

Clinical Factors Affecting the Costs of Hospitalized Chronic Obstructive Pulmonary Disease Exacerbations

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Abstract

Objective: Chronic obstructive pulmonary disease (COPD) is a major public health problem with severe economic consequences. In this study, we tried to estimate the clinical factors affecting the economic cost of COPD exacerbations requiring hospitalization.

Methods: A total of 241 patients who were hospitalized due to COPD exacerbations were included in the study. Data were examined retrospectively using hospital charts.

Results: The average length of the hospital stay of the patients was 9.6±4.6 days. The average total direct cost for hospitalization was 1103.2±557.3 Turkish Lira (TL). The length of hospital stay or total costs were not different between male and female patients (respectively, p=0.78 and p=0.28) or between patients above 65 years old and others (respectively, p=0.77 and p=0.92). Presence of comorbidities increased total costs significantly (p=0.008). The total costs of medications and antibiotic costs, together with laboratory costs, were significantly higher in patients with comorbidities (p=0.02, p=0.003, and p<0.001). Length of hospital stay also tended to be higher in patients with comorbidities, but it was not statistically significant (p=0.09). Total costs and length of hospital stay tended to increase as the number of comorbidities increased (p=0.02 and p=0.008). Type of social insurance did not affect total costs or length of hospital stay (p=0.16 and p=0.21).

Conclusion: Length of hospital stay and direct costs of hospitalized COPD exacerbations significantly increased in the presence of comorbidities, while age, sex, and type of insurance did not have any significant effects.

Keywords: COPD, cost, exacerbation, length of hospital stay

Özet

Amaç: Kronik obstrüktif akciğer hastalığı (KOA) ciddi ekonomik yükü olan sık görülen bir sağlık sorunudur. Çalışmamızda, hastaneye yatırılmayı gerektiren KOA alevlenmelerinin maliyetine etki eden klinik faktörleri belirlemeyi amaçladık.

Yöntemler: Çalışmamıza KOA alevlenme nedeniyle hastaneye yatırılan 241 olgu dahil edildi. Hastane kayıtlarının retrospektif olarak incelenmesi ile veriler elde edildi.

Bulgular: Olguların ortalama hastanede kalış süresi 9.6±4.6 gündü. Toplam maliyet ortalama 1103.2±557.3 Türk Lirası (TL) idi. Cinsiyete göre hastanede kalış süresi ve toplam maliyet değerlendirildiğinde, erkek ve kadın olguların hastanede kalış süresi ve toplam maliyeti açısından anlamlı fark izlenmedi (sırasıyla p=0.78 ve p=0.28). 65 yaş üzeri olgular değerlendirildiğinde hastanede kalış süresi ve toplam maliyet açısından diğer olgularla aralarında anlamlı fark olmadığı görüldü (sırasıyla, p=0.77 ve p=0.92). Komorbite varlığında olguların toplam maliyetlerinin anlamlı olarak arttığı gözlemlendi (p=0.008). Maliyet bileşenleri incelendiğinde toplam ilaç ve antibiyotik maliyetleri ile genel laboratuvar maliyetlerinin komorbiditesi olan olgularda daha yüksek olduğu görüldü (p=0.02, p=0.003 ve p<0.001). Hastanede kalış süresinin komorbidite varlığında arttığı gözlemlendi, ancak istatistiksel olarak anlamlı değildi (p=0.09). Komorbidite sayısı arttıkça hastanede kalış süresinin ve toplam sağlık maliyetlerinin anlamlı arttığı gözlemlendi (p=0.02 ve p=0.008). Olguların sosyal güvence tiplerinin toplam maliyet ve hastanede kalış süresine etkisi görülmedi (p=0.16 ve p=0.21).

Sonuç: KOA alevlenmelerinde komorbidite varlığının hastanede kalış süresi ve direkt maliyet miktarlarını anlamlı olarak arttırdığı görülmüşken, cinsiyet, yaş ve sosyal güvence tipinin herhangi bir etkisi gözlemlenmedi.

Anahtar Kelimeler: Alevlenme, hastanede yatış süresi, KOA, maliyet

Received Date / Alındığı Tarih: 01.05.2014

Accepted Date / Kabul Tarihi: 02.08.2014

Available Online Date /

Çevrimiçi Yayın Tarihi: 25.11.2014

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Eurasian J Pulmonol 2014

DOI: 10.5152/ejp.2014.46855

• Available online at www.eurasianj pulmonol.com

INTRODUCTION

The prevalence of pulmonary diseases and their economic burden are increasing in correlation with the increasing rates of tobacco use in the world and in our country. Chronic obstructive pulmonary disease (COPD) is a major health problem with severe direct and indirect economic and social consequences. Direct costs of the disease include medication costs, costs of diagnostic utilities, costs of management and follow-up of disease, and outpatient clinic, hospitalization, and emergency costs. The most important component of direct costs is hospitalization costs (1). Direct costs of pulmonary diseases constitute 6% of the total health budget in European Union countries, 56% (38.6 billion euros) of which is formed by COPD direct costs. In 2002, direct treatments for COPD-related illness accounted for 18 billion dollars, and indirect costs of COPD-related illness accounted for 14.1 billion

dollars in the USA (2, 3). In Turkey, risk factors, like tobacco use and inside and outside airway pollution, are seen widely, but there are limited studies analyzing the economic burden of COPD. According to the records of the Ministry of Health, the numbers of patients discharged from all hospitals with a diagnosis of chronic bronchitis, asthma, and emphysema increased 3.1 times between 1965 and 1997, with a 5.1-fold increase in the rates of death due to these illnesses. In 1997, 127,000 patients were discharged with a diagnosis of chronic bronchitis, asthma, and emphysema from all hospitals in Turkey. A study of national disease burden detected COPD as being the third highest cause of death, causing 26,000 deaths per year (4). COPD is the eighth highest disease, with a rate of 2.8% within the first 10 causes of national disease burden. COPD prevalence was found to be 14.1% (19.3% in males and 9.8% in females) among adults above 40 years old in central the district of Zonguldak (5). The Burden of Obstructive Lung Disease (BOLD) study, in Adana, showed that the COPD prevalence was 19.6% in adults over 40 years of age (28% in males and 10.3% in females) (6).

COPD has an increasing economic and social burden due to direct or indirect costs of the disease. There is a limited number of studies analyzing the cost of this particular disease in our country, and no study has been conducted in a secondary state hospital. In this study, we tried to estimate the clinical factors affecting the direct economic costs of COPD exacerbations requiring hospitalization in a secondary state hospital.

METHODS

This was a 6-month (September 2012-February 2013) retrospective observational study conducted in a pulmonary clinic of a secondary care state hospital. The diagnosis of COPD was established by the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria (7). Patients presenting with clinical symptoms suggestive of COPD and postbronchodilator $FEV_1/FVC < 70\%$ in the spirometric examination were diagnosed with COPD. Spirometric tests of all subjects were done in accordance with the criteria recommended by the European Respiratory Society using computer-assisted spirometry (One Flow FVC, Clement Clarke International, Essex, UK). The diagnosis was established by the clinical findings in the presence of risk factors for COPD in patients who could not comply with the spirometric examination. The Anthonisen criteria were used for the antibiotic treatment of COPD exacerbations (8). Demographic features, clinical data, and hospitalization bills of a total of 241 hospitalization files were screened retrospectively using the electronic hospital charts.

The costs were calculated as medication costs, hospitalization costs, and total costs. The total cost of one hospitalization was calculated as the sum of the bed fees, costs of medications, and diagnostic utilities (radiological, microbiological, and biochemical). The drugs used during hospitalizations were calculated as medication costs.

Cost data were calculated in Turkish Lira (TL) and was converted to United States (US) Dollars (\$) and Euros (€) using average currency exchange rates at the time of the study period. Expenditures were calculated in US Dollars (the average exchange rate at the time of the study was 1.80 Turkish Liras per US Dollar and 2.32 Turkish Liras per Euro) (9).

Statistical Analysis

Statistical Package for the Social Sciences (SPSS), version 16.0, for Windows (SPSS Inc, Chicago, IL, USA) was used for the statistical

analysis. Independent samples t-test was used for the comparison of groups. Descriptive statistical data were obtained. As the data were not normally distributed, Kruskal-Wallis test was used for the comparison of groups for a dependent variable. The level of statistical significance was $p=0.05$.

RESULTS

Two hundred forty-one COPD patients were included in our study; 91.3% of patients ($n=220$) was male and 9.7% ($n= 21$) was female. The average age of the patients was 69.9 ± 10.1 years (range 24–88); 73% of patients ($n=176$) were above 65 years old. Also, 7.1% of patients ($n=17$) were never-smokers, 4.5% was an active smoker, and 88.4% was quitter. The average rate of smoking history was 35.3 ± 12.8 pack-years. The characteristics of the study population are seen in Table 1.

When the social insurance systems for patients were evaluated, it was seen that 38.2% of patients (92 patients) were members of Social Security Institution, 21.2% (51 patients) were self-employed (Bağ-Kur), 6.2% (15 patients) were members of a retirement fund, and 19.9% (48 patients) had a green card. Total costs and length of hospital stay were not different among social insurance types.

In 47.7% of patients, there was at least one comorbidity, and in 10%, there was more than one comorbidity. Most frequent comorbidities were pneumonia (22%) and cardiovascular diseases, including hypertension (24.5%).

Mean length of hospital stay was 9.6 ± 4.6 days. Mean total direct cost was 1103.2 ± 557.3 TL ($\$612.8\pm 309.6$; 475.5 ± 240.2 €). When the means of the components of total costs were evaluated, they were found to be 307.8 ± 162.7 TL ($\$171\pm 90.4$; 132.7 ± 70.1 €) for total bed fees, 559.0 ± 334.4 TL ($\$310.6\pm 185.8$; 240.9 ± 144.1 €) for medication costs, and 200.9 ± 139.2 TL ($\$111.6\pm 77.3$; 86.6 ± 60.0 €) for antibiotic costs. The components of total hospitalization costs are seen in Figure 1.

Table 1. Characteristics of patients included in the study

Total number of cases	241
Sex	
Male, %(n)	91.3 (220)
Female, %(n)	8.7 (21)
Age, mean \pm SD	69.9 \pm 10.1 (73% over 65 years)
Smoking history	
Active smoker, %(n)	4.6 (n=11)
Quitter, %(n)	88.4 (n=213)
Never-smoker, %(n)	7.1 (n=17)
Comorbidities	
None, %(n)	52.3 (126)
1 comorbidity, %(n)	37.8 (91)
> 1 comorbidities, %(n)	10 (24)
Pneumonia, %(n)	22 (53)
Diabetes mellitus, %(n)	6.6 (16)
Hypertension and cardiovascular disease, %(n)	24.5 (59)

Total direct costs of hospitalization and length of hospital stay were not different between male and female patients (respectively, $p=0.783$ and $p=0.281$) or between patients over 65 years old and others (respectively, $p=0.771$ and $p=0.926$).

The presence of comorbidities increased total direct costs ($p=0.008$). When the components of direct costs were evaluated, patients with at least one comorbidity had higher medication and antibiotic costs, bed fees, and laboratory expenditures (respectively, $p=0.02$, $p=0.003$, 0.037 , and $p<0.001$). Length of hospital stay tended to be longer in patients with a comorbidity, but it did not reach the level of significance ($p=0.09$). With the presence of pneumonia accompanying COPD, total direct costs and medication costs were significantly higher (respectively, $p=0.005$ and $p=0.007$), and total length of hospital stay was longer ($p=0.025$). Presence of diabetes did not affect the length of hospital stay or total costs (respectively, $p=0.06$ and $p=0.09$). As the number of comorbidities increased, the length of hospital stay and total direct costs increased (respectively, $p=0.02$ and $p=0.008$).

According to social insurance type, total costs and length of hospital stay did not differ among groups ($p=0.168$ and 0.205).

DISCUSSION

Chronic obstructive pulmonary disease is a common pulmonary disease with severe health and economic consequences. Especially, exacerbations causing hospitalizations form an important part of this economic burden (10). In a study of Grasso et al. (11), per capita expenditures for an aged Medicare beneficiary with COPD ($n=42,472$) were found to be 2.4 times the per capita expenditures for all Medi-

care beneficiaries ($n=1,221,615$). In a one -year follow-up study from Spain, the global mean direct yearly cost of chronic bronchitis and COPD was \$1876, and costs of hospitalizations constituted 43.8% of this burden (12). In another study by Hilleman et al. (13), hospitalizations accompany for 40%–63% of total cost in COPD patients, with direct costs of hospitalizations of \$680, \$2658, and \$6770, respectively, for mild, moderate, and severe COPD stages. In a retrospective claims-based analysis including 37,089 COPD patients, mean costs for COPD patients were found to be \$2008 for all patients and \$305 for outpatients, \$274 for emergency applications, \$327 for emergency patients, \$9745 for hospitalized patients, and \$33,440 for intensive care hospitalizations (14).

Direct costs of hospitalized COPD exacerbations differ among different countries. In our study, mean length of hospital stay was 9.6 ± 4.6 days, mean total direct cost was 1103.2 ± 557.3 TL, total bed fees were 307.8 ± 162.7 TL, and medication cost was 559.0 ± 334.4 TL. The results of other studies on this topic from our country are represented in Table 2. In the study of Hacıevliyagil and colleagues (15), they explored the direct costs of hospitalized patients in a pulmonary clinic and found that hospitalizations due to COPD caused the majority of the costs, with an average cost of hospitalization of 1336 TL for 105 COPD patients.

In the study of Özkaya et al. (16), in a large sample of patients hospitalized with COPD acute exacerbations ($n=7832$), the estimated total cost was $\$718\pm 364$ per admission, and mean length of hospital stay was found to be 14.8 ± 9.5 days. In a study of direct costs of a sample of 72 hospitalized COPD patients (22 in the ICU and 50 in the clinic), mean hospitalization cost was 1876.28 ± 1238 TL and mean ICU hospitalization cost was 6871.20 ± 5342 TL, and total costs of COPD hospitalizations were increased with accompanying chronic renal failure, anemia, and pneumonia (17). As seen in Table 2, the average total costs of similar studies seem to be higher than our results. There may be two main reasons for this situation. Firstly, we did not include ICU hospitalizations in our study, because we were not able to explore the components of direct costs due to the packet pricing system of ICU hospitalizations. ICU hospitalizations constitute a major part of direct costs and may increase the costs of hospitalizations if they are included in the study population. Secondly, other studies are from tertiary reference hospitals or university hospitals, and their study populations should include more severe exacerbations associated with more complex comorbidities, and this would also be a direct factor of the increment in total costs and length of hospital stay.

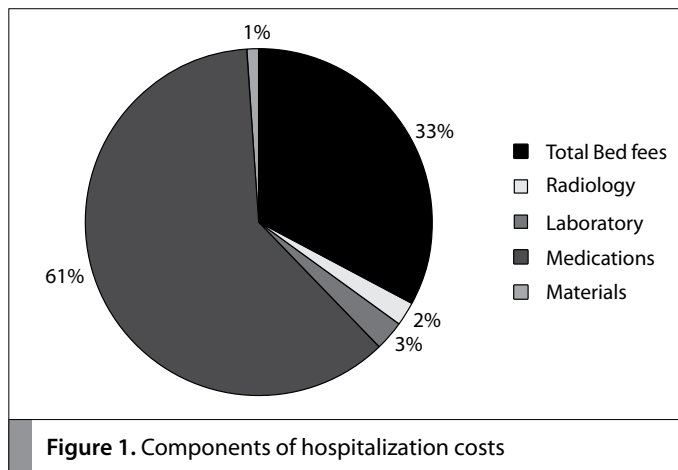


Figure 1. Components of hospitalization costs

Table 2. Results of studies analyzing the cost of chronic obstructive pulmonary disease (COPD) hospitalizations

	n	Mean length of hospital stay (days)	Total costs	Costs of medications	Bed costs
Our study	241	9.6	1103.2 TL*	559.00 TL	307.80 TL
Hacıevliyagil et al. (15)	105	12.1	1336.2 TL	419.08 TL	181.23 TL
Örnek et al. (17)	72 (n:22 ICU*)	11.09	1876.2 TL	716.84 TL	
Varol et al. (21)	376 (n:25 ICU)	9.86	1833.8 TL	526.50 TL	
Özkaya et al. (16)	7832	14.8	718 Dollars	380.5 Dollars	140.7 Dollars

TL=Turkish Lira, ICU= Intensive care unit

Toy et al. (18) found the range of costs per COPD exacerbation to vary substantially between \$88 and \$7757 in 11 original research articles. Hospitalizations were the major cost category in these studies, accounting for 38%-93% of total costs. Also, in a study of O'Reilly et al. (19), 149 patients hospitalized due to COPD exacerbation had a mean total direct cost of 2130.34£, and the median length of hospital stay was 9 days (1-54, mean 11 days).

In a multicenter study from China, 439 COPD patients hospitalized due to exacerbation were evaluated, and age and length of hospital stay were found to be positively correlated with total direct cost of hospitalization (respectively, $p < 0.01$ and $p < 0.01$) (20). Varol et al. (21) found that antibiotic usage increased the length of hospital stay and total costs.

As COPD is a tobacco-related illness, it is linked with other smoking- or age-related comorbid diseases (22). In addition, it is known that the systemic effects of COPD can also cause comorbidities, and the presence of comorbidities in hospitalized COPD patients surely increases the total cost of disease (23, 24); 47.7% of our study population had at least one comorbid disease. Presence of comorbidities significantly increased total costs ($p = 0.008$). Total medication and antibiotic cost and total laboratory costs were higher in patients with at least one comorbid disease (respectively, $p = 0.02$; $p = 0.003$; $p < 0.001$). Length of hospital stay was not significantly different in patients with comorbidities ($p = 0.09$). Presence of pneumonia increased the total costs and length of hospital stay ($p < 0.001$ and $p = 0.011$). As the number of comorbidities increased, the length of hospital stay and total direct costs increased (respectively, $p = 0.02$ and $p = 0.008$).

CONCLUSION

Chronic obstructive pulmonary disease has a substantial economic burden, and the main step to decrease this burden is the cessation of tobacco usage. COPD costs are expected to increase with the increasing prevalence of the illness. Future studies with large population samples would provide precise data about the direct and indirect costs of COPD in our country.

Ethics Committee Approval: N/A.

Informed Consent: N/A.

Peer-review: Externally peer reviewed.

Author contributions: Concept - J.Ç.E., A.B.; Design - J.Ç.E., Ö.Ö., A.B., A.T.Ö., S.D., Ü.A., P.Ö.; Supervision - P.Ö., A.T.Ö.; Resource - J.Ç.E., A.B.; Materials - J.Ç.Ö., Ü.A.; Data Collection&/or Processing - J.Ç.E., Ü.A.; Analysis&/or Interpretation - J.Ç.Ö., P.Ö., A.B., A.T.Ö., Ö.Ö., S.D.; Literature Search - S.D., P.Ö., J.Ç.E.; Writing - J.Ç.E., A.B., Ö.Ö.; Critical Reviews - A.T.Ö., P.Ö., Ü.A., S.D.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

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