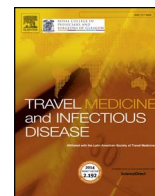




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Expected immunizations and health protection for Hajj and Umrah 2018 —An overview



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ABSTRACT

Background: The annual Hajj and Umrah are one of the largest recurring religious mass gatherings across the globe drawing pilgrims from more than 185 countries. The living circumstances and activities of the pilgrims may create an environment for the occurrence and spread of communicable diseases. Each year, the Health authority of the Kingdom of Saudi Arabia, in coordination with international health authorities, updates health requirements for pilgrims. The Hajj for 2017 took place from August 24 to September 5, 2017. Here, we review the expected obligations for immunizations for the 2018 Hajj and Umrah.

Results: The Hajj and Umrah vaccine requirements include mandatory vaccinations against yellow fever, quadrivalent meningococcal polysaccharide (every 3 years) or conjugated (every 5 years) vaccines and poliomyelitis vaccine. Influenza vaccine utilizing the 2016 (Southern Hemisphere vaccine to all pilgrims) was recommended but was not obligatory for pilgrims. Ciprofloxacin is required for individuals > 12 years excluding pregnant women as chemoprophylaxis to be given at the port of entry for Pilgrims coming from the meningitis belt. With the ongoing outbreaks of measles in Europe, it is recommended that all pilgrims have an updated immunization against vaccine-preventable diseases (diphtheria, tetanus, pertussis, polio, measles and mumps).

Conclusion: The mandatory vaccines remain the same with continued vigilance for the development of any new or emerging infectious diseases. Continuing surveillance for Zika virus, cholera and MERS-CoV are ongoing.

1. Introduction

The annual Hajj and Umrah are one of the largest recurring religious mass gatherings across the globe drawing pilgrims from more than 185 countries. The number of pilgrims from each country is determined based on the number of Muslims in each country and is based on a ratio of one pilgrim per one thousand Muslims in that country [1]. The Hajj season occurs at a fixed time each year from the 8th to the 13th day of the 12th month (Dhu al-Hijjah) in the Islamic calendar which is 11 days shorter than the Gregorian calendar. Thus, the Hajj season occurs in different time of the Gregorian calendar. On the other hand, the Umrah season is year round and is more intense during the month of Ramadhan (the month of fasting). The month of Ramadhan occurred May 27 to June 24, 2017 and will take place May 15 to June 14, 2018. Hajj is compulsory for all Muslims who have the resources once in a life

time and the Umrah is not compulsory. The number of the annual Hajj pilgrims is about three million with two million non-Saudis pilgrims arriving from overseas countries and mainly arriving by air and others from neighboring countries may travel via land [2–4]. In 2016, the majority (94%) of pilgrims arrived by air, 5% arrived by land and only 1% arrived through the sea. The number of pilgrims per year is shown in Fig. 1. The Kingdom of Saudi Arabia (KSA) provides healthcare free of charge to all pilgrims during the Hajj as done previously through 25 hospitals which have 5000 beds including 500 critical care beds and 550 emergency care beds and 155 healthcare centers staffed with 30,000 Ministry of Health staff [2–4]. In this year's Hajj more than 540,000 pilgrims were serviced in these healthcare facilities with emergency departments serving 23,000 pilgrims. The annual required vaccinations for the Hajj and Umrah seasons are issued by the Saudi Ministry of Health including the 2017 recommendations [5]. In this

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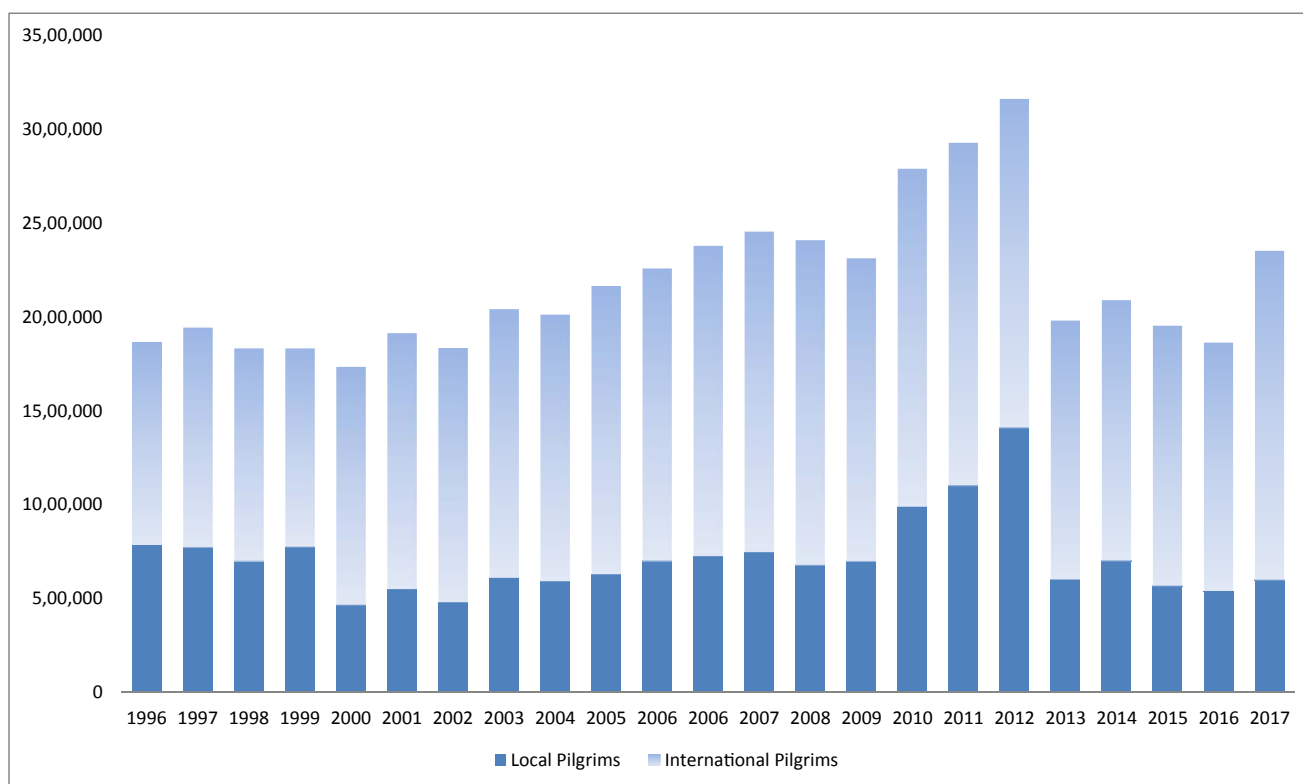


Fig. 1. Annual Number of Pilgrims per year from 1996 to 2017.

article we summarize the recommended vaccinations for the 2018 Hajj and Umrah season.

1.1. Medical advice for Hajj and Umrah travelers

Each year the Saudi Ministry of Health publishes Hajj and Umrah requirements with emphasis on the required vaccinations. These guidelines are updated annually to reflect the changes in the epidemiology of important infectious diseases [1,2,6,7]. The mandatory and recommended vaccines for the 2018 season are discussed further.

1.2. Vaccination during the Hajj and Umrah season

The vaccination requirements during the Hajj and Umrah are divided into: 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).

1.3. Meningococcal vaccination

Nisseria meningitidis is associated with a high rate of carriage of 80% [8]. In a recent study, 3.4% of 1055 arriving pilgrims were classified as nasopharyngeal carriage of *N. meningitidis* and of them 66.7% had serogroup B [9]. The requirement of the meningococcal vaccination for pilgrims came in effect in 1987 after the occurrence of meningococcal outbreaks [2]. The vaccine initially was a bivalent A and C meningococcal vaccine and then was expanded to the quadrivalent vaccine (A,C,Y, W135) in May 2001 [10,11]. This expansion of the vaccine resulted from the occurrence of two meningococcal outbreaks with serogroup W135 in 2000 and 2001 [12–14]. The mean numbers of Hajj-related invasive meningococcal disease cases decreased from 13 to 2 cases per year in 1995 compared to 2011 [11]. The requirement of the quadrivalent meningococcal vaccine includes all pilgrims from any

country. Either polysaccharide or conjugated vaccine could be used with differing need for re-dosing according to ministry of health guidance (every 3 yrs for the polysaccharide vaccine while for the conjugated vaccine every 5 yrs). The advantages of the conjugated vaccine include the ability to eradicate carriage and prevent outbreaks among returning colonized pilgrims. Moreover, ciprofloxacin (500 mg tablets) is administered as an oral chemoprophylaxis to pilgrims arriving from the African meningitis belt [2,6,8,15,16]. In one study, the carriage rate of *N. meningitidis* was 3.6% and 1.4% in a paired cohort of pilgrims from high endemic countries at arrival and departure, respectively [9]. In an earlier study, the carriage rate of *N. meningitidis* after a single dose of ciprofloxacin was 5.2% before and 4.6% after the Hajj ($P = 0.65$) [17]. The carriage rate of *N. meningitidis* among returning pilgrims varies from 0% to 0.6% [17–20] and thus ciprofloxacin was not adopted as a strategy post-Hajj. The compliance rate with the recommended meningococcal vaccination among arriving international pilgrims is 97–100% [9]. In one study 1055 arriving pilgrims at King Abdul Aziz International Airport, 98% of the pilgrims had the quadrivalent polysaccharide vaccine and 2% had the quadrivalent meningococcal conjugate vaccine (MCV4) [9]. Recently, *N. meningitidis* serogroup B is becoming an important cause of meningococcal meningitis in Europe, Australia, and north America and may cause outbreaks [21–24]. Currently, a vaccine is available against *N. meningitidis* serogroup B [25] and there is no sufficient data to recommend the addition of this vaccine to the required Hajj vaccines [9]. An ideal meningococcal vaccine would contain the 4 currently available serogroups in addition to serogroup B.

1.4. Poliomyelitis

Poliomyelitis is a vaccine preventable disease; however, poliomyelitis eradication is hindered by the potential spread by international travelers [26]. There are reports of Hajj associated poliomyelitis cases. In a mathematical model, it was estimated that there is a potential of 21 importations of poliovirus into Saudi Arabia via Hajj pilgrims [27].

Table 1
Health Requirements and Recommendations for Entry Visas for the Hajj and Umrah.

	Countries or areas at risk	Requirement
Yellow fever	<p>Africa: Angola, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Cote 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.</p> <p>South and Central America: Argentina, Venezuela, Brazil, Colombia, Ecuador, French Guiana, Guyana, Panama, Paraguay, Peru, Bolivia, Suriname, and Trinidad and Tobago.,</p>	A valid yellow fever vaccination certificate (≥ 10 days after the date of vaccination). If no proof of vaccination, persons will be placed under strict surveillance for 6 days from the last date of potential exposure to infection.
Meningococcal meningitis (Either polysaccharide or conjugate vaccines)	<p>a) Any visitor</p> <p>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</p> <p>c) Interior pilgrims and the Hajj workers:</p>	<p>a) Certificate of vaccination with the quadrivalent (ACYW135) vaccine was not given > 3 years (for polysaccharide vaccines) and not > 5 years (for conjugate vaccines) and not < 10 days before arrival in Saudi Arabia.</p> <p>b) ACYW135 vaccine (as above) AND ciprofloxacin 500 mg (for individuals ≥ 12 years excluding pregnant women) as chemoprophylaxis to be given at the port of entry.</p> <p>c) Vaccination with quadrivalent (ACYW135) vaccine is required if not vaccinated during the past 3 years with a polysaccharide vaccine or 5 years with a conjugate vaccine for: i) All citizens and residents of Medina and Mecca. ii) All citizens and residents undertaking the Hajj. iii) All Hajj workers. -iv) Any individual working at entry points or in direct contact with pilgrims in Saudi Arabia.</p>
Poliomyelitis	<p>a) Areas infected with Wild Polio Virus 1 or circulating Vaccine Derived Polio Virus: Afghanistan, Nigeria and Pakistan.</p> <p>b) Areas vulnerable to re-infection: Cameroon, Central African Republic, Chad, Guinea, Laos People's Democratic Republic, Madagascar, Myanmar, Niger, and Ukraine.</p> <p>c) States which remain vulnerable to Polio: Democratic Republic of the Congo, Equatorial Guinea, Ethiopia, Iraq, Kenya, Liberia, Sierra Leone, Somalia, South Sudan, Syrian Arab Republic and Yemen</p>	<p>- proof of at least one dose of oral polio vaccine (OPV), or inactivated poliovirus vaccine (IPV), in the last 12 months and ≥ 4 weeks prior to departure, is required to apply for an entry visa to Kingdom of Saudi Arabia</p> <p>- All travelers will receive 1 dose of OPV on arrival to Saudi Arabia.</p>
Seasonal influenza	All pilgrims (internal and international) and all health-care workers in the Hajj area	It recommends to have seasonal influenza vaccination
Cholera		No specific vaccine requirement

There are many countries which harbor patients infected with the Wild Polio Virus 1 or having a Vaccine Derived Polio Virus such as: Afghanistan, Nigeria and Pakistan. There are also countries which are prone to have re-infection of patients such as: Cameroon, Central African Republic, Chad, Guinea, Laos People's Democratic Republic, Madagascar, Myanmar, Niger, and Ukraine. And there are countries which are open to have Poliomyelitis: Democratic Republic of the Congo, Equatorial Guinea, Ethiopia, Iraq, Kenya, Liberia, Sierra Leone, Somalia, South Sudan, Syrian Arab Republic and Yemen. The Hajj requirement for those people coming from these three areas is summarized in Table 1. In a recent study of vaccination compliance among pilgrims showed that 99.5% of pilgrims coming from at-risk countries: Pakistan, India, Nigeria, or Afghanistan had poliomyelitis vaccination [28].

1.5. Yellow fever vaccinations

The International Health Regulations (IHR) requires documentation of yellow fever vaccines for travelers from areas at risk of yellow fever transmission [29]. Although, yellow fever vaccination was considered valid for 10 years, the WHO World Health Assembly adopted an amended resolution that the yellow fever vaccination will be sufficient for the duration of the life of the vaccinated person starting July 11, 2017. This new guidelines apply to existing and new certificates and the validity begins 10 days after the date of vaccination [30]. The 2016 updated International travel and health lists the following countries as

at risk of yellow fever [31]: Africa (Angola, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, South Sudan, Sudan, Togo and Uganda), and Americas (Argentina, the Bolivarian Republic of Venezuela, Brazil, Colombia, Ecuador, French Guiana, Guyana, Panama, Paraguay, Peru, Plurinational State of Bolivia, Suriname and Trinidad and Tobago).

1.6. Influenza vaccinations

The prevalence of the occurrence of influenza virus by PCR among pilgrims varies depending on the study and ranges from 0.5%–28.6% (average of 9.2%) in various studies [20,32–48] (Fig. 2). The impact of the pandemic H1N1 influenza was evaluated in five studies [36,41–43,45]. The largest study included 2699 departing pilgrims and 0.1% were positive for H1N1 virus [43] and other studies showed a prevalence of less than 2% [36,42]. Influenza vaccine decreases development of influenza like-illness among pilgrims [49]. The compliance with influenza vaccination varies from 7.1% to 100% with an overall compliance of 96.3% [49–51]. The occurrence of the mismatch between vaccine and circulating influenza strains occur frequently and affect the Hajj pilgrims [52]. Currently, it is recommended that all pilgrims and Umrah visitors receive seasonal influenza vaccination [5]. However, influenza vaccine is currently not obligatory for pilgrims. The

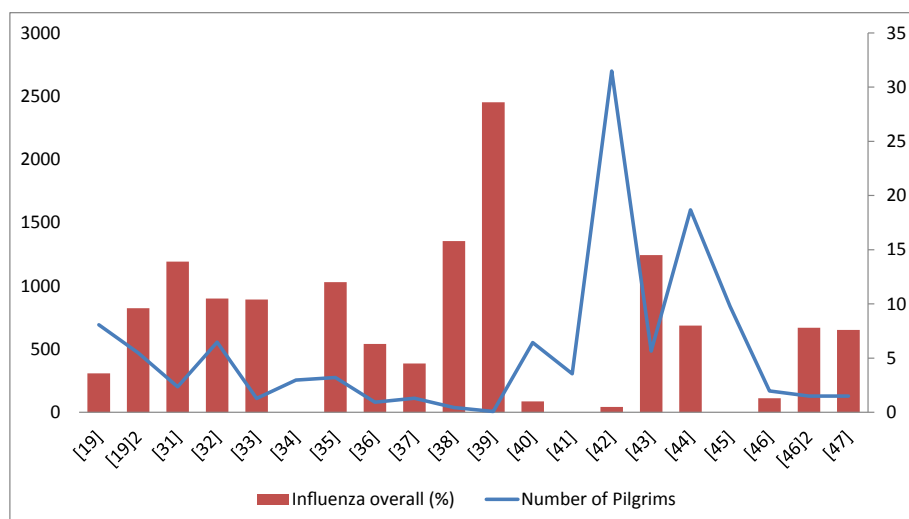


Fig. 2. Prevalence of Influenza (%) as detected by PCR among Pilgrims in Various Studies.

issue of influenza vaccine availability to match Southern and Northern hemispheres was discussed by the Saudi Ministry of Health in consultation with the World Health Organization and it was recommended to use the available hemisphere strain as long as there is a match in circulating strains.

1.7. Middle East Respiratory Syndrome Coronavirus (MERS-CoV)

The initial description of the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) was few weeks before the 2012 Hajj season [34,41,53]. Subsequently, the following Hajj and Umrah seasons witnessed no transmission of MERS-CoV among pilgrims. Methodical screening of departing pilgrims was evaluated among a large number of visitors with no evidence of MERS-CoV transmission [20,28,38,40,44,46,47,53–58]. It is advisable that pilgrims adhere to hand hygiene and follow the cough etiquette and avoid contacts with camels [2].

1.8. Pneumococcal disease

The available literature shows that 7–37% of pilgrims are older adults (≥ 65 years of age), and that the compliance with age specific pneumococcal vaccine among pilgrims is 5% [59]. In a recent review, the carriage of pneumococcal vaccine serotype was higher in the post-Hajj period compared to the pre-Hajj period [60]. However, the available data do not support a firm recommendation for the *S. pneumoniae* vaccination of all pilgrims.

1.9. Cholera and diarrheal diseases

Only few reports describe the specific incidence and etiology of diarrhea among pilgrims [61]. Cholera caused multiple outbreaks during the Hajj and the last ones were after the Hajj in 1984–86 and 1989 [62,63]. Multiple factors contribute to diarrheal illness during the Hajj including inadequate food hygiene, presence asymptomatic carriers of bacteria, and mass food preparation. Cholera continues to cause outbreaks around the globe. World health Organization (WHO) recently reported an outbreak of cholera in Kenya and in Yemen, where the cases in the latter reached 500,000 [64,65]. There are no recent cholera outbreaks among pilgrims. The Ministry of Health of Saudi Arabia takes active role in observing arriving pilgrims from areas with active cholera outbreaks and initiate quarantine and contact tracing once a case is suspected [2]. In addition, early detection of cases and timely treatment once the pilgrims are diagnosed. There had been extensive improvement and availability of water sources and good sewage systems.

Currently, there is no mandatory cholera vaccine for pilgrims arriving from countries with cholera outbreaks.

1.10. Measles and rubella

There are multiple recent outbreaks of measles around the globe. However, to date 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 had been recently reviewed [66]. One measles outbreak took place in Pennsylvania, USA in an international youth sporting event [67]. The index case was a twelve year-old child, and seven (0.32%) of 1250 contacts in 8 states were diagnosed with measles [67]. Two other measles outbreaks occurred among attendees of a church gathering and in the 2010 Taizé festival in France [68,69].

Most patients were young adults and were unvaccinated. Currently, the Saudi ministry of health as always makes a strong recommendation that all pilgrims are to update their immunization against vaccine-preventable diseases (diphtheria, tetanus, pertussis, polio, measles and mumps) before coming to Umrah or Hajj. Due to the occurrence of outbreaks of measles, there is a potential spread among susceptible populations. The European CDC strongly recommends measles immunization for non-immune pilgrims attending the Hajj [70].

1.11. Vector borne viruses (zika and dengue)

The concern of Zika, Dengue virus and other flaviviruses remain a valid point in the case of mass gatherings such as the Hajj and Umrah. Zika may produce asymptomatic infection in up to 80% of infected population [71]. The situation might be complicated by the presence of *Aedes aegyptii* in the surrounding cities of the Hajj and Umrah areas. The mosquito transmitting zika virus is the vector of the Yellow fever virus, Dengue Virus and chikungunya virus [72]. In a study of 159 cases of Dengue fever, only two patients were pilgrims [73]. Thus, despite the lack of large studies, it is thought that Dengue virus infection remains limited during the Hajj and Umrah. Thus, pilgrimages during the Hajj and Umrah are advised to take measures to avoid insect bite to reduce the risk of infection with Dengue and other mosquito borne diseases.

1.12. Antimicrobial resistance

A recent systematic review showed a high prevalence and/or a high risk of acquisition of MDR-bacteria in pilgrims during the Hajj [74]. Diarrhea and the use of antibiotics for upper respiratory tract infection were the strongest determinants of extended spectrum betalactamase

producing Enterobacteriaceae acquisition in one study [75]. Overuse of antibiotics by Hajj pilgrims should be discouraged.

2. Conclusion and comments

Each year, the planning for the following Hajj and Umrah season take place with input from many players within the Kingdom of Saudi Arabia [6]. Additionally, the occurrence of outbreak and emerging diseases is received from World Health Organization (WHO), European Centre for Disease Prevention and Control (ECDC), Public Health England (PHE) and United States Centers for Disease Prevention and Control (CDC) through the Public Health Directorate of the Ministry of Health. These combined efforts are coordinated by 24 different committees [6]. The Saudi Ministry of Health then issues recommendations for the required vaccinations and other preventive measures. The ministry also ensures compliance with these required vaccines. Multiple studies showed excellent compliance rates with the recommended vaccinations for the pilgrimage and was 97–100% in case of meningococcal vaccination among arriving international pilgrims [9]. There is a concern that these verified numbers through vaccination cards might represent a false data. In order to verify the reported compliance rates, a serologic study of 796 pilgrims showed that the majority of pilgrims were vaccinated and protected against meningococcal serogroups ACWY [76]. The 2017 Hajj season ended with no reported outbreaks. The experience from each Hajj is growing each year and the planning for the 2018 Hajj had already began. The required vaccines will most likely remain the same with close monitoring for the development of any outbreaks internationally.

Conflict on interest

None.

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