INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA):IJPS00]
Journal Homepage: https://www.ijpsjournal.com

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**Review Article**

# A Review-Understanding The Burden Of Asthma On Individuals And Healthcare Systems

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ARTICLE INFO

Received: 07 June 2024
Accepted: 11 June 2024
Published: 16 June 2024
Keywords:
Asthma, Burden, Costs, Healthcare, Economic, Public Health.
DOI:
10.5281/zenodo.11767498

## ABSTRACT

Asthma imposes a significant burden on both individuals and healthcare systems worldwide. This burden manifests in various forms, including impaired quality of life, increased healthcare utilization, and substantial economic costs. Understanding the multifaceted nature of this burden is crucial for developing effective strategies for asthma management and prevention. This article explores the diverse impacts of asthma, from its effects on daily activities and productivity to its strain on healthcare resources. By shedding light on the complexities of asthma's burden, we aim to promote awareness and facilitate the implementation of targeted interventions to alleviate the challenges faced by individuals and healthcare systems. Furthermore, the burden of asthma extends beyond the individual level, influencing societal productivity and healthcare infrastructure. Addressing this burden requires a comprehensive approach that integrates medical management, patient education, and public health initiatives.

## INTRODUCTION

Globally, asthma is a common chronic disease that affects people of all ages. It is a significant contributor to the burden of disease, contributing to both early mortality and decreased quality of life in people of all ages [1]. Asthma is the most prevalent long-term illness in kids and teenagers, and it accounts for a significant portion of medical costs for people of all ages. The number of people with asthma has significantly expanded over the past few decades; there are already 300 million asthma sufferers worldwide, and by 2025, there will likely be an additional 100 million [2]. Almost 26 million Americans suffer from asthma, which is a common illness that costs $56 billion annually. The severity and morbidity of asthma are the main factors that influence its clinical and financial effects. Despite the fact that less than 10% of asthma patients have severe disease, increasing asthma severity and morbidity are associated with

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**Relevant conflicts of interest/financial disclosures**: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

lower quality of life, poorer productivity at work, increased mortality risk, and significantly higher health care resource consumption and costs [3]. Asthma severity and morbidity are the main factors that influence the financial and medical costs of the disease. Notwithstanding the fact that less than 10% of asthmatics have severe illness,[4-5]. Asthma severity and morbidity are associated with significantly higher health care resource and expense consumption, lower quality of life, decreased productivity at work, and increased mortality risk. [6-12]. The cost of asthma medication, which includes both long-term controller treatment and short-term relief medications, is the most expensive part of asthma-related medical costs for people with severe asthma [13-14]. As total medical costs climb, the healthcare business is becoming more and more cost-conscious. So, while evaluating healthcare products and services, it is important to consider their financial impact on the cost of healthcare in addition to their efficacy and safety. Like in economics, the fundamental concept in Pharmacoeconomics is efficiency, and this idea helps formulate strategies for maximising benefits for a given resource use.[15]. Insurance companies are looking for information to assist decisions regarding contracting, acquiring, and adding new drugs to formularies in an environment when healthcare prices are growing. Drug producers must therefore assess the value of their goods in terms of both their financial worth and therapeutic efficacy [16]."Doctors prescribe, patients consume, and progressively around the world, third purchasing parties (government insurance companies) pay the bills with cash they have gotten from more concerned healthy members of the population"[17]

**Pharmacoeconomics**

Pharmacoeconomics is defined by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) as "the field of study that evaluates the behaviour of individuals, firms, and markets relevant to the use of pharmaceutical products, services, and programmes, and which frequently focuses on the costs (inputs) and consequences (outcomes) of that use."[18].In pharmacoeconomics, the costs and impacts of pharmacological commodities and services are discovered, evaluated, and compared[19].It encompasses the economic evaluation of drug development, production, and marketing, or all the steps from the time the drug is created until it is administered to patients[20].

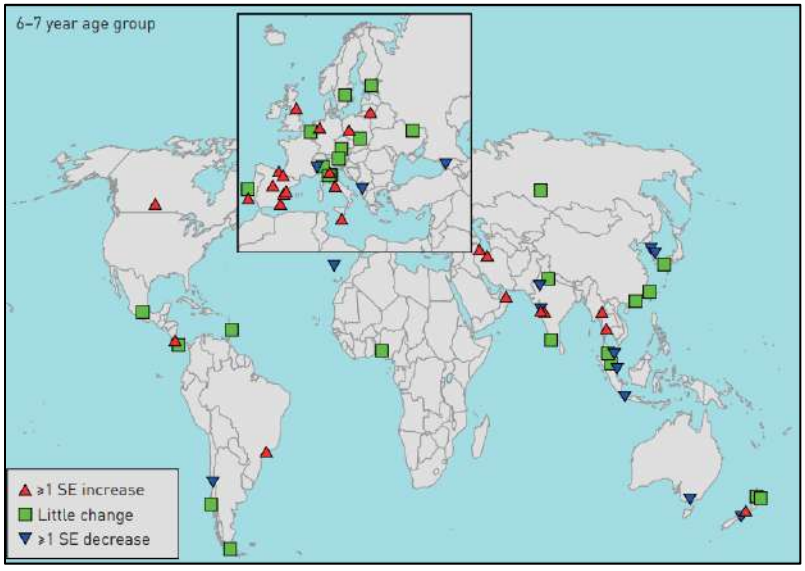
**Genesis of pharmacoeconomics**

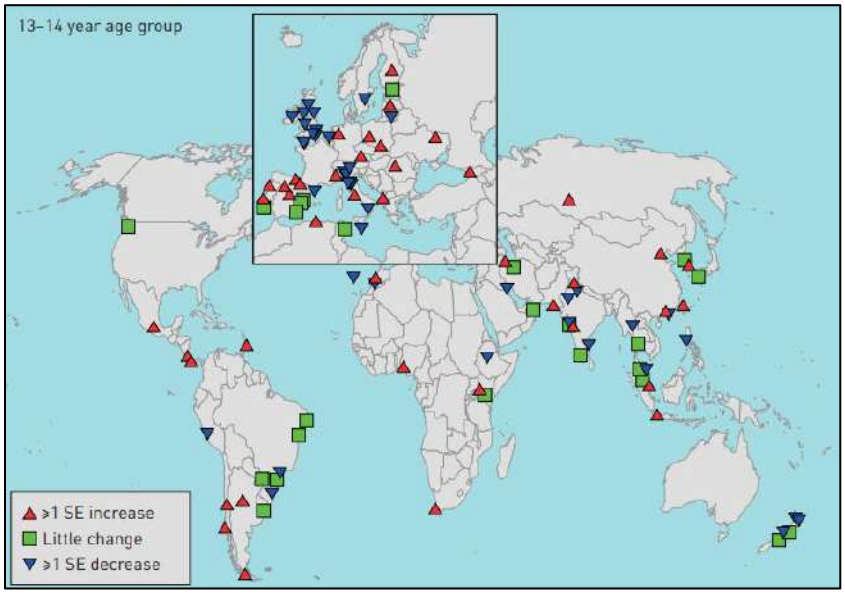
Early in the 1960s, the medical system formally recognised pharmacy as a clinical discipline. During this time, the pharmaceutical sciences such as pharmacokinetics, drug information, and clinical pharmacy had started to have a big impact on pharmacy education. Pharmacoeconomics started to gain popularity in the 1970s. [21].The first book on health economics was released in 1973, and the concept of cost-benefit and cost-effectiveness analysis was created by McGhan, Rowland, and Bootman from the University of Minnesota in 1978.[22].“A specialised pharmacy academic programme was introduced in 1983 by the Ohio State University College of Pharmacy with the intention of providing an overview of the use of cost benefit and cost effective analysis in healthcare, with a focus on their application to the provision of pharmaceutical treatment. This phrase was formerly defined as "the study of the costs of pharmaceutical therapy to healthcare systems and society,"[21].The term "pharmacoeconomics" first appeared in the literature in 1986, when Townsend's study was published to highlight the need for research efforts in this new field. In 1992, the journal "Pharmacoeconomics" was founded.[22]

**Epidemiology**

Asthma is a common chronic illness that affects 1% to 21.5% of persons globally. [23] In

comparison to the rest of the world, China has a low prevalence of asthma: the estimated rate of clinical (treated) asthma there is 1.42%, compared to the equivalent global average of 4.46% [23]. More recent statistics show that asthma affects 1.24% of Chinese persons over the age of 14[24].Asthma prevalence varies greatly across Asia, from 5.2% in Taipei to 30% in New Zealand, compared to a range of 10–17% in other countries. Strong evidence suggests that prevalence is increasing internationally, and there are numerous factors that may be contributing to this growth or the variations in prevalence between different countries. There is general consensus, nevertheless, that environmental factors—such as elevated pollution exposure, allergies, the Western way of life, and ambient cigarette smoke—are the main offenders.[25-28].ISAAC Phases One and Three temporal trends in prevalence were evaluated for three linked conditions:Among 304679 teenagers from 106 centres in 56 countries and 193 404 children from 66 centres in 37 countries, there were cases of asthma, rhinitis, and eczema [29].Replication of standardised methodologies is crucial, and ISAAC Phase Three and Phase One methodological comparisons were determined to be favourable [30].Figure 2 shows that the average global symptom prevalence of current wheeze in the past 12 months increased slightly from 13.2% to 13.7% in adolescents (a mean increase of 0.06% per year) and from 11.1% to 11.6% in children (a mean increase of 0.13% per year). These changes were seen in Oceania (20.39% and 20.21%), Latin America (+0.32% and +0.07%), Northern and Eastern Europe (+0.26% and +0.05%), Africa (+0.16% and +0.10%), Northern and Eastern Asia. Asia-Pacific (+0.07% and 20.06%), Eastern Mediterranean (20.10% and +0.79%), and the Indian subcontinent (+0.02% and +0.06%). The prevalence of present asthma symptoms decreased significantly in English-speaking nations (20.5% and 20.1%), and patterns resembling these were seen for symptoms of severe asthma. However, the proportion of kids who reported having asthma at some point in their life (also known as "asthma ever") climbed by 0.18% per year in kids and by 0.28% per year in adolescents. [31]






the GBD estimates of the global asthma deaths have degrees of variation which may be explainable by differences in number of sites reporting asthma deaths and their accuracy: 380 200 to 504 300 in the year 1990 [65, 66], 218 000 in 2000 [59], 449 900 in 2005 [67], 345 700 in 2010 [66], 489000 in 2013 [65], 397 100 in 2015 [58, 67], 420 000 in 2016 [68] and 495 100 in 2017[32-33].The International Study of Asthma and Allergies in Childhood (ISAAC) discovered that the historical perception of asthma as a disease of high-income countries (HICs) is no longer true: the majority of those affected live in low- and middle-income countries (LMICs), where asthma prevalence is estimated to be rising at the fastest rate . These nations are home to the majority of the world's population [34]. Several HICs and LMICs have created asthma strategies (or asthma programmes, as some nations refer to them) at the national or regional level to lessen the burden of asthma. As a result, the adverse effects of asthma have been rapidly reduced. (35).

**Mortality, morbidity, and poverty**

From 1985 to 1987, the number of deaths due to asthma per 100,000 people ranged from 2 (Hong Kong Special Administrative Region of China and USA) to 7 (New Zealand) to more than 9 (in Germany), however rates for underprivileged groups were significantly higher in all of these nations (38, 39). When the severity of an asthma attack was overestimated and undertreated, which typically happened before the fatal attack, these deaths mostly involved young people and happened at the patient's home (in 50–60% of cases) [36-37].Despite an increase in the frequency of asthma, the rising trend in mortality has slowed or reversed in certain developed nations (38), which is likely due to better usage of inhaled corticosteroids among those who have access to such treatment (39).

**Direct and indirect costs of asthma**

According to the definition of direct costs as resources used, a disease's direct costs also include hospital expenses, doctor visits, and prices for drugs and gadgets. The term "indirect costs" refers to the resources that a sickness depletes, such as time lost from work due to the patient's illness, time spent caring for the patient at home, and early retirement or death. (Table 1). Direct costs are easier to estimate than indirect costs since their worth depends on a variety of societal factors, including how well the labour market is working. Knowing the expenses of asthma is a first step towards a more detailed examination of where to invest money in the future and will assist decide where money is spent and whether it is being spent

efficiently. As statistics on the total cost of asthma are accessible, it is possible to determine the cost of uncontrolled disease using knowledge of the direct and indirect expenses of asthma [40-41].

**Table 1. – Types of cost associated with asthma**

| | | |
|---|---|---|
| Direct costs (resources consumed) | Indirect costs (resources lost) | Intangible cost(quality of life) |
| Cost of doctors'/nurses' time | Loss of productive work by patient | Grief |
| Cost of social support (e.g. home help) | Loss of productive work by patient's family Fear and friends (e.g. mother taking time off work to care for child with asthma) | Fear |
| Cost of drugs | Loss of productive work due to patient's early retirement or premature death | Pain |
| Cost of hospital treatment | | Unhappiness |
| Cost of disposable equipment<br>Capital cost of land, buildings, equipment | | #All of the above apply not only to the patient but also to his/her friends and family |
| Direct costs (resources consumed) | Indirect costs (resources lost) | Intangible cost(quality of life) |

The amount of information provided about costs varied; for instance, only two studies took into account the indirect costs associated with premature mortality; as a result, this review will only present data on the indirect costs associated with asthma morbidity and will not include indirect costs associated with asthma mortality. The relative contributions of direct and indirect expenses related to asthma morbidity for each study are summarised in Figure 1. The large degree of diversity between the research may be due to various factors, including different data sources, methodological tweaks, and actual cost discrepancies between the various countries' health care systems. The TEELING-SMITH [42] study in particular demonstrates the extremely low direct expenses related to asthma. This may be the result of the fact that this early study was conducted when drug costs were low, a factor that has since increased and now accounts for a sizable portion of direct expenditures. When the relevant information is combined, it becomes clear that direct and indirect expenses make up roughly equal portions of the total expenditures. Yet, it has been demonstrated in Canada that 10% of people with asthma contribute for more than 50% of the costs [43]. Less than 7% of the entire cost of childhood asthma is spent on emergency treatment, despite the fact that children use it very frequently.[44]

**Direct costs**

The severity of the disease, adherence to medicine, the overall prevalence of the disease, and the cost of health care—for instance, healthcare prices are greater in the USA—will all affect direct costs. The research have quite different conclusions about the relative weights of the elements that make up direct expenses. (fig. 2). Generally,

physician costs make up the smallest portion, followed by hospitalisation costs, which are somewhat higher and roughly equal to the cost of medications, which make up the majority of the direct costs of treating mild-to-moderate asthma [45].

**Physician costs**

Three of the studies differentiated physician costs into general and specialist practitioners [46,47, 48], and one into in-patient and out-patient care [11]. Physician costs average 22%, of which 75% relates to general practitioner (GP) consultations and 25% to specialist consultations. Therefore, GP care accounts for the highest proportion of the physician costs. These figures are in agreement with resource data from two additional studies in the UK [49, 50]. If GP care accounts for a portion of the expense of managing asthma, asthma treated by specialist doctors accounts for a portion of the cost of uncontrolled asthma. Improved GP treatment of asthma may thereby lessen the need for emergency hospital visits and, as a result, result in long-term financial savings. Successful GP management of asthma needs increased patient surveillance and control evaluation.

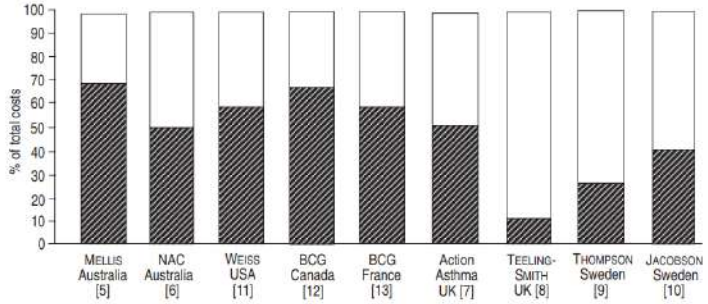



Fig. 1. – Direct and indirect costs of asthma. The first author, country and reference number are given for each study. NAC: National Asthma Campaign; BCG: Boston Consulting Group. ▨: direct costs, □: indirect costs.

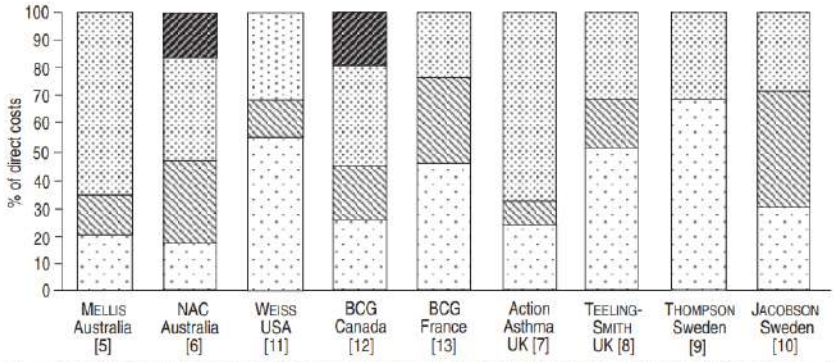



Fig. 2. – Breakdown of direct costs associated with asthma. The first author, country and reference number are given for each study. NAC: National Asthma Campaign; BCG; Boston Consulting Group. □: hospital; ▨: physician; ⁙: drugs/devices; ▨: others.

**Drug costs**

The majority of expenses for people with mild to moderate asthma are drug costs, which account for around 37% of all direct costs associated with the disease. As long as individuals take their medications as prescribed, the majority of medications and equipment can be considered to be a portion of the expense of controlling asthma. Poor patient adherence to asthma treatment, especially preventative therapy [51–53], and the morbidity that results costs a lot of money. According to a recent study by BOSELY et al. [54], only 15% of patients took their medications exactly as prescribed for more than 80% of the study time. The fact that rescue therapy now costs more than preventative therapy suggests that there is room for improvement in therapy. International management guidelines [55-56] recommend raising spending on preventative therapy, which should cut down on the need for rescue therapy

and, by improving the control of asthma, may potentially minimise hospital costs with subsequent savings in total health care expenditures. However, current regimens for asthma therapy and delivery systems are complex and patients may have difficulty understanding them [57].

**Hospital costs**

Although four of the nine studies had significant discrepancies, overall hospital expenses typically range from 20 to 25 percent of the direct cost of asthma. As THOMPSON [58] included hospital out-patient treatment, which accounted for more than half of all physician visits in Sweden, the reported statistic is excessive. The large number cited by TEELING-SMITH [59] might be related to the extremely low drug cost estimate. WIESS et al. [60] reported a high percentage in relation to hospital expenses; this could be because in-patient care in the USA is relatively expensive per unit. Understanding the causes of hospitalisation and identifying the hospitalised population are required in order to reduce the number of admissions. Patients with illnesses pay the majority of the hospital bills Hospitalization is typically required for patients with moderate to severe asthma whose asthma therapy has failed to stop an expensive acute severe attack [61]. Any healthcare organization's goal must be to strike a balance between the advantages of medical interventions and their price.

**Other direct costs**

Co-morbidity (the additional costs incurred in treating asthmatic patients for other conditions), the cost of home care, spending on "alternative medicine," nursing home fees, and the cost of ambulance call-outs are some other direct expenses linked to asthma.

**Indirect costs**

Indirect expenses are only incurred when asthma is severe enough to interfere with a patient's lifestyle, and are thus primarily linked to uncontrolled asthma. Costs connected with the patient's loss of ability to work, early retirement, and time spent by others caring for sick family members are all considered indirect expenses. Often it is simpler to think about indirect costs in terms of physical resources, such as the number of lost working days or the number of premature deaths, rather than attempting to value these units. [62,63]

**Intangible costs**

A patient with asthma may experience considerable reductions in life quality. As there is no cure, therapy focuses on easing symptoms so that the patient can live a relatively normal life. In order to attain patient satisfaction in the management of asthma, it is crucial to learn about the opinions and perceptions of the patient population. Measuring the quality of life involves evaluating these demands, in particular evaluating how the patient perceives how their asthma has affected their quality of lifeThe severity of the ailment and the patient's age both affect intangible costs. Few youngsters believe that having moderate asthma will significantly interrupt their life, despite the fact that these patients find the respiratory symptoms of the condition bothersome. Yet, the parents of these kids believed that professionals could take steps to alleviate the typical anxiety and concerns about the child's asthma [64]. The Saint George's Respiratory Questionnaire was created to provide a measure of asthmatic patient quality of life. It enables direct numerical comparisons between study populations, therapies, and patient populations, and it is sensitive to both moderate and severe disease. [65]

**Costs of controlled versus uncontrolled disease**

Asthma is thought to be a minor condition that is best treated with ambulatory treatment. Yet, a third of the average direct cost of asthma is associated with visits to the ER, hospitalisation, and fatalities. This strongly suggests that increasing disease

control could result in a large cost decrease. Depending on the severity of the condition and the level of control attained, the pattern of costs borne by asthmatic patients will change. Doctors and health economists have varied perspectives on "control." Clinically speaking, the absence of clinic visits by the patient's doctor is a sign of good control; but, according to health economists, control is measured by the patient's improved quality of life. [66-67]

**Effects of intervention on the cost of asthma**

The economic cost of asthma, especially moderate-to-severe disease, is substantial. 50% of the cost of asthma is made up of indirect expenses. The costs of managing controlled asthma can be attributed to medications (37%), GP care (16%), and the remaining costs (mostly hospital costs), which can be attributed to the treatment of failed control. Hence, based on these presumptions, it appears that about three-quarters of the overall cost is the result of poorly managed disease. There is strong evidence that disease management strategies can dramatically reduce the expenses of uncontrolled asthma (hospitalisation, emergency admission, and missed work and school days) (patient education and prophylactic therapy). When analysed, the cost savings associated with treating uncontrolled asthma outweighed the additional expense of the control strategies by a significant margin. The National Asthma Campaign of Australia [68] suggests that, for adults with severe asthma, all categories of direct medical expenditure could be reduced by achieving optimal disease control in all patients.

Prophylactic therapy and reduction of costs

International guidelines emphasise that preventative therapy should be started early in the course of treating asthma. Reduced hospitalisations and lost workdays will more than make up for the shift in the disease's direct costs, which will now place a higher emphasis on drug and doctor expenses. Three years of treatment with inhaled steroids can be had for the price of one hospital admission [69].

**Barriers to reducing the burden of asthma**

1. Generic barriers including poverty, poor education, and poor infrastructure.
2. Environmental barriers including indoor and outdoor air pollution, tobacco smoking, and occupational exposures.
3. Low public health priority due to the importance of other respiratory illnesses such as tuberculosis and pneumonia and the lack of data on morbidity and mortality from asthma.
4. The lack of symptom-based rather than diseasebased approaches to the management of respiratory diseases including asthma.
5. Unsustainable generalizations across cultures and health care systems which may make management guidelines developed in high-income countries difficult to implement in low and middle-income countries.
6. Inherent barriers in the organization of health care services in terms of:

- geography
- type of professional responding
- education and training systems
- public and private care e. tendency of care to be ‘‘acute’’ rather than ‘‘routine.’’

7. The limited availability and use of medications including:

- omission of basic medications from WHO or national essential drug lists
- poor supply and distribution infrastructure
- cost
- cultural attitudes towards drug delivery systems, e.g. inhalers

8. Patient barriers including:

- cultural factors
- lack of information
- underuse of self-management
- over-reliance on acute care
- e. use of alternative unproven therapies.

9. Inadequate government resources provided for health care including asthma
10. The requirement of respiratory specialists and related organizations to care for a wide variety of diseases, which has in some regions resulted in a failure to adequately promote awareness of asthma.

**Actions required to reduce the burden of asthma**

1. Recognize asthma as an important cause of morbidity, economic cost, and mortality worldwide.
2. Measure and monitor the prevalence of asthma, and the morbidity and mortality due to asthma throughout the world.
3. Identify and address the economic and political factors which limit the availability of health care.
4. Improve accessibility to essential drugs for the management of asthma in low- and middle-income countries.
5. Identify and address the environmental factors including indoor and outdoor pollution which affect respiratory morbidity including that due to asthma.
6. Promote and implement anti-tobacco public health policies to reduce tobacco consumption.
7. Adapt international asthma guidelines for developing countries to ensure they are practical and realistic in terms of different health care systems. This includes dissemination strategies for their implementation.
8. Integrate the GINA guidelines with other global respiratory guidelines for children and adults. In this respect, there is a requirement to merge the key elements of the different respiratory guidelines into an algorithm for use at the first point of entry of a respiratory patient's contact with health services.
9. Promote cost-effective management approaches which have been proven to reduce morbidity and mortality, thereby ensuring optimal treatment is available to as many persons as possible with asthma worldwide.
10. Research the causation of asthma, primary and secondary intervention strategies, and management programs including those for use in developing countries [70-72]

| Rank | Disorder | Number of DALYs (×10⁶) |
|---|---|---|
| 1 | Perinatal conditions | 98.4 |
| 2 | Lower respiratory tract infections | 90.7 |
| 3 | HIV/AIDS | 88.4 |
| 4 | Unipolar depressive disorders | 65.9 |
| 5 | Diarrhoeal disease | 62.5 |
| 6 | Ischaemic heart disease | 58.7 |
| 7 | Cerebrovascular disease | 45.9 |
| 8 | Malaria | 42.3 |
| 9 | Road traffic accidents | 37.7 |
| 10 | Tuberculosis | 36.0 |
| 11 | Maternal conditions | 30.9 |
| 12 | Chronic obstructive pulmonary disease | 29.9 |
| 13 | Congenital abnormalities | 28.1 |
| 14 | Measles | 26.5 |
| 15 | Hearing loss - adult onset | 25.9 |
| 16 | Violence | 20.2 |
| 17 | Self-inflicted injuries | 19.9 |
| 18 | Alcohol use disorders | 19.8 |
| 19 | Protein-energy malnutrition | 16.7 |
| 20 | Osteoarthritis | 16.4 |
| 21 | Schizophrenia | 15.9 |
| 22 | Falls | 15.7 |
| 23 | Diabetes mellitus | 15.4 |
| 24 | Cirrhosis of the liver | 15.1 |
| 25 | ASTHMA | 15.0 |
| 26 | Bipolar affective disorder | 13.8 |
| 27 | Pertussis | 12.5 |
| 28 | Alzheimers and other dementias | 12.4 |
| 29 | Sexually transmitted diseases excluding HIV | 12.4 |
| 30 | Iron deficiency anaemia | 12.0 |

**Figure 7. Disability-Adjusted Life Years Lost Due to Asthma World-wide – Ranking with Other Common Disorders (Note: Disability adjusted life years (DALYs) combine information about morbidity and mortality in numbers of healthy years lost. The calculation of disease-specific health loss in DALYs is the sum of years of life lost (YLLs) and years lived with disability (YLDs) weighted for severity. Each state of health is assigned a disability weighting by an expert panel on a scale from zero (perfect health) to one (death). To calculate the burden of a certain disease, the disability weighting is multiplied by the number of years lived in that health state and is added to the number of years lost due to that disease.).**

## Limitations

This study has inherent limitations that accompany observational studies that use administrative claims. Claims data lack clinically important information, such as lung function and symptom severity, to classify asthma severity. In our data source, there were few SA patients with a blood eosinophil count. Blood eosinophil count is a recognised biomarker for severe eosinophilic asthma, however it is not a conclusive indicator of the condition[73]. However, to identify persistent and severe asthma in claims databases, we employed a proven algorithm[74-75] and the health care costs of patients with a severity classification based on claims have been shown to be substantially similar to patients whose severity classification was defined by pulmonary function test[76].

## CONCLUSIONS:

Individuals with SA who had two or more exacerbations used controller drugs 2.1 times more frequently and adhered to controller therapy more frequently than patients with PA. Despite receiving more intensive pharmacotherapy, SA patients had adjusted asthma-related expenditures that were 2.9 times higher and adjusted asthma medication costs that were 3 times higher than PA patients. The rate of health care use was consistently greater in patients with SA. In conclusion, asthma expenses are high, accounting for more than 1% of all health care expenses in the USA. Costs are primarily the result of uncontrolled

disease, which suggests that present treatments are either underutilised or used improperly in actual practise. Costs are expected to total $5.5 billion in the USA and £322-686 million in the UK annually. By example, it is estimated that chronic diabetes costs the UK £260 million and the US $19.8 billion. Somewhat surprisingly, for a condition for which effective preventive medicines are available, a large portion of the cost associated with asthma pertains to expenses that could be avoided or decreased by better disease control. Indirect expenses are incurred when the condition is not properly treated and develops severe enough to have an impact on daily living, such as time away from work or school and early retirement. 50% of the cost of disease is made up of these expenses. Asthma also has a major economical impact on not just the patients themselves but also on the entire family, according to quality of life assessments. Hospitalization accounts for 20–25% of direct costs; almost all of them are in-patient or emergency admissions, therefore they are caused by insufficient illness control. About 20–30% of direct expenditures come from physician expenses, of which about a quarter are connected to non–GP services. It indicates that at least 30% of the direct cost of asthma is therefore attributed to the condition being insufficiently treated, if all GP services, all medications, and all devices are judged to be attributable to controlled asthma. At least 75% of the overall cost of disease comes from paying to treat the aftereffects of inadequate asthma management when indirect expenses are taken into account. Through better disease control, these costs—direct and indirect—can be decreased. As inhaled corticosteroid use grew, so did the number of hospitalisations for asthma in Sweden. Patient education programmes have repeatedly been demonstrated to reduce emergency room visits, GP visits, hospital admissions, and time away from work and school, and the stated savings have always been said to outweigh the costs of intervention. Opportunities exist for cost-savings in asthma, particularly in patients with moderate-to-severe disease. However, to utilize resources more efficiently, interventions have to be assessed in terms of their costs, potential costsavings, and outcomes for patients. Therefore, it is important that health economists and clinicians work together to find out how to optimize expenditure on asthma care.

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HOW TO CITE: Mohd Razi, Rajesh Kumar Sharma, Basharat Nawaz, Heri Tada, Akhilesh Patel, A Review- Understanding The Burden Of Asthma On Individuals And Healthcare Systems, Int. J. of Pharm. Sci., 2024, Vol 2, Issue 6, 904-918. https://doi.org/10.5281/zenodo.11767498