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Original Article

Five-Year Trends in Direct Costs of Chronic Obstructive Pulmonary Disease in Turkey: COPDTURKEY-3

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Abstract

OBJECTIVE: Chronic obstructive pulmonary disease (COPD) is one of the major causes of mortality and morbidity worldwide. The aim of this study was to reveal the trend in direct costs related to COPD between 2012 and 2016, and to evaluate hospital costs in 2016, together with their subcomponents.

MATERIAL AND METHODS: A population-based descriptive study was conducted using administrative healthcare data in Turkey. The total direct cost of COPD diagnosis-treatment for each year from 2012 to 2016, was calculated. The distribution of the hospital's COPD-related costs for the year 2016 was also examined, together with morbidity data.

RESULTS: The direct costs of the patients who were admitted to step 1, step 2, and step 3 health care centers between 2012 and 2016 increased by 41% [895 041 403TL ($496 930 501) in 2012 to 1 263 288 269TL ($417 834 197) in 2016]; the increase was 60% and 24%, for inpatient and outpatient groups respectively. In the year 2016, the direct total cost was 1003TL ($332) per patient. In 2016, mean specialist consultations per patient with mean cost per specialist consultation, and mean emergency visits per patient with mean cost per emergency visit, were 1.7, 42 TL ($14), and 0.4, 71TL ($23) respectively. For the inpatient group, the mean number of hospitalizations per patient, mean number of hospitalization days, and the mean cost per hospitalization were 0.4, 6.5, and 1926TL ($637), respectively.

CONCLUSION: When the readmissions of patients with COPD were evaluated together with the costs, and compared with the statistics from other countries, it was found that the costs per patient were lower in Turkey. However, the reasons for the significant rise in inpatient costs compared to outpatient costs should be investigated. Further investigations are required regarding pulmonary rehabilitation, home health care services, preventive measures for infections, management of comorbidities, and treatment optimization, which may reduce hospitalizations.

KEYWORDS: Mean cost per patient, mean cost per visit, mean cost per hospitalization, outpatient cost, inpatient cost
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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) was responsible for 5.5% (n = 2.9 million) of deaths in 2010 and is the third most common cause of death in all over the world.[1,2] In 2010, The Global Burden of Disease Study ranked COPD as the third leading cause of mortality and the ninth leading cause of disability-adjusted life years lost.[2] COPD was associated with a prominent economic burden.[2,3] In the BREATHE study, a cohort of 11 countries including Turkey, Middle East countries, and Pakistan, it was reported that the profile of patients with more severe COPD, more exacerbations, and high scores on the COPD assessment test, and those with more comorbidities, had higher medical costs.[4] In cost studies related to COPD, it was found that work efficiency was decreased and labor loss increased in patients with more severe COPD and with more comorbidities at advanced ages.[5] The direct economic cost attributable to COPD and asthma in 2008 has been estimated at $53.7 billion in the United States.[6] The annual costs associated with COPD in European countries range from 109 to 541 million euros.[7] In a cohort study held in Canada which shows the trend, it was shown that there has been a significant rise in the cost of COPD.[8] A previous study in the US reported that the hospitalization costs significantly drove the total health care costs for COPD patients who were commercially insured.[9] The studies about COPD costs in Turkey are limited in number and also single-centered.[10]

Data generated from these types of studies are important for understanding the true economic burden of COPD, and may have important implications for targeting resources and forming public health policies.

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The aim of this study is to reveal the direct cost trend related to COPD between the years 2012 and 2016, and to evaluate hospital costs together with their subcomponents. We believe that our findings will benefit health policies related to the costs of COPD.

MATERIAL AND METHODS

Data Sources

A population-based descriptive study was conducted using administrative healthcare data in Turkey for the period from January 1, 2012 to December 31, 2016. The Turkish Social Security Institution (TSSI) that is the source of the data covers 98.6% of the Turkish population; therefore, the data we evaluated is confidential information. All the billing records were analyzed by data-mining officials of the TSSI.

Patients medically diagnosed with COPD were enrolled in the study. The number of patients followed by the outpatient and inpatient services was determined. The International classification of diseases (ICD)-10 J44.0-J44.9 codes for diagnostic and/or therapeutic purposes and all prescription records were evaluated in this retrospective descriptive study. The total direct costs of COPD diagnosis-treatment for each year from 2012 to 2016 were calculated. The hospital's direct cost of diagnosis-treatment for 2016 was analyzed separately. The detailed data of the patients for emergency department (ED), outpatient services, and inpatient follow-up records were determined.

In our country, and in this study, step 1 organizations correspond to primary care healthcare which is provided by the family medicine system; step 2 organizations correspond to secondary care; and step 3 hospitals correspond to tertiary care healthcare systems. In Turkey, step 2 healthcare is provided by step 2 Ministry of Health hospitals (S2-MHH), and step 2 private hospitals (S2-PH); step 3 healthcare is provided by step 3 Ministry of Health hospitals (S3-MHH), step 3 state university hospitals (S3-SUH), and step 3 foundation university hospitals (S3-FUH).

Statistics, Querying, and Cost Calculations

All data were provided from Oracle database using the Tools for Oracle Application Development (TOAD) 9.6.0.27 program. Structured Query Language queries were written for the TOAD program. For the mean age and standard deviation in 2016, SAS Enterprise Guide 5.1 was used.

MAIN POINTS

- The direct costs of the patients who were admitted step 1,2,3 health care centers between the years 2012-2016 has been increased as 41%.
- We determined dramatic increase in the cost of hospitalized COPD patients compared to the cost of ambulatory patients.
- When the re-admissions of patients with COPD were evaluated together with the costs and compared with other countries, it was found that the costs per patient were lower in Turkey.
- Our study is important as it shows the direct costs of COPD across Turkey.

Outpatient and inpatient diagnosis-treatment costs for the last 5 years were analyzed for COPD. Outpatient diagnosis-treatment costs were determined by the cost of outpatient or emergency examinations, laboratory tests, imaging examinations, cost of medicines, consumables, and equipment. While determining inpatient diagnosis-treatment costs, clinical or intensive care examination, hospitalization fees, laboratory tests, imaging tests, and cost of drugs, consumables, and device costs were taken into consideration. In these costs, all patients of the step 1, 2, and 3 systems, and the supplies for these patients, namely the medication, consumables and devices (oxygen concentrators, nebulizers, non-invasive and invasive ventilators, etc.) provided from free pharmacies and free medical firms were also included. In addition, the cost of the patients was evaluated according to their admission to the step 2 and 3 hospitals in 2016. The primary classification was made based on the type and level of hospitals and the secondary classification was based on treatment as an inpatient, outpatient, or in the ED. In these costs, drugs and consumables used in hospitals were included in the cost, while drugs, consumables, and devices prescribed to free pharmacies and medical firms were not included in the calculation. The Turkish currency was converted into the US dollar based on the exchange rate, which was determined separately for each year (US$1 = 1.80114TL in 2012; 1.90543 in 2013; 2.19232 in 2014; 2.72515 in 2015; and 3.02342 in 2016).

RESULTS

While the outpatient costs increased by 24% [from 467 477 073TL ($259 545 106) in 2012 to 580 374 592TL ($191 959 632) in 2016], the costs of the hospitalized patients increased as well, by 60% [from 427 564 330TL ($237 385 395) in 2012 to 682 913 677TL ($225 874 564) in 2016]. The total direct cost of the COPD patients was increased by 41% [895 041 403TL ($496 930 501) in 2012 to 1 263 288 269TL ($417 834 197) in 2016]. The cost per patient was increased from 811TL ($450) to 1003TL ($332), which is a 24% elevation. In 2016, inpatient costs [682 913 677TL ($225 874 565)] constituted 54% of the total cost [1 263 288 269TL ($417 834 197)] (Table 1).

In the year 2016, 946 467 patients, 65% of them males, with a mean age of 65.75 ± 13.42, were diagnosed with COPD in hospitals. Seventy-four percent of them were admitted to the step 2 hospitals. Foundation university hospitals were in the last place, with a percentage of 2% (Table 2).

In the group of outpatients (except for the ED patients), mean visit per patient was found to be 1.7, and mean cost per patient was found to be 42TL ($14). In this group, the least cost was found to be in the S2-MHH [32TL ($11)], and most of the cost was in S3-FUH [87TL ($29)]. When the ED group was evaluated, mean visit per patient was found to be 0.4, and the mean cost per visit was found to be 71TL ($23). In this group, lowest mean cost per patient was in the S2-PH [42TL ($14)], and the highest was in the S3-SUH [160TL ($53)]. In the inpatient group, mean hospitalization per patient, mean hospitalization days and mean cost per hospitalization were found to be 0.4, 6.5, and 1926TL ($637), respectively. Mean cost per hospitalization was the lowest

Table 1. Total Direct Cost of Patients with Chronic Obstructive Pulmonary Disease Between 2012 and 2016*

	2012	2013	2014	2015	2016
	***n* = 1 104 120**	***n* = 1 169 162**	***n* = 1 221 870**	***n* = 1 256 119**	***n* = 1 259 629**
Outpatient cost (including ED), TL (US$)	467 477 073 (259 545 106)	494 366 893 (259 451 616)	542 683 504 (247 538 454)	537 382 930 (197 193 890)	580 374 592 (191 959 632)
Inpatient cost (including ICU), TL (US$)	427 564 330 (237 385 395)	466 231 044 (244 685 474)	543 705 240 (248 004 507)	605 781 350 (222 292 846)	682 913 677 (225 874 564)
Total cost, TL(US$)	895 041 403 (496 930 501)	960 597 937 (504 137 091)	1 086 388 744 (495 542 960)	1 143 164 280 (419 486 737)	1 263 288 269 (417 834 197)
Mean cost per patient, TL (US$)	811 (450)	822 (431)	889 (406)	910 (334)	1003 (332)

*Prescriptions written by primary care physicians in step 1 and specialists in step 2 and step 3 hospitals were included.
ED, emergency department; ICU, intensive care unit; TL, Turkish Lira.

in S2-MHH [1441TL ($477)] and the highest in S3-SUH [3222TL ($1066)] (Table 2).

In the hospitals, the direct cost of COPD was calculated as 778 412 573TL ($257 460 946). In this sectoral distribution of costs, S2-MHH, S2-PH, S3-MHH, S3-SUH, S3-FUH accounted for 39%, 33%, 17%, 9% and 2%, respectively (Figure 1).

DISCUSSION

Our study was the first to access data to show the trend of the direct costs of COPD in Turkey, and to analyze the data on contribution of the hospitals to these costs, along with the morbidity data of TSSI. Our data covered almost the entire population of Turkey. It was determined in our study that, the total direct cost of COPD patients between the years 2012 and 2016 was increased by 41%. We determined a dramatic increase in the cost of hospitalized COPD patients compared to the cost of ambulatory patients. The cost per patient in 2016 was calculated as 1003TL ($332). In the same period, the rate of the cost of hospitalized patients as part of the total cost, was determined as 54%. In 2016, 74% of the patients who were hospitalized applied to step 2 hospitals. The share of step 2 hospitals in all COPD-related hospital costs was 72%.

Certain limitations in this study should be mentioned. The major limitation was the evaluation of physician-diagnosed COPD patients. Patients who were not diagnosed by a physician or unable to be diagnosed were not involved in this study. This study was a database study and some COPD patients could have been missed. Although the TSSI, which was our data source, covers almost the entire population of Turkey, costs of the examinations and treatments that were met through private health insurances or met by the patients using their own sources could not be included in the cost calculations. Another limitation was that we had access only to calculated data, while raw data was not shared due to the confidentiality and security policy of TSSI. Thus, analytical comparisons, and calculation of standard deviations of the mean values of morbidity and cost data were not possible. This study was a descriptive study and did not cover factors such as tobacco use, or environmental, sociocultural and occupational factors to define health service use of COPD patients.

Table 2. Sectoral Distribution of Patients with Chronic Obstructive Pulmonary Disease Presenting to Hospitals (Steps 2 and 3) in 2016

	Step 2 Private Hospital	Step 2 Ministry of Health Hospital	Step 3 Ministry of Health Hospital	Step 3 State University Hospital	Step 3 Foundation University Hospital	Total
Patient, *n* (%)	235 568 (25)	468 370 (49)	190 566 (20)	35 287 (4)	16 676 (2)	946 467
Outpatient (specialist visit)						
Mean visits per patient	1.5	1.8	1.6	1.4	1.6	1.7
Mean cost per visit, TL (US$)	44 (15)	32 (11)	56 (19)	80 (26)	87 (29)	42 (14)
Emergency visit						
Mean visits per patient (*n*)	0.2	0.6	0.4	0.3	0.2	0.4
Mean cost per visit, TL (US$)	42 (14)	70 (23)	82(27)	160 (53)	78 (26)	71 (23)
Inpatient						
Mean hospitalizations per patient (*n*)	0.5	0.4	0.3	0.6	0.3	0.4
Mean hospitalization days	4.8	7.1	7.2	8.3	5.5	6.5
Mean cost per hospitalization TL (US$)	2269 (750)	1441 (477)	2339 (774)	3222 (1066)	3061 (1012)	1926 (637)

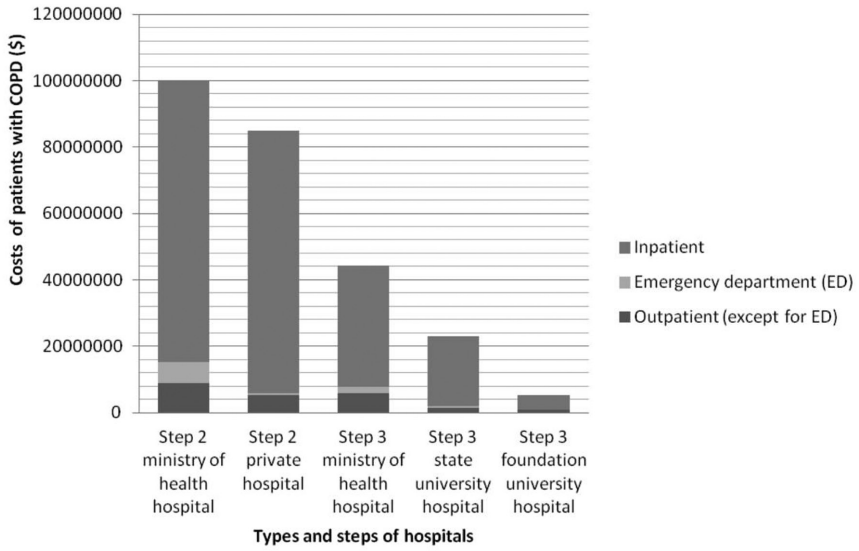

Figure 1. The distribution of the direct hospital cost of COPD according to the steps (2 and 3) and the types of hospitals: step 2 hospitals at the hospital level, and the inpatients at the patient group level, had a significant share in the cost of chronic obstructive pulmonary disease.

COPD causes increasing economical and social burden worldwide.[2,3] The health burden of COPD, which is both a preventable and curable public health problem, is expected to increase in the following decades due to continuous exposure to risk factors and an aging population.[11] There is a dramatically direct relation between the seriousness of the condition and the cost of care for COPD. The cost distribution changes as the disease progresses.[12] Low socioeconomic status is related to increased risk in the progress of COPD. It is observed that the deterioration in the social determinants of health (adequate income, appropriate housing, living and working conditions, quality education and access to health services, etc.), which are the main determinants of COPD development, have not been examined.[13]

In a cohort study performed in Finland, the direct and indirect costs for COPD over a 10-year period were calculated as ğ100-110 million per year. Compared to the previous periods, there was a moderate increase in costs. With this mathematical calculation, the cost between 2007 and 2030 is estimated to increase by 60% to €160 million.[14]

A similar cohort study showed an increase of 88% in Finland over a 10-year period.[15] Another cohort study in the US calculated the cost at 32.1 billion dollars in 2010, and this value was estimated to be 49 billion dollars in 2020 (53% increase).[16] In our study, the increase of the direct cost of COPD in 5 years was evaluated as 41%. When the reason for the increase was evaluated considering outpatient treatment and hospitalization, the cost of the outpatient treatment increased by 24%, while the inpatients' cost showed a significant increase (60%).

It is shown that hospitalization costs increase the health costs of COPD significantly.[9] In 2016, as stated in our study, the cost of the hospitalized patients was 54% of the total costs. In a study involving the participation of 12 countries, the highest proportions of inpatient hospital cost to direct cost were shown in 5 countries; France (54%), Germany (53%), Spain (50%), US (33%), and North Korea (26%).[17] A wider study mentioned that out of 7 countries, the cost of hospitalized patients was (52-84%) in 5 of them.[18] In Taiwan, the hospitalization costs for COPD patients accounted for 74-95% of their total health care costs.[19]

In our opinion, another parameter that should be compared is the direct cost per patient. We think that this cost should be evaluated along with the morbidity data such as mean visit per patient, mean emergency visit per patient, mean hospitalizations per patient, and mean hospitalization days. In a multi-center study done by Foo et al.,[17] it was shown that the least cost per COPD patient was in North Korea ($504) and the highest was in the US ($9981). In this study, visit per patient was the lowest in Russia with 1.6, and the highest was in Japan with 5.1; mean emergency visit per patient was the lowest in Japan, Holland, and Italy with 0.1, and the highest was in Brazil with 1.3; mean hospitalization was the lowest in South Korea, Japan, Holland, Italy and Germany with 0.1, and the highest was in Brazil with 0.4.[17] In a study performed by Wouters EF, the mean cost per COPD patient was the highest in the US with $4119 and in Spain with $3196, and the lowest was in Holland with $606 and in France with $522. Mean visit per patient was the lowest in the United Kingdom with 0.84, and the highest was in the US with 1.78; mean emergency visits per patient was the lowest in Italy with 0.10, and the highest in Spain with 0.78; the mean number of hospitalizations was the lowest in Holland with 0.27, and the highest in Spain with 1.00.[18] In a study which was performed in Korea, the mean direct cost per patient was found to be $2803 and the mean number of hospitalization days was 11.[20] In a study which was performed in China that covered 4 cities, the mean direct cost per patient was calculated as $1853.[21] In studies which were reported regarding the official data of Canada, the mean direct cost per patient was found to be $8600, the mean hospitalizations per patient was 0.31 and the mean emergency visits per patient was 0.33.[8,22] In our study, in the year 2016, it was evaluated that the mean cost per patient was 1005TL ($332), mean visit per patient (from 1.4 in S3-SUH to 1.8 in S2-MHH) was 1.7. Mean emergency visits per patient (from 0.2 in S2-PH and

S3-FUH to 0.6 in S2-MHH) was 0.4. In the inpatient group, mean hospitalizations per patient (from 0.3 in S3-MHH and S3-FUH to 0.6 in S3-SUH) was 0.4. Mean hospitalization days was the lowest in S2-PH (4.8 days), and the highest was in S3-SUH (8.3 days), the general mean number of days was 6.5. Although the rate of the mean cost per patient was the highest in the S3-SUH which covers 4% (n = 35 287) of the total patients, the number of mean specialist visits per patient and the emergency visits per patient were lower than the average (1.4, 0.3, respectively). This situation was thought to be a reason for the decrease in re- admissions after optimal treatment.

Bellamy et al.[23] in their study, calculated that the mean cost of a visit to a chest physician was $20, the mean cost of an ED service visit was $98, the mean hospitalization cost per day was $313, and the mean cost of hospitalization in the intensive care unit was $1092.[23] In the study of Wilson et al.,[24] it was found that the cost per hospitalization was $2361; the mean cost per outpatient physical examination was $25, and the mean cost per ED admission was $237. In another study done in Northeast China, it was determined that in the year 2005, the mean cost per hospitalized patient increased from $638 to $1569, between the years 2005 and 2015.[25] In our study, it was found that the mean cost of physical examination by a specialist physician was 42TL ($14) [from 32TL ($11) in S2-MHH to 87TL ($29) in S3-FUH], the mean cost of the physical examination in the ED was 71TL ($23) [from 42TL ($14) in S2-PH to 160TL ($53) in S3-SUH], and the cost of each hospitalization was 1926TL ($637) [from 1441TL ($477) in S2-MHH to 3222TL ($1066) in S3-SUH].

In our study, 74% of the patients applied to step 2 hospitals, and the step 3 hospitals covered the remaining 26% of them. Step 2 hospitals took over 72% of the cost. When the statistics of the Turkish Republic Ministry of Health was evaluated, it was realized that out of all the patients who have been admitted to the hospitals, 71% (n = 290 995 966) of them have applied to the step 2 hospitals, and 29% (n = 119 824 432) of them have applied to the step 3 hospitals.[26] This distribution of COPD patients between the 3 steps of hospitals was compatible with Turkey's general patient profile. According to the findings of our study, when the cost of the COPD patients was compared to the step 3, it was evaluated that even though the number of step 2 hospitals was less, the large number of patients visiting these hospitals was right, with respect to the management of costs, and it has a positive impact on the cost per COPD patient, which were less in number.

The goal should be to prevent development and progress of disease in order to overcome the COPD burden. Risk factors should be defined and exposure decreased. Smokers have to continuously be encouraged to quit tobacco use. In addition, we should target decreasing the total personal exposure to occupational dust, fumes, gases, and indoor/outdoor environmental polluters.[1] Getting rid of socioeconomic inequality, measured with education, occupation, and level of income, is considered more effective than COPD medications.[27] Unsurprisingly, low socioeconomic level is related with increasing COPD risk.[28,29] It is possible to decrease COPD progress by 80% using proper preventive measures, and focusing on medicine and hospital treatment alone will not have a great effect on disease mortality and natural progress of disease, and shall not contribute significantly to solving the global and national COPD problem.[19]

CONCLUSION

The direct cost of COPD patients in Turkey and cost per patient have increased over the years. However, cost per patient in our country was lower when admissions of COPD patients were evaluated together with costs and compared with the data of the other countries. Hospitalization costs showed dramatic increase when compared with ambulatory treatment. The reasons have to be investigated. We consider that preventive measures and supportive approaches have to be conducted for COPD patients, including pulmonary rehabilitation, home health care services, control of recurrent infections, management of comorbidities, and treatment optimizations, to reduce hospitalizations.

Ethics Committee Approval: Ethics committee approval was received for this study from the Local Ethics Committee of University of Health Sciences Dr. Abdurrahman Yurtaslan Oncology Training and Research Hospital (date: November 14, 2018, number: 2018-11/136).

Informed Consent: Informed consent was not obtained from the patients because it was a retrospective, observational study.

Peer-review: Externally peer-reviewed.

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