

Original Article

An observational study on the prevalence of hearing loss among construction workers in South Chennai

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ABSTRACT

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Introduction: The construction industry is one of the biggest industries in the world. Noise levels are considered hazardous when they reach 85 decibels or higher. Hearing loss adversely affects both the quality of life and the risk of damage. The study's primary objective was to estimate the prevalence of hearing loss among construction workers, and the secondary objective was to assess the factors associated with hearing loss among construction workers in the urban area of Chennai.

Methods: A cross-sectional study was conducted on a total of 100 construction workers who were chosen by simple random sampling from February to July 2024. A comprehensive Ear Nose Throat and otoscopic examination were done. Using Pure Tone Audiometry, the degree and type of hearing loss were assessed. Problems, if any, were identified and treated accordingly. Data was input into a spreadsheet in Microsoft Excel. The data analysis tool utilized was SPSS version 21. Fischer's exact test and the Chi-square test were used to determine the degree of association. p-values below 0.05 were regarded as significant.

Results: The mean age was 36 ± 10 years. Most of them $n=73$ (73%) were literate. The mean exposure was 15 ± 8 years. Most of the study population $n=68$ (68%) did not use any PPE. Only 21 of them (21%) had symptoms of earache, hard of hearing, or tinnitus. Almost 79 of them (79%) had no such symptoms. Almost 84 participants (84%) had normal ear examinations. Out of the 11 who complained of being hard of hearing, 2 were diagnosed with unilateral conductive hearing loss, and 9 were diagnosed with bilateral sensorineural hearing loss. The majority who used PPE were aged <30 years $n=15$ (46.9%), among them about $n=29$ (90.6%) were literate and 93.8% were employed for <20 years in construction sites. Factors like age, education, and years of occupation were found to be associated with PPE use among the study population. Factors like age, educational status, years of occupation, and use of PPE were found to be significantly associated with hearing loss by Fischer's exact test.

Conclusion: Factors contributing to hearing loss among construction workers are age, education, years of exposure, and PPE use. Periodical ear checkups and use of PPE like ear plugs must be insisted among people working in noisy environment.

Keywords: Construction Workers, Personal Protective Equipment, Pure Tone Audiometry

Introduction

Construction and manufacturing are two of the loudest industries that can result in hearing impairment for workers.¹ When noise levels in a

workplace are beyond the threshold for hearing, it can cause noise-induced hearing loss (NIHL). Reduced attention, exhaustion, headaches, sleep

difficulties, and job loss are some of the effects of this illness. Prolonged exposure to noise at work can cause tinnitus, earaches, hyperacusis, and hearing loss.² Long-term daily noise exposure higher than the lower action limit of 80 dB may eventually result in NIHL. It may significantly affect a worker's standard of living.³ Continuous exposure to excessive noise, generally over the years, results in occupational noise-induced hearing loss (ONIHL). When noise levels in the workplace are 85 dB or higher throughout an eight-hour shift, either continuously or intermittently, or when impact noise levels are 120 dB or higher, it is deemed dangerous.

One of the most prevalent chronic occupational disorders and a significant health burden is noise-induced hearing loss, which is caused by exposure to high noise levels at work.⁴ In addition to causing stress to the ears and destroying the tiny hair cells in the inner ear's cochlea, loud noises can also induce long-term hearing loss. Due to a larger likelihood of inner hair cell degradation, hearing loss is more likely to occur in older workers.⁵ Generally, an audiogram notched at 3, 4, or 6 kHz, with a recovery at 8 kHz, is the earliest indication of NIHL. As noise exposure increases, this audiometric notch eventually deepens and evolves towards lower frequencies.⁶ Hearing conservation programs are created because noise-induced hearing loss (NIHL) may be avoided. These programs frequently depend on employees wearing hearing protection devices (HPDs) rather than reducing noise exposure at its source.⁶ Although most cases of NIHL are reversible, there are several considerations for improving the design and use of hearing protection in the building industry. The study's primary objective was to estimate the prevalence of hearing loss among construction workers in the urban area of Chennai. The secondary objective was to assess the factors associated with hearing loss among the construction workers in the urban area of Chennai.

Methods

The Ear, Nose, and Throat department of a tertiary care hospital in Chennai conducted cross-sectional research from February to July 2024 after clearance from the Institutional Human Ethics Committee (Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education). Based on 80% power, 10% allowable error, and a universal prevalence of 50%, a sample size of 100 was determined.

Construction workers from 18 to 60 years old were included. A complete list of construction workers from 10 construction sites in the South zone of Chennai was chosen. Out of that, the required number of samples was selected by a simple random sampling technique that fulfilled the inclusion criteria. All types of workers employed at the construction site, like masons, helpers, construction inspectors, flooring installers, tile setters, plumbers, electricians, painters, machine operators, iron and steel workers, and woodworkers, were included in the study.

We excluded known cases of Chronic otitis media, those with a history of ear surgery, and those with post-viral sequelae, as well as individuals with congenital ear problems.

All patients were enrolled after receiving clearance from the institutional human ethics committee in compliance with the inclusion and exclusion criteria. A series of health camps were held at random in South Chennai construction sites. Patients were referred to a tertiary care hospital, where they underwent a comprehensive clinical examination after providing their informed consent and having their medical history thoroughly taken. A list of sociodemographic characteristics was collected, including age, gender, education, duration of employment, history of NIHL, and usage of personal protective equipment (PPE) - earplugs. Pure tone audiometry was done to assess each research participant's hearing capacity after an otoscopy screening for ear complaints. Any

problems identified were addressed appropriately.

An Excel spreadsheet created on Microsoft was utilized to enter data. The data was analyzed in version 21 of the Statistical Package for the Social Sciences (SPSS). Qualitative data are given as frequencies, and quantitative factors are presented as mean and standard deviation. Fischer's exact and Chi-square tests were used to determine the degree of association. P-values below 0.05 were considered significant.

Results

The mean age of the study participants was $36 \pm$

10.64 years. The majority of the study population, $n = 43$ (43%), was aged between 31 and 40 years. Only a few participants ($n = 12$, 12%) were aged 51 to 60 years. There were no female employees. Most of the study participants were literate, 73 (73%), and so were migrants, 79 (79%). The mean exposure of the study participants was 15 ± 8.31 years. Most of the study population, 52 (52%), had a minimum exposure of 10 years. Only 4 participants (4%) were exposed for over 30 years. Most of the study population, $n = 68$ (68%), did not use personal protective measures. Only 32 participants (32%) used personal protective measures during working hours. (Table 1)

Table 1: Distribution of age, years of exposure, and PPE use among study participants ($n=100$)

Study characteristics	Frequency (Percentage), n (%)
Age (years)	
<30	29 (29)
31-40	43 (43)
41-50	16 (16)
51-60	12 (12)
Education	
Literate	73 (73)
Illiterate	27 (27)
Residence	
Migrants	79 (79)
Non-migrants	21 (21)
Exposure (years)	
<10	28 (28)
11-20	52 (52)
21-30	16 (16)
>30	4 (4)
PPE use	
Yes	32 (32)
No	68 (68)

Only 21 participants (21%) had symptoms of earache, hard of hearing, or tinnitus. Almost 79 out of 100 participants (79%) had no such symptoms. About 14 participants among the study population (14%) had a retracted tympanic membrane and two participants had a perforated tympanic membrane. Almost 84 out of 100

participants (84%) had regular ear examinations. Out of the 11 who complained of being hard of hearing, 2 participants were diagnosed with unilateral conductive hearing loss, and 9 of them were diagnosed with bilateral sensorineural hearing loss (Table 2).

Table 2: Distribution of symptoms, ear examination, hearing loss, and type of hearing loss among study participants (n=100)

Ear findings	Frequency, n (%)
Symptoms	
Present	21 (21)
Absent	79 (79)
Ear examination	
Normal	84 (84)
Retracted tympanic membrane	14 (14)
Perforated tympanic membrane	2 (2)
Hearing loss	
Present	11 (11)
Absent	89 (89)
Type of hearing loss (n=11)	
Bilateral SNHL*	9 (9)
Unilateral CHL**	2 (2)

*SNHL – Sensorineural Hearing Loss; **CHL – Conductive Hearing Loss; ***statistically significant at p<0.05

The majority of the study population who used PPE were aged less than 30 years, n=15 (46.9%), among them about n=29 (90.6%) were literate and nearly 93.8% were employed for less than 20 years in construction sites. Factors like age, education, and years of occupation were found to

be associated with PPE use among the study population. Upon applying Fisher's exact test, the association was found to be statistically significant with p-values of 0.029, 0.006, and 0.011, respectively (p < 0.05). (Table 3)

Table 3: Factors associated with the use of PPE among the study population (n=100)

Parameters	PPE use		Fischer's exact value	P value
	Yes, n = 32 (%)	No, n= 68 (%)		
Age (years)				
<30	15 (46.9)	14 (20.6)	8.965	0.029***
31-40	12 (37.5)	31 (45.6)		
41-50	4 (12.5)	12 (17.6)		
51-60	1 (3.1)	11 (16.2)		
Education of workers				
Literate	29 (90.6)	44 (64.7)	7.417	0.006***
Illiterate	3 (9.4)	24 (35.3)		
Years of occupation (years)				
<10	15 (46.9)	13 (19.1)	11.191	0.011***
11-20	15 (46.9)	37 (54.4)		
21-30	1 (3.1)	15 (22.1)		
>30	1 (3.1)	3 (4.4)		

***statistically significant at p<0.05

Factors like age, educational status, and years of occupation were found to be significantly associated with hearing loss by Fisher's exact test, and the association was found to be statistically significant with p-values of 0.002, 0.004, and 0.001,

respectively (p<0.05). In addition, the association between PPE use and hearing loss was also proved to be statistically significant by the Chi-square test with a p-value of 0.044 (p<0.05) (Table 4).

Table 4: Factors associated with hearing loss in the study population (n=100)

Study characteristics	Hearing loss		Fischer's exact value	P value
	Yes, n = 11 (%)	No, n = 89 (%)		
Age (years)				
<30	-	29 (32.6)	14.994	0.002***
31-40	2 (18.2)	41 (46.1)		
41-50	5 (45.5)	11 (12.4)		
51-60	4 (36.4)	8 (9)		
Education of workers				
Literate	4 (36.4)	69 (77.5)	8.417	0.004***
Illiterate	7 (63.6)	20 (22.5)		
Years of occupation (years)				
<10	-	28 (31.5)	19.407	0.001***
11-20	3 (27.3)	49 (55)		
21-30	6 (54.5)	10 (11.2)		
>30	2 (18.2)	2 (2.2)		
PPE use				
Yes	-	32 (36)	4.057	0.044***
No	11 (100)	57 (64)		

***statistically significant at p<0.05

Discussion

One of the world's steadily expanding sectors is the construction industry. It is estimated that about 8.5 million workers in the country are engaged in building and other construction work. From extremely slight discomfort to serious and even fatal illnesses, construction workers face a wide spectrum of occupational dangers. Compared to employees in many other industries, migrant construction workers are more likely to experience various illnesses and health problems. Pre-testing equipment, materials, and procedures can help avoid these issues later. Exposure monitoring and risk assessment are vital components of occupational health and safety systems.⁷

CDC reported that approximately 14% of all Construction workers had hearing difficulty, which is higher than our study findings. Additionally, they found that 52% of noise-exposed construction workers reported not wearing hearing protection, whereas the proportion exposed was high (68%) in our study population, which included all construction workers.⁸ This difference could be attributed to the number of years of exposure being a

minimum of 10 years in most of them.

Only 21 participants (21%) had earache, hard of hearing, or tinnitus symptoms. Almost 79 out of 100 participants (79%) had no such symptoms. About 14 participants (14%) among the study population had a retracted tympanic membrane, and two participants had a perforated tympanic membrane. Almost 84 out of 100 participants had normal ear examinations. Retracted tympanic membrane in some workers could be a complication of chronic rhinitis as they work in an environment polluted with particulate matter.

Since all construction works, such as brickwork, flooring, tiling, and plumbing, were happening simultaneously, and electrical works, steel works, wood works, and painting happened together, assessing the exposure of each type of work was practically impossible in large construction sites.

In a study conducted by Hameed et al., the majority of the study subjects, 47.3%, were between 18 and 30 years. About 65.5% of the workforce consisted of migrant laborers, the majority of whom, 85.5%, had worked in construction for less than 15 years, and 68% of them had worked there for less than five years. In

a study conducted by Dement et al., the mean age of all participants was 59.2 years.⁹ In our study, the mean age of the study participants was 36 ± 10.64 years. Most of the study population, $n = 39$ (68%), were aged between 30 and 40 years. Only a few participants, $n=4$ (29%), were 50 to 60 years old. Most of the study participants in our study were literate, 73%, and so were migrants, 79%, and the mean exposure of the study participants was 15 ± 8.31 years. Most of the study population, 52 (52%), had a minimum exposure of 10 years. Only 4 participants (4%) were exposed for over 30 years.

In a study by Hameed et al., the advantage of wearing earplugs or muffs was the least known. Wearing masks, earplugs/muffs, and helmets was used by 45.5%, 1.8%, and 54.5% of people, respectively. The percentage of building construction workers who used at least one PPE was 58.1%. Normal hearing was present in the right ear in 54.5% of cases and in the left ear in 60%. Twenty-seven percent of the workers had little to moderate conductive hearing loss in the left ear, and forty percent had mild to severe hearing loss in the right ear. After SNHL assessment, 5.4% of the right ear had mild to moderate SNHL, and 12.7% of the left ear had minimal to severe SNHL. Among the workers, 14.5% had SNHL in one or both ears.³ In a study conducted by Seixas NS et al., those with lower baseline hearing were less consistent HPD users; we do not think protective devices could account for this significant difference in effect, given the low prevalence of HPD use in the study group and the lack of evidence of HPD use's effects.¹⁰ Similarly, in our study, the majority of the study population, 68%, did not use any personnel protective measures. Only some participants 32% were using personal protective measures during working hours. In our study, out of the 11 participants who complained of being hard of hearing, 2 participants were diagnosed with unilateral conductive hearing loss, and 9 of them were diagnosed with bilateral sensorineural hearing loss.

A study conducted by Hameed et al. showed that workers' knowledge of the advantages of personal protective equipment (PPE), such as masks, helmets, and earplugs/muffs, was 56.4%, 58.2%, and 14.5%, respectively.³ According to research by Jasani et al., only 26% of workers knew that utilizing personal protective equipment (PPE) might avoid work-related dangers. In comparison, 25% of workers reported using PPE in some way. In line with this study's findings, the least amount of earplug use was seen.¹¹ Different research by Ashish et al. discovered that only 12% used PPE.¹² Similarly, in our study, the majority of the study population who used PPE were aged less than 30 years, $n=15$ (46.9%); among them, about $n=29$ (90.6%) were literate, and nearly 93.8% were employed for less than 20 years in construction sites. Factors like age, education, and years of occupation were associated with PPE use among the study population, and the association was found to be statistically significant.

According to research by Merck, Rampal, and Ismail, noise-induced hearing loss (NIHL) is a significant issue for construction workers subjected to noise levels between 85 and 120 dB.^{13,14,15} In our study, factors like age, educational status, years of occupation, and use of PPE were found to be significantly associated with hearing loss by Fischer's exact test, and the association was statistically significant.

Within the first 3 years of employment, construction workers have minor but detectable impairments in their hearing from noise exposure, even at average exposure levels below 90 dBA. Seixas et al. suggest that a quantitative assessment of noise exposure, taking into account the reduction in exposure brought about by wearing hearing protection, is needed.¹⁶ Lusk et al. suggest that psychosocial variables that were related to trade group and gender differences in the utilization of the program should be taken into account when developing future hearing conservation initiatives.¹⁷

Though there are Government schemes for

construction workers like

Life and disability cover is available under Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY). PMJJBY is available to people aged 18 to 50 years, and it provides risk coverage of Rs. 2.00 lakh in case of death due to any reason at an annual premium of Rs. 436.

Pradhan Mantri Suraksha Bima Yojana (PMSBY) is based on contributions made by subscribers. The Pradhan Mantri Suraksha Bima Yojana (PMSBY) is available to people in the age group of 18 to 70 years with risk coverage of Rs 2.00 lakh in case of accidental death or total permanent disability and Rs 1.00 lakh for partial permanent disability on payment of an annual premium of Rs 20.

Including insurance schemes, it provides benefits like (a) Every building worker who has completed 18 years of age, but has not completed 60 years of age, and who has been engaged in any building or other construction work for not less than ninety days during the preceding twelve months shall be eligible for registration as a beneficiary under this Act; (b) Immediate assistance to a beneficiary in case of accident; (c) Make payment of pension to the beneficiaries who have completed the age of sixty years; (d) Sanction loans and advances to a beneficiary for construction of a house not exceeding such amount and on such terms and conditions as may be prescribed; (e) Financial assistance for the education of children of the beneficiaries as may be prescribed; (f) Medical expenses for treatment of major ailments of a beneficiary or, such dependent, as may be prescribed; (g) Payment of maternity benefit to the female beneficiaries; (h) Fix the number of hours of work which shall constitute a typical working day for a building worker, inclusive of one or more specified intervals; and provide for a day of rest in every

period of 7 days which shall be allowed to all building workers and for the payment of remuneration in respect of such days of rest; (i) In every establishment wherein 500 or more building workers are ordinarily employed, the employer shall constitute a Safety Committee consisting of such number of representatives of the employer and the building workers as may be prescribed by the State Government.¹⁸

Construction workers often suffer from health issues as they are unaware that the Government provides temporary services on a contract basis. Even though administrators ensure prompt medical care for emergencies, workers don't consider long-standing exposure to construction materials (allergens) a serious issue. This may be the reason for poor reliance on PPE.

Limitations and Strengths

It was projected that construction workers who routinely used face masks and earplugs had lower chances of Ear, Nose, and Throat infections; however, the number of workers who did so was small. Therefore, longitudinal research with a larger sample size is needed to correlate the temporal relationships between documented associations. It is important to adhere to the regulations, and further study in this field would improve the health of construction workers by providing early diagnosis and treatment.

Conclusions

Age, education, years of exposure, and PPE use are factors contributing to hearing loss among construction workers. Periodic ear checkups and the use of PPE-like earplugs must be insisted on among people working in noisy environments. In addition, noise dosimeters can help measure noise exposure levels. As age and years of exposure are directly associated with hearing loss, elderly people must be placed in jobs that don't threaten their sense of hearing.

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