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Perspective

# The Hajj 2019 Vaccine Requirements and Possible New Challenges

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**ABSTRACT**

Each year millions of pilgrims perform the annual Hajj from more than 180 countries around the world. This is one of the largest mass gathering events and may result in the occurrence and spread of infectious diseases. As such, there are mandatory vaccinations for the pilgrims such as meningococcal vaccines. The 2019 annual Hajj will take place during August 8–13, 2019. Thus, we review the recommended and mandated vaccinations for the 2019 Hajj and Umrah. The mandatory vaccines required to secure the visa include the quadrivalent meningococcal vaccine for all pilgrims, while yellow fever, and poliomyelitis vaccines are required for pilgrims coming from countries endemic or with disease activity. The recommended vaccines are influenza, pneumococcal, in addition to full compliance with basic vaccines for all pilgrims against diphtheria, tetanus, pertussis, polio, measles, and mumps. It is imperative to continue surveillance for the spread of antimicrobial resistance and occurrence of all infectious diseases causing outbreaks across the globe in the last year, like Zika virus, MDR-Typhoid, Nipah, Ebola, cholera, chikungunya and Middle East Respiratory Syndrome Coronavirus.



## 1. INTRODUCTION

Each year millions of people from more than 180 countries gather to perform the annual Hajj pilgrimage in Makkah, Saudi Arabia. The Hajj season occurs at a fixed time each year from 8th to 13th day of the 12th month (Dhu al-Hijjah) in the Islamic calendar [1]. The Islamic/Lunar calendar is 11 days shorter than the Gregorian calendar [1]. This year the annual Hajj is expected to take place during August 8–13, 2019. The annual Hajj is one of the largest recurring mass gathering in the world and is the most studied mass gathering [1–8]. The number of pilgrims traveling to Saudi Arabia is based on the number of Muslims in each country and is calculated as one pilgrim per 1000 Muslims in the specific country [7]. The annual pilgrimage number had increased from 58,584 in 1920 to 3,161,573 in 2012 and of those pilgrims in 2012 about 1,752,932 were international pilgrims coming from outside Saudi Arabia [5]. The international pilgrims arrive to Saudi Arabia mainly by air and others may travel via land [4,8,9]. In previous years, there were occurrences of Hajj-related outbreaks [10–14] such as the 1987 international meningococcal disease outbreak caused by *Neisseria meningitidis* serogroup A [15–17], and serogroup W135 [18], and the 2000–2001 *N. meningitidis* outbreak [14,15]. Thus, the annual Hajj requirements are updated annually in response to the occurrence of newly emerging infectious diseases such as Middle East Respiratory Syndrome Coronavirus (MERS-CoV) [1,6,19] and the occurrence of international outbreaks such as Ebola [7,8]. The recommended vaccinations for the Hajj are updated annually [6–9,20]. The 2019 required and recommended vaccinations were issued by the Saudi Ministry of Health [20]. Here, we summarize the 2019 Hajj mandatory and recommended vaccinations and discuss the possible impact of newly occurring outbreaks internationally, one of the most globally spread outbreaks is measles [21–23].

## 2. MANDATORY AND RECOMMENDED VACCINATION FOR THE 2019 HAJJ

The recommended and mandatory vaccinations for pilgrims are summarized in Table 1. These vaccines include mandatory vaccinations (meningococcal vaccination, poliomyelitis vaccine, and yellow fever vaccine); recommended vaccination (influenza), and other immunization against vaccine-preventable diseases (diphtheria, tetanus, pertussis, polio, measles and mumps).

### 2.1. Meningococcal Vaccination

The carriage rate of *N. meningitidis* was 3.4% arriving pilgrims [24]. The requirement of a bivalent A and C meningococcal vaccine for

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**Table 1** | Required and recommended vaccination for the 2019 Hajj season

| | Pilgrims coming from | Vaccination |
|---|---|---|
| Yellow fever | Africa:<br>Angola, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Ethiopia, Gabon, Guinea, Guinea-Bissau, Gambia, Ghana, Kenya, Liberia, Mali, Mauritania, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Sudan, South Sudan, Togo and Uganda<br>South and Central America:<br>Argentina, Venezuela, Brazil, Colombia, Ecuador, French Guiana, Guyana, Panama, Paraguay, Peru, Bolivia, Suriname, and Trinidad and Tobago | • Yellow fever vaccination (≥10 days after the date of vaccination)<br>• If no proof of vaccination, pilgrims will be placed under surveillance for 6 days from the last date of potential exposure |
| Meningococcal vaccine (polysaccharide or conjugate) | (a) Any visitor | (a) Vaccination with ACYW135: vaccine within the last 3 years (polysaccharide vaccines); within 5 years (conjugate vaccines), and >10 days before arriving Saudi Arabia |
| | (b) Visitors from African meningitis belt: Benin, Burkina Faso, Cameroon, Chad, Central African Republic, Côte d'Ivoire, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Mali, Niger, Nigeria, Senegal and Sudan | (b) ACYW135 vaccine (as above) |
| | (c) Pilgrims from within Saudi and the Hajj workers: all citizens and residents of Medina and Makkah | (c) ACYW135 vaccine (as above) |
| Poliomyelitis | (a) Pilgrims from areas with active poliovirus transmission of a wild or vaccine-derived poliovirus: Afghanistan, Nigeria and Pakistan | (a) At least one dose of bivalent oral polio vaccine (bOPV), or inactivated poliovirus vaccine (IPV), in the last 12 months and ≥ 4 weeks prior to departure |
| | (b) Countries at risk of polio reintroduction: Cameroon, Central African Republic, Chad, Guinea, Laos People's Democratic Republic, Madagascar, Myanmar, Niger, and Ukraine | (b) As above |
| | (c) Countries which remain vulnerable to Polio: Afghanistan, Nigeria, Pakistan, Papua New Guinea, Syria, Myanmar, Yemen and Somalia | (c) As above and additionally those pilgrims will receive 1 dose of OPV on arrival to Saudi Arabia |
| Seasonal influenza | All pilgrims (internal and international) and all health-care workers in the Hajj area | A recommendation |
| Cholera | | No specific vaccine requirement |

pilgrims came in effect in 1987 after the occurrence of meningococcal outbreaks [8], and the quadrivalent (A,C,Y, W135) vaccine became a requirement May 2001 [25,26] after the occurrence of two meningococcal outbreaks with serogroup W135 in 2000 and 2001 [27–29]. Subsequent to the introduction of the meningococcal vaccination during the Hajj, the mean numbers of cases per year of Hajj-related invasive meningococcal disease decreased from 13 in 1995 to 2 cases in 2011 [26]. A meningococcal vaccine is required for all pilgrims and specifically a conjugate vaccine is required for healthcare workers working at the Hajj. In a previous study, 97-100% of international pilgrims had the recommended meningococcal vaccination with the quadrivalent vaccine [24]. In recent years, *N. meningitidis* serogroup B vaccine became available [30] and a study showed that the majority of 3.4% of pilgrims with *N. meningitidis* carriage were due to serogroup B [24]. However, it was felt that this vaccine is not required due to insufficient data from the Hajj [24]. In previous years, ciprofloxacin (500 mg tablets) was administered as an oral chemoprophylaxis to pilgrims arriving from the African meningitis belt [6,8,15,31,32]. These recommendations were based on studies showing the carriage rate of *N. meningitidis* of 3.6% and 1.4% in a paired cohort of pilgrims from high endemic countries at arrival and departure, respectively [24]. However, the role of ciprofloxacin in eradicating the carrier sates of *N. meningitidis* showed a rate of 5.2% before and 4.6% after the Hajj following a single dose of ciprofloxacin ($p = 0.65$) [33]. The carriage rate of *N. meningitidis* among returning pilgrims varies from 0% to 0.6% [33–36]. Thus, ciprofloxacin was not adopted as a strategy post-Hajj and the current recommendations from the Ministry of Health in Saudi Arabia reserve the option to administer prophylactic antibiotics to some travelers at the points of entry if deemed necessary [20].

## 2.2. Poliomyelitis

Although poliomyelitis is a vaccine preventable disease, its eradication is delayed by the potential spread by international travelers [37]. The number of poliomyelitis in 2018 and 2019 across many countries is shown in Figure 1, data were based on the Polio Global Eradication Initiative [38]. According to the World Health Organization, Saudi Arabia had been poliomyelitis free since October, 1995 [39]. However, a case was reported on January 24, 1998, and the virus was closely related to a strain in Afghanistan/Pakistan, and another case in 2004 was in a Sudanese child [39]. Based on a mathematical model, there is a possibility of 21 importations of poliovirus into Saudi Arabia via Hajj pilgrims [40]. Of the total 1,722,372 pilgrims in 2017, 25% were from polio priority countries [41]. It is also important to note that poliomyelitis is a disease of children <5 years old and the number of those among pilgrims is very small [42]. The Hajj requirement for people coming from polio priority countries is summarized in Table 1 and Figure 1.

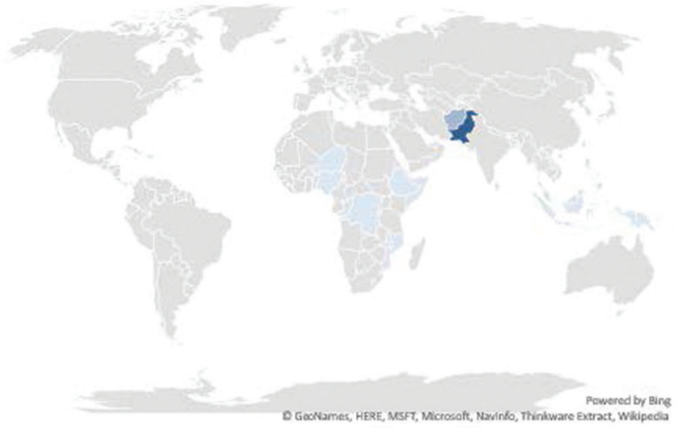


**Figure 1** | A world map showing countries where pilgrims are required to have poliomyelitis vaccination.

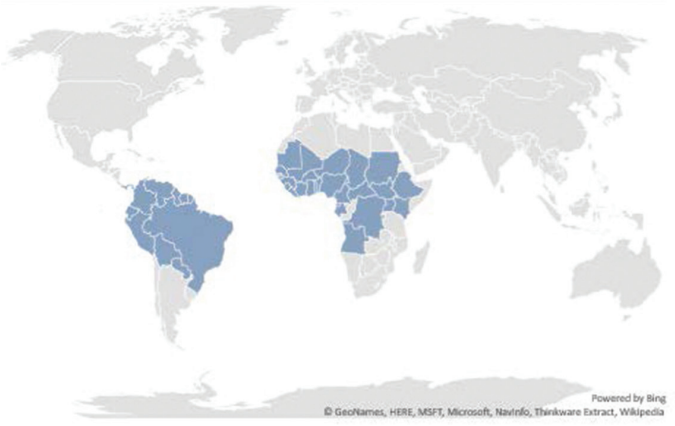


**Figure 2** | A map showing the updated international travel and health lists of countries at risk of yellow fever.

Compliance with this requirement was 99.5% among pilgrims from at-risk countries: Pakistan, India, Nigeria, and Afghanistan [19].

## 2.3. Yellow Fever Vaccinations

Yellow fever vaccines are required by the International Health Regulations (IHR) for travelers from areas at risk of yellow fever transmission [43]. According to Annex 7 of the IHR in 2005, the WHO World Health Assembly approved lifelong protection of yellow fever vaccination and validity begins 10 days after the date of vaccination [44]. The updated international travel and health lists the following countries as at risk of yellow fever [45] is shown in Figure 2.

## 2.4. Influenza Vaccinations

The prevalence of the occurrence of influenza virus among pilgrims varies depending on the study type and the diagnostic tool used with a range of 0–28.6% [36,46–62]. Influenza vaccine decreases development of influenza like-illness among pilgrims [63]. It is recommended that Hajj and Umrah pilgrims receive seasonal influenza vaccination [64]. However, influenza vaccine is currently not obligatory for pilgrims and thus compliance rate was 7.1–100% [63,65,66].

## 2.5. Pneumococcal Disease

There are limited data on the occurrence of pneumococcal disease among pilgrims. In a systematic review, the carriage of pneumococcal vaccine serotype was higher in the post-Hajj period compared with the pre-Hajj period [67] and the available data do not support a firm recommendation for the *Streptococcus pneumoniae* vaccination. However, it is known that 7–37% of pilgrims are older adults (>65 years old), and the compliance rate with *S. pneumoniae* vaccination is 5% among pilgrims [68].

## 2.6. Newly Emerging and Re-emerging Infectious Diseases and the Risk during the Annual Hajj

The MERS-CoV was described only few weeks before the 2012 Hajj season and created a significant fear of the spread of this newly discovered virus [47,56,69]. Multiple studies examined departing pilgrims with no evidence of MERS transmission [19,36,50,52,53,60,62,69–74]. However, there were few reports of MERS-CoV cases associated with the mini-Hajj, the Umrah [75,76]. Currently, pilgrims are advised to observe hand hygiene and follow cough etiquette and avoid contacts with camels [8]. This is also important to avoid the occurrence of diarrheal diseases. Few studies described the incidence and etiology of diarrhea among pilgrims [5]. In the past, cholera caused multiple outbreaks during the Hajj and the last ones were after the Hajj in 1984–86 and 1989 [42,77]. Contributing factors to the development of diarrheal disease are inadequate food hygiene, asymptomatic carriers of bacteria, and mass food preparation.

## 2.7. Measles and Rubella

There are multiple recent outbreaks of measles around the world. Since 2017, the number of measles cases increased 300% in the first 3 months of 2019 and multiple outbreaks in the United States [78–81]. There were reports of the occurrence of measles outbreak in relation to mass gathering events such as an international youth sporting event in USA resulting in cases in eight states [23], and the occurrence of measles among attendees of a church gathering and in the 2010 Taizé festival in France [21,22]. However, till date there is no reported outbreaks of measles during the Hajj. Few studies confirmed the occurrence of measles in relation to other mass gatherings and had been reported and recently reviewed [82]. The Saudi Ministry of Health strongly recommends that pilgrims update their immunization [1].

# 3. CONCLUSION AND COMMENTS

As usual, the Saudi Ministry of Health continues to observe the occurrence of any disease outbreaks around the world and issues recommendations for Hajj vaccinations and preventive measures [1,8]. There are mandated vaccines and additional recommended vaccines based on the available data and risk of spread of any disease. It is a cumulative experience from each Hajj and the dedication to provide a safe and healthy pilgrimage that draw on these guidelines and drive the annual planning for each Hajj [5,83,84].

## CONFLICTS OF INTEREST

The authors declare they have no conflicts of interest.

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