Current practices in noise health surveillance

An exploratory study on the delivery of noise health surveillance programmes in Britain

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Alison Codling and David Fox from the Health and Safety Executive present the results of a study undertaken on current practices in noise health surveillance, and key practice points for occupational health practitioners.

AN estimated 10 million people suffer from hearing loss in the UK[1]. By 2031, this could rise to 14.1 million people – 20% of the population[1]. These figures mean there is increasing attention being paid to the effects that workplace noise exposure is having. Research suggests that over 1.1 million people in Britain are exposed to noise levels above 85 dB(A)[2] at work[3]. Data from the Labour Force Survey (three-year average period 2013/14–2015/16) suggest that around 20,000 people working during the previous year suffered from noise-induced hearing loss (NIHL) – new as well as longstanding cases caused or made worse by work, equating to a rate of 62 cases per 100,000 workers[4]. The Industrial Injuries Disablement Benefit scheme (IIDB) had 100 new claims for NIHL in 2015, compared with 130 in 2014 and 120 in 2013[4].

IIDB claims relate to NIHL cases of significant sensorineural hearing loss of at least 50 decibels in each ear (one ear to occupational noise), of the average hearing loss at 1 KHz, 2 KHz and 3 KHz audiometric frequencies[5]. This means that noise at work (in a listed occupation) must have caused the hearing loss in at least one ear. The approach adopted by the UK courts for the assessment of hearing disability is by measuring the hearing threshold level in decibels averaged over 1 KHz, 2 KHz and 3 KHz[6].

The *Control of Noise at Work Regulations 2005* (Noise Regulations) came into force in April 2006. They aim to ensure that workers' hearing is protected from

excessive noise at their place of work. The Health and Safety Executive (HSE) has provided guidance on employers' duties, approach to compliance, advice on the management and control of noise risk, and health surveillance[7]. The Noise Regulations state that employers should provide health surveillance for workers who are frequently exposed to noise above the upper exposure action values: a daily or weekly personal noise exposure of 85 dB(A) or peak sound pressure of 137 dB(C)[7,8]. Health surveillance should also be provided if an individual is identified to be particularly sensitive to noise and exposure is between the lower and upper exposure action values, or when only occasionally exposed above the upper exposure action values. It is the employer's duty to ensure that noise health surveillance is undertaken where there is a risk to health and for ensuring the proper conduct of health surveillance for noise-exposed workers. Guidance for workers is available that tells them how to protect their hearing, and informs them about different types of hearing protection and what they can expect from their employer[9].

The HSE has developed a categorisation scheme designed to guide the practitioner completing the test on the appropriate action to take[7]. This scheme replaces that previously endorsed in the HSE's 1995 guidance note MS26 (*A guide to audiometric testing programmes*[10]). The HSE categorisation scheme is based on a summation of the hearing levels obtained at 1 kHz, 2 kHz, 3 kHz, 4 kHz and 6 kHz, for each ear separately and has four categories: category 1 – acceptable hearing ability; category 2 – mild hearing impairment, which may indicate developing NIHL; category 3 – poor hearing, suggestive of significant NIHL; and category 4 – rapid hearing loss, changes could be caused by noise exposure or disease. Those with category 3 or 4 hearing loss should have a medical referral.

The HSE categorisation scheme is not designed to be used as a diagnostic tool and does not replace the need to thoroughly review the audiogram trace. Most commercial audiometers used in occupational health (OH) practice have the categorisation scheme built into the audiometer and produce it automatically as an output of the completed audiogram.

The HSE undertook an exploratory study into the range of practices around noise health surveillance in Britain. The findings are presented below and will provide OH practitioners with some valuable key points that can help improve the quality of the noise health surveillance they undertake. The findings are also being considered in the current guidance review of the Noise Regulations.

METHODS

The research team used their established contacts to invite a sample of practitioners who are actively involved in health surveillance to take part in the study[11]. Study participants were interviewed by telephone by a researcher experienced in noise health surveillance. Each interview lasted around 45 minutes and was carried out according to a schedule[11] designed to look at the HSE guidance and explore responses in relation to specific areas. These included: routine practices; the training and experience of practitioners; interaction with employers; ensuring the provision of quality health surveillance programmes; and how data are utilised.

All interviews were recorded and transcribed, and descriptive statistics (simple summaries) of the study population and the measures taken were reported. Qualitative data were analysed using thematic analyses[12], examining themes using a process of coding to create meaningful patterns.

RESULTS

Sixteen practitioners working in a range of roles in different settings participated in the study. There were three physicians, six nurses, two technicians, three audiologists, one general practitioner and one audiometry training provider. Fifteen participants were interviewed by telephone; the other replied to the interview schedule in writing[11]. Practitioners' experiences and the occurrence of involvement in noise health surveillance ranged from four-and-a-half to 27 years, and between daily and fortnightly, respectively.

Training, measurement and supervision

There was variation in respondents' experience of audiometry training and qualifications. Practitioners described attending various types of training courses, including short courses run by audiometer equipment providers, detailed training provided by NHS audiology departments, and audiometry training as part of practitioner degree courses (OH and audiology degrees). Some practitioners were unsure whether or not the training they had received was formally approved by the British Society of Audiology (BSA). The time since practitioners completed their initial training varied from three years to 30 years. Refresher training had been undertaken by some practitioners.

In OH settings, the OH physicians tended to assume responsibility for the management of noise health surveillance programmes, but did not routinely conduct audiometry. Audiometry was usually undertaken by OH nurses and technicians, while audiologists tended to lead noise health surveillance programmes, working both independently and alongside OH practitioners.

Communication with employers

Responses from practitioners suggested that they were aware of the importance of communication with the employer if noise health surveillance was to be successful; it was seen as an essential component of the overall effectiveness of noise health surveillance

programmes. Practitioners were asked about systems and agreement for regular communication with the employer. Communication was not always formally established; some practitioners described communication with the employer as being difficult, but the responses suggested that this depended on the work setting.

Those practitioners leading noise health surveillance programmes demonstrated their competence and technical knowledge. The most detailed technical responses came from audiologists. All practitioners were able to demonstrate knowledge of the employer's risk assessment and the importance of this process, but access to it was dependant on the relationship between the employer and practitioner.

Quality assurance

All practitioners said they regarded equipment calibration as vital to quality control, but their responses indicated inconsistency in its undertaking. Using new equipment and conducting tests in an audio booth were perceived by some practitioners to produce better-quality results. Only a minority of practitioners said they verified the equipment before use; the remaining practitioners did not report undertaking verification checks, and, when probed, were not able to explain the rationale for this. The most detailed responses came from audiologists, who carried out more detailed and technical quality control measures, including: weekly calibration; checking response buttons and earphone cups; testing the equipment using an artificial electro-acoustic ear; conducting their own audiometry as a biological verification; and pre-test checking of background noise levels.

Completing pre-test questionnaires and performing otoscopy were the most frequently mentioned actions performed before completing audiometry. The majority of practitioners reported using questionnaires (keeping a written record) and a small number used verbal questioning only (no written record). Pre-test questionnaires typically collected data regarding medical history, recent health issues (eg colds, infections), recent noise exposure and past medical history of tinnitus.

Otoscopy was often carried out; however, practitioners' decisions following the ear examination varied. Some practitioners reported postponing testing when infection or excessive cerumen (earwax) was identified, but others stated that they would test even if excessive or hard cerumen were apparent. One participant said they only conducted otoscopy following abnormal audiometry results. Tympanometry was only mentioned by those practitioners with audiology qualifications.

Other steps to ensure good-quality results included making sure workers understood the instructions for audiometry (eg if English was not their first language) and comparing the current audiometry results with previous tests. Some practitioners mentioned checking prior noise exposure, but the time periods varied from two to 24 hours. A number of practitioners reported that if the client had been exposed to noise prior to the test, they checked to see if hearing protection had been worn.

Practitioners reported conducting audiometry most commonly in an audio booth (typically in OH premises or in a mobile facility). A small number of practitioners reported that in situations where it was not practical to conduct audiometry in an audio booth, testing was carried out in a quiet room; on these occasions practitioners mentioned the use of noise-attenuating headphones or audio cups as a means of creating the quietest possible environment. Some practitioners made reference to background noise being assessed subjectively, but no practitioners mentioned a formal background noise assessment being completed before testing in a quiet room.

Although there was no specific question on this issue, no practitioner mentioned repeating the audiogram – as a quality control measure – if it showed a difference from the previous result of more than 10 dB at any frequency.

Types of audiometry undertaken

Practitioners mainly reported using two audiometry techniques: Békésy audiometry and the Hughson-Westlake method[13]. For OH practitioners, automatic audiometry tended to be the default, reverting in some instances to manual audiometry in specific circumstances – eg an abnormal audiogram or a problematic testing process. Audiologists reported undertaking a broader range of tests in addition to pure tone audiometry, including bone conduction audiometry, tympanometry, loudness discomfort levels, speech tests and otoacoustic emissions testing. Those practitioners who focused purely on audiometry completion were able to describe a more detailed range of audiometry techniques.

The schedule of audiometric testing carried out by the majority of practitioners did not specifically align with HSE guidance[7,11]. Some practitioners reported carrying out additional testing beyond that required by the HSE guidance, whilst other practitioners' schedules were less frequent than that required by it. One response suggested the schedule of testing was determined by the employer[11].

Interpretation of results

Some practitioners said it was 'vital' to compare current hearing test results with previous results, and most practitioners reported doing this for each worker. Practitioners who reported not doing this typically cited a change in OH provider and the difficulties in the subsequent transfer of medical records as influencing their ability to do this.

Responses from the OH practitioners suggested that

Noise health surveillance: key practice points

Practitioners should ensure they:

- have access to the employer's risk assessment
- have established good communication channels between themselves and the employer, and have a defined scope of work (contract or service-level agreement), which includes what information they will require access to, eg risk assessment, previous medical records
- have completed an appropriate audiometry training course as detailed in the HSE guidance
- are able to demonstrate their competence (including experience) to undertake noise health surveillance
- are familiar with the full range of quality control measures to ensure they are producing quality audiometry results
- have the competence to be able to complete both manual and automatic audiometry
- are able to interpret the audiogram without relying on the automatic HSE categorisation produced by the audiometer
- are familiar with the HSE guidance on the schedule of audiometric testing (when audiometry should be repeated)
- manage the results from noise health surveillance proactively, including making comparisons with previous results
- provide the employer with health records that detail fitness for work and, where applicable, present grouped anonymised data
- keep themselves up to date with changes to HSE guidance that may influence their practice

there was a reliance on the audiometer software to calculate the audiogram categorisation. The latter process may not always include a review of the audiogram trace. Practitioners were specifically asked how they analysed the audiogram trace that presented as NIHL, but was nonetheless categorised as HSE category 1 ('acceptable hearing ability'). Although not universal, responses suggested that there may have been instances of missed opportunities where early intervention to prevent further hearing loss were not captured. The HSE categorisation scheme[7] was used for audiogram interpretation by all but one practitioner. This individual had developed a bespoke scheme, as they believed the HSE scheme had limitations in identifying NIHL.

Where audiometry was undertaken by practitioners solely involved in this activity (eg OH technicians) but within a multidisciplinary team, these individuals reported that they would refer to a more qualified member of staff for the interpretation of results.

Feedback of results

Practitioners' responses presented a picture of feedback being provided to both worker and employer, but the content and detail varied. Feedback to the worker (at the time of testing) was mainly verbal, which in some instances was backed up with written information, such as providing the HSE 'pocket guide'[9]. Feedback to the employer was mainly on an individual basis and focused on fitness to work. If audiometry categories were disclosed to the employer, it was with the worker's written consent.

Not all feedback from non-OH professionals included fitness-for-work advice. Only some practitioners reported providing grouped anonymised data to the employer. When abnormal audiometry results were identified, the reported actions included onward referral to an OH nurse or physician, and/or referral to the worker's GP.

DISCUSSION

Despite HSE guidance[7] on how noise health surveillance should be undertaken, differences in perspectives and practices have been identified in this study, which may affect the quality of noise health surveillance. Practices varied according to professional background, training completed, level of skills and knowledge. Practices were influenced by the settings in which the practitioners worked.

OH practitioners were unable to confirm with any degree of certainty that the training they had received had been approved by the BSA, despite this being recommended in HSE guidance[7]. Practitioners' approaches to practical issues differed, such as conducting manual as well as automatic audiometry, and an over-reliance on the audiometer software's automatic categorisation. Respondents were specifically asked what action they would take following an audiogram trace that presented as NIHL, but was nonetheless classified by the audiometer software as 'acceptable hearing ability' (HSE category 1). The responses from OH practitioners suggested an over reliance on the HSE categorisation scheme provided as standard by the audiometer as the sole means of analysing the results of the hearing test, without necessarily reviewing the detail of the audiogram. This creates the potential for cases that should be referred for follow up being missed; and a missed opportunity to manage potential hearing loss proactively.

Despite it being easy to generate grouped audiometry data using modern audiometers, very few practitioners reported providing anonymised grouped data – in addition to the individual feedback – to the employer, as recommended in the HSE guidance[7]. Not providing this information potentially makes it more difficult for the employer to assess the impact and effectiveness of their management of noise.

There were also differences in: equipment verification before use; whether or not pre-test otoscopy was undertaken; checking if prior noise exposure was linked to the potential existence of temporary threshold shift before testing; testing environmental conditions; and the schedule of audiometry testing (when audiometry is repeated), which was particularly varied. All of these can potentially affect the overall quality of health

surveillance outcomes. Another area of concern for some practitioners was not being able to access previous noise health surveillance results, because this limited the value of the health surveillance being undertaken.

Although there is a paucity of evidence available on noise health surveillance to be able to compare our results with other studies, findings on the varied ways practitioners undertake health surveillance for occupational asthma and its potential impact on the quality of such programmes have been identified in research undertaken by Fishwick et al[14].

Approaches that could in future be considered to help mitigate the variations in practice found in this study include developing a standard of care for the prevention of occupational NIHL and reviewing the content of practitioners' training courses. The standard-of-care approach has been adopted for other occupational diseases, such as occupational asthma[15], occupational chronic obstructive pulmonary disease[16] and occupational dermatitis[17].

In relation to training practitioners, ensuring that health surveillance for noise-exposed workers is compliant with the Noise Regulations is more complex than just being able to perform audiometry. There should be a greater emphasis on the quality-assurance aspects and being able to interpret the audiogram trace. Supported by a better understanding of what compliant health surveillance looks like, and how the results from noise health surveillance feed into the wider management of workers exposed to noise, will ensure a fully integrated health risk management system is in place. ■

CONCLUSIONS

- **A** study has provided insight into noise health surveillance programmes with analysis of qualitative data from a small sample of practitioners
- **Practitioners** were aware of the importance of employers' risk assessments to the management of workers exposed to noise, but access to the assessments was not always possible. Noise health surveillance is thus at risk of being undertaken in isolation rather than being part of an integrated risk-management system
- **The findings** from this study are informing the review of HSE guidance
- **In future** it may be appropriate for a recognised body to develop a standard of care for the prevention of occupational noise-induced hearing loss, ensuring that evidence-based, practical, high-quality approaches are developed
- **To improve** the quality of noise health surveillance, there should be access to training courses that not only cover the practical elements of undertaking audiometry, but also the key components of compliant noise health surveillance and the principles of integrated health risk management

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Notes

1 Commission on Hearing Loss: Final report. London: International Longevity Centre UK, 2014. ohaw.co/2dNyNM4

2 A-weighting, dB(A): A-weighting is applied to instrument-measured, steady-state sound levels to account for the relative loudness perceived by the human ear. It attenuates at low and high frequency, and slightly amplifies at speech frequencies.

3 Final regulatory impact assessment of the Control of Noise at Work Regulations 2005. Bootle: Health and Safety Executive, 2005. Sections 5–6. ohaw.co/2eIDmJ2

4 Noise-induced hearing loss (NIHL) in Great Britain. Bootle: Health and Safety Executive, 2016. ohaw.co/2fjv3E2

5 Industrial Injuries Disablement Benefits: technical guidance. London: Department for Work and Pensions, 2015. ohaw.co/2eTkbNa

6 Industrial Injuries Advisory Council. Occupational deafness. CM 5672. London: Department for Work and Pensions, 2002. ohaw.co/2fjw52O

7 Controlling noise at work. The Control of Noise at Work Regulations 2005 (L108). Sudbury: HSE Books, 2005. ohaw.co/2dZkcAg

8 C-weighting, dB(C): C-weighting is applied to instrument-measured, impulsive, explosive or peak sound levels to account for how the human ear perceives impulsive, explosive or peak acoustic events. It includes much more low frequency energy than A-weighting.

9 Noise: Don't lose your hearing. Bootle: Health and Safety Executive, 2012. ohaw.co/2eOWiGU

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