

# Management, Medication Use and Economic Burden of Asthma among Hajj and Umrah Pilgrims

**Running Title: Management and Burden of asthma among pilgrims**

## ABSTRACT

**Introduction:** During Hajj and Umrah season, asthma-related acute admissions produce the enormous burden on healthcare facilities and causes delay in admissions for more severe cases, e.g. myocardial infarction, cardiac failure, and severe trauma cases. Therefore, the snapshot of asthma-related admissions during the Hajj and Umrah season was determined by asthma-related admissions and medication use, and economic burden during Hajj and Umrah pilgrimage season.

**Methodology:** All asthma-related admissions during the month of Ramadan (fasting month) and Hajj pilgrimage were assessed to record patient's data retrospectively. The convenience sampling strategy was used to record study variables. Statistical Package for Social Science (SPSS) Version 22.0 was used to analyze the data.

**Results:** A total of 271 patients were selected as per inclusion criteria, the majority of them were males 153 (56.5%), while most of them were Saudi 70 (35.8%) and Egyptians 86 (31.7%). During hospitalization, the common treatment for acute exacerbations was inhaled corticosteroids 224 (86.3%), IV corticosteroids 129 (47.6 %), Inhaled short-acting beta-agonists 244 (90%) and inhaled bronchodilators (ipratropium bromide) 237(87.5 5%).

**Conclusion:** This periodic mapping of asthma-related admissions and its management during these massive gathering events is indeed a significant effort to explore issues of

acute asthma exacerbations management and to provide information to plan for future interventions and policies.

**Keywords:** Hajj, Umrah, Asthma, Pilgrims, Economic burden, Saudi Arabia

## INTRODUCTION

Asthma is an inflammatory disease of the airways considered by a variable degree of airflow obstruction which is at least partially reversible [1]. The global morbidity, mortality, and prevalence of respiratory diseases especially asthma have significantly increased over the last four decades [2-4]. About 300 million people have been affected by asthma and its prevalence increases by 50% every 10 years<sup>4</sup>. In Australia, the number of adults affected by asthma is estimated at 7%<sup>5</sup>.

In Saudi Arabia, the prevalence of asthma varies from 3.7% to 24.5%<sup>5</sup>. This variation has been linked to environmental and weather factors that differ across the regions<sup>5</sup>. Besides, asthma has affected 4.2% of males and 4% of females in Saudi Arabia<sup>5-7</sup>. Moreover, the asthma prevalence among Saudi children has increased threefold, which is much higher than the rise experienced in other countries. Additionally, several factors have been shown to exacerbate the effects of asthma among sufferers<sup>8-11</sup>.

These include environmental factors, social changes and poor inhalation techniques of inhalation devices<sup>11-13</sup>. The development of the metered-dose inhaler (MDI) was remarkably effective in the management of asthma. Nevertheless, its effectiveness can be significantly reduced if the users adopt the incorrect inhalation technique<sup>5, 15</sup>. Incorrect techniques have been reported with both the MDI and the dry powder inhaler (DPI) (28% to 68%)<sup>7</sup>.

Further, acute asthma severity assessment depends on various factors, e.g. medical history, physical examination, lung function tests (FEV1/FVC ratio), etc. As asthma severity is reversible, timely and effective acute management return patients to normal. These treatments vary, starting from using inhaled short-acting beta-agonists (Salbutamol) for mild exacerbations till systemic corticosteroid use for life-threatening severities to inhibit inflammation and relieve exacerbations <sup>16,17</sup>.

Millions of Muslims used to visit Makkah, Saudi Arabia to perform religious pilgrimage known as Hajj. They come from various nationalities and belong to many ethnic subgroups. The most common causes of visiting the hospitals among pilgrims are respiratory, cardiovascular, and gastrointestinal disorders respectively. The highest incidence of admissions was related to respiratory disorders, including asthma (39.4%) and COPD (14.4 %) <sup>16,18</sup>.

During Hajj and Umrah season, asthma-related acute admissions produce a huge burden on healthcare facilities and cause delays in admissions for more severe cases, e.g. myocardial infarction, cardiac failure, and severe trauma cases. Therefore, a snapshot of asthma-related admissions during the Hajj and Umrah season, will be highlighted the clinical and economic impact of the disease and guide healthcare professionals to initiate preventive measures to decrease such affliction <sup>19,20</sup>.

In Saudi Arabia, to the best of our knowledge, there has been no exact study done before regarding the prevalence, management and economic burden of asthma in an emergency setting during Hajj and Umrah Pilgrimage at Holy Makkah. As per the 2030 vision of Saudi Arabia and the National Transformation Program 2020 vision, the health ministry

has initiated several new projects to ensure cost-effective use of medicines. Asthma is the major reason for hospital admission among Hajj and Umrah pilgrims visiting acute care settings in Holy Makkah.

## **METHODOLOGY**

This was a retrospective observational study. Data were retrospectively retrieved from the month of Ramadan & Hajj season, respectively from the medical record for all patients admitted to the emergency department with asthma as the final diagnosis. **This study was conducted at a hospital with acute admissions from Holy Masjid Al- Haram. Data were retrieved from the month of Ramadan and Hajj season, 2016 (July & October 2016) respectively.** The study was approved by the concerned authorities. All pilgrims suffering from asthma exacerbations with poor inhaler techniques from multiple nationalities were approached. Exclusion criteria were patients with suspected Pneumonia or any other chest infection, patients complaining of severe heart failure or CAD, children, patients on immunosuppressive agents before admission and COPD patients. Convenience sampling was used to include patients in the study. The study was started after the approval of the ethical committee of the institution. Data were analyzed using SPSS version 22 for statistical analysis.

## **RESULTS**

Table 1 represents the demographic characteristics of respondents. The majority were males 153 (56.5%) and most of them were Saudis 70 (35.8%) and Egyptians 86 (31.7%) . The mean age was 50.35 ( $\pm 1.03$ ) and most of the patients were with mild asthma 168 (61.9%) and only 3 (1.1%) were severe.

**Table 1. Descriptive characteristics of respondents**

| <b>Demographic characteristics</b> | <b>n (%)</b> |
|------------------------------------|--------------|
| <b>Nationality</b>                 |              |
| Saudis                             | 70 (35.8)    |
| Egyptians                          | 86 (31.7)    |
| Morrocons                          | 32 (11.8)    |
| Algerians                          | 12 (4.4)     |
| Iraqis                             | 11 (4.1)     |
| Libians                            | 4 (1.5)      |
| Sudanis                            | 5 (1.8)      |
| Yamanis                            | 7 (2.6)      |
| Pakistanis                         | 19 (7.0)     |
| Indians                            | 6 (2.2)      |
| Bangalis                           | 6 (2.2)      |
| Malaysians                         | 2 (0.7)      |
| <b>Age (mean±SD)</b>               | 50.35 (1.03) |
| <b>Gender</b>                      |              |
| Male                               | 153(56.5)    |
| Females                            | 118(43.5)    |
| <b>BMI</b>                         |              |
| Underweight                        | 10 (3.7)     |
| Normal                             | 103 (38.0)   |
| Over Weight                        | 99 (36.5)    |
| Obese Class 1                      | 48 (17.7)    |
| Obese Class 2                      | 10 (3.7)     |
| Obese Class 3                      | 1 (0.4)      |
| <b>Asthma severity</b>             |              |
| Mild                               | 168 (61.9)   |
| Moderate                           | 100 (37)     |
| Severe                             | 3 (1.1)      |
| <b>Patients' status</b>            |              |
| Hajj Pilgrim                       | 197 (72.7)   |
| Umrah Pilgrim                      | 31 (11.4)    |
| Resident                           | 43 (15.9)    |

As shown in table 2, most prescribed medication during hospitalization are salbutamol 5mg nebulization (n=244, 90%) and ipratropium bromide 500 mcg (n= 237, 87.5%).

Similarly, intravenous hydrocortisone 100mg was the least medication prescribed for in-patients (n=4 1.5%).

**Table 2. Inpatient medications therapy during hospitalization.**

| Medications                                      | n (%)       |
|--|-------------|
| <b>Inhaled corticosteroids</b>                   |             |
| Budesonide Nebulizer 1mg                         | 217(80.1%)  |
| Budesonide Nebulizer 500 mcg                     | 7(6.2%)     |
| Not used   | 47(13.7%)   |
| <b>Intravenous corticosteroids</b>               |             |
| Hydrocortisone IV 100mg                          | 4(1.5%)     |
| Hydrocortisone IV 200mg                          | 125(46.1%)  |
| Not used   | 142(52.4%)  |
| <b>Inhaled short-acting beta 2 agonists</b>      |             |
| Salbutamol 5mg Nebulizer                         | 244 (90%)   |
| Not used   | 27 (10%)    |
| <b>Inhaled bronchodilator (Anticholinergics)</b> |             |
| Ipratropium Bromide 500 mcg                      | 237 (87.5%) |
| Not used   | 33 (12.2%)  |
| <b>Analgesics</b>                                |             |
| Acetaminophen (Paracetamol) IV 1gm               | 29 (10.7%)  |
| Not used   | 242 (89.3%) |

Table 3 illustrates the medication therapy of asthmatic patients at their discharge from the hospital. Salbutamol inhalers for 191 patients (70.5%) and seritide for 125 patients (34.7%) respectively. In addition, azithromycin 500mg was the least antibiotic prescribed to 4 patients (1.5%) as discharge medication.

**Table 3: Outpatient medications provided at discharge**

| <b>Medications</b>                                   | <b>n (%)</b> |
|--|--------------|
| <b>Oral corticosteroids</b>                          |              |
| Prednisolone   | 14 (5.2%)    |
| <b>Inhaled corticosteroids with beta 2 agonists</b>  |              |
| Symbicort (Formoterol + Budesonide)                  | 18 (6.6 %)   |
| Seritide 125 (Fluticasone 125 mg + Salmeterol 25mcg) | 94 (34.7 %)  |
| Seritide 250 (Fluticasone 250 mg + Salmeterol 25mcg) | 16 (5.9 %)   |
| <b>Inhaled Beta 2 receptor agonists</b>              |              |
| Salbutamol Inhaler                                   | 191 (70.5%)  |
| <b>Other supportive therapy</b>                      |              |
| Bromhexine Syrup                                     | 28(10.3 %)   |
| Diphenhydramine Syrup                                | 30 (11.1 %)  |
| Dextromethorphan Syrup                               | 18(6.6 %)    |
| <b>Antibiotics</b>                                   |              |
| Amoxiclin 500 mg                                     | 12 (4.4 %)   |
| Augmentine 625mg (Amoxicilline + Clavulanic acid)    | 9 (3.3 %)    |
| Cefuroxime 250 mg                                    | 18(6.6%)     |
| Azithromycin 500mg                                   | 4(1.5%)      |

**Economic analysis of pharmacotherapy provided to the patients**

The cost of medications used to treat asthma divides between the treatment/preventive, and complementary medications. Treatment/preventive medications included fluticasone 250 mcg + salmeterol 25 mg, budesonide + formoterol, fluticasone 125 mcg + salmeterol 25 mg, salbutamol inhaler, prednisolone 20 mg, budesonide nebulizer, hydrocortisone IV,

ipratropium bromide and salbutamol nebulizer. While complementary medication included augmentin 625 mg, cefuroxime 250 mg, azithromycin 500 mg, amoxicillin 500, bromhexine syrup, diphenhydramine, and dextromethorphan. The estimated total medication expenditure due to asthma in pilgrims was 37,333 SAR with an average cost of 137.76 SR for each patient. Treatment/preventive medication cost were 27,692.92 SAR (74.18% of total cost) while complementary medication costs were 9,640 SAR (25.82%). Seretide 125 accounted for the highest expenditure in the total medication cost, costing 15,594.6 SAR (41%) while Seretide 250 had the highest cost among asthma medications. It costs 169 SAR for one box (9.38% of the total cost).

**Table 4: Total inpatient medication costs**

| <b>Medication according to price</b> | <b>Average cost/patient</b> | <b>No. of patients treated</b> | <b>Total cost</b> |
|--------------------------------------|-----------------------------|--------------------------------|-------------------|
| Budesonide nebule                    | 8.22                        | 46                             | 378.12            |
| Hydrocortisone IV                    | 4.82                        | 129                            | 621.78            |
| Ipratropium bromide                  | 2.5                         | 237                            | 592.5             |
| Salbutamol nebule                    | 0.77                        | 191                            | 147.07            |

Tables 4 show in-patient medication expenditures to 7413 SAR (18% of total cost) and table 5 represents total discharge medications cost up to 30,737 SAR (82%).

**Table 5: Total discharge medication cost**

| <b>Medication according to price</b>  | <b>Average cost/patient</b> | <b>No. of patients treated</b> | <b>Total cost</b> |
|---------------------------------------|-----------------------------|--------------------------------|-------------------|
| Fluticasone 250 mcg + salmetrol 25 mg | 218.9                       | 16                             | 3502.4            |
| Budesonide + formetrol                | 209.75                      | 18                             | 3775.5            |
| Fluticasone 125 mcg + salmetrol 25 mg | 165.9                       | 94                             | 15594.6           |
| Augmentin 625 mg                      | 62.16                       | 9                              | 559.44            |
| Cefuroxime 250 mg                     | 57.29                       | 18                             | 1031.22           |
| Azithromycin 500 mg                   | 36.2                        | 4                              | 144.8             |
| Amoxicillin 500 mg                    | 23.55                       | 12                             | 282.6             |
| Salbutamol inhaler                    | 15.65                       | 191                            | 2989.15           |
| Bromhexin syrup                       | 7.45                        | 28                             | 442.25            |
| Diphenhydramin                        | 7.15                        | 30                             | 214.5             |



|                    |     |    |       |
|--------------------|-----|----|-------|
| Prednisolone 20 mg | 6.2 | 14 | 86.8  |
| Dextromethorphan   | 5.9 | 18 | 106.2 |

## DISCUSSION

This study highlighted the impact of asthma-related admission at emergency facilities dealing with pilgrims during the Hajj & Umrah Pilgrimage season. Our findings are consistent with previous studies conducted by Mirza et al. and Al Sindy et al.<sup>21,22</sup> during Hajj and Umrah season. Mild and moderate asthma exacerbations were the most commonly reported severities during both seasons. Mirza et al. reported in a study done during Hajj season 2011, that the most common type of asthma exacerbation reported in an emergency setting, were mild (46%) and moderate (31%) exacerbation, interestingly there was no life-threatening asthma reported during the study period<sup>21</sup>. Similarly, in another study by Sindy et al., acute severe asthma was the major reason for admission during hajj pilgrimage on the day of Arafat<sup>22</sup>.

The prevalence of bronchial asthma and the prevalence of allergic rhinitis was significantly higher and moderately-higher, respectively, as reported by another study done in Saudi Arabia. That study also revealed increased exposure to environmental factors such as tobacco smoke<sup>23</sup>. The mean age of patients was (50±1.03) and more than half of the patients were admitted with mild Asthma exacerbations 168 (61.9%) followed by moderate severity 100 (37%). The total estimated medical cost (pharmaceuticals) was 37,333 SAR with an average cost of 137.76 SR for each patient. Fluticasone 125 mcg + salmeterol 25 mg drug accounted for the highest expenditure, with total cost 15,594.6

SAR (41%) followed by budesonide + formoterol and fluticasone 250 mcg + salmeterol 25 mg.

Asthma medication cost was accounted for the highest economic burden among patients. Similarly, other studies reported a high economic burden for asthma treatment, in Australia, the asthma expenditure for the period of 2000 to 2001 was AU \$693 million, which represents 1.4% of the total health expenditure <sup>9</sup>. The United States' annual expenditure for the treatment of asthma was estimated to be the US \$37.2 billion in 2007, which represents a remarkable segment of healthcare resources consumption <sup>10</sup>. Furthermore, incorrect inhalation techniques lead to wasting money between the 7-15.5 billion USD annually in the United States which calculates to an average percentage of 30% <sup>11</sup>.

Eduardo et al reported in a previous study that the cost related to isolated asthma was US\$1,155.43/patient-year (SD=1,305.58) and that the cost of medications for asthma accounted for 62.2% of the direct costs of asthma <sup>24</sup>. The majority of the patients were discharged on inhaled short-acting beta-agonist (salbutamol) 191 (70.5 %), followed by inhaled long-acting beta-agonists with corticosteroids (fluticasone 125 mg + salmeterol 25mcg) 94 (34.7 %).

Interestingly, the majority of the patients 243 (89.7 %) were cured and discharged after receiving acute medical care in emergency settings of the hospital. In general, outpatient medications cost was accounted for the highest economic burden among patients. Mild and moderate asthma exacerbations were accounted for the main cause of asthma-related admissions that may increase the severity of the disease. According to another study

findings, asthma severity was mainly associated with its exacerbation episodes, hospitalizations, indirect and direct medical costs and days patients' stayed at hospital <sup>25</sup>.

## **CONCLUSION**

Most of the asthma-related admissions were mild and moderate and many patients were not discharged on oral corticosteroids (prednisolone). Asthma-related emergency admissions were associated with a high cost for medication utilizations. Out patient's medication cost was highly related to medication dispensed during discharge. Most of the patients were at the age of 50 with multiple comorbidities.

## **STUDY LIMITATIONS**

There are a few limitations to this study i.e. we did not include life-threatening asthma exacerbations; as such patients were admitted to the intensive care units and reported with multiple co-morbidities. Besides, we did not study the poor inhaler technique as a risk factor for the reason of admission due to the retrospective nature of the study. Secondly, as this study was conducted in a single-center, our outcomes may not represent a generalized snapshot of the burden of asthma. In addition, due to the retrospective nature of the study, there were chances of missing data and may impact sample size and indirectly influence the generalizability of the results. **Based on the data obtained this study brought an estimative sum, without including working hours, infrastructure (ward, housing, nutrition, cleaning service etc) and indirect costs of a disease (loss of working hours etc).**

### **Consent Disclaimer:**

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

### **COMPETING INTERESTS DISCLAIMER**

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but the advancement of knowledge. Also, the research was not funded by any medicine producing company.

### **ACKNOWLEDGMENT**

The authors would like to thank the Deanship of Scientific Research at Prince Sattam bin Abdulaziz University, Alkharj, Saudi Arabia for the support in the publication of this manuscript. The authors would also like to express his sincere gratitude to all of the participants involved in this study in any capacity.

## REFERENCES

1. Domino FJ: The 5-minute clinical consult. Philadelphia: Lippincott, Williams & Wilkins, 20th edition 2012
2. Barbara Wells, Joseph DiPiro, Terry Schwinghammer and Cecily DiPiro : Pharmacotherapy handbook. New York: McGraw-Hill Medical Pub, 7th edition 2009.
3. Welte T and Groneberg DA: Asthma and COPD. Experimental and Toxicologic Pathology 2006;57, Supplement 2(0):35-40.
4. Braman SS: The global burden of asthma. CHEST Journal 2006;130(1\_suppl):4S-12S.
5. Al-Wasil MA and Al-Mohaimeed A: Assessment of inhalation technique in primary care Asthmatic patients using metered-dose inhalers with or without a spacer. Annals of Saudi Medicine 2003;23(3-4):264-9.
6. Al-Mobeireek A and Alamoudi O: The efficacy of a management protocol in reducing emergency visits and hospitalizations in chronic asthmatics. Saudi medical journal 2003;24(6):694-.
7. Basheti IA, Reddel HK, Armour CL and Bosnic-Anticevich SZ: Improved asthma outcomes with a simple inhaler technique intervention by community pharmacists. The Journal of allergy and clinical immunology 2007;119(6):1537-8.
8. Lenney J, Innes JA and Crompton GK: Inappropriate inhaler use: assessment of use and patient preference of seven inhalation devices. Respiratory Medicine 2000;94(5):496-500.

9. Canberra Australian Institute of Health and Welfare: Health care expenditure and the burden of disease due to asthma in Australia 2005. Available from: <http://www.aihw.gov.au/publication-detail/?id=6442467732>.
10. Kamble S and Bharmal M: Incremental direct expenditure of treating asthma in the United States. *Journal of Asthma* 2009;46(1):73-80.
11. Basheti IA, Armour CL, Bosnic-Anticevich SZ and Reddel HK: Evaluation of a novel educational strategy, including inhaler-based reminder labels, to improve asthma inhaler technique. *Patient Education and Counseling* 2008;72(1):26.
12. Banjar HH: Inhalation devices in asthma. *Annals of Saudi Medicine Journal* 2003;23:347-8.
13. Cordina M and McElnay JC: Assessment of a community pharmacy- based program for patients with asthma. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy* 2001;21(10):1196-203.
14. Närhi U, Airaksinen M, Tanskanen P and Enlund H: The effects of a pharmacy-based intervention on the knowledge and attitudes of asthma patients. *Patient Education and Counseling* 2001;43(2):171-7.
15. Fernandes AK, Mallmann F, Steinhorst AM, Nogueira FL, Avila EM, Saucedo DZ, Machado FJ, Raymundi MG, Barreto SS and Dalcin Pde T: Characteristics of acute asthma patients attended frequently compared with those attended only occasionally in an emergency department. *Journal of Asthma* 2003;40(6):683-90.
16. Health conditions for travellers to Saudi Arabia for the pilgrimage to Mecca (Hajj). *Releve epidemiologique hebdomadaire* 2006;81(44):422-3.
17. Ahmed AE1, Al-Jahdali H, Al-Harbi A, Khan M, Ali Y, Al Shimemeri A, Al-Muhsen S and Halwani R: Factors associated with poor asthma control among asthmatic patient visiting emergency department. *The clinical respiratory journal* 2014;8(4):431-6.
18. El Bashir H, Rashid H, Memish ZA and Shafi S: Meningococcal vaccine coverage in Hajj pilgrims. *The Lancet* 2007;369(9570):1343.

19. Ahmed QA and Memish ZA: Hajj medicine for the Guests of God: a public health frontier revisited. *Journal of Infection and Public Health* 2008;1(2):57-61.
20. Memish ZA, Stephens GM, Steffen R and Ahmed QA: Emergence of medicine for mass gatherings: lessons from the Hajj. *The Lancet Infectious Diseases* 2012;12(1):56-65.
21. Mirza TA, Fillimban A, Maimini O, Khiyat EY, Dhafar KO, Farooq MU and Gazzaz ZJ: Predictors of asthma severity during the pilgrimage to Mecca (Hajj). *Polish Archives of Internal Medicine* 2011;121(10):327-32.
22. Sindy AI, Baljoon MJ, Zubairi NA, Dhafar KO, Gazzaz ZJ, Deiab BA and Hothali FA: Pattern of patients and diseases during mass transit: The day of Arafat experience. *Pakistan journal of medical sciences* 2015;31(5):1099.
23. Al Frayh AR, Shakoor Z, Gad ElRab MO and Hasnain SM: Increased prevalence of asthma in Saudi Arabia. *Annals of Allergy, Asthma & Immunology* 2001;86(3):292-296
24. Costa E, Caetano R, Werneck GL, Bregman M, Araújo DV, Rufino R: Estimated cost of asthma in outpatient treatment: a real-world study. *Revista de Saúde Pública*. 2018;9;52:27.
25. Suruki RY, Daugherty JB, Boudiaf N, Albers FC: The frequency of asthma exacerbations and healthcare utilization in patients with asthma from the UK and USA. *BMC Pulmonary Medicine* 2017;17:74.