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Comparison of outpatient and inpatient costs of moderate and severe exacerbations of chronic obstructive pulmonary disease in Poland

Abstract

Introduction: The aim of the study was to examine the direct and indirect costs of COPD exacerbations under usual clinical practice in primary and secondary care from a societal perspective in Poland.

Material and methods: An observational, prospective study was conducted among patients with exacerbation of moderate or severe COPD. Seventy-three patients were included in the study — 39 treated in hospital (HC) and 34 treated in ambulatory care (AC). The direct costs included the cost of drugs, diagnostic tests, in-hospital and outpatient care. The indirect costs included costs of transportation to the health-care provider and work days lost.

Results: The mean duration of COPD exacerbation did not differ significantly between the groups [HC: 11.2 (CI 95%: 9.6–12.8) days; AC: 10.8 (CI 95%: 9.1–12.1); $p > 0.05$]. The total health-care cost per exacerbation was EUR 1197 (4137.9 PLN) in secondary care (the HC group), and it was 6 times higher than the total cost of exacerbation in primary care (the AC group) — EUR 199.8 (446.9 PLN). The costs of drugs and diagnostic tests were significantly higher in the HC group than in the AC group; however, it was the cost of in-hospital stay and medical visits in the HC group that most influenced expenditure related to COPD exacerbations, as they were 27 times higher than in the AC group.

Conclusions: In Poland the costs of COPD exacerbation managed in secondary care are 6-fold higher than in primary care. Therefore, the decisions about admission of patients with COPD exacerbation to hospital should be made carefully.

Key words: COPD, exacerbations, costs

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Introduction

Chronic obstructive pulmonary disease (COPD) is a very common but under-recognized cause of adult airflow obstruction. The national results of early detection and prevention of COPD in Poland showed frequent (20%) diagnosis of airflow limitation, but the subjects screened were unaware of the disease [1]. The prevalence of COPD in the general population is estimated to be 1% across all ages, rising steeply to $> 10\%$ amongst those aged > 40 years [2–4]. A very important but often overlooked parameter of COPD is the occur-

rence of exacerbations [5–7]. These exacerbations differ in severity, are infrequent in early COPD, and are largely a feature of moderate-to-severe disease. It has been estimated that the average COPD patient experiences about one to four acute exacerbations per year. Exacerbations are related to a reduced quality of life [8]. Furthermore, exacerbations are the most frequent cause of hospital admission and death among subjects with COPD. These patients create considerable health/economic issues [6]. Based on healthcare utilization, an exacerbation is frequently classified as: mild, when the patient has an increased need for medication,

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which he can manage in his own normal environment; moderate, when the patient has an increased need for medication and feels the need to seek additional medical assistance; or severe, when the patient/caregiver recognizes obvious and/or rapid deterioration in condition, requiring hospitalization [5]. Some studies conducted during the last decade have followed the earlier definition of COPD exacerbation used by Anthonisen [9]. It should be stressed that at present there is no universally accepted clinical definition of what constitutes an acute exacerbation of COPD or of how to grade the severity of such an exacerbation [10].

There are quite a lot of studies confirming the fact that severe exacerbations of COPD are much more costly than mild or moderate exacerbations [2–6]. In Poland, however, data on the economic burden of exacerbations are very scarce.

The aim of this study was to examine the direct and indirect costs of moderate and severe COPD exacerbations in primary and secondary care from a societal perspective in Poland.

Material and methods

An observational, prospective study was conducted among patients with moderate or severe COPD who were treated because of exacerbation between June and December 2006. The study was approved by the ethics committee of the Military Institute of Health Service (no 111/WIM/2006). Seventy-three patients were included in the study — 39 treated in hospital pulmonary departments and 34 treated in ambulatory care. The severity of COPD in the patients was determined according to the GOLD criteria [11]. COPD exacerbations were classified as type I or type II of the Anthonisen classification [9], according to which, exacerbation involves the presence of two (type II) or three (type I) of the following symptoms: increase of sputum purulence, increase of sputum volume, and increase of difficulty in breathing plus at least one of the following: upper respiratory infection in the past five days, fever without another apparent cause, increased wheezing, increased cough, or increase in respiratory rate or heart rate by 20% above baseline [9].

Only patients with COPD recognized according to the GOLD criteria at least 12 months before admission and treated for at least 30 days before exacerbation according to the GOLD recommendations were included in the study [11].

The total costs of COPD exacerbations were calculated from a societal perspective. The direct costs included the cost of drugs, diagnostic tests, and in-hospital and outpatient care. The indirect

costs included the costs of transportation to the health-care provider and work days lost. The total costs of in-hospital and outpatient care of COPD exacerbations were compared.

Statistical analysis

Chi-square and Kolmogorov-Smirnov tests were used for non-parametric comparative analysis of in-hospital and outpatient costs of treatment. confidence interval (CI) was set at 95% ($p < 0.05$ was considered statistically significant).

Results

There were no significant differences between the two groups in terms of age, smoking status, severity of COPD, intensity of exacerbation symptoms, or frequency of concomitant diseases (Table 1).

All patients were treated according to the GOLD recommendations for treatment of moderate and severe COPD for at least one month before exacerbation [11]. The mean cost of one-month maintenance therapy before worsening of symptoms did not differ significantly between the groups and amounted to EUR 45.1 (CI: 33.6–56.6) in the hospitalized patients and EUR 47.2 (CI: 35.9–58.6) in the outpatient group ($p > 0.05$).

There was no significant difference in the mean duration of COPD exacerbation (understood as the period from worsening of disease symptoms to a return to the intensity of symptoms observed before exacerbation) between the groups. The mean duration was 11.2 (CI 95%: 9.6–12.8) days in the hospitalized patients and 10.8 (CI 95%: 9.1–12.1) days in the ambulatory subjects ($p > 0.05$).

During exacerbation most of the in- and outpatients were administered antibiotics. Systemic and inhaled steroids, inhaled long acting β_2 -agonists, xanthines and combined drugs (short acting β_2 -agonist plus anticholinergics) were used significantly more often in the hospitalized patients (Table 2).

Among the hospitalized patients, 8% were full-time employees, 3% were part-time employees, 59% were retired, and 30% received a disability pension. Among the outpatients, 9% were full-time employees, 62% were retired, and 29% received a disability pension. All of the employees in both groups were on sick leave during exacerbation.

In the case of the ambulatory treated, 4 patients (12%) were admitted to hospital because of treatment failure; however, nobody had a new episode of exacerbation during the 30 days after the end of the treatment. Three inpatients (7.7%) required new hospitalization because of exacerbation recurrence during the 30 days after the end of treatment of the first episode.

Table 1. Baseline characteristic of patients

	Outpatient care group	Inpatient care group	p
Chi-square test			
	n (%)	n (%)	
Number of patients	34 (100)	39 (100)	
Females	12 (35.3)	11 (29.2)	0.4
Males	22 (64.7)	28 (70.8)	
Severity of COPD according to GOLD criteria before exacerbation	34 (100)	39 (100)	
Moderate	13 (38.2)	17 (43.6)	0.7
Severe	21 (61.8)	22 (56.4)	
Severity of exacerbation according to Anthonisen classification — type I	26 (76)	27 (69)	0.3
Severity of exacerbation according to Anthonisen classification — type II	8 (24)	12 (31)	0.5
Dyspnoe/wheezing	19 (56)	17 (44)	0.3
Tobacco smoking patients	29 (85)	35 (90)	0.6
Concomitant chronic diseases			
Diabetes	4 (12)	8 (21)	0.3
Arterial hypertension	15 (44)	22 (56)	0.3
Coronary heart disease	16 (47)	15 (38)	0.3
Heart failure	6 (18)	6 (15)	0.5
Retired patients	31 (91)	35 (89)	0.8
Kolmogorov-Smirnov test			
	Mean (CI)	Mean (CI)	
Age	66.9 (63.3–70.4)	66.0 (62.5–69.8)	> 0.05
Body temperature (°C)	37.3 (37.0–37.6)	36.9 (36.7–37.1)	> 0.05
Respiratory rate/min ⁻¹	20.8 (18.8–22.8)	21.2 (19.0–22.3)	> 0.05
Pulse rate/min ⁻¹	86.8 (83.4–90.2)	88.7 (80.2–92.7)	> 0.05
Mean lung function tests results before exacerbation			
FEV ₁ (l) (% of predicted)	1.25 (47.6)	1.43 (48.5)	> 0.05
FVC (l) (% of predicted)	2.37 (70.8)	2.67 (69.3)	> 0.05
FEV ₁ /FVC	0.39	0.42	> 0.05

Table 2. Medication use for COPD exacerbation treatment by drug class (% of patients; chi-square test)

Therapeutic group	Outpatient n (%)	Inpatient n (%)	p
Systemic steroids	21 (61.8)	34 (87.9)	0.01
Antibiotics	25 (73.5)	31 (79.5)	0.5
Long-acting β_2 -agonists	14 (41.2)	29 (74.4)	0.004
Combination of short-acting β_2 -agonists and anticholinergics	6 (17.6)	21 (53.8)	0.001
Inhaled steroids	12 (35.3)	23 (59.0)	0.04
Anticholinergics	10 (29.4)	15 (38.5)	0.4
Xanthines	14 (41.2)	33 (84.6)	0.0001

The mean total healthcare cost per exacerbation in secondary care was EUR 1197 (4137.9 PLN), and it was 6 times higher than the total cost of exacerbation in primary care — EUR 199.8 (446 PLN) (Tables 3, 4). The costs of drugs and diagnostic tests were significantly higher in the hospitalized group than in the outpatient group; however, it was the cost of hospital stay and medical visits that influenced expenditure related to COPD exacerbations most, as they were 27 times higher in the inpatients than in the ambulatory group (Tables 3, 4).

There were no significant differences in the average indirect costs per exacerbation between the studied groups. They were EUR 144.1 (566.3 PLN) in the inpatients and EUR 86.1 (338.4 PLN) in the outpatients.

Discussion

Exacerbations and hospitalizations in particular constitute the most important direct healthcare costs associated with COPD. It is estimated that approximately 68% of direct medical expenditure associated with COPD treatment is the cost of ho-

spitalization [12]. Some studies have shown that the cost of hospital stay represents 40–57% of the total direct costs generated by patients with COPD, reaching up to 63% in severe patients [2, 3, 13–15]. In our study, the costs of hospital accommodation reached 59.3% of the total costs of exacerbation treatment. To our knowledge, this is the first follow-up study of patients with moderate-to-severe COPD exacerbation in Poland aimed at prospectively quantifying the direct and indirect costs under usual clinical practice in primary and secondary care from a societal perspective. The system of health-care in Poland does not provide clear criteria for hospitalization of patients with COPD, so the decision about hospitalization frequently depends on the good will and experience of doctors.

Hospital admissions are often precipitated by lack of social support and serious comorbidities. Therefore, hospital at home schemes could be safely used to care for patients with exacerbation of COPD who would otherwise be admitted to hospital [16]. Clinicians should consider this form of management, especially as there is increasing pressure for inpatient beds.

Table 3. Costs (EUR) of COPD exacerbation in studied groups (Kolmogorov-Smirnov test)

Total costs (EUR)	In-hospital Mean (CI) (EUR)	Outpatient Mean (CI) (EUR)	p
Costs of drugs per exacerbation	116.0 (88.8–1143.2)	46.7 (31.8–61.6)	< 0.001*
Costs of drugs per concomitant diseases	15.8 (7.7–23.9)	Not assessed	
Overall costs of drugs	183.7 (149.1–218.3)	46.7 (31.8–61.6)	< 0.001*
Costs of diagnostic tests	150.8 (112.5–189.0)	35.5 (16.7–54.2)	< 0.001*
Costs of portable medical implements (i.e. nebulisers)	0.4 (0.0–0.9)	18.5 (8.2–28.9)	< 0.05*
Oxygen therapy	6.9 (4.3–9.6)	Not assessed	
Cost of hospitalization and ambulatory visits	710.7 (593.3–802.1)	26.0 (26.0–26.0)	< 0.001*
Overall direct costs	1052.9 (909.4–1169.5)	113.7 (80.1–147.2)	< 0.001*
Indirect costs of work days lost*	123.7 (0.0–247.9)	72.9 (0.0–164.7)	> 0.05
Indirect costs of transportation**	20.4 (12.5–28.3)	13.2 (7.3–19.1)	> 0.05
Overall indirect costs	144.1 (18.9–269.4)	86.1 (0.0–177.5)	> 0.05
Total costs	1197.6 (1022.1–1345.1)	199.8 (106.5–293.1)	< 0.001*

*Measured by human capital approach using per capita productivity lost from absenteeism per worker, and average daily earnings

**Number of kilometres multiplied by the price of one litre of petrol in 2006

Table 4. Costs (PLN) of COPD exacerbation in studied groups (Kolmogorov-Smirnov test)

Total costs (PLN)	In-hospital Mean (CI) (PLN)	Outpatient Mean (CI) (PLN)	p
Costs of drugs per exacerbation	455.9 (348.9–4492.8)	183.5 (124.9–242.1)	< 0.001*
Costs of drugs per concomitant diseases	62.1 (30.2–93.9)	Not assessed	
Overall costs of drugs	721.9 (585.9–857.9)	183.5 (124.9–242.1)	< 0.001*
Costs of diagnostic tests	592.6 (442.1–742.8)	139.5 (65.6–213.0)	< 0.001*
Costs of portable medical implements (i.e. nebulisers)	1.6 (0.0–3.5)	72.7 (32.2–113.6)	< 0.05*
Oxygen therapy	27.1 (16.9–37.7)	Not assessed	
Cost of hospitalization and ambulatory visits	2793.1 (2331.7–3152.2)	102.2 (102.2–102.2)	< 0.001*
Overall direct costs	4137.9 (3573.9–4596.1)	446.9 (314.8–578.5)	< 0.001*
Indirect costs of work days lost*	486.1 (0.0–974.2)	286.5 (0.0–647.3)	> 0.05
Indirect costs of transportation**	80.2 (49.1–111.2)	51.9 (28.7–75.1)	> 0.05
Overall indirect costs	566.3 (74.3–1058.7)	338.4 (0.0–697.6)	> 0.05
Total costs	4706.6 (4016.8–5286.2)	785.2 (418.5–1151.9)	< 0.001*

*Measured by human capital approach using per capita productivity lost from absenteeism per worker, and average daily earnings

**Number of kilometres multiplied by price of one litre of petrol in 2006

It is well known that health-care costs of severe exacerbations of COPD are many times higher than those of mild or moderate exacerbations [13]. Unfortunately, exacerbations of COPD are variously defined in medical literature [10]. In this study, the Anthonisen criteria of exacerbation were used, including severe — type I, and moderate — type II [9]. It appeared that these criteria were not good enough in predicting the necessity of hospitalization in the course of COPD exacerbation. Neither group differed significantly in the proportion of subjects with severe exacerbations (type I). Such exacerbations occurred in 76% of outpatient and 69% of inpatient subjects. The mean duration of exacerbation was 11.2 days in the hospitalized patients and 10.8 days in the ambulatory subjects. Treatment failure in the outpatient group (12%) was comparable with the frequency of exacerbation recurrences (7.7%) observed in the in-hospital group.

In both groups the effects of treatment were comparable; however, the resource utilization was markedly higher in the hospitalized group. So,

even in cases of severe exacerbations according to Anthonisen criteria, ambulatory treatment could be considered as a more cost-effective procedure.

Conclusions

In Poland the costs of COPD exacerbation managed in secondary care are 6-fold higher than in primary care. Therefore, the decisions about admission of patients with COPD exacerbation to hospital should be made carefully. Unfortunately, Anthonisen criteria of COPD exacerbation severity do not appear helpful in determining the necessity of hospitalization.

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