

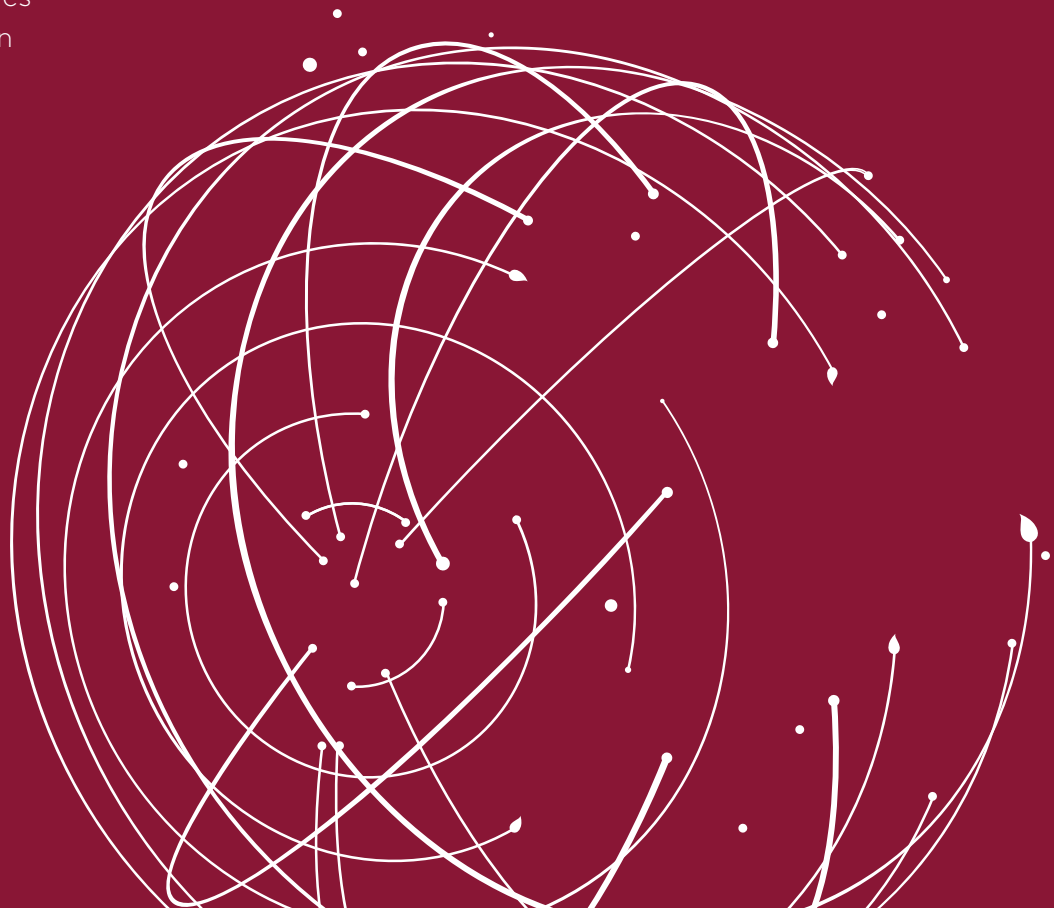
NOVEMBER 2020



STEPPING UP TO THE PLATE

PLANNING FOR A LASTING HEALTH
LEGACY FROM MAJOR SPORTING EVENTS

Didi Thompson
Steve McAteer
Nicolette Davies
Abby Hoffman



ONE WORLD
OUR HEALTH 

Suggested reference for this report: Thompson D, McAteer S, Davies N, Hoffman A. Stepping up to the plate: Planning for a lasting health legacy from major sporting events. Doha, Qatar: World Innovation Summit for Health, 2020.

ISBN: 978-1-913991-04-3

STEPPING UP TO THE PLATE PLANNING FOR A LASTING HEALTH LEGACY FROM MAJOR SPORTING EVENTS

WISH 2020 Forum on the Health Challenges
of Major Sporting Events

CONTENTS

03	Foreword
04	Executive summary
08	Section 1. Background and scope
14	Section 2. Protect health during the event
27	Section 3. Establish a health and public health legacy
32	Section 4. Share learning
33	Section 5. Conclusion and policy recommendations
35	Key definitions
35	Further resources
36	Acknowledgments
38	References

FOREWORD

In every part of the world, sporting events bring people together. Sport spectating has a universal capacity to boost morale, promote a common sense of belonging, and fulfill a fundamental human need for social connection.

Hosting a major sporting event, particularly a large-scale international competition, is a colossal undertaking but in return can impart a multitude of benefits to host countries, including a sense of national pride, valuable infrastructure investment, increased tourism income, and an opportunity to raise the international profile and reputation of the country as well as the host city. However, because of their high-profile nature, failure of any kind puts at risk the billions of dollars invested by host countries, and therefore careful contingency planning and flawless execution is essential.

Mass gatherings present a range of challenges for the host country, particularly in the healthcare sector, as highlighted by the widespread cancellation or postponement of many sporting competitions due to the COVID-19 pandemic. Assembling large numbers of people in a concentrated area can lead to increased transmission of infectious diseases, the risk of mass injury, and ensuing pressure on existing health systems and services. Local environmental conditions often produce additional challenges for participants and visitors. It is therefore imperative to adopt a comprehensive and co-ordinated approach across public health, primary care, tertiary care, and emergency services to minimize and mitigate the health risks associated with the delivery of these events.

As we move closer to the upcoming Qatar 2022 Fédération Internationale de Football Association (FIFA) World Cup, this Forum report will serve as a point of reference to complement current preparations. It provides a set of actionable recommendations for policymakers to effectively plan and address key public health and healthcare challenges, while creating a lasting public health and health legacy.



**Professor the Lord Darzi of Denham,
OM, KBE, PC, FRS**
Executive Chair, WISH, Qatar Foundation
Co-Director, Institute of Global Health
Innovation, Imperial College London



Abby Hoffman
Senior Executive, Ministry of Health, Canada
Member, World Athletics Executive Board
Four-time Olympian

EXECUTIVE SUMMARY

Major sporting events bring millions of people together from across the globe, providing many benefits to host countries, including valuable infrastructure investment, increased tourism income and a heightened sense of national pride. However, such events also present a multitude of challenges and risks.

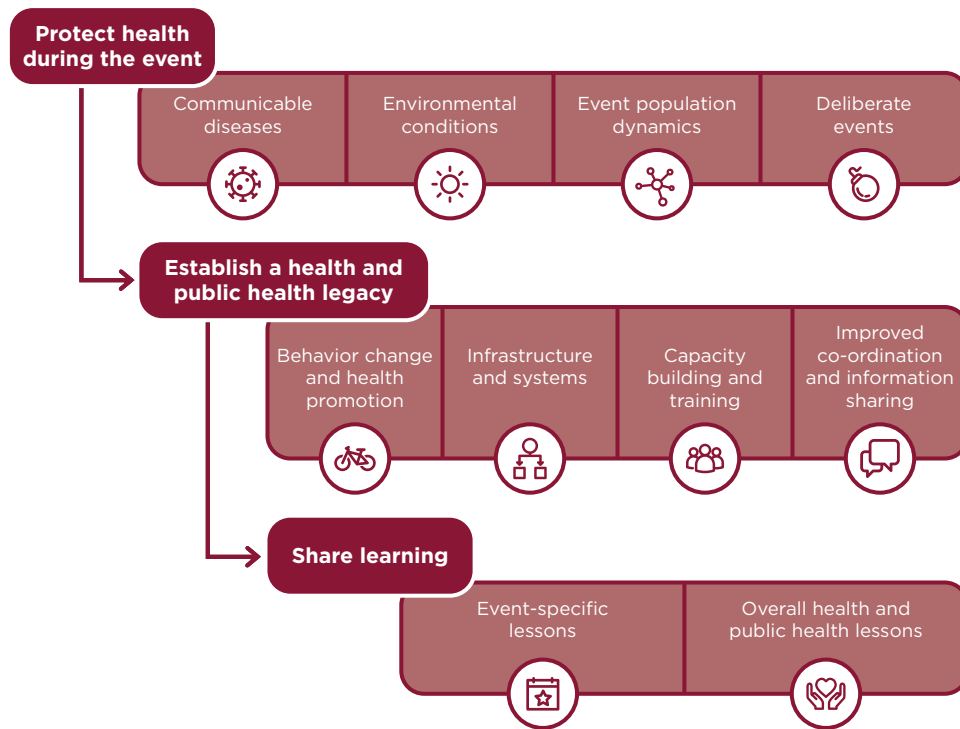
Legacy planning is often not prioritized when dealing with the many stressful demands of delivering a successful event and can result in a missed opportunity in realizing future health and public health benefits.

This report demonstrates how effective planning for these challenges can be leveraged to achieve three primary health goals:

- **Protect health during the event:** Protect the health of visitors, spectators, participants and the local population during the event.
- **Establish a health and public health legacy:** Plan for the sporting event to deliver assets, change health behaviors, encourage infrastructure investment and develop capacity.
- **Share learning:** Codify and disseminate lessons learned to future hosts.

Figure 1 illustrates this as a framework for addressing the health challenges involved in hosting major sporting events.

Figure 1. Framework for addressing health challenges in major sporting events



To illustrate current best practice, international case study examples are presented throughout the report.

The report concludes with a series of recommendations outlining how governments, policymakers, public health systems, and health systems can work together with organizers to achieve these goals.

1. Protect health during the event

Protect the health of visitors, spectators, participants and the local population during the event:

- Increase collaboration and **information sharing** across security (intelligence agencies as well as public safety and law enforcement) and healthcare departments.
- Support comprehensive **risk management** in conjunction with event organizers – with public health representatives involved from day one.

- Assign a **single point of accountability** for health and health messaging for clarity and consistency (for instance, a Games Chief Medical Officer).
- **Proactively communicate public health messages** to attendees and the broader public in advance of, during, and beyond the event.

2. Establish a health and public health legacy

Use event planning as an opportunity to design a lasting health and public health legacy:

- Assign a **single point of accountability for health and public health legacy** planning to maximize impact (for instance, a Health and Public Health Legacy Officer).
- **Legacy planning should start on day one** and continue beyond the event to maximize the return on investment (ROI).
- Use staff training (medical, security, emergency medical technicians, and so on) as an opportunity for **emergency response preparedness beyond the event**. This is an opportunity that might otherwise not occur.
- Ensure that the **benefits of legacy initiatives are clearly measured** to allow for accurate ROI assessments.

3. Share learning

Ensure that lessons learned are disseminated internationally and to future hosts:

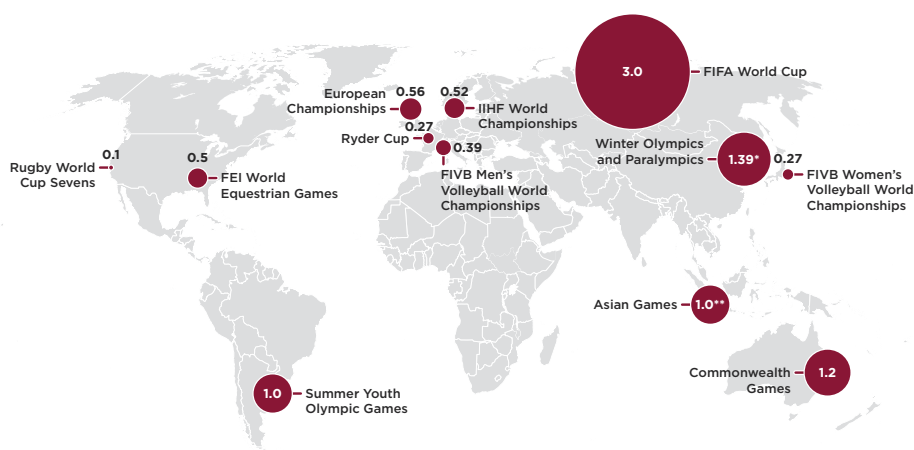
- Identify a list of **quantifiable health and public health metrics** to track throughout, contributing to a thorough review of the event and ensuring that recommendations are evidence-based.
- **Commit to a comprehensive assessment of health and public health performance** immediately after the event, as well as at set intervals following its conclusion; this will add to the health legacy evidence base, which is often neglected.

- Produce a **single-source manual that codifies lessons identified and implemented** from the event for the benefit of future hosts.
- Encourage **peer-reviewed publication as well as commentary** and white paper resources.

SECTION 1. BACKGROUND AND SCOPE

Major sporting events provide a unique opportunity to bring people from many countries together, united by common interests. Millions of people attend these competitions each year (see Figure 2). Television audiences for these events are even greater, with an average global viewership of 3.5 billion for FIFA World Cup events and 2.6 billion for the Tour de France.¹ Perhaps no other sector has the ability to mobilize people across countries, borders and cultures to unite in creating a sense of camaraderie and universality.

Figure 2. Attendance at selected major global sporting events, 2018 (millions)



*As of 22 February 2018

**Projected

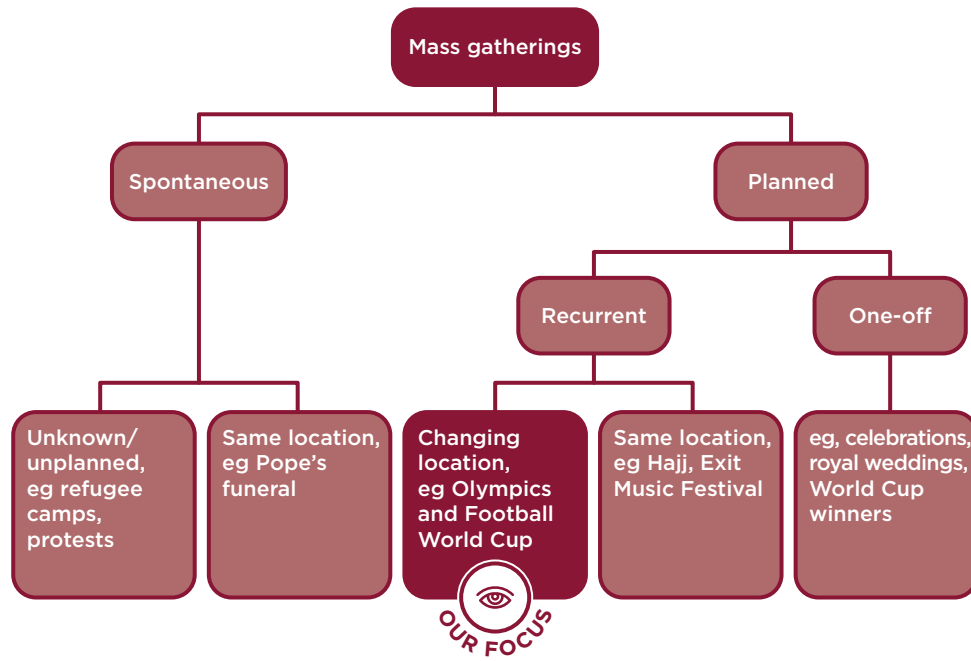
Sources: Statista (2019)²; Gold Coast 2018 Commonwealth Games Post Game Report (2019)³; Sportsnaut (2018)⁴; Glasgow City Council (2019)⁵; IOC (2018)⁶; Around the Rings (2018)⁷; IPC (2018)⁸; Ryder Cup (2019)⁹; Volleymob (2018)¹⁰; US Equestrian Federation (2020)¹¹; Volleymob (2018)¹²

Mass gatherings and mega-events

Much of the literature surrounding the production and management of major sporting events draws on lessons learned from mass gatherings of all kinds. The World Health Organization (WHO) defines mass gatherings as “characterized by the concentration of people at a specific location for a specific purpose over a set period of time and which has the potential to strain the planning and response resources of the country or community.”¹³

The planning considerations for different types of mass gatherings vary depending on their characteristics, such as whether they are: spontaneous or planned; recurrent or one-off; in the same, an unknown, or a changing location (see Figure 3).

Figure 3. Types of mass gatherings



Source: WHO (2015)¹⁴

Some literature also uses ‘mega-event’ to describe large-scale events, which have been defined as “ambulatory occasions of a fixed duration that attract a large number of visitors, have a large mediated reach, come with large costs and have large impacts on the built environment and the population.”¹⁵

For this report, our focus centers on planned, recurrent, mass sporting event gatherings that change locations, including ‘mega-events’. While certain lessons can apply to same-location or one-off sporting events and international mass gatherings outside the sports sector, these are not our primary focus.

Why host a major sporting event?

Hosting high-profile sporting events comes with significant financial and reputational risks. Failure can result in the loss of billions of dollars of investment; yet major sporting events can provide a multitude of benefits to host countries (see Figure 4).

Figure 4. Motivation for hosting a major sporting event



Staging a large-scale sporting event is an opportunity to enhance the host's international profile, particularly for countries with no previous experience of organizing such competitions.^{16,17,18}

The overall economic benefits of hosting a major sporting event vary widely, but tend only to be moderately positive and often lower than expected¹⁹ due to budget over-runs, which contribute to diminished economic returns.^{20,21} Additional challenges arising from the COVID-19 pandemic will also have a financial impact. It is estimated that the postponement and cancellation of several sporting events will result in a colossal loss of revenue, including: the 2020 Tokyo Olympics (\$6 billion); US professional sports leagues (\$5.5 billion); and the mainstream Spanish, French, Italian and English football leagues (\$3.5 billion).²²

Policymakers can capitalize on the publicity surrounding these events to promote population-wide public health efforts. While direct public health benefits – via increased participation in sports or activity levels – are limited and generally short term, there are often indirect health benefits for host cities through improved sports facilities, transport, housing and healthcare infrastructure.^{23,24,25}

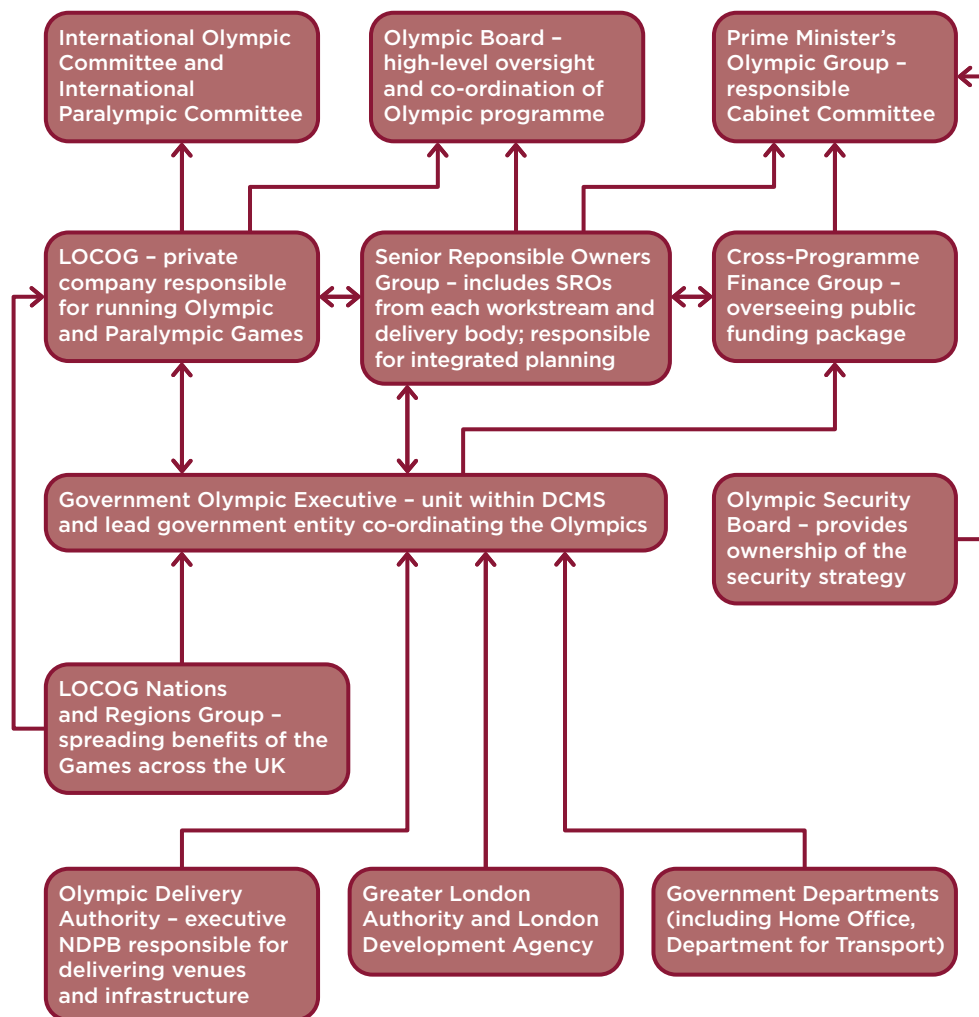
Finally, there is often widespread support from local citizens for hosting these events, which typically increases throughout preparations in the months leading up to the competition.²⁶ Though economic benefits are often cited as a reason for this support, research shows that residents value the social benefits more highly – for example, the opportunity to volunteer at the event.^{27,28}

Our scope

Staging a major sporting event is a complex undertaking that requires careful co-ordination across multiple participants and sectors. Typically, the international franchise holder – for example, the International Olympic Committee (IOC), FIFA, World Athletics – has well-established and strict organizational structures that exercise considerable control over the arrangements for the competition and, consequently, the host city. While the host may want to maximize benefits for the local population, the constraints and demands of the international body may lead to significant adjustments in priorities.

The local organizing committee, which varies in composition depending on the event, constantly balances the demands of their national government, the international sport governing body, sponsors, media, and other governments, the complexity of which is highlighted in [Figure 5](#).

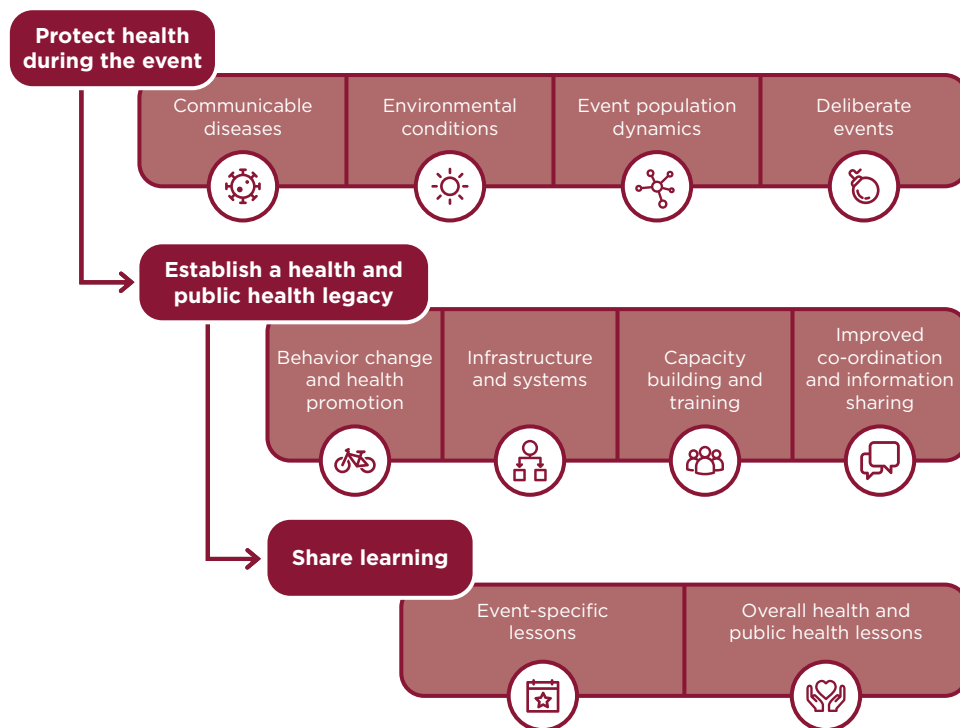
Figure 5. London 2012 Olympic Games governance structure



Abbreviations: LOCOG: London Organising Committee of the Olympic and Paralympic Games. DCMS: Department for Culture, Media & Sport. NDPB: Non-departmental public body
 Source: Institute for Government (2013)²⁹

This report focuses specifically on the health and public health challenges in hosting major sporting events. Its recommendations are complementary to the more in-depth and targeted guidance provided by other organizations and initiatives. Our goal is to outline how governments, policymakers, public health systems and health systems can work together with organizers throughout the event to: protect the health of visitors, spectators, participants and the local population; use event planning efforts as an opportunity to design a lasting health and public health legacy in host cities and countries; and ensure that this knowledge and learning is shared with future hosts (see Figure 6).

Figure 6. Framework for addressing health challenges in major sporting events



SECTION 2. PROTECT HEALTH DURING THE EVENT

Major sporting events bring large groups of people together at specific locations over prolonged periods of time. Such events have the potential to strain local public health and healthcare systems, often with limited extra capacity to accommodate routine care beyond the local population.

This section explores the most pressing public health and healthcare issues to consider when hosting major sporting events. It outlines the key challenges and opportunities for policymakers and healthcare systems to effectively plan for and address these issues. Case studies illustrate best practice and lessons learned at major sporting events worldwide.



Communicable diseases

Managing an infectious disease outbreak is one of the principal health concerns when hosting major sporting events. The close proximity of crowds risks rapid transmission – both person-to-person as well as via contaminated food or water sources. The importance of preparing for potential outbreaks should not be overlooked. Infectious disease outbreaks affect those attending the events, but also the wider local population, with diseases spreading to non-attendees too.

- **Respiratory illness:** Dense crowding combined with varied immunity and vaccination rates can lead to the rapid spread of respiratory illnesses through airborne transmission.³⁰ There have been multiple instances of influenza outbreaks, including the 2002 Salt Lake City Winter Olympics. Vaccinations, enhanced surveillance and infection control can avert some outbreaks, as in the H1N1 influenza case at the 2009 Singapore Asian Youth Games.³¹
- **Viruses:** Temporary or pop-up food stalls at major events may have difficulty maintaining hygiene standards, which can lead to food and water contamination. Several norovirus outbreaks have been reported at major sporting events, including the 2018 PyeongChang Winter Olympics and the 2017 London World Athletics Championships.³²

Despite a few high-profile instances of infectious disease outbreaks, the evidence on the overall instance of healthcare appointments related to infectious diseases during mass gatherings is mixed.³³ At the 2008 Beijing Olympics, communicable disease cases reduced by 40 percent compared to the previous year.³⁴ A potential explanation for this is food safety and hygiene improvements, and the temporary movement of the local population out of the area for the duration of the event.^{35,36}

Infection can also be spread by event attendees as they return to their countries of origin. Air travel increases the rate and reach of transmission, and mega-events have been linked to international outbreaks of meningitis, measles and norovirus.³⁷

Safe, rapid decisions are required when managing a biological shock such as the COVID-19 pandemic. The US National Basketball Association stopped its season as soon as one of its players tested positive for COVID-19. Prior to this, the individual had played seven teams in five locations, potentially infecting hundreds of others.³⁸ Consequently, a slower response could have had a detrimental impact. Three major sporting events were held in the UK after the arrival of COVID-19, but ahead of the government's lockdown. All were attended by tens of thousands of people, many from overseas, and resulted in an apparent spike of hospital deaths in the surrounding areas.³⁹

- **Sexually transmitted infections:** Large sporting events have also been anecdotally linked to outbreaks of sexually transmitted infections (STIs), however, evidence of pressure on local sexual health services is limited.^{40,41} During the 2000 Sydney Olympics, data suggests that local demand for these services decreased among residents who temporarily left the city; however, there was a concurrent increase in demand from visitors, resulting in comparable levels of typical patient attendance overall. Nearly twice as many patients presented with symptoms of STIs during the Olympics than during the previous year, which would support the notion of increased unsafe sex practices during these types of sporting events.⁴²

Box 1. COVID-19

At the time of writing, many countries had implemented restrictions on movement and mass gatherings in response to the COVID-19 pandemic. This resulted in widespread cancellation or postponement of major sporting events that were scheduled to take place in spring and summer of 2020, including the 2020 Tokyo Olympic and Paralympic Games, UEFA European Football Championship, and the Wimbledon Championships.⁴³

Making the decision to postpone or cancel these events was extraordinarily complex. Event organizers and public authorities were, and remain, uncertain of how to ensure the safe delivery of events due to rapidly emerging – and sometimes conflicting – information about the disease. This includes insights about the disease’s trajectory and modes of transmission, varied levels and pace of infection rates, and different policy responses across countries. Initially, many of the decisions to cancel or postpone mass gatherings were made with limited evidence on COVID-19 epidemiology and effective risk mitigation strategies. The World Health Organization has since published interim guidance to help organizers and hosts review the key considerations for hosting events in the context of the pandemic. The guidance includes a risk assessment tool to support risk management and mitigation actions.⁴⁴ Some international sport bodies – World Athletics, for example – have also developed detailed guidelines for the conduct of competition in their specific sport.⁴⁵

As each day passes, more is known about countermeasures to protect against the virus, but at the same time, the apparent ease with which infections spread make the risks greater. Securing compliance with countermeasures among participants and across populations is challenging as COVID-19 fatigue sets in after prolonged lockdowns, even while the crisis deepens globally. This adds an additional layer of complexity for decision-makers planning for immediate upcoming events or those scheduled over the coming year.

Resuming activities will be a slow and cautious process to avoid any potential risk to those involved. Best practice guidance is still evolving. Some sports – many contact sports, those involving play at close quarters or indoors – can only be conducted safely in highly controlled environments as social distancing is impossible. Risk assessments, (including for travel and accommodation of athletes, teams, spectators and media), and practical measures will need to be in place to ensure that sport events do not become super-spreader occasions.⁴⁶

Some events have begun implementing changes to resume safely, using tactics such as:

- no, or strict limits on, spectators (national football leagues in Germany, England, Spain, Italy, South Korea and Turkey).
- limiting the number of participants (Tokyo Marathon) and canceling mass participation races, which are part of most major marathons and key to their business models.
- testing, retesting and quarantining of all teams, support personnel, media and event management (National Basketball Association in the US), and prohibiting spectators.^{47,48,49}

Meanwhile, a panel comprising officials from the Tokyo 2020 Organising Committee, the Tokyo Metropolitan Government, and the Japanese Government will host a series of meetings to determine the appropriate COVID-19 countermeasures ahead of the rescheduled Olympic Games. Measures will likely include border controls, test and trace systems, and additional medical staffing and resources.⁵⁰

Though still developing, it is clear that these modifications will have significant economic, logistical, and social impacts on host communities and sports organizations. This furthers the case for evidence-based, multisectoral, transparent planning and execution for future events. Managing the public reaction to the perceived inequality in the general public's access to public health protections, while enormous effort is concentrated on the safety of teams, international visitors, media and others involved in a major sport event is another challenge. Even with screening, relaxed border access for travelers from abroad may be resented when there is continued severe restrictions on domestic mobility.

Lessons learned: Governments, policymakers, and event organizers will be challenged as they balance precaution, public perception, and the tolerance of risk with the realities of making decisions based on rapidly evolving evidence and the persistence of many unknowns. Collaboration between public authorities, sport event organizing committees, participating teams, local population, and international visitors must reach a new level of solidarity and co-operation if international sport is to resume before a COVID-19 vaccine is universally available and delivered.

Managing potential outbreaks

Managing potential infectious disease outbreaks for global events requires widespread co-operation and engagement. While event organizers and facility managers are directly responsible for many factors that contribute to communicable disease outbreaks, public health and health-care systems play an integral role in planning for and mitigating the risks of potential outbreaks. These systems are uniquely placed to unite stakeholders across sectors, which often operate in isolation.

Prior to the event, public health experts should engage in a comprehensive risk assessment to identify the conditions and diseases most likely to impact the event – in terms of negative health effects for attendees as well as potential disruptions to the event from negative media coverage.

Characteristics of priority diseases for surveillance include:

- Outbreak and transmission potential.
- Severity of illness.
- Differences in immunity across attendees and host population.⁵¹
- Diseases that are required to be reported under International Health Regulations.

Most developed countries maintain public health surveillance systems. However, their current capacity should be assessed in advance, as many are not designed to deal with the increased volume and rapid response demands of a mega-event.⁵² Lab capacity may also need to be augmented to handle additional testing over a short period of time, particularly to alleviate the effects of false or sensationalized stories spread on social media.⁵³

Public health officials are key to ensuring co-ordination and collaboration of host country resources. They also play an important role in consulting with event staff on infection prevention and control measures, such as ensuring adequate hygiene standards and practices, and promoting public health messages to attendees and the wider public.



CASE STUDY 1. NOROVIRUS OUTBREAK AT PYEONGCHANG 2018

Republic of South Korea

Organizers struggled with a norovirus outbreak during the 2018 PyeongChang Winter Olympics. After identifying a cluster of 41 cases in civilian security guards, all 1,200 civilian security guards were quarantined, and South Korean military personnel took over their duties.⁵⁴ In addition to initial quarantine measures, public health officials and event organizers implemented strategies to prevent the disease spreading – particularly through the Olympic Village and to the athlete population – including: limiting entrance to the athlete's village; distributing hand sanitizer to each room; and promoting public health information, such as key updates from the Korea Centers for Disease Control & Prevention.⁵⁵ While the outbreak remained largely contained among security and other Olympic staff, nearly 200 individuals fell ill with norovirus during the Games. The cause was later found to be linked to contaminated water tanks within portable lavatories used by staff.⁵⁶

Lessons learned: Efficient and robust surveillance is essential for identifying the source of infectious disease outbreaks. Infection control measures, such as hand hygiene and timely public health messaging, can help prevent further spread.



Environmental conditions

Extreme weather conditions (such as excessive heat or cold) along with wider weather and geological hazards – from rain to earthquakes – can sharply increase the demand for healthcare services, and this effect is exacerbated during mass gatherings. Though the effect of these conditions on athletes’ health typically receives more attention, extreme environmental conditions also have health effects for spectators, event staff and the media.

Extreme heat or cold: Exposure to a hot environment may result in a variety of heat-related illnesses – from less severe dehydration to more serious conditions that require immediate management – sometimes leading to the need for hospitalization.^{57,58} In outdoor venues, heat effects are compounded by the risk of sunburn and other skin reactions. Insect bites can also be of concern and can link to the risk of infectious disease spread, as seen with the Zika virus outbreak at the 2014 FIFA World Cup in Brazil.⁵⁹ Extreme heat can also exacerbate chronic conditions, such as asthma, diabetes, and cardiovascular disease, which has been linked to greater use of hospital services.⁶⁰ (See [WISH 2020 Climate Change and Communicable Diseases Report](#), and [Healthy Dry Cities Report](#) for further information.) Meanwhile, extreme cold can lead to hypothermia and frostbite, which both require medical attention.⁶¹

See [WISH 2020 Climate Change and Communicable Diseases Report](#).

See [WISH 2020 Healthy Dry Cities Report](#).

Environmental events: Additional environmental hazards have the potential to strike mass gatherings and affect the host community more broadly. Heavy thunderstorms and snowstorms can lead to an increase in traffic accidents for attendees traveling to events; lightning strikes pose hazards during outdoor events; and structural collapse is possible during heavy snow or flooding. Each hazard has the potential to strain healthcare resources if not adequately managed. As geological hazards such as earthquakes are comparatively rare, there is little evidence on their direct effects on mass gatherings.⁶² Nevertheless, organizers for events in prime earthquake zones – including the Tokyo 2020 and Los Angeles 2028 Olympic Games – should consider contingency planning for these circumstances.

Climate change: Climate change is contributing to more instances of extreme weather events, making it more challenging for health systems to predict demand and plan services accordingly. The 2019 Australian Open in Melbourne, for example, was plagued by poor air quality due to smoke from bushfires linked to climate change; this posed a danger to athletes and spectators, who reported breathing and respiratory problems.⁶³ (See [WISH 2020 Climate Change and Health Report](#) for further information.) Also, several matches were canceled during the 2019 Japan Rugby World Cup due to Typhoon Hagibis.⁶⁴

See [WISH 2020 Climate Change and Health Report](#), page 13.

Pollution: Pollution can affect air and water quality and is an important consideration for the health of participants and attendees. Poor air quality – often common in large, densely populated cities that host major sporting events – is linked to many negative health effects, including coughing, difficulty breathing, and throat and eye irritation. These effects are exacerbated for people with underlying conditions or with prolonged exposure.⁶⁵ Increased traffic and air travel within the city during the event can further increase pollution levels.⁶⁶

Planning for environmental issues

While not all weather or environmental events are avoidable, advanced planning can help to limit their negative health effects. Host countries should work with event organizers to undertake a comprehensive assessment of environmental hazards, building on environmental impact assessments that should have been undertaken in earlier planning phases. Where possible, plans should be implemented to mitigate these risks. Governments should ensure that new event facilities are constructed in conjunction with environmental health teams to guarantee that appropriate controls are in place.⁶⁷

In the case of extreme heat, outdoor or endurance events may be scheduled to avoid the hottest time of day. However, there is often tension with the international governing body, who wish to capture maximum market share from international television audiences, which may occur during sub-optimal times from a health standpoint in the host city.^{68,69,70} Dealing with these tensions requires superior negotiating skills and advanced planning from local organizers.⁷¹

To raise awareness of potential hazards, public health leaders should work with event organizers to promote messaging to participants and attendees around sunscreen use, appropriate clothing, hydration and other actions individual spectators can take.⁷² (See [WISH 2015 Communicating Complex Health Messages Report](#) for further information.)

See [WISH 2015 Communicating Complex Health Messages Report](#), page 4.



CASE STUDY 2. IAAF WORLD ATHLETICS CHAMPIONSHIPS, DOHA 2019

Qatar⁷³

The 2019 IAAF World Athletics Championships were held in Doha, Qatar, where hot and humid conditions are common. To ensure the safety of participants, volunteers and spectators, event organizers worked closely with the Ministry of Public Health and the Qatari meteorological authorities to implement a comprehensive, four-point risk management process:



Comprehensive assessment of meteorological risks

Organizers undertook a retrospective 25-year historical review of temperature and humidity rates, dust storms, and the wet-bulb global temperature index, which is used to gauge the effect of the weather on humans. They used this information to identify the safest times for outdoor events.



Meteorological risk mitigation strategy

Organizers drafted a detailed risk mitigation plan, including steps such as:

- hosting many events inside a climate-controlled stadium
- scheduling outdoor events at night, when temperatures are at a minimum
- a public health information and communication campaign to educate athletes, staff and visitors on climate risks
- additional training for medical staff.



Reassessment of risks following implementation of mitigation strategy

Plans were reviewed, and all outdoor endurance events were scheduled to begin between 11.30pm and midnight to further minimize risks to participants and spectators.



Contingency plan to address residual risks

Contingency measures included:

- further delaying race start times by up to two hours
- rescheduling select races to alternate days
- activating Crisis Units to address additional medical needs.

Lessons learned: Close collaboration between local organizers, the Ministry of Public Health and local weather agencies facilitated comprehensive risk management and seamless co-ordination across multiple stakeholders.



Event population dynamics

The influx of spectators, event staff, and athletes during a large sporting event can put pressure on existing healthcare providers and systems, even without an unexpected event or disease outbreak.

- **Crowd behavior:** Crowds and their behavior can be inherently dangerous. At the 1985 European Cup Final, fans from one team broke through a security barrier. The perimeter wall collapsed, resulting in 38 deaths and more than 400 injuries.⁷⁴ Poor crowd management can lead to a host of issues – from traffic congestion to poor road safety when entering and exiting the event.⁷⁵ Similarly, overcrowding or limited exits within the venue can increase the risk of stampedes and trampling.

Issues of disobedience and alcohol or drug misuse can lead to additional healthcare needs. Violence between rival fans, fueled by alcohol use – inside the stadium and at neighboring spectator locations, such as bars – can result in injury and death. The UEFA Euro 2016 Football Championships, for example, saw multiple instances of violence and disorder, resulting in dozens of injuries.⁷⁶

- **Temporary population increase:** Though unlikely to have a large impact on local services, demand for routine care, tertiary care, and emergency services is likely to increase during large events due to the temporary increase in population in a concentrated area. Emergency services in particular can see an increase in use, as many participants at mega-sporting events are not local to the area and use this service as a gateway to the healthcare system.⁷⁷

Controlling crowds

Risk mitigation plans should include crowd control measures and careful co-ordination of emergency response and medical services by the event organizers, with the active engagement of local police. This should be arranged both on- and off-site by appointing a single point for accountability.

Host countries should ensure that event organizers implement suitable crowd control measures, including sufficient entries/exits to prevent bottlenecks, staggered arrivals, attendance limits, appropriate signposting, and enough staff to control and guide crowds.⁷⁸

Information on emergency evacuations should be clearly signposted to the public, before and throughout the event.

Educating spectators

Well-designed on-site medical services, in conjunction with interventions aimed at curbing alcohol and drug misuse, can decrease pressure on local healthcare systems.

- **On-site medical services:** Provision of on-site medical services in key areas has been shown to reduce the demand for hospital care from attendees, alleviating pressure on local ambulances and hospital services.⁷⁹ The services offered on site should be based on a risk assessment identifying the projected need, which takes into account weather, number of participants, availability of alcohol, and other factors.⁸⁰
- **Alcohol interventions:** Alcohol policies can vary widely across events and countries. Some host countries limit the amount of alcohol available for purchase, while others ban its consumption at events.⁸¹ Euro 2012, for instance, implemented an alcohol-free stadiums policy and used the opportunity to promote public health messaging around responsible alcohol consumption.⁸²
- **Cultural norms:** Briefing spectators and staff on host country cultural norms and expectations before they get to an event provides an opportunity to address behavioral issues. For instance, hosts of the 2019 Japan Rugby World Cup worked with foreign embassies to distribute visitor advice on issues such as local laws and customs, behavioral expectations, and health information.⁸³



CASE STUDY 3. HILLSBOROUGH DISASTER

UK^{84,85}

In an attempt to segregate opposing fans during a Football Association (FA) Cup match at the Hillsborough Stadium in Sheffield, England in 1989, entry to the venue was managed through designated points around the stadium. Due to the limited number of turnstiles opened, thousands of Liverpool fans remained outside the venue just prior to kick-off. Subsequent opening of an additional gate resulted in the uncontrolled entry of more than 2,000 fans through a steep tunnel into already overcrowded sections of the ground. This caused a barrier to collapse, crushing many people and resulting in 96 deaths, and 760 people injured.

A number of key factors led to the catastrophic sequence of events. Organizers did not adopt a systemic approach to risk management and contingency planning. For instance, police and stewards were not informed about which procedures should be followed if an exit gate needed to be opened. Alternative options to ensure safety, such as delaying the start of the match, were not considered. There was also a lack of communication and co-ordination, with staff unclear of their roles, as shown when an additional gate was opened and officers working inside the venue were not given advance warning to prepare for subsequent crowd influx. Finally, the layout of the stadium itself had not been comprehensively evaluated for safety – in part due to gradual and unco-ordinated alterations of a long-standing facility.

Lessons learned: Comprehensive crowd management, contingency planning, communication and co-ordination mechanisms must be in place to prevent incidents from escalating.



Deliberate events

Mass gatherings and mega-events can attract the risk of deliberate large-scale injury or mass casualty events.

Potential terrorist threat: Although unlikely, terrorist attacks remain a risk at major sporting events due to the mass gathering of people in a confined space, and the potential for widespread media coverage.^{86,87} High-profile attacks occurred during the 1972 Munich Olympics, the 1996 Atlanta Olympics, and the 2013 Boston Marathon, resulting in many deaths and injuries.^{88,89,90}

Preparing for possible deliberate events

Disaster preparation and contingency planning are essential to mitigate the risks of deliberate events.

- **Risk assessment:** Prior to the event, public health and health system leaders should work with local police, national security, intelligence authorities, foreign affairs ministries and others to contribute to a comprehensive risk assessment to identify the most likely threats. This should include reviewing whether surveillance systems are able to detect terrorist incidents of a chemical or biological nature.⁹¹ Risk assessments should also include forecasts of the level of care and staffing required on site. On-site medical services should focus on treating minor injuries that do not require hospitalization, and monitoring and identifying any potential threats from unusual activity.
- **Build on contingency plans:** In most countries, local healthcare systems have a contingency plan in place for mass injury events that are not related to sports. These contingency plans should be strengthened to ensure that they are robust and suitable for sporting events too.⁹²
- **Cross-sectoral collaboration:** While public health input is important, cross-sectoral collaboration and information sharing is a crucial factor for success. Yet in many countries, security and intelligence agencies do not freely share information across sectors.⁹³ It is essential for local healthcare systems and emergency responders to be involved in contingency planning for disaster response to minimize the chance of overwhelming local care providers.

SECTION 3. ESTABLISH A HEALTH AND PUBLIC HEALTH LEGACY

Host nations often spend millions of dollars planning for and providing public health interventions and health services to support major sporting events. If managed appropriately, countries can use these investments to benefit the health of their populations in the years to come. However, legacy planning is often not prioritized when dealing with the many stressful demands of delivering a successful event. This lack of deliberate planning and subsequent evaluation often results in a weak or incomplete evidence base to support legacy benefits that arise.

Though much has been written about legacy planning for major sporting events, we have identified four key components that are needed to realize a public health and health focused legacy:

- Behavior change and health promotion.
- Investment in infrastructure and systems.
- Capacity building and training.
- Improved co-ordination and information sharing across agencies.



Behavior change and health promotion

Major sporting events generate significant media attention and provide an opportunity to build on community enthusiasm for active lifestyles. While direct evidence is limited, governments should still consider using the time around these competitions to strengthen health promotion activities.^{94,95} Many countries choose to link healthy eating, increased physical activity, smoking cessation and responsible alcohol consumption messaging with a major event; others also provide structural support, such as smoke-free venues. (See [WISH 2018 Behavioral Insights Report](#) for further information.) The use of social media to target specific groups and increase impact has shown promise.⁹⁶ However, there is a need for evaluation after these campaigns to build the evidence base and identify effective interventions.

See [WISH 2018 Behavioral Insights Report](#), page 23.



Investment in infrastructure and systems

The most visible legacy effects from major sporting events are improvements in infrastructure. Direct investment in healthcare infrastructure – such as new hospitals, clinics, or ambulances – can increase capacity and improve user experience. Expanded or strengthened public health surveillance systems facilitate better tracking of and response to disease threats beyond the end of the event. However, these investments should be made strategically to ensure that there is adequate demand and funding for any expanded services.⁹⁷ Local health and security forces should use emergency preparation for major sporting events to plan for other health threats that may arise in the future.

Infrastructure investments outside of the health sector can improve health. Expanded public transport and improved highway safety can reduce traffic accidents; improved housing options lead to future health benefits.⁹⁸



Capacity building and training

Co-ordination and training of staff – medical, security, emergency medical technicians, and others – for a mega-event can provide the chance to prepare for an emergency response beyond the event. This is an opportunity that might otherwise not occur. Emergency preparedness and contingency planning can result in: better co-ordination across stakeholders; improved understanding of roles and responsibilities; increased number of trained staff; and identification of areas that need improvement.⁹⁹

Major sporting competitions typically rely on mass numbers of volunteers to support event delivery, and this spirit of volunteerism should be encouraged. While there is limited evidence that these events increase community volunteering overall, volunteers themselves report an improvement in their social and leadership skills.¹⁰⁰



Improved co-ordination and information sharing across agencies

Successful delivery of a major sporting event requires the collaboration of multiple stakeholders from health, public health, transport, security and others, who often operate in isolation. Bringing these sectors together for a common purpose provides an opportunity to strengthen working relationships and update policies to improve cross-sectoral organization and integration.¹⁰¹



CASE STUDY 4. PUBLIC HEALTH SURVEILLANCE LEGACY, LONDON 2012

UK^{102,103,104}

Legacy planning was central to London's bid for the 2012 Summer Olympics, including urban and social regeneration of East London, encouraging sports participation and strengthening public health systems. Sports participation, spiked in the weeks before and immediately following the event, though it is unclear whether this was sustained. The public health surveillance systems developed for the event, however, represent a clear and lasting public health legacy.

In the weeks before the Games, the UK Health Protection Agency (now part of the National Institute for Health Protection) developed two new syndromic surveillance systems that analyze real-time health data to provide early detection of potential outbreaks: one was for emergency departments and the other for out-of-hours general practitioner services. This facilitated near real-time collation and dissemination of data to rapidly identify potential public health threats during the Games.

These systems have enhanced surveillance capacity and remain in use – for example, contributing to seasonal surveillance programs for influenza and norovirus.

Lessons learned: Policymakers should ensure that systems and infrastructure developed for major sporting events are sustainable and adaptable to the broader city/country context.



CASE STUDY 5. AIR QUALITY AT BEIJING 2008

China¹⁰⁵

In 2001, after being awarded the 2008 Summer Olympics, Beijing officials invested 140 billion Yuan in a number of air-quality improvement programs. Investments in public transport, such as expanding rail lines and reducing bus and subway fares, targeted individual vehicle emissions; more stringent emissions standards were also introduced. More than 140 factories were closed, relocated, or technically renovated to reduce industrial pollution. Environmental standards for construction sites were strictly enforced. Officials expanded and automated the city's air-quality monitoring system and reported real-time air-quality data through major media outlets. This reporting was coupled with a 'Green Olympics' media campaign to raise public awareness of environmental issues.

As a result, there was a 50 percent reduction in air pollution during the Games compared to previous years, reaching its lowest levels in 10 years. A lasting legacy for Beijing was realized through: improved public transport infrastructure; stricter dust control regulations in the construction industry; emissions standards for vehicles; comprehensive air-quality monitoring equipment; and enhanced public awareness of air-quality issues.

Lessons learned: High-profile sporting events can provide hosts with an opportunity to invest in local improvement initiatives that lead to lasting benefits.

SECTION 4. SHARE LEARNING

Recurring sporting events provide an opportunity for hosts to review performance and, importantly, identify areas to improve for subsequent competitions. Sharing lessons learned will also guide other host nations in how to maximize their health and public health legacies.

Event-specific lessons

While some event organizers, such as the IOC, have structures in place to disseminate lessons learned from one event to the next, there is much to be done in terms of codifying and sharing best practices. Transparent, data-driven evaluations will help future hosts to deliver safer events; and best practice examples can be used more widely to improve the health and public health infrastructures of all countries.

Overall health and public health lessons

The focus of health and public health investments and activities varies across host countries. They have different baseline characteristics, system strengths and weaknesses, and overall health priorities. Despite the differences, the lessons learned from these activities can have a wider application beyond sports gatherings – for example, strengthening contingency plans for mass injury events.¹⁰⁶ Codifying the effectiveness of responses to new threats, such as the current COVID-19 pandemic, will have far-reaching impacts. To maximize this benefit, stakeholders must publish and disseminate this information and add to the evidence base of effective interventions.

SECTION 5. CONCLUSION AND POLICY RECOMMENDATIONS

Despite mixed data on the economic benefits of putting on major sporting events, it is undeniable that sports play a pivotal role in bringing societies together. Hosting these events promotes a sense of pride for host nations and their citizens. Sports spectating is social by nature and so has the ability to promote a wider sense of belonging and social cohesion.

Yet organizing these large and complex events brings with it many challenges, particularly in the healthcare sector. Host countries and cities invest millions of dollars to increase public health and health system capacity and create detailed plans to address unexpected health emergencies. It is therefore imperative to invest wisely and with a view toward a lasting legacy.

Below, we outline three primary health goals for major sporting events, with a number of recommendations to help policymakers to successfully achieve them.

1. Protect health during the event

Protect the health of visitors, spectators, participants, and the local population during the event:

- Increase collaboration and **information sharing** across security (intelligence agencies as well as public safety and law enforcement) and healthcare sectors.
- Support comprehensive **risk management** in conjunction with event organizers – with public health representatives involved from day one.
- Assign a **single point of accountability** for health and health messaging for clarity and consistency (for instance, a Games Chief Medical Officer).
- **Proactively communicate public health messages** to attendees and the broader public in advance of, during, and beyond the event.

2. Establish a health and public health legacy

Use event planning as an opportunity to design a lasting health and public health legacy:

- Assign a **single point of accountability for health and public health legacy** planning to maximize impact (for instance, a Health and Public Health Legacy Officer).
- **Legacy planning should start on day one** and continue beyond the event to maximize the return on investment (ROI).
- Use staff training (medical, security, emergency medical technicians, and so on) as an opportunity for **emergency response preparedness beyond the event**. This is an opportunity that might otherwise not occur.
- Ensure that the **benefits of legacy initiatives are clearly measured** to allow for accurate ROI assessments.

3. Share learning

Ensure that lessons learned are disseminated internationally and to future hosts:

- Identify a list of **quantifiable health and public metrics** to track throughout, contributing to a thorough review of the event and ensuring that recommendations are evidence-based.
- **Commit to a comprehensive assessment of health and public health performance** immediately after the event, as well as at set intervals following its conclusion – this will add to the health legacy evidence base, which is often neglected.
- Produce a **single-source manual that codifies lessons identified and implemented** from the event for the benefit of future hosts.
- Encourage **peer-reviewed publication as well as commentary** and white paper resources.

The nature of the specific sporting event – as well as regional or country-level context and health goals – will influence the implementation of these recommendations. However, we hope that this framework will serve as a helpful starting point for officials who are preparing to host a major sporting event.

KEY DEFINITIONS^{107,108,109,110,111}

Deliberate event – A deliberate event is an act (or threat) involving the intentional release of hazardous substances to cause harm. They can be on a large scale, such as the deliberate release of biological, chemical or radionuclear material for terrorist purposes.

Health – Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

Healthcare – The organized provision of medical care to individuals or a community.

Host – The entity or entities responsible for organizing a mass gathering or mega-event.

Legacy – The assets, capacity and infrastructure developed as a result of hosting a mass gathering.

Mass gathering – The concentration of people at a specific location for a specific purpose over a set period of time and which has the potential to strain the planning and response resources of the country or community.

Mega-event – Public occasions of a fixed duration that attract a large number of visitors, have a wide mediated reach, come with considerable costs and have substantial impacts on the built environment and the population.

Public health – The art and science of preventing disease, prolonging life and promoting health through the organized efforts of society.

Surveillance – The systematic ongoing collection, collation and analysis of data, and the timely dissemination of information to those who need to know it in order for action to be taken.

Syndromic surveillance systems – syndromic surveillance analyzes existing real-time health data to provide early detection of potential outbreaks.

FURTHER RESOURCES

Further resources are listed on the WISH [website](#).

ACKNOWLEDGMENTS

The Forum Advisory Board for this paper was chaired by Abby Hoffman, Senior Executive, Ministry of Health, Canada.

This paper was written by Abby Hoffman in collaboration with Didi Thompson, Institute of Global Health Innovation, Imperial College London, with support from Forum Fellow Steve McAteer, Institute of Global Health Innovation, Imperial College London and Nicolette Davies, Institute of Global Health Innovation, Imperial College London.

Sincere thanks are extended to the members of the advisory board of the WISH 2020 Forum on Health Challenges of Major Sporting Events, who contributed their unique insights to this paper:

- Qanta Ahmed, Associate Professor of Medicine, NYU Langone, New York, USA
- Juan-Manuel Alonso, Sports Medicine Physician, Aspetar Orthopaedic and Sports Medicine Hospital, Qatar
- Paul Arbon, Director, Torrens Resilience Institute, Flinders University, Australia
- Maurizio Barbeschi, Senior Adviser to the Executive Director, WHO Health Emergencies Programme
- Lucille Blumberg, Deputy Director, National Institute for Communicable Diseases, South Africa
- Tina Endericks, Head of Global Health Security, Public Health England, UK
- Adam Lund, Clinical Associate Professor, Royal Columbian and Eagle Ridge Hospital, Department of Emergency Medicine, and Academic Director, Mass Gathering Medicine Interest Group, University of British Columbia, Canada
- Brian McCloskey, Senior Consulting Fellow, Global Health Programme, Chatham House, UK
- Sheila Turris, Adjunct Professor, Department of Emergency Medicine, and co-lead Mass Gathering Medicine Interest Group, University of British Columbia, Canada
- Alimuddin Zumla, Professor of Infectious Diseases and International Health, University College London

The interviews that informed this report were conducted by Didi Thompson. The Chair and authors thank all who contributed. Any errors or omissions remain the responsibility of the authors.

We would like to thank the WISH team for their support and guidance in preparing this report: Nicolette Davies, Gianluca Fontana, and Niki O'Brien, Institute of Global Health Innovation, Imperial College London.

REFERENCES

1. Shazi N. *10 most-watched sport events in the history of television*. Huffington Post. www.huffingtonpost.co.uk/2018/02/21/10-most-watched-sport-events-in-the-history-of-television_a_23367211 [accessed 10 August 2020].
2. Gough C. *Average and total attendance at FIFA football World Cup games from 1930 to 2018*. Statista. www.statista.com/statistics/264441/number-of-spectators-at-football-world-cups-since-1930 [accessed 10 August 2020].
3. Office of the Commonwealth Games, Department of Innovation, Tourism Industry Development and the Commonwealth Games. *Gold Coast 2018 Commonwealth Games: Post Games report*. State of Queensland; 2019.
4. Reed J. *2018 Winter Olympics finally reaches 1 million in attendance*. Sportsnaut. sportsnaut.com/2018/02/2018-winter-olympics-finally-reaches-1-million-attendance [accessed 10 August 2020].
5. Glasgow City Council. *Glasgow attracted worldwide TV audience of more than 1 billion as attendance figures smashed*. www.glasgow.gov.uk/article/24739/Glasgow-2018-attracted-worldwide-TV-audience-of-more-than-1-billion-as-attendance-figures-smashed [accessed 10 August 2020].
6. International Olympic Committee. *Curtain comes down on a record-breaking Buenos Aires 2018*. www.olympic.org/news/curtain-comes-down-on-a-record-breaking-buenos-aires-2018 [accessed 10 August 2020].
7. Hula E. *Jakarta 2018 on course to break attendance, merchandise sales targets*. Around the Rings. aroundtherings.com/site/A__74403/Title__Jakarta-2018-On-Course-to-Break-Attendance-Merchandise-Sales-Targets/292/Articles [accessed 10 August 2020].
8. International Paralympic Committee. *PyeongChang 2018: Record ticket sales*. www.paralympic.org/news/pyeongchang-2018-record-ticket-sales [accessed 10 August 2020].
9. Ryder Cup Europe. *Economic activity from 2018 Ryder Cup exceeds €235 million*. www.rydercup.com/news-media/economic-activity-from-2018-ryder-cup-exceeds-235-million [accessed 10 August 2020].
10. Braden K. *Attendance facts and figures from the 2018 Men's World Championships*. VolleyMob. volleymob.com/attendance-facts-and-figures-from-the-2018-mens-world-championships [accessed 10 August 2020].
11. US Equestrian. *Attendance to the Alltech FEI World Equestrian Games tops half million*. www.usef.org/media/press-releases/6289_attendance-to-the-alltech-fei-world-equestrian-games-tops-half-million [accessed 10 August 2020].
12. Braden K. *Women's Volleyball World Championship attendance falls 32% in 2018*. VolleyMob. volleymob.com/womens-volleyball-world-championship-attendance-falls-32-in-2018 [accessed 10 August 2020].
13. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.

14. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
15. Müller M. What makes an event a mega-event? Definitions and sizes. *Leisure Studies*. 2015; 34(6), P627–642.
16. Oldenboom ER. *Costs and Benefits of Major Sports Events: A Case Study of Euro 2000*. Amsterdam: Meerwaade; 2006.
17. Chalip L, Green BC, Hill B. Effects on sport event media on destination image and intention to visit. *Journal of Sport Management*. 2003; 17, P214–234.
18. Gripsrud G, Nes E, Olsson U. Effects of hosting a mega-sport event on country image. *Event Management*. 2010; 14(3), P193–204.
19. Zimbalist A. *Circus Maximus: The economic gamble behind hosting the Olympics and the World Cup*. Washington, DC: Brookings Institution Press; 2015.
20. Molloy E, Chetty T. The rocky road to legacy: Lessons from the 2010 FIFA World Cup South Africa Stadium Program. *Project Management Journal*. 2015; 46(3), P88–107.
21. Müller M. After Sochi 2014: Costs and impacts of Russia's Olympic Games. *Eurasian Geography and Economics*. 2014; 55(6), P628–655.
22. Al Jazeera. *Coronavirus: What sporting events are affected by the pandemic?* www.aljazeera.com/news/2020/03/coronavirus-sporting-events-affected-outbreak-200310084205890.html [accessed 22 July 2020].
23. McCartney G, et al. The health and socioeconomic impacts of major multi-sport events: systematic review (1978–2008). *BMJ*. 2010; 340, c2369.
24. Mahtani KR, et al. Can the London 2012 Olympics “inspire a generation” to do more physical or sporting activities? An overview of systematic reviews. *BMJ Open*. 2013; 3, e002058.
25. MacAuley D. The health legacy of hosting major sporting events. *Canadian Medical Association Journal*. 2015; 187(17), P1267.
26. Preuss H, Solberg HA. Attracting major sporting events: The role of local residents. *European Sport Management Quarterly*. 2006; 6, P391–411.
27. Solberg HA, Ulvnes AM. Major sports events – the reasons for hosting them. *European Journal of Sports Studies*. 2016; 4.
28. Preuss H, Solberg HA. Attracting major sporting events: The role of local residents. *European Sport Management Quarterly*. 2006; 6, P391–411.
29. Norris E, Rutter J, Medland J. *Making the Games: What we can learn from London 2012*. London: Institute for Government; 2013.
30. Abubakar I, et al. Global perspectives for prevention of infectious diseases associated with mass gatherings. *The Lancet Infectious Diseases*. 2012; 12, P66–74.
31. Lim HC, et al. The influenza A (H1N1–2009) experience at the inaugural Asian Youth Games Singapore 2009: Mass gathering during a developing pandemic. *British Journal of Sports Medicine*, 2010; 44, P528–532.

32. BBC. *Winter Olympics: Swiss athletes hit by norovirus outbreak*. BBC News. www.bbc.co.uk/news/world-asia-43082002 [accessed 10 August 2020].
33. McCloskey B, et al. London 2012 Olympic and Paralympic Games: Public health surveillance and epidemiology. *The Lancet*. 2014; 383, P2083-2089.
34. World Health Organization. *The Health Legacy of the 2008 Beijing Olympics Games: Successes and recommendations*. Geneva: World Health Organization Western Pacific Region; 2008.
35. Moy GG, Han F, Chen J. Ensuring and promoting food safety during the 2008 Beijing Olympics. *Foodborne Pathogens and Disease*. 2010; 7, P981-983.
36. McCloskey B, et al. London 2012 Olympic and Paralympic Games: Public health surveillance and epidemiology. *The Lancet*. 2014; 383, P2083-2089.
37. Abubakar I, et al. Global perspectives for prevention of infectious diseases associated with mass gatherings. *The Lancet Infectious Diseases*. 2012; 12, P66-74.
38. Killion A. *Sports is plotting a return. The stakes are huge*. San Francisco Chronicle. www.sfchronicle.com/sports/annkillion/article/Sports-can-help-lead-societal-recovery-from-15259341.php [accessed 10 August 2020].
39. Nuki P. *Revealed: The three UK sporting events that may have led to a coronavirus death spike*. The Telegraph. www.telegraph.co.uk/global-health/science-and-disease/revealed-three-uk-sporting-events-may-have-led-coronavirus-death [accessed 10 August 2020].
40. Hall V, et al. Olympics and Paralympics 2012 mass gathering in London: Time-series analysis shows no increase in attendances at sexual health clinics. *Sexually Transmitted Infections*. 2015; 91(8), P592-597.
41. Pitts SR. The Sherman effect: Decreased ambulatory care volumes in Atlanta during the 1996 Olympic Games. *The Medical Journal of Australia*. 2000; 173, P309-311.
42. McNulty A, Rohrsheim R, Donovan B. Demand for sexual health services during the Olympic Games: Both sides of the Sherman effect. *International Journal of STD & AIDS*. 2003; 14, P307-308.
43. Aarons E. Coronavirus and sport – a list of the major cancellations. *The Guardian*. www.theguardian.com/sport/2020/mar/13/coronavirus-and-sport-a-list-of-the-major-cancellations [accessed 10 August 2020].
44. World Health Organization (WHO). *Key planning recommendations for mass gatherings in the context of the current COVID-19 outbreak. Interim guidance*. 29 May, 2020. Geneva: WHO; 2020. www.who.int/publications/i/item/key-planning-recommendations-for-mass-gatherings-in-the-context-of-the-current-covid-19-outbreak [accessed 10 August 2020].
45. World Athletics. *In stadium outdoor athletics competition – COVID 19 guidelines*. 10 June 2020. www.worldathletics.org/download/download?filename=a12b1d02-0871-47bf-939f-7f2dec71b4a5.pdf&urlslug=in-stadium-outdoor-athletics-competition-co [accessed 7 October 2020].

46. Carmody S, et al. When can professional sport recommence safely during the COVID-19 pandemic? Risk assessment and factors to consider. *British Journal of Sports Medicine*. 2020; 54(16), 946–948.
47. Phillips M. *Football's coming back, but empty stadiums could push smaller clubs to the brink*. BisNow. 15 June 2020. www.bisnow.com/london/news/commercial-real-estate/footballs-coming-back-but-empty-stadiums-could-push-smaller-clubs-to-the-brink-104815 [accessed 10 August 2020].
48. McCarthy K. Tokyo Marathon takes place for elite runners on empty streets. *Runner's World*. 2 March 2020. www.runnersworld.com/uk/news/a31184971/tokyo-marathon-coronavirus [accessed 10 August 2020].
49. Stein M. As N.B.A. teams arrive at Disney, focus turns to keeping the virus out. *The New York Times*. 7 July 2020. www.nytimes.com/2020/07/07/sports/basketball/nba-disney-world-bubble.html [accessed 10 August 2020].
50. Pavitt, M. Coronavirus countermeasures panel expect adjustments to ensure safety of Tokyo 2020. *Inside the Games*. 4 September 2020. www.insidethegames.biz/articles/1098047/tokyo-2020-coronavirus-countermeasures [accessed 2 October 2020].
51. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
52. McCloskey B, et al. London 2012 Olympic and Paralympic Games: Public health surveillance and epidemiology. *The Lancet*. 2014; 383, P2083–2089.
53. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
54. Snyder M. *Olympic fever: Infectious diseases at the winter games*. Outbreak Observatory, John Hopkins Bloomberg School of Public Health/Center for Health Security. www.outbreakobservatory.org/outbreakthursday-1/2/8/2018/olympic-fever-infectious-diseases-at-the-winter-games [accessed 10 August 2020].
55. Kim DS, et al. PyeongChang 2018 Winter Olympic Games and athletes' usage of 'polyclinic' medical services. *BMJ Open Sport & Exercise Medicine*. 2019; 5(1), e000548.
56. Etchells D. *Norovirus outbreak at PyeongChang 2018 caused by toilet water tanks*. The Sport Digest. thesportdigest.com/2018/03/norovirus-outbreak-at-pyeongchang-2018-caused-by-toilet-water-tanks [accessed 10 August 2020].
57. Yezli S, et al. Knowledge, attitude and practice of pilgrims regarding heat-related illnesses during the 2017 Hajj Mass Gathering. *International Journal of Environmental Research and Public Health*. 2019; 17(17), P3215.
58. Tavan A, et al. Risks threatening the health of people participating in mass gatherings: A systematic review. *Journal of Education Health Promotion*. 2019; 8, P209.
59. Gallego V, et al. The 2014 FIFA World Cup: Communicable disease risks and advice for visitors to Brazil – A review from the Latin American Society for Travel Medicine (SLAMVI). *Travel Medicine and Infectious Disease*. 2014; 12, P208–218.

60. Feldman LY, et al. Estimating Toronto's health services use for the 2015 Pan American and Parapan American games. *Perspectives in Public Health*. 2016; 136, P93–98.
61. Gocotano AE, et al. Exposure to cold weather during a mass gathering in the Philippines. *Bulletin of the World Health Organization*. 2015; 93, P810–814.
62. Soomaroo L, Murray V. Weather and environmental hazards at mass gatherings. *PLoS Currents*. 2012; 4, e4fca9ee30afc4.
63. Green C, Smidt R. *What the Australian bushfires tell us about climate change*. United Nations Foundation. unfoundation.org/blog/post/what-australian-bushfires-tell-us-about-health-and-climate-change [accessed 10 August 2020].
64. Busfield S. *Typhoon stops play at Rugby World Cup*. Forbes. www.forbes.com/sites/stevenbusfield/2019/10/12/typhoon-hagibis-stops-play-at-rugby-world-cup/#5330ddaf3513 [accessed 10 August 2020].
65. Brocherie F, Girard O, Millet G. Emerging environmental and weather challenges in outdoor sports. *Climate*. 2015; 3(3), P492–521.
66. Campelli M. *Air pollution: Tackling sport's invisible threat*. The Sustainability Report. sustainabilityreport.com/2020/04/23/air-pollution-tackling-sports-invisible-threat [accessed 10 August 2020].
67. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
68. Mountjoy M, et al. Hyperthermic-related challenges in aquatics, athletics, football, tennis and triathlon. *British Journal of Sports Medicine*. 2012; 46(11), P800–804.
69. Bermon S, Adami PE. Meteorological risks in Doha 2019 Athletics World Championships: Health considerations from organizers. *Frontiers in Sports and Active Living*. 2019; 1, P58.
70. Nakamura S, et al. Health risks and precautions for visitors to the Tokyo 2020 Olympic and Paralympic Games. *Travel Medicine and Infectious Disease*. 2018; 22, P3–7.
71. Vanos JK, et al. Planning for spectator thermal comfort and health in the face of extreme heat: The Tokyo 2020 Olympic marathons. *Science of the Total Environment*. 2019; 657, P904–917.
72. Soomaroo L, Murray V. Weather and environmental hazards at mass gatherings. *PLoS Currents*. 2012; 4, e4fca9ee30afc4.
73. Bermon S, Adami PE. Meteorological risks in Doha 2019 Athletics World Championships: Health considerations from organizers. *Frontiers in Sports and Active Living*. 2019; 1, P58.
74. Elliott D, Smith D. Football stadia disasters in the United Kingdom: Learning from tragedy? *Industrial & Environmental Crisis Quarterly*. 1993; 7(3), P205–229.
75. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
76. BBC. *Euro 2016: Violence mars England-Russia match*. BBC News. www.bbc.co.uk/news/uk-36506917 [accessed 10 August 2020].

77. Salhanick SD, Sheahan W, Bazarian JJ. Use and analysis of field criteria for mass gatherings. *Prehospital and Disaster Medicine*. 2003; 18, P347–352.
78. Steffen R, et al. Non-communicable health risks during mass gatherings. *The Lancet Infectious Diseases*. 2012; 12, P142–149.
79. Steffen R, et al. Non-communicable health risks during mass gatherings. *The Lancet Infectious Diseases*. 2012; 12, P142–149.
80. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
81. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
82. Smallwood C, et al. Euro 2012 European Football Championship Finals: Planning for a health legacy. *The Lancet*. 2014; 383, P2090–2097.
83. McElhinney D. *The Rugby World Cup fan etiquette guide: Japan behavior dos & don'ts*. Tokyo Weekender. www.tokyoweekender.com/2019/09/the-rugby-world-cup-fan-etiquette-guide-japan-behavior-dos-donts [accessed 10 August 2020].
84. Tikkan A. *Hillsborough disaster*. Encyclopedia Britannica. www.britannica.com/event/Hillsborough-disaster [accessed 10 August 2020].
85. Challenger R, Clegg CW. Crowd disasters: A socio-technical systems perspective. *Contemporary Social Science*. 2011; 6(3), P343–360.
86. US House of Representatives, Committee for Homeland Security. *Public Health, Safety and Security for Mass Gatherings*. Washington, DC: Committee for Homeland Security; 2008.
87. Steffen R, et al. Non-communicable health risks during mass gatherings. *The Lancet Infectious Diseases*. 2012; 12, 142–149.
88. Feliciano DV. Management of casualties from the bombing at the Centennial Olympics. *The American Journal of Surgery*. 1998; 176, P538–543.
89. Richards A. *Terrorism and the Olympics: Major Event Security and Lessons for the Future*. New York: Routledge; 2010.
90. CNN. *Boston Marathon terror attack fast facts*. edition.cnn.com/2013/06/03/us/boston-marathon-terror-attack-fast-facts/index.html [accessed 10 August 2020].
91. Buehler JW, et al. Syndromic surveillance and bioterrorism-related epidemics. *Emerging Infectious Diseases*. 2003; 9, P1197.
92. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
93. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
94. Craig CL, Bauman AE. The impact of the Vancouver Winter Olympics on population level physical activity and sport participation among Canadian children and adolescents: Population based study. *International Journal of Behavioral Nutrition and Physical Activity*. 2014; 11, P107.

95. Mahtani KR, et al. Can the London 2012 Olympics “inspire a generation” to do more physical or sporting activities? An overview of systematic reviews. *BMJ Open*. 2013; 3, e002058.
96. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
97. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
98. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
99. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
100. Kemp S. The hidden workforce: Volunteers’ learning in the Olympics. *Journal of European Industrial Training*. 2002; 26, P109–116.
101. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
102. McCloskey B, et al. London 2012 Olympic and Paralympic Games: Public health surveillance and epidemiology. *The Lancet*. 2014; 383, P2083–2089.
103. Lee YH, Kim JM. Olympic health legacy: Essentials for lasting development of host city. *Journal of Lifestyle Medicine*. 2013; 3(1), P9–18.
104. Elliot AJ, et al. Syndromic surveillance – a public health legacy of the London 2012 Olympic and Paralympic Games. *Public Health*. 2013; 127(8), P777–781.
105. Fitch K, et al. Air quality and control. In Dapeng J, Ljungqvist A, Troedsson H (eds). *The Health Legacy of the 2008 Beijing Olympic Games: Successes and recommendations*. Geneva: World Health Organization; 2010. P106–115.
106. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
107. World Health Organization. *Public Health for Mass Gatherings: Key considerations*. Geneva: World Health Organization; 2015.
108. Rechel B, McKee M. *Facets of Public Health in Europe*. European Observatory on Health Systems and Policies Series. Maidenhead: Open University Press; 2014.
109. World Health Organization. *Preamble to the Constitution of WHO as adopted by the International Health Conference, New York, 19 June – 22 July 1946; signed on 22 July 1946 by the representatives of 61 States*. Official Records of World Health Organization. 2, P100.
110. Oxford English Dictionary. *healthcare*. www.lexico.com/definition/healthcare [accessed 15 August 2020].
111. Acheson D. *Acheson Report: Independent inquiry into inequalities in health report*. London: The Stationery Office; 1988.

WISH RESEARCH PARTNERS



WISH gratefully acknowledges the support of the Ministry of Public Health



THE AGA KHAN UNIVERSITY

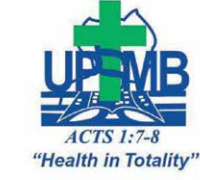


Changi
General Hospital
SingHealth



醫院管理局
HOSPITAL
AUTHORITY





ISBN 978-1-9139910-4-3



9 781913 991043 >

www.wish.org.qa