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Perspectives in Disease Prevention and Health Promotion Leading Work-Related Diseases and Injuries -- United States

The National Institute for Occupational Safety and Health (NIOSH) has developed a suggested list of 10 leading work-related diseases and injuries (1). The first seven categories have been described (1-7); this article focuses on the eighth category, noise-induced loss of hearing. NOISE-INDUCED LOSS OF HEARING

Occupational deafness was first documented among metalworkers in the sixteenth century (8). Since then, workers have experienced excessive hearing loss in many occupations associated with noise. Typical occupational and nonoccupational noise levels are shown in Figure 1. Noise-induced loss of hearing is an irreversible, sensorineural condition that progresses with exposure. Although hearing ability declines with age (presbycusis) in all populations, exposure to noise produces hearing loss higher than that resulting from the natural aging process; this is caused by damage to nerve cells of the inner ear (cochlea) and, unlike some conductive hearing disorders, cannot be treated medically.

While loss of hearing may result from a single exposure to a very brief impulse noise or explosion, such traumatic losses are rare. In most cases, noise-induced hearing loss is insidious. Typically, it begins to develop at 4,000 hertz (Hz, or cycles per second) in the hearing range of 20 Hz to 20,000 Hz and spreads to lower and higher frequencies. Often, material impairment has occurred before the condition is clearly recognized.

Such impairment is usually severe enough to permanently affect a person's ability to hear and understand speech under everyday conditions. Although the primary frequencies of human speech range from 200 Hz to 2,000 Hz, research has shown that the consonant sounds, which enable people to distinguish words such as "fish" from "fist," have still higher frequency components. As a result, an average hearing threshold (lowest audible sound level) at separate frequencies of 1,000 Hz, 2,000 Hz, and 3,000 Hz is used widely to define material impairment caused by noise (10,11).

Recent estimates by the Occupational Safety and Health Administration (OSHA) indicate that about 9,400,000 U.S. production workers (7,900,000 active and 1,500,000 retired) either now work or have worked in industrial locations where noise-exposure levels are 80 decibels (dBA) or higher. This estimate includes most noisy workplaces in the United States, except agricultural, mining, construction, transportation, and government (Table 1) (11). At exposure levels below 80 decibels (weighted to the approximate response of the human ear, dBA), an increased risk of hearing loss caused by occupational noise has not been found. Based on the average hearing threshold level at 1,000 Hz, 2,000 Hz, and 3,000 Hz, OSHA estimated that 1,624,000 (17%) production workers have at least mild hearing loss resulting from their occupational noise exposures; 1,060,000 (11%) have material hearing impairment; and 473,000 (5%) have moderate to severe impairment (Table 2) (11). These estimates generally agree with NIOSH survey findings, which indicate that one-fourth of persons 55 years of age or older who have been exposed over their working lifetime to an average of about 90 dBA have developed a material hearing impairment caused by occupational noise exposure (10,12). An estimated $835 million will be paid in workers' compensation claims for occupational hearing impairment for the 10-year period 1978-1987 (13). Reported by Physical Agents Effects Br, Div of Biomedical and Behavioral Science, National Institute for Occupational Safety and Health, CDC.

Editorial Note

Editorial Note: Occupational noise-induced loss of hearing is preventable. In its 1990 objectives for the nation, the U.S. Public Health Service set an objective that "By 1990, the prevalence of occupational noise-induced hearing loss should be reduced to 415,000 cases" (14). This objective relates to the number of cases of hearing loss that result in moderate to severe impairment (Table 2). However, it is important to note that if the number of moderate to severe impairments is reduced, the number of mild hearing loss and of material impairments would be reduced proportionately. OSHA has estimated that within 10 years, the number of cases of noise-induced hearing impairment can be reduced by 20% if all workers exposed to noise levels higher than 85 dBA wear personal hearing protectors (earplugs or muffs) and receive on the average 15 dBA noise reduction (11). However, this estimate hinges on effective use of hearing protectors to an extent that has not yet been demonstrated for all workers. NIOSH field investigations of industrial workers who routinely use earplugs indicate average noise reduction ranging from 7 dBA to 20 dBA, depending on the type of plug used (15).

A noise-control/hearing-conservation program is the most important step in eliminating occupational hearing loss. Such a program must include:

1. Reduction of noise through engineering controls and the purchase of new, noise-engineered equipment.
2. Proper fit of personal hearing-protection devices.
3. Education of workers and managers about certain characteristics of noise-induced loss of hearing (e.g., irreversible, subtle in onset, psychologically distressing).
4. Proper periodic audiometric testing and notification of workers who are developing hearing loss.
5. Visible commitment of management and workers to the program. The joint efforts of management, labor, and health-care providers

are needed to establish effective hearing-conservation programs in industry. All interested groups must work together to achieve the goal of protecting workers' hearing.

References

1. CDC. Leading work-related diseases and injuries--United States. MMWR 1983;32:24-6, 32.
2. CDC. Leading work-related diseases and injuries--United States. MMWR 1983;32:189-91.
3. CDC. Leading work-related diseases and injuries--United States. MMWR 1984;33:125-8.
4. CDC. Leading work-related diseases and injuries--United States. MMWR 1984;33:213-5.
5. CDC. Leading work-related diseases and injuries--United States. MMWR 1985;34:219-22, 227.
6. CDC. Leading work-related diseases and injuries--United States. MMWR 1985;34:537-40.
7. CDC. Leading work-related diseases and injuries--United States. MMWR 1986;35:113-6, 121-3.
8. Alberti (1591), cited by Bunch CC. Traumatic deafness. In: Fowler EP Jr, ed. Medicine of the ear, Chapter X (Reprinted, Translations of the Beltone Institute for Hearing Research, No. 23, 1970).
9. Michael PL. Physics of sound. In: NIOSH. The industrial environment--its evaluation and control. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1973.
10. NIOSH. Criteria for a recommended standard\.\.\. occupational exposure to noise. Department of Health, Education, and Welfare, Health Services and Mental Health Administration, 1972; NIOSH publication no. HSM 73-11001.
11. Occupational Safety and Health Administration. Final regulatory analysis of the hearing conservation amendment. Department of Labor, 1981, GPO No. 723-860/752 1-3.
12. Schmidek ME, Layne MA, Lempert BL, Fleming RF. Survey of hearing conservation programs in industry. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1975; HEW publication no. NIOSH 75-178.
13. Ginnold RE. Occupational hearing loss. Workers compensation under state and federal programs. Environmental Protection Agency report no. EPA 550/9-79-101, 1979.
14. U.S. Public Health Service. Promoting health/preventing disease: objectives for the nation. Washington, D.C.: Department of Health and Human Services, 1980:39-43.
15. Lempert BL, Edwards RG. Field investigations of noise reduction afforded by insert-type hearing protectors. Am Ind Hyg Assoc J 1983;12:894-902.