



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

I have received personal fees from Biogen Idec, Cytokinetics, GlaxoSmithKline, Chronos Therapeutics, and Daval International, all unrelated to the topic of this Comment.

- 1 Johnston CA, Stanton BR, Turner MR, et al. Amyotrophic lateral sclerosis in an urban setting: a population based study of inner city London. *J Neurol* 2006; **253**: 1642–43.
- 2 Fang F, Valdimarsdóttir U, Fürst CJ, et al. Suicide among patients with amyotrophic lateral sclerosis. *Brain* 2008; **131**: 2729–33.
- 3 Maessen M, Veldink JH, van den Berg LH, Schouten HJ, van der Wal G, Onwuteaka-Philipsen BD. Requests for euthanasia: origin of suffering in ALS, heart failure, and cancer patients. *J Neurol* 2010; **257**: 1192–98.
- 4 Fornai F, Longone P, Cafaro L, et al. Lithium delays progression of amyotrophic lateral sclerosis. *Proc Natl Acad Sci USA* 2008; **105**: 2052–57.
- 5 UKMND-LiCALS Study Group. Lithium in patients with amyotrophic lateral sclerosis (LiCALS): a phase 3 multicentre, randomised, double-blind, placebo-controlled trial. *Lancet Neurol* 2013; **12**: 339–45.
- 6 Rudnicki SA, Berry JD, Ingersoll E, et al. Dexamprapexole effects on functional decline and survival in subjects with amyotrophic lateral sclerosis in a phase II study: subgroup analysis of demographic and clinical characteristics. *Amyotroph Lateral Scler Frontotemporal Degener* 2013; **14**: 44–51.
- 7 Cudkovic ME, van den Berg LH, Shefner JM, et al, for the EMPOWER investigators. Dexamprapexole versus placebo for patients with amyotrophic lateral sclerosis (EMPOWER): a randomised, double-blind, phase 3 trial. *Lancet Neurol* 2013; **12**: 1059–67.
- 8 Wills A-M, Hubbard J, Macklin EA, et al, for the MDA Clinical Research Network. Hypercaloric enteral nutrition in patients with amyotrophic lateral sclerosis: a randomised, double-blind, placebo-controlled phase 2 trial. *Lancet* 2014; published online Feb 28. [http://dx.doi.org/10.1016/S0140-6736\(14\)60222-1](http://dx.doi.org/10.1016/S0140-6736(14)60222-1).
- 9 Bouteloup C, Desport JC, Clavelou P, et al. Hypermetabolism in ALS patients: an early and persistent phenomenon. *J Neurol* 2009; **256**: 1236–42.
- 10 Dupuis L, Oudart H, Rene F, Gonzalez de Aguilar JL, Loeffler JP. Evidence for defective energy homeostasis in amyotrophic lateral sclerosis: benefit of a high-energy diet in a transgenic mouse model. *Proc Natl Acad Sci USA* 2004; **101**: 11159–64.
- 11 Kasarskis EJ, Berryman S, Vanderleest JG, Schneider AR, McClain CJ. Nutritional status of patients with amyotrophic lateral sclerosis: relation to the proximity of death. *Am J Clin Nutr* 1996; **63**: 130–37.
- 12 Dupuis L, Corcia P, Fergani A, et al. Dyslipidemia is a protective factor in amyotrophic lateral sclerosis. *Neurology* 2008; **70**: 1004–09.
- 13 Dorst J, Kuhnlein P, Hendrich C, Kassubek J, Sperfeld AD, Ludolph AC. Patients with elevated triglyceride and cholesterol serum levels have a prolonged survival in amyotrophic lateral sclerosis. *J Neurol* 2011; **258**: 613–17.
- 14 Marin B, Desport JC, Kajeu P, et al. Alteration of nutritional status at diagnosis is a prognostic factor for survival of amyotrophic lateral sclerosis patients. *J Neurol Neurosurg Psychiatry* 2011; **82**: 628–34.
- 15 Wicks P, Vaughan T, Heywood J. Subjects no more: what happens when trial participants realize they hold the power? *BMJ* 2014; **348**: g368.

W Mass gatherings medicine: international cooperation and progress

Published Online

May 21, 2014

[http://dx.doi.org/10.1016/S0140-6736\(14\)60225-7](http://dx.doi.org/10.1016/S0140-6736(14)60225-7)

See *Series* pages 2073, 2083, and 2090

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.^{1,2} 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 WHO³ 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,⁴ 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;⁵ the



Crowds of people at the London 2012 Olympic Games Park in Stratford on Aug 9, 2012

2012 European Football Championship (Euro 2012),⁶ hosted jointly by Poland and Ukraine; and Hajj 2012 and Hajj 2013.⁷ 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.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 Games⁵ and Euro 2012 Football Championship⁶ 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 WHO⁸ in 2008, taking into account the experiences of previous host cities. The report about the Hajj⁷ 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 events⁵⁻⁷ 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 reports⁵⁻⁷ 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.



Muslim pilgrims circumambulate the Ka'aba during the Hajj in Makkah, Saudia Arabia, on Oct 17, 2013

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.^{9,10} 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,¹¹ 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,^{12,13} and the development of specific recommendations for Hajj 2013.¹²⁻¹⁸ 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.¹⁸ 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 issues⁸ and will continue to provide serious public health challenges—but these challenges can be met through effective collaborative research, education, training, and capacity building.

*Ziad A Memish, Alimuddin Zumla, Brian McCloskey, David Heymann, Abdullah A Al Rabeeah, Maurizio Barbeschi, Richard Horton

Global Center for Mass Gathering Medicine, Ministry of Health, Riyadh 11176, Saudi Arabia (ZAM, AAAR); Al-Faisal University, Riyadh, Saudi Arabia (ZAM); Division of Infection and Immunity, University College London, and University College London Hospitals, London, UK (AZ); Global Health and WHO Collaborating Centre on Mass Gatherings, Public Health England, London, UK (BM); Chatham House, London, UK (DH); London School of Hygiene & Tropical Medicine, London, UK (DH); World Health Organization, Geneva, Switzerland (MB); and *The Lancet*, London, UK (RH)
zmemish@yahoo.com

ZAM, AZ, BM, DH, AAAR, and MB are board members of the Global Center for Mass Gathering Medicine.

©2014. World Health Organization. Published by Elsevier Ltd/Inc/BV. All rights reserved.

- 1 Al Rabeeah A, Memish ZA, Zumla A, et al. Mass gatherings medicine and global health security. *Lancet* 2012; **380**: 3-4.
- 2 The Lancet. Mass gatherings health—creating a public health legacy. *Lancet* 2012; **380**: 1.
- 3 Ministry of Health, Kingdom of Saudi Arabia. WHO General Assembly embraces the Saudi proposal of creating a program for mass gathering medicine. May 27, 2012. <http://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/news-2012-05-27-001.aspx> (accessed Feb 10, 2014).
- 4 Global Center for Mass Gathering Medicine. <http://gcmgm.com/> (accessed Feb 12, 2014).
- 5 McCloskey B, Endericks T, Catchpole M, et al. London 2012 Olympic and Paralympic Games: public health surveillance and epidemiology. *Lancet* 2014; published online May 21. [http://dx.doi.org/10.1016/S0140-6736\(13\)62342-9](http://dx.doi.org/10.1016/S0140-6736(13)62342-9).
- 6 Smallwood CAH, Arbuthnott KG, Banczak-Mysiak B, et al. Euro 2012 European Football Championship Finals: planning for a health legacy. *Lancet* 2014; published online May 21. [http://dx.doi.org/10.1016/S0140-6736\(13\)62384-3](http://dx.doi.org/10.1016/S0140-6736(13)62384-3).
- 7 Memish ZA, Zumla A, Alhakeem RF, et al. Hajj: infectious disease surveillance and control. *Lancet* 2014; published online May 21. [http://dx.doi.org/10.1016/S0140-6736\(14\)60381-0](http://dx.doi.org/10.1016/S0140-6736(14)60381-0).
- 8 WHO. Communicable disease alert and response for mass gatherings—key considerations. Geneva: World Health Organization, 2008. http://www.who.int/csr/Mass_gatherings2.pdf (accessed Feb 3, 2014).
- 9 Zaki AM, van Boheemen S, Bestebroer TM, Osterhaus AD, Fouchier RA. Isolation of a novel coronavirus from a man with pneumonia in Saudi Arabia. *N Engl J Med* 2012; **367**: 1814-20.
- 10 McCloskey B, Zumla A, Stephens G, Heymann DL, Memish ZA. Applying lessons from SARS to a newly identified coronavirus. *Lancet Infect Dis* 2013; **13**: 384-85.
- 11 WHO. WHO IHR Emergency Committee concerning Middle East respiratory syndrome coronavirus (MERS-CoV). 2013. http://www.who.int/ihr/ihr_ec_2013/en/ (accessed Jan 9, 2014).
- 12 Memish ZA, Zumla AI, Al-Hakeem RF, Al-Rabeeah AA, Stephens GM. Family cluster of Middle East respiratory syndrome coronavirus infections. *N Engl J Med* 2013; **368**: 2487-94.
- 13 Assiri A, McGeer A, Perl TM, et al. Hospital outbreak of Middle East respiratory syndrome coronavirus. *N Engl J Med* 2013; **369**: 407-16.
- 14 Memish ZA, Al-Rabeeah AA. Public health management of mass gatherings: the Saudi Arabian experience with MERS-CoV. *Bull World Health Organ* 2013; **91**: 899-99A.
- 15 Assiri A, Al-Tawfiq JA, Al-Rabeeah AA, et al. Epidemiological, demographic, and clinical characteristics of 47 cases of Middle East respiratory syndrome coronavirus disease from Saudi Arabia: a descriptive study. *Lancet Infect Dis* 2013; **13**: 752-61.
- 16 Cotten M, Watson SJ, Kellam P, et al. Transmission and evolution of the Middle East respiratory syndrome coronavirus in Saudi Arabia: a descriptive genomic study. *Lancet* 2013; **382**: 1993-2002.
- 17 Memish ZA, Zumla AI, Assiri A. Middle East respiratory syndrome coronavirus infections in health care workers. *N Engl J Med* 2013; **369**: 884-86.
- 18 Memish ZA, Al-Tawfiq JA, Makhdoom HQ, et al. Screening for Middle East Respiratory Syndrome Coronavirus infection in hospital patients and their health care worker and family contacts: a prospective descriptive study. *Clin Microbiol Infect* 2014; published online Jan 24. DOI:10.1111/1469-0691.12562.