

# The Asthma Cost in Oman

\*Nasser H. Al-Busaidi,<sup>1</sup> Zulfikar Habibullah,<sup>2</sup> Joan B. Soriano<sup>3</sup>

## التكلفة العلاجية للربو في عمان

ناصر محمد البوسعيدى ذو الفقار حبيب الله . جوان سوريانو

**المخلص:** الهدف: هذه الدراسة تقيّم التكلفة المباشرة لعلاج الربو في السلطنة. الطريقة: مدى انتشار الربو و حساب التكلفة مبني على نتائج عن مجموعة من الخبراء باستخدام تقنية "دلفي". هذه الحسابات تم تطبيقها على مجموع سكان عمان فوق عمر خمس سنوات للحصول على عدد المصابين بالربو في عمان ومن ثم اخذ العدد المحسوب من تقنية "دلفي" وضربه بنسبة المرضى الذين يستخدمون المستشفيات الحكومية وذلك لتقدير عدد مرضى الربو العمانيين المعالجين في عمان. التكلفة العلاجية تم حسابها باستخدام العدد الناتج من من تقنية "دلفي" و الدراسات السابقة لمرض الربو في عمان بعنوان نظره إلى واقع الربو في منطقة الخليج والشرق الأدنى. وحسبت بالريال العماني والدولار الأمريكي. النتائج مدى انتشار الربو في عمان هو 7.3% في الكبار و12.7% في الأطفال وهذا يمثل 96,470 مريض من الكبار و58,344 من الأطفال. 95% منهم يترددون على المراكز الصحية و المستشفيات الحكومية. كذلك بينت الدراسة أن 55% من التكلفة العلاجية للربو تعود للمرضى المنومين بسبب نوبات الربو الحادة، 25% لزيارات قسم الطوارئ، 20% للعيادات الخارجية و جزء ضئيل جداً يمثل اقل من 0.2% من التكلفة العلاجية للأدوية. التكلفة الإجمالية بدون الأدوية 34,273,696 ريال عماني (89,111,609 دولار أمريكي) و27,014,735 ريال عماني (70,238,311 دولار أمريكي) للأطفال. وإذا ما أضفنا الأدوية المستخدمة تقدّر التكلفة الإجمالية لعلاج الربو في عمان ما يزيد عن 61,500,294 ريال عماني (159,900,761 دولار أمريكي). الخلاصة: بينت هذه الدراسة أن التكلفة العالية لعلاج الربو تعود إلى الزيارات للطوارئ و للمرضى المنومين بسبب حالات الربو الحادة مقارنة بالإنفاق البسيط للأدوية، ولذا على المهتمين بهذا الجانب النظر في كيفية السيطرة على أعراض الربو كأولوية وليس الاقتصاد في صرف المبالغ الخاصة بأدوية الربو.

مفتاح الكلمات: ربو؛ تكلفه الربو؛ أدوية الربو؛ اقتصاد؛ استخدام الخدمات الصحية؛ عمان.

**ABSTRACT: Objectives:** This study evaluates the direct costs of treating asthma in Oman. **Methods:** Asthma prevalence and unit cost estimates were based on results from a panel using the Delphi technique, and were applied to the total Omani population aged 5 and older to obtain the number of people diagnosed with asthma. The estimates from the Delphi exercise were multiplied by the percentage of patients using government facilities to estimate the number of asthma patients managed in Oman. Treatment costs were also calculated using data from the Delphi exercise and the Asthma Insights and Reality for the Gulf and Near East study (reported in Omani riyals [OMR] and US dollars [USD]). **Results:** The prevalence of asthma was estimated to be 7.3% of adults (n = 96,470) and 12.7% of children (n = 58,344). Of these, 95% of both adults and children were estimated to be using government healthcare facilities. Inpatient visits accounted for the largest proportion of total direct costs (55%), followed by emergency room and outpatient visits (25% and 20%, respectively) and medications (<0.2%). The annual cost of treatment excluding medications, was OMR 34,273,696 (USD 89,111,609) for adults and OMR 27,014,735 (USD 70,238,311) for children. Including medications, the total annual direct cost of asthma treatment was estimated to be over OMR 61,500,294 (USD 159,900,761). **Conclusion:** Given the high medical expenditures associated with facility visits relative to the lower medication costs, the focus of Oman's asthma cost savings should be on improving asthma control rather than reducing medication costs.

**Keywords:** Asthma; Cost of asthma; Asthma medications; Economy; Health service utilization; Oman.

### ADVANCES IN KNOWLEDGE

- This is the first study to address the cost of asthma in Oman.
- This study presents comprehensive Omani medical data.

### APPLICATIONS TO PATIENT CARE

- Proper outpatient management will reduce the cost of inpatient and emergency visits.
- Adequate management of asthma with proper medications will reduce the number of exacerbations and subsequent emergency room and inpatient visits.

**T**HE WORLD HEALTH ORGANIZATION (WHO) estimates that 300 million people suffer from asthma worldwide; it is the most common chronic illness among children, and one of the most frequent in adults.<sup>1</sup> In the Phase III International Study of Asthma and Allergies in Children (ISAAC), 13.8% of school children aged 13–14 years worldwide reported that they had had asthma at some time in their lives, although with large regional variability.<sup>2</sup>

Given the prevalence of the disease and its symptoms, asthma imposes a considerable economic burden on healthcare systems. One study found that the annual direct medical expenditure for asthma treatment in the USA in 2007 was US dollars (USD) 37.2 billion.<sup>3</sup> In Europe, the annual direct cost of asthma is estimated to be Euros (EUR) 7.9 billion.<sup>4</sup> Furthermore, another study in the USA found that the total incremental cost of asthma to society, also including indirect costs, was USD 56 billion in 2007.<sup>5</sup>

Estimation of national expenditure for asthma treatment can provide useful information to guide clinicians and policymakers in improving the management of asthma through better treatment. To our knowledge, medical literature is lacking in studies that estimate the costs of asthma treatment in Oman, although Bazdawi *et al.* reported the prevalence rates of reported diagnoses of asthma in older children (13–14 years old) at 20.7%, and at 10.5% in younger children in Oman (6–7 years old).<sup>6</sup> Al Rawas and colleagues reported that asthma prevalence was increasing. The geographic variation in the prevalence of self-reported of asthma symptoms among Omani school children still persisted with further increase in the Sharqiya region. The findings also suggest under-diagnosis and/or poor recognition of asthma, which had not improved over time.<sup>7</sup> The current study aims to evaluate the direct costs of treating asthma in Oman, specifically focusing on Omani nationals treated in government healthcare facilities in Oman. These include costs of outpatient treatment, hospital emergency visits, inpatient treatment, medicines, and total direct costs of treatment for asthma.

## Methods

Population figures were obtained from the 2009 census data from the Omani Ministry of

Economy.<sup>8</sup> Drug usage and costs were provided by the Ministry of Healths (MOH) Purchasing Department.<sup>9</sup> Typical treatment profiles, including emergency visits, outpatient visits, inpatient stays, and pharmacological treatment use were obtained from the Asthma Insights and Reality for the Gulf and Near East (AIRGNE) study.<sup>10</sup>

Due to a lack of published data on asthma prevalence and unit costs of asthma treatment, a modified Delphi technique was used to gather consensus estimates of this data. One of the main advantages of using the Delphi technique rather than a face-to-face group panel approach is its ability to obtain expert knowledge from each participant without the influence of others involved in the study.<sup>11–13</sup> The Delphi panel methodology consisted of consensus consultations with 10 leading physicians in asthma treatment in Oman. Two rounds of data collection from the panel were conducted to determine these estimates.

Currently available data on asthma prevalence and unit costs of asthma treatment were provided to each of the panel members. Treatment costs included outpatient and emergency room (ER) visits, and inpatient costs for both adults and children. Each panel member provided their own expert estimates individually, including upper and lower estimates, in addition to a “best” estimate. An average of the combined estimates from the panel members in round one was calculated for each data input, and then used in round two.

During round two, the panellists were given these mean values to consider, and were given the opportunity to revise their round one estimates where they thought it was appropriate. The revised estimates for prevalence and costs (for both adults and children) generated in this second round were used in the main calculations of the current study.

Costs are reported in Omani riyals (OMR) and USD, using the 2010 exchange rate of 1 OMR = 2.60010 USD.

The asthma prevalence determined in round two of the Delphi exercise was applied to the total Omani population aged 5 and over to obtain the percentage of individuals (both adults and children) diagnosed with asthma in Oman. Individuals aged 5 to 15 were categorised as children, and those aged 16 or older were categorised as adults. Estimates from round two were then multiplied by the percentage of patients using government facilities

**Table 1:** Statistics on Omani nationals suffering from asthma and using Ministry of Health facilities

	Adults (16+)	Children (5+)
Population 2009	1,321,501	459,398
Asthma prevalence	7.3%	12.7%
Subtotal number of asthma sufferers	96,470	58,344
Percentage using government facilities	95%	95%
Total asthma sufferers using government facilities	91,646	55,426

as reported in the AIRGNE study to determine the total number of asthma patients managed in government healthcare facilities.<sup>10</sup>

To obtain an estimation of total outpatient treatment costs, the total number of asthma patients treated in government healthcare facilities was multiplied by the average number of outpatient visits per year as reported in the AIRGNE study to determine the total number of outpatient visits per year which was then multiplied by the unit cost of an outpatient visit as determined in round two of the Delphi panel exercise.<sup>10</sup> Figures were estimated for both adults and children.

To obtain an estimation of the number of emergency room (ER) visits and total inpatient treatment costs, the percentage of asthma sufferers visiting an ER as reported in the AIRGNE study was

**Table 2:** Calculations leading to total cost of inpatient treatments of asthma for Omani nationals in Omani riyals

	Adults (16+)	Children (5+)
Total asthma sufferers using MOH facilities	91,646	55,426
Percentage hospitalised in past year	27%	42%
Number of sufferers hospitalised	24,744	23,279
Number of hospital stays per patient	4.2	2.4
Average nights hospitalised per patient per year	2.6	3.9
Total hospital nights per year	270,209	217,892
Cost of an overnight stay in OMR	67	73
Cost of inpatient visits in OMR	18,104,026	15,906,126

MOH = Ministry of Health; OMR = Omani riyals.

**Table 3:** Calculations leading to the total cost of emergency room visits by Omani nationals due to asthma in Omani riyals

	Adults (16+)	Children (5+)
Total number of asthma sufferers using MOH	91,646	55,426
Percentage making an emergency visit in past year	58%	55%
Total number of sufferers making ER visits	53,155	30,485
Average number of visits per patient per year	3.8	6.3
Total number of visits per year	201,988	192,052
Unit cost of an emergency visit	39	39
Total cost of emergency visits in OMR	7,877,532	7,490,042

MOH = Ministry of Health; ER = emergency room; OMR = Omani riyals.

multiplied by the total number of asthma patients treated in government healthcare facilities. The result was then multiplied by the average number of ER visits per year as reported in the AIRGNE study and the Asthma Control in Oman study to obtain the total number of ER visits per year.<sup>12,14</sup> The unit cost of an ER visit as determined in round two of the Delphi exercise was used to obtain the total cost of ER visits. Costs were estimated for both adults and children.

The total inpatient treatment cost estimate was calculated in a similar manner using estimates from round two of the Delphi exercise. To obtain an estimation of total direct treatment cost, the total direct costs for adults and children were estimated to be the sum of costs for outpatient and inpatient care, ER visits, and the costs of asthma medications. All data were obtained from the MOH Purchasing Department. A sensitivity analysis, according to the results from the Delphi panel, was conducted based on the lowest 50% of the values collected in round one.

## Results

The best estimates of asthma prevalence in Oman obtained from the Delphi panel were 7.3% of adults and 12.7% of children, which corresponded to a total of 91,646 adults and 55,426 children, respectively.

**Table 4:** Calculations leading to the total cost of outpatient visits by Omani nationals (Omani riyals)

	Adults (16+)	Children (5+)
Total number of asthma sufferers using MOH	91,646	55,426
Percentage needing outpatient treatment in a year	87%	81%
Asthma sufferers who are MOH patients	79,732	44,895
Outpatient visits per patient per year (AIRGNE)	4.0	3.1
Total number of outpatient visits per year	318,928	139,176
Unit cost of an outpatient visit	26	26
Total cost of outpatient visits	8,292,139	3,618,566

MOH = Ministry of Health; AIRGNE = Asthma Insights and Reality for the Gulf and Near East.

Of these, 95% adults and the percentage of children were estimated to be using government healthcare facilities [Table 1].

Inpatient visits accounted for the largest portion of total direct costs for asthma treatment. The total number of nights that adult asthma patients spent in hospital per year was estimated to be 270,209, incurring a total cost of OMR 18,104,026. The corresponding numbers for children were estimated to be 217,892 nights, at a total cost of OMR 15,906,126 [Table 2].

The second largest component of total direct costs was the cost of ER visits at 25%. The total estimated number of ER visits per year for adults with asthma was 53,155 at a total cost of OMR 7,877,532. For children, the total number of ER visits per year was 30,485 at a total cost of OMR 7,490,042 [Table 3]. There were 318,928 outpatient visits per year estimated for adults with asthma and 139,176 for children. The total cost of outpatient visits for adults was OMR 8,292,139 and for children, OMR 3,618,566, making up 20% of the total cost of asthma treatment [Table 4].

The overall cost of asthma treatment is shown in Table 5. The subtotal (before including the cost of medicines) for treatment visits for adults and children was OMR 61,288,431. Added together with the cost of medicine, the total direct cost of asthma treatment was over OMR 61 million (OMR 418 per patient).

**Table 5:** Calculations leading to an estimate of the total direct cost of asthma treatment in Oman (in Omani riyals [OMR]).

Total treatment costs	Adults (16+)	Children (5+)	Totals
Cost of outpatient visits	8,292,139	3,618,566	11,910,705
Cost of emergency visits	7,877,532	7,490,042	15,367,574
Cost of inpatient stays	18,104,026	15,906,126	34,010,152
Total non-drug cost	34,273,696	27,014,735	61,288,431
Cost of medicines			211,862
<b>Total direct cost of treatment</b>			<b>61,500,293</b>

Although the costs changed when using the lowest 50% of the values collected in round one of the Delphi exercise, the inpatient and ER treatment costs still made up the largest portion of the total direct costs, while the cost of medications was substantially smaller.

## Discussion

To our knowledge, the present study is the first to evaluate the cost burden of asthma in Oman. We found that asthma treatment causes a substantial financial burden on the healthcare system with results showing that the direct cost of asthma treatment is estimated to be OMR 61,500,293/ USD 159,900,762. This cost was primarily driven by inpatient stays and ER visits, which made up approximately 80% of direct costs. Compared to these costs, the cost of medications is minimal, less than 1% of the total direct costs. It should be noted that these estimates comprise only the costs incurred by Omani nationals in government healthcare facilities, and do not include the private sector or the treatment of expatriates, the majority of whom are followed up in the private sector.

This high proportion of costs is further emphasised when noting that the number of ER visits and hospitalisations for asthma patients in Oman are considerably higher than in Europe. The AIRGNE study reported that 21% of adults and children with asthma in Oman reported visiting an ER in the year preceding the study.<sup>14</sup> In contrast, only 10% of asthma sufferers in Europe reported

visiting an ER in the year preceding the study, as reported in the Asthma Insights and Reality in Europe (AIRE) study.<sup>14</sup> In addition, the AIRE study reported that only 7% of sufferers required overnight hospitalisation in Europe during the previous 12 months compared to 30% in Oman as reported in the AIRGNE study.<sup>15</sup> Inpatient stays and ER visits are both correlated with a lower level of asthma control, leading to a potentially larger cost burden to the MOH.

In contrast to the distribution of costs in Europe, of the EUR 7.9 billion in annual direct costs 48% (EUR 3.8 billion) was for outpatient care, 46% (EUR 3.6 billion) was for drug costs and 6% (EUR 0.5 billion) for inpatient care.<sup>4</sup> In the USA, it was reported that prescription medications and physician office visits accounted for the largest share of total expenditures and comprised approximately 38% of the total incremental expenditures for asthma in children and approximately 49% among adults.<sup>5</sup> Comparatively, the higher proportion of expenditures on outpatient visits, inpatient stays, and ER visits for asthma in Oman could reflect a different level of disease control to that of asthma patients in the USA and Europe.

The strengths of this study include its novelty and the overall comprehensiveness of national Omani data. However, there are some limitations to our research. Asthma prevalence and unit cost estimates were based on results from an expert panel using the Delphi technique. Although the use of two rounds enhanced the reliability of the estimates, the results are still dependent on the individual opinions of the panel members which may result in the subjective estimation of costs and prevalence.

## Conclusion

The best method of controlling asthma is the regular use of controller medication and the education of patients, family, caregivers, school personnel, and so on. Given the high medical expenditures associated with ER and inpatient visits, and the relatively lower expenditure on medications in Oman, it is reasonable to expect that improving levels of asthma control would correspond to a positive impact on total MOH expenditure, even if this expenditure increases over time. Cost-saving efforts should therefore be focused on improving asthma

control rather than on reducing expenditures on medication procurement.

## References

1. Bousquet J, Kiley J, Bateman ED, Viegi G, Cruz AA, Khaltaev N, et al. Prioritised research agenda for prevention and control of chronic respiratory diseases. *Eur Respir J* 2010; 36:995–1001.
2. Pearce N, Ait-Khaled N, Beasley R, Mallol J, Keil U, Mitchell E, et al. The ISAAC Phase Three Study Group. Worldwide trends in the prevalence of asthma symptoms: Phase III of the International Study of Asthma and Allergies in Childhood (ISAAC). *Thorax* 2007; 62:758–66.
3. Kamble S, Bharmal M. Incremental direct expenditure of treating asthma in the United States. *J Asthma* 2009; 46:73–80.
4. European Lung Foundation. *European Lung White Book*. European Respiratory Society: Geneva, 2003.
5. Barnett SB, Nurmagambetov TA. Costs of asthma in the United States: 2002-2007. *J Allergy Clin Immunol* 2011; 127:145–52.
6. Al-Riyami BM, Al-Rawas OA, Al-Riyami A, Jasim LG, Mohammed AJ. Relatively high prevalence and severity of asthma, allergic rhinitis, and atopic eczema in school children in Sultanate of Oman. *Respirology* 2003; 8:69–76.
7. Al-Rawas OA, Al-Riyami BM, Al-Kindy H, Al-Maniri AA, Al-Riyami AA. Regional variation in the prevalence of asthma symptoms among Omani school children: Comparisons from two nationwide cross-sectional surveys six years apart. *Sultan Qaboos University Med J* 2008; 8:157–64.
8. Directorate General, Oman Ministry of Economy. *Omani Population Census 2009*. Muscat: Ministry of Economy, 2009.
9. Purchasing Department, Directorate General of Pharmaceutical Affairs, Ministry of Health, Oman. *Drug Costs 2009*. Muscat: Ministry of Health, 2009.
10. Khadadah M, Mahboub B, Al-Busaidi NH, Sliman N, Soriano JB, Bahous J. Asthma insights and reality in the Gulf and the near East. *Int J Tuberc Lung Dis* 2009; 13:1015–22.
11. Rosengart MR, Nathens AB, Schiff MA. The identification of criteria to evaluate prehospital trauma care using the Delphi technique. *J Trauma* 2007; 62:708–13.
12. Bramwell L, Hykawy E. The Delphi Technique: A possible tool for predicting future events in nursing education. *Nurs Pap* 1974; 6:23–32.
13. Kumaran KM, Lemieux M, Satchell G. Problem solving with the Delphi technique. *Dimens Health Serv* 1976; 53:34–5.
14. Al Busaidi N, Soriano JB. Asthma control in Oman:

National results within the Asthma Insights and Reality in the Gulf and the Near East (AIRGNE) Study. Sultan Qaboos Univ Med J 2011; 11:45–51.

15. Rabe KF, Vermeire PA, Soriano JB, Maier WC. Clinical management of asthma in 1999: the Asthma Insights and Reality in Europe (AIRE) study. *Eur Respir J* 2000; 16:802–7.