

KNOWLEDGE, ATTITUDE, AND PRACTICE TOWARD NOISE-INDUCED HEARING LOSS AMONG CONSTRUCTION WORKERS IN CHENNAI: A CROSS-SECTIONAL STUDY

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Abstract

Background: Noise-induced hearing loss (NIHL) is one of the most common preventable occupational disorders among workers exposed to excessive workplace noise. Construction workers are particularly vulnerable because of prolonged exposure to high-intensity sound and inconsistent use of hearing protection. Information regarding their knowledge, attitudes, and preventive practices is limited in Chennai.

Objectives: To assess the knowledge, attitude, and practices related to noise-induced hearing loss among construction workers employed at selected construction sites in Chennai.

Methods: A cross-sectional survey was carried out over a period of three months among 100 construction workers selected through convenience sampling. Data were collected using a structured interviewer-administered questionnaire comprising socio-demographic details and separate domains assessing knowledge, attitude, and practice regarding NIHL. Domain scores of 70% or higher were considered indicative of good knowledge, favourable attitude, and adequate preventive practice. Associations between participant characteristics and KAP domains were analysed using the Chi-square test, while correlations among domain scores were examined using Pearson's correlation coefficient.

Results: Among the 100 participants, 38% demonstrated good knowledge, 52% showed favourable attitudes, and only 19% reported adequate preventive practices. Although most workers recognised that prolonged noise exposure could result in permanent hearing loss, misconceptions regarding treatment and poor awareness of early symptoms remained common. Consistent use of hearing protection was reported by only 22% of participants. Educational status and the availability of personal protective equipment were significantly associated with knowledge scores. Positive correlations were observed between knowledge, attitude, and practice, although the association between knowledge and practice was relatively weak.

Conclusion: Construction workers demonstrated moderate awareness and generally positive attitudes towards hearing conservation; however, the adoption of preventive practices remained unsatisfactory. Strengthening workplace education, improving access to hearing protection devices, and promoting employer-supported hearing conservation programmes may help bridge the gap between awareness and actual protective behaviour.

Keywords: Noise-induced hearing loss; construction workers; knowledge; attitude; practice; occupational health; hearing protection

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Introduction

Noise-induced hearing loss (NIHL) is one of the most common occupational disorders affecting workers exposed to excessive workplace noise. Although the condition is irreversible once established, it is largely preventable through appropriate workplace interventions and consistent use of hearing conservation measures. Occupational exposure to noise levels exceeding 85 A-weighted decibels (dBA) over an 8-hour work shift is widely recognised as a significant risk factor for the development of NIHL [1]. Unlike many acute occupational injuries, hearing loss develops gradually,

and affected individuals may remain unaware of the progressive decline in hearing until irreversible damage has occurred. Consequently, timely preventive strategies and regular hearing surveillance play a crucial role in reducing the burden of occupational hearing impairment [1].

Occupational noise exposure continues to be a major contributor to hearing disability worldwide. According to estimates from the Global Burden of Disease (GBD) 2021 study, occupational noise accounts for a considerable proportion of adult hearing impairment

across different populations [2]. Furthermore, occupational NIHL was responsible for more than 7.8 million disability-adjusted life years (DALYs) globally in 2021, representing a substantial increase compared with previous decades. The burden is particularly high in South Asia and East Asia, where rapid industrialisation and expanding construction activities expose large numbers of workers to hazardous noise levels [3].

The construction industry represents one of the highest-risk occupational sectors for NIHL because workers are routinely exposed to noise generated by heavy machinery, drilling equipment, concrete mixers, compressors, and other construction tools. In India, this risk is further amplified by the predominance of informal employment, inadequate enforcement of occupational safety regulations, and limited availability or inconsistent use of personal protective equipment (PPE). These workplace conditions increase workers' susceptibility to preventable hearing loss and highlight the need for effective occupational health interventions.

Evidence from India also demonstrates the magnitude of this problem. A systematic review and meta-analysis published in 2022 reported that nearly half of workers employed in noisy occupations exhibited evidence of NIHL, although the reported prevalence varied considerably across studies [4]. The same review also observed that workers in the informal sector frequently lacked access to appropriate hearing protection devices, suggesting that inadequate workplace safety measures contribute substantially to occupational hearing damage [4].

Assessment of workers' knowledge, attitudes, and practices (KAP) provides valuable information for planning preventive programmes and identifying barriers to hearing conservation. Previous studies among construction workers have shown that awareness regarding NIHL may not necessarily translate into appropriate preventive behaviour. A KAP survey conducted among construction workers in Delhi demonstrated significantly lower knowledge, attitude, and practice scores compared with engineers working at the same sites, with educational status emerging as an important determinant of hearing conservation practices [5]. These findings emphasise that educational interventions alone may not be sufficient unless accompanied by improved workplace safety policies and easier access to hearing protection devices.

Despite the growing body of evidence on occupational NIHL, information regarding the knowledge, attitudes, and preventive practices of construction workers in Chennai remains limited. Chennai has experienced rapid urban development with continuous expansion of construction activities, employing a large workforce that is potentially exposed to hazardous occupational noise. However, locally generated evidence is scarce, making it difficult to develop region-specific hearing conservation strategies. Therefore, the present study was undertaken to assess the knowledge, attitudes, and practices regarding noise-induced hearing loss among construction workers employed at selected construction sites in Chennai.

MATERIALS AND METHODS:

Study Design

A cross-sectional study was conducted to assess the knowledge, attitude, and practices regarding noise-induced hearing loss (NIHL) among construction workers.

Study Location

The study was carried out at various construction sites in Chennai, Tamil Nadu, India.

Duration of Study

Data collection was undertaken over a period of three months.

Study Subjects

The study population consisted of construction workers who were actively engaged in construction activities at the selected study sites.

Inclusion Criteria

- (i) Construction workers aged 18–60 years.
- (ii) Individuals with at least six months of construction work experience before enrolment in the study.

Exclusion Criteria

Workers with a history of congenital hearing impairment or pre-existing ear disorders were excluded to minimise the influence of non-occupational causes of hearing loss.

Sample Size

The sample size was estimated using the standard formula for calculating a population proportion:

$$n = 4pq/L^2$$

where p represents the expected proportion of workers having adequate knowledge regarding NIHL, $q = (1 - p)$, and L denotes the permissible error. Based on a previously reported prevalence of 44% among comparable occupational groups [6], with an absolute precision of 10%, the minimum required sample size was calculated as 99, which was rounded off to 100 participants.

Sampling Technique

A convenience sampling method was adopted to recruit eligible participants from the selected construction sites because of the mobile nature of the construction workforce and practical constraints in accessing workers.

Study Tool

Information was collected using a structured interviewer-administered questionnaire consisting of four sections: (1) socio-demographic and occupational characteristics; (2) a knowledge domain comprising 10 questions (score range: 0–10); (3) an attitude domain comprising 8 questions (score range: 0–8); and (4) a practice domain comprising 10 questions (score range: 0–10). Participants scoring 70% or above in the respective domains were categorised as having good knowledge, favourable attitude, and adequate practice.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using SPSS version 25. Categorical variables were expressed as frequencies and percentages. The Chi-square test was used to examine the association between participant characteristics and the categorised knowledge, attitude, and practice levels. Pearson's correlation coefficient was applied to determine the relationship among the continuous knowledge, attitude, and practice scores. A P value of less than 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee before commencement of the study. Written informed consent was obtained from all participants prior to data collection, and confidentiality of the information collected was maintained throughout the study.

RESULTS;

In this cross-sectional study on KAP survey of NIHL among 100 construction workers occupationally exposed to noise, 15 out of 115 subjects screened for eligibility were excluded from the study (10 subjects declined to give informed consent, 5 subjects suffering from previous ear diseases or undergoing surgery). Workers

were chosen from different construction activities such as masonry/cement works (38%), carpentry/scaffolding (24%), heavy machinery (21%) and unskilled labor works (17%).

SOCIODEMOGRAPHIC PROFILE

In all, there were 100 participants in the study. The average age of the participants was 34.6 ± 8.2 years, which shows that the participants in the study were mostly young to middle-aged individuals. More than half of the participants (53%) fell under the age group of 30–45 years, while 32% were younger than 30 years and 15% were more than 45 years.

The male participants constituted the majority of the participants (92%), while only 8% of the participants were female.

As far as the education level of the participants was concerned, most of them (54%) had education up to the secondary/higher secondary level, whereas 28% of them were either illiterate or had studied till primary level. Only 18% of them had higher education (graduate or diploma).

As far as the socioeconomic status of the participants is concerned, 46% of them had their monthly income between ₹15,000 and ₹25,000, while 41% of them had an income less than ₹15,000. Only 13% of them had a monthly income of more than ₹25,000.

Table 1. Socio-demographic Characteristics of Participants (N = 100)

Variable	Category / Summary	n (%) / Mean $\pm$ SD
Age (years)	Mean $\pm$ SD	34.6 $\pm$ 8.2
	< 30	32 (32.0%)
	30–45	53 (53.0%)
	> 45	15 (15.0%)
Gender	Male	92 (92.0%)
	Female	8 (8.0%)
Education Level	Illiterate / Primary	28 (28.0%)
	Secondary / High School	54 (54.0%)
	Graduate / Diploma	18 (18.0%)
Monthly Income (INR)	< 15,000	41 (41.0%)
	15,000–25,000	46 (46.0%)
	> 25,000	13 (13.0%)

Values are n (%) unless otherwise indicated.

Occupational profiles of the research participants indicated that the mean length of time spent working was 7.4 ± 4.5 years. This indicates that most workers had some years of experience in the construction industry. On average, the duration of work per day was 8.8 ± 1.2 hours. Thus, the research participants worked on a typical full-time basis for many hours per day.

The job roles of most of the study participants were as follows: 38% of the participants were working as masons or concrete workers, 24% were carpenters/scaffold installers, 21% were heavy machinery operators, and 17% were helpers/general laborers. Thus, the

construction industry involved different job roles among its employees.

As for the noise exposure level, a very large proportion (68%) reported high noise exposure where normal conversation requires shouting, 26% experienced moderate noise exposure, and only 6% reported low noise exposure. It means that most participants were exposed to noise on a regular basis in their work.

As for hearing protection, only 42% of the workers reported provision of personal protective equipment such as earplugs or earmuffs, while 58% of the workers did not have any hearing protection devices

Table 2. Occupational and Noise Exposure Profile (N = 100)

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Variable	Category / Summary	n (%) / Mean $\pm$ SD
Duration of Employment (years)	Mean $\pm$ SD	7.4 $\pm$ 4.5
Daily Work Duration (hours)	Mean $\pm$ SD	8.8 $\pm$ 1.2
Job Role	Masonry / Concrete worker	38 (38.0%)
	Carpenter / Scaffold installer	24 (24.0%)
	Heavy machinery operator	21 (21.0%)
	Helper / General laborer	17 (17.0%)
Self-reported Noise Level	High (hard to speak without shouting)	68 (68.0%)
	Moderate	26 (26.0%)
	Low	6 (6.0%)
PPE (Earplugs/Earmuffs) Provided	Yes	42 (42.0%)
	No	58 (58.0%)

KNOWLEDGE DOMAIN

Majority of the respondents (74%) knew that continuous exposure to loud noises could result in hearing impairment for the rest of their lives. However, almost half of the respondents (48%) held a misconception that noise induced hearing impairment could be treated using medication. Knowledge concerning the role played by earplugs was moderately high (62%), but awareness concerning tinnitus as an early sign of hearing impairment (39%) and hearing screening (45%) was comparatively low.

Table 3. Knowledge Domain: Item-wise Summary (N = 100)

Knowledge Item	Correct Response n (%)	Remarks
Prolonged exposure to loud noise causes permanent hearing loss	74 (74.0%)	High baseline awareness
NIHL can be cured with regular medication	48 (48.0%)	Common misconception present
Earplugs/earmuffs effectively prevent noise damage	62 (62.0%)	Moderate awareness
Tinnitus (ringing in ears) is an early warning sign of hearing loss	39 (39.0%)	Low awareness
Periodic hearing screening is necessary for noisy jobs	45 (45.0%)	Moderate awareness

Attitude Domain

In general, there was a positive attitude among participants towards hearing conservation. Majority (68%) believed that hearing protection is important, while 82% believed that employers should supply hearing protection equipment. Yet, 34% viewed hearing protection as a hindrance to effective communication at the workplace, and 41% believed that hearing damage is an inevitable occupational hazard for those working in the construction industry.

Table 4. Attitude Domain: Item-wise Summary (N = 100)

Attitude Statement	Favorable Response n (%)	Remarks
Wearing hearing protection during work is essential	68 (68.0%)	Positive disposition
Hearing protection interferes with workplace communication	34 (34.0%)	High perception of barrier
Employer should mandatorily provide hearing protection	82 (82.0%)	Strongly favorable
Hearing loss is an unavoidable part of construction work	41 (41.0%)	Fatalistic attitude present

Practice Domain

While there is satisfactory knowledge and positive attitudes towards safety, the practice of safe hearing was not satisfactory. Only 22% had consistent use of hearing protectors, while 35% had a break from noisy environment and only 11% had annual hearing tests. Also, only 29% had reported any noise hazard or hearing protectors' malfunction in their workplace.

Table 5. Practice Domain: Item-wise Summary (N = 100)

Practice Item	Desirable Practice n (%)	Remarks
Use earplugs/earmuffs consistently at noisy work areas	22 (22.0%)	Significant practice gap
Take short breaks away from loud machinery when possible	35 (35.0%)	Moderate practice

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Practice Item	Desirable Practice n (%)	Remarks
Undergo annual hearing check-up	11 (11.0%)	Very low practice
Report workplace noise issues or damaged PPE to supervisor	29 (29.0%)	Low practice

Categorized Knowledge, Attitude, and Practice Levels – Interpretation

On average, 38% of the respondents had adequate knowledge about NIHL, while most of them (62%) had poor knowledge. More than half (52%) of them had positive attitudes toward hearing preservation, while 48% of them had negative attitudes. On the other hand, only 19% of the respondents had good prevention practices, while 81% of them had poor prevention practices.

Table 6. Categorized Knowledge, Attitude, and Practice Levels (N = 100)

Domain	Category Definition	n (%)
Knowledge Level	Good ($\geq 70\%$)	38 (38.0%)
	Poor ($< 70\%$)	62 (62.0%)
Attitude Level	Favorable ($\geq 70\%$)	52 (52.0%)
	Unfavorable ($< 70\%$)	48 (48.0%)
Practice Level	Adequate ($\geq 70\%$)	19 (19.0%)
	Inadequate ($< 70\%$)	81 (81.0%)

There was a significant relationship between the level of education and knowledge of noise-induced deafness ($\chi^2 = 11.42$, $p = 0.003$). The individuals who attained higher levels of education had more knowledge where 66.7% of those that were graduates/diplomas showed good knowledge compared to 38.9% and 17.9% that had secondary and primary/no formal education respectively.

The level of knowledge was significantly associated with provision of personal protective equipment (PPE) ($\chi^2 = 5.86$, $p = 0.015$). Those who were given earplugs or earmuffs had a higher percentage of good knowledge (52.4%) compared to those who were not given PPE (27.6%).

Table 7. Association Between Participant Characteristics and Knowledge Category

Independent Variable	Poor Knowledge (n=62)	Good Knowledge (n=38)	χ^2 / df / p-value
Education Level			$\chi^2 = 11.42$, df = 2, $p = 0.003$
Illiterate / Primary	23 (82.1%)	5 (17.9%)	
Secondary / High School	33 (61.1%)	21 (38.9%)	
Graduate / Diploma	6 (33.3%)	12 (66.7%)	
PPE Provision			$\chi^2 = 5.86$, df = 1, $p = 0.015$
Yes	20 (47.6%)	22 (52.4%)	
No	42 (72.4%)	16 (27.6%)	

Chi-square test of independence; $p < 0.05$ considered statistically significant.

There was a significant positive correlation between knowledge and attitude scores ($r = 0.46$, $p < 0.001$), meaning that the individuals who knew more about hearing conservation practices tended to have more positive attitudes regarding hearing conservation.

The knowledge scores were also found to be significantly positively correlated with the practice scores ($r = 0.31$, $p = 0.002$), meaning that those who knew more about hearing conservation tended to engage in more hearing conservation practices; however, the correlation was fairly low.

In the same vein, attitude and practice scores were found to be moderately positively correlated ($r = 0.38$, $p < 0.001$).

Table 8. Pearson Correlation Among Continuous KAP Scores

Variable Pair	Pearson Correlation (r)	p-value
Knowledge Score vs. Attitude Score	r = 0.46	p < 0.001
Knowledge Score vs. Practice Score	r = 0.31	p = 0.002
Attitude Score vs. Practice Score	r = 0.38	p < 0.001

Figures

Figure 1. Participant Inclusion Flow Diagram

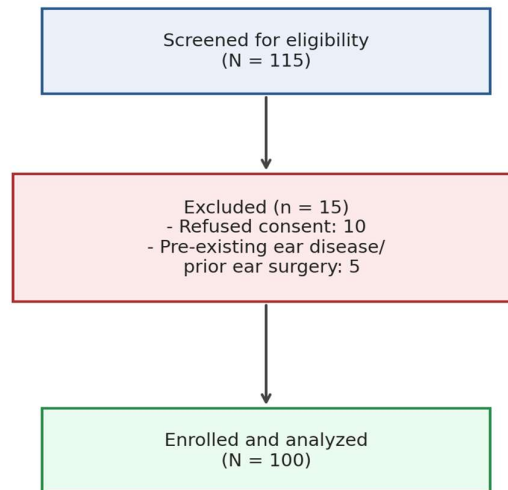


Figure 1. Participant Inclusion Flow Diagram

Out of a total of 115 employees who were screened, 15 individuals were excluded (10 individuals who did not give consent and 5 individuals who had pre-existing ear condition or history of surgery). The mean knowledge score was 5.4 ± 2.1 while the median knowledge score was 5.0. The majority of the participants scored moderately on knowledge about NIHL but only a few scored highly.

Figure 2. Distribution of Knowledge Scores (N = 100)

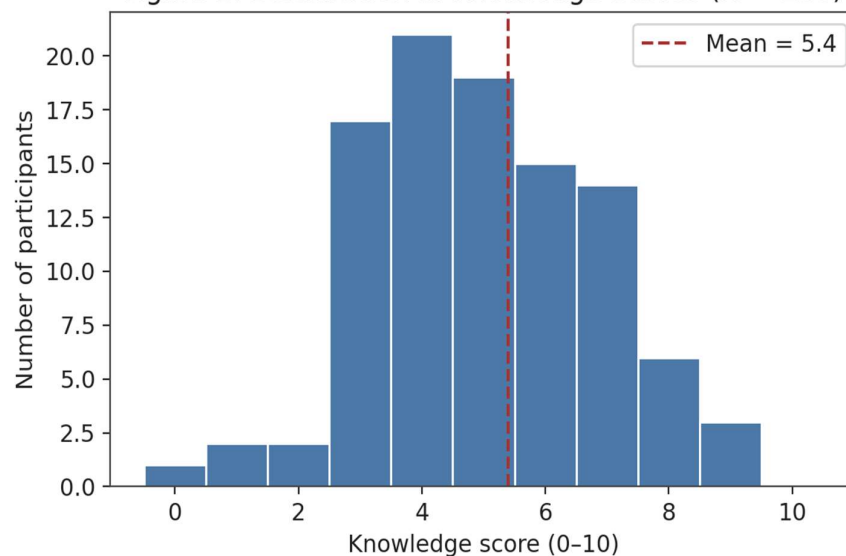


Figure 2. Distribution of Knowledge Scores (N = 100)

Knowledge score range 0–10; Mean $\pm$ SD = 5.4 ± 2.1 , Median = 5.0.

Attitude scores were clustered around the higher end of the scale, with a mean score of 4.8 ± 1.6 and a median of 5.0. This suggests that most participants had a generally positive attitude towards hearing conservation and the use of protective measures.

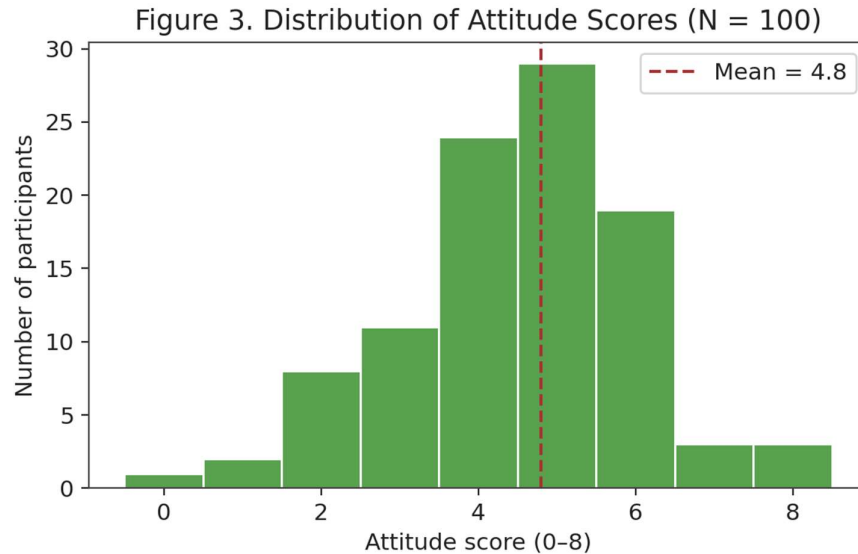


Figure 3. Distribution of Attitude Scores (N = 100)

Attitude score range 0–8; Mean $\pm$ SD = 4.8 ± 1.6 , Median = 5.0.

Practice scores showed a right-skewed distribution, with a mean score of 3.1 ± 1.9 and a median of 3.0. Most participants had low practice scores, indicating poor compliance with recommended hearing protection and preventive measures despite having moderate knowledge and positive attitudes.

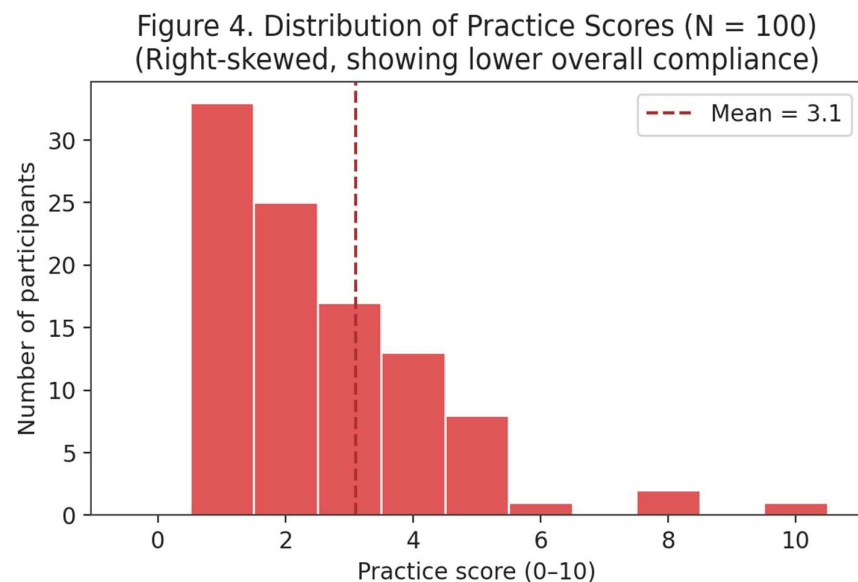


Figure 4. Distribution of Practice Scores (N = 100)

Practice score range 0–10; Mean $\pm$ SD = 3.1 ± 1.9 , Median = 3.0. Distribution is right-skewed, reflecting lower overall compliance.

The comparison of KAP levels showed that 62% of participants had poor knowledge, while 38% had good knowledge. Slightly more than half (52%) demonstrated a favorable attitude, but only 19% had adequate preventive practices, with 81% showing inadequate practices.

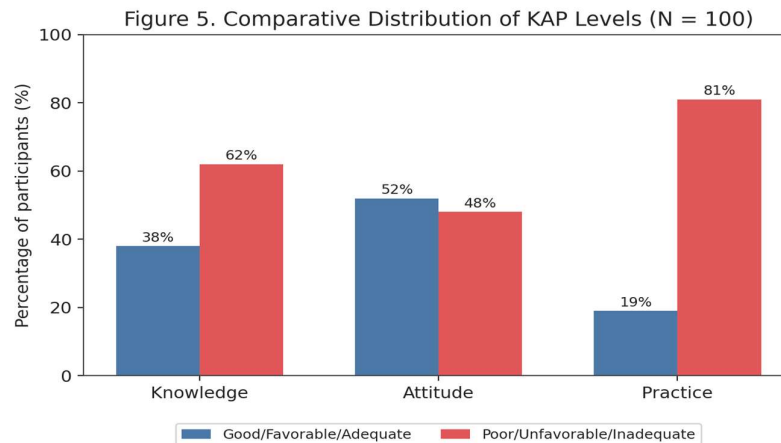


Figure 5. Comparative Distribution of KAP Levels (N = 100)

Knowledge: 38% good vs. 62% poor. Attitude: 52% favorable vs. 48% unfavorable. Practice: 19% adequate vs. 81% inadequate.

DISCUSSION

The present study assessed the knowledge, attitudes, and preventive practices related to noise-induced hearing loss (NIHL) among construction workers in Chennai. Although over one-third of the participants demonstrated good knowledge (38%) and more than half exhibited favourable attitudes (52%), only 19% reported adequate preventive practices. This disparity suggests that awareness alone is insufficient to promote safe hearing-related behaviour and highlights the persistent gap between knowledge and actual workplace practices.

Sociodemographic and Occupational Profile

Most participants were male (92%) with a mean age of 34.6 ± 8.2 years, reflecting the demographic profile commonly reported among construction workers in India. A comparable study conducted among construction workers in Puducherry also reported a predominantly young male workforce and demonstrated an association between similar demographic characteristics and the occurrence of NIHL.⁷ In the present study, 68% of workers reported exposure to high levels of workplace noise requiring them to raise their voices during communication. This observation is consistent with findings from a systematic review and meta-analysis of occupational studies conducted in India, which identified prolonged noise exposure as an important contributor to NIHL among workers.⁸

Knowledge Domain

Only 38% of the participants achieved good knowledge scores, indicating that awareness regarding NIHL remains inadequate among construction workers. Similar deficiencies have been reported among workers employed in the iron and steel industry in India, where poor knowledge and preventive practices persisted

despite generally favourable attitudes.⁹ Likewise, construction workers in Delhi demonstrated lower knowledge levels than civil engineers working at the same sites, emphasising the influence of educational attainment on occupational health awareness.¹⁰ The present study also demonstrated a significant association between educational status and knowledge, with graduates and diploma holders performing considerably better than workers with lower educational qualifications ($p = 0.003$).¹¹

Nearly half of the participants incorrectly believed that hearing loss caused by occupational noise could be treated with medication. Similar misconceptions have been reported among factory workers in Tanzania, where knowledge regarding the irreversible nature of NIHL remained inadequate despite moderate overall awareness.¹² Such misconceptions are important because workers who believe that hearing loss is reversible may be less likely to adopt preventive measures consistently.

Attitude Domain

Overall, participants demonstrated a favourable attitude towards hearing conservation. More than four-fifths believed that employers should provide hearing protection devices, indicating recognition of the employer's responsibility in maintaining workplace safety. Comparable findings have been reported from Tanzania, where favourable attitudes were associated primarily with educational status.⁶ Nevertheless, 41% of workers in the present study considered hearing loss to be an unavoidable consequence of construction work. Similar fatalistic beliefs have been described in the Bhutan–Malaysia comparative study, where inadequate awareness and poor utilisation of hearing protection devices limited effective hearing conservation.¹³

Practice Domain

Preventive practices represented the weakest component of the KAP assessment. Only 22% of workers reported regular use of hearing protection devices, while annual hearing examinations were undertaken by merely 11% of participants. These findings indicate that appropriate preventive behaviour remains unsatisfactory despite reasonable awareness. Similar observations have been reported among printing press workers in Kerala, where acceptable knowledge did not translate into consistent hearing conservation practices.¹⁴ Likewise, the Bhutan–Malaysia study documented substantially lower use of hearing protectors among workers who subsequently demonstrated a higher prevalence of hearing impairment.¹³ Collectively, these findings suggest that behavioural and workplace barriers, including limited availability of personal protective equipment and poor compliance, continue to hinder effective prevention of NIHL.

Correlation Between Knowledge, Attitude and Practice

The positive correlations observed among knowledge, attitude, and practice indicate that these domains are interrelated. However, the weaker association between knowledge and practice suggests that acquiring knowledge alone does not necessarily result in behavioural change. Practical barriers such as inadequate access to hearing protection devices, discomfort during their use, and communication difficulties at noisy worksites may limit the translation of knowledge into routine preventive practices. Addressing these organisational and workplace factors may therefore be as important as improving workers' awareness.

CONCLUSION

The present study identified a clear gap between the knowledge and attitudes of construction workers towards hearing conservation and their actual preventive practices. Although awareness regarding noise-induced hearing loss was reasonably satisfactory, the regular use of hearing protection remained inadequate. Limited availability of hearing protection devices and workplace-related barriers may have contributed to this discrepancy. Therefore, strengthening worker education, improving access to personal protective equipment, and enhancing employer participation in hearing conservation programmes are essential for reducing the burden of occupational noise-induced hearing loss.

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