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# Impact of Occupational Noise in Organized Transportation Sector Human Resources

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## ABSTRACT

Occupational noise exposure is a major area of concern all over the world including our own country. Different activities in transportation sector generate a lot of noise. The working condition in organized sector is generally expected to be better. In this backdrop a study has been conducted to assess the impact of occupational noise, if any, on hearing status of human resources engaged in organized railway transportation sector. Individuals working for at least a period of 9 years were approached. 49 consenting male human resources, aged in the range 31-40 years, working in different workshops constituted the high noise exposed group and 26 male employees of comparable age working in administrative offices constituted the low noise exposed group. Sound pressure level in different work-zones was measured. Results indicated that in high noise exposed group individuals 77.6 % had hearing loss at speech frequency whereas it was only 30.8 % in low noise exposed group. Hearing impairment was also calculated, for both high and low noise exposed groups, taking into consideration audiometric data till 4 kHz and 6 kHz for both the ears. From the present study, it may be concluded that the hearing ability of the human resources engaged in the work in relatively high noise zone is getting significantly impaired compared to their low noise exposed group counterparts.

**Key words:** speech frequency, audiometry, PPD, periodic medical examination, impairment

## INTRODUCTION

The term noise is commonly used to describe sounds that are disagreeable or unpleasant produced by acoustic waves of random intensities and frequencies [1]. Some authors define noise as any audible acoustic energy that adversely affects the physiological or psychological well being of the people [2]. With respect to population growth; it is inevitable that there will be an increasing need for more technology and industrial development in order to address the needs of evolving communities. Mechanization of common processes enables creation of time-saving production lines, which at times generate different hazards including noise [3].

About 30 million workers in the USA are exposed to unauthorized noise [4], and it is estimated that about 600 million workers are exposed to workplace noise all over the world [5]. Long-term exposure to noise mainly damages hair cells of the organ of Corti in the inner ear [6], and eventually leads to noise-induced hearing loss (NIHL), which is usually characterized by bilateral sensorineural hearing loss. First part of the inner ear damaged, is a part of cochlea sensitive to sound frequencies 4000 Hz (between 3000 and 5000 Hz). This

damage is gradually spread to adjacent areas sensitive to other frequencies, especially between 6000 and 8000 Hz [7-8]. According to National Institute on Occupational Safety and Health (NIOSH), 14% of workers are exposed to noise greater than 90 dB, and in some industries (e.g. textile, petroleum, food and transportation) this estimate reaches up to 25% [7, 9]. It should be mentioned that NIHL can impose a large social and economic burden on the society. In addition, it can cause early removal of skilful and experienced workers from production cycle, which in turn can induce many psychosocial problems, e.g. isolation, depression and increased likelihood of accidents [10-11]. In this backdrop, the present study has been undertaken to assess the effect of noise in human resources occupationally engaged in organized transportation sector.

## MATERIALS AND METHODS

The study was conducted on 49 human resources of age range 31-40 years, working in different workshops in organized transportation sector, after obtaining necessary permission. Inclusion criteria were human resources who had been working at least for a period of 9 years continuously, constituting the high noise exposed group (HN). 26 human resources of comparable age range, working in administrative offices chosen to constitute the low noise exposed group (LN). Information about age (year), working experience (year), nature and duration of daily activity, socio-economic condition and past incidence of major illness of self were recorded in pre-designed schedule. Exclusion criteria were human resources who previously worked in noise induced area in other place, human resources with brain injury, middle ear infection, ototoxic medication usage, systemic disease, hereditary hearing loss, heavy smokers and those who regularly consume alcoholic drinks [12]. Audiometric test was carried out, prior to commencement of work in the shift, with a portable audiometer for obtaining the hearing threshold at different frequencies (0.25 kHz - 8 kHz) [13], in a calm and quiet room. The audiometric assessment was carried out on each individual at a time for both ears separately using the air conduction mode in pure tone. The back ground sound level in the room was within 47.8 dB (A) and was periodically checked. After determining the hearing threshold at different frequencies, hearing impairment was calculated. Obtained data were tabulated and used for further statistical analysis and the chosen level of significance is  $P < 0.05$ .

## RESULTS

Sample size (n), age (yr), working Experience of HN and LN has been presented in table 1.

**Table 1:** Basic information of study participants

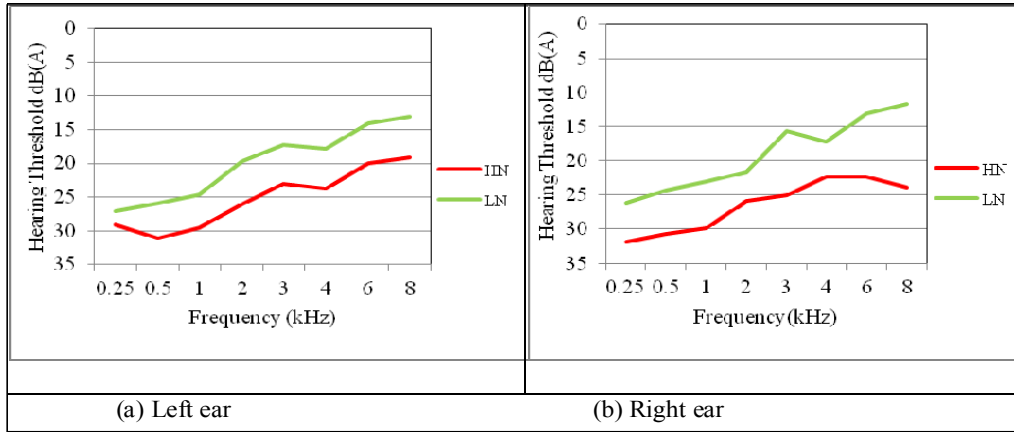
	<b>HN</b>	<b>LN</b>
Sample size(n)	49	26
Age (year)	35.0 ± 3.75	34.8 ± 3.38
Working experience (year)	11.1 ± 4.29	9.2 ± 4.15

AM ± SD, ^ns

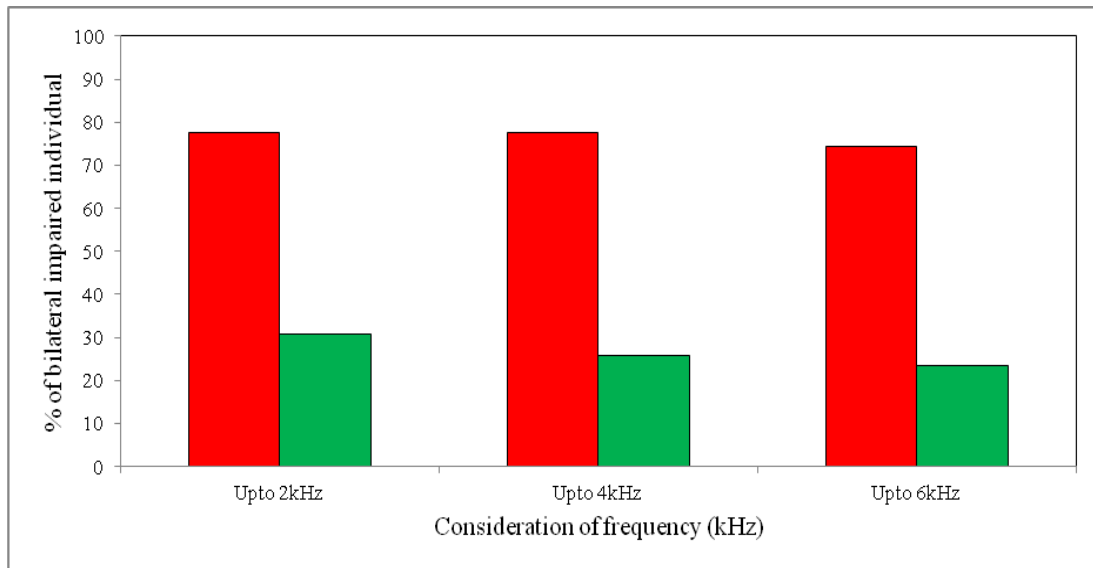
A Comparison of average hearing threshold in left ear and right ear of HN and LN individuals in different frequencies has been presented in fig 1.

A comparison of HN and LN individuals in respect of bilateral hearing impairment status has been presented in fig 2.

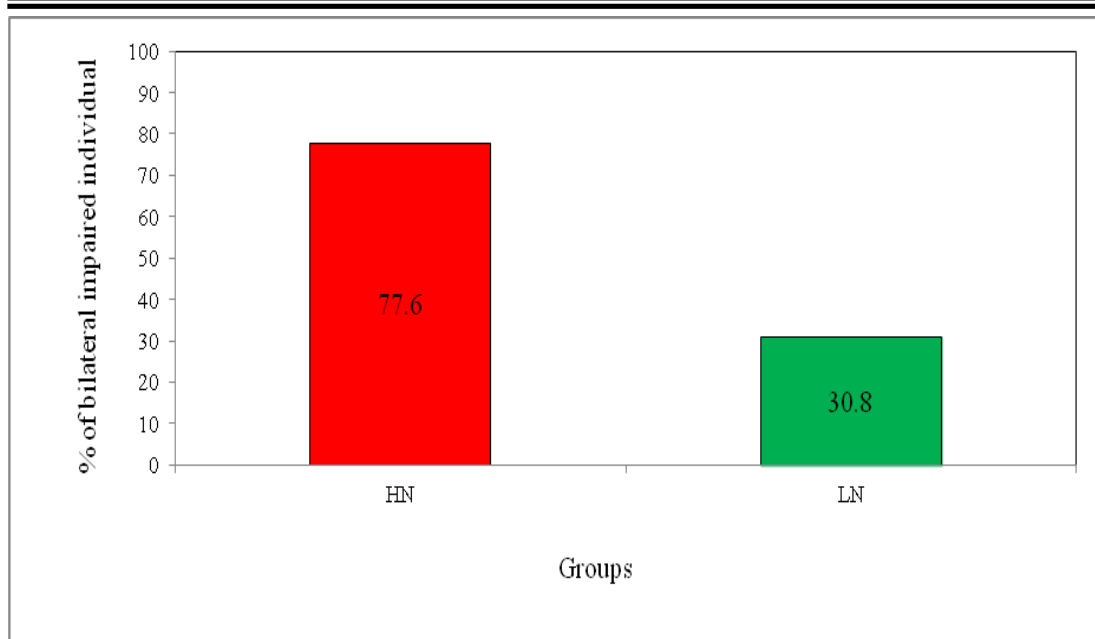
A comparison of HN and LN individuals in respect of bilateral hearing impairment status upto 2kHz, upto 4kHz and upto 6 kHz has been presented in fig 3.



**Fig 1: Comparison between HN and LN individuals in respect of average hearing threshold in left (a) and right (b) ears**



**Fig 2: Comparison between HN and LN individuals in respect of bilateral hearing impairment status upto 2 kHz, upto 4 kHz and upto 6 kHz**



**Fig 3: Comparison between HN and LN individuals in respect of bilateral hearing impairment status**

## DISCUSSIONS

In table 1, the age (year) and working experience (year) have been presented in  $AM \pm SD$  form. There is no significant difference between HN and LN individuals in respect of age (year). Average hearing threshold of both HN and LN individuals in different frequencies (0.25 - 8 kHz) have been presented in fig 1 (a) for left ear and fig 1 (b) for right ear. In HN individuals, the hearing threshold shift is observed to be more in lower frequencies compared to higher frequencies for both left and right ears. A characteristic notch at 4 kHz is observed in the graphical representation generated from the average of the individual values obtained in audiometric assessment carried out for the HN individuals [fig 1. (a)]; the observation is similar to the findings of McBride et al [14], who worked with workers of electricity transmission company in England and Wales. Salmivalli [15] found that the notch begins at 6 kHz twice as often as it begins at 4 kHz; Axelsson [16] reported that the earliest change might be found at this frequency and a standard otolaryngological text [17] advised that- the very earliest changes in young subjects exposed to broad band noise for 1-2 years occur around 6 kHz. With duration of exposure to noise of 2-5 years, noise induced permanent threshold shift (NIPTS) slides into the 4 kHz region.

The present study has been conducted on 49 HN and 26 LN individuals. At speech frequency, 77.6% HN individuals and 30.8% LN individuals had bilateral hearing impairment. When the frequency upto 4 kHz is taken into consideration, 77.6% of HN individuals and 25.8% LN

individuals were found to have bilateral hearing impairment. When the frequency upto 6 kHz is taken into consideration 74.3% of HN individuals and 23.4 % of LN individuals were found to have bilateral hearing impairment (fig 2).

The findings of the present study indicate that out of 49 HN and 26 LN individuals, 38 (77.6%) of HN and 8 (30.8%) of LN individuals had bilateral hearing impairment; a significant difference ( $P < 0.01$ ) has been observed between HN and LN individuals in respect of their impairment status (fig 3). In a similar type of study conducted in steel industry in Indonesia , more (84%) individual in the 'case' group and 4% of the control group of individuals occupationally exposed to noise, were found to be impaired [12], compared to about 77.6% of the human resources of HN in the present study. In other studies of similar nature, 60% of the human resources exposed to noise in construction work in US [18] and 79.8% of the human resources from a textile factory in US have been reported to suffer from hearing impairment [19] and 80% of the human resources from textile industry in Surat have been reported to suffer from some degree of hearing loss[13].

On the basis of the present study, it may be concluded that the human resources engaged in organized transportation sector, regularly exposed to high noise have significantly more ( $P < 0.01$ ) hearing impairment compared to their counterparts.

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**CONFLICT OF INTEREST:** None

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