

Original Research Article

Assessment of knowledge, attitudes, and practices regarding personal protective equipment use among employees in a thermal power station of central India: a cross-sectional study

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ABSTRACT

Background: Personal protective equipment (PPE) is crucial for ensuring work safety in high-risk environments, such as thermal power stations. Proper use of PPE reduces the risk of occupational hazards. This study aims to assess the knowledge, attitudes, and practices (KAP) regarding PPE use among thermal power station employees.

Methods: A cross-sectional study was conducted among 250 employees of a thermal power station. Data was collected using a structured questionnaire designed to evaluate KAP towards PPE use. Descriptive statistics, including frequency and percentages, were used for data analysis to summarize participants' responses.

Results: The majority 96.8% knows about the types of PPE used. The 82% had a positive attitude towards its use while 60.8% study subjects reported that they consistently wear all relevant PPE at their workplace.

Conclusions: The employees had adequate knowledge and attitudes towards PPE, however actual compliance with its use remains suboptimal. Interventions focused on reinforcing PPE usage practices are needed.

Keywords: PPE, KAP study, Thermal power station, Occupational safety, Cross-sectional study

INTRODUCTION

The industrial sector plays a pivotal role in the economic development of nations, driving technological advancements, economic growth, and employment opportunities. Among the diverse industries, thermal power stations are integral to national energy grids, converting heat energy into electrical power through the combustion of fossil fuels. Thermal power stations play a crucial role in a nation's development by providing a dependable source of electricity that drives industries, supports infrastructure and powers homes.¹

Despite their critical importance, these power stations are often associated with challenging work environments that can have significant implications on the health of the employees. Workers in thermal power stations are

exposed to a variety of occupational hazards that can significantly impact their health, leading to both acute and chronic health issues. These hazards include exposure to high temperatures, noise, dust, and harmful chemicals leading to various health challenges including respiratory conditions due to dust and chemical exposure, hearing loss from prolonged exposure to high noise levels, heat-related illnesses, and musculoskeletal disorders from manual handling and repetitive tasks.²

These hazards make the use of personal protective equipment (PPE) essential for safeguarding workers' health and preventing injuries. PPE, which includes helmets, gloves, safety goggles, and protective clothing, serves as an important line of defence in reducing exposure to workplace hazards when engineering and administrative controls are insufficient.³

The effectiveness of PPE depends not only on its availability but also on workers' knowledge of its correct usage, attitudes toward its necessity, and adherence to proper practices.

The present study aims to assess KAP regarding the use of PPE among Employees in a Thermal Power Station. Adequate knowledge can translate into appropriate PPE usage and improved compliance thereby reducing occupational hazards.

METHODS

Study design and settings

The present cross-sectional study was conducted among 250 study subjects at Koradi thermal power station, Nagpur, Maharashtra, India. After necessary approval from the institutional ethics committee, this study was conducted from July 2024 to September 2024.

Inclusion and exclusion criteria

Those who were working in the selected thermal power station for more than one year were recruited for the study. Study subjects who didn't give consent and those who were on long leave and could not be contacted even after three consecutive visits were excluded from the study.

Sample size

According to the study by Tankian et al.⁴ by taking the estimated proportion of high level of attitude on PPE usage at 20.5%.

The sample size was estimated by using the formula as follows:

$$n = \frac{Z_{1-\alpha/2}^2 p(1-p)}{d^2}$$

The desired confidence interval as 95%, and the absolute precision as 5%, the sample size was 250.

Data collection method and technique

The total number of subjects to be recruited from each section was determined using probability proportion-to-size (PPS) sampling. Based on the distribution of employees, 98 participants were selected from the administrative section, 60 from the operational unit, 40 from the coal handling plant, 5 from civil maintenance, 14 from electrical maintenance, 10 from boiler maintenance, 8 from turbine maintenance, and 15 from the ash handling plant, ensuring a total of 250 subjects from a workforce of 1,430 employees. Study subjects were then selected from each section through systematic random sampling.

Data collection tools

Data was collected using a predesigned and pretested questionnaire by face to face interview technique after getting written informed consent from the subject. Their socio-demographic details were recorded and other information like work experience, working hours, use of PPE and KAP regarding PPE was assessed.

Statistical analysis

Data was entered in Microsoft excel. Continuous variable summarized as mean with standard deviation and categorical variable summarized as proportion and percentage.

Ethical considerations

Written informed consent of individual study subjects was obtained in their vernacular language after explaining to them the nature and the purpose of the study. They were assured that their personal identity would be kept confidential and the data will be used for research purpose. Permission from chief engineer of thermal power station was obtained. The study was approved by the institute ethics committee of Government Medical College, Nagpur, Maharashtra.

RESULTS

Demographic and background characteristics

One third (32.8%) of total participants belonged between 31 to 40 years of age while only 12.8% of total participants were between 18-30. A male preponderance was seen in present study forming 78.4% (n=196) of the total participants. Majority of participants were Hindu by religion and married comprising of 89.2% (223). Among total employee, 39.2% (98) works in Administration section followed by operational unit 24% (60).

Knowledge regarding PPE

Table 2 shows knowledge of study subjects regarding use of PPE. For questions on hazards and risks study subjects were considered to have answered correctly if they provided three or more correct responses-98.4% were correctly aware about the hazards and risks of working in the thermal power station such as accidents, dust pollution, noise pollution, high temperature exposure, steam, electric shock, chemical exposure, falling objects and head injuries, etc.

The 96.8% knows about the types of PPE used such as safety shoes, helmet, insulated gloves, face shield, goggles, respirators and dust masks, ear plugs, reflective jackets, etc. Here again study subjects who gave three or more correct responses were considered to have correct knowledge. Overall, it was observed that study subjects had good knowledge regarding use of PPE.

Attitude toward PPE

Table 3 shows attitude of the study subjects regarding use of PPE, majority 166 (66.4%) were of opinion that their workplace exposes them to various hazards. Two hundred and five (82%) study subjects opined that positive attitude towards PPE is crucial for maintaining a safe working environment. Two hundred and twenty-seven (90.7%) study subjects felt that all should receive regular training and refresher sessions to reinforce positive attitude towards PPE. Over 80% study subjects felt that following safety rules will protect all workers from hazards, also they were of the opinion that it is responsibility of the employer to reduce work place hazards and risks.

Practice regarding use of PPE

Figure 1 shows practices of study subjects towards PPE. Majority 144 (57.6%) reported that their employers always promote and ensure consistent and proper use of PPE, 152 (60.8%) study subjects reported that they consistently wear all relevant PPE at their workplace, 163 (65.2%) study subjects reported that they regularly clean, sanitize/replace their PPE. Communicating and reporting of issues/concerns related to PPE to their supervisors was done by 137 (54.8%) of respondents. In present study 83 (33.2%) employees had received some training regarding use of PPE. Majority i.e., 185 (74%) said that trainings should be held more frequently.

Table 1: Participants demographic and background characteristics.

Variables	N	Percentage (%)
Age (in years)		
18-30	48	19.2
31-40	102	40.8
41-50	55	22
51-58	45	18
Gender		
Male	196	78.4
Female	54	21.6
Religions		
Hindu	215	86
Buddhist	27	10.8
Muslim	07	2.8
Sikh	01	0.4
Marital status		
Married	223	89.2
Unmarried	26	10.4
Divorced	1	0.4
Work sections		
Administration	98	39.2
Operational unit	60	24
Coal handling plant	40	16
Civil	15	6
Ash handling plant	14	5.6
Boiler	10	4
Turbine	08	3.2
Electrical	05	2
Employee designation		
Engineers	23	9.2
Administration	98	39.2
Supervisor and technicians	129	51.6

Table 2: Knowledge regarding use of PPE.

Knowledge	Study subject response (n=250)			
	Correct		Incorrect	
	N	%	N	%
Hazards and risks	246	98.4	4	1.6
Types of PPE	242	96.8	8	3.2
The employer has obligation to maintain employees health	214	85.6	36	14.4
Health hazards in thermal power plant can be reduced by giving break time during work	231	92.4	19	7.6

Continued.

Knowledge	Study subject response (n=250)			
	Correct		Incorrect	
	N	%	N	%
Health hazards can be reduced by job rotation	222	88.8	28	11.2
Health hazards can be reduced by consistent and appropriate use also continuous and regular supply of PPE	228	91.2	22	8.8
Health hazards can be reduced by training and educating about proper use and maintenance of PPE	233	93.2	17	6.8

Table 3: Attitude regarding use of PPE.

Attitude	Study subject response (n=250)					
	Agree		Disagree		Neutral	
	N	%	N	%	N	%
Workplace exposes me to various hazards	166	66.4	31	12.4	53	21.2
Consistent use of PPE during work will protect me	208	83.2	15	6	42	16.8
I feel that following safety rules and using PPE will protect all workers from hazards	221	88.4	10	4	19	7.6
I feel that every employee should follow safety rules and use PPE	216	86.4	8	3.2	26	10.4
I am of the opinion that it is the responsibility of the employer to reduce work place hazard	222	88.8	12	4.8	16	6.4
I am of the opinion that it is the responsibility of the employer to provide PPE to all employees	215	86	13	5.2	22	8.8
I feel that positive attitude toward the use of PPE is crucial for maintaining a safe working environment	205	82	18	7.2	27	10.8
I am of the opinion that all employee should be given regular training and refresher sessions to reinforce positive attitude towards PPE	227	90.8	9	3.6	14	5.6
I feel that employer and supervisor can promote a positive attitude towards PPE use	209	83.6	13	5.2	28	11.2
I feel peer influence and support play a role in shaping attitudes towards wearing PPE	220	88	8	3.2	22	8.8

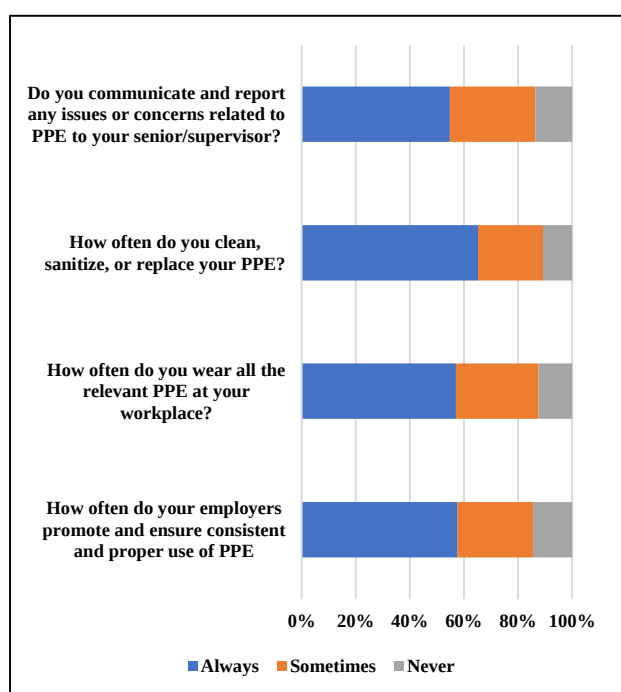


Figure 1: Practice regarding use of PPE.

DISCUSSION

PPE is essential for maintaining safety in high-risk industries like energy production. This study found that while employees had good knowledge of workplace hazards and a positive attitude toward PPE, their actual practice of using PPE was inconsistent. Common issues included failure to wear all necessary PPE, poor maintenance, and inadequate communication of concerns to supervisors.

In this study 96.8% of study subjects had knowledge about PPE. Ziauddin et al conducted a similar study among employees of the steel plant at Vishakhapatnam.³ This study found that 75% of steel plant workers exhibited a high level of knowledge regarding PPE use. Tankian et al conducted a study among mechanical maintenance workers of a power generation unit in Thailand.⁴ This study reported that 43.3% of power plant workers had a high level of knowledge about PPE, while 54.6% had moderate knowledge, and 2.1% demonstrated low knowledge. Kralam et al conducted a study among Steel Industry Workers in Thailand.⁷ This study reported that 62.2% of workers had a good level of knowledge

about PPE. Ahmad et al conducted a study among sandstone mineworkers in Rajasthan, India.⁹ This study reported that 87.6% of workers had a knowledge about PPE. Noviarimi et al conducted a study among chemical industry workers.¹¹ This study reported that 73% of workers had a good knowledge about PPE. Nalugya et al conducted a study among welders in small scale workshop in Nansana municipality, Wakiso district, Uganda.¹² This study reported that 61.4% of workers had a good knowledge about PPE.

In the current study, 82% of study subjects had a positive attitude towards PPE usage. Ziauddin et al reported that 97% of employees responded positively.³ Tankian et al reported that only 20.5% showed a high level of attitude on PPE usage.⁴ Kralam et al reported that 23.2% showed a good level of attitude on PPE usage.⁷ Noviarimi et al reported that 62.2% showed a good level of attitude on PPE usage.¹¹ Nalugya et al reported that 31.3% showed a good level of attitude on PPE usage.¹²

In the current study, 60.8% study subjects reported that they consistently wear all relevant PPE at their workplace. Tankian et al reported 77% of workers did not regularly use recommended PPEs while working.⁴ Khoshakhlagh et al conducted a study among workers of small and medium-sized enterprises in Kashan city.⁵ This study reported 72.4% of workers use some PPE. Ashraf et al conducted a study among coal mine workers of Shangla district, Pakistan.⁶ This study reported that 25.75% of workers use some PPE. Kralam et al reported that 21.4% of workers has good practice level of using PPE.⁷ Ahmad et al reported that 16.5% of them used PPEs during their employment.⁹ Acharya et al reported that 87.2% workers used any kind of PPE while working in worksite.¹⁰ Noviarimi et al reported that 37.1% workers used any kind of PPE while working in worksite.¹¹ Nalugya et al reported that 64.9% workers used any kind of PPE while working in worksite.¹² Damayanti et al reported that 30.6% workers used any kind of PPE while working.¹³

However, the current study's relatively low compliance rate indicates that even positive attitudes do not always translate into regular practice. Factors such as discomfort, equipment availability, lack of safety training, and weak management enforcement contribute to this disparity. Behavioural influences, peer pressure, and inadequate recognition of long-term health risks further hinder proper PPE use.

A key finding of the study is that 90.8 % of study subjects consistently advocate for more frequent and regular training sessions to reinforce positive attitudes towards PPE.

This suggests a strong recognition of the need for ongoing skill development and reinforcement of safety protocols, which would likely enhance both operational efficiency and workplace safety.

Strength and limitation

The study thoroughly evaluates KAP regarding PPE use among thermal power station employees, identifying awareness and safety gaps. By employing PPS sampling, it reflects diverse work environments, enhancing the validity of the findings. Finally, this study is unique in that it is one of the few of its sort to be conducted in central India. The present study has inherent limitations of a cross-sectional study and that the study relied on self-reported knowledge and practices, which may introduce recall or social desirability bias.

Future aspects

Studies could explore specific barriers to PPE compliance, such as ergonomic factors, workplace culture, or management support, to design more tailored interventions. Further studies with larger sample sizes and different designs are recommended to throw more light on these issues.

The findings could be extended to other high-risk industries to assess the generalizability of the results and address occupational safety challenges across various sectors.

CONCLUSION

The study highlights that employees of the thermal power station possess a high level of knowledge regarding occupational hazards and the appropriate use of PPE. Most participants were aware of the potential risks associated with their work environment and were knowledgeable about the types of PPE available to mitigate these risks.

However, inconsistent practice highlights the need for reinforcing adherence through continuous training and supervision. Employees consistently advocate that trainings sessions should be conducted more frequently and on a regular basis.

Recommendations

Regular, comprehensive training to bridge the gap between knowledge and practice, ensuring both safety and operational efficiency should be carried out.

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