Original Article

Prevalence and health status of COPD in rural West Bengal

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ABSTRACT

Background: Understanding the spirometry-based prevalence with concomitant assessment of the health status is important to appreciate the chronic obstructive pulmonary disease (COPD)-scenario in a geographic area. There is hardly any such rural data available from the developing world. **Methods:** We screened the adult population (>40 but <75 years) of seven villages in two different blocks of Birbhum district, West Bengal, for the presence respiratory symptoms (active or historical within 1 year). Those screened positive were tested with spirometry to diagnose COPD on having post bronchodilator FEV1/FVC <0.7. The COPD subjects were then applied with COPD assessment test (CAT). **Results:** Out of 6255 subjects residing in the villages, 1984 subjects belonged to the target age group and 51.56% (1013 of 1984) of them qualified for spirometry which was possible in 953 (88.81%) of them. COPD was identified in 166 (16.36%) of symptomatic individuals. The calculated prevalence of COPD was 2.65% in overall population and 8.367% in population above 40 years. The COPD patients (mean age 59.77 ± 9.47 years) had a male preponderance (120 [72.29%] of 166). They were mostly malnourished (body mass index = 17.15 ± 2.97), with poorhealth status (CAT = 15) and moderate degree (GOLD category-II) of airflow limitation showing FEV1/FVC as 0.60 ± 0.07 and the mean post bronchodilator FEV1 as 52% of predicted (1.26 ± 0.42 L). Most of the sufferers (74.09%) were either active (*n* = 88) or ex-smokers (*n* = 35) (>10 pack-years). The nonsmokers constituted 25, 90% (*n* = 43). **Conclusion:** The rural COPD prevalence in Bengal is far higher than the estimated national average with the health status of the sufferers been poor.

KEY WORDS: Chronic obstructive pulmonary disease, health status, rural prevalence

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a globally rising noncommunicable malady with significant morbidity and mortality. The disease develops mostly from chronic exposure noxious gases in genetically susceptible individuals.[1] COPD stands as the fifth driving reason for death worldwide[2] and been projected to occupy the third causal position for mortality by 2030. In India, the epidemiological projections of COPD are showing rising trend with the situation in the rural hinterland being poorly addressed both in terms of accessing the status of the situation as well as the interventions to tackle the diseases.[3] Active or passive smoking, or exposure to air pollution or biomass smoke or occupational dusts and chemicals are the main causes of COPD.[4] The diagnosis of COPD is made by demonstration of airflow limitation with spirometry (FEV1/FVC <0.7),[5] and spirometric information has

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helped to expose many cases that remained undiagnosed.[6] COPD may remain an undiagnosed or a delayed-diagnosed for the fact that people often remain either ignorant of the early symptoms or they tend to ignore them.[7] The available prevalence of the disease, thus, appears to be an underestimation[4] especially because the use of the varied diagnostic parameters, some of which often not even validated, and are frequently exclusive of spirometry.[8] Incidentally, in India, the rural epidemiology is neglected or rarely done with spirometry-based documentation of COPD while the majority of the population resides in the rural areas. The present manuscript deals with an effort to compensate the deficiency of information regarding the rural prevalence of COPD in the country. The authors here have also adopted a pragmatic strategy and adjoined an appraisal of the health status of these rural COPD patients.

MATERIALS AND METHODS

The study, been approved by the institutional ethics committee, was conducted in assistance with the West Bengal Liver Foundation (WBLF), another research and benevolent organization working in the same geographical area. We integrated the job as a part of the project to look for the impact on single-point intensive education and training intervention in the rural COPD population.[9] We selected eight interested and capable volunteers first following an interactive session with a batch of 24 volunteers of the WBLF. These volunteers were the pivotal manpower in accomplishment of the project. The formal selection of the villages for the survey was made as per the as per the operational feasibility of the volunteers. Thus, six villages from the Rajnagar block (Aligar, Babanipur, Chandrapur, Ganeshpur, Gobra, Ranigram) and one village from the Mayureswar block (Krishnanagar) were selected for convenience as the volunteers belonged to those villages.

Following the selection of the volunteers, who happened to be local unqualified practitioners, we trained them regarding spirometry (through the certification course of the Indian Chest Society), (b) systematic population-based data collection from door to door in a village, (c) filling up the basic data record form, (d) doing electrocardiography independently, (e) other necessary issues that appeared essential as using internet to exchange data with the center and getting chest X-rays done transporting the patients in a group to the nearest town. The volunteers were also trained to assist in collecting response from the patients about their health status through COPD assessment test (CAT) (validated Bengali version). One of the senior volunteers with previous experience of epidemiological data collection was entrusted with the responsibility to supervise the rest of the manpower involved. He was trained to check the adherence to the protocol by the others in performing the job, to communicate with the Institute and the PI regularly, and to send the data (especially spirometric, and Electrocardiography (EGC)) for the quality check. In addition, the overall performance and the quality-control were checked by a resource person deputed from the Institute to stay at the locality during those days of performance in the villages.

The information about the population was gathered from the census report (2011) published by the Union government.[10] The volunteers marked the individual houses systematically to record the details of the residents under the name of the family heads.

Thereafter, the people with age between 40 and 75 years were applied with a simple questionnaire asking a few questions on the common respiratory symptoms (active or history of presence in the preceding one year) as shortness of breath, cough, expectoration, chest pain, wheeze, and hemoptysis.

All positive responders were then assessed with spirometry following the American Thoracic Society guideline[11] at their villages by the skilled volunteers cum technicians. Each of the spirometry was sent to the experts at Kolkata through internet for authentication of acceptability and reproducibility. The test was repeated whenever required as felt necessary by the investigators.

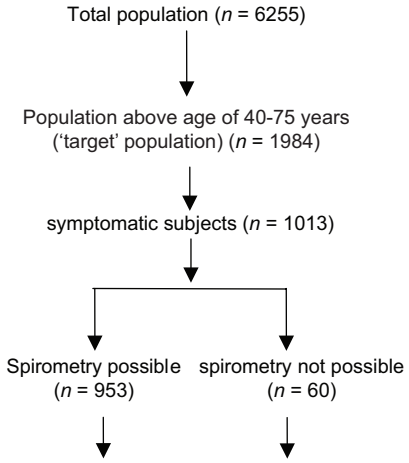
COPD patients were diagnosed from those spirometry results on basis of criteria of postbronchodilator FEV1/FVC <0.70and FEV1 <80% of predicted laid out by the GOLD guideline.[4] All these subjects of COPD were further assessed with chest X-ray (PA view), to rule out any other concomitant lung pathology and assessment of their health status was performed through use of CAT scoring.[12]

RESULTS

We had recorded a total population of 6255 with 1984 (31.72%) of them being adults in the selected age group of 40–75 years. Among them 1013 (51.06%) had a positive response for respiratory symptoms [Table 1] We could manage to complete spirometry in 953 (i.e., 94.08%) of these symptomatic adult population. The reason for nonperformance of spirometry (60 patients; 5.92%) were also noted [Table 1; 17 could not perform spirometry, 19 were not available as they moved outside the villages during the study period and the rest (n = 24) declined to participate]. COPD was diagnosed 166 subjects from the screened population [Table 1].

Thus, the calculated prevalence of COPD came out to be 26.539 per 1000 population (166 cases in a population of 6255). The same turned out to be 83, 67 per 1000 population for belonging to the age of 40–75 years in our survey. Concomitant to the diagnosis of COPD, these subjects did not show any significant associated respiratory ailment on chest X-ray (PA view) and clinical examination. The lung function status and the details of the demographic features are shown in Table 2.

Table 1: The table elaborates the details of the population been looked for the symptoms, investigated with spirometry, and diagnosed COPD in the seven selected villages. (PFT not possible: unwilling- 24, not-available-19, and cannot perform properly- 17)



	Population	Age>40 and <75 years	Positive respiratory symptoms	Spirometry done	Spirometry not possible	COPD Identified	Prev. in symptomatic subjects
Peruli	609	237	99	94	5	14	5.9
Khurigarh	680	213	128	122	6	25	11.7
Aligarh	530	153	104	104	0	16	10.45
Ranigram	646	192	91	91	0	30	15.62
Chandrapur	1049	361	153	147	6	26	7.20
Ganeshpur	1021	323	132	112	20	21	6.5
Bonbataspur	1720	505	306	283	23	34	6.73
	6255	1984	1013	953	60	166	8.367
% of COPD	2.654	8.367	16.3877	17.419			

DISCUSSION

In our study, the prevalence of COPD has been found to be 8.36% or 83.6 per 1000 adult population (>40 and <75 years). This figure is quite impressive and is far above the assessed national average of COPD as 4%–5% in adults.[13-15]

The demographic structures show that the mean age of the sufferers is about 60 years with obvious male preponderance and low nutritional status (mean body mass index of 17.15 ± 2.97). As regards the spirometric lung function values are concerned, the degree of airflow limitation is mostly moderate to severe [Table 2] with barely 70 ml of reversibility of FEV_1 and suggestion of airflow limitation in small airways evident from the reduction of FEF_{25-75}.[16] The mean CAT score of 15 is indicative of significantly compromised health status.[17] Another significant revelation is the wide variation of the prevalence between different villages [Table 1].

The prevalence of COPD differs from country to country and it depends on the surveyed population and also the technique of diagnosis. There seems to be an extensive variation in the prevalence of COPD in different studies; it ranges from 2%–22% in men to 1.2%–19% in women.[18] The disease can remain completely un-diagnosed from self-reporting and make itself evident only on spirometric evaluation although both seem to unveil its presence in a higher proportion with advanced age.[19]

Since the 1960s, several authors in India have derived different prevalence rate without any uniform diagnostic criteria or method of estimation without including spirometry to determine the prevalence.[15,20-22] In the initial studies (in 60s), the diagnosis was based on interview and radiological assessments. Subsequently, questionnaire-based diagnoses along with symptom analysis were done later in 90s and beyond. The bulk and the variety of the population pose difficulty in making proper prevalence studies in India. In two publications on collected series of studies, it is suggested that 5% of the adults could have been affected by COPD.[13] The disease is found higher in smokers, males and in inhabitants of rural areas depending on the socioeconomic status and the type of domestic fuel been used. Of late, several spirometry based cross-sectional studies have been published over last one decade.[23-25]

The first multi-centric study was published in 2006[15] that included a total of 35,295 subjects from four cities as Bengaluru, Chandigarh, Kanpur, and Delhi and the overall prevalence was reported as 4.1/100 population. The disease, however, appeared most prevalent in lower socioeconomic class. The first systematic review on the prevalence of COPD in India was published in 2012; the

Table 2: The table elaborates the demographic characteristics and the spirometric status of the participants; the "pre-BD" and "post-BD" means pre and post bronchodilator states and "% predicted" means the percentage of the predicted value

Number	166			
Mean Age	59.77±9.47 years			
M:F	120:46			
Mean Height (centimetre)	156±9			
Mean Weight (kilograms)	42±9			
Mean BMI	17.15±2.97			
Spirometry Parameters ⇩	**Pre BD**		**Post BD**	
	Absolute value (mean±SD)	**% predicted**	**Absolute value (mean±SD)**	**% predicted**
FEV1/FVC	59±8		60±7	
FEV1(Litre)	1.19±0.41	49	1.26±0.42	52
FVC (Litre)	1.99±0.57	62	2.05±0.56	65
FEF25-75 (Litre/ min)	0.63±0.28	24	0.69±0.31	26
CAT score (mean±SD)	15.06±10.25(95% CI 13.05-17.08)			

authors estimated the prevalence of COPD between 6.5% and 7.7% in adults.[7] The prevalence of COPD varies between the urban and rural population and also on the strategy of detection. Spirometry is the most objective way to identify COPD. In a spirometry based survey the sensitivity and specificity of a questionnaire was found to be 52.5% and 87.6% respectively to detect COPD.[26] The questionnaire was applied to population aged above 45 years of two villages (n = 900) in Mysore where the overall prevalence of COPD was 7.1% (males-11.1 and females-4.5%).[27] Our effort has been more in-depth to pick up COPD based on spirometry in symptomatic population. It reveals that the estimated prevalence of COPD (8.367%) has been over double fold the estimated national average of 4.1%.[6] People have noticed that in another publication few authors found the-risk of COPD is 3.2 times higher in Biomass fuel inhaled smokers than nonsmoker LPG user.[15]

Of late, a meta-analysis with eight identified studies, (pooled sample of 8,569 individuals), revealed an estimated prevalence as 7.4% (95% confidence interval [CI]: 5.0%–9.8%); the prevalence was found higher in males and more in urban areas and in the northern region of the country.[28] Our result shows a higher prevalence than been derived at the meta-analysis.

The incorporation of the CAT score in the assessment beyond spirometry in our study has made it exceptional and more valuable. CAT is a validated tool to assess the health status of the COPD subjects.[12] The high CAT score of 15.06 (95% CI 13.05–17.08) suggests poor health status which was subsequently found largely amenable to proper pharmacotherapy and supervised sustained practice of simple exercises and other behavioral interventions with adherence to medication.[9] An additional radiological assessment is likewise interesting as tuberculosis and lung infections can frequently have obstructive airway pattern in spirometry. Hence, excluding them to select unmixed COPD is a better exercise from epidemiological point of view. Incidentally, none of the patients of ours had radiological clue for tuberculosis. Another operational beauty of our work is related to the training of the rural practitioners and utilizing them for the purpose of the study. In fact, the training of workforce is one of the most important issues in diagnosing COPD at the primary health care level and this point has been stressed by the authors of the meta-analysis. Our endeavor can act as a role model as regards effective human resource mobilization for many such public health-related epidemiological and operational research in the developing world.

There are several weaknesses of the study. The noninclusion of biomass smoke related information has been a serious omission. It is noted that that nonsmoking causes play very significantly in the development of COPD in India.[28] It is possible that nonsmoking causes could have augmented the development of COPD and contributed to the severity of the disease in many of our subjects. Again, it is possible that a few patients may have escaped the evaluation as being asymptomatic since the rural people could be less sensitive to recognize early symptoms. This could have been avoided by performing spirometry universally which was not possible. Some of those who were sick enough to be unable to join the protocol could have COPD concomitant to other diseases. It remains important to explore the wide variation in prevalence between the different villages [5.9%–15.6% of the symptomatic adults; see Table 1]; a more detailed and in depth investigation is warranted to unearth the reasons behind that. Some of the villages had some ethnic and religious preponderance; they might have influenced such difference. Further, we do not have any information regarding the functional ability, comorbidities, exacerbation rate, and financial burden of the disease. It will be interesting to study the impact of socioeconomic, lifestyle, and cultural aspects separately to see their role in COPD as the disease appear differently in different villages with different ethnic inhabitants.

Future directions

The study encourages looking for further details of the rural COPD patients including their etiological and functional factors, history of exacerbations, logistic issues related to the access to treatment, and impact of the disease on their livelihood. A systematic survey may help to prevent and alleviate the suffering of the rural patients of COPD. The study also points toward the need of consorted research and innovations to prevent and tackle COPD in the country.

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Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Vestbo J, Hurd SS, Agustí AG, Jones PW, Vogelmeier C, Anzueto A, *et al*. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. Am J Respir Crit Care Med 2013;187:347-65.
2. Kassa M, Grace J. The global burden and perspectives on Non-Communicable Diseases (NCDs) and the prevention, data availability and systems approach of NCDs in low-resource countries. In: Public Health in Developing Countries-Challenges and Opportunities. London, UK: Intech Open; 2019. [doi: 10.5772/intechopen. 89516].
3. Bhome AB. COPD in India: Iceberg or volcano? J Thorac Dis 2012;4:298-309.
4. Salvi SS, Manap R, Beasley R. Understanding the true burden of COPD: The epidemiological challenges. Prim Care Respir J 2012;21:249-51.
5. Rabe KF, Hurd S, Anzueto A, Barnes PJ, Buist SA, Calverley P, *et al*. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary: Updated consensus guidelines for the diagnosis, management and prevention of COPD. Am J RespirCrit Care Med 2007;176:532-55.
6. Diab N, Gershon AS, Sin DD, Tan WC, Bourbeau J, Boulet LP, *et al*. Underdiagnosis and overdiagnosis of chronic obstructive pulmonary disease. Am J Respir Crit Care Med 2018;198:1130-9.
7. Walters JA, Hansen EC, Walters EH, Wood-Baker R. Under-diagnosis of chronic obstructive pulmonary disease: A qualitative study in primary care. Respir Med 2008;102:738-43.
8. McKay AJ, Mahesh PA, Fordham JZ, Majeed A. Prevalence of COPD in India: A systematic review. Prim Care Respir J 2012;21:313-21.
9. Bhattacharyya P, Ghosh R, Saha D, Chakraborty B, Bhattacharyya P, Sarma M, *et al*. The impact on health status in short- and long-terms of a novel and non-orthodox real-world COPD rehabilitation effort in rural India: An appraisal. Int J Chron Obstruct Pulmon Dis 2018;13:3313-9.
10. Census of India 2011; West Bengal. Series 20, Part XII-A, District Census Handbook, Birbhum, Village and Town Directory. Directorate of Census Operations West Bengal. 2015. Available from: https://censusindia.gov.in/2011census/dchb/DCHB_A/19/1908_PART_A_DCHB_BIRBHUM.pdf.
11. Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, *et al*. American Thoracic Society/European Respiratory Society task force: Standardization of spirometry. Eur Respir J 2005;26:319-38.
12. Jones PW, Harding G, Berry P, Wiklund I, Chen WH, Kline Leidy N. Development and first validation of the COPD Assessment Test. Eur Respir J 2009;34:648-54.
13. Jindal SK. Emergence of chronic obstructive pulmonary disease as an epidemic in India. Indian J Med Res 2006;124:619-30.
14. Jindal SK, Aggarwal AN, Gupta D, Agarwal R, Kumar R, Kaur T, *et al*. Indian study on epidemiology of asthma, respiratory symptoms and chronic bronchitis in adults (INSEARCH). Int J Tuberc Lung Dis 2012;16:1270-7.
15. Salvi S, Juvekar S, Londhe J, Brashier B, Madas S, Barnes PJ. Prevalence of COPD in a rural population in India. Eur Respir J 2011;38:2954.
16. McFadden ER Jr., Linden DA. A reduction in maximum mid-expiratory flow rate. A spirographic manifestation of small airway disease. Am J Med 1972;52:725-37.
17. Ghobadi H, Ahari SS, Kameli A, Lari SM. The relationship between COPD Assessment Test (CAT) scores and severity of airflow obstruction in stable COPD patients. Tanaffos 2012;11:22-6.
18. Jindal SK, Aggarwal AN, Gupta D. A review of population studies from India to estimate national burden of chronic obstructive pulmonary disease and its association with smoking. Indian J Chest Dis Allied Sci 2001;43:139-47.
19. Murray CJ, Lopez AD. Evidence-based health policy – Lessons from the global burden of disease study. Science 1996;274:740-3.
20. Jindal SK. A field study on follow up at 10 years of prevalence of chronic obstructive pulmonary disease & peak expiratory flow rate. Indian J Med Res 1993;98:20-6.
21. Jindal SK, Aggarwal AN, Chaudhry K, Chhabra SK, D'Souza GA, Gupta D, *et al*. A multicentric study on epidemiology of chronic obstructive pulmonary disease and its relationship with tobacco smoking and environmental tobacco smoke exposure. Indian J Chest Dis Allied Sci 2006;48:23-9.
22. Viswanathan K, Rakesh PS, Balakrishnan S, Shanavas A, Dharman V. Prevalence of chronic respiratory diseases from a rural area in Kerala, southern India. Indian J Tuberc 2018;65:48-51.
23. Rajavel S, Raghav P, Gupta MK, Muralidhar V. Silico-tuberculosis, silicosis and other respiratory morbidities among sandstone mine workers in Rajasthan – A cross-sectional study. PLoS One 2020;15:e0230574.
24. Christopher DJ, Oommen AM, George K, Shankar D, Agrawal A, Thangakunam B. Prevalence of airflow obstruction as measured by spirometry, in rural southern Indian adults. COPD 2020;17:128-35.
25. Koul PA, Hakim NA, Malik SA, Khan UH, Patel J, Gnatiuc L, *et al*. Prevalence of chronic airflow limitation in Kashmir, North India: Results from the BOLD study. Int J Tuberc Lung Dis 2016;20:1399-404.
26. Mahesh PA, Jayaraj BS, Prahlad ST, Chaya SK, Prabhakar AK, Agarwal AN, *et al*. Validation of a structured questionnaire for COPD and prevalence of COPD in rural area of Mysore: A pilot study. Lung India 2009;26:63-9.
27. Daniel RA, Aggarwal P, Kalaivani M, Gupta SK. Prevalence of chronic obstructive pulmonary disease in India: A systematic review and meta-analysis. Lung India 2021;38:506-13.
28. Mahmood T, Singh RK, Kant S, Shukla AD, Chandra A, Srivastava RK. Prevalence and etiological profile of chronic obstructive pulmonary disease in nonsmokers. Lung India 2017;34:122-6.