

EVALUATION OF THE TREATMENT COSTS OF ASTHMA EXACERBATIONS IN OUTPATIENTS

EDYTA RYSIAK^{1*}, ALEKSANDRA KUCZYŃSKA¹, ILONA ZARĘBA¹, ROBERT MRÓZ^{2,3}
and JERZY PAŁKA¹

¹Department of Medicinal Chemistry, Medical University of Białystok,
Mickiewicza 2D, 15-222 Białystok, Poland

²Respiratory Medicine Center, Piasta 9A, 15-044 Białystok, Poland

³Department of Lung Diseases and Tuberculosis, Medical University of Białystok,
Żurawia 14, 15-540 Białystok, Poland

Abstract: The aim of this study was to assess the correlation between the costs of controlled and uncontrolled asthma therapy in outpatients care. To determine the efficacy of the medicinal care there was performed a retrospective study on a group of 150 patients. Thirty eight patients have been enrolled to study group. Drug costs were estimated on the basis of documentation of patients. The assessment takes into account the cost of the retail price of drugs, the cost of diagnostic tests and outpatient care. Evaluation of the costs of treatment of patients was performed from a societal perspective. In the study there was calculated the value of the daily, monthly and annual treatment of the patient depending on the degree of asthma control. There was analyzed the frequency of reception of certain preparations in the study group. It was compared the annual cost of therapy for the given preparation in both examined groups. The total annual costs of therapy in patients with controlled and uncontrolled asthma were compared. Properly controlled asthma is potential source of savings. Treatment of asthma in an outpatient setting allow to avoid exacerbation of the disease, reducing and limiting direct and indirect costs of disease and improving the quality of patient's life.

Keywords: asthma, economics pharmaceutical, recurrence, direct services costs, health care costs

Asthma is a chronic, complex and multifactorial disease of the lower respiratory tract. It is characterized by bronchial hyperreactivity and remodeling (1, 2). The diagnosis of clinical symptoms beyond the parameters is based on the discovery of spirometry and bronchial hyperresponsiveness (3). The pathogenesis of the disease involves many cells and substances released by them, and processes associated with the internal modulation of cell signaling pathways (1, 2). Due to the long and complex definition of asthma in epidemiological studies are used less precise criteria for diagnosis of the disease, which causes a significant difference in the incidence of the disease (4). Available data indicate that, depending on the age, asthma prevalence is changed (3, 5). It is assumed that the number of patients with asthma is in the range between 1 and 18% compared to the general population. Although in some studies and populations this ratio may be higher and even be up to approximately of 30% (6, 7). Studies carried

out in our country showed that the rate was 8.6% among children, and 5.4% among adults. Similar results were obtained in other countries of the same geographical region (8). Over the last year it was reported continuous increase in the percentage of asthmatics, which is closely connected with risk factors for asthma. Complicated mechanism for the development of asthma and factors affecting activation of disease processes are very complex and closely interrelated. Nevertheless, among the risk criteria, one can distinguish individual factors, environmental, climatic and professional as well as additional factors, such as tobacco smoke, infections, diet and lifestyle (9-11). Pathogenicity, a variety of risk factors and complicated process of diagnosis significantly affect the mortality of patients with asthma. It seems that the mortality in patents with asthma is more varied than the prevalence. It is important that there were no significant correlations between the morbidity and mortality in a population

* Corresponding author: e-mail: edyta.rysiak@umb.edu.pl

of asthma. The mortality rate for asthma is largely dependent on socio-economic conditions of the population and the quality and accessibility of medical care and studied group. Unfortunately, these are not the only factors influencing the number of deaths from this disease. An important role is played by complications that are necessary for proper assessment of the severity of the disease and the associated dangers. Incorrect assessment of the disease is the fault of the doctor and the patient. The patient is not able to properly assess the degree of severity of dyspnea and respiratory distress. In most countries, mortality from asthma varies between 1 and 5 deaths per 100 000 inhabitants. In Poland, it is approximately 2. The mortality rate is about 20-40 / 100 000 patients with asthma (12, 13). Significant impact on the growth rate of mortality is a sudden exacerbation of the disease. It is characterized by the severity of symptoms, often with varying frequency, intensity and severity. Exacerbations may occur at various stages of the disease and even during stabilization phase. Stimulus causing the disease can be divided into factors initiating and inducing asthma. Initiation factors are responsible for initiating bronchospasm, and inducers cause allergic inflammation of the

lower respiratory tract. The first group of stimuli induces the most transient and brief attack of asthma, but with varying degrees of seriousness. This group includes, among others, the fog and the physical. Inducing factors should be: exposure to inhaled allergens and small molecule substances unions and also upper respiratory infections, especially viral etiology. Short exposure to an allergen can cause a mild and brief asthma attack. However, prolonged exposure can trigger a slow progression of symptoms associated with the induction of eosinophilic inflammation. Control of asthma is not easy, therefore, the disease is often inadequately controlled. This type of situation leads to asthma exacerbations, which generate additional economic and social burden (4, 10, 14, 15).

The aim of the study was to evaluate the correlation between the properly selected patient care and socio-economic costs incurred by the state budget.

METHODOLOGY

A retrospective study was conducted among 150 patients with asthma treated at the Centre for Respiratory Medicine in Białystok in the period

Table 1. Classification of asthma control.

Criterion	Controlled asthma	Part-controlled asthma	Uncontrolled asthma
Daytime symptoms	≤ 2 per week	> 2 per week	Complied with more than 3 from part-controlled asthma
Limitation of vital activity	Lack	Present	
Nocturnal symptoms	Lack	Present	
Emergency treatment	Lack	> 2 per week	
Lung function (PEF, FEV ₁)	Correct	< 80%	
Exacerbations	Lack	≥ 1 per year	Present

Table 2. Characteristics of study group.

Study group	Total	38	
	Women	13	
	Men	25	
Age	Age ranges	Women	Men
	< 35	3	2
	36-50	3	3
	51-60	2	8
	> 61	5	12
Degree of asthma control	Controlled asthma	19	
	Uncontrolled asthma	19	

Table 3. The frequency of admission of the preparation during the treatment of asthma and exacerbations.

The frequency of admission of the preparation during the treatment of asthma	Total	51	
	Foradil (12 mg)	3	
	Miflonide (400 mg)	6	
	Sybicort (320 + 9 mg)	4	
	Oxodil (1 mg)	6	
	Seretide	19	
	Alvesco (160 mg)	13	
	Pulmoterol	5	
The frequency of temporarily admission Ventolin during treatment of asthma	Total	28	
	Controlled asthma	15	
	Uncontrolled asthma	13	
The frequency of admission of selected agents used temporarily during exacerbations		Controlled asthma	Uncontrolled asthma
	Total	30	28
	Steroids	19	16
	Seretide	9	10
	Pulmoterol	3	2

from January 2013 to December 2013. The retrospective study did not require the consent of the Ethics Committee. The studied group was 38 patients enrolled. In the study, criteria were evaluated on the extent and course of the disease, treatment regimen, diagnostic test results, coexisting diseases and infections, and the general condition of the patient. It was the division of patients depending on the level of disease control. This allowed for an analysis of the cost effectiveness of pharmacotherapy in terms of the intensity of treatment. Patients were classified into groups based on the classification of the degree of control of the disease (16). To confirm the identification of developing asthma, patients undergone respiratory function tests by spirometry (17). The spirometry was examined as part of the medical examination, however in reaserch, test results of the study were analyzed. The permission to do spirometry was obtained from each patient before the study. The study was made at the Laboratory of Functional Respiratory Respiratory Medicine Center by using camera CPFS / D Company Pro-medica. The study was performed in accordance with the recommendations for the standardization of spirometry (18, 19) in a sitting position, with the nose clip established in constant ambient conditions (humidity - less than 50%, air temperature 21-22°C). The study consisted in forced expiratory performed three times, during which the

speed and volume of air flow were recorded. The spirometry was evaluated the following parameters: FVC, FEV₁, FEV₁ / VC, PEF and MEF (17-19). The characteristics of the study group are presented in Table 2.

In estimating the cost of the disease, the average cost of outpatient treatment of asthma and its exacerbations came from the documentation of patients. Evaluation of the costs of treatment of patients was performed from a societal perspective. The direct costs included the price of drugs, the cost of diagnostic tests and outpatient care. The unit costs came from data from the National Health Fund. Drug costs, determined the gross retail price, derived from existing in 2013 lists published by the Minister of Health. The characteristics of the study population was developed using descriptive statistics - the average and standard deviations for quantitative data and numbers and percentages for qualitative data were calculated. The significance of differences was tested using the nonparametric Mann-Whitney test. The use of health care resources and the individual cost components of the disease are presented as the average cost per patient per year; 95-percent confidence intervals (CI) were calculated using bootstrapping method (20). Value of $p < 0.05$ was considered statistically significant. In the case of data aggregation, CI were not designated.

Table 4. Evaluation of the costs of certain preparations at standard dose of the drug. The value of the costs is presented in Polish currency (PLN).

Name of preparation	Dose	Dosage	Package size	Cost of 1 package	Cost of 1 dose of preparation	Value of daily treatment	Value of monthly treatment	Value of annual treatment
Foradil	12 µg	2 × 1	30	70.14	2.338	4.676	140.28	1706.74
Miflonide	400 mg	2 × 1	60	42.00	0.70	1.40	42.00	511.00
Symbicort	360 + 9 µg	2 × 1	60	145.95	2.43	4.87	145.95	1775.76
Oxodil	2 mg		60	60.06	1.00	2.00	60.06	730.73
Seretide		2 × 1	120	127.05	1.06	2.12	63.53	772.89
Alvesco	160 mg	1 × 1	120	152.57	1.27	1.27	38.14	464.07
Ventolin	100 µg	2 × 1	200	14.03	0.07	0.14	4.21	51.21
Metypred	4 mg	2 × 1	30	9.21	0.31	0.614	18.42	224.11

Table 5. The frequency of admission of the preparation by the patient with controlled and uncontrolled asthma.

Name of preparation	Foradil	Miflonide	Oxodil	Seretide	Alvesco	Symbicort	Ventolin	Metypred
Controlled asthma	1	3	1	9	6	-	15	-
Uncontrolled asthma	2	3	5	16	7	4	13	15

Table 6. The evaluation of the costs of certain preparations for specific treatment with a standard dose of the drug for a specified number of patients (k) of the controlled type of asthma. The values in the table are presented in Polish currency (PLN).

Name of preparation	Foradil	Miflonide	Oxodil	Seretide	Alvesco	Ventolin	Metypred
Number of patients (n)	1	3	1	9	6	15	14
Value of daily treatment (k = 1)	4.68	1.40	2.00	2.12	1.27	0.14	0.61
Value of monthly treatment (k = n)	140.28	126.00	60.06	571.73	228.86	4.21	257.88
Value of annual treatment (k = n)	1706.74	1533.00	730.73	6955.99	2784.4	768.14	3137.54

Table 7. The evaluation of the costs of certain preparations for specific treatment with a standard dose of the drug for a specified number of patients (k) of the uncontrolled type of asthma. The values in the table are presented in Polish currency (PLN).

Name of preparation	Foradil	Miflonide	Oxodil	Seretide	Alvesco	Symbicort	Ventolin	Metypred
Number of patients (n)	2	3	5	16	7	4	13	15
Value of daily treatment (k = 1)	4.68	1.40	2.00	2.12	1.27	4.87	0.14	0.61
Value of monthly treatment (k = n)	280.56	126.00	300.30	1016.40	267.00	583.8	54.72	276.30
Value of annual treatment (k = n)	3413.48	1533.00	3653.65	12366.20	3248.47	7102.9	665.72	3361.65

RESULTS

Preparations, which were adopted by the study group of patients, are: Foradil 12 mg, Miflonide 400 mg, Symbicort 320 + 9 mg, Oxodil 12 mg, Seretide, Alvesco 160 mg, Ventolin and Metypred 8 mg. Metypred was used in the case of exacerbations as a life-saving drug. The study analyzed the frequency of admission of the preparation during the treatment of asthma and the frequency of non-systematic use of Ventolin. We compared the frequency of steroid medication and preparations Seretide and Pulmoterol in patients with varying degrees of asthma control. Data are provided in Table 3.

We studied the costs of certain preparations with a standard dose of the drug. Calculated values

represent costs of daily, monthly and annual treatment per patient. The data are presented in Table 4. The frequency of admission of the preparation by the patient was analyzed taking into account the distribution of the degree of asthma control (Table 5). We assessed the cost of some preparations with a standard dosage of drugs, including the value of the monthly and annual treatment. Data are shown in Tables 6 and 7. The value of the annual cost of therapy for a given preparation were compared in both groups (Fig. 1). The total annual cost of therapy was compared in patients with controlled and uncontrolled asthma (Fig. 2). The average monthly cost of treatment with selected preparations for controlled asthma was 1 189.02 PLN, while in the case of non-controlled asthma was PLN 2 905.08. The annual

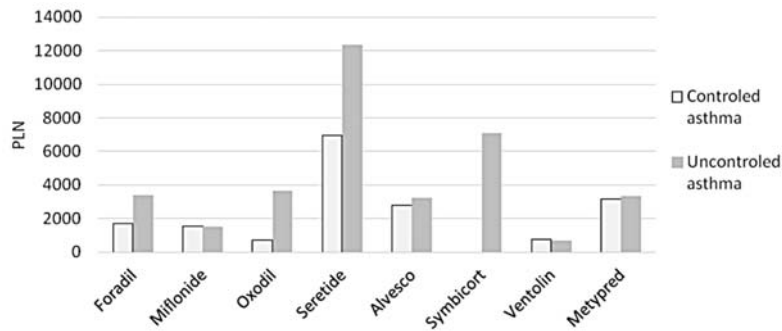


Figure 1. The comparison of the cost of preparations for the treatment of patients with controlled or uncontrolled type of asthma with a standard dose of the drug per one year. The values on the figure are presented in Polish currency (PLN)

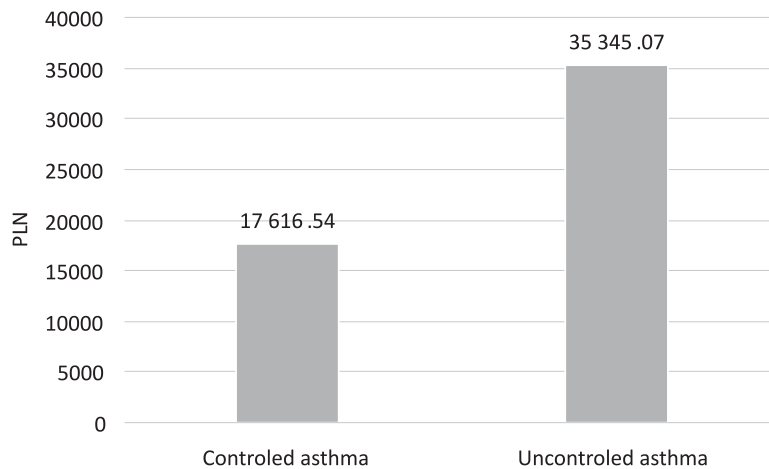


Figure 2. The comparison of the total cost of preparations for the treatment of patients with controlled or uncontrolled type of asthma with a standard dose of the drug per one year. The values on the figure are presented in Polish currency (PLN)

cost of controlled asthma therapy was 17 616.54 PLN and uncontrolled 35 345.07 PLN.

DISCUSSION

Uncontrolled asthma significantly impairs functioning and life activity of the patient. The disease significantly impairs quality of life and, consequently, often posing a threat to life. The main problem is a correct diagnosis and assessment of the degree of asthma control in the longer term to determine appropriate treatment. Incorrect determination of one of the aforementioned key issues leads to incorrect diagnosis, poor asthma control and progression of disease. It is also associated with the frequent interventions in emergencies, frequent hospitalization, life-threatening attacks, and even deaths due to asthma.

In the past ten years, the number of patients with asthma increased twice. The World Health Organization estimates that about 300 million people on the world have asthma, and in Europe it is about 30 million. Asthma is qualified as a chronic disease of civilization occurring mainly in developed countries (21). A risk factor for asthma and other diseases are genetic changes, but these are progressing slowly. The rapid increase in the incidence of asthma applies to the last 30 years. Epidemiologists are reporting that one of the most important factors determining the development of asthma are rapidly changing environmental conditions and way of life (22). The disease is a serious health problem, social and economic. It concerns a large part of society, impairing quality of life. As a result, asthma affects the activity of professional and social life of patients. Asthma is characterized by frequent and troublesome symptoms, which makes it one of the most common causes of incapacity for work as well as a frequent cause of hospitalization. According to World Health Organisation estimates, every year, 15 million "years in health" is lost because of asthma. This represents 1% of the burden caused by diseases. It is estimated that due to asthma die 255 000 people a year. However, one of the 250 total deaths worldwide are due to asthma (23). Ninety percent of these deaths could be prevented by improving medical care and reducing exposure to risk factors of patients (24).

The problem of the rapid increase in the incidence of asthma and other allergic diseases is also a problem in Poland. The prevalence of asthma in Poland is estimated at 8.6% (95% CI 7.7-9.6) among children and 5.4% (95% CI 5.0-5.8) in adults (25). In 2005, the results of a nationwide epidemiological

study - ECAP, confirmed the higher incidence of asthma in urban areas (26). The biggest problems in Poland are under-diagnosis of asthma and inadequate control of asthma in patients (27, 28). In 2006, there were about 58 000 hospital admissions of patients with asthma. Of these, 5000 had asthmatic condition which constituted a direct threat to life. The average length of hospitalization for asthma lasted eight days, and because of status asthmaticus 12 days (29). Poland is a country where the mortality rate due to asthma is 5-10 cases per 10 000 of patients. This represents one of the highest rates in Europe (30).

In the European Union, costs of the treatment of asthma are estimated at 17.7 billion euros. Loss of productivity due to poor asthma control costs 9.8 billion euros per year (24). A study conducted in Finland reported that treatment of patients with severe asthma is 13 times more expensive than in patients with mild asthma. In Finland there are about 20% of patients with severe form of asthma. Expenditures on treatment of these patients were 60% funding for the treatment of asthma (31). The largest percentage of costs were incurred for hospitalization. Asthma hospitalizations in the United States amounted to 51.2% of direct costs for the treatment of asthma, 10.5% are temporary aid, 18.4% outpatient treatment, while 19.9% are subsidies for drugs (32). In addition to the direct costs, asthma generates high indirect costs, so-called non-medical costs. These include: loss of productivity, dismissal, sickness pension, benefits care (33). The main measure of the cost of the disease is sudden worsening of the patient's condition, called exacerbations. It is estimated that about 80% of the financing for the treatment of asthma include costs associated with the occurrence of exacerbations. Severe attacks of breathlessness significantly worsen the patient's condition. They cause a decrease in its functioning and increase the frequency of use of drugs to treat the disease and used when needed. These types of episodes closely correlate directly with the costs and by the patient and indirectly from the financial outlay incurred by the state. Indirect costs significantly outweigh the costs directly associated with the disease. Therefore, it is difficult to calculate them and they are rarely considered. Studies show that properly controlled asthma is a source of potential savings for institutional payers. The conclusion that arises after such analyses is that asthma should be treated in an outpatient setting, properly controlled with avoidance of exacerbations. This leads to a cost reduction of disease-related direct costs, and hence improve the quality of life

of the patient and also reduce the direct costs associated with the lost of productivity of the patients.

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