

## **Hearing loss and morbidity among construction site workers in National Capital Region of Delhi, India**

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### **ABSTRACT**

Among construction workers hearing deficiencies caused by noise is one of the most important occupational diseases. Hearing difficulty, tinnitus, ear discharge and posture disturbances, and auditory disorders, particularly noise induced hearing loss (NIHL) have become common problems throughout industry. This study was undertaken to assess the morbidity profile and Risk factors for occupational hearing loss among construction site workers. Multistage Random Sampling Design was used to select the study subjects of construction sites from National Capital Region of Delhi, India. A total sample size of 451 was selected depending on the number of workers in each of the sites identified in the seven zones. On analyzing the data it was found that about one third of the workers were exposed to loud noises at the workplace. It was seen that 16.4% of the respondents perceived the workplace noise control to be bad. Further assessment revealed hearing loss of varying degree in up to 40% of the sample size on audiological assessment. Based on findings, interventions for workplace control of noise and use of other protective measures and health education was advocated.

### **Introduction**

Construction is one of the important industries employing a large number of people on its workforce. Workers represent half the world's population and are major contributors to economic and social development [1]. In India they work in both organized and unorganized sectors. In India, nearly two-thirds of the contribution to the net domestic product is by the unorganized sector [2]. The workers engaged in this industry often become victims of different occupational disorders and psychosocial stresses.

About 25.71 million building and other construction workers are estimated in India as per estimates of National Sample Survey (2004-2005) [3]. The building and other construction workers are one of the most vulnerable segments of the unorganized sector workers in India. The construction workers are often unskilled, migrant, socially backward, uneducated with low bargaining power [4].

As per census 2001, 29.90 million workers migrated for reasons of employment [5]. Employment-driven migration is mainly from the "relatively less developed" states to large

metropolises and other large cities, wherein the migrants get absorbed in low-paid jobs in the unorganized sectors [6]. The workers' living conditions are poor with denial of basic amenities to maintain the standard of living, making them prone to health problems.

Occupational health is defined by the International Labour Office (ILO) and the WHO, as 'the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations. Whereas in the United Kingdom (UK) the definition of health used by the Health and Safety Executive is 'ill health includes acute and chronic ill health caused by physical, chemical or biological agents as well as adverse effects on mental health'[7].

Work may well have an adverse effect on health, but may also be beneficial. The worker who is healthy is more likely to be productive. Those workers whose health is impaired are likely to be less productive, possibly a danger to themselves, other workers, and the community as well.

Construction has a reputation for being a particularly unhealthy industry because its rate of work-related illness being one of the highest of all occupational groups. Health problems among this group occur because of the number of high-risk activities involved, and the peripatetic nature of the workforce.

Among construction workers hearing deficiencies caused by noise have been one of the most important occupational diseases. Disorders of the ear can affect the workers fitness for work in several ways. Hearing difficulty, tinnitus, ear discharge and posture disturbances, and auditory disorders, particularly noise induced hearing loss (NIHL) have become common problems throughout industry [8]. Small but irreversible damage occurs during the earliest stages of hearing loss without the person being even cognisant that a physical injury has taken place. Due to the frequent use of noisy machinery, such as mechanical saws, compressors, grinding machines, drills, and other cutting tools, the construction workers' exposure to noise is remarkably high. The damaging effects depend on the overall intensity of noise, total duration of exposure, frequency characteristics of the noise, and the susceptibility of the individual worker.

These adverse effects of noise exposure may include sleep disturbance, irritability, stress, tension, distraction, risk of ischemic heart disease, influence on quality of life, interference with communication, health and well-being outcomes, behavioral and mental health effects and diminished performance [9]. Fortunately, it is one of the most preventable occupational health problems hence a more comprehensive hearing conservation program including a periodic audiometric testing and training on use of hearing protective devices should be implemented in the construction industry

In Germany, a study of the health of workers aged 40–64 years in the construction industry showed that construction workers as compared with white collar workers, had higher prevalence of hearing deficiencies, musculoskeletal abnormalities, high body mass index, and signs of obstructive lung disease [10].

Noise-induced hearing loss (NIHL) is a major occupational health hazard and is the second most reported occupational disease and injury in the USA [11]. Using a different approach to measure noise exposure, Lusk et al. asked construction workers (n = 837) about their perception of exposure to high noise, defined as a noise level compelling them to shout to be heard by a co-worker three feet or less away from them. Majority of workers which included plumbers(70%), carpenters(78%) and national plumber/pipefitter trainers, 69% reported that they were exposed to high noise on their recent job sites. Both noise monitoring data on the various types of noise exposures encountered in construction site and the self-reported

worker's perception on noise exposure demonstrate that construction workers are working in the presence of hazardous noise [12].

In India, noise is regarded as a pollutant under the air (Prevention and Control of Pollution) Act, 1981 [13]. Also, there is scarce published scientific literature on the health effects of noise pollution at the workplace like at construction sites in India.

With this background, a cross-sectional study had been planned among construction site workers at construction sites in the National Capital Region of Delhi to generate information regarding the baseline socio-demographic profile and morbidity pattern of construction workers.

## **Materials and Methods**

The National Capital Region (NCR) in India is the designation for the conurbation or metropolitan area encompassing the entire National Capital Territory of Delhi, which includes New Delhi, as well as urban areas surrounding it in neighboring states of Haryana, Uttar Pradesh and Rajasthan. A total of 22 districts in three neighbouring states of Haryana, Uttar Pradesh and Rajasthan along with whole of the National Capital Territory of Delhi constitute the National Capital Region (NCR) of India as defined in National Capital Region Planning Board (NCRPB) Act, 1985.

Multistage Random Sampling Design was used to select the study subjects from National Capital Region of Delhi. The whole city of Delhi comprises of 12 MCD zones. They are namely-City(1), Central(2), South(3), Karol Bagh(4), Sadar, Paharganj(5), West(6), Civil Lines(7), Shahadra(south)(8), Shahadra (north)(9), Rohini(10), Narela(11), Najafgarh(12)

These were divided into North, East, West, South and Central according to the geographical locations –

- North - Narela, Rohini, Civil Lines
- East - Shahadra(North), Shahadra(South), City
- Central - Sadar Paharganj
- South - South, Central
- West - Karol Bagh, West, Najafgarh

Out of these five geographical divisions one zone was selected randomly, and one zone each from the Districts of the neighboring states of Haryana and Uttar Pradesh were selected randomly. Thus the seven zones selected randomly for the study namely were from the North – Narela, from the East Shahadra (north), from the Central- Sadar Paharganj, from the South - South, from the West – Najafgarh, from Haryana region – Gurgaon and from Uttar Pradesh region – Gautam Budh Nagar were selected randomly.

In the beginning of study, the first construction site was identified in each Zone of National Capital Region of Delhi. Then another 3-4 sites were identified within 5 kms distance of first site. Among the sites identified in a Zone, one of the sites was selected randomly. List of all workers at the identified site in each Zone was procured from the contractor. Now by systematic random sampling workers were selected for interviewed from this list. If somebody was not willing, next consecutive worker was interviewed. A total sample size of 451 was selected depending on the number of workers in each of the sites identified in the seven zones. The subjects were interviewed using a predesigned, pretested, semi structured questionnaire. Before starting the interview, the construction workers were explained the purpose of the study. Then an informed consent was taken from him/her. Choice was also

given to leave study at any time if he/she was unwilling to continue. The questionnaire consisted of following items:

1) Identification data and other Socio-demographic factors which included age, gender, working zone, education status, marital status and family, native place, income and saving, housing, water source, availability and use of toilets and sleep duration.

2) Disease profile, health seeking behavior and expenditure on treatment. This catered to both Acute illnesses (last 15 days) and those requiring Hospitalization (in last 1 year) with respect to type and duration of problem, source and expenditure on treatment and health seeking behavior was assessed by questions on system of medicine and type of facility treatment sought from and reasons for preference.

3) Occupational Exposure and Hazards and Work related physical factors which included different types of occupational exposures, work nature and demand, mobility and posture, hours and shift of work.

4) Workplace related factors and work related psychological factors like on workplace noise, comfort and status of sanitation and satisfaction in terms of autonomy, skill use and work demand.

Physical examination of the patient included height, weight, waist circumference, blood pressure and body mass index. Anthropometric measurements of the subject were done for height, weight and waist circumference. Monitoring of blood pressure along with blood sugar testing and hemoglobin estimation was done. Also Peak Expiratory Flow Rate (PEFR) was measured.

The whole data was used only for research purpose. Permission was taken for the study from Institutional Ethics Committee. The collected data was entered in MS-Excel and then was analyzed and statistically evaluated using SPSS-PE-17 version. Quantitative data was expressed by mean and standard deviation. The significance of difference between the means was assessed by applying the t- test and qualitative data was expressed as percentages and significance of difference between the proportions was observed by chi square test or Fischer exact test. Odds ratio and 95% confidence interval were worked out to quantify the risk factors.

## Results

Large number of workers (47%) was working as unskilled Labourers, followed by those engaged in handling and moulding of Iron items (19.5%) and Mason work (16%). Rest of the workers were working in small percentages in a diverse range of activities at the construction sites and the number of these workers was very less.

Out of 451 subjects, majority of them i.e. 82.9% were in the younger age group (18 to 40 years), followed by 16.6% in the 41-59 yrs age group and there were 2 workers over the age of 60 years. The proportion of males was more as compared to females and the difference in age distribution of the subjects was found to significant ( $\chi^2=16.58$ ,  $p<0.05$ ).

A large number of the study subjects were illiterate (47.7%), among educated study subjects majority (89%) of them received education up to high school, followed by those who had senior secondary education (7.6%). A small number of study subjects were either graduate or post graduate. Male study subjects were more educated than females and the difference was found to be statistically significant ( $\chi^2= 7.79$ ,  $p<0.05$ ). Only a small number (3.3%) had an income < Rs 5000, whereas majority (81.4%) of the subjects had a monthly income between Rs 5000-10000 followed by 15.3% of them who had an income > Rs 10000. The

median monthly income was Rs 7500. Relatively, male study subjects had more income than the female study subjects and the difference was observed to be statistically significant( $\chi^2=1.191$ ,  $p<0.05$ ).

Sixty nine percent of the subjects were Hindus and sixty one percent were married. It was observed the proportion of unmarried males was relatively higher as compared to females and the difference was significant ( $\chi^2=7.36$ ,  $p=0.025$ ).

**Occupational hazards and work related factor** - The various parameters that were analyzed for construction workers dealt with the type of occupation, different types of occupational exposures present at the worksite and with respect to the physical nature of the work.

**Table 1** – Distribution according to Work Profile of Study Subjects (N=451)

Characteristic	Males (n=347)	Females (n=104)	Total (N=451)
<b>Type of Occupation</b>			
Unskilled	96(49.2)	99(50.8)	195(43.2)
Semiskilled	29(90.6)	3(9.4)	32(7.1)
Skilled	222(99.1)	2(0.9)	224(49.7)
<b>Hours of Work</b>			
<8 hrs	1(100)	0	1(0.2)
8 hrs	138(78.8)	37(21.2)	175(38.8)
9-21 hrs	208(75.6)	67(24.4)	275(61.0)
<b>Type of Occupational Exposure present</b>			
Chemicals			
Dust/Smoke	177(76.9)	53(23.1)	230(51.0)
Noise	137(75.7)	44(24.3)	181(40.1)
Heat	115(74.7)	39(25.3)	154(34.1)
Cold	11(78.6)	3(21.4)	14(3.1)
Fumes	2(25.0)	6(75.0)	8(1.8)
Vibration	1(50.0)	1(50.0)	2(0.8)
	1(50.0)	1(50.0)	2(0.8)

Table 1 shows that amongst occupational exposures at worksite, occupational exposure to noise was present in 34.1% of the subjects amongst which three-fourth were males and the remaining females.

Table 2 - Perceptions of Study Subjects about Conditions at Workplace (n=451)

Condition	Perception		
	Good	Okay	Bad
Noise Control	23 (5.1)	354 (78.5)	74 (16.4)
Smelling	12 (2.7)	384 (84.1)	55 (12.2)
Ventilation	8 (1.8)	436 (96.7)	7 (1.5)
Comfort	81 (18.0)	267 (59.2)	103 (22.8)
Sanitation	47 (10.4)	254 (56.3)	150 (33.3)
Lighting	44 (9.8)	350 (77.6)	57 (12.6)

Table 2 shows the perception of the respondents about conditions at workplace. It was seen that 16.4% of the respondents perceived the workplace noise control to be bad whereas it was perceived to be okay by majority of the study subjects. On being asked “Which of the following Personal Protective Equipment (PPE) is/are provided by your employer at work?”, nearly two thirds (64.3%) said that no PPE was provided. Amongst the rest the PPE provided included safety helmet (in 12%), safety shoes (in 8.4%), safety hand glove (in 5.8%) and facemask (in 5.1%). On being asked whether “Do you think the PPE provided by your employer is adequate?” 63.4% of the respondents disagreed and 18% were neutral in their opinion. On being asked “Do you often use PPE at work?”, 67.8% of the respondents replied in the negative and said no.

Further assessment for hearing loss was done. On examination, all study subjects were examined by conducting the Rinne and Weber tests. For all subjects a Pure Tone Audiometry (PTA) was also done by a trained audiologist. It was found that 39.6% of the study subjects suffered from some degree of hearing loss based on finding of the above examinations.

## Discussion

Like other studies, both males and females were observed to be working in the construction industry in the present study [14]. However, the majority of the study subjects (76.9%) were males. The male dominance in the construction occupation is possibly due to the socio cultural effect as women are often engaged in household work and the males have to go outside for doing work to meet the financial needs of the family and also because of the nature of the job demanding strong physical involvement.

Depending on the type of work the study subjects were engaged in they have been categorized into unskilled, semi-skilled and skilled workers. In the present study nearly half (49.7%) of the workers were involved in skilled jobs like mason, machine operator, electrician etc. Whereas 43.2% of the workers were involved in unskilled jobs like labourers. When occupations are ranked according to their contribution to specific diseases, unskilled construction workers rank consistently high in most lists of diseases [15].

Occupational exposure to noise was experienced by 34.1% of the subjects in current study. The adverse effects of noise exposure leads to sleep disturbance, irritability, stress, tension,

distraction, risk of ischemic heart disease, influence on quality of life, interference with communication, health and well-being outcomes, behavioural and mental health effects and diminished performance [9]. These problems are the most preventable occupational health problems hence a comprehensive hearing conservation program including periodic audiometric testing and training on use of hearing protective devices should be implemented in the construction industry.

In the present study 16.4% of the respondents perceived that noise control was bad at the workplace. The perception for smell was same. Workplace was perceived to be uncomfortable by nearly one fourth (22.8%) of the workers and one third (33%) of the respondents found sanitation at the workplace was poor. These observations are important as Workplace factors, most notably poor housekeeping and problems with the site layout and space availability, were considered to have contributed in half (49%) of the accidents in earlier studies [16]. This highlights the need that Acts like The Buildings and Other Construction Workers (regulation of employment and conditions of service) Act, 1996, Act no. 27 which regulates the employment and service condition of buildings and other construction workers, to provide for their safety, health, and welfare measures should strictly be implemented and monitored regularly thereafter [17].

### **Conclusion and Recommendations**

It should be stressed that this workforce is exposed to a variety of occupational and work related hazards and diseases and hence there is a need to tackle the same in a holistic manner and look at primordial and primary prevention. Intensive Information, Education and Communication (IEC) activities about various workplace exposures and risks should be undertaken and they should be made aware of existence of risk factors.

Health education regarding all these aspects should be imparted in multiple interactive sessions with small groups of construction workers making use of audio-visual aids such as flip charts and posters in local vernacular language, which could facilitate better understanding of the messages.

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### **Conflict of Interest**

None

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