NOISE HAZARDS

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Sound is a vibratory motion. Human ear can perceive the vibratory motion (sound wave) in the range between 10 CPR and 24000 CPS. A pure tone is a simple wave. A complex tone consists of a simple wave combined with various overtones. The frequency of a tone determines its pitch. It is expressed in CPS. The intensity of a tone determines its loudness as heard by the ears. It is expressed in decibel (dd; dB; dBA).

Noise is a sound complex containing a number of unrelated frequencies of pressure waves in air. In simple term it is defined as 'unwanted sound'.

The various levels of noise commonly encountered from different sources have been estimated which are as follows :—

Source	Relative loudness	Relative intensity
Rustle of leaves	10 db	
Average whisper; Quiet garden	20 db	10
Quiet office	30 db	1000.
Quiet room; Average office	40 db	10,000.
Normal conversation	60 db	1000,000.
Motor vehicle; Typewriter	70 db	10,000,000.
Motor cycle	80 db	100,000,000.
Autohorns; Approaching to big airports	100 db	10,000,000,000.
Thunder	110 db	100,000,000,000.
Dacota aircraft	120 db	1000,000,000,000.
Jet aircraft	130 db	10,000,000,000,000.

There are various thresholds for the human ear. Any noise above 85 db produces threshold shift and given rest returns to normal threshold. At 120 db and above there is threshold of feeling discomfort. At 140 db and above there is threshold of pain. Threshold of hearing is 0 db for a young healthy adult.

With the advancement of so-called modern civilisation and with the increase of the traffic noise and industrialisation there is bound to increase sources of noise. In any developing country

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one should keep in mind about this problem in time so that from the outset this could be minimised with proper planning and with the aid of modern scientific achievements. The problem of noise has been having a lot of attention in the highly developed countries.

Some of the problems associated with noise are interference with conversation, leisure and sleep, on efficiency of work and potentially harmful effect on hearing.

Effects of noise—

The various effects of noise depends on

- (i) frequency— greater the frequency more the effect;
- (ii) loudness— greater the loudness more the effect;
- (iii) duration— continuous noise above 85 db is harmful than interrupted and cyclic noise;
- (iv) Individual susceptibility— varies.

1. Psychological effect—

Depending on the mood of the person and individual tolerance noise may be a source of annoyance. Some noises may be a source of annoyance to the community even. Road traffic remains the greatest source of noise. Aircraft noise and children are equally disturbing. The disturbance by neighbours mainly consists of miscellaneous impact noises due to walking and disturbance of loudspeakers of radios and record players.

Adequate sleep is physiological necessity. The noises may produce lack of sleep and appetite and may make the individual irritable.

2. Effect on efficiency—

Unfamiliar and irritating noise reduces the accuracy of work specially in skilled task and performance though the speed at which work is carried out remains unchanged. It may interfere working capacity of an individual. This may lead failure to notice unexpected event.

3. Effect on communication—

Noise causes increase in threshold of hearing. Hence during loud noise one has to shout for conversation. Even then speech, directly or by telephone or by loudspeaker may be interfered by noise. The potential dangers as well as the inconvenience and disruption of work or leisure of these effects are self evident.

4. General effects—

The general effect of noise on health remains difficult either to confirm or disprove. According to W.H.O., "Health is a state of complete physical, mental and social well-being and not merely an absence of disease and infirmity." Accordingly it means health is prejudiced by interference with peace of mind, privacy, the pursuit of work and pleasure, or with the basic requirements of a natural and undisturbed nightly sleep. Noise can disrupt sleep, cause annoyance, interrupt conversation and trains of thought as well as inflict physical damage to the ears.

5. Physical illness—

Noise exposure may be regarded as an additional stress. It is claimed stress may be a factor in the production of physical disease e. g., thyrotoxicosis, duodenal ulcer. Hence the possibility of noise having similar effect (to stress) has been suggested. Russian scientists claim noise to be responsible to many diseases including cardiovascular afflictions. French Academy of medicine cites noise as contributory factor in majority of heart and nervous ailments.

When a sudden loud unfamiliar noise, e. g., blast, loud bang, sonic boom, firing of artillery guns etc. begins there is increase of muscular activity, increase in pulse and respiration rates rise in B. P. and sweating. In addition there is constriction of arterioles of the hands and possibility of feet. These changes are temporary and occurs all in less than one fifth of a second. Homeostasis takes place in most of the cases. All the above changes disappear even if the noise is continued. The significance of these changes is not yet clear. However it may lead to exhaustion if it occurs repeatedly.

The only definite physical disease attributed to noise is injury to the hearing mechanism.

Very little clear evidence so far has been obtained in the relation between noise and mental upset.

6. Noise and patients—

As mentioned before noise is potentially capable of making healthy people cripple. A sick person who is already at a lower level both physically and mentally, whose defensive mechanism is already at a lower level—naturally suffers a lot from the detrimental effects of noise.

A patient who needs rest and relaxation is definitely irritated and annoyed by the disturbing and irritating noise. An ill patient will neither enjoy a song blaring from the loudspeaker from the city or from a transistor radio in the ward, nor he will relish to hear the irritating noise from the city traffic, banging of doors and windows of the wards. A pleasing gossip and humour may be a source of annoyance and disturbance to an ill patient. The effect of noise can retard the recovery period of patients thereby unnecessarily prolonging hospitalisation time. A nation has to suffer both ways by more budgetary provision for prolonged hospitalisation of sick people and loss of working men for a long time. Hence it is very essential that there should be no unwanted noise in the hospital wards, quietness in the hospital compound and location of a hospital far away from the din and bustle of city life.

7. Effect of noise on hearing—

Temporary and permanent hearing damage can result from noise.

Temporary loss of hearing—

Sudden noise of about 85 db or more can produce temporary threshold shift, i. e., temporary deterioration of hearing. Temporary signifies this effect is reversible (to normal) lasting from

seconds to months. This effect depends on individual susceptibility, the intensity, duration and frequency of the exposure sound. It is due to fatigue of the auditory mechanism.

Permanent loss of hearing—

The deterioration of hearing here is permanent. The longer the exposure and fewer the periods of respite the greater becomes the likelihood of permanent deafness. Exposure to sound over 90 db places an individual at risk of inner ear damage. The greater the intensity of noise shorter the time required to produce deafness. Upper frequency range noise is more damaging. Narrow frequency spectrum noise is more harmful. Exposure to gunfire, service with artillery units, exposure to airplane engines particularly jet, are well known hazards. Deafness has long been known as occupational hazard of boilermakers, hammermen, welders, drillers and workers with pneumatic road drills. Individual susceptibility varies to noise. Those who already have some degree of deafness are more prone to be affected.

Two types of permanent hearing loss are described—acute and chronic.

Acute permanent hearing loss—

The deafness is of sudden onset. A momentary exposure of a single sharp sound of high intensity of more than 150 db produces a permanent sensory neural loss in exposed ear, e. g., following firework, atmospheric disturbances in a telephone receiver, high pitched shrill of whistle near the year, small arms fire, gun fire, etc. The audiometric pattern is variable usually with diplacusis (sound seems of higher pitched in the affected ear and musical tone is heard as rough and non-musical quality).

There is change in Organ of Corti from minor to even complete breakdown. There may be rupture of T.M. and damage of ossicles in addition. The rural reflex has a latent period of 10 mSec. and is insufficient to establish fully the protective function against sudden sound, i. e., one single intense sound can damage the ear before the protective reflex has time to act.

Chronic permanent hearing loss—

This is of insidious onset. Prolonged exposure to noise above 85 db results into chronic acoustrauma, e. g., prolonged exposure to sounds of aircraft engines, to gunfire, to industrial noises as already mentioned. The effect is a more common progressive depression of audiogram in the region of 4000 CPS— the so-called C_5 dip. If exposure to noise continues the dip at 4000 CPS deepens. In advanced cases the dip widens in the higher frequencies. The final effect is a picture of perceptive deafness.

Mr. X., 30 years old, working in x-ray department for the past 10 years noticed discomfort in ears five and half years after working with x-ray machine. He was seen by me first on 2025/2/27 (1968). Audiogram left ear showed notching at 4000 CPS. Repeat audiograms at intervals showed persistence of the dip at 4000 CPS all the time. His last audiogram of the left ear is as shown—

Passing reference has been made of the above case just to keep in mind the possible danger of chronic permanent deafness that can occur though very rare when working with the x-ray machine as well for a longer period in addition to the hazard of x-ray exposure.

Explosive trauma shows labyrinthine damage in addition to any middle ear deafness caused by T. M. damage. But the typical so-called C_5 dip is not seen in audiogram. Hence unlike following noise of gunfire, explosive trauma may be accompanied by giddiness.

Small calibre firearm such as pistol and rifles produce a pure trauma while guns of heavy calibre produce trauma of explosive nature as well.

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