

## Health Management in Crowded Events: Hajj and Kumbh

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**Abstract** - *Reoccurrence of life threatening communicable diseases like EBOLA, HIV Aids, SARS, MERS in various regions of the globe have made management large crowds challenging. These viruses and the associated diseases can spread at an alarming rate and cause havoc in societies. Crowd managers need to firstly take adequate steps to control the infiltration of infected people into the crowds and secondly to have in place a management regime of effectively treating the infected people, if found. Failing to manage deadly viruses and diseases in crowds can bring catastrophes of large magnitude not witnessed in the modern times. In this article we provide an overview of managing large crowds from health point of view. Our framework of health management for crowded events will be presented in the cases of Hajj (an annual pilgrimage to Mecca) and Kumbh Mela (a periodic religious gathering in India), both of which are known to be very complex and highly crowded events.*

**Index Terms** – Crowd, Health, Management, Viruses, Hajj, Kumbh

### 1.0 INTRODUCTION

Recent outbreak of EBOLA [1, 2 and 3] in some West African nations has seriously challenged medical fertility in the world. Despite many efforts by the World Health Organisation (WHO) and some developed nations, EBOLA continues to claim many human lives. During the last decade we have witnessed other kinds of dangerous outbreaks like Severe Acute Respiratory Syndrome (SARC) [4]. Currently, some countries of the Middle East, including Saudi Arabia, are battling with the Middle East Respiratory Syndrome (MERS) also known as corona-virus [5 and 6]. There are already ongoing problems of HIV virus in large part of the world.

While spread of these and other contagious viruses and diseases is not checked, events with large crowds run a risk of catastrophic loss of human lives if they are not organised properly. Many crowded events take place time to time. Some are well defined and occur regularly where there are others which are one off gatherings. Historically, crowded events have witnessed stampedes, fires, drowning and mismanagement resulting in the loss of thousands of human lives. An account of the people killed in the last decade during various crowded events in the world can be found from multiple sources including [7, 8 and 9]. In this article we are mainly concerned with the health issues of the participants of crowded events, and propose solutions to deal with health risks and make the

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events safer. In particular we will deal with the cases arising from the communicable viruses and diseases. Our study uses two of the most crowded events which occur regularly, the Hajj [7, 8 and 10] also see Pic 1 [19], an annual pilgrimage in Saudi Arabia and Kumbh [11], also see Pic 2 [20], a periodic pilgrimage in Allahabad and other cities of India. Ironically both of these events are religious in nature. Incidentally, the most crowded events of world are religious in nature. First we will provide a description of the Hajj and the Kumbh from organisational point of view.

### 1.1 The Hajj

The Hajj is an annual pilgrimage to Makkah (Mecca) in Saudi Arabia. Anybody belonging to the Islamic faith, irrespective of their geographical location, can apply to perform Hajj through travel agents in the country of their residence. It takes place every year during 8th-12th Dhulhijja, a month of Islamic calendar. Being lunar, Islamic calendar is shorter than a Gregorian calendar by 10-12 days depending on the year, hence it completes a full cycle of all seasons in about thirty three years. Every year about three millions out of an estimated ten million applicants are granted permission to perform the Hajj. Main rituals of the Hajj are performed during four days. However, limitation of international transportation and other reasons, many pilgrims spend about a month in Saudi Arabia. During this extended period of their stay, they perform pilgrimage at the prophet's mosque, built by Mohammed - the prophet of Islam in Madinah, the second most sacred mosque in the world, at a distance of about four hundred kilometres from Makkah. One of the most complex Hajj operations is the transportation of more than three million pilgrims from the tent city Mina to a short but congested journey to and from the Valley of Mount Arafat. Some of the rituals, infrastructure, management problems and other issues of the Hajj can be found in [7, 8 and 10].

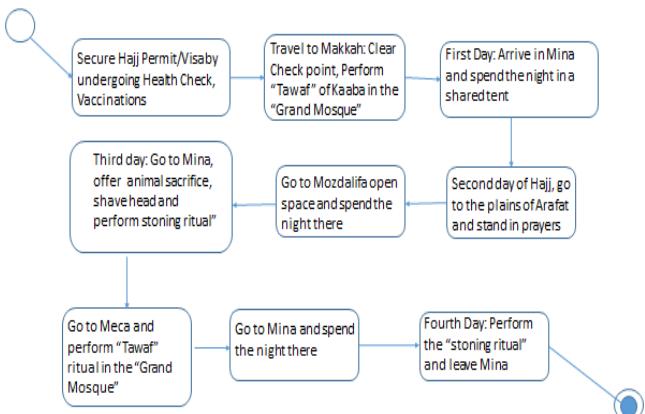


Figure 1: Hajj Rituals

## 1.2 The Kumbh Mela

Kumbh Mela is a pilgrimage, a festival and a fair which is the largest gathering of people in the world. In 2013 an estimated one hundred million pilgrims visited Kumbh (Kumbh Mela)



**Figure 2: Hajj Gatherings**

[11]. Kumbh is organised periodically every three years in four different cities of India along the banks of scared rivers namely, Ganga (Ganges) in Haridwar and Allahabad, Yamuna (Jamuna) and Saraswati in Allahabad, Godawari at Nasik and Shipra in Ujjain. The largest of the Kumbh Mella, known as full Kumbh takes place every twelve years in Allahabad and the Ardha Kumbh (Half Kumbh) takes place every six years in Haridwar. The duration of Kumbh is about six weeks during which pilgrims come and go back after performing their pilgrimage for a few days. One of the main rituals of Kumbh is a dip in the scared river wherever it takes place. The pinnacle of the rituals is known as Shahi Snanam on a particular day known as Mauni Amavasya when a large number of pilgrims dip in the river. In 2014 Kumbh at Allahabad about thirty million pilgrims made it to Shahi Snanam. Most of the Kumbh pilgrims come from within India itself. The event does, however, welcomes and facilitates pilgrims from any country. Focus of the management is local population which usually travels with land routes including rail, road and on foot.

## 2.0 AN OVERVIEW CROWD MANAGEMENT ISSUES

One of the most worrying aspects of the Hajj and Kumbh managements is to control the number of pilgrims. The number of permits issued every year for performing Hajj is less than two million. However, the number of unauthorised pilgrims in some years had nearly equalled the number of authorised pilgrims. For example, during 2012 Hajj, more than 3.65 million people performed Hajj [7]. As for the Kumbh, there are no restrictions on the number of pilgrims as long as they comply with very basic health checks and undergo required vaccinations. To minimise the chances of spread of diseases and other catastrophes like stampedes, drowning and fires, the size of crowds must be contained to manageable limits. For, it is desirable to have some binding international standards for limiting the number of people which should be permitted to gather in a specified space or area. Organisation of crowded events, in particular of those having millions of participants like Hajj and Kumbh, would become relatively easier to administer if such standards were agreed upon and

implemented. In the last decade or so, many technological advances have produced tools and gadgets which can be utilised to remarkably improve the crowd management's abilities to respond to emergencies. In particular sensor and



**Figure 3: Kumbh Gatherings**

biometric technology, tools and gadgets can be immensely helpful in improving the crowd management. Some of the intensely crowded events like the Hajj and Kumbh often involve simultaneous on-foot movement of very large congregations, which creates possibilities of stampedes and contamination of contagious viruses and diseases. In such situations, tracking, accessibility and identification of pilgrims is critically important. Many of the sensor and wireless devices available today, including Radio Frequency Identification (RFID) as shown in Pic 3, also see [12, 13, 14 and 15], can be used for controlling and monitoring the movement of crowds. These technologies are already proving to be very beneficial in securing and managing various aspects of daily life. A description of ubiquitous technologies including RFID, sensor networks, biometric and scanning devices can be found in [14].

## 3.0 CROWDS AND HEALTH RISKS

Recent spread of EBOLA and other highly contagious viruses and diseases has served an alarm to the crowd managers around the world. Various Strands of flu viruses have already caused havocs in various societies in the recent years. Re-emergence of these viruses has discouraged many people from participating in crowded events like Hajj and Kumbh. In Saudi Arabia, the country where the Hajj pilgrimage takes place, has been working very hard to contain the spread of the Middle Eastern Respiratory Syndrome (MERS), which has taken hundreds of lives in the Middle East. Fortunately, this virus hasn't so far affected the Hajj pilgrims. However, the Hajj and Kumbh pilgrims suffer from various other health issues due to unhygienic conditions as a result of crowding and mismanagement. Usually, the lack of cleaning results in the growth of dangerous bacteria, which has already been witnessed in some cases [16 and 17]. Another serious health risk is from the inability of preventing infected illegal pilgrims from entering to the crowded events like the Hajj and Kumbh. Due to intense crowding and lack of infrastructure, it is not feasible to check and process all pilgrims within realistic timeframe. The Hajj procedures, as can be seen in Fig 1, require pilgrims to undergo a medical check-up, which is a

precondition to the grant of hajj permit. As for the illegal pilgrims, boarders of Makkah can be sealed off to prevent the entry of illegal pilgrims. The biometric scans at all the major air and sea ports of Saudi Arabia are capable of identifying



**Figure 4: RFID Tags and Bands**

pilgrims with forged documents. The problem however still remains to check the local pilgrims from Makkah region and prevent unauthorised ones from performing the Hajj. But in case of Kumbh, it is difficult to ensure that

pilgrims do not carry dangerous viruses into the event as there is no system in place of granting a permit on the basis of full health check-up. Another aspect is that it is difficult to ensure that the health examinations carried out in all countries are not compromised. Thus there are real possibilities of some pilgrims carrying contagious viruses and diseases into the Hajj and Kumbh.

#### 4.0 RECONILIATION WITH INFECTED PILGRIMS

Both Hajj and Kumbh are religious events and the aspirants of performing these events would want to be there with a hope of washing off their sins before leaving this world. A terminally ill person would feel more urge to fulfil his or her religious obligation. Socially, it is a challenging job for the governments and hence the organisers to deny the aspirants a chance of a lifetime pilgrimage. On the other hand, in many states, medical reports can be compromised and infected people may succeed to secure a false certificate of health. So,

- (1) it is almost impossible to ensure that no pilgrims with communicable diseases would enter the crowded event, and
- (2) it is socially not a good idea to prevent dying people from performing the pilgrimage

That being the case, the organisers of religious events like the Hajj and Kumbh should seriously revise their policies on sick people and seriously consider allowing them to perform the pilgrimage. However, for it to be accomplished, the organisers must make separate arrangements for the sick, infected and terminally ill people to perform their pilgrimages. A huge advantage of this would be that the people with health risk to others will not try to gain permission by unfair or illegal means. Key to successful organisations of crowded events is to know the kind of participants and plan for their management accordingly. Not having basic knowledge about the pilgrims, in particular the health information, the organisers would not be able to take precautions and hence would not be able to safeguard the health of masses in the crowded events. Spread of a communicable disease in a crowded event may have devastating results. However, all of these considerations and concessions shouldn't apply in cases of diseases like EBOLA

which are difficult to contain, until a satisfactory way of preventing their spread is available. However, people infected with HIV and Hepatitis viruses are capable of being managed and hence could be allowed under supervision. The management shouldn't neglect disabled and elderly pilgrims and should make adequate arrangements for their well being during their participation in the event.

#### 5.0 DEALING WITH HEALTH RISK PILGRIMS

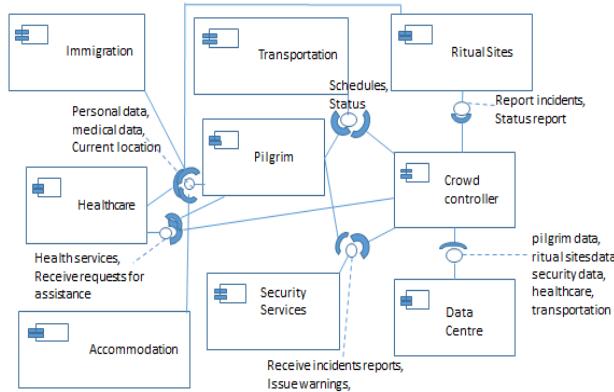
Despite the best efforts from crowd managers, it is probable that some pilgrims would carry HIV, SARS, MARS and other bacteria or virus with them into Hajj and Kumbh. Naturally such pilgrims wouldn't be known to the management and hence would be living and moving with other pilgrims. These pilgrims would pose a serious risk of infecting other pilgrims. To detect and manage such pilgrims, event organisers should have pilgrim workflow architecture like the Hajj pilgrim workflow architecture shown in Fig 2, see [7]. Event organisers must also have adequate and easy access to health facilities on the sites of the event. If any of these people become ill, they should be isolated and treated promptly. If such patients were not identified in time and not treated accordingly, the bacteria might spread into a large number of participants. The Hajj is a highly organised event but still needs to refine and articulate its operations. The Kumbh is not a highly organised event because of the huge number of participants with open borders to the rest of country. Also in the Kumbh, an overwhelming number of participants come from within India. There are no visa requirements which would otherwise provide an automatic capture and storing data like in the case of the Hajj. It is recommended that the organisers of the Kumbh introduce a permit system based on health and security. Here are some guidelines which the event managers could follow:

1. Introduce the system of ID base entry permit to the event
2. Make through health check-up mandatory as a precondition for an entry to the event
3. Manage and control health check-up centres around the globe with the help of established health organisations and healthcare providers
4. Introduce RFID enabled wrist or waist bands, as shown in Pic 3 [21], to be worn by all pilgrims
5. Capture all personal and health data into the pilgrim tag
6. Make adequate arrangements for isolation of pilgrims found to be carrying communicable diseases
7. Introduce mandatory health awareness classes in all countries with the help of local authorities to be sponsored by tour operators of the event
8. Punish tour operators for noncompliance of health procedures

If the health risk pilgrims remain undetected, there is very little that event organisers could do. Crowd managers should use the latest technology to track, identify and treat ill participants. For managing the health and wellbeing of the pilgrims, including those infected with contagious bacteria, the RFID technology can play a very significant role [18].

## 6.0 CONCLUSIONS

We do not want spread of life threatening diseases into masses. So far the Hajj and the Kumbh have not caused large scale infections. However, there is no assurance that this would always be the case. Some viruses like EBOLA and SARS can



**Figure 5: Hajj Pilgrim Workflow Architecture**

spread like a fire. The organisers of the Hajj, Kumbh and other crowded events must revise their procedures and action plans to prevent and contain these viruses from spreading on a larger scale. National and international bodies should actively play their role in helping to streamline the organisers to ensure the safety and wellbeing of the participants of crowded events where monitoring and controlling the participants are not easy. Crowd management should consider using various tracking and identification devices like RFID as well as biometric technology. Indeed the infected pilgrims must be isolated from the rest of the pilgrims. In this paper we present and analyse a number of problems of Hajj management, and offer some solutions including architecture for improving the management. These solutions can indeed be applied in many other and similar crowded events such as Kumbh.

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