

Leisure Noise-Induced Hearing Loss

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Abstract—Sound is an essential medium by which we interact with between others and our environment. However, temporary or permanent threshold shifts which are health hazards can be caused by excessive noise.

I. INTRODUCTION

At birth, there are approximately 15, 000 hair cells in our auditory system which helps us to hear by detecting varying pitch and frequency. We lose these hair cells in a process known as wear and tear. When we lose too many of them, we start to have problems hearing. This is normal and is known as age-related hearing loss. However, noise-induced hearing loss (NIHL) happens when we are exposed to loud noises for extended periods of time.

II. NIHL

A. Sound Level Limits

Immediate cellular death and mechanical rupture of structures in the inner ear can be due to exposure to very high sound intensity. Research from the World Health Organization has shown that an exposure of 85 dB(A) for 8 hours is damaging to one's hearing, and that for every 3 dB increase in intensity, the exposure time for damage to occur is halved. Despite that, the loudest recommended exposure with use of hearing protection is 140 dB [4].

B. Prominence

In recent years, leisure NIHL occurring in adolescents and young adults are becoming relatively prominent. Studies have shown that at least 95% of youths listen to their personal stereo on a daily basis [1], a significant proportion of study participants engage in leisure activities that exposes them to loud noises [2], and only a minority defined hearing loss as a big problem [3]. The study participants reported having hearing impairments, tinnitus and problems hearing in background noise [2]. 66% of the study participants in another study said that they would use ear protection if they were aware that loud leisure noise can cause hearing loss [3]. Leisure NIHL is becoming prominent because adolescents and young adults are not aware of the potential harm and risks that it could bring to their hearing and even if they are aware, some would still not use ear protection because a very small percentage of people regard hearing loss as something of significance.

C. Leisure Noise

Some of leisure noise includes toys, fireworks, all kinds of electronically amplified music from personal listening devices, to discos, open-air concerts, televisions, radio, speakers etc with high sound energy, target practice shooting, crackers and video game play. There are 2 types of noise exposures: continuous noise exposure and impulse noise exposure. Impulse noise exposure is referring to being exposed to acoustic noise which can be intermittent or fluctuating unwanted and almost instantaneous sharp sounds like clicks and pops. On the other hand, continuous noise exposure is a steadily long and repeated exposure to sounds that are at least 85 dB. Although impulse noise occurs for a few short bursts, it is more critical than continuous noise because it can be on par with exposure to higher levels of continuous noise for few hours.

III. HEARING LOSS

There are basically 4 types of leisure noise-induced hearing loss: temporary threshold shift (TTS), permanent threshold shift (PTS), tinnitus and chronic tinnitus.

A. Temporary Threshold Shift

TTS is a reversible hearing loss that results from exposure to intense impulse or continuous noise. The threshold upwards shift reduces the sensitivity level of the ear for a short period of time, dependent on the exposure duration.

B. Permanent Threshold Shift

Unlike TTS, hearing loss resulting from PTS is irreversible. Although TTS is temporal, continuous exposure to loud sound despite of it will cause it to become PTS. PTS may be due to micro-trauma of hair cells which are not given sufficient recovery time, or damage to the mechanical structure like tympanic membrane, auditory ossicles or intra-cochlear membranes.

C. Tinnitus

Tinnitus is a soft or loud, high- or low- pitched ringing, roaring, clicking, hissing or buzzing in either one of both ears, or even in the head. It may subside over time, but can sometimes persevere constantly or occasionally throughout the lifetime.

D. Chronic Tinnitus

Chronic tinnitus is defined as when tinnitus is experienced continuously or regularly, especially when there is less environmental noise to mask the sound, eg. during the night.

IV. SOUND LEVEL OUTPUTS

Research revealed that 1 in 6 youths are at risk of developing leisure NIHL, and it has been found that the major leading cause is due to the lack of awareness [1]. People know that loud sounds causes hearing loss, but they are unaware that music-related leisure activities which produces electronically amplified sounds are a source of loud sounds as well.

TABLE I. SOUND LEVEL OUTPUT OF LEISURE ACTIVITIES

Source	dB(A)		
	Average	Low Range	High Range
Nightclub/discotheque	98	80	106
Rock/pop concert	104	80	120
Jazz concert	91	77	100
Symphony concert	90	80	100
Karaoke	92	75	103
Movie theater	81	72	104
Live shows	85	85	85
Sporting events	106	94	114

a. Sound Level Output of Leisure Activities. (music-related)

TABLE II. SOUND LEVEL OUTPUT OF LEISURE ACTIVITIES

Source	dB(C)		
	Average	Low Range	High Range
Revolver, .357, .38, 41, 44 caliber	161	156	164
Rifle, .22 caliber	138	134	140
Shotgun	160	159	168
Capgun	153	143	163
Firecracker	146	125	162
Rifle, .30 caliber	163	156	172
Howitzer	175	164	183
Automobile airbag	169	169	170

a. Sound Level Output of Leisure Activities. (weapons, impulse)

The two tables provided gives us an insight of the sound level output of different leisure activities, with Table I showing the dB averages of continuous leisure noise and Table II the averages of impulse leisure noise. Both are causing damage to the ears, because as mentioned, impulse noise can be considered comparable to exposure to extended period of higher levels continuous noise.

TABLE III. SOUND LEVEL OUTPUT OF OCCUPATIONAL ACTIVITIES

Source	dB(A)		
	Average	Low Range	High Range
Bulldozer	98	87	110
Excavator	90	80	102
Jackhammer	109	88	130
Earth scraper	100	85	117
Chainsaw	102	77	115
Tractor	93	76	108
Lawnmower	93	88	116
Welding	91	65	110
Paving machines	96	89	110
Generator	76	58	98

a. Sound Level Output of Occupational Activities. (machinery, equipment)

Table III shows the dB averages of continuous noise generated by machinery and equipment which are commonly used in occupation. These machines are often referred to as occupational hazards, and workers operating such machineries are required to wear hearing protection, like ear plugs and/or ear muffs.

In Table I and III, we can see that the dB averages produced by the machinery and that of speakers in concerts etc is significantly tantamount to each other. However, unlike machine operators who uses hearing protection on their job, party-goers do not use any form of hearing protection while being exposed to almost the same sound level output as them.

V. DISCUSSIONS

Industrial workers have rigorous regulations in place which are meant to protect them from excessive noise at their workplace. Singapore’s Workplace Safety and Health (Noise) Regulation states that potentially noise hazardous workplaces should enforce a hearing conversation program (HCP) which includes identification of potential noise hazards and implementation of noise control measures, usage of hearing protectors and annual audiometric examinations [6].

Unlike industrial workers who have been given much attention in regards to constant noise exposure, party-goers do not receive similar attention as much, and most of them are not even aware of such a problem. There are some possible measures that can be implemented: education and audiometric screening.

A. Education

Educating the general public on the leisure NIHL will raise their awareness of it. In agreement with suggestions made in the United States [7], compulsory implementation of hearing conversation curricula in all primary, secondary and tertiary institutes in Singapore on a continuing basis should be made. The curricula may be to educate students on leisure NIHL,

demonstrate the evidence of NIHL and its consequences as well as to encourage and inculcate in them responsible healthy listening habits.

B. Audiometric Screening

Audiometric examination essentially plays an important part of HCP. Signs and symptoms of NIHL will not be apparent until the occurrence of significant threshold shift. Periodic audiometric examination however, can help to detect hearing loss at an early stage. With early detection comes opportunities for immediate measures to be taken to prevent further hearing loss.

Siemens' Singapore has been organizing a Hearing Awareness Week (HAW) annually since 2008. HAW offers performances, talks by health professionals and informative booths, which helps in creating awareness on leisure NIHL. Free audiometric screening was also provided at the event, and to cater to those who could not attend the event, a free island-wide hearing screening was made available to all of Singapore through Siemens' authorized hearing care professionals for two weeks [9]. Although audiometric screening is said to aid in the prevention of further hearing loss, a vast majority of people would not be interested in paying for an audiometric examination. Therefore, registration for a free audiometric screening will entice the public to be screened for their hearing health and thus, early detection of hearing loss can be made possible. The organizers advertise HAW weeks prior to the event to promote awareness on the event.

VI. CONCLUSION

In spite of the attention that has been brought about to the public by the various organizations that promote awareness, the mere fact is that leisure NIHL is constantly overlooked. The measures taken are simply not enough. Music-related leisure activities come with no suitable means to help protect the parties who are exposed to the same sound levels as industrial workers. With the help of education in schools from an early age, as well as audiometric screening made available in schools and publicly available locations, awareness, and ultimately the reduction of leisure NIHL occurrences is possible.

ACKNOWLEDGMENT

I would like to take this opportunity to express my profound gratitude and deep regards to Mr. Gary Lee Jek Chong for his exemplary guidance, valuable feedback and constant encouragement throughout the duration of a project I had undertaken. The project sparked my interest in the audiology sector, which led me to be concerned about the lack of awareness that leisure noise can cause hearing loss. His valuable suggestions were of immense help throughout my project work, and his perceptive criticism kept me working to make this project in a much better work. Working under him was an extremely knowledgeable experience for me.

I would also like to give my sincere gratitude to all my friends and project mates who gave their utmost unbiased opinions, without which this research would be incomplete.

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