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

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Authors’ contributions

This work was carried out in collaboration among all authors. Authors AH, ASA, NNB and SMB designed the study. Authors AH, SEOA, DJR and WWK performed the statistical analysis. Authors EAA, GAN and MF wrote the protocol. Authors AH, MF, TMNAS and MSI wrote the first draft of the manuscript. Authors ASA, NNB, S MB, SEOA and DJR managed the analyses of the study. Authors AH, WWK, EAA, GAN, MF, TMNAS and MSI revised the manuscript. All authors read and approved the final manuscript.

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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 from patients’ data retrospectively. The convenience sampling strategy was used to retrieve 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%).

**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.

1. 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 [4]. In Australia, the number of adults affected by asthma is estimated at 7% [5].

In Saudi Arabia, the prevalence of asthma varies from 3.7% to 24.5% [5]. This variation has been linked to environmental and weather factors that differ across the regions [5]. Besides, asthma has affected 4.2% of males and 4% of females in Saudi Arabia [5-7]. 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 [8-11].

These include environmental factors, social changes and poor inhalation techniques of inhalation devices [11-13]. 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 [5-15]. Incorrect techniques have been reported with both the MDI and the dry powder inhaler (DPI) (28% to 68%) [7].

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 [16,17].

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%) [16,18].

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 [19,20].

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 admissions among Hajj and Umrah pilgrims visiting Holy Makkah.

2. METHODOLOGY

This was a retrospective observational study. Data were retrieved from the month of Ramadan and Hajj season from the medical record for all patients admitted to the emergency department with asthma as the final diagnosis. 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 from the concerned authorities. Data were analyzed using SPSS version 22 for statistical analysis.

3. 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%).

| Demographic characteristics | N (%)   |
|-----------------------------|---------|
| Nationality                 |         |
| Saudis                      | 70 (35.8) |
| Egyptians                   | 86 (31.7) |
| Morrocos                    | 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)   |
| Bangalisis                  | 6 (2.2)   |
| Malaysians                  | 2 (0.7)   |
| Age (mean±SD)               | 50.35 (1.03) |
| Gender                      |         |
| Male                        | 153 (56.5) |
| Females                     | 118 (43.5) |
| BMI                         |         |
| 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)    |
| Asthma severity             |         |
| Mild                        | 168 (61.9) |
| Moderate                    | 100 (37)   |
| Severe                      | 3 (1.1)    |
| Patients’ status            |         |
| Hajj Pilgrim                | 197 (72.7) |
| Umrah Pilgrim               | 31 (11.4)  |
| Resident                    | 43 (15.9)  |
Table 2. Inpatient medications therapy during hospitalization

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

Table 3. Outpatient medications provided at discharge

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

The mean age was 50.35 ± 1.03 and most of the patients were with mild asthma 168 (61.9%) and only 3 (1.1%) were severe.

As shown in Table 2, most prescribed medication during hospitalization are salbutamol 5 mg 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 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.

3.1 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 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%).

4. DISCUSSION

This study highlighted the impact of asthma-related admission at emergency facilities dealing with pilgrims during the Hajj and Umrah Pilgrimage season. Our findings are consistent with previous studies conducted by Mirza et al. and Al Sindy et al [21,22] during Hajj and Umrah season. Mild and moderate asthma exacerbations were the most commonly reported severities during both seasons. Mirza et al. [21] 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 [21]. Similarly, in another study by Sindy et al., acute severe asthma was the major reason for admission during the Hajj pilgrimage on the day of Arafat [22].

The prevalence of bronchial asthma and the prevalence of allergic rhinitis were 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 [23]. 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.

| Medication according to price | Average cost/patient | No. of patients treated | Total cost  
|-----------------------------|---------------------|------------------------|----------|
| 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   |

**Table 4. Total inpatient medication costs**

| Medication according to price | Average cost/patient | No. of patients treated | Total cost  
|-----------------------------|---------------------|------------------------|----------|
| Fluticasone 250 mcg + salmeterol 25 mg | 218.9              | 16                     | 3502.4   |
| Budesonide + formetaol      | 209.75              | 18                     | 3775.5   |
| Fluticasone 125 mcg + salmeterol 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    |

**Table 5. Total discharge medication cost**
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 [9]. 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 [10]. 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% [11].

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 [24]. 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 finding, asthma severity was mainly associated with its exacerbation episodes, hospitalizations, indirect and direct medical costs and days patients’ stayed at the hospital [25].

5. 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.

6. 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).

DISCLAIMER

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.

CONSENT

As per international standards patients’ consent had been taken before the start of the study.

ETHICAL APPROVAL

The study was started after the approval of the concerned authorities. Data were analyzed using SPSS version 22 for statistical analysis.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.
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