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.

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"Healthy Hajj 2019" — what you need to know, before you go

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In August 2019, Saudi Arabia (KSA) will host the largest annual mass gathering; the Hajj. In its 1436 year history [1], the 2019 Hajj event will be the largest in volume (projected to exceed 2.2 million international attendees). As it attracts pilgrims from over 180 countries, and with the ever increasing infectious disease threats, the Hajj is a closely watched event of significance to global public health [1–3].While the pilgrims and their families make preparations for the journey, both the Saudi health authorities and international public health stakeholders are on high alert in the months before and after Hajj [1–5]. Preceding the Hajj, the stakeholders debate and formulate advisories around hypothetical scenarios of *"what if"* (potential spread of ongoing disease outbreaks), and "*what will*" (emerge as new threats during the Hajj). Post-Hajj, the scenarios are much more challenging as we try to assess "*what was transmitted*" and "*where did it go*" in a global landscape of patchy and non-standardized disease surveillance systems. Adding to the conundrum is the ever increasing volume of pilgrims to the Kingdom of Saudi Arabia (KSA), with a projected 4.5 million annual attendees by 2030; and the lesser known, year-around, religious ritual, the Umrah (30 million pilgrims), during which some diseases may have already been transmitted and Hajj-related travelers can unknowingly amplify transmission.

Disease outbreaks are of key importance for Hajj pilgrims. While 19 diseases top the World Health Organization (WHO)'s watch list (Box 1), the reported outbreaks of the recent 12 months that made headlines include the Ebola (Congo, Uganda), wild and vaccine derived polio in 27 countries (in 3 endemic, 10 outbreak, 14 polio high-risk), measles in an ever expanding list of countries (163 in 2018, 170 in 2019), Nipah in Kerala (India), yellow fever in Nigeria, Brazil and one imported case in the Netherlands ex Gambia, and MDR typhoid in Pakistan [6,7]. Shadowed by these outbreaks are the persistent and rapidly changing types influenza viruses and their pandemic potential, the uncertain course of the MERS-CoV which is still circulating in Saudi Arabia, frequent outbreaks of chikungunya (recently in Sudan), and cholera (in multiple countries). Furthermore, the risk of transmission of tuberculosis, respiratory infections [8], and antimicrobial resistance remains.

There are no '*one-size-fits-all*' transmission scenarios, threat levels or countermeasures that are applicable to all these conditions during the Hajj. The Hajj will bring people from over 180 countries in the most possible dense human gathering (with 6–8 persons per square meter). The majority of the Hajj pilgrims are elderly (43%: 56 years of age or older), many have preexisting health conditions (50%), originate from developing countries with low income (66%), from countries that are in conflict (18%), or those have suboptimal health care and disease surveillance or prevention education. In addition, the intense and exhausting nature of the pilgrimage rituals and the extreme desert temperature, all create a unique environment for infectious disease transmission and allow outbreaks to go undetected before reaching epidemic thresholds [1–3,8,9].

Saudi Arabia, with global stakeholder consultation and collaboration, implements specific visa-dependent public health measures such as a mandatory meningococcal vaccine, publishes advisories, advocates pilgrim home country partnerships in disease prevention, and operates and finances a well-established Hajj health clinical care service provided free of cost to pilgrims. For the 2019 Hajj, quadrivalent meningococcal vaccine for all pilgrims aged two years and older and yellow fever and polio vaccines for pilgrims arriving from endemic countries will be a requirement for Hajj visa, while influenza vaccine (southern hemisphere seasonal influence vaccine), pneumococcal vaccine and updated basic adult vaccines are recommended[Box 2]. [4,5] In addition, decolonization of *N meningitidis* with a single dose of ciprofloxacin will be administered at the ports of entry for pilgrims coming from the African meningitis belt. Waterborne and mosquito borne diseases have been minimized in recent Hajj events due to public health measures. Hajj health advisories are frequently updated by the WHO and the Saudi health ministry [4,5].

While these robust efforts can help minimize disease transmission at the Hajj, they may fall short of addressing the broader challenges. First of all, health advisories and vaccination requirements for participation in Hajj are based on known threats and countermeasures and may not offer '*carte blanche*' protection against other infectious diseases that emerge (eg: novel influenza viruses) or the changing geography of transmission (eg: Nipah, 2018). Secondly, potential Hajj-related transmission risk is not just for the Hajj pilgrims. As Hajj pilgrims mingle with other passengers and airline staff inflight, transit airports and airline hubs, any transmitted infection by a pilgrim is a risk for all travelers, and ultimately for their home communities and the "global

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Box 1
Pandemic and epidemic prone diseases, 2019[6]

- Chikungunya
- Cholera
- Crimean-Congo haemorrhagic fever
- Ebola virus disease
- Hendra virus infection
- Influenza (pandemic, seasonal, zoonotic)
- Lassa fever
- Marburg virus disease
- Meningitis
- MERS-CoV
- Monkeypox
- Nipah virus infection
- Plague
- Rift Valley fever
- SARS
- Smallpox
- Tularaemia
- Yellow fever
- Zika virus disease

Box 2
The 2019 vaccination and health requirements for Hajj attendees[4,5]

Mandatory Vaccines:

- Quadrivalent meningococcal vaccine for pilgrims age 2 years or older
- Yellow Fever for pilgrims from yellow fever, endemic countries
- Polio vaccine for pilgrims arriving from countries with ongoing polio transmission

Recommended Vaccines:

- Pneumococcal vaccine for high risk pilgrims
- Seasonal influenza vaccine for all pilgrims
- Updated childhood vaccination (MMR, VZV, HAV, HBV, Polio, Tetanus, Diphtheria)

village" that is our world.

In our interconnected world, a disease emerging anywhere can achieve global significance in 36 hours, and therefore, additional efforts by all including the pilgrims' home country intuitions, individual pilgrims, non-pilgrim travelers, and transportation companies will be required to minimize the potential of disease acquisition and transmission. While the WHO International Health Regulations provide the platform for coordination among countries, travel health services (both in the host and home countries) can serve as venues to alert patients on asymmetrical disease threats and ensure the practice of the highest level of personal protection. In addition to explicitly recommended measures in WHO and Saudi communiques [4,5], pilgrims need to maintain good personal hygiene and health measures, comply with adequate treatment for existing co-morbidities such as diabetes, and seek medical care when needed. As shown by the containment of recent Nipah outbreak in Kerala, early reporting of illness to health authorities can help authorities to detect emerging threats and to mount and coordinate control efforts. Health care providers and disease surveillance entities around the world need to be aware of this seasonal annual event to enable early assessment of unusual symptoms and disease patterns. With these simple measures, each pilgrim, each travel health care provider, each surveillance officer can contribute to protecting the health of all pilgrims, and thereby the rest of the world.

Have a safe and healthy Hajj 2019.

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