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# KING ABDULLAH FELLOWSHIP PROGRAM

Hubert Department of Global Health

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# Cohort of 2011

## Hubert Department of Global Health

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Master of Public Health Thesis: Sleepless in Makkah City, Saudi Arabia: Prevalence and Risk Factors of Insomnia and the Variations in Sleep Quality amongVisitors of Primary Health Care Centers
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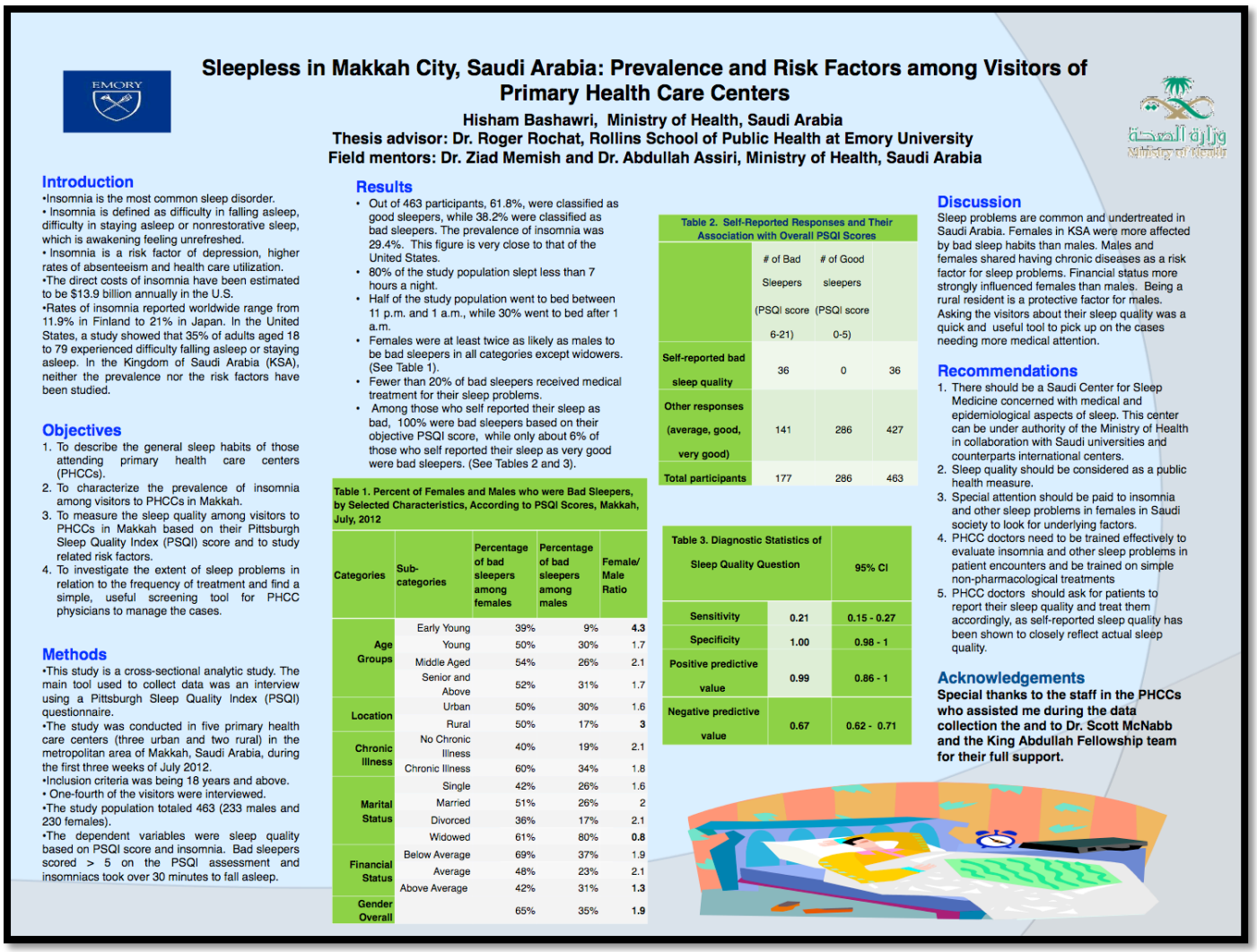

### Sleepless in Makkah City, Saudi Arabia: Prevalence and Risk Factors among Visitors of Primary Health Care Centers

Hisham Bashawri, Ministry of Health, Saudi Arabia
Thesis advisor: Dr. Roger Rochat, Rollins School of Public Health at Emory University
Field mentors: Dr. Ziad Memish and Dr. Abdullah Assiri, Ministry of Health, Saudi Arabia

**Introduction**

•Insomnia is the most common sleep disorder.
• Insomnia is defined as difficulty in falling asleep, difficulty in staying asleep or nonrestorative sleep, which is awakening feeling unrefreshed.
• Insomnia is a risk factor of depression, higher rates of absenteeism and health care utilization.
•The direct costs of insomnia have been estimated to be $13.9 billion annually in the U.S.
•Rates of insomnia reported worldwide range from 11.9% in Finland to 21% in Japan. In the United States, a study showed that 35% of adults aged 18 to 79 experienced difficulty falling asleep or staying asleep. In the Kingdom of Saudi Arabia (KSA), neither the prevalence nor the risk factors have been studied.

**Objectives**

1. To describe the general sleep habits of those attending primary health care centers (PHCCs).
2. To characterize the prevalence of insomnia among visitors to PHCCs in Makkah.
3. To measure the sleep quality among visitors to PHCCs in Makkah based on their Pittsburgh Sleep Quality Index (PSQI) score and to study related risk factors.
4. To investigate the extent of sleep problems in relation to the frequency of treatment and find a simple, useful screening tool for PHCC physicians to manage the cases.

**Methods**

•This study is a cross-sectional analytic study. The main tool used to collect data was an interview using a Pittsburgh Sleep Quality Index (PSQI) questionnaire.
•The study was conducted in five primary health care centers (three urban and two rural) in the metropolitan area of Makkah, Saudi Arabia, during the first three weeks of July 2012.
•Inclusion criteria was being 18 years and above.
• One-fourth of the visitors were interviewed.
•The study population totaled 463 (233 males and 230 females).
•The dependent variables were sleep quality based on PSQI score and insomnia. Bad sleepers scored > 5 on the PSQI assessment and insomniacs took over 30 minutes to fall asleep.

**Results**

- Out of 463 participants, 61.8%, were classified as good sleepers, while 38.2% were classified as bad sleepers. The prevalence of insomnia was 29.4%. This figure is very close to that of the United States.
- 80% of the study population slept less than 7 hours a night.
- Half of the study population went to bed between 11 p.m. and 1 a.m., while 30% went to bed after 1 a.m.
- Females were at least twice as likely as males to be bad sleepers in all categories except widowers. (See Table 1).
- Fewer than 20% of bad sleepers received medical treatment for their sleep problems.
- Among those who self reported their sleep as bad, 100% were bad sleepers based on their objective PSQI score, while only about 6% of those who self reported their sleep as very good were bad sleepers. (See Tables 2 and 3).

Table 1. Percent of Females and Males who were Bad Sleepers, by Selected Characteristics, According to PSQI Scores, Makkah, July, 2012

| Categories | Sub-categories | Percentage of bad sleepers among females | Percentage of bad sleepers among males | Female/ Male Ratio |
|---|---|---|---|---|
| Age Groups | Early Young | 39% | 9% | 4.3 |
| | Young | 50% | 30% | 1.7 |
| | Middle Aged | 54% | 26% | 2.1 |
| | Senior and Above | 52% | 31% | 1.7 |
| Location | Urban | 50% | 30% | 1.6 |
| | Rural | 50% | 17% | 3 |
| Chronic Illness | No Chronic Illness | 40% | 19% | 2.1 |
| | Chronic Illness | 60% | 34% | 1.8 |
| Marital Status | Single | 42% | 26% | 1.6 |
| | Married | 51% | 26% | 2 |
| | Divorced | 36% | 17% | 2.1 |
| | Widowed | 61% | 80% | 0.8 |
| Financial Status | Below Average | 69% | 37% | 1.9 |
| | Average | 48% | 23% | 2.1 |
| | Above Average | 42% | 31% | 1.3 |
| Gender Overall | | 65% | 35% | 1.9 |

Table 2. Self-Reported Responses and Their Association with Overall PSQI Scores

| | # of Bad Sleepers (PSQI score 6-21) | # of Good sleepers (PSQI score 0-5) | |
|---|---|---|---|
| Self-reported bad sleep quality | 36 | 0 | 36 |
| Other responses (average, good, very good) | 141 | 286 | 427 |
| Total participants | 177 | 286 | 463 |

Table 3. Diagnostic Statistics of Sleep Quality Question

| | | 95% CI |
|---|---|---|
| Sensitivity | 0.21 | 0.15 - 0.27 |
| Specificity | 1.00 | 0.98 - 1 |
| Positive predictive value | 0.99 | 0.86 - 1 |
| Negative predictive value | 0.67 | 0.62 - 0.71 |

**Discussion**

Sleep problems are common and undertreated in Saudi Arabia. Females in KSA were more affected by bad sleep habits than males. Males and females shared having chronic diseases as a risk factor for sleep problems. Financial status more strongly influenced females than males. Being a rural resident is a protective factor for males. Asking the visitors about their sleep quality was a quick and useful tool to pick up on the cases needing more medical attention.

**Recommendations**

1. There should be a Saudi Center for Sleep Medicine concerned with medical and epidemiological aspects of sleep. This center can be under authority of the Ministry of Health in collaboration with Saudi universities and counterparts international centers.
2. Sleep quality should be considered as a public health measure.
3. Special attention should be paid to insomnia and other sleep problems in females in Saudi society to look for underlying factors.
4. PHCC doctors need to be trained effectively to evaluate insomnia and other sleep problems in patient encounters and be trained on simple non-pharmacological treatments
5. PHCC doctors should ask for patients to report their sleep quality and treat them accordingly, as self-reported sleep quality has been shown to closely reflect actual sleep quality.

**Acknowledgements**

**Special thanks to the staff in the PHCCs who assisted me during the data collection the and to Dr. Scott McNabb and the King Abdullah Fellowship team for their full support.**

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## Evaluation of Tuberculosis Public Health Surveillance in Al-Madinah Province, Kingdom of Saudi Arabia, 2012

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وزارة الصحة
Ministry of Health

EMORY ROLLINS SCHOOL OF PUBLIC HEALTH

### Introduction:

Tuberculosis (TB) is a significant global health problem. Among infectious diseases, TB is the second leading cause of death globally and the single most infectious killer among youth and adults. Currently, ⅓ of the world's population is infected with *Mycobacterium tuberculosis*.

The Kingdom of Saudi Arabia (KSA) does not have a high TB burden, yet it faces real challenges in controlling and preventing TB due to its huge number of pilgrims and migrant workers.

In 2011, there were 6,200 cases in KSA; 4,900 were incident cases. In the same period, there were 1,100 deaths due to TB. In addition, there were 110 cases of TB and HIV co-infections. According to WHO, 80% of the TB cases were detected, and most of the new cases were smear-positive, the most contagious type. In contrast to other countries in the region, whose prevalence and mortality rates have decreased, the rates in KSA in the last ten years have remained almost unchanged.

To control and eliminate TB, KSA launched a TB surveillance program in 1992. This program is responsible for data collection, analysis, and feedback, as well as the implementation of actions.

### Objectives:

To evaluate the quality of the data, the sensitivity of the surveillance, and the completeness of identification and investigation of patient's contacts of TB PHS (Public Health Surveillance) in Al-Madinah province.

### Methods:

- The study was conducted in KSA during the summer of 2012. The study covered all new TB cases diagnosed between Jan. 1, 2011 and Dec. 31, 2011.
- The missed cases (sensitivity) were identified by comparing all of the cases that were reported to the regional coordinator with all of the cases registered in the labs and hospitals.
- Due to the highly infectious nature of TB, all of the contact investigations were reviewed. The TB program requires investigation of pulmonary TB patients and their contacts with positive sputum smears.
- All notifications sent from any health facilities to the regional coordinator were examined to assess external completeness.
- To describe the internal completeness of data, monthly reports sent to the national coordinator were compared with patient treatment cards.

### Results:

The results revealed high completeness rates for demographic and disease data and low completeness rates for the test result fields. The lowest completeness was seen in the HIV test result field. The contact identification and investigation showed that 42 smear-positive cases' contacts were not identified. Out of the 448 contacts identified, only 301 (67%) of them were investigated. The review of hospital records and lab registers showed that 244 cases were not reported, in spite of the fact that 213 of them (87.3%) were confirmed by labs.

| Category | Issue | Missed | Label it (not done) | Completeness rate |
|---|---|---|---|---|
| Demographic data | Name | Zero | - | 100% |
| | Nationality | Zero | - | 100% |
| | Age | 1 | - | 99.5% |
| | Gender | 3 | - | 98.5% |
| | ID | 17 | - | 91.5% |
| Contact information | Patient telephone number | 21 | | 89.5% |
| Disease data | Sign and symptoms | 5 | - | 97.5% |
| | Patient's classification | 11 | - | 94.5% |
| | Treatment plan | 11 | - | 94.5% |
| | Past history | 12 | - | 94% |
| | Site of the disease | 18 | - | 91% |
| Investigation results | Sputum smear | 37 (92.5%) | 3 (7.5%) | 80% |
| | Chest x-ray | 36 (87.8%) | 5 (12.2%) | 79.5% |
| | Tuberculin test | 90 (83.3%) | 18 (16.7%) | 46% |
| | Sputum culture | 110 (80.3%) | 27 (19.7%) | 31.5% |
| | HIV test | 130 (86.7%) | 20 (13.3%) | 25% |
| | Admission date | 9 | - | 95.5% |
| | Hospital name | 31 | - | 84.5% |
| | Doctor name or signature | 41 | - | 79.5% |

Table 1. Completeness Rate of Different Categories on TB Notification Forms, 2011, Saudi Arabia, Al-Madinah Province

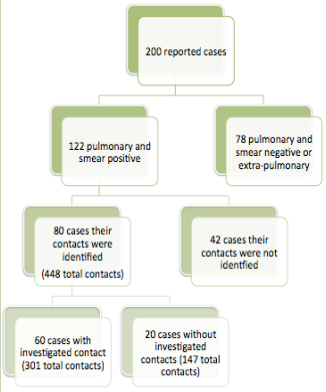


Figure 1. The Identification and Investigation of the Contacts in 2011, Saudi Arabia, Al-Madinah Province.

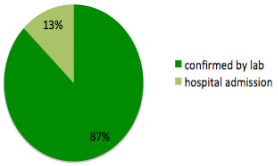


Figure 2. The Distribution of Missed Cases in 2011, Saudi Arabia, Al-Madinah Province

| Field | Discrepancies |
|---|---|
| Result of treatment * | 8 (8.5%) |
| X-ray | 16 (8%) |
| Sputum smear | 11 (5.5%) |
| Treatment plan | 6 (3%) |
| TB code | 5 (2.5%) |

Table 2. Discrepancies Between Register Book and Monthly Reports, 2011, Saudi Arabia, Al-Madinah Province

* The results in the report that was sent to Ministry Of Health were available for only 94 patients. The rest were not sent until after the data collection.

### Recommendations:

**Implementation of automated notification and reporting**

Rapid and complete reporting is required in order to control and prevent TB. Electronic reporting should include both providers and laboratories. Such a system will reduce incompleteness in data and delays in reporting that result from paper-based notifications.

**Mandatory lab and suspected cases reporting**

Because laboratories identified most of the missed cases, it is essential to implement mandatory laboratory reports. Also, all suspected cases should be reported to the coordinator even before lab confirmation. By providing a brief summary of suspected cases, the coordinator can follow up on the cases through the hospitals and labs looking for either confirmation or incorrect diagnosis. In addition, s/he can investigate the contacts early and interrupt the transmission. As a result, the rate of underreported cases will be reduced.

**Investigation of the contacts**

Improving the communication between different health providers, especially in primary care centers, will improve the investigation and facilitate progress.

Other strategies, like initiating a specific outreach program and continuous training program tailored to healthcare providers, will increase doctors' awareness and improve their response rate. Also, a revision of the national TB control program manual, which includes disease information, reporting guidelines and control recommendations, would also increase awareness and improve reporting. Periodic feedback from headquarters to regional coordinators and the dissemination of progress reports will increase the confidence of the providers in the program. Finally, the program should be evaluated periodically to improve its quality and achieve optimum disease control.

### Limitations:

First, all data were handwritten, which took a long time to read and evaluate. Second, the lab registrations were unclear and did not contain the whole names. Third, the treatment cards of some patients were not on hand at the coordinator's office. Fourth, there were no other TB patient record systems, so we could not apply the capture-recapture method. Finally, there were no electronic records of the inpatients in the hospitals, so we could not find the missed admitted cases.

### Conclusion:

The study showed that the rates of completeness for the different notification report fields varied; the lab results and HIV test fields had the lowest rates of completion. Also, over half of the patients' contacts were not identified or investigated, and there were a significant number of unreported cases, even though most all of them were laboratory confirmed. Finally, there were discrepancies between different records and the reported data.

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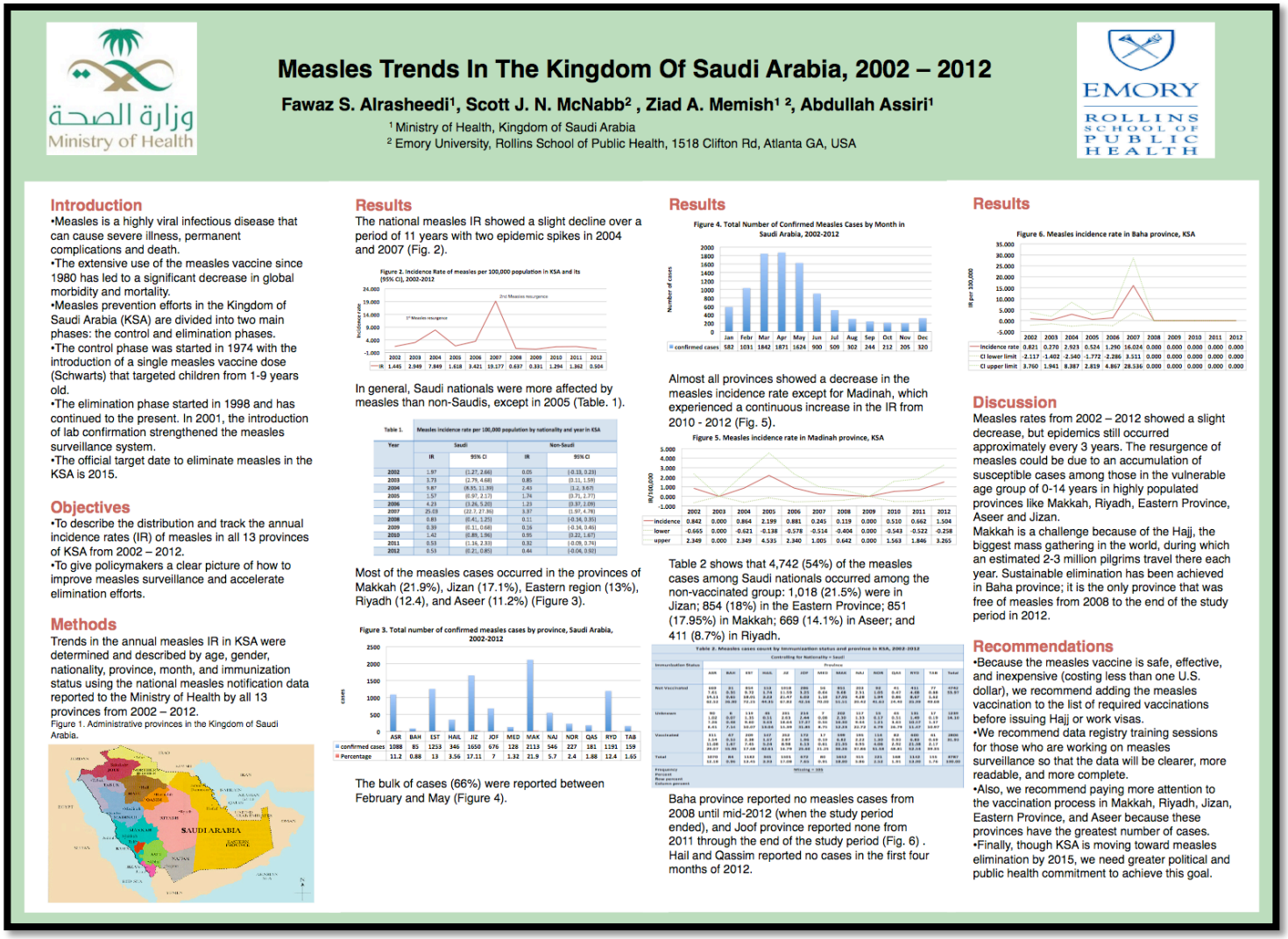

## Measles Trends In The Kingdom Of Saudi Arabia, 2002 – 2012

**Fawaz S. Alrasheedi[1], Scott J. N. McNabb[2] , Ziad A. Memish[1 2], Abdullah Assiri[1]**

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### Introduction

•Measles is a highly viral infectious disease that can cause severe illness, permanent complications and death.
•The extensive use of the measles vaccine since 1980 has led to a significant decrease in global morbidity and mortality.
•Measles prevention efforts in the Kingdom of Saudi Arabia (KSA) are divided into two main phases: the control and elimination phases.
•The control phase was started in 1974 with the introduction of a single measles vaccine dose (Schwarts) that targeted children from 1-9 years old.
•The elimination phase started in 1998 and has continued to the present. In 2001, the introduction of lab confirmation strengthened the measles surveillance system.
•The official target date to eliminate measles in the KSA is 2015.

### Objectives

•To describe the distribution and track the annual incidence rates (IR) of measles in all 13 provinces of KSA from 2002 – 2012.
•To give policymakers a clear picture of how to improve measles surveillance and accelerate elimination efforts.

### Methods

Trends in the annual measles IR in KSA were determined and described by age, gender, nationality, province, month, and immunization status using the national measles notification data reported to the Ministry of Health by all 13 provinces from 2002 – 2012.

Figure 1. Administrative provinces in the Kingdom of Saudi Arabia.




### Results

The national measles IR showed a slight decline over a period of 11 years with two epidemic spikes in 2004 and 2007 (Fig. 2).

Figure 2. Incidence Rate of measles per 100,000 population in KSA and its (95% CI), 2002-2012



| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| IR | 1.445 | 2.949 | 7.849 | 1.618 | 3.421 | 19.177 | 0.637 | 0.331 | 1.294 | 1.362 | 0.504 |

In general, Saudi nationals were more affected by measles than non-Saudis, except in 2005 (Table. 1).

Table 1. Measles incidence rate per 100,000 population by nationality and year in KSA

| Year | Saudi | | Non-Saudi | |
|---|---|---|---|---|
| | IR | 95% CI | IR | 95% CI |
| 2002 | 1.97 | (1.27, 2.66) | 0.05 | (-0.33, 0.23) |
| 2003 | 3.73 | (2.79, 4.68) | 0.85 | (0.11, 1.59) |
| 2004 | 9.87 | (8.55, 11.19) | 2.43 | (1.2, 3.67) |
| 2005 | 1.57 | (0.97, 2.17) | 1.74 | (0.71, 2.77) |
| 2006 | 4.23 | (3.26, 5.20) | 1.23 | (0.37, 2.09) |
| 2007 | 25.03 | (22.7, 27.36) | 3.37 | (1.97, 4.78) |
| 2008 | 0.83 | (0.41, 1.25) | 0.11 | (-0.14, 0.35) |
| 2009 | 0.39 | (0.11, 0.68) | 0.16 | (-0.14, 0.46) |
| 2010 | 1.42 | (0.89, 1.96) | 0.95 | (0.22, 1.67) |
| 2011 | 0.53 | (-1.16, 2.23) | 0.32 | (-0.09, 0.74) |
| 2012 | 0.53 | (0.21, 0.85) | 0.44 | (-0.04, 0.92) |

Most of the measles cases occurred in the provinces of Makkah (21.9%), Jizan (17.1%), Eastern region (13%), Riyadh (12.4), and Aseer (11.2%) (Figure 3).

Figure 3. Total number of confirmed measles cases by province, Saudi Arabia, 2002-2012



| | ASR | BAH | EST | HAIL | JIZ | JOF | MED | MAK | NAJ | NOR | QAS | RYD | TAB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| confirmed cases | 1088 | 85 | 1253 | 346 | 1650 | 676 | 128 | 2113 | 546 | 227 | 181 | 1191 | 159 |
| Percentage | 11.2 | 0.88 | 13 | 3.56 | 17.11 | 7 | 1.32 | 21.9 | 5.7 | 2.4 | 1.88 | 12.4 | 1.65 |

The bulk of cases (66%) were reported between February and May (Figure 4).

### Results

Figure 4. Total Number of Confirmed Measles Cases by Month in Saudi Arabia, 2002-2012



| | Jan | Febr | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| confirmed cases | 582 | 1031 | 1842 | 1871 | 1624 | 900 | 509 | 302 | 244 | 212 | 205 | 320 |

Almost all provinces showed a decrease in the measles incidence rate except for Madinah, which experienced a continuous increase in the IR from 2010 - 2012 (Fig. 5).

Figure 5. Measles incidence rate in Madinah province, KSA



| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| incidence | 0.842 | 0.000 | 0.864 | 2.199 | 0.881 | 0.245 | 0.119 | 0.000 | 0.510 | 0.662 | 1.504 |
| lower | -0.665 | 0.000 | -0.621 | -0.138 | -0.578 | -0.514 | -0.404 | 0.000 | -0.543 | -0.522 | -0.258 |
| upper | 2.349 | 0.000 | 2.349 | 4.535 | 2.340 | 1.005 | 0.642 | 0.000 | 1.563 | 1.846 | 3.265 |

Table 2 shows that 4,742 (54%) of the measles cases among Saudi nationals occurred among the non-vaccinated group: 1,018 (21.5%) were in Jizan; 854 (18%) in the Eastern Province; 851 (17.95%) in Makkah; 669 (14.1%) in Aseer; and 411 (8.7%) in Riyadh.



Baha province reported no measles cases from 2008 until mid-2012 (when the study period ended), and Joof province reported none from 2011 through the end of the study period (Fig. 6) . Hail and Qassim reported no cases in the first four months of 2012.

### Results

Figure 6. Measles incidence rate in Baha province, KSA



| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| incidence rate | 0.821 | 0.270 | 2.923 | 0.524 | 1.290 | 16.024 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| CI lower limit | -2.117 | -1.402 | -2.540 | -1.772 | -2.286 | 3.511 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| CI upper limit | 3.760 | 1.941 | 8.387 | 2.819 | 4.867 | 28.536 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

### Discussion

Measles rates from 2002 – 2012 showed a slight decrease, but epidemics still occurred approximately every 3 years. The resurgence of measles could be due to an accumulation of susceptible cases among those in the vulnerable age group of 0-14 years in highly populated provinces like Makkah, Riyadh, Eastern Province, Aseer and Jizan.
Makkah is a challenge because of the Hajj, the biggest mass gathering in the world, during which an estimated 2-3 million pilgrims travel there each year. Sustainable elimination has been achieved in Baha province; it is the only province that was free of measles from 2008 to the end of the study period in 2012.

### Recommendations

•Because the measles vaccine is safe, effective, and inexpensive (costing less than one U.S. dollar), we recommend adding the measles vaccination to the list of required vaccinations before issuing Hajj or work visas.
•We recommend data registry training sessions for those who are working on measles surveillance so that the data will be clearer, more readable, and more complete.
•Also, we recommend paying more attention to the vaccination process in Makkah, Riyadh, Jizan, Eastern Province, and Aseer because these provinces have the greatest number of cases.
•Finally, though KSA is moving toward measles elimination by 2015, we need greater political and public health commitment to achieve this goal.

# Emory University | Rollins School of Public Health

Fatima Younis Al Slail, M.D., MPH

Master of Public Health Thesis: A Descriptive study of Cardiovascular Risk Profiles of Adults with Type 2 Diabetes from Hospitals in Urban Saudi Arabia over a Five Year Period (2008-2012), Riyadh, Saudi Arabia
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EMORY ROLLINS SCHOOL OF PUBLIC HEALTH

## *A Descriptive Study of Cardiovascular Risk Profiles of Adults with Type 2 Diabetes from Hospitals in Urban Saudi Arabia*

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وزارة الصحة Ministry of Health

### Introduction

- Diabetes mellitus (DM) patients have always had a higher risk of cardiovascular disease (CVD) complications than those without diabetes.
- Those with DM have a 2-4-fold increased risk of dying from coronary artery disease. Several studies of diabetic patients have shown a significant reduction in cardiovascular morbidity and mortality when these patients closely control their glycemia and the main cardiovascular risk factors, such as hypertension and dyslipidemia.

**Table 1: Summary of data regarding DM in KSA from 1982-2010**

| Year | Prevalence | Study type |
|---|---|---|
| 1982 | 2.5% | A study of 1,385 male participants in the Al-Kharj area using the WHO criteria for screening. |
| 1999 | 6% | A study of 14,660 participants in a screening survey in five different regions. |
| 2000 | 21.9% | A community-based study. |
| 2004 | 24% | A community-based study with 17,232 participants. |
| 2009 | 30% | A cross-sectional study of 6,024 patients attending a primary care clinic. |
| 2010 | 34.7% | A cohort study in Riyadh. |

### Objectives

- To determine the prevalence of CVD risk factors among people with type 2 diabetes mellitus (T2DM) attending two different hospitals in Riyadh, Saudi Arabia, from 2008 -2012.
- To determine the percentage of patients achieving the recommended optimal control levels of multiple CVD risks based on the American Diabetes Association (ADA) guidelines.

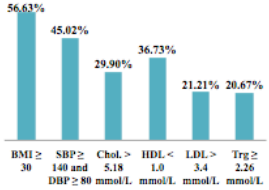
### Methods

- A retrospective study that used outpatient data from King Fahad Medical City (KFMC) and Prince Salman Hospital (PSH) from 2008 to 2012.
- Exploratory analyses of the data were done to produce summary statistics.
- Continuous variables were summarized with descriptive statistics.
- A cross tab association analysis of demographic, clinical and metabolic features of KFMC vs. PSH was conducted using a Chi-Square analysis.

### Results

- 422 patients were included; 50.24% were women (n = 212), and the average age was 52 years (n=422).
- From KFMC, there were 228 (54.03%), and 64% (n=146) were women, while from PSH, 34% (n=66) were women.

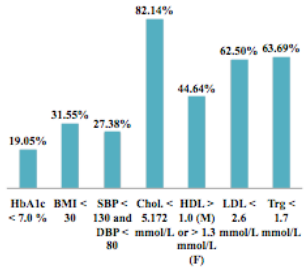
**Figure 1. Prevalence of the Cardiovascular Risks**




### Discussion

- This study provides useful baseline data about whether diabetes patients reach the ADA's optimal target controls of T2DM management in two different diabetes centers, one a tertiary healthcare setting (KFMC) and the other a secondary hospital in Riyadh (PSH).
- There was a high prevalence of CVD risk factors among patients with diabetes in urban KSA, and a large proportion of these risk factors were not well controlled.
- The results of this study reveal that a strategic in-depth study and assessment of the management of care and control of T2DM are needed to achieve further improvements.

**Figure 2. Patients with Optimal Control Level Using the ADA Guidelines**




### Conclusion

The quality of care and management provided to T2DM patients in two health centers appears to be far from reaching international evidence-based goals. The percentage of patients with poor glycemic, blood pressure, and lipid control was high. This implies that these centers need to make major efforts to improve these services in order to reduce the gap between the optimal levels of risk factor control and what the current reality reflects.

### Recommendations

- Review current T2DM management program.
- Create a National Diabetes Committee.
- Develop a public awareness program.
- Increase the level of physical activity in the Kingdom

### Acknowledgements

The Minister of Health,
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# Dengue Fever in Makkah, Kingdom of Saudi Arabia, 2008 – 2012

May 1, 2013 Thesis

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FIGURE 1. Aedes aegypti mosquito

## INTRODUCTION

Dengue fever is a serious disease with many complications. It is a vector-born disease that is transmitted from person to person through a mosquito's bite. According to the Centers for Disease Control (CDC), there are two species of mosquitos that transmit dengue fever, but the primary vector of dengue is *Aedes aegypti*, which lives mainly inside buildings in dark areas (closets, bathrooms) and consumes human blood. However, it can be also be found in outdoor areas with standing water, like construction sites and gardens.
Dengue fever has a wide range of presentations, from mild with a low self-limited fever to severe with life-threating hemorrhagic shock. The incubation period of the dengue fever virus in humans ranges from 3 to 14 days. Moreover, this disease has a major impact on the health and economy of any population.
Makkah is a holy city for Muslims, and more than 15 million visitors travel there annually to perform the pilgrimages of Omrah and Hajj. The city houses the Masjid al-Haram, which is the largest mosque in the world. It has a population of about two million and is located in the western region of Saudi Arabia, about 70 km from Jeddah city. It is the third largest city after Riyadh and Jeddah.
Controlling dengue fever infections is a priority in Makkah. To do this, it is important to calculate the incidence rate and analyze the distribution of dengue fever cases over time. Moreover, we need to know the distribution of cases from a demographic standpoint so that we can disseminate the data and use it to guide the development of new policies.

## OBJECTIVE

1- Describe all reported cases of dengue fever investigated by the VBDU from 2008 to 2012.
2 -Identify risk factors.
3-Make evidence-based recommendations for improved prevention and control.

FIGURE 2. Map of Kingdom of Saudi Arabia


## METHODS

**Data sources**
Dengue fever is a notifiable disease in Makkah; weekly and yearly aggregates (2008-2009) of dengue fever cases by gender, nationality, age and work were reported to Vector-Borne Disease Unit (VBDU) department in Makkah. Since 2008, the dengue fever registry has been maintained electronically. Population data (nationality, age, gender) were obtained from the KSA Ministry of Economy and Planning, Central Department of Statistics and Information, which draws statistical information from censuses, field surveys, and statistical studies, in addition to extracting data from administrative records.

**Statistical Analysis**
This is a secondary data analysis. We used incidence rates that were calculated per 100,000. Rates were analyzed over a 5-year period (2008-2012) using Poisson regression and classified as increasing, decreasing, or stable as determined by positive, negative or non-significant coefficients. Significance was determined at a 5% level using two-sided P values. Rates were compared using rate ration and 95% confidence intervals. Graphs and tables were created using Microsoft Excel.

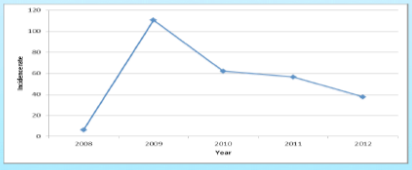
**Ethics**
This secondary data analysis (without any personal identifiers) does not meet the definition of Human Subjects Research, so it did not require Institutional Review Board approval.

Table 1. Dengue Fever Incidence Rate per 100,000 Population and Number of Cases, Kingdom of Saudi Arabia, Makkah, 2008-2012

| Year | Rate (n) | 95% CI |
|---|---|---|
| 2008 | 6.2 (95) | 5-7.5 |
| 2009 | 110.6 (1697) | 105.4-115.9 |
| 2010 | 62(951) | 58.1-66 |
| 2011 | 56.5 (867) | 52.8-60.3 |
| 2012 | 37.6(577) | 34.6-40.8 |

CI = confidence interval.

FIGURE 3. Dengue Fever Incidence Rate Trends, Kingdom of Saudi Arabia, Makkah, 2008-2012




## RESULTS

The incidence rate of dengue fever was 6.2 (95% CI 5-7.5) per 100,000 in 2008, and this number increase almost 20-fold in 2009 (110.6 (95% CI 105.4-115.9)). After that, the incidence rate started to decline with 62 (95% CI 58.1-66) in 2010, 56.5 (95% CI 52.8-60.3) in 2011, and 37.6 (95% CI 34.6-40.8) in 2012. We observed significant increases in the dengue fever incidence among males during these years. Also, we observed significant increases among those aged 25-44. Moreover, we observed significant increases of the dengue fever incidence among Saudis compared to non-Saudis. There were no significant trends among males or females by nationality.

FIGURE 4. Dengue Fever Reported Cases by Month, Kingdom of Saudi Arabia, Makkah, 2008-2012

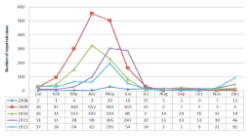


FIGURE 6. Dengue Fever Incidence Rate per 100,000 Population and Number of Cases by Nationality, Kingdom of Saudi Arabia, Makkah, 2008-2012

FIGURE 5. Dengue Fever Incidence Rate per 100,000 Population and Number of Cases by Gender, Kingdom of Saudi Arabia, Makkah, 2008-2012

Table 2. Dengue Fever Incidence Rate per 100,000 Population and Number of Cases by Gender, Kingdom of Saudi Arabia, Makkah, 2008-2012

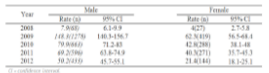
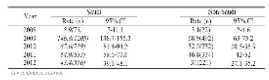


Table 3. Dengue Fever Incidence Rate per 100,000 Population and Number of Cases by Nationality, Kingdom of Saudi Arabia, Makkah, 2008-2012



## CONCLUSIONS

Dengue fever is considered to be endemic in Makkah. There was an outbreak in 2009. We recommend improving the surveillance notification system to include the types of dengue fever (dengue fever (DF), dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS)) and the outcome of the case after notification (full recovery, recovery with complication, or death). Also, we recommend using the revised WHO 2009 classification system instead of the older one. Additionally, data should be disseminated to the public to increase awareness about the seriousness of this infection. Finally, more effort regarding vector control should be implemented, like improving the health education program.

## RECOMMENDATIONS

- Using the newer WHO dengue case classifications, revised in 2009.
- Identifying the type of dengue infection (DF, DH, and DSS) instead of reporting cases only as dengue fever from lab confirmations. Differentiating those with primary infections from those with secondary infections.
- Following cases of dengue infection after they have been reported to discover the outcomes (full recovery, recovery with complication, death).
- Providing feedback to the management team in the hospitals immediately after the lab confirmation. Many doctors in the hospitals don't know the results of the lab.
- Engaging in more frequent door-to-door health education with the involvement of the community.
- Monitoring all construction sites in Makkah and administering penalties to those who don't cover the water containers properly.
- Including health education material about vector control in the school curriculum.
- Involving the media, especially TV, to present health education material regarding dengue fever.
- Initiating a consultation with the WHO regarding dengue activity requirements under the International Health Regulations. Disseminating the results of the dengue infection surveillance data to the public to increase the awareness of the magnitude of the problem and encourage changes in their behavior towards vector control.
- Ensuring that the VBDU follow the strategic approach to vector control promoted by the WHO, called Integrated Vector Management (IVM).

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## Analyses of Foodborne Disease Outbreaks During Hajj, Makkah, Kingdom of Saudi Arabia, 2009 – 2011

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### INTRODUCTION

The Hajj is an annual mass gathering where > 1.8 million Muslim pilgrims from 183 countries come to Makkah, Kingdom of Saudi Arabia (KSA), for approximately two weeks. The KSA Ministry of Health (MOH) is responsible for ensuring the early detection and prevention of infectious diseases that can be transmitted among the markedly great number of pilgrims, such as foodborne illnesses. Foodborne illnesses are especially significant public health problems during mass gatherings. From 2009 – 2011, the Hajj Food Safety Unit (FSU) gathered data on all foodborne disease outbreaks (FBDOs), yet these data have yet to be fully analyzed to determine the underlining risk factors and the best methods for prevention and control of further outbreaks.

### OBJECTIVES

- Describe all foodborne outbreaks investigated by the FSU from 2009 – 2011;
- Identify risk factors (e.g., type of food, food handling, and storage) for foodborne outbreaks; and
- Make evidence-based recommendations for improved prevention and control.

### METHODS

Data was collected using the FSU reports of FBDOs during Hajj in Makkah, KSA, from 2009 to 2011. All reports were written in Arabic, so they were translated. The data from 2009 – 2011 outbreaks was concatenated and statistically analyzed using SAS. Graphs and tables were created using Microsoft Excel.

### RESULTS

- A total of seven FBDOs were reported with a range of two to 45 cases per outbreak, totaling 107 cases. Among these cases, 74 were female (69 %) and 33 were male (31%). Egyptians were the most common nationality affected (69%), followed by Saudis, Malaysians and Turks (23%, 6%, and 2% respectively). The mean age among cases was 46 years with a SD of 16 years (Table 1).
- All of the cases had the typical presentation of foodborne illness, with abdominal pain and diarrhea as the most common symptoms (93% and 85% respectively), followed by nausea and vomiting (43% and 44%) (Table 2).
- A total of 15 cases were admitted to the hospitals; all the cases were stable with no complications and no reported mortality. Of the total, 8 cases were males and 7 were females. Moreover, 8 cases were Saudis and the remaining were Egyptians (Table 3).

(continued)

### RESULTS (CONT.)

- This study found a strong relationship between the three largest FBDOs during Hajj (#1, #6 and #7) and the storage conditions and food handling methods.
- *Salmonella, Staphylococcus aureus* and *Bacillus cereus* were the most commonly suspected pathogens in these outbreaks based on the epidemiological data collected, including IP (Table 4 & Figures 1, 2 & 3).
- In reviewing the FSU reports, it was observed that no single outbreak among the reported FBDOs was linked bacteriologically by lab tests to a certain pathogen.

**Table 1. Demographic Characteristics of Cases in Hajj Foodborne Disease Outbreaks, Kingdom of Saudi Arabia, 2009 – 2011**

| | | 2009 | 2010 | 2011 | Total (%) |
|---|---|---|---|---|---|
| Gender | Male | 0 | 7 | 26 | 33 (31) |
| | Female | 29 | 4 | 41 | 74 (69) |
| Nationality | Egyptian | 29 | NA | 45 | 74 (69) |
| | Saudi | NA | 3 | 22 | 25 (23) |
| | Malaysian | NA | 6 | NA | 6 (6) |
| | Turkish | NA | 2 | NA | 2 (2) |
| Age Group | < 5 | 0 | 1 | 1 | 2 (2) |
| | 5 – 18 years | 0 | 2 | 3 | 5 (5) |
| | 18 – 45 years | 5 | 6 | 16 | 27 (25) |
| | 45 – 65 years | 23 | 2 | 47 | 72 (67) |
| | > 65 | 1 | 0 | 0 | 1 (1) |

**Table 2. Symptoms of Cases in Hajj Foodborne Disease Outbreaks, 2009 – 2011**

| Reported Symptoms | 2009 | 2010 | 2011 | Total (%) |
|---|---|---|---|---|
| Abdominal Pain | 29 | 9 | 61 | 99 (93) |
| Diarrhea | 20 | 11 | 60 | 91 (85) |
| Vomiting | 21 | 11 | 15 | 47 (44) |
| Nausea | 16 | 4 | 26 | 46 (43) |
| Fever | NA | 6 | 10 | 16 (15) |
| Headache | NA | 6 | 2 | 8 (7) |
| Itching | NA | 4 | NA | 4 (4) |
| Chills | NA | 2 | NA | 2 (2) |
| Bloody Diarrhea | NA | 1 | NA | 1 (1) |

**Table 3. Demographic Characteristics of Cases Admitted to Hospitals During Hajj Foodborne Outbreaks, Kingdom of Saudi Arabia, 2009 – 2011**

| | | 2009 | 2010 | 2011 | Total (%) |
|---|---|---|---|---|---|
| Gender | Male | 0 | 0 | 8 | 8 (53%) |
| | Female | 0 | 2 | 5 | 7 (47%) |
| Nationality | Egyptian | NA | NA | 7 | 7 (47%) |
| | Saudi | NA | 2 | 6 | 8 (53%) |
| | Malaysian | NA | NA | NA | NA |
| | Turkish | NA | NA | NA | NA |
| Age Group | < 5 | NA | 0 | 1 | 1 (7%) |
| | 5 – 18 years | NA | 2 | 2 | 2 (13 %) |
| | 18 – 45 years | NA | 0 | 3 | 3 (20%) |
| | 45 – 65 years | NA | 0 | 7 | 7 (47%) |
| | > 65 | NA | 0 | 0 | 0 (0%) |

**Table 4. Number of Cases Reported during Hajj Foodborne Outbreaks and Suspected Pathogens, Kingdom of Saudi Arabia, 2009 – 2011**

| | 2009 | 2010 | | | | 2011 | | Total |
|---|---|---|---|---|---|---|---|---|
| | FBDO#1 | FBDO#2 | FBDO#3 | FBDO#4 | FBDO#5 | FBDO#6 | FBDO#7 | |
| Number of cases | 29 | 3 | 2 | 6 | 3 | 45 | 19 | 107 |
| Suspected Pathogen | *Staphylococcus aureus* | Unknown | Unknown | Unknown | Unknown | *Staphylococcus aureus* or *Bacillus cereus* | *Salmonella* or *Bacillus cereus* | |

Figure 1. Epidemic Curve for Hajj Foodborne Disease Outbreak #1, Kingdom of Saudi Arabia, 2009

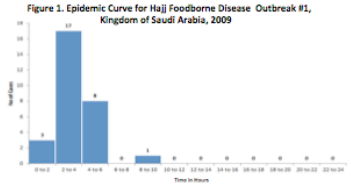

Figure 2. Epidemic Curve for Hajj Foodborne Disease Outbreak #6, Kingdom of Saudi Arabia, 2011

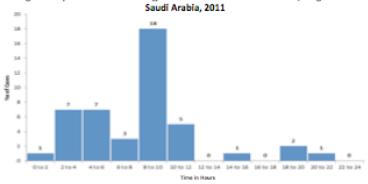

Figure 3. Epidemic Curve for Hajj Foodborne Disease Outbreak #7, Kingdom of Saudi Arabia, 2011

### RECOMMENDATIONS

- Improving compliance with the Hazard Analysis Critical Control Point (HACCP) program.
- Establishing training programs in food safety for the food handlers and food managers.
- Reassessing the lab methods used in FBDO investigations.
- Expanding the electronic notification system.

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