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Research Article

A Study to Assess Occupational Health Hazards and Preventive Measures among Employees in a Selected Railway Workshop

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Abstract

Background: Occupational health hazards pose significant risks to workers' well-being, particularly in industrial settings such as railway workshops. This study assesses the prevalence of occupational health hazards and the preventive measures adopted by employees in a selected Central Railway workshop.

Methods: A quantitative descriptive study was conducted among 300 employees using a structured interview schedule and physical examination checklist. Data were collected on demographic characteristics, occupational exposure, health conditions, and preventive practices. Statistical analysis was performed using frequency distribution, t-tests, and correlation analysis.

Results: The study assessed the occupational health status of 300 employees, revealing significant health risks. The majority (51.67%) were aged 51–60 years, with a predominantly male workforce (94%) and a high prevalence of hypertension (46.34%) and diabetes (24.39%). Occupational exposures included dust (58.33%), fumes (56.67%), and extreme heat (60.33%), with 67% exposed for over 8 years. Lifestyle factors showed 24% tobacco use and 9.33% alcohol consumption. Nutritional assessments indicated that 33% were overweight and 8.67% obese, whereas 66% had abnormal blood pressure. Respiratory evaluations identified 55.33% with reduced lung function, and 13.67% had occupational skin disorders. The findings highlight the urgent need for preventive measures, health monitoring, and targeted interventions to improve employee well-being.

Conclusion: Despite awareness of occupational hazards, adherence to preventive measures remains suboptimal. Strengthening workplace safety protocols, regular health screenings, and employee education programs are recommended.

Keywords: Industrial safety, occupational health, preventive measures, railway employees, workplace hazards

Introduction

Occupational health is a crucial aspect of industrial work environments, particularly in industries where employees are frequently exposed to hazardous conditions. Railway maintenance workshops present a significant occupational risk due to the nature of the work, which involves welding, fitting, painting, and handling heavy machinery. These activities expose workers to various hazards, including exposure to toxic chemicals, excessive noise, dust, and extreme physical strain. Given the physically demanding nature of railway maintenance, employees are at risk of developing work-related health conditions, which can impact their long-term well-being and productivity if preventive measures are not adequately followed.[1]

The classification of occupational hazards in railway workshops includes physical hazards such as noise pollution, extreme temperatures, and radiation; chemical hazards such as toxic fumes, solvents, and diesel exhaust; biological hazards from

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exposure to infectious agents; and ergonomic hazards resulting from repetitive motion injuries and poor posture.[2] Prolonged exposure to such hazards has been linked to the development of chronic health conditions, including respiratory illnesses, musculoskeletal disorders, skin diseases, and occupational hearing loss. Studies indicate that with industrialization and urbanization, workplace safety concerns have intensified, making it imperative to assess workplace health risks and enforce preventive strategies to protect employees from occupational diseases.[3]

Railway employees, particularly those working in maintenance workshops, form a significant portion of India's workforce, with approximately 1.3 million employees engaged in operations that require direct exposure to hazardous environments (Indian Railways Statistical Publications, 2016–2017). Chronic exposure to welding fumes, paint vapors, and dust has been linked to respiratory conditions such as chronic obstructive pulmonary disease (COPD), bronchitis, and asthma.[4] Skin disorders, including dermatitis and chemical burns, are also common due to prolonged contact with irritants, while exposure to bright welding arcs increases the risk of developing vision problems such as presbyopia and cataracts.[5] Noise-induced hearing loss is another major concern, as workers frequently operate in environments with high-intensity sound exposure that exceeds safe limits, leading to irreversible auditory impairment.[6]

Despite the presence of occupational health policies, adherence to preventive measures among railway workshop employees remains inconsistent. While personal protective equipment (PPE), including gloves, masks, and safety goggles, is often available, studies indicate that usage is not uniform across all worker categories. Many employees do not regularly use protective gear due to discomfort, lack of awareness, or non-availability at critical times.[7] In addition, while periodic medical checkups are part of occupational health policies, there are limited data on how effectively they contribute to early disease detection and prevention among railway employees. The lack of structured workplace safety education and health promotion initiatives further contributes to suboptimal health outcomes.

Given the high prevalence of occupational hazards in railway workshops, there is a pressing need to assess the current health risks faced by employees and examine the preventive measures adopted in real-world settings. Most available studies have focused on general occupational health risks but have not specifically explored the long-term impact of workplace exposures in the Indian railway industry. This research, therefore, aims to bridge this gap by evaluating the prevalence of occupational health hazards and examining the effectiveness of preventive strategies among railway maintenance employees.

By assessing workers' health conditions, exposure levels, and adherence to safety practices, this study seeks to generate data that can inform policy decisions and workplace safety improvements. The study will also help identify gaps in the implementation of occupational health programs, leading to recommendations for enhanced protective measures, training initiatives, and improved safety protocols. The findings will be valuable for railway authorities, policymakers, and occupational health professionals in formulating targeted interventions to minimize health risks and improve employee well-being.

This study specifically aims to assess the occupational health hazards among employees in a selected railway workshop, evaluate the preventive measures they adopt, and determine the relationship between occupational health risks and selected demographic variables. The insights gained from this research will contribute to the development of more effective workplace safety interventions, helping to safeguard the health of railway maintenance employees while ensuring compliance with occupational health standards.

Problem statement

A study to assess occupational health hazards and evaluate the preventive measures adopted by employees in a selected Central Railway workshop.

Objectives

1. To assess the occupational health hazards among employees working in a selected workshop of the central railway
2. To assess the preventive measures adopted by the employees regarding occupational health hazards
3. To determine the relationship between occupational health hazards and preventive measures with selected demographic variables.

Methods

Research design

A descriptive exploratory survey design was adopted to assess occupational health hazards and the preventive measures employed by railway workshop employees.

Study setting and population

The study was conducted at the Central Railway Loco Workshop, Parel, Mumbai, a major railway maintenance facility in India. The population consisted of employees working in various trades, including fitters, welders, painters, electricians, carpenters, and cleaners.

Sample and sampling technique

A total of 300 employees were selected using non-probability convenience sampling. The inclusion criteria required employees to be actively working in the workshop, willing to participate, and proficient in Hindi or English. Employees on long-term leave or unwilling to provide consent were excluded.

Data collection tools and techniques

The study utilized three primary tools:

1. Semi-structured interview schedule: Collected demographic data, medical and occupational history, and self-reported preventive practices

2. Observation checklist for physical examination: Employed to assess signs of occupational diseases, including respiratory conditions (cough, bronchitis, and asthma), skin disorders (dermatitis, burns, and infections), eye problems (cataracts, eye strain, and injuries), and hearing impairments
3. Inventory checklist: Evaluated the use of PPE and compliance with safety protocols.

Data were gathered through interviews, self-reporting, and direct physical examinations conducted by the investigator.

Validity and reliability

The research instrument was validated by a panel of 14 experts, including specialists in respiratory medicine, dermatology, occupational health, ENT, and nursing. The observation checklist for physical examination was tested for reliability using the inter-rater method, yielding a high-reliability coefficient of 0.99.

Pilot study

A pilot study was conducted with 30 employees from a similar railway workshop at Matunga, Mumbai, to assess the feasibility of the data collection process. Minor modifications were made based on participant feedback and expert suggestions.

Data collection procedure

The data collection process spanned from August 23 to September 27, 2019. The investigator obtained formal written consent from the Chief Workshop Manager and individual employees. Participants were interviewed using a structured schedule, followed by a focused physical examination. Each session lasted approximately 30 min.

Data analysis

The collected data were analyzed using both descriptive and inferential statistical methods:

- Descriptive statistics: Frequency, percentage distributions, and graphical representations
- Inferential statistics: T-tests were conducted to determine the relationship between occupational health hazards and demographic/occupational variables.

Ethical considerations

The study was approved by relevant institutional authorities, and informed consent was obtained from all participants. Confidentiality and anonymity were maintained throughout the research process.

Results

Table 1 presents the demographic distribution of the employees. The majority (51.67%) of employees belonged to the 51–60 years age group, with no employees below 21 years. Males constituted 94% of the sample, whereas females made up only 6%. The marital status distribution showed that most employees (94%) were married. Regarding religion, 96.67% of employees were Hindus, followed by Muslims and Christians (1.33% each), and a small percentage (0.67%) belonged to other religions. Educational qualifications revealed that 77% had secondary education, 15.33% were graduates, whereas only 3.33% had primary education. The workforce experience indicated that 58.33% of employees had over 16 years of service, with only 9% having 1–5 years of experience. Among designations, fitters (29.67%) formed the largest group, followed by welders (21%) and painters (20%). The majority of employees (56%) had worked for more than 15 years in their current designation.

Table 1: Distribution of employees based on demographic variables

S. No	Demographic data	Categories	Frequency (f)	Percentage
1	Age (years)	Below 21	0	0.00
		21–30	41	13.67
		31–40	64	21.33
		41–50	40	13.33
		51–60	155	51.67
2	Gender	Male	282	94.00
		Female	18	6.00
3	Marital Status	Married	282	94.00
		Unmarried	15	5.00
		Widow	3	1.00
		Widower	0	0.00
4	Religion	Hindu	290	96.67
		Muslim	4	1.33
		Christian	4	1.33
		Others	2	0.67
5	Educational status	Primary education	10	3.33
		Secondary education	231	77.00
		Professional diploma	13	4.33
		Graduate	46	15.33
6	Years of Service	1–5	27	9.00
		6–10	63	21.00
		11–15	37	11.67
		16 and above	175	58.33
7	Designation	Welder	63	21.00
		Electrician	30	10.00
		Fitter	89	29.67
		Carpenter	35	11.67
		Painter	60	20.00
		Cleaner	23	7.67
8	Duration of Work	1–5 years	29	9.67
		6–10 years	66	22.00
		11–15 years	37	12.33
		More than 15 years	168	56.00

Table 2 presents the medical profile of employees, showing that 87% underwent medical checkups within the past year, with 52.33% having done so 1 year back. A smaller portion (7%) had not undergone checkups in over 2 years.

Regarding major health issues, 72.67% reported no known illnesses, whereas 27.33% had a diagnosed condition. Hypertension (HTN) (46.34%) and diabetes mellitus (DM) (24.39%) were the most prevalent conditions, with some employees having co-existing diseases such as DM and HTN (13.41%). Notably, only one employee had been diagnosed

Table 2: Distribution of employees based on medical data

S. No	Medical Data	Categories	Frequency (f)	Percentage
1	Last Health Checkup	3 months back	19	6.33
		6 months back	103	34.33
		1 year back	157	52.33
		More than 2 years	21	7.00
2	Past Major Health Problems	Yes	82	27.33
		No	218	72.67
3	Specific Health Conditions	COPD	1	1.21
		DM	20	24.39
		HTN	38	46.34
		DM and HTN	11	13.41
		HTN and Hypothyroidism	1	1.21
		HTN, DM, and IHD	2	2.44
		Hypothyroidism	3	3.66
		Arthritis	1	1.21
		BPH	1	1.21
		BPH and DM	1	1.21
		CABG	2	2.44
		DM and CABG	1	1.21
4	Undergone Treatment	Yes	81	27.00
		No	219	73.00
5	Recovered Completely	Yes	0	0.00
		No	300	100.00
6	Still on Treatment	Yes	81	27.00
		No	219	73.00
7	Still on Medications	Bronchodilators	1	1.21
		Anti-allergic	0	0.00
		Steroids	0	0.00
		Anti-tubercular drugs	0	0.00
		Antibiotics	0	0.00
		Antifungal	0	0.00
		Diabetic drugs	20	24.39
		Anti-hypertensive drugs	38	46.34
		Diabetic and Hypertensive drugs	11	13.41
		Drugs for HTN and Hypothyroidism	1	1.21
		Drugs for HTN, DM, and IHD	2	2.44
		Drugs for Hypothyroidism	3	3.66
		Drugs for Arthritis	1	1.21
		Drugs for BPH	1	1.21
		Drugs for BPH and DM	1	1.21
		Drugs for CABG	2	2.44
		Drugs for DM and CABG	1	1.21

COPD: Chronic obstructive pulmonary disease, DM: Diabetes mellitus, HTN: Hypertension, BPH: Benign prostatic hyperplasia, CABG: Coronary artery bypass graft

with COPD despite exposure to welding fumes and dust. Among those diagnosed with a health issue, 27% were actively receiving treatment, and none reported full recovery from their conditions, indicating the chronic nature of these illnesses. The most commonly prescribed medications were anti-hypertensive drugs (46.34%) and diabetic drugs (24.39%). These findings suggest that while medical checkups are conducted regularly, chronic conditions, such as HTN and diabetes, remain prevalent, necessitating ongoing workplace health interventions.

Table 3 presents the distribution of employees exposed to occupational hazards at their workplace. The most common exposures were dust (58.33%), fumes and noxious gases (56.67%), and solvents (36.33%). Among those exposed to fumes and noxious gases, the majority (71.76%) had over 8 years of exposure. Similarly, most employees exposed to dust (65.14%) and diesel exhaust (71.21%) had over 8 years of exposure. Only a small fraction (1.33%) reported exposure to high voltage electric supply, whereas 11.33% faced seasonal exposure to mosquito-related hazards. The findings indicate prolonged occupational exposure to various hazards, underscoring the need for improved safety measures and protective equipment compliance.

Table 4 illustrates the distribution of employees based on their occupational environment. Extreme heat was reported by 181 employees (60.33%), with the majority (65.19%) exposed for 4–6 h daily. Similarly, 161 employees (53.67%) reported exposure to extreme noise, with 89.44% experiencing it for 2–4 h/day. High humidity was reported by only 6 employees (2.00%), all experiencing it for 2–4 h daily. Poor ventilation was rarely an issue, as only 1 employee (0.33%) reported exposure, primarily for 6–8 h/day. The findings highlight key environmental stressors affecting workers and the need for workplace interventions to mitigate adverse conditions.

Table 5 presents the combined distribution of employees based on family history of illness, addiction history, and hearing loss. Only 2 employees (0.67%) reported a family history of illness, specifically asthma and tuberculosis. Regarding addiction, 24% of employees used tobacco in various forms, whereas 9.33% reported alcohol consumption. Gutkha use was absent among employees. Hearing loss symptoms were rare, with only 1.67% experiencing difficulty hearing on the phone, 2.33% struggling to understand speech, and 1% needing higher TV volume or struggling to hear in noisy environments. These findings indicate a relatively low prevalence of family illness and hearing loss but highlight concerns about tobacco and alcohol consumption in the workforce.

Table 6 presents the anthropometric and physiological parameters of employees. The majority (54.33%) had a normal body mass index (BMI), whereas 33% were classified as overweight and 8.67% as obese. Regarding blood pressure, 66% of employees had abnormal readings, with 27.33% in the pre-hypertensive stage and 29.67% in stage 1 HTN. In terms of peak expiratory flow rate (PEFR), 55.33% of employees fell within the yellow zone, indicating a subclinical decline in respiratory function. This can potentially be improved through regular exercise and the adoption of a healthier lifestyle.

Table 3: Distribution of employees with regard to exposure to occupational hazards (*n*=300)

S. No	Occupational pollutants	Exposed (f)	Percentage	<1 year (%)	1–3 years (%)	4–7 years (%)	>8 years (%)
1	Fumes and Noxious Gases	170	56.67	1 (0.58)	10 (5.88)	37 (21.76)	122 (71.76)
2	Dust	175	58.33	8 (4.57)	12 (6.85)	41 (23.43)	114 (65.14)
3	Diesel Exhaust	66	22.00	4 (6.06)	7 (10.60)	8 (12.12)	47 (71.21)
4	Chemicals (Acids and Alkalis)	3	1.00	0 (0.00)	1 (33.33)	0 (0.00)	2 (66.67)
5	Solvents	109	36.33	1 (0.91)	10 (9.17)	47 (43.11)	51 (46.79)
6	Paints	74	24.67	0 (0.00)	8 (10.81)	27 (36.49)	39 (52.70)
7	High Voltage Electric Supply	4	1.33	1 (25.00)	0 (0.00)	0 (0.00)	3 (75.00)
8	Grease	68	22.67	2 (2.57)	8 (11.76)	26 (38.23)	33 (48.53)
9	Any Other (Mosquitoes)	34	11.33	34 (100.00)	-	-	-

Table 4: Distribution of employees with regard to occupational environment (*n*=300)

S. No	Occupational environment	Exposed (f)	Percentage	2–4 h (%)	4–6 h (%)	6–8 h (%)	>8 h (%)
1	Extreme Heat	181	60.33	57 (31.49)	118 (65.19)	4 (2.20)	2 (1.10)
2	Extreme Noise	161	53.67	144 (89.44)	14 (8.69)	3 (1.86)	0 (0.00)
3	High Humidity	6	2.00	6 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)
4	Poor Ventilation	1	0.33	0 (0.00)	0 (0.00)	1 (100.00)	0 (0.00)

Table 5: Combined distribution of employees with regard to family history of illness, addiction history, and hearing loss (*n*=300)

S. No	Category	Response	Frequency (f)	Percentage
1	Family History of Illness	Yes	2	0.67
		No	298	99.33
	Asthma	-	1	50.00
	Tuberculosis	-	1	50.00
2	Addiction History	Tobacco chewing	59	19.67
		Cigarette smoking	10	3.33
		Bidi smoking	2	0.67
		Gutkha	0	0.00
		Pan chewing	3	1.00
		Alcohol consumption	28	9.33
3	Hearing Loss Symptoms	Trouble hearing on phone	5	1.67
		Difficulty understanding speech	7	2.33
		Higher TV volume requirement	3	1.00
		Difficulty hearing in noise	3	1.00

Table 7 summarizes findings from physical examinations. The majority (86.33%) of employees had normal skin integrity, whereas 13.67% had various skin conditions. Visual problems, particularly presbyopia, were prevalent (72%). Hearing assessments showed no significant issues, with over 99% having normal results. Nasal and mouth assessments found no abnormalities. Chest auscultation revealed abnormal breath sounds in 1% of employees, and extremities examinations were normal across all participants. These findings highlight the need for targeted health interventions, particularly for managing HTN, declined respiratory function, and vision-related concerns.

Table 8 presents the distribution of employees based on their preventive practices to avoid occupational diseases. While the majority adhered to basic protective measures, such as wearing uniforms (99.33%), masks (97.33%), and headgear (96%), compliance with specialized protective gear was significantly lower. Only 21% used protective face shields, and negligible adherence was seen for welding fume extractors (0.33%) and earplugs (0%). The findings suggest the need for improved safety training and workplace interventions, particularly for stress reduction and lifestyle-related health concerns such as HTN.

The analysis revealed a significant inverse relationship between PEFR and age, as well as PEFR and duration of service. Employees below 50 years had a higher mean PEFR (545.34) than those above 50 (418.38), with a statistically significant t-value of 12.852. Similarly, employees with service duration below 15 years exhibited a higher mean PEFR (548.8) compared to those with over 15 years of service (431.26), with a significant t-value of 11.274. These findings indicate that respiratory function declines with increasing age and prolonged service duration [Table 9]. In contrast, occupational exposure to welding fumes and dust did not show a statistically significant impact on PEFR. The t-values for both exposures were below the critical value (1.645), indicating no significant relationship.

Regarding designation, the mean PEFR scores varied across different job roles. Cleaners (511.52), painters (505.17), and electricians (491.33) had higher PEFR values, suggesting better respiratory function. Conversely, carpenters (455.86), welders (465.16), and fitters (471.85) had lower PEFR, likely due to greater exposure to airborne pollutants. Although a statistical test could not be conducted due to varying sample sizes, these findings suggest that targeted preventive measures, such as the use of protective equipment and respiratory exercises, should be emphasized for at-risk job categories, particularly carpenters, welders, and fitters.

Table 6: Distribution of employees based on anthropometric measurements, blood pressure, PEFR, skin, and eye disorders (n=300)

S. No	Parameters	Categories	Frequency (f)	Percentage
1	Body mass index	Underweight	8	2.67
		Normal	163	54.33
		Overweight	99	33
		Obese	26	8.67
		Severely obese	4	1.33
2	Blood pressure	Normal	102	34
		Pre-hypertension	82	27.33
		Hypertension-Stage 1	89	29.67
		Hypertension-Stage 2	18	6
		Hypertensive crisis	9	3
3	PEFR	Green	128	42.67
		Yellow	166	55.33
		Red	6	2
4	Skin Problems	Normal skin integrity	259	86.33
		Abnormal skin conditions	41	13.67
	Skin Issues	Skin lesions	17	41.46*
		Skin nodules	1	2.43*
		Dermatitis	12	29.27*
		Skin infections	14	34.15*
		Skin burns	7	17.07*
		Non-healing ulcers	2	4.88*
		White patches	5	12.19*
		Blackish discoloration	3	7.31*
5	Eye Disorders	Normal eyes	81	27
		Cataract	1	0.33
		Eye injury	1	0.33
		Eye inflammations	1	0.33
		Visual problems	216	72

*Percentage calculated from total cases of skin problems, n=41. PEFR: Peak expiratory flow rate

Table 7: Distribution of employees based on hearing, nasal, mouth, chest, and extremity assessment (n=300)

S. No	Parameters	Categories	Frequency (f)	Percentage
1	Hearing Test	Normal whispered voice test (RE)	298	99.33
		Normal whispered voice test (LE)	299	99.67
		Normal Rinne test (RE)	299	99.67
		Normal Rinne test (LE)	300	100
		No lateralization (Weber test)	298	99.33
2	Nasal Problems	Normal structure	300	100
		Normal sinuses	300	100
3	Mouth Disorders	Normal mouth	300	100
		Angular stomatitis	0	0
		Central cyanosis	0	0
		Pharyngitis	0	0
4	Chest Abnormalities	Normal inspection	297	99
		Presence of scar	3	1
		Normal palpation	300	100
		Wheezing heard	1	0.33
		Rhonchi heard	2	0.66
5	Extremities	Normal extremities	300	100
		Presence of clubbing	0	0
		Presence of tremors	0	0
		Presence of peripheral cyanosis	0	0

Relationship between preventive measures and demographic variables (n=300)

The mean score for preventive practices was 14.21, with a standard deviation of 0.793, indicating minimal variation in adherence to preventive measures across different demographic groups. Due to the heterogeneous nature of the sample, statistical analysis of relationships between preventive practices and demographic variables could not be conducted. However, the findings suggest a general uniformity in preventive practices adopted by the employees.

Analysis of occupational health hazards and preventive practices

Out of the 24 preventive practices listed in the inventory checklist, 14 were followed by more than 99% of employees, whereas eight were entirely neglected. The least practiced measures included using a welding fume extractor, applying earplugs, changing and cleaning earplugs daily, wearing aprons, using barricade cream, undergoing stress management training, and practicing yoga. The absence of these practices may be attributed to the unavailability of resources or inconvenience in their usage.

Despite non-compliance with ear protection, only two employees (both aged above 50) reported hearing issues, suggesting that noise levels in the workshop were within permissible limits. However, the lack of barricade cream usage, along with inconsistent uniform changes, may have contributed to skin diseases (13.67%). In addition, HTN and increased BMI were prevalent, indicating the necessity for stress reduction programs and lifestyle modifications. The railway administration could implement workplace wellness initiatives to mitigate these occupational health risks.

Discussion

The findings of this study indicate that while employees in the railway workshop were exposed to occupational hazards, such as welding fumes, dust, and solvents, no major occupational health hazards were identified. The decline in respiratory

Table 8: Distribution of employees based on preventive practices (*n*=300)

S. No	Preventive Practices	Yes (f)	Yes (%)	No (f)	No (%)
1	Wearing uniform on duty	298	99.33	2	0.66
2	Changing uniform every day	8	2.66	292	97.33
3	Wearing a mask during fieldwork	293	97.33	7	2.33
4	Wearing headgear during fieldwork	288	96.00	12	4.00
5	Wearing protective face shields	63	21.00	237	79.00
6	Using a welding fume extractor during welding	1	0.33	299	99.67
7	Applying earplugs during fieldwork	0	0.00	300	100.00
8	Changing earplugs every day	0	0.00	300	100.00

Table 9: Relationship between PEFR and selected demographic variables

Variables	Groups	*n*	Mean PEFR	SD	SED	t-value (0.05)	Significance
Age	Below 50	145	545.34	96.54	85.51	12.852	*Significant*
	Above 50	155	418.38	73.71			
Duration of service	1–15 years	124	548.8	99.19	10.42	11.274	*Significant*
	Above 15 years	174	431.26	81.59			
Occupational Exposure	Fume Exposed	-	475.23	-	-	0.930	*Not Significant*
	Non-Exposed	-	486.77	-			
Dust Exposure	Exposed	-	477.51	-	-	0.523	*Not Significant*
	Non-Exposed	-	484.04	-			
Designation	Welder	63	465.16	-	-	-	-
	Electrician	30	491.33	-	-	-	-
	Fitter	89	471.85	-	-	-	-
	Carpenter	35	455.86	-	-	-	-
	Painter	60	505.17	-	-	-	-
	Cleaner	23	511.52	-	-	-	-

PEFR: Peak expiratory flow rate

function, as measured by PEFR, and the high prevalence of visual impairments were found to be primarily associated with aging rather than occupational exposure. In addition, HTN was a significant health concern, reinforcing the need for stress reduction programs and lifestyle modifications among employees. These findings are consistent with previous studies that have reported a high prevalence of non-communicable diseases such as HTN and diabetes among industrial workers due to occupational stress and workplace exposures (Pareek and Pareek, 2019).[8]

Although 55.33% of employees had reduced PEFR and fell into the "yellow zone," statistical analysis revealed that exposure to welding fumes and dust was not significantly associated with this decline. Instead, age and years of service were found to be the primary contributing factors. These results are in contrast with findings from Ithnin *et al*. (2019),[9] who demonstrated a strong correlation between welding fume exposure and reduced lung function among shipyard workers. The discrepancy may be attributed to variations in workplace safety standards, the use of protective equipment, and the implementation of health monitoring programs in railway workshops.

Skin disorders were observed in 13.67% of employees, including dermatitis, burns, and discoloration. While PPE compliance was inconsistent, with only 21% of employees using protective face shields, other factors such as infrequent uniform changes (97.33%) and the absence of barricade cream application contributed to these conditions. This aligns with previous research by Gupta *et al*. (2017),[7] which found that the risk of occupational skin injuries in railway workshops was associated with inadequate hygiene practices and poor compliance with safety protocols. Strengthening PPE adherence and promoting workplace hygiene measures could significantly reduce dermatological issues among employees.

Despite 53.67% of employees reporting exposure to extreme noise, no significant hearing loss was detected in this study. This suggests that noise levels in the workshop remained within permissible limits or that the workers had developed adaptive mechanisms over time. Previous studies, such as those conducted by Jayakumar (2017),[10] have indicated that chronic noise exposure can contribute to occupational hearing loss, reinforcing the need for continuous monitoring of auditory health in railway workshops.

Visual impairments were prevalent among employees, with presbyopia being the most common condition, affecting 72% of the workforce. While age was the primary factor associated with vision problems, welders and fitters demonstrated a higher prevalence of eye disorders, likely due to prolonged exposure to welding arcs. Atukunda *et al*. (2019)[11] reported similar findings, where small-scale welders exhibited a high incidence of ocular disorders, including conjunctivitis and presbyopia. The use of proper eye protection, such as welding goggles and face shields, should be emphasized to mitigate these risks.

Although awareness of workplace hazards was high, adherence to preventive measures was suboptimal in certain areas. The absence of stress management programs, non-use of earplugs, welding fume extractors, and barricade creams highlights gaps

in occupational safety practices. Stress reduction programs and workplace wellness initiatives have been shown to be effective in managing HTN and improving overall well-being (Jayakumar, 2017).[10] Implementing structured stress management training, along with regular PPE training, could significantly enhance occupational health outcomes among railway employees.

Conclusion

The study revealed no major occupational health hazards among railway workshop employees, likely due to effective preventive policies, regular health checkups, and safety training. However, a decline in respiratory function (PEFR) and visual problems was observed, mainly due to aging, with carpenters, welders, and fitters being the most affected. In addition, lifestyle diseases, such as HTN and obesity, were on the rise, necessitating stress reduction programs and lifestyle modifications. Strengthening PPE adherence and preventive health initiatives could further enhance employee well-being.

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Conflicts of Interest

None.

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