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The Prevalence and Correlates of Self-Reported Hearing Impairment in the Ibadan Study of Ageing

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Abstract

This cohort study of persons aged 65 years and over, conducted in the Yoruba-speaking regions of Nigeria determines the prevalence and correlates of hearing impairment (HI) in the elderly population. Self-reports of HI and its putative risk factors among several indices were obtained using face-to-face interviews. HI was based on self-report, complemented by observer's evaluation. HI was found in 79, giving a prevalence of 6.1%. Gender difference was not significant but increasing age was associated with higher prevalence. Logistic regression analysis that adjusted for age and sex, revealed that history of recurrent suppurative otitis media (OR=4.6, CI=2.3-8.9, P=0.01) and head injury (OR=2.2, CI=1.1-4.3, P=0.02) and current hypertension (OR=2.1, CI=1.2-3.6, P=0.01) were significantly associated with HI. No identifiable risk factors were found in 32 (40.5%) of the respondents. We conclude that the prevalence of HI among the elderly in Nigeria is comparable to reports from other countries. Identified risk factors were preventable or controllable. The large proportion of elderly with no identifiable risk factors, presumably presbycusis, suggests a need for further study. The strategies for control of these risk factors and hearing aid support should be integrated into health care policy initiative for elderly persons in the sub-Saharan Africa.

Introduction

Hearing impairment (HI) is the most common sensory deficit among older adults and its effects can be socially and psychologically devastating, leading to loneliness, isolation, anxiety and depression; and associated with other sensory impairment.^{1, 2} The projected

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Authorship

OG did the conception and design of the study, OG, AOL and TA did the analysis and interpretation of data, OG and AOL did the conception of the paper and interpretation of the data, AOL did the drafting of the article and OG and AOL revised the article critically for intellectual content and final approval of the content. OG is the guarantor of the paper.

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global rise in the proportion of persons aged 65 years and over is likely to be associated with increasing prevalence of HI among the elderly.^{3, 4}

The control of risk factors offers the prospect of stemming the rise in the prevalence of HI. Studies from developed countries have documented age, noise, head trauma and chronic medical illnesses as significant risk factors for HI.^{3, 5, 6} Risk factors may be different in developing countries. For example, in view of large sections of the population residing in rural areas in the developing countries, noise may be a less important factor. On the other hand, poor access to medical service may mean that medical conditions that could otherwise be promptly treated may become chronic and therefore predispose to hearing impairment. **For example, poorly controlled hypertension or diabetes may predispose to HI through the occurrence of chronic atherosclerosis which in turn causes a reduction in the blood supply to the inner ear 4–6. It is also plausible to speculate that the presence of chronic recurrent rhinosinusitis and chronic ear discharge will predispose to HI in the elderly.**

Even though the majority of elderly persons in the world reside in developing countries (and projected to rise even further) there has been little study of the major causes of disability among them. Specifically, there is a paucity of studies addressing the prevalence and correlates of HI in the elderly in these countries with a consequent gap in our knowledge about effective strategies to prevent the problem.^{5, 6} In this report, we present the results of an epidemiologic study of hearing loss in a community sample of elderly persons. The report examines the prevalence and putative risk factors associated with hearing loss in the elderly.

Methods

Sampling

The Ibadan Study of Aging (ISA) is a longitudinal cohort study of the mental and physical health status as well as the functioning and disability of elderly persons (aged 65 years and over) residing in the Yoruba-speaking areas of Nigeria, consisting of eight contiguous states in the south-western and north-central regions (Lagos, Ogun, Osun, Oyo, Ondo, Ekiti, Kogi and Kwara). These states account for about 22% of the Nigerian population (approximately, 25 million people). The baseline survey was conducted between November 2003 and August 2004 and the methodology has been described in full elsewhere,^{7, 8} and only a brief summary is provided here. Respondents were selected using a multi-stage stratified area probability sampling of households. In households with more than one eligible person (aged 65 years and fluent in the language of the study, Yoruba), the Kish table selection method was used to select one respondent.

Data Collection

Face-to face interviews were carried out on 2152 respondents who provided consent to participate, representing a response rate of 74.2%.

An annual three-wave follow-up of the cohort was begun in 2007. Hearing problems were examined during the second wave in 2008. The sample in 2008 consisted of 1387 surviving respondents from the previous wave. Of these, 1190 (86%) were successfully interviewed.

The majority of those not interviewed had either relocated, too sick to be interviewed or could not be found after multiple calls. Refusals were less than 1%.

Measures

Along with several other assessments, a checklist of chronic physical and pain conditions was included in the ISA.9 At the 2008 follow-up; respondents were asked if they had been told by a physician that they had diabetes or hypertension. The Rose Angina Questionnaire¹⁰ was used to assess presence of angina. Questions were asked about hearing-related problems. Specifically, respondents were asked: if they had a) “difficulty hearing clearly”; b) “recurrent pus discharge from the ear in the past”; c) “recurrent nasal congestion and rhinorrhoea” and d). “any previous head injury”; The diagnoses of recurrent suppurative otitis media and recurrent rhinosinusitis were made based on positive response to the questions “b” and “c” respectively. Respondents were required to give a yes or no answer to each of these questions. At the end of assessment, lasting an average of 1 hour, interviewers completed a set of questions reflecting their observation during the interview. One of the items was whether difficulty of hearing had been noted during the interview. In this report, only persons with reported hearing difficulty that was complemented by interviewer observation were regarded as having HI.

The survey was approved by the University of Ibadan/University College Hospital, Ibadan Joint Ethical Review Board.

Data analysis

We present the unweighted estimates of the occurrence of HI. Univariate analysis was used to determine the significance of the differences in the occurrence of the demographic and clinical variables between the subjects with and without HI. Associations with socio-economic variables and comorbid conditions were explored using logistic regression and the results are presented as odds ratios (ORs) with 95% confidence intervals. Economic status was assessed by taking an inventory of household and personal items such as chairs, clock, bucket, radio, television set, fans, stove or cooker, car, telephone, etc. The list was composed of 21 such items. This is a standard and validated method of estimating economic wealth of elderly persons in low income settings. 7. Respondents’ economic status is categorized by relating each respondent’s total possessions to the median number of possessions of the entire sample. Thus, economic status is rated low if its ratio to the median is 0.5 or less, low-average if the ratio is 0.5 – 1.0, high-average if it is 1.0 – 2.0, and high if it is over 2.0. Residence was classified as rural (less than 12,000 households), semi-urban (12,000 – 20,000 households) and urban (greater than 20,000 households). The odds for the occurrence of variables were determined with multivariate analysis. The clinical correlates were explored with logistic regression analysis after adjusting for age 11 and the estimates of standard errors of the Odds Ratio (OR’s) obtained were made with the STATA. All of the confidence intervals reported are adjusted for design effects. In order to take account of the sample design, we used the jackknife replication method implemented with the STATA statistical package to estimate standard errors for the means and proportions. 12 Statistical significance was set at 0.05 in two-sided tests.

Result

The sample consisted of 750(57.7%) females and 552(42.3%) males with a mean age of 77.3years (SD=0.3). Most respondents resided in rural or semi-urban households 1002 (77.8%) and had no formal education, 552 (54.2%), table 1. Table 2 shows that hearing loss was reported and confirmed by observers in 79, giving a prevalence of 6.1% (SD=1.2). Residence was rural in 22(27.9%), 40(50.6%) smoked cigarette while 41(51.9%) indulge in alcohol drinking.

Comparing persons with HI and those without, revealed that age (P=0.01) was a significant difference while gender (P=0.41), formal education (P=0.86), economic status(P=0.34), residence(P=0.36), alcohol consumption (P=0.42) and cigarette smoking(P=0.17) were not found to be significant.

In logistic regression analysis in which sex was controlled for, age remained a significant correlate with the likelihood of HI diminishing with decreasing age. . In contrast, none of gender, formal education, economic status, residence, cigarette smoking or alcohol consumption was a significant correlate of HI, table 2.

Various putative risk factors were examined for association with HI. These included previous recurrent suppurative otitis media, head injury, recurrent rhinosinusitis, angina, hypertension and diabetes mellitus. Of the 79 respondents with HI, 32 (40.5%) reported none of the risk factors. A comparison of those who reported none of the assessed risk factors with those who reported one or more 47(59.5%), revealed no significant difference in the mean age (P=0.47), gender (P=0.63), educational grade (P=0.35), economic status (P=0.59) or residence (P=0.97).

Table 3 shows the results of univariate analysis comparing the clinical correlates of elderly subjects with HI and those without HI. History of previous recurrent suppurative otitis media (P = 0.01) and head injury (P=0.02) and current hypertension (p=0.04) were found to be significant correlates while the other variables were not. However after adjusting for age and gender in a logistic regression analysis, self-reported history of recurrent suppurative otitis media (OR=4.6, CI=2.34-8.99, P=0.01), head injury (OR=2.2, CI=1.14-4.26, P=0.02) and hypertension (OR=2.1, CI=1.18-3.57, P=0.01) were found to be significantly associated with HI table 4. On the other hand none of self-reported recurrent rhinosinusitis (OR=1.1, CI= 0.52-2.20, P=0.86), transient ischaemic attack (OR=1.43, CI=0.60-3.44, P=0.42), or diabetes mellitus (OR=1.5, CI=0.51-3.57, P=0.48) was a significant associated factor.

Discussion

In this study, we have presented an estimate of 6.1% for hearing loss in community-dwelling elderly Nigerians, aged 65 years and above. We have shown that the prevalence of HI significantly increased with age but had no relationship with other socio-economic and lifestyle factors. In addition, HI was significantly related to self-report of suppurative otitis media and of head injury as well as assessed hypertension. However, recurrent rhinosinusitis, transient ischemic attack or diabetes mellitus were not significant correlates.

The estimated prevalence of HI in this sample is close to that reported by Bazargan et al⁵ who reported fair to poor hearing in between 9.3% and 26% of their sample. However, our estimate was low when compared to the 30% prevalence of hearing impairment reported in 977 elderly people residing in a community in UK¹³ and 21% of those aged 60 and older in the Alameda County in California.¹ Our observation of age as a significant risk factor is in conformity with the assertion made by Moscicki et al¹⁴ and others^{1, 5, 13} that advanced age might be the most important risk factor for hearing loss. One factor which might predispose to higher occurrence of HI in the elderly is the exposure to multiple medications, common in the very old. Multiple medications have been reported to produce cumulative deleterious effect on hearing.^{15–17} That is, when only one drug was administered, it might not be ototoxic, but in conjunction with other medications, or noise, it could affect an individual's hearing. The myriad number of medications which could be obtained across the counter in our setting and the nearly unlimited number of possible combinations in which they could be used, makes this hypothesis very difficult to explore in our study.

Even though higher estimate of HI was found in women compared to men, gender was not found to be significant in the occurrence of HI. There has been inconsistency in the report of gender as a risk factor for HI in the literature. For example, while some have found females to be at elevated risk,^{4, 5} others have not found this to be the case.^{1, 3, 13} These differences might reflect the differential exposure to putative risk factors between the genders in various study populations. In a previous report, while a history of noise exposure was found to be a significant risk factor for men, history of meniere's disease and medical illness was found to be significant risk factors for women.^{18–22} Furthermore, access to health care might also be important in determining the rate of HI between men and women. Generally in Africa, the economic status of women tends to be lower than men and this may reduce access to healthcare.

The main risk factors identified in this report were previous suppurative otitis media, head injury and hypertension. Macandie & O'Reilly²² reported that the differences in preoperative HI (assessed using bone conduction threshold) between the ears with previous suppurative otitis media and contra-lateral normal ears were statistically significant ($P < 0.01$). Similarly, Cusimano et al¹⁹ reported that the sensorineural component in hearing loss correlated with the duration of chronic otitis media. All of these previous observations would appear to support the significance of previous suppurative otitis media in the development of HI as found in our study. In another study, post – traumatic HI was reported in 60% of patients with head injury; 43% was conductive while 52% was sensorineural.²¹ Evidence showed that while concussion injury of the inner ear structure was the principal mechanism of post-traumatic HI, ossicular injuries, labyrinthine contusion and petechial hemorrhages into the brainstem have also been implicated.²³

Based on the proportion of elderly with HI who were negative for any of the assessed risk factors in this study, it could be assumed that presbycusis probably accounted for 41% of the HI in the elderly. This proportion was high compared to 16% reported by Moscicki et al¹⁴. Those authors interpreted their findings to mean that an unexplained hearing loss in an elderly person can, in fact, be explained in most instances by age.^{20, 23} However, this high frequency of presbycusis would not rule out the possibility that there might be other

etiological factors of HI in a large proportion of the elderly, which were not considered in our study.

Gilad and Glorig¹⁸ regarded hearing loss among the elderly as the culmination of multiple, damaging processes throughout an individual's life; other investigators have suggested cardiovascular risk as the major factors.^{5, 13} This might explain the significance of hypertension as found in this study. Also, some other workers have suggested a role for genetics and immunobiology in the occurrence of HI in the elderly.^{18, 20} Cumulatively, it would appear that middle-aged and older people with a genetic vulnerability to hearing loss should be particularly careful about environmental risk factors such as harmful noises and medications whose side effects could be detrimental to hearing.²⁰ One important limitation of this study was that acoustic trauma due to noise which is becoming a significant health problem in many societies was not addressed. The use of self-report questionnaire survey to gather information would have made the assessment of relative noise exposure open to significant recall bias. We found a non-significant trend for HI to be less prevalent among rural compared to urban elderly residents. This trend might reflect the observation that hearing levels were poorer in urbanized communities²³ than in isolated or agrarian societies,²⁴ as is the case in Nigeria and other sub-saharan African countries.

In agreement with the reports of Brant et al²⁴ and Gates et al²⁵, our study has not established a positive association of HI with smoking and alcohol drinking, a finding that was in contrast to those of Itoh et al²⁷ and others²⁷ who found smoking to be a significant risk factor in their surveys. The suggestion has been made that cigarette smoking increased the body's need for oxygen because the carbon monoxide that is inhaled with smoke could partially block hemoglobin.²⁷ In addition smoking was implicated in the reduction of blood supply to the cochlear because of vasospasm caused by nicotine as well as atherosclerotic narrowing of vessels and thrombotic occlusion by aggregation of platelets.^{27, 29} This has led to the speculation that smoking might adversely affect the vascular system of the inner ear. In addition, histopathological studies of ageing gerbils have provided strong evidence for vascular involvement in age-related hearing loss.²⁹ Morphometric analyses of lateral wall preparations stained to contrast blood vessels have shown losses of strial capillary area in aged animals. The vascular pathological changes first occurred as small focal lesions mainly in the apical and lower basal turns and progressed with age to encompass large regions at both ends of the cochlea.^{29, 30}

In conclusion, this report has documented the prevalence of hearing impairment in the elderly in Nigeria which is comparable to those reported for other elderly populations. It also identified age and controllable factors such as previous suppurative otitis media, head injury and hypertension as correlates for HI. However, the high proportion of presumed presbycusis suggests a need for further study in this group. **The implication of this study is that the control of preventable or ameliorable factors and provision of hearing aid should be an important item on any health care policy initiative for elderly persons in the other countries in subregion which also share similar epidemiological parameters to Nigeria.** At the present time, most elderly persons in need are unable to afford this important device that may help improve their quality of life.

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Table 1
Demographic features of the respondents (n=1,302)

Age	
65-69	189(14.5%)
70-74	363(27.9%)
75-79	267(20.5%)
80+	483(37.1%)
Gender	
Female	750 (57.6%)
Male	552(42.4%)
Education, years completed	
13+	97(7.5%)
7-12	173(13.3%)
1-6	328(25.4%)
0	704(54.1%)
Economic	
High	110(8.5%)
High-average	399(30.7%)
Low-average	488(37.5%)
Low	305(23.4%)
Residence	
Urban	300(23.0%)
Semi-urban	562(43.2%)
Rural	440(33.8%)

Table 2
Logistic regression analysis of the sociodemographic and life-style correlates of HI* n=79

Variables	Unweighted N with HI	Odds Ratio**	Confidence Interval	P value
Age				
80+	43	reference	reference	reference
75-79	19	0.8	0.45-1.37	NS
70-74	12	0.3	0.18-0.67	0.01
65-69	5	0.3	0.11-0.71	0.02
Gender –				
Females	47	reference	reference	reference
Male	32	1.2	0.75-1.89	NS
Education, number of years				
13+	8	reference	reference	reference
7-12	10	0.7	0.22-2.42	NS
1-6	20	1.0	0.36-2.85	NS
0	41	1.0	0.38-2.62	NS
Economic				
High	3	reference	reference	reference
High average	24	2.1	0.62-7.28	NS
Low average	29	1.9	0.55-6.24	NS
Low	23	2.4	0.69-8.11	NS
Residence				
Urban	17	reference	reference	reference
Semi-urban	40	1.2	0.66-2.17	NS
Rural	22	0.8	0.42-1.55	NS
Alcohol Drinking				
Never	39	reference	reference	reference
Ever	40	0.8	0.52-1.33	NS
Cigarette smoking				
Never	38	Reference	Reference	Reference
Ever	41	1.2	0.78-1.97	NS

* HI means hearing impairment

* Adjusted for sex, age, or both as appropriate.

NS- Non significant

Table 3
Univariate analysis comparing clinical features between elderly subjects with and without HI*

Variable	% Yes		P value
	HI Present	HI Absent	
History of Suppurative otitis media	21.0%	5.3%	0.01
History of Head injury	10.9%	5.6%	0.05
Hypertension	9.1%	5.4%	0.05
History of recurrent rhinosinusitis	6.7%	6.0%	NS
Diabetes mellitus	7.5%	5.9%	NS
Transient ischemic attack	8.5%	5.9%	NS

* HI means hearing impairment

NS- Non significant

Table 4
Logistic regression analysis of the clinical correlates of HI*

Risk factors	Unweighted N with HI*	Odds ratio**	Confidence interval	P value
History of suppurative otitis media	13	4.6	2.34-8.99	0.01
History of Head injury	12	2.2	1.14-4.26	0.02
History of recurrent rhinosinusitis	9	1.1	0.52-2.20	NS
Transient ischemic attack	6	1.4	0.60-3.44	NS
Diabetes mellitus	4	1.5	0.51-3.57	NS
Hypertension	19	2.1	1.18-3.57	0.01

* HI means hearing impairment.

** Adjusted for age.

NS- Non significant