

# The Burden of Illness of Acute Exacerbation of Asthma

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## Abstract

**Objective:** The objective of this study was to determine the direct cost of acute exacerbation of asthma (AEXA) among asthmatic patients. **Materials and Methods:** A total of 111 asthma patients who were admitted to a public hospital with AEXA included in this study. The costs, including investigation charge, unit costs of treatment per bed, medication charge, food costs, transportation costs, and loss of productivity per asthma episode, were calculated. Data were analyzed using Statistical Package for the Social Sciences (SPSS) ver.23.0. **Results:** A median medical cost of AEXA under the government perspective was USD 105.00 per episode. Medication cost comprised the majority (52.38%) of the total medical costs and lab investigations. A median medical cost of AEXA under the patient's perspective was USD 22.50 per episode. **Conclusion:** AEXA and total days stay in the hospital were directly proportional to the total direct costs.

**Key words:** Acute exacerbation of asthma, asthma, direct medical costs

## INTRODUCTION

National asthma guidelines of Pakistan based on the Global Initiative for Asthma recommendations were firstly published by the National Asthma Council in 1995. Later in 2001, the Pakistan Chest Society published its revised version to streamline the appropriate diagnosis and proper management of asthma.<sup>[1,2]</sup>

Asthma is a chronic respiratory disorder of the lungs that affect all people no matter age, race, and gender.<sup>[3]</sup> Asthma is a significant source of morbidity and mortality worldwide. It is associated with recurrent episodes of wheezing, shortness of breath, sputum production, airways hyper-responsiveness, chest tightness, and coughing which often happens at night or early in the morning.<sup>4</sup> When there is an allergen or any other trigger enters into the airways, swelling of the bronchial tubes, narrowing of the airways, and reducing of the airflow in or out of the lungs, results in asthma attack that is called acute exacerbation of asthma (AEXA).<sup>[1-4]</sup>

According to the World Health Organization reports that approximately 245 million people are suffering from asthma. An increment of 33%

or 400 million people would have severe asthma problems in 2025.<sup>[5,6]</sup> In 2007, a study in Sweden reported that the average annual direct cost per episode of AEXA was USD 493.00 which was mainly dependent on disease severity and increasing age.<sup>[7]</sup>

In 2002, a study done in Malaysia reported that the average direct cost of medical care provided to treat bronchial asthma for 6 months was USD 4366.71, where the major of its proportion was subsidized by the government.<sup>[8]</sup> The direct costs of asthma were categorized as the costs of maintenance therapy, acute asthma-related emergency, and asthma-related hospitalization.

Although the exact epidemiological data are lacking, asthma is a major health issue in Pakistan which poses a high burden of illness among asthma patients.<sup>[8,9]</sup> It is also projected that around 5–7% of the total populace is currently suffering, where approximately more than 5% is pediatrics.<sup>[9]</sup> A study

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conducted in Karachi showed that asthma prevalence was around 18% among various age groups.<sup>[10]</sup> Global Initiative for Asthma statistics showed a prevalence of 4–5% of asthma patients in Pakistan.<sup>[11,12]</sup> The economic burden of asthma has been assessed by several studies in different countries and according to their findings, major risk factors responsible for AEXA were environmental pollution, sedentary lifestyle, lack of exercise, and obesity.<sup>[7-18]</sup>

These study findings are firm evidence that shows that the prevalence of asthma is rising and is of great interest to the national health-care system because this rise, if it continues, could eventually pose a major economic challenge to deal with.<sup>[7-18]</sup> However, very limited information about the direct costs of treating AEXA is evident in the literature. The majority of studies in Pakistan mainly focus on asthma outcomes treatment. This study aimed to focus on the costs of AEXA, including emergency care and hospitalization as well.

## MATERIALS AND METHODS

This study was performed at a district headquarter (DHQ) public hospital in Pakistan and started after the permission of the concerned authorities. Research tools were developed according to local settings to achieve the desired objectives of this study. All the study protocols were revalidated by face and content validation. The content used in the development of the research tools was for the assessment of the study outcomes. The reliability of the research tools was examined by Cronbach's alpha which was 0.813.

This study focused on asthmatic patients admitted to the DHQ hospital. All 111 patients had a firmly established diagnosis of mild to life-threatening exacerbation of asthma. Patients with underlying diseases such as cystic fibrosis, ischemic heart disease, chronic obstructive pulmonary disorder, or eosinophilia lung disease were not included in this study. Each patient was given informed consent before taking part in the study. The patient's particulars were recorded. A questionnaire was used to guide interviews with the patients and their caretakers. The treatment costs of AEXA were obtained from medical records, prescription reviews, medication prescribed, laboratory tests, and discharged bills.

All collected data were analyzed with SPSS (version 23.0). The details of patients' sociodemographics were obtained using descriptive statistics. In inferential statistics, the Spearman test was used to assess the relationship between two variables which can be described using a monotonic function.  $P < 0.05$  was taken as statistically significant.

## RESULTS

Among the total of 129 asthmatic patients, 111 fulfilled the study protocol and included in the final analysis. The

remaining 18 patients who were not able to fulfill inclusion criteria were subsequently excluded from the study. The majority of the patients were Punjabi, female, non-working and non-smoker. The common precipitating factors were haze, dust, and cough. Most of the asthmatic patients were having sinusitis and allergic rhinitis. Of 111 asthmatic patients, 74 (66.67%) were hospitalized with a mild exacerbation of asthma [Table 1].

The direct pharmacotherapy costs comprised the majority of the total medical costs (52.38%). The costs that subsidized by Government were found to be USD 105.00 which included miscellaneous costs, i.e., unit costs of treatment per bed, medication prescribed, laboratory tests, and the discharged bills. As this study was conducted in a public hospital, only food, transportation, some medications, and loss of productivity had to be born by the patients [Table 2].

**Table 1: Demographics and disease features of the study group (n=111)**

Patients' demographics	n (%)
Gender	
Female	64 (57.66)
Male	47 (42.34)
Age, years	51.6
Employment/business	
Non-working	70 (63.06)
Working	41 (36.94)
Mother tongue	
Punjabi	56 (50.45)
Saraiki	37 (33.33)
Others	18 (16.22)
Current smokers	12 (10.81)
Precipitating factors	
Haze	33 (18.33)
Dust	22 (12.22)
Cough	25 (13.89)
Smoke	16 (8.89)
Flu	17 (9.44)
Cold	12 (6.67)
Comorbid disorders	
Allergic rhinitis	26 (23.42)
Sinusitis	62 (55.86)
Nasal polyps	23 (20.72)
Asthma severity	
Mild	74 (66.67)
Moderate	15 (13.51)
Severe	11 (9.91)
Life threatening	11 (9.91)

**Table 2:** Distribution of total medical costs

Variables	Government perspective		Patient perspective	
	Median (USD)	Percentage	Median (USD)	Percentage
Investigation charge	-	-	-	-
Unit costs of treatment per bed	50	47.62	-	-
Medication charge	55	52.38	4.50	17.65
Food costs	-	-	7.00	27.45
Transportation cost	-	-	5.50	21.57
Loss of productivity	-	-	8.50	33.33
Total direct costs	105	100	25.50	100

Spearman's correlation test was performed to test the relationship between the total costs of acute exacerbation with severity and length of stay, respectively [Table 3]. The direct costs of different severity levels of AEXA mean, the more severe the attack of asthma, the higher were the costs because it increased the length of the stay in the hospital. Based on the observed findings, statistically significant and positive correlations were observed between direct costs and severity of the disease and the total length of stay at the hospital in both the government perspective and patient perspective. The strength of correlation among direct costs and severity of the disease in the government perspective was very-strong (Spearman's  $r > 0.8$ ), whereas for patients' perspective, it was moderately-strong (Spearman's  $r = 0.38$ ). Moreover, similar findings were observed for length of stay versus total costs for both government perspective and patients' perspective.

## DISCUSSION

This study determined the direct costs of AEXA among asthma patients. The costs that subsidized by the Government were found to be higher than the costs paid by the patients ( $P < 0.05$ ). The median of the government total treatment costs was estimated to be USD 105.00. For patients who are government servants, pensioners, and physically or mentally handicapped, they do not have to pay for their treatment. Thus, it showed a great burden on national health-care resources and the economy of the country in total but beneficial for the public. The median of the patient's total treatment costs was estimated to be USD 25.50 only. This could be because this study was conducted in a relatively mid-sized hospital in a moderately populated district and the majority of the patients came to the hospital using private transport. Still, just a small amount had to be paid by the patients against transport because of the short distance from their home to the hospital.

Costs of the medication used among AEXA patients significantly varied based on the clinical manifestations and the severity of the attack and their length of stay in the hospital, and insurance coverage, if they have. Usually, to treat an AEXA attack short-acting beta-agonists (any form),

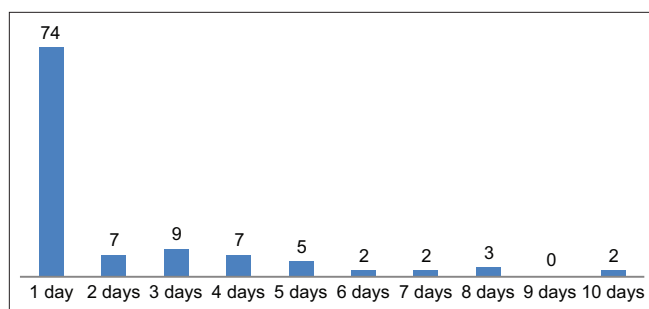
**Table 3:** Spearman's correlations coefficients

	Severity versus total direct costs of acute exacerbation of asthma	
	Government perspective	Patient perspective
Correlation coefficient	0.8120	0.3830
Sig. (2-tailed)	0.0001*	0.0170*
	Length of stay versus total direct costs of acute exacerbation of asthma	
	Government perspective	Patient perspective
Correlation coefficient	0.8360	0.4270
Sig. (2-tailed)	0.0001*	0.0110*

The level of significance ( $\alpha$ ) was set at 0.05

corticosteroids (any form), anticholinergics, leukotriene receptor antagonists, antihistamines, and some aided therapies such as intubation, oxygen, and ventilation are given to the patients. In Switzerland, the annual direct medical costs of asthma were USD 1889.28 in 1999, whereas, in Sweden, the average annual direct costs of asthma were USD 493.00 in 2007.<sup>[7,16]</sup> All these medical costs were significantly higher compared to Pakistan. A reasonable explanation for this discrepancy could be the differences between countries in the organizational structure of the health-care system, economic status, as well as the facilities provided.

Previous studies reported that hospitalization expenses comprised a major fraction of asthma-related costs in many countries.<sup>[13]</sup> However, hospitalization rates seemed to have decreased after the use of anti-inflammatory drugs in persistent asthma patients. This might be due to adequate control of the disease.<sup>[14,15]</sup> Now, hospital costs are no longer the largest component of the expenditure of asthma treatment. As shown in Table 3, there was a statistically significant difference ( $P < 0.05$ ) observed regarding the costs of AEXA between the government perspective and the patients' perspective in two attributes, i.e., the severity of the asthma attack and length of stay in the hospital, which strongly evidenced the hypothesis that the majority of the costs these days, are borne by the Government, not by the patients. Medication costs have replaced hospital costs. Medication cost constituted the majority (52.38%) of the



**Figure 1:** Distribution of length of stay

total medical expenditures as reported in the study. This figure is higher than in previous studies which reported that drug costs make up 30–40% of the total direct cost of asthma in some of the countries.<sup>[14,15]</sup> The possible explanation might be because of the cheaper diagnostic tests and medication costs in the country. Besides, the previously used oral theophylline and inhaled cromones were cheaper than newer asthma drugs. The prices of newer asthma drugs such as inhaled corticosteroid, long-acting beta-2 agonists, and leukotriene modifiers were much expensive compared with older asthma drugs.

In the year 1998, a study was done in Spain to investigate the relationship between the costs of asthma, depending on the degree of severity of asthma, i.e., AEXA.<sup>[13]</sup> An increase in asthma-related morbidity and mortality rate in Spain has influenced the economic impact in the country. The average direct costs arisen by asthma patients over a year were determined in that study. Those costs were estimated at USD 6393, USD 2407, and USD 1336 based on severe controlled asthma, moderately controlled asthma, and poorly controlled asthma, respectively.<sup>[13]</sup> Our study results were in accordance with their study, the cost of asthma was surprisingly high and varied substantially, depending on the degree of severity of asthma, especially during episodes of AEXA.

According to two other studies that were done in the United States and Canada, a large proportion of the hospitalization cost was due to a small proportion of asthmatics that are common among both of the studies. First, older patients likely contribute to higher hospitalization costs. The older the age is, the higher the hospitalization. Second, some significant comorbidities such as obesity, diabetes, hypertension, and other pulmonary disorders play an important role that contributes to higher hospitalization costs. Third, the cost was higher for patients with intensive care unit admissions. In Northern California, a study found out that resource such as nursing care, respiratory therapy, and medical supplies along with equipment use and physician fees to account for the majority of the hospital costs of asthma. The less severe of asthma exacerbation and the shorter the length of stay, the lesser the hospitalization costs. In this study, most of the asthmatic patients (66.67%) were admitted into the hospital for a day only [Figure 1].

## CONCLUSION

The total direct costs of AEXA in different severity levels were significantly different from the government perspective than the patient perspective. There was a linear relationship found in our study results that as the severity of the AEXA increased the costs also increased. In other words, the findings manifestly indicated that there were differences between the costs of different severity levels of AEXA, i.e., the more severe the grades of exacerbation and the higher were the costs. The same is with the length of the stay in the hospital. Although Pakistan does not have an excellent health-care infrastructure still these days, in mid-sized and bigger public hospitals, a substantial proportion of the direct costs of AEXA is somehow subsidized by the government.

## LIMITATIONS OF THE STUDY

This study was done in a middle-sized hospital, so these findings cannot be extrapolated to all patients of AEXA. Another limitation was that due to less sample size and shortage of time, this study was not representative of the entire country. Furthermore, this study just assessed the direct costs of AEXA among asthmatic patients and did not include indirect costs in it.

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