



A Cross-sectional Observational Study on Pharmacoeconomic Burden of Asthma in a Tertiary Care Teaching Hospital

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Asthma remains one of the most common chronic respiratory diseases. Even with significant advancement in the diagnosis and management of asthma, its control remains suboptimal. As the overall health expenditures are escalating, the healthcare community has become more sensitive to the concept of Pharmacoeconomic.

Objective: We aimed to assess the healthcare cost; economic burden associated with the management of asthma.

Methodology: A Prospective Observational Study was conducted in a Hospital of Vadodara, Gujarat, India with the sample of 120 patients. Patient's data, financial data and the healthcare cost were collected while interviewing the patient. The healthcare costs included were direct medical cost, direct non-medical cost, and indirect cost.

Result: The average costs per asthmatic patient per month with severe, moderate and mild asthma were found to be USD 65.27, USD 50.89, and USD 48.85, respectively. The average

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overall cost with or without co-morbidity were calculated as USD 56 and USD 38, respectively. Out of USD 53.6, the average direct medical cost was USD 29.6, the average direct non-medical cost was USD 17.4, and the average total indirect cost was USD 6.6. The mean total cost for inpatient was calculated to be USD 105.12 and for outpatient it was USD 56.09. The 43% of the population had burden of illness less than 30% and 40% of the population had burden of illness between 60-80%. Only 6.6% of population had more than 80% of Pharmacoeconomic burden of asthma. **Conclusion:** In our study, it was concluded that the patients with severe asthma and/or co-morbidity have higher treatment cost. Out of the overall cost, the maximum cost borne by the patient was the direct medical cost. The hospitalization increased the total health care cost by about 47%. The 43% of the population has less than 30% of burden of asthma while only 6.67% of population had more than 80% of burden of asthma.

Keywords: Asthma; pharmacoeconomic; direct medical cost; direct non- medical cost; indirect cost.

1. INTRODUCTION

Asthma remains one of the most common chronic respiratory diseases. It is estimated that approximately 300 million people of all ages and all ethnic backgrounds suffer from asthma and the burden related to this disease to governments and health care systems. [1,2] Asthma affects 5-10% people which can be estimated to 23.4 million people which include 7 million children. 300 million individuals are estimated to be affected by asthma worldwide. The WHO (World Health Organization) has estimated that 15 million disability adjusted life years are lost annually, and 250000 asthma deaths are reported worldwide. The economic cost of asthma is considerable both in terms of direct medical costs (that includes hospital admissions and cost of pharmaceuticals) and indirect costs (such as time lost from work and premature death). [3] Available data about the economic burden of India are very scant. About 18% of the world's total population resides in India, and many of the states of India have populations higher than or like those of large countries. And India is a home to about 1/10th of the world's asthmatics. [4] Resources allocated for healthcare such as materials and equipment are scarce; however, their possible usages are infinite. As a result, it is quite a challenge for healthcare professionals to provide the patient with quality healthcare and minimum cost. Due to the limitations on healthcare resources, there is increased interest in assessing the economic efficiency of healthcare treatments and programs. Though difficult to accomplish, economic evaluation, analyzing costs and outcomes of several alternative therapies can be a useful approach. Pharmacoeconomic studies compare various aspects such as costs, clinical and humanistic outcomes related with different therapies. Pharmacoeconomics can be defined

as the branch of economics that uses cost-benefit, cost-effectiveness, cost-minimization, cost of illness and cost-utility analyses to compare pharmaceutical products and treatment strategies. [5] The International Society for Pharmacoeconomics and Outcomes Research (ISPOR) defines Pharmacoeconomics as "the field of study that evaluates the behavior of individuals, firms, and markets relevant to the use of pharmaceutical products, services, and programs, and which frequently focuses on the costs and consequences of that use". It involves the economic evaluation of drug development, drug production, and drug marketing i.e., all the steps that take place from the time the drug is manufactured to the time when it reaches the patients. [5] Pharmacoeconomic and pharmacological knowledge is essential in practical prescribing skills. Conventional pharmacists also do not have much knowledge regarding proper medication use. Current qualification of pharmacist in India is B. Pharm 4-year degree program or Diploma in pharmacy (2-year study plus 500hr practical training in hospital) and the curriculum of these courses does not provide sufficient information, knowledge and practice regarding Pharmacoeconomics. As a result, to overcome such a dilemma, the Indian government introduced a new program in pharmacy education named PharmD (2008), which features the principles of Pharmacoeconomics in its syllabus so that they can be more beneficial than the conventional pharmacists as they can be assumed to implement the principles of Pharmacoeconomics in daily practice in hospital and community pharmacies. [5]

2. METHODOLOGY

It was a cross-sectional observational study conducted for a period of 6 months (October-

2019 to March- 2020) at the Department of Respiratory, Dhiraj General Hospital, Vadodara. 120 patients were enrolled in the study as per the selection criteria. All the patients of asthma who were prescribed with anti- asthmatic drugs who visited or admitted in the department of respiratory of our hospital were included in the study. All asthma patients were screened for the study. Exclusion criteria were those patients who did not give consent for the study. Patients who were fulfilled the inclusion criteria were enrolled in the study after explaining to the patients the details of the study, the Informed consent form was taken from the patient. It was assured that all information and records would be kept confidential and the procedure would be helpful for both the patient and the researcher. All the relevant data (patient demographics, detailed history, general physical examination, lab tests, and details of prescribed medications) was obtained from the patients' medical records and through counseling the patients who visited the Out- Patient Department (OPD) or In-Patient Department (IPD) of Respiratory Department. The data collection included direct medical cost, direct non-medical cost and indirect cost. The collected data were analyzed for the average cost incurred in treating the asthma patient and calculated based on the total amount spent by

the patient per month. Data collected were tabulated in the Microsoft excel sheet. Mean and one-way ANOVA methods were used for statistical analysis.

3. RESULT

A total of 120 patients were enrolled in the studies according to the proposed inclusion and exclusion criteria. Table 1 shows the demographic details of the study patients.

Healthcare cost on the basis of severity: Out of 120 patients, 58 and 32 of them had mild and moderate asthma, respectively. And remaining 30 patients were diagnosed with severe asthma. The severity of asthma was obtained based on the American Thoracic Society Grades for Severity of a Pulmonary Function Test Abnormality. The mean overall cost of severe asthma was found to be USD 65.27 (40%) and the overall cost of mild and moderate asthma were recorded as USD 48.085 (30%) and USD 50.89 (31%), respectively. This shows that patients with severe asthma were found to spend more healthcare cost compared to others. (Table 2).

Table 1. Demographic Details

Demographic Details	Number of Patients (%)
<u>Gender</u>	
Male	51.67%
Female	48.33%
<u>Educational Qualification</u>	
Professional Degree	3.33%
Graduate	15%
Undergraduate	5%
High School	20%
Primary School	37%
Illiterate	19.17%
<u>Occupational status</u>	
Professional	17%
Clerical/shop/farm	32%
Unemployed	39%
Skilled	12%
Unskilled worker	1%
Demographic Details	
<u>Age groups</u>	
20-29	22.50%
30-39	27.50%
40-49	19.17%
50-59	16.67%
60-69	14.17%

<u>Co morbidities</u>	
Respiratory	11%
Endocrine illness	11%
Hypertension	13%
Others	2%
<u>Duration of illness</u>	
0-5 years	82.50%
6-10 years	1%
>10 years	7%
<u>Types of patients</u>	
In patient	5.83%
Outpatient	94.17%

Table 2. Health Care Cost on the Basis of Severity

Variable	Severity	N	SD	P-Value
Overall Cost	Mild	58	1634.25	0.054
	Moderate	32	1786.03	
	Severe	30	1705.10	
	Total	120	1687.56	



Fig. 1. Healthcare cost based on the Serverity

Healthcare cost based on co-morbidity: The average overall cost for the treatment of asthma with co-morbidities (per patient) were found to be USD 56 whereas for the treatment of asthma without co-morbidity (per patient) was calculated USD 38. This shows that patients with co-morbidities had to spend more treatment cost as compared to patients without co-morbidities. (Table 3). The average overall cost for asthmatic patients with co-morbidities was USD 51.87 for respiratory diseases, USD 69.13 for endocrine illness and USD 45.39 for other diseases. This indicates that patients having endocrine illness (e.g., diabetes or hypothyroidism) spend more treatment cost as compared to other co-morbidities. (Table 4)

Healthcare cost based on direct and indirect cost component: In our study, the Direct Non-medical Cost per patient was calculated as USD

17.4. Out of this, USD 14.3 was for transportation and food cost was recorded as USD 3.1. This showed that travelling cost was more in comparison of food cost. The Direct Medical cost per patient was INR 2181.4. Out of this, USD 4.63 was for laboratory investigations, USD 20.8 for medication of asthma and USD 4.18 for the medication of co-morbidity. This result indicates that the cost for the treatment of asthma is more than other direct medical cost. The Indirect Cost (i.e., productivity loss) of patient was found to be USD 6.6. (Table 5)

Comparison of Components of Costs: In this study, on comparing the different components of costs, we found that the direct medical cost for asthma was more, followed by direct non-medical cost and indirect cost, respectively. The cost calculated for direct medical was USD 29.6, USD 17.4 for direct non-medical and USD 6.6 for indirect cost.

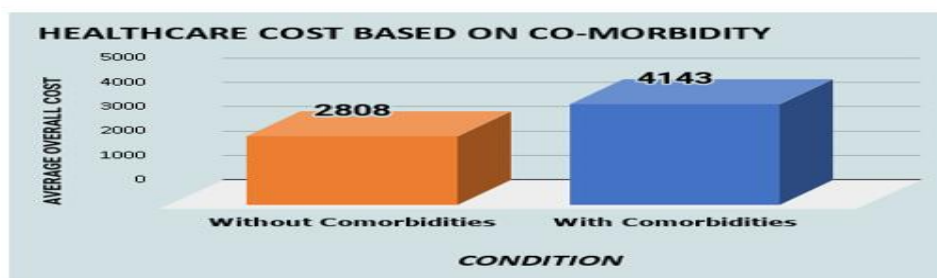


Fig. 2. Healthcare cost based on co-morbidities

Table 3. Health Care Cost On the basis of co morbidities

Conditions	Average Overall Cost	
	INR	USD
Without Comorbidities	2808	38
With Comorbidities	4143	56

Table 4. Cost of Individual Comorbidities

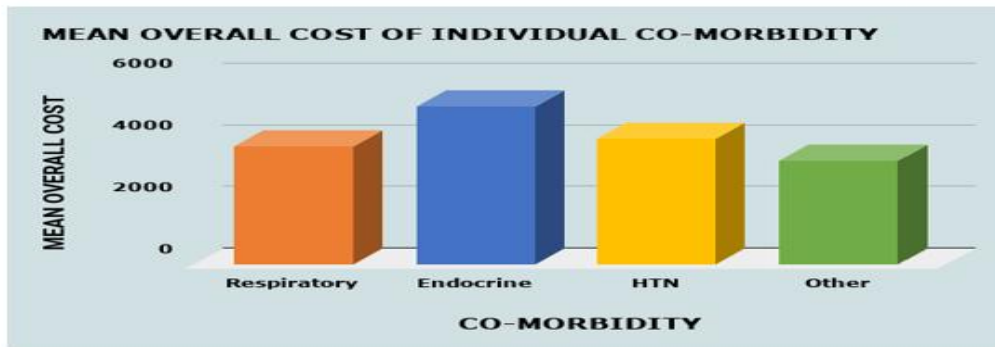
Variable	Morbid Condition	N	Mean overall cost		P-Value
			INR	USD	
Overall Cost	Respiratory	12	3823.61	51.87	0.025
	Endocrine	13	5096.38	69.13	
	HTN	15	4069.87	55.21	
	Other	3	3345.67	45.39	
	Nil	77	2958	40.13	

Table 5. Direct non-medical cost and direct medical cost

Direct Non-Medication Cost Component (per patient)			
Components of Cost	Total Cost		Percentage
	INR	USD	
Transportation Cost	1054.8	14.3	82%
Food Cost	230.8	3.1	18%
Total	1285.5	17.4	100%
Direct Medical Cost (per patient)			
Components Of Costs	Total Cost		Percentage
	INR	USD	
Lab Investigations	341.6	4.63	16%
Medications for Asthma	1531.3	20.8	70%
Medications for Co morbidities	308.5	4.18	14%
Total	2181.4	29.6	100%

Table 6. Components of costs (per patient)

Components	Total Cost		Percentage
	INR	USD	
Direct Non- Medical Cost	1285.5	17.4	32.54%
Direct Medical Cost	2181.4	29.6	55.22%
Indirect Cost	483.6	6.6	12.24%
Total	3950.5	53.6	100.00%



(Respiratory- Allergic Rhinitis, COPD, TB; Endocrine- Diabetes Mellitus, Hypothyroidism; HTN- Hypertension)

Fig. 3. Healthcare cost of individual co-morbidity

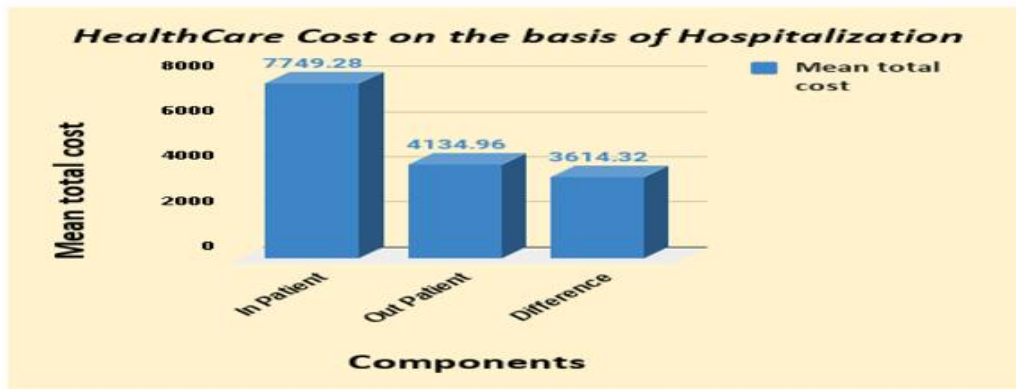


Fig. 4. Comparison of healthcare cost based on Hospitalization

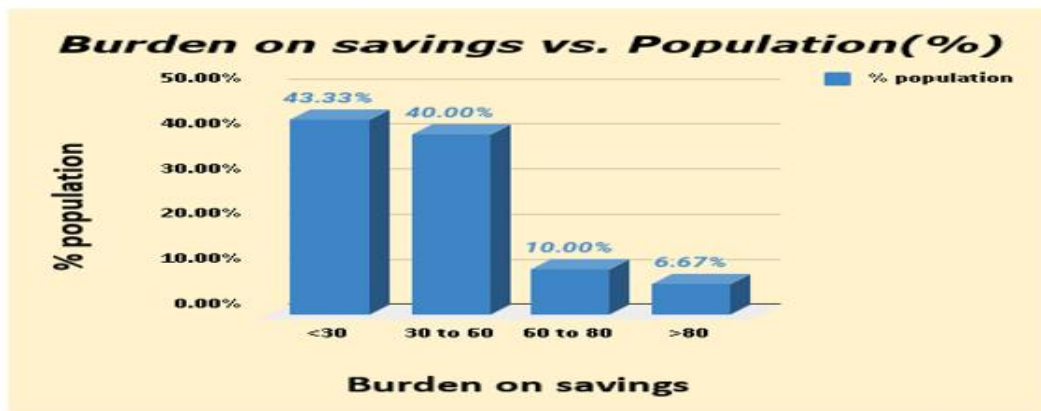


Fig. 5. The percentage of Pharmacoeconomic burden of asthma

Healthcare cost based on hospitalization: Based on our study, the hospitalization increases the treatment cost of asthma. To support this statement, the treatment cost of asthma of both

the inpatient and outpatient were recorded. The treatment cost for inpatient was USD 105.12 and for outpatient were USD 56.09. This data proves that the hospitalization increases the

treatment cost. The difference between the two costs was calculated to be USD 49.03. This shows that up to 47% of cost increased on hospitalization. (Table 7)

Pharmacoeconomic burden of asthma: In our study, we calculated the Pharmacoeconomic burden by calculating the percentage difference between the savings before addition of overall cost of asthma (Savings 1) and the savings after the addition overall cost of asthma (Savings 2). The data of savings 1 was recorded while interviewing the patient and savings 2 was calculated by subtracting the overall cost of asthma from savings 1. The 43% (N=52) of the population had illness burden of <30%. Similarly, 40% (N=48) of population had burden between 30-60%. The other 10% (N=12) of population had 60-80 % burden of illness. And only 6.67% (N=8) population had more than 80% of Pharmacoeconomic burden of asthma. (Table 8)

DISCUSSION

This study was conducted on a population of 120 patients out of which 51.67% were male and 48.33% were female, it was found that the direct non-medical cost was higher (46.6%) when compared to direct medical (43.7%) and indirect cost (9.7%). The direct non-medical charges increased mainly due to the transportation costs borne by the visiting patients. It is not unlikely that the health care cost of asthma was found to increase in the presence of exacerbations and with disease of greater severity (39.6%) when compared to patients with mild (29.6%) and moderate (30.8%) disease. The health care cost also increased by 20% in patients with other comorbid conditions, out of which the patients

suffering from endocrine disease endured higher costs compared to the patients with other comorbidities. This study also shows that out of the total sample size 43.33% population endured <30% economic burden on their total savings and 6.67% of the total population endured >80% economic burden on their total savings, it was noted that the population with lower total income suffer from maximum economic burden as opposed to population with higher total income. It can also be said that the economic burden on savings endured by a person is inversely proportional to the total income. [6-11]

Pharmacists who are practicing in community, hospital, and clinical settings can benefit considerably from the application of pharmacoeconomic principles in the normal practice settings. It will empower the pharmacy practitioners and administrators to make better and more informed decisions regarding the services and products they provide. Pharmacoeconomics will impart evidence contraindicating the promotion of certain types of high- cost medicines and services. This study was conducted in a trust based tertiary care teaching hospital; hence this study was not exposed to consultation and hospitalization charges. This restricts the generalization of the study. Most of the patients enrolled in the hospital were from rural backgrounds with poor socio economic status and low educational levels, due to which wide variation could not be achieved in the study population. The finding of this study shows the economic burden on a person but does not define the methods to decrease it. However, further studies should be done for cost benefit or cost minimization analysis defining the methods to decrease the burden. [11-15]

Table 7. Health care Cost on the basis of Hospitalization

Components	Mean total cost	
	INR	USD
In Patient	7749.28	105.12
Out Patient	4134.96	56.09
Difference	3614.32	49.03

Table 8. Pharmacoeconomic Burden of Asthma

Burden on savings	Number of people	% Population
<30	52.00	43.33%
30 to 60	48.00	40.00%
60 to 80	12.00	10.00%
>80	8.00	6.67%

These findings highlight the critical need to strengthen and further support asthma control strategies through increased provision of guideline-based care, reduction of environmental asthma triggers and improvements in self-management to reduce hospitalizations, ER visits, absenteeism, and mortality. In recent decades, several guidelines, both national/ regional and at global levels (e.g., GINA) were created trying to mark out better diagnosis and treatment strategies, emphasizing that reducing future risk and achieving clinical control should be the primary targets of asthma management. [2] Moreover, they also propose measures that promote a more adequate use of healthcare resources and cost-effective strategies.

Pharmacoeconomics has great use in health policy decision making and can be done by several healthcare professionals such as primary healthcare providers, policy makers, health managers and healthcare administrators. The primary care providers are often bombarded with new drugs of the same category, in addition to the existing drugs. Introduction of such new drugs can confuse the healthcare professionals for the judicious selection and rational use of medicines. When a new drug is introduced, it should have equal or more efficiency compared to the existing drug and should have some economic or related advantage. Given that severe attack is associated with increase in direct costs, healthcare policies targeting achievement of better and stricter control of asthma and lower disease severity during the stable periods of the disease will play a crucial role in the reduction of economic burden of asthma. Also, as hospitalization and drugs are the principal components of direct cost, rationale prescribing of drugs as well as appropriate hospitalization seems to have a crucial role in the reduction of burden of asthma attacks on health economics. When the combined costs of medical care, mortality and absenteeism are considered, it renders the total cost of asthma a substantial and serious economic burden on society. [16-20]

The economic burden of asthma is an important tool of its effect on society. Asthma related costs are high and so should be systematically monitored using standardized methods. Natural history of the disease, environmental impact, incidence and prevalence trends, co-morbidities, ageing of the population, quality of life, the effect of guidelines implementation and differences in national health systems and income levels must

be considered. The development of Pharmacoeconomics at the moment is at infancy stage in India, despite the rapid growth of clinical research. The India Chapter of ISPOR has been formed, but it needs to develop the platform for Pharmacoeconomics. This study is a cost of illness analysis which can be further used as a study reference for cost benefit analysis, cost minimization analysis, cost utility analysis and cost effectiveness analysis. [21-23]

CONCLUSION

In conclusion, given that severe attack is associated with increase in direct costs, healthcare policies targeting achievement of better and stricter control of asthma and lower disease severity during the stable periods of the disease will play a crucial role in the reduction of economic burden of asthma. Also, as hospitalization and drugs are the principal components of direct cost, rationale prescribing of drugs as well as appropriate hospitalization seems to have a crucial role in the reduction of burden of asthma attacks on health economics. When the combined costs of medical care, mortality and absenteeism are considered, it renders the total cost of asthma a substantial and serious economic burden on society. The economic burden of asthma is an important tool of its effect on society. Asthma related costs are high and so should be systematically monitored using standardized methods. Natural history of the disease, environmental impact, incidence and prevalence trends, co-morbidities, ageing of the population, quality of life, the effect of guidelines implementation and differences in national health systems and income levels must be considered. These findings highlight the critical need to strengthen and further support asthma control strategies through increased provision of guideline-based care, reduction of environmental asthma triggers and improvements in self-management to reduce hospitalizations, ER visits, absenteeism, and mortality. In recent decades, several guidelines, both national/ regional and at global levels (e.g., GINA) were created trying to mark out better diagnosis and treatment strategies, emphasizing that reducing future risk and achieving clinical control should be the primary targets of asthma management. Moreover, they also propose measures that promote a more adequate use of healthcare resources and cost-effective strategies. The development of Pharmacoeconomics at the moment is at infancy stage in India, despite the rapid growth of clinical

research. The India Chapter of ISPOR has been formed, but it needs to develop the platform for Pharmacoeconomics. We hope clinical pharmacists including Pharm.D graduates be more beneficial than conventional pharmacists as they can implement the principles of economics in daily basis practice in various healthcare settings.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

The study obtained ethical approval from the Sumandeeep Vidyapeeth Institutional Ethics Committee (Ref no: SVIEC/ON/Phar/BNPG18/D19035).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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