

Research Article

Chronic asthma in childhood and its economic impact on the familyThalagahage KNH^{1*}, Ramya Ediriweera², Ranasinge EP³¹Postgraduate Institute of Medicine, Colombo, Sri Lanka²Lady Ridgeway Hospital, Colombo, Sri Lanka³Office of the Regional Director of Health Services, Colombo**Abstract**

Asthma is an inflammatory condition that leads to narrowing of airways, especially in the lower respiratory tract. Chronic asthma can cause airway swelling, cough, shortness of breath (SOB), and chest tightness. In Sri Lanka, between 13% to 25% of asthmatics are children who are between 5 to 11 years of age. The current study was planned to assess and explain the economic burden to families having children with bronchial asthma. This descriptive cross-sectional study was conducted with 388 patients (age range: 5 to 15 years) attending the asthma clinic at the Lady Ridgeway Hospital, Colombo, Sri Lanka over the period of April 2020 to September 2020.

A total of 388 patients were studied with the majority being female children (n=203, 52.5%). The mean income of the guardians was noted as Rs. 46992 ± 62949. The total expenses related to drug purchase was Rs.1389.18 ± 1237.06. The highest expenditure out of the cost of equipment(s) was for the nebulizer machines and masks (Rs. 10259.67 ± 2381.11). Expenses for the steroid inhalers was the highest (Rs. 1215.15 ± 225.68) in the category of “drugs”. Considering other expenses related to childhood asthma, an average of Rs.1033.06 ± 1796.70 were spent monthly on travel, and 73 (18.8%) parents spent Rs. 2465.48 (±2798.36) on vitamins and related foods to relieve asthma. Further, parents lost an average of Rs.4117.00 (±7776.38) monthly allowance due to absenteeism, and 30 (7.7%) parents had obtained loans to treat the child. Gender of the child, the number of people involved for clinic visit, spending night away from home, spending money on food at the clinic, use of ayurvedic treatment, providing additional supplements, and having medical insurance exhibited significant relationships with higher expenditure. There is a significant burden endured by guardians on account of childhood asthma.

In addition to the expenditure on the drugs and equipment, a significant amount of money is spent by the families of the children with asthma on traveling to Colombo and staying overnight for clinics. This may be minimized by timely referral of patients to local clinics instead of getting them down to tertiary care centres on a regular basis.

Keywords: Chronic asthma, Expense, Burden, Cost, Pediatric asthma**Copyright:** © 2020 Thalagahage et al.  This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.**Funding:** None**Competing interest:** None*✉ Correspondence: kthalagahage@gmail.com

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Introduction

Asthma is an inflammatory condition that leads to the narrowing of the airways, especially in the lower respiratory tract. Chronic asthma can cause airway swelling, cough, shortness of breath (SOB), and chest tightness (1). In the US, more than 25 million suffer from this disease, which includes 7 million minors. The severity of asthma can vary depending on the person and the disease status. It is primarily treated with bronchodilators, corticosteroids, and other relevant anti-inflammatory drugs (2); thus, it requires a significantly stable state of the economy to purchase medications and related equipment.

In Sri Lanka, asthma is a major health concern due to its rise in an alarming nature. It is not considered as much as it should be as a non-communicable disease in Sri Lanka, where between 13% to 25% of the patients suffering from bronchial asthma are children who are between 5 to 11 years of age. It can affect at any age, but individuals who have a strong family history or children who are more exposed to dust, pollen, and/or cigarette smoke, including passive smoking, are more prone to get the disease (3).

Sri Lanka, being a developing country with a fair percentage of the public having a lower economic background, it is crucial to study the burden of asthma on the family, despite the free health care provided by the Sri Lankan government.

Our study aimed to assess and explain the economic burden the families with children having bronchial asthma face and to explore their socio-demographic characteristics.

The economic impact was evaluated in terms of expenditure on drugs and investigations, expenses related to clinic visits and inward treatment cost, and loss of income due to loss of working hours/days.

With the results that we obtained from this study, we might be able to make necessary changes on the frequency of clinic visits, frequency of drug/inhaler issuing, and timing of referring children to local hospitals for shared care if such measures reduce the economic burden of the family without affecting optimal asthma care.

Asthma, as well as allergic rhino-conjunctivitis and atopic dermatitis (eczema), have proven to cause a

significant burden, specifically to the families of low-income countries (4).

In middle-income countries, it would consume one-fourth of the income of the family. This is a major burden compared to that of high-income families and countries. This could be lessened by adequate and proper management of asthma (5). In the European setting and also in other regions, the burden of asthma mainly circulates itself around the quality of life not only of the patient but also of the family. This will cost more to society as well because 2% of the healthcare providence of developed countries is spent on the optimal management of asthma (6).

The burden has been looked into in an Australian perspective, and they found out that more than one-third of the asthmatic children have sleep disturbance, and more than 60% have had limitations of their activities such as missing school. This should be further evaluated with the adult profile to determine whether it has continued up to adult life as well (7).

In the UK, 0.15% of the total healthcare budget of 1998/1999 has been spent on asthmatic or wheezing preschool children (2.6 million Stirling pounds). Therefore, primary preventive measures are encouraged (8).

In a semi-prospective clinical trial conducted in a Sri Lankan setting, this concept has been studied for the use of steroid inhalers in asthma management. Before starting the treatment, it has cost the family a significantly high amount compared with that of the cost after treatment, along with its effect/outcome as well. This indicates the neediness of proper deliverance of knowledge along with proper management strategies to help improve the disease condition as well as the cost. It was concluded that inhaled steroids, in particular, even in a developing country with problematic financial aspects, can be an effective mode of treatment considering both the disease and the cost-effectiveness (9).

Tests such as the Asthma Control Test™ (ACT) and childhood ACT (C - ACT) could help the practitioners to assess asthma disease status and to adjust medication accordingly (10). Asthma has forced the parents of affected children to limit their child's activities such as bathing, food, and play activities in Sri Lanka (11).

Methods

Study setting

The study was conducted at Lady Ridgeway Hospital (LRH), Colombo, Sri Lanka at wards 1,2,3,4, 8, and 9, from April 2020 to September 2020.

Children with bronchial asthma for less than one year, children aged less than five years or more than 15 years, and children with diagnosed respiratory diseases other than asthma (e.g., cystic fibrosis, bronchiectasis) were excluded from the study.

Calculation of sample size

The following equation was used to calculate the sample size (12).

$$N = Z^2 P (1 - P) / d^2$$

P = anticipated population proportion for economic impact of chronic bronchial asthma (no available previous study findings)

Z= 95% confidence level

d= absolute precision required on either side of the proportion (0.05)

$$N = 1.96^2 \times 0.05 \times 0.05 / 0.05^2$$

$$N = 386$$

Non-responsive rate = 10%

Sample size is 423.

Sampling technique

A consecutive, non-probability sampling method was used. The starting date of data collection was a random day in April 2020.

Study instruments

A structured, interviewer-administered questionnaire - available in all three languages- was used as the study instrument.

The questionnaire consisted of three parts.

1. Child's socio-demographic details such as age, sex, address, parents' occupation, and siblings
2. Expenses on medical treatments and investigations (e.g., investigations done out of LRH, drugs bought out of LRH, or any equipment bought out of LRH)
3. Other expenses for a clinic visit (e.g., travelling, meals, lodging, special food supplements)

Data collection method

A structured, interviewer-administered questionnaire was used for data collection; the principal investigator and another well-trained research assistant who can speak Sinhalese, Tamil, and English fluently collected data from eligible, consenting patient's parents who were waiting at wards 1,2,3,4, 8, and 9 paediatric clinics, of LRH. 15-20 minutes were spent to complete the questionnaire, and the principal investigator or the trained research assistant explained each question, and their answers were documented.

Data analysis and interpretation

The investigation results and the data collected in structured data sheets were entered and stored in a computerized database (Microsoft Excel™). Data analysis was done using SPSS (version 22.0) statistical software to assess the statistical significance of the results. The basic descriptive parameters were analyzed using measures of central tendency. The significance was assessed by Chi-square. It was used to compare study variables with students t-test. Statistical significance was based on 95% confidence.

Results

The study was conducted following obtaining data from 388 parents/ caregivers of children who attended the paediatric clinic of LRH between April 2020 to September 2020.

Demographic Information

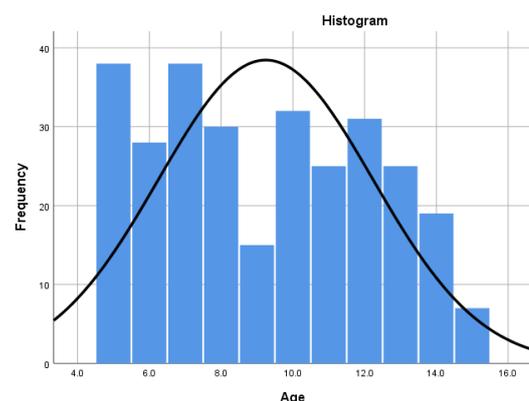


Figure 1. Age distribution of the participant children

The minimum age of the studied respondents was noted as five years, whereas the maximum age was noted to be

15 years with a mean age of 9.24 ± 2.99 years (Figure 1). The gender, ethnic and religious background of the participant children are described in the table 1.

The other demographic characteristics and the income of parents of the participants are stated in table 2.

Drugs and equipment purchased from outside during the last six months

A mean of Rs.1,389.18 (Range: 200-8400; $SD \pm 1,237.06$) was expended per month for the asthma drugs of the participants. This included antibiotics (mean: Rs. 925; $SD \pm 734.36$), beta-agonist inhalers (mean: Rs. 875; $SD \pm 95.25$), steroid inhalers (mean: Rs. 1,215.15; $SD \pm 225.68$), steroid nasal spray (mean: Rs. 251.25; $SD \pm 75.86$), leukotriene receptor blockers (mean: Rs. 148.42; $SD \pm 98.14$), antihistamines (mean: Rs.353.27; $SD \pm 142.19$) and other drugs (mean: Rs. 1,406.25; $SD \pm 467.85$). In addition, a mean of Rs.10,259.67($SD \pm 2381.11$) has been spent on nebulizer machines and masks.

Table 3 shows the details of clinic visits and the related expenses. The mean expense of travelling to the clinic was Rs.1,033.06 ($SD \pm 1,796.7$).

Table 1. Gender, ethnic and religious background of study participants

Characteristic	Frequency (Percentage)
Gender	
Male	184 (47.5)
Female	203 (52.5)
Ethnicity	
Sinhala	301 (77.6)
Tamil	43 (11.1)
Muslim	42 (10.7)
Other	3 (0.8)
Religion	
Buddhist	268 (69.1)
Catholic	52 (13.5)
Islam	43 (11.1)
Hindu	22 (5.4)
Other	4 (1.0)

Table 2. Demographic characteristics of study participants

Characteristic	Frequency (Percentage)
Mother age	
Mean \pm SD	36.9 ± 6.38 years
Minimum	20 years
Maximum	55 years
Father age	
Mean \pm SD	40.28 ± 7.20 years
Minimum	26 years
Maximum	66 years
Mother's income (/month)	
Mean \pm SD	Rs.32700.00 \pm 29,658
Minimum	Rs.20,000
Maximum	Rs.120,000
Father's income (/month)	
Mean \pm SD	Rs.45106 \pm 57838
Minimum	Rs.25,000
Maximum	Rs.500,000
Total Income (/month)	
Mean \pm SD	Rs.46992 \pm 62949
Minimum	Rs.35,000
Maximum	Rs.570,000
Mother's education	
No Schooling	6 (1.5)
Primary only education	59 (15.2)
Up to O/L	176 (45.4)
Up to A/L	137 (35.3)
Graduated	10 (2.6)
Father's education	
No Schooling	1 (0.3)
Primary only education	58 (14.9)
Up to O/L	231 (59.4)
Up to A/L	88 (22.7)
Graduated	10 (2.6)

Table 3. Clinic visits and related expenses

Variable	Frequency (Percentage)	
<i>Number of People Participating clinic visits</i>		
	1	161 (41.5)
	2	165 (42.5)
	3	41 (10.6)
	4	21 (5.4)
<i>People participating clinic visits</i>		
Father (parents)	338 (87.1)	
Sibling	1 (0.3)	
Parents/Sibling	14 (3.6)	
Parents/Other	6 (1.5)	
Either Family member	29 (7.5)	
<i>Travelling mode</i>		
Bus	18 (4.6)	
Three Wheel	121 (31.2)	
Car	175 (45.1)	
Combination of above	52 (13.4)	
Other	22 (5.7)	
<i>Travelling Expenses</i>		
Mean (SD)	Rs.1033.06 ± 1796.7	
Spending night at Colombo	14 (4.9)	
<i>Accommodation Expenses</i>		
Mean (SD)	Rs.3090.00 (± 1692.00)	
<i>Participants need to purchase food during clinic visits</i>		
	293 (75.5)	
Expenses for Food	Mean (SD)	Rs.472.00 ± 379.14
<i>Participants with other expenses related to clinic visit</i>		
	49 (12.6)	
	339 (87.4)	
Other Expenses	Mean (SD)	Rs.825.93 ±408.0

Of the participants, 14 (4.8%) are forced to stay overnight in Colombo for attending clinics, and the mean spending for accommodation was Rs. 3,090.00 (SD±1,692.00).

In addition to the allopathic treatment, 23 (5.9%) patients were receiving Ayurveda and 3 (0.8%) were receiving homeopathic treatment, for which they had additional expenses (Table 4)

It is evident that parents carry the major burden of the child’s asthma expenses as well as other sacrifices to relieve the child’s asthma. Thus, 272 (70.4%) parents have lost work due to clinic visits and 58 (14.9%) due to hospitalization of their child. The majority of 219 (56.4%) parents missed one workday to sacrifice their time for the clinic visit of the child while losing an average monthly allowance of Rs. 4,117.0±7,776.38.

Table 4. Asthma-related other expenses

Factor	Frequency (Percentage)	
Use of ayurvedic medicine	23 (5.9)	
<i>Expenses for Ayurvedic medicine</i>		
Mean (SD)	Rs.5385.71 (±8893.71)	
Use of homoeopathic remedies	3 (0.8)	
<i>Giving specific food/drinks/vitamins in the hope of relieving asthma</i>		
	73 (18.8)	
Expenses for foods/drinks/vitamins	Rs.2465.48 (±2798.36)	
<i>Reason for loss of work</i>		
Hospitalization	58 (14.9)	
Clinic visit	272 (70.1)	
Private consultation	6 (1.5)	
Combination above	52 (13.4)	
<i>No. days not going for work for the parents/ guardian</i>		
	1	219 (56.4)
	2	106 (27.3)
	3	26 (6.7)
	4	6 (1.5)
	>4	31 (8.0)
<i>Monthly lost allowance due to absenteeism at work</i>		
Mean (SD)	Rs.4117.00 (±7776.38)	
<i>Medical Insurance coverage</i>		
	28 (9.8)	
<i>Obtained a bank loan to treat the child</i>		
	30 (7.7)	
<i>Monthly instalment for the loan</i>		
Mean (SD)	Rs.11,325 (±5243.72)	

Twenty-eight (9.8%) of the respondents mentioned the fact that they hold medical insurance, whereas around the same number of respondents, 30 (7.7%), mentioned that they had obtained loans to aid the expenses of child asthma with average monthly instalments of Rs. 11,325±5,243.72 (Table 4).

Table 5 shows the association between demographic variables and the total expenditure borne by the guardians of the patient.

Table 5. Associations between a higher total expenditure for asthma treatment with the demographics.

Factor	p-value
Male gender	0.007
Ethnicity	0.51
Religion	0.04
Mother's education	0.005
Father's education	0.139
Number of people participating	<0.001
Spending the night at Colombo	<0.001
Spending money on food at the clinic	<0.001
Traditional Ayurveda treatment	<0.001
Providing additional nutritional supplements/ vitamins to relieve asthma	<0.001
Having a medical insurance	<0.001

The factors that demonstrate a significant relationship with the total expenditure are male gender ($p=0.007$), religion ($p=0.04$), mother's education ($p=0.005$), number of people participating ($p <0.001$), spending the night in Colombo ($p <0.001$), spending money on food at the clinic ($p <0.001$), traditional Ayurveda treatment ($p <0.001$), providing additional nutritional supplements/vitamins to relieve asthma ($p <0.001$) and having a medical insurance ($p <0.001$)

Discussion

Asthma is a chronic obstructive respiratory disorder of the bronchial tree that causes reversible bronchoconstriction due to airway hypersensitivity to a variety of stimuli (13). Globally, the number of childhood asthma cases shows an upward trend, and it has become a socio-economic burden, especially to developing countries (14).

Management of a child with asthma also involves notable monetary expenditure, including costs of medication, consultation fees, costs for investigations, and cost of health service utilization such as clinic visits and hospital admissions. Providing optimal long-term medical management is pivotal to maintaining the

quality of life, including childhood activities and schooling, even though there is a considerable financial burden on the family (15-18). Ferrante et al. showed that globally, direct costs substantially account for 50–80% of the total costs related to asthma (19). In the US, estimates of this cost range from 5.5% to 14.5% of the total family income (20, 21). Poor asthma control is associated with the higher economic costs due to asthma due to reducing the quality of life and loss of productivity.

In our study, the expenditure on asthma drugs for a patient ranged from 3-18% of the monthly income of the family. The other significant expenses included travelling, accommodation, and meals during clinic visits. A similar result is demonstrated in a study done in Nigeria, with the mean cost per clinic visit at USD 27.08, which was catastrophic in 12 (18.2%) households (22).

We also found that being a male child carried higher total expenditures on asthma. Similarly, the Iranian study also exhibited the same results of a significant increase in boys' total costs (11). The reason for these results might be the smaller size of lungs and airways of boys before the age of 14, hence increasing the risk for asthma (23,24). Health insurance coverage may minimize the intensity of the economic burden of asthma for families for those who have access to insurance coverage.

Perera et al. showed that the total expenses spent to relieve childhood asthma and the money spent by the parents on the disease has reduced largely following the control of the disease (09). The total cost of the disease, including the expenses of the medications, consultation charges, and indirect costs - for instance, loss of work for the parents - came down from about Rs. 2,650 per month on average to around rupees 450 per month following the use of the medications and sufficient control of the disease. Therefore, this was a notable saving for the parents (25) their income on the management of asthma. As our study revealed, a significant amount of money is spent on travelling to Colombo and staying there overnight for clinics. This may be minimized by timely referral of patients to local clinics instead of getting them down to tertiary care centres regularly. Also, we found that a significant amount of money is spent on vitamin-related medications. This should be further studied. If this is practised by parents believing that vitamins can improve asthma, such families will need further health education and counselling. Furthermore, it should always be kept in mind that a positive economic outcome

may not be necessarily synonymous with a positive clinical outcome. One limitation of this study was, due to the Covid -19 pandemic, frequent attendance of the patients to the clinic was disturbed, failing to complete the intended sample size.

In conclusion, in addition to the considerable expenditure on the drugs and equipment, a significant amount of money is spent by the families of the children with asthma on traveling to Colombo and staying overnight for clinics. This may be minimized by timely

referral of patients to local clinics instead of getting them down to tertiary care centres on a regular basis.

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