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Review article

# Health response to Hajj mass gathering from emergency perspective, narrative review

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ABSTRACT

Hajj is a unique gathering with Mecca and Kaaba being spiritually important to many faiths across the globe, especially Muslims. This is because of the proclamation of the prophet's father, Ibrahaam, when he called all mankind to perform Hajj. That is why all Muslims on Earth feel that they have to visit Mecca and Kaaba on a specific date and time, and that is the reason this small location hosts one of the largest human gatherings in the world. Hajj is one of the five pillars of Islam that every financially and physically able Muslim must perform once in his/her lifetime. For 14 centuries countless millions of Muslim men and women from the four corners of the earth have undertaken pilgrimage to Mecca.

In conclusion this review article confirm that Hajj is oldest and largest mass gathering in all mankind and there is some issues influence the health response such as size of gathering. diversity of population, climate and health facilities around hajj site, also we discuss the infectious and non infectious related illness in hajj and their prevention methods.



There are specific issues related to the Hajj that influence the health response such as:

A. Size of gathering

It is the largest and oldest mass gathering known to mankind with an average of 3 million people in the same area, at the same time and doing the same thing. There is a high population density of 8–9 persons per square meter. Human stampedes at Hajj are frequent especially with high population density doing same things in the same time at same location in small crowded area and associated with high mortality rate.

B. Diversity of population

Pilgrims come from different countries, with diversity in ethnic origin, different languages and socioeconomic status.[1] All attend the Hajj together with different medical background and many of co-morbidities especially with older people. Many of pilgrims arrive from low-income countries, many will have had little, if any, pre-Hajj health care, which lead to some infectious disease can easy to spread and cardiovascular diseases can happen.

The access to hajj account 92% arriving by air, 7% traveling over land and 1% by maritime[2]

This makes large number of Pilgrims able to come to Hajj with short time by air travel.

C. Climate

Mecca features an extremely arid climate. Unlike other Saudi Arabian cities, Mecca retains its warm temperature in winter, which can range from 18 °C (64 °F) at night to 30 °C (86 °F) in the afternoon. Summer temperatures are very hot and break the 40 °C (104 °F) mark in the afternoon dropping to 30 °C (86 °F) in the evening. Rainfall in Mecca is infrequent and falls between November and January. Mecca in summer time are very hot and Heatstroke cases frequent during the pilgrimage to Mecca, for example August 1985, 2000 cases of heatstroke were reported and more than 1000 of these individuals died within a few days.[3] Outdoor Pilgrimage activities associated with heatstroke, heat exhaustion, dehydration and sunburn.

D. Health Facilities around the Hajj Sites:

Facilities vary from year to year, and capacity surge of these facilities vary from year to year based on number of pilgrims arrived to Mecca however certain facilities i.e. those made of

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bricks and mortar are obvious more permanent. For this reason facilities are available in the three main areas Mina, Muzdallifah and Arafat. In 2012 – 25 hospitals with 4427 bed capacity (500 critical care and 550 emergency care). 141 health centers in vicinity of the Hajj with 20 000 qualified specialized personnel (Fig. 1), All Health care provided at Hajj are free to all Pilgrims arrived to Saudi Arabia. All these on site health care facilities connected to the tertiary hospital at Mecca and Jeddah.

1 Mina area: During the Hajj season a number of mobile temporary facilities are set up, especially around the outskirts of the Jamaraat (the place whether the symbolic stoning of Satan takes place. As well as these in Mina there are three main hospitals. Mina Bridge Hospital. This is located just ahead of the King Khalid Bridge on the Mecca side adjacent to the famous Masjid Alkhaif in Mina. Being in close proximity to the entry point of the Jamarsat area is the place where injured people may be taken in the event of a stampede around the Jamaraat. Mina General Hospital located near the King Abdulla Bridge deep inside the tented are of Mina. It is larger than the hospital mentioned above Al- Wadi Hospital. This is located on the other side of Mina compared to hospital 1 and 2 above.
2 Arafat area: Arafat has a number of Hospitals. The easiest to find is probably the one at the base of Jabal-e-Rahma (the mount of Mercy. As well as the above there are two other hospitals, Arafat General Hospital and Nimrah Hospital.

Other medical facilities during the Hajj season include a huge number of mobile and temporary clinics that are set up in and around the sites of Mina, Muzdallifah and Arafat. The vast majority of these however will be located near the Jamaraat. They are often poorly signposted. However the clue is wherever there is a mass of stationary ambulances there is likely to be a mobile clinic.[4] The Ministry of Health of the Kingdom of Saudi Arabia seeks to serve the pilgrims, and it strives to provide all health services that help the pilgrims and non-pilgrims to perform the rituals of Hajj with ease and convenience. Based on its faith in the importance of utilizing technology to facilitate and accelerate the work of health institutions spreading in the Kingdom in general, and those located in the areas performing Hajj in particular, the Ministry of Health takes pride, in calling all related Health agency and related sectors, (Civil defense, Police, traffic agency, communications agency and media) to participate in this human Mass gathering and potential disaster.[5]

## 1. Clinical issues during Hajj

Over the history of the Hajj a number of specific health related issues have arisen;

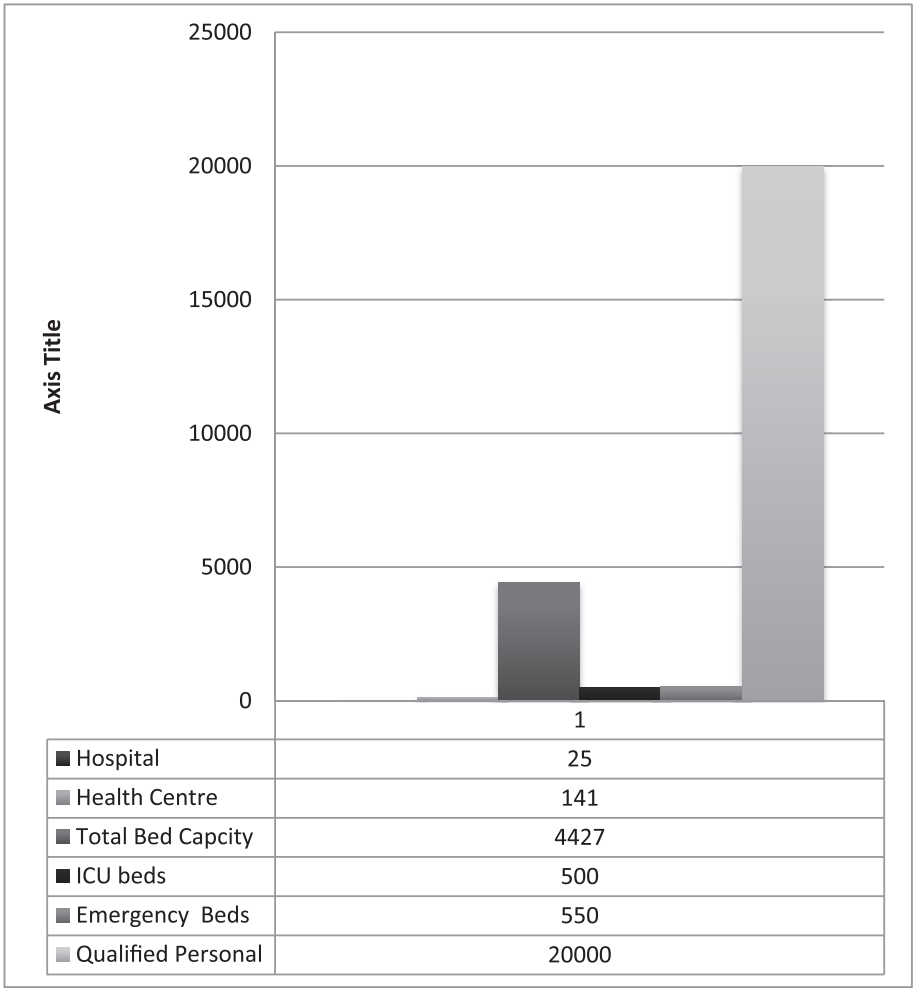


**Fig. 1.** Capacity of health Facilities at Hajj 2012.

### 1.1. Infectious related illness during Hajj and prevention

Infection was a frequent feature of the Hajj especially with poor pre-Hajj Health care from Pilgrims came from low-income countries, crowded accommodations. Poor hygiene, unknown medical background, Extreme heat, poor prepared stored food and inadequate pre-Hajj vaccination are leading to many of infectious diseases like respiratory/airborne diseases, Meningitis, food/water borne diseases and blood borne diseases.

The Respiratory infectious diseases considered most common causes of admission in the hospital at hajj.[6–12]

The response to severe acute respiratory distress syndrome (SARS) after its emergence as a threat in 2003, the handling in 2009 of influenza A H1N1 and in 2012–2013 MERS Coronavirus are shows the potential for severe consequences of infections at Hajj and the ability of properly organized public health plans to stop their spread.

The concern was that SARS, H1N1 and MERS would be drawn into the Hajj by traveling pilgrims, where it would then locally propagate before being transported back to cities and countries around the world and could amplify and accelerate the global spread of the infection.[13–17]

The Saudi Minster of Health recognized the threat early and instituted a variety of infectious control measures, including[18,19] screening, Monitoring port of entry and isolation for suspected cases, surveillance for infectious diseases epidemiology, and computer-based information systems, laboratory testing, infection control; and provide proper treatment.

Saudi recommendation to all pilgrims to wear surgical facemask when in crowds, hands hygiene and to be vaccinated against seasonal influenza.[20,21]

Apart from vaccination in a pandemic situation, the effectiveness of yearly influenza vaccination for Hajj pilgrims is questionable because of differences in the viral strains used in vaccines in the northern and southern hemispheres.[22,23]

Saudi Ministry of Health reported no cases were detected of SARS, H1N1 and MERS at Hajj since 2003 till 2014.

After a Hajj-associated outbreak of N meningitides W135 in 2000 and 2001 there was global spread,[24] meningococcal disease is considered risk at Hajj and vaccine should be taken among all pilgrims before arrived to Saudi.[25–27]

Gastrointestinal illness are considered as third causes of admission at Hajj 2002,[28] with low morbidity and mortality rate,[29] However in Hajj 1980 the outbreak cholera was reported.[30,31] The recommendation will be personal hygiene and clean environment, adequate rehydration and notification, surveillance any cases at hajj.

The 2014 Ebola epidemic is one of concern of Hajj 2014 and were some of regulation were taken including not allowed Pilgrims from countries in West Africa to attending Hajj 2014, screening and isolation of suspected cases, surveillance for Ebola diseases and rapid testing and proper treatment. Ministry of health in Saudi Arabia reported no any cases of Ebola viruses at Hajj 2014.

At end of Hajj activates, all pilgrims should shaving their head which, unsterile razor can be risk of transmission of blood borne disease such as Hepatitis B, C and HIV but there is no evidence for blood borne diseases transmission at the Hajj, Nevertheless, vaccination of Hepatitis B before travel and regulation of sterilized razors can prevent the transmission of blood born diseases.

The preventive measures to control the infectious diseases as follow updated annual vaccination, enforcement of regulations about food and water security, regulation of head shaving and sterilized razors, Pilgrims awareness for hands hygiene, adequate hydration, facemask use, Sunscreen, Insect repellents, food and water and personal hygiene, avoid severe crowds. Initiate self-treatment as needed, continue usual medications, reporting illness and recommendations about respiratory hygiene. These improvement have taken place at the same time as important changes to infrastructure, including accommodation for pilgrims to reduce overcrowding and risk of spread of infection.[32–38]

### 1.2. Non – infectious related illness and prevention during Hajj

Non infectious diseases like as human stampedes or crush injuries, fires, heat exhaustion, heatstroke, severe acute cardiovascular events secondary to heat, intense emotional stress, dehydration, and also been the target of terrorism considered more mortality and morbidity,[39–42] than infectious diseases in Hajj.

Over the history of the Hajj, a number of specific non-infectious issues have arisen:

***Stampedes at hajj*:** Over the history of Hajj there is some incidents are Shown at Table 1.[43–49]

***Prevention measures for Stampedes*:** Human stampedes are preventable, providing mitigation measures are taken in advance.

The Hajj attracts about 3 million pilgrims during 1 week. It is very crowded, with millions of pilgrims undertaking their religious duties within strict constraints in terms of space and time; this rigour and strictness have led to a series of large crowd disasters over several years,[50] thus putting pressure on the authorities. In the past few years, efforts have increased to solve this difficulty by scientific means, use of crowd simulation models,[50–52] assessment of the best ways of grouping and scheduling pilgrims,[53] crowd management and control,[54] luggage management, video monitoring[51,55,56] and changes in the construction of the transport system for the event.[57] After applying those measure no stampedes since 2006.

#### 1.2.1. Fire incidents in hajj

Fire is a potential hazard but only a couple of major incidents shown at (Table 1).

There is fire safety regulation and measured should every pilgrims followed according the civil defense instruction to prevent the fire, all those measures help to avoid fire like makeshift tents were replaced with permanent fiberglass structures; no pilgrim is allowed to set up his own tent. Cooking in the tents is also prohibited and availability of fire Extinguisher in each tent.

**Table 1**
Stampede and fires incidents at Hajj.

| Type of incidents | Time of incidence | Death | Injured |
|---|---|---|---|
| A stampede inside a pedestrian tunnel (Al-Ma'aisim tunnel) | July 2, 1990 | 1426 pilgrims. | |
| A stampede at the stoning of the Devil ritual. | May 23, 1994 | 270 pilgrims | |
| A stampede at Jamarat Bridge. | April 9, 1998 | 118 pilgrims | 180 injured |
| A stampede at the stoning of the Devil ritual. | March 5, 2001 | 35 pilgrims | |
| A stampede at the stoning of the Devil ritual. | February 11, 2003 | 14 pilgrims | |
| A stampede at the stoning of the Devil ritual. | February 1, 2004 | 251 pilgrims | 244 injured |
| A stampede at Jamarat Bridge. | January 12, 2006 | 346 pilgrims | 289 injured |
| An exploding gas cylinder caused a fire in a tent colony | December 1975 | 200 pilgrims | |
| A tent fire in MINA | April 15, 1997 | 343 pilgrims | 1500 injured |

*1.2.2. Terrorism*

The reasons are high population density, international visibility, and symbolic means through which terrorists might amplify the effects of their actions.[51,56] In July 9, 1989 two bombs exploded, killing 1 pilgrim and wounding another sixteen. Saudi authorities executed 16 Kuwaiti Shia Muslims for the bombings after originally suspecting Iranian terrorists[47]

*1.2.3. Heat-related illnesses*

Mecca in summer time are very hot and Heatstroke cases frequent during the pilgrimage to Mecca, for example August 1985, 2000 cases of heatstroke were reported and more than 1000 of these individuals died within a few days.[3]

A review of the effect of warm weather showed a strong correlation between high temperatures or humidity and the use of medical care during Hajj more than 1000 deaths from heatstroke in a few days and more than 18 000 people needing treatment in emergency departments for heat exhaustion.[58]

Heat-related mortality and morbidity are preventable; the risk of heat-related death is increased with old age and pre-existing illnesses, particularly cardiovascular, pulmonary, and psychiatric disorders.[59]

Non infectious related illness are preventable like stampedes by crowd management and control, grouping and scheduling pilgrims, changes in the construction of the transport system and video monitoring of pilgrims lead to no stampedes since 2006. Also Saudi civil defense were apply restrict safety regulation to prevent fire should every pilgrims followed also they are replaced the tents with permanent fiberglass tents. To prevent heat-related illness, every pilgrims need used sun protection equipment's such as umbrella, sunscreen. Avoid prolonged exposure to heat during hajj activities, drink adequate rehydration solution, using fans, cooling bus, places and accommodation.

## 2. General considerations

A. Residency Training and Hajj:

Due to the annual Hajj pilgrimage, Emergency Medicine training in Saudi Arabia emphasizes mass gathering casualty care, disaster preparedness and ability to cope with multicultural people with no background medical knowledge. Emergency Medicine training programs include a National Hajj Preparation course and mandatory Hajj rotation during the residency program to prepare for this real-world challenge.[60]

It is mandatory for R3 (PGY 3) residents in the Saudi Emergency Medicine Program, to do one-month Hajj rotation.

For 10 years now, every year 10–20 residents attend the Hajj, they get exposed to all kinds of emergencies, traumatic and medical, the acuity is often high, because the goal of all pilgrims are to complete their Hajj faith, so they attend wait to emergency in their extreme of sickness.

Residents are also exposed to the EMS activities and prehospital care intervention, with extra responsibilities in regard to medical direction and oversight. They are also involved in evacuation plan in all seasonal and permanent hospital in Mecca.

B. Research priorities in Hajj:

The research is important to develop planning, risk management, crowded management, and develop polices and guidelines help to identified issues and possible solutions.

There is Hajj research center in Mecca role to conduct research annually and submitted their recommendation to high authority of Hajj to evaluate annually.

## 3. Conclusion

This review article confirm that Hajj is oldest and largest mass gathering in all mankind and there is some issues influence the health response such as size of gathering. Diversity of population, climate and health facilities around hajj site, also we discuss the infectious and non infectious related illness in hajj and their prevention methods.

## Limitation

There is limitation to find RCT articles or well-designed articles talking about Hajj and there is limited articles to review related to hajj.

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