صحة حجاج بيت الله الحرام في القرنين العشرين والواحد والعشرين

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إدارة الصحة العامة

Abstract

Introduction: Al Hajj is an annual, six- day, mobile, outdoor, religious event when more than 3 million Muslims from more than 180 countries including the Kingdom of Saudi Arabia (KSA), gather in the holy shrine of Holy Makkah (Earth Umbilicus) to perform this 5th cornerstone ritual of Islam. In 1926, the Founder King Abdul Aziz Bin Abdul Rahman Al Saud established the Public Health Affairs and Ambulance Services in the Holy Capital of Makkah to meet the evolving health demands of citizens and pilgrims. This study aimed to give an overview of pilgrims health and its related scientific research in particular and Mass Gathering Medicine (MGM) in general.

Methods: An extensive review was conducted using the documents of King Abdul Aziz Foundation (DARAH) and the computerized databases Medline and PubMed for searches from 1966 through January 2013. Islamic books, biomedical journals and the proceedings of the Lancet 1st International Conference on MGM and the World Congress on Disaster and Emergency Medicine (WCDEM) were also scanned for relevant citations. Articles containing information pertinent to pilgrims health and MGM were read, abstracted, analyzed and compiled.

Results: MGM is a field of Emergency Medicine that provide pre hospital medical services (EMS) to religious, political, sports or entertainment gatherings. Al Hajj is the oldest and largest Mass Gathering. Various large- scale, health issues were reported during Hajj. General Hajj- related health issues included mass casualties incidents (MCIs), pilgrims satisfaction with ambulatory health services, on- scene utilization of automated external defibrillators (AEDs). Specialized patient- related health issues were divided into non- communicable and communicable health issues. Non- communicable health issues included heat emergencies and critical health services. Communicable health issues included the national and international efforts to prevent and control infectious diseases before, during and after Al Hajj. These included malaria, tuberculosis (TB), poliomyelitis, cholera, outbreaks of new strains meningococcal meningitis, Rift Valley fever (RVF), dengue fever, Alkhurma viral hemorrhagic fever virus (AHFV), yellow fever, A H1 N1 & H5 N1 influenza pandemics, severe acute respiratory syndrome (SARS)/ novel corona virus infections and food/water borne diseases.

Conclusions: Pilgrims health is key priority of the government of the Custodian of the Two Holy Mosques King Abdullah Bin Abdul Aziz Al Saud. Pilgrims health represents a challenge to Saudi Arabian health authorities. The reconnaissance and developing understanding of various health factors associated with Al Hajj should be the first strategies for prevention, control, planning and resource allocation of hazards.

Key Words:
KSA, Makkah, Al Hajj, Pilgrims, MGM, Health, Safety, Hazards, Harm, Incident, Risk, Disease, Illness, Infection, Prevention, Control, Accident, Emergency, Natural Disaster, Man- made Disasters, MCIs.

PILGRIMS HEALTH IN THE 20th AND THE 21st CENTURIES

INTRODUCTION

Pilgrims health is key priority of the government of the Custodian of the Two Holy Mosques King Abdullah Bin Abdul Aziz Al Saud, His Crown Prince the Deputy Prime and Minister of Defense His Royal Highness Prince Salman Bin Abdul Aziz Al Saud, the Second Deputy Prime Minister King's Advisor and Special Envoy His Royal Highness Prince Mugrin Bin Abdul Aziz Al Saud and the Governor of Holy Makkah Region, the Chairman of Central Hajj Committee His Royal Highness Prince Khalid Al Faisal Bin Abdul Aziz Al Saud. Before the union of the kingdom in 1902, health was mainly reliant on the services of Makkah Ajyad general hospital (1881), Jeddah Bab Sharif hospital (1890) and traditional medicine (Onal S 1994). In 1926, the Founder King Abdul Aziz Bin Abdul Rahman Al Saud officially created the Public Health Affairs and Ambulance Services in the Holy Capital of Makkah to meet the evolving health demands of citizens and pilgrims. In 1951, The Founder King Abdul Aziz Al Saud established the Saudi Ministry of Health (MOH) by issuing his Royal Decree Number 5/11/8697and declaring His Royal Highness Prince Abdullah Al Faisal Bin Abdul Aziz Al Saud as the first Minister of Health (King Abdul Aziz Foundation DARAH 2013). This study aimed to give an overview of pilgrims health and its related scientific research in particular and MGM in general.

METHODS

An extensive review was conducted using the documents of DARAH and computerized databases Medline and PubMed for searches from 1966 through January 2013. Islamic books, biomedical journals and the proceedings of the Lancet 1st International Conference on MGM and WCDEM were also scanned for relevant topics. Arabic/ English language articles containing information pertinent to pilgrims health, Al Hajj and various Mass Gatherings were read, abstracted, analyzed and compiled. Non- peer reviewed articles, unethical articles, news paper reports, internet information and anecdotal information were excluded. However, the web sites of

recognized governmental and non- governmental organizations (e.g. DARAH, World Association for Disaster and Emergency Medicine WADEM) were accessed in search for suitable important citations. Two hundred sixty nine potentially relevant articles were identified of which 80 met the inclusion criteria. Health issues reported during Al Hajj were classified into two groups; General Hajj- related Health Issues and Specialized Patient- related Health Issues. The Specialized Patient- related Health Issues were further classified into Non- communicable and Communicable Health Issues.

RESULTS AND DISSCUSSION

The resultant materials identified for the review were predominantly descriptive in nature derived from observational, case studies, surveys and documentary research. However, several other works (eg. Alshinkity et al 2005, Al- Hogail et al 2010) gave specific scientific answers to varieties of Al Hajj and MGM questions and provided exemplars for prospective interventional studies of mass gathering environment. Millions of people attend mass gathering events every year. The collapse and death of two un- resuscitated spectators in the Nebraska University Football Stadium in 1965 was a stimulus for the modern era of MGM (American college of Emergency Physicians ACEP 2013). The common feature of all mass gatherings is that the injury, illness rate and cardiac arrest incidence of those attending are greater than the average non- gathered population and that they may be the subject to a catastrophic accident or attack with large numbers of injured or dead persons. The incidence of cardiac arrest in mass gatherings ranges from 0.3 to 4 per 1,000,000 spectators with high survival- to- discharge rate of 20 % - 100 %. The overall patient presentation rate (PPR) is of 1/1000 spectators and transport- to- hospital rate (TTHR) of 40.3/1000 in Olympic Games (Franaszek J 1986, Wetterhall et al 1998). Casualty rates vary considerably with the type of event and its characteristics (Table 1).

Holy Quran stated: {And proclaim to all mankind *Al Hajj* (pilgrimage). They will come to you on foot and on every lean camel, they will come from every deep and distant (wide) mountain highway (to perform *Al Hajj)*. That they may witness things that are of benefit to them (i.e. reward of *Al Hajj* in the Hereafter, and also some worldly gain from trade), and mention the Name of Almighty Allah on appointed days (i.e. 10th, 11th, 12th, and 13th day of Dhul-Hijjah), over the beast of animals that He has

provided for them (for sacrifice), [at the time of their slaughtering by saying: (*Bismillah*, *Wallahu-Akbar*, *Allahumma Minka wa Ilaik*).] Then eat thereof and feed therewith the poor having a hard time. Then let them complete their prescribed duties (*Manasik* of *Al Hajj*) and perform their vows, and circumambulate the Ancient House: *Al Ka'bah* at Holy Makkah (Al Hajj 22,332:27-29)}.

Al Hajj mass gathering represents many incomparable distinguished characteristics. It is the oldest mass gathering ever known to mankind which first started by Angels, Adam and Eve (peace be upon them) before Almighty God asked Prophet Ibrahim (peace be upon him) to proclaim Al Hajj to all mankind. In addition, Al Hajj is a religious obligation for adult Muslims who are physically and financially able to perform it once per life.

Table 1: Casualty rate in mass gathering world major incidents

Event	Casualty rate/ 1000 Participants, Spectators
Stampede MCI during Al Hajj 1999 (International Disaster Database 2012)	0.7
Four football stadium stampede MCIs in Africa 2001 (Madzimbamuto FD 2003)	1.2
Los Angeles Olympic Games in 1984 (ACEP 2010)	1.6
Organized Rave With mobile dancing crowds, Houston, Texas in 1990 (Russell et al 1999)	9
At a scout camp (Pierce et al 1998)	10
At a large rock festival (Hewitt et al 1996)	17
Among marathon finishers (Exercise Medicine Australia EMA 2013)	28
Jonestown California mass murder and suicide in 1978 (ACEP 2000)	1000 deaths

Broad socioeconomic backgrounds of more than 180 countries are represented during Al Hajj. It is a day and night event with challenging fixed physical holy locations in which pilgrims perform their same rituals in the same time. Al Hajj is all- season event circulating from January to December, as Islamic calendar follows Lunar rather than Gregorian calendar.

Al Hajj is the largest six- day safe mass gathering with average 580,000 participants per day, high appointed physician rate (1: 1500 people) and low casualty incident rate (0.7/1000). Pilgrims are active mobile participants rather than just all- seater attendants. They benefit

from the services of 15 (primary, secondary, tertiary and quaternary) governmental hospitals, 4427 beds including 500 intensive care units (ICU) and 550 emergency department (ED) beds and total of 20000 specialized healthcare workers.

The pilgrims satisfaction with ambulatory health services is acceptable with some physicians and waiting area services need special attention to improve satisfaction levels in future Hajj season (Al Hugail et al 2010). The accepted level of pilgrims satisfaction is a result of the extent to which health services fulfilled pilgrims expectations. On the other hand, this may translate the increased revenue from increased patient volume and service utilization in private sectors. The overemphasis on patient satisfaction should be dealt with cautiously.

It has been suggested that stressing on patient satisfaction could have unanticipated adverse effects. Patients who are the most satisfied with their doctors are more likely to be hospitalized, accumulate more health care and drug expenditures, and have higher mortality rates than patients who are less satisfied with their care (Alshinkity IS 2001, Fenton et al 2012).

At mass gatherings, injuries are accounting for 35% of all medical visits and were more common among athletes (51.9%, $P < 0.001$) than among spectators and volunteers (Wetterhall et al 1998). Trauma especially orthopedic and neurosurgical trauma during Al Hajj is a real surgical problem with 60% of trauma patients were involved in road traffic accident (RTA).

Among ICU admitted patients, trauma represented 6.4% of total ICU admissions (Al Harthi A and Al Harbi M 2001, Madani et al 2007). Between 1975 and 2006, five major incidents were reported during Al Hajj. Two fire incidents, two stampede MCIs and one building collapse. The death toll in these five incidents was 2315 people (International Disaster Database 2012). Many factors were behind these catastrophic events including violation of the Al Hajj regulations, fire- susceptible tenting, old Jamarat area layout, high crowd density (more than 4 persons/M2) and the level of pilgrims religious education (Alshinkity IS 2007, Al Turki M 2010). The Saudi Arabian government spends billions of Riyals improving Al Hajj infrastructure to avoid of stampede MCIs and other incidents to make Al Hajj safer and healthier (Z Al Abideen H 2010, Alshinkity IS 2005). In efforts to learn from the previous Hajj experience, King Abdullah Bin Abdul Aziz greatest expansions to the Two Holy Mosques in Holy Makkah and Holy Medina and nearby holy sites are in progress.

Early defibrillation is the use of AEDs by trained public-safety personnel (Kassanoff et al 1975, Seraj and Harvey 2007). First responder AED programs may increase the number of people experiencing sudden cardiac arrest who receive bystander CPR; can reduce time to defibrillation; and may improve survival from sudden cardiac arrest. Strategic placement of AEDs is pivotal for public-access defibrillation. Regardless the financial implications, areas with a high incidence of cardiac arrests were defined as those with 1 cardiac arrest every 5 years. AEDs are needed to be deployed in 10.6% of the city area, providing coverage for 66.8% of all cardiac arrests (Hazinski et al 2005). The incidence of cardiac arrest and the efficiency of AED application in the Grand Mosque of Holy Makkah were studied by Dr. Al Dosari. He concluded that many deaths were potentially preventable and that the utilization of AEDs as well as the mobile emergency medical technicians (EMTs) units is highly recommended (Alshinkity IS 2007). Given the targeted response times (180 s) and the goals at mass gatherings, the number of AEDs required can be calculated (Crocco et al 2004). Studies from the University of North Carolina Hospitals found that the predicted EMTs response times were 363 s for the longest football stadium distance, and 187s for the basketball arena (Motyka et al 2005).

Heat illnesses have been the most frequent cause of environmentally related death in the United States of America (USA) more than lightening, tornado, floods, hurricane and winter fatalities. Heatstroke was found to be the main cause of death among pilgrims claiming 1000 lives among 2000 victims in August 1987 during Holy Makkah hot waves (National Weather Service NWS 2013, Bouchama A 2010). Rapid reduction of the core temperature to below 40°C is the primary goal of treatment and is accomplished by physical cooling techniques. The two primary methods for physical cooling in the clinical setting are evaporative cooling and cold- water immersion. Makkah Body- Cooling Unit (Makkah BCU) is one of the most effective means of providing evaporative cooling. The unique feature of the Makkah BCU is that it works best for patients who are vasodilated and live in a dry environment (ACEP 2004). Cardipulmonary bypass, cold- water lavages, endovascular cooling and plasma exchange are invasive cooling techniques that can be used when evaporative and immersion means of physical cooling are not sufficient (Broessner et al 2005, Lyden et al 2012).

When interpreting ST-T changes in the electrocardiogram (ECG) of a heatstroke patient, caution should be used so as to not misdiagnose it as an acute myocardial

infarction (Akhtar et al 1993, Wakino et al 2005).Thermal regulatory function of growth hormone (GH) and the prognostic implication of serum enzymes in heat stroke were investigated (Al Zeer et al 1997). The most useful indicator was lactate dehydrogenase (LD), as it could distinguish significantly between the groups of patients who died and those who had a quick recovery. The degree of GH response was more pronounced in older individuals and in those who died. They were followed by CK, aspartate aminotransferase (AST) and procalcitonin as useful prognostic factors (Nylen et al 1997). Heat stroke patients are not fluid debleted and should not be briskly transfused because this can lead to acute overload problems; the potential to develop adult respiratory distress syndrome and disseminated intravascular coagulopathy (Seraj et al 1991). The role of pulse oximetry in detecting hypoxaemia in patients suffering from heat exhaustion was examined. One hundred thirty-four patients (86.5%) showed a form of hypoxia which necessitated oxygen (O2) administration (El Bakry et al 1996). It is suggested that hyperbaric oxygen therapy (HBOT) is useful for treatment of heatstroke with multiple organ dysfunction (Niu et al 2009). The elevated circulating interleukin- 6 (IL-6), interleukin- 1- beta (IL-1 beta), and interferon gamma (INF-gamma) in the acute phase response of heatstroke, and their correlation with the severity of the illness could lead to new therapeutic and prognostic strategies (Bouchama et al 1993, Lu et al 2004).

Of 3.3 million attendants to the 253 events analyzed during the 10-month study period, there were only 0.08% patient encounters with uncommon critical illnesses (Varon et al 2003). More than 50% of cases could have been dealt with in the outpatient department or primary health care centers (**Al** Harbi MA 2000). However, majority of difficult emergency patients (difficult vs. easy vs. known) were presented during evening shift (4PM- 12AM) when consultant, research team and special investigation tools were unavailable (Alshinkity et al 2004). During Al Hajj, the majority of admissions (79%) were co- morbid patients older than 40 years whom were sent to medical wards (71.2%) (Madani et al 2006).

Morbidity and mortality due to critical illnesses can be low even among an older pilgrim population. Among ICU pilgrim patients, the Acute Physiology and Chronic

Health Evaluation IV score (APACHE IV) was 60.5 (47-78.3) (Madani et al 2007, Mandourah et al 2012). Severe infections including reportable infectious diseases and cardiac diseases represent the majority medical emergencies during Al Hajj. Studies suggested that statins may have a positive role in the treatment of patients with severe sepsis. Meta-analyses demonstrated that treatment with statins has been found to reduce the mortality from severe sepsis associated with respiratory tract infections (Gautret et al 2009, Falagas et al 2008, Tleyjeh et al 2009).

The usefulness of public health surveillance data depends on its uniformity, simplicity and timeliness (CDC 2013). The Centers for Disease Control and Prevention (CDC) in Atlanta, USA, publishes a list of notifiable infectious diseases that is updated and revised routinely. The most recent update includes 61 nationally and internationally notifiable diseases ordered alphabetically from Anthrax to Yellow fever. This includes malaria, cholera (only Vibrio choleraae O1 and O139), plague, poliomyelitis, TB, meningococcal strains (specially A, B, C, W- 135, Y), Ebola, dengue fever, RVF, A H1 N1 & H5 N1 influenza, SARS, the novel corona virus infection and varicella infection (death only).

The overall risk of exposure to infectious agents can be divided into High, Moderate, Low and Very low. The high risk (1 in 10 travelers) includes diarrhea and URTIs. The moderate risk (1 in 200) includes dengue fever, gastro- enteroviral infection, hepatitis A, malaria, salmonella, sexually- transmitted diseases (STDs) and shigellosis. The low risk (1 in 1000) includes amebiasis, ascariasis, measles, mumps, entrobiasis, scabies, TB, typhoid fever and hepatitis B. The Very low risk (1 in more than 1000) includes human immunodeficiency virus (HIV), anthrax, Chagas disease, pertussis, plague, typhus and hookworm infections (CDC 2013). The therapy of tropical diseases is organism specific and in all cases, the potential for a bioterrorist agent should be suspected.

The divergence of the disease presentation from the typical epidemiology of the community and an atypical number of patients presenting with similar clinical syndromes suggest international release of weaponized agent (e.g. anthrax, plague, RVF, tularemia).

The proper vaccination against hepatitis A/ B/C, meningococcal disease (polysaccharide and quadrivalent A/C/Y/W-135 conjugate vaccines), typhoid fever, yellow fever and scheduled routine vaccinations can effectively rule these out as a cause of illness. Meningococcal outbreaks during Al Hajj 1987, 2000 and 2001

affected more than 2000 people worldwide with multiple deaths in the later two outbreaks of meningococcal W- 135 strain (Khalil MK and Borrow R 2009, Heymann and Moolla 2010). The adherence to appropriate chemoprophylaxis can significantly reduce the risk of acquiring meningitis and malaria. However, the use of mefloquine prophylaxis and antipyretics can still result in late- appearing fever caused by malaria breakthrough. The transmission of pulmonary TB in mass gathering had been studied with 10% estimated risk of acquisition during Al Hajj and total mortality of 17% (Alzeer et al 1998, Wilder-Smith et al 2005). WHO requires air passengers exposed to smear- positive and negative cases of pulmonary TB who sat in adjacent rows for longer than 8 hrs to be followed up (Abubakar I 2010).

Dengue hemorrhagic fever and the potential of polio disease international outbreaks have been controlled by rigorous Saudi MOH management. Control of animals and vectors at points of entry is set to avoid importation of diseases such as RVF, dengue, plague and yellow fever. The Saudi MOH evaluated the feasibility of a randomized, placebo-controlled trial using intravenous ribavirin in patients with suspected severe RVF. However, and over 2 months, a total of 1971 cases were reported with 245 deaths (CDC 2000). During current and last centuries, cholera outbreaks decreased dramatically. However, CDC responds to cholera across the world using the Global Water, Sanitation, & Hygiene (WASH) program (CDC 2013, Savel'ev et al 1995).

Another example of success in the management of pilgrims was during the influenza N1H1 pandemic in 2009. Pilgrims travelling to the KSA were recommended to be immunized against N1H1 influenza and significant prevention and control measures were implemented to avoid spread during Al Hajj.

The Holy Water of Zamzam has a complementary anti cancer and healing power (Shomar B 2012, Jazieh et al 2012). All sources of surface and underground waters are disinfected using parameters such as turbidity, coliform counts , chlorine, ozone, ultraviolet and the presence of human enteric viruses, Cryptosporidium parvum and Giardia lambalia cysts as target organisms to assess efficacy of treatment.

Holy Quran stated: {O our Lord! I have made some of my offspring to dwell in an uncultivable valley by Your Sacred House (*Al Ka'bah* at Holy Makkah) in order, O our Lord, that they may perform *AS-Salat* (*Iqamat-AS-Salat*). So fill some hearts among peopl with love towards them, and (O Allah) provide them with fruits so that they may give thanks (Ibrahim 14; 260:37)}. Prophet Ibrahim (peace be upon him) supplicated to the Almighty God to supply the plant- free valley of Holy Makkah

with all kind of food, fruits and vegetables, and now we see the volume of imported fresh food has escalated. The majority of food/ water- borne illnesses is caused by un-known or un- identified pathogens. Three pathogens, Salmonella, Listeria and Toxoplasma cause more than 75% of all deaths caused by known pathogens. Salmonella enteritidis oubreaks have occurred due to contaminated meals on airlines and railways (CDC 2012). The outbreak of food- borne diarrheal illness in Mina during Hajj 2006 was most likely caused by eating contaminated rice. The most likely organisms were Bacillus cereus, and/or Clostridium puerfringens (Al Joudy A 2007).

CONCLUSIONS AND RECOMMENDATIONS

Pilgrims health is key priority of the government of the Custodian of the Two Holy Mosques King Abdullah Bin Abdul Aziz Al Saud. Al Hajj represents a challenge to Saudi Arabian health authorities. The reconnaissance and developing understanding of various health factors associated with Al Hajj should be the first strategies for prevention, control, planning and resource allocation of hazards. Future directions have to focus on the followings:

1) Establishing a several specialty teams called **Al Hajj Health Response System** as a principal coordinator of Al Hajj related national emergency and disasters, leading asset-sharing program between MOH, EMS, Red Crescent Society, Incident Command System-ICS (Police/ Fire/ Public health), Armed Force and private organizations. This system will be developed to provide surge capacity for MCIs during disasters and is comprised of Emergency Physicians, Nurses, Medics, Pharmacist and Logisticians that deploy in response to declared disasters and emergencies including HAZ/MAT. The response program can be divided into: prevention including safety/ security measures and epidemiologic intelligence; real- time surveillance and detection of the existing or pending emergencies; health alert and laboratory response; evacuation/ relocation or defend in place measures; control and bioterrorism rapid response, pharmaceutical (medications/ antidotes/ vaccination) stockpile of ultra rapid and rapid deliveries; recovery and public relations.

2) Improving survival from sudden cardiac arrest within the targeted response times in Grand Mosque and Al Masha'ir through establishing First responder AEDs program and Public-access AEDs program covering the Grand Mosque and Al Masha'ir area.

3) Institution of several public health and public education measures to prevent heat emergencies including paying attention to environmental conditions, specially heat index (combined temperature and humidity) and allowing for pre- Hajj acclimatization for fit pilgrims and worker over 7-10 days by daily moderate exercise

in a hot environment for 60-100 minutes or by simple exposure to a hot environment for 1-4 hrs a day for 2 weeks for elderly patients.

4) Provision of information and advice of protective behaviors, safe food- handling techniques/ preparation skills, advanced water/ sanitation as well as the guidelines and recommendations about safe and healthy Hajj practice to pilgrims as well as healthcare workers. In addition, pre-Hajj functional assessment should be carried out to identify patients at high risk of mortality.

5) Increase the Saudi socioeconomic interest and investment in outbreak-affected regions of the world and developing the necessary information base and negotiating skill to successfully ensure that funds are channeled to such opportunities.

6) Using Rumor Surveillance to decrease the national/ international anxiety and the propagation of unofficial disaster reports or disease rumors (e.g. Zamzam 1971- 2011, bird influenza N1H1 pandemic 2009, SARS outbreaks 2003, Ebola outbreak 2000, Chernobyl nuclear incident 1986).

7) Widening the evidence base standards and high level sensitivity definitions supporting Al Hajj health research priorities. Potential specific research areas include e.g.:

a) Immunogenicity of meningococcal meningitis in very young children and the elderly and the work on development of the pentavalent vaccine; b) interventional trials on standardized approaches, diagnostic accuracy and proper management of Al Hajj related health issues;

c) controlled studies comparing the effects of the various cooling techniques on cooling times and outcome in patients with heatstroke; d) randomized controlled trials on the positive role of Statins in reducing mortality of pilgrims with sepsis and severe respiratory infections;

e) overall pilgrim satisfaction with health services and its relation to unexpected adverse effects and crowd mood; f) the assessment of potential for disaster or catastrophic emergency involving mass gatherings (terrorism, displaced populations, evacuation strategies and refugee settings).

8) Employing the Definite Noun Al Hajj and Holy Makkah as appropriate scientific term and correct linguistic aspect of translation in biomedical literature rather than just Hajj and Mecca, respectively.

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