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In July, 2012, we discussed plans to move the complex public health issues surrounding mass gatherings into a formal scientific discipline, and to create a global network for mass gatherings research, training, and capacity development. We believed that it was important for this network to be led by Saudi Arabia, since the country has extensive experience through many decades of managing millions of pilgrims from 184 countries at the largest yearly recurring religious mass gathering in the world—the Hajj. Subsequently, the Saudi Government and WHO1 strongly supported mass gatherings medicine as a scientific discipline, establishing the Saudi Global Center for Mass Gathering Medicine (GCMGM), with its headquarters in Riyadh and membership from other Gulf countries, and a virtual research network linked with other WHO collaborating centres for mass gatherings. This network has brought together global academic and public health institutions with complementary expertise to gather and translate the most appropriate public health policy evidence for use by countries that host, or plan to host, mass gathering events.

The GCMGM consists of an overarching board chaired by the Saudi Minister of Health, with a membership of experts from WHO, University College London, Public Health England, the London School of Hygiene & Tropical Medicine, the Saudi Council for Health Specialties, and King Abdulaziz City for Science and Technology (the national research funding agency in Saudi Arabia). In its continued commitment to supporting the Global Mass Gatherings Network, The Lancet is publishing a Series of reports about different mass gatherings: the London 2012 Olympic and Paralympic Games; the
2012 European Football Championship (Euro 2012),\textsuperscript{4} hosted jointly by Poland and Ukraine; and Hajj 2012 and Hajj 2013.\textsuperscript{7} These reports, led by board members of the GCMGM, set out the planning and surveillance systems used to monitor public health risks, and describe the public health experiences and lessons learnt for the planning of future events. For all of these events, the host countries and international public health agencies undertook major planning activities to assess and build capacity, and to develop effective strategies for public health services and health messaging. All the events in question took place without major disease outbreaks or public health issues.\textsuperscript{5–7}

These reports show that rapid and effective information sharing and early exploitation of knowledge networks can optimise the planning and delivery of effective public health services during major events. The London 2012 Olympic and Paralympic Games\textsuperscript{5} and Euro 2012 Football Championship\textsuperscript{6} were the culmination of years of careful preparation to manage acute public health risks with potentially global effects. Public health planning started several years before these events, as laid out by WHO\textsuperscript{8} in 2008, taking into account the experiences of previous host cities. The report about the Hajj\textsuperscript{7} details the extensive public health planning, surveillance systems used to monitor public health risks, and health services provided and accessed during Hajj 2012 and Hajj 2013. The continued success of infectious diseases alert and response planning at the Hajj is attributed to the many decades of experience of the Saudi Government in providing health care at the yearly pilgrimage.

The experience of planning and risk management from all three mass gathering events\textsuperscript{5–7} presents an opportunity to improve future public health management of mass gatherings, in terms of investment for capacity building, targeted health interventions, risk management strategies, and training in mass gatherings medicine. There is an urgent need to address health issues related to mass gatherings such as the need for systems and adequate capacity to be in place to receive and analyse information rapidly from surveillance, reporting, and intelligence systems, and to identify and respond to any potential public health threat. The reports\textsuperscript{5–7} show that these lessons have become embedded as a direct legacy of these events, and will be used by organisers of future mass gatherings such as the 2016 Olympic Games and Hajj 2014.

Mass gatherings medicine provides an opportunity to generate a wealth of knowledge and expertise, and sharing the experiences of organisers can assist in shaping a positive legacy and provide valuable lessons for organisers of future events. The value to planners of mass gatherings and their governments in sharing best practices is clear, as is the need for new operational research into mass gatherings, with systematic collection and analysis of data to inform planning activities for future events. Through provision of scientific evidence, the GCMGM aims to drive the best health promotion and prevention guidelines and practice, including health education for attendees of mass gatherings across different contexts. The Hajj provides an ideal model for research into mass gatherings that recur yearly in the same location, and the very large sporting events provide a different context and complementary opportunities for research and training. Substantial gaps in research remain, particularly in relation to mass gatherings in low-resource settings and in unplanned or spontaneous mass gatherings.

The GCMGM could have a major positive public health legacy through the development of an evidence base for improvements in health systems and services at mass gatherings. For example, our experiences have shown that effective planning for mass gatherings can be used to improve the public health systems of host countries. The potential benefit of the GCMGM became evident when, in September, 2012, a serious respiratory
disease caused by a novel betacoronavirus (later named Middle East respiratory syndrome or MERS-CoV) emerged in Saudi Arabia. International media attention focused on MERS-CoV after the detection of fatal cases in France, Germany, and the UK, all of which had a connection with the Arabian Peninsula. A WHO emergency committee on MERS-CoV was formed, which included a GCMGM board member. In view of the impending Hajj in November, 2013, during which an estimated 3 million pilgrims were expected to visit Saudi Arabia, the possibility that MERS-CoV could occur in pilgrims and then spread as they returned home, causing a worldwide epidemic, was a major concern. Extensive research done under the remit of the GCMGM MERS-CoV study group led to the rapid definition of hospital outbreaks, identification of the mode of transmission, and the development of specific recommendations for Hajj 2013.

No MERS-CoV cases were detected at either Hajj 2012 or Hajj 2013, and none have been reported from the pilgrims’ home countries after return. Case-control studies to investigate various hypotheses about the source of MERS-CoV infection have not yet been done, but such studies are being planned.

As the events around the MERS-CoV outbreak show, mass gatherings will constantly face new issues and will continue to provide serious public health challenges—but these challenges can be met through effective collaborative research, education, training, and capacity building.

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