

## **Infectious Diseases Surveillance Systems during the 2015 Hajj mass gathering**

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### **Abstract**

Hajj is one of the largest and the most ethnically and culturally diverse mass gatherings worldwide. The risk of transmission of infectious diseases is not confined to the participants of the mass gathering; it extends to the host country's population and the home population of the pilgrims after the event. The Saudi authorities have invested significant resources in developing model infectious diseases surveillance systems for the Hajj, ensuring the safety and wellbeing of pilgrims, the Saudi population and the population of countries sending pilgrims for the Hajj. A regular infectious disease surveillance system generates routine reports from health facilities within the Kingdom to the regional and central public health directorate all year round. During Hajj, enhanced surveillance systems complement the existing surveillance tool to ensure timely reporting of event information for appropriate action by public health officials. We describe the characteristics of the infectious diseases surveillance systems that were operational during the 2015 Hajj, highlighting best practices and gaps, and proposing strategies for strengthening and improvement. We also emphasize the importance of international engagement to strengthen infectious diseases surveillance during Hajj to prevent the globalization of infectious agents which undermines global health security.

**Keywords:** Infectious diseases; Surveillance; Outbreak; Hajj; Mass gathering

## 1. Introduction

The number of pilgrims participating in the Hajj religious mass gathering has increased significantly over the years, with about 2 million pilgrims attending annually in the last 2 years compared to 135,265 in 1954.<sup>1,2</sup> Unhygienic practices and close contacts between pilgrims in overcrowded situations during the rituals, as well as international travel, increase the risks of outbreaks and the spread of infectious diseases among pilgrims.<sup>3-5</sup> The risk of infectious diseases transmission may extend to the local Saudi population and to the home population of returning pilgrims after Hajj. This could strain the public health services in Saudi Arabia and may threaten global health security.<sup>2,6-8</sup>

Historically, several outbreaks of infectious diseases have been reported at the Hajj. The first in existing records was an outbreak of malaria in 632 AD, which was originally referred to as Oasis fever or Yethrib fever.<sup>1</sup> More recent examples included the international Hajj-related outbreaks of meningococcal diseases in 1987, 2000 and 2001.<sup>8</sup> Although no meningococcal outbreaks have been recorded in Hajj since 2001, the disease remains a major concern as do other infectious disease with global significance such as tuberculosis and Ebola Virus Disease (EVD).<sup>7</sup> In addition, new and emerging infectious disease agents such as influenza H1N1 virus, Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) remain an ever present threat to mass gatherings such as Hajj. For instance, influenza H1N1 was associated with acute respiratory illnesses among pilgrims resulting in hospital admissions during Hajj.<sup>2,9,10</sup> As yet, no confirmed cases of MERS-CoV were reported during Hajj. However, given the current outbreak of the disease in the Kingdom, MERS-CoV continues to be a major risk during the event.

Epidemic intelligence, including disease surveillance, as well as information management and dissemination, allow the formulation of appropriate strategies to prevent and/or control outbreaks and the international spread of diseases.<sup>11</sup> The use of

appropriate surveillance systems during mass gatherings ensures the timely collection, analysis and interpretation of health data for effective planning and response to infectious diseases threats.<sup>12,13</sup> Additionally, public health surveillance systems play a substantial role in providing reassurance of the absence of a deleterious public health event to mass gathering organizers and political office holders during an international mass gathering.<sup>13</sup> In the context of Hajj and Saudi Arabia, MERS-CoV is a case in point. Thus an effective Infectious Diseases Surveillance System (IDSS) during Hajj should be highly sensitive to detect infectious diseases events in a timely manner, to prevent unnecessary panic and unwarranted morbidity and mortality among pilgrims, the Saudi local population and the returning pilgrims' home population after Hajj.

In practice, several IDSSs are operational during Hajj. A regular IDSS is applicable Kingdom-wide and generates routine reports from the health facilities to the regional and central public health directorates of the Ministry of Health (MoH) all year round. During Hajj, this system is complemented by enhanced IDSSs to ensure timely reporting of event information for appropriate action by public health officials. However, there is little documentation of the components and operations of each system, their advantages and disadvantages as well as their efficiency in terms of timeliness of alerts and channels of reporting. Here we describe the characteristics of the IDSSs that were operational during the 2015 Hajj, highlighting best practices and gaps, and proposing strategies for strengthening and improvement.

## **2. Hajj public health planning and organization of health services in 2015**

Hajj is one of the oldest annual mass gatherings worldwide dating as far back as 632 AD. The main Hajj rituals take place on day 8-14 *Dhu-al Hijjah* (Hajj month in the Islamic calendar). Planning for the 2015 Hajj started as soon as the previous Hajj ended under the leadership of the supreme Hajj committee. The latter coordinated all the 2015 Hajj through the Ministry of Hajj, the MoH, Hajj sub-committees, government parastatals and other agencies. The MoH's main focus in the Hajj planning and management is the provision of key public health services such as food and water safety, vector control, vaccination and environmental sanitation as well as public health risk assessments. To

that end, the MoH conducted various risks assessments in preparation for the 2015 Hajj, including an International Health Regulations (IHR) public health core capacity assessment at the points of entry and disseminated the updated pre-travel advice and health requirements for pilgrims and workers involved in the Hajj.<sup>14</sup> The latter includes details of the vaccination requirement for meningococcal meningitis, yellow fever, seasonal influenza and polio.

In line with IHR 2005, pilgrims arriving from certain countries in Africa, and South and Central America were required to present a valid yellow fever vaccination certificate, with evidence of vaccination at least 10 days prior to arrival at the points of entry. Additionally, disinfection according to the WHO recommended methods were required for all aircrafts, ships and other conveyances transporting pilgrims from these countries. All pilgrims regardless of the country of origin were required to present valid certificate of vaccination with quadrivalent (ACYW135) meningococcal vaccine issued at least 10 days before arrival and within three years of the pilgrimage. Pilgrims over 12 years of age, arriving from countries in the African Meningitis belt, including Benin, Burkina Faso, Cameroun, Chad, Central African Republic, Cote d' Ivoire, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Mali, Niger, Nigeria, Senegal, South Sudan and the Sudan were given 500 mg of oral Ciprofloxacin as chemoprophylaxis to lower meningococcal carriage rate among these pilgrims. All pilgrims travelling from polio risk countries namely Pakistan, Afghanistan, Nigeria, Cameroon, Niger, Chad, Ethiopia, Syria, Somalia, Kenya, Yemen, Palestine, Guinea and Iraq, required proof of polio vaccination at least 6 weeks prior to departure and also receive 1 dose of Oral Polio Vaccine (OPV) at borders points on arrival in Saudi Arabia regardless of age and vaccination status. The MoH also recommended the administration of seasonal influenza vaccine to all pilgrims before arrival for Hajj, particularly pilgrims at risk of seasonal influenza. These include, pregnant women, children aged over 5 years, elderly pilgrims as well as pilgrims with pre-existing chronic illnesses.

The Command and Control Centre (CCC) is a special MoH unit created in the aftermath of the MERS-CoV outbreak in 2012 to coordinate an appropriate response to infectious

diseases outbreaks in Saudi Arabia. As the crisis management arm of the MoH, the CCC coordinated the outbreak response plans of the MoH during the 2015 Hajj, establishing clearly defined interfaces between various MoH departments and international organizations to ensure appropriate and timely response to outbreaks of infectious diseases. The CCC created three situation rooms at key locations in Hajj sites; the Health Directorate of Makkah Region (HDMR), Almahbat Mina and the Mina Emergency Hospital. These sites were selected because pilgrims spend most of their time in Makkah and Mina, performing Hajj rituals which potentially impacts on their safety and well-being. The situation rooms were equipped with sophisticated communication equipment and electronic dashboards for monitoring health events and for initiating a coordinated response to public health emergencies during the Hajj.

Overall, 1,952,817 pilgrims, including 193,645 Saudis and 1,759,172 non-Saudis from 135 countries participated in the 2015 Hajj. There was a sharp decline in the number of pilgrims attending Hajj since 2013 attributed to limited Hajj permits issued by the Saudi authorities due to ongoing reconstruction to expand the Grand Mosque to accommodate more pilgrims<sup>2</sup>. Within Makkah city and the Holy areas, the Saudi government provided free healthcare services through 128 primary healthcare centers and 16 hospitals including, 7 seasonal health facilities only operational during Hajj (Figure 1). The hospitals had a combined bed capacity of 4214 beds.

### **3. Types of infectious disease surveillance operational during the 2015 Hajj**

#### **a. Regular infectious diseases surveillance**

This indicator-based IDSS is implemented country-wide in Saudi Arabia for routine facility-based data collection and reporting of infectious diseases events all year round, including during Hajj. Each regional public health directorate is made up of 3-6 administrative sub-units known as “health sectors”. These sub-units directly supervise surveillance activities and other disease control initiatives in health facilities within specified geographical areas in the region. Furthermore, the health sectors receive and

review infectious disease surveillance data from the health facilities for reporting to the regional public health directorates (Figure 1).

In the Makkah region, 85 primary health centres, 9 MoH hospitals, 7 private hospitals, 2 government (non-MoH) hospitals, as well as 34 poly-clinics utilize mostly a paper-based system to report infectious diseases events via the health sectors to the HDMR for appropriate action. Diseases classified under section 1 (Table 1) are reported within 24 hours through a phone call or fax message to the regional public health directorates and the IHR National Focal Point (NFP), and trigger a coordinated response plan. The IHR NFP is the national center designated by a country and accessible at all times for communication with the WHO IHR contact points under the IHR.<sup>15</sup> On the other hand, diseases classified under section 11 (Table 1) are recorded on pre-designed excel sheets and reported on a weekly basis to the regional public health directorates.

The surveillance team at the regional-level collates the data pooled from the health sectors on disease-specific excel sheets for monthly reporting to the central directorate of public health at the MoH headquarters (Figure 2). Additionally, the regional surveillance team is required to submit weekly zero report (no cases detected) of acute flaccid paralysis in children less than 15 years, suspected measles, rubella, mumps and H1N1 to the central directorate of public health. A specific protocol that defines the notification of suspected cases of MERS-CoV through an emergency hotline known as the 937 call center, for consultation on safe handling and transfer of cases to designated treatment facilities is provided by the CCC.<sup>16</sup> Most reports submitted to the MoH are not routinely analyzed to identify disease-specific thresholds for setting outbreak alerts or to more accurately predict the pattern and trends of diseases over time. Despite the limited data management capabilities, this surveillance system was proven effective in detecting and triggered a timely response to outbreaks of measles and scabies in the Kingdom in 2012/2013 and 2015 respectively.

#### **b. Enhanced infectious diseases surveillance**

Enhanced IDSSs are activated during the Hajj season to ensure early detection and prompt response to infectious diseases outbreaks. Since pilgrims could be incubating infections on arrival for Hajj, the focus of this surveillance during the Hajj is to proactively detect and respond to threats through early diagnosis and treatment, as well as contact tracing and rapid isolation of cases. For the 2015 Hajj the enhanced surveillance became operational from the 1<sup>st</sup> *Dhul-Qa'dah* (Islamic calendar month preceding Hajj) with the arrival of the first batch of pilgrims, and continued until the end of *Moharam* (1<sup>st</sup> month of the Islamic year following Hajj) after the departure of the last group of pilgrims. Enhanced infectious disease surveillance during Hajj is active at three main points: key points of entry to the Kingdom, healthcare facilities in the Hajj areas and medical office for pilgrims formerly known as medical missions.

### **1. Points of entry surveillance**

Effective surveillance at the points of entry is required to prevent and control the international spread of diseases during mass gatherings, including the importation of infectious agents to the host country.<sup>12</sup> During the 2015 Hajj, public health surveillance teams trained to detect and report public health threats and to monitor the compliance of arriving pilgrims with the health requirements for the Hajj were deployed at the Kingdom's Hajj entry points. These teams consisted of 589 personnel at Jeddah airport, 101 at Jeddah seaport and 187 at Medina airport. The teams worked in shifts, ensuring a round-the-clock coverage of the points of entry to promptly detect, report and transfer any suspected cases of notifiable infectious diseases to pre-designated health facilities for confirmation of diagnosis and further management of affected pilgrims.

At each point of entry, the surveillance teams reviewed the vaccination status of arriving pilgrims by checking their vaccination cards, reported any cases of unvaccinated pilgrims or those with unverifiable vaccination status and recommended appropriate actions for these cases. The surveillance teams were also responsible for identifying and managing ill pilgrims or suspected cases of infectious diseases. These cases were initially assessed at the primary health centres located within the point of entry before the appropriate course of action was taken. Such cases were directly notified to the

respective regional directorates and the NFP (Figure 3), through a phone call, email and/or fax message, triggering an alert for a coordinated response by the concerned authorities.

## ***2. Health facility-level surveillance***

Hospital-based surveillance teams were operating in each hospital within the Hajj areas in 2015. These were hospital staff trained to rapidly detect and report manually and electronically cases of infectious diseases presenting to the hospitals. Suspected cases of infectious diseases identified at primary health centres were referred to pre-specified hospitals for confirmation of diagnosis, further management and notification to the CCC. The hospital teams were reinforced by 21 fixed and 15 mobile surveillance teams from the regional directorates to ensure 24-hours active surveillance during the Hajj. The number of personnel in each team varied with the capacity of the hospital or the area covered by the surveillance teams. The fixed surveillance teams were assigned to each hospital operating in the Hajj areas and reviewed admission logbooks for cases with clinical features of infectious diseases and followed up on cases admitted into the wards to identify and report suspected cases of notifiable diseases to ensure no cases were missed by the hospital surveillance teams. The mobile surveillance teams were tasked to conduct field investigations for reported cases of infectious diseases. These included active case finding and safe transfer of suspected cases to designated facilities, contact tracing, risk communication and liaison with medical office for pilgrims (see below) to facilitate case reporting and effective follow up of contacts of cases.

The activities of the various surveillance teams were monitored by the public health supervisory units from the regional directorates, which in turn reported directly to the CCC (Figure 3). The supervisory units were also responsible for the isolation of suspected cases, follow-up of laboratory investigations and clinical status of hospitalized cases, as well as monitoring to ensure the implementation of the appropriate infection prevention and control procedures for patients, healthcare personnel and visitors.



Although the surveillance teams investigated all suspected infectious diseases cases, the following diseases were listed as high priority during Hajj, and clear guidelines were provided for managing suspected cases of these disease: MERS-CoV, EVD, cholera, meningococcal meningitis, yellow fever, polio, Rift Valley fever, Crimean fever, Dengue fever, malaria, influenza and food poisoning. Of all suspected cases detected by the IDSSs in the 2015 Hajj, 94 cases of malaria, 72 cases of influenza H1N1, 3 cases of Dengue and 2 cases of non-meningococcal meningitis were confirmed after investigations. There were no confirmed cases of MERS-CoV illness, EVD, cholera or food poisoning during the 2015 Hajj season.

### ***3. Medical office for pilgrims-level surveillance***

Hajj medical office for pilgrims refers to the healthcare representatives of some countries which send pilgrims for the Hajj and accompany pilgrims during the event. They may set up clinics or hospitals within the Hajj areas and provide healthcare services for their own pilgrims in compliance with the Saudi MoH rules and regulations. The composition of the medical office for pilgrims varies from country to country; however, it is recommended that a minimum of 20% of their staff should have a public health background.<sup>17</sup> A Memorandum of Understanding is established between the Saudi authorities and the medical office for pilgrims for effective coordination and communication of the standard public health requirements for the Hajj. The medical offices are required to comply with the standard sanitary requirements for food preparation and handling, to educate pilgrims on personal hygiene and proper waste disposal and to submit a valid contract with an accredited firm for medical waste management to the HDMR. Additionally, they are required to provide daily reports on notifiable diseases, to establish isolation areas for suspected cases and to coordinate with the public health supervisory teams for the safe transfer of these cases when necessary.

Six mobile surveillance teams from the regional directorates were dedicated to the medical office for pilgrims in the 2015 Hajj. These teams paid regular visits to the health facilities managed by the medical offices during the Hajj to review the quality of reporting of notifiable diseases and other standard requirements. Of the 60 medical office for

pilgrims operational during the 2015 Hajj only 20 (33%) were found to be compliant with the standard requirements of the Saudi MoH. In some cases the level of non-compliance warranted the closure of the culpable healthcare facilities until the MoH requirements were met.

#### **4. Infectious diseases surveillance tools during Hajj**

##### **a. Conventional (non-electronic) tools (paper, fax, telephone)**

Traditionally, infectious diseases data in the Kingdom has been managed principally using paper-based surveillance systems. Here disease-specific data forms are designed using Microsoft Word or Excel and are printed on paper for the collection of relevant surveillance data for record keeping, analysis and reporting to the appropriate authorities. This process slows down reporting and impacts on the timeliness of response to infectious diseases threats. In addition, deterioration of paper stored in archives over time may result in loss of precious data. In some areas in Saudi Arabia, the paper-based surveillance tools are still used for routine collection of facility-based data and for reporting to the regional and central public health directorates. This is complemented by telephone, email or fax, when there is a need for immediate notification of infectious diseases events. Although telephones are useful in these circumstances, the information transferred is often unstandardized; hence significant details could be missed by the caller.

##### **b. Electronic surveillance systems (HESN, CETRIX)**

Increasingly electronic surveillance systems are gaining international recognition as effective public health tool for real-time data management by stakeholders operating from different locations.<sup>2,18</sup> Overall, two electronic surveillance systems were operational during the 2015 Hajj: the Health Electronic Surveillance Network (HESN) and the electronic statistical system for Hajj referred to as CITREX. HESN is a web-based electronic solution, introduced by the Saudi MoH to improve communication among public health professionals involved in outbreak management as well as to provide quality health data for planning and effective allocation of resources. HESN was initially implemented as a pilot in Makkah region of Saudi Arabia in 2012. By January 2014, a

country-wide implementation was initiated to control the outbreak of MERS-CoV in the Kingdom. During the 2015 Hajj, in addition to the traditional data capture and reporting tools, the hospital surveillance teams also collated and entered infectious diseases data directly into HESN once a notification was received from the laboratory, emergency rooms, isolation wards and other departments in hospitals. The uploaded data was immediately displayed on electronic dash boards in the CCC's situation rooms. Data was analyzed and reports generated in real-time that could be immediately accessed by public health officials and decision makers or disseminated through phone messages to responsible persons for immediate action.

CITREX is a web-based electronic solution that predates HESN and was used in the preceding Hajj seasons. In 2015 Hajj this system was operational alongside HESN. Unlike HESN which is implemented country-wide, CITREX is used only during Hajj to manage infectious diseases data captured in-real time from the health facilities in the Holy areas (Makkah, Medina, Arafat and Mina). While the hospital surveillance teams handled data entry into HESN, the fixed surveillance teams captured the same health data into CITREX for analysis and notification on distinct electronic dashboards at the CCC.

## **5. Gaps and areas for strengthening and improvement**

Over the years, the Saudi government has allocated substantial resources to protecting public health during the Hajj. This contributed to the development of modern surveillance systems for the Hajj, evolving from the paper-based reporting tools to a more efficient web-based electronic surveillance systems. Enhanced IDSSs were introduced to complement the conventional surveillance system in addressing the increased risks of infectious diseases transmission and outbreaks during the Hajj. Existing electronic surveillance systems (HESN and CITREX) automatically generates reports and have the advantage of timeliness, as public health personnel at different locations can access and synchronize information management once data is captured at the reporting sites. However, the implication of having parallel systems capturing and interpreting the same

health data has some potential implications, including duplication of work, depletion of already limited resources during Hajj and uncertainty of the accuracy of the data. In addition, in case there is discrepancy in the data captured by the two systems, this may lead to confusion and uncertainty regarding the actions to be taken and mobilization of resources. Therefore, there is a need to conduct operational studies to assess the feasibility of integrating the diverse surveillance systems utilized during Hajj into one efficient tool. Prioritizing systems that remain operational for routine surveillance after Hajj may promote the most efficient use of resources.<sup>12</sup>

Although useful for detecting common infectious disease, indicator-based surveillance, including notifiable diseases surveillance systems, sentinel surveillance and laboratory surveillance are not suitable for the detection of rare or emerging and unknown infectious diseases.<sup>19</sup> For detecting the latter, event-based surveillance is more useful. In contrast to indicator-based surveillance, event-based surveillance focuses less on routine data collection and triggered thresholds for intervention, but rather on unstructured descriptions and reports.<sup>19</sup> This type of surveillance is limited during Hajj. In the 2015 Hajj, the 937 emergency call centre of the MoH provided 24 hours services as the centre frequently dealt with enquiries from the public about health services within the Kingdom. However, the use of the centre for event-based surveillance was hampered by the limited capacity of the call centre heightened by the increased call traffic during the stampede incident. This meant that analysis of the pattern of enquiries from the population was insufficient to identify thresholds for responding to rumors. In Medina, media monitoring is conducted regularly; however, there is no standardized procedure for processing information as part of a holistic Hajj surveillance plan. Thus media monitoring seems to be more reactionary for reputational management, rather than proactively strategic for capturing event information from target populations.

Event-based surveillance could thrive on rumors of unexplained deaths in the population or media to rapidly detect emerging and high-impact outbreaks during mass gatherings such as the Hajj. In addition to serving as an additional data source for detecting rare threats, event-based surveillance systems could capture events that may undermine the

legacy of the mass gathering such as potential health risks from poor sanitary conditions of mass gathering facilities.<sup>13</sup> For these reasons, the WHO considers event-based surveillance complementary to indicator-based surveillance and recommends that both systems should be essential components of a single national surveillance system.<sup>12</sup> Hence, in the context of the Hajj, public health stakeholders should consider developing a strategy to integrate event-based surveillance in the general framework of infectious diseases surveillance for future events.

Only around 45% of countries sending pilgrims to the Hajj have functional medical offices for pilgrims and staff members of some medical offices are recruited just before the Hajj season and relieved of their duties soon after the event. In addition compliance of these medical offices with the Saudi health authority's requirements has so far been poor. These factors hinder sustainable long term planning and weaken the partnership between the medical offices and the Saudi health authorities. There is a need for effective international initiatives to improve and strengthen the partnership between the Saudi health authorities and the medical offices for the benefit of all pilgrims.

## **6. International engagement**

Ensuring the health and safety, security and wellbeing of pilgrims are top priorities for the Kingdom. Achieving this is a collective responsibility that needs to be shared by Saudi Arabia and each country that sends pilgrims to the Hajj. This is because the Hajj experience is not limited to the few days pilgrims spend performing the Hajj rituals. Rather it starts well before they arrive to the Kingdom and lasts long after they have returned to their home countries. Prevention of importation and exportation of infectious agents in Hajj is key for global health security and effective infectious disease surveillance both in the Kingdom during Hajj, as well as in the countries of origin of pilgrims, is crucial in achieving this. Therefore, it is apparent that there is a great need for the development of a well-structured, harmonized and effective collaboration, data collection and information sharing network involving the Saudi health authorities and representatives from all countries sending pilgrims to the Hajj. Such a network would be crucial in strengthening infectious disease surveillance, preventing illnesses and

responding to outbreaks during Hajj, minimizing disease transmission as well as strengthening global health security.

For these reasons, the Global Centre for Mass Gatherings Medicine (GCMGM) in collaboration with the World Health Organization (WHO) intends to create this global network by the appointment of a Hajj and Umrah focal point in each country which sends pilgrims to Saudi Arabia for these mass gatherings. These focal points shall engage in public health preparedness activities such as dissemination of health education messages, monitoring pilgrims' health status and compliance with the Hajj and Umrah health requirements, as well as routine surveillance for public health emergencies of international concern. Additionally, they shall develop and maintain a database on pilgrims' demographics and health information as well as on public health threats including disease outbreaks in pilgrims' home countries. This database will allow the focal point to generate periodic and on-request reports on infectious disease to the WHO, the GCMGM or the local health authorities as required, facilitating the monitoring of disease patterns and trends globally and strengthening the Kingdom's public health Hajj preparedness and response capabilities.

## **7. Summary**

The Saudi authorities have invested significant resources in developing model IDSSs for the Hajj to ensure the safety and wellbeing of pilgrims, the Saudi population and the population of countries sending pilgrims for the Hajj. Existing surveillance systems operating during Hajj facilitate timely notification of cases and rapid response to outbreak alerts, but they ought to be integrated to ensure the most efficient use of resources. Event-based surveillance should be developed and strengthened further to complement the well-established indicator-based surveillance during Hajj. Since the Hajj experience is not limited to the short time pilgrims spend performing the Hajj in Saudi Arabia, there is a need for sustainable international collaborations between the Saudi authorities, countries which send pilgrims for the Hajj and international organizations to strengthen infectious diseases surveillance and to prevent disease transmission and globalization of infectious agents which could undermine global health security

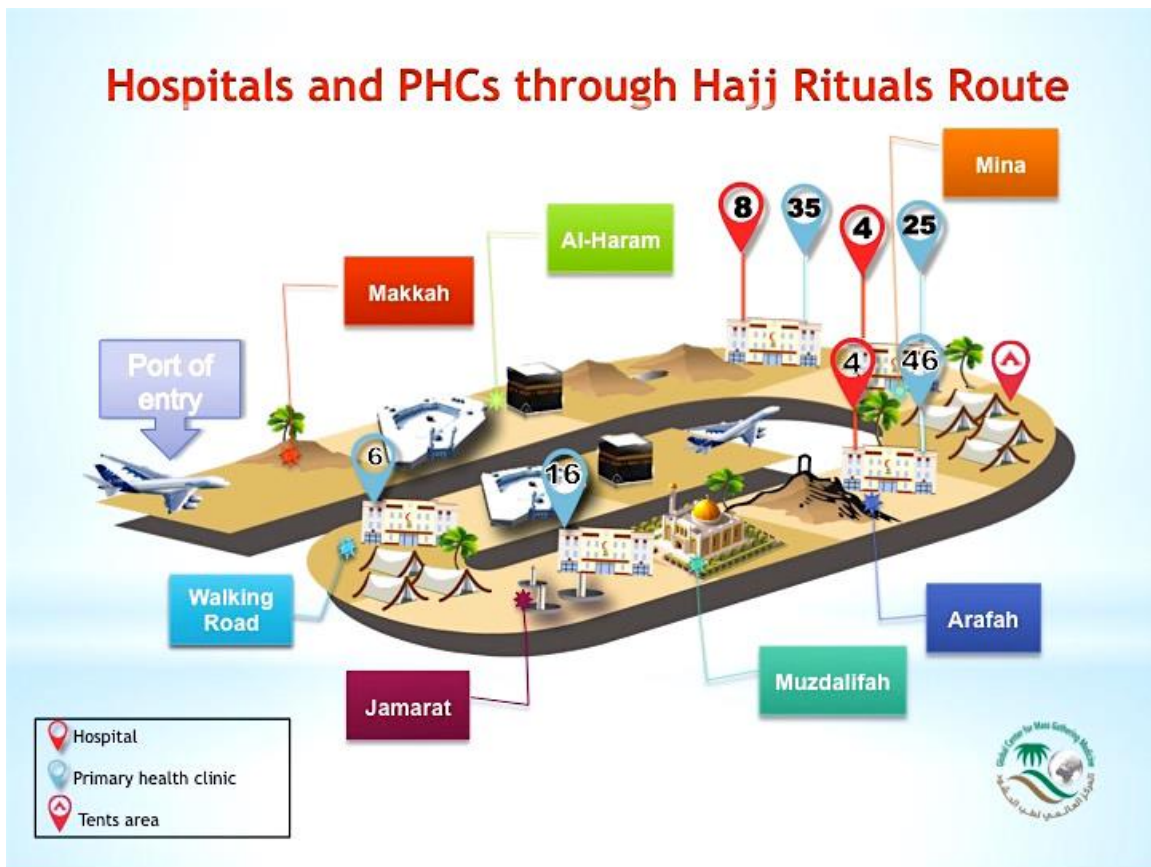
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Figure 1: Distribution of healthcare facilities in the Holy places during the 2015Hajj



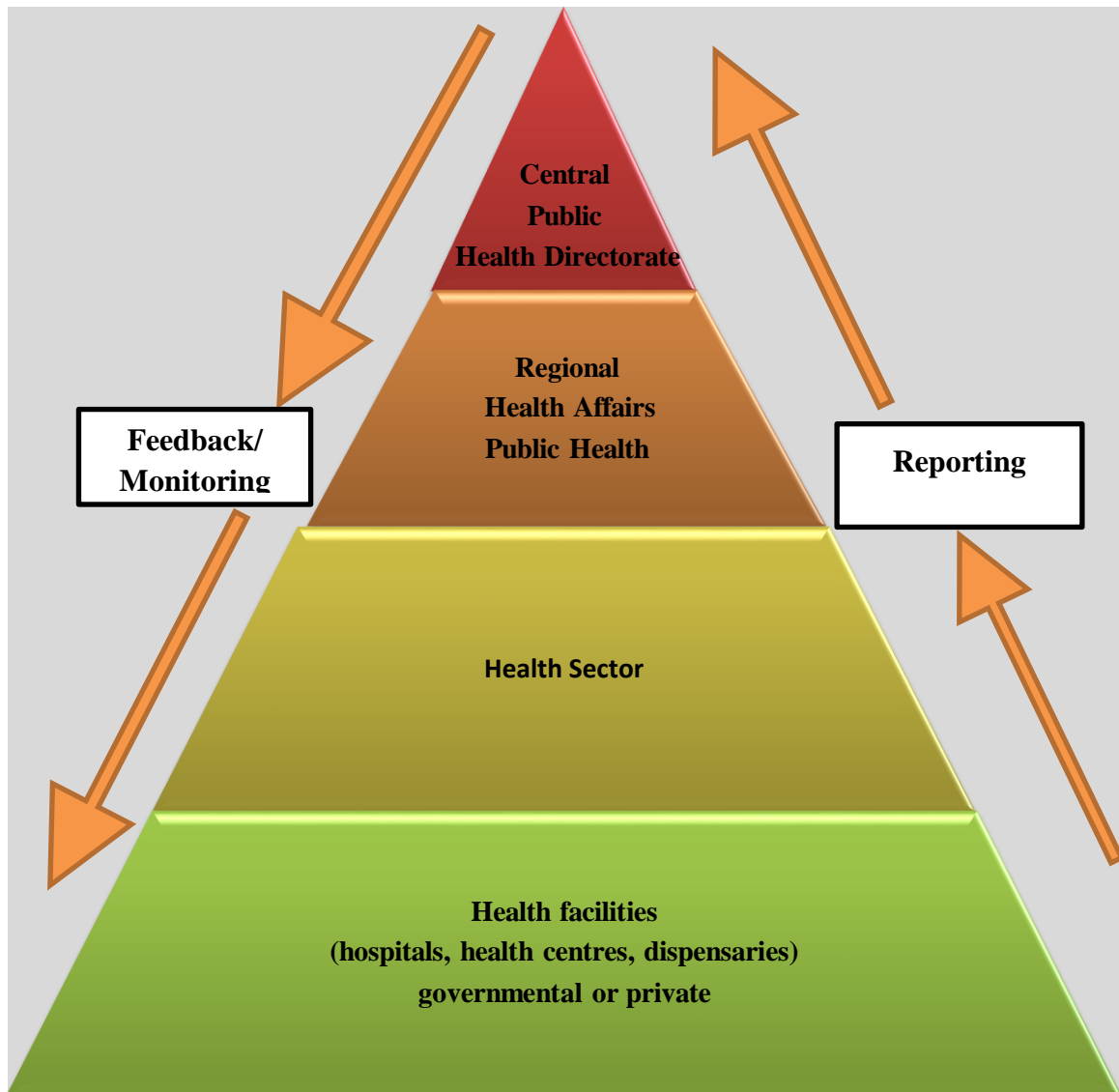
**Table 1: list of notifiable diseases in Saudi Arabia**

<b>Section 1</b> <b>Notified immediately (within 24H)</b>	<b>Section 11</b> <b>Notified weekly</b>
1. Cholera	1. Chicken pox
2. Plaque	2. Tetanus other types
3. Yellow Fever	3. Viral hepatitis
4. Neonatal Tetanus	- Hepatitis A
5. Diphtheria	- Hepatitis B
6. Measles	- Hepatitis C
7. Rubella	- Hepatitis D
8. Congenital rubella	- Hepatitis E
9. Mumps	- Unspecified hepatitis
10. Pertussis	(other types)
11. Acute Flaccid Paralysis	4. Typhoid and paratyphoid
- Suspected	5. Brucellosis
- Poliomyelitis	6. Amoebiasis
- Guillain-Barre	7. Salmonellosis
- Transverse	8. Shigellosis
- Myelitis	9. Pneumococcal meningitis
- Other suspected	10. Haemophallus meningitis
Polio cases	11. Other meningitis
12. Meningococcal meningitis	12. Haemolytic uremic syndrome
13. Haemorrhagic fever:	13. Echinococcosis
- Dengue fever	14. Influenza H1N1
- Rift Valley fever	
- Lassa fever	
- Ebola Virus Disease	
- Crimean -Congo	
- Alkhumra	
- Other haemorrhagic fevers	
14. West Nile Virus fever	
15. SARS	
16. Rabies	
17. Antrax	
18. Avian Flu	
19. MERS-CoV illness	
20. Influenza H1N1 critical cases	

21. Any emerging disease

22. Any disease that appears in epidemic even if it is not included in a section 1 & 11

Figure2: Reporting pathway for the regular infectious diseases surveillance system



**Figure 3: Reporting pathway for enhanced infectious disease surveillance systems during the 2015 Hajj.**

