

# Cardiovascular disease in Hajj pilgrims

Abdullah Al Shimemeri\*

Intensive Care Department, College of Medicine, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia

The changing pattern of hospital admissions during Hajj, the Muslims yearly pilgrimage attracting millions of pilgrims from all around the globe, has gradually seen infectious causes of hospital admission replaced by cardiovascular diseases as a leading cause of both intensive care unit admission and death. While this trend is partly associated with the high quality of medical services and awareness programs targeted at reducing the spread of infections, at the same time it underscores an urgent need to establish a pragmatic system to manage the challenge of cardiovascular morbidities and mortality during Hajj.

*Search strategy and inclusion criteria:* A PubMed Central (PMC) literature search without date restrictions was performed for articles reporting on the medical experience during Hajj. There were 109 articles were returned using "Hajj" and "mortality" as search terms. After determining relevance to the current theme based on both direct and indirect reference to the pattern hospital admission during Hajj, 20 articles reporting on conducted studies were obtained. Data from these studies reporting on the pattern and outcome of hospitalization during Hajj were examined and helped in arriving at the conclusions presented in this review.

© 2012 King Saud University. Production and hosting by Elsevier B.V. All rights reserved.

**Keywords:** Cardiovascular diseases, Mortality, Makkah, Saudi Arabia, Hajj, Pilgrim

## Contents

Cardiovascular diseases, the principal cause of death during Hajj .....	124
Conclusion .....	127
Conflict of Interest .....	127
References .....	127

Once in a lifetime every Muslim is expected to undergo a holy pilgrimage, known as Hajj, which takes place in the 12th month of the Islamic lunar calendar. Every year an estimated two

million Muslim pilgrims gather from all around the world to perform the holy pilgrimage. The rituals performed during include a walk around Kaaba, a cube-shaped building in Makkah considered

Received 4 November 2011; revised 4 January 2012; accepted 5 February 2012.

Available online 16 February 2012

\* Tel.: +966 1 801111x18855.

E-mail addresses: [aftercom@yahoo.com](mailto:aftercom@yahoo.com), [shimemeri@ksau-hs.edu.sa](mailto:shimemeri@ksau-hs.edu.sa).



1016-7315 © 2012 King Saud University.  
Production and hosting by Elsevier B.V. All rights reserved.

Peer review under responsibility of King Saud University.  
URL: [www.ksu.edu.sa](http://www.ksu.edu.sa)  
doi:10.1016/j.jscha.2012.02.004



P.O. Box 2925 Riyadh – 11461KSA  
Tel: +966 1 2520088 ext 40151  
Fax: +966 1 2520718  
Email: [sha@sha.org.sa](mailto:sha@sha.org.sa)  
URL: [www.sha.org.sa](http://www.sha.org.sa)



Production and hosting by Elsevier

the most sacred site in Islam, followed by the Sa'i consisting of walking between two hills (Safa and Marwa) seven times, each with a distance of about 450 m to a total of 3.15 km. Other rites include a 14.5 km journey to the desert Arafat, a night spent at Muzdalifah where pebbles to be thrown the following day at Mena (about 5 km from Makkah).

For pilgrims in good health the pilgrimage and the involved rites, though requiring significant amount of physical exertion, do not constitute any reason for medical concern. In the studied pilgrims traumas and illnesses usually directly or indirectly stem from overcrowding, for instance resulting from stampede resulting from mass panic, and communicable infections. As for non-communicable illnesses, pre-Hajj medical state and individual pilgrims' characteristics come into play directing both the pattern and outcome of hospitalization. In 1995, a study by Yousaf et al. identified diabetes mellitus, respiratory infection (pneumonia in particular) and ischemic heart disease as the diseases most commonly reported during Hajj [2]. The high incidence of communicable illnesses may be attributed to the overcrowded condition and the spread of infections. Prior to the recent dominance of respiratory infection in hospital admissions during the holy month, cholera and meningitis were the principal causes of morbidity and mortality; the improved hygiene, health care and education can be credited for the current reduction in incidence of these infectious diseases [2-5]. In a study recruiting over 2000 Hajj pilgrims from Pakistan, pre-Hajj vaccination against influenza virus was observed to reduce the incidence of influenza-associated illnesses by about 24%. [6] However a separate English study conducted in 2004 failed to reproduce a similar pattern of correlation between vaccination and disease occurrence [7]. This was in part a result of the inclusion of fewer pilgrims (115 compared to 2000 in the Pakistani study) in the study, but mostly as a result of a mismatch of the viral strain employed for vaccination [7].

### Cardiovascular diseases, the principal cause of death during Hajj

Over the past few years cardiovascular diseases have emerged as an important cause both of intensive care unit (ICU) admission and of mortality during Hajj. For instance, in a study analyzing Hajj hospital admissions in 2004 as a function of pilgrims' geographical origin, myocardial infarction was identified as the major cause of admission into the intensive care units (ICU) of seven

hospitals (four in Mena, three in Arafat), ahead of pneumonia, asthma, chronic obstructive pulmonary disorder (COPD) and pulmonary edema [1]. More than 60% of the ICU admissions came from cardiovascular causes of which myocardial infarction and left ventricular failure occurred with the highest frequencies.

This was slightly different from a 2009 prospective study involving over 500 Hajj pilgrims from France (median age 61) attending the 2007 [8] (5 km). While cardiovascular disease-related conditions (e.g., hypocholesterolemia and hypertension) represented significant co-morbidities in the pilgrims prior to Hajj, the reported hospitalization was much lower than in the previous study. While this particular study represented a highly non-generalizable account of Hajj medical experience, it adequately represents the stratification according to age often reported for pilgrims attending Hajj (median age 61 years). According to the study, pilgrims with ages ranging from 65 to 74 years had the highest number of age-related chronic conditions like diabetes mellitus (31%), hypertension (27.5%), and hypercholesterolemia (11.4%) This age group understandably would constitute the highest number of hospitalizations during Hajj. The pattern shown in this particular study suggests a need to separate the overall number of hospitalization from ICU admissions and contribution to total reported mortalities reportedly dominated by cardiovascular conditions [9]. Also, it is necessary to view the French study within the highly restricted context of the study group not representative of the overall Hajj attendance. Similarly, in another study involving a total of 105,713 Iranian pilgrims covering two successive Hajj pilgrimages (2004 and 2005), cardiovascular diseases were responsible for only a small number of the overall hospitalizations [10]. This was attributed to effective pre-Hajj screening procedures that successfully reduced the number of high risk groups composed mainly of individuals with cardiovascular diseases. It is only fair to expect the outcome of similar studies would be different where such pre-Hajj screening of high risk groups is absent.

In 2005 the Ministry of Health of the Kingdom of Saudi Arabia identified deaths resulting from cardiovascular diseases as the highest recorded during Hajj (Health Statistics: Saudi Ministry of Health, 2005). Casualties of 7% was reported by Gazzaz et al. for the 2001/2002 Hajj at the Al-Noor specialist hospital recruiting 166 patients [11]. Although the medical causes of the recorded deaths were not mentioned in the study, the

highest number of admissions were reportedly observed in the coronary care unit of the hospital. In a separate report by Madani et al., cardiovascular disease caused approximately 64% of total admission of which myocardial infarction was the most common diagnosis and 10.7% (68.6% above 40 years of age) mortality was reported [1]. Up to half of the recorded deaths were said to result from myocardial infarction alone. Of the total admissions into the intensive care units studied, 57.9% were also reportedly for cardiovascular disease and hypertension (ischemic heart disease, 24.4%; congestive heart failure, 7.1% and; hypertension, 26.4%).

In a 2006 review article examining the pattern of care transfer from the emergency rooms (ERs) of the Mashaer, Makkah and Madinah hospitals to the ICUs during the Hajj of 2002, cardiovascular disease was at the top of the death chart (45.8% of which hypertension accounted for 2.7% of the deaths, Table 1) [12]. Mortality totaling 13.8% resulted exclusively from respiratory-related diseases, well behind cardiovascular causes. A further 14.3% of the reported deaths were caused by combined respiratory and cardiovascular failure. A separate study by Al-Ghamdi et al. with fewer patients (160) showed the overall hospital admission dominated by respiratory diseases (57%) while admission into ICUs was led by cardiovascular diseases [13]. A similar pattern was reported for the 2004 Hajj with respiratory diseases leading admission into seven hospitals (three in Arafat, and four in Mena) in the holy month, followed by cardiovascular conditions [1].

Two points may be noted in the studies. First, respiratory infections often dominate overall hospitalization during Hajj [10,14,15]. Second, cardiovascular diseases during the pilgrimage cause more death than other medical ailments, both communicable and non-communicable. Recognition of this trend will help both in planning health management for the pilgrimage and for reducing mortalities via a medical history-based screening that reduces the number of high risk groups.

An interesting dimension, however, was observed in the study on 2002 Hajj [12]. The percent mortality recorded at Makkah hospitals were four times those reported at Madinah. Although it remains unknown the details of the particular events culminating in death, at the same time it appears reasonable to attribute the pattern to the level of physical exertion accompanying at the sites which are more accessible to the Makkah hospitals than to clinics in Madinah. In addition, the reported ER and ICU admissions were dominated by elderly patients making age an important factor in the pattern of ICU admission, especially since this age category is usually characterized by cardiac co-morbidities. This explains why cardiovascular diseases, rather than respiratory illnesses (which rather than being age-specific are mostly infectious diseases contracted from the highly crowded population), should dominate mortalities witnessed during Hajj. The commonly reported cardiovascular conditions were different kinds of shock (hypovolemic, obstructive, septic and cardiogenic), myocardial infarction, and hypertensive emergencies. Thus, while infectious causes may dominate admission into the medical wards and the ERs, cardiovascular diseases, often existing in the pilgrims prior to Hajj, dominate ICU admissions and are responsible for a larger portion of recorded deaths.

An analysis of the age distribution in some studies showed that Hajj hospital admission is often dominated by pilgrims older than 40 years [16]. This is of significance with respect to clinical outcome since the risk of morbidity and mortality following cardiovascular diseases increases significantly with age, with age groups above 80 years carrying very serious risk (Table 2). In addition, the age-related predisposition to cardiovascular morbidity and mortality needs to be considered against a backdrop of a series of physically demanding religious rites pilgrims are eager to take part in even when their health should prevent from doing so. This, for reasons advanced shortly, contradicts the positive role of exercise and physical activities in improving both morbidity and mortality in patients with cardiovascular diseases. As

Table 1. Most significant causes of death during 2002 Hajj (adapted from Yaseen and Sameer [12]).

Diseases	Mortality (%)
Cardiovascular diseases (with hypertension)	45.8
Respiratory causes	13.8
Respiratory and cardiac system failure	14.3
Traffic accidents and other traumas	6.4
Cerebrovascular diseases	3.4

Table 2. Correlation of pilgrims' age with mortality. Reproduced from Khan et al. [16].

Age (years)	Mortality (%)
Less than 20	0 (0)
20–39	3.5 (13.3)
40–59	20.2 (12.6)
60–79	67.5 (18.1)
Greater than or equal to 80	8.8 (21.3)

an example, a study published as early as 1975 correlating mortality in cardiovascular ailments with the level of physical exertion involved in the patients' day-to-day work [17], found annual mortality per 10,000 in longshoremen significantly reduced compared to the general population (26.9 vs 49.0). Many other subsequent studies have arrived at the similar conclusions regarding the beneficial role of exercise in preventing cardiovascular morbidity and mortality. However, this perception can be contended in the context of Hajj where most of the pilgrims (quite advanced in years) had all along led a sedentary life prior to making Hajj against a long-standing recommendation of controlled exercise recommended in the context of the management of cardiovascular diseases. *Sudden* physical activities in individuals with cardiovascular diseases elicit a number of mechanisms including a lowering of the venous return and reduction in cardiac output likely to precipitate acute cardiovascular attack. These processes are counterproductive and can compromise disease management, and in extreme cases lead to the death of the individual.

In a 1998 published work, Afshin-Nia et al. reported a study comparing health indices in pilgrims with at least one cardiovascular disease from the Isfahan district in Iran before and after the 1993 Hajj [18]. Only pilgrims with adequately controlled cardiovascular conditions were included in the study. Hypertension and ischemic heart disease were the principal cardiovascular diseases encountered. Although no casualty was recorded in this particular group of pilgrims, this was more a reflection of an effective screening of intended pilgrims and the exclusion of patients with poor health conditions than an indication of low mortality. Comparison of signs and symptoms before and after Hajj indicates no significant worsening as a result of Hajj, with an interesting exception – medication consumption increased from 36% pre-Hajj, to 94% post-Hajj in a randomly selected subset of the population under study. This directly reveals the impact of the physical strain inherent in performing Hajj rites, especially on pilgrims with heart conditions or other age-related diseases. We should bear in mind that this study was strictly limited to pilgrims with adequately managed cardiovascular diseases. It might not be far-fetched to suppose that the consequence on pilgrims with poorly controlled age-related cardiovascular illnesses would have been devastating and possibly fatal, especially when it is further considered that in the present study a greater number of pilgrims with carefully controlled car-

diovascular diseases were unable to perform Hajj rites compared to similar age group (control) without heart-related diseases. For this, Hajj rites were grouped into *Tawaf* (circumambulation of Kaaba, an aggregate distance of about 40 km), *Saay*, *Ramy* and *Woghoof*, and 9.6%, 14.1%, 23.6% and 9.6% of pilgrims with carefully controlled cardiovascular ailments were, respectively, unable to perform the rites. Each of these values is more than double the figures obtained in the control group (3.5%, 4.2%, 11.6%, and 2.2%, respectively) [18].

The study by Afshin-Nia et al. indirectly demonstrated the increased risk of morbidity (and by extension, mortality) associated with cardiovascular conditions in Hajj pilgrims. By employing a protocol exploiting the medical status of intended pilgrims as exclusion criteria the authorities of the city of Isfahan were able to reduce both morbidity (0.94% hospitalization) and mortality (equivalent of 13 per 100,000) compared to other provinces (1.85% hospitalization, and 66 deaths per 100,000) where similar pre-Hajj screening was not conducted [18]. Further studies are required to establish the relationship between cardiovascular disease-related mortality recorded during Hajj and the quality of pre-Hajj healthcare management available to intended pilgrims. This will help separate the risks intrinsically inherent in cardiovascular diseases from those resulting from the adequacy (or lack of it) of therapeutic management of such conditions.

It may be tempting to ask the question: should the Saudi Arabian authorities institute an age-based exclusion criterion for granting admittance onto the pilgrimage? Perhaps, it would be of greater help, however, to have the different national and regional authorities work together with the Saudi Arabian authorities in ensuring intended pilgrims are adequately screened for likely risk factors such as cardiovascular diseases with a special attention to how well such chronic diseases have been managed by the individual. Expectedly, this will parametrically consider age as a risk factor; however, such screening should primarily focus on disease risk factors. This is already in force in certain cases where intended pilgrims from Turkey and Malaysia with severe heart conditions are prevented from performing the Hajj [19]. Further studies paying particular attention to the manner in which each type of medical condition (acute or chronic) contributes to mortalities [20] are needed as these will help in effecting more effective national and international policies for preventing deaths during Hajj.

## Conclusion

Hajj pilgrimage often demands substantial financial preparation on the part of the pilgrims and many do not attain the necessary financial readiness until much later in their life when age has become an important predisposing factor for chronic disorders, cardiovascular diseases in particular. Such co-morbidities coupled with age and the physical strain associated with the performance of Hajj offer a valid explanation for the recent emergence of cardiovascular diseases as the most important cause of death during Hajj. This review discusses the predictive value of ICU admission rather than total hospitalization in while discussing the importance of cardiovascular diseases with respect to the mortalities recorded during Hajj. Elaborate plans based on effective medical screening to rule out risk factors of cardiovascular diseases (especially poorly controlled conditions) calls for collaborative efforts between the pilgrims' host countries and the Kingdom of Saudi Arabia to be urgently instituted in order to reduce the casualties.

## Conflict of Interest

Authors have no conflict of interest to declare.

## References

- [1] Madani TA, Ghabrah TM, Albarrak AM, Alhazmi MA, Alazraqi TA, Althaqafi AO, et al. Causes of admission to intensive care units in the Hajj period of the Islamic year 1424 (2004). *Ann Saudi Med* 2007;27(2):101–5.
- [2] Yousaf M, Al-Saudi DAA, Sheikh RA, Lone MS, Yousaf SM, Turner P. Pattern of medical problem among hajj pilgrims admitted to King Abdul Aziz Hospital, Medina Al-Munawarah. *Ann Saudi Med* 1995;15:619–21.
- [3] Ataur-Rahim M. Pilgrimage and cholera epidemic in Saudi Arabia: a bibliographic survey from 1813–1979. *Hamdard Medicus* 1986;29:121–5.
- [4] Yousaf M, Nadeem A. Meningococcal infection among Pilgrims visiting Madinah Al-Munawarah despite prior AC vaccination. *JPMMA* 2000;50:184–6.
- [5] Shafi S, Memish ZA, Gatrard AR, Sheikh A. Hajj 2006: communicable disease and other health risks and current official guidance for pilgrims. *Surveillance Rep, Eurosurveillance Wkly Release* 2005;10(12):1–3.
- [6] Qureshi H, Gessner BD, Leboulloux D, Hasan H, Alam SE, Moulton LH. The incidence of vaccine preventable influenza-like illness and medication use among Pakistani pilgrims to the Haj in Saudi Arabia. *Vaccine* 2000;18(26):2956–62.
- [7] El BH, Haworth E, Zambon M, Shafi S, Zuckerman J, Booy R. Influenza among U.K. pilgrims to Hajj, 2003. *Emerg Infect Dis* 2004;10(10):1882–3.
- [8] Gautret P, Soula G, Delmont J, Parola P, Brouqui P. Common health hazards in French pilgrims during the Hajj of 2007: a prospective cohort study. *J Travel Med* 2009;16(6):377–81.
- [9] Ahmed QA, Arabi YM, Memish ZA. Health risks at the Hajj. *Lancet* 2006;367(9515):1008–15.
- [10] Meysamie A, Ardakani HZ, Ravazi SM, Doroodi T. Comparison of mortality and morbidity rates among Iranian pilgrims in Hajj 2004 and 2005. *Saudi Med J* 2006;27:1049–53.
- [11] Gazzaz ZJ, Dhaffar KO, Hahbaz J. Hajj (1422H) In-patient characteristics in Al-Noor specialist hospital. *Kuwait Med J* 2004;36(4):279–80.
- [12] Yassen MA, Sameer MA. Emergency room to the intensive care unit in Hajj. The chain of life. *Saudi Med J* 2006;27(7):937–41.
- [13] Al-Ghamdi SM, Akbar HO, Qari YA, Fathaldin OA, Al-Rashed RS. Pattern of admission to hospitals during muslim pilgrimage (Hajj). *Saudi Med J* 2003;24(10):1073–6.
- [14] Alzeer AH. Respiratory tract infection during Hajj. *Ann Thorac Med* 2009;4(2):50–3.
- [15] Shakir Haani AS, Gazzaz Zohair J, Dhaffar Khalid O, Shahbaz Javeria. Outpatient services during (1423h) Hajj season. *Sultan Qaboos Univ Med J* 2006;6(1):47–50.
- [16] Khan NA, Ishag AM, Ahmad MS, El-Sayed FM, Bachal ZA, Abbas TG. Pattern of medical diseases and determinants of prognosis of hospitalization during 2005 Muslim pilgrimage Hajj in a tertiary care hospital. A prospective cohort study. *Saudi Med J* 2006;27(9):1373–80.
- [17] Paffenbarger RS, Hale WE. *N Engl J Med* 1975;292(11):545–50.
- [18] Afshin-Nia F, Dehkordi HM, Fazel MR, Ghanei M. How to reduce cardiovascular mortality and morbidity among Hajj Pilgrims: a multiphasic screening, intervention and assessment. *Ann Saudi Med* 1999;19(1):55–7.
- [19] Serafi AS. Pattern of cardiovascular diseases in pilgrims admitted in Al-Noor hospital Makkah during Hajj 1429H. *Ann Phys Rehabil Med* 2010;6(1):14–7.
- [20] Razavi SM, Ziaei H, Sedaghat M. Morbidity and mortality in Iranian pilgrims in year 2003. *J Tehran Faculty Med* 2005;5:353–60.