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# Mass Gatherings

*Annelies Wilder-Smith and Robert Steffen*

## KEY POINTS

- Mass gatherings are the temporary collection of large numbers of people at one site or location for a common purpose.
- Mass gatherings present some of the most complex management challenges faced by governments and organizers.
- Mass gatherings may lead to three potential infectious disease public health threats: the risk of importation of infectious diseases usually not seen in the country of the gathering; the amplification of transmission during the event; and the international spread of infectious disease through global mobility networks.
- While infectious diseases may be of greater global public health relevance, noncommunicable diseases, accidents, and stampede usually have a higher local impact with respect to morbidity and mortality during mass gatherings.

## INTRODUCTION

Mass gatherings are usually considered to be a temporary collection of large numbers of people at one site or location for a common purpose.<sup>1</sup> The purpose of the mass gathering can be manifold, such as major sport events (e.g., the Olympic Games, the FIFA World Cup), other spectator events (e.g., air shows, concerts), pilgrimages (e.g., the *hajj* pilgrimage), or religious mass gatherings (such as a papal visit) and political or business events (e.g., conferences, trade fairs). Gatherings can be short term (for a few hours as in a sporting event or concert) or longer (for several days to weeks, as in the Olympic Games or the *hajj*). A gathering can be held at one location or spread over different sites. The sizes of mass gatherings vary. For example, there were around 3.4 million spectators during the FIFA World Cup in Brazil in 2014; the *hajj* pilgrimage usually attracts some 2 million Muslims each year; the Hindu pilgrimage Kumbh Mela in India can attract up to 130 million pilgrims. There is no consensus on a threshold of the number of people that constitute a mass gathering.

The World Health Organization (WHO) defines a mass gathering as “any occasion, either organized or spontaneous, that attracts sufficient numbers of people to strain the planning and response resources of the community, city or nation hosting the event.”<sup>2</sup>

**Mass gatherings pose a high risk of a disproportionate sudden surge in health care demand beyond the capabilities of existing infrastructures.** The influx of large numbers of people, often from different parts of the world, and the infrastructural changes needed to support them are a formidable challenge for any public health system. Effective management of mass casualty incidents requires coordinated efforts across a wide variety of sectors. Mass gatherings can be a target for terrorist attacks, and may attract deliberate releases of chemical, biologic, or radioactive agents, or even firearms or bomb attacks. The purpose, location, characteristics and number of participants, and duration of the event will determine the nature of a mass gathering.

## COMMUNICABLE DISEASES

As mass gatherings draw visitors from countries around the world, there are three potential public health problems: the risk of importation of infectious diseases usually not seen in the country of the gathering; the amplification of transmission during the event; and the international spread of infectious disease via the visitors and travelers returning to their home countries. Surveillance and public health response may not be developed for diseases that are usually not endemic in the host country. Gatherings with international participants potentially pose specific challenges for implementing control measures, such as contact tracing in case of an outbreak. Despite the theoretical concerns, however, infectious diseases have historically not been a major issue in association with mass gatherings, except for the *hajj* pilgrimage.

The risk depends on mode of transmission of particular diseases. The close proximity/high density of people during mass gatherings provides ideal grounds for rapid spread of diseases via respiratory secretions or close human-to-human transmission. The rapid spread of influenza, avian influenza, severe acute respiratory syndrome (SARS), and meningococcal disease has therefore always been the main concern in mass gathering settings.<sup>3–10</sup> Poor sanitary or food conditions may lead to outbreaks of diarrheal disease. If mass gatherings take place in areas with high mosquito presence, there could be a risk of malaria, dengue, Zika, chikungunya, or other vectorborne diseases.<sup>11–13</sup> Particular practices or religious rituals during the mass gathering may increase risk of transmission of certain diseases.

## NONCOMMUNICABLE DISEASES AND TRAUMA

Whereas infectious diseases may be of greater global public health relevance, noncommunicable diseases and accidents usually have a higher local impact with respect to morbidity and mortality during mass gatherings.<sup>14</sup> For example, during the 1996 Olympics in Atlanta, Georgia, a review of all medical records at the Olympic medical site showed that

**Abstract**

A mass gathering is “any occasion, either organized or spontaneous, that attracts sufficient numbers of people to strain the planning and response resources of the community, city, or nation hosting the event.”<sup>2</sup> Often the existing infrastructure (e.g., public health, health care, or emergency services) is inadequate for the disproportionate sudden surge in demand, hence careful planning is required. Although infectious diseases are most feared due to the potential for rapid international spread, noncommunicable diseases, accidents, and stampedes are more frequent. Mass gatherings may lead to three potential infectious disease public health threats: the risk of importation of infectious diseases usually not seen in the country of the gathering; the amplification of transmission during the event; and the international spread of infectious disease through global mobility networks.

**Keywords**

Disease surveillance  
*Hajj*  
International spread  
Mass casualties  
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Mass gatherings medicine  
Meningococcal disease  
Outbreaks  
Pilgrimage  
Vaccine-preventable diseases  
Zika

injuries accounted for 31% of all visits (in athletes, 56.1%).<sup>15</sup> Infrastructure and crowd density are risk factors for trauma. Heat/meteorologic conditions may trigger heat exhaustion, heat stroke, and/or accidents due to lightning. Overexertion may result in dehydration or severe cardiovascular events. Emotional stress such as at sporting tournaments has been associated with acute cardiovascular events. Alcohol and drug consumption may result in appropriate behavior including violence. Among the accidents, stampedes are the worst-case scenario.

## SPECIFIC MASS GATHERINGS

### Hajj Pilgrimage

*Hajj*, the unique annual mass gathering of over 2 million Muslims from all over the world, presents enormous challenges to the authorities in Saudi Arabia<sup>16</sup> (Fig. 41.1). Saudi Arabia has developed a comprehensive program, which is updated annually to ensure that all aspects of *hajj* rituals are conducted safely and without major incident.<sup>17</sup> The inevitable overcrowding in a confined area of such large numbers increases the risk of respiratory infections. The *hajj* has historically been associated with outbreaks of meningococcal disease, with a major outbreak of serogroup A occurring in 1998.<sup>4,5</sup> In response to this outbreak, the Ministry of Health in Saudi Arabia introduced vaccination against serogroup A as a *hajj* visa requirement. In 2000 and 2001 outbreaks of meningococcal disease due to W135 serogroup were reported, including a high acquisition rate of W135 meningococcal carriage.<sup>18</sup> Returning pilgrims with W135 carriage triggered various clusters of W135 meningococcal disease in household contacts.<sup>19</sup> Tetravalent meningococcal vaccine covering A, C, Y, and W135 became a mandatory *hajj* visa requirement in 2002, and no further *hajj*-related outbreaks occurred. The Saudi Ministry of Health also introduced eradication of meningococcal carriage through administering single-dose antibiotics to pilgrims arriving from the African meningitis belt. Monitoring carriage states of visitors and local inhabitants in the Kingdom of Saudi Arabia, as well as the implementation of preventive measures that impact carriage, are warranted to reduce the risk of *hajj*-related and *umrah*-related meningococcal disease outbreaks.<sup>20</sup>

Although H1N1 was a concern prior to *Hajj* 2009, massive amplification of this pandemic through the *hajj* did not take place, partly because of the preventive measures that were taken, and partly because *Hajj* 2009 took place at the tail end of the epidemic.<sup>21</sup> Similarly, an outbreak of Middle East respiratory syndrome (MERS) during the *hajj* has not yet materialized despite the fact that the epicenter of MERS is Saudi Arabia.<sup>22</sup>



**FIG. 41.1** Jamarat Bridge crowding at *hajj*. (Courtesy of Prof. Ziad Memish, Riyadh.)

Given that countries such as Pakistan and Afghanistan are still polio endemic with large numbers of pilgrims attending the yearly *hajj*, there is also concern about the potential for international spread of wild poliovirus via pilgrims.<sup>23</sup> Cholera was well documented during past *hajj* pilgrimages, but has not been observed in recent decades due to the improved sanitation standards. Vectorborne diseases such as dengue or Zika have been feared but additional outbreaks have not been documented, possibly because vector control measures are more rigorous during the *hajj*.

Intense religious rituals are associated with health risks. For example, shaving heads during the *hajj* was reported to increase the risk of hepatitis B, slaughtering of animals during the *hajj* was associated with Orf and Rift valley fever, stoning rituals were associated with accidents, and walking barefoot resulted in severe sole burns.<sup>16</sup> A large proportion of *hajj* pilgrims are older adults, many with preexisting illnesses that may be aggravated by heat or exertion. Overcrowded conditions during the mass migration from one ritual event to the next led to many deaths due to stampede. The most recent one occurred at *Hajj* 2015 with more than 2000 victims.<sup>24</sup>

### Olympic Games, FIFA, and Other Sport Events

Mass events such as the Olympic Games provide an opportunity to strengthen the health system's capacity to manage health emergencies as well as to promote preventive services and healthy lifestyles. The experience of the Olympics 2012 in London shows that it is possible to advance a public health agenda by capitalizing on the attention generated by the Games among government agencies and civil society. The overall experience in London was that infectious diseases accounted for <1% of all health care visits; there were no relevant outbreaks. Associated with a variety of other mass gatherings, outbreaks of respiratory and gastrointestinal infections (including various pathogens, norovirus, and hepatitis A), or mumps were recorded.<sup>25</sup>

### Other Community Events

Besides religious and sports events there are also political rallies and funerals. Increasingly other interest groups meet for huge events, such as street or love parades (e.g., EuroPride). The latter in Amsterdam in 2016 has been associated with outbreaks of hepatitis A among men who have sex with men ( $n = 1173$ ) in 15 European countries and Israel.<sup>26</sup>

## CANCELING MASS GATHERINGS

The decision to proceed with a mass gathering or to restrict, modify, postpone, or cancel the event due to, for example, pandemic influenza, MERS, or Zika should be based on a thorough risk assessment as the economic losses to a country can be enormous.<sup>27–29</sup> Event planners undertake such an assessment in partnership with local and national public health authorities. In view of concerns about Zika infections at the Summer Olympics in Brazil 2016, the WHO/International Health Regulations (IHR) Emergency Committee became involved. The risk assessment for such events may take into account available information at global, national, and local levels, such as severity of illness, and periods of communicability and incubation. If the severity of illness is high and the periods of communicability or incubation are less than the duration of the event, there is a greater risk of overwhelming the local health services.

## PLANNING FOR MASS GATHERINGS

To meet the challenges posed by a mass gathering, countries and organizers must conduct advanced risk assessment, planning, and

system enhancement. Event planners and other stakeholders are advised to work in close collaboration with local public health officials when planning events, taking into account local factors while conducting a risk assessment of the event. Preplanning includes a multisectoral approach that includes assessing the local health services, medical emergency services and blood supply, local law enforcement, and public health preparation for potential nuclear, biologic, chemical, and explosive terrorist actions. It also includes ensuring food safety, air quality, and vector control where needed. These are critical to identifying potential public health risks, both natural and manmade, and to preventing, minimizing, and responding to all emergencies.

Surveillance and health response mechanisms should be upgraded to take into account possible importation of diseases not usually seen in the host country. Surveillance should focus on issues identified in a formal risk assessment but should cover all hazards. The integration of development in Internet-based global infectious disease surveillance, transportation modeling of populations traveling to and from mass gatherings, mobile phone technology for surveillance, metapopulation epidemic modeling, and crowd behavior modeling is important for progress in studying health during mass gatherings.<sup>6</sup>

## INDIVIDUAL PREGATHERING ADVICE

The travel health professional advising individuals planning to attend a mass gathering should offer the usual pretravel advice depending on destination, which should include advice on appropriate immunizations, malaria prophylaxis (if the gathering takes place in a malaria-endemic area), advice on food and water hygiene, and avoidance of traffic accidents. With regard to immunizations, particular attention should be given to recommending influenza vaccination, updating the tetanus/pertussis/diphtheria status, and ensuring that primary schedules for polio vaccination have been completed. For those traveling from areas where wild poliovirus is still circulating, polio vaccination 4 weeks prior to departure should be given. Yellow fever vaccination should be given for those traveling from yellow fever–endemic countries to countries where *Aedes* mosquitoes exist. Furthermore, the importance of being immune against measles cannot be overemphasized, particularly in light of declining vaccine coverage rates in some countries, highlighting that routine immunizations should be up to date. If prolonged crowding conditions are to be expected, quadrivalent meningococcal vaccine may be indicated. The quadrivalent meningococcal vaccine is a *hajj* visa requirement. As much as possible, travelers must be made aware of the risk of stampede, so that they are aware of the danger and can avoid critical situations.

## CONCLUSIONS

Mass gatherings present some of the most complex management challenges faced by governments and organizers. The influx of large numbers of people and accompanying infrastructural changes to support such events pose tremendous challenges for the public health system—including risk of importing infectious diseases, amplifying transmission and further spread spreading of infectious disease through global mobility networks. Although infectious diseases during mass gatherings may be of greater concern to global public health, noncommunicable diseases (eg. accidents and stampedes) are shown to have higher local impact with respect to morbidity and mortality during such gatherings.

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