Infection Prevention and Control for the MERS-COV, 2019: A Teaching Case-Study

Student's Guide

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Abstract:

The Middle East Respiratory Syndrome Coronavirus (MERS-CoV) is a viral respiratory disease caused by a novel coronavirus that was first identified in the Kingdom of Saudi Arabia (KSA) in 2012. On the 12th of February 2019, the Ministry of Health (MOH) represented by the Control and Command Center (CCC) reported an increase in MERS-CoV cases in Wadi Al-Dawasir Province, KSA, which in conjunction with the camel mating season. The CCC confirmed that the epidemiological surveillance field teams at the Ministry of Environment, Water and Agriculture (MEWA) have detected a number of positive samples of MERS-CoV in camels.

This case study aims to develop the capacity of trainees in the processes of public health infection control and prevention, based on a MERS-CoV outbreak investigation in Wadi Aldawasir – KSA. This case study is designed for the training of basic level field epidemiology trainees or any other health care workers working in public health-related fields. It can be administered in 3-4 hours. Used as adjunct training material, the case study provides the trainees with competencies in investigating an outbreak in preparation for the actual real-life experience of such outbreaks.

Keywords: MERS-CoV, prevention, Saudi Arabia

How to Use the Case Study

General instructions: This case study should be used as adjunct training material for novice epidemiology trainees to reinforce the concepts taught in prior lectures. The case study is ideally taught by a facilitator in groups of about 20 participants. Participants are to take turns reading the case study, usually a paragraph per student. The facilitator guides the discussion on possible responses to questions. The facilitator may make use of flip charts to illustrate certain points. Additional instructor's notes for facilitation are coupled with each question in the instructor's guide to aid facilitation.

Audience: This case study was developed for novice field epidemiology students. These participants are commonly health care workers working in the county departments of health whose background may be as medical doctors, nurses, environmental health officers or laboratory scientists who work in public health-related fields. Most have a health science or biology background.

Prerequisites: Before using this case study, participants should have received lectures on disease surveillance and outbreak investigation. Infection control and prevention

Materials needed: Flash drive, flip charts, markers, computers with MS Excel

Level of training and associated public health activity: Novice – Outbreak investigation

Time required: 3-4 hours

Language: English

Goal of Case Study

To develop the capacity of trainees in the processes of public health infection control and prevention, based on a MERS-CoV outbreak investigation in Wadi Aldawasir – KSA.

Learning Objectives

At the conclusion of the teaching session, participants will be able to:

1. Understand the main concepts of any outbreak investigation
2. Differentiate between suspected and confirmed cases
3. Calculate the case fatality rate
4. Discuss MERS-CoV prevention and control measures

Introduction

The Kingdom of Saudi Arabia (KSA) is a country in Western Asia constituting the bulk of the Arabian Peninsula. With a land area of approximately 2,150,000 km^2 (830,000 sq. miles). Saudi Arabia is bordered by Jordan and Iraq to the north, Kuwait to the northeast, Qatar, Bahrain, and the United Arab Emirates to the east, Oman to the southeast and Yemen to the south. Saudi Arabia's 2020 population is estimated at 34,813,871 people at mid-year according to UN data. Saudi Arabia's population is equivalent to 0.45% of the total world population, where 84.0% of the population is urban, and the median age in Saudi Arabia is 31.8 years.

Saudi Arabia is the birthplace of the religion of Islam, which is one of the largest religions in the world. It is also sometimes referred to as "The Land of Two Holy Mosques"

The Kingdom is divided into thirteen Administrative Regions, each headed by a governor. There are 20 Health Directorates covering all Saudi Arabia's regions and provinces, they fully cooperate with the central MOH to provide and supervise health services.

The Ministry of Health's (MOH) responsibilities includes: the provision of healthcare at all levels, promotion of general health and prevention of diseases, in addition to developing laws and legislations regulating both the governmental and private health sectors. One of the public health challenges in KSA in terms of infectious disease is the Middle East respiratory syndrome coronavirus, or MERS-CoV, which was first identified in KSA in 2012 (Figure 1).

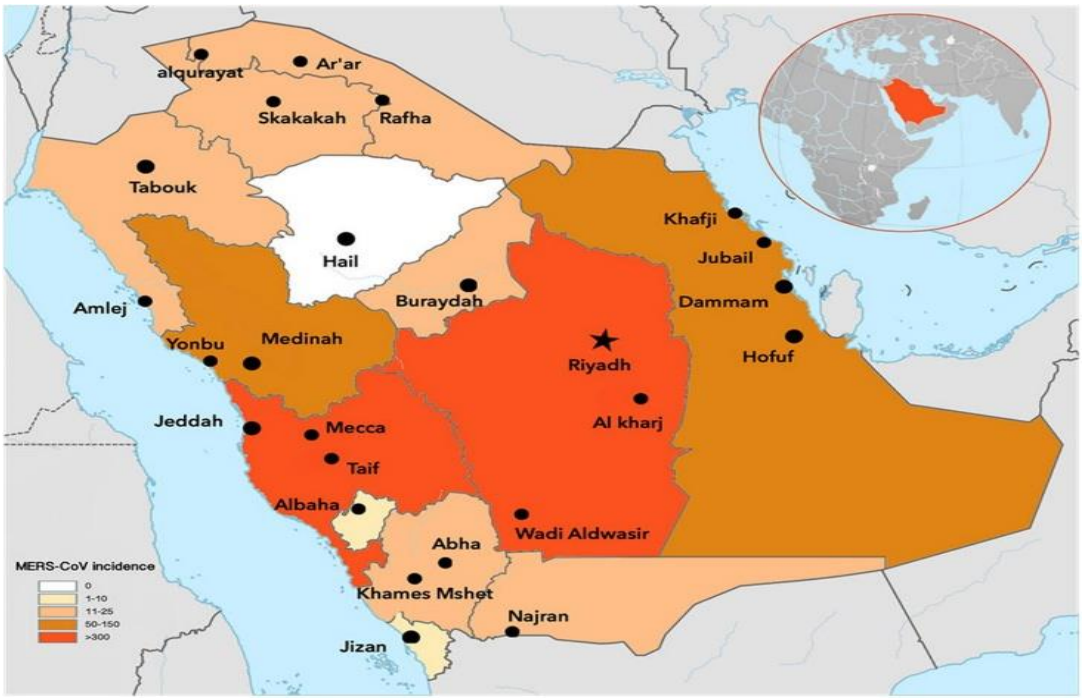

Figure 1. Incidence of MERS-CoV infections (1250 confirmed cases) across KSA from 2012 to 2015

Part 1: Story

MERS-CoV is a viral respiratory disease caused by a novel coronavirus that was first identified in KSA in 2012 [1]. The clinical aspects of MERS-CoV can range from asymptomatic to severe forms of respiratory symptoms, which may result in high morbidity and mortality: according to MOH estimates, the case fatality rate is 35% [2]. The source of the virus is zoonotic and the determined and proved transmission was linked to exposure to symptomatic patients in healthcare/household settings or from direct/indirect contact with infected dromedary camels. The role of infection prevention and control (IPC) procedures (actions) are crucial to prevent the possible spread of MERS-CoV in healthcare settings [4-7]. Accordingly, early identification, case management, and isolation, together with appropriate infection prevention and control measures can prevent human-to-human transmission of MERS-CoV.

On the 12th of February 2019, the MOH, represented by the Control and Command Center (CCC) reported an increase in the MERS-CoV cases in Wadi Al-Dawasir Province, in conjunction with the camel mating season. The CCC confirmed that epidemiological surveillance by the Ministry

of Environment, Water and Agriculture's (MEWA) field teams detected a number of positive samples of MERS-CoV in camels.

Question 1. What is the Command and Control Center (CCC)? What would be the CCC's functions?

Question 2. Why would the Ministry of Environment, Water and Agriculture's (MEWA) be involved in field investigation?

Question 3. What is one health approach?

Question 4. Based on the provided information, is MERS-CoV an emerging or reemerging disease? Why?

Part 2: Methods

From the 14th of February through the 31st of March 2019, the International Health Regulations (IHR) Focal Point of Saudi Arabia reported 22 additional cases of MERS-CoV infection associated with the outbreak in Wadi Aldwasir which lead to four deaths. Of the 22 cases, 19 were reported from Wadi Aldwasir city including two healthcare workers. The remaining three cases, which are epidemiologically linked to the outbreak, were healthcare workers from a hospital in Khamees Mushait city, Asir region.

(Please refer to excel sheet: Annex 1)

Question 5. Discuss the associated risk factors. What is the meaning of "epidemiologically linked"?

Question 6. Calculate the case fatality rate. (Please refer to excel sheet: Annex 1)

Since the beginning of this outbreak in January of 2019, a total of 61 MERS-CoV cases, with a case fatality ratio of 13.1% (8/61), have been reported in Wadi Aldwasir city. The median age of reported cases was 46 years (range 16 to 85 years). Of the 61 cases, 65% (n=46) were male, and

23% (n = 14) were health care workers. Investigations into the source of infection of the 61 cases found that 37 were healthcare setting acquired infections, 14 were primary cases presumed to be infected from contact with dromedary camels and the remaining 10 infections occurred among close contacts outside of healthcare settings.

Question 7. As an epidemiologist, what is the most important step to take at this point? *i.e. what prevention measures should be applied in health institutions*

Question 8. What are the types/classifications of infection control precautions?

Part 3: Results

As reported previously, the Saudi Arabian MoH conducted and completed a full-scale investigation into the MERS-CoV outbreak in Wadi Aldwasir which included identifying all households' and healthcare workers' contacts of confirmed patients in all hospitals affected.

As of the 31st of March 2019, a total of 380 contacts have been identified including 260 household contacts and 120 healthcare workers contacts. All identified contacts were monitored for 14 days from the last date of exposure as per WHO and national guidelines for MERS-CoV. All secondary cases have been reported to WHO.

The listed contacts were all tested for MERS-CoV infection by reverse transcription polymerase chain reaction (RT-PCR) at least once and many contacts of known patients have been tested repeatedly. All secondary cases of MERS-CoV infection have been reported to WHO. The last case from Wadi Aldwasir was reported on the 12th of March 2019.

Within the affected health care facilities, infection prevention and control measures were enhanced and included intensive mandatory on-the-job training on infection control measures for all healthcare workers in emergency room and intensive care units. Disinfection was carried out in the emergency room and the ICU of hospital A, which was fully operational and additional staff were mobilized to support infection control activities. Respiratory triage has been enforced in all healthcare facilities in the Riyadh region.

Question 9. Define of the following: Primary case, confirmed case, suspected case.

Question 10. Can we expect additional cases exported to other countries and further transmission?

Part 4: Discussion

The MoH media department launched an awareness campaign targeting Wadi Aldawasir city with special focus on camel owners and camel related activities.

The Ministry of Agriculture tested dromedary camels in Wadi Aldwasir city and initial results identified several PCR positive dromedaries in the city. Positive testing camels were removed from the market and movement in and out of the camel market was restricted. Camels owned by confirmed human cases were quarantined regardless of testing results. Full genome sequencing of available human and dromedary specimens were conducted. Laboratory findings of camel testing by the Ministry of Agriculture were reported to the World Organization for Animal Health (OIE).

Question 11. As a base on droplet precaution, what is the fitting test? Who to conduct?

Part 5: Conclusion

Infection prevention and control (IPC) measures are critical to prevent the possible spread of MERS-CoV in health care facilities. It is not always possible to identify patients with MERS-CoV infection early on because, like other respiratory infections, the early symptoms of MERS are non-specific. Therefore, healthcare workers should always apply standard precautions consistently with all patients regardless of their diagnosis. Droplet precautions should be added to standard precautions when providing care to patients with symptoms of acute respiratory infection: contact precautions and eye protection should be included when caring for probable or confirmed cases of MERS-CoV, and airborne precautions should be applied when performing aerosol generating procedures.

Early identification and case management and isolation, together with appropriate infection prevention and control measures can prevent human-to-human transmission of MERS-CoV.

Question 15. Summarize the public health response to the MERS-CoV outbreak

Annex 1: MERS-CoV cases reported between 14 February and 31 March 2019*

Acknowledgements

Authors would like to thank the Eastern Mediterranean Public Health Network (EMPHNET) for their technical support. We also acknowledge officers at the Epidemiological Surveillance Program and Expanded Program on Immunization at the Ministry of Public Health who investigated and responded to the measles outbreak on which this case study is based.

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7. World health Organization. Middle East respiratory syndrome coronavirus (MERS-CoV). https://www.who.int/emergencies/mers-cov/en/

Further resources for reading

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https://www.moh.gov.sa/en/ccc/about/Pages/default.aspx

2. Middle East respiratory syndrome coronavirus: Case definition for reporting to WHO

https://www.who.int/csr/disease/coronavirus_infections/case_definition/en/