

Original Research Article

Prevalence, knowledge and risk factors associated with respiratory morbidities among petrol pump workers in selected petrol filling stations of South West district of Delhi, India: a cross-sectional study

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ABSTRACT

Background: Petrol filling stations pose a significant risk to workers due to exposure to both petrol/diesel vapours and vehicular exhaust. In India, these stations are typically staffed by attendants, with self-filling stations being uncommon, leading to a higher likelihood of exposure to toxic exhaust fumes.

Methods: A cross-sectional study was conducted among 300 petrol pump workers of south west district of Delhi selected by non-probability purposive sampling. Data was collected using structured respiratory symptoms assessment proforma, structured risk factors assessment proforma and structured knowledge interview schedule. The data obtained were analyzed and interpreted using both descriptive and inferential statistics.

Results: Majority (70%) of respondents peak expiratory flow rate (PEFR) fell within the yellow zone (>230-460 LPM), 3.3% fell within the red zone (less than 230 LPM), indicating severe airflow limitation and potential respiratory problems. Regarding risk factors- majority of respondents (73%) have more than 4 years of work experience and 66% have worked up to 48 hours per week, 93.7% did not use any protective gear, 82.7% of workers were not undergoing any regular health check-up. No statistically significant association was found between knowledge and the prevalence of respiratory morbidities indicating that knowledge alone does not mitigate health risks.

Conclusions: The study's findings can help to advocate for better occupational health policies and regulations at petrol pumps including advocating for improved ventilation systems, provision of PPE, and regular health monitoring.

Keywords: Associated risk factors, Petrol pump workers, Prevalence, Respiratory morbidity

INTRODUCTION

Occupational health and safety are a cross -disciplinary area concerned with protecting the safety, health and welfare of people engaged in work or employment. The goal of all occupational health and safety program is to foster a safe work environment. The term “occupational environment” refers to the collective external factors

affecting workers’ health at their workplace. It encompasses the intricate interactions between workers and environmental agents, machinery, and other individuals, all of which are increasingly complex due to human innovation.¹

Gas station employees face exposure to both organic and inorganic compounds found in gasoline, as well as

volatile aromatic hydrocarbons present in the station's atmosphere.² Benzene, a solvent in gasoline, can cause respiratory issues, neurological disorders, genetic effects, and carcinogenesis. Ethylbenzene, another compound present, can lead to respiratory irritation, eye discomfort, and neurological symptoms.³

Rapid urbanization trends have led to a significant increase in the number of vehicles, resulting in a greater demand for petrol. Consequently, there has been a steady rise in the number of petrol pumps across the country. The growing number of vehicles has substantially elevated air pollution levels in various Indian cities.⁴ Currently air pollution is one of the crucial issues with growing concern. Air pollution has become a critical issue of growing concern. Automobile exhaust comprises a mixture of soot, gases such as sulphur oxides and nitrogen oxides, carbon monoxide, and liquid aerosols and particles. This pollution contributes to various lung disorders, carcinogenesis, and alterations in haematological parameters.⁵ The high concentration of solvents and pollutants can trigger significant pulmonary inflammation, leading to decreased forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and inspiratory and expiratory flow rates.

Air pollutants are a significant occupational hazard for petrol pump workers due to their constant exposure to vehicle emissions and petrol vapours. These pollutants can have various adverse health effects, particularly on the respiratory system. The health hazards get more severe when the duration of exposure increases.⁶ The health impacts of occupational exposure to petroleum vapours and vehicular air pollution on petrol station workers remain largely unexplored. Previous studies have primarily focused on clinical symptoms, with limited attention given to lung function or respiratory health issues among these workers.⁷

Objectives of the study

To assess the prevalence, knowledge and risk factors associated with respiratory morbidities among petrol

pump workers of selected petrol filling station. To determine the association of prevalence with selected risk factors and knowledge on respiratory morbidities among petrol pump workers. To seek the association of prevalence and knowledge of petrol pump workers regarding respiratory morbidities with selected variables: age, gender, marital status, educational status, family income.

METHODS

A survey approach with descriptive survey design was used. A total of 300 petrol pump workers who are currently working were selected from petrol pump of the South West district of Delhi. Purposive sampling technique was used to determine the prevalence of respiratory morbidities among the participants.

Data collection tools and techniques

Data was collected using the tools structured respiratory symptoms assessment proforma, structured risk factors assessment proforma and structured knowledge interview schedule. The content validity of the tools was established by giving it to 11 experts from the field of community medicine, community health nursing, medical surgical nursing, department of pulmonary medicine. The reliability was established as structured risk factor assessment proforma (0.75) by Cronbach alpha, structured knowledge interview schedule (0.80) by KR-20, structured symptom assessment proforma (0.79) by KR-20 and peak expiratory flowmeter (0.99) by inter-observer reliability. After obtaining formal administrative approval from appropriate authority the final study was conducted from 7th February 2024 to 6th April 2024 in south-west district of Delhi.

Sample size

300 petrol pump workers were selected using Raosoft sample size calculator.

Table 1: Data collection.

Tool	Purpose	Technique
Tool I: Structured respiratory symptoms assessment proforma		
Section A: structured socio-demographic data proforma	To assess personal information	Interviewing
Section B: Structured symptoms assessment proforma	To assess the symptoms associated with respiratory morbidity	Interviewing
Section C: Biophysiological measurement	To assess height, weight, BMI, blood pressure, heart rate, respiratory rate, SpO ₂ , peak expiratory flow rate	Physical examination
Tool II: structured risk factors assessment proforma	To assess the risk factors associated with respiratory morbidities	Interviewing
Tool III: structured knowledge interview schedule	To assess the knowledge of petrol pump workers regarding respiratory morbidities	Interviewing

Table 2: Raosoft sample size calculator software.

RAOSOFT	
Margin of error can you accept	5.62%
Confidence level	95%
Population size (use 20,000 if not known)	20,000
Response distribution	50
Recommended sample size	300

Inclusion criteria

Petrol pump workers involved in petrol filling in the vehicles. Between 19 to 59 years of age. Who had minimum 1 year experience at petrol pump. Who were willing for the study.

Exclusion criteria

Petrol pump workers who were involved in other works like supervisor, housekeeping.

Sampling technique

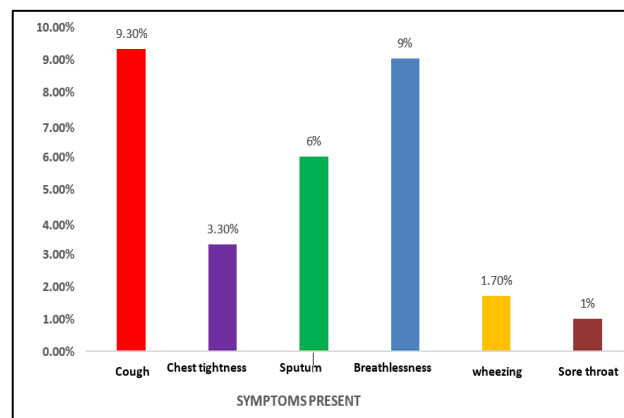
For the present study purposive sampling technique was used for selecting petrol pump workers in south west district of Delhi. After getting the permission from institutional ethical committee, the data collection for main study was done from 07/02/2024 to 06/04/2024. Sample was taken from 18 petrol pumps across south west district of Delhi selected by purposive sampling technique. Permission obtained from managers of petrol pump.

Petrol pump workers were explained about the nature of study and their participation in the study. Nature and purpose of the study was informed to the respondents. Written consent taken from the participants. Confidentiality and anonymity of the responses was assured to the subjects and was maintained throughout the study and thereafter. Self-introduction and establishment of a rapport with participants were done. Data collection was done through face-to-face interview and assessment proforma. Data has been collected from 300 petrol pump workers of selected petrol filling stations of south-west district of Delhi. Firstly, symptoms assessment and biophysical measurement was done followed by structured risk factor assessment to determine their associated risk factors and structured knowledge interview was done regarding respiratory morbidity among petrol pump workers. Time taken for completion of the interview was 40-45 minutes.

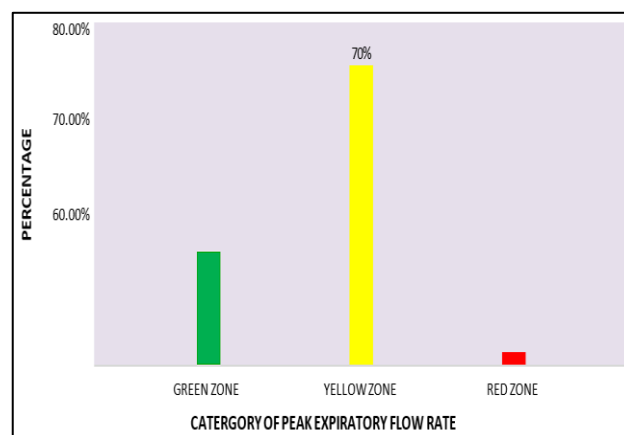
RESULTS

Majority (32%) of petrol pump workers were in the age group 30-39 years and were male (85.33%). Most (85.3%) of the petrol pump workers were married and 42.3% were having education up to secondary school. 60.3% of petrol pump workers resided in nuclear family.

Majority (82%) of petrol pump workers were having monthly family income between Rs.10,000-20,000. Majority of the workers (70.66%) were non vegetarians. Majority (75.7%) of the petrol pump workers were not having any respiratory symptoms whereas (9.3%) reported cough, (9%) breathlessness and (3.3%) chest tightness.

**Figure 1: Bar diagram showing percentage distribution of Petrol pump workers according to symptoms of respiratory morbidity.**

Regarding peak expiratory flow rate (PEFR), the majority of respondents (70%) fell within the yellow zone (>230-460 LPM). (3.3%) fell within the red zone (less than 230 LPM), indicating severe airflow limitation and potential respiratory problems. 26.7% of the respondent fell into green zone category (460-900 LPM) indicating good lung function.

**Figure 2: Bar diagram showing percentage distribution of petrol pump workers according to category of Peak Expiratory flow rate.**

Majority (43.7%) the petrol pump workers were overweight where as 33.33% were having obesity. The majority of workers (51%) were having hypertension stage II, indicating significantly elevated blood pressure level. Majority (92%) of workers had normal heart rate and respiratory rate (85.6%) whereas 14.3% showed signs

of tachypnoea (>20 breaths/minute), which could indicate potential respiratory problem. All workers having normal SpO_2 levels above 95%, indicating adequate oxygenation.

The majority of petrol pump workers (73%) have more than 4 years of work experience. 28.3% of petrol pump workers were working work more than 12 hours/day and 5.3% works for 12 hour/day. The majority of petrol pump workers (66%) have worked up to 48 hours per week. Majority of petrol pump workers (92.7%) were getting breaks during duty shifts, most of the workers 38.48% have breaks of 30 minutes.

The utilization of personal protective equipment (PPE) among petrol pump workers: (6.3%) reported using PPE while working, while the majority (93.7%), indicated not using any protective gear. Among those who reported using PPE, all, (6.3%) individuals exclusively using face masks. However, there were no respondents who indicated using goggles or gloves as part of their protective equipment. substance use was common in the petrol pump workers (54%). Among those reported of substance use, alcohol consumption (25.33%) was the most common habit, followed by smoking (18.33%) and chewing tobacco (16.66%). The majority of those who reported substance use had been engaged in it for 5 years or less.

It was found that (7.3%) were tested positive for COVID-19 and they were isolated at home during the infection period. The data also shows that (95.7%) were vaccinated against COVID-19, (68.6%) has taken second dose of the vaccine. Majority of petrol pump workers were not diagnosed with respiratory morbidity whereas (2.33%) of petrol pump workers were diagnosed with tuberculosis, asthma and pneumonia. Only (14.28%) of the workers were hospitalized for respiratory problems among the hospitalized cases there was no indication of oxygen therapy. (10.33%) of workers have been diagnosed with other co-morbidities such as hypertension (3.3) and diabetes mellitus (3.7%).

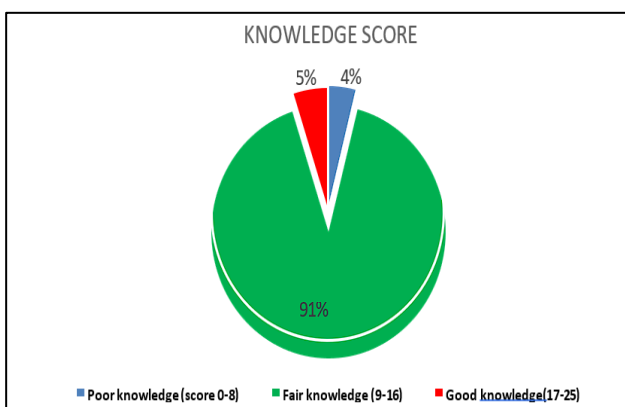


Figure 3: Pie diagram showing percentage distribution of petrol pump workers according to their knowledge scores.

It was observed that 82.7% of petrol pump workers were not undergoing any health checkups. Among those who were getting health check services 16.3% at the duration of 6 months to 1 year. Regarding regular exercise (78.33%) petrol pump workers does not engage in regular exercise. A significant portion of petrol pump workers around 63.3% petrol pump workers report- consuming an adequate amount of water daily 7-8 glass per day. The majority of petrol pump workers (64.7%) report sleeping for 6 to 8 hours during the night.

The data indicates that a vast majority of petrol pump workers (91%) demonstrated fair knowledge on factors associated with respiratory morbidity, while only a small percentage showed poor knowledge (4%) and good knowledge (5%) respectively. It suggests that petrol pump have lack of knowledge in these areas however knowledge scores in the area of diagnosis treatment and complications and preventive measures were greater as compared to others.

The computed Chi-square between prevalence of respiratory morbidity and associated risk factors like no use of PPE (0.03), longest work duration (2.39), diagnosis of COVID (3.37), periodic health check-up (0.05), no handwashing (0.06) and diagnosis of respiratory disease were found to be statistically not significant at 0.05 level of significance except for duration of work at petrol pump (9.660) and substance use (7.59).

The computed Chi-square value between knowledge and prevalence (1.03) was found to be statistically not significant at 0.05 level of significance. The computed Chi-square between prevalence and selected variables age (0.954), gender (2.391), marital status (0.332), educational status (0.363) and monthly family income (2.53) were found to be statistically not significant at 0.05 level of significance and the computed Chi square between knowledge and selected variables like age (7.73), gender (2.119), marital status (3.22), family income (10.2) and educational status (7.059) were found to be statistically not significant at 0.05 level of significance

DISCUSSION

Findings related to description of sample characteristics

In the present study the socio-demographic findings shows that the majority (32%) of the petrol pump workers were in the age group 30-39 years, (93.3%) were male and (85.3%) were married.

These findings are consistent to the findings reported by Azhar et al who reported that 59.5% of workers were males, 37.07% were in the age group 35-42 year and 85% of the workers were married.⁸ These findings indicates that the majority of petrol pump workers were adults and this workforce mostly has the male population.

Findings related to prevalence of respiratory morbidity among petrol pump workers

In the present study the data suggests that most common chest symptoms found were cough (9.3%), sputum expectoration (9%) and (3.3%) chest tightness. These symptoms can be attributed to the chronic inhalation of petrol fumes. In the present study, majority (70%) of the petrol pump workers were in yellow zone of the peak expiratory flow rate. Low PEFR indicates that chronic exposure to petrol fumes and diesel exhaust leads to restrictive lung disease among the workers. However, PEFR nomogram for Indian population is yet to be developed. These findings are consistent with Thomas JS, Mercy et al study which revealed where 17% of petrol pump workers present with the history of respiratory signs and symptoms most commonly chest tightness (9.5%), presence of sputum expectoration (6.3%) and cough (5.1%).⁹

In another study conducted in Pakistan in 2016, the results showed that respiratory symptoms including wheezing, shortness of breath, and persistent cough have been reported by gas station employees; furthermore, a 2014 study that looked at the symptoms and lung function of Nigerian gas station attendants supported these findings.

Study reported by Mustafa et al revealed that along with the length of exposure, the participants who had worked at the gas stations for an extended amount of time had lower mean peak flow meter values. This decline may be due in part to the subjects' advanced age as well as the fact that gas stations are located close to busy roadways, exposing their employees to air pollution as drivers approach to fill up on gasoline or diesel.⁶

Findings related to associated risk factors of respiratory morbidity among petrol pump workers

In the present study about 93.70% of petrol pump workers does not use any personal protective measures and majority of the petrol pump workers 43% were engaged in substance use among those reported substance using alcohol consumption (25.33%) was the most prevalent habit, followed by smoking (18.33%) and chewing tobacco (16.66%). Smoking worsens the respiratory symptoms.

These findings are consistent with the findings of Verneker et al which reported smoking exacerbates coughing because of the cumulative effect of irritating vapors or toxic gases in gasoline and smoke, smoking makes coughing worse for employees who work at gas pumps.¹⁰ A study by Solanki et al found a similar effect. Working conditions like prolong work duration and long working hours more than 12 hours a day are the risk factor. Only 17% of the petrol pump workers have undergone regular health checkups.¹¹

This study is consistent with Dube et al at Nanded which reported derangement of pulmonary function may be due to longer duration of working hours and continuous exposure to petrol pump and diesel fumes and it also reported no use of PPE. As petrol pump workers also works for a longer duration of time and are continuously inhaling petrol fumes, air pollutants at workplace.¹² A study by Verneker et al also revealed that there was a gradual drop in PEFR with an increase in work time of more than a year; PEFR aids in the early detection of lung function deterioration and there are other natural pollutants than petroleum products that contain benzene that might irritate the respiratory tract. It has been demonstrated that routine medical examinations, the provision of air pollution masks, and health education for workers on the harmful effects of fuel may all lower mortality.¹⁰

In the present study most of the petrol pump workers were having overweight and obesity. One of the most significant variables influencing pollution absorption is body mass index (BMI). due to the fact that the lipophilic volatile pollutants generated in petrol stations are absorbed in proportion to BMI and adipose mass.

Findings related to knowledge regarding respiratory morbidity among petrol pump workers

In the present study majority of the petrol pump workers (91%) had fair knowledge regarding respiratory morbidities among petrol pump workers. These findings are consistent with Thomas et al it was discovered that overall knowledge regarding workplace hazards, awareness of respiratory morbidities among petrol pump workers and the methods of prevention was found to be moderate.⁹

The present study was limited to 300 petrol pump workers of southwest district of Delhi that posing restriction to make a broader generalization. Study sample were restricted to only one setting. The information collected from petrol pump workers was based on their expressed responses. Participants might provide socially acceptable responses leading to potential underreporting of high-risk behaviours.

CONCLUSION

The present study highlighted the prevalence of respiratory illnesses among petrol pump, which are mostly caused by long-term exposure to petroleum fumes, vehicle emissions, and dispersed particulate matter. Despite the known health risks, awareness and use of personal protective equipment (PPE) remains low among employees. These results highlight the critical necessity for ongoing health monitoring, the adoption of workplace safety protocols, and educational initiatives targeted at reducing exposure-related hazards. To safeguard the respiratory health of this susceptible workforce, it is imperative to undertake long-term follow-up studies,

enforce environmental and workplace safety regulations, and strengthen regulatory monitoring.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee of RAK College of Nursing, New Delhi in October 2023

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