

10.2.5 Noise 1671

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The Divers' Alert Network, for instance, has international coverage, and contact details can be obtained from <http://www.diversalertnetwork.org/contact/international.asp>

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10.2.5 Noise

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ESSENTIALS Noise can affect hearing in the occupational setting but can have other effects where exposures are nonoccupational. For clinical † It is with great regret that we report that Tar-Ching Aw died on 18 July, 2017.

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1672 purposes, noise is measured in decibels weighted according to the sensitivity of the human ear (dB(A)). Regardless of source, the effects of overexposure to noise are similar. Initially there is a temporary threshold shift, where reversibility of hearing loss is possible with removal away from further noise. Noise-induced hearing loss occurs following prolonged or intense exposure, with poor prospects for improvement of hearing. The classical audiogram for noise-induced hearing loss shows a 4 kHz dip. Nonauditory effects of prolonged noise exposure include annoyance, sleep disturbance, hypertension, and cardiovascular disease, stress, and impaired cognitive performance. Prevention of noise-induced hearing loss is by reducing exposure to noise at source, minimizing exposure time, using hearing protection, and participating in surveillance.

Introduction Noise is any unwanted sound. Excessive noise damages the cochlear hair cells, breaking and disrupting the cilia, which act as local electromechanical amplifiers. This can result in physical and psychological harm.

Exposure The two important characteristics of sound are its intensity and frequency. The human audible sound intensity range is 0–120 decibels. The decibel (dB) scale is logarithmic rather than linear, therefore every increase in sound intensity of 3 dB is equivalent to a doubling of sound intensity. In young adults, the ear sound frequency ranges from 20 Hz to 20 kHz, but its sensitivity is not equal across this range. To mimic the response of the human ear and to allow for the variation in ear sensitivity to different frequencies, sound level meters apply a

weighting to the sound intensities, and express the readings as dB(A), that is, decibels weighted by the A scale (as defined by international standards). Typical sound levels are 65 dB(A) for normal conversation at a distance of 1 m; 140 dB(A) for a jet aircraft taking off 25 m away; and 160 dB(A) for a rivet gun near the ear. Noisy industries include manufacturing, construction, engineering, metalworking, motor sports, the military, and entertainment industries. Instantaneous noise levels can be assessed using a noise meter. For cumulative noise exposure, a personal noise dosimeter provides an 'equivalent noise dose' by averaging the frequencies and intensities over an 8-h shift. In the United Kingdom, the Control of Noise at Work Regulations 2005 stipulate an exposure limit of 87 dB(A) averaged over 8 h/day or 140 dB(A) for any instantaneous impulse noise. Besides occupational exposure, lower intensity community noise (e.g. from airports or urban traffic) is recognized to be associated with adverse health effects. Several studies have shown increased mortality from cardiovascular diseases among people living near noisy airports. The use of personal music players at excessive volumes for prolonged periods can also result in significant and hazardous noise exposure. There is also evidence that background noise can impair learning in schools. Clinical effects Exposure to loud noise can cause auditory and nonauditory effects. There is wide variation in individual susceptibility. Massive impulse pressures (e.g. from bomb blasts), can cause acute acoustic trauma. There can be a perforation of the tympanic membrane or disruption of the ossicular chain with associated pain and hearing loss, or occasionally hyperacusis. An early response to loud noise exposure (e.g. among those who work in noisy environments or those attending loud musical events) is temporarily increased hearing threshold. This temporary threshold shift might be accompanied by tinnitus. The transient dullness of hearing typically lasts up to 24 h, after which hearing thresholds return to normal. With continuing exposure, the magnitude of this temporary sensorineural hearing loss and the recovery time increase until, after months or years, there is a permanent shift in threshold, which might be accompanied by tinnitus. Hearing damage due to chronic or variable noise exposure might not become apparent until early or middle age, depending on when exposure commenced, and on duration and intensity of the noise. On audiograms, noise-induced hearing loss is detected as a dip at 4 kHz (Fig. 10.2.5.1). Affected people find it difficult to distinguish between similar sounds, particularly consonants, in the presence of moderate background noise. With severe hearing loss, the listener may experience 'loudness recruitment', a rapid, uncomfortable increase in sound perceived when intensity increases beyond the already abnormal hearing thresholds. With continued noise exposure, the 4-kHz dip on audiograms extends to lower frequencies and hearing thresholds worsen. This might be combined with presbycusis (age-related hearing loss) in later years. Worldwide, about 16% of hearing loss is estimated to be associated with occupational noise exposure. In addition to hearing loss, noise exposure can lead to non-auditory effects such as sleep disturbance, hypertension, and cardiovascular disease, stress, and impaired cognitive performance.

125 110 100 90 80 70 60 50 40 30 20 10 0 Frequency (Hz) Hearing level (dB) 250
 500 8000 4000 1000 2000 Fig. 10.2.5.1 Audiogram typical of noise-induced hearing loss with a dip at 4 kHz frequency. Red circles, right ear; blue crosses, left ear.

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