ORIGINAL ARTICLE

Predictors of asthma severity during the pilgrimage to Mecca (Hajj)

Tariq A. Mirza[1], Abdulwahab Fillimban[2], Othman Maimini[3], Emad Y. Khiyat[3], Khalid O. Dhafar[4], Mian U. Farooq[3], Zohair J. Gazzaz[5]

1 King Abdul Aziz Hospital, Mecca, Saudi Arabia
2 Directorate General of Accreditation for Health Care Institutions, Mecca, Saudi Arabia
3 King Abdullah Medical City, Mecca, Saudi Arabia
4 Directorate General of Health Affairs, Mecca, Saudi Arabia
5 Alnoor Specialist Hospital, Mecca, Saudi Arabia

KEY WORDS

asthma, emergency department, risk factors, severity

ABSTRACT

INTRODUCTION The annual pilgrimage to Mecca (Hajj) is one of the largest gatherings in the world and thus its participants are exposed to various communicable and noncommunicable diseases. This provides an opportunity to study travel epidemiology.

OBJECTIVES The aim of the study was to estimate the predictors of asthma severity during the Hajj.

PATIENTS AND METHODS The study cohort was recruited from patients who presented to the emergency department (ED) of the King Abdul Aziz Hospital, Mecca, Saudi Arabia, between December 3 and 18, 2008 (5–20 Dhul-Hijjah 1429 H). We included newly diagnosed and previously documented cases presenting with asthma symptoms. Sociodemographic and clinical data were collected and the risk factors were assessed. The severity of asthma exacerbation was measured according to the National Heart, Lung, and Blood Institute guidelines. Data were analyzed using the SPSS software.

RESULTS The study involved 58 subjects, including 38 women (65.5%). There were 27 subjects (46.6%) with mild asthma attack, 18 (31%) with moderate asthma attack, and no cases with life-threatening asthma. Insignificantly increased risk of severe asthma attack was observed in the following groups: women, people aged 46–60 years, pilgrims (hajis) who did not belong to a hajj group, non-hajis, illiterates, and nonsmokers – the odds ratio (OR) (95% confidence interval [CI]) was 3.7 (0.7–18.5), 1.7 (0.5–6.3), 2.4 (0.7–8.5), 5.1 (0.6–44.1), 2.3 (0.7–9.1), and 2.0 (0.4–10.4), respectively. Forty-six subjects (79.3%) had a history of allergy to components of smoke, detergents, dust, animal dander, and perfumes, while only 5 patients (8.6%) had drug allergy. High risk of severe asthma was observed in subjects with a history of drug allergy, as well as in obese subjects and those who often presented to the ED – OR (95% CI) was 6.5 (0.9–43.9), 18.0 (4.0–80.7), and 3.1 (0.8–11.5), respectively.

CONCLUSIONS Higher risk of severe asthma attack was observed in women, people aged 46–60 years, hajis who did not belong to a hajj group, non-hajis, illiterates, nonsmokers, obese patients, and those who often presented to the ED within the previous 12 months due to asthma exacerbation.

Correspondence to:
Mian U. Farooq, MBBS, MBA, MSc, Performance Measurement Manager, Health Research Centre, Alnoor Specialist Hospital, King Abdullah Medical City, 21955 Mecca, Saudi Arabia, phone: +966-568-232-502, fax: +966-255-499-99, e-mail: drus76@yahoo.com
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INTRODUCTION The Kingdom of Saudi Arabia covers the four-fifths of the Arabian Peninsula. As the site of the two holiest cities in Islam – Mecca and Medina – Saudi Arabia has an exclusive position in the Islamic world. The cities attract from 2 to 2.5 million pilgrims every year with one-third coming from Arabia itself. The annual pilgrimage to Mecca (Hajj) is one of the largest gatherings in the world. As such, it gives us an opportunity to study travel epidemiology, because it is associated with various communicable and noncommunicable diseases carried on a large scale.[1,2]

Because the Islamic calendar is a lunar calendar, and thus is shorter than the Gregorian calendar, the date of the Hajj changes from year to year, which requires attentiveness and consideration on

the part of health policy planners.[3] For this reason, the Government of the Custodian of the Two Holy Mosques is fully involved and makes every effort to prevent the spread of diseases by employing highly qualified professionals and by using the most modern medical methods and state-of-the-art technology.

Acute asthma exacerbation is typically caused by respiratory tract infection, which is the most common infection and accounts for 35% of communicable diseases identified in the primary care setting.[4] Other causes include physical exertion, air pollution, and weather change,[5] all of which are commonly observed during the Hajj.[2,6,7] Pilgrims travelling to Mecca (so called hajis) are subject to overcrowding and prolonged contact in semi-closed settings where the obligatory rituals are performed, including circumambulation of the Ka'bah or moving in a body to the Mina, Arafat, and Muzdalifah valleys (sacred places on the outskirts of Mecca). This increases their exposure to airborne infections and may cause exacerbations of noncommunicable diseases.[2,6,7]

Asthma exacerbations are among the most common medical emergencies. They are a frequent cause of emergency department (ED) visits and hospital admissions.[8] There are several misconceptions regarding asthma treatment. Numerous physicians consider mild asthma as well-controlled asthma and severe asthma as poorly controlled asthma. This classification is not appropriate, because "severity" refers to the intensity of the underlying disease process before treatment and "control" refers to the adequacy of response to treatment. Proper treatment allows to control severe asthma adequately, while improper treatment, which does not follow the guidelines, may lead to inadequate control even of mild asthma.[9]

Although our understanding of asthma is now much better, the rate of relapse after administration of treatment and discharge from the ED is still high and ranges from 17% to 30%. Many of these asthma patients will be frequently admitted to the ED in the future.[8]

Our study involved asthma patients admitted to the ED of the King Abdul Aziz Hospital, Mecca, Saudi Arabia, during the 2008 Hajj, with presenting signs and symptoms of previously or newly diagnosed asthma. The aim of the study was to estimate the predictors of asthma exacerbations during the pilgrimage to Mecca.

PATIENTS AND METHODS The study cohort was recruited consecutively from patients who presented to the ED of the King Abdul Aziz Hospital between December 3 and 18, 2008 (5–20 Dhul-Hijjah 1429 H). The hospital provides free primary, emergency, and inpatient care for hajis. Our study involved hajis and non-hajis who presented with symptoms of asthma and whose asthma was either newly or previously diagnosed. Data were collected using a prospective tool. Consultants were briefly instructed about the tool and the strategy to collect data. Physicians who assisted patients at presentation to the ED had to overcome the language barrier. Data on the risk factors as well as sociodemographic and clinical data were collected (age groups of 16–30, 31–45, 46–60, and >60 years, sex, nationality, educational status, symptoms). Patients were asked about previous treatment and family history (use of nonsteroidal anti-inflammatory drugs, short- and long-acting β_2-agonists, inhaled or systemic steroids, history of asthma or atopy). Subjects were classified into 4 groups: 1) patients on steroids, 2) on β_2-agonists, 3) on steroids and β_2-agonists, 4) on no medications. By atopy, we mean sensitivity to any type of allergen (e.g., pollen, dust, smoke, exhaust gas, animal dander). Physicians were divided into 2 groups based on their first language (Arabic or non-Arabic). Patients were classified into 4 groups based on their educational status: <5 years of primary education (illiterate), 5–10 years of primary education, 1–4 years of higher education, and >4 years of higher education.

Physical examination was performed including the body mass index (BMI), pulse and respiratory rate, axillary temperature, arterial oxygen saturation by pulse oximeter with the first reading included in the analysis. The peak expiratory flow rate was measured 3 times and the highest reading was recorded. History of immunization against meningococcal disease and *Haemophilus influenzae* was recorded. Chest X-ray, complete blood tests with differentials, and electrocardiography were performed. Asthma and severity of asthma exacerbation in the emergency care setting were identified, measured, and classified according to the 2007 Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma, National Asthma Education and Prevention Program, National Heart, Lung, and Blood Institute (United States).[10] After completing the history, examination, and treatment, the data collection tool was filled out. The questionnaire included questions about a visit to the ED within the previous year due to asthma exacerbation, which reflected history of asthma control. Moreover, the subjects were classified into 2 groups depending on the number of ED visits. Frequent visitors were defined as those who had more than 2 visits to the ED in the previous year and occasional visitors as those who had 2 or fewer visits. A consultant examined the use of metered-dose inhaler and peak flow meter, and the precision of usage was recorded on the data collection tool. We excluded patients with gastroesophageal reflux disease, hypertension, chronic obstructive pulmonary disease, and tuberculosis because of the overlapping symptoms.

Data were analyzed using the SPSS v. 16 (SPSS Inc., Chicago, Illinois, United States) and subjected to descriptive analysis. Numeric values expressed as mean ± standard deviation (SD) and calculations for nonparametric data were performed using the Wiloxin signed-rank test for

TABLE 1 Sociodemographic data of the subjects associated with severity of asthma exacerbation

Variables		Severity of asthma exacerbation		
		mild (n = 27)	moderate (n = 18)	severe (n = 13)
sex	male	44.4	33.3 0.9 (0.3–3.0)	15.4 0.3 (0.1–1.4)
	female	55.6	66.7 1.2 (0.3–3.5)	84.6 3.7 (0.7–18.5)
Hajj status	hajis	51.9	66.7 2.2 (0.7–7.1)	38.5 0.5 (0.2–1.6)
	non-hajis	48.1	33.3 0.5 (0.1–1.4)	61.5 2.4 (0.7–8.5)
Hajj group	member	92.9	83.3 0.9 (0.1–6.6)	60 0.2 (0.02–1.7)
	non-member	7.1	16.7 1.1 (0.2–7.5)	40 5.1 (0.6–44.1)
age, y	16–30	29.6	33.3 1.5 (0.4–5.0)	15.4) 0.4 (0.1–2.1)
	31–45	33.3	33.3 0.9 (0.3–3.0)	38.5 1.3 (0.3–4.5)
	46–60	25.9	27.8 0.9 (0.3–3.1)	38.5 1.7 (0.5–6.3)
	>60	11.1	3.6 0.5 (0.1–5.1)	7.7 0.9 (0.1–8.4)
language	Arabic	59.3	83.3 3.0 (0.7–12.1)	69.2 1 (0.3–3.9)
	non-Arabic	40.7	16.7 0.3 (0.1–1.3)	30.8 0.9 (0.3–3.7)
educational status	illiterate	22.2	44.4 1.5 (0.5–4.6)	53.8 2.3 (0.7–9.1)
	5–10 years of primary education	37.0	22.2 0.6 (0.2–2.3)	23.1 0.7 (0.2–2.8)
	1–4 years of higher education	22.2	27.8 1.3 (0.4–4.7)	15.4 0.6 (0.1–2.9)
	>4 years of higher education	18.5	3.7 0.4 (0.04–3.8)	7.7 0.5 (0.1–4.9)
smoking history	nonsmokers	74.1	72.2 0.8 (0.2–2.7)	84.6 2 (0.4–10.4)
	smokers/ex-smokers	25.9	27.8 1.5 (0.4–5.6)	15.4 0.2 (0.02–2.0)

Data are presented as percentage, odds ratio (95% confidence interval). Odds ratio was measured as moderate vs. combined mild and severe asthma and severe vs. combined mild and moderate asthma.

2 groups and the Kruskal-Wallis one-way analysis of variance (ANOVA) for comparison between more than 2 groups. Nominal values were expressed as n (%); inter- and intragroup comparison was made using the χ^2 test with the Yates correction for 2 variables. The odds ratio (OR) and 95% confidence interval (CI) were measured for risk assessment. All directional *P* values were 2-tailed and significance was assigned to the values <0.05. The study protocol was approved by our institutional review board.

RESULTS Only 58 subjects of about 17 different nationalities fulfilled the inclusion criteria. There were more women (38; 65.5%) than men (*P* <0.05). The majority of patients were Saudis (27; 46.6%), followed by Turks (4; 6.9%). Twenty-seven subjects (46.6%) presented to the ED with mild asthma attack, 18 (31%) with moderate attack, and the remaining patients with severe attack (*P* >0.05). There were no cases of life-threatening asthma. The mean age of study participants was 41.5 ±15.2 years (men: 41.9 ±15.5; women: 41.3 ±15.3; *P* >0.05). The age group of 46–60 years showed high risk of severe asthma attack (OR 1.7, 95% CI 0.5–6.3). The risk of severe attack was also observed to be higher in women (OR 3.7, 95% CI 0.7–18.5). There were more hajis (31; 53.4%) than non-hajis (*P* >0.05). There were more hajis who belonged to a particular Hajj group or mission (26; 83.9%) than those who did not (*P* <0.01). The non-hajis as well as hajis who

TABLE 2 Asthma triggering factors and family, vaccination, and medication history depending on the severity of asthma exacerbation

Variables		Severity of asthma exacerbation		
		mild (n = 27)	moderate (n = 18)	severe (n = 13)
asthma triggering factors	exercise/exhaustion	55.6	50.0 0.7 (0.2–2.3)	61.5 1.4 (0.4–4.9)
	respiratory tract infection	37.1	38.9 0.9 (0.3–2.7)	53.8 1.9 (0.6–6.9)
	smoke, dust, perfumes, detergent, animal dander	85.2	83.3 1.5 (0.3–6.2)	61.5 0.3 (0.1–1.2)
	emotional expression	7.4	16.7 1.8 (0.4–9)	15.4 1.5 (0.2–8.5)
	environmental	37.0	38.9 1.1 (0.3–3.3)	38.5 1.0 (0.3–3.7)
	drugs	3.7	5.5 0.5 (0.1–5.1)	23.1 6.5 (0.9–43.9)
family history of asthma or atopy		48.1	50.0 0.7 (0.2–2)	84.6 5.6 (1.1–28.9)
no history of *H. influenza* vaccination		63.0	55.5 1.5 (0.5–4.7)	61.5 1.2 (0.3–3.8)
body mass index, kg/m^2	normal	85.2	38.9 0.4 (0.1–1.3)	7.7 0.04 (0–0.4)
	overweight	11.1	38.9 3.6 (0.9–13)	23.1 1.1 (0.2–4.6)
	obese	3.7	22.2 0.8 (0.2–3.2)	69.2 18.0 (4–80.7)
history of regular medication use	β_2-agonists	48.2	33.3 0.7 (0.2–2.2)	30.8 0.6 (0.2–2.3)
	steroids	0	5.5 1.1 (0.1–13.2)	15.4 8.0 (0.7–96.5)
	β_2-agonists and steroids	40.7	33.3 0.8 (0.3–2.7)	30.8 0.7 (0.2–2.7)
	no medications	11.1	18.5 2.2 (0.6–8.2)	23.1 1.4 (0.3–6.2)
previous asthma control (based on the number of visits to the emergency department)	occasional visitors	70.4	38.9 0.5 (0.1–1.5)	30.8 0.3 (0.1–1.2)
	frequent visitors	29.6	61.1 2.1 (0.7–6.6)	69.2 3.1 (0.8–11.5)

Data are presented as percentage, odds ratio (95% confidence interval). Odds ratio was measured as moderate vs. combined mild and severe asthma and severe vs. combined mild and moderate asthma. Most subjects reported history of more than 1 triggering factor.

did not belong to a Hajj group were at a higher risk of severe asthma attack (OR 2.4, 95% CI 0.7–8.5 and OR 5.1, 95% CI 0.6–44.1, respectively). There were 21 illiterate subjects (36.2%); they also had a slightly higher risk of severe asthma attack (OR 2.3, 95% CI 0.7–9.1). The mean age of hajis was higher than that of non-hajis (46.7 ±15.4 vs. 36.4 ±13.1 years; P <0.05). The majority of the study group were Arabic-speaking individuals (40; 69%; P <0.05); they were at a high risk of moderate asthma attack (OR 3.0, 95% CI 0.7–12.1). Most subjects were nonsmokers (44; 75.9%; P <0.05) with a higher risk of severe attack (OR 2.0, 95% CI 0.4–10.4) (TABLE 1).

The most common asthma symptoms were shortness of breath (53 patients; 91.4%) and cough (52 patients; 89.7%). Forty-six subjects (79.3%) had a history of allergy to smoke, detergents, dust, animal dander, and perfumes, while only 5 patients (8.6%) had drug allergy. Risk of severe asthma was particularly high in subjects with a history of drug allergy (OR 6.5; 95% CI 0.9–43.9). Thirteen patients (22.4%) were overweight; they were at a high risk of severe asthma attack (OR 18.0, 95% CI 4.0–80.7). There was a significant difference in the BMI between patients with mild (21.8±4.1), moderate (27.2 ±4.9), and severe (32.3 ±3.3) asthma attack (Kruskal-Wallis ANOVA; P <0.05). Most patients (23; 39.7%) used only β_2-agonists on regular basis; these patients had a low risk of moderate (OR 0.7, 95% CI 0.2–2.2) and severe attack (OR 0.6, 95% CI 0.2–2.3). Patients who often presented to the ED in the previous year had a higher risk of severe asthma attack (OR 3.1, 95% CI 0.8–11.5). Only 5 subjects (8.6%) who suffered

from severe attack were admitted to the wards, and the remaining subjects were discharged from the ED (TABLE 2).

DISCUSSION In our study, we focused on the characteristics of patients with varying levels of asthma severity referred to our hospital for emergency reasons. The results of our study showed that nearly half of the subjects suffered from mild asthma and there were no cases of life-threatening asthma. The characteristics of patients were compared to identify the risk factors for mild, moderate, and severe asthma attacks. The design of the study allowed us to identify these factors in a more accurate and standardized way than it was previously possible.

There were more women than men in our study group. Such ratio was also observed in other studies, for example in Fernandes et al.[11] and Mitchell et al.[12] Baibergenova et al.[13] identified the characteristics of patients who presented to the ED with nocturnal asthma. They observed that nocturnal asthma was associated with sex. No data have been published to date suggesting that nocturnal asthma is more prevalent in men than in women, but the higher proportion of men among night-time patients suggests that there are sex-related differences either in the progression of asthma symptoms or health-seeking behavior. It has been observed that men are more likely to have rapid-onset asthma than women.[13,14]

In our study, the risk of severe asthma attack was higher in the case of acute respiratory tract infections (ARTIs). Several factors contribute to a wide spread of ARTIs, including direct contact with infected people, change in climate, or the presence in a crowded place. All these factors are present during the Hajj.[15]

As observed in other studies, the risk of ARTIs caused by viruses, especially respiratory syncytial and influenza viruses, increases during colder months, with the peak in January and February.[16] The winter season coincided with the dates of the Hajj in 2008, so high incidence of ARTIs was expected.

Our study showed that the risk of severe attack was particularly high in hajis who did not belong to any Hajj group. Usually, a Hajj group, especially if it is based outside Saudi Arabia, has its own medical initiatives to prevent and cure common health problems of their hajis. That is why the risk was higher in patients who were not the members of a Hajj group. The risk of severe asthma was observed also in illiterate patients and in nonsmokers. The possible reason for the higher risk in nonsmoking patients was air pollution, which is typical in such a crowded setting.

Among asthma-triggering factors, drugs played a major role in the case of severe exacerbation. This can be explained by the fact that hajis were mostly tired or even exhausted and they used medications such as nonsteroidal anti-inflammatory drugs or aspirin for headaches. These analgesics are usually contraindicated in patients with asthma.

Limitations It was a hospital-based, short-term study with patients recruited only from the ED. To evaluate the risk factors for acute asthma during the Hajj, more study settings should be included, particularly the hospitals in the area of Mina, Muzdalifah, and Arafat where the majority of hajis gather during the Hajj. All the hospitals serving the hajis in Mecca and Medina should engage in a study on asthma predictors to help draw a clearer picture of this issue.

Conclusions The majority of cases in our study had mild asthma attack. High risk of severe attack was observed in women, non-hajis, hajis who were not members of a hajj group, nonsmokers, and illiterate patients. Subjects with respiratory infection, medication use, obesity, family history of atopy, and those receiving only 1 drug for asthma (e.g., oral steroid) were more prone to severe asthma attack. Proper health care guidance before the Hajj provided by health care officials on an international level may reduce emergency department visits for asthma exacerbation.

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ARTYKUŁ ORYGINALNY

Czynniki ryzyka ciężkości astmy podczas pielgrzymki do Mekki (hadżdż)

Tariq A. Mirza[1], Abdulwahab Fillimban[2], Othman Maimini[3], Emad Y. Khiyat[3], Khalid O. Dhafar[4], Mian U. Farooq[3], Zohair J. Gazzaz[5]

1 King Abdul Aziz Hospital, Mekka, Arabia Saudyjska
2 Directorate General of Accreditation for Health Care Institutions, Mekka, Arabia Saudyjska
3 King Abdullah Medical City, Mekka, Arabia Saudyjska
4 Directorate General of Health Affairs, Mekka, Arabia Saudyjska
5 Alnoor Specialist Hospital, Mekka, Arabia Saudyjska

SŁOWA KLUCZOWE

astma, ciężkość, czynniki ryzyka, oddział ratunkowy

STRESZCZENIE

WPROWADZENIE Coroczna pielgrzymka do Mekki (hadżdż) jest jednym z największych zgromadzeń ludzi na świecie, przez co jej uczestnicy narażeni są na różne choroby zakaźne i niezakaźne. Wydarzenie to umożliwia prowadzenie badań związanych z medycyną podróży.

CELE Celem badania była ocena czynników ryzyka ciężkości napadu astmy podczas hadżdż.

PACJENCI I METODY Badaną populację stanowili chorzy wybrani z grupy osób przyjętych na oddział ratunkowy szpitala King Abdul Aziz w Mekce w Arabii Saudyjskiej pomiędzy 3 a 18 grudnia 2008 roku (5–20 Dhul-Hijjah 1429 H). Do badania włączono chorych z objawami astmy nowo rozpoznanej oraz wcześniej zdiagnozowanej. Zebrano dane socjodemograficzne i kliniczne oraz określono czynniki ryzyka. Ciężkość napadu astmy oceniano według wytycznych National Heart, Lung, and Blood Institute. Dane analizowano przy użyciu pakietu SPSS.

WYNIKI W badaniu wzięło udział 58 chorych, w tym 38 kobiet (65,5%). Wśród badanej populacji u 27 pacjentów (46,6%) stwierdzono łagodny atak astmy, a u 18 (31%) – umiarkowany; nie zaobserwowano przypadków astmy zagrażającej życiu. Nieznamiennie zwiększone ryzyko ciężkiego napadu astmy zaobserwowano u kobiet, osób pomiędzy 46 a 60 rokiem życia, pielgrzymów nienależących do grup hadżdż, osób niebędących pielgrzymami, analfabetów i osób niepalących – iloraz szans (95% przedział ufności [CI]) wynosił odpowiednio 3,7 (0,7–18,5); 1,7 (0,5–6,3); 2,4 (0,7–8,5); 5,1 (0,6–44,1); 2,3 (0,7–9,1) i 2 (0,4–10,4). U 46 osób (79,3%) stwierdzono dodatni wywiad w kierunku nadwrażliwości na składniki dymu, detergenty, roztocza, naskórek zwierząt oraz składniki perfum, natomiast jedynie u 5 chorych (8,6%) wykazano uczulenie na leki. Duże ryzyko wystąpienia ciężkiej astmy zaobserwowano u chorych z alergią na leki, otyłych i często przyjmowanych na oddział ratunkowy – iloraz szans (95% CI) wynosił odpowiednio 6,5 (0,9–43,9); 18,0 (4,0–80,7), i 3,1 (0,8–11,5).

WNIOSKI Zwiększoną tendencję do wystąpienia ciężkiego ataku astmy stwierdzono u kobiet, osób pomiędzy 46 a 60 rokiem życia, pielgrzymów nienależących do grup hadżdż, osób niebędących pielgrzymami, analfabetów, niepalących, otyłych oraz u pacjentów często przyjmowanych na oddział ratunkowy w ciągu ostatnich 12 miesięcy z powodu pogorszenia astmy.

Adres do korespondencji:
Mian U. Farooq, MBBS, MBA, MSc, Performance Measurement Manager, Health Research Centre, Alnoor Specialist Hospital, King Abdullah Medical City, 21 955 Mekka, Saudi Arabia, tel.: +966-568-232-502, fax: +966-255-499-99, e-mail: drus76@yahoo.com

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