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London 2012 Olympic and Paralympic Games: public health surveillance and epidemiology

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Mass gatherings are regarded as potential risks for transmission of infectious diseases, and might compromise the health system of countries in which they are hosted. The evidence for increased transmission of infectious diseases at international sporting mass gatherings that attract many visitors from all over the world is not clear, and the evidence base for public health surveillance, epidemiology, and response at events such as the Olympics is small. However, infectious diseases are a recognised risk, and public health planning is, and should remain, a crucial part of the overall planning of sporting events. In this Series paper, we set out the planning and the surveillance systems that were used to monitor public health risks during the London 2012 Olympic and Paralympic Games in the summer of 2012, and draw attention to the public health issues—infectious diseases and chemical, radiation, and environmental hazards—that arose. Although the absolute risk of health-protection problems, including infectious diseases, at sporting mass gatherings is small, the need for reassurance of the absence of problems is higher than has previously been considered; this could challenge conventional public health surveillance systems. Recognition of the limitations of health-surveillance systems needs to be part of the planning for future sporting events.

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Introduction

Mass gatherings are seen as potential risks for transmission of infectious diseases,[1] and might be expected to compromise the health system of the city, country, or region in which they are held. This risk and expectation is clearly true for the yearly Hajj in Saudi Arabia, where infectious diseases have been a major problem and where substantial effort is now made by the host country's authorities to mitigate and manage the risk.[2] The evidence for the risk of transmission at international sporting mass gatherings—such as the Olympic Games and World Cup—is not clear, but nevertheless public health planning and response are an essential part of the overall planning for these events.

Although reports on the epidemiology of individual mass gatherings have been published, these have been neither comprehensive nor extensive. In this Series paper, we present the planning and surveillance systems used by UK authorities to monitor public health risks—including infectious diseases and chemical, radiation, and environmental hazards—during the London 2012 Olympic and Paralympic Games (known collectively as the 2012 Games), and draw attention to the public health issues that arose and some of the lessons identified from these.

Infectious diseases at Olympic Games

During the 1996 Atlanta and 2000 Sydney Olympic Games, infectious diseases accounted for less than 1% of health-care visits.[3] Data for the Attica region in Greece (in which Athens is located) during the Athens 2004 Games showed that, of the health problems for which people visited a primary-care physician, the most common were respiratory infections (6·7%) and gastroenteritis (3·7%). Across all four regions where the Games were located, in areas representing 51% of Greece's population, salmonellosis accounted for about 50% of the mandatory notifications, tuberculosis 17%, hepatitis B 5%, aseptic meningitis 4%, and bacterial meningitis 3%. Recorded morbidity from infectious diseases was very low (2–3%). 14 small clusters (2–4 people) and eight large clusters (6–38 people) of foodborne or waterborne disease were reported in August, 2004. None of these outbreaks was reported from an Olympic venue, highlighting the tendency for all events in an Olympic City during the Games to be labelled as Olympics-related.[4]

In the Beijing 2008 Olympic Games, the number of cases of communicable diseases (including gastrointestinal infections) paradoxically reduced by 40% compared with the previous year, and no infectious

Search strategy and selection criteria

We searched PubMed, Medline, and Embase using the search terms "mass gatherings" or "crowds" in combination with the terms "sporting events" or "Olympics". We selected publications from the past 5 years, but did not exclude commonly referenced and highly regarded older publications. We also searched the reference lists of articles identified by this search strategy and selected those we deemed relevant. Review articles and websites on mass gatherings and sporting events are cited to provide readers with more details and more references than can be supplied in this paper. We searched only articles published in English.

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disease outbreaks were reported.[5] Enhancement of health-protection measures, particularly food safety and hygiene along the entire food-supply chain, might have caused an absolute decrease in morbidity.[6] However, the experience of the Democratic National Convention in Boston, MA, USA, where a reduction in health attendance was also noted during the event, suggests that movement of the resident population out of the mass-gathering environment might also partly explain the reduction in reported cases of communicable diseases.

Changes in normal catering and food-preparation systems during mass gatherings—such as the introduction of temporary or mobile food outlets or catering environments where good standards of hygiene are difficult to maintain—can lead to an increase in the risk of contaminated food and water causing incidents and outbreaks of gastrointestinal diseases. Several gastrointestinal incidents have been reported from mass gatherings such as festivals and sports events.[7–12]

Respiratory illnesses have always been major concerns for mass gatherings, as evidenced by the Middle East respiratory syndrome coronavirus. Indeed, airborne spread of microorganisms in the context of a mass gathering could result in not only respiratory tract diseases but also clusters of diseases such as measles, mumps, and meningococcal infection.[13] Influenza has frequently been recorded at sporting and music events such as the 2002 Winter Olympics in Salt Lake City, UT, USA,[14] and music festivals in 2009 in Belgium,[15] Serbia,[16] and Hungary,[17] and also at the World Youth Day in Sydney, NSW, Australia, in July, 2008.[18] However, sustained control measures, including vaccination, during the global pandemic in 2009 averted outbreaks of influenza A H1N1 at the Hajj and the Asian Youth Games, Singapore.[19,20]

The extent to which information needs at these mass gatherings are driven by politics and the media rather than by epidemiology or public health risk is not clear from published work. Demand is huge for information about any possible risk to the Games and to the reputation of the host city. Politicians and decision makers often seek reassurance that nothing is happening—this negative finding is not easily and reliably available from traditional surveillance systems. Recognition of the limits of surveillance systems needs to be part of mass-gathering planning.

London 2012 Olympic and Paralympic public health system

Planning and preparation

In the summer of 2012, London hosted the Olympic and Paralympic Games, respectively the largest and second largest international sporting mass gatherings in the world. The Olympics involved 10 500 competitors from 205 nations in 26 sports, and the Paralympics included 4200 competitors from 147 nations in 21 sports. More than 9 million tickets were sold for the Olympic and Paralympic Games, and an estimated 11 million spectators attended across all venues.[21,22]

Authorities began public health planning more than 7 years before the Games, following the principles laid out in the WHO Communicable Disease Alert and Response for Mass Gatherings Guidelines, and the experiences of previous host cities.[23–25] Planners recognised that during mass gatherings such as the 2012 Games it is important to address public health issues with the utmost urgency. The systems and capacity need to be in place to rapidly receive and analyse information from surveillance, reporting, and intelligence systems, and to identify and respond to any potential health-protection threat.

The UK Health Protection Agency (HPA, now Public Health England [PHE]), in partnership with other local, national, and international agencies such as WHO, local government authorities, and the UK Food Standards Agency, developed a public health risk assessment for the Games. This assessment informed the UK national cross-government Olympic risk assessment, which formed the basis for the UK Government's Olympic planning.

The approach taken to the public health risk assessment was to follow the principles of risk analysis (what might happen?), surveillance and reporting (how will we know when it happens?), and response (what will we do if it happens?). In response to this risk assessment, systems were enhanced to provide additional surveillance data, improve understanding of the public health effect of the 2012 Games, and raise public awareness and understanding of public health concerns.

Traditional surveillance

The UK, like most developed countries, has well established public health surveillance based on clinician, environmental, and laboratory reporting, augmented in the UK by syndromic reporting systems. These systems are coordinated and managed across England by the PHE as the lead public health agency. Although the systems are very effective, the risk assessment for the Games suggested that they would not be sufficient in terms of speed and comprehensiveness of coverage. Several enhancements to these systems were therefore implemented as part of preparations for the 2012 Games,[26,27] including the addition of data for attendance at Olympics venues to the core reporting requirement of notified cases, and a move from weekly to daily analysis and reports.[27] The national Centre for Infectious Disease Surveillance and Control routinely collates reports of incidents, outbreaks, and adverse trends from across the UK; during the Games, in addition to undertaking this daily, they collated the enhanced systems we describe in this Series paper.

Daily analyses of mortality data were also done, and a new system was introduced for sentinel intensive care units to report unexplained illness of probable infectious cause.[28] This system involved clinicians in paediatric