International Journal of Community Medicine and Public Health
Manivannan T et al. Int J Community Med Public Health. 2024 Nov;11(11):4379-4383
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20243302

Original Research Article

A study on association between respiratory morbidity and type of work, duration of work among unorganized sector workers in Tamil Nadu

Tamilamudhan Manivannan*, Chitra Ayyappan

Department of Community Medicine, Madras Medical College, Chennai, Tamil Nadu, India

Received: 28 August 2024
Accepted: 09 October 2024

***Correspondence:**
Dr. Tamilamudhan Manivannan,
E-mail: ajithamudhan@gmail.com

ABSTRACT

Background: In Tamil Nadu around 70 lakh workers including construction workers were enrolled in the e-SHRAM portal as of 31st March 2022. Occupation related respiratory disease occurs due to inhalation of dust in working place and this depends on the duration and type of work. This study aimed to find the association of respiratory morbidity with type of work and duration of work among workers in unorganized sectors in Tamil Nadu.
Methods: Cross sectional study conducted among adult workers in unorganized sectors in randomly selected districts of Tamil Nadu.
Results: The risk for respiratory morbidity was higher among quarry workers (AOR=9.489 with p value <0.001). The risk for restrictive lung disease among workers with a duration of work <5 years was more (OR=1.76 with 95% CI (1.14 - 2.71)).
Conclusions: The risk for respiratory morbidity was high among occupations with dust exposure. This study shows that restrictive lung disease occurs within 5 years of work, hence periodic screening should be advocated from the early days of joining the workplace.

Keywords: Adult workers, Respiratory morbidity, Restrictive lung disease

INTRODUCTION

Occupational health is an area of work in public health to promote and maintain the highest degree of physical, mental and social well-being of workers in all occupations" by WHO.[1] Globally Work-related diseases and injuries were responsible for the deaths of 1.9 million people in 2016, according to International Labour Organization (ILO).[2] Occupational exposure leads to an increased burden of non-malignant lung diseases in India in addition to the burden of occupational pneumoconiosis.[3] Occupational lung diseases are defined as "lung diseases that are caused, aggravated, or exacerbated by exposure to dust, gases, fumes, and vapours in the workplace".[4] The prevalence of restrictive lung disease was higher among workers in puffed rice workers. The respiratory morbidity is positively associated with the duration of work. As the duration of work increases the prevalence of respiratory morbidity also increases.[5] "Restrictive lung diseases are a heterogeneous set of pulmonary disorders defined by restrictive patterns on spirometry. These disorders are characterized by a reduced distensibility of the lungs and compromising lung expansion particularly with reduced total lung capacity (TLC)".[6] A study of air pollutant levels at Delhi metro construction sites reports alarmingly high levels of particulate matter pollution.[7] In Tamil Nadu 70,48,529 workers including construction workers who have been registered in the e-SHRAM Portal as of 31st March 2022.[8,9] The prevalence of respiratory morbidity varies across different sectors and the duration of work is positively associated with respiratory morbidity. However, there is a shortage of information regarding the prevalence of respiratory morbidity among workers in unorganised sectors in Tamil Nadu. This study aimed to find the prevalence of respiratory morbidity among

workers in unorganised sectors and to find the association between year of work and type of work with respiratory morbidity among workers in unorganised sectors.

METHODS

It was a community based cross sectional study done in randomly selected districts of Tamil Nadu among workers in the unorganised sectors. The ethical approval for the study has been obtained from the Institutional Ethics Committee (IEC), Directorate of Public Health and Preventive Medicine, Tamil Nadu (S.No; DPHPM/SAC/2022/078). It was based on the cluster random sampling technique. One unorganised sector was considered as one cluster. The sample size calculated based on the prevalence of respiratory problems among construction workers in India as per "National Institute of Occupational Safety and Health Report" was 51.4%. Considering the level of confidence of 95%, the margin of error was 2.5%, the design effect was 1.2 and the Non-responders rate was 20%. The sample size was calculated as 2215. From the 38 districts of Tamil Nadu, 10 districts were selected by simple random technique (lottery method). From each district 20 unorganised sectors were selected based on the advanced tour programme of the labour mobile medical unit. Workers who were available on the date of the visit were included in the study. Totally 2236 workers in unorganised sectors were recruited for the study. The workers were recruited based on the inclusion and exclusion criteria. The workers included in this study were brick klin workers, ceramic and carpeting workers, cleaning workers, construction workers, drivers, engineers, fabric workers, labourers, machine operators, packing workers, painters, poultry feed making, quarry workers, securities, welders and bar benders, sweepers, clerical workers.

Study period

The study was conducted from September 2022 to October 2022.

Inclusion criteria

Male and female workers (≥18 years) employed in the unorganised sectors.

Exclusion criteria

Haemoptysis of unknown origin, history of recent myocardial infarction, acute disorders like nausea/vomiting, recent eye surgery/recent thoracic/abdominal surgical procedures, females in second and third-trimester pregnancy, upper or lower respiratory tract infection in the past three weeks, resting heart rate of more than 120 beats per minute who give consent for the study were excluded.

After obtaining the informed consent, the data collection was done using an interviewer-administered semi-structured questionnaire. The airflow and lung volumes are measured by spirometry.

Operational definition

Unorganised sectors

"Consisting of all unincorporated private enterprises owned by individuals or households engaged in the sale or production of goods and services operated on a proprietary or partnership basis and with less than ten total workers."[10]

Spirometry

A spirometer was used for measuring the airflow and lung volumes. It provides an objective measurement of lung function. It is a gold standard test for measuring lung function. The guidelines of the American Thoracic Society/European Respiratory Society (ATS/ERS) on pulmonary function tests were adhered to throughout the study. The following lung function parameters were recorded for analysis: 1) Forced vital capacity (FVC), 2) Forced expiratory volume at 1 second (FEV_1), 3) Ratio of FEV_1 to FVC (FEV_1/FVC), expressed as percentage (%).

Restrictive lung disease

A condition that reduces the total lung capacity, the amount of air that the lungs can hold. It is characterized by a decreased FVC (forced vital capacity), which is the volume of air that can be forcibly exhaled after a full inhalation. The FEV1/FVC ratio (the ratio of forced expiratory volume in one second to FVC) is usually normal or increased.

Obstructive lung disease

A condition that impairs the airflow out of the lungs. It is characterized by a decreased FEV1/FVC ratio, which indicates that the lungs are less efficient at exhaling air.

Respiratory morbidity

It combines both restrictive lung disease and obstructive lung disease.

Statistical analysis

The data were entered into Excel and analyzed using SPSS 21. The prevalence of respiratory morbidity was expressed as a proportion. Univariate analysis and Multi variable logistic regression was used to find the association between respiratory morbidity and type, duration of work. The Chi-square test was used to find the p value in univariate analysis. P value <0.05 was considered statistically significant.

RESULTS

As shown in Figure 1, the prevalence of respiratory morbidity was 59% among workers in the unorganised sectors. Among them, the prevalence of restrictive lung disease (55%, n=1223) was higher than obstructive lung disease (4%, n=90).

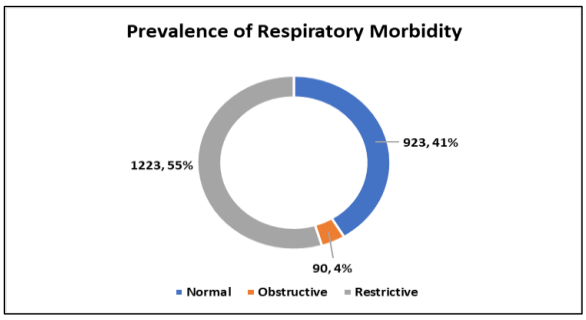

Figure 1: Prevalence of respiratory morbidity among unorganised sectors.

Table 1 shows that based on univariate analysis male sex, <5 years of work, smokers, brick klin workers, construction workers, labourers, cleaning workers quarry workers and labourers were found to be risk factors for developing respiratory morbidity People employed in fabric working, poultry feed making and securities were found to have no risk for respiratory morbidity. The regular mask usage was found to be a protective factors for respiratory morbidity.

After adjusting to other variables using multivariable analysis brick klin workers, construction workers, cleaning workers, labourers and quarry workers were found to be risk for developing respiratory morbidity. People employed in machine operation and poultry feed making were found to have no risk for respiratory morbidity. Regular mask usage was found to be protective factors. The $R^2_{Negalkerke}$=0.164, i.e. 16.4% variability in the dependent variable can be predicted by the independent variables. The overall p value <0.001.

Table 1: Association between predictor variables and respiratory morbidity.

Variable	Respiratory morbidity	Univariate analysis		Multivariate analysis	
	Yes (%)	OR	P value	AOR	P value
Age (years)					
16-30	517 (64.5)	1.49	0.276	0.946	0.892
30-45	561 (54.9)	1	0.995	0.8552	0.696
45-60	218 (57.2)	1.1	0.797	0.7374	0.454
>60	17 (54.8)	1			
Gender					
Male	948 (64.8)	2.041	<0.001	1.2395	0.076
Female	365 (47.3)	1		1	
Years of work					
< 5 years	784 (61.7)	1.33	0.001	1.1784	0.135
>5 years	529 (54.8)	1		1	
Smoking status					
Yes	307 (67.6)	1.61	0.001	0.8272	0.161
No	1006 (56.5)	1		1	
Mask usage					
Regular	206 (46.9)	0.613	0.00001	0.5723	0.00076
nil	905 (62.2)	1.14	0.284	1.1481	0.289
Irregular	202 (59.1)	1		1	
Type of work					
Brick klin workers	34 (89.5)	8.92	0.00005	7.6748	0.00017
Ceramic and carpeting workers	30 (63.8)	1.8	0.055	1.8601	0.057
Cleaning workers	116 (58.9)	1.5	0.022	1.5855	0.013
Construction workers	463 (74.3)	3.03	0.00001	2.5781	0.00001
Drivers	11 (37.9)	0.6	0.263	0.581	0.177
Engineers	49 (60.5)	1.6	0.058	1.4778	0.128
Fabric workers	75 (37.3)	0.62	0.009	0.856	0.423
Labourers	82 (63.1)	1.79	0.005	1.8929	0.003
Machine operators	94 (41.4)	0.74	0.079	0.6938	0.037
Packing workers	22 (40)	0.7	0.225	0.7935	0.442
Painters	10 (62.5)	1.74	0.288	1.5133	0.436
Poultry feed makers	1 (10)	0.11	0.042	0.0841	0.02

Continued.

Variable	Respiratory morbidity	Univariate analysis		Multivariate analysis	
Quarry workers	82 (82.8)	5.06	0.00001	9.489	0.00001
Securities	4 (22.2)	0.3	0.037	0.3207	0.055
Welders and bar benders	37 (52.1)	1.14	0.6	1.2323	0.428
Sweepers	21 (100)	6040000	0.96	5850000	0.96
Clerical workers	182 (48.8)	1		1	1

Table 2: Model fit.

Model fit				
R^2_{McF}	R^2_N	χ^2	df	P value
0.0957	0.164	290	24	<0.001

Table 3: Association between years of work and type of respiratory morbidity.

Years of work	Restrictive lung disease	Obstructive lung disease	Total	OR	95% CI	P value
< 5 years	742	42	784			
>5 years	481	48	529	1.76	1.14 - 2.71	0.009
Total	1223	90	1313			

Table 3 shows that workers with less than 5 years of work had higher risk of developing restrictive lung disease (OR=1.76, p=0.009) than workers with years of work more than 5 years.

DISCUSSION

In this present study, more than half of the workers suffer from respiratory morbidity (both obstructive and restrictive). Similar results were found in a study done by Muntazeem et al, Jani et al.[5,11] The prevalence of restrictive lung disease (54.7%) was higher among the unorganised sector workers than obstructive lung disease (41.0%). Similar results were found by Muntazeem et al, Tawade et al and a case study was done by the Energy Research Institute, Bangalore.[5,12,13] In this study respiratory morbidity was positively associated with duration of work. Similar results were found by Rana et al, Ajeel et al, Prakash et al.[14-16] The risk of respiratory morbidity was high among workers with a duration of work less than 5 years (1.3, p=0.001) and also risk of restrictive lung disease was high among workers with a duration of work less than 5 years (OR = 1.76, p=0.001) which was not similar to the study done by Muntazeem et al.[5] The respiratory morbidity occurs within 5 years of joining work in unorganised sectors which was against our general expectations and the reason for early occurrence could be high level of occupational exposure, long duration of work per day, personal habits like smoking, nutritional status, co-morbidities and also workers leaving their job at an earlier period due to respiratory symptoms which will have to exploded further by qualitative studies. Workers with regular mask usage had a lower risk (OR=0.57, p<0.001) of respiratory morbidity which was similar to the study done by Okoffo et al.[17] In the present study risk for respiratory morbidity was higher among quarry workers (OR = 9.489 with p-value <0.001) which was similar to the study done by Ahadzi et al.[18] The high respiratory morbidity among quarry workers was due to exposure to silica dust exposure. Next to Quarry workers, brick klin workers (OR = 7.67 with p value <0.001) had a higher risk of respiratory morbidity. This was because clay dust contains a mixture of inorganic compounds like magnesium compounds, free silica, various organic materials.[19] The Construction workers had (OR=2.5, p<0.001) higher risk of having respiratory morbidity. This was due to exposure to cement dust, a wide range of inorganic respiratory allergens and welding fumes.[20] The above results show that occupations with exposure to dust, fumes, and silica had a higher risk of respiratory morbidity, particularly restrictive lung disease in a shorter duration of work. In Tamil Nadu unorganised sector workforce constitutes 93% of the total workforce. They introduced 50 mobile health clinics for screening workers in unorganised sectors.[21] Even though they are working efficiently there should be a programme for screening workers before joining work and also screening to be started as early as possible. Both the Factories Act, 1948 and the Atomic Energy (Factories) Rules, 1996 have provisions for the use of appropriate types of personal protective equipment.[22] The practice of using personal protective equipment was low among workers. Hence proper education about the usage of personal protective equipment is to be done among workers.

This study has few limitations. It is a cross-sectional study, so prospective studies to be done further to find the early onset of disease and other risk factors. The follow-up study to be done on restrictive lung disease patient after 5 years to know their status.

CONCLUSION

The prevalence of restrictive lung diseases was high among the study population. The risk for respiratory morbidity was high among occupations with dust exposure. Wearing a mask had a protection towards the

development of respiratory morbidity. This study shows that restrictive lung disease occurs within 5 years of work, hence periodic screening and proper safety measures should be advocated from the early days of joining the workplace.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. World Health Organisation. Occupational Health. Available at: https://www.who.int/health-topics/occupational-health. Accessed 01 August 2024.
2. World Health Organisation. WHO/ILO joint estimates of the work-related burden of disease and injury, 2000-2016: global monitoring report. Available at: https://www.who.int/publications/i/item/9789240034945. Accessed 01 August 2024.
3. Blanc PD, Annesi-Maesano I, Balmes JR, Cummings KJ, Fishwick D, Miedinger D, et al. The occupational burden of nonmalignant respiratory diseases. An official American Thoracic Society and European Respiratory Society statement. Am J Respirat Crit Care Medi. 201;199(11):1312-34.
4. Jameson JL, Fauci AS. Harrison's Principles of Internal Medicine. 12th ed. (Vol.1 & Vol.2). Mc Graw Hill; 1990.
5. Muhammed Muntazeem G, Dsouza MJ, Varadaraja Rao BA, Patil BK, Kengal P. Association of respiratory morbidity with duration of work among puffed rice workers in Davanagere city, Karnataka, India. Int J Community Med Public Health. 2020;7(4):1387.
6. Robinson HC. Respiratory conditions update: restrictive lung disease. FP Essent. 2016;448:29-34.
7. Roy S, Dasgupta A, Bandyopadhyay L, Paul B, Bandyopadhyay S, Kumar M. Morbidities of rice mill workers and associated factors in a block of West Bengal: A matter of concern. J Fam Med Prim Care. 2020;9(1):359.
8. Ministry of Labour and Employment Labour Bureau. Report on Employement Sector and Conditions of Informal Employment volume 4, 2013-2014. Available at: https://cms.tn.gov.in/sites/default/files/documents/lwsd_e_pn_2022_23.pdf. Accessed 01 August 2024.
9. Labour Welfare and Skill Development Department. Policy Note 2022-2023, 2022. Available at: https://labour.gov.in/sites/default/files/Report%20vol%204%20final.pdf. Accessed 01 August 2024.
10. National Commission for Enterprises in the Un-organised Sector. Reports on conditions of work and promotion of livelihoods in the un organised sectors, 2007. Available at: https://msme.gov.in/national-commission-enterprises-un-organised-sectornceus. Accessed 01 August 2024.
11. Jani C, Jain K, Joshi A, Bala DV, Jadav H, Jetpariya D. Assessment of pulmonary function of industrial workers in four different industries of Gujarat. Int J Community Med Public Health. 2019;6(8):3234.
12. Tawde A. kasi, Subhash MK. Effects of breathing exercise and preventive measure on pulmonary functions in flour mill workers. Int J Health Sci Res. 2015;(5):241-9.
13. The energy and research institute, India. Assessing and mitigating health risks form puffed rice cluster: A case study of Davangere, Karnataka, 2006. Available at: https://idl-bnc.idrc.ca.dspace.bitstream. Accessed 01 August 2024.
14. Rana M, Naskar S, Roy R, Das D, Das S. Respiratory morbidity among rice mill workers in an urban area of Burdwan District, West Bengal: A cross-sectional study. Indian J Occup Environ Med. 2018;22(1):5.
15. Ajeel AH, Al-Yassen AK. Work-related allergic disorders among flour mill workers. Med J Basrah Univ. 2007;25(1):29-32.
16. Prakash S, Manjunatha S, Shashikala C. Morbidity patterns among rice mill workers: A cross sectional study. Indian J Occup Environ Med. 2010;14(3):91.
17. Okoffo ED, Mensah M, Fosu-Mensah BY. Pesticides exposure and the use of personal protective equipment by cocoa farmers in Ghana. Environ Syst Res. 2016;5(1):17.
18. Ahadzi DF, Afitiri AR, Ekumah B, Kanatey V, Afedzi A. Self-reported disease symptoms of stone quarry workers exposed to silica dust in Ghana. Health Sci Rep. 2020;3(4):e189.
19. Gupta R, Gupta R, Jan R, Langer B, Gupta RK, Singh P. Prevalence of respiratory morbidity among brick kiln workers: a cross sectional study from rural north India. Int J Res Med Sci. 2019;7(5):1506.
20. Chittaluru P, Korra R, Asuri V, Annakula P, Reddy GM. An analytical cross-sectional study to compare pulmonary function and respiratory morbidity-related quality of life between construction workers with age-and gender-matched controls. Indian J Occup Environ Med. 2021;25(1):22.
21. National Health Mission Tamil Nadu. Occupational health programme. Available at: https://www.nhm.tn.gov.in/en. Accessed 05 August 2024.
22. Atomic Energy Regulatory Board. AERB safety guidelines. Available at: www.rfhha.org/images/law/8.21%20PERSONAL%20PROTECTIVE%20EQUIPMENT.PDF. Accessed 05 August 2024.

Cite this article as: Manivannan T, Ayyappan C. A study on association between respiratory morbidity and type of work, duration of work among unorganized sector workers in Tamil Nadu. Int J Community Med Public Health 2024;11:4379-83.