THE HEARING OF UNDERGRADUATES A PILOT STUDY USING AUDIOMETRY

By R. W. PARNELL (Oxford)*

BEFORE considering the more precise information obtained by using an audiometer it is desirable to state the prevalence of deafness as a defect and handicap, determined by the simplest method available. As part of the routine health examination of undergraduates the question was asked, " Is your hearing all right ? " In addition a wristwatch was brought gradually closer to the ear and the subject was asked to indicate how soon the sound of ticking could be identified. Of 297 men, 16 per cent. were found to be deaf. Among some of them deafness was of slight degree, in fact they were unaware that their hearing was diminished until this was revealed by the watch test. Auroscopy was carried out only when deafness was discovered. In 4 per cent. a complete curtain of wax was found obstructing the external meatus. The symptom of tinnitus was found in 1 per cent. Among 177 women, 11 per cent. were deaf. In 7 per cent. deafness was slight ; in 2 per cent. excessive wax was found. The sex difference in prevalence of deafness, though it might be thought suggestive of more deafness in men, does not, in fact, reach the level of statistical significance.

It was the observation that 14 per cent. of undergraduates were deaf which served as the starting point for an audiometric study. The main purpose of this study was to assess the value of a pure tone audiometer for student health work.

Audiometry

A pure tone audiometer was used to test auditory acuity by air conduction in both ears to sounds at three frequencies, 512, 1024 and 2048 cycles per second. The tests were carried out using where necessary both ascending and descending approaches to the threshold. Up to ten minutes were allowed for the test, depending on the speed with which the subject answered, and this allowance was sufficient to prevent any undue sense of hurry. The room in which the tests were conducted was a quiet room at the back of a building situated in a cul-de-sac. Such extraneous noises as occurred were as a rule intermittent and so avoidable,

* From the Institute of Social Medicine, Oxford.

https://doi.org/10.1017/S0022215100010860 Published online by Cambridge University Press

but no special sound-dampening equipment was installed. A statement of findings among the whole group tested appears in Table I.

TABLE I.

AUDITORY ACUITY BY AIR CONDUCTION.
PERCENTAGE DISTRIBUTION AMONG HEALTHY* UNDERGRADUATES.

	512	1024	2048
Men (92)	%	%	%
+ 5 decibels	0·0	0·0	1·6
0 ,,	1·6	2·2	7·6
− 5 ,,	13·0	12·5	37·0
− 10 ,,	34·8	33·7	37·5
− 15 ,,	33·2	35·4	12·0
− 20 ,,	14·1	14·7	3·8
− 25 ,,	2·7	1·6	0·5
− 30 ,,	0·5	0·0	0·0
Women (101)	%	%	%
+ 5 decibels	0·0	0·0	1·0
0 ,,	1·0	1·9	12·9
− 5 ,,	11·4	5·9	39·6
− 10 ,,	35·6	42·5	30·7
− 15 ,,	37·2	35·6	12·9
− 20 ,,	10·4	10·9	2·5
− 25 ,,	3·9	2·9	0·0
− 30 ,,	0·5	0·5	0·0
− 35 ,,	0·0	0·0	0·5

Auditory acuity is slightly better at 2048 than at 1024 cycles per second. Satisfactory acuity at these two frequencies permits most speech sounds to be identified correctly. A committee appointed to consider hearing defects among American college students recommended in 1947 that students found after retesting to have more than 15 decibels loss at frequencies 512, 1024 and 2048 should be referred to an otologist having a special interest in the conservation of hearing. It was believed that about 10 per cent. of college students would show significant hearing loss in one or both ears. At Oxford about 4 per cent. showed more than 15 decibels loss at 2048 but no less than 15 per cent. at 512 and 1024 cycles per second. Comparison will not be pressed further because neither the calibration of individual instruments nor the arrangements for sound-dampening can be compared.

Influence of Middle-Ear Infection and of Age

To determine the permanent effects of middle-ear infection on hearing, students with a history of this, with or without mastoid infection, were compared with those who had not suffered (see Table II).

* "Healthy" excludes those who complained or knew they were deaf, and those found by simpler tests to be deaf.

https://doi.org/10.1017/S0022215100010860 Published online by Cambridge University Press

TABLE II.

THE PERMANENT EFFECT OF OTITIS MEDIA ON HEARING.

	No. Persons	Mean Age	No. Observns.	Mean Loss in dbs.	S.D.	Observ. Diff. / S.E. Diff.
Men						
No ear infection	53	20·9	318	10·97	5·50	—
History of Otitis Media	16	20·0	96	10·10	5·55	0·55
Women						
No ear infection	65	20·3	390	10·85	3·95	—
History of Otitis Media	16	19·1	96	11·82	5·35	0·60

Each ear was tested at 512, 1024 and 2048 cycles per second, making six observations on each individual. The number of persons (a more severe test than the number of observations) was used in calculating statistical significance. Neither in the men nor among the women did the group with a history of middle-ear infection have significantly worse hearing. The conclusion may be drawn that recovery of hearing which may be lost during an attack of otitis media is usually good.

In the next table (Table III) the influence of age is analysed among men who had no history of nasal catarrh, otitis media or mastoid infection. A trend of increasing hearing loss occurs in association with age which reaches the level of statistical significance when those aged 23 to 30 are compared with the 17-20 year age group. When comparing the same age groups among women (not shown in the table) a suggestive

TABLE III.

AGE AND HEARING AMONG MEN WITH NORMAL E.N.T. HISTORY.

Men	No. of Men	Mean loss dbs.	S.D.	Observ. Diff. / S.E. Diff.	Gain or loss
512 *cycles/sec.*					
Age 17–20	18	11·11	4·25	—	—
21–22	19	12·37	5·80	0·75	Loss
23–30	16	15·46	4·25	2·98	Loss
1024 *cycles/sec.*					
Age 17–20	18	11·11	5·25	—	—
21–22	19	12·11	4·85	0·60	Loss
23–30	16	13·70	4·50	1·55	Loss
2048 *cycles/sec.*					
Age 17–20	18	6·25	5·40	—	—
21–22	19	7·77	4·25	0·95	Loss
23–30	16	9·54	3·90	2·05	Loss

https://doi.org/10.1017/S0022215100010860 Published online by Cambridge University Press

though not significant loss was found (the observed difference ÷ standard error of the difference did not exceed 1·52).

Considering the last two tables together the conclusion may be reached that although in the ordinary practice of curative medicine middle-ear infection is well recognized as a cause both of transient and less often of permanent deafness, complete recovery of hearing usually takes place after acute otitis media. This is contrary to the important role which such infections are commonly held to play in causing deafness in the general population. Yet while considering the trend of association between age and deafness a significant trend was seen among young adults, and the observation leads to a further question: Could this general loss be due to deafness of another type, for example nerve deafness?

This is the limit to which this audiometric study extends. Wilkins (1948) has discussed the prevalence of deafness in the United Kingdom, but so far no published account has been discovered of audiometric findings among healthy young adults. The most comprehensive information available comes from the studies of the National Health Survey of the United States. Beasley (1940) in his report on the general problem of deafness in the American population mentions various trends in the prevalence of deafness associated with social circumstances, in particular family income, employment status and occupational class. Such differences were not demonstrated in the Oxford sample when auditory acuity was sorted by social class and by schools attended. The main reason for this may be the smallness of the sample. Beasley was also able to demonstrate conclusively by bone conduction audiometry that loss of good hearing with advancing age in the urban population is balanced chiefly by increase in the prevalence of progressive nerve deafness. It was not entirely clear however from his report, because age was grouped in the ten-year periods 5-14, 15-24, etc., that progressive nerve deafness in the population starts before the age of 24. This is what it appears to do among undergraduates.

The Oxford data of hearing loss was sorted against varying types of physique using the body index $\text{Ht.}/\sqrt[3]{\text{Wt.}}$. No significant association with auditory acuity could be demonstrated. Lastly, the possible effects were considered of gunfire and noise of aircraft or other engines on the hearing of those who had served in the Forces. Because ex-service men were older there is difficulty in distinguishing these effects from those of age. But it is doubtful whether older women would as a group have been exposed to noise of similar intensity and duration while serving in the Forces; as has been said, in their case the decline in hearing associated with age was suggestive, though not significant in the small sample of only 101. Beasley (loc. cit.), it may be noted, found an equivalent rate of decline in hearing in men and women.

https://doi.org/10.1017/S0022215100010860 Published online by Cambridge University Press

The Hearing of Undergraduates

Audiometry for Student Health Services

In assessing the value of an audiometer to student health services the following advantages may be listed. From the remedial angle it is of diagnostic value. It also provides a positive and objective record against which future deterioration in hearing may be assessed. It detects minor degrees of loss, especially of high tones, among those who consider their hearing normal. On the other hand hearing defects constituting a present handicap can be detected by simpler methods and there may be doubt of the wisdom of drawing attention to minor degrees of loss which do not constitute an appreciable handicap at the time of discovery. Viewed from the angle of research surveys, the audiometer is clearly the most suitable precision instrument producing a positive and objective record of hearing by air or bone conduction. Future developments in understanding the ætiology of hearing loss in any particular group of the population would appear to be likely to depend on its use.

Conclusions

1. Fourteen per cent. of undergraduates were found by the simplest clinical tests to be deaf in at least one ear.

2. The percentage distribution of hearing loss among healthy undergraduates is given for frequencies 512, 1024 and 2048 cycles per second.

3. The group with a past history of middle-ear infection had hearing as good as those with no such history.

4. Hearing loss in the undergraduate population increases in association with age. Nerve deafness is considered to be the most likely cause.

5. The value of audiometry to student health services is discussed.

Acknowledgments

I wish to thank Mr. R. G. Macbeth, Director of the Department of Oto-Laryngology, the Radcliffe Infirmary, Oxford, and Dr. C. S. Hallpike of the M.R.C. Otological Research Unit, The National Hospital, Queen's Square, W.C.1, for helpful criticism and advice.

REFERENCES

A HEALTH PROGRAM FOR COLLEGES. (1947) Report of the Third National Conference on Health in Colleges. (U.S.A.)

BEASLEY, W. C. (1940) "General problem of deafness in the population", *Laryngoscope, St. Louis*, **50**, 856.

WILKINS, L. T. (1948) "The Prevalence of Deafness in the Population of England, Scotland and Wales." Report to the Medical Research Council.

https://doi.org/10.1017/S0022215100010860 Published online by Cambridge University Press