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REVIEW

Hajj: Health lessons for mass gatherings

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Abstract The potential for spread of infectious diseases associated with mass gatherings is well recognised. Hajj, the unique annual mass gathering of over 2 million Muslims from all over the world, presents enormous challenges to the authorities in Saudi Arabia. They have a comprehensive programme updated annually, to ensure that all aspects of Hajj rituals are conducted safely and without major incident.

The inevitable overcrowding in a confined area of such large numbers increases the risk of respiratory infections. Of these 'Hajj cough' is the most frequently reported complaint and is caused by a variety of viruses and bacteria. The outbreaks of meningococcal W135 strains in 2000 and 2001 with the associated high mortality showed the potential for international spread at mass gatherings. Collaboration between health policy makers and community leaders in the UK resulted in a rapid and impressive reduction of these infections.

On-going disease surveillance and data analysis is necessary to better understand health risks and strengthen evidence base for health policy and prevention. The battle against spread of travel-related infections is a shared responsibility. Countries sending pilgrims should co-ordinate preventive measures by healthcare professionals and community groups. A multi-pronged approach involving awareness programme

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for pilgrims and their health advisers, supported by rapid diagnosis, timely treatment, prevention by vaccine, community measures, infection prevention and control practices are necessary.
The benefits from such measures go beyond the Hajj to protect health and reduce inequalities. Establishing an international centre for public health relating to the Hajj will enable co-ordinating international health action and appropriate intervention.

Introduction

Hajj, the pilgrimage to Mecca, Saudi Arabia, is the largest and most long-standing annual mass gathering event on earth. Today, following an exponential rise in the numbers of non-Saudi pilgrims attending the Hajj in the last decade (Fig. 1), 2 million people from over 140 countries assemble annually. This presents an enormous challenge to Saudi Arabian authorities who, as functionaries to the Custodians of the two Holy Sites (Mecca and Medina), provide extensive, multi-faceted programs to serve these 'Guests of God'. The Saudi state arranges pro bono visas, free health care services (including critical care medicine delivery at the Hajj sites themselves), security services, crowd control and licensed abattoirs and barbers to ensure that all aspects of the pilgrimage rituals are conducted safely and without major incident throughout the 5 days of Hajj. The massive operation exercised by the Saudi authorities, arguably is no less than organising an Olympics every year.

Performing the Hajj pilgrimage to Mecca is one of the five fundamental pillars of Islam, but required only of those with adequate means and health.

''*Pilgrimage thereto is a duty men owe to God—-those who can afford the journey*'' (The Quran 3:96—97).

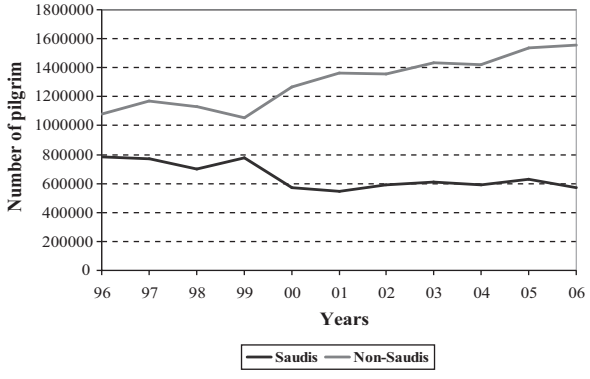

Figure 1 Number of pilgrims attending the Hajj over the last decade (source: http://www.hajinformation.com).

Public Health Implications

Before modernity, journeying to and from the Hajj was a months-long ordeal with many succumbing along the way. Modern day air travel has made the Hajj journey safer and faster as the world has shrunk into a global village.

The potential for spread of infectious diseases associated with travel has long been recognised [1]. Throughout its 14-century history, Hajj has been witness to a series of major health issues. Historical records document outbreaks of plague and cholera, involving large numbers of pilgrims, when quarantine was the prime means of control [2].

Now the speed of air travel means pilgrims incubating infectious diseases at their time of departure may not manifest illness until after arrival in another country thereby facilitating the spread of disease and even full blown epidemics. The risk of pandemic instigation by this means is especially concerning and with the Hajj season determined by the lunar calendar, the dynamism of the event poses unique concerns when Hajj season and influenza season eclipse. Furthermore the extreme and inescapable overcrowding at the Hajj facilitates disease transmission. Infections acquired thus may be subsequently carried to pilgrims' countries of origin upon their return.

This potential for international spread of infection was demonstrated recently. In both 2000 and 2001, national meningococcal reference laboratories in England and France and their field Epidemiology services identified clusters of meningococcal cases caused by the hitherto uncommon meningococcal serogroup W135. Soon these clusters were linked to either a history of recent return from the Hajj or of household contact with returned pilgrims (Fig. 2) [3]. Globally, more than 2000 individuals from a score of countries were affected; one fifth of the global outbreak patients had been in Saudi Arabia inside the Hajj [4].

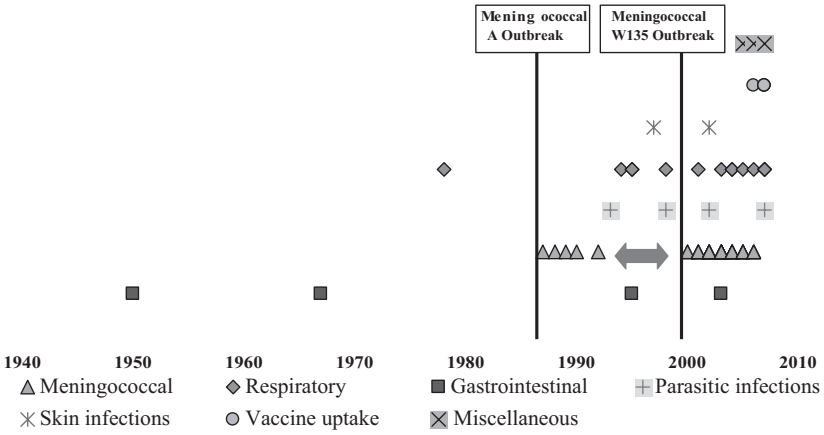

Figure 2 Summary of publications on infections associated with the Hajj (a clearly distinguishable gap of a decade is seen between two meningococcal outbreaks when no research on meningococcal disease was conducted).

Working with the community

The largest cluster of paediatric cases in Europe occurred in East London [5,6], where eight children developed meningococcal W135 disease after a single case of W135 meningococcal infection in an elderly (returned) pilgrim. None of the children had travelled to the Hajj and only three of them were direct contacts of pilgrims. The likely explanation was that adults who had been to the Hajj (and only been immunised with A, C polysaccharide meningococcal vaccine) had returned as carriers of W135 and the organism had spread within their contacts in the local community. This wave of meningococcal. W135 infections which resulted in almost 20% mortality directly influenced health policy in the UK. In response, the Chief Medical Officer in England launched a high profile campaign to increase health awareness about the risk of meningococcal infection among the Muslim community. Furthermore the Saudi consulate under the direction of the Saudi Ministry of Health immediately made quadrivalent (ACWY) meningococcal polysaccharide vaccine a prerequisite for travel to Hajj and Umrah. To augment efforts, government policy partnered quickly with community leaders: working with the Muslim Council of Great Britain, the UK Department of Health has since made relevant health information leaflets in different languages, widely available to the British Muslim community, particularly through Mosques [7].

With these aggressive measures, the number of meningococcal infections and resulting deaths due to W135 strain were reduced from 45 cases in 2000 to just 6 by 2002 with no cases of Hajj-associated W135 meningococcal infections since [8]. The campaign proved to be successful directly as a result of collaboration between public health policy makers and community leaders. In contrast recent surveys suggest that a large number of domestic pilgrims including health care workers (Saudis and expatriates) miss the vaccine [9,10].

Since the current quadrivalent polysaccharide vaccine does not reduce carriage in the long term and causes hyporesponsiveness to booster doses, especially for serogroup C, there is a need for a conjugate quadrivalent vaccine capable of both reducing pharyngeal carriage and providing long lasting immunity. Such a vaccine is used in the USA and Canada (e.g., Menactra®, Sanofi Pastuer) for pilgrims aged 2—55 years and a conjugate vaccine capable of inducing satisfactory immune response in infants has become available and is pending licensure (Menveo™, Novartis Vaccines) [11]. Those attending the Hajj or travelling to other meningococcal endemic areas, including young children, should benefit from this vaccine.

Pre travel advice — preparing the pilgrims

Performance of Hajj and its rites is physically very demanding. Extreme physical stressors such as heat, sun exposure, thirst, crowding, traffic congestions, steep inclines and rough ground underfoot increase the risk of communicable diseases, particularly respiratory infections in those with certain preexisting health conditions such as heart disease, renal disease, chronic lung disease and other conditions including diabetes mellitus.

Physicians and health personnel must be aware of these and other risks of blood borne virus infections such as Hepatitis B and Hepatitis C that could

spread through sharing or using communal razors for head shaving [4], to appropriately educate, immunize and prepare these travellers for the Hajj.

Pilgrims are well advised to have pre- and post-Hajj physicals for approporate counselling and screening for illnesses before and after Hajj.

The recent outbreaks of meningococcal infection associated with the Hajj, described above, serve as a timely reminder for robust, well considered and sustainable arrangements in anticipation of newly emerging challenges.

''Hajj cough'': Influenza and other respiratory infections

Respiratory infections are the most frequently reported complaints among Hajj pilgrims; the ''Hajj cough'' is considered by pilgrims almost *de rigeur*. The severity and clinical spectrum of disease varies from mild inconvenience to severe pneumonia leading to hospitalisation and even death [12]. Influenza and other viruses, tuberculosis and pertussis have all been reported among pilgrims [13—15]. Some studies show tuberculosis to be the primary cause of community-acquired pneumonia in pilgrims hospitalised at the Hajj [15]. Influenza is the most common vaccine preventable respiratory virus infection identified among Hajj pilgrims [16], but its epidemiology at mass gatherings such as the Hajj is poorly understood [17]. At this time we recommend a multi-pronged approach encompassing immunisation, education and awareness programs targetted at pilgrims, supported by national surveillance databases, rapid diagnosis, timely treatment and excellent infection control practices at the site of religious rites [17]. Hajj provides an ideal opportunity for studying and assessing the specific impact each of these measures exerts in curtailing spread of respiratory disease-valuable lessons which may ultimately become applicable to other mass gatherings.

Infection Prevention & Control — a shared responsibility

The battle against spread of travel-related infection in the setting of mass migration is a shared one. Responsibilities extend beyond the host nation's jurisdiction. Many infections and outbreaks are avoidable if appropriate awareness and prophylactic measures are implemented before pilgrims arrive at Mecca. Identifying and preparing citizens planning to perform Hajj is critical before their departure from the home country. Prevention and control of infection is a collective responsibility. Countries sending pilgrims or delegates to such international mass gatherings play a vital role. Well co-ordinated and collaborative efforts from statutory bodies, healthcare professionals and community groups are needed. In recognition of precisely such coordination, the WHO, in its first publication of guidance on communicable disease management for mass gatherings published in June 2008 has included as exemplary, the experience of Saudi Arabia and the Hajj in making modern-day mass gatherings safer [18]. Saudi Health Policy makers and public health officials have acquired a valuable, seasoned expertise which must be shared to benefit not only future Hajj seasons but also other mass gatherings and proposals for a field of Hajj Medicine are now growing.

Increasing Health awareness in the community

Much can be achieved by increasing the awareness among individual pilgrims and the authorities in their country of origin.

Approximately 25,000 British pilgrims perform Hajj each year. Motivated by the recent meningococcal outbreaks and the growing threat of other emerging infectious diseases, a team of health protection professionals, public health experts and other healthcare officials from UK, Saudi Arabia and Australia formed the Health at Hajj and Umrah (HAHU) Research Group. The Group's objectives focus on to the study of respiratory disease prevalence, epidemiological patterns and efforts to, identify vaccine preventable and treatable respiratory infections. A central goal of the HAHU Research Group's mission is to increase awareness of disease prevention both amid prospective pilgrims and their physicians. This involves working with communities to find practical ways of implementing respiratory hygiene and cough etiquette at the grassroots level and to engage early on with specialist tour operators to provide health advice, collaborate with Mosque committees and eventually to collaborate in identifying opportunities to expand community-based research initiatives on pilgrims beyond Hajj itself. The impact of such measures on health protection and their contribution to reducing health inequalities in communities cannot be overstated.

Surveillance and monitoring

Thus far experience highlights a pressing need for on-going disease surveillance and data analysis to

Table 1 Selected publications from HAHU research group

Authors	Title	References
Ahmed et al. [4]	Health risks at the Hajj	*Lancet* 2006; 367:1008—15
El Bashir et al.	Influenza among U.K. pilgrims to hajj, 2003	*Emerg Infect Dis* 2004; 10:1882—3
El Bashir et al.	Meningococcal W135 carriage; enhanced surveillance amongst east London Muslim pilgrims and their household contacts before and after attending the 2002 Hajj	*Travel Med Infect Dis* 2004; 2:13—5
El Bashir et al. [9]	Meningococcal vaccine coverage in Hajj pilgrims	*Lancet* 2007; 369:1343
Gatrad et al.	Hajj and the risk of influenza	*BMJ* 2006; 333:1182—3
Klaber et al. [5]	Sustained outbreak of W135 meningococcal disease in east London, UK	*Lancet* 2002; 360:644
Rashid et al.	Influenza vaccine in Hajj pilgrims: policy issues from field studies	*Vaccine* 2008;26:4809-12
Rashid et al. [17]	Pandemic influenza: mass gatherings and mass infection	*Lancet Infect Dis* 2008; 8:526—27
Rashid et al. [13]	Viral respiratory infections at the Hajj: comparison between UK and Saudi pilgrims	*Clin Microbiol Infect* 2008; 14:569—74
Rashid et al.	Influenza and respiratory syncytial virus infections in British Hajj pilgrims	*Emerg Health Threats J* 2008; 1:e2
Rashid et al.	Influenza and the Hajj: defining influenza-like illness clinically	*Int J Infect Dis* 2008;12:102—3
Rashid et al.	Value of rapid testing for influenza among Hajj pilgrims	*Travel Med Infect Dis* 2007; 5:310—3
Rashid et al.	Conjugate versus polysaccharide meningococcal vaccine	*Lancet Infect Dis* 2008;8:215
Rashid et al.	Influenza and RSV among returning travellers	*Br J Infect Control* 2008; 9:17—18
Shafi et al.	Hajj 2006: communicable disease and other health risks and current official guidance for pilgrims	*Euro Surveill* 2005; 10:E051215.2.
Shafi et al.	Vaccinations for Hajj	*J R Soc Health* 2006;126:68—9
Shafi et al.	Influenza vaccine uptake among British Muslims attending Hajj, 2005 and 2006	*BMJ* 2006; 333:1220

better understand health risks and to strengthen the evidence-base on which to formulate and update policies relating to immunisations, infection control and health protection. Sharing of information and research findings are critically important elements of the programme. A ''Health at Hajj and Umrah'' symposium was held in London on the 16th November 2006 in collaboration with the Health Protection Agency, the Queen Mary University of London and the Muslim Council of Britain. This 1 day conference brought together British Hajj tour operators and their health advisers, representatives of the British Hajj Delegation, UK health protection officials and public health professionals with national and international experts on travel medicine and infectious disease in the first such opportunity to share knowledge and experience. The HAHU Research Group has worked closely with major stakeholders and in a relatively short space of time has published widely on practical issues related to infection and public health with the aim of improving health at mass gatherings (Table 1). The symposium offered useful insights into the benefits of multi-professional approach to providing a healthy Hajj experience and the expectation is that this will become a regular event for fostering intellectual exchange and collaborative research pertaining to Hajj in the future.

Many health care professionals already have wide experience, whether from regular annual visits as Group doctors for the tour operators or provide 'Good Samaritan' services to fellow pilgrims as a resource for the tour operator or other healthcare professionals who either accompany tour operators—all are a useful resource for training doctors.

Conclusions

The Hajj is unique in many respects, particularly in measures of scale and mass migration: Hajj provides an excellent annual opportunity for co-ordinated international research on populations of

different countries with a view to comparing different interventions attempting to reduce the risk of spread of infection. A well co-ordinated global approach is required to respond to mass events and their health risk. While HAHU Research Group represents the first germinal efforts to nurture such an approach, establishing an international centre for public health affairs at Hajj would progress this and must now become a matter of priority.

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