HEARING ABILITIES OF A GROUP OF NOISE EXPOSED MINEWORKERS

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1. INTRODUCTION

Personal shift noise exposure levels underground in the UK coal mining industry are typically around 90dB(A), e.g. JONES (1988). However, limited studies of selected mineworkers' hearing levels revealed hearing loss and social disability considerably less than expected from the observed noise exposure levels, e.g. DICK (1975). A trial epidemiological study of personal noise exposure levels and hearing abilities was therefore undertaken at one colliery to determine whether mineworkers' hearing abilities were consistent with those predicted from the data of the type upon which current and draft European legislation is based.

Although retrospective noise exposure studies are difficult to carry out, the colliery selected offered a unique opportunity for assessing mineworkers' noise exposure histories. The colliery had been one of the Pneumoconiosis Field Research (PFR) HURLEY *et al* (1982) collieries for which very detailed individual work histories had been recorded between 1955 and 1985. In addition extensive noise measurement studies had been carried out between 1974 and 1985 by both British Coal (BC) Scientific Department and the Institute of Occupational Medicine (IOM).

This paper concentrates on the results of the analysis of the audiometric data. Determination of the retrospective noise exposure indices is described in the IOM Final Report on the study, ROBERTSON *et al* (1989).

2. STUDY METHODS

Audiometric survey

The Medical Service of BC carried out a detailed audiometric survey at the colliery in 1986. Prior to the suvey, the colliery manager wrote to every employee inviting him to participate in the study. A total of 765 persons out of a colliery population of 878 offered themselves for examination.

Approximately five minutes familiarisation/training was given to each subject before examination.

A four booth mobile audiometric unit fitted with Peters self-recording 'Bekesy' audiometers was used. Eight frequencies were tested per ear – the left ear first. A final check at 1kHz in the left ear was then carried out automatically. The audiometers were calibrated prior to the survey and all four were found to be within specification at the end of the survey.

Subjects were categorised according to HSE (1978). All subjects were informed of their own result. Subjects with Category 4 (warning), Category 3 (referral) or Category 2 (unilateral) were requested to complete a questionnaire. Subjects whose wears had been syringed were retested after at least 48 hours.

Statistical Analysis

For statistical analysis the subjects were grouped according to age (eight, five year age groups between 19 and >55 years) and mean and quartile values of hearing levels at each frequency within groups were tabulated. Informal comparison of age-related hearing levels with 'predicted' values from ISO/DIS 1999, ISO, (1985) and ROBINSON (1987) were undertaken using graphical displays of the tabulated data. As the reference audiometric data are based on manual audiometry whereas the survey data had been obtained using self-recording audiometers, 2.5dB was subtracted from the reference data to correct for the different audiometric techniques, ROBINSON (1988). The significance of the relationship between age and hearing level was determined as was the relationship between hearing level and age and personal noise exposure. Details of the statisticaly techniques are given in ROBERTSON *et al* (1989).

The numbers of men exceeding the 30 and 50dB hearing level 'fences' were determined and compared with the predicted numbers from ROBINSON (1987).

3. RESULTS AND DISCUSSION

Personal noise exposures of mineworkers

From ROBERTSON *et al* (1989) all assigned Equivalent Continuous Sound Levels (L_{eq}) were between 84 and 96dB(A) with 70 per cent between 89 and 92dB(A).

Hearing levels of mineworkers

The median and upper and lower quartile hearing levels at 1kHz for the eight age groups are shown in Figure 1. The Figure also shows the age-matched predicted median hearing levels from ISO/DIS 1999, ISO (1988) for non-noise exposed males.

From the Figure it can be seen that for other than the group with mean age of 42.5 years, the observed hearing levels of the noise exposed mineworkers were lower than the median hearing levels predicted for age-matched non-noise exposed men. Similar results were obtained for all audiometric frequencies between 0.5 and 6kHz. Analysis confirmed that for all frequencies tested, the median observed hearing levels were significantly lower than the predicted median values for non-noise exposed persons from ISO/DIS 1999, (ISO 1988).

Comparison of the observed data with ROBINSON (1987) gave similar results except at 6kHz where the observed medians were greater than those predicted for non-noise exposed persons.

That is, although 70 per cent of the mineworkers had lifetime L_{eq} greater than 89dB(A), their hearing levels were significantly better, i.e. exhibited less hearing loss, than predicted from either ISO/DISS 1999, ISO (1988) or ROBINSON (1987).

Any evaluation of possible sources of error in the data simply amplifies the under-observation of hearing loss: conventional screening audiometry tends to overestimate hearing levels, ROBINSON *et al* (1973), and examination of individual audiograms revealed that of the 24 men with mean hearing levels >30dB and of the 3 men with mean levels >50dB over 1, 2 and 3kHz, 11 and 2 men respectively had marked unilateral loss of a type unlikely to have been due to noise exposure.

While the study result might appear surprising, it is in agreement with the earlier BC studies, DICK (1978), DICK and COLEMAN (1988) and with the recent study of MALLESON (personal communication 1988). Similarly, BURNS *et al* (1977) revealed that calculation of exposure levels from the hearing levels of steelworkers, all of whom worked in 'noisy' parts of a steel plant for about 40 years, gave a mean 40 year L_{eq} of 87dB(A).

4. CONCLUSION

While the study was relatively limited in scope, it is clear that although most of the mineworkers had lifetime L_{eq} greater than 89dB(A), they exhibited significantly better hearing levels, i.e. had less hearing loss, than would be predicted for age-matched non-noise exposed men.

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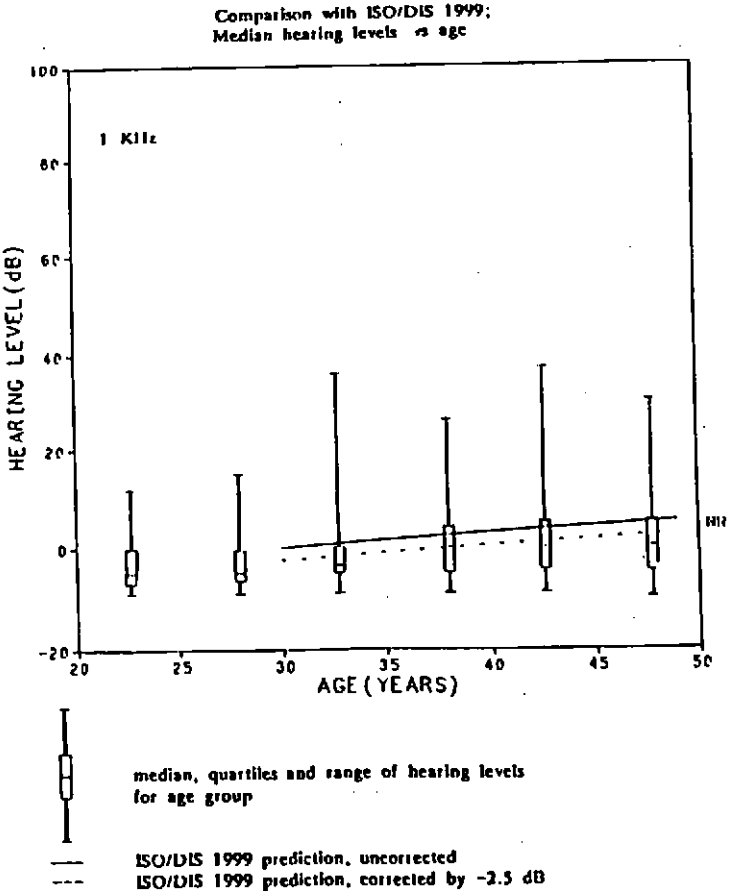

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