pISSN 2394-6032 | eISSN 2394-6040

# **Review Article**

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20213051

# A review on hearing loss caused by occupational hazard and trauma

# Dyana Lekha Selvanayagam\*, Amuthaganesh Mathialagan

Department of Medicine, Perdana University, Damansara, Kuala Lumpur, Malaysia

Received: 16 June 2021 Revised: 16 July 2021 Accepted: 17 July 2021

# \*Correspondence:

Dyana Lekha Selvanayagam, E-mail: dyanalekha@gmail.com

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#### **ABSTRACT**

Occupational hearing loss (OHL) is known to be one of the most common occupational diseases. Common causes are being exposed to workplace hazardous noise levels, ototoxic chemicals, head injuries and barotrauma. Occupational noise-induced hearing loss is mostly due to the death or damage of hair cells in our ear, which do not grow back. On the other hand, ototoxic chemicals affect the structures in cochlear and auditory neurological pathways leading to hearing loss. In occupational head trauma, the parts of the ear that are damaged are the tympanic membrane, middle ear and cochlea which leads to hearing disability. Huge changes in pressure on the outside and the inside of the ear leads to barotrauma causing potential hearing loss. Many of the research available are regarding noise-induced OHL or chemicals causing OHL followed by barotrauma. More studies on OHL due to workplace head trauma should be conducted. Preventative measures should be taken by the worker's supervisors or the government to implement safety measures to prevent and reduce OHL. This can be done via providing equipment and facilities that prevent hearing loss and education on OHL.

**Keywords:** Hearing loss, Occupational hearing loss, Noise induced hearing loss, Chemically induced hearing loss, Head trauma induced hearing loss, Barotrauma induced hearing loss

### INTRODUCTION

OHL is known to be one of the most common occupational diseases. Common causes of OHL occurring are due to workers being exposed to hazardous noise levels, ototoxic chemicals, head injuries and barotrauma. This is one of the most significant health concerns in the workplace as it is preventable yet mostly frequently reported. Noise-induced hearing loss is the most extensively reported OHL throughout the world. Any sound above 85 decibels is hazardous to our ears. This hazardous workplace condition is experienced by workers in heavy industries, factories, construction sites. Exposure to ototoxic chemicals is the other cause of OHL. These chemicals cause the ear to be more vulnerable to damaging effects induced by hazardous

noise.<sup>1</sup> This information reveals the fact that both causes of OHL are related to one another. Approximately 25% of workers in the United States were exposed to noises at hazardous levels, with the number reaching 22 million in 2018. Workers with hearing difficulty and tinnitus were 12% and 8% respectively.<sup>2</sup> In Great Britain, there were roughly 21000 cases of work related hearing problems in the space of the last 2 years with research indicating that nearly 170000 people suffer from noise induced hearing loss.<sup>3</sup> In 2018, 4506 out of 5139 (87.7%) occupational disease cases reported in Malaysia were due to noise-induced hearing loss. This overwhelming majority indicates how severe OHL is.<sup>4</sup> Age, gender, noise intensity, length and period of noise exposure, existing ear conditions and poor usage of hearing protection

devices are among the many factors contributing to OHL.<sup>5</sup>

Not many studies have been done to investigate the causes of OHL. Hence, this systematic review was done to gather all available research about potential causes of OHL. This was in order to find out the extent of information availability regarding this topic.

#### **DISCUSSION**

This was a systematic review of hearing loss caused by occupational hazard and trauma.

Occupational noise induced hearing loss (NIHL) is one of the most common causes of hearing loss in the workplace. Workers from construction sites, large factories and emergency physicians are prone to suffering from hearing loss induced by noise. Prolonged loud noise exposure to workers that are higher than 85 dB causes noise induced damage to the hearing.6 NIHL is mostly due to the death or damage of hair cells in our ear, which do not grow back. Hair cells receive vibrations from the cochlea and assist in the process of creating an electrical signal, which is carried by the auditory nerve to the brain. The severity of hearing loss effects is greater when the period of noise exposure is longer. The aging factor also contributed to this, as the older we get, the higher the risk of hair cell damage.8 The damage caused by loud noises was gradual, beginning with hearing mildly distorted sounds till it was severe enough to require hearing aid. Moreover, another form of NIHL was a loud buzzing or ringing in the ear known as tinnitus, which was also caused by hair cell damage.<sup>7</sup>

Occupational chemically induced hearing loss (CIHL) is known to be one of the causes of hearing loss from hazardous occupational exposures. People working in the chemicals related industry are at a high risk of being exposed to ototoxic chemicals that can enter our body through inhalation, ingestion and absorption through skin. Carbon disulfide, ethylbenzene, styrene, toluene, trichloroethylene and xylene are some of the commonly found chemicals in the industrial setting that cause ototoxicity. These chemicals affect the structures in cochlear and auditory neurological pathways leading to hearing loss.<sup>9</sup>

OHL also occurs due to head trauma. There are high chances for army soldiers, heavy construction workers etc. to suffer heavy blows to the head which may cause traumatic hearing loss. The parts of the ear that suffer from trauma are tympanic membrane, middle ear and cochlea. Conductive and sensorineural hearing loss, vestibular impairments and tinnitus are the types of ear impairment incurred due to trauma. Conductive hearing loss happened when sound waves are disrupted in their passage from the outer ear to the middle ear while sensorineural hearing loss was due to damage in the inner ear or the vestibulocochlear nerve. <sup>10</sup> There were not many

studies focusing on OHL caused by workplace head trauma. More studies should be suggested to be done for this topic.

Lastly, occupational hearing loss was due to exposure to barotrauma. Huge changes in pressure on the outside and the inside of the ear leads to barotrauma causing potential hearing loss.<sup>11</sup> This was commonly experienced by occupations which involve flying, where the ear hurts from the change of external pressure due to altitude. But this most often does not lead to any severe damage to our hearing as the pressure change is not significantly large enough.<sup>12</sup> Occupational divers also suffer from barotrauma to their ears much more frequently as the rate of change of pressure while diving is a lot higher than flying. To put it in context, pressure changes by 0.5 atm after 18000 feet (5486 m) in the air, while it only required a depth of 0.5 m below water level to experience the same pressure changes. 13 The high disparity in pressure causes damage to the tissue and eardrum, which may result in permanent hearing loss. Besides diving, blast trauma may also cause barotrauma. Hearing loss was the most regular type of auditory impairment reported from victims of blast trauma. Blast-like sounds, gunshots, bombs and even loud firework explosions give rise to the eardrum being perforated, ossicular disruption and tinnitus.<sup>14</sup> The severity of blast trauma was such that up to 50% of victims may permanently lose their hearing.<sup>14</sup>

#### **CONCLUSION**

Researches from various occupations have shown few different causes of OHL which are mainly exposure to noise, ototoxic chemicals, barotrauma and head injuries. Preventative measures should be taken by the worker's supervisors or the government to implement safety measures to prevent and reduce OHL. This can be done by providing proper equipment and facilities for the workers. Besides that, they should also educate their workers on the importance of taking precautions to encourage them to use and follow the safety measures designed to protect hearing loss.

Funding: No funding sources Conflict of interest: None declared Ethical approval: Not required

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**Cite this article as:** Selvanayagam DL, Mathialagan A. A review on hearing loss caused by occupational hazard and trauma. Int J Community Med Public Health 2021;8:4116-8.