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Original Article

Prevalence And Risk Factors of Occupational Respiratory Disorders Among Eco-Guardians in Bengaluru: A Cross-Sectional Study

Pradeepa Prasad[1], Abinaya Sangavi A[2,*], A Muthukumar[3], C Povindhar[3], Aishwarya K[2], Lakshmi P[2]

[1]Department of Pharmaceutical Chemistry, The Oxford College of Pharmacy, Bengaluru, Karnataka, INDIA.
[2]Department of Pharmacy Practice, The Oxford College of Pharmacy, Bengaluru, Karnataka, INDIA.
[3]Department of Pharmacology, The Oxford College of Pharmacy, Bengaluru, Karnataka, INDIA.

ABSTRACT

Background: Eco-guardians are routinely exposed to pollutants, dust, and bioaerosols, which ultimately leads to an increase in risk of developing occupational respiratory disorder. The present study focuses on determining the prevalence of bronchial dysfunction and identifying associated risk factors among eco-guardians in Bengaluru. **Materials and Methods:** A cross-sectional study was carried out among 130 eco-guardians to assess occupational respiratory problems and their contributing factors. Lung functions were evaluated using pulmonary function tests. The study was approved by the institutional ethics committee and supported by an undergraduate research grant. **Results:** Among 130 participants most of them were female (63.08%), with an average age of 43.6 years. Although most participants (96.92%) were aware of the risks associated with dust exposure, the use of protective measures was inadequate. Around 80% of the participants reported not using gloves or masks on a regular basis, and none reported practicing breathing exercises or using inhalers. A large proportion (86.15%) experienced symptoms such as wheezing, coughing, and breathlessness. Pulmonary function tests showed reduced FVC in 64.62% and impaired FEV1 in 70.77% of participants, with many showing mild-to-moderate obstruction. **Conclusion:** Eco-guardians are regularly exposed to dust at work, and this can significantly affect their respiratory health. The findings suggest that although there is some awareness about these risks, it is not always reflected in daily preventive practices. There is a clear need to improve health education, ensure the availability and proper use of protective equipment, and strengthen policies that support regular health check-ups and training. Taking these steps can help better protect this vulnerable group.

Keywords: Bronchial Problems, Eco-Guardians, Health Education, Occupational Hazards, Spirometry.

Correspondence:
Ms. Abinaya Sangavi A
Department of Pharmacy Practice,
The Oxford College of Pharmacy,
Bengaluru-560068, Karnataka, INDIA.
Email: abinayasangavi01@gmail.com

INTRODUCTION

Occupational exposure to dust and airborne pollutants remains a significant public health concern, particularly among the individuals involved in outdoor manual work. Eco-guardians, as part of their daily duties, are consistently exposed to a mixture of environmental contaminants, including road dust, vehicular emissions, bioaerosols, and particulate matter.[1] Prolonged inhalation of these substances has been associated with a range of respiratory conditions, such as chronic cough, wheezing, bronchitis, and a decline in lung function.[2] Over time, this sustained exposure contributes to the growing burden of occupational lung diseases and adversely affects the quality of life of affected workers.[3]

Despite the recognized risks, the working conditions of eco-guardians often do not adequately support protective practices. The use of Personal Protective Equipment (PPE), including masks and gloves, remains inconsistent, and in many cases, insufficient. Contributing factors such as limited awareness, lack of structured training, and restricted access to healthcare services further increase their vulnerability to respiratory morbidity.[4,5] The gap between known occupational measures reflects a broader issue in workplace health and safety management within this group.

While previous studies have explored occupational respiratory risks, there is limited region-specific evidence focusing on eco-guardians in rapidly urbanizing settings such as Bengaluru.[6] Variations in environmental conditions, occupational practices, and socio-economic contexts highlight the need for localized

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investigations. Generating such evidence is essential for informing targeted public health interventions and improving preventive strategies. In this context, the present study aims to assess the prevalence of respiratory problems among eco-guardians in Bengaluru and to examine associated risk factors, along with their knowledge, attitudes, and practices related to respiratory health and to use of protective measures.

MATERIALS AND METHODS

A cross-sectional study[7] was conducted among eco-guardians in Bengaluru, Karnataka, India, to determine the prevalence of occupational respiratory problems and identify associated risk factors. Members and non-members of both genders aged 21 years and older with at least two years of occupational exposure were included in the study.

Using Cochran's formula[8] with a 95% confidence level, and 5% margin of error, a minimum sample size of 128 participants was calculated. A total of 130 individuals were recruited in order to achieve adequate power.

Participant selection was based upon predetermined inclusion and exclusion criteria. Exclusion criteria included unwilling to participate; having pre-existing respiratory diseases under treatment, recent surgery, or serious acute or chronic illness that may limit participation. The study was conducted in selected BBMP (Bruhat Bengaluru Mahanagara Palike) wards across Bengaluru between April 21 and April 26, 2025.

Statistical analysis was performed using Microsoft Excel and SPSS software version 25.0. Descriptive statistics, including mean, standard deviation, frequency, and percentage, were used to summarize demographic characteristics, questionnaire responses, and pulmonary function test findings. Ethical considerations were upheld, and informed consent was obtained from all participants with the confidentiality of information maintained.

Data Collection

Data collection was performed after receiving permission from the corresponding authorities and obtaining informed consent from subjects. Data were collected using a re-validated questionnaire, which was structured and translated into Kannada (local language).

The questionnaire consisted of four sections:

- Demographic details,
- Occupational exposure history,
- Knowledge, Attitude, and Practice (KAP) related to respiratory health and protective measures, and
- Respiratory symptoms experienced during work.

The questionnaire included both closed-ended and multiple-choice questions. Content validity of the questionnaire was reviewed by academic experts, and a pilot study was conducted among a small group of participants to ensure clarity and reliability before final data collection.

Besides the questionnaire, pulmonary function tests were done by a peak flow meter using Forced Vital Capacity (FVC),[9] Forced Expiratory Volume in one second (FEV1)[10] and Peak Expiratory Flow (PEF).[11] These parameters were used to assess pulmonary function and classify the severity of respiratory impairment among the study participants.

In addition, participants were given health education regarding respiratory protection. This included teaching breathing exercises and how to properly wear Personal Protective Equipment (PPE). Pamphlets were also distributed to raise awareness of occupational hazards and preventive practices.

RESULTS

The demographic characteristics of the participants are presented in Tables 1 and 2. The study included 130 eco-guardians with a mean age of 43.6 years. The majority of participants belonged to the 41-60 years age group (62.31%), followed by the 21-40 years age group (36.15%), while only 1.54% belonged to the 61-80 years age group. Females constituted 63.08% of the study population, whereas males accounted for 36.92%. The majority of participants were married (97.69%). Regarding educational status, 72.31% had no formal education, while 27.69% had completed primary school education. Tobacco use was reported by 12.31% of participants, and 14.62% reported alcohol consumption.

The Knowledge, Attitude, and Practice (KAP) responses of the participants are summarized in Table 3 and Figure 1. Overall, the mean knowledge score was 43.96%, while the mean attitude and practice scores were 42.64% and 26.26%, respectively. Knowledge assessment indicated that most participants (96.92%) were aware of dust exposure during sweeping and recognized its association with breathing problems (72.31%). However, awareness regarding respiratory disease transmission (33.85%), preventive measures (18.46%), and symptoms such as fever and sore throat (30.77%) was comparatively low. Furthermore, only 25.38% of participants were aware that respiratory infections could spread through contact with contaminated items.

In terms of attitude, the majority of participants (86.15%) reported experiencing respiratory symptoms while working, indicating a considerable occupational health burden. However, only 17.69% had undergone a recent respiratory health check-up, reflecting low utilization of healthcare services. While 47.69% recognized the importance of protective equipment, only 20% had received any training regarding its use. In addition, 70% of participants were unwilling to wear gloves, and only 32.31%

believed that appropriate protective equipment could effectively prevent respiratory problems.

Practice-related findings indicated poor adoption of protective measures. Only 20% of respondents reported regularly using masks and gloves, while 27.69% cleaned their protective equipment appropriately. A majority (71.54%) reported that masks interfered with their work. Notably, none of the participants used respiratory inhalers or practiced breathing exercises. Furthermore, 55.38% handled waste using bare hands, while only 9.23% used specialized techniques to reduce dust exposure. These findings indicate poor adherence to occupational safety practices.

The pulmonary function test findings are presented in Table 4 and Figure 2. Assessment of pulmonary function revealed varying degrees of respiratory impairment among participants. FVC results showed that 35.38% had normal lung function, 50.00% had mild impairment, 13.08% had moderate impairment, and 1.54% had severe impairment. For FEV1, 29.23% were classified as normal, 24.62% had mild impairment, 43.08% had moderate impairment, and 3.08% had severe impairment. PEF results showed that 30.00% had normal lung function, 50.77% had mild impairment, and 21.54% had moderate impairment, with no participants exhibiting severe impairment.

Overall, the findings indicate a high burden of respiratory symptoms, impaired pulmonary function, and inadequate knowledge, attitude, and practice regarding occupational respiratory health among eco-guardians.

DISCUSSION

The present study demonstrates a high prevalence of respiratory symptoms (86.15%) with considerable impairment in pulmonary function among eco-guardians in Bengaluru. These findings point toward a substantial occupational health burden, likely resulting from prolonged exposure to dust and airborne pollutants. Similar patterns have been reported in previous studies, where individuals exposed to environmental dust and bioaerosols showed increased respiratory morbidity.

A study by Hashemi Habybabady *et al.*[12] reported a significantly higher occurrence of respiratory symptoms among eco-guardians compared to control group, with coughing observed in 81% of exposed workers ($p<0.05$). In line with these findings, a large proportion of participants in the present study reported symptoms

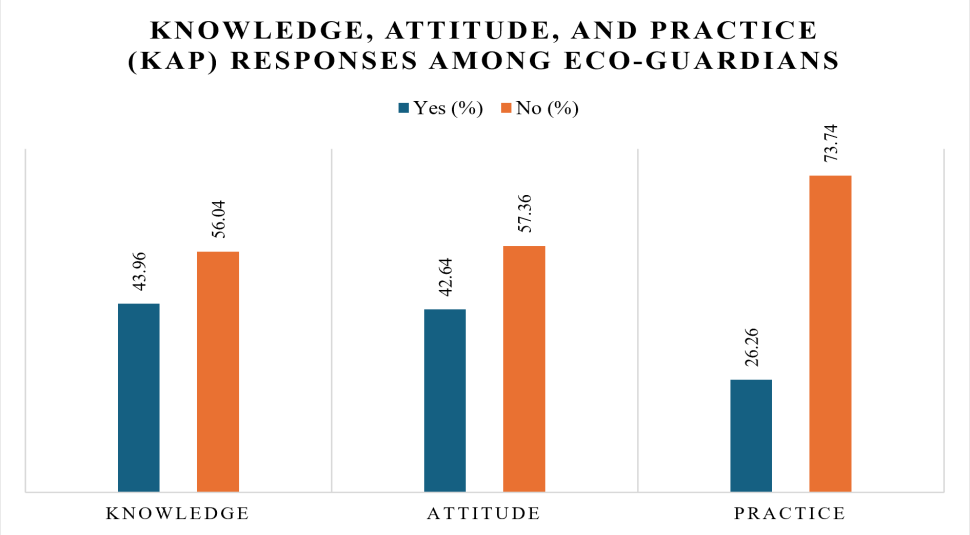


Figure 1: Overall Knowledge, Attitude, and Practice (KAP) scores among eco-guardians regarding occupational respiratory health.

Table 1: Study Site Details and Participant Distribution.

Date	Study Site	Time	No. of Subjects
21/04/25	BBMP Ward No. 171 (Tavarekere)	9:00 am-2:00 pm	23
22/04/25	BBMP Ward No. 189 (Hongasandra)	9:00 am-2:00 pm	28
23/04/25	BBMP Ward No. 192 (Begur)	9:00 am-2:00 pm	22
24/04/25	BBMP Ward No. 191 (Singasandra)	9:00 am-2:00 pm	16
25/04/25	BBMP Ward No. 28 (Kammanahalli)	9:00 am-2:00 pm	13
25/04/25	BBMP Ward No. 176 (BTM Layout 1st Stage)	9:00 am-2:00 pm	10
26/04/25	BBMP Ward No. 172 (Madiwala)	9:00 am-2:00 pm	18

such as cough, wheezing, and breathlessness. This consistency strengthens the evidence linking occupational dust exposure to respiratory health problems and highlights street sweeping as a high-risk occupation for the development of chronic respiratory conditions.

With respect to pulmonary function, the findings are comparable to those reported by Anwar *et al.*[13] who observed a significant reduction in Forced Expiratory Volume in One Second (FEV1) and Forced Vital Capacity (FVC) among exposed workers. Their study demonstrated reduced FEV1 (66% vs 85%) and FVC values, suggesting an obstructive pattern of lung disease associated with occupational exposure. Similarly, in the present study, impaired FEV1 was observed in 70.77% of participants and abnormal FVC in 64.62%, with most cases falling within mild to moderate impairment. These findings further support the role of long-term dust inhalation in causing progressive airflow limitation and declining lung function.

Previous research has also emphasized the importance of duration of exposure as a key determinant of respiratory impairment. The dose-response relationship described by Anwar *et al.* reinforces the association between prolonged occupational exposure and deterioration in lung function. Although the cross-sectional nature of this study limits causal interpretation, the high prevalence of respiratory abnormalities provides strong supportive evidence for this relationship.

An important finding of the present study is the gap between awareness and actual preventive practices. Despite 96.92% of participants being aware of health risks associated with dust exposure, only 20% reported consistent use of Personal Protective Equipment (PPE), and none practiced breathing exercises or used inhalers. This suggests that awareness alone does not necessarily translate into behavioral change. Similar observations have been reported in other occupational health studies, where factors such as discomfort, inadequate training, and lack of enforcement contribute to poor compliance with PPE use.

Socio-demographic factors may also play a role in this gap. A large proportion of participants (72.31%) had no formal education, which limited their ability to understand and adopt preventive measures effectively. This underscores the need for tailored health education programs that are adapted to the literacy levels of workers, supported by practical demonstrations and workplace-based interventions.

Overall, the findings of this study, together with existing evidence, highlight the urgent need for comprehensive occupational health strategies. These should include regular health screening, adequate provision and strict enforcement of PPE use, mechanization of sweeping processes, and implementation of policy-level interventions aimed at safeguarding the health and well-being of this vulnerable workforce.

LIMITATIONS

While this study offers significant findings on respiratory health of eco-guardians, several limitations should be acknowledged. First, the cross-sectional design illustrates data at a single point in time, which restricts the ability to establish a clear cause-and-effect relationship between occupational dust exposure and respiratory impairment.

The study was conducted in selected BBMP wards of Bengaluru with a relatively small sample size, which may limit the generalizability of the findings to other regions or populations. Additionally, the use of self-reported data introduced the possibility of recall and response bias, particularly with respect to reported symptoms and workplace practices.

From a clinical standpoint, pulmonary function was assessed using a peak flow meter. Although this method is useful for initial

Table 2: Demographic Characteristics of Participants (*n*=130).

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	48	36.92
	Female	82	63.08
Age (years)	21-40	47	36.15
	41-60	81	62.31
	61-80	2	1.54
Marital Status	Married	127	97.69
	Unmarried	3	2.31
Education	No Education	94	72.31
	Primary School	36	27.69
Tobacco Use	Yes	16	12.31
	No	114	87.69
Alcohol Consumption	Yes	19	14.62
	No	111	85.38

Table 3: Knowledge, Attitude and Practice (KAP) Responses among Participants (*n*=130).

Domain	Question	Yes n (%)	No n (%)
Knowledge	Aware of dust exposure during sweeping	126 (96.92)	4 (3.08)
Knowledge	Dust exposure leads to breathing problems	94 (72.31)	36 (27.69)
Knowledge	Aware of breathing disorders and their spread	44 (33.85)	86 (66.15)
Knowledge	Frequent dust exposure affects respiratory health	52 (40.00)	78 (60.00)
Knowledge	Aware of preventive measures	24 (18.46)	106 (81.54)
Knowledge	Aware that fever and sore throat are respiratory symptoms	27 (20.77)	103 (79.23)
Knowledge	Respiratory infections spread via contaminated items	33 (25.38)	97 (74.62)
Attitude	Experience respiratory symptoms while sweeping	112 (86.15)	18 (13.85)
Attitude	Undergone respiratory check-up recently	23 (17.69)	107 (82.31)
Attitude	Aware of importance of protective equipment	62 (47.69)	68 (52.31)
Attitude	Received education on protective equipment	26 (20.00)	104 (80.00)
Attitude	Opposed to wearing gloves	91 (70.00)	39 (30.00)
Attitude	Believe PPE prevents respiratory issues	42 (32.31)	88 (67.69)
Practice	Regularly use mask and gloves	26 (20.00)	104 (80.00)
Practice	Clean protective gear after use	36 (27.69)	94 (72.31)
Practice	Feel mask interferes with work	93 (71.54)	37 (28.46)
Practice	Use respiratory inhaler/nebuliser	0 (0.00)	130 (100.00)
Practice	Practice breathing exercises	0 (0.00)	130 (100.00)
Practice	Pick waste using bare hands	72 (55.38)	58 (44.62)
Practice	Use techniques to reduce dust exposure	12 (9.23)	118 (90.77)

Table 4: Pulmonary Function Test Results among Participants (*n*=130).

SEVERITY	FVC (%)	FEV1 (%)	PEF (%)
Normal	35.38	29.23	30.00
Mild	50.00	24.62	50.77
Moderate	13.08	43.08	21.54
Severe	1.54	3.08	0.00

screening, it does not provide the level of diagnostic accuracy offered by standard spirometry techniques. This may have led to underestimation or less precise characterization of lung function impairment.

Furthermore, certain potential confounding factors such as ambient air pollution, nutritional status, and cumulative duration and intensity of exposure were not comprehensively evaluated. These factors could influence respiratory outcomes and should be considered in future studies.

FUTURE ASPECTS

Future efforts aimed at improving the respiratory health and overall well-being of eco-guardians should prioritize the adoption of mechanized cleaning methods to minimize direct exposure to dust. In addition, ensuring the availability and consistent use of high-quality Personal Protective Equipment (PPE) is essential, which requires not only provision but also strict implementation and regular monitoring at the workplace.

The establishment of workplace-based health surveillance systems is equally important. Periodic assessment of lung function, along with access to occupational health services, would facilitate early identification and timely management of respiratory problems. Furthermore, structured health education programs tailored to the literacy levels of workers are necessary to enhance understanding and promote safe practices, including proper use and maintenance of PPE as well as simple breathing exercises.

Future research should focus on larger and more diverse populations to improve the generalizability of findings. Longitudinal study designs would be particularly valuable in understanding the long-term impact of occupational exposure on respiratory health. Additionally, incorporating environmental monitoring and evaluating other potential risk factors would

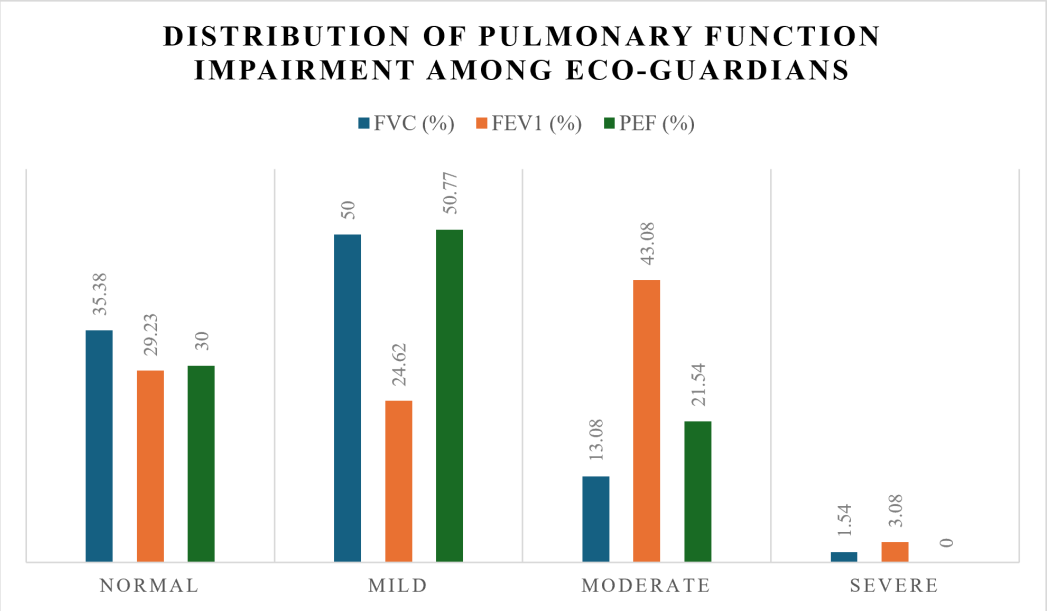


Figure 2: Distribution of pulmonary function impairment based on FVC, FEV1, and PEF among eco-guardians.

provide a more comprehensive understanding of the determinants of respiratory impairment in this population.

CONCLUSION

This study demonstrates a high prevalence of respiratory symptoms and reduced lung function among eco-guardians in Bengaluru, largely associated with prolonged exposure to dust and airborne pollutants. Although most workers were aware of occupational health risks, the consistent use of protective measures was found to be inadequate.

The findings highlight a clear gap between awareness and actual practice, indicating the need for focused and practical interventions. Enhancing access to appropriate protective equipment, strengthening worker-oriented health education, and implementing regular health screening programs are key steps in reducing occupational health risks.

Overall, addressing this issue requires coordinated action at individual, organizational, and policy levels. Such efforts are essential to safeguard this vulnerable workforce and improve both their respiratory health and overall quality of life.

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ABBREVIATIONS

BBMP: Bruhat Bengaluru Mahanagara Palike; **FEV1:** Forced Expiratory Volume in 1 Second; **FVC:** Forced Vital Capacity; **KAP:** Knowledge, Attitude, and Practice; **PEF:** Peak Expiratory Flow; **PPE:** Personal Protective Equipment.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

FUNDING

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AUTHOR CONTRIBUTIONS

All authors contributed to the conception and design of the study, data collection, data analysis, interpretation of results, manuscript preparation, and critical revision of the manuscript. All authors read and approved the final manuscript.

SUMMARY

- Occupational dust exposure among eco-guardians is associated with a high prevalence of respiratory symptoms and impaired pulmonary function.
- Despite high awareness regarding the health risks of dust exposure, adherence to protective practices such as the use of masks and gloves remains inadequate.
- Pulmonary function assessment revealed reduced FVC, FEV1, and PEF values in a substantial proportion of participants.

- Limited use of personal protective equipment and lack of regular respiratory health check-ups may contribute to the increased burden of respiratory disorders.
- Strengthening occupational health education, improving access to protective equipment, and implementing regular health surveillance programs are essential to protect the respiratory health of eco-guardians.

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