Original Article

Physical, Psycho-social and Economic Burden of Chronic Obstructive Pulmonary Disease: A Hospital-Based Study in Kolkata, West Bengal, India

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This article is available on www.vpci.org.in

ARTICLE INFO

Received: January 8, 2020

Accepted after revision: October 20, 2020

Indian J Chest Dis Allied Sci 2021;63:81-88

KEY WORDS

Psycho-social, Economic burden, COPD.

ABBRIVATIONS USED IN THIS ARTICLE

COPD = Chronic Obstructive Pulmonary Disease

CAT = COPD Assessment Test

FEV_1 = Forced Expiratory Volume in First Second

IQR = Interquartile Range

OPD = Out-Patient Department

CI = Confidence Interval

FVC = Forced Vital Capacity

BPL = Below Poverty Line

Abstract

Objective. Chronic obstructive pulmonary disease (COPD) is a common chronic lung disease posing a huge challenge to the public health system of India. The present study was designed to assess the physical, psycho-social and economic burden of COPD depending on severity of airflow limitation.

Methods. A cross-sectional, hospital-based study was done among 200 patients diagnosed with COPD attending a tertiary care hospital in Kolkata, West Bengal. COPD Assessment Test (CAT) questionnaire and modified British Medical Research Council Questionnaire were used to assess the physical burden of COPD on daily life and severity of the breathlessness. Psycho-social and economic burden were assessed with a structured, validated questionnaire.

Results. Nearly half (46%) had severe or very severe airflow limitation as per predicted forced expiratory volume in the first second (FEV_1). Severity of dyspnoea and CAT score increased linearly with the severity of the airflow limitation. In last 30 days, proportion of patients needing support in self-care and chores were 28% and 51%, respectively. Median (± interquartile range [IQR]) direct and indirect cost of managing COPD were Indian rupee (INR) 319.5 (± 55.0) and 49.5 (± 600.0), respectively. A considerable proportion (87%) of patients took recourse to different cost-cutting measures. Physical, psycho-social and economic burden had significant association with severity of airflow limitation.

Conclusion. In our study, COPD had a staggering physical, psycho-social and economic burden on patients and their families.

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Introduction

Chronic obstructive pulmonary disease (COPD) is a common illness related to airway and/or alveolar abnormalities, leading to airflow limitation and persistent respiratory symptoms.[1] The global prevalence of COPD is estimated to be about 11.7%; (95% confidence interval [CI], 8.4% to 15%) according to some large epidemiological studies.[2] COPD accounts for about 6% of all cause mortality globally and is projected to become the third leading cause of mortality.[1] Emphysema and chronic bronchitis are clinically grouped together and referred as COPD. The main hallmark of the entity is the presence of irreversible airflow limitation. Tobacco smoke, occupational exposure to dust (coal, silica etc), indoor air pollution, recurrent lungs infection and low socio-economic status are associated with the development of COPD.[1,2]

Chronic obstructive pulmonary disease is a major public health problem worldwide contributing to more than 30 lakh deaths in 2005. It is estimated to be the third most important cause of death worldwide by 2020.[2,3] Likewise, Indian studies have also observed that COPD is a significant public health problem.[4,5] As COPD involves a gradual and progressive decline in lung function, it results in increased breathlessness and reduced ability to perform daily activities. COPD includes a range of symptoms of varying severity and limits the ability to work, impairs household chores, family and social activities.[2,6,7] In a European study, 33% to 50% patients with COPD reported that their day-to-day activities were significantly affected by the symptoms every day in the past week.[8] Psychological distress and mental health issues are also common in COPD patients.[2,6] The cost for the management of COPD includes direct cost of health-care as well as indirect costs in loss of wages of the patients and their care-givers. The cost of managing COPD is substantial and is projected to increase with time.[9] A study in India observed that around 30% of total annual income of the individual with COPD was spent on management of COPD.[4] There is a paucity of studies comprehensively assessing the burden of COPD in resource-limited settings, like India.[3,9] The present study was undertaken among the patients with diagnosed COPD attending the out-patient department (OPD) of chest medicine of a medical college in Kolkata, West Bengal, to assess the physical, psycho-social and economic burden of the disease, with different grades of airflow limitation.

Material and Methods

A cross-sectional, hospital-based study was conducted in a medical college in Kolkata, West Bengal over a period of two months (June-July 2018) after ethical clearance from the Institutional Ethics Committee. Patients attending Chest OPD with a diagnosis of COPD as per severity of airflow limitation by a pulmonologist were included in the study.

As there was lack of robust data of a study in a similar setting in our country, the objective was to select highest optimum sample size for a pre-defined precision, proportion of patients experiencing burden of COPD. Considering 95% confidence interval (CI) and absolute precision of 0.5, the sample size was calculated as 192, which was rounded off to 200 subjects. Twenty days were used to collect data and the dates of data collection were selected randomly from the OPD days in the study period. Based on the estimated number of COPD patients attending chest OPD for the day, systematic random sampling was used to select ten persons per day for interview.

After obtaining written informed consent from each participant, the patients interviewed in the OPD in a separate chamber maintaining privacy using a pre-designed structured questionnaire. The questionnaire had four sections:

1. The first section was for collecting socio-demographic, economic and individual characteristics of the patients along with relevant information regarding COPD, like age, gender, caste, religion, education, occupation, socio-economic status, marital status, duration of diseases, smoking including passive smoking, indoor smoke exposure, fuel used for cooking, history of asthma including childhood asthma and severe chest infection in childhood.
2. The second section for collecting information regarding forced expiratory volume in first second (FEV_1), forced vital capacity (FVC) and age- and gender-matched predicted FEV_1% to confirm the diagnosis of COPD and to assess the severity of airflow limitation within last eight weeks. This was collected from the previous reports and records.
3. The third section consisted of validated COPD Assessment Test questionnaire and modified British Medical Research Council Questionnaire to assess the physical burden of COPD on daily life and severity of the breathlessness. The mMRC scale is a 5-item (0–4) scale that establishes dyspnoea severity in relation to various physical tasks. It is scored on a range of 0 (no dyspnoea or only with strenuous exertion) to 4 (dyspnoea at rest). CAT is a specific questionnaire for COPD that evaluates the physical burden of COPD due to not only dyspnoea; but also other respiratory symptoms, such as the presence and intensity of

cough or sputum. It has eight items, including exercise capacity, sleep and activities of daily life, producing a score of between 0 and 40; a higher score indicates a poorer state of health.

4. The fourth section was intended to assess the psycho-social burden of the disease. The psychological aspect included inability on number of days to perform self-care, household chores, restricted to bed feeling depressed or other mental traits in last 30 days. The economic burden aspects, like direct and indirect cost of care, presence or absence of financial stress in terms of debt, selling or mortgage of property, adopting cross-cutting measures in daily life were also recorded.

Total number of cost-saving measures adopted by the family to cope with financial stress include: (i) drop-out of any school-going children in the family, (ii) compulsion of any younger member to be involved in wage earning activities, (iii) cost-cutting measures in daily living and (iv) cost-cutting measures in social events. Each affirmative answer was given a score of '1' and a negative answer a score of '0'. The score range was 0-4. The amount of money incurred for diagnosis, fees, drugs, consumables, travel to- and from-health-care facilities were included in direct cost as out of pocket expenditure. The economic loss of the subjects and his/her relatives due to absence in job, cost of care-takers were included in the indirect cost.

The fourth section of the interview schedule was pre-tested among COPD patients before the study and assessed for understandability, appropriateness and acceptability. This portion of the schedule was also evaluated by five experts from pulmonology and public health to assess the validity.

Statistical Analysis

The data were analysed for consistency and completeness and entered in Microsoft Excel datasheet. Median (±interquartile range [IQR]) and percentages were used to present summary measures of quantitative and qualitative data. Kruskal-Wallis test, non-parametric test, was used to determine difference in physical, psycho-social and financial burden, based on the grades of severity of airflow limitation. A P-value of <0.05 was considered significant.

Results

A total of 200 COPD patients who attended chest OPD during study period were interviewed. Approximately half of the participants (46%) had severe or very severe airflow limitation (Table 1). Out of total respondents, 94% were males. Female patients had mostly mild or moderate airflow limitation. The mean age of the participants was 60.3±8.2 years and severity of the airflow limitation increased with age. Approximately, three-fourth (74%) of the study participants were current smokers, another 21% were reformed smokers; while only 5% patients were non-smokers.

The proportion of current smokers was lowest among those with predicted FEV_1 <30%. Majority of respondents (91%) were exposed to passive smoking regularly. However, exposure to indoor smoke was minimal (2%) among the study participants. It was observed that 11% patients had history of asthma including childhood asthma; while 41% had past history of severe chest infections in childhood.

Among the study subjects, one-fourth (25%) were manual workers, 23% worked in office or small business, 3% were executive or professionals, 6% were home-maker while 43% were either retired or unemployed. Almost half (47%) possessed below poverty line (BPL) cards. Majority of the study participants (90%) were married. Table 2 shows concurrence of grades of airflow limitation, measured with predicted FEV_1, with severity of dyspnoea that was assessed with mMRC questionnaire (Kappa = 0.826).

The median CAT score was 22.5 (±13.0 [IQR]) with a range from 8 to 35. Table 3 shows that the CAT score increased gradually with the severity of airflow limitation. The duration of physical illness was positively associated with severity of airflow limitation. Among the respondents, 28% needed support in self-care during last 30 days.

Table 1. Distribution of the study participants according to severity of airflow limitation based on predicted FEV_1 (N=200)

Predicted FEV_1	Airflow Limitation	N (%)	Age (Years) Mean (± SD)	Male N (%)	Current Smokers N (%)
FEV_1>80%	Mild	44 (22)	51.8±6.8	34 (77.3)	32 (72.7)
50%<FEV_1<80%	Moderate	64 (32)	57.8±5.3	62 (96.9)	58 (90.6)
30%<FEV_1<50%	Severe	52 (26)	63.6±4.5	52 (100)	38 (73.1)
FEV_1<30%	Very severe	40 (20)	69.3±5.4	40 (100)	20 (50)
Total		200 (100)	60.3±8.2	188 (94)	148 (74)

Similarly, 51% of the respondents required support for household chores during last 30 days. The number of days requiring support increased linearly with the predicted FEV_1 (Table 3). Almost one-fourth (26%) respondents were bed-ridden for at least one day in last 30 days. Proportion of respondents feeling sad or depressed at least once in last 30 days was 80% (Table 3) with the median number of days of feeling sad was 6.5 (±7.0 [IQR]) which was the highest among COPD patients with very severe airflow limitation. Among the study population, 35% were hospitalised for at least once in last 12 months.

While estimating the economic impact of COPD on the study participants according to severity of airflow limitation, it was observed that the median [IQR] direct cost for management of COPD in last 30 days was INR 319.5 (±55 [IQR]) with a range from INR 264 to 1310 (Table 4). Similarly, median indirect cost for the management of COPD was INR 49.5 (±600 [IQR]) with a range from INR 0 to 5003 in last 30 days.

Table 2. Agreement between air-flow limitation and severity of breathlessness according to modified MRC questionnaire

Modified MRC Questionnaire	Air-flow Limitation Based on Predicted FEV1				Total N (%)	Kappa (P value)
	Mild N (%)	Moderate N (%)	Severe N (%)	Very Severe N (%)		
No/ Mild dyspnoea	44 (81.5)	10 (18.5)	0	0	54 (100)	0.826 (< 0.001)
Moderate dyspnoea	0	52 (92.9)	4 (7.1)	0	56 (100)	
Severe dyspnoea	0	2 (4.2)	42 (87.5)	4 (8.3)	48 (100)	
Very severe dyspnoea	0	0	6 (14.3)	36 (85.7)	42 (100)	
Total	44 (22)	64 (32)	52 (26.0)	40 (2)	200 (100)	

Table 3. Physical and psycho-social burden of COPD according to the severity of airflow limitation

Variables	Statistics	Mild (N=44) FEV_1>80%	Moderate (N=64) 50%<FEV_1<80%	Severe (N=52) 30%<FEV_1<50%	Very severe (N=40) FEV_1<30%	Total (N=200)	KW-H (P value)
COPD Assessment Test	Median±IQR	10.5±3.0	21.0±4.0	27.0±3.0	33.0±2.0	22.5±13.0	180.21 (<0.001)
	Mean Rank	23.5	75.8	137.6	176.5		
Days Physically ill	Median±IQR	2.0±1.0	4.0±2.0	7.0±3.0	15.0±8.0	5.0±5.0	141.93 (<0.001)
	Mean Rank	35.9	77.9	126.5	174.0		
Hospitalisation in last 12 months	Median±IQR	0.0±0.0	0.0±0.0	1.0±1.0	2.0±1.0	0.0±1.0	142.52 (<0.001)
	Mean Rank	63.5	70.9	108.5	176.0		
Days need help in self-care	Median±IQR	0.0±0.0	0.0±2.0	2.0±3.0	7.0±5.0	0.0±2.0	107.01 (<0.001)
	Mean Rank	55.8	83.4	104.6	171.7		
Days need help in chores	Median±IQR	0.0±0.0	0.0±2.0	3.0±2.0	7.0±5.0	1.0±4.0	140.68 (<0.001)
	Mean Rank	46.5	70.9	117.2	171.3		
Days bed-ridden	Median±IQR	0.0±0.0	0.0±0.0	0.0±2.0	4.0±4.0	0.0±1.75	98.07 (<0.001)
	Mean Rank	74.5	80.2	102.2	159.4		
Days feeling sad	Median±IQR	3.0±5.0	5.0±1.0	7.0±3.0	20.0±7.0	6.5±7.0	128.62 (<0.001)
	Mean Rank	34.0	62.9	104.2	150.1		

Nearly half of the patients did not report any indirect cost. It was observed that 23% was in debt with range of INR 0 to 5000.

Eighty-seven per cent families resorted to cost cutting measures, like drop-out of school-going children, involvement of younger member in wage earning, cost-cutting in daily living or social events. with the median (± IQR) number of measures of 2(± 2). More than two-thirds (70.6%) of the wage-earners remained absent from their jobs for at least one day in last 30 days. Almost a month (≥24 days) of the absence per annum was reported by nearly one-fourth of the wage earners.

The amount of direct and indirect cost of managing COPD, depleted savings, amount of debt, number of cost-cutting measures adopted and the duration of absence in job increased proportionately with the severity of airflow limitation (Table 4).

For objective assessment and to avoid 'wish bias' of the participants, the socio-economic status was measured by possession of BPL cards. Although the proportion of severe and very severe disease in respect to airflow limitation, dyspnoea and CAT score was higher among persons having BPL card, the difference in proportion was not significant (Table 5).

Discussion

Chronic obstructive pulmonary disease represents an important public health challenge and is a major cause of chronic morbidity and mortality throughout the world. COPD has a debilitating effect on the quality of daily life in the form of limitation of work capacity, routine daily activity, sleep patterns and social activity which leads to indirect economic burden on the patient.[10]

It was observed in the present study that majority of the COPD patients who sought treatment had moderate to severe airflow limitation and only a small proportion attended the health-care facility in the earlier grades of airflow limitation. This was corroborative with a study in Russian Federation which stated that up to 53% of the patients had severe or very severe COPD.[11] The results were also corroborated with the studies conducted in Kerala and Delhi.[12-13] Similar findings were also noted by Lipinska and Kuna from Poland.[14] However, in a study from Spain by Izquierdo *et al*[7], it was noted that only around one-fourth had severe or very severe airflow limitation.

In the present study, it was noted that more than three-fourth participants had moderate to severe or very severe breathlessness as per mMRC questionnaire.

Table 4. Socio-economic burden of COPD according to the severity of airflow limitation

Variables	Statistics	Mild (N=44) FEV_1>80%)	Moderate (N=64) 50%<FEV_1<80%	Severe (N=52) 30%<FEV_1<50%	Very severe (N=40) FEV_1<30%	Total (N=200)	KW-H (P value)
Direct cost (Rs)	Median±IQR	296.0±54.5	317.0±48.8	312.0±45.0	710.0±675.5	319.5±55.0	52.26
	Mean Rank	73.7	86.3	83.3	157.4		(<0.001)
Indirect Cost (Rs)	Median±IQR	0.0±187.5	275.0±500.0	0.0±425.8	1103.0±1527.5	49.5±600.0	57.17
	Mean Rank	70.9	100.0	84.8	154.4		(<0.001)
Saving decayed (Rs)	Median±IQR	0.0±0.0	0.0±200.0	99.0±500.0	800.0±500.0	99.0±500.0	81.14
	Mean Rank	60.6	82.2	108.8	163.0		(<0.001)
Debt (Rs)	Median±IQR	0.0±0.0	0.0±0.0	0.0±0.0	299.5±1000.0	0.0±0.0	64.10
	Mean Rank	85.9	86.78	92.8	148.5		(<0.001)
Number of cost-cutting measures*	Median±IQR	1.0±1.0	2.0±1.0	2.0±1.0	3.0±1.0	2.0±2.0	80.82
	Mean Rank	48.7	88.0	123.4	147.7		(<0.001)
Days absent in job #	Median±IQR	1.0±1.0 (n =34)	1.0±1.0 (n = 46)	2.0±3.0 (n = 16)	7.0±15.0 (n=6)	1.0±2.0 (n=102)	22.12 (<0.001)
	Mean Rank	34.2	56.0	67.6	72.2		

* Total number of cost-cutting measured adopted by the family out of (1) drop-out of any school-going children in the family, (2) compulsion of any younger member to be involved in wage earning activities, (3) cost-cutting measures in daily living and (4) cost-cutting measures in social events

Excluding those who are not involved in any wage earning activities

Table 5. Association of socio-economic status with airflow limitation, grades of dyspnoea and CAT score

Possession of BPL Card	Airflow Limitation				Total N (%)	P value
	Mild N (%)	Moderate N (%)	Severe N (%)	Very Severe N (%)		
No	26 (24.5)	34 (32.1)	28 (26.4)	18 (17.0)	106 (100)	1.698 (0.637)
Yes	18 (19.1)	30 (31.9)	24 (25.5)	22 (23.4)	94 (100)	
Total	44 (22)	64 (32)	52 (26)	40 (20)	200 (100)	
			Grade of Dyspnoea			
	No or mild No (%)	Moderate No (%)	Severe No (%)	Very Severe No (%)	Total No (%)	
No	32 (30.2)	32 (30.2)	24 (22.6)	18 (17)	106 (100)	3.733 (0.443)
Yes	22 (23.4)	24 (25.5)	24 (25.5)	24 (25.5)	94 (100)	
Total	54 (27)	56 (28)	48 (24)	42 (21)	200 (100)	
			CAT Grade			
	Low	Medium	High	Very High	Total	
No	4 (3.8)	40 (37.7)	48 (45.3)	14 (13.2)	106 (100)	3.342 (0.342)
Yes	6 (6.4)	30 (31.9)	38 (40.4)	20 (21.3)	94 (100)	
Total	10 (5)	70 (35)	86 (43)	34 (17)	200 (100)	

Similar findings from United Kingdom were observed by Mullerova *et al.*[15] However, Izquierdo *et al*[7] from Spain reported that around one-sixth had severe or very severe breathlessness and in South Korea, Kim *et al*[16] reported that more than 60% patients had no symptoms or minimal breathlessness.

The CAT questionnaire reflects the effects of the disease on the patient's health. Based on this, it was found that more than half of respondents had high or very high physical burden of COPD; while around one-third respondents have medium physical burden of COPD on their daily life. Similar findings from Iran were reported by Ghobadi *et al*[17] Almost one-third COPD patients in a study in South Korea had high to very high physical burden of the disease as per CAT score and almost another one-third had medium burden, while the mean score was lower than the present study.[16] As reported by Brien *et al*[18], almost half of the COPD patients had high/ very high physical burden of COPD, as evident from CAT score.

Both mMRC and CAT score showed significant correlation with the severity of airflow limitation in the present study. This finding was corroborated by the earlier findings of Kim *et al*[14] and Ghobadi *et al.*[17] Shavro *et al*[12] in Kerala found significant correlation of airflow limitation with mMRC score as well as other indices of health-related quality-of-life. Corroborating the findings of Ghobadi *et al*[17], the present study reported dose-response relationship between airflow limitation and CAT score.

Physical activities of the COPD patients including self-care were grossly worsened with the severity of the disease.[19,20] In the present study, almost one-third participants needed support for self care and around half needed it for doing household chores. While nearly one-fourth reported a period restricted to bed in last 30 days, considerable proportion felt sad and helpless and the stint of sadness, in half of the patients, extended to approximately 80 days in a year. All these figures depicted the severe psycho-social burden of COPD. Biswas *et al*[21] reported high prevalence of depression and anxiety among COPD patients. Similar observations have been reported from other countries as well.[7, 22]

Chronic obstructive pulmonary disease imposes a huge financial burden on the patients, their families and the country. The cost incurred is proportionally increased with the severity of the disease and the number of hospitalisations required.[23] In spite of the fact that the government hospitals provided free diagnostic facilities and certain medicines as well as doctor's consultation at INR 2 only to all patients, the median out-of-pocket expenditure for treatment of COPD was around INR 4000 per annum. A considerable amount of indirect cost further increased

the burden. This is also corroborative with the study conducted in Vadodara.[11] Huge financial stress of COPD was also reported from other countries.[24]

Chronic obstructive pulmonary disease was reported by individuals to have a significant impact on their productivity and ability to undertake daily work, and was a limitation to their life-style choices.[25-27] Around one-fourth of those who were in regular job, lost almost a month's salary per annum due to absence from job. An earlier study reported average loss of work days per patient to be 16.5 days per year.[11] Ding *et al*[25] also reported severity of symptoms of COPD, as defined by CAT score, was significantly associated with the absence in job or impairment of work time as well as total activity impairment. This was also corroborative with a study on Dutch population and Bulgarian COPD patients.[26,27] In the present study, nearly half of the study participants were not involved in wage earning activities currently. Among those who were regular wage earners, more than two-thirds remained absent in the job for varying duration due to the disease burden. This reduced the family income and further increases the economic burden over the other family members. A considerable proportion spent their savings, borrowed money or resorted to other cost-cutting measures to cope with the financial stress of COPD. These coping behaviours to chronic illness are common in resource-constrained settings across the world.[28,29]

The proportion of severe to very severe disease in terms of airflow limitation, dyspnoea and CAT score was high among persons possessing BPL card. Reporting late to health-care facility by the persons having BPL card due to resource constraint may be a very important reason for the same.[30]

The major limitation of the present study includes subjects of the study were selected from one tertiary care government hospital and were not representative of COPD patients in the community. All the parameters were assessed on the same time frame and the temporality could not be established. Although the recall period was limited to 30 days, some amount of error in recalling the facts and figures could not be ruled out.

In spite of these limitations, *to the best of our knowledge*, this was probably the first study from eastern India which comprehensibly assessed the physical, psycho-social and financial burden of COPD among patients attending a tertiary care government hospital.

Conclusions

Majority of patients with COPD in the present study had severe and very severe airflow limitation. Although there was variability in perception of symptoms in mMRC score of dyspnoea and the COPD Assessment Test, the overall physical burden of COPD was pervasive. A considerable proportion of COPD patients needed frequent support for self-care or household chores and reported absence in wage earning activities. Majority of the participants felt sad and helpless and that too frequently. In spite of availability of free treatment in public hospitals, the amount of average direct and indirect cost for managing COPD was considerable in Indian context. COPD progressively compromises the patients' ability to function optimally in terms of their physical, psychological and socio-economic dimensions of health and the present study put forward evidences in support of it.

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