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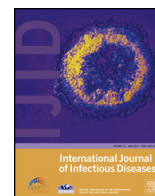
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# The annual Hajj pilgrimage—minimizing the risk of ill health in pilgrims from Europe and opportunity for driving the best prevention and health promotion guidelines



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## SUMMARY

Mass gatherings at religious events can pose major public health challenges, particularly the transmission of infectious diseases. Every year the Kingdom of Saudi Arabia (KSA) hosts the Hajj pilgrimage, the largest gathering held on an annual basis where over 2 million people come to KSA from over 180 countries. Living together in crowded conditions exposes the pilgrims and the local population to a range of infectious diseases. Respiratory and gastrointestinal tract bacterial and viral infections can spread rapidly and affect attendees of mass gatherings. Lethal infectious disease outbreaks were common during Hajj in the 19th and 20th centuries although they have now been controlled to a great extent by the huge investments made by the KSA into public health prevention and surveillance programs. The KSA provides regular updated Hajj travel advice and health regulations through international public health agencies such as the WHO, Public Health England, the Centers for Disease Control and Prevention, and Hajj travel agencies. During the Hajj, an additional 25 000 health workers are deployed; there are eight hospitals in Makkah and Mina complete with state-of-the-art surgical wards and intensive care units made specifically available for pilgrims. All medical facilities offer high quality of care, and services are offered free to Hajj pilgrims to ensure the risks of ill health to all pilgrims and KSA residents are minimal. A summary of the key health issues that arise in pilgrims from Europe during Hajj and of the KSA Hajj guidelines, together with other factors that may play a role in reducing the risks to pilgrims and to wider global health security, is provided herein.

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## 1. Introduction

Mass gathering sporting and religious events pose important public health challenges, including the transmission of infectious diseases, exacerbation of non-communicable diseases, and

disorders related to climate change.<sup>1–5</sup> Every year, the Kingdom of Saudi Arabia (KSA) hosts the Hajj pilgrimage, which is the largest mass gathering in the world held on a recurrent annual basis.<sup>3</sup> The Hajj occurs annually from the eighth to the 12<sup>th</sup> of Dhul al-Hijah, the last (12<sup>th</sup>) month of the Islamic calendar, and two to three million people perform the pilgrimage during this period.<sup>3</sup> A further seven million complete a ‘mini’ pilgrimage, known as Umrah, outside the Hajj period throughout the year.

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In light of the huge number of pilgrims from all around the world – of which thousands come from low-income countries with minimal access to healthcare – mixing closely for several days in a difficult terrain, it is remarkable that the majority of pilgrims complete the Hajj without experiencing any major health issues. Infectious disease outbreaks were common during Hajj in the 19<sup>th</sup> and 20<sup>th</sup> centuries and have been controlled to a great extent, although proactive surveillance of the transmission of potential epidemic threats at Hajj is critical to preserving global health security.<sup>3,5</sup> Crush injuries and stampedes, which can pose major risks at mass gatherings, are infrequent during the Hajj relative to its size and logistical complexity. A summary of the key health issues that arise in pilgrims from Europe during Hajj and of the KSA Hajj guidelines, together with other factors that may play a role in reducing the risks to pilgrims and to wider global health security, is provided herein.

## 2. Health risks during the Hajj

### 2.1. Communicable diseases

Respiratory and gastrointestinal tract bacterial and viral infections spread rapidly and affect almost all pilgrims during Hajj.<sup>6–13</sup> Respiratory tract infections – whose spread through coughing and sneezing is exacerbated by the crowded Hajj conditions – include community-acquired pneumonia, influenza, and tuberculosis (TB). While bacterial and viral pneumonia are well-documented causes of hospital admission in pilgrims,<sup>13</sup> quantifying the increase in risk of TB transmission is more challenging owing to the longer time period between infection and the development of symptoms. The elderly and those with comorbid diseases such as diabetes are particularly vulnerable to morbidity from respiratory illnesses.

### 2.2. Gastrointestinal disorders

Acute food poisoning is common during the Hajj and is caused by toxins produced by *Staphylococcus aureus* and *Bacillus cereus*. Gastroenteritis due to *Salmonella spp* and viruses such as rotavirus and norovirus are common during Hajj.<sup>3,12</sup> Factors responsible for increasing the spread of gastrointestinal diseases during Hajj include contamination of food through unhygienic preparation, prolonged storage of food, drinking from contaminated water sources, and a shortage of water for hand washing. The risks of dehydration are heightened when Hajj occurs during summer months, owing to the extremely hot climate in Saudi Arabia.<sup>14</sup>

Other infectious disease risks include meningococcal disease, which caused outbreaks during Hajj in the early 2000s owing to overcrowding and high carrier rates of *Neisseria meningitidis* among pilgrims.<sup>3,15–17</sup> Mosquito species responsible for the transmission of malaria and the arbovirus that causes dengue are present in the KSA, although the country has been classified by the World Health Organization (WHO) as a low, geographically restricted malaria transmission area since 2008.<sup>3</sup>

### 2.3. Non-communicable diseases

Historically, infectious diseases were the largest cause of morbidity and mortality during Hajj, but non-communicable diseases are now a major burden.<sup>3</sup> Many pilgrims both elderly and young have existing non-communicable diseases such as diabetes, hypertension, arthritis, epilepsy, liver and kidney disease, which can be worsened by strenuous Hajj conditions or if regular medications are neglected during the spiritual activities. In addition to cardiovascular disease, heat exhaustion and heatstroke are important causes of death; again health-related morbidity is exacerbated when Hajj occurs during the summer months.

### 2.4. Fire and trauma

The risk of injury from fires has been reduced since tents were replaced with fibreglass and cooking in tents was prohibited following a fire in 1997. However, risks from stampedes and crush injuries remain due to the overcrowding. As the events of the falling cranes and the stampede in the 2015 Hajj illustrate, trauma can be a major cause of injury and death during Hajj. Furthermore, many pilgrims who walk long distances as part of the rituals invariably are injured by motor vehicles.

## 3. Factors reducing health risks (Table 1)

Table 1

### 3.1. Pre-Hajj preparations

The KSA Government employs a well-coordinated, inter-sectoral approach to the planning, communication, public health, and safety issues of the Hajj.<sup>3</sup> Planning for Hajj starts soon after the end of the current Hajj and the KSA Ministry of Hajj and Ministry of Health liaise with the governments of all countries from which pilgrims come to the KSA. Recommendations discussed are pre-travel health regulations and advice about vaccinations, health checks, and specific immunizations at the port of entry. Well before each Hajj, the Saudi Ministry of Health generates the health requirements for the issue of travel visas. It also provides health education campaigns through the provision of reading materials and through travel agents, pilgrim group leaders, websites, and the media, both before and during the Hajj.

The KSA Government also provides regular updated Hajj travel advice and health regulations through international public health agencies such as the WHO, Public Health England, the Centers for Disease Control and Prevention (CDC), and Hajj travel agencies. For the 2015 Hajj, for example, alerts were raised for the prevailing global threats from Middle East respiratory syndrome coronavirus (MERS-CoV), influenza and other respiratory tract viruses, multidrug-resistant TB, multi-antibiotic-resistant bacteria, and Ebola.<sup>18–21,6,22,23</sup>

### 3.2. Measures taken during Hajj

During the Hajj, an additional 25 000 health workers are deployed; there are eight hospitals in Makkah and Mina complete with state-of-the-art surgical wards and intensive care units made specifically available for pilgrims.<sup>3</sup> All medical facilities offer high quality of care, and services are offered free to Hajj pilgrims to ensure the risks of ill health to all pilgrims and KSA residents are minimal.

In terms of preventative measures, in addition to the vaccination requirements described below, measures are put in place to ensure food safety and the Ministry of Health ensures strict enforcement of the regulation that pilgrims are not allowed to bring fresh food or agricultural products into the country. Other coordinated activities include targeted insecticide spraying to control mosquito populations, the distribution of health promotion materials to pilgrims, and electronic surveillance of infectious diseases.<sup>3</sup>

### 3.3. Hajj regulations for incoming pilgrims

The health requirements for pilgrimage to Mecca (Hajj and Umrah) are published annually by the KSA Government. Information for pilgrims is made available on the Saudi Arabia Ministry of Health website.<sup>24–26</sup>

**Table 1**  
Factors contributing to reducing the health risks from Hajj

	Hajj preparation activities, guidelines, and recommendations
Hajj norms and rules	The elderly, sick, and disabled are exempted from the obligation of performing Hajj Crime is strictly forbidden during the pilgrimage, reducing the risk of violent altercations The environment is weapon-free, drug-free, and alcohol-free Tobacco intake is banned, curtailing the risk of inadvertent fire hazards Sexual relations are not allowed, and male and female pilgrims are accommodated separately
Extensive pre-Hajj activities undertaken by the KSA	The Ministry of Health liaises closely with the KSA Ministry of Hajj to ensure entry requirements and Hajj health regulations are fulfilled Extensive preparations by the KSA include lessons learned from the previous Hajj; preparations for the Hajj start as soon as possible after Hajj Sophisticated command and control centre in place Free healthcare through numerous hospitals and clinics at all points of the Hajj ritual journeys The KSA Ministry of Health liaises with and updates all international public health agencies including the WHO, Public Health England, ECDC, and CDC Close collaboration with relevant stakeholders (travel agents, Muslim councils, and tour organizers) in the countries where the pilgrims come from to develop appropriate material for health education Issuing of vaccination and other health precautions guidelines well before the Hajj and vaccination certificates required prior to visa approval
KSA Hajj activities	Border controls to ensure fresh or unprocessed food is not imported by pilgrims Ministry of Hajj, Ministry of Public Health, and the Ministry of Agriculture coordinate regular pesticide spraying An additional 25 000 health workers are deployed specifically for pilgrims Public health teams stationed through the Hajj site supervise key public health and preventive matters Screening at port of entry for vaccinations; arrangements for one dose of oral polio vaccine for travellers arriving from polio-endemic countries and children under 15 years Proactive command and control centre for Hajj Use of the electronic health surveillance systems
Areas under development	Strategies to encourage personal hygiene behaviour (beyond educational messaging) for pilgrims and those handling food Improving guidelines for non-communicable disease control (existing guidelines focus on communicable disease control)

KSA, Kingdom of Saudi Arabia; WHO, World Health Organization; ECDC, European Centre for Disease Prevention and Control; CDC, US Centers for Disease Control and Prevention.

Meningococcal vaccine is a prerequisite for all pilgrims; Hajj visas cannot be issued without proof of meningococcal vaccination. All adults and children aged >2 years must have received a single dose of quadrivalent A/C/Y/W-135 vaccine and must show proof of vaccination on a valid International Certificate of Vaccination or Prophylaxis. Children between 3 months and 2 years of age must show proof of vaccination with two doses of meningococcal A monovalent vaccine with a 3-month interval between the doses. Hajj pilgrims need to have had the meningococcal vaccine  $\leq 3$  years and  $\geq 10$  days before arriving in Saudi Arabia.

Other vaccination requirements for Hajj pilgrims entering from specific countries include yellow fever and polio vaccines. The yellow fever vaccine is mandatory for all travellers arriving from countries listed by the WHO as being a yellow fever risk. Polio vaccine is required for travellers arriving from countries that have polio virus circulating, or from countries at high risk of re-importation of polio virus, regardless of age and vaccination status. Those who do not have evidence certificates are immunized at the port of entry.<sup>3</sup> The Saudi Ministry of Health recommends seasonal influenza vaccine for those at increased risk, such as the elderly and those with chronic comorbidities.<sup>24</sup> However, there is conflicting evidence about the efficacy of influenza vaccine in protecting Hajj pilgrims.<sup>27,28</sup> Pneumonia is among the most common causes of hospital admission during Hajj,<sup>14</sup> and thus the prevention of pneumococcal infection is crucial. Pneumococcal polysaccharide vaccine is recommended for pilgrims aged  $\geq 65$  years and for younger pilgrims with comorbidities.<sup>29</sup> Finally, with regard to measles and rubella vaccines, updating immunization against vaccine-preventable diseases in all travellers is strongly recommended.

#### 4. Lessons for and beyond mass gatherings

The prevention and management of threats to global health security and protecting the health and lives of pilgrims requires

effective cooperation between numerous agencies within and outside the KSA.<sup>30</sup> The Hajj can therefore provide important lessons for setting up and maintaining inter-sectoral collaborations, for example between agencies responsible for health, transport, border control, and environmental health. The value of the Hajj experience to planners of mass gatherings in sharing best practices is evident, but lessons can go beyond mass gatherings to inform other areas of public health that require inter-sectoral engagement, such as One Health and the control of antimicrobial resistance. The Hajj also provides an opportunity for research, not only into all aspects of mass gatherings, but also into faith-based health promotion and electronic disease surveillance capacity building.

*Conflict of interest:* All authors have an interest in infectious diseases transmission at mass gatherings.

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