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Review Article

«The Mecca pilgrimage and its medical preparedness»



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Abstract

The pilgrimage to Mecca, in Saudi Arabia, is an annual mass gathering which attracts over 2.5 million pilgrims, who must perform the Hajj (pilgrimage to Mecca) at least once in their lifetime if they can afford to do so. It is the most important of all Muslim pilgrimages and one of the largest, culturally and geographically diverse, mass gatherings in the world. Because of its moving target date, since it follows the Islamic lunar calendar, and the volume of its attendance, it presents a unique and important public-health challenge, demanding constant preparedness of the host country. The Hajj occasions vast numbers of travelers from over 140 countries to perform demanding rituals in highly overcrowded conditions, which means that emerging infectious diseases have the potential to quickly turn into epidemics. There are many infectious and non-communicable diseases that pilgrims might face in the strenuous experience of the Hajj, as well as other health hazards, namely stampedes and traumas.

The terms “hajj”, “mecca”, “pilgrimage” and “preparedness” were used in a search through PubMed, MEDLINE, Google Scholar and Cochrane Library. Articles were chosen from 1995 to 2012, with the majority of them being written in the last ten years.

The Hajj presents a significant challenge that impacts the international public health as a very large number of humans move through continents to arrive to Mecca, with everything this entails in terms of potential risks in disease transmission and other health hazards. The preparations of the Saudi Arabia authorities in connection with international bodies concerning this mass gathering are integral for the managing of the Hajj and the successful outcome of the event.

Keywords: Hajj, Mecca, pilgrimage to Mecca, preparedness

Περίληψη

Το προσκύνημα στη Μέκκα στη Σαουδική Αραβία, είναι μια ετήσια μαζική συγκέντρωση. Προσελκύει πάνω από 2,5 εκατομμύρια προσκυνητές, οι οποίοι, σύμφωνα με το Ισλάμ, πρέπει να πραγματοποιήσουν το Hajj (προσκύνημα στη Μέκκα) τουλάχιστον μία φορά στη ζωή τους, εάν αυτό είναι δυνατό. Είναι το πιο σημαντικό προσκήνυμα των μουσουλμάνων και μια από τις μεγαλύτερες, με πολιτισμικές και γεωγραφικές διαφορές, μαζικές συγκεντρώσεις στον κόσμο. Λόγω της κινούμενης ημερομηνίας του, καθώς συμβαδίζει με το σεληνιακό ημερολόγιο, και του όγκου της συμμετοχής του, παρουσιάζει μια μοναδική και ιδιαίτερα σημαντική, για τη δημόσια υγεία πρόκληση που απαιτεί συνεχή ετοιμότητα της χώρας υποδοχής. Ο τεράστιος αριθμός των ταξιδιωτών πάνω από 140 χώρες, πραγματοποιεί απαιτητικές τελετές σε εξαιρετικά δύσκολες συνθήκες μεγάλου συνωστισμού, κάτι που έχει ως αποτέλεσμα να μεταδίδονται πολύ πιο εύκολα διάφορες μολυσματικές ασθένειες που έχουν τη δυνατότητα να μετατραπούν ταχύτατα σε επιδημίες. Οι προσκυνητές ενδέχεται να αντιμετωπίσουν μολυσματικές και μη μεταδοτικές ασθένειες, καθώς και άλλους κινδύνους για την υγεία τους, όπως σοβαρά τραύματα.

Χρησιμοποιήθηκαν οι όροι "hajj", "mecca", "pilgrimage" και "preparedness" σε μια αναζήτηση στις βάσεις δεδομένων PubMed, MEDLINE, Google Scholar και Cochrane Library. Τα άρθρα που επιλέχθηκαν βρίσκονταν μεταξύ των ημερομηνιών 1995 - 2012, με την πλειοψηφία τους να αποτελούν αυτά των τελευταίων δέκα χρόνων.

Το προσκύνημα στη Μέκκα παρουσιάζει μια σημαντική πρόκληση που επηρεάζει τη διεθνή δημόσια υγεία, καθώς ένας πολύ μεγάλος αριθμός ανθρώπων μετακινείται και συγκεντρώνεται για το Hajj. Η σωστή ετοιμότητα και οργάνωση των αρχών της Σαουδικής Αραβίας σε συνεργασία με τους διεθνούς φορείς είναι απαραίτητη για την ασφαλή διεξαγωγή και έκβαση του προσκυνήματος.

Λέξεις κλειδιά: προσκύνημα στη Μέκκα, Μέκκα

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Abbreviations

CDC: Centers for Disease Control and Prevention

ECDC: European Centre for Disease Prevention and Control

MCD: Meningococcal disease

MoH: Ministry of Health

PCR: Polymerase chain reaction

SARS: Severe acute respiratory syndrome

TB: Tuberculosis

VHF: Viral haemorrhagic fever

WHO: World Health Organization

The Mecca pilgrimage and its medical preparedness

1. Introduction

A pilgrimage is a long journey or search of great moral significance, usually in the context of religion and spirituality. Sometimes, it is a journey to a sacred place or shrine of importance to a person's beliefs and faith, such as the place of birth or death of founders or saints, the place of their "calling" or spiritual awakening, the locations where miracles were performed or witnessed, the locations where a deity is said to live or be "housed," or any site that is seen to have special spiritual powers. In Islam, the pilgrimage to Mecca, the Hajj, is one of the Five Pillars of Islam. According to Islam, every physically able Muslim who can afford to do so, must undertake the Hajj at least once in his/her lifetime.^{1, 2} It is the most important of all Muslim pilgrimages and is the largest pilgrimage for Muslims³, as well as one of the largest, culturally and geographically diverse mass gatherings in the world, attracting over 2.5 million pilgrims^{4,5} who must perform the Hajj by travelling to Mecca, retracing the footsteps of the Prophet Mohammed and undertaking identical rituals.² Considering the fact that the Hajj is dictated by the Islamic lunar calendar, which is shorter than the Gregorian calendar thus moving 10 or 11 days earlier every year⁶ and occurring at different seasonal times, it presents a unique and important public-health challenge because of its moving target date and the volume of its attendance, demanding constant preparedness of the host country, Saudi Arabia, and adding burden to the traveler's country of origin.⁵ This mass migration that takes place during the Hajj has its risks of numerous health hazards such as infectious as well as non-communicable diseases.⁷ Additionally, because of the sheer number of people, crowd turbulence can easily trigger panic and stampede, particularly seen at the Jamarat sites, where ritualistic stoning occurs.⁷ With each Hajj, authorities refine the management of Hajj health procedures by implementing each year's recommendations and putting many of them into practice.^{1,4,8,9} This review examines the medical risks of traveling to Mecca during the Hajj, as well as the preparedness measures taken by the host country and its respective authorities towards this mass gathering.

2. The Mecca pilgrimage, figures and facts

The 2012 Hajj pilgrimage to Makkah (Mecca), Saudi Arabia, is expected to fall between 24 and 29 October. Pilgrims join hundreds of thousands of people, who must dress in Ihram clothing (which consists of two white sheets), and simultaneously converge on Mecca for the week of the Hajj, performing a series of rituals: each person walks counter-clockwise seven times (Tawaf) around the Ka'aba, the cube-shaped building which acts as the Muslim direction of prayer and which Muslims consider the house of God, then travels seven times between Mount Safa and Mount Marwah, drinks from the Zamzam Well and goes to the Plain of Arafat, a few miles east of Mecca, to stand in vigil in a ritual called "Day of Standing", making overnight stops in Mina en route to Arafat, and in Muzdaliffah on return. On returning to Mina, the pilgrim stops at Jamarat to stone the pillars that are effigies of Satan, a ritual known as "Stoning of the Devil". The new Hajji (a pilgrim who has completed the Hajj) then shave their heads, perform a ritual of animal sacrifice as thanks for an accepted Hajj, and celebrate the three day global festival called Eid al-Adha.^{10,2} The Hajj is a demonstration of the solidarity of the Muslim people and should be an expression of devotion to God.

Each year, over 2.5 million pilgrims participate in the Hajj^{4,5}. In 2011, at least 1.8 million were foreign visitors, while around 1.1 million came from within Saudi Arabia¹¹. These numbers pose some of the world's most important public-health and infection control challenges¹² because, while distances may be small during the Hajj, the high congregation of pilgrims in confined areas and the annual date change present a significant problem that all government sectors of Saudi Arabia are called to take action for and plan their public-health policies with caution and effectiveness to ensure that all aspects of Hajj rituals are conducted safely and without major incident.

According to the records of the Royal Embassy of Saudi Arabia, in 2008, 1.7 million pilgrims¹³ from 140 countries travelled to Mecca to perform the Hajj, of which, 91.0% arrived by air,¹⁴ while in 2009, 91.7% of 1.6 million foreign pilgrims¹⁵ travelled the same way¹⁶. With these numbers in mind and considering the manner of transportation, with the speed of global air travelling, pilgrims incubating infectious diseases at their time of departure may not manifest illness until after arrival in another country,¹⁷ thereby increasing the imminent danger for international spread of infections in Hajj. Since the travelling pilgrims originate from all

places of the world where, for example, a seasonal influenza might take place, or one disease might be endemic (in a developing country from which the pilgrim begins its journey), they are essentially bringing the disease in the extreme and inescapable overcrowding at the Hajj, which further facilitates disease transmissions. The severe congestion of people means that emerging infectious diseases have the potential to quickly turn into epidemics and extended stays at Hajj sites, physical exhaustion, extreme heat, and crowded accommodation encourage disease transmission, especially of airborne agents.² Infections acquired thus may be also subsequently carried to pilgrims' countries of origin upon their return.¹⁷

Apart from the spreading of infectious diseases, other health hazards that have been recorded are stampedes and failures of crowd control due to the resulting overcrowding in Hajj sites, traffic accidents¹⁸ and fire injuries. The advanced age of many pilgrims (25% of all attendees over the age of 65 years old between 2006 – 2008)¹⁹ translates to the increased number of deaths due to their possible pre-existing health problems and inadequate health access to advanced pre-Hajj health care,^{20,5} in combination with the strenuous experience of the Hajj.

One of the major contributors to the planning and strategizing for the well-being of the pilgrims is the Saudi Ministry of Health (MoH), which plays a critical role in the management of the annual Hajj pilgrimage and whose Infection Control and Preventive Medicine Policies are established every year, based on knowledge of current global outbreaks, epidemiology of infectious diseases, and established effective preventive medicine strategies.¹⁶

3. Infectious diseases and subsequent preventive measures

Meningococcal disease outbreak is well recognized at the Hajj.⁷ In unconfined populations, risks of meningococcal disease transmission are low, but during the Hajj, with the physically overcrowded conditions, the high humidity, and dense air pollution, carrier rates for meningococcal disease (MCD) have been reported to rise to a level as high as 80%²¹, in which outbreaks may become a real public health threat.⁷ The largest meningococcal outbreak among pilgrims occurred in 1987 with meningococcal serogroup A

affecting pilgrims of all nationalities, including Saudi nationals, in Mecca²² and internationally (in Qatar, 15 cases were seen within the first 3 weeks after the hajj²³). At that time, the Saudi Arabia health authorities took the preventive measures of a) mandating vaccination with bivalent A and C vaccine for all pilgrims arriving for the Hajj, b) simultaneously launching aggressive vaccination campaigns for all living in high-risk areas (local residents of Mecca and the surrounding holy sites)^{7,24} and c) implementing compulsory oral ciprofloxacin to pilgrims from sub-Saharan Africa, to reduce carrier rates^{4,25, 26, 2} Outbreaks of meningitis appeared controlled for the next several years, although some minor sporadic outbreaks followed in Mecca and Jeddah in 1992 and 1993, which were ascribed to serotype A (in 1992) and W-135 (in 1993).^{21,27,7} By February 1999, there was no evidence of ongoing MCD epidemic in Saudi Arabia, and the US Centers for Disease Control and Prevention (CDC) lifted the requirements described above.^{28,29,2} However, in the years 2000 and 2001 during the Hajj season, two large outbreaks of meningococcal serogroup W135^{4,16} occurred among pilgrims and their close contacts, in Saudi Arabia and nine other countries^{30,31,32,7} affecting 1300 and 1109 people, respectively.² The mortality rate in the 2001 outbreak especially was enormous, with 35 deaths in 109 cases seen in Saudi Arabia, mainly hajjies from overseas.^{33,7} These marked the first two major outbreaks due to the W-135 strain, which, while occurring in a minor outbreak in 1993, had not been previously seen in major epidemic patterns.

Since then, Saudi Arabia has been mandating quadrivalent polysaccharide vaccination (of the A, C, Y, W135 form) for all those entering the kingdom for the Hajj, and all Mecca and Medina area residents who are by definition at high risk, suppressing thus any meningococcal outbreaks since 2002.^{34,35} Vaccination is also required of all supporting staff, local population, and residents of the two holy mosques. Documented proof of vaccination is needed by the health authorities, with the vaccine given 10 days before arrival and no longer than 3 years before. Internally, Saudi Arabia has a strict domestic policy allowing only those Saudi pilgrims who possess documented certification of appropriate vaccination to arrive in Mecca and access to holy sites is denied without these documents. Public health education programs are in place to prevent local Saudis from failing to receive timely vaccination.⁷ However, concerns still persist about the trend of increased serogroup B meningococcal disease, a serogroup for which there is no universal vaccine available, in neighboring countries with large Muslim population.³⁵ Lack of herd immunity and persistence of

meningococcal carriage among vaccinated pilgrims with the polysaccharide vaccine prompted the Saudi MoH to replace the local recommendations for meningococcal vaccination from polysaccharide to conjugated meningococcal vaccine³⁶ but, excessive cost of the conjugated meningococcal vaccines prohibited the MoH from mandating this recommendation to all international pilgrims.¹⁶ There is no doubt that there must be an increase of the respective health authorities' preparedness due to the possible and sudden changes in the etiology of MCD during the Hajj.

Respiratory infections are the most frequently reported among pilgrims. Prolonged close contact, intense congestion, shared sleeping accommodations (tents in Mina) and the dense air pollution all combine to increase the risk of airborne respiratory disease transmission, with the upper respiratory tract infection - particularly influenza-^{37, 38} the most common cause (57%) of admission to hospital during the Hajj³⁹ and pneumonia being the leading reason for admission, with 39.4% of all patients in 2002⁴⁰ and 19.7% in 2003 Hajj season respectively.^{41,42} The Saudi MoH requires from all healthcare workers working in Mecca and Medina to be vaccinated according to the Advisory Committee on Immunization Practices and recommends influenza as well as pneumococcal polysaccharide vaccination for pilgrims older than 65 years and for those younger with underlying co-morbidities⁴³ such as cardiovascular disease, chronic lung disease, diabetes, alcoholism, liver disease etc. However, a 2009 study in Malaysian pilgrims⁴² showed that, these vaccinations were not helpful to reduce influenza-like infections and respiratory tract symptoms and there were no significant differences of respiratory symptoms between vaccinated and unvaccinated groups.

Tuberculosis (TB) has been shown in studies to be the primary cause of community-acquired pneumonia in pilgrims hospitalized at the Hajj^{44,17} In a 2002 study, a 10% incidence rate among 357 Singaporean Hajj pilgrims' immune response to the QuantiFERON TB assay antigens post-Hajj when compared to a pre-Hajj test was recorded.⁴⁵ This shows that the prevalence of resistant TB and the annual risk of infection are three times higher in Saudi Arabian cities hosting pilgrims, mainly Mecca, Jeddah and Medina, than the national average,^{46, 47, 7} due to the annual influx of pilgrims from areas of high tuberculosis-endemicity,⁷ since many pilgrims come from developing nations where TB is endemic. The close, crowded, congested conditions where most of them share tents or rooms with many others, allow transmission and pilgrims who acquire TB

infection during the Hajj may become a source of TB upon return to their home countries -and given that nearly all Muslims go to the Hajj at least once in their lifetime, this could have a significant impact on TB incidence in countries with large Muslim populations.⁴⁵ Even though the best policy of reducing the importation and subsequent dissemination of TB during the pilgrimage would be to implement screening on the departing pilgrims from TB-endemic countries (especially to those returning to low-TB-endemicity countries)⁴⁵ it is nearly impossible to do so, due to the enormous number of visitors but also because of the short window during which people visit. The only real safe guard, therefore, should be to forewarn pilgrims of the high risk of disease before arrival.⁷ There are conflicting references regarding the need for facemasks as a precaution; even though it is a simple and inexpensive infection control measure, there are few data that support its effectiveness in the prevention of respiratory tract infections and its protectiveness against them, at the Hajj,^{48, 2} whereas other studies claim that facemasks are probably the best means to limit infection of TB cases.⁴⁹ The Saudi MoH has made concerted efforts to encourage facemask usage, but there have been poor compliance rates.⁷

Diarrhoeal disease is the most commonly reported medical problem when visiting developing nations. A study in 2002 showed that diarrhea was the third most common cause for hospitalization during Hajj.¹⁶ Despite its high prevalence among hajjies, no studies have documented its incidence nor the most common etiologic agents.⁷ Several cholera outbreaks occurred after the Hajj in the 1984-86 period with the last one reported by the Saudi MoH in 1989, affecting 102 pilgrims. Significant improvement in water supply and sewage treatment has eliminated such outbreaks.¹⁶ However, there are still some sporadic cases of cholera diagnosed in Saudi Arabia^{50,51} and concerns persist about importing cholera with pilgrims from affected countries, which will cause widespread outbreaks in Mecca.¹⁶

Food poisoning is another important cause of diarrhoea and vomiting during the Hajj.⁵² The number of reported cases of food poisoning has ranged from 44 to 132 in each Hajj season during the past 12 years. Prevention of diarrhoeal disease includes education of the pilgrims regarding hand hygiene, avoidance of local vendor food (including ice), and of foods made with fresh eggs.² The Saudi MoH has strict guidelines on food importation by pilgrims. Food carried by visitors and pilgrims is banned and not allowed into the

country. Only properly canned foods and in very small amounts, enough for one person for the duration of the visit are allowed, sufficient for 24 hours^{53,16} The MoH mandates the surveillance of pilgrims arriving from cholera-affected countries in weekly World Health Organization (WHO) reports and if suspected, samples are taken and those infected are quarantined.⁵³

Hepatitis A is also common in Saudi Arabia,^{54,55} with 90% of adults being immune from natural infection; it is the most frequent vaccine-preventable illness contracted by travelers and, although there are no data, this is probably true for hajj pilgrims as well.⁷ Hepatitis A virus vaccine is recommended for pilgrims from developed countries—it is probably unnecessary for those from developing countries since they are likely to be immune because of childhood exposure. Travelers can be checked for hepatitis A virus immunoglobulin G (IgG) before administration of the vaccine, to avoid needless vaccination^{56,2}

Pilgrims must be educated about self-treatment of diarrhoeal disease. Should the pilgrim traveler develop diarrhea, proper hydration and fluid intake is vital. The inclement conditions at the Hajj predispose to dehydration in all adults, let alone the extremes of age where dehydration is more expected. Self-administered antibiotics with an extended spectrum macrolide, azithromycin or an oral quinolone are probably indicated for moderate to severe travelers' diarrhea.² Most pilgrims can be advised to carry a 3-day course of antibiotic therapy, an antimotility agent such as loperamide, and a thermometer.⁷

Blood-borne diseases can be transmitted through the shaving of the pilgrim's head, a ritual with which the Hajj is completed but an important means of transmission of blood-borne disease (including hepatitis B, C and HIV) as well.^{57,16} Unlicensed barbers operating at the Hajj shave hair at the roadside with non-sterile blades that are re-used on several people. In a 1999 study which examined hepatitis serology in 158 Hajj barbers showed that 4% of them (7) were positive for HBsAg (hepatitis B surface antigen), 10% (16) were HCV-positive, and 0.6% (1) was positive for HbeAg (hepatitis B "e" antigen), indicating high infectivity.^{58,2} All pilgrims need to be aware of these hazards, should avoid unlicensed barbers and must be shaved only at designated centers. Saudi authorities continue to take an aggressive legislative stance to prevent unlicensed barbers from operating during the Hajj and the Saudi MoH encourages all pilgrims to receive the full series of hepatitis B vaccination prior to travel to Hajj.² Since there are no published data to document the

significance of head shaving in HBV transmission to pilgrims, and since the HBV vaccine series takes 6 months to complete, it is difficult to recommend the HBV vaccine to all pilgrims.

Emerging infectious diseases are a special concern in Hajj health care. Regarding viral haemorrhagic fever (VHF) syndromes, in 2000 the Saudi MoH and of agriculture collaborated to restrict the entry of sheep to the holy sites after a first documented case of Rift Valley fever (which mainly affects livestock but also humans) from regions outside of Africa, in Saudi Arabia and Yemen^{59, 60, 2} and launched an educational program for Mecca abattoir workers. There hasn't been any outbreak of Rift Valley fever at the Hajj yet. During the Hajj in 2001, four cases of a new VHF, the pathogen of which has been identified as *Alkhumra virus*, were diagnosed in Mecca.⁶¹ So far, there have been 37 cases. Ebola virus is another cause of VHF that has caused several outbreaks in Africa. Saudi Arabia banned all Ugandan residents from attending the 2001 Hajj because of the concern over Ebola, which has killed close to 200 Ugandans^{62,63} but this ban was lifted by the end of the 2001 Hajj season.

In 2003, a potentially enormous threat to Hajj pilgrims, the severe acute respiratory syndrome (SARS) greatly concerned Saudi Arabia. The rapidity with which the disease spread from the starting country, China, to involve at least 25 countries worldwide suggested a simple mode of transmission such as droplet or contact transmission. It is understandable that the conditions of the Hajj could turn a single case of SARS into an epidemic of unparalleled scale. Saudi authorities implemented several strategies to prevent the entry of SARS, starting by barring the entry to pilgrims from countries reporting local SARS transmission. At international airports, all incoming passengers were checked for fever by health personnel and thermal scanners were installed before immigration clearance in the Damam, Jeddah, and Riyadh international airports to detect febrile patients.⁶⁴ The Saudi MoH also launched an educational campaign about infection control strategies for health-care personnel who might encounter SARS patients. There were no SARS imported into Saudi Arabia, and no case of SARS was detected by airport screening. This was most likely the result of the immediate ban on any incoming passengers from SARS-hit countries which was lifted on July 2003, following positive reports from the WHO that no new cases had been reported for the previous 20 days.⁶⁵

The pandemic influenza A (H1N1) in 2009 worried confoundedly the Saudi Arabian authorities since the potential for importation of H1N1 into Mecca during the Hajj was deemed considerable given that a) most of the world's Muslims reside in the Northern hemisphere, which would be in the midst of influenza season at the onset of the 2009 Hajj and b) because a significant proportion of traveling pilgrims was expected to originate from resource-limited countries that would not have access to H1N1 vaccine prior to the onset of the Hajj.⁶⁴ A preparedness consultation was convened in June 2009, with national and international public health agencies such as the WHO, the CDC, and the European Centre for Disease Prevention and Control (ECDC) to consider the most effective measures available to mitigate the impact of H1N1 on the health and well being of pilgrims performing the Hajj and a minimum disease transmission back on their home countries^{66,14} Specific population groups were considered to be at high risk for complications from influenza such as pregnant women, those with chronic diseases, and people under 12 or over 65 years of age, and it was recommended for them to voluntarily refrain from participating in the 2009 Hajj,¹⁹ an action that may have limited the spread of H1N1 influenza virus by breaking the chain of infection at its weakest point. For pilgrims traveling to Saudi Arabia by air, a detailed screening protocol was implemented at the Hajj terminal at Jeddah International Airport. All pilgrims were screened for fever and a medical team was stationed at the Hajj terminal to assess febrile pilgrims. If a pilgrim's signs and symptoms were deemed to be compatible with influenza, the pilgrim was immediately transported to a dedicated isolation hospital where they tested for H1N1 by polymerase chain reaction (PCR). Among an estimated 2.5 million pilgrims, only 73 cases of H1N1, including five deaths (fatality rate 4.9%), were identified during the 2009 Hajj.¹⁴ H1N1 prevalence among departing pilgrims was very low (0.1%), a finding that may indicate a low transmission of H1N1 influenza during the 2009 Hajj season, given the 1–4-day incubation period of influenza viruses and the 5-day duration of Hajj activities. This could be attributed to the liberal use of specific influenza antiviral without testing and the aggressive campaign by the Saudi MoH to use protective measures including wearing face masks, avoiding crowds when possible, and using respiratory etiquette.^{5,67}

Avian influenza (H5N1) is of major global concern.^{68, 2} So far, no human case of avian influenza A (H5N1) has been reported at the Hajj or in Saudi Arabia, but cases of H5N1 in human beings have been reported in Indonesia, Pakistan, and Turkey, countries from which many people make the annual pilgrimage to Mecca.

Counting Bangladesh, Iraq, Egypt, Azerbaijan, Nigeria, and Djibouti, a total of nine countries with predominantly Muslim populations, have already been affected by the virus. As of July 25, 2008, over half (214/385) of the reported number of H5N1 influenza cases have been in Muslims.^{69,70} An outbreak of H5N1 influenza in Saudi poultry was reported earlier last year and the Saudi Authorities have already restricted bird importation in order to prevent avian influenza entering the country.² There isn't any effective vaccine so far.⁷¹ Awareness campaigns and better surveillance could play an important role to prevent an influenza outbreak during the Hajj as was the case with the SARS approach in 2003.⁷⁰

4. Non-communicable diseases and other health hazards

Cardiovascular disease is the most common cause (43%) of death during the Hajj.⁷² Hajj is a strenuous experience, with the completion and the correct performance of the obligatory rites usually in hot weather and often in the midst of a huge crowd, even for healthy adults; for those with pre-existing cardiac disease, the physical stress can easily become fatal. These considerations prompted the Hajj Medical Group in Isfahan to design guidelines to screen potential pilgrims with cardiovascular disorders. The main objectives were: a) to screen cardiovascular disorders among subjects older than 50 years before Hajj, b) to adopt appropriate intervention measures and c) to assess the outcome of the intervention measures. The objective was the prevention of increasing mortality and morbidity among pilgrims during the pilgrimage.⁷³ Cardiac patients planning for the Hajj should consult with their doctors before the journey and ensure sufficient supply of medications. They should avoid crowds, perform some rituals by proxy, and report to the closest health centre for any symptom indicating cardiac decompensation.²

Trauma is a major cause of morbidity and mortality at the Hajj. For a large part of the Hajj, pilgrims travel either by foot and walking through or near dense traffic, or by chartered bus, or car. Extreme traffic buildup, poor compliance with seatbelts, and disordered traffic flow contributes to trauma risk with many casualties

and deaths during the Hajj.² In a 2001 prospective study on 713 trauma patients who were injured while performing Hajj, presenting to the emergency room, 248 (35%) were admitted to surgical departments and intensive care.⁷⁴ One of the most grave trauma hazard is stampede which is very likely to happen at the Hajj because of the extraordinary pressure of numbers in a limited space. Mass panic in a crowd can often lead to stampedes with many fatalities as people are crushed or trampled underfoot. At the Hajj in 2006, stampedes followed pilgrims tripping over fallen luggage, and resulted in 380 deaths, from asphyxiation or head injury, and 289 wounded.² There is no indicator on when a stampede may occur; certain measures can be taken, as in the case of the Jamarat site for the 'stoning of the devil' ritual, where crowds surge around the pillars by crossing the massive two-layer flyover-style Jamarat Bridge.⁴ To reduce the overcrowding, the cylindrical columns have been replaced with elliptical ones, increasing the surface area available for stoning and dissipating intense crowd pressure surrounding each column.²

Heat exhaustion and heat stroke could become a major cause of morbidity and mortality in pilgrims when the Hajj falls during the summertime, where temperatures may reach from 37 to 45°C. Appropriate precautions should be taken, such as reducing the level of activity, drinking additional water, consume salty food and increase the amount of time the pilgrims spend in air conditioned environment.⁶ Other hazards include fire related injuries, namely the 1997 incident with a fire that destroyed many tents in Mina and led to 343 deaths and more than 1500 estimated casualties.⁷⁵ Since then, all makeshift tents have been replaced by permanent fiberglass installations and at Hajj time, teflon-coated awnings are added and the aluminum frames remain in place the rest of the year. Pilgrims are not permitted to set up their own tents and are not allowed to cook food at Mina. Continuous public education is being undertaken to further reduce fire risk.²

5. Preparedness during Hajj

Saudi Arabia provides free healthcare to all pilgrims during the Hajj. Seven modern, fully equipped hospitals, with a cumulative bed capacity of 2,070 are permanently located in the city. In 2009 specifically, the Saudi MoH prepared 24 hospitals with a total bed capacity of 4,964, of which 547 were critical care beds. Moreover, 136 healthcare centers in the vicinity of the Hajj were equipped with the latest emergency

management medical systems and staffed with 17,609 specialized personnel to provide state of the art healthcare to all pilgrims free of charge.

Along the pilgrimage route, seventy-three medical centers of the Saudi MoH, the Saudi National Guard, the Internal Security Forces, the Ministry of Defense and Aviation and the Saudi Red Crescent Society provide 24-hour free medical care and operate without cost to the pilgrim patient.

Twenty four supervisory committees reporting to the Minister of Health are ready to assist in the Hajj planning and coordination. The preventive medicine committee is one of the committees which oversee all key public health and preventative matters during the Hajj and supervises a large number of public health officers who control the ports of entry for all pilgrims (land, sea and airports) and ensure compliance with Saudi MoH requirements for performing Hajj. In addition, 39 public health teams are distributed around where the Hajj takes place of which, 18 are stationary and are located in healthcare facilities and 21 are mobile teams which rotate through the different pilgrim camps.

At the Hajj terminal based at King Abdulaziz International Airport in Jeddah, the key port of entry for the majority of pilgrims, an independent, newly renovated Hajj terminal accommodates 80,000 pilgrims at any one time. At each of its 18 hubs receiving pilgrim flights, there are two clinical examination rooms and a large holding area to assess arriving pilgrims, check their immunization status and administer any recommended prophylactic medicines. Any pilgrim with a suspected communicable disease requiring isolation is escorted back through the airport grounds by ambulance to a nearby bed hospital.

The public health teams (stationary and mobile) as well as the ports of entry teams report directly to the command center on nine communicable diseases using an electronic surveillance form based on an updated disease case definition submitted via mobile phones. These diseases include influenza, influenza-like illness, meningococcal disease, food poisoning, viral hemorrhagic fevers, yellow fever, cholera etc. ^{16, 7}

6. Conclusion

The Hajj is unique in many respects, particularly in measures of scale and mass migration.¹⁷ It presents a significant challenge that impacts the international public health as an increasing number of humans become more mobile, with everything this entails in terms of potential risks disease transmission and other health hazards. Hajj management is an overwhelming task. International collaboration (in planning vaccination campaigns, developing visa quotas, arranging rapid repatriation, managing health hazards at the Hajj and providing care beyond the holy sites) is vital. The most important role is assigned to the Saudi Arabia authorities, whose work and preparation for a mass gathering of such proportions is decisive and integral for the managing of the Hajj and the outcome of the whole event.

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