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Study of Economic Burden and Health Care Resource Utilization by Chronic Obstructive Pulmonary Disease Patients in a Tertiary Care Hospital in Western India

Meenakshi Shah[1], Varsha Godbole[2], Tejas K Patel[3], Tejas R Patel[4]

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Author's Affiliation:
[1]Associate Professor, Dept of Medicine; [2]Professor, Dept of Medicine; [3]Asst Prof, Dept of Pharmacology; [4]Resident, Dept of Medidicne, GMERS Medical College, Vadodara

Correspondence
Meenakshi Shah
drmeenakshi30@yahoo.com

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ABSTRACT

Introduction: Chronic obstructive pulmonary disease (COPD) is a leading cause of death and disability worldwide and accounts for a huge financial burden on health care resources. This study was done over a one year period to determine the cost burden due to COPD, demographic profile and different treatment protocols.

Methods: This cross sectional study included data from 200 patients diagnosed with COPD. This included the data for emergency visits, hospitalization, daily medications used and the costs incurred by the patients. In addition indirect cost burden for work days lost were also calculated.

Results: The average OPD visits per patient per year were 11.32. Emergency room visits were required for almost 50% of the patients. Average admission rate was 1.45 per patient per year. The mean costs incurred per COPD patient per year was Rs. 5654.16 in government set up and Rs. 35,290.28 for private setup. Average loss of work days per patient was 16.45 days per year.

Conclusions: COPD is a huge economic burden to the society. Major costs incurred are due to recurrent hospital admissions for exacerbations. Early diagnosis and proper treatment can significantly reduce the economic burden of the disease and help in efficient utilization of health care resources.

Key words: COPD, Economic burden, Hospitalization, Medications, Costs

INTRODUCTION

COPD is defined differently by clinicians, pathologists and epidemiologists using different criteria base on symptoms, physiological impairment and pathological abnormalities. It is characterized by persistent airflow limitation not substantially reversed by bronchodilators.[1]

US National Heart Lung Institute and WHO have published Global Initiative for Chronic Obstructive Lung Disease (GOLD) report in 2001, updated in 2003.[2] GOLD had provided comprehensive guidelines for management of COPD and includes four main components which include assessment and monitoring, reduction of risk factors, management of stable COPD as well as of exacerbations.[2]

COPD is currently the seventh leading cause of death and disability worldwide and is expected to rise to fifth position by 2020.[3,4,5,6,7] Asian and African countries are expected to see a dramatic rise in morbidity and mortality from COPD in next two decades because of increasing prevalence of smoking and increased life expectancy.[8] Biomass fuel causes indoor air pollution and is an additional risk factor in our country. Other risk factors include air pollution, occupational dust and a history of respiratory infections in childhood.[9] 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. The whopping direct costs are accounted for by

emergency hospital visits and admissions for COPD exacerbation and medications for chronic use.[10,11] Frequent association of comorbid conditions with COPD also adds to the cost.[12] This study was undertaken to determine the direct and indirect cost burden due to COPD in a government tertiary care hospital in Western India. This data can help plan optimal use of health care resources.

MATERIAL AND METHODS

This cross sectional study included already diagnosed COPD patients on treatment, attending either outpatient department or admitted in the GMERS Medical College and Hospital, Vadodara, Gujarat. The study duration was of one year, from August 2105 to July 2016. A total of 200 adult patients were enrolled and a detailed history of their illness in the previous one year from the time of first contact with the patient was evaluated. Persons having other respiratory conditions like asthma, interstitial lung disease, pulmonary hypertension, and tuberculosis and lung malignancy were excluded. The evaluation included details of duration of symptoms, risk factors, co-morbid conditions, treatment details and the number of routine follow-up visits, emergency room visits(less than 12 hours stay) and the total number of indoor admission in the previous one year. Details of factors accounting for indirect cost burden like number of work days lost; number of persons accompanying the person to the hospital and travel expenses was also documented. Cost analysis was done for emergency visits, indoor admission and daily medical expenses per patient for one year. These included cost of hospitalization, laboratory expenses, medical and conveyance expenses.

Data was presented in absolute numbers and proportion for demography, risk factors, duration of symptoms, co-morbid conditions, annual frequency of visits, medication use and commonly used regimes used to manage COPD cases. Data was presented in mean {95% confidence interval (CI)} for the smoking years, duration of symptoms, number of drugs received and economic burden for COPD management. All the statistical analysis was performed using Graph Pad Prism Version 6.0 software.

Informed written consent was obtained from all study subjects. The study was conducted after obtaining the necessary permission from the Institutional ethics committee.

RESULTS

In this observational cross sectional study, 200 COPD patients were evaluated. Males outnumbered females by a ratio of 3.16:1; with 76% being males and 24% being females. COPD was most prevalent in the elderly and majority of the patients had illness duration of less than 5 years as shown in Table 1.

Table 1: Demography, risk factors, duration of symptoms and co-morbid conditions present in COPD patients (n=200)

Variables	Frequency (%)
Age group (years)	
21-40	08 (4)
41-60	94 (47)
61-80	96 (48)
>80	02 (1)
Gender	
Male	152 (76)
Female	48 (24)
Smoking status	
Ex-smoker	116 (58)
Current smoker	50 (25)
Non smoker	34 (17)
Pack years	
≤10 pack	57 (28.5)
11-20 pack	59 (29.5)
>20 pack	51 (25.5)
Exposure to chulha	42 (21)
Duration of symptoms	
< 5 years	101 (50.5)
5-10 years	98 (49)
>10 years	10 (5)
Comorbid conditions	
Hypertension	61 (30.5)
Ischemic heart disease	22 (11)
Diabetes mellitus	04 (2)
Gastro-esophageal reflux	02 (1)
ALD	01 (0.5)
Psychiatric illness	01 (0.5)
Others	03 (1.5)

Table 2: Annual frequency of outpatient visits, emergency visits and indoor admission by COPD patients

Number of Visits/admission	Frequency (%)
Outpatient visits	
1-5	32 (16)
6-10	62 (31)
11-15	86 (43)
>15	20 (10)
Emergency visits	
1-2	62 (31)
3-4	21 (10.5)
≥5	17 (8.5)
Indoor admission	
1	82 (41)
2	50 (25)
3	17 (8.5)
4	04 (2)
≥5	07 (3.5)

Risk factor analysis showed that 166 patients (83%) were smokers of which 58% were ex-smokers and 25% were current smokers. Biomass fuel exposure (chullah) was observed in 42 patients (range 4 to 40 years). All of them were females. Mean exposure to smoking was 19.78 pack years (95% CI: 17.70-21.85). On analyzing the co-morbid conditions associated with COPD, hypertension was the leading co-morbidity (35%) and ischemic heart disease accounted for 11% of the cases (Table 1)

As shown in table 2, average OPD visits per patient per year were 11.32 (95%CI: 10.32-12.32). A staggering 50% of the patients required emergency room visits (stay <12 hours) for their worsening COPD symptoms/exacerbation. These were visit to their local doctors or to the emergency department of the hospital. Forty one percent patients were managed by parenteral bronchodilators and steroids while 9% patients required oxygen and nebulization additionally. Nearly 81% patients required admission for their symptoms of which 39% were admitted more than once. Average admission rate was 1.45 per patient (95% CI: 1.31-1.68).

Amongst the oral medications combinations of Etophylline and Theophylline was use by 96% patients and of the inhalational agents long acting beta agonist (LABA) and steroids were the most frequently used (Table 2).

Table 3: Frequency of use of oral and inhalation drugs in COPD outpatients

Drugs	Frequency (%)
Oral drugs	
Etofylline+theophylline	192 (96)
Salbutamol	59 (29.5)
Oral corticosteroids	05 (2.5)
Inhaled drugs	
Corticosteroids	02 (1)
SABA	22 (11)
SABA + corticosteroids	17 (8.5)
LABA + corticosteroids	95 (47.5)
SABA + anticholinergics	27 (13.5)
Anticholinergics	01 (0.5)

SABA- short acting β_2 agonist; LABA- long acting β_2 agonist

Table 4: Commonly used regimen to manage COPD outpatients

Regimen	n (%)
(Etofylline+theophylline) + (LABA+ Inhaled corticosteroids)	64 (32)
(Etofylline+ theophylline)	31 (15.5)
(Etofylline+ theophylline) + Oral salbutamol+ (LABA+ Inhaled corticosteroids)	24 (12)
(Etofylline+ theophylline) + SABA	14 (7)
(Etofylline+ theophylline) + (SABA + anticholinergics)	14 (7)
(Etofylline+ theophylline) +Oral salbutamol	13 (6.5)
(Etofylline+ theophylline) + (SABA+ Inhaled corticosteroids)	09 (4.5)
(Etofylline+ theophylline) + Oral salbutamol + SABA	04 (2)
(Etofylline+ theophylline) + Oral salbutamol + (SABA+ anticholinergics)	04 (2)
(Etofylline+ theophylline) + Oral salbutamol + (SABA+ Inhaled corticosteroids)	03 (1.5)
Oral salbutamol + (LABA+ Inhaled corticosteroids)	02 (1)
(Etofylline+ theophylline) + Oral salbutamol + (LABA+ Inhaled corticosteroids) + (SABA+ anticholinergics)	02 (1)
SABA	02 (1)
Others	13 (6.5)

SABA- short acting β_2 agonist; LABA- long acting β_2 agonist

The patients were investigated with complete blood counts, routine biochemical investigations, ECG and Chest X'ray. The treatment given to admitted patients was in the form of oxygen therapy, parenteral antibiotics, bronchodilators, nebulization with short acting beta agonist and anticholinergics, inhaled &/or parenteral corticosteroids. Overall treatment was given as combination of various drugs detailed in Table 4.The regimen most frequently used for domiciliary treatment of COPD was LABA + inhaled corticosteroids and oral Etophylline + theophylline (32%). Second most common regimen included only oral Etophylline and theophylline combination (15.5%). Regimen containing Inhaled LABA + oral salbutamol, Etophylline and theophylline was third commonly used medications (12%).

As shown in table 5 the average number of drug used per patient per day for COPD and other comorbid conditions was 3.21(95% CI; 3-3.42), out of which an average of 2.80 was used for COPD patients alone.

Table 5: Total number of drugs received by patients for daily management

Variables	Mean (95% CI)
Drugs for COPD & co-morbid conditions	3.21 (3.0, 3.42)
COPD medications	2.80 (2.64, 2.95)
Oral COPD medications	1.28 (1.21, 1.35)
Inhaled COPD medications	1.52 (1.38, 1.65)

Table 6: Economic burden to COPD patient per year

Cost analysis variables	Govt. set up - Mean Cost (95% CI)			Private set up
	Hospital	Patient	Total Mean	Mean (95% CI)
Emergency visit	60.06 (51.96-68.16)	366.13 (306.96-425.30)	426.19 (361.72-490.66)	2015.45 (1771.4-2259.5)
Conveyance cost	--	352.6 (296.77-408.43)	352.6 (296.77-408.43)	352.6 (296.77-408.43)
Treatment cost	60.06 (51.96-68.16)	13.53 (3.70-23.35)	73.59 (58.24-88.94)	1662.85 (1454.4-1871.3)
Indoor admission	2087.78 (1846.30-2329.20)	733.90 (655.04-812.76)	2821.68 (2504.40-3138.9)	26482.94 (23485-29481)
Conveyance cost	--	351.14 (311.74-390.55)	351.14 (311.74-390.55)	351.14 (311.74-390.55)
Treatment cost	2087.78 (1846.30-2329.20)	382.76 (338.50-427.02)	2470.53 (2184.80-2756.2)	26131.80 (23165-29099)
Daily treatment	276.46 (243.07-309.84)	2129.83 (1864.5- 2395.2)	2406.3 (2140.3-2672.3)	6791.89 (6257.6-7326.2)
Conveyance cost	--	1040.93 (832.99-1248.9)	1040.93 (832.99-1248.9)	1040.93 (832.99-1248.9)
Treatment	276.46 (243.07-309.84)	1088.9 (923.22-1254.6)	1365.36 (1197.4-1533.3)	5750.96 (5357.8-6144.2)
Total burden (n=200)	2424.30 (1758.7, 2236.5)	3229.86 (2551.5-3163.20)	5654.16 (4404.00-5705.9)	35290.28 (27268-36316)

% of burden to patient as per annual income 7.17% (95% CI: 6.22-8.12)

Economic burden to COPD patients at our set up

The overall costs incurred per COPD patient for one year was Rs 5654.16 (Table 6). This included charges for emergency room visits, indoor admissions and daily treatment. The maximum expenditure was incurred due to hospital admission. The convenience cost also contributed significantly to the economic burden to the patient.

Economic burden to COPD patients in private set up

The estimated overall yearly average cost of management per COPD patient was □35290.28 (Table 6). The average burden to patients was almost 6.2 times higher in private than our set up (□35290.28 vs. □ 5654.67). Overall emergency visits accounted for 5.8%, hospital admission for 75% and daily cost of medications for 19.2% of total expenses per year.

Loss of work days due to COPD

The average loss of work days to COPD patients per year is 16.45 days (95% CI: 14.99-17.92). It was ranged from 1 to 65 days. Total 17 patients (8.5%) lost more than 30 work days due to COPD in one year. It was 17.15 days (95% CI: 15.62-18.63) for those who required admission and 7.9 days (95% CI: 5.15-10.65) for those who did not require hospitalization in a year.

DISCUSSION

The understanding of economics and psychosocial burden of COPD on individuals and the country is essential to device allocation of health care resources and formation of National Health Care Policy. COPD has wide ramifications in both the developed and developing countries. WHO's Global burden of disease and risk factors project (2001) puts COPD as fifth leading cause of death in high income countries (3-8% of total deaths and sixth leading cause of death in low and middle income countries (4-9% of total deaths).[9]SusannahBennady points out that death rate after an exacerbation of COPD (lung attack) was as high as mortality for a heart attack in Candian population.[3]

The results of our observational cross sectional study showed a male predominance (76%) over females (24 %). This correlates with a study of Marc Miravitlles et. al. done in Spanish population.[6] This may be attributed to increased smoking and greater occupational exposure to dust and fumes in males. The prevalence of COPD is becoming similar in men and women in developed countries due to somewhat similar exposure to smoking in both sexes. [13] According to WHO in developed nations 73% of COPD mortality is related to smoking while it is 40% in developing nations.[9]Airflow limitation which is the hallmark of COPD is associated with an abnormal inflammatory response of the lungs to noxius particles or gases. According to Lunback et al. fifty percent of elderly smokers had developed COPD, out of which 94% were symptomatic, but only 31% had been diagnosed as COPD prior to their study.[14,15]

In our study of the COPD subjects 83% were smokers, 58% being former smokers while 25% were active smokers, which was different from the study done by K.D.Patel et al which had 28% former smokers, 54% were current smokers. [16] In the same study the mean age of COPD subjects was 60.21 ±10.29. In our study too mean age was 61.25 years (95% CI 59.92 – 62.60) confirming the fact that old age and smoking are the two most important risk factors for COPD as also noted in the study by David M. Mannino et al.[9] Nonsmokers (17%) were mostly made up by females (total 42 women) exposed to biomass fuel exposure (Chula smoke).

On quantifying the burden of the disease in the form of duration of illness we found that the mean duration of illness to be 5.89 years (95%CI 5.12 – 6.04) which was in accordance with K.D.Patel et al. which had 42.9% patients with 1-5 years of illness and 38.6% with 6 – 10 years of illness. [16] Thus the majority of patients have been living with social and economic burden of the disease for about 5 yrs

which has an enormous impact on their lives.

Comorbid illness especially hypertension , diabetes, dyslipidemia, heart failure and lung cancer play a major role in determining the economic burden in COPD patients as these patients are more likely to be hospitalized for exacerbations. According to Athony J. Guarascio et al. systemic inflammation is supposed to play a role in the development of these comorbidities and elevated biomarkers like C reactive protein are associated with increased risk of comorbid condition. [4] In our study we found hypertension (30%), Ischemic heart disease (11%) as the leading comorbidities. Marc Miravitlleset al. found hypertension, diabetes and Ischemic heart disease as the most common comorbities. [17]

The burden of the disease includes burden on the healthcare system. It includes direct costs i.e the cost of medicines, laboratory investigations and hospitalization. Indirect costs includes conveyance cost, food costs incurred by the bystander as also the loss of work days due to hospitalization of both the patient and the bystander. [18,19] The psychosocial costs include disruption of normal life pattern, altered sleep patterns (50%), reduced physical exertion (70%),and reduced ability to work (51%) according to Anthony Gurascio et al. [4]

In our study we found that the average yearly cost of management per COPD patient was Rs. 5654.67 in the government set up as against Rs 35290 in the private set up. Of this 75 % was accounted for by hospitalization, 19.2% for daily medications and physician visits while 5.8% was for emergency room visits. According to a report by Canadian Institute of health 18% of COPD patients were admitted once and 14% twice in a year.[3] In our study 41 % were admitted once a year and 50% twice a year. Thus hospital admissions and or comorbidities are a major source of drain on the economy and need to be effectively controlled for cost reduction. In the study by Anthony J. Guarascioet al.[4] in USA, direct health care costs accounted for two thirds of the COPD cost. The hospitalization costs accounted for 45-50% of the total direct cost and the expenses escalated as the severity of the disease progressed from stage I to stage III.

Table 7: Comparison of Economic burden of COPD in different countries

Study	Cost evaluated	Cost per patient per year
Marc M et al. 2003; Spain	Direct	$ 1760
Hilleman et al 2000;USA	Direct	Stage 1 - $ 1681 Stage 2 - $ 5037 Stage 3 - $ 10,812
Present study; India	Direct & Indirect	Rs 35,290/$ 526

Medication cost accounted for 40.8% of the total direct costs in study by Marc Miravitlles et al [6], compared to 19.2% in our study. This low cost in our study may be due to difference in management strategies and lower cost of medications and hospitalization in India as compared to USA and Europe. In the above study the most frequently used medication by COPD patient was inhaled short acting beta agonist (SABA) at 59% while in our study SABA was used by 11% , SABA and steroids by 85%. Long acting beta agonists (LABA) and steroids was used by 47.5% as compared to 46.4% LABA in study by Marc Miravitlles. [6] Oral Etophylline and theophylline was the most commonly used medication probably because of being available in the government supply and also due to being inexpensive as compared to inhalation medications.

There were certain limitations in our study. Severity of COPD could not be not assessed as spirometry was not done in the patients. Hence the cost according to severity of thedisease could not be assessed. Also the sample might not be representative of all the COPD patients as this study was carried out in a tertiary care hospital where mostly moderate to severe cases are treated and therefore the mild cases of COPD might have been missed.

CONCLUSION

COPD is major economic buden on the scarce health care resources in our country. The major cost burden incurred in COPD management is due to recurrent indoor admissions. Early diagnosis and proper treatment can prevent exacerbations thereby recucing the number of hospital admission. The easy availability of good care in primary health care centres can reduce the indirect costs considerably. A patient education plan to help them stop smoking and teach them proper use of inhaled medications can go a long way in reducing the cost burden of the disease.

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