Mecca Bound: The Challenges Ahead

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Each year some 2 million Muslims perform the hajj, the annual pilgrimage to Mecca. This mass migration has its own attendant risks of infectious and noninfectious hazards. This review examines the medical risks of traveling to Mecca during the hajj and gives advice for appropriate prophylactic measures to ensure a safe trip. Special attention is given to the considerable noninfectious insults the pilgrim traveler may face.

Characteristics of Pilgrimage to Mecca

Mecca was once a central point on the caravan routes traversing the Arabian Peninsula. An ancient city, Mecca predates Islam, and has been revered as a holy city, long before the Qur’an was revealed. Abraham and his son Ishmael built the Ka’abah four millennia earlier, which is now the center of Mecca. The Ka’abah is a rectangular building made of bricks, draped with a black cloth called the kiswa and represents the spiritual and physical center of Islam. Surrounding the Ka’abah is the Al Haram or Holy Mosque, beyond which are the houses that make up Mecca proper. Mecca today has a population of 618,000 and is located in the southwestern region of the Kingdom of Saudi Arabia, some 80 km from the Red Sea coast. Saudi Arabia has a desert climate where heat can reach intense levels. Mecca is inland from the coastal area so the conditions here are often extremely humid. The pilgrimage to Mecca is one of the five pillars of Islam and each Muslim is duty bound to perform one hajj in his lifetime. Islam stipulates the pilgrim be both healthy and of appropriate means before considering the hajj (Fig.).

During the late 20th century, the Kingdom of Saudi Arabia has developed the Al Haram to accommodate the colossal numbers of pilgrims now seen during the hajj ceremony. The Al Haram is built on three levels covering an area of 356,000 square meters and has a capacity of 1 million at any one time. The neighboring mosque at Madinah, which is often visited around the time of the hajj, is also large, approximately 165,000 square meters in area, easily accommodating 750,000 pilgrims at once.

From an epidemiological stance, the hajj occasions vast numbers of travelers, from over 140 countries, to perform demanding rituals in highly overcrowded conditions. Many of the pilgrims are from the developing world, where particular diseases may be endemic. In 2001, 1,804,800 pilgrims arrived in Saudi Arabia, over 75% of whom had traveled internationally by air (the majority), land, and sea. With such diverse routes of travel, varying prevailing health conditions at the pilgrim’s home, and the close proximity dictated by these circumstances, a number of health considerations arise which are unique to the hajj. Breakdown of international pilgrims in 1994 by country of origin was as follows: 63% from Arab countries, 30% from remainder of Asian countries, 5% from African countries, and 2% from European, American, and Australian countries.

The hajj is scheduled according to the lunar calendar and therefore each year moves 11 days earlier on the Gregorian calendar. Over time, there is seasonal variation, as the hajj occurs at different times each year. From 1983 until 1996 the hajj took place during the summer months when ambient nocturnal temperatures in Saudi Arabia can reach 55°C or more. The heat, humidity, vehicular congestion and resulting air pollution combine to produce additional challenges to even the most seasoned traveler. Add to this the highly religious and sacred nature of this journey and the importance of good health and wise medical preparation cannot be overemphasized.

Vigilant infection control implemented by the Saudi Arabian Ministry of Health (MOH) has played a major role in safeguarding the hajj.
At Mecca itself, the kingdom provides free health care to all pilgrims. Seven modern, fully equipped hospitals, with a cumulative bed capacity of 2,070 are permanently located in the city. Seventy-three medical centers providing 24-hour access are distributed throughout the pilgrimage route and operate without cost to the pilgrim patient. The medical centers work under the collaborative administration of the Ministry of Health, the Saudi National Guard, the Internal Security Forces, and the Saudi Red Crescent Society.

Travel to the hajj poses a unique risk of blood-borne disease to male pilgrims, most of whom shave their heads at the completion of the hajj in keeping with religious beliefs. Barbers can be seen curbside at the hajj, shaving men immediately after their rites are completed, a sea of human hair underfoot and lines of pilgrims in waiting. Barbers often reuse razors on many men. Grazes or abrasions from razor nicks are often seen on newly shorn pilgrims.

At the hajj, accommodations range from the most basic to the most sophisticated, but most pilgrims have to share public facilities and live in semi-permanent tents. Inadequate storage, cooking or transportation, lack of refrigeration, and lack of proper food handling all contribute to the pilgrim’s risk. The kingdom makes every effort to accommodate these needs and clean drinking water is readily available in Saudi Arabia, including at the holy sites themselves.

Stampede is particularly seen at the Jamarat sites, where ritualistic stoning occurs. The pillars at Jamarat represent the personification of the devil and hajj culminates in the stoning of each pillar, by each pilgrim. The pilgrim uses pebbles gathered from the nearby Mina area and, though these pebbles are required by Islam to be small and quietly thrown, over zealous fervent crowds often get carried away hurling larger stones with great ferocity. The area can become overwhelmingly crowded: a million or more pilgrims focusing only on the pillars at one time.

Similarly, circumambulation of the Ka’bah at the center of the Holy Mosque can produce stampede conditions, particularly at bottleneck points. In recent years, the kingdom has built aboveground walkways to increase access to various sites, including at Jamarat where crowds can reach the monument both at ground level and on a separate, first level through a massive approach. This reduces the density of pilgrims and also affords shade to those on the ground level. Pilgrim flow is maintained by military police stationed at the area. Pilgrims are actively encouraged to keep moving and help is at hand immediately from soldiers and police, should the crowd appear too tumultuous. The Islamic decree of each woman to be accompanied by a male member of her family now seems utterly logical. Men folk are seen to be appropriately physically protective of their less sturdy female counterparts. Priests or community leaders separately escort any groups of single women, in an organized fashion, so that any inadvertent crowd exposure to more vulnerable women is minimized.

Crowd stampedes are usually induced by panic such as the threat of fire in a building, or drowning on a sinking ship. Other times, stampedes can result from a rush for seats, at a stadium for instance, or for no apparent reason. Panicked individuals show maladaptive and relentless mass behavior like jamming, pushing, and life threatening overcrowding. Once the stampede develops,
several characteristics of escape panic can be identified. People try moving faster than normal and start pushing; physical interactions arise. Moving, and passing bottlenecks, becomes uncoordinated and arching or clogging becomes apparent at exits. Jams build up and an enormous pressure can develop, up to 4,450 N/m², literally enough to bring down entire walls. Escape is further impeded by falling or fallen individuals who act as obstacles to the outflow of the crowd. The group displays mass behavior: people do what other people do, nearby exits may be missed in the pandemonium of the herd.

During the three days of celebration immediately following the hajj, known as Eid, more than 2 million sheep are slaughtered. Much of the slaughtering is done by laypersons, joyful Muslims who may never have slaughtered any animal previously. As a result, accidental hand injuries are very common. Commercial government regulated slaughterhouses exist in Mecca where qualified butchers slaughter sheep, cows, and some camels, limiting these hazards. Despite the endemicity of brucellosis in the kingdom, there are no published reports on brucellosis outbreaks among slaughterhouse workers during the hajj.

Meningococcal Disease

General Considerations

In unconfined populations risks of meningococcal disease transmission are low, but a chance encounter with a carrier can lead to infection. When carriers are in confined, restricted conditions, such as college, the military or at Mecca, these risks multiply. During the hajj, the physically overcrowded conditions, the high humidity, and dense air pollution all contribute to carrier rates as high as 80%. When carrier rates become so abnormally high, outbreaks become a real public health threat. In households where a family member has had meningococcal disease transmission are low, but a chance encounter or immunological changes in the host population predispose to invasive infection. As upper respiratory tract infection is compromised airway epithelial integrity predisposing to invasive infection. As upper respiratory tract infection is almost inevitable at the hajj, the setting for meningococcal disease is nearly ideal.

Outbreaks of Meningococcal Disease Related to the Hajj

Meningococcal disease outbreak is well recognized at the hajj. The 1987 outbreak in Saudi Arabia involved hajjies (pilgrims attending a hajj) of all nationalities, including Saudi nationals. Outbreaks soon followed in surrounding Gulf States. In Qatar, an island off the Persian Gulf, 15 cases were seen within the first 3 weeks after the hajj. Serogroup A was implicated. The offending strain probably originated in Nepal.

At the time, a two-pronged approach was adopted: the kingdom mandated vaccination with available bivalent A and C preparations for all pilgrims arriving for the hajj and simultaneously launched aggressive vaccination campaigns for all local residents of Mecca and the surrounding holy sites, who were considered at high risk. Additionally, all Muslims arriving from the African meningitis belt received oral ciprofloxacin to reduce carrier rates. Outbreaks of meningitis appeared controlled for the next several years, although minor sporadic outbreaks continued in Mecca and Jeddah in 1992 and 1993. These outbreaks were ascribed to serotype A yet again in 1992 and W-135 in 1993 among individuals who had escaped vaccination.

In March 2000, coinciding with the hajj, more than 300 cases of meningococcal W-135 serotype infection were reported in Saudi Arabia and nine other countries. These cases involved either hajjies themselves or their close contacts. This marked the first major outbreak due to the W-135 strain, which previously had not been seen in major epidemic patterns. Attempts were made to revise the vaccination policies to include the quadrivalent preparation, which covers A, C, Y and W-135, but the 2000/2001 vaccination programs were frustrated by inadequate vaccine supplies from the industry.

There were fewer cases of meningococcal in hajj 2001 but the mortality was enormous; of the 109 cases seen in Saudi Arabia, again mainly hajjies from overseas, 35 deaths resulted. The majority of cases were due to the W-135 strain. In 2001, the Centers for Disease Control and Prevention (CDC) looked at nasopharyngeal carrier status amongst hajjies before the hajj and after leaving Saudi Arabia. No statistically significant differences in W-135 nasopharyngeal carriage were seen in homebound pilgrims. Based on this finding routine chemoprophylaxis was not recommended.

Geographic changes in serotype prevalence present unique challenges. Immunization programs have a superimposed effect; the use of bivalent vaccine probably selected for W-135. Additionally, newly virulent strains or immunological changes in the host population present further dilemmas.

These shifts in etiology are disturbing. Modern travel affords the meningococcus unprecedented transcontinental mobility. The specter of the “hajj hub” sending far-reaching “spoke effects” is cause for grave concern. Year after year, the 2 million pilgrims at the hajj foster near ideal conditions for devastating epidemics of meningococcal disease.

Despite all advances in treatment, mortality is between 1 to 5%. In Mecca, these case fatality rates are...
much higher, up to 16.7% in some studies.\textsuperscript{16} Chemoprophylaxis, if given early can indeed avoid secondary infection but these constitute few of the cases seen in epidemics. Hence, the public health impact of chemoprophylaxis can only be minimal.

Specific Meningococcal Risks for the Hajjies

Risk of meningococcal disease for travelers to any location depends on host status, level of contact, mode of transportation, and the duration of stay.

Commercial aircraft are suitable environments for airborne or aerosolized disease propagation, including \textit{Neisseria meningitidis}. Air travel associated meningococcal disease has been defined as onset of meningococcal infection within 14 days of air travel of at least 8 hours in duration, including ground or runway time.\textsuperscript{17} The enormous number of hajjies traveling by air (1.2 million in the 2001 hajj season), most of whom are from the African subcontinent and other developing nations, present a monumental public health risk, of which airlines need to be acutely aware. The CDC now has recommendations for public health precautions necessary for passenger contact protection, should an in-flight index case arise. Health authorities insist that public health authorities be notified by the crew, before landing, whenever possible, so that passenger lists may be retrieved and possible close contacts (adjacent passengers around the suspected index case) rapidly identified. In the past, notification of passenger contacts has been difficult—airlines often discard passenger lists a mere week after deplaning, often while infection is still incubating.

Prevention and Future Public Health Policies

Vaccination is essential and needs to be given 2 weeks prior to arrival into the kingdom. Antibody response to polysaccharide vaccine is highly age dependent, peaking in adulthood. Meningococcal vaccination protects only the recipient; no herd immunity has been demonstrated. Several vaccine formulations are commercially available; monovalent (A or C), bivalent (A and C), and quadrivalent (A, C, Y, and W-135). Safety and efficacy of bivalent and quadrivalent vaccines is proven from age 2 until adulthood. Children over the age of 4 acquire a lasting immunity within 14 days of administration, protecting them for a further 3 years. In contrast, adults show antibodies against serotypes A and C up to 10 years after vaccination.\textsuperscript{18–20} Children under 2 years are recommended to receive two doses of the A vaccine 3 months apart. Serogroup polysaccharide vaccine A however, can elicit an immune response in the first 3 months of life. Serotype B lacks an immunogenic capsule, so effective vaccination cannot be developed. Serogroup C polysaccharide vaccine almost never confers protective immunity under the age of 2.

Difficult but valuable lessons have been gained from these epidemics. Saudi Arabia’s active infection control bodies have set a precedent for proactivity in this unique public health arena. The kingdom is now mandating quadrivalent vaccination for all those entering the kingdom for the hajj and all Mecca and Madinah area residents, who are by definition at high risk. Vaccination is required of all supporting staff, local population, and residents of the two holy mosques. International health authorities are kept abreast of these changes.\textsuperscript{21} Documented proof of vaccination is needed by the health authorities, with the vaccine given 2 weeks 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. 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. Fears of future vaccine shortages remain.

Antimicrobial prophylaxis is the primary method of limiting the spread of meningococcal infection. In normal conditions, antimicrobial prophylaxis can only limit the smallest proportion of infection, as most outbreaks are sporadic. At the hajj under the crowded conditions, antimicrobial prophylaxis can become a powerful tool. For the upcoming hajj season (2002) the Saudi health authority is recommending that local pilgrims use ciprofloxacin before leaving Mecca to avoid carrying the endemic strain of meningococcus back to their families.

Hepatitis B

Investigators have looked at the profile of hepatitis amongst barbers at the hajj. One hundred and fifty-eight barbers were tested. Significant disease was found, with 10% positive for hepatitis C virus, 4% hepatitis B surface antigen (HbsAg) positive, indicating active infection at the time of shaving clients, and 0.6% were positive for hepatitis B e antigen (HBeAg), meaning they were highly infectious.\textsuperscript{22–24} The very real threat of disease transmission is apparent from these data and active public health campaigns are needed. The kingdom now demands licensure of barbers to avoid ill-trained individuals from practicing and the MOH now operates and regulates headshaving areas to government standards.

Prevention

Hepatitis B immunization is now part of the routine immunization in many countries, mainly in neonates, preschool children, and young adults. Ultimately, this will eliminate the need for hepatitis B vaccination arising during travel. In the meantime, at least those who stay at risk for more than 1 month should be recommended for
immunization, since any traveler may be at risk for hepatitis B during travel. Pilgrims begin gathering in Mecca a month or so before the hajj season. For immunization to be effective, the pilgrim should ideally commence vaccination 6 months prior to his planned hajj travel.

Respiratory Infections

The severe congestion and proximity of pilgrims performing religious rites predisposes to airborne infection. Upper respiratory tract infection (URTI) is very common. Risk of infection is the worst during the fall and winter months.

Investigators looked at outpatient respiratory tract infection during the 1991 to 1992 hajj season through serial sputum cultures. Three hundred and ninety-five samples were recovered. Cultures were positive in 118 of the specimens (30%); the commonest pathogens recovered were Haemophilus influenzae, Klebsiella pneumoniae, and Streptococcus pneumoniae. In the same study, investigators obtained 761 throat swabs for viral screening of which 20% were positive. Influenza and adenoviruses predominated.

Winter is the Saudi influenza season. Traveling with or in large organized groups is an additional risk, as transmission rates will be magnified. The brief 1 to 4 day incubation period ensures that many hajjies will contract and then transmit influenza during the peak of the hajj. Patients can be asymptomatically infectious, before the viral syndrome is evident, aggravating transmission. Patients can be asymptomatically infectious, before the viral syndrome is evident, aggravating transmission. Complications, hospitalizations, and deaths from influenza are greatest at the extremes of age and in those with co-morbidities. The majority of hajjies are adults and many are elderly, infirm Muslims, from poor nations. The risk to hajjies, many of whom have saved lifelong to make the journey to Mecca late in life, is therefore great.

Prevention and Control of Influenza at Mecca

All travelers planning to attend the hajj should be informed of the likelihood of bronchitis during or immediately after their trip. Immunoprophylaxis is the main method of controlling the spread and attenuating active influenza infection. Recently, the benefit of influenza vaccination of pilgrims has been documented with a reduction in the incidence of influenza-like illness and reduced medication use among Pakistani pilgrims who received the vaccine prior to performing the hajj.

Antiviral chemoprophylaxis is important as an adjunct, though vaccination is never supplanted by antiviral therapy. Caution should be exercised in recommending antiviral therapy for hajjies, as increased prevalence of amantadine resistance has been reported in populations where amantadine has been used for both treatment and prophylaxis, which could easily arise at the hajj. New oral selective neuraminidase inhibitors have recently been mandated. Currently, the utility of these agents is limited by their high cost.

In a controlled nosocomial setting where the incidence of tuberculosis (TB) is high, personal respiratory precautions are advised for those who may be inadvertently exposed to TB. Adequate respiratory protection is provided only by specified high efficiency particulate air (HEPA) filter respirators; clearly impractical and too costly at the hajj. The hajj is an uncontrolled environment where TB is virtually endemic. Routine respiratory precautions are not feasible, but surgical masks may be of benefit. The CDC recommends the use of simple surgical masks to reduce the expulsion of droplet nuclei into the air in patients suspected of having TB, when these patients are not in TB isolation rooms. This simple measure is probably the only means of reducing inhalation of aerosolized droplet nuclei at the hajj where many pilgrims will have undiagnosed active TB. Additionally, pilgrims prefer to wear masks to minimize the effects of dense smoke and pollution, so a double benefit is likely conferred. By extension, reduction in influenza transmission may be similarly reduced in the congested hajj conditions.

Other precautions such as restricting contact between the infected and noninfected, cohorting patients, and vaccinating staff that may have missed vaccination earlier on are also useful. Unfortunately, few of these measures are practical at the hajj, where certainly movements cannot be restricted and vaccination programs may not be possible. The onus therefore is on the pilgrim to receive appropriate vaccination prior to arrival, as well as education of pilgrims to wear facemasks when in public places or in contact with symptomatic patients. International mechanisms such as ongoing, current education programs in the pilgrim’s home countries are badly needed.

Community-Acquired Pneumonia

Investigators have looked at community-acquired pneumonia (CAP) in the 1994 hajj season. Sixty-four patients were admitted with CAP at two large community hospitals. A microbiological diagnosis was established in 46 (72%) patients. The data differs starkly from commonly found etiologies of CAP in non-hajj communities. The commonest pathogen is usually S. pneumoniae. Additionally, cultures yielding no organisms may well be infections due to S. pneumoniae. In the 1994 hajj season, the commonest causative organism identified for CAP in this series was Mycobacterium tuberculosis in 72% of all patients (n = 46), clearly a deviation from the norm. Other organisms recovered included gram-negative bacilli in 18.8% of the sample. S. pneumoniae accounted for a mere 10% of all cases, and atypical pathogens including Legionella spp and Mycoplasma spp accounted for 6% of cases.
is interesting to note that cultures were so often positive. Many studies looking at diagnostic bacteriology in the CAP patient find cultures positive only about 30% of the time. In CAP at the hajj, pathogen-burden is probably high, leading to frequently positive cultures.

**Role of Pneumococcal Vaccine**

Currently the American Thoracic Society recommends vaccination to all those over 65 and all those younger than 65 with co-morbidities such as cardiovascular disease, chronic lung disease, diabetes, alcoholism, liver disease, functional or anatomic asplenia, and those with cerebrospinal fluid leaks. No recommendation is made regarding the hajj specifically, although again a pre-hajj visit to assess pneumococcus vaccination status is highly advisable.

**Tuberculosis**

Several cases of mycobacterium TB have been acquired directly during air travel with one index case passenger on board. The prevalence of resistant tuberculosis and the annual risk of infection are three times higher in Saudi Arabian cities hosting pilgrims, mainly Mecca, Jeddah, and Medinah, than the national average. Risk of TB is a real hazard. Additionally, many pilgrims are from developing nations where TB is endemic. Risk of exposure is normally dependent on local TB rates. At the hajj, the local population is effectively comprised of many hundreds of thousands of people, traveling from areas of high risk, all densely concentrating in one area.

Although the average pilgrim may stay about 2 weeks to a month between the various holy sites, their contact with others is great. The close, crowded, congested conditions where most pilgrims will be sharing tents or rooms with many others allow transmission. Co-morbidities increase the risks. Ideally, the pilgrim will be skin tested at home and know his exposure history, having taken appropriate prophylaxis if indicated, and a follow-up skin test a few months after return may be useful in detecting converters.

A two-step approach to purified protein derivative (PPD) skin testing reduces the likelihood that boosted reactions might be misinterpreted as recent infection. This is useful in much of the hajj populous, as many pilgrims will be over 55 years of age and be more likely to have a waning type IV hypersensitivity reaction. If the first tuberculin test result is negative, that is less than 5 mm in a low risk pilgrim, a second 5-tuberculin units (TU) test should be administered 1 to 3 weeks later. A subsequent positive second result indicates boosting from either a past (inactive) infection or prior Bacillus Calmette-Guerin (BCG) vaccination (which may also be likely in many pilgrims). These pilgrims with a boosted reaction are reactors, not converters. If the second result is negative, the person is probably uninfected, and a positive reaction to subsequent tests, when the pilgrim returns from his hajj, indicates a true tuberculin skin-test conversion.

It is probably impossible to implement skin testing and prophylaxis programs at the hajj due to the enormous number of visitors but also because of the short window during which people visit. The only real safe guard, therefore, is forewarning pilgrims of the high risk of disease before arrival and the need for facemasks as a precaution. Facemasks are probably the best means to limit infection at the hajj as previously mentioned.26 The Saudi MOH has made concerted efforts to encourage facemask usage, but they are limited by poor compliance rates. A study looked at facemask compliance rates in 1999.35 Southeast Asian pilgrims were the most compliant with rates of 46% and Muslims from sub-Saharan Africa and the Gulf Cooperation Council states were the least compliant. Efforts need to be redoubled to educate the government and peoples of these (largely Islamic) countries before the pilgrims depart for Saudi Arabia.

**Diarrheal Disease**

Travelers commonly face diarrhea, being the most commonly reported medical problem when visiting developing nations. Episodes often begin abruptly, either during travel or on returning home. Origin, destination, host factors, and type of travel are very important in determining risk. Despite its high prevalence among hajjies, no studies have documented its incidence nor the most common etiologic agents.

Saudi Arabia is considered endemic for hepatitis A with 90% of adults being immune from natural infection. Hepatitis A is the most frequently vaccine preventable illness contracted by travelers and although there are no data, this is probably also true for hajj pilgrims.

**Prevention of Diarrheal Disease**

Prevention includes education of the pilgrims, avoidance of local street vendors and appropriate choice of food, avoiding products made with fresh eggs. It is probably best to avoid ice cubes also, as one cannot be certain of their origin. All travelers visiting regions endemic for hepatitis A virus (HAV) are advised to be immune, particularly if the traveler is from a developed country. If indicated, travelers can be checked for immunoglobulin G (IgG) HAV prior to administration of the vaccine, so that unecessary vaccination is avoided.

**Self-Treatment for Diarrheal Disease**

Should the pilgrim traveler develop diarrhea, proper hydration 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. Appropriate fluid intake is essential and thirst may not necessarily be any index to hydration.

Self-administered antibiotics with an extended spectrum macrolide, azithromycin or an oral quinolone are probably indicated for moderate to severe traveler’s diarrhea. Ciprofloxacin reduces the duration of diarrhea, the frequency of stool, and associated cramps or abdominal symptoms. Most pilgrims can be advised to carry a 3-day course of antibiotic therapy, an antimotility agent such as loperamide, and a thermometer. Loperamide should not be continued for prolonged periods to avoid the risk of colonic dilatation or even perforation.

Noninfectious Hazards

The vast numbers of pilgrims present unique challenges, which must be addressed. Any Muslim planning to attend hajj is well advised to be informed of these risks in advance.

Crowd Stampede

Stampedes at the hajj have been widely televised and reported. Stampedes are likely at the hajj because of the extraordinary pressure of numbers in a limited, if large, space. It is possible that one or two individuals may stumble and then fall thereby precipitating an entire stampede. Panic quickly courses through the crowd. Mass panic in a crowd is probably the most collectively destructive behavior imaginable, often leading to fatalities as people are crushed or trampled underfoot. Death can be due to head injury or asphyxiation, probably at the stampede itself, or subsequent to other injuries received at the time. In 2001, more than 80 pilgrims were injured and some elderly pilgrims died following their injuries.

Sadly, no amount of preparation can predict when or where stampedes may occur. The pilgrim patient needs to be forewarned of this risk, strongly admonished to go with his family or group at all times, to afford some protection, and to be especially cautious in the more confined areas. Elderly and infirm individuals may need wheelchairs—all the holy sites are wheelchair accessible and with a reliable companion this may indeed be the only way for the individual to complete his hajj. Again, hajj is a strenuous experience really intended only for the physically fit.

Trauma

The very word hajj implies movement. Transport during the hajj will be by chartered bus, or car, or on foot. Much of the pilgrimage is spent either moving on foot or in dense traffic for hours at a time. The population of Mecca swells fourfold or more during the hajj season and this leads to inordinate traffic congestion. Motor vehicle trauma involving other passengers or pedestrians is to be expected. Pilgrims often do not use seatbelts.

Burn injuries have also been described at the hajj, namely in a 1997 fire that destroyed many tents and led to fatalities. The fire was probably caused by open gas stoves used for cooking, which have since been banned. The kingdom has replaced all the tents in the Mina area, where the pilgrims reside during most of their hajj, with a variety which are semipermanent and made of aluminum frames with fiberglass Teflon coated awnings. The risk of fire is now considered much lower.

Other burns commonly seen in the past resulted from sun exposure. Many pilgrims perform their rites at night if the heat is too intense. Sunburn on the face of women and on the upper body of men, who must wear special garments exposing these areas during their hajj, are to be expected. Appropriate protection in the use of fragrance free sunscreen (fragrance of any kind is not permitted during the hajj) is recommended and should be purchased before the pilgrim leaves home.

Pilgrims are barefoot in the holy areas; shoes are left outside or carried with them. As a result, standing on scorching marble in the noonday sun can produce severe burns to the soles of the feet. Full thickness burns have been described.36,37 Recently new marble surfaces were installed at the Holy Mosque, which do not absorb heat to the same degree. A subterranean system of cooling water in pipes is also in place so the surface remains paradoxically cool.

The Holy Mosque at Mecca has three levels each with ample shade, where the pilgrim can seek shelter from the sun whilst praying. Pilgrims may be advised to wear socks, which are permitted, although surfaces can become slippery. It is best to avoid the peak hours of sunshine or to perform the rites at night and seek shaded areas, especially if the pilgrim is unused to extreme heat.

Hand injuries are also commonly reported during the hajj largely due to ceremonial slaughtering of sheep to celebrate the end of the hajj. One series, over a 4-year period, examined hand injuries presenting to an emergency department in Mecca. Over 298 hand injuries were seen, all related to animal slaughter, of which 80% were from knives, the majority involving the hand. Whilst not life-threatening, they are certainly unnecessary.38 New pilgrims arriving to the hajj can be reassured that slaughtering can be arranged by a professional and a receipt documenting the slaughter of the animal can be obtained, rather than attempt slaughtering themselves.

Conclusion

Travel to Mecca for the hajj involves the en masse movement of millions, from areas of high endemic disease, to become, for a brief period, a single, diverse population.
Ahead, the pilgrim faces multiple infectious and environmental challenges, many of which are unavoidable. The hajj affords an epidemiologically unique environment, which demands respect. The vigilant Mecca bound traveler can minimize and contain these risks by following a few key recommendations we outline in the Table.

Adequate preparation for anyone embarking on the hajj is protective for the individual and more importantly, for many others. Appropriate preparation of the individual translates as safety for the masses. Vaccination, hydration, and knowledge of the conditions awaiting the pilgrim are vital.

Much work remains in the public health arena to implement all these measures. Through successive hajj our growing medical knowledge continues to support this extraordinary journey.

References


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