

## **AMERICAN COLLEGE OF OCCUPATIONAL AND ENVIRONMENTAL MEDICINE POLICIES & POSITION STATEMENTS**

### **The Role of the Professional Supervisor in the Audiometric Testing Component of Hearing Conservation Programs**

#### **Background**

Noise is one of the most ubiquitous work-place exposures, and noise-induced hearing loss (NIHL) is one of the most prevalent occupational medical conditions.<sup>1,2</sup> Prevention and early detection of this condition should therefore be a priority for occupational medicine. The American College of Occupational and Environmental Medicine's (ACOEM's) statement about noise-induced hearing loss<sup>3</sup> stresses the role that occupational medicine clinicians play in professional supervision of audiometric surveillance conducted under the auspices of hearing conservation programs. This document reviews the regulatory and scientific basis for this supervisory role.

#### **Hearing Conservation Programs and the Basis of the Professional Supervisor Role**

The 1983 Occupational Safety and Health Administration's (OSHA's) Hearing Conservation Amendment<sup>4</sup> mandated that workplaces where workers are exposed to noise levels at or exceeding 85 dBA for an 8-hour time-weighted average (TWA) put in place hearing conservation programs. Such programs must include noise assessment and engineering controls, training, administrative controls, and hearing surveillance of noise exposed workers. In its requirements for audiometric testing, the OSHA standard makes specific reference to the role of health care professionals in the hearing conservation program:

##### 1910.95(g)(3) Audiometric Testing Program

"Audiometric tests shall be performed by a licensed or certified audiologist, otolaryngologist, or other physician, or by a technician who is certified by the Council for Accreditation of Occupational Hearing Conservation...A technician who performs audiometric tests must be responsible to an audiologist, otolaryngologist, or physician."

##### 1910.95(g)(7) (iii) Evaluation of audiogram

"The audiologist, otolaryngologist, or physician shall review problem audiograms and shall determine whether there is need for further evaluation."

##### 1910.95(g)(8) Follow-up Procedures

###### 1910.95(g)(8)(i)

If a comparison of the annual audiogram to the baseline audiogram indicates a standard threshold shift as defined in paragraph (g)(10) of this section has occurred, the employee shall be informed of this fact in writing, within 21 days of the determination.

###### 1910.95(g)(8)(ii)

Unless a physician determines that the standard threshold shift is not work related or aggravated by occupational noise exposure, the employer shall ensure that the following steps are taken when a standard threshold shift occurs:

###### 1910.95(g)(8)(ii)(A)

Employees not using hearing protectors shall be fitted with hearing protectors, trained in their use and care, and required to use them.

###### 1910.95(g)(8)(ii)(B)

Employees already using hearing protectors shall be refitted and retrained in the use of hearing protectors and provided with hearing protectors offering greater attenuation if necessary.

1910.95(g)(8)(ii)(C)

The employee shall be referred for a clinical audiological evaluation or an otological examination, as appropriate, if additional testing is necessary or if the employer suspects that a medical pathology of the ear is caused or aggravated by the use of hearing protectors.

1910.95(g)(9)

Revised baseline. An annual audiogram may be substituted for the baseline audiogram when, in the judgment of the audiologist, otolaryngologist, or physician who is evaluating the audiogram:

1910.95(g)(9)(i)

The standard threshold shift revealed by the audiogram is persistent; or

1910.95(g)(9)(ii)

The hearing threshold shown in the annual audiogram indicates significant improvement over the baseline audiogram.”

Similarly, the MSHA Noise Regulation (30 CFR Part 62) states that an audiometric technician must be under the supervision of a physician or an audiologist (62.170)[3].5

These regulatory stipulations, therefore, outline responsibilities for physicians and audiologists working in hearing conservation programs related to audiometric testing and follow-up of employees who have experienced a standard threshold shift in hearing (including determination of work-relatedness and medical referral of hearing loss cases). Guidelines for best practice in these areas of responsibility are outlined in this document.

## **Roles of the Professional Supervisor**

### *Supervision of audiometric testing*

As demonstrated above, OSHA mandates that audiometric testing of noise exposed workers must be accomplished either by the physician or audiologist providing professional services to the hearing conservation program, or by a technician under the supervision of this professional. Therefore, the Professional Supervisor has responsibility for ensuring the adequacy of audiometric testing environment, procedures, and recordkeeping, as well as the training of audiometric technicians. The Council for Accreditation in Occupational Hearing Conservation (CAOHC) is the national certifying body for occupational hearing conservationists (OHCs) serving as audiometric technicians in industrial hearing conservation settings. Having CAOHC-certified audiometric technicians is an important component of a hearing conservation program, but the professional supervisor must still be vigilant for problems with testing reliability. This can include sudden shifts in hearing thresholds and inconsistent testing responses. It may also be useful to review the variability of all audiometric tests conducted in a given time period, looking for sudden changes that could signal problems with audiometric calibration or testing environment. While there are no standardized methods for assessing audiometric variability, the audiometric database analysis methods outlined in draft American National Standards Institute (ANSI) standard S12.13-1991 allow for calculation of test-test variability resulting from either testing problems or noise-induced threshold shifts.

#### *Follow-up of employees with hearing loss*

OSHA defines a standard threshold shift (STS) as a worsening of hearing from baseline of 10 dB in the average of 2, 3, and 4 KHz in either ear. Such shifts are potentially recordable on the OSHA log if the average of hearing thresholds at these same frequencies is at least 25 dB, and no other cause can be found to completely explain the loss. OSHA requires that unless a physician or audiologist determines an STS to be not work-related, the worker must be notified, counseled, and refitted with hearing protection. Audiometric technicians are not allowed to interpret audiograms or diagnose ear disorders.

The follow-up of employees with hearing loss involves several judgments for the professional supervisor: 1) what baseline should be used; 2) should age correction be employed; 3) is the loss work-related; and 4) what additional follow-up is necessary.

#### *Baseline audiogram decisions*

According to OSHA guidelines, an employee's initial hearing test is conducted following a noise-free period of at least 14 hours, and serves as the baseline audiogram against which subsequent audiometric tests are compared. If however, later audiograms show significant improvement, due either to improved testing ability of the employee (the learning effect;<sup>7</sup> or a resolving medical condition, it is more valid to use the improved audiogram as a "revised" baseline. Similarly, if an STS occurs, OSHA guidelines indicate that the baseline should be revised in the ear where the STS has occurred. The decision about whether to revise a baseline must be made by the Professional Supervisor. The National Hearing Conservation Association has published recommended guidelines for baseline revision.<sup>8</sup>

#### *Use of age correction*

Whether or not to use age correction routinely in the calculation of STSs is an important decision for Professional Supervisors of audiometric testing programs. Under the 1983 OSHA Hearing Conservation standard, the use of age correction is optional. The recent OSHA record-keeping rule also considers age correction of audiometric shifts to be optional, stating that it "may be applied." OSHA does not, however, allow age correction of the threshold values used to calculate whether the pure tone average of thresholds at 2, 3, and 4 KHz is at least 25 dB.

Age correction reduces the magnitude of a calculated threshold shift by the amount of hearing loss expected due to aging, based on age-specific median population values. As a result, some 10dB STS cases among a group of noise-exposed workers would, after age correction, no longer meet the STS definition or require any OSHA-mandated action. Therefore, programs that routinely apply age correction would be expected to have lower rates of STS than programs that do not.

The National Institute for Occupational Safety and Health (NIOSH) has recommended that age correction not be used in STS determinations, citing concerns that its routine use could delay diagnosis of noise-induced hearing loss and that it is "technically inappropriate to apply population statistics to an individual."<sup>9</sup> An analysis of a large industrial audiometric database found that the occurrence in an individual of an age-corrected STS meeting the OSHA recordability criteria took place, on average, after the development of potentially compensable hearing impairment by American Medical Association (AMA) criteria.<sup>10,11</sup> In some states, age correction for the purpose of calculating STSs is not allowed under law. Nationally, there are no data on the

prevalence of the practice of age correction in hearing surveillance, although it is believed to be the norm.

There are several potential advantages to the use of age correction, however. Just as a worker's pulmonary function test results can be compared to age-corrected "predicted" values, age correction can suggest whether expected loss due to aging could explain a worker's case of hearing loss. In this way it can help prevent "false positive" diagnoses of NIHL. The clearest indication for the use of age correction would be for the comparison of STS rates between worker populations with differing age structures.

In summary, while age-correction has a role in the standardized reporting of hearing loss cases, the age-corrected STS meeting OSHA recordability criteria is not an early indicator for hearing loss in an individual. For the early detection of NIHL, other more sensitive indicators should be employed. A number of such "early flags" have been proposed, including the NIOSH "15 dB twice" criteria, and the use of the non-age corrected 10 dB STS. Significant differences in sensitivity have been found between the various measures.<sup>12</sup> Concerns have been raised that the more sensitive measures could create an unacceptable number of "false positives" due to audiometric variability alone.<sup>13</sup> At present, there is insufficient outcomes based research to support the use of any one particular measure. Consequently, in selecting a metric to use for "early warning," the professional supervisor should consider the optimal balance between false positives and false negatives given available program resources and degree of hearing loss risk.

#### *Determining work-relatedness*

Recent changes in the OSHA recordkeeping rule<sup>14</sup> have set new criteria for recordable hearing loss cases, and have therefore given increased importance to the role of the Professional Supervisor in determining work-relatedness of hearing loss. Studies have found that the revised OSHA recordkeeping rule increased the potential numbers of recordable hearing loss cases by as much as eight-fold.<sup>10</sup>

According to the OSHA standard, the occurrence of an STS triggers notification and corrective action, regardless of whether criteria for recordability are met, unless the professional supervisor determines that the hearing loss is not work related. There are four basic steps to making such a determination: 1) is the audiometric test valid? 2) Was the occupational noise exposure sufficient to cause hearing loss? 3) Is there a medical condition that completely explains the loss? 4) On a "more likely than not" basis, did occupational noise exposure cause the loss?

First, the professional supervisor must determine whether the audiometric test is valid, or whether there is evidence of testing irregularity. Reasons for invalid testing include excessive noise in testing environment, inadequate instruction in testing, audiometer malfunction, errors in test recording, recent illness, and malingering.

Second, there is a need to determine the degree of noise exposure that an individual has experienced. Ideally this is based on records of noise surveys and dosimetry in the individual's work area. A work history can be assembled of years worked at each job and the noise levels at each job. ANSI standard 3.44 gives a formula to calculate an equivalent noise exposure level based on this work history.<sup>15</sup>

In assessing noise exposure, the clinician should also keep in mind that time weighted averages may not adequately capture the occurrence of peak noise exposures and short duration impulse noise that has been shown to be deleterious to hearing.<sup>16</sup> In addition, although the OSHA action level for noise exposure is 85 dBA, data are insufficient to conclude that exposures between 80 and 85 dBA are incapable of causing hearing loss, especially in susceptible individuals. Records of hearing protection use should also be reviewed, however it should be kept in mind that field performance of hearing protectors has been found to be highly variable and not well correlated with manufacturer NRR ratings.<sup>17</sup> Therefore, documentation that a worker has been wearing hearing protection at work may not by itself provide sufficient proof that they received adequate protection from noise effects. As part of the exposure history, the clinician should document any significant exposure to ototoxic drugs such as aminoglycosides or cisplatin. Likewise, past occupational exposures to potentially ototoxic chemicals such as organic solvents or heavy metals should be assessed<sup>18</sup>, especially if there is a history of acute or chronic neurotoxicity due to such exposures. Non-occupational noise exposure should also be part of a comprehensive exposure assessment, including frequency and intensity of exposures to recreational noise sources including firearms, vehicles, machinery, and amplified music. At the same time, documentation of significant non-occupational noise exposure is not sufficient evidence to consider a case of hearing loss non-work related. Based on this information, the professional supervisor should reach a clinical decision whether the individual has been sufficiently exposed to noise and/or ototoxic chemicals in the workplace to have an elevated risk of occupational hearing loss.

Third, the professional supervisor must also determine whether the hearing loss is consistent with noise-induced hearing loss, or whether another etiology can explain the loss. The differential diagnosis of noise-induced hearing loss includes other sensorineural processes including presbycusis (age-related hearing loss), 8th nerve neoplasm, sudden sensorineural hearing loss and head trauma, as well as conductive hearing loss due to infection, otosclerosis, or cerumen impaction. Since the surveillance audiogram is usually limited to measurement of air conduction pure tone hearing thresholds, an important decision for the professional supervisor is whether more complete audiological testing including bone conduction, speech discrimination or other testing modalities could assist in the differential diagnosis of the hearing loss case. The ACOEM evidence-based statement on noise-induced hearing loss lists clinical characteristics of NIHL that can be used to differentiate it from other conditions. One feature is the “notching” of the audiogram in the higher frequencies around 4000 Hz. This feature of the audiometric configuration has been used successfully in medical legal determinations of hearing loss.<sup>19</sup> A recent study found good agreement between objective criteria for audiometric notching and the judgments of an expert panel.<sup>20</sup>

The final step in a work-relatedness determination is for the professional supervisor to consider all the evidence accumulated during steps 1-3, and then to decide, on a “more likely than not” basis, whether the hearing loss was related to work exposures.<sup>21</sup> The OSHA recordkeeping standard for hearing loss refers to general OSHA guidance of presumption of work-relatedness unless a specific exception can be found.<sup>22</sup> OSHA allows for such a determination of exception to the work-relatedness presumption, on a case-by-case basis. In cases of hearing loss, this would mean demonstrating that the hearing loss is due solely to non-occupational noise exposure or a medical cause (including aging), and that occupational noise was not a contributing factor. Ideally, this issue should have been addressed during the evaluation process outlined above.



#### *Additional follow-up of the worker with hearing loss*

In every hearing loss evaluation, the professional supervisor should consider whether further referral for possibly treatable hearing loss is medically indicated. Some conditions such as cerumen impaction or otitis media or externa may be appropriately treated in a primary care setting, while others including retrocochlear tumors or sudden hearing loss require specialist care. The American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS) has published recommended criteria for referring individuals in hearing conservation programs to an otolaryngologist.<sup>23</sup>

Workers with hearing loss may also require accommodation in the workplace. The impact of the hearing status on safety sensitive jobs must be considered, as well as the possible need for hearing protection that is appropriate for individuals with preexisting hearing loss and that avoids over attenuation. OSHA has published recommendations for workplace accommodation of the hearing impaired worker.<sup>24</sup>

Finally, the professional supervisor should ensure that each evaluation of a worker with hearing loss becomes an opportunity for prevention. Such cases can be important indications that noise controls and personal protective measures in the workplace are ineffective and require corrective action. The counseling, training and refitting of individuals can potentially help prevent further loss, although studies of the efficacy of such measures are lacking.

#### **Professional Supervisor Training and Qualifications**

The professional supervisor carrying out the activities listed above must be either a physician or audiologist. While OSHA requires no specific training, it is evident that the required competencies involve both familiarity with supervision of audiometric testing, diagnosis of hearing disorders, exposure assessment, and work-relatedness determinations. ACOEM believes that the functions of a professional supervisor in hearing conservation programs are part of the “core practice” of occupational medicine. ACOEM therefore recommends that occupational medicine training programs ensure that current trainees achieve competency in these areas, and that occupational medicine professionals in practice utilize continuing medical education programs as necessary to address these competencies. The Council for Accreditation in Occupational Hearing Conservation has created a scope of practice document for professional supervisors<sup>25</sup> and a training course for physicians and audiologists leading to CAOHC certification as a professional supervisor of the Audiometric Component of Hearing Conservation Program (CPS/A). The American College of Occupational and Environmental Medicine has been a joint sponsor of this training at the annual American Occupational Health Conference.

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