Mass gathering medicine: 2014 Hajj and Umra preparation as a leading example

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S U M M A R Y

The importation of infectious diseases during a mass gathering may result in outbreaks. Infectious diseases associated with mass gatherings vary depending on the type and location of the mass gathering. The annual Hajj to Makkah in Saudi Arabia is one of the largest annual religious mass gatherings in the world. Preparation for the Hajj encompasses multiple sectors to develop comprehensive plans. These plans include risk assessment, utilizing existing medical infrastructure, developing electronic and paper-based surveillance activity, and the use of information technology. In this review, we describe key features of the preparedness for the 2014 Hajj and Umra, review the recent impact of emerging viruses such as Ebola in West Africa and the Middle East respiratory syndrome coronavirus (MERS-CoV) in affected countries, and highlight the updated requirements and the required vaccines.

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1. Introduction

A mass gathering is defined as a group of more than 1000 people present in one location; however, most of the published literature reflects much larger congregations (>25 000 people).[1] A more inclusive definition is a large number of people attending an event that is focused at specific sites for a finite time.[2–4] The World Health Organization (WHO) definition is "events attended by a sufficient number of people to strain the planning and response resources of a community, state or nation".[5]

Mass gatherings can be classified into two types: spontaneous gatherings (e.g., the Pope's funeral) and planned gatherings. Planned gatherings may be recurrent at different locations (e.g., Olympics and World Cup) or recurrent events at the same location (e.g., Hajj pilgrimage in Saudi Arabia). The numerous examples of mass gathering events and the number of attendees have been reviewed.[6]

One of the major concerns regarding mass gatherings is the importation of infectious diseases resulting in outbreaks, or the exportation thereof, especially at events drawing visitors from different nations, regions, and cultures.[7] Infectious diseases associated with mass gatherings vary depending on the type and location of the mass gathering.[8] For example, religious gatherings are usually associated with respiratory and gastrointestinal diseases.

The annual Hajj to Makkah in Saudi Arabia is considered one of the largest annually recurring religious mass gatherings in the world. The number of pilgrims attending the annual Hajj or Umra each year is about 10 million, and these pilgrims originate from 184 countries.[9] The annual number of pilgrims increased from 58 584 in 1920 to 3 161 573 in 2012.[10] The annual Hajj is an excellent example for a discussion on the public health preparation from a mass gathering medicine perspective. Thus, in this review we present an overview of the preparation for the Hajj as an example of a mass gathering. Further, we discuss the methodology for surveillance and the control measures for infectious diseases. Given the importance of Middle East respiratory syndrome (MERS) at recent and upcoming Hajj gatherings, we also provide an overview of Middle East respiratory syndrome coronavirus (MERS-CoV) preparedness.

2. Preparations for mass gatherings and public health interventions

There are three core areas that should be considered for mass gathering preparedness: risk assessment for what might happen,

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robust surveillance to identify when a disease occurs, and the response when there is a disease outbreak.[1]

During the Hajj, public health efforts take place to maintain the highest level of excellence and these efforts are coordinated by 24 committees.[9–11] Regarding the Hajj, and based on the US Centers for Disease Control and Prevention (CDC) Risk Assessment Framework for the Severity and Probability Analysis,[8] the preventive program framework consists of many players who are involved from the beginning in the preparation and risk assessment (Figure 1).

The Supreme Hajj Committee is charged with coordinating and developing the annual Hajj plan and all studies, and in formulating the recommendations for developing Hajj facilities. The Hajj Preventive Medicine Committee is responsible for public health and preventive matters during the Hajj.[12] The Committee is also responsible for the control of ports of entry for all pilgrims and confirms compliance with Hajj requirements.[13] In addition, input regarding outbreak management and emerging diseases is received from the WHO, European Centre for Disease Prevention and Control (ECDC), Public Health England (PHE), and the CDC, through the Public Health Directorate of the Ministry of Health of the Kingdom of Saudi Arabia (KSA MoH) (Figure 2).

3. Medical infrastructure, surveillance activity during Hajj, and use of information technology

During the Hajj, surveillance depends on both electronic and paper systems (Table 1).

Information technology (IT) is used for public health surveillance during the Hajj. IT plays an essential and important role in the success of the pilgrimage season in many ways, most notably by providing a robust medium that transfers and analyzes data in a timely manner to prepare accurate statistics, which facilitates appropriate decision-making. A centralized and dedicated data center was built to eliminate the process of connecting to different sites in order to obtain the data needed for the Hajj operation team.

The first step in gathering and sending data to the Hajj operation team at the command center involves the end-user stations. Therefore, major local area network (LAN) projects were implemented to connect all end-user stations with both wired and wireless connections to the data center. These projects included all the hospitals and medical centers at the Holy sites (Mena, Arafat, and Mozdalefah). Due to constant connectivity problems related to the service provider, a major wireless wide area network project was started in 2011 to cover all participating hospitals, medical centers, and directorates in both Makkah and Madina cities. The new network is owned by the Ministry of Health and has various connection speeds – starting from 54 MB and going up to 1.2 GB – depending on each site's criticality and workload.

In the past, raw data were gathered and submitted to the statistics team in the form of printed papers and the team had to perform the analysis manually. Nowadays, following the implementation of the business intelligence (BI) system, the data are gathered automatically and the BI system performs all the analyses required, presenting the end result statistics in the form of dashboards displayed on a video wall and interactive board for the Hajj operation team at the command center.

Hospitals at Holy sites previously lacked a unified system to gather patient-related data and depended heavily on manual efforts to gather the data required. The Hajj System was built to address this issue and provides a computer-based entry for all data, thus eliminating any delay and human error in gathering and sending the necessary data. The system is web-based with multisite capabilities and was implemented in Mena Emergency Hospital this year and will be rolled out to the other seven hospitals by next year.

The Healthcare Electronic Surveillance Network (HESN) is a web-based electronic health solution that is being implemented in KSA. HESN is the KSA MoH configured system of the Public Health Solution for Disease Surveillance and Management, which is organized into seven major components: communicable disease case management, outbreak management, immunization
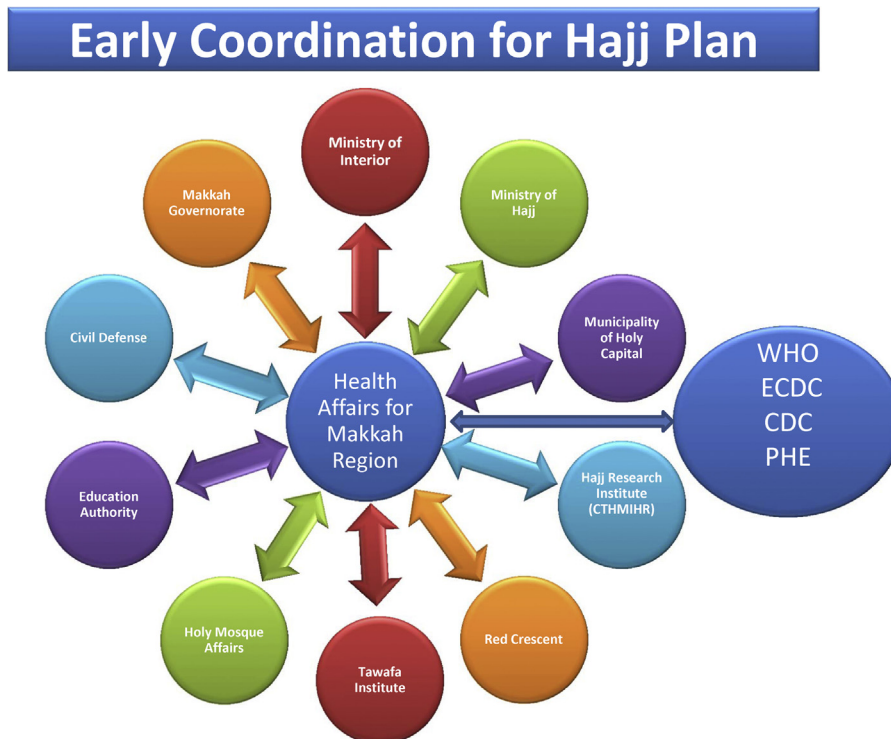
Figure 1. Structure of the Saudi committees for the Hajj from the local Makkah region to the Supreme Hajj Committee. These different committees coordinate the preparation and risk assessment of each Hajj season.