RESEARCH PAPER

A Descriptive Study To Assess The Auditory Assessment Of Welding Workers In Selected Areas Of Pune City In a View To Develop An Information Booklet

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ABSTRACT

Introduction: Occupational noise exposure is a major public health concern among industrial workers, particularly welding workers who are continuously exposed to high levels of noise generated from welding equipment and associated machinery. Prolonged exposure to such noise can lead to auditory impairment, which is often gradual, irreversible, and unnoticed in its early stages. Early identification through auditory assessment is essential to prevent further complications and improve quality of life.

Purpose: The study assessed the auditory status of welding workers in selected areas of Pune city and to develop an information booklet based on the findings.

Materials and methods: A quantitative approach with a descriptive research design was adopted. The study was conducted among 100 welding workers in selected areas of Pune city using a non-probability convenient sampling technique. Data were collected using a structured auditory assessment tool consisting of demographic variables and hearing assessment. Weber's test, Rinne's test, and the Whisper test were used for auditory screening. The tool was validated, reliability was done using inter-raters test and feasibility was checked by pilot study and data were analyzed using descriptive statistics such as frequency and percentage.

Results: The final result showed that the majority of welding workers (87%) had normal hearing, indicating adequate auditory functioning across most individuals. However, (13%) of the workers were found to have suspected hearing loss based on the combined results of Weber, Rinne, and Whisper tests. Although the proportion of suspected cases is relatively small, it still highlights the presence of early auditory changes among a segment of workers, possibly due to prolonged exposure to occupational noise. This suggests the need for regular hearing screening and reinforcement of protective device use to prevent further auditory decline.

Conclusion: The study concludes that welding workers are at a high risk of developing noise-induced hearing loss due to continuous exposure to occupational noise. Regular auditory screening, health education, and use of protective devices are essential to prevent further deterioration. The information booklet developed based on the study findings can help in creating awareness and improving preventive behaviors among workers.

Keywords: Auditory assessment, Welding workers, Occupational noise, Hearing impairment, Noise-induced hearing loss.

How to cite this article: Gaikwad SM, Bashyal PB, Jose J, Mulla M. A Descriptive Study To Assess The Auditory Assessment Of Welding Workers In Selected Areas Of Pune City In a View To Develop An Information Booklet. Int J Drug Deliv Technol. 2026;16(52s): 1083-1088. DOI: 10.25258/ijddt.16.52s.138

Source of support: Nil.

Conflict of interest: None.

INTRODUCTION

Hearing is an essential sensory function that enables communication, social interaction, and safety in daily life. Occupational noise exposure is one of the leading causes of preventable hearing loss worldwide. Welding workers are particularly vulnerable due to continuous exposure to high-intensity noise produced by welding machines, metal cutting tools, and industrial environments. Prolonged exposure to such noise can result in noise-induced hearing loss, which is often gradual, irreversible, and unnoticed in its early stages. In developing countries like India, occupational health hazards among industrial workers often receive limited attention. Welding workers frequently work without adequate hearing protection and are unaware of the long-term consequences of noise exposure.

World Health Organization reports that prolonged exposure to high levels of noise may lead to permanent damage to hearing, especially when proper protection is not used. The WHO emphasizes that sound levels above 85 decibels (dB) are hazardous when workers are exposed for extended period, of time and it estimates that around 16% of disabling

hearing loss in adults is attributable to occupational noise exposure. [1]

The National Institute for Occupational Safety and Health has highlighted that noise levels typical in welding activities can exceed 100 dB, which is potentially dangerous for workers without adequate protection. Their guidelines state that employers and workers must adapt to preventive strategies such as the use of earplugs, earmuffs, and regular hearing assessments to avoid hearing damage. Despite of these recommendations, NIOSH reports that a significant portion of workers continue to be exposed to high levels of noise without proper hearing protection due to lack of awareness and resources. [2] Early auditory assessment is an effective strategy for identifying hearing problems at an initial stage and preventing further deterioration. However, lack of awareness, poor access to health services, and negligence towards preventive care contribute to delayed.

NEED OF THE STUDY

Occupational hearing loss is a growing concern among industrial workers, especially welding workers who are exposed to excessive noise levels for prolonged periods. According to various studies, noise-induced hearing loss is one of the most common occupational diseases, yet it remains largely preventable. Welding workers often lack awareness regarding the harmful effects of continuous noise exposure and the importance of hearing protection. Previous research indicates that many industrial workers do not undergo regular auditory assessments, leading to delayed identification of hearing impairment. Early auditory changes, if detected timely, can be managed through preventive strategies such as use of ear protection, periodic screening, and health education. Scholars emphasize that regular hearing assessment is crucial in reducing the burden of occupational hearing loss. A study conducted by the Occupational Safety and Health Administration (OSHA) found that hearing conservation programmes are found to be effective in reducing the incidence of hearing loss when workers are educated about risks and prevention. The research concluded the study by stating that awareness campaigns and regular auditory check-ups significantly improve workers' ability to protect themselves and seek early medical advice when needed. Educational materials and workshops provided were also noted as essential tools in promoting hearing health in industrial settings. [3] In the Indian context, limited studies have focused on auditory assessment among welding workers at the community level. Assessing their auditory status will help in identifying existing hearing problems and the need for preventive interventions. The findings of the study will also assist healthcare professionals, especially nurses, in planning occupational health programs.

AIM OF THE STUDY

To assess the auditory status of welding workers in selected areas of Pune city and to develop an information booklet based on the findings of the study.

Research Methodology

Research Objectives:

1. To assess the Auditory Assessment among welding workers
2. To associate the findings with selected demographic variables.
3. To develop an information booklet on the Auditory Assessment.

Research Approach: Quantitative research approach was used to collect the data in numbers to assess the auditory assessment.

Research Design: Descriptive research design.

Setting of the Study: The study was conducted in selected areas of Pune city.

Population: Welding workers working in selected areas of Pune city.

Sample Size: The sample consisted of 100 welding workers.

Sampling Technique: Non-probability convenient sampling technique was adopted to select the welding workers who were accessible and willing to participate in the study.

Tool for Data Collection

A structured auditory assessment tool consisting of:

- Section A: Demographic variables
- Section B: Auditory assessment

Development of the tool:Weber's test, Rinne's test,Whisper test was used as Tool.

a. **Section 1:**

Demographic Data - It includes four items such as age, educational status, duration of work, work experience, use of protective devices, tinnitus and past history of ear problems.

b. Section 2:

Auditory Assessment -

1. **Inspection** - It contains 6 checklist questions which deal with assessing auditory health among welding workers.
2. **Weber's Test** - The Weber's test was used as a standardized tuning-fork assessment to determine the lateralization of sound among participants.
3. **Rinne's Test**-The Rinne's test was included to compare air and bone conduction using a 512 Hz tuning fork as per standard clinical guidelines.

4. **Whisper Test** - The Whisper test was used as a simple standardized tool to screen for gross hearing impairment in the participants.

Validity and Reliability

The tool was validated by experts in the field of nursing and medicine. Reliability was established using appropriate statistical methods. Inter-rater test was used and r value was 0.90 which is considered acceptable and highly reliable

Pilot Study

A pilot study was conducted to assess the feasibility of the study and the tool.

Data Analysis

Data were analyzed using descriptive statistics such as frequency and percentage.

RESULT

SECTION I: Demographic variables

Table 1: Frequency and Percentage Distribution of Welding Workers according to Demographic Variables

(n = 100)

Demographic Variable	Categories	Frequency (n)	Percentage (%)
Age (years)	20–29	35	35%
	30–39	34	34%
	40 & above	31	31%
Education	No formal education	10	10%
	Primary	34	34%
	Secondary	48	48%
	Graduate & above	8	8%
Experience	<5 years	32	32%
	5–10 years	38	38%
	11–15 years	20	20%
	>15 years	10	10%
Working Hours/day	2–4 hours	40	40%
	5–7 hours	35	35%
	>7 hours	25	25%
Use of Protective Devices	Always	23	23%
	Sometimes	45	45%
	Never	32	32%
Presence of Tinnitus	Yes	20	20%
	No	80	80%
Past Ear Problems	Yes	18	18%
	No	82	82%

Table no.1 reveals that the majority of the welding workers belonged to the young and middle-aged adult group, with 69% falling in the age group of 20–39. Regarding educational status, most of the workers had completed secondary education (48%), while only a small proportion were graduates (6%), suggesting limited higher educational attainment among welding workers. In terms of work experience, 5–10 years of experience was found to be the most common (38%), indicating prolonged occupational exposure to welding activities. A significant proportion of workers (75%) reported working for more than 4 hours per day. The use of protective devices was found to be inadequate, as only 23% of workers consistently used protective equipment, while 32% reported never using any protective devices. This highlights poor adherence to safety practices in the workplace. Additionally, 20% of workers experienced tinnitus, and 18% reported a past history of ear problems, suggesting a possible association between prolonged noise exposure and auditory health issues among welding workers.

SECTION II: Findings related to final hearing status

Figure 1: Final Hearing Status - Interpretation

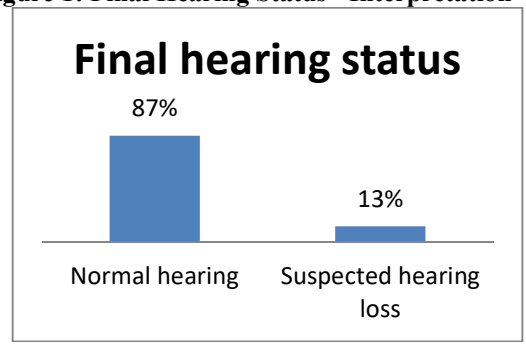

Figure no.1 demonstrates the results which revealed that although the proportion of suspected cases is relatively small, it still highlights the presence of early auditory changes among a segment of workers, possibly due to prolonged exposure to occupational noise. This suggests the need for regular hearing

screening and reinforcement of protective device use to prevent further auditory decline.

SECTION III: Findings related to Association between selected demographic and occupational variables and auditory assessment findings among welding workers

TABLE 2 – Association Of Demographic Variables And Final Hearing Status

Demographic Variable	Categories	Normal	Suspected	Total	Chi-square (cal.)	Chi-square (table)	d.f.	p-value	Association
Age (years)	Below 20 yrs	0	0	0	**11.38**	7.815	3	0.0097	**Significant**
	20–29 yrs	35	0	35					
	30–39 yrs	31	3	34					
	40 yrs & above	21	10	31					
	Total	**87**	**13**	**100**					
Education	No formal education	4	6	10	**15.84**	9.488	4	0.0032	**Significant**
	Primary	29	5	34					
	Secondary	46	2	48					
	Graduate	6	0	6					
	Postgraduate	2	0	2					
	Total	**87**	**13**	**100**					
Occupation / Experience	<5 years	32	0	32	**54.22**	7.815	3	<0.0001	**Highly Significant**
	5–10 years	38	0	38					
	11–15 years	16	4	20					
	>15 years	1	9	10					
	Total	**87**	**13**	**100**					
Working hours/ day	2–4 hrs	40	0	40	**20.41**	5.991	2	<0.001	**Significant**
	5–7 hrs	29	6	35					
	>7 hrs	18	7	25					
	Total	**87**	**13**	**100**					
Use of Protective Devices	Always	23	0	23	**9.57**	5.991	2	0.0084	**Significant**
	Sometimes	40	5	45					
	Never	24	8	32					
	Total	**87**	**13**	**100**					
Presence of Tinnitus	Yes	18	2	20	**0.037**	3.841	1	0.847	**Not Significant**
	No	69	11	80					
	Total	**87**	**13**	**100**					
Past Ear Problems	Yes	13	5	18	**5.20**	3.841	1	0.022	**Significant**
	No	74	8	82					
	Total	**87**	**13**	**100**					

Table no.2 presents the association between selected demographic and occupational variables and auditory assessment findings among welding workers. The findings reveal a statistically significant association between age group ($p = 0.0097$), education ($p = 0.0032$), experience ($p < 0.00001$), working hours ($p < 0.001$), use of protective devices ($p = 0.0084$), and past ear problems ($p = 0.022$) with auditory assessment findings. Experience showed a highly significant association. However, tinnitus did not show a statistically significant association with auditory assessment findings ($p = 0.847$).

DISCUSSION

The present study assessed the auditory status of welding workers in selected areas of Pune city. The final result showed that the majority of welding workers (87%) had normal hearing, indicating adequate auditory functioning across most individuals. However, (13%) of the workers were found to have suspected hearing loss based on the combined results of Weber, Rinnes, and Whisper tests. Although the proportion of suspected cases is relatively small, it still highlights the presence of early auditory changes among a segment of workers, possibly due to prolonged exposure to occupational noise. This suggests the need for regular hearing screening and reinforcement of protective device use to prevent further auditory decline.

Elshaer et al. (2023) also observed a notable prevalence of occupational noise-induced hearing loss among industrial workers, highlighting the need for preventive strategies. The study findings also revealed a lack of awareness regarding hearing protection and irregular use of personal protective equipment among many participants. This may be due to inadequate health education, lack of training, and negligence towards occupational safety measures. Similar observations have been noted in previous research, where workers demonstrated poor compliance with protective measures due to lack of knowledge and accessibility issues.Early identification through auditory assessment plays a crucial role in preventing further deterioration of hearing. Regular screening programs can help in early diagnosis, timely intervention, and reduction of complications. The findings emphasize the need for implementing occupational health programs focusing on awareness, prevention, and regular monitoring of hearing status among welding workers. Nurses play a vital role in occupational health by conducting regular health assessments, educating workers about preventive measures, and promoting the use of personal protective equipment. The development of an information booklet based on the study findings serves as an effective educational tool to improve awareness and encourage healthy practices.

CONCLUSION

The study concludes that welding workers are at a significant risk of developing auditory impairment due to continuous exposure to occupational noise. A considerable number of workers exhibited early signs of hearing difficulty, highlighting the need for regular auditory assessment and preventive measures. Lack of awareness and inadequate use of personal protective devices were identified as major contributing factors to the increased risk of hearing loss among welding workers. Regular screening, health education, and early intervention can significantly reduce the burden of occupational hearing loss. Implementation of workplace safety measures and strict adherence to the use of protective equipment are essential to prevent further complications. Nurses have a crucial role in promoting auditory health, conducting regular assessments, and educating workers about preventive strategies. The development of an information booklet based on the study findings will help in creating awareness and improving knowledge among welding workers regarding auditory health. Future efforts should focus on strengthening occupational health policies and ensuring accessibility to regular screening services. Overall, early detection and effective preventive strategies can contribute to improving the quality of life of welding workers.

Additional Information / Disclosures

Human subjects: Authors have confirmed that human participants were involved in this study.

Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue.

Conflicts of interest: The authors declare that they have no involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this paper.

Funding Source: There is no funding source for this study.

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