (69%) of the 72 respondents who were depressed were also deaf. A significant relation was found (table VII) between deafness and depression ($p < 0.01$). No relation could be found, however, between the severity of depression and the severity of deafness. When age and socioeconomic state were controlled for (using ANOVA, a subprogram of the Statistical Package for the Social Sciences for analysis of variance) a significant relation between deafness and depression remained (using an adjusted χ^2 test $p < 0.05$).

TABLE VII—Relation between depression and deafness. Figures are numbers (%) of respondents

	Depression		Total
	Not depressed	Limited and pervasive depression	
Not deaf (0-34 db)	73 (50)	50 (69)	123 (57)
Deaf (35+ db)	72 (50)	22 (31)	94 (43)
Total	145 (100)	72 (100)	217 (100)

$\chi^2 = 6.39$; $df = 1$; $p < 0.01$.

Discussion

The use of audiometric techniques to assess the prevalence of deafness yielded estimates almost double those produced by other studies, all of which relied solely on self-reporting by patients or clinical judgment. This gross discrepancy was confirmed by the only two comparable studies in which audiometry was used, both of which were concerned with the elderly in residential institutions (D K Burton, unpublished results).¹⁵ Considerable doubt is cast, therefore, on the validity of all studies estimating the prevalence of deafness when audiometry is not carried out.

Contrary to the suggestions of other researchers and to conventional belief, we could find no relation between deafness and dementia. An explanation for this is probably that audiometry was not performed in any previous studies looking at the possible aetiology of dementia. Although the present study showed an apparently closer relation between deafness and dementia than other studies, in that 79% of the respondents with dementia were also deaf, it also showed for the first time that deafness is the norm and not the exception, particularly in those aged over 80. Some link may possibly exist between dementia and deafness of early onset. As a strong component of dementia is poor memory recall, however, without recourse to longitudinal studies using audiometric techniques causal associations cannot be made.

Two main implications arise for diagnosing and managing mental disorders in the elderly in the community. The first concerns the increasingly common practice for both research and clinical purposes of using screening devices, in the form of standardised tests, as an aid to establishing the presence of mental disorders, particularly dementia.¹⁶⁻¹⁸ Indeed, we used such a device in the present study. Many compilers of these measures caution would-be users that the tests, being essentially verbal, may be unsuitable for deaf subjects.¹⁷⁻¹⁹ Since 82% of those aged 80 and over and 89% of those with pronounced dementia in this study were deaf (table VIII), the validity of all such screening devices would seem to be questionable.

TABLE VIII—Relation between severity of dementia and deafness. Figures are numbers (%) of respondents

	Dementia			Total
	Not demented	Mild dementia	Pronounced dementia	
Not deaf (0-34 db)	87 (42)	6 (30)	2 (11)	95 (39)
Deaf (35+ db)	119 (58)	14 (70)	17 (89)	150 (61)
Total	206 (100)	20 (100)	19 (100)	245 (100)

$\chi^2 = 8.07$; $df = 2$; $p < 0.05$.

Nevertheless, tackling assessment and diagnostic procedures firmly expecting deafness in nearly all patients with dementia and most elderly patients with depression should overcome this problem.

We found that severely deaf respondents were initially loth to make the effort to respond to the interview questionnaire until they realised that their communication difficulties were fully appreciated and would be allowed for. This raises questions about the positioning in interviews of tests for dementia, which require maximum concentration and yet are frequently placed too early for good rapport to have been established between patient and clinician. It is essential to use great care, patience, and ingenuity to ensure maximum audibility and visibility of the spoken word and to be prepared, if necessary, to use the written word. Conventional clinical techniques may prove inadequate, in which case probably no assumptions about mental state should be made without carrying out audiography. There is a danger of regarding, and therefore treating, elderly people as demented or confused when they are actually severely deaf, particularly as the manifestations of both these disorders are in many ways so similar. Such fears have already been voiced by researchers, particularly with regard to residents in local authority homes for the elderly.²⁰⁻²¹

The second matter concerns management and treatment of people with impaired hearing. Not wearing a hearing aid does not appear to worsen the impairment—that is, the degree of deafness. Without an aid, however, the social and psychological effects of deafness—namely, withdrawal, depression, and the frustration of other people—are unalleviated and may feed back into the disorder, accentuating alienation and discrimination.

This study is unremarkable in its finding that only 13% of

the elderly population (of whom 60% were deaf) possessed hearing aids; thus there is evidently vast scope for action. While deafness is not a major cause of depression in old age, it is certainly a contributing factor and one that may be more readily ameliorated than many others.

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ONE HUNDRED YEARS AGO We are requested to announce that the full-sized clay model of the statue of Harvey, which is to be erected at Folkestone, has nearly approached completion; and that the sculptor, Mr A B Joy, invites the subscribers to the Harvey Tercentenary Memorial Fund to a private view of the model (upon presentation of address cards) on Wednesday next, August 4th, from 11 to 5.30 o'clock, at his studio, No. 8, The Avenue, 76 Fulham Road, SW. (*British Medical Journal*, 1880.)