

## Acquired Hearing Loss and Psychiatric Illness: An Estimate of Prevalence and Co-morbidity in a Geriatric Setting

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Hearing impairment and mental disorders are common among residents of nursing homes and homes for the aged; however, the relationship between sensory deficit and psychiatric illness has been little investigated in this population. The prevalence of hearing impairment, psychiatric illness, and co-morbidity was investigated in a sample of 102 elderly residents from consecutive admissions to a home for the aged. Examining the coincidence of these disorders showed evidence of an association between hearing loss and paraphrenia, and hearing loss and dysphoric states, but not between hearing and cognitive impairment. The results of this survey provide only suggestive evidence regarding aetiology, but strongly support conjoint assessment of the elderly.

Estimates of the prevalence of hearing disorder vary, as do definitions of 'hearing impairment' and 'the elderly'. There is, however, general consensus that the majority of hearing-impaired individuals have an acquired loss, that the risk of hearing loss increases with age, and that the resulting decrement in auditory stimulation may have detrimental social and psychological effects (Noble, 1978; Gilhome-Herbst & Humphrey, 1980; Thomas, 1981).

Nursing home residents and those living in homes for the aged are thought to be particularly at risk for unattended hearing disorders. This is so firstly because of the advanced age and infirmity of the population and secondly due to nihilistic attitudes of both staff and residents towards rehabilitation (Alpiner, 1978). Likewise mental disorders, particularly depression and dementia, are thought to be common in such settings. The true prevalence of these disorders would be expected to vary between populations and with the use of different diagnostic criteria (Gurland & Cross, 1982).

An association between hearing deficits and mental disorders in old age has generally been assumed, but has been the subject of little systematic research. Experimental studies of induced hearing loss in young subjects (Hebb *et al.*, 1954; Zimbardo *et al.*, 1981) provide suggestive evidence of emotional disturbance; but these findings may have little relevance, as the characteristics of the subjects, the social contexts, and even the nature of the hearing deficits differ from the pattern presented by the elderly. The congenitally or pre-lingually deaf also clearly face a different set of circumstances from

that faced by elderly adults, who lose hearing gradually, and usually only partially.

There is a small body of psychiatric literature which suggests an aetiological, or at least correlational association between hearing loss and the mental disorders of old age. Slater & Roth (1969), in their textbook *Clinical Psychiatry*, describe one-third of paraphrenics and two-thirds of patients with organic brain syndromes as having a "hearing impairment". They state that the association "... seems too strong to be wholly explained by the advanced age of the subjects" (p. 548). Cooper and his co-workers (1974) reported higher rates of hearing impairment accompanying paranoid disorders than in a series of age matched affective disorders, and described higher rates of severe conductive hearing loss of long duration in the paranoid patient group. Cooper (1976) suggested that individuals with a genetic predisposition for developing schizophrenia may be made more vulnerable by the social isolation imposed by long-standing hearing impairment.

Gilhome-Herbst & Humphrey (1980) reported a significant relationship between hearing impairment and dysphoria in an elderly population living at home. A correlation between degree of hearing loss and degree of cognitive impairment disappeared when the effect of age was eliminated, which suggests that the association between hearing impairment and cognitive deficit, at least, may be due to age alone. Other work, however, has indicated that hearing deficits may interfere with the assessment of cognitive function in elderly individuals irrespective of their cognitive ability

(Ohta *et al*, 1981; Thomas *et al*, 1983).

Given that the co-morbidity of hearing impairment and mental disorders in a geriatric population may be of both practical and aetiological significance, the present study was undertaken to estimate the prevalence of the two types of disorder, and the rate of their coincidence, in a population selected for neither.

## Method

### Sample

The sample consisted of residents admitted to a 440-bed metropolitan Toronto home for the aged between January 1981 and June 1983, who met the following criteria for inclusion: (1) they were aged 60 years or over; (2) they were English-speaking; and (3) they were able and willing to provide informed consent to participate.

### Procedure

Participants were interviewed to obtain demographic information and were given the *Mini-Mental State Examination* (MMSE, Folstein *et al*, 1975) as a screen for cognitive impairment. They were seen next by an ear, nose, and throat consultant who took a brief history, examined them for current ear pathology, and treated any acute problems prior to audiometry. The audiologist assessed hearing using standard audiometric procedures. Pure tone air and bone conduction thresholds were obtained at eight frequencies, ranging from 0.25 to 8 kHz, using a Madsen ERO76 audiometer, and TDH-39 earphones in a TRACOR booth. Speech reception thresholds and speech discrimination scores were obtained using recorded speech on Madsen cassettes. Audiological diagnoses of presence, degree, and type of hearing loss were made on the basis of the configuration of threshold measures across frequencies, a contrast of air and bone conduction thresholds, and impedance measures. The measure of degree of hearing impairment used in correlations with other measures was the Pure Tone Average weighted ratio (PTA<sub>ro</sub>). This was derived by calculating the pure tone average across tested frequencies for the right and left ears independently, then taking an average weighted 7:1 for the better ear, as described by Noble (1978).

Participants were also referred to a psychiatrist, who reviewed medication and results of previous investigations (e.g., computer assisted tomographic scans and thyroid function tests), took a psychiatric history, repeated the MMSE, and administered the Present State Examination (PSE, Wing *et al*, 1974). Residents described as having a mental disorder all met diagnostic criteria for psychiatric illness according to the World Health Organisation (1978) ICD-9 classification. Interviews with hearing-impaired individuals were assisted by an amplification device, consisting of a microphone, a small amplifier, and a set of headphones with independent volume controls. Clinical follow-up was conducted, as appropriate, for residents found to have either impaired hearing or mental disorder.

### Data analysis

Statistical analyses were conducted using the Statistical Package for the Social Sciences, (SPSS, Nie *et al*, 1975). Pearson correlation procedures were followed to examine the strength of associations between variables, and chi-square analyses were used to test for differences between groups.

## Results

### Sample characteristics

Of 205 residents admitted to the home for the aged during the 30-month intake period, 102 were admitted to the study and were seen in the departments of ENT, audiology, and psychiatry. Of the 103 residents not included in the study, 41% did not speak English, 21% were cognitively impaired to a degree which precluded informed consent or meaningful interview, 24% refused to participate, and 13% died or were transferred before all investigations were complete. The sample was comprised mainly of elderly, widowed females, and in these respects did not differ from the population in this or other homes for the aged. Ages ranged from 61 to 99 years, with a mean and median age of 82 years. Fifty-seven per cent of the sample was female, 53% was widowed, 24% married, and 23% single, separated or divorced. The sample was somewhat better educated than expected, as only 14% had less than five years of schooling and 45% had completed at least 12 years of formal education.

### Otology findings

Of the 102 participants in the study who underwent ENT examination, 46% required cerumen removal prior to referral for audiology. In 30%, the ear wax probably caused an appreciable conductive hearing loss, and required softening for removal. Although a history of middle ear infections in childhood was not uncommon and was reported by 14% of the sample, no active disease was found on examination. Thirteen per cent of the sample reported a history of exposure to loud noise.

### Audiology findings

The mean audiogram, representing pure-tone thresholds across the tested frequencies for the sample tested, presented a mean configuration of increasing thresholds at higher frequencies, characteristic of a presbycusis hearing loss. The variability within the sample, as represented by the standard deviations at each frequency, was relatively stable across the tested frequencies, at about 20 decibels.

Using the weighted PTA<sub>ro</sub> described above, hearing function for the sample is described in Table 1. The appropriate criteria for designating and categorising degrees of hearing impairment are controversial (Schow & Nerbonne, 1981); however, the generally accepted range for social adequacy includes thresholds below 24–34 dB HL. Only 34% of our sample obtained PTA ratios in this range. Of the residents with clinically significant hearing loss ( $n = 67$  or 66% of the sample tested), 63% had a

TABLE I  
Degree of hearing impairment in study sample (n = 102)

	n	Percentage
Normal hearing to mild impairment (<35 decibels hearing loss)	35	34
Mild to moderate impairment (35–44 dB HL)	20	20
Moderate to severe impairment (45–59 dB HL)	31	30
Severe to profound impairment ( $\geq 60$ dB HL)	16	16
	102	100

sensori-neural hearing loss, 35% had a mixed hearing loss (i.e., both conductive sensori-neural components), and 2% had a purely conductive hearing loss.

#### Psychiatric findings

The distribution of psychiatric diagnoses in the sample is shown in Table II. The 40 cases in the category 'Organic brain syndrome' (OBS) included: multi-infarct dementia (10%), alcohol-induced dementia (3%), and degenerative dementia of unknown aetiology, probable Alzheimer's disease (87%). The affective disorders were represented by two bipolar patients, both currently controlled on lithium carbonate, and three unipolar cases with symptoms of anxiety. The paraphrenic disorders had previously been unrecognised, except in one case controlled on haloperidol 0.5 mg. daily. They had been regarded as probable dementias, although none of the patients was cognitively impaired and all were clearly delusional on mental state examination. The neurotic and personality disorders included one anxious obsessive-compulsive individual and one immature personality with a history, from admission, of belligerence and irritability with staff and other residents.

#### Associations between hearing and psychiatric disorder

The proportions of this sample with hearing impairment, psychiatric disorder, and coincident pathology are shown in Table III. Although both clinically significant hearing impairment and psychiatric disorder were common in this sample, their coincidence did not indicate a strong relationship ( $\chi^2(1df) = 0.09$ , n.s.).

TABLE II  
Psychiatric diagnoses of study sample (n = 102)

	n	Percentage
No psychiatric illness	49	48
Organic brain syndrome	40	39
Affective disorder	5	5
Paranoid state or paraphrenia	6	6
Neuroses and personality disorder	2	2
	102	100

TABLE III  
Coincidence of hearing impairment and psychiatric disorder in study sample (n = 102)

	Psychiatric disorder	No psychiatric disorder	Total
Hearing impairment	36%	30%	66%
No hearing impairment	17%	17%	34%
Total	53%	47%	100%

The relationship between degree of hearing impairment and presence or absence of psychiatric disorder, shown in Table IV, was stronger. While residents with normal or mildly impaired hearing were equally divided with respect to psychiatric disorder, over 60% of those with severe-to-profound impairment had a psychiatric disorder.

Examining the relationship between psychiatric diagnosis and degree of hearing impairment, as shown in Table V, indicates a possible source of this association. Although there were no differences in the distributions across degrees of hearing impairment for residents with no psychiatric illness and those with diagnoses of organic brain syndromes, residents with functional diagnoses more commonly had moderate-to-severe hearing impairment. Thus, in contrasting those with functional psychiatric illness with those with no diagnosis or an organic brain syndrome, there appears to be a greater association between functional psychiatric disorder and more severe hearing loss. The total numbers with functional diagnoses were small in the sample, however, and generalisations cannot be made with any assurance. The

TABLE IV  
Relationship between hearing impairment and psychiatric disorder — by degree

	Psychiatric disorder	No psychiatric disorder
Normal hearing to mild impairment	49%	51%
Mild to moderate impairment	45%	55%
Moderate to severe impairment	55%	45%
Severe to profound impairment	62%	38%

TABLE V  
Relationship between psychiatric disorder category and degree of hearing impairment

Psychiatric diagnosis	Degree of hearing impairment			
	None	Mild	Moderate	Severe
No psychiatric disorder	37%	23%	29%	11%
Organic brain syndrome	33%	29%	28%	10%
Affective disorder	40%	—	60%	—
Paranoid disorder	17%	—	33%	50%
Neurosis/personality	33%	—	33%	33%

absence of an association between degree of hearing impairment and organic brain syndromes also was noted in the correlation between *MMSE* scores and PTA ratios. The correlation coefficient was not statistically significant for either the total group (df 102,  $r = -0.09$ ,  $P = 0.19$ ), or for the organic brain syndrome group (df 40,  $r = -0.3$ ,  $P = 0.07$ ). Likewise, although age was positively correlated with PTA ratios (df 102,  $r = 0.60$ ,  $P = 0.001$ ), age and *MMSE* scores were not significantly correlated for either the total sample (df 102,  $r = 0.10$ ,  $P = 0.15$ ) or the organic group (df 40,  $r = 0.20$ ,  $P = 0.11$ ).

The temporal association between onset of hearing loss and psychiatric symptoms could not be examined in this series, due to unreliable information and lack of documentation. Even the acknowledgement of a current hearing problem was uncertain. Nearly half of those with hearing loss in the moderate range, and 20% of those with severe-to-profound losses, described their hearing as normal; conversely, more than one-third of those with normal-to-mild losses described difficulty in hearing and understanding speech. This lack of congruence between self-report and audiometry gives little confidence in the interview as a method of identifying the hearing-impaired elderly (Corbin *et al*, 1984).

### Discussion

The morbidity rates identified in this sample may seem high, with 66% of the subjects hearing-impaired and 52% with mental disorder; however, these are not likely due to a deteriorated condition of our sample in particular. Firstly, the rates are congruent with findings in a community sample reported by Gilhorne-Herbst and Humphrey (1980), who found 60% of their elderly subjects to be hearing-impaired, 35% depressed, and 16% demented. Secondly, the residents who were unable to provide informed consent or to complete the investigative protocol were usually cognitively impaired, and some may also have had impaired hearing; their elimination from the study by our sample selection procedure had the likely effect of lowering the rates of morbidity. The others eliminated who were not English-speaking were neither more nor less likely to be hearing-impaired, or cognitively impaired, but may have been at greater risk of dysphoria or other functional illness due to social isolation. Thus, although the results of this survey provide only estimates of the prevalence of these disorders in a home for the aged, they are likely if anything to be under-estimates.

The lack of reliable information regarding sequence of events obscured any possible aetiological relationships; however, the associations between types of mental disorder and degree of hearing loss are of interest, particularly as this

evidence comes from a series of individuals not selected for either psychiatric or hearing impairment. The absence of a relationship between the diagnosis of organic brain syndrome and degree of hearing impairment appears to disagree with previous reports of an association (Slater & Roth, 1969; O'Neal & Calhoun, 1975). Gilhorne-Herbst and Humphrey (1980) also reported a non-significant correlation between degree of cognitive impairment and degree of hearing loss; but, in their study, the effect of age first had to be factored out. In the present series, age was correlated with degree of hearing loss but not with degree of cognitive impairment. Previous findings of a relationship between hearing impairment and cognitive impairment may have been due, in part, to communication problems alluded to above (Ohta *et al*, 1981; Thomas *et al*, 1983). Inappropriate or inadequate responses to questioning are common among both the hearing-impaired and the cognitively-impaired. One way of determining the probable contribution of each is to test by audiometry before attempting a mental state examination. If there is evidence of a hearing loss, communication may be improved with the use of an amplification device, and by interviewing in a quiet environment. As effective communication is essential in the practice of psychiatry, instruments such as the amplifier described above are a valuable addition to the armamentarium of the psycho-geriatrician.

In this series, hearing impairment was more common among the residents with functional psychiatric disorders, paraphrenia in particular, than among those with organic disorders or with no psychiatric illness. The number in the paraphrenic group was small, and they tended to be quite elderly; still, the proportion with moderate-to-severe hearing loss was striking. Also noteworthy was the rate of misdiagnosis in this group.

These findings encourage conjoint assessment and management of elderly residents. The principle benefit in most cases may be an improvement in diagnosis; however, in a previously reported case, the remediation of a hearing loss was followed by a reduction in the psychotic symptoms of a paraphrenic patient (Eastwood *et al*, 1981).

The association between hearing impairment and psychiatric illness in this sample was not statistically significant. Yet, with the two types of disorder coincident in more than one-third of the series, the clinical implications should not be over-looked. Assessment and management of elderly psychiatric patients is certainly complicated by the communica-

tion disorder which accompanies hearing loss. Likewise, effective rehabilitation programmes for hearing-impaired elderly residents of homes for the aged must take into account the prevalence of cognitive impairment, and the variable response to rehabilitation efforts which may be caused by functional mental disorders.

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