Global Health Development

EMPHNET
The Eastern Mediterranean Public Health Network

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Case Studies in Field Epidemiology: EMR experience

GHD|EMPHNET 2019-2020

Public Health Case Studies

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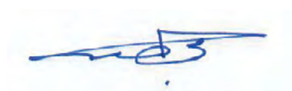
Foreward

The future of healthcare is becoming increasingly complex. Educating healthcare professionals for the current and future healthcare system should include common core competencies. In a rapidly changing world, marked by frequent turnover and unexpected changes, the need to provide continuous education for public health practitioners remains a priority. In many low and middle-income countries, keeping educated health professionals in-country is challenging. Working continuously in improving health status in the Eastern Mediterranean Region (EMR) by building national and regional capacities in several priority public health areas becomes a necessity. Case study teaching method is becoming an increasingly common teaching strategy in public health education, and it is highly adaptable style of teaching that involves problem-based learning and promotes the development of analytical skills.

GHD|EMPHNET continues its efforts to build public health workers' capacity - especially Field epidemiology workers , public health leaders, and academicians in the EMR- by supporting the development of new and diverse case studies in Field Epidemiology and various public health disciplines after realizing the scarcity of local case studies that are tailored to EMR contexts, considering that case studies are stories that are used as a teaching tool and a powerful student-centered teaching strategy that shows the application of a theory or concept to real, and an effective tool for simulating real-life public health functions and services in public health training programs.

These cases are not merely stories that relate compelling public health issues. Rather, they are carefully constructed narratives, most of which put learners in the seat of a protagonist who has a problem to solve.

I would like to thank Field epidemiology training program's graduates, supervisors, and technical advisors from different EMR countries for their efforts in developing these educational case studies. My gratitude and appreciation are also extended to the consultants without whom this book would not have been possible.



Dr. Mohannad Al-Nsour
Excecutive Director

How to use this resource

Thank you for reading and considering the Public Health Case Studies open educational resource. The resource you are looking at right now is not your traditional academic textbook. Almost all academic textbooks are linear and are read from page 1 to the end. Teaching Case Studies is not like that and is designed to be taken apart and each part exploited to support learning. This book covers 30 teaching case studies with focus on real examples and data from the EMR. Each case study includes the story that models the best practice (at the time of publishing) in healthcare settings.

The case studies can be used online in a learning management system or in a classroom discussion. This flexibility is intentional and allows the educator to choose how best to convey the concepts presented in each case to the learner and allows to create learning opportunities to match the learning objectives of the curriculum and the needs of the student.

Each case study can be used as adjunct training material for novice epidemiology trainees mainly. The case study is ideally taught by a facilitator in groups of about 20 participants or via online system.

Case studies were developed for public health workers mainly novice field epidemiology students. These participants are commonly health care workers working in the country 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. Moreover, these cases studies can be used for training students enrolled in academic public health programs.

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We would like to acknowledge our special thanks to the committed team of educators, subject matter experts, Field epidemiology training program's graduates, supervisors, and technical advisors without whom this book would not have been possible.

They graciously donated their time to contribute to this book because of their strong commitment to public health education.

Thank you to the team experts in brainstorming, creating, and writing these case studies:

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Introduction

Welcome to case studies in field epidemiology: EMR context, a collection of 31 teaching and learning cases. Each case based on real events and problems, they were developed as a learning tool for public health practitioners, it introduces case studies based on real events in EMR contexts and written by experienced field epidemiologists mainly field epidemiology training programs' technical advisers, residents, and graduates and other experts in various areas of public health. Core areas covered in detail are investigating outbreaks, surveillance systems, epidemiology, and infections control. Case-based learning may be an even more effective approach for developing competency in highly applied cross-cutting domains such as communication, diversity and culture, leadership and systems thinking. Cases provide opportunities to analyze current health issues.

The Case studies in this resource are from Iraq, Morocco, Pakistan, Afghanistan, Saudi Arabia, Lebanon, Egypt, Sudan, Jordan, and Yemen, focusing on major outbreaks occurred in each country such as dengue outbreak in Yemen, Diphtheria outbreak in Sudan, MERS-COV in Saudi Arabia and Hepatitis E in Pakistan and main health issues that are being investigated such as COVID19 pandemic, infectious diseases in Mass Gatherings in Iraq, hemorrhagic diseases in Sudan.

Case studies were developed in the same format, with open-ended questions to be answered by the trainees including questions about possible solutions for specific health issues. This resource offers great opportunity for trainees to build competencies by analyzing and interpreting data to make decisions on containing similar public health threats with consideration of the regional and country contexts. These case studies stimulate the trainees to consolidate their knowledge and improve their public health practices to detect, timely respond to major health events and control/prevent them. The trainees learned the format, process, and guidelines for developing a public health case study, their research skills will improve as well as evaluation of multiple sources of data.

By presenting content in the format of a narrative accompanied by questions and activities that promote discussion and solving of complex problems, case studies facilitate development of the higher levels of Bloom's taxonomy of cognitive learning; moving beyond recall of knowledge to analysis, evaluation, and application. [1, 2]

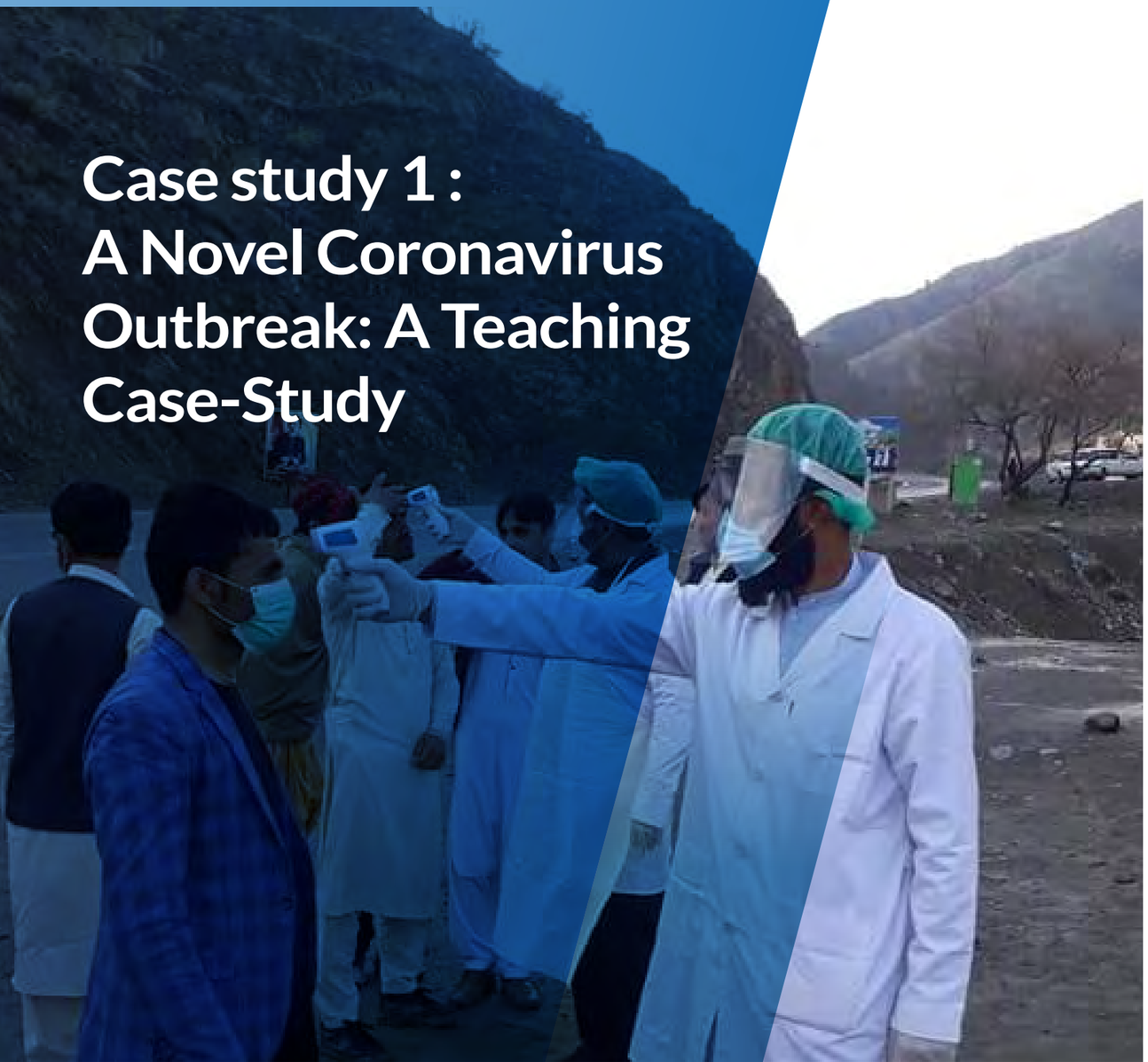
1Anderson LW, Krathwohl D. A taxonomy for learning, teaching, and assessing: a revision of bloom's taxonomy of educational objectives, complete edition. Longman Publishing Group; White Plains, New York: 2000
2Herreid CF. Case studies in science—a novel method of science education. J Col Sci Teach. 229–221:(4)23;1994.

Each case study is presented in a systematic fashion to facilitate learning, with the case, background, story, methodology, results, conclusions, and recommendation references discussed for each case.

This book is a valuable resource for public health workers such as field epidemiologists , public health students, medical students, trainers, and researchers with specialized knowledge who need further information on the general background and history of public health and important scientific discoveries within the field. It is an ideal resource for workers who seek training in public health, applied epidemiology, outbreak investigations and surveillance. from the past to present and future research.

Part I: Case studies in outbreak investigations

Case study 1 : A Novel Coronavirus Outbreak: A Teaching Case-Study



A Novel Coronavirus Outbreak: A Teaching Case-Study

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Goal of Case Study:

The goal of this case study is to consolidate the knowledge and improve practices of the participants to detect, response to and control/prevent threating pandemics.

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. State the case definition of suspected, probable and confirmed cases of novel respiratory virus infection
2. Identify and apply IHR guidelines for the preparedness and response to international spread of diseases
3. Calculate and interpret important epidemiological characteristics, demographic and clinical indicators of novel respiratory virus infection
4. Describe the surveillance settings during a novel virus outbreak
5. Discuss how to implement preventive and infection control measures under the One Health approach
6. Create a public health communication plan for multiple audiences at the national and regional levels
7. Establish a coordination mechanism with relevant stakeholders within the country, region and worldwide

Introduction

The People's Republic of China (PRC), in East Asia is the world's most populous country, with a population of around 1.428 billion in 2017. China covers approximately 9,600,000 square kilometers with population density of 149.93 people per square kilometer.[1] About 17% of the population were 14 years old or younger, 70% were between 15 and 59 years old, and 13% were over 60 years old. The population growth rate for 2018 is estimated to be 0.46%. By 2015, less than 3.1% of the Chinese population lived below the international poverty line of US$1.9 per day.

The People's Republic of China is divided into 22 provinces, five autonomous regions (each with a designated minority group), and four municipalities—collectively referred to as "mainland China"—as well as the special administrative regions (SARs) of Hong Kong and Macau. Geographically, all 31 provincial divisions of mainland China are grouped into six regions: North China, Northeast China, East China, South Central China, Southwest China, and Northwest China.

Since the late 1990s, China's national road network has been significantly expanded through the creation of a network of national highways and expressways. In 2018, China's highways had reached a total length of 142,500 km (88,500 mi), making it the longest highway system in the world; and China's railways reached a total length of 127,000 km by 2017. By the end of 2018, China's high-speed railway network reached a length of 29,000 km, representing more than 60% of the world's total.

Figure 1.1: China map
From: Wikimedia Commons

By October 2014, there were 81 such bridges and tunnels. The railways strain to meet enormous demand particularly during the Chinese New Year holiday, when the world's largest annual human migration takes place. In 2013, Chinese railways delivered 2.106 billion passenger trips, generating 1,059.56 billion passenger-kilometers, and carried 3.967 billion tons of freight, generating 2,917.4 billion cargo tons-kilometers. There were approximately 229 airports in 2017, with around 240 planned by 2020. With rapid expansion in civil aviation, the largest airports in China have also

joined the ranks of the busiest in the world. In 2018, Beijing's Capital Airport ranked second in the world by passenger traffic. Since 2010, the Hong Kong International Airport and Shanghai Pudong International Airport have ranked first and third in air cargo tonnage. China has over 2,000 river and seaports, about 130 of which are open to foreign shipping. In 2017, the Ports of Shanghai, Hong Kong, Shenzhen, Ningbo-Zhoushan, Guangzhou, Qingdao and Tianjin ranked in the Top 10 in the world in container traffic and cargo tonnage.

Water supply and sanitation infrastructure in China face challenges due to rapid urbanization, as well as water scarcity, contamination, and pollution. About 36% of the rural population in China still did not have access to improved sanitation. There are around 1,944 municipal wastewater treatment plants across China's city/urban regions and 1,599 municipal wastewater treatment plants across China's counties, accounting for daily processing capacities of 140 and 29 million cubic meters respectively.

The National Health and Family Planning Commission, together with its counterparts in the local commissions, oversees the health needs of the Chinese population. An emphasis on public health and preventive medicine has characterized Chinese health policy since the early 1950s. Diseases such as cholera, typhoid and scarlet fever, which were previously rife in China, were nearly eradicated by the Patriotic Health Campaign. After economic reforms in 1978, the health of the Chinese public improved rapidly. Healthcare in China became mostly privatized and experienced a significant rise in quality. In 2009, the government began a 3-year large-scale healthcare provision initiative, the campaign resulted in 95% of China's population having basic health insurance coverage. In 2011, China was estimated to be the world's third-largest supplier of pharmaceuticals, but its population has suffered from the development and distribution of counterfeit medications.

China has several emerging public health problems, such as respiratory illnesses caused by widespread air pollution, hundreds of millions of cigarette smokers, and large population and densely populated cities. In recent years, China was challenged by 2003 outbreak of SARS, and in 2010, air pollution caused 1.2 million premature deaths in China.

Part 1: The Story

On 31 December 2019, the WHO China Country Office was informed of cases of pneumonia of unknown etiology (unknown cause) detected in Wuhan City, Hubei Province of China. From 31 December 2019 through 3 January 2020, a total of 44 case-patients with pneumonia of unknown etiology were reported to WHO by the national authorities in China. During this reported period, the causal agent was not identified. On 11 and 12 January 2020, WHO received further detailed information from the National Health Commission China that the disease was associated with exposures in one seafood market in Wuhan City.

Part 1 questions:

Question 1. With such a profile, what is the risk of developing an outbreak of viral respiratory disease in China? Explain the main vulnerability and capacity factors that contribute to this outbreak.

Question 2. What are the possible causes of this condition?

Question 3. Is this an outbreak or an epidemic? Why?

Question 4. What additional data sources are needed at this stage of the event?

Public health authorities in China decided to implement case-based surveillance to enhance the surveillance system.

Question 5. What variables should they consider?

Question 6. What are the features that make case-based surveillance of good quality?

Question 7. What indices that could be generated from case-based surveillance?

Factsheet 1

Coronaviruses (CoV) are a large family of viruses that cause illness ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV).

Coronaviruses are zoonotic, meaning they are transmitted between animals and people. Detailed investigations found that SARS-CoV was transmitted from civet cats to humans and MERS-CoV from dromedary camels to humans. Several known coronaviruses are circulating in animals that have not yet infected humans.

The first identified case of MERS occurred in 2012 in Saudi Arabia, and the outbreak was primarily contained in the Arabian Peninsula. However, there was a larger outbreak in the Republic of Korea in 2015, transmitted by someone who had visited Saudi Arabia, the UAE and Bahrain. There were approximately 186 cases and 36 deaths from this outbreak.

Following notification of cases of pneumonia of unknown cause in Wuhan, China on 31 December 2019, a novel coronavirus (COVID-19) was identified as the cause by Chinese authorities on 7 January.

Question 8. What is a novel virus?

Question 9. Public health authorities in China classified cases into probable, suspected, and confirmed cases as the two groups require different approaches. State the case definition of the each?

Question 10. Preliminary data indicate that the incubation period for COVID-19 ranges from 2 to 14 days. Why is it important to know the incubation period?

Part 2: Methods

As news of the outbreak spread globally, neighboring countries and elsewhere heightened their surveillance to quickly detect potential new cases of the virus. More people infected with COVID-19 were identified in China, and cases were exported to other countries. This was not entirely unexpected given the volume of travel between Wuhan and other countries. Given the initial link between cases and a live animal market, as well as other coronaviruses that have animal reservoirs, an animal source seems the most likely primary source of the outbreak, with some human-to-human transmission occurring.

Part 2 Questions

Question 11. Describe steps and type of surveillance system that need to be activated to detect and respond to such an outbreak in China? Do you need to apply the same steps and type in your country? Why? If yes, how?

The Emergency Committee convened on 22 and 23 January 2020 under the International Health Regulations (IHR 2005), and decided that it was not appropriate to declare the COVID-19 outbreak in China a public health emergency of international concern (PHEIC) given the disease's spread and the control efforts undertaken by the PRC.. The WHO Director General accepted this advice. "Make no mistake," commented Dr Tedros, "This is an emergency in China, but it has not yet become a global health emergency. It may yet become one". The Emergency Committee on the novel coronavirus (COVID-19) under the International Health Regulations (IHR 2005) was reconvened on 30 January. WHO declared the outbreak to be a public health emergency of international concern.

Question 12. On what basis do you think the WHO declared that it is PHEIC?

Question 13. What are the consequences of declaring the status of PHEIC on China, and other countries? What measures need to be activated and/or introduced?

Question 14. What are preventive measures regarding travel around the world?

Question 15. What specific measures to be considered at the points of entry?

Question 16. What would be the impact of such travel bans?

Many countries started the operations of Voluntary evacuations of their citizens from China, with some started quarantining their citizens upon arrival to their home country.

Fact Sheet 2

In May 2005 the World Health Assembly adopted the revised International Health Regulations (IHR). On June 15, 2007, IHR entered into force and are binding on 194 States Parties.

The purpose and scope of IHR is to prevent, protect against, control and provide a public health response to the international spread of disease and to establish a single code of procedures and practices for routine public health measures.

The benefits to the Member States include; improved surveillance system, effective detection and quick response to public health risks, use of modern communication tools and have access to global resources.
The IHR has identified core capacity requirements that countries must have to detect, report, and respond to risks in general, and to those at international ports, airports and land crossings.

"Public Health Emergency of International Concern" (PHEIC) means an extraordinary event which constitutes a public health risk to other States through the international spread of disease, and potentially requires a coordinated international response. If two or more of the four basic criteria are identified, the IHR Focal Point is obliged to report the event to WHO as a PHEIC.

*more details in the reading's annexes

Question 17. Why countries may decide to evacuate their citizens? What are the arrangements need to accompany the evacuation process?

The leader of the surveillance team at the airport called you at 2:30 am to inform you about two arrivals who meet the definition of suspected cases.

Question 18. What actions will you take? Would you announce the updates to the public? Why? If yes, how?

The director of the Epidemiology department requested to collect samples from the two arrivals and send the samples to the lab.

Question 19. What samples are needed to be collected? From where should the samples be collected?

Question 20. Describe the process of handling the samples from the collection till they arrive to the lab? Specify the safety methods and Personal Protection Equipment needed in this case?

Question 21. What considerations should be taken into account at the receiving lab and what are the common laboratory test/s done to confirm the presence of novel corona viruses?

Question 22. What is the role of media at this level to increase awareness and decrease panic?

Part 3: Results

A small study of 99 cases observed at Wuhan Jinyintan Hospital, 49 had been exposed to the seafood and animal market believed to be at the center of the outbreak. The average age was 55.5 years and most (67) were men. Fever and cough were the most common symptoms. Seventeen patients developed acute respiratory distress syndrome and 11 of them died of multiple organ failure; 31 of the 99 had been released from the hospital by 25 January.

Question 23. What is the case fatality rate in Wuhan Jinyintan hospital? What does it tell?

By January 31, China has reported 15,238 suspected cases and 9,720 cases were confirmed. The reported deaths due to the outbreak is 213 deaths and 1,527 severe cases. 106 cases were confirmed outside of China in 19 countries in 4 contents.

Question 24. In reference to Table 1, draw the epidemic curve for the total cases at the international level till February 1st?

Question 25. Using the same data draw two additional epidemic curves for new daily cases reported from China and another for cases reported outside China. What are the differences between the two curves? Explain

Table 1.1. Countries with reported confirmed cases of COVID-19, Jan 21 to Feb 1, 2020

	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
China	446	579	581	846	1300	2000	2800	4600	6100	7800	9800	12000
Thailand	0	0	4	4	4	5	5	14	14	14	19	19
Japan	0	0	1	1	3	3	4	6	7	11	15	17
Singapore	0	0	0	1	3	4	4	7	7	10	16	16
Australia	0	0	0	0	3	4	4	5	7	7	9	12
Republic of Korea	0	0	1	2	2	2	3	4	4	4	11	12
Malaysia	0	0	0	0	0	3	4	4	4	7	8	8
Germany	0	0	0	0	0	0	0	1	4	4	6	7
USA	0	0	1	1	2	2	5	5	5	5	6	7
Viet Nam	0	0	0	2	2	2	2	2	2	2	2	5
France	0	0	0	0	3	3	3	3	4	5	6	6
Canada	0	0	0	0	0	0	1	2	3	3	3	4
UAE	0	0	0	0	0	0	0	0	4	4	4	4
Italy	0	0	0	0	0	0	0	0	0	0	2	2
Russia	0	0	0	0	0	0	0	0	0	0	2	2
UK	0	0	0	0	0	0	0	0	0	0	2	2
Spain	0	0	0	0	0	0	0	0	0	0	0	1
Sweden	0	0	0	0	0	0	0	0	0	0	1	1
Sri Lanka	0	0	0	0	0	0	0	1	1	1	1	1
Nepal	0	0	0	0	1	1	1	1	1	1	1	1
Philippines	0	0	0	0	0	0	0	0	0	1	1	1
India	0	0	0	0	0	0	0	0	0	1	1	1
Cambodia	0	0	0	0	0	0	0	0	0	1	1	1
Finland	0	0	0	0	0	0	0	0	0	1	1	1

Till February 1st, all deaths due to the corona outbreak were reported in China. The summary of deaths is shown in Table 2

Table 1.2: Summary of total deaths from COVID-19 worldwide

Date	Deaths
21-Jan	9
22-Jan	17
23-Jan	25
24-Jan	41
25-Jan	56
26-Jan	80
27-Jan	106
28-Jan	132
29-Jan	170
30-Jan	213
31-Jan	259

Question 26. Draw the curve for the total deaths worldwide till February 1st?

Question 27. Calculate the fatality rate? Compare the calculated case fatality rate (CFR) to those of SARS, MERS-COV, and measles?

Question 28. The Transmission Rate (R0) for COVID 19 is estimated at between 1.5 to 3.5. How is it calculated? What does this rate mean?

Part 4: Discussion

EMPHNET, has invited the FETP Directors and Technical Advisors in the EMR region to discuss the current threat and provides technical recommendation to MOHs. You are assigned as the facilitator of this meeting

Question 29. What strategic objectives for response would you suggest for the audience to discuss and recommend to MOHs in the regional levels?

In response to the epidemic, WHO has released some guidelines and tools, two of them are; the "Household transmission investigation (HTI) protocol for 2019-novel coronavirus (COVID-19) infection" and the "First Few X cases (FFX)" protocols.

Question 30. Compare between the HTI and FFX regarding their purposes, uses, and limitations.

It was seen that the cases were exported to 28 countries except to central Asia, Middle East (except one country) and African continent.

Question 31. What will be the main reasons for not reporting imported cases in those parts of the world?

The World Health Organization on Feb. 11 convened 400 scientists at a global research and innovation forum to draw up an R&D blueprint for COVID-19. Now, companies and institutions are developing technologies to develop rapid and flexible diagnostics, including Point of Care (POC) diagnostics, vaccines, and therapeutics against novel coronavirus and the efforts are still ongoing.

Question 32. How long it will take to develop vaccines, diagnostics, and therapeutics for unknown viral infections?

Since its announcement, many countries, and peoples around the global started to be concerned by the outbreak and some panicked. MOH has assigned you as the focal person for risk communication during this event.

Question 33. Design a risk communication plan to manage the situation during the current out-break at the national level?

Part 5: Conclusion

Coronavirus infection is considered highly contagious, and the countries of the EMR are at high risk. The countries need to collaborate and work in a coordinated fashion to support each other's capacity. Now, you have been assigned by EMPHNET as the focal person to coordinate the preparedness and response activities with the countries and other partners.

Question 34. Suggest a coordination plan to facilitate coordinating the EMR countries to manage effectively and efficiently the current the threat.

Question 35. What is the role of FETP in the country to support the national efforts in preparing for and responding to such an outbreak?

FETPs in the region have been updating their countries' daily COVID-19 cases and deaths.

Question 36. Referring to the table in the annex, draw the epidemic curve for each country as well as the regional curve. What is the CFR in each country?

Annexes

Annex 1: "Household Transmission Investigation"
Annex 2: "First Few X cases (FFX)" protocol
Annex 3: International health regulations (2005)
Annex 4: Daily cases and deaths of COVID-19 in the EMR

References

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Resources and reading materials

1. Asian Development Bank. https://www.adb.org/countries/prc/economy
2. Disease outbreak news, Novel Coronavirus: https://www.who.int/csr/don/en/
3. Macrotrends.net. https://www.macrotrends.net/countries/CHN/china/population
4. Notice sent out from Health and Food Safety Planning Division, Quarantine Station Operation Management Office https://www.mhlw.go.jp/content/10900000/000582967.pdf
5. Press statement by Ministry of Health, Labour and Welfare, Japan on 16 January 2020: https://www.mhlw.go.jp/stf/newpage_08906.html
6. Press statement by Ministry of Health, Labour and Welfare, Japan on 6 January 2020 (in Japanese): https://www.mhlw.go.jp/stf/newpage_08767.html
7. Second Press statement by KCDC: https://www.cdc.go.kr/board/board.es
8. Technical interim guidance for novel coronavirus, WHO: https://www.who.int/health-topics/coronavirus
9. Thailand Ministry of Public Health situation update on novel coronavirus: https://ddc.moph.go.th/viralpneumonia/index.html
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Case study 2: A Large-scale outbreak of Botulism Associated with a Traditional Celebratory Egyptian Fish Dish in Five Governorates – Lower Egypt, 2019

A Large-scale outbreak of Botulism Associated with a Traditional Celebratory Egyptian Fish Dish in Five Governorates – Lower Egypt, 2019

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Goal of Case Study

The goal of this case study is to build the capacity of trainees in investigating outbreaks.

Learning Objectives

At the conclusion of the case study, participants will be able to:

1. Define the terms epidemic and outbreak
2. Describe the major decisions that need to be addressed before beginning a field investigation
3. Develop a case definition for an outbreak investigation
4. Interpret data provided in tables and charts
5. Communicate study results and their implications to public health decision-makers

Introduction

Botulism is a rare but serious illness caused by a toxin that is made by Clostridium botulinum and sometimes Clostridium butyricum and Clostridium baratii bacteria. [1] This toxin blocks cholinergic neuromuscular junctions, resulting in a characteristic syndrome of symmetric cranial nerve palsies followed, to a varying extent, by symmetric descending paralysis of voluntary muscle that can progress to respiratory failure and death. [2]

The bacteria that make the Botulinum toxin are found naturally in many places, but it is rarely cause illness in people. These bacteria make spores which act like protective coatings and help the bacteria survive in the environment, even in extreme conditions. The spores usually do not cause people to become sick, even when ingested. But under certain conditions, these spores can grow and make one of the most lethal toxins known to mankind. [3]

Figure 2.1: Map of Egypt and Neighboring Countries

A meal called Feseekh is a traditional Egyptian fish preserve made from fermented, salted, and dried gray mullet; a saltwater fish that lives in both the Mediterranean and the Red Sea. The traditional process of preparing Feseekh is to dry the fish under the sun before preserving it in salt. The process of making this dish is quite elaborated, with the production techniques passed from father to son in certain families. The occupation of making Feseekh has a special name in Egypt: Fasakhani.

Egypt is located in the northeast corner of Africa and is bordered to the west by Libya, to the south by Sudan, to the east by the Red Sea, and to the north the Mediterranean (Figure 1).

Egypt ranks as the highest Arab country in terms of population density. The total area of the country is approximately one million square kilometers, however, only 7.7% of its area is populated, and the populated areas are concentrated in the Delta and Nile Valley.

Egypt is divided administratively into 27 governorates, four of which are urban governorates (Cairo, Alexandria, Port Said, and Suez). The twenty-three other governorates are divided into urban and rural areas: nine are in Lower Egypt, nine in Upper Egypt, and five are border provinces.

Salted fish (Feseekh) is considered a major industry in the Delta region, especially in Kafr Elsheikh and the Behira governorates (Figure 2).

Part 1: Story

On September 24th, 2019 the emergency department at the Ministry of Health and Population (MOHP) was notified by a local health officer from the Alexandria governorate about a case admitted to toxicology center's ICU with symptoms of abdominal pain, diarrhea, dysphagia, and dyspnea after consuming homemade Feseekh. Next day, several cases were reported from five different governorates all displaying the same symptoms after eating Feseekh from different sources. Most of the cases were admitted to the ICU in toxicology centers and two cases died.

Part 1 Questions

Question 1. Would you call this situation an epidemic or an outbreak? Justify your answer.

Question 2. What should be the objectives of the investigation into the reported cases?

Question 3. Before going to the field, what other preparations and decisions should be made regarding the investigative team's composition, role, responsibilities?

Question 4. What is the differential diagnosis for the reported cases?

Part 2: Methods

The central rapid response team immediately moved to the Alexandria and Behira governorates to conduct field investigations with the help of peripheral teams. A sensitive case definition was developed to find and line list all cases. Suspected cases were interviewed in the toxicology centers and general hospitals using a semi-structured questionnaire to collect data.

Figure 2.2: The Delta Region of Egypt

Part 2 Questions

Question 5. What clinical and epidemiologic information could be of importance in the investigation?

Question 6. What components should you include in the case definition? Develop a case definition for this event?

Question 7. How would you search for additional cases?

By the next week, several cases were reported from other governorates. Investigation teams reached cases and carried out contact tracing. Investigations pointed towards certain private fish farms as the source of the outbreak. Farm products were traced in governorates and found that dead fish were sold in the market at very low prices.

Question 8. According to the above information, what should be your next step?

Question 9. What samples would you recommend being collected and tested by laboratory technicians?

Blood specimens from suspected cases were collected and sent to the central laboratories in Cairo for testing. Environmental samples such as food and water supply from private fish farm, markets and the patients' homes were collected. Samples from street vendors were also collected for laboratory testing. Public health professionals conducted community workshops to increase overall awareness about the hazards of eating Feseekh from unknown or untrustworthy sources.

Part 3: Results

After compiling a line list for all cases, the collected data was cleaned, tabulated, and analyzed using SPSS software. Among the 374 persons who ate Feseekh, 92 (24.6%) developed symptoms of Botulism. Patients' median age was 24 years [IQR: 13-40], and 65 (70.7%) were females. From all patients, 85 (92.4%) consumed homemade Feseekh. Neurological symptoms were reported in 24 (26.1%) patients, and gastrointestinal in 35 (38.0%) patients, while 33 (35.9%) had displayed both symptoms.

Among all suspected patients, 43 (46.8%) recovered spontaneously with no treatment and 49 (53.2%) required treatment using the botulinum antitoxin. Of those treated with antitoxin (47) recovered and 2 died.

From the 35 serum samples tested, 17 (48.6%) were positive for Botulism, and from the 5 food samples tested, 2 (40.0%) were positive for botulism.

Part 3 Questions

Question 10. What other result should have been illustrated?

Question 11. What kind of graph should be used to present the male-to-female ratio?

Question 12. Using the data from the following table, please complete the missing column then present the data in a suitable graph.

Table 2.1. Number of cases in each governorate

Governorate	Number of Cases	Percentage
Kafr Elsheikh	40	
Alexandria	24	
Behira	22	
Sharkya	4	
Gharbeya	2	
Totals	92	

Question 13. Draw an Epi-curve using the data below. What type of an epidemic curve is it?

Table 2.2. Number of cases in each date.

Date	Frequency	Percentage
25-09-2019	3	3.3
26-09-2019	1	1.1
27-09-2019	2	2.2
28-09-2019	9	9.8
29-09-2019	14	15.2
30-09-2019	10	10.9
01-10-2019	10	10.9
02-10-2019	2	2.2
03-10-2019	5	5.4
04-10-2019	6	6.5
05-10-2019	4	4.3
06-10-2019	7	7.6
07-10-2019	5	5.4
08-10-2019	1	1.1
09-10-2019	3	3.3
10-10-2019	2	2.2
12-10-2019	3	3.3
13-10-2019	2	2.2
19-10-2019	1	1.1
20-10-2019	1	1.1
25-10-2019	1	1.1
Total	92	100%

Part 4: Discussion

The Egyptian celebration of the Sham El-Neseem national holiday in April is marked by eating Fesseekh, and every year, botulism cases are expected at this time of the year. This outbreak arrived on a surprisingly unusual time in September. Investigation revealed that the death of large number of fishs in a private fish farm and their illegal selling in markets were behind this large outbreak. Most of the Botulism cases had consumed homemade fish had bought from untrustworthy sources.

Part 4 Questions

Question 14. What are steps for outbreak investigation?

Question 15. What type of surveillance should be used to ensure that there are no new cases of Botulism?

Part 5: Conclusion

After reading the draft epidemic report and summarizing its findings using descriptive epidemiology, the investigating team concluded that health education, increased community awareness, and facilitated provision of the Botulism anti-toxin for critical cases were crucial to control future outbreaks and decrease mortalities.

Part 5 Questions

Question 16. Which other partners could you contact and involve helping in implementing prevention and control measures?

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Case study 3: Outbreak of Rift Valley Fever, River Nile State, Sudan– 2019

Outbreak of Rift Valley Fever, River Nile State, Sudan– 2019

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Goal of Case Study

The goal of this case study is to strengthen the capacity of trainees in outbreak investigation of a zoonotic disease using an integrated approach.

Learning Objectives

At the conclusion of the case study, participants will be able to:

1. Describe criteria that warrant a field investigation
2. Explain the key tasks needed to investigate an outbreak
3. Describe the etiology and risk factors of Rift Valley fever
4. Exemplify methods for integrating responses to a zoonotic disease outbreak
5. Analyze, evaluate, and interpret surveillance data collected during an outbreak
6. List prevention and control measures
7. Identify ethical issues related to disease outbreaks that affect the livelihoods of the population

Introduction

The River Nile state is one of the 18 states of Sudan, it lies towards the north-east of the country and is bordered by Egypt from the north, the Red Sea and Kassala states from the east, the Northern State from the west and Khartoum state to the south. It has an area of 122,123 km² (47,152 mi²) and an estimated population of 1,433,700 in 2019.

The state has 7 localities and is known for its agriculture, pyramids, gold, railway, and cement and iron factories. About 68 % of the population live in rural areas, while 29.9% live in urban areas and around 2.5% are nomads (Central Sector Commission, 2010).

Sudan is generally well known for its livestock sector which is one of the largest in Africa and plays a major role in the economy (Figure 1). Sudan is a vast country, and the livestock markets are widely distributed in different states (Wilson, 2018). Cattle, sheep, goats, and camels provide milk and meat for locals, while live animals and their meat are also exported to nearby countries such as Egypt, Saudi Arabia, and Yemen. Agriculture, including livestock, is responsible of 80 % of economic activities in the River Nile state and the main types of livestock present are sheep, cattle, and goats.

Sudan is affected by a heavy burden of vector-borne diseases, including malaria, visceral and cutaneous leishmaniasis, schistosomiasis, dengue, onchocerciasis and lymphatic filariasis. Sudan has witnessed several outbreaks of zoonotic arbovirus diseases such as Rift-Valley fever (2007-2008), Crimean-Congo haemorrhagic fever (2008), yellow fever (2005, 2012) and dengue (2014-2018).However, the recent history of epidemics at the River Nile state in particular include: Rift Valley Fever in 2007, a Measles outbreak in 2012, Acute watery diarrhea in 2016-17, and a Measles outbreak 2018 (River Nile MOH report, 2019).

Figure 3.1: Map of Sudan showing the River Nile State, source:https://en.wikipedia.org/

Rift Valley fever (RVF) is a viral zoonosis that was first identified in Kenya in 1931. This mosquito-borne disease primarily affects animals but also has the capacity to infect humans. The majority of animal infections result from the bites of infected mosquitoes, while most human infections are caused by direct or indirect contact with the blood or organs of infected animals. Contact between humans and animals can happen during care or slaughtering of infected animals, or with the ingestion of raw animal milk (WHO, 2009).

In eastern Africa, RVF is commensurate to periods of heavy rainfall that occur during the warm phase of what is known as the El Niño/Southern Oscillation (ENSO) phenomenon. With such climatic changes, mosquito breeding and populations, acting as vectors and reservoirs of the disease, are increased. Spread of RVF from endemic areas can occur with the movement of livestock and the introduction of viremic animals in conducive areas, such as irrigation schemes. At the primary foci site, the virus is maintained in the vectors and/or hosts. At the secondary foci, the virus is imported and subsequently spread between new ruminants through vectors for RVF such as certain Culex and Anopheles mosquito species (WHO,2009).

There is very limited data about animal outbreaks available, thus most of information on RVF is based on human case data. However, it must be noted that the location of the human cases may not always reflect the real place were the virus emerged, as many reports refer to hospitals where the sick were treated. Furthermore, the virus amplifies in animals, and its distribution may be much wider and is affected by the movement of these animals.

RVF is considered endemic in many African countries, but transmission differs depending on countries' ecosystems. Nevertheless, distinction must be made between virus activity, outbreak, and disease. In the perspective of users - ministries of health, ministries of agriculture, FAO, and WHO - the objective is to focus on major epidemics.

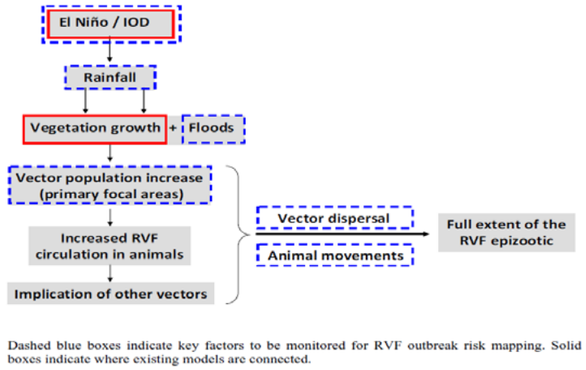

Figure 3.2: El Niño/Southern Oscillation (ENSO) phenomenon. Dashed blue boxes indicate key factors to be monitored for RVF outbreak risk mapping. Solid red boxes indicate where existing models are connected.

Source: Joint FAO - WHO experts' consultation, 2009

Part 1: Story

On the 6th of June 2019, the second day of Eid El-Fitr, a national holiday, and amid the revolution and a turbulent political situation in Sudan, a medical officer at a health center located at the Sedon administrative unit at the Aldamer locality in River Nile State (north of the Atbara River state)called the Health Emergency directorate at the Ministry of Health/River Nile state and notified them that there have been several recent cases of an unknown febrile illness affecting residents in the area; the illness seemed quite similar to malaria, however three deaths have occurred.

Part 1 Questions

Question 1. Before considering a further course of action, what other questions might you ask over the phone?

Question 2. What criteria that you would use in deciding whether to start a field investigation of a possible outbreak?

Question 3. Assuming you will conduct an outbreak investigation, what are the steps that you would follow?

Part 2: Methods

After receiving the call from Sedon, the Ministry of Health sent a team from the Epidemiology Department to investigate. The team noted that the area of the outbreak has special characteristics where most of its inhabitants are nomads from the Arabian Rashaida tribe. These tribes have a considerable number of cattle and sheep that travel with them, and their livelihood depends on grazing and farming in the rainy season where they move between valleys from one place to another and cross the borders to neighboring states (Kassala, Red Sea, etc.). Furthermore, it is part of their culture to live very closely with their animals, often sharing the same space. These tribes are also considered disadvantaged and have low levels of education and health status.

Agriculture in the affected area uses axial irrigation, which favors the breeding of mosquitoes in large quantities. During investigation, the team took four samples from cases and three of them tested positive for RVF. Control and prevention measures were accordingly started jointly between the locality and state level, and the response included the following areas for action:

- Surveillance and epidemiological investigation.
- Treatment of cases
- Vector control activities.
- Health promotion
- Environmental health and food control
- Veterinary participation
- Coordination

Part 2 Questions

Question 4. What type of surveillance does the team need to conduct?

Question 5. What risk factors do you think are involved in the occurrence of this outbreak?

Part 3: Results

The outbreak started to expand and the number of villages where the epidemic spread at the Sedon administrative unit reached 38 villages. Few other cases were reported from other administrative units and other localities (Barbar, Atbara) that could be linked to Sedon's outbreak. The last case recorded was on the 20th of August 2019. By that time the total number of suspected cases was 1,129 in the state leading to the death of 19 people.

After the decline of the epidemic in the locality of Al-Damer and the cessation of reports of new cases by the 20th of August, a short lived period (about one month) of zero cases was witnessed, however on the 18th of September 2019, a report was received from Barbar locality, particularly from the area of Fatwar located in the Al-Bawga administrative unit in the west bank of the Nile. The report stated that there are large number of deaths and abortions among animals in the area, accompanied by the emergence of symptoms of fever and an increase in malaria cases in the region. During that time, the rainy season started in Sudan and there were flash floods in 17 of its 18 states including River Nile state.

Immediately after receiving the communication, an investigation team from the ministry headed towards Barbar locality and interviewed the local health system department to verify the notification. The team then headed to the area of concern and carried out a field investigation. Five blood samples were taken from patients present at the time of the visit and sent to the national laboratory, where all tested positive for RVF.

The outbreak in Barbar spread to the east and west sides of the riverbank and extended north to an area overlapping with the locality of Abu Hamad.

On the 23rd of October 2019, a notification was received of a suspected case at Aldamer locality, the case resided in the Atbarawi administrative unit adjacent to the Sedon unit, where the outbreak first occurred that year. The investigation team took a blood sample which was confirmed to have RVF. Afterwards, reports started rolling from the area of Abuson and its neighboring villages in Sedon in the west bank of the Atbara River parallel to areas of the previous epidemic.

This prompted for control measures to proceed in both localities (Aldamer & Barbar) at the same time and the involvement of community committees in surveillance and control measures to help combat the expanding outbreak. A federal team also visited to provide support.

Part 3 Questions

Question 7. Using the attached dataset please draw an epidemic curve of cases for the outbreak that started in September and calculate the case fatality rate.

Question 8. What are the risk factors that contributed to the spread of RVF in Fatwar?

Question 9. Are cases in Fatwar considered of secondary foci or primary foci? What is the impact of that on control measures?

Question 10. What is the role of climate and what should be integrated for forecasting and risk assessment of RVF?

Part 4: Discussion

The outbreak was considered to be controlled in December after the expansion of control measures and the involvement of community and partners. The following summarizes the events of the outbreak.

In the Barbar and Abuhamad:

- The total number of suspected cases in Barbar locality was 160, with one death recorded
- The number of suspected cases in the Abu Hamad locality reached 10 cases with three deaths recorded
- Number of villages affected in the Barbar locality were 17
- There were some sporadic cases in Atbara locality and the Al-Matama locality
- The last case recorded in the Barbar locality was on the 19th of December 2019 Aldamer locality:
- The number of suspected cases in Aldamer locality was 59 leading to 3 deaths
- Fourteen villages were affected
- The last positive case recorded in the Aldamer locality was on the 24thof November 2019

Part 4 Questions

Question 11. What are the proper measures and criteria to announce that an area is free from an outbreak?

Question 12. Describe the role of community participation in prevention and control of the Rift Valley Fever.

Part 5: Conclusion

The epidemic in Atbara continued for about 6 months, however secondary foci occurred in another five states due to the movement of animals. The state with the largest secondary foci was Red Sea state in the east of Sudan. Even though the epidemic was concentrated in certain focal areas, there was concern among livestock traders, especially in distant western states of the country of the effect of this announcement on livestock trade, which provoked a discussion about the multiple ethical issues that arise with such outbreaks.

Part 5 Questions

Question 13. What actions should the team have conducted to prevent the spread of the outbreak to other states?

Question 14. Discuss the socioeconomic implications of announcing an outbreak in a country that is dependent on livestock trading. Please refer to the International Health Regulations (IHR) guidelines in your answer.

Annexes:

Annex 1: RVF case study data

References and related readings

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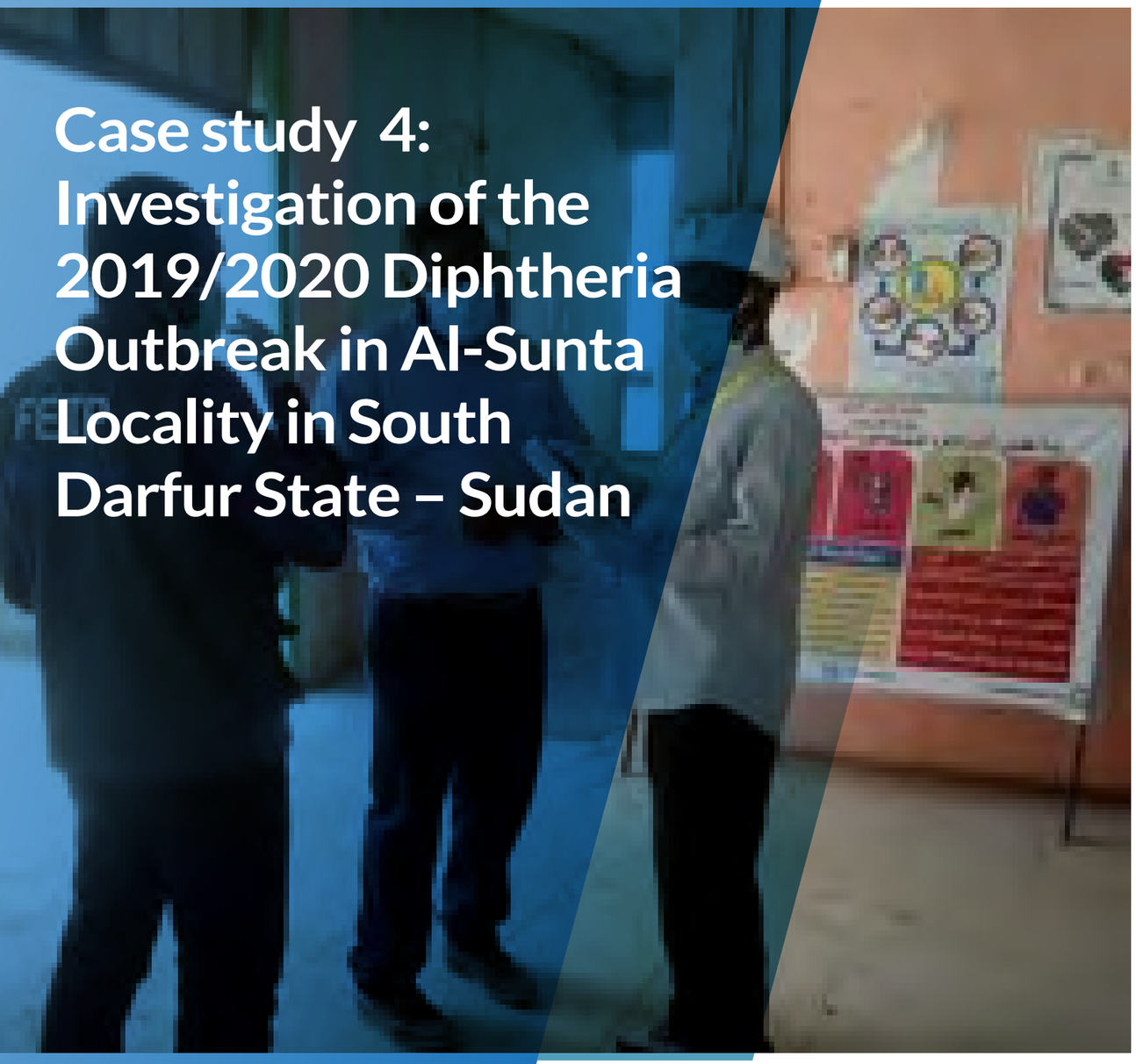

Case study 4: Investigation of the 2019/2020 Diphtheria Outbreak in Al-Sunta Locality in South Darfur State – Sudan

Investigation of the 2019/2020 Diphtheria Outbreak in Al-Sunta Locality in South Darfur State – Sudan

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Goal of Case Study

To build the capacity of FETP residents and strengthen their competencies in outbreak investigation and response to vaccine-preventable disease outbreaks.

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. Identify and define vaccine-preventable disease outbreaks.
2. Describe the epidemiological profile of diphtheria.
3. Outline the steps in outbreak investigation, including the role of rapid response team.
4. Measure the disease frequency and association.
5. Understand the importance of adequately functioning surveillance system.

Introduction

Diphtheria is a highly contagious and potentially life-threatening bacterial infection caused by Corynebacterium species; most commonly by toxin-producing Corynebacterium diphtheriae. [1, 2] In the past decade, the annual global case reporting of diphtheria range between 4,000 to 8,000 cases, with case fatality ratio of up to 10% [1]. It should be noted that the actual disease burden is an underestimation, mainly due to under-reporting and misdiagnosis. [1]

Figure 4.1: Khartoum map

The "non-spore-forming, non-encapsulated, non-motile, Gram-positive bacillus" that causes diphtheria commonly affects the throat and upper airways causing necrosis of tissues and building a pseudo membrane that obstructs breathing and swallowing. In severe cases the bacteria may cause septicemia, myocarditis, peripheral neuropathy, and death [1,2,4] Diphtheria predominantly affects children under the age of 12, however, it may occur in adults over 40 years of age.

Question 1. What are the symptoms and complications of diphtheria?

Question 2. How is it transmitted?

The incubation period of Corynebacterium diphtheriae is 2-5 days, however it could also range from 1-10 days. The disease is typically transmitted via respiratory droplets from coughing and sneezing. It can also be transmitted through contacting surfaces that have the bacteria on it, and rarely [1, 2]

The first documented successful use of diphtheria antitoxin dates back to 1894; in the following year, the production and testing of diphtheria antitoxin commenced. Upon further testing, Professor Emil von Behring discovered that the mixture of diphtheria toxin and antitoxin produces safer and lasting immunity to diphtheria in humans [3]. With the World Health Organization introducing DTP in the list of vaccines within the EPI, the world witnessed a significant decline in the morbidity and mortality rates of diphtheria. Unfortunately, this decline was more evident in developed countries as compared to developing countries where EPI coverage is relatively less [1, 3-4]

Vaccination against diphtheria is given to infants as a primary vaccination series of 3 doses that is followed by 3 booster doses to ensure long-term protection against the disease. The primary series begins at 6 weeks of age with the following doses administered with a minimum interval of 4 weeks between doses. The first booster dose is administered during the second year of life (12-23 months), the second dose at 4-7 years and the third booster dose at age 9-15. [1, 4] In cases where diphtheria is confirmed, patients receive diphtheria antitoxin to counteract the toxin produced by the bacteria, as well as antibiotics (erythromycin or benzylpenicillin) to kill the bacteria itself [1, 9]

Ranked as the third largest country in Africa, and occupying approximately 1,861,484 sq. km, Sudan hosts a population of approximately 45,561,556 with a population growth rate of 2.69%. Following the separation of South Sudan, the country is bordered by 6 other countries, namely Central African Republic, Chad, Egypt, Eritrea, Ethiopia and Libya. [5]

The first documented diphtheria outbreak in Sudan was in 1974, where 1640 cases were reported. Following the introduction of the Expanded Program on Immunization (EPI); which covered BCG, polio, DTP (Diphtheria-Tetanus-Pertussis) and measles vaccines, the number of cases significantly dropped in the following year. However, in 1978, the highest documented outbreak occurred, and 1816 cases were reported. [6, 7] In the years to follow, relatively lower number of cases were reported, however, in 1990 a comparatively higher number of diphtheria cases (1342) were reported. During the past two decades, the number of diphtheria cases reported fluctuated, with the highest reaching 193 cases in 2011 and the lowest of 1 case in 2010; zero cases of diphtheria were reported in 2013 and 2016. [8] In late 2019 early 2020 a cumulative of 102 diphtheria cases were reported across 7 states.

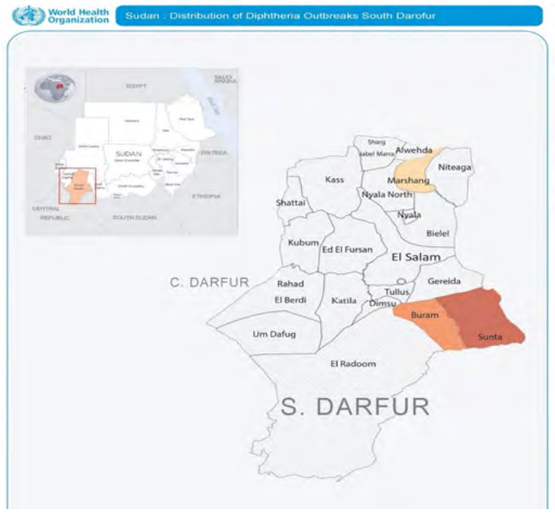

Figure 4..2: Location of Al-Sunta locality

South Darfur state is divided into 21 localities and has a population of approximately 4.4 million, 20% of which are nomadic pastoralists. Children under the age of 5 years constitute around 17% (748,919) of the state population. According to the official records of the State Ministry of Health the immunization coverage ranges between 68% to 92%.

Al-Sunta locality is located in the south-eastern part of South Darfur State; it is located at the periphery of the state and has poor infrastructure, no paved road and no electricity. The locality hosts a total of 90,880 people who reside in 41 scattered villages. 3.64% (3,311) of its population are under 1 year of age, and 17% (15,441) are under 5-year-old children. A large proportion of the population are nomadic pastoralists, IDPs and refugees. There is one hospital, and Primary Health Care services are provided via two health facility, one of which belongs to the health insurance.

Part 1: Story

On the 2nd of October 2019, the Directorate of Emergency and Epidemiology at the State Ministry of Health received a report of two suspected cases of diphtheria from Buram Hospital in Al-Sunta locality. The two cases were siblings (brother and sister) from Tigreeba village in Al-Sunta locality; both cases died during that week.

It was not until epidemiological week 43 of 2019, that a village midwife had noticed the occurrence of a cluster of suspected cases of diphtheria among children in Um Kiteka village in Al-Sunta locality. The Disease Surveillance Department, in South Darfur State, was notified the week after.

Question 3. What is the definition of disease outbreak?

Question 4. What is the case definition of diphtheria; suspected, probable, and confirmed case?

Question 5. What is the incubation period of diphtheria?

Question 6. With regards to the incubation period, list and define the epidemiological classification of disease spread/transmission in the affected population.

Question 7. What is the epidemiological classification of diphtheria in terms of spread in the population?

Question 8. Regarding the two suspected cases reported on the 2nd of October, are they part of the Diphtheria outbreak? Please elaborate why.

Question 9. What background information about the locality do you need to know before investigating an outbreak?

Part 2: Methods

Based on the notification of the village midwife, the State Ministry of Health deployed a rapid response team to investigate, take samples and verify the diagnosis of the suspected Diphtheria cases.

The reporting of cluster cases from Al-Sunta locality was alarmingly high. A rapid response team from the Federal Ministry of Health was sent to Al-Sunta locality on the 21st of November 2019 to further investigate the situation. Upon their arrival, the team decided to remain in the locality due to the severity of the situation.

Question 10. Who should be included in the rapid response team? Propose a list of members?

Question 11. Describe the steps you would take in an outbreak investigation.

Question 12. What is the case-based data that need to be gathered?

Question 13. What samples should be collected for laboratory investigations?

Part 3: Results

The first index case of diphtheria was an 8-year-old girl from Um Kitekah village in Al-Sunta locality (there was no information regarding how she contracted the disease; no travel history or visitors from other states). The subsequent two cases were epidemiologically linked (index case was playing with the 2 subsequent cases; siblings). All of the three first cases passed away.

With the rise in number of cases, the Ministry of Health initiated health promotion messages to raise awareness on diphtheria. On the first of January, February and March 2020, the State Ministry of Health, with the assistance of the Federal Ministry of Health commenced mass vaccination campaigns across the villages of Al-Sunta locality. By 4th of March 2020; date of last reported case, the cumulative number of reported diphtheria cases in Al-Sunta locality reached 96 cases. The total number of deaths were 11.

Question 14. Draw an epidemic curve and interpret it.

Question 15. Use the line list to construct appropriate tables or diagrams to illustrate the demographics of cases and deaths (Age, gender and village).

Question 16. Are there any information missing that need to be included in the line list? If yes, please identify.

Question 17. Using the available data, calculate the attack rate (cumulative incidence).

Question 18. Calculate the confidence interval for the attack rate.

Question 19. Stratify the attack rate by age (< 5 and ³ 5). Construct a 2 by 2 table from the available data. Please interpret your result.

Question 20. Is there an association between age and the risk of getting diphtheria? Calculate the rate ratio as the measure of association. Please interpret your result.

Question 21. Is the attack rate among ³ 5 year-old significantly different compared to the attack rate in children < 5? i.e. is this rate ratio statistically significant?

Question 22. Calculate the case fatality rate? Stratify by age (< 5 and ³ 5) and gender. Interpret your result.

Question 23. What proportion of cases were not vaccinated - Categorize by age and gender.

Question 24. What is the mortality rate among unvaccinated cases?

Part 4 Discussion

Al-Sunta locality is one of the most underserved localities in South Darfur State. There is over 44,400 children under the age of 15 years, and they are at high risk for the disease. Lack of physicians within the locality further exacerbates the situation. The available PHC centers are run by the nurses, community health workers and midwives who are not trained in diagnosis and/or management of diphtheria.

Question 25. In such context, how would you improve case diagnosis and case management.

Part 5: Conclusion

The outbreak of diphtheria in Al-Sunta locality South Darfur was an event that alarmed all stakeholders, including and not limited to the Federal and State Ministry of Health and relevant non-governmental organizations.

Question 26. What recommendations would you make to improve the surveillance system?

Annexes:

Annex 1: Diphtheria case study line list

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Case study 5: Investigation and Control of Measles Outbreak in Puli-Khumri and Baghlan-Markazi Districts, Baghlan province, Afghanistan

Investigation and Control of Measles Outbreak in Puli-Khumri and Baghlan-Markazi Districts, Baghlan province, Afghanistan

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Goal of Case Study

The goal of this case study is to develop competencies and consolidate understanding of participants to investigate and control outbreaks.

Learning Objectives

At the conclusion of the case study, participants will be able to:

1. Discuss recommended measures for investigating and confirming measles outbreaks
2. Outline the recommended control measures for measles outbreaks
3. Explain the preparations made before conducting a field investigation
4. Develop a case definition and discuss how to use it to conduct active case findings
5. Describe the role of the laboratory in disease surveillance and outbreak investigation
6. Define and calculate demographic proportions
7. Conduct descriptive analysis and calculate attack rate and case fatality rate
8. Draw an epidemic curve using MS-Excel
9. Evaluate and interpret the results from curves and tables
10. Identify key channels of communicating findings from a field investigation

Introduction

Measles is a highly contagious viral disease. It remains an important cause of death among young children globally, despite the availability of a safe and effective vaccine. Under the Global Vaccine Action Plan, measles and rubella are targeted for elimination in five WHO Regions by 2020. Measles is transmitted via droplets from the nose, mouth, or throat of infected persons. Initial symptoms, which usually appear 10–12 days after infection, include high fever, a runny nose, bloodshot eyes, and tiny white spots on the inside of the mouth. Several days later, a rash develops, starting on the face and upper neck and gradually spreading downwards. Severe measles is more likely among poorly nourished young children. The most serious complications include blindness, encephalitis (an infection that causes brain swelling), severe diarrhea and related dehydration, and severe respiratory infections such as pneumonia.

Routine measles vaccination for children, combined with mass immunization campaigns in countries with low routine coverage, are key public health strategies to reduce global measles deaths. While vaccination has drastically reduced global measles deaths — a 73% drop between 2000-2018 worldwide — measles is still common in many developing countries, particularly in parts of Africa and Asia. More than 140,000 people died from measles in 2018. The overwhelming majority (more than 95%) of measles deaths occur in countries with low per capita incomes and weak health infrastructures.

The measles vaccine has been in use since the 1960s. It is safe, effective, and inexpensive. Reaching all children with 2 doses of measles vaccine, either alone, or in a measles-rubella (MR), measles-mumps-rubella (MMR), or measles-mumps-rubella-varicella (MMRV) combination, should be the standard for all national immunization programs [1] Many countries around the world are experiencing measles outbreaks. As of 5 November 2019, there have been 413,308 confirmed cases reported to WHO through official monthly reporting by 187 Member States in 2019.

From January 1st through November 17th, 2019, Lebanon reported 1,060 confirmed cases of measles. As of November 8th, 2019, current outbreaks of concern include Yemen with 5,847 confirmed cases, Sudan with 3,659 confirmed cases, Somalia with 2,795 cases, Pakistan with 1,978 confirmed cases, Tunisia with 1,367 cases, and Iraq with 1,222 cases of measles [2]

Afghanistan is a low-income country located in heart of Asia and administratively divided to 34 provinces with almost 396 districts. Afghanistan is bordered by Turkmenistan, Uzbekistan, and Tajikistan to the north, China to the far northeast, Pakistan to the east and south, and Iran to the west. Spread over a territory covering 652,000 km2, the 41st largest country in the world, Afghanistan is a

landlocked country comprising terrain mostly rugged mountains with plains in the north and southeast. The Hindu Kush Mountains that run northeast to southwest divide the Northern provinces from the rest of the country. Climate is continental with harsh cold winters in central highland with average summer temperatures not exceeding 15o C, and winter temperatures below zero. [3]

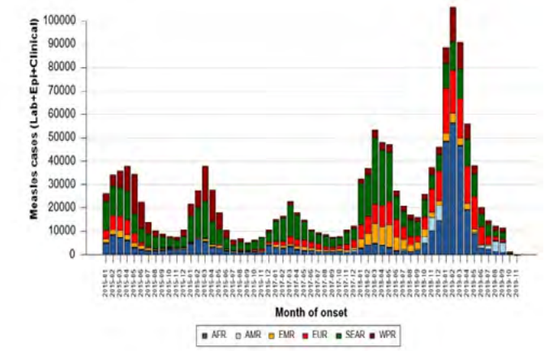

Figure 5.1: Measles case distribution by month and WHO Region (2019-2015), Data as of 8 November 2019

Source: World Health Organization. Measles – Global situation, Disease outbreak news, 27 November 2019, www.who.int/csr/don/

The commonly occurring natural hazards in Afghanistan include damaging earthquakes in Hindu Kush Mountains, flooding in rainy seasons, and droughts. Nearly 58% of the total land is agricultural whereas only 11.9% of the total land is arable. Of the total agricultural land, only 5.5% is irrigated. Road density is very low (4km of road per 100 square km of land area) out of which almost one-third are paved roads. The geographical and climatic characteristics pose challenges to the health care delivery including immunization services. The hilly and mountainous terrain require additional manpower for outreach health services. Harsh weather conditions create problems in maintaining supply and cold chain systems. [4]

In 2003, the Ministry of Public Health (MOPH) undertook a series of critical and strategic steps including defining a Basic Package of Health Services (BPHS) and later an Essential Package of Hospital Services (EPHS). Meanwhile, MoPH established a contracting arrangement on a large scale with international and national non-governmental organizations (NGOs) for delivery of BPHS and EPHS. As a result, the country had substantial gains as the under-five and infant mortality rate which were reduced from 257 in 2002 to 55 in 2018 and from 165 in 2002 to 45 per 1,000 live births in 2018, respectively. The maternal mortality ratio dropped from 1,600 in 2002 to 396 per 100,000 live births in 2018. The number of health centers have increased to more than 3500 in 2019.

However, despite of all these gains there are challenges to overcome such as high maternal mortality, high level of stunting, and low contraceptive prevalence rate. Quantity, quality, and distribution of human resources for health is another challenge facing the health system. Communicable diseases, vaccine preventable disease, and polio are persisting health problems.
Measles is one of the most contagious infections known to humans and ranks among the top 4 child-

hood killers worldwide. In Afghanistan, of the 25,000 reported cases in 2017, 85% are among children under the age of 10. This spans over 20 of the 34 provinces across Afghanistan, with the worst affected provinces being Kabul, Paktika, Kunar, Badghis and Ghor. [5]

The majority of outbreaks are reported, investigated, and responded throughout recent years in the country. [6] There were 133, 200, 110, 176, and 215 outbreaks from 2014 to 2018, respectively. Furthermore, the national coverage of measles immunization ranges from 53% in 2005 to 64% in 2018. It should be mentioned that the country introduced compulsory immunization in 1978. Conflict, political instability, hard-to-reach populations, and poor infrastructure continue to pose challenges to sustainable immunization coverage.

Figure 5.2: Map of Afghanistan
Source: https://commons.wikimedia.org/w/index.php?curid=16493127

Baghlan is a northern province of the country (Figure 2) which has been divided into 15 districts of which the Baghlan-Markazi and Puli-Khumri are the urban areas. The high roads which connect the northern province to Kabul pass through Baghlan province. It is a semi secure area with considerable health challenges including low immunization coverage, and an experience of polio and communicable diseases in 2020. The healthcare services including primary and tertiary in the province are provided by a contracted NGO since 2003.

Part 1: Story

On January 14th 2017, the surveillance focal point of Pule Khumri provincial hospital reported that there are some cases of measles from the Arab Tepa village (part of Dandi-Ghori district) that were referred to a provincial hospital which admitted them into the isolation ward. The issue was discussed in the Emergency Preparedness and Response (EPR) committee at Baghlan province. A team was assigned from local health staff to investigate and control the outbreak. A small team travelled to the area and investigated the cluster of cases; however, they didn't find any new cases in the affected village. It should be noted that the village is covered by the Bagh-Shamal clinic which is a sentinel site for National Disease Surveillance and Response (NDSR) and it is controlled by antigovernment elements (AGE). However, the team made a line list of five cases who were hospitalized, and four blood samples were collected and sent to the Central Public Health Laboratory (CPHL) for confirmation. The team started vaccinating children in the affected village as well as neighboring villages for prevention and control. The cases were managed in the hospital and were discharged after recovery.

A week later, the Baghlan surveillance team informed the central surveillance department in the MOPH about an increase in cases of fever and maculopapular rash among children living in two districts of Baghlan province (Pule-Khumri and Baghlan-Markazi). The surveillance officer suspected another wave of measles outbreak because a group of cases were registered in two health centers of the mentioned province based on the case definition developed for the surveillance system. According to the reports, critical cases of measles were hospitalized, and all of them had a history of contact with children having similar signs and symptoms. After coordination and communication with all stakeholders at the provincial level, the implementer NGO did not accept that an outbreak has occurred. The central team provided justification based on analysis of weekly data as well as laboratory examinations to confirm the continuation of an outbreak. The surveillance team continued to keep regular record of all the similar cases and continued further investigation for confirming new measles cases in the area, and there was a steady increase in the suspected cases. In the second week of the outbreak, 21 cases were verified and confirmed, and in the third week there were 14 new cases and cases continued to increase.

Question 1. What is public health surveillance?

Question 2. What are the types of surveillance?

Question 3. What is a case definition for surveillance?

Question 4. What is difference of suspected, probable, and confirmed cases?

Question 5. Is it necessary for the provincial surveillance officer to report this occurrence? Why?

Question 6. If the implementer NGO is in doubt of accepting the outbreak, how would you convince them?

Part 2: Methods

After receiving the initial report of a 2nd wave of the outbreak in two districts of Baghlan province, the emergency preparedness and response (ERPR) committee met at the provincial level and requested the central level to support them in field investigation. A supporting team departed to Baghlan province, and you as field epidemiologists accompanied them. Both the provincial and central teams prepared to leave for the area. The team consisted of representatives from surveillance, EPI team, the implementer NGO, and other stakeholders. Many coordination meetings conducted at the provincial level discussed the situation and findings. In the meetings they also made decisions about treatment of the cases and control measures to be implemented in the area.

Question 7. What is the necessary preparation for an outbreak investigation?

Question 8. Who should be part of the team for this outbreak investigation?

The investigation team visited the Baghlan Markazi and Pule-Khumri districts. They investigated hospitals' registries at both Baghlan district hospitals and Puli-Khumri provincial hospitals. The team made a line list of all cases and updated the list daily. The team shared their initial investigation findings with local, provincial, regional, and central health authorities. The team planned for active case finding in the community where they focused on standard case management and provision of health education. In the area surrounding these hospitals they found more cases and referred them to hospitals. Due to lack of security, they were not able to visit remote areas and visit all affected villages. However, the provincial EPI team conducted immunization of villages close to health facilities. The provincial surveillance team continued line listing of cases to get ready to carry out descriptive epidemiology. They interviewed the caretakers of the children to find out about their vaccination status. Almost all respondents were not sure about completeness of their children's vaccination. The team continuously collected samples from the hospitalized children and sent them to CPHL in Kabul.

Question 9. What is line listing in outbreak investigations?

Question 10. What is descriptive epidemiology?

Question 11. What samples should be collected for testing?

Question 12. What are your recommendations for sample collection, transportation, and testing?

Question 13. What role do you think the laboratory plays in this scenario?

Question 14. How many samples should be taken during an outbreak to be confirmed?

Part 3: Results

After data collection and finalizing the line lists, all the data was entered into Microsoft Excel (Annex 1). The data from the conducted analysis entered into excel showed that the measles cases were increased in two districts of Baghlan province (Pule-Khumri and Baghlan-Markazi) in 2017. During 2016, a mop up campaign was planned in 92 high-risk districts including two districts of Baghlan province. However, the EPI team was able to implement the campaign in 50 districts in 2016 and in 37 districts including the two mentioned districts of Baghlan province in 2017. It was assumed that after this intervention the cases should have been prevented, yet during 2017 the cases continued to arrive at the two hospitals previously mentioned from the community. Continuation of the line list reached to a total of 1,151 cases including 5 cases from Arab Tepa with 31 deaths in 2017. All cases were registered, and line listed in two surveillance sentinel sites (Pule-Khumri Mulki hospital and Baghlan-Markazi district hospitals). The surveillance team at provincial level commented that the majority of the cases were sporadic from various villages surrounding insecure areas.

The team assigned you to compare the number and rate of cases with the average of the last three years and to calculate the attack rate and case fatality rates.

Question 15. What is Attack rate and how will you calculate it for this outbreak?

Question 16. What is Case fatality rate and how will you calculate it for this outbreak?

The outbreak continued throughout 2018 and higher numbers of cases were registered, and line listed. Total number of cases line listed in 2018 were 456 more cases. Finally, the MoPH in collaboration with the United Nations Children's Fund (UNICEF), the World Health Organization (WHO), and Gavi (the Vaccine Alliance) launched a nationwide vaccination campaign to protect 13.8 million children aged 9-months to 10 years against measles. The measles vaccine was administered free of charge in all mosques, villages, and health facilities throughout the country, targeting all children under the age of ten, irrespective of their previous measles vaccination status or history of disease. The campaign was conducted in two phases during September and November of 2018.

The team reported the proportion of females and males affected and mentioned that more cases were recorded in children under 2 years of age. Age at infection is an important factor in the mortality of measles. There is an impression that the risk of dying from measles is widely considered to drop significantly after the age of 5. Based on limited evidence, almost all age classes under 5 years of age exhibit a decreasing trend in mortality with each additional year, though mortality rates appear to be very similar for children 0-11 months and 12-23 months of age.

Question 17. What is the proportion of males to females, illustrate this proportion in a pie chart? And How about proportion and main sign and symptoms?

Question 18. How could you show that the age group of under 2 years are more affected? Develop the necessary tables to demonstrate this statistic.

Question 19. Can you illustrate the geographical distribution of cases on a map? What are the percentages? Why are they from various residential places outside the outbreaks area?

Question 20. What is the hospitalization rate?

Question 21. Can you classify the age group of death cases? illustrate this data using bar charts.

Question 22. What is vaccination status of those affected in the line list?

Part 4: Discussion

While the team continued to update the line list and follow-up the cases at the provincial level, in a series of high-level meetings in Kabul under the leadership of the Deputy Minister for Health provision, a meeting was conducted in which all stakeholders including surveillance teams at the central level attended. They discussed focusing on routine immunization as a key strategy for enhancing the immunization coverage. They also discussed that the mass immunization campaign will probably reduce the cases and stop the outbreak. The surveillance field staff were updating the surveillance system regularly and the cases showed a decrease compared to the pre-campaign cases; deaths were not reported anymore. Case management was done based on standards. Totally ,157 samples were collected by focal points of surveillance sentinel sites and sent to the central public health laboratories (CPHL). From this number of samples 111 samples tested positive for Measles. The surveillance system continued the follow up and updated all stakeholders. Due to the vaccination campaigns and other control measures there was a decrease in cases and the outbreak was completely controlled and it was declared over.

Question 23. Can you develop an epi curve of the cases using the line list?

Question 24. How has the campaign affected the progression of the outbreak? Show this using an epi curve and interpret the results.

Question 25. What is the positivity rate for samples sent to the lab?

Part 5: Conclusion

A full report of the outbreak investigation and control measures was developed by the surveillance team and using communication channels, including wide email groups of surveillance departments, it was shared with all stakeholders. In addition, an abstract was developed, submitted, and presented in two national scientific conferences in Kabul. Experts alleged that measles outbreaks are happening all over the country between the two campaigns while after the campaigns they were reduced; therefore, the main reason was identified as low immunization coverage due to low routine immunizations. The challenges for implementing routine immunization were reflected as mass population displacements, persistent insecurity, misconceptions, and lack of access to children. By the end of the epidemic, the NSDR and MoPH authorities emphasized on the need for documentation of this experience and having a well written epidemic report.

Question 26. What are the main reasons for low routine immunization in the country?

Question 27. Why are the lessons learned from the outbreak investigation so important?

Question 28. What is the best/standard control and preventive measures you would recommend?

Question 29. What are the channels of communication that should be used to disseminate the results of the outbreak?

Question 30. How do you assess the implementation of standard steps of outbreak investigation in this measles outbreak?

Annexes:

Annex 1: Baghlan line list case study

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- Managing epidemics: key facts about major deadly diseases. Geneva: World Health Organization; 2018. License: CC BY-NC-SA 3.0 IGO. Cataloguing-in-Publication (CIP) data. from:http://www.who.int/emergencies/diseases/managing-epidemics/en/
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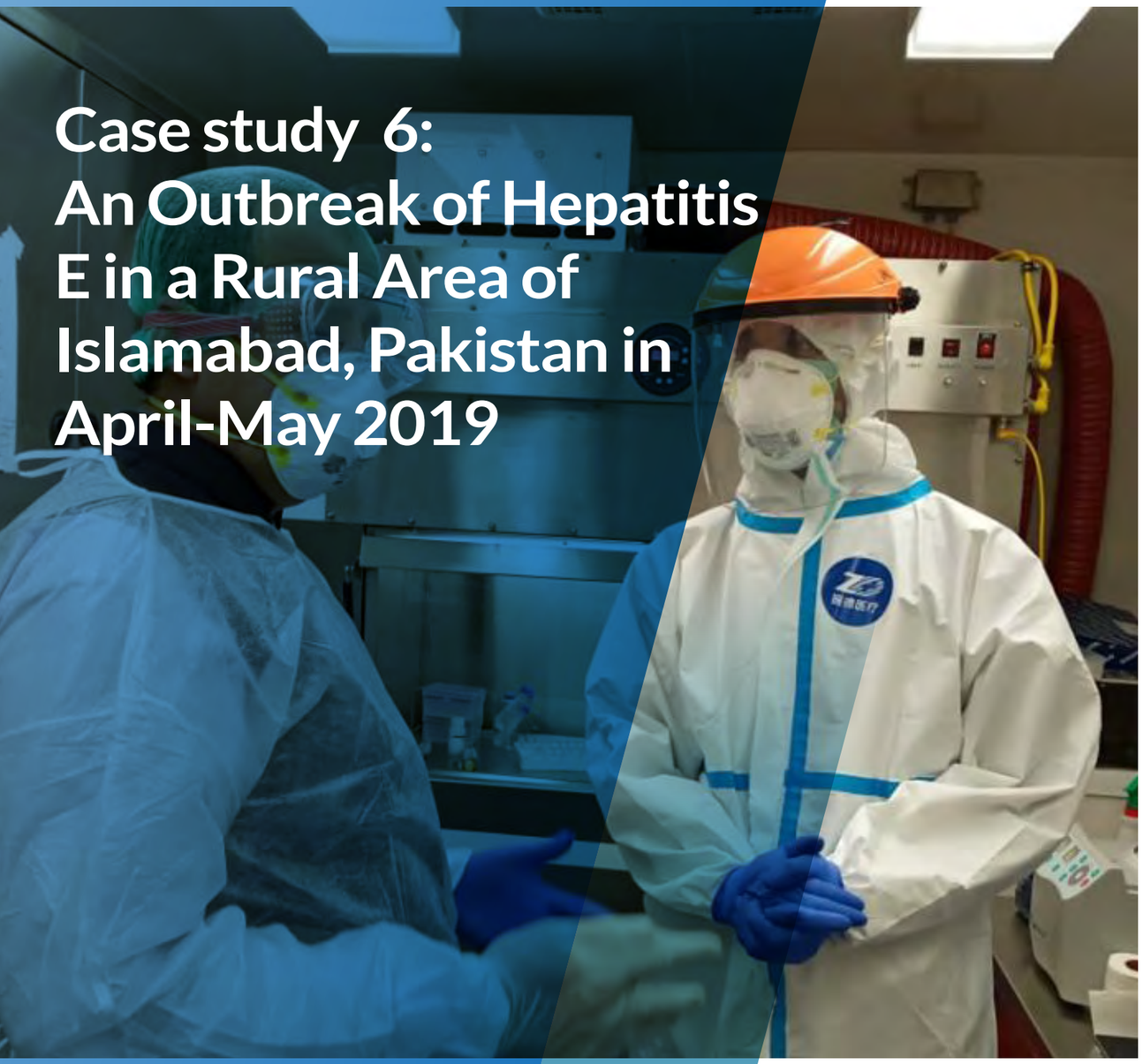
- National Disease Surveillance and Response (NDSR) Manual. Kabul Afghanistan
- NDSR Annual reports for 2010 to 2018

Case study 5

Case study 6: An Outbreak of Hepatitis E in a Rural Area of Islamabad, Pakistan in April-May 2019



An Outbreak of Hepatitis E in a Rural Area of Islamabad, Pakistan in April-May 2019

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Goal of Case Study:

The goal of this case study is to develop student's capabilities in investigating outbreaks.

Learning Objectives

At the conclusion of the case study, participants will be able to:

1. Define an outbreak
2. List the steps of outbreak investigation
3. To identify the role of the laboratory in disease surveillance systems
4. Identify the determinants of an outbreak and create an action plan to control an outbreak
5. Recognize the importance of communicating findings during outbreaks
6. Conduct descriptive analysis of data using MS excel

Introduction

Hepatitis E virus (HEV) is a positive stranded RNA virus which causes acute hepatitis. [1] Infection with HEV is endemic in developing countries and sometimes leads to epidemics due to the existence of favorable conditions for the virus in those countries. [2] HEV typically spreads by fecal contamination of water. [3]

HEV is one of the major causes of acute viral hepatitis in Pakistan where it mostly affects adults from lower socioeconomic groups; Pakistan is endemic for HEV.[4] The country experiences all four seasons, and due to lack of proper sanitation and infrastructure, the rainy season leads to floods in the country. [5]

Islamabad is the capital city of Pakistan. It is divided into two administrative subdivisions that is Islamabad urban and Islamabad rural. The city is divided into 52 union councils, of which 24 are urban union councils and 28 are rural union councils. Union council Tarlai Kalan is in the rural area of Islamabad. [6,7] This particular outbreak was investigated in the Irfanabad town in the Tarlai Kalan union council. The total population of Pakistan is approximately 200 million, and the total population of the Tarlai union council is approximately 244,000. The outbreak investigation area included 100 residences housing around 500 people. The streets of the investigation area had an open drainage system, and garbage was disposed of on the streets, which were not fully cemented. Most of the water bore pumps are located street side outside homes. There are no proper water supply connections in this town. Map in figure 1 is showing the location of Islamabad city in Pakistan. [8]

Figure 6.1. Map of Pakistan

Part 1: Story

On the 24th of April 2019, a call was received at the National Institute of Health (NIH) in Islamabad from a resident of the Irfanabad town. The caller was worried since his family and neighbors had fallen sick and displayed fever, lethargy, abdominal pain, and vomiting for the last few days. As an FETP fellow, I was requested to go with an outbreak investigation team to that area. A questionnaire was designed to investigate the situation. During investigation, it was observed that the town was unhygienic, the streets were full of garbage dumps, and there was stagnant water with algae growth. The team reached the home of the person who informed the NIH about the illness and found his two sons and daughter to be ill.

Part 1 Questions

Question 1. What is the probable cause of the illness in the cases?

Question 2. What type of questionnaire should be made? Group the questionnaires questions into categories.

Question 3. What is the purpose of creating an investigation team?

Question 4. What type of case definition should be made?

Question 5. What preparedness is required before visiting the field to investigate the outbreak? Who should be on the investigation team?

Part 2: Methods

The next day, the team visited the field with a designed questionnaire, where door-to-door surveillance and face to face interviews took place. During surveillance, it was found that there was no proper water supply in the town and the only mode of supply was three water boring pumps on the street. Two neighbors who shared water from one pump and their neighbors who got water from the other two pumps were all affected by illness. The team visited every house in the community to carry outdoor-to-door surveillance, and seven illness cases were found on the first day of field investigation. Blood samples were sent to the NIH laboratory for testing. Four days later, three more affected people were investigated.

Questionnaires were filled out and blood samples were sent to NIH laboratory for confirmation of the disease. Water samples from the pumps and the filtration plants were also sent to the laboratory for testing as an environmental sample. Random water sampling was also carried out by taking samples from pumps in an area three streets away from the affected street, which was also used by the community for drinking and household purposes. The team conducted community interviews and questionnaires were filled-out in order to avoid missing other illness cases, and follow-up procedure was started.

Part 2 Questions

Question 6. What samples should be taken for testing? What etiological agent should the lab test for?

Question 7. What are the recommendations for sample collection, transportation, and testing?

Question 8. What is the role of the laboratory in this scenario?

Question 9. What is the importance of line listing?

Part 3: Results

Line listing was completed based on the questionnaires filled-out in the community and attack rates were calculated in the specified population. Information was collected regarding 55 suspected cases out of which 11 were laboratory confirmed HEV cases for the period spanning April to May 2019.

The questionnaire was developed based on data regarding demographic information, clinical features, and risk factors of the patients, a pumped water samples were collected for lab testing. Data entry and cleaning was carried out using Microsoft excel and descriptive analysis using Epi Info. The data was grouped, tabulated, and represented graphically, while geographic locations of cases were mapped. Figure 2 is showing the affected age groups. A survey of the entire community was carried out to find any new cases.

Eleven cases (20%) were confirmed to have HEV and showed illness signs and symptoms (Table 1), they were all were living on the same street. During investigation it was found that it had rained about a week ago and rainwater had accumulated on the streets due to the lack of a rain-water drainage system.

Figure 6.2. Frequency of HEV Infections by Age Group

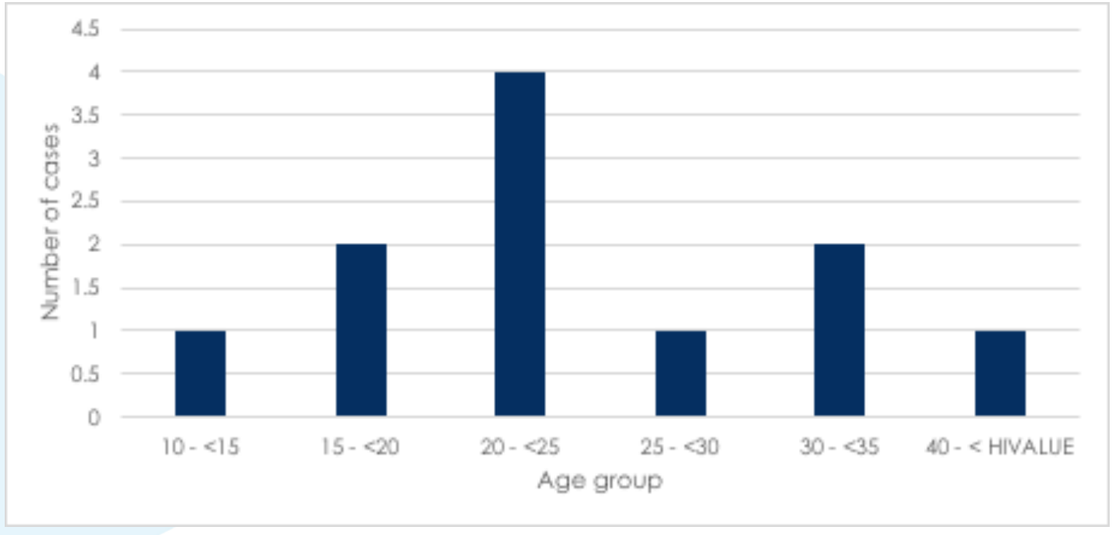

Table 1. Patient Data Collected from the Questionnaire and Lab Results

Symptoms	Percent
Fever	100.00%
Lethargy	100.00%
Anorexia	63.64%
Jaundice	63.64%
Vomiting	54.55%
Urine discoloration	81.82%
Gender	
F	54.55%
M	45.45%
Health Status	
ill	100.00%
Lab confirmation	
Hepatitis E IgM	100.00%
Hospitalization	18.18%
Outdoor Eating	81.82%
Source of Drinking Water	
Boring	72.73%
Filtration	27.27%
Source of Water for House Consumption	
Boring	100.00%

Part 3 Questions

Question 10. What is the importance of the spot map?

Question 11. How will you interpret the provided data analysis?

Question 12. How will you calculate the attack rate of the population?

Question 13. What is the most probable mode of transmission?

Question 14. Which is the most affected age group?

Part 4: Discussion

The most probable cause of the illness was the source of drinking water used by the cases. Persons who were using filtered water from the filtration plants and water tankers did not develop any symptom and remained well; water samples from filtration plants and water tankers were also sent to laboratory for testing. People who used water from bores in their homes also remained well. The eleven illness cases resided in the same street and used drinking water from water bores on the street. The street had an open drainage system located adjacent to the water bores. After the reported rains, the drains over flooded and the street was filled by rain and drainage water. Due to the low surface level of the three water bores that were uncovered, accumulated street water entered the bores. Figure 3 is showing the open drainage system adjacent to boring of the water. Hence boring water was contaminated with street water.

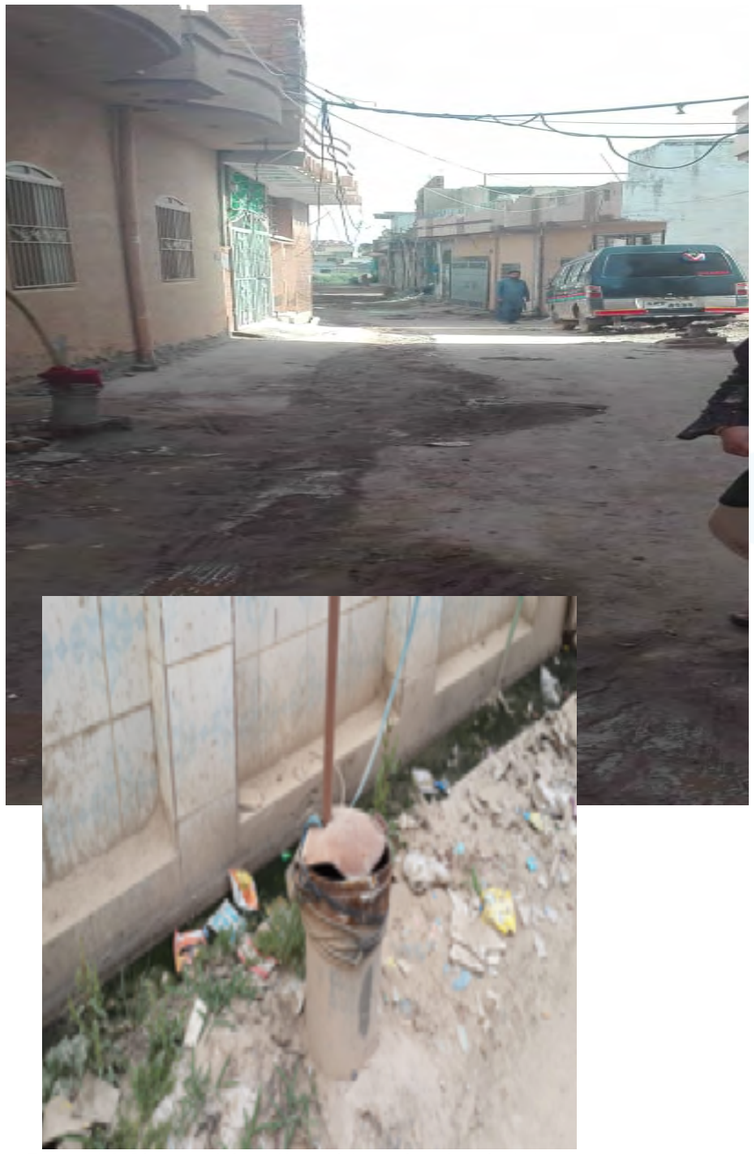

Figure 6.3. Photos of the Affected Area showing the Water, Drainage, and Sewage Systems

Part 4 Questions

Question 15. Which department should be involved to stop the outbreak?

Question 16. What is the role of information, education, and communication (IEC) material?

Question 17. What precautions would prevent the further spread of the disease?

Question 18. What is the difference between active and passive surveillance?

Part 5: Conclusion

Due to open sewage drains located adjacent to water boring pumps which were at a lower surface level, rainwater accumulated up to a level above three of the borings in the same area which lead to contamination of the pump water. The people who were not using the street water bore remained well.

The investigation team followed-up with the confirmed and suspect cases regularly, and awareness sessions were carried out by the team to community members regarding safe water usage through the boiling of drinking water, and advised people not to use the boring water due to the presence of coliforms (according to laboratory reports).

The community stopped using the bore water and repaired the water bores to prevent any accumulated street water from entering the bore. The municipal corporation and the water and sanitation department were informed of the problem and they repaired the open sewage lines of the street.

The District Health Office sent sanitary inspectors along with the investigation team to perform door-to-door awareness regarding preventive disease control measures. The NIH conducted a training session for the 14 health workers of the local union council to raise their awareness about acute viral hepatitis, and explain preventive measures to them. The health workers of the union council were also involved in later health awareness activities, followed-up on existing cases, and reported any new suspected case, if they found any. Follow-up of the cases took place twice a week for two months to find any new suspected cases. No new case were found due to newly instilled awareness of community members regarding safe water use for drinking and household purposes.

Question 19. Based on the preliminary findings above, what control and prevention measures do you think should the investigating team recommend?

Question 20. What actions would you take to engage the community while implementing prevention and control measures?

Annexes:

Annex 1: Questionnaire page 1
Annex 2: Questionnaire page 2
Annex 3: Hepatitis E cases spot map
Annex 4: Hepatitis E outbreak all suspected and confirmed cases

References:

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Case study 7: What are the risk factors for dengue outbreak in Taiz city, Yemen

What are the risk factors for dengue outbreak in Taiz city, Yemen

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Goal of Case Study:

The goal of this study is to improve skills of FETP residents to investigate and response to dengue outbreak in Yemen.

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. Describe steps for descriptive phase of an outbreak investigation
2. Describe steps for analytical phase of an outbreak investigation
3. Describe steps for response phase of an outbreak investigation
4. Balance between investigation and control measures
5. Discuss the WHO/ CDC/ recommended control measures for vector born outbreak.
6. Identify the role of the laboratory and entomology in vector born outbreak investigation
7. Identify the appropriate control measures needed to contain dengue outbreak
8. Conduct descriptive analysis of the data using excel software.
9. Conduct bivariate an multivariate analysis for risk factor by using Epi info 7

Introduction

Dengue fever (DF) is a mosquito-borne disease caused by dengue virus that transmitted by Aedes aegypti [1] Severe cases causing serious illness and death. Some patient may develop dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). Globally, more than 40% of the population is currently at risk of dengue [2] Approximately 50-100 million cases of DF and 250-500 thousand cases of DHF are reported every year. Mortality rate of dengue is 5-10% [3]
Since 1998, epidemics of DF and DHF have been reported in East Mediterranean Region with increasing in frequency and geographically distribution of the viruses. Outbreaks have been reported from Pakistan, Djibouti, Saudi Arabia, Somalia, Sudan and Yemen [4]

Yemen is located in the southern end of the Arabian Peninsula. The estimated population for 2018 reached 28,498,687 person.
It is divided into 23 governorates and 333 districts and covers an area of 555,000 Km2.
It is bordered to the north by Saudi Arabia, to the East by Oman, and to the South and West by a 2,200 km coastline along the Gulf of Aden, Arabian Sea and the Red Sea [5]

On 1 November 2018, Taiz governorate surveillance officer notified Ministry of Public Health and Population (MoPHP) about increased number of DF in Al Qahirah District, Taiz city. On 2 November 2018, the director of Y-FETP assigned a team for investigation; official letter including the names of team members was issued. The team travelled and arrived to Taiz at the evening of the same day.

Figure 7.1: Yemen Map, 2018(sourece Central statistical organization)

Part 1 questions

Question 1: If you were a member of YFETP investigation team, what things would you consider before travelling?

On 3 November 2018, a meeting was held at Taiz governorate health office including the general director of health office, and surveillance officers. The situation of DF was discussed and the surveillance record was reviewed. “Five-suspected DF were admitted to Al Swaidy hospital, all cases were from Al Qahirah district, not confirmed yet, and it is the first time to report dengue cases from this district. We need to determine the risk factors, however the preventive and control measure that we had implemented for every outbreak in affected districts, the disease is spread to main city of the governorate. Many areas in the city are still not affected and they are not accessible to us due to conflict. People there need to be educated to prevent themselves through community participation “, the general director said.

Question 2: Based on this information, what actions should be done?

Part 2: Methods

The team visited Al Swaidy hospital, met the director of the hospital. The director stated, “More cases are admitted yesterday and today early morning”. The team also met the doctors who were responsible for treating cases and discussed the signs and symptoms of cases.With the collaboration of surveillance focal point at the hospital the team collected the data of all admitted patients. No one of them had travelled.

The team constructed case definition to be used for collecting data of cases. The team then moved to other health facilities then to the affected neighbourhoods in to Al Qahirah district.

Question 3: What is the purpose of discussing signs and symptoms? What is the purpose of visiting affected areas?

Question 4: What are the components of case definition? Please, state a suitable one

The team performed active search for cases from house to house. The laboratory technicians collected human samples and the entomologist collected environmental samples.

Question 5: What are the samples that should be collected by laboratory technicians? and what are the recommendation that should be follow for human sample transportation ?

Question 6: What is the mosquito form you expect to be detected by Entomological survey? What are the indices that would be used?

During active search form house to house, the team leader received a phone call from the lab and informed that one sample of admitted patients was dengue IgM positive. As well as, the entomologist informed him that Aedes aegypti with high density was found in some houses of infected patient.

Question 7: Based on the findings above, what action should be done by the team?

In response to the new information, the team leader asked you (As FETP resident) to revise the

WHO /CDC guideline and recommend immediate contaminate measures and to prepare study design for risk factors to be implemented in the next day.

Question 8: What are the immediate containment measures you would recommend?

Question 9: What is the best study design for risk factors? Justify your answer

Question 10: What is the selection criterial that should be used for selecting study participants?

On 4th November, the team started to collect data for case control study. Two control for each case. All cases that already included in the line list were considered as cases. The controls were defined as; any person lived in the same neighborhood of the cases during the same period and did not developed DF symptoms. A pre-designed questionnaire were used for collecting data related to behavioral and environmental factors.

Part 3: Results

The team leader reviewed the laboratory and entomology reports and found that; out of 19 tested blood samples, 58% (11/19) were positive for dengue IgM. The housed of affected people lacked to safe water supply and people usually store water in-house for domestic use. Aedes aegypti was found in high density and all entomological indices were in favor of dengue fever.

The team leader reported these results to the general director of governorate health office and recommended urgently to send medical doctors, nurses and drugs and intravenous fluids to support case management at hospital level. He also asked for vector control specialists, insecticides, and fogging machines to start urgently vector control measures.
The general director of health office with the support from of local council of Taiz governorate start-

ed the implementation of control measures.

As you are FETP resident, the team leader provided you the data of 150 persons (50 cases and 100 controls) in excel file (Annex 1), he asked you to provide answers the following questions by using Epi Info and/ or excel

Question 11. Draw Epi-curve by using epi weeks instead of date of onset?

Question 12. Fill data of cases in table 1:

Table 7.1: Characteristics of suspected DF, Al Qahirah district, Taiz City, November 2018

Characteristics	Frequency	Percentage
Gender		
Male		
Female		
Age (years)		
Mean (SD)		
Sub district		
Ausaiferah		
Al Kawthar		
Al Dhaboah		
Al Rawdah		
Working status		
Working		
Not working		
Educational status		
Illiterate		
Educated		

Question 13: Present the suspected cases by age group using adequate graph. You can use the following age groups: <15, 15- 29, 30-44, 45-59

Question 14: Present the suspected cases by gender using adequate graph.

Question 15: Present the suspected cases by symptoms using adequate graph?

Question 16: Use frequency feature to fill the following lab result ;

Table (7.2): Lab result of dengue fever in Al Qahirah District, November 2018

Results	IgM	
	No	%
Positive		
Negative		
Total	19	100

Question 17: Use the bivariate analysis in Epi info and fill tables No 7.3 ,7.4 and 7.5

Table (7.3): Socio-demographic factors associated with dengue fever

Factors	Cases No. (%) n = 50	Controls No. (%) n = 100	OR (95% CI	P value
Sex (example)				
Male	26 (52)	62 (62)	0.7 (0.3 - 1.3)	
Female	24 (48)	38 (38)	Reference	
Educational level (Illiterate)				
Illiterate		26 (52)		
Educate		24 (48)	Reference	
Working status				
Not working	0.24	0.24	*	*
Working			Reference	

Table (7.4): Behavioral factors associated with dengue fever.

Risk factors	Cases No. (%) n = 50	Controls No. (%) n = 100	Risk fac OR (95% CI) to	P value
Storing of water in containers				
Yes			1 (0.3 - 3.1)	1
No			Reference	
Covering container				
Yes				
No			Reference	
Use mosquito repellent				
Yes				
No			Reference	
Use window nets				
Yes				
No			Reference	
Wearing short sleeves and pants				
Yes				
No			Reference	
Traveling history before 2 weeks				
Yes				
No			Reference	

Table (7.5): Environmental factors associated with dengue fever.

Risk factors	Cases No. (%) n = 50	Controls No. (%) n = 100	OR (95% CI)	Factors
Clean around house				
No				< 0.001
Yes			Reference	
Good sanitation				
No				
Yes			Reference	
Presence of indoor bonsai				
No				
Yes			Reference	
Screening window				
No				
Yes			Reference	

Question 18: Use the binary logistic regression to determine the main risk factors (from risk factor that were significant in the tables 7.3, 7.4,7.5) and fill the following table

Risk factors	Adjusted Odds Ratio	95%CI	P-Value
Wearing short sleeves and pants (Yes/No) example	34.0	7.0-170	<0.001
Working Status (Not working/working)			
Screen window: (No/Yes)			
Presences of Outdoor bonsai: (Yes/No)			
Not covering the water containers at home			

Part 4: Discussion

Dengue is endemic in coastal area of Yemen since 2002. During 2017, many outbreaks were frequently reported from coastal governorates including Taiz governorate. The recent outbreak was in Taiz city for the first time. A well written report is required by health authority in order to document the experience form this outbreak especially the risk factors which were from local context to be used for educational material for community.

Involving community participation in per epidemic preparedness is an essential tool for effective prevention and control measures against DF. It is an important to have information, education and communication materials based on local context and language to involve community.

Question 19. Being aware about the situation and thoroughly analyzed the data, please write an outline for the outbreak.

Part 5: Conclusion

After reading the draft report of the outbreak and summarizing their findings using descriptive and analytical epidemiology. The team leader arranged a meeting with governorate health authority and asked you to be prepared to answer the following questions in the meeting:

Question 20. Based on the information of data analysis, what control and prevention measures do you think the investigating team should recommend?

Question 21. What actions would you take to engage the community while implementing prevention and control measures?

Question 22. As a member of the team, what forum/channels would you used to share findings with all the relevant partners, including, health authority, and organizations such as Médecins Sans Frontières (MSF; Doctors Without Borders) and the World Health Organization (WHO)?

Annexes:

Annex 1: line list for dengue case study

References

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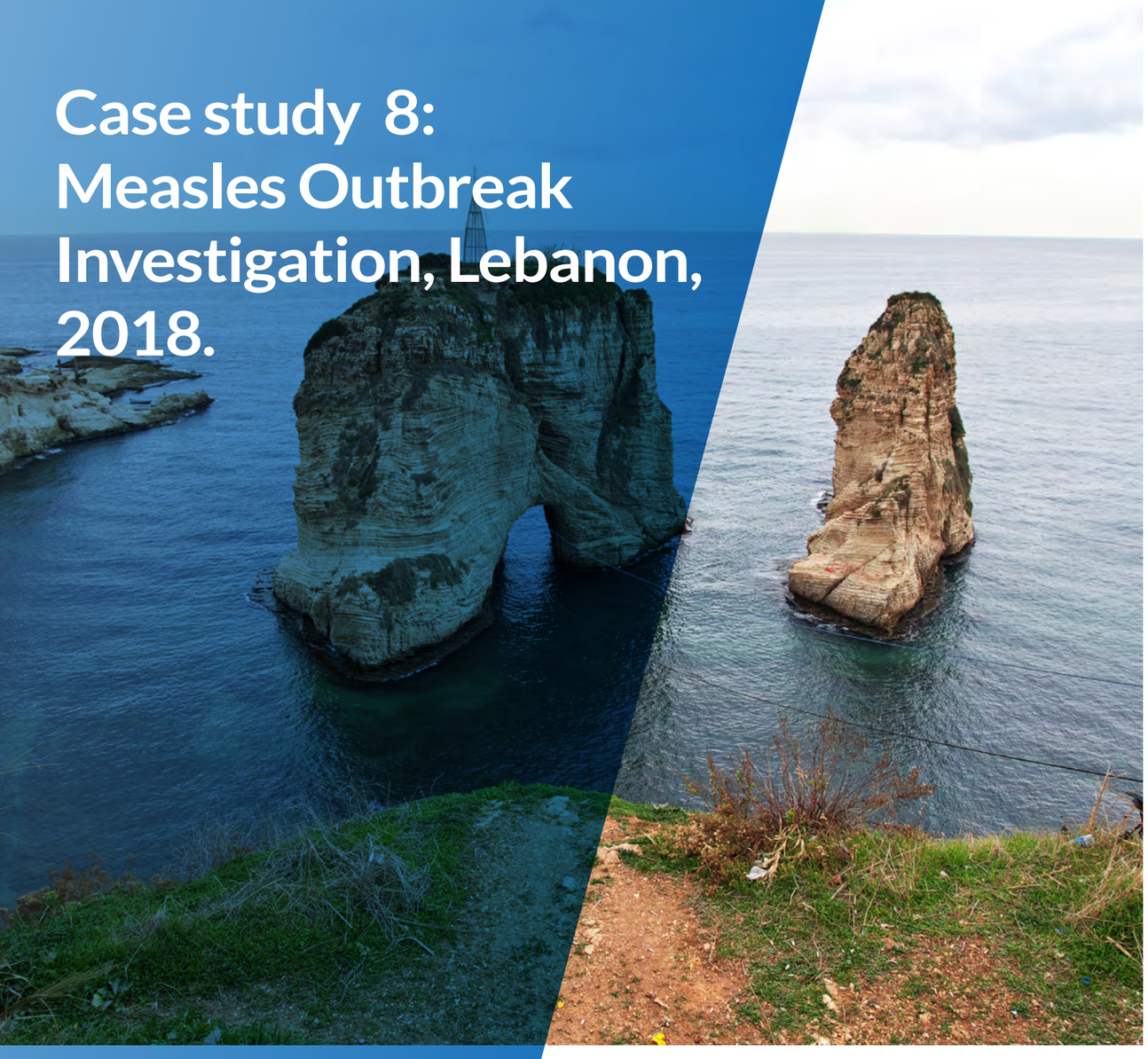
Case Study Related Readings

1. Dengue control in Pakistan: prior planning is better than controlling too late.
2. Dengue Vector Control through Community Empowerment: Lessons Learned from a Community-Based Study in Yogyakarta
3. Environmental management for dengue control: a systematic review protocol
4. Dengue fever outbreak in Oman: A country previously without local transmission.
5. Risk Factors Associated with Dengue Virus Infection in Guangdong Province: A Community-Based Case-Control Study.
6. Risk factors for dengue outbreaks in Odisha, India: A case-control study

Case study 7

Case study 8: Measles Outbreak Investigation, Lebanon, 2018.



Measles Outbreak Investigation, Lebanon, 2018.

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Goal of the study

Develop competencies in analyzing measles surveillance data based on a measles outbreak in Lebanon in 2018.

Learning Objectives

At the conclusion of the case study, participants will be able to:

1. Identify the types of data that should be collected as part of an outbreak investigation
2. List strategies to enhance surveillance activities during an outbreak
3. Analyze surveillance data collected during an outbreak
4. Draw an epidemic curve using EXCEL
5. Calculate attack rates
6. Conduct basic descriptive analyses of cases by person, place, and time
7. Discuss the importance of sharing information and coordination between different partners to ensure an adequate response to an outbreak
8. Draft an epidemiological report

Introduction

Lebanon is a middle income, small country (10 452 sq. km) located in western Asia. It is bordered by Syria to the north and east and occupied Palestine to the south while Cyprus lies west across the Mediterranean Sea (Figure 1). In 2018, the resident population was estimated at 4,743,973, in addition to more than 997,522 displaced Syrian individuals (due to the current Syrian crisis).

Lebanon is divided into eight governorates which are further subdivided into twenty-six districts. Public health services are in charge of the Epidemiological Surveillance Program (ESU) present at the district, province, and central levels. ESU is connected to different channels of reporting including medical and health centers, hospitals, laboratories, and schools. However, vaccination services are provided by the Expanded Program on Immunization (EPI) as well as the private sector.

Measles is a highly contagious disease caused by a virus which can lead to serious complications including pneumonia and inflammation of the brain that can cause permanent damage and death, especially in children less than 5 years of age. [1] Measles is transmitted via droplets from the nose, mouth, or throat of infected persons. Initial symptoms, which usually appear 10–12 days after infection, include high fever usually accompanied by one or several of the following symptoms: runny nose, conjunctivitis, cough, and tiny white spots on the inside of the mouth. [2]

Accelerated immunization activities have had a major effort on reducing measles deaths. [3] The World Health Organization (WHO) estimated that measles related deaths decreased by 73% between 2000 and 2018. [3]

In 2012, the World Health Assembly (WHA) endorsed the objective towards the elimination of measles in five WHO regions by 2020 by ensuing 95% immunization coverage nationally and reducing measles incidence to <5 cases per million inhabitants [4] Despite considerable progress in measles control, the virus continues to circulate. Globally, and many countries were lately hit with large measles outbreaks. [5]

Figure 8.1: Map of Lebanon

According to officials, the immunization strategy employed by the Lebanon public health sector includes both measles vaccine given at 9 months of age (introduced in 1987), and Measles Mumps Rubella (MMR) vaccine given to children as two doses at 12 and 18 months of age (MMR, introduced in 1996). The private sector administers MMR vaccination to children at 12 months and 4-5 years of age. The vaccine is provided free of charge at primary healthcare centers through the Expanded Program on Immunizations (EPI). However, measles immunization coverage rates have fallen far below the recommended threshold necessary to prevent illness and outbreaks [6]

Measles transmission is a public health concern in Lebanon. The country has witnessed several measles outbreaks. In the 1997-1998 outbreak, North Lebanon reported 980 measles cases and 3 deaths. From 2003-2007, annual epidemic waves were observed with recurring outbreaks every 2 years in North Lebanon. In 2013, a national measles outbreak occurred with 1,760 cases and 4 deaths [7] (Figure 2).

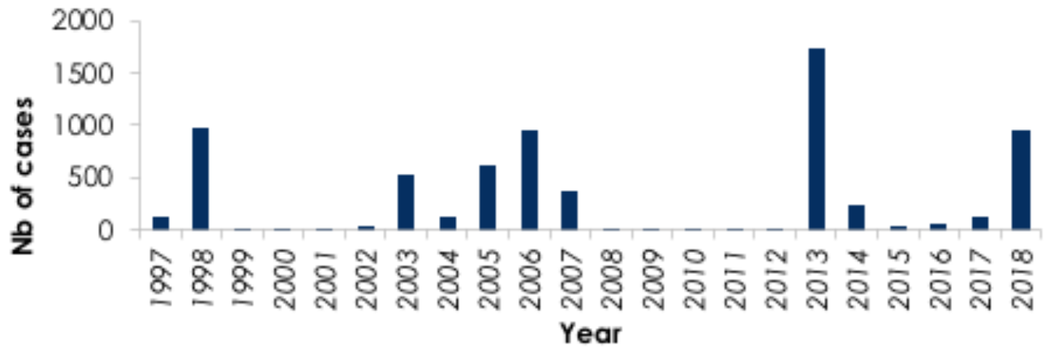

Figure 2: Reported Measles Cases by Year, Lebanon, 1997-2018

Part 1: Story

From the 1st of January to the 16th of March, 2018, the number of measles cases reported to the Epidemiological Surveillance Program (ESU) reached 117, with a national attack rate of 2/100,000.The most affected areas are the locality of Faour in the Zahleh district, and Shatila camp in Ghobayreh locality in Ba'abda district. The ESU team investigated the reported cases and conducted field visits to the affected areas. Laboratory testing at the national reference measles laboratory demonstrated 93 positive results.

Question 1. What should be the target incidence for measles/rubella in Lebanon?

Question 2. What is the measles and rubella case definition that should be in use in Lebanon?

Question 3. Develop a case-based investigation form to be used during data collection.

Question 4. What is the importance of laboratory testing at this point? Describe the type of specimens that should be collected.

Question 5. Would you consider this to be a measles outbreak? Explain.

Question 6. What public health agencies should be notified about this event? Why?

On the 19th of March 2018, the Ministry of Public Health officially declared a measles outbreak in Lebanon (Box 8.1).

Date: 19/03/2018 *Author:* Minister Office *Source:* MoPH

MOPH Warns Against Measles Outbreak in Lebanon and Assures It will Secure Vaccines Free of Charge

The Information office of the Ministry of Public Health issued the following statement:

Lebanon is currently witnessing an outbreak of measles cases among unvaccinated children, in particular in the districts of Baabda, Zahleh and some north districts, threatening the children's health.

The Ministry of Public Health sounds the alarm about the risk of this disease and urges the parents to take responsibility of vaccinating their children, knowing that the Ministry is providing vaccines free of charge in all the healthcare centers and dispensaries across Lebanon.

The Ministry of Public Health has proceeded in taking the necessary measures in the regions where measles cases are reported, as it is conducting intensive measles vaccination campaigns targeting children up to 18 years of age, in addition to rubella and mumps vaccination.

The Ministry reminds the citizens of its readiness to respond to any inquiry made by parents by calling 1214.

Box 8.1: Media Press Release

Question 7. What is the importance of an early outbreak announcement?

Part 2: Methods

Response to the declared outbreak was initiated with focused measles vaccination campaigns in the affected areas, namely the Shatila and Fa'our camps, with coordination between the MOPH, WHO, UNICEF, Médecins Sans Frontières (MSF) and local NGOs. In parallel, the ESU was conducting a list of activities to enhance case detection, reporting, investigation, and lab confirmation. Also, a measles database was timely shared with the EPI team and a weekly epidemiological report was shared.

Question 8. Would you move at this stage towards a national measles immunization campaign? Discuss your point of view.

Question 9. Suggest some strategies to enhance each of the mentioned core surveillance functions?

Question 10. What are some reasons to write an outbreak epidemiological report?

Question 11. To whom should this report be disseminated? How might you disseminate this information?

Part 3: Results

In 2018, 1,187 rash cases were detected in Lebanon. Among them, 71% were tested for measles and 20% were measles discarded. The final number of measles cases following investigation was 939, including 39% clinical, 58% laboratory confirmed cases, and 3% epi-link cases. You will receive an excel sheet (Annex 1) with detailed information about cases. Data on age, gender, nationality, province of residence, week of symptoms onset, vaccination status, and source of reporting are provided in this sheet. More information is provided in the following tables.

Table 1: Annual incidence rate (per 100,000) by province, Lebanon, 2018

Province	P 2018	N2018	R2018
North	890,306		
Beqaa	524,717		
Nabatieh	326,817		
South	732,174		
Mount	2,006,048		
Beirut	469,963		
Akkar	381,492		
Baalbeck/Her	409,976		
Total	5,741,493		

Table 2: Distribution of measles cases by age groups Lebanon, 2018

Age group	Population	n	%	Rate/100000
Under 9 Months	589,519			
9-11 Months				
1-4 Years				
5-9 Years	643,653			
10-14 Years	622,577			
15-24 Years	1,104,979			
>25 years	2,780,768			

Table3: Distribution of measles cases by nationality, Lebanon, 2018

Nationality	n	%	Rate/ 100000
Lebanese			
Palestinian			-
Syrian			

Question 12. Draw the epidemic curve by week of onset.

Question 13. Complete Table 1 by calculating the attack rate by provinces. Identify the most affected provinces.

Question 14. Complete table 2 by calculating the percentage and attack rate by age group. Identify the high-risk groups.

Question 15. Complete Table 3 by calculating percentage and attack rate by nationality. Which group is most affected?

Question 16. Present the cases by gender using an adequate graph.

Question 17. Present the suspected cases by age group and vaccination status using an adequate graph.

Question 18. Present unvaccinated cases by birth cohort using an adequate graph. Which generation is the most susceptible?

Question 19. Present the cases by source of reporting using an adequate graph.

Part 4: Discussion

A total of 939 measles cases were reported including 39% clinical, 58% laboratory confirmed cases and 3% epi-link cases. The highest attack rate was observed among children from 1-9 years of age. The majority of cases were not vaccinated or with unspecified vaccination status. According to the latest national sero-survey conducted between December 2015 and June 2016, 86.7% of Lebanese and 79.3% of Syrians received the MCV 1st dose. As for the MCV 2nd dose, 64.8% of Lebanese and 51.6% of Syrians had received it[6].

Most cases were inpatient ones and were reported by hospitals. The circulating virus was isolated through 12 oral fluid samples collected from three different provinces and the detected genotype was D8. During the outbreak, close coordination between the MOH and different partners (such as WHO, UNICEF, and others) was established and maintained to guide the necessary response immunization activities.

Question 20. Based on the presented findings, what caused the measles outbreak in Lebanon?

Question 21. How might you explain the low percentage of measles epi linked cases?

Question 22. How might you explain the discrepancy in the number of reported cases between hospitals and medical centers?

Question 23. List two positive features that characterized this outbreak

Part 5: Conclusion

In 2018, a measles outbreak hit Lebanon causing 939 classified cases and zero death. Children under 10 years of age were the most affected group. The outbreak was due to lack in vaccination coverage. Under-reporting of outpatients was also present. To prevent the spread of measles, the recommendation was to improve population immunization and strengthen surveillance capacities.

Question 24. In small groups, draft an outline of an outbreak epidemiological report listing all the topics that should be included.

Annexes:

Annex 1: Final data for measles outbreak case study

References

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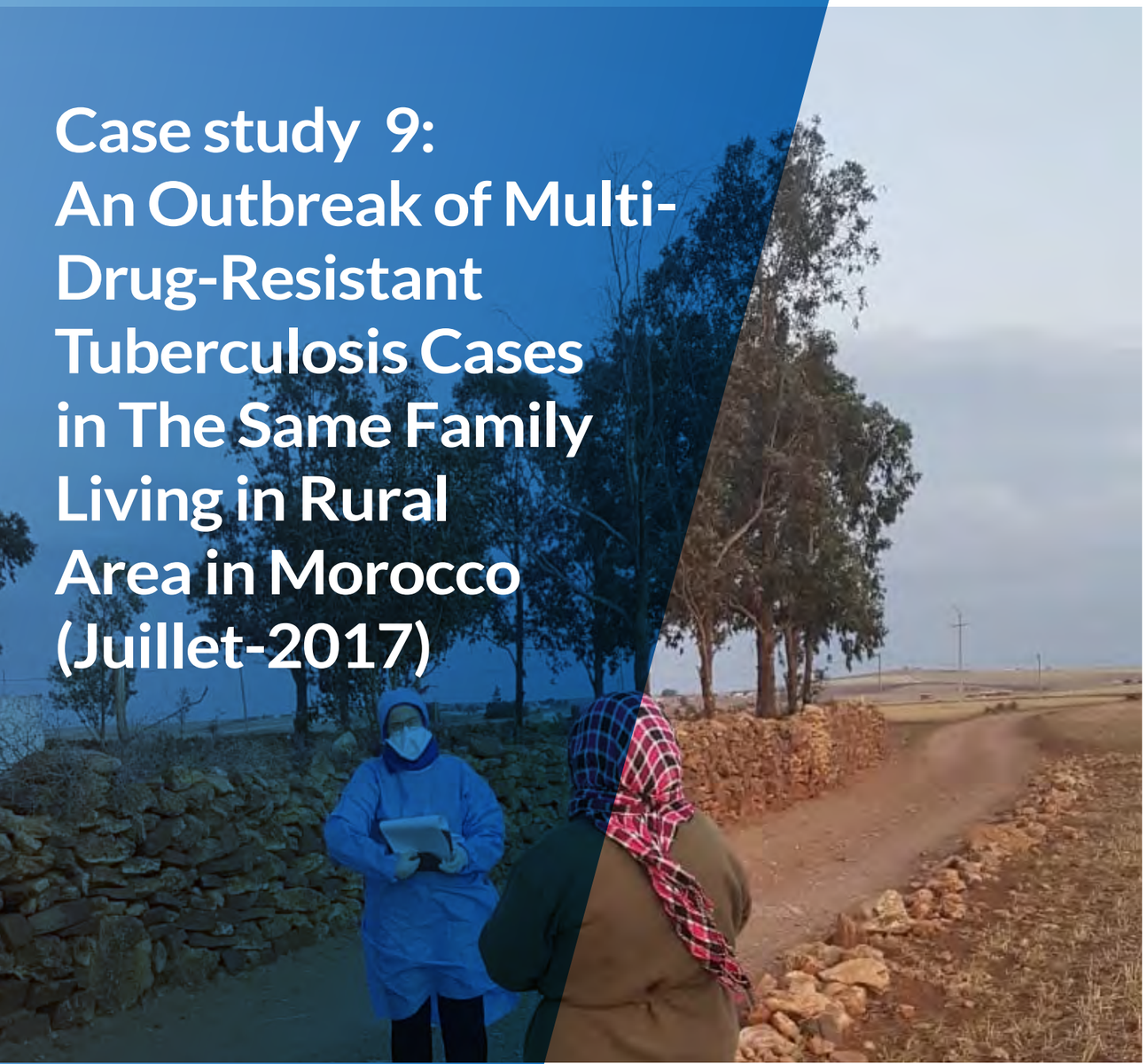
Case study 9: An Outbreak of Multi-Drug-Resistant Tuberculosis Cases in The Same Family Living in Rural Area in Morocco (Juillet-2017)



An Outbreak of Multi-Drug-Resistant Tuberculosis Cases in The Same Family Living in Rural Area in Morocco (Juillet-2017)

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Goal of Case Study

The goal of this case study is to build the capacity of trainees to investigate outbreaks.

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. Redefine the steps of investigation and the specificity of certain situations such as grouped cases
2. Develop a data collection tool and the variables it contains
3. Conduct descriptive analysis of the provided data
4. Discuss the Limits of investigation.
5. Make and Propose the préventives measures, as well as innovative actions to decrease the burden on the healthcare system

Introduction:

According to WHO, tuberculosis is a disease that can be prevented and cured by administering standard treatment for 6 months, however adherence can be difficult, and the disease can spread. So multidrug-resistant tuberculosis is a serious form of tuberculosis due to a bacillus that does not respond to isoniazide and rifampicine[1].

The Multidrug-resistant tuberculosis (MDR-TB) is a public health problem worldwide (450,000 out of a total of 8.6 million TB cases). MDR-TB requires rapid detection and appropriate response, yet each case needs to be investigated around its indexes and has been an obstacle to effective TB control since the 19802. Hence, the fight against tuberculosis in Morocco is considered by the public authorities as a priority health intervention. It has been organized for several decades as part of the National Tuberculosis Control Program (PNLT), which has adopted the Stop TB Strategy to improve and consolidate the achievements of the DOTS Strategy and develop new strategic interventions such as collaborative TB/HIV activities, programmatic management of drug-resistant tuberculosis (PCPTPR), or the practical approach to respiratory health (APSR). Several efforts have been made under this program to consolidate control and surveillance.

The prevalence of MDR-TB remains low, according to a 2014 survey: only 1% in new cases and 8.7% in previously treated cases4. However, this disease remains a concern for public health, since it has several specificities in terms of survey management and screening that are somewhat different from conventional surveys. It is a chronic and communicable disease, whose time between infection and disease (its incubation period) varies greatly from 2 months to 2 years, or up to 50 years, so the identification and management of contacts requires a specialized level of expertise for the diagnosis of MDR-TB cases and the organization of a well-defined and regionally coordinated care channel. In addition, the lack of validated chemoprophylaxis protocol for MDR-TB and usable TB drugs to date, caused the occurrence of some adverse events, particularly in children5.

A study was conducted in one of the four tuberculosis and Respiratory Disease (CDTMR) diagnostic centers in the Rabat-Salé-Zemmour-Zaer region, (Khémisset is a province in this region) that covers a population of about 2,678,000 people and has a population density of 277 inhabitants per km2. The population remains young with an age of less than 30 years (58.6%), 85% of this population is urban and men make up 49.3% of the population8.

Part 1: Story

Following the notification by the medical delegation of the province of Khemisset of grouped cases of MDR-TB from the same community, an investigation was carried out on the 27th and 28th of July, 2017 by the Directorate of Epidemiology (two participants in the public health epidemiology sector of the National School of Public Health FETP-Morocco) in coordination with the Khmisset medical delegation and pulmonologist at the Tuberculosis and Respiratory Diseases Diagnostics Centre.

The aim of this investigation was to:

- Validate the reports and confirm that these are grouped cases,
- Check that the intervention measures already recommended by the National Tuberculosis Control Program have been taken and propose, if necessary, further control measures, to correct the situation at the local level.

Preparatory step to investigate:

Question 1: This event constitutes a public health alert? WHY?

Question 2: What are the steps prior to the implementation of the investigation?

Chronology

Chronologically, the first case of MDR-TB corresponded to a 56-year-old diabetic woman who after two months of treatment for Pulmonary Tuberculosis was diagnosed with MDR-TB in June 2014, she died the same year.

- **In 2015,** the screening revealed the existence of a 5-year-old son and a 52-year-old woman with diabetes with MDR-TB.
- **In 2016,** two more cases developed the disease.
- **In 2017,** three cases of MDR-TB were reported in succession, which led to the start of the investigation.

Part 2: Methods

Before the Survey:

- Background reports of MDR-TB investigations and supervision in the province
- Idea about geographical and epidemiological situation of the area

Epidemiological Survey:

Study Design: This is a descriptive investigation of a series of cases.

Case definition: Prior to 2011, reporting of cases of drug-resistant TB registry mainly concerned suspected cases of drug resistance without confirmation of TDS resistance and classified as chronic TB until 2010.

As of 2011, the case definition was based on the results of phenotypic and genotypic TDS as follows:

- MDR-TB is defined as TB case resistant to both Isoniazide and Rifampicine
- MDR-TB confirmed, based on rapid diagnostic test Xpert MTB-RIF and conventional DST results

Data Collection: The investigation took place during the 27th and 28th of July 2017 from the medical records and via the consultation registry

Study tool: Structured questionnaire

Variables studied: Sociodemographic/Socioeconomic/Clinical

Descriptive analysis: Quantitative variable (the mean or the median) categorical variables (the proportion)

Administrative, legal, and ethical considerations: Favorable Opinion of the person/ Anonymous

Environmental investigation: A home survey with interviews of cases and contacts defined according to the National Tuberculosis Control Program, using a simple questionnaire and standards developed in advance, to verify the response measures taken for case contact topics. This survey

focused on three areas, the number of people living under one roof, ventilation, sunshine, lifestyle, and adherence to treatment.

Question 3. What type of information is needed to conduct an investigation and how to build a questionnaire?

Question 4. What type of information is needed to conduct an investigation and how to build a questionnaire? How should the data be collected and transmitted?

Part 3: Results

A total of eight MDR-TB cases were diagnosed (bacteriologically confirmed) from the same family living in a rural area.

- The male/female ratio was 1; median age was 31 years old.
- All cases had a tuberculosis contagion notion and were seronegative for the acquired immunodeficiency virus
- The first case was a woman 56-year-old, diagnosed in June 2014 (two months after the beginning of pulmonary tuberculosis treatment). She died after a few months. In 2015, two cases were discovered by screening: a 5-year old child and a 52-year old woman. Two and three other cases were reported respectively in 2016 and 2017.
- 7/8 of patients received free treatment.
- 2/8 patients were diabetic
- 2/8 were smokers and 4/8 had a bad observance to anti-tuberculosis treatment.

The home survey allowed us to know about the epidemic determinants of MDR-TB, such as unhealthy habitat, lack of aeration, and insufficient sunshine.

Question 5. What role of this investigation bring to the surveillance program?

Part 4: Discussion

Multi-drug resistant tuberculosis (MDR-TB) is a global threat to TB control efforts, especially in resource-limited countries where sensitivity testing is not routine. The onset of MDR-TB is mainly due to human error, although genetic factors are also believed to contribute to some extent. It is generally suggestive of mismanagement through incomplete treatment that occurs when patients stop taking the prescribed medications regularly or for the time medication needs to eliminate the disease, either because they begin to feel better or are not informed about the risks associated with incomplete treatment by doctors and health service staff who should provide sufficient information, education, and awareness to the patient and those around him in therapeutic success. Another factor is the risk of poor prescription of drugs according to the World Health Organization, 2012.

The analysis of the epidemic curve has found evidence of a common source, the cases are therefore young, which is consistent with the literature where it is recognized that tuberculosis in general affects young people more7,8. The cases were male as well as women with a sex ratio M/F of 1.

Our survey revealed the presence of a child among these clustered cases where the literature shows that childhood tuberculosis is estimated at 10-15% of the total burden, but the burden of MDR-TB in children in developing countries is not proven to be higher10.

According to the WHO, children should be suspected of having MDR-TB if they are in contact with a case of MDR-TB or do not respond to the standard TB regimen.

From the literature and our descriptive analysis some of the sociodemographic and epidemiological characteristics are considered risk determinants and are in favor of TMR of the cases investigated, these determinants can be divided into two categories:

- Certain lifestyle habits (eating from a common dish, close contact, way of salvation), poor adherence, irregularity in the use of medication, history of diabetes, smoking, etc.
- Other parts of the particular conditions that seem some patients more vulnerable to resistance as many persons live under the same roof, vulnerability, ignorance, unsatisfactory hygiene conditions, etc.

This is consistent with the literature that the irregular use of treatment has been the main cause of

resistance in countries, and that the factors promoting resistance in Africa are related to human resources, hygiene, inappropriate diagnosis resulting in overuse of antibiotics, and poor prescription practices[10].

Thus 3/8 patients had a notion of abandonment of TB treatment, which is consistent with other studies that have shown that it is a common cause of therapeutic failure[12,13]. The association between discontinuation of TB treatment and therapeutic failure is found in other studies11,24; Indeed, it is contrary to human nature to take medication for a prolonged period of time when the symptoms of the disease have disappeared, especially if the side effects of treatment are more unpleasant than the disease itself.

Question 6. What hypothesis can we develop through the descriptive analysis concerning the risk factors for multidrug-resistant tuberculosis?

From the literature and our descriptive analysis some of the sociodemographic and epidemiological characteristics are considered risk determinants and are in favor of TMR of the cases investigated, these determinants can be divided into two categories:

- Certain lifestyle habits (eating from a common dish, close contact, way of salvation), poor adherence, irregularity in the use of medication, history of diabetes, smoking, etc.
- Other parts of the particular conditions that seem some patients more vulnerable to resistance as many persons live under the same roof, vulnerability, ignorance, unsatisfactory hygiene conditions, etc.

This is consistent with the literature that the irregular use of treatment has been the main cause of resistance in countries, and that the factors promoting resistance in Africa are related to human resources, hygiene, inappropriate diagnosis resulting in overuse of antibiotics, and poor prescription practices10.

3/8 patients avaient une notion d'abandon du traitement antituberculeux, ce qui est cohérent avec d'autres études qui ont montré qu'il s'agit d'une cause courante d'échec thérapeutique12,13. L'association entre l'arrêt du traitement antituberculeux et l'échec thérapeutique se retrouve dans d'autres études11,24;

Survey limits:

- Difficulty to questioning all contacts.
- Lack of means and time to further investigate (seek witnesses for analysis)
- The particularity of the disease, such as the difficulty of determining the date of onset of symptoms (silent disease).

Public health implications

This investigation has led to the following actions:

- Consolidating efforts for prospective monitoring of MDR-TB cases in the province to detect possible re- colonisation
- Reinforcing information sessions, education, communication for cases and contact
- Strengthening case management (staffing of diagnostic and treatment resources)
- The proposal by the program to establish and generalize a 2-year contact monitoring register for MDR and 5 years for XDR with both clinical and radiological (pulmonary radio) semi-annual monitoring to detect the occurrence of active tuberculosis that is likely multi-resistant and thus avoid the occurrence of secondary cases.
- A concise report has been prepared and addressed to the Director of Management.

Part 5: Conclusion

This study indicates the importance of early alert because a single case of MDR-TB can be a source of an outbreak, and the importance of conducting awareness, education, and information sessions around the cases and their contacts. However, further investigation and research of the determinants of this situation are needed.

Question 7. In your opinion, what is the point of monitoring grouped cases?

Recommendations

- Strengthen the implementation of Information, education, and communication sessions around cases and their contacts.
- Consolidate the efforts for prospective surveillance of TMR cases at the provincial level to detect potential recolonization.
- Establish a register (and use it throughout the country) of contact follow-up for 2 years for MDRs and 5 years for XDRs with a half-yearly follow-up report of both clinical and radiological (pulmonary radiology) reports in order to detect the occurrence of active tuberculosis early, which could presumably be multi-resistant, and thus avoid the occurrence of secondary cases
- Reinforce investments in research for the development of programs and the risk assessment methods
- Decentralize expertise such as microbiological expertise and organized therapeutic advice
- Strengthen screening around a case with regular check-ups every six months for cases and contacts.
- Involve social workers in case investigations
- Introduce acceptable measures in consultation with the patient, family, and community to allow for evaluation and encouragement of good adherence to treatment

In addition:

- Audit all cases of therapeutic failures by the ministry of health.
- Analyze the determinants of TB treatment failure in the RSZZ region by developing epidemiological research
- Identify TB-MR contacts, i.e. family members and people in close contact.
- Equip the laboratories of the prefectures and provinces as well as the provincial hospital with Gene Expert stress tests.

Question 8. If you were tasked with making actions of public health to decrease the burden on the health care system, what are the most important points that you would include in this plan?
Or
What control and prevention measures should be strengthened and taken?

The primary reason for the investigation of the epidemic being to bring the best risk control, the implementation measures to manage the epidemic will have to take into account reactively and regularly the results of the investigation. It is say the importance of the relationship between the team that leads the investigation, risk managers and decision makers and the organization of their institutional interface. The nature of the measures will vary from one epidemic to another and according to the investigation stage. General at the start of the investigation, the measurements will quickly become much more targeted according to the hypotheses and results of the survey.

In our Situation: Are these results effective for A CONDUCT TO HOLD even if the study and description with the environmental survey And the literature review and the surveys made at the level of this region We were able to Effectively Establish a register for the Exhaustive follow-up of all the ontacts And control the implementation of certain preventive measures already recommended by the program (separation of domicile from the family who previously lived together; construction of windows for ventilation ...)

Also the results of the investigation of the epidemic will also be used for the possible updating of prevention recommendations once the current epidemic has been brought under control and may lead to their review, in particular when the survey highlights new risk factors, modes of transmission (Environmental) or new management methods. So insist on carrying out other analytical studies looking for risk factors (an in-depth survey in this region and specifically for this family

Annexes:

Annex 1. MDR Survey

Annex 2. MDR terminology

Annex 3. Table of MDR data

References:

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Figure 1: Map of Lebanon

(Source: Global Engineering Office (http://geo-co.net/contact.php

Case study 10: Health Investigation Following an Outbreak of Highly Pathogenic Avian Influenza A (H5N1) in Poultry in Nabi Chit, Lebanon, 2016

Health Investigation Following an Outbreak of Highly Pathogenic Avian Influenza A (H5N1) in Poultry in Nabi Chit, Lebanon, 2016

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Goal of Case Study:

To develop competencies of investigating and responding to outbreaks based on an outbreak of influenza A (H5N1) among poultry in Nabi Chit village, Lebanon in 2016.

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. Describe the principles of event notification to WHO based on IHR (2005).
2. Recognize the importance of preparedness plans in outbreak investigations.
3. Assess the importance of risk communication during outbreaks.
4. Conclude the importance of multidisciplinary approach in controlling and containing zoonotic disease outbreaks.
5. Develop a follow up form to be used for collecting follow up data.
6. Design a press release to be used during an outbreak.
7. Conduct descriptive analysis of the data using excel software.
8. Estimate the importance of communicating findings during outbreaks.
9. Outline the principles of containment at source and the role of the MOPH in identification of exposed persons, conducting follow up and detecting/investigating cases.
10. Estimate the appropriate control measures needed to contain H5N1 poultry outbreaks
11. Identify the role of the laboratory in outbreak investigation

Introduction

Highly pathogenic avian influenza A(H5N1) is a type of influenza virus that causes a highly infectious, severe respiratory disease in birds. Human infection with H5N1 is rare and results from animal-to-human transmission. Symptoms among humans can range from mild disease to severe respiratory illness with multi-organ disorders. When people do become infected, the mortality rate is about 60%. Transmission to humans is associated with close contact with infected live or dead birds, or H5N1-contaminated environments. [1]

More than 50 countries worldwide have detected the virus in poultry or wild birds. [2] Since 2006, several H5N1 incursions were observed in the Middle East countries. Although the Syrian Arab Republic has not yet reported any case, the Food and Agriculture Organization (FAO) is concerned about H5N1 circulation due to the high poultry production in Syria and the low biosecurity along its borders with Iraq. [3]

Lebanon is a small country (10 452 sq. Km.) on the eastern coast of the Mediterranean and shares large borders with Syria (Figure 1). In 2016, the regular population was estimated to 4 million, in addition of more than 1 million of displaced Syrian population (due to the Syrian crisis). Lebanon is divided into eight governorates which are further subdivided into twenty-six districts. Many public administrations, like the Ministry of Public Health (MOpH) and Ministry of Agriculture (MOA), have offices in the different governorates and districts. Their central administrations are located in the capital, Beirut.

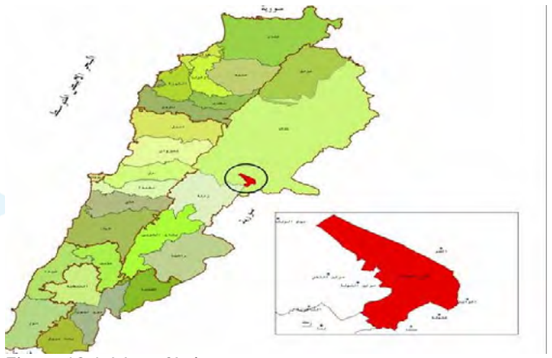

Figure 10.1: Map of Lebanon
Source: Global Engineering Office (http://geo-co.net/contact.php)

Poultry production is the most active livestock sector in Lebanon. [4] Around thirty thousand families in Lebanon rely on this sector - directly or indirectly- to earn their living. The national agriculture survey of 2010 reported the presence of 14421 poultry farms with an annual poultry production exceeding 12 million [5] Lebanon has always been at risk of having H5N1 cases. Since the emergence of H5N1 and based on WHO recommendations, the authorities have started to prepare the national preparedness plan. A first multi-sectoral preparedness plan was developed in 2007 with a containment strategy. The plan focused on how to contain any H5N1 outbreak and ensure good coordination between the different sectors [6] In 2009-2010, the plan was amended in the context of the influenza pandemic A (H1N1) to include the mitigation strategy.

Nabi Chit is a village in Baalbek district located in the Bekaa governorate, with a population of 15000 inhabitants. This village is close to Lebanon's borders with Syria. Nabi Chit residents seek healthcare either in a primary healthcare center located in the village or in hospitals located in nearby villages. In Nabi Chit, there is an important poultry production via poultry farms in addition to many households that raise poultry in their backyards.

Part 1: Story

On the 20th of April 2016, the Ministry of Public Health (MOPH) central office received a call from the Ministry of Agriculture (MOA) about the death of 20000 birds in 2 farms in Nabi Chit due to H5N1. MOA had detected the cases following an alert: the owner of a closed farm notified abnormal mortality among his birds, in Nabi Chit. The MOA team verified and investigated the alert. Field visits and animal sampling were conducted. Laboratory testing at the national reference laboratory of the MOA demonstrated positive PCR result for A(H5N1). This was a first occurrence of A(H5N1) in poultry in a defined zone in Lebanon.

Question 1. Should this event be reported to the World Health Organization (WHO) and International Organization for Epizooties (OIE)? Why? If yes, by whom?

Question 2. What algorithm is used to identify events to be reported to the WHO? Summarize the algorithm.

On the 20th of April 2016 evening, an urgent meeting was held at the MOA central administration, including representatives of the MOPH and other ministries and authorities. At the end of the meeting, the decision was to activate urgently the national preparedness plan with containment at the source strategy. 3 km radius was set as objective area for containment.

Question 3. What are the objectives of having a national preparedness plan?

Question 4. What does it mean the containment at source? What is the mean of 3 km radius?

On the 21st of April 2016, a press conference was held gathering the Minister of Agriculture and the Minister of Public Health. The outbreak was announced. The plan of action of both ministries was explained, based on the activated preparedness plan. A statement was also issued and disseminated by the Ministry of Health about the disease: its symptoms, mode of transmission and preventive measures.

Lebanon on alert as bird flu hits Bekaa Valley

Agriculture Ministry insists plans are in place to prevent full-fledged epidemic

The Daily Star (Lebanon) 22 Apr 2016 By Ghinwa Obeid

BEIRUT: Lebanon faces a deadly outbreak of H5N1 bird flu virus after a number of cases led to the destruction of tens of thousands of chickens Thursday, although the Agriculture Ministry insists plans are in place to prevent full-fledged epidemic.

H5N1 is a highly contagious avian flu that, while not often infecting humans, can be life threatening.

The virus was identified in a number of poultry farms in the Baalbek-Hermel village of Nabi Sheet east of Lebanon, after a regular and urgent inspection carried out by the department, Agriculture Minister Akram Chehayeb told a news conference.

The outbreak was noted after a number of birds died at several farms in the area.

The detection of the outbreaks led to both the agriculture and health ministries putting in place a national plan from 2007 to combat and control the virus.

The best means to combat the virus is destroying chickens and preventing the movement of birds in order to limit the spread. Early treatment for those potentially exposed is also crucial.

"This influenza is transmitted from birds to people and there's a possibility for people in contact with the birds to be affected, even if there are no symptoms," Dr. Walid Ammar, director-general of the Health Ministry, told The Daily Star.

There are, as yet, no recorded human infections from the virus, but Ammar explained that they were anticipating some cases. He also said that the infected birds were likely smuggled into the country.

As a preventive measure, people in affected areas who have had contact with infected birds are being treated, even if they have no symptoms.

"And all those suspected [of having been exposed] will be notified," Ammar added.

He explained that there were three main factors that would put the person on the "suspected" list, those who show signs of influenza, are in the infected area, and have had contact with chickens.

Those who fit the criteria will be examined and immediately receive treatment, even before the results of tests show exposure to the virus.

At the conference, Chehayeb said that the Army had isolated 10 farms and that the birds at these infected farms would be destroyed.

By Thursday evening, the National News Agency reported that 20,000 chickens had already been killed.

Chehayeb added that the cull wasn't taking place haphazardly, but the Environment Ministry was supervising the sanitary disposal of the birds.

The Lebanese Syndicate for Poultry Farmers said that it would commit to the measures needed to prevent the spread of H5N1.

"The affected area was isolated. The infected birds and the birds present within a 3-kilometer radius were slaughtered, even if they weren't affected," a syndicate statement said.

The NNA added that domestic birds belonging to local residents in ad-

Figure 10.2: Daily star news on the 22nd April 2018

Question 5. Explain why a press conference was needed.

Question 6. The MOPH issued a press release. Prepare a press release and identify the content and the main messages.

On the same day, a multi-sectorial meeting was held at Nabi Chit municipality. It was attended by representatives from the Ministry of Agriculture, the Ministry of Public Health, the Ministry of Environment, the Ministry of Interior, the Lebanese Army, the Higher Relief Council, and the local community.

Question 7. What will be the plan of action of the different stakeholders? Answer this question by filling the table below

Stakeholders	Needed activities
Ministry of Agriculture	
Ministry of Health	
Ministry of Environment	
Armed forces (Ministry of Interior, Ministry of Defense)	
Municipality	
Higher Relief Council	

Question 8. Why is it crucial to involve the community?

Part 2: Methods

Starting the 22nd April 2016, the Ministry of Agriculture (MOA) proceeded with culling domestic birds within a 3 km radius of infected farms. Seven farms were targeted, including those infected in addition to 10 households with backyards. MOA and municipality staff were involved in this activity.

On the same day, the Ministry of Public Health team visited the farms to initiate investigation and needed activities. A dedicated team was formed including staff from central, governorate and district level with physicians, epidemiologists, and nurses. You are a member of the team.

You started to identify the exposed persons. The definition used for an exposed person was: any person who was exposed to: a) poultry or their remains or b) environments contaminated by their faeces in the area targeted by the Ministry of Agriculture, regardless of the use of personal protective equipment (PPE).

Question 9. List potential groups of exposed persons.

Question 10. Why do you need to identify exposed persons?

Question 11. What strategies will you use to have an exhaustive list of exposed persons?

On daily basis, coordination between the MOPH and MOA was conducted. At central level, the HQ

of both MOPH and MOA were exchanging information. At governorate level, the field teams from both the MOPH and MOA were also exchanging information.

Question 12. What is needed to establish the coordination? How?

Question 13. What crucial information do you need from MOA on daily basis?

Exposure identification and listing were managed by the MOPH team. The majority of exposed persons were identified by the team in the field.

On the other hand, MOA field teams were involved in stamping out animals and disinfecting farms. They were supported by workers and municipality staff. All had to wear personal protective equipment (PPE) during the field activities. With the advice of the Ministry of Environment, they identified a spot where they disposed the poultry remains safely.

Question 14. For the MOPH, what is the added value of the field visits?

Question 15. There is a medical center in the village. How could you benefit from its presence in the village?

The outbreak is declared in animals. However, there is risk for animal-to-human transmission. There is need to detect any human case. The surveillance system in place includes both indicator-based (IBS) and event-based systems (EBS). The Indicator-Based Surveillance (IBS) is the systematic (regular) collection, monitoring, analysis and interpretation of structured data, i.e. of indicators produced by a number of well-identified, mostly health-based, formal sources [5]

The Event-Based Surveillance (EBS) is defined as the organized collection, monitoring, assessment, and interpretation of mainly unstructured ad hoc information regarding health events or risks, which may represent an acute risk to human health [5]

Question 16. What various strategies will you include to enhance case detection via indicator-based systems?

Question 17. What health care professionals will be your target?

Question 18. What various strategies will you include to enhance case detection via event-based systems?

Once identified, exposed persons were provided with antiviral prophylaxis according to a well-defined protocol. Oseltamivir was orally administered to those above one year of age, up to 10 days after the last documented exposure. The posology was 75mg per day for adults and 35mg per day for children.

On the other hand, monitoring exposed persons is crucial in such situations in order to identify any suspected case. Exposed persons should be monitored for 7 days after the last exposure.

Since it was the first incursion of the disease in Lebanon, a sensitive case definition was used. A suspected case was defined as any exposed person presenting with fever (>38°C) and/or respiratory symptoms (cough, dyspnea, coryza, sore throat) since the 20th of April 2016, living or working in Nabi Chit village.

For any suspected case, a nasopharyngeal swab was collected and sent to the National Influenza Center for PCR testing.

As MOPH was working with limited human resources, it was decided to perform the monitoring through phone calls. You are part of the MOH governorate team who was in charge of monitoring exposed persons.

Question 19. What are needed resources for the follow up?

Question 20. You need to document the follow up. Identify needed variables. Develop the follow up form.

Question 21. How long should the anti-viral prophylaxis be maintained?

Question 22. How long should the follow up be maintained?

Part 3: Results

As a total, 183 exposed persons were identified and followed through daily phone calls for at least 7 days. A total of 41 exposed persons showed symptoms. You will receive an excel sheet (Annex 1) with detailed information about them. Data on age, gender, nationality, type of exposure, date of last exposure, prophylaxis, contact details, symptoms are provided in this sheet.

Question 23. Using the excel sheet data, fill in the table below

Table: Characteristics of suspected cases, H5N1 outbreak among poultry, Lebanon, 2016

Characteristics	Frequency	Percentage
Gender		
Male		
Female		
Age (years)		
Mean (SD)		
Nationality		
Lebanese		
Syrian		
Other		
Type of exposure		
Exposure in farms		
Intervention teams		
Antiviral prophylaxis		
Yes		
No		
Contacted details available		
Yes		
No		
Collected specimens		
Yes		
No		
Laboratory results		
Positive for A(H5N1)		
Negative		

Question 24. Present the suspected cases by age group using adequate graph. You can use the following age groups: 0-9, 10-19, 20-39, 40-59, 60+.

Question 25. Present the suspected cases by gender using adequate graph.

Question 26. Present the suspected cases by symptoms using adequate graph. What will be the numerator and denominator?

For any suspected case, a naso-pharyngeal swab was collected and sent to the National Influenza Center for PCR testing. As a total, 183 exposed persons were identified and followed through daily phone calls for at least 7 days. A total of 40 exposed persons showed symptoms.

Question 27. What needed logistics is needed for specimen collection?

Question 28. Explore places to collect specimens from suspected cases.

Part 4: Discussion

At the MOPH, all data gathered on exposed, follow up and suspected cases was entered in specific application at Nabi Chit medical center and at Bekaa governorate level. The application was built using Epidata with Winglue. It enables offline data entry. On daily basis, zipped files were sent to the central team. During the outbreak period, a daily report was generated by the MOPH and shared with MOPH involved staff and the MOA by email.

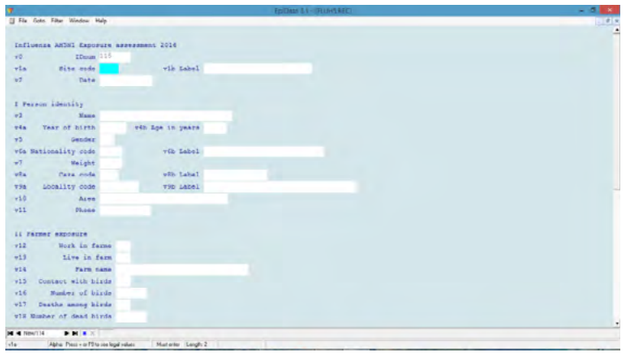

Figure 2: Data entry screen

Figure 3: Daily report

Question 29. What is the added value of using a database?

Question 30. What indicators do you need to monitor?

During such outbreak, it is important to have information, education and communication (IEC) material to be used in various sensitization sessions for healthcare workers and awareness sessions for communities. Awareness sessions for the public are very beneficial in order to involve the community. Since it is the first time the disease is reported in this country, session's material in the local language was not available. However, Egypt is known to have experience with A(H5N1) in poultry and animals.

MOA staff collected also specimens from dead poultry and sent them to a supranational laboratory for subtyping. The isolated virus (clade 2.3.2.1c) was very similar to the one detected between January and March 2015 in wild and domestic birds in Bulgaria, Romania and Turkey [3]

Question 31. You need to develop a brochure within few hours. How shall you proceed?

Question 32. Based on the information provided in the background section, what could be the possible source of incursion?

Part 5: Conclusion

By the 1stofMay, the MOPH succeeded in identifying 185 exposed persons and providing prophylaxis for 97% of them. 183 exposed persons were followed through daily phone calls for at least 7 days. A total of 40 exposed persons showed symptoms. Oropharyngeal swabs were collected from 39 persons either in the field or at the local health center. Collected specimens, tested at to the National Influenza center by real-time polymerase chain reaction (RT-PCR), were all negative for H5N1 virus.

On the MOA side, 80000 domestic birds were culled, all target farms were disinfected and remains were disposed safely. The source was attributed to illegal movement of animals.
On the 10th May 2016, another foci of A(H5N1) was detected in Serine Tahta, neighboring Nabi Chit. A(H5N1) was confirmed. Same activities were implemented in Sereint Tahata as in Nabi Chit. The outbreak was declared resolved on 01/06/2016.

All affected farms by disease and stamping out received compensation from the High Relief Council.

Question 33. Discuss the main reasons behind the successful containment of this outbreak.

Summary of the case, actions taken and recommendations.

The first incursion of influenza A (H5N1) in poultry in Lebanon was reported in 2016.It resulted in the death of 20,000 poultry and the cull of 60,000 poultry. Although 185 persons were exposed, no human cases were identified. The reason behind the successful containment of the foci was the early intervention of the Ministries of Agriculture and Public Health according to a preliminary agreed preparedness plan. What is crucial is to update the plan based on lessons learnt in view of the continuous high risk of new H5N1 incursions.

Annexes:

Annex 1: H5N1 case study table 2

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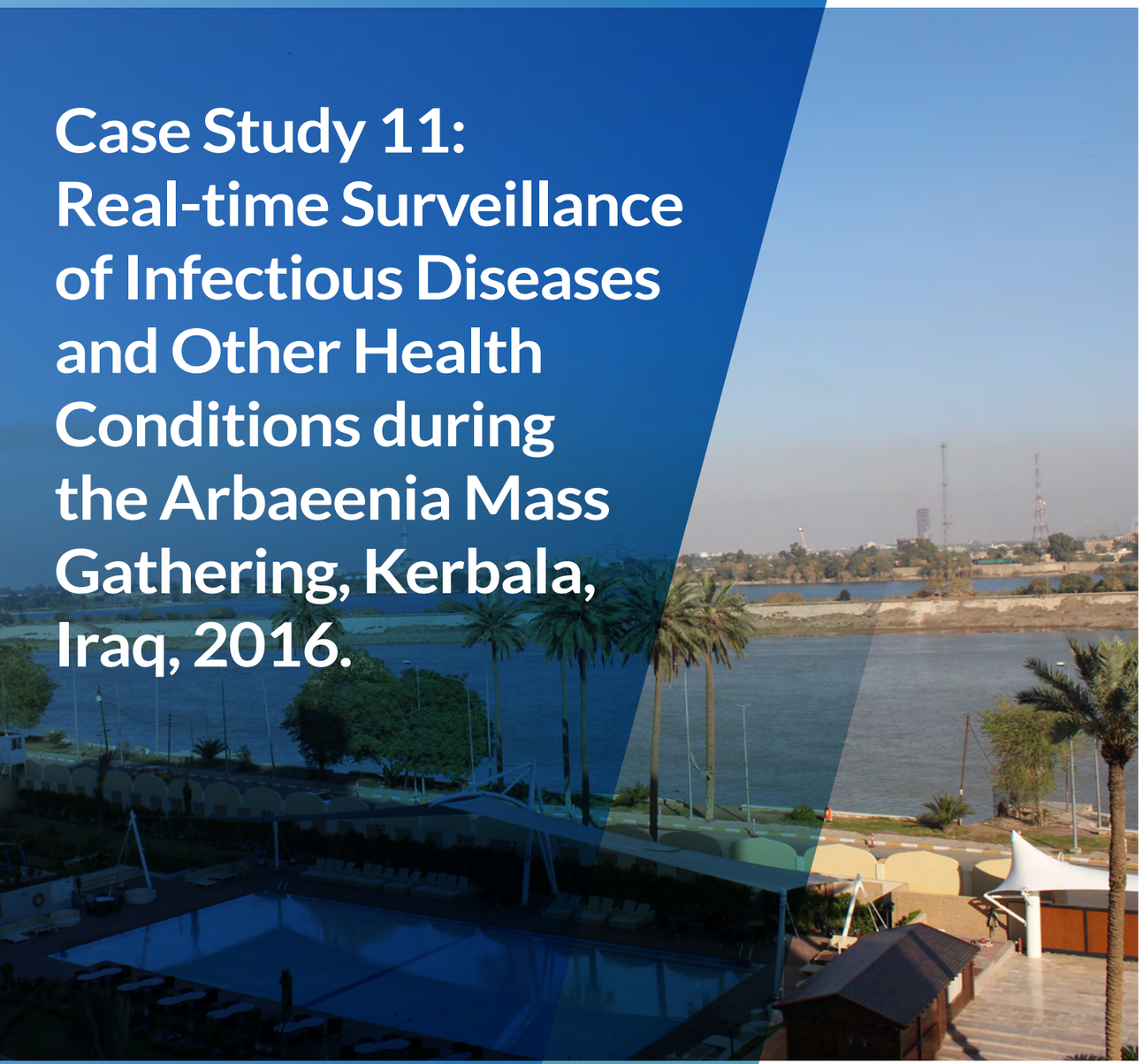
Case Study 11: Real-time Surveillance of Infectious Diseases and Other Health Conditions during the Arbaeenia Mass Gathering, Kerbala, Iraq, 2016.



Real-time Surveillance of Infectious Diseases and Other Health Conditions during the Arbaeenia Mass Gathering, Kerbala, Iraq, 2016.

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Goal of Case Study

The goal of this case study to build the capacity of trainees on how to improve the surveillance systems for infectious diseases and other health conditions during MGs.

Learning Objectives

At the conclusion of the case study, participants will be able to:

1. Develop syndrome surveillance during emergency situations that could take place in MGs.
2. Recognize the importance of real-time surveillance for early detection, analysis, and response during MGs.
3. Identify the most common infectious disease and other health conditions that might be reported during a MG which differ according to the nature of event.
4. Create descriptive analysis from surveillance data organized by time, place, and people.
5. Interpret surveillance data.
6. Suggest recommendations to improve surveillance systems during future MGs.

Introduction:

MGs are frequent events around the world and include religious and sports events, musical festival, and other activities [1,2] Religious MGs are well established in the Arab world such as the Hajj in Saudi Arabia, and Arbaeenia in Iraq. MGs are held throughout the year in Kerbala, Najaf, and Baghdad. [3,4] The remembrance of Imam Hussain ibn Ali is considered the largest MG in Iraq, it occurs annually on the 20th of the lunar month Safar in Kerbala. Kerbala is located 100 km south-east of the capital Baghdad and has a population of approximately 1.2 million inhabitants. The Kerbala health directorate encompasses four districts with three main hospitals in the center of the province, and another three hospitals at the periphery of the city, in addition to 31 primary health care centers. Figure 1 shows the map indicating to the main routes for the pilgrims travelling towards Kerbala annually by walking on feet.

Part 1: The Story

The increasing number of participants who gather annually at the Kerbala governorate each year to attend the Imam Hussain Arbaeenia (20% of which come from abroad) require more than what is available from local resources, especially local health care services and particularly preventive care services. The MG places attendants at risk of contracting air, water, and foodborne communicable diseases as well as sustaining injuries and complications of health problems related to existing chronic diseases due to poor adherence to diet and medication as well as walking for long distance.[5-7]

Figure 1. Map indicating the major routes of travel for attendee of the Arbaenia mass gathering, Kerbala, Iraq, 2016. Source: JMIR Public Health and Surveillance

Health services are provided to participants along their journey to Karbala through temporary mobile clinics provided by the Iraqi health directorates. These clinics provide basic curative care, so health conditions presented at these facilities were not reported in the routine surveillance system. Therefore, the implementation of a syndromic approach for communicable diseases surveillance at these health facilities during MGs was recommended in order to fill in this gap, which is what happened during the 2014 Arbaeenia MG[8]. Nevertheless, the first time that a real-time surveillance system was implemented during MGs was in 2016, however, it was implemented during the past years amongst health facilities present in the internally displaced and migrant's camps as a part of the early warning, alert, and response network.

In Iraq, the national surveillance system is a passive one that collects data on immediate notified diseases, case-based diseases, and aggregated diseases (see Annex).

Part 1 questions:

Question 1. Define public health surveillance, what are the objectives of surveillance during MGs?

Question 2. Define Mass Gatherings, what is the impact of a MG on the host country's health system?

Question 3. Do you think the routine surveillance system in Iraq will work effectively during mass gatherings? Justify your answer.

Case study 11

Part 2: Methods

A total of 20 health care facilities run by the Iraqi Health Ministry are distributed along the Ya-Hussain road which is the main road between the Najaf and Karbala provinces (80 km road and 10 health facilities in each province). The majority of people attending Arbaeenia Imam Hussain passed through this road over a period of 11 days from the 12th to the 22nd of November 2016. For each health facility, three data collectors were assigned to cover services provided 24-hours a day. A structured questionnaire created on the D4 application by the information technology team at EMPHNET and installed on smart devices (tablets) with access to the Internet were able to send data in a real-time manner. These tablets were distributed amongst selected health facilities and the location of each tablet one was determined using GPS (Global Positioning System).

The questionnaire included:

- An ID number assigned for each selected health facility, for each data collector, and for each case,
- Demographic information such as age, gender, nationality, and province of residency for Iraqi patients.
- Patient presented health complaints consisting of symptoms and signs related to acute infectious conditions, chronic conditions, injuries, and other conditions related to walking for long distances such as joint pain and blisters.

Part 2 Questions:

Question 4a. What is the type of surveillance system implemented during this study?

Question 4b. When do you think that this type of surveillance system should be established? Justify your answer.

Question 5. List the signs and symptoms related to acute infectious diseases that might be reported during the MG?

Access to the real-time online collected data was provided to the surveillance supervising team in Kerbala and Najaf governorates, where they were able to monitor data collection in real-time and take any actions in a timely manner. Daily reports were provided to the surveillance section manager in the communicable diseases and control center in Baghdad and the manager of the public health department in Kerbala and Najaf. Microsoft Excel was used for data management and analysis.

Part 3: Results

During the study period, a total of 41,689 patients attended the selected health facilities. You will receive an excel sheet with information related to the patients attending these facilities such as age, gender, nationality, province of residency for Iraqi patients and type of health complaints.

Part 3 questions:

Question 6. Using the data from the excel sheet, fill in the table below regarding the socio-demographic characteristic of patients attending the selected health facilities during Arbaeenia Imam Hussain, Karbala, Iraq, 2016

Table 11.1. Sociodemographic characteristics of patients attending related health facilities.

Variable	Number	Percentage
Age / year		
Mean (SD)		
Gender		
Male		
Female		
Total		
Nationality		
Iraqi		
Iranian		
Bahraini		
Lebanese		
Saudi		
Kuwait		
Pakistani		
Others		
Total		

Question 7a. Calculate the percentages for acute or infectious conditions, chronic conditions, injuries and dermatological conditions amongst all attendee of selected health facilities. Present your findings in a table.

Question 7b. By a suitable graph, show the distribution of acute or infectious conditions among attendee of selected health facilities.

Question 8. Create a suitable graph to display the distribution of patients with acute or infectious conditions over the 11-days study period.

Question 9. Show the distribution of acute or infectious conditions by age group.

Question 10. Present the types and causes of reported injuries using a suitable graph.

Part 4: Discussion

The Arbaeenia MS is considered the biggest religious MG in Iraq that occurs annually in the Kerbala governorate and causes a burden on local health resources.[9] A total of 41,689 patients seeked medical care and presented different health complaints, where more than 58% (n=24,398) had acute or infectious conditions, and two thirds of these patients complained from fever, coughing, or a flu, with a considerable percentage of patients suffering from vomiting and diarrhea (although these infections were expected as a result of overcrowding, but their numbers were still less than expected, which is consistent with a previous study conducted during the 2014 Arbaeenia MG.[8]

More than one third of all patient complaints were related to chronic conditions such as hypertension, hyperglycemia, or heart problems. These finding are consistent with the results of other studies.[7] Since the data was collected and monitored in real-time, the supervising surveillance team was able to watch this data in real-time which enabled them to clarify any clustering of specific cases or outbreaks, and enabled appropriate action to take place accordingly at in a timely manner.

Part 4 Questions

Question 11. How could these findings be used to address the burden of MGs on the public health system in Iraq?

Question 12. Discuss the importance of real-time surveillance.

Question 13. Since the main objective of surveillance is information for action, to whom should this surveillance data be made available?

Part 5: Conclusion

Many health problems are expected to be witnessed during the Arbeenia MG given that overcrowding at MGs increase the risk of transmission of infectious diseases and injuries. Therefore, efforts should be made before and during the event to ensure proper health care services are provided to MG participants in the form of sufficient numbers of medical staff and units supported with essential medical equipment, drugs, and human resources for the management and control of different conditions. Regarding the surveillance system, the implementation of a real-time syndromic surveillance system to monitor presented health problems during the event more efficiently as a part of an alert, early detection, and response measures.

Question 14. Based on the information provided in the introduction and the result sections, what are your recommendations to improve surveillance systems in future MGs in Iraq?

Question 15. What actions should be taken to engage the community in planning for future MGs?

Annexes:

Annex 1: Data real time surveillance MG, IRAQ,2016

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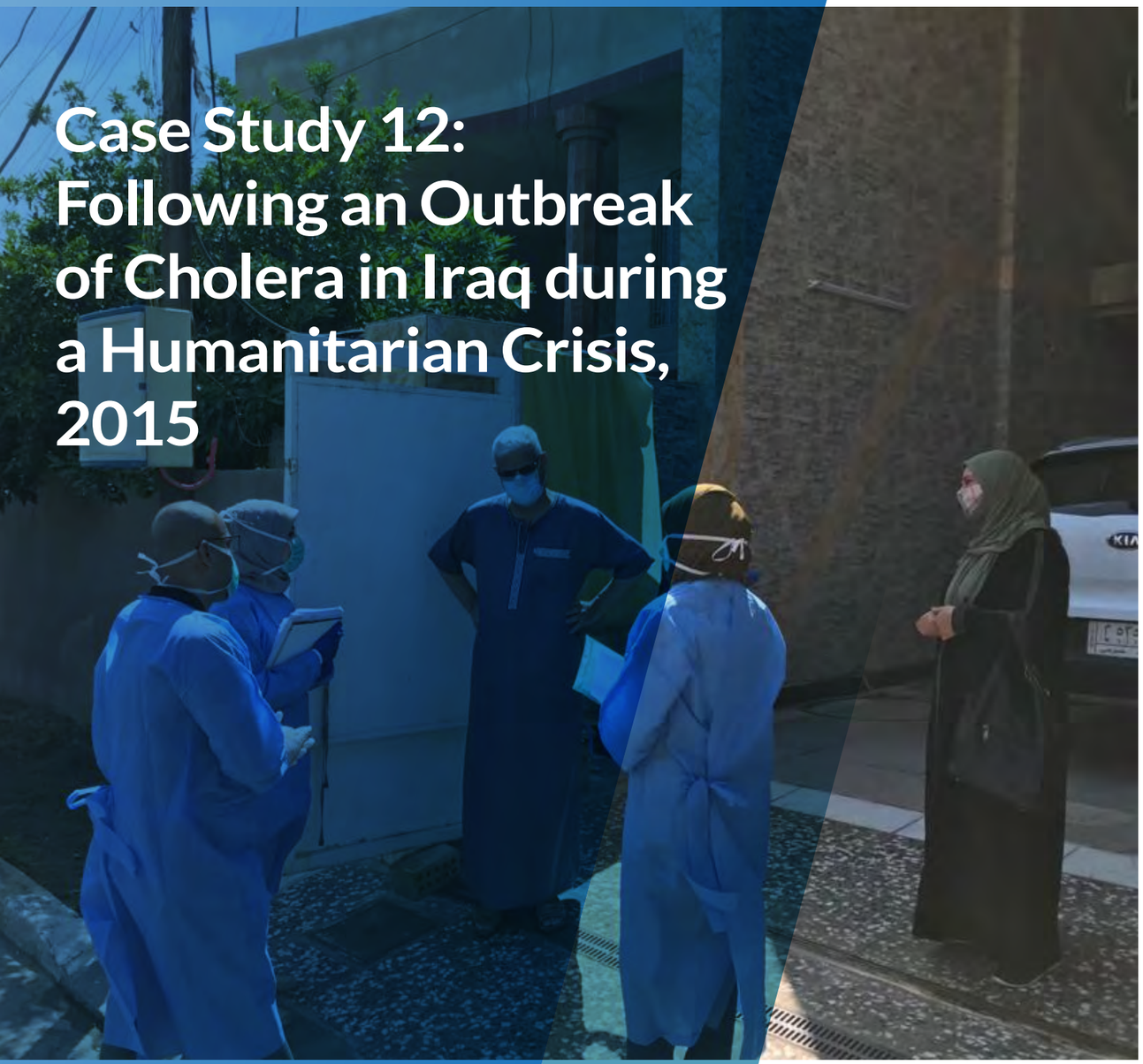

Case Study 12: Following an Outbreak of Cholera in Iraq during a Humanitarian Crisis, 2015

Following an Outbreak of Cholera in Iraq during a Humanitarian Crisis, 2015

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Goal of Case Study

Develop skills to investigate and respond to outbreaks based on cholera outbreakin Iraq, in 2015.

Learning Objectives

At the conclusion of the case study, participants will be able to:

1. Define outbreak, endemic, and epidemic
2. Describe surveillance system.
3. Discuss the WHO / Ministry of health recommended control measures for epidemic.
4. Calculate attack rate and case fatality rate.
5. Compare between affected areas in terms of cases, deaths, socio-demographic characteristics, and districts affected.

Introduction

Cholera is an infectious disease caused by the consumption of contaminated food or water with the bacterium Vibrio cholerae. V. cholera has many subgroups; only two (O1 and O139) of them can lead to outbreaks. Recent cholera outbreaks were all caused by V. cholera O. The availability of safe water and sanitation is vital for controlling transmission of cholera and other waterborne diseases. Several Cholera outbreaks were reported in countries of the Eastern Mediterranean Region (EMR) in the last decade, including Afghanistan, Djibouti, Iraq, Pakistan, Sudan, Somalia and Yemen. Cholera is endemic in Iraq; it was first reported in Basrah, in the year 1820. Over the last 5 decades, Iraq experienced many epidemics all together because of underdevelopment and infrastructure damage as a result of wars and conflicts. In addition to bad sewage system, shortages in the supply of safe water exacerbate several outbreaks in the last decade. [1]

Iraq has 18 provinces, and the Ministry of Health organizes the health authority, which controls all health facilities (public and private sectors) at the central and peripheral levels. It has an estimated total population of 35 million; it has 19 Health Directorates, 135 Health Districts and 1350 Health Surveillance Sites 22 [2].

In Iraq, cholera became an endemic disease, strikes in epidemic form almost every 10 years but with irregular outbreaks. Iraq is facing major disasters caused by the destruction of infrastructure with a shortage of electricity and safe drinking water, particularly in poor districts and refugee camps, which help waterborne diseases, including cholera, to appear. The sewage disposal facilities have also been severely damaged or obstructed. [2]

Figure 12.1: Iraq Map

(/Source: Worldometer (https://www.worldometers.info/maps/iraq-political-map

Part 1: Story

Roughly 3.3 million internally displaced persons (IDPs) were dispersed across Iraq in 2015 as a result of increased violence by an armed anti-government group and subsequent counter-insurgency operations by Iraqi government and coalition forces, and Iraq was hosting more than 20,000 Syrian refugees as a result of ongoing conflict between the government and several opposition groups in Syria. Due to the large number of displaced populations residing in camps, informal settlements, or temporary placement sites (collective centers), the risk of communicable disease epidemics in Iraq is increased. Such sites are generally overcrowded and have inadequate housing provisions and limited access to sanitation facilities, safe drinking water, nutritious food and basic health care services. Such risk factors, coupled with austerity measures and their impact on health services, contributed to cholera transmission in Iraq.

On 30th August 2015, an outbreak was declared by the Iraq Ministry of Health (MoH). On the 15th of September; activation of the Cholera Control and Command Center followed the declaration of outbreak. The outbreak continued to spread rapidly across the country, and by October 2015, a total of 1,656 laboratory-confirmed cases of Vibrio cholerae had been reported from 15 of 18 governorates; 1,000 (representing 60%) of these cases were reported in southern and central governorates of Babylon and Baghdad.

Part 1 Questions:

Question 1. What possible risk factors may be imposed by living in IDP camps?

Question 2. What is the difference between endemic and epidemic?

Question 3. Was the response to the outbreak by forming the Cholera Control and Command Center prompt enough?

Question 4. Should this event be reported to the World Health Organization (WHO) Why? If yes, by whom?

Part 2: Methods

WHO recommended oral cholera vaccines (OCVs) as a complementary method for effective prevention and control of cholera, in addition to the primary intervention of safe water, sanitation and hygiene measures (WaSH). WHO prequalifies three OCVs: Dukoral, Shanchol, and Euvichol. A global OCV stockpile was founded in early 2013, with initial support from several donors, and supported by Gavi, the Vaccine Alliance, for funding support. The stockpile is managed by the International Coordinating Group, which consists of four decision making partners: the International Federation of Red Cross and Red Crescent Societies; Médecins Sans Frontières; the United Nations Children's Fund; and the WHO, which also acts as the Secretariat.

When the 2015 cholera outbreak in Iraq began, the Iraq MoH and implementing partners immediately began preparing a vaccination campaign using the OCV to supplement WASH and other measures to prevent cholera. The 2-dose OCV campaign targeted around 255,000 people who are more than 1 years of age living in identified refugee camps, IDP camps, and community centers due to increased cholera risk due to living conditions. The delivery of 510,000 OCV doses in Iraq has been the largest outbreak and humanitarian response to date from the global OCV stockpile. As part of the required monitoring and assessment activities for these deployments, the MoH asked partners to conduct a vaccination coverage survey to determine vaccine compliance, awareness of OCV programs, explanations for vaccine acceptance or non-acceptance and any adverse events reported after the campaign.

Part 2 Questions:

Question 5. What role do you think the laboratory plays in this scenario? Should we collect samples for testing?

Question 6. What are your recommendations for sample collection, transportation, and testing?

Question 7. The team leader asked you to revise the WHO recommendations, what are the immediate measures you would recommend?

Question 8. What is importance of conducting a vaccination coverage survey?

Part 3: Results

In the year 2015, Iraq faced an epidemic of cholera that began during the third week-on September-through all its governorates. The total number of admitted cholera cases confirmed by the laboratory till 6/11/2015 is 2651 cases, and only two reported deaths.

The deaths were one male from Baghdad and one female from Babylon; their age was fifty years and thirty years respectively; they died due to irreversible circulatory collapse and renal failure due to delay in reaching the hospital. By November 6, 2015, a total number of 2651 were identified as confirmed cholera cases

The number of cases was estimated to be 1691 to the eleventh of October 2015, added to it through the MoH's official daily report, and the addition of confirmed cases of 960 cases of cholera to raise the total to 2651 confirmed cases by November 6, 2015.

Part 3 Questions:

Question 9. What is the definition of an outbreak?

Question 10. How many confirmed cholera cases are required for the County Director of Health (CDH) to declare the existence of a cholera outbreak?

Question 11. What kind of preparations do you think the investigation team should undertake before heading out to the field? Provide answer in terms of scientific and administrative activities.

Question 12. Summarize the steps of an outbreak investigation.

Part 4: Discussion

All data were obtained using application Survey123. It has been installed on electronic tablets to track survey teams in real-time data entry and global positioning system (GPS). During this humanitarian crisis, data was entered electronically, and the survey teams were tracked using GPS to control the spatial pattern of selected households and data quality. Within each household, all persons

in each of three age groups (1–4 years, 5–14 years, and >15 years of age) were interviewed.
In a humanitarian emergency the aim of vaccination is to efficiently reduce the risk of disease to protect a population during periods of extreme vulnerability. Due to massive population movements and overcrowding, the risk of cholera epidemics among displaced populations may be increased. Furthermore, the lack of access to clean water, proper sanitation and shelter are also associated risk factors for cholera epidemics. OCV use has been recommended by the World Health Assembly (WHA) and WHO in the sense of a humanitarian emergency to minimize morbidity and cholera mortality. Also, because of the global rise in cholera incidence, the WHA called for an integrated and comprehensive approach to cholera prevention in 2011. It included rapid provision of safe water, effective case management at health facilities, enhanced case detection through early warning surveillance and laboratory confirmation, and cholera vaccination.

Part 4 Questions:

Question 13. What is a case definition?

Question 14. What is the difference between active surveillance and passive surveillance?

Question 15. What type of surveillance would be most appropriate for use during the cholera outbreak? Why?

Question 16. Suggest suspected, probable, and confirmed case definitions for a cholera case for use in this investigation.

Question 17. Where would you suggest that the team look for additional cases?

Part 5: Conclusion

Iraq's government launched the first round of the oral cholera vaccine program with help from WHO and UNICEF. The program resulted in 229,000 refugees and internally displaced persons (IDPs) being vaccinated across 62 camps in 13 governorates. There were no concerns regarding the vaccine. In the first week of December, the second round of vaccinations will began to complete the recommended dosing regimen and optimize clinical protection in the target population. Moreover, Oral cholera vaccination should be part of a comprehensive and integrated program that also includes clean water, better sanitation and hygiene to ensure maximum protection against cholera and other diarrheal diseases.

Part 5 Questions:

Question 18. Based on the preliminary findings above, what control and prevention measures do you think the investigating team should recommend?

Question 19. What actions would you take to engage the community while implementing prevention and control measures?

Question 20. As a member of the team, what forum/channels would you use to share findings with all the relevant partners?

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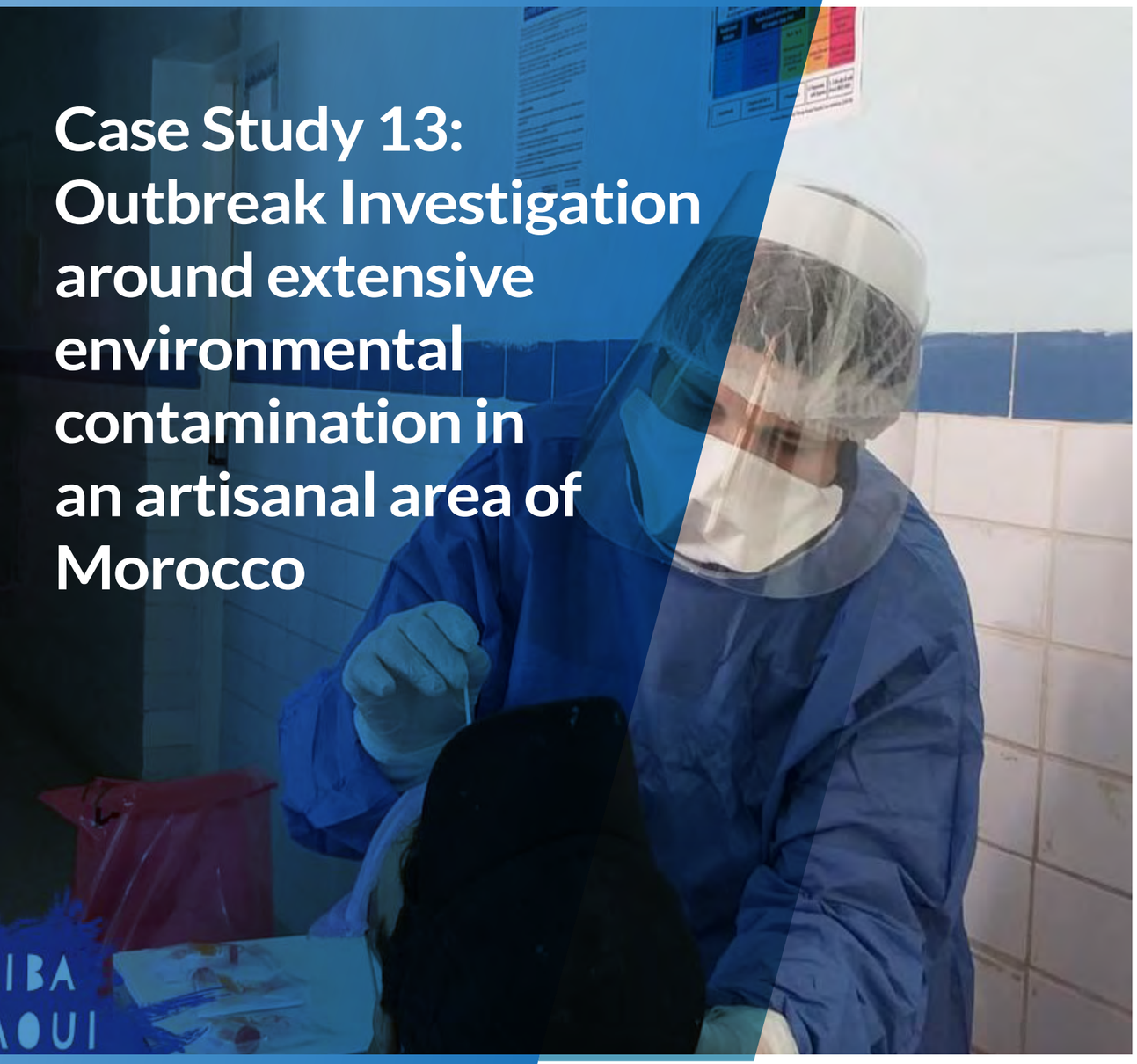
Case Study 13: Outbreak Investigation around extensive environmental contamination in an artisanal area of Morocco



Outbreak Investigation around extensive environmental contamination in an artisanal area of Morocco

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Goal of the case-study:

The goal of this case study is to equip trainees with skills to conduct an outbreak investigation on extensive lead environmental contamination.

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. Explain the details of how to verify the diagnosis and establish the existence of an outbreak.
2. Describe the steps in an outbreak investigation and prioritize actions to be undertaken.
3. Understand the process of resource mobilisation and coordination.
4. Conduct descriptive analysis.
5. Choose a suitable analytic study design for an outbreak investigation.
6. Recommend evidence-based control measures.
7. Describe the types of communications and their targeted stakeholders

Introduction

The artisanal area is located in the capital of artisanal and industrial activities city, located at the central northern region of Morocco. Since the 1970s, the artisanal place was implanted in the old medina; it employs approximately 250 craftsmen (potters and tanners), and it is an essential catalyst for social and economic development of the region.

Pollution is a threat to health, especially for children who live in the surrounding communities of artisanal and industrial sites, such as mineral smelters and refineries. They are exposed to heavy metals through inhalation and ingestion of contaminated soil and dust. In addition, the new habitats agglomerations are located around the industrial site. The releases from this site cause environmental pollution exposing citizens to the risk of lead exposure.

The World Health Organization (WHO) estimates that lead poisoning causes 0.6 % of the global burden of disease and contributes to approximately 600,000 cases of intellectual disability in children annually. [1] In Morocco, there is no lead poisoning surveillance system. However, Poison Control Centre, 24-hour resource for poison information and educational resources, generate useful data for identifying emerging problems or new populations at risk of disease and investigating outbreaks or clusters of diseases.

Figure 13.1. Toxic emissions in an artisanal area of Morocco

Questions

Question 1. What are the health effects of lead poisoning?

Question 2. What are the sources and routes of lead exposure?

Part 1: Story

On May 30, 2014, the Poisona call from the Fez Children's Hospital (FCH) concerning a 3-year-old male child who ingested a week previously a stick pile. The child had oral ulcerations, for which a general practitioner from the private sector prescribed symptomatic treatment. Faced with the persistence of ulcerations and worsening of the child's condition, the treating doctor sent him to RCH for generalized care. The RCH doctor contacted the CAPM for clinical orientations. The interrogation of the calling physician, first general practitioner consulted, and the child's mother revealed that the child had Pica syndrome. The child was from Ain Nokbi located in the Industrial Region of Fez. He lived in a house where the paint was peeled off. For these purposes, the MPCC doctors made a provisional diagnosis of lead poisoning. He requested for determination of heavy metals level in blood simples on June 1, 2014. Diagnostic tests of this symptomatic child revealed blood lead level (BLL) of 134 µg/ l and hemoglobin level of 9 g / l. The Centers for Disease Control and Prevention (CDC) recommended threshold for public health action if blood lead in children is 50µg/l.

Part 1 Questions

Question 3. As an epidemiological Officer, do you think it is necessary to notify this case? If yes, to whom?

Question 4. Do you think it is necessary to investigate around this case? Justify.

Question 5. What would you suggest as the objectives of the investigation?

Following this case, the MPCC physician officially requested assistance from the Morocco Field Epidemiology Training Program (M-FETP) and National Institute of Health to discuss which tasks are appropriate next steps. The team was mobilized to collect additional information about the source of contamination of this child in order to determine if ingestion of pile was the only source of contamination of this child or there were other cumulative sources.

Question 6. Before going to the field, what preparations and decisions should be made regarding:

- Team composition, role, responsibilities
- Epidemiologic / scientific aspects of the investigation
- Supplies and equipment
- Administrative issues

Question 7. As an Epidemiological Officer, what are you going to do? describe the steps you will follow.

Question 8. To verify the diagnosis and determine the presence of an outbreak, do you need additional information?

Question 9. What role do you think the laboratory plays in this scenario? What samples should be collected for testing?

Part 2: Methods

As part of the epidemiological investigation, the team conducted a population survey by door-to door visits in the neighboring of YAN habitation. YAN's family lived on the first floor of a house near a factory with toxic emissions. During visit, the painting of the walls was black, and the windowpanes were covered with black dust. On the ground floor lived another family of 2 adults and 3 children aged 3, 5 and 15 years. The house was poorly ventilated.

The clinical information collected from inhabitants revealed that two children have shortness of breath and difficulty walking. The technician from National Institute of Hygiene conducted laboratory investigations. He collected venous blood samples from all inhabitants to measure lead levels.

The technician from the Ministry of environment collected soil samples from areas where children played and tap water to determine levels of household contamination. He also collected vegetables from the YAN family that they bought from the local market and which are irrigated by wastewater from the industrial zone.

The blood and environmental samples taken during this investigation were analyzed respectively in toxicology laboratory of the MPCC and in the Ministry of environment. The results of the blood and environmental samples are reported in Tables 1 and 2. Senior MOH officials asked the investigators to report what they had learned so far and what were their current hypotheses about the cause of the outbreak.

Table 13.1. Blood lead levels related to the investigation of lead poisoning in the industrial area - Morocco, 2014.

Individuals	Members	Age (year)	Blood lead
Famille de YAN	Maman WR	-	86.94 µg/l
	Fille AK	9	71.24 µg/l
	Fille MK	17	75.00 µg/l
Voisins de la Famille YAN	Maman NA	34	82.44 µg/l
	Fils SF	15	93.00 µg/l
Famille qui s'approvisionne en eau de puits	Maman FB	28	77.75 µg/l
	Fils MB	6	87.13 µg/l
	Neveu MB	10	60.90 µg/l
Ouvriers de l'usine	Ouvrier MN	44	62.00µg/l
	Ouvrier AA	44	58.98 µg/l
	OuvrierMNa	42	71.80 µg/l
	Ouvrier KA	51	44.04 µg/l

Table 13.2: Lead concentration in environmental samples of industrial Area-Morocco 2014.

Nature of sample	Lead concentration
Wastewater discharge	<3 µg/l
Well water	<3 µg/l

Part 2 Questions

Question 10. Would you say that an outbreak exists?

Question 11. Based on these findings, what is the working hypothesis on the source of contamination?

Part 3. Results

The identification of source of contamination has encountered several limitations:

- The main source of lead contamination has not been identified for cases of infant lead poisoning detected
- The dust samples deposited on the terraces of houses and collected vegetables were not analyzed by the LNESP while the results could tell us about soil contamination

To face this situation, your supervisor wanted you to conduct a quick study to determine the extent of the problem and identify possible factors associated with high lead level concentration in this exposed population.

Part 3 Questions

Question 12. What type of study would you propose? Why?

Question 13. The investigators decided to carry out a retrospective cohort study, what would be the population under study?

Question 14. What clinical and epidemiological information might be helpful in determining the etiologic agent(s)?

The investigators decided to carry out a retrospective cohort study. It was meant to determine blood lead levels in children considered to be an exposed population who live in the industrial area compared with blood lead levels of children of other areas of the same city considered to be unexposed.

Question 15. What are the study outcomes?

Question 16. What are the samples to be analyzed during the environmental investigation? Why?

Part 4: Analytic epidemiology study results:

After summarizing the results of the descriptive epidemiology, the investigators formulated their hypothesis, and conducted a retrospective cohort study between January 2014 and April 2015 to test their hypothesis. This study was performed on 120 children (exposed and unexposed) whose ages ranged from 6 months to 12 years. It was meant to determine blood lead levels in children considered to be an exposed population [EP (N = 60)] who live in the industrial area compared with blood lead levels of children of other areas of the same city considered to be unexposed [UP (N = 60)]. The EP children were recruited at the health center located in the area at risk and UP children at the Fez University Hospital. They were selected in a random manner during pediatric consultation and based on the address of their habitat. Exclusion criteria included severe diseases that involve vital prognosis or antecedent of recent blood transfusion. Parents or guardians of each participating child were asked to complete a sociodemographic questionnaire including age, parental occupation, smoking, type of housing, type of water consumption, use of kohl, and use of lead-based utensils.

Five milligrams of venous blood sample were collected from each child in trace-metal free ethylene diamine tetra acetic acid-vacutainer tubes at the time of recruitment in the health center and in the hospital university. When collecting the samples, precautionary measures were taken to exclude the possibility of sample contamination from lead on the skin.

According to the classification given by the Centers of Disease Control and Prevention (CDC 2005), children of our study were classified in accordance with their BLL as follows: class I = BLL<100 µg/L; class IIa = BLL 100 to <149 µg/L; and class IIb = BLL 150 to <249 µg/L).
As a complement to the study, water samples were taken after one-night stagnation from the households of the children with BLLs >100 lg/L. This allowed evaluation of the maximum exposure to lead from drinking water. The water samples were collected in precleaned polyethylene bottles. The determination of lead in the air was not performed due to the lack of technical means to do so. The FETP residents, part of team investigation entered all information into Microsoft Excel "LeadCohortData" (Annex 1) and performed Statistical analysis using Epiinfo Version 7 software.

Part 4 Questions

Question 17. Use data in the "LeadCohortData" tab to describe exposed and unexposed population and evaluate whether the exposed and unexposed are similar for the other criteria (complete table 13.3)

Table 13.3. Form to describe exposed and unexposed population

Charactaristics	Exposed		Unexposed		P
	N=60	%	N=60	%	
Classes by age (year)					
0-5					
6-12					
Sex					
Male					
Female					
Pica					
Yes					
No					
Parents function at risk					
Yes					
No					
Passive Smoke inhalation					
Yes					
No					
Use of kohl (mothers and/or children)					
Consumption of tap water					

Question 18. Describe the distribution of BLL in exposed and unexposed children under 12 years.

Question 19. Compare the Means of BLLs in exposed and unexposed.

Table 4: calculation of mean and standard deviation for both exposed and unexposed

BLLs (µg/L)				
	N	Mean	SD	p
Exposed	60			
Unexposed	60			

Question 20. Is there any association between exposition (living in industrial area) and BLL?

Question 21. Use MS-Excel or EPI INFO 7 to calculate and interpret RR

Question 22. Which other analysis do you need to perform?

Part 5: Discussion

Sitting in a small, nice room in Poison control Centre office, the team members discussed their current analytic epidemiology study results. They agreed in this step on three decisions:

1. Only children with BLL C100 lg/L will benefit from a clinical examination which will be performed by a group of medical specialists (neurologists, pediatricians, pediatric endocrinologists, and toxicologists), biological tests (complete blood count, renal and hepatic function, and determination of iron, calcium, and magnesium), and medical follow-up.
2. Parents of participants will also be invited to attend awareness sessions concerning the hygiene advice to follow to decrease lead exposure.
3. BLL control as well as clinical and biological examinations will be performed 9 months after the first screening to check the evolution of exposure in children who had BLLs C100 lg/L.

Part 5 Questions

Question 23. Do you agree with this decision to include only children with BLL>100 lg/L? Why or why not?

Question 24. Based on these findings above, what was the control and prevention measure that decrease the BLL?

Part 6: Conclusion

After summarizing their findings using descriptive epidemiology and analytic epidemiology study results, the investigating team observed a high prevalence of BLLs >100 µg/L (31.7%) in the exposed population. The average BLLs in EP (86.4 ± 40.6µg/L) children was significantly

Part 6 Questions

Question 25. How should the findings be communicated? Who is the target audience?

Summary of the case, actions taken and recommendations

In the case of the YAN child, the discovery of elevated BLL was fortuitous. Indeed, it is the MPCC who suspected the Pica syndrome in the child following the ingestion of the battery stick and he recommended the achievement of blood lead levels which proved to be very high. Our health professionals are not sufficiently aware of the symptoms related to lead poisoning. Neither the private doctor who consults YAN after ingesting the baton battery nor The CHU doctor asked the family to perform a heavy metals test. We could have missed out on the diagnosis if the MPCC doctor had not suspected Pica's syndrome.

The investigations detected high blood lead levels, exceeding the rapid intervention threshold, in all children living in Ain Nokbi. Lead poisoning is most often silent. Clinical signs may occur, but they are not specific: vague digestive disorders (anorexia, recurrent abdominal pain, constipation, vomiting), behavioral disorders (apathy or irritability, hyperactivity), attention and sleep disorders, poor development psychomotor, pallor in connection with anemia. The diagnosis of lead poisoning can only be made by a blood lead test.

This investigation also revealed the absence of a national strategy for the fight against infantile lead poisoning and other extensive environmental contamination.

We recommend a wide awareness campaign to change dietary and hygiene behaviors at home level. Also, a screening must be implanted to detect cases of childhood lead poisoning. This screening will target children who have the above-mentioned risk factors for lead exposure to be tested for blood lead. The relocation of the industrial site associated with corrective and preventive measures will help to decrease exposure as well as decrease the prevalence of BLLs C100 µg/L

In the follow-up of these children (19 cases), BLL monitoring and biological and clinical examinations were performed 9 months after the first screening and showed the results in Table 13.7.

BLL groups and problems	At the time of screening		After 9 months	
	No.	%	No.	%
BLL group				
Class I (BLL ≤100 µg/L)	0	0	12	63.2
Class II a (100≤ BLL ≤149 µg/L)	6	31.5	7	36.8
Class II b (BLL 150 to ≤249 µg/L)	13	68.5	0	0
Clinical and biological perturbations				
Clinical signs				
Neurological disorders	25	54.34	21	45.65
Gastrointestinal disorders	9	90	1	10
Locomotor disorders	6	54.54	5	45.45
Other signs	16	53.33	14	46.66
Biological signs				
Anemia	7	77.77	2	22.22
Hypocalcemia	8	72.72	3	27.27
Iron deficiency	4	66.66	2	33.33
Magnesium deficiency	18	51.42	17	48.57

BLLs blood lead levels

Table 13.7: Monitoring clinical, biological, and toxicological problems presented by children with BLLs 100µg/L (N=19)

Annexes:

Annex 1: Case study line list.

References

1. World Health Organization (2010b). Exposure to lead: a major public health concern. WHO, Geneva, Switzerland. http://www.who.int/ipcs/features/lead.pdf.

Case Study Related Readings

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Part II
Case studies in Surveillance

Case Study 14: Evaluation of Influenza Sentinel Surveillance System, Saudi Arabia, 2017-2018

Evaluation of Influenza Sentinel Surveillance System, Saudi Arabia, 2017-2018

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Goal of Case Study

To build capacity of trainees in the processes of public health surveillance evaluation and to develop essential trainee's competencies in surveillance programs evaluation.

Learning Objectives

At the conclusion of the case study, participants will be able to:

1. Discuss sentinel surveillance system, such as features, advantages, and disadvantages.
2. Describe the purpose and operation of sentinel surveillance for influenza.
3. Identify steps followed for evaluating surveillance systems.
4. Identify how to assess usefulness of a surveillance system.
5. Enumerate and define attributes for assessing surveillance system performance.
6. Develop a scoring system and calculate scores of system attributes.
7. Evaluate and interpret the results of evaluation process.
8. Draw a line graph, using MS-Excel to show disease (influenza) seasonality.
9. Outline the template for an evaluation report.

Introduction

The Kingdom of Saudi Arabia (KSA) occupies about four-fifths of the Arabian Peninsula with a land area of 2.15 million square kilometers of arid desert, lowland, and mountains. The country shares boundaries with eight countries (Figure 1) and is the heart of the Islamic world where it is occasionally referred to as "the Land of the Two Holy Mosques" since it hosts the two holiest Islamic places: Makkah and Al-Medina.

The total estimated population of KSA in 2017 was 32.94 million people who, according to official Saudi figures, are mostly urbanized and young []. Since it is the largest oil exporter in the world, the Kingdom has the largest economy of the region. The climate is predominantly hot with regional variation. Administratively the Kingdom is divided into 13 regions (Emarah) and 20 health regions. The Ministry of Health (MOH) runs public health services and manages factors influencing local health that include pilgrims coming from endemic countries during seasons of Hajj and Umra, environmental factors, the presence of non-immunized people, and frequent population movements to and from other countries. Infectious diseases prevention and control programs are implemented through units in each health region and supported by an efficient national surveillance system for communicable diseases. The surveillance system is implemented through two arms: general (integrated) surveillance for infectious diseases, and a number of disease-specific surveillance systems. The MOH introduced free influenza immunization as a response to the 2009 H1N1 pandemic, later on, the MOH recognized the importance of building a national influenza control program as a vertical program with a core unit and a surveillance unit.

Figure 14.1: Map of Administrative Regions of the Kingdom of Saudi Arabia, Showing Cities with Influenza Surveillance Sites

Part 1: Story

Influenza is a very contagious viral disease that causes a range of clinical symptoms varying from a common cold to severe respiratory illness which sometimes could be fatal. Due to the significance of influenza, the World Health Organization (WHO) recommends the use of two terms as case definitions: Influenza Like Illness (ILI) and Severe Acute Respiratory Illness (SARI). [2] In 2017, following other countries, the KSA joined the Eastern Mediterranean Flu Network (EMFLU), which is a regional platform for sharing epidemiological and virologic data on influenza in the WHO Eastern Mediterranean Region. [3] EMFLU provides direct data entry at the country level using a web-based interface. The platform also provides quantitative and qualitative data on trend, spread, intensity, and impact of influenza. The platform is intended to provide useful information for informed decision-making regarding influenza prevention and control strategies.

On February 3rd, 2019, the National Influenza Surveillance Program in Saudi Arabia (ISSA) requested from our FETP to conduct an evaluation of their program. The ISSA, which was launched in January of 2017, had entered its third year, and wanted to fulfil the WHO's recommendation that "influenza surveillance systems should be evaluated periodically, starting 1 to 2 years after their implementation". [2]

The FETP willingly accepted to carry out the request and formulated an evaluation team. You and some of your colleagues were nominated as members of this team and started by drafting the proposal for the evaluation.

Part 1 Questions

Question 1. Briefly state what the objectives of Influenza Surveillance System should be.

Question 2. To build an influenza surveillance system, you have the choice between using a population-based or a sentinel system. What do these terms mean? Which one will you choose and why?

Question 3. To evaluate such a surveillance system, what would be the steps or components of the evaluation process? Mention any the guidelines you are referring to.

Question 4. Based on the above-provided information, what might be the sources of data used to conduct the evaluation?

Part 2: Methods

Based on their approved proposal, the team started with identifying stakeholders, meeting with them, and collecting provisional information about how the program is organized and running. The system is based on collecting data from 50 purposely selected sites distributed all over the 20 health regions as was shown previously in the map of KSA) Figure 1). Each region has two hospital sites for SARI cases and one primary health center (PHC) for ILI cases. According to a pre-stated protocol, nasopharyngeal swaps are collected from a selected number of ILI and SARI cases and sent to specified laboratories for further testing. Reporting sites forward their weekly reports to the regional coordinator for monitoring and review in addition to adding virological results from laboratories. Regional coordinators then send the information to the national level for compilation and later entered into the EMFLU's website. [3]

Nada, a member of the team, was assigned to draft a description of the surveillance system (ISSA) as part of the evaluation process. Available epidemiological data on influenza cases was retrieved from the EMFLU system into an MS-Excel spreadsheet (Annex 1. File 1). Your colleague Ahmed, who is another team member, was assigned to list data variables from File 1 and carry out the necessary descriptive analysis. Further information on other aspects were identified and collected using a structured questionnaire from all staff members working in the system. The data was stored in another MS-Excel file (Annex 2, File 2). The team also collected copies of the periodical reports produced by the unit and reviewed them.
You were assigned to work with this data set.

Part 2 Questions

Question 5. The team started out by identifying stakeholders. Who are the stakeholders in this situation? What is the purpose and importance of meeting with them and engaging them at this very early stage?

Question 6. Laboratory specimens were taken from selected cases at each center. How can these cases be selected to minimize selection bias?

Question 7. Nada, who is working on describing the ISSA system, requested help. What items/headings should be included in her report?

Question 8. The dataset with Ahmed comprises the epidemiological data on cases (ILI and SARI). What variables do you expect to find for each category from ILI and SARI?

Part 3: Results

By mid-March, the evaluation team had worked on analysis of collected data. The first part of results regarding description of the system needed an organizational chart. [4]

Part 3 Questions

Question 9. Using the description provided in the previous sections (Part 2), draw a simplified flow chart for the Saudi Influenza Surveillance System.

Ahmed generated the following tables and requested further improvement of his tables in order to simplify their descriptive interpretation. Below is Table 1 which summarizes some characteristics of the SARI cases extracted from EMFLU. Table 2 shows the distribution of ILI cases by month. [5]

Table 14.1: Characteristics of Reported SARI Cases, EMFLU, Saudi Arabia, 2017 - 2018

Characteristic	2017	2018	Total
Total number of cases	2,720	7,881	10,601
Age Group			
Less than 2 yrs	272	1,251	1,523
From 2 to 5 yrs	121	537	658
From 6 to 15 yrs	162	525	687
From 16 to 50 yrs	860	2,393	3,253
From 51 to 65 yrs	583	1,221	1,804
Greater than 65 yrs	722	1,954	2,676
Gender			
Female	1,263	3,376	4,639
Male	1,457	4,505	5,962
Season			
Quarter 1	492	2,023	2,515
Quarter 2	527	1,765	2,292
Quarter 3	485	1,346	1,831
Quarter 4	1,216	2,747	3,963

Table 14.2: Monthly Reported ILI cases, EMFLU, Saudi Arabia, 2017 - 2018

Month	2017	2018	Total
Jan	47	38	85
Feb	77	113	190
Mar	39	101	140
Apr	23	52	75
May	3	22	25
Jun	1	18	19
Jul	1	44	45
Aug	5	28	33
Sep	23	92	115
Oct	68	78	146
Nov	54	118	172
Dec	72	134	206
Total	413	838	1251

Question 10. Add necessary columns and/or calculations to Table 1 and then describe the findings in a short paragraph.

Question 11. Choose a suitable chart to display and visualize the seasonality of cases and comment on your findings.

Out of the 10,601 enrolled SARI cases, 5,378 cases were verified as to meet the case definition of SARI (An acute respiratory infection with: measured fever of ≥38 °C, cough with onset within the last 10 days, and a condition requiring hospitalization). Table 3 below summarizes the lab results among cases (diseased/not diseased) according to the verified case definition.

Table 14.3: Distribution of Cases according to Lab Results

Case Definition	Diseased	Not Diseased	Total
Test Positive	998	687	1,685
Test negative	4,280	4,388	8,668
No Results	100	148	248
Total	5,378	5,223	10,601

Question 12. How would you interpret these findings?

Part 4: Discussion

According to the evaluation plan, the team assessed the usefulness of the system by answering a set of questions regarding the ability of the system to achieve its objectives. [5] To assess the system's performance, a set of attributes were identified and studied. Both the epidemiological and the survey data sources were used in the evaluation.

Question 13. One data set was obtained from the staff working on the system using a questionnaire. List the categories of whom should be included in this survey.

Question 14. Provide some questions to answer for the assessment of the system's usefulness.

Question 15. List the attributes to be included for assessing the system's performance.

Question 16. Choose one attribute as an example and explain how you would measure it.

Part 5: Conclusion

On a scale of 1 to 5, most of the system's examined attributes recorded high scores. Completeness of Data, Simplicity, Stability, and Acceptability all scored a 4, while timeliness scored a 5. The system, based on the distribution of its selected sites, was representative of the country to a great extent. Nevertheless, what was alarming is that only 61% of doctors were clear about the SARI case definition. Intensive crash-training for health care workers was the main recommendation, in addition to matters related to completeness of data. On the 2nd of May 2019, the final evaluation report was submitted.

Question 17. Outline a template for such an evaluation report.

Question 18. What happens after the report is submitted? Is submitting the report considered the end of the mission?

Annexes

Annex1: Epidemiological data (modified) of ILI & SARI cases, MS-Excel "file 1"
Annex2: Survey data on influenza surveillance attributes, MS-Excel "file 2"
Annex3: Influenza surveillance evaluation Survey questionnaire.

References

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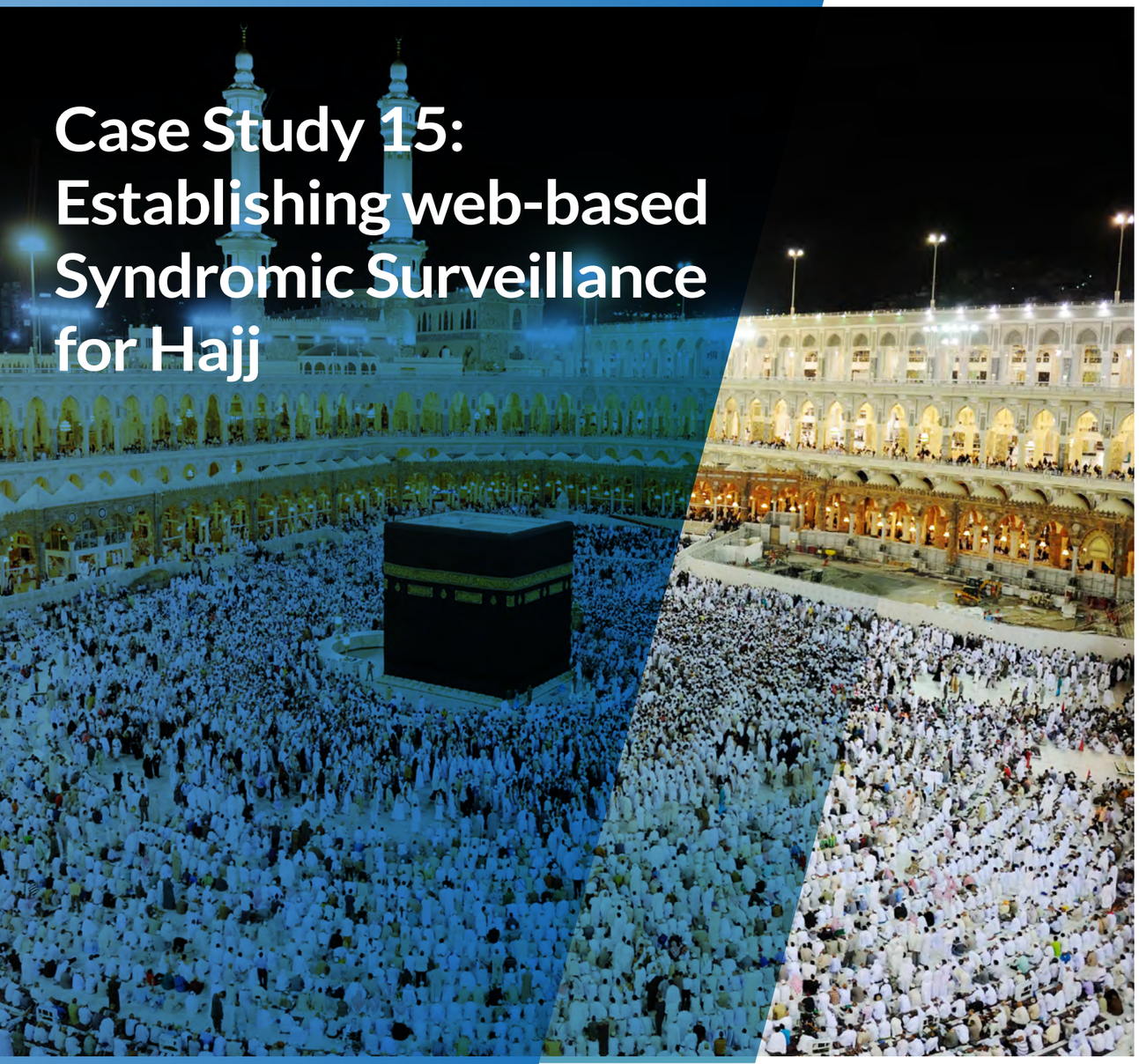
Case study 14



Case Study 15: Establishing web-based Syndromic Surveillance for Hajj

Establishing web-based Syndromic Surveillance for Hajj

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Goal of Case Study

The goal of this case study is to simulate process of designing a customized electronic surveillance system in mass gathering settings like Hajj season.

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. Define Surveillance and Syndromic Surveillance.
2. Explain the differences between routine surveillance and syndromic surveillance.
3. Develop a list of parameters (in this case symptoms) on which Syndromic Surveillance relevant to Hajj is built.
4. Create logic algorithm for creating syndromes.
5. Recognize prerequisites for a web-based surveillance system.
6. Identify performance indicators for a chosen appropriate software platform.
7. Design informative output templates for syndromes monitoring.

Introduction

Hajj, the Muslim pilgrimage to Makkah in Saudi Arabia (Figure 1), is a unique annually and everlasting mass gathering event.

More than two million persons from Muslim countries and all continents gather to this ritual event for a lengthy period (15 – 40 days) who perform their ritual activities in crowding with excessive outdoor activities within a limited area under physical exertion and harsh climatic conditions (Figure 2).

Public health surveillance is the core tool for priority diseases identification, monitoring and control during Hajj season which is being intensified for 45 days (15th of the 11th lunar month to 30th of the 12th month). [1] The effectiveness of the containment or control measures is highly dependent on prudent planning and enhancement of surveillance. The most needed for is real-time (or near real-time) notification of every suspected case.

Figure 15.1: Saudi Arabia Map showing location of Makkah. Source: google maps

Despite the improvement in public health surveillance techniques in the Saudi health system and the many but fragmented attempts to digitize the notification flow, Public Health Department still rely mainly on traditional laborious surveillance methods during Hajj. During previous Hajj seasons (2009 &2010), the Saudi Ministry of Health (MOH) implemented a limited new technology for monitoring infectious diseases using mobile-based devices. There were several lessons learned from that experience that had been addressed to ensure a more sustainable and smooth surveillance during the following Hajj seasons. Syndromic surveillance for Hajj (SS-Hajj) can augment and complement other monitoring activities through a near real-time alert generating signals for possible outbreak or clustering of cases in addition to improving situational awareness of health officials. [2]

Part 1: The Story

The idea of establishing a Syndromic Surveillance during Hajj season was initiated by the Global Center for Mass Gathering Medicine (GCMGM) in collaboration with the Field Epidemiology Training Program (FETP) as a technical partner. You were nominated as a member of a small task force working group to lead the mission of establishing this type of surveillance (Syndromic). The group realized the need for better understanding, early multi-disciplinary coordination, preparations and commitment in addition to thorough planning to start such system. Many questions and queries emerged during brain storming stage that needed to be clearly explored before going into full spectrum expanded system at this stage.

Figure 15.2: Crowds of Hajjis gathering at Arafat, "The day of Hajj" 9th Dul Hijjah, Makkah, Saudi Arabia. From photo gallery, FETP website; www.fetp.edu.sa

Part 1 questions

Question 1. What is Syndromic Surveillance? Define its purpose in this situation.

Question 2. Identify stakeholders who should be involved in establishing a Syndromic Surveillance? Point out briefly the role and responsibilities for each (i.e. terms of reference).

Your task force team invited representatives of stakeholder departments for a brief meeting about the task and clarifying the role and responsibilities of each. That was considered as an agreement between departments and commitment was insured. To organize the work, the members were divided into subcommittees; Epidemiology (Epi) team, Information Technology (IT) team and a Logistic team. Each team was requested to identify the needs under their domain.

Question 3. State and organize the prerequisites for establishing a Syndromic Surveillance system for each domain?

Part 2: Methods

As a member of the Epi team you were assigned to take the responsibility of the epidemiological requirements for the proposed system. Your team started reviewing the top priority epidemic diseases related to Hajj as defined by the Public Health Department (Annex 1). The purpose of this review was to define and formulate syndromes out of those conditions to be included under this surveillance system. Part of your assignment was also to conduct a field visit to assess the readiness of the Health System to accommodate the proposed system at Hajj site (Makkah Health Directorate).

Part 2 Questions

Question 4. Using the "Priority epidemic prone disease for Hajj seasons" (Annex 1), generate a short list of syndromes to be targeted (included) in the proposed system using the following template.

Designated Syndrome	Main symptoms	comments

Question 5. Generate a short list of symptoms to be forwarded to the IT team in order to include in the software application as variables.

List of Symptoms to be included as variables

No.	Symptoms
1	
2	
3	
4	
5	
You may expand or shorten the list as you think is appropriate	

Question 6. Describe in broad lines activities to be carried out during the field assessment visit to Makkah.

The IT team worked on software developing to accommodate the required functions of the system. Your Epi team provided the targeted list of syndromes and their determinants (symptoms). Accordingly, the IT team created the logical algorithms to transform symptoms into syndromes as shown in Annex 2. They also finished designing a customized Web-based Online Database System. The system included a limited number of variables in its data entry e-form including facility name, date and time of data entry, patient's age, gender, nationality and various presenting symptoms. Most of the data entry was designed to be as a click, to ease the process and to avoid errors (Annex 3, screenshot of e-form)

Part 2 Questions

Question 7. Describe what would be the features and characteristics of such computerized system.

Part 3: Results

The system included data on six priority syndromes. The system was designed to auto generate outputs displayed in the dashboard of the application in a graphic mode which update every 15 minutes. Your Epi team decided to use graphics to visualize the distributions of syndromes on the dashboard.

Question 8. Use the list below to identify the appropriate type of graph for each measure/indicator.

List of the Graphs identified by the Epi team for the Master Dashboard for Syndromic Surveillance in Hajj

Measure/indicator	Graph Type
Six-hourly time trends of each identified syndrome based on total number of cases from all the health facilities.	
Six-hourly time trends of each identified syndrome based on proportion of the cases from all the health facilities.	
The total number of the cases for each identified syndrome from all the health facilities	
The total number of cases for each syndrome from the Hospitals in Mina.	
The total number of cases for each syndrome from the PHCs in Mina.	
The total number of cases for each syndrome from the Hospitals in Arafat.	
The total number of cases for each syndrome from the PHCs in Arafat.	
The distribution of cases according to gender from all health facilities	
The distribution of cases according to age groups from all health facilities	

In order to assess the performance of the system, the IT team identified a set of five components for the system: capturing data, Data management, Software, Internet connectivity, and Work place set-up. The IT team consulted to create the indicators and explain how they are calculated. Afterwards, they would deal with how the system would generate these indicators.

Question 9. Generate a set of assessment indicators for each of the five components of the system.

Component	Indicators
Capturing data	--
Data management	-
Software	-
Internet connectivity	-
Workplace setup	-

Part 4: Discussion

To test the system, it was piloted in one health center in Mina (part of Hajj area) for few days with the following outcome according to the system components:

Data capturing:

1. Data was captured from all health center visitors during the project period, with a total of 2613.
2. All data capturing indicators scored 100%. (Completed forms, demographic variables and all visitors).

Data management:

- All output dashboards were easily displayed and read on multiple devices, with prompt navigations and instantly functioning refreshing function.

Software:

- Focus group discussion with data collectors revealed an overall high level of satisfaction regarding usability of the system. Data entry was simple and smooth. There was sometimes an infrequent delay in uploading, few occasions (3 times) of internet failure lasted for 5 to 20 minutes bearing in mind they were using personal wireless routers.

Connectivity of internet

- Was generally stable except for the before mentioned occasions of failure, during which data were stored according to an alternative plan using Epi info software, on tablet devises, which was later transferred to database. This later accounted for 0.8% of total records.

Workplace setup:

- The most convenient site for data capturing was the reception desk. This activity was never noticed to interfere with the flow of work. On the contrary, the reception desk clerks were appreciating someone sharing the process of data recording.

Part 4 Questions

Question 10. Review the above report and accordingly state your recommendations on continuity of this project.

Part 5: conclusion

The local public health professionals of MOH were successfully able to design and develop a novel Syndromic Surveillance System based on the local needs of Hajj. The System was developed through integrated coordination between epidemiological staff (Epid team) and those working on information technology (IT team) with logistical support from the logistic team. Previous exposure to electronic systems motivated the working teams to handle the task. The system was based on data (symptoms) routinely collected in the health system without adding extra burden. Output auto-generated graphics were convenient in monitoring the epidemiological situation as well for better situational awareness.

Annexes:

Annex 1: Hajj Priority Conditions Case Definitions

Annex 2: Summary of algorithms for targeted Syndrome's defined by ONLY symptoms

Annex 3: Image of Data Entry e-form (http://www.fetp.edu.sa/sshajj/)

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Case study 15

Case Study 16: Acute Flaccid Paralysis (AFP) Surveillance System in Lebanon

Acute Flaccid Paralysis (AFP) Surveillance System in Lebanon

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Goal of Case Study

The goal of the case study is to enhance AFP reporting and prepare health care staff to any polio importation into the country.

Learning Objectives

At the conclusion of the case study, participants will be able to:

1. Understand the AFP case definition
2. Identify the role of AFP reporting for each party at the hospital level
3. Describe the process of AFP specimen collection
4. Acknowledge the importance of filling the AFP form completely and in a correct way in continuous coordination with the Ministry of Public Health teams
5. Identify special measures at the hospital setting in case of suspected polio
6. Understand the definition of Vaccine Derived Polio Virus (VDPV)

Introduction

Lebanon has reported the last two polio indigenous cases in 1994[1]. In 1998, the AFP surveillance system was established in Lebanon as per WHO recommendations and as per Lebanese law issued in 1957 that requests from all physicians to report communicable diseases to the Epidemiological Surveillance program at the Ministry of Public Health[2]. In 2003, Lebanon has detected an imported polio case[1]. The case was a 9-month old Lebanese child from the North province, however, the virus was imported from India[1]. The Ministry of Public Health back then managed to contain the outbreak immediately where the virus was isolated only from two healthy contacts of the case (sibling and a relative)[1]. No other paralyzed cases were identified since then[1].

In 2013-2014, Syria reported 36 Wild Poliovirus (WPV) cases followed by two polio cases in Iraq[3]. Upon the declaration of an outbreak, countries of the region, including Lebanon, have enhanced their surveillance systems to timely detect any imported cases and efficiently contain any possible outbreaks[4]. On the 21st of January 2015, WHO announced the closure of the outbreak in Syria after 12 months from the last reported polio case[5].

In April 2014, 155 countries have successfully withdrawn the trivalent Oral Polio Vaccine (OPV type 1, 2, and 3) and replaced it with bivalent OPV (type 1 and 3) in a well-coordinated regional process[6]. This process was known by the "Switch" which is worth mentioning as it is considered as one of the most important global achievements[7], [6].

In 2017, Syria witnessed a vaccine derived poliovirus (cVDPV) outbreak causing 74 paralytic cases[8]. Again, countries of the region conducted national vaccination campaigns and enhanced their AFP surveillance systems[9]. On the 21st of September 2018, WHO announced the closure of the cVDPV outbreak in Syria after 12 months from the last reported polio case[10]. This outbreak was considered one of the biggest outbreaks in history of cVDPV worldwide[8].

Since polio has not been yet eradicated globally, all polio-free countries are at risk of polio virus importation[11]. Moreover, as Lebanon is considered at high risk for polio importation due to the geographic proximity to Syria, not to mention the huge Syrian refugee influx into the country[12].

Part 1: Story

Sara is a Syrian young girl born in 2016 who lives in the Zarif neighborhood of Beirut. On the 5th of August 2018, Sara started having gastroenteritis symptoms, mainly diarrhea accompanied with fever. After 3 days, the mother noticed that Sara started limping and started falling to the ground and complaining about pain from her right leg; Sara was a healthy child before this incidence. On the 11th of August 2018, the mother took Sara to a doctor at a private clinic to be examined. The doctor advised that Sara be transferred to a hospital as soon as possible. Sara's main clinical symptoms are high grade fever, flaccidity in the right leg, and not being able to stand up as before.

Part 1 questions.

Question 1. Can this case be considered an AFP case? Why?

Question 2. What is the AFP case definition?

Question 3. What is the difference between Poliomyelitis and AFP?

Question 4. What is the date of onset of weakness symptoms?

Part 2: Methods

On the 15th of August 2018, Sara went to the ER of the Naja University hospital and was examined by the resident ER physician. You work at the ER.

Question 5. Since you work at the ER, will you report this case to the Ministry of Public Health? And why?

Question 6. As per the regulations of the hospital you work in, who is the assigned party at the hospital responsible to report communicable diseases including AFP? And should you (working at ER) coordinate with this assigned party?

The case until this point has not been reported to Ministry of Public Health. Sara was admitted to the pediatric floor. On the following day, the surveillance officer from the Ministry of Public Health passed by in her weekly visit to the hospital. She passed first to the ER and did not find the name of Sara in the ER sheet.

Question 7. Has it ever happened in your hospital that a case of AFP (or any other case) does not get registered in the logbook of the ER? If yes, in what circumstances could this happen? And how can we address this gap?

Question 8. The Ministry of Public Health has distributed AFP posters and each hospital was requested to hang these posters in their ER. Do you think that these posters are enough to sensitize the health staff at ER? If not, what do you suggest?

At the pediatric floor: You are the head nurse of the pediatric floor. The physician examined Sara and identified weakness in her clinical presentation; however, the physician didn't request the case to be reported to the Ministry and he didn't even discuss the case with the head nurse as he was busy and left immediately. Since today is the day that the surveillance officer from the MOPH visits the ward, you as a head nurse wait for the MOPH staff to arrive to inform her.

Question 9. What is your role in this situation? And what are the challenges?

Question 10. What if the visit of the MOPH staff was delayed? What steps would you take?

The MOPH surveillance officer reached the pediatric ward and before she opened the admission logbook, one of the nurses informed the officer about Sara. Immediately, the surveillance officer requested to proceed with needed investigation procedures.

Question 11. What would these investigation procedures include?

Question 12. What specimens should be collected from Sara? And what does it mean to have adequate specimens?

Question 13. In what type of container should the specimens be collected? why?

Question 14. Where should those specimens be preserved? What information should be included on the vial?

Two stool specimens have been collected from Sara on the 19th of August; the first one was in the morning and the second was in the evening. Another stool specimen was collected from Sara on the 23rd of August and both specimens were collected by ministry personnel from the hospital. Since the specimens were inadequate, the Ministry of Public Health contacted the parents of Sara to request specimen collection from 3 close contacts. According to Sara's mother, her daughter has received a few vaccines, but she does not know which vaccines she received nor how many doses she has taken. As for the vaccination card, it is lost.

Question 15. What challenges would you face in the process of specimen collection or preservation?

Question 16. What is your assessment of the vaccination status of Sara? And what is your role in facilitating the collection of vaccination information from patients?

In case a vaccination card is missing or the child has taken incomplete doses, the Epidemiological Surveillance Program teams at the Ministry of Public Health would conduct coverage surveys immediately in the neighborhood of the case to assess the vaccination situation. The MOPH team surveyed around 30 households and checked the vaccination status of 30 children who have completed 6 months of age and who are under the age of 5 years.
For the sake of our scenario, the results of the vaccination coverage survey in the neighborhood of Sara came as follows: 67% of children had received at least 3 doses of OPV and/or IPV; and 53% of children had available vaccination cards.

Question 17. As a result of the aforementioned results, how do you assess the vaccination situation of Sara's neighborhood?

You work in the infection control department. The surveillance officer requested that to follow up on filling the AFP reporting form by the treating physician. You found a copy of the form that the physician has already filled. You still work in the infection control department. At this level, Sara's situation is deteriorating. The treating physician suspected poliomyelitis and referred the case to a neurologist. In the meantime, the physician requested some para-clinical tests to confirm polio.

Question 18. Referring to the form in your hands, which information needs to be re-assessed and corrected before sending the form to the Ministry of Public Health?

Question 19. What do you tell the physician about these para-clinical tests? What are tests should the Ministry of Public health conduct to confirm poliomyelitis?

Question 20. In light of the physician's suspicion of polio, and given the pending results, is there any reason to be concerned at this stage?

Sara's situation is getting worse and she is unable to move her right leg at all. The specimen's results would take 2 more days according to the ministry. Panic among the health care staff begins in fear of the spread of the disease. Given that you work at the infection control department, you requested to enhance the suitable preventive precautions.

Question 21. Knowing that the polio virus is transmitted fecal-orally, what are the prevention precaution measures that should be adopted?

Part 3: Results

On the 10th of September, the results come out positive where VDPV type 1 has been isolated from Sara's stool specimens.

Question 22. After the tests proved positive to VDPV, what other preventive measures should the hospital adopt?

Part 4: Discussion

In the light of the confirmed VDPV confirmed case in the country, the Ministry of Public Health (mainly the Epidemiological Surveillance Program) conducted the following steps:

- Informed WHO country office
- Enhanced the AFP surveillance system
  - Collected stool specimens from close contacts
  - Searched for similar cases (in neighborhood and hospitals in the area)
  - Conducted a vaccination coverage survey in the case's neighborhood
  - Collected stool specimens from healthy children in the neighborhood
  - Enhanced the active surveillance system and increased the network of the active sites
- Activated Environmental Surveillance (ES) in the area of the patient
- Collected ES specimens from the sewage plant that the patient's neighborhood is linked to

After all the above measures, no VDPV virus was isolated from any of the stool or ES specimens; and no other cases were identified. Therefore, the case was classified as ambiguous (aVDPV).

The ministry of Public Health conducted a vaccination campaign in the patient's neighborhood using bOPV.

Annexes:

Annex 1: case study form

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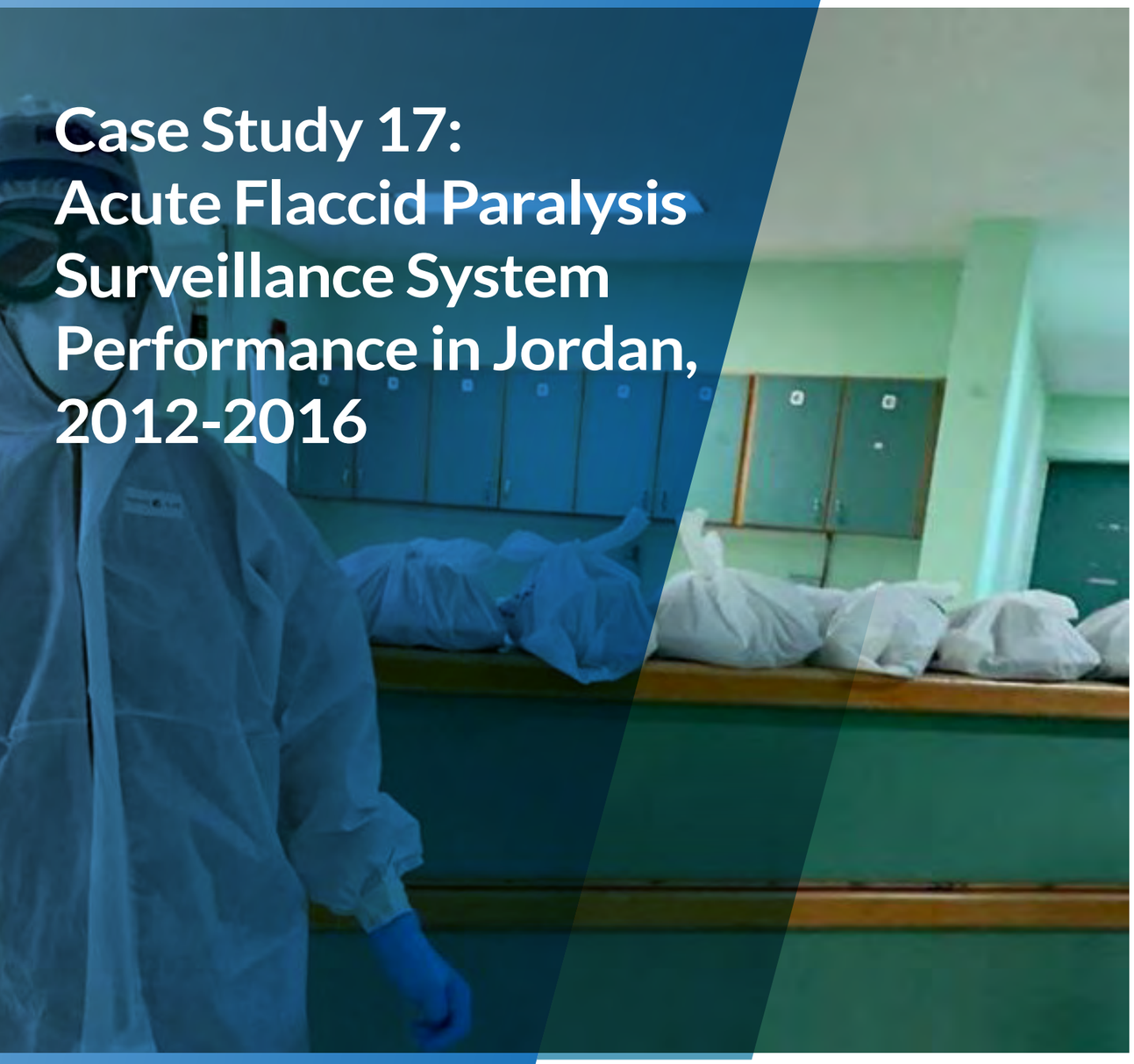
Resources and reading materials

www.moph.gov.lb > prevention > Epidemiological Surveillance Program > Communicable disease surveillance > polio/AFP surveillance system > AFP guideline

www.polioeradication.org

Case Study 17: Acute Flaccid Paralysis Surveillance System Performance in Jordan, 2012-2016



Acute Flaccid Paralysis Surveillance System Performance in Jordan, 2012-2016

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Goal of the case-study

To build the capacity of trainees in the evaluation of Acute Flaccid Paralysis (AFP) surveillance system.

Learning objectives:

At the conclusion of the case study, participants will be able to:

1. Define public health surveillance.
2. Describe the purpose of AFP surveillance
3. Describe the AFP surveillance performance indicators for evaluation
4. Use the AFP surveillance performance indicators for evaluation
5. Compare AFP surveillance performance indicators with the WHO expected targets.
6. Identify strengths and limitations of the AFP surveillance system
7. Make recommendations for further improvement

Introduction

Poliomyelitis was once a disease feared worldwide and that resulted in the launch of the Global Polio Eradication Initiative (GPEI) which is the largest ever internationally- coordinated public health effort in history. [1] Since then the number of polio cases has fallen with four World Health Organization (WHO) regions (Americans, Western pacific, European and South-East Asian) were certified polio-free. [2] One of the key strategies recommended by WHO through the GPEI is conducting AFP surveillance that has been adopted globally.

Jordan is divided into 12 governorates and 21 districts (Figure 1); the health system is represented in five health sectors: Ministry of Health (MoH), Royal Medical Services (RMS), Private Sector, Teaching Hospitals and United Nations Relief and Works Agency (UNRWA). Approximately 37.3% of population is under 15 years of age.

Figure 17.1. Jordan's Map. [Source: http://www.dailymail.co.uk/news/article-3429835/King-Abdullah-says-Jordan-boiling-point-number-Syrian-refugees.html#i-cce8350cb90f5d45]

Routine immunization against polio has been mandatory since 1979. The Polio Eradication Program led by the Jordan's Expanded Program on Immunization (EPI) and endorsed by WHO has successful story in contributing to the decrease of poliomyelitis cases throughout the country and their considerable role in WHO polio-free certification. The EPI- Jordan has routinely collected AFP surveillance data according to the WHO case definition since 1999.

Since 10/2014 WHO-Jordan, through a special team (WHO AFP medical officers), ensures that all AFP cases be notified and investigated as prospective polio cases immediately, maintaining timeliness and completeness as advised by WHO.

Jordan reported the last indigenous polio case in 1988, although the last virologically- confirmed polio case was reported on 3 March 1992, with the probable origin of virus from Pakistan.

Part 1 The Story

On 1/5/2017 the public health surveillance officer in Mafraq governorate reported a hot case of AFP; it was 5 years old Syrian boy coming from Rogban camp as humanitarian case who was admitted to a governmental hospital with symptoms of flaccid paralysis and fever of acute onset, his vaccination status was unknown. He was tested for polio and the result was negative. He passed away few days later after being diagnosed with meningoencephalitis.

One of the EPI-Jordan personnel at the ministry of Health said: "What if it was a case of polio? Do our surveillance system is capable to detect similar cases especially for Syrians living in Jordan?". As a member of Ministry of Health team, you are designated to evaluate the AFP surveillance system over 5 years period 2012-2016 to ensure that the system is functioning with the required standards.

Part 1 Questions

Question 1. Define public health surveillance.

Question 2. What is the purpose of the AFP surveillance?

Question 3. Do you think that the evaluation of AFP surveillance is needed in a polio-free country? Justify.

Part 2: Methods

All AFP cases reported to the EPI from the 12 governorates and all health sectors that were routinely collected between 2012 and 2016 were included. The AFP case investigation form, laboratory investigation form, sample results, and 60-day follow-up were evaluated. The WHO minimum performance indicators were used to evaluate the quality of AFP surveillance.

Part 2 Questions

Question 4. What kind of study design the evaluation adopted?

Question 5. What is the WHO minimum performance indicators used to evaluate AFP surveillance?

When a patient meets the AFP case definition, the health care practitioners notify the local public health officer who conducts a comprehensive investigation using the standard WHO case investigation form and then the report is sent to the EPI. The collected specimens are sent to the WHO accredited poliovirus isolation laboratory at the National central laboratory for enterovirus analysis.

Question 6. What is the AFP case definition?

Question 7. Based on the WHO minimum performance indicators, what is the timeline of case investigation and being sent to the laboratory?

Question 8. What kind of specimen should be collected?

Question 9. What are the criteria of specimen adequacy?

Question 10. What role do you think the laboratory plays in this evaluation? Why?

Part 3: Results

A cumulative number of 328 AFP cases had been reported to the EPI between January 2012 and December 2016. All cases had been discarded. Of all cases, approximately half (51.3%) were between one year and 5 years of age and almost 56% were males. GBS was the most common diagnosis with 35.1% followed by myositis (Table17.1)

Table17.1: Descriptive epidemiology of 328 AFP cases reported in Jordan between January 2012 and December 2016

Characteristics	Percentage
Sex	
Male	55.8
Female	44.2
Age (year)	
<1	10.4
1-5	51.3
6-10	26.8
11-15	11.5
Diagnosis	
GBS	35.1
Myositis	14.9
Encephalitis	4.9
Transverse Myelitis	4.3
Irritable hip	4.3
Other	36.5
Source: Ministry of Health Jordan	

Figure 2 shows the annualized non-polio AFP rate per 100,000 populations below 15 years per year, Jordan, 2012-2016. Disaggregating the annualized non-polio AFP rate by governorates and year is shown in figure 3. Table 2 shows the AFP surveillance performance indicators for Jordan, 2012-2016

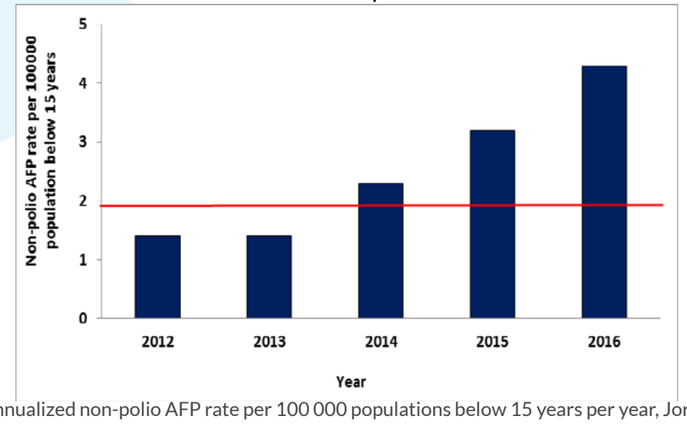

Figure 17.2. Annualized non-polio AFP rate per 100 000 populations below 15 years per year, Jordan, 2012-2016
Source: Ministry of Health Jordan

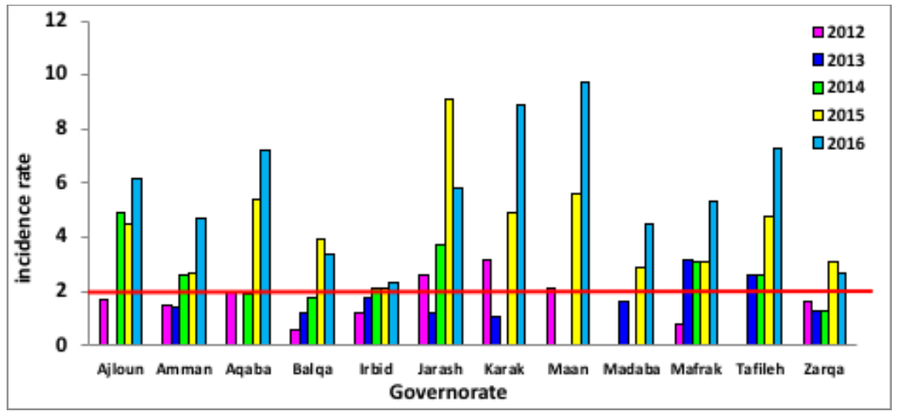

Figure 17.3: Annualized non-polio AFP rate per 100 000 populations below 15 years per year and governorate, Jordan, 2012-2016 Source: Ministry of Health Jordan

Table 17.2. AFP surveillance performance indicators for Jordan, 2012-2016

Indicators of surveillance performance	Target	Country performance by year				
		2016	2015	2014	2013	2012
Percentage of all expected monthly reports that were received	≥90%	100%	100%	100%	100%	100%
Annualized non-polio AFP rate per 100000 children under 15 years of age	≥2/100000	4.3	3.2	2.3	1.4	1.4
Percentage of AFP cases investigated within 48 hours	≥ 80%	95%	98%	98%	100%	100%
Percentage of AFP cases with two adequate stool specimens collected 24–48 hours apart and ≤14 days after onset	≥ 80%	100%	97%	97%	91%	85%
Percentage of specimens arriving at the laboratory in good condition	≥ 80%	100%	100%	100%	100%	100%
Percentage of specimens arriving at a WHO-accredited laboratory within three days of being sent	≥ 80%	98.6	94.4	95.2	97.1	100
Percentage of specimens for which laboratory results sent within 28 days of receipt of specimens	≥ 80%	96	100	100	100	97
Non-polio enterovirus isolation rate of stool specimens submitted to the laboratory should have non-polio enterovirus isolated.	≥10%	10	6	6	6	3
60-day follow-up examination of AFP cases requiring a follow-up examination should be examined at 60 days after the onset of paralysis	≥ 80%	95	90	97	94	94

Source: Ministry of Health Jordan

Part 3 Question

Question 11. What is the annualized non-polio AFP rate per 100000 populations below 15 years per year? What it reflects?

Question 12. What does the red line represent in the Figure 2?

Question 13. Comment on the trend in Figure 2.

Question 14. Comment on the graph (Figure 3) regarding the annualized non-polio AFP rate for each governorate over years.

Question 15. What is a silent AFP area?

Question 16. Compare in few sentences AFP surveillance performance indicators with the WHO targets?

Question 17. What does the Non-polio enterovirus isolation rate represent?

Part 4: Discussion

This evaluation showed that Jordan is one of the countries that earned the polio-free certification. There was no wild polio virus isolated or any compatible case classified by the National Polio Expert Committee. However, importation of polio virus remains a potential threat.

GBS was the most common cause of AFP and found in 35.1% of cases. It is worth mentioning that Jordan performed well in fulfilling the WHO target in 2014, 2015 and impressively 2016.

Sub-nationally, the annualized non-polio AFP rate revealed that even in 2014 the expected target was not met for certain governorates that were totally silent.

The timeliness of investigation of AFP cases reported exceeded the WHO target from 2012-2016. However, there is an alarming decreasing trend.

Jordan's national poliovirus laboratory performed well in accomplishing the timeliness of AFP surveillance system however the Non-Polio Entero-Virus rate is not achieved except in 2016.

Part 4 Questions

Question 18. What does GBS > 50% reflect?

Question 19. Explain the variety of AFP surveillance performance regarding the annualized non polio AFP rate over 5 year's period.

Question 20. Compare between the national and the sub-national annualized non-polio AFP rate (Figure1 vs. Figure 2)

Question 21. Explain the decrease of the timeliness of investigation of AFP cases.

Question 22. Regarding the Non-Polio Entero-Virus rate, what are the possible explanations of failure to achieve the WHO target?

Part 5: Conclusion

Question 23. Based on findings and discussion how well the AFP surveillance system was performing?

Question 24. What are the strengths and weaknesses of the system?

Summary of the case, actions taken and recommendations

Question 25. According to your conclusion make recommendations to improve the system.

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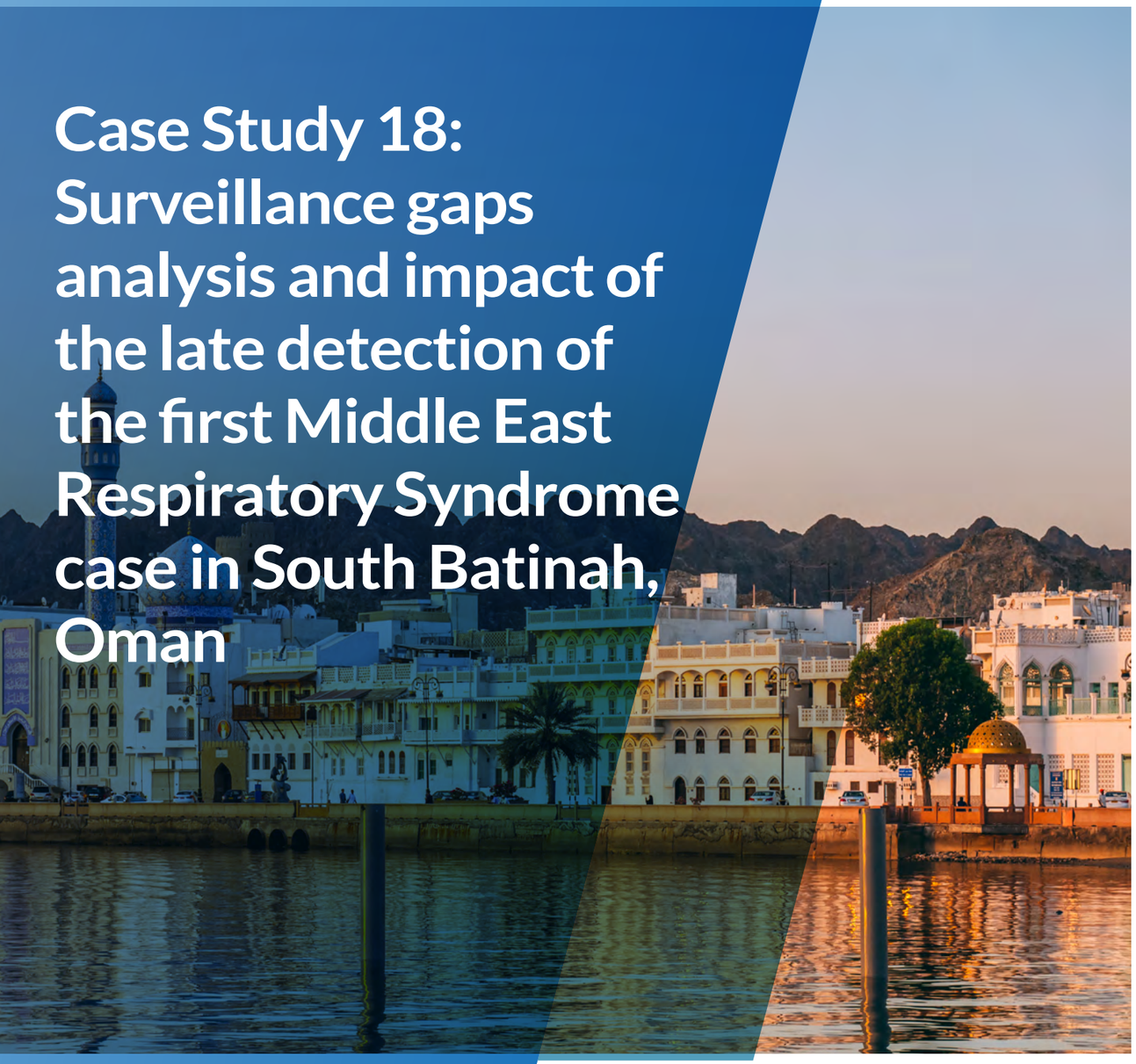
Case Study 18: Surveillance gaps analysis and impact of the late detection of the first Middle East Respiratory Syndrome case in South Batinah, Oman



Surveillance gaps analysis and impact of the late detection of the first Middle East Respiratory Syndrome case in South Batinah, Oman

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Goal of Case Study
The goal of this case study is to simulate the components of the health surveillance system and control measures upon detection of a Middle East Respiratory Syndrome case.

Learning Objectives
At the conclusion of the case study, participants will be able to:

1. State the case definition of a suspected MERS-CoV as per the guidelines of Ministry of Health
2. Assess the sensitivity and specificity of the case definition
3. Describe the Intensified Surveillance of Severe Acute Respiratory Illnesses adopted in the secondary hospitals
4. Analyze the major surveillance gaps which result in a significant late detection of the case and explain how to improve them
5. Assess the impact of late detection of MERS-CoV to the public health system
6. Communicate findings and recommendations with the relevant authorities

Introduction

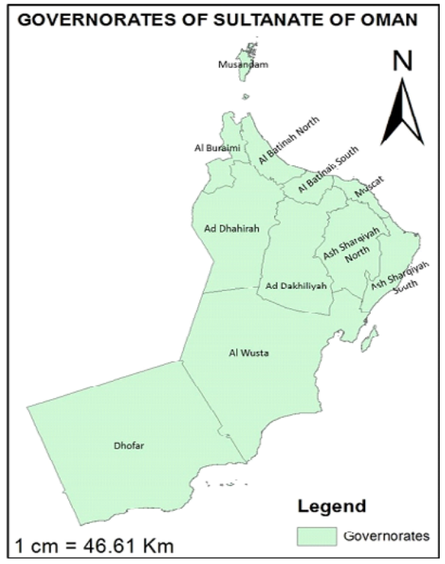
Oman is located in the southern east part of the Arabic peninsula, with a total population size of 4,414,051 (census 2016). Administratively, it is divided into eleven governorates which are subdivided into states. South Batinah is the fifth most populated governorate in Oman with about 400,967 inhabitants. (Figure 1) It almost comprises 9.1% of the whole population of Oman. [1] There are six states within south Batinah Governorate: Barka, Rustaq, Musanaa, Nakhal, Wadi Mawel and Awabi.

There has been a noticeable transformation since 1970 in all aspects of governmental services including the health sector. The impact of change is easily appreciated in the control of communicable diseases, such as, Malaria, Polio, Tuberculosis (TB), Measles, Rubella, etc.

The primary health care system in Oman is well recognized with the successes achieved and the international standard level. It provides services to the community, disease management, consultation, immunization, and other national screening programs. However, the newly emerging infectious diseases have raised the concern of the public health authorities, and in particular the Middle East Respiratory Syndrome (MERS-CoV) which was firstly identified in the kingdom of Saudi Arabia in June 2012. Recent studies have shown the cause to be the association with the dromedary camels in the gulf region, which have already been proved to have high-titre neutralizing antibodies against MERS-CoV. [2,3]

As of end-2016, Oman reported seven cases of Middle East Respiratory Syndrome Coronavirus (MERS-CoV) from three main governorates; Al-Dakhilyah (4 cases), North Batinah (2 cases) and North Sharqiyah (1 case). Two other cases were diagnosed outside Oman, but they were originally from North Sharqiyah and North Batinah as well. Though Oman is regarded as one of the endemic countries of MERS-CoV, no major outbreaks have occurred, apart from the three cluster cases which were reported at the end of 2014 in Nizwa, Al-Dakhilyah governorate.

Figure 18.1 Governorates of Sultanate Oman



Part 1 The Story

The department of disease surveillance and control was getting prepared to initiate the National immunization campaign against Measles disease from 10th to 16th of September 2017 in response to the ongoing measles outbreak which occurred in different governorates in Oman. While the regional epidemiologist and public health staff of South Batinah governorate were conducting a visit to Nakhal state on 29th August 2017, as part of the preparation actions for the immunization campaign, the regional epidemiologist received a call from the Central Public Health Laboratory in Muscat informing him about a positive MERS-CoV sample of a 54 years old, Omani patient, who lives in Musanaa state.

The epidemiologist was informed that patient was admitted in the regional hospital for a couple of days, and then he was escorted to Sultan Qaboos University Hospital in Muscat on 28th August 2017. On the following day, the patient was diagnosed as MERS-CoV. The epidemiologist was concerned that the case was missed from the health surveillance system in his region and many other people could have been exposed to the infection with a serious disease.

Part 1 Questions

Question 1. What is the public health surveillance system? List three main uses?

Question 2. List the two main concerns of the epidemiologist after he was told about a positive MERS-CoV case?

Question 3. What is the next immediate action of the epidemiologist?

Part 2: Methods

A team, composed of the regional epidemiologist, infection control staff and health inspector, was formed to investigate the case. The infection control in-charge of the regional hospital was immediately called to trace the health care workers' contacts of the patients and provide further details.

The patient, found to be hypertensive and diabetic, had been moved from a private hospital to the emergency department (ED) of the regional hospital on 23rd August with the impression of severe pneumonia and respiratory distress. At ED he presented with a history of fever> 38°C, productive cough, and shortness of breath for more than a week. The clinical evaluation and investigation suggested pneumonia with severe respiratory distress. The next day, his condition deteriorated, and he was shifted to the ICU and intubated. The treating physician investigated the case for tuberculosis, and other viral infections, not including MERS-CoV.

It was also found out that the patient had visited a local health center two days prior to private hospital admission. There was no history of contact with camels, but the patient was socially active in his village, being a Mosque Imam, and had recently attended large social gatherings, attended by Omanis and visitors from Saudi Arabia and United Arab Emirates.

Part 2 Questions

Question 4. What immediate control measures should be taken at this stage?

Question 5. For how long would you advise monitoring the contacts of this patient? Would you suggest screening them all?

Question 6. Evaluate the surveillance gap at this stage.

Part 3: Results

Further investigation revealed that the patient started to complain of fever and respiratory symptoms around the 9th of August, when the patient had socialized with hundreds of people from inside and outside Oman. He used to organize some religious activities in different mosques and at his house.

Family members and health care workers' contacts of the patient were identified by the investigation team and the infection control staff in the three health institutions. The health care workers were classified according to the risk. High risk group included those exposed to any aerosol generated procedures done to the patient, or any close contact to the patient without personal protective equipment (PPE). A total of 73 contacts had been identified in all health facilities, of whom 20 were considered high risk group. Family contacts were 36, of whom three were symptomatic.

When the investigation team contacted the regional hospital to ensure contact identification and monitoring, they knew that many of the high-risk group contacts were not contacted; not to mention that the ED doctor, who first evaluated the MERS-CoV case, was still on the job though he had respiratory infection symptoms.

Part 3 Questions

Question 7. Critique the infection control practices in the hospital based on the above-mentioned scenario.

Question 8. Suggest an urgent management plan to be undertaken by the investigation team.

Question 9. Define the sensitivity, specificity, and predictive value positive of any health surveillance system?

It is noteworthy here, that part of surveillance enhancement towards the MERS-CoV epidemic in the gulf region, was the establishment of the Intensified Surveillance of Severe Acute Respiratory Infections (SARI-IS) in all hospitals in Oman in November 2016. Table 18.1 summarizes the SARI-IS case definition.

Table 18.1. Severe Acute Respiratory Infections intensified surveillance

Case definition	Admitted patient with the respiratory symptoms, i.e. fever > 38°C and cough (or exacerbation) or breathing difficulty And one of the following: • Evidence of severe illness progression, i.e. either radiographic evidence of infiltrates consistent with pneumonia or a diagnosis of ARDS or severe ILI which may also include complications, such as encephalitis, myocarditis or other severe and life-threatening complications • The patient needs admission to the ICU or another area of the hospital where critically ill patients are cared for with or without mechanical ventilation • No alternate diagnosis within 72 hours of hospitalization, i.e. results of preliminary clinical and or laboratory investigations, within 72 hours of hospitalization, cannot ascertain a diagnosis that reasonably explains the illness • High-risk groups (pregnancy, immunocompromised, chronic conditions viz. DM/ HTN) • One or more of the following exposures/conditions: o Residence in or recent travel within < 10 days of illness onset to a country Where human cases of novel influenza virus or other emerging/re-emerging pathogens have recently been detected or are known to be circulating in animals o Close contact with a confirmed case with emerging/re-emerging pathogens within10 days prior to onset of symptoms o History of exposure involving direct health care, laboratory, animal exposure o Part of cluster with similar respiratory symptoms
Laboratory samples	Specimens from ICU SARI-IS admitted cases using real time RT-PCR will be tested for: MERS-CoV and the respiratory viral panel which includes the following viruses: influenza A, influenza A (H1N1) pdm09, influenza B, rhinovirus, coronavirus NL63, 229E, OC43, HKU1, parainfluenza 1, 2, 3,4, human metapneumovirus A/B (HMP), bocavirus, respiratory syncytial virus A/B (RSV), adenovirus, enterovirus, human parechovirus infection and Mycoplasma pneumonia).

Part 3 Quetions

Question 10. Why do you think Intensified surveillance (SARI-IR) was adopted in all hospitals of Oman in 2016?

Question 11. Explain whether this patient fits the case definition of the SARI-IS?

Question 12. List the possible causes for not suspecting the case to be a case of MERS-CoV?

On further investigation, it was clear that the responsible physicians were not fully aware about the SARI-IS, the case definition of MERS-CoV and the notification mechanism. Besides, some of them showed dissatisfaction about the needful actions of notifications, and others were upset that the sample results took long time. They didn't receive any follow-up trainings after the initiation of SARI-IS.

The investigating team also contacted the head of the primary health center in Musanaa state which was visited by the patient on 21st August, two days prior to his admission. On that day, along with his respiratory symptoms, he also presented with diarrhoea. His stool analysis investigation showed Entamoeba Histolytica and serum ESR was 45 mm/hr. The patient was discharged on metronidazole, Augmentin, and amoxicillin.

Question 13. With referral to the clinical scenario of this patient, should the GP have offered further evaluation management or consultation?

Question 14. The primary health institution plays a vital role for the health of any community. What do you think the challenges encountered at the level of a primary health center which affect the functions of the surveillance system?

The epidemiologist and the head of the health center agreed that the case should have been transferred to the regional hospital for further management, especially with the high ESR and possibility of pneumonia. The high influx of the patients, stress of work load, and the absence of the triaging system were the reasons of not fully assessing this patient.
Epidemiologist also reviewed the case definition of a suspected MERS-CoV in the primary health centers as followed by the Ministry of Health.

Question 15. Compare between this case definition and the SARI-IS case definition of the regional hospital?

Question 16. Knowing that Oman is considered one of the endemic countries of MERS-CoV, construct a more specific case definition?

Part 4: Discussion

Apparently, long time elapsed before the patient got proper medical consultation and management, which increased the risk of disease transmission to others. Because of unnecessary delay, it was also difficult to find out the source of the infection or trace hundreds of patient contacts before and after the onset of symptoms. The obvious gaps in the surveillance system, may increase them is sing of cases if not urgently managed.

MERS-CoV disease may present in multiple clinical forms; some of the cases might be entirely asymptomatic. This is why specifying the case definition for the primary health care in Oman, would minimize the missing of clinically serious cases and would give a reasonable representation about the epidemiology of such cases. Equally important is raising the alertness of the people and training them about the case definition, and control measures for the disease.

Part 4 Questions

Question 17. Assess the impact of the late detection of MERS-CoV on the public health?

Question 18. Suggest recommendations to ensure early detection for such suspected cases of MERS-Co, in the future?

Part 5: Conclusion

The timely reporting of any notifiable disease would save a lot of time, efforts and cost. Most importantly, the control actions and preventive measures will be applied in a very reasonable time. Further studies on the MERS-CoV disease are required, especially regarding the risk factors and transmission mechanisms. However, that should go in line with fortifying the surveillance system and control measures in the health care setup.

Part 5 Questions

Question 19. Whom would you advise the epidemiologist to share the findings and recommendations of this case?

Question 20. What further innovative tools do you suggest improving the health surveillance system?

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Case Study 19: Analysis of Hepatitis C Cascade of Care in Qatar, 2017

Analysis of Hepatitis C Cascade of Care in Qatar, 2017

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Goal of Case Study

The goal of this case study is to simulate Hepatitis C cascade of care framework analysis and identify barriers to different elements and recommend control interventions.

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. Describe the concept of Hepatitis C cascade of care framework.
2. Explain the importance of Hepatitis C cascade of care framework in Hepatitis elimination.
3. Interpret the results of Hepatitis C cascade of care framework analysis.
4. Formulate screening and treatment approaches tailored to the results of Hepatitis C cascade of care analysis.

Introduction

Qatar is in the Arabian Gulf area and is a member of the Gulf Cooperation Council (GCC) (Figure 1). It has diverse, dynamic, and rapidly growing population. Qatar's rapidly growing population comprise of multiple sub-populations. As of 2016, the population of Qatari Statistics demonstrate clear effects of single male labor immigration on the population structure, with the majority of the transient populations is from South Asia regions. Together with other sub-population groups, these populations require special considerations in designing public health initiatives and programs. As of 2016, a total of 532,700 stable population (around 275,000 Qatari and 257,700 non-Qatari) and 2,342,634 non-stable population has been estimated in the country, with around 70% of non-stable population are from 5 nationalities: India, Nepal, Bangladesh, Philippines, and Egypt. [1]

Hepatitis C is a liver infection caused by the Hepatitis C virus (HCV). Hepatitis C is a blood-borne virus. There is a number of people who are at risk of developing the disease including people who inject drugs, prisoners and healthcare workers. HCV infection causes both acute and chronic hepatitis. When left untreated, cases of acute hepatitis evolve into chronic hepatitis in 85% of the cases and can lead to cirrhosis, liver failure, and liver cancer. Chronic hepatitis resulting from HCV is usually the main cause of cirrhosis and liver transplant in many settings. [2]

In 2015, there were 1.75 million new HCV infections globally. During the same year an estimated 71 million people globally were living with HCV infection with an estimated 400000 deaths, primarily due to liver cancer and cirrhosis. In the same year, the WHO Eastern Mediterranean Region had the highest HCV prevalence (2.3%).

Overall, Qatar is among countries characterized by low prevalence for both HBV and HCV, but viral hepatitis continues to cause a public health challenge in Qatar despite this low prevalence. This is mainly due to the serious complications of undiagnosed cases of Hepatitis C and B. The prevalence of HCV in Qatar is estimated around 0.8% among general population and approximately 38,857 persons are estimated to be infected chronically with HCV. [1]

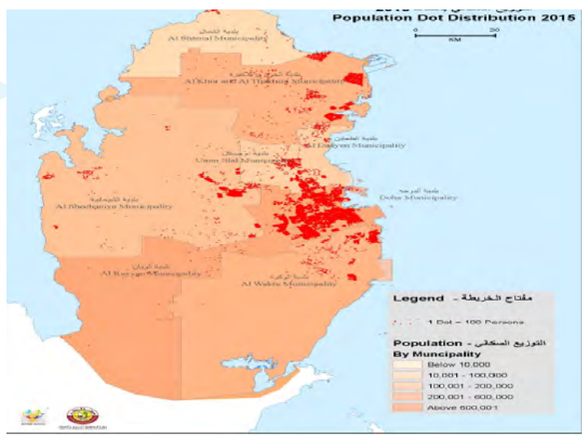

Figure 19.2 Map of Qatar on population distribution

The 2030 Agenda for Sustainable Development set global targets to end viral hepatitis as a public health threat. Global Strategy and Regional Action Plan were developed to support WHO member states to achieve this goal. In Qatar Public Health Strategy 2017-2022 under-communicable diseases objectives, Qatar will adopt these plans by implementing an effective viral hepatitis prevention program.

Part 1: Story

In the year 2017, data presented at the World Hepatitis Summit indicated that Qatar is one of the 9 countries on track to reach their 2030 elimination goals for hepatitis C. [4] During the same year, anti-HCV prevalence was estimated to be 0.8% in Qatar. An average of 400 HCV cases were reported annually to Ministry of Public Health (MOPH) "MOPH unpublished data". Testing, diagnosis, and treatment services are available and accessible, especially in public sector. National strategic plans were set in line with the global plans aiming at achieving the strategic objective of eliminating viral hepatitis as public health threat. This is done with continuous performance review across the viral hepatitis cascade of care services and continue identifying barriers to access and retention, and strategically address them. [5]

Part 1 Questions

Question 1. What is the WHO definition of viral hepatitis elimination?

Question 2. What is Hepatitis cascade of care framework?

Part 2: Methods

In 2017, there were 498 HCV cases reported to MOPH using the notification form. These notifications are received from different facilities that perform HCV screening. One of the most challenging service coverage targets of the global strategy is to increase the detection/diagnostic rate among infected, with the global milestone of 30% by 2020 and 90% by 2030. In Qatar, the screening services are provided mainly through primary health centers and some private facilities (around 25 centers in 2017).

Screened positive cases are listed in a registry in Ministry of Public Health (MOPH), and then referred to the Hepatology team in Hamad Medical Corporation (HMC). All cases should be tested for viremia and positive cases are scheduled for treatment within a month from the date of screening. Qatar Red Crescent collaborated with the HMC and MOPH in availing Direct Acting Anti-viral (DAA) free of charge for ALL HCV cases.

Part 2 Questions

Question 3. Using the notification form in Annex 1, please identify the key variables to analyze and suggest analysis plan.

Question 4. From the data provided on the number of reported cases are you able to calculate the cascade of care indicator for people infected who are diagnosed? Please discuss.

Part 3: Results

Since 2014, there was more focus on achieving early diagnosis of HCV cases by adopting a strong effective and strategic approach on screening to reach a large proportion of estimated cases. In 2017, 498 cases were notified to Qatar MOPH. Using the data from the notification form, the below data entry table was developed, and analysis performed.

Table 19.1: Data entry table form

S. N	Date	Age	Sex	National-ity	Health Card Number	Phone Number	Reporting Healthcare Facilities	Lab. result

Qatar has laboratory infrastructure to provide high-quality diagnostic services, i.e., confirmatory tests for HCV. The confirmatory tests currently centralized in Hamad Medical Corporation in Doha. After referal to HMC, confirmatory tests are perfomred. The following table on HCV diagnositic acheivments was procuded.

Table 19.2: HCV Diagnosis achievements

	Estimated prevalence	People living with viral hepatitis PLVH	People already diagnosed	% coverage of PLVH
HCV among stable population	0.8	4,261	2,180	51%
HCV among non-stable population	1.1	25,892	8,700	34%

Part 3 Questions

Question 5. Now please comment on the cascade of care indicator of people infected who are diagnosed? Please discuss and highlight the difference between stable and non-stable population and apply this concept on population movement in other countries in the region.

In Qatar, there are national clinical guidelines for the management of viral hepatitis, which include recommendations for cases with HIV coinfection. These guidelines are aligned with the WHO guidelines for treatment of chronic viral hepatitis B and C infection. Direct-acting antivirals for the treatment of chronic hepatitis C virus have been introduced since 2015.

Please have a look also at the following table on HCV trearment acheivments.

Table 3: HCV Treatment achievements

	People living with viral hepatitis (PLVH)	People already diagnosed	People on treatment	% of people diagnosed	% of PLVH
HCV among stable population	4,261	2,180	1,767	81%	42%
HCV among non-stable population	25,892	8,700	442	5%	1.7%

Question 6. Please comment on the Proportion confirmed/treated cases.

Part 4: Discussion

Part 4 Questions

Question 7. From all parts of the case-study, please discuss the importance of data entry quality measures specially when we use different sources to create single database (Hint: discuss the use of Unique Identifier)

Question 8. In the context of Qatar, what are the criteria to consider when evaluating HCV screening program (Hint: please consider issues related to the test, population, public health infrastructure, cost and politics).

Question 9. What are your recommendations for screening approach in Qatar i.e. who should be screened?

Question 10. What are the factors that causes delayed confirmation, delayed treatment, and non-favorable treatment outcomes and what are your recommendations to improve these services?

Part 5: Conclusion

Part 5 Questions

Question 11. Please summarize the strategic interventions that are needed to eliminate HCV in Qatar by 2030?

Question 12. Please reflect on HCV elimination in our region (Hint: comment on screening and treatment availability and population movement)

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Case Study Related Readings

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2. Guidelines for the care and treatment of persons diagnosed with chronic hepatitis C virus infectionhttp://apps.who.int/iris/bitstream/handle/10665/273174/9789241550345-eng.pdf?ua=1
3. Monitoring and evaluation for viral hepatitis B and C: recommended indicators and framework.http://apps.who.int/iris/bitstream/handle/10665/204790/9789241510288_eng.pdf;jsessionid=569902B24B6202A4FFBB6318A2785A38?sequence=1

Case Study 20: Imported Outbreak of Poliomyelitis in Sudan 2004-2005

Imported Outbreak of Poliomyelitis in Sudan 2004-2005

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Goal of Case Study

The goal of this study is to develop competencies of learners in Acute Flaccid Paralysis (AFP) surveillance systems, as a part of epidemiological control actions during a poliomyelitis outbreak.

Learning Objectives

At the conclusion of the case study, participants will be able to:

1. Describe the characteristics of an efficient Acute Flaccid paralysis surveillance system.
2. Discuss the risk factors associated with the transmission of poliomyelitis virus
3. Describe steps needed to undertake an outbreak investigation of Poliomyelitis
4. Describe the principals of eradication and elimination of disease.
5. Interpret data gathered in an outbreak investigation of Acute Flaccid Paralysis to inform decision making and control measures.
6. Plan a comprehensive mop-up operation using oral polio vaccine
7. Design a plan for preparedness and control in case of poliomyelitis outbreak at a national level.

Introduction

The Republic of Sudan is in the Northeast of Africa (Figure 1). Prior to the secession of South Sudan in 2011, Sudan has been the largest country in Africa bordered with nine countries (Egypt, Libya, Chad, Eretria, Ethiopia, Central Africa Republic, Democratic Republic of Congo, Uganda and Kenya). Although Sudan gained its independence on the year 1956, it remained to struggle from war and conflict, mostly in the south and west parts. In the South, the conflict continued through two periods, during 1955 to 1972 and then again from 1983 to 2005. While in the west region of Darfur, the conflict broke in 2003.

Poliovirus is a member of the enterovirus subgroup, family Picornaviridae. Enteroviruses are considered inhabitants of the gastrointestinal tract, which are stable in an acidic media. These viruses are small and have an RNA genome. The poliovirus has three serotypes (P1, P2, and P3). However, immunity to one stereotype does not produce immunity to the others. The virus enters the body through the mouth, and then multiplication occurs in the pharynx -at the site of implantation- and the gastrointestinal tract. The virus can be detected present in the throat and stool before the onset of disease.

Non-paralytic poliomyelitis has an incubation period of 3-6 days while in paralytic poliomyelitis, the incubation period is usually 7 to 21 days until paralysis occurs. How individuals respond to the poliovirus infection is extremely variable thus categorized based on the severity of clinical presentation. In general, 72% of all polio infections in children are asymptomatic; with infected persons shedding the virus in the stool and able to transmit it to others. Another 24% of polio infections in children cause a minor, nonspecific illness without clinical or laboratory evidence of central nervous system invasion.

Figure 20.1: Republic of Sudan Map

A non-paralytic aseptic meningitis occurs in around 1%–5% of polio infections in children while less than 1% of infected children develop flaccid paralysis. Ministers of health of all member states endorsed a polio eradication resolution unanimously at the World Health Assembly (WHA) in 1988. By the next year -in 1989- the World Health Organization regional committees adopted regional eradication goals. Health and political leaders from low-, middle- and high-income countries continued to reaffirm their commitment to polio eradication.

Background Questions:

Question 1. What is the mode of transmission of poliomyelitis?

Question 2. Polio virus has 3 types; please describe the types of polio vaccines used, their advantages and disadvantages.

Question 3. In your opinion, why was poliomyelitis selected for eradication?

Part 1: Story

Poliomyelitis surveillance in Sudan: Sudan was one of the countries that adopted the 1988 World Health Assembly (WHA) resolution to eradicate polio by the year 2000. Eradication efforts started in 1994 triggered by the occurrence of a major polio outbreak in 1993 which resulted in a total of 252 cases in only 7 months. AFP surveillance system was established in 1996 and 1998 in the north and the south, respectively. At the beginning of the year 2000, WHO provided technical and financial support; consequently early at 2001, the AFP surveillance in the country attained the globally required certification level. AFP surveillance improved to the extent that reported AFP rates exceeded 1 per 100,000 under 15 years population [1].

Routine Vaccination

The Sudanese Ministry of Health reported that 74% of infants had received 3 doses of oral poliovirus vaccine (OPV3) in 2003, whereas WHO and the United Nations Children's Fund (UNICEF) estimated national OPV3 coverage in Sudan to be 50% for the same year. However, OPV3 coverage in conflict-affected southern Sudan is estimated to be substantially lower than national estimates [2,3].

Supplementary Immunization Activities

A double-round campaign of national immunization days (NIDs) was conducted every year until 1999. As a result of conflict in the period of year 1994 to 1997, these campaigns covered mainly the government-controlled areas in the northern and southern sectors. However, starting from 1998, areas under control of the Sudan People Liberation Movement/Army (SPLM/A) were covered by Oral Polio Vaccine (OPV) immunization. Sudan conducted two rounds of National Immunization Days (NIDs) every year from 1998 to 2002, reaching around 7 million children per round. After 2 years of conducting NIDs and not detecting any new WPV cases, nationwide immunization campaigns were discontinued; nonetheless, Sudan continued to conduct Sub-national Immunization Days (SNIDs), resulting in vaccination of 68,000 to 3 million children per round during 2003 (three rounds) and the first half of 2004 (two rounds).

WHO in collaboration with its partners in Operation Lifeline Sudan programme (OLS) were responsible for conducting supplementary immunization activities (SIAs) as well as AFP surveillance. War-affected areas were reached frequently using the benefit of periods of tranquillity secured by government of Sudan (GOS) and SPLM/A.

State of Poliomyelitis: The stool samples from the GOS-controlled area and from SPLM/A controlled area were tested in the national polio laboratory in Khartoum and Nairobi respectively. Sudan has not reported polio cases since April 2001 when one wild polio case P1 was reported from Unity state (OLS area). The virus was an orphan. As the polio free period was more than three years, the country submitted its national certification document to EMRO certification committee and continued to provide annual updates.

On 20th of May 2004, an AFP case was detected in a remote area of West Darfur. The case was investigated and confirmed to be a polio case due to polio virus 1 (PV1). The genetic sequencing in reference laboratories confirmed that the virus was imported from Chad, which is traced back to a virus that has been imported to Chad from Nigeria (Figure 2).

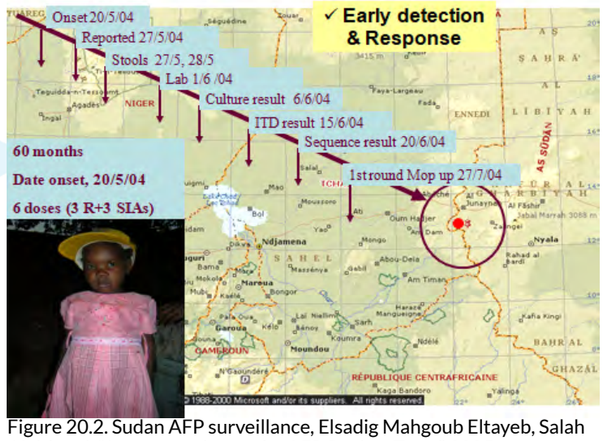

Figure 20.2. Sudan AFP surveillance, Elsadig Mahgoub Eltayeb, Salah .Haithami. "A presentation to the AFP Review Team" 2005

After WVP type 1 (WPV1) was detected in May 2004 in West Darfur, statewide immunization activities were conducted in North, South, and West Darfur states in July and August 2004 (West Kordofan was also included in August 2004), resulting in vaccination of 1.0 million and 1.4 million children during those periods, respectively. In addition, two rounds of immunization activities were conducted in Bahr El Gazal states in August and September 2004, resulting in vaccination of approximately 500,000 children during each round. NID rounds conducted in October and November 2004 reached an estimated 7.6 million children. An additional round was conducted in December 2004 in parts of Upper Nile after the detection of a WPV1 case there in November. Although high coverage (95%) was reported for the 2004 rounds, certain areas of southern and western Sudan were not accessible because of conflict.

Part 1 Questions:

Question 4. It has been noted in the text that when the AFP surveillance improved in Sudan the number of reported cases exceeded 1 per 100,000 under 15 years population; what are the minimum standards for certification of AFP surveillance?

Question 5. Please explain why does the surveillance system target a symptom which is Acute Flaccid Paralysis rather than the disease poliomyelitis?

Question 6. What is the differential diagnosis of Acute Flaccid Paralysis?

Question 7. How is the diagnosis of a suspected case of Poliomyelitis confirmed? Please start your explanation with case definition and continue steps till final confirmation.

Question 8. Since the country was free of polio for 3 years (since 2001), Sudan submitted its national certification document to EMRO certification committee, please describe the certification requirements for announcing that a country/region is free from polio and what is the status of poliomyelitis elimination and eradication in the Eastern Mediterranean region?

Part 2: Methods

Following the first imported case, other polio cases were detected among the population in Kass administrative unit, and from there the virus spread to other states. Laboratory confirmed the occurrence of 127 wild polio cases during 2004 and 27 wild polio cases during 2005. The last case was reported from River Nile State on the 17th of June 2005. The spread of the disease coincides with the migration of laborers and West African pilgrims through the country (Figure 3). Kordufan, Khartoum and Red Sea states were affected earlier than the south eastern parts of the country, of note, travelers to the former states often use air, buses and cars for their travel while in southern eastern parts of the country they use other less swift methods and they usually work during their march.

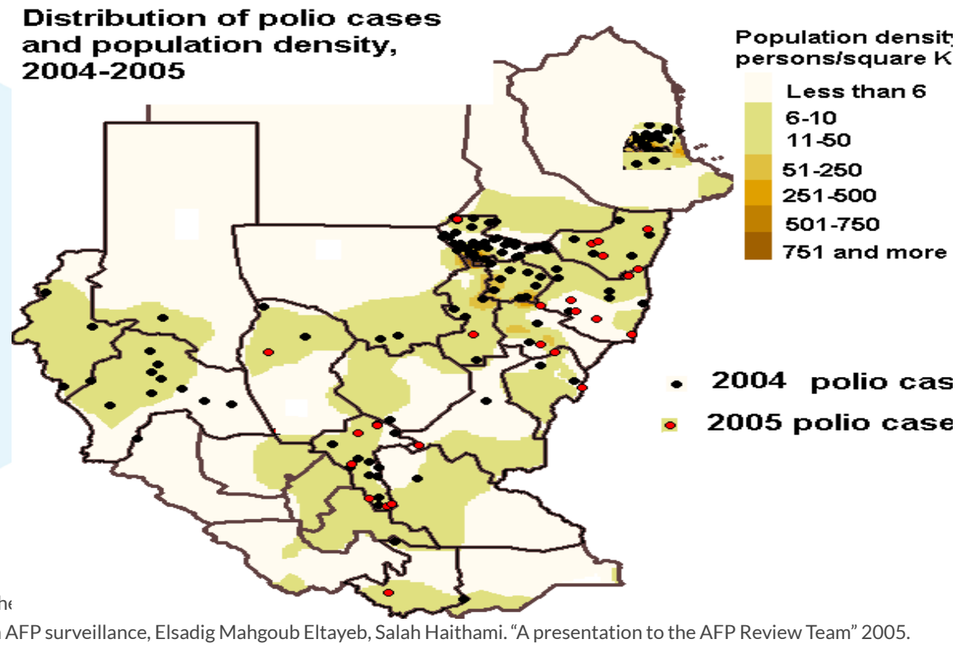

Figure 20.3. The
Source: Sudan AFP surveillance, Elsadig Mahgoub Eltayeb, Salah Haithami. "A presentation to the AFP Review Team" 2005.

Part 2 Questions

Question 9. What are the steps of an outbreak investigation?

Question 10. From the information presented what are the risk factors that contributed to the importation of the disease and the pattern of spread and transmission throughout Sudan?

Question 11. In addition to the factors you have described above, do you think spread can also be related to behavioral issues? if yes, please discuss why?

Part 3: Results

The surveillance data has been analyzed by time and place of polio cases due to the epidemic. The distribution of cases in different states is also illustrated in Figure 20.4. During 2004, the imported virus caused cases in 18 states of the country, while during 2005, one more state reported a case (River Nile). The epidemic curve is presented in Figure 20.5. Seven states did not report any wild polio virus case (Northern, Warab, West Equatoria, West Bahrelgazal, Elbuhairat, North Bahrelgazal & East Equatoria). The majority of cases were less than three years old (> 80%). Almost 50% of these cases were not immunized or partially immunized, particularly those under three years.

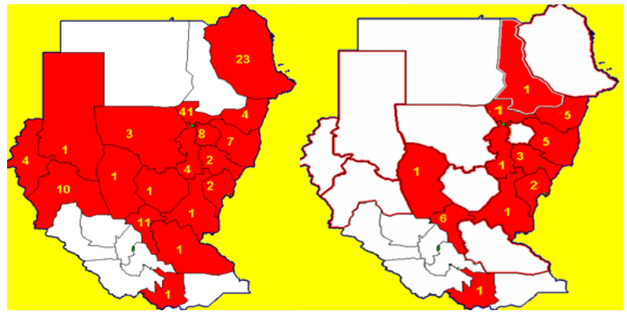

Figure 20.4: The distribution of polio cases in Sudan, 2004-2005 (Source: E.M. Eltayeb, S.S. Haithami, E.A Elsayed. "Combating an outbreak of Poliomyelitis in Sudan following wild poliovirus importation: A success story" Report).

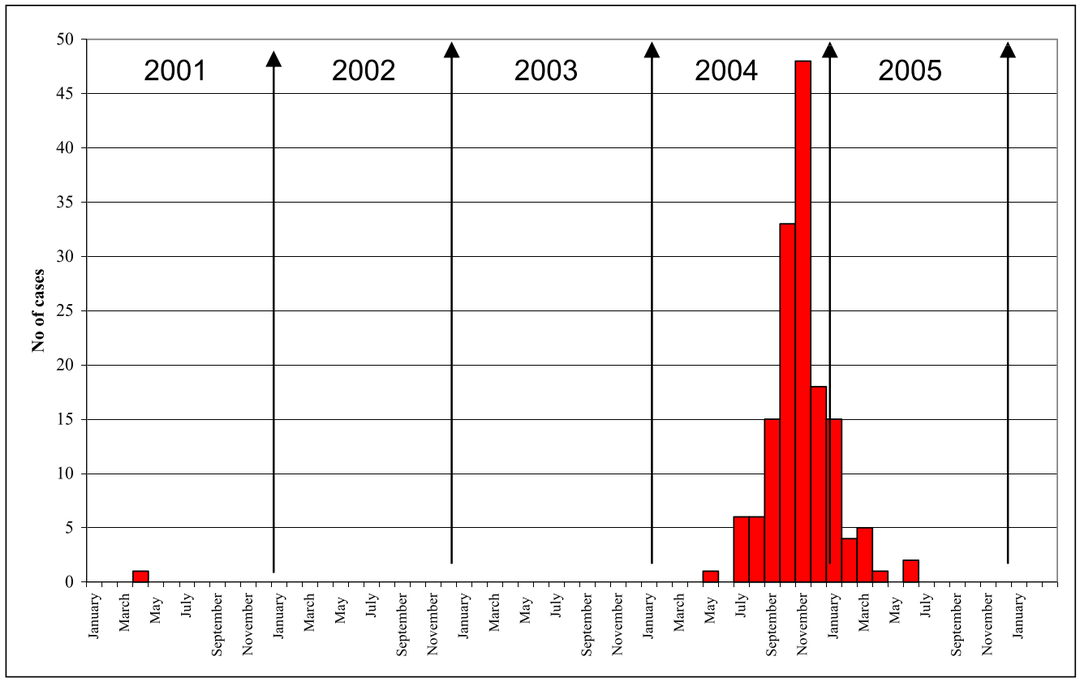

Figure 20.5: The epidemic curve (Source: E.M. Eltayeb, S.S. Haithami, E.A Elsayed. "Combating an outbreak of Poliomyelitis in Sudan following wild poliovirus importation: A success story" Report)

Part 3 Questions:

Question 12. What are the recommended minimum data elements that need to be collected in AFP surveillance?

Question 13. How many confirmed poliomyelitis cases are required to declare the existence of an outbreak?

Question 14. Please describe the pattern of the epidemic curve in this case.

Part 4: Discussion

In response to this outbreak, high risk areas and population groups were identified and continuously updated for Greater Darfur as well as other parts of the country. Reporting sites and/or focal persons at borders and high-risk areas were strengthened. State EPI/AFP officers were continuously sensitized to the risk of importation and active search of cases was conducted during SIAs. In terms of Supplementary Immunization Activities, a rapid plan was prepared to cover children by OPV in the three states of Darfur (Mop up immunization). Implementation of that plan started at the end of June 2004. The first round of immunization was launched on 27 July 2004 for three days in Darfur. A little more than one million children were vaccinated. The coverage rate was 98%. The second round followed on 28 August 2004 and achieved 102% coverage rate. Further National immunization days were conducted country wise (NIDs), the following represent the dates in which they were done:

10 - 12 October 2004	21 – 23 November 2004
10 – 12 January 2005	27 Feb - 1 Mar 2005
11 - 13 April 2005	24 – 26 May 2005
21-23 November 2005	20-22 February 2006

Cross border coordination meetings were held with all neighboring countries to synchronize the NIDs and exchange of information effectively. Efforts were undertaken to improve the routine EPI using GAVI fund.

Part 4 Questions

Question 15. Briefly summarize what are the challenges that were faced by the response team in this case scenario.

Question 16. Please describe what are the measures that Sudan should take to control the spread of the disease?

Question 17. Please list at least 3 lessons that Sudan and other countries can learn from this outbreak of poliomyelitis.

Part 5: Case study conclusion

The poliovirus importation and the following consequences was a challenging experience to Sudan. However, the polio eradication team showed a high level of responsiveness and exhibited a competency to respond effectively with acceptable performance.

To conclude, even though Sudan showed a continued commitment to eradicate polio, a large polio outbreak occurred in 2004, affecting 17 of its 26 states back then. While there were multiple SNIDs conducted after NIDs ceased in 2002, the scale and spread of the outbreak suggests considerable gaps in the population immunity. Therefore, the outbreak confirms the importance of continued SIAs for polio-free countries with low routine vaccination coverage, even in areas with moderate to low population density, such as those found in Sudan. It also emphasizes the importance of high surveillance quality throughout the country, even in areas of instability due to armed conflict and difficult access.

Part 5 Questions:

Question 18. Draft a brief plan for control and preparedness of poliomyelitis given the unique risk factors in Sudan.

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Case Study 21: Trends of DPT3 Vaccination Coverage in Afghanistan 2016-2017, Changes and Comparisons

Trends of DPT3 Vaccination Coverage in Afghanistan 2016-2017, Changes and Comparisons

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Goal of the Case Study

To simulate analysis of vaccination coverage and understand the reasons for low vaccine coverage.

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. Estimate the levels of immunization coverage at national and province levels in Afghanistan. 2016-2017
2. Explain reasons for low vaccine coverage in Afghanistan, 2016-2017
3. Propose an appropriate study to determine factors associated with decreasing the DPT3 Coverage in Afghanistan. 2016-2017.
4. Discuss the evidenced-based intervention and recommendations to be implemented in Afghanistan to improve the DPT vaccine immunization coverage.

Introduction

Immunization is a cost-effective intervention to prevent illness and disability and saves millions of lives every year. Immunization is a process through which a child/adult will be made immune or resistant to infectious diseases typically by the administration of vaccines at different ages of a person. Vaccines stimulate the body's own immune system to protect the child/adult against infection(s) or disease(s).

The series of immunizations known as DPT can prevent diphtheria, pertussis (whooping cough) and tetanus. To be fully protected, children must receive three doses of the vaccine. The percentage of children receiving the final dose (DPT3) is a revealing and vital gauge of how well countries are providing immunization coverage for their children.

Diphtheria is a bacterial infection caused by Corynebacterium diphtheria, transmitted from person to person through close physical and respiratory contact. Tetanus is acquired through exposure to the spores of the bacterium Clostridium tetani which are universally present in the soil. The disease is caused by the action of a potent neurotoxin produced during the growth of the bacteria in dead tissues, e.g. in dirty wounds or in the umbilicus following non-sterile delivery.

Tetanus is not transmitted from person to person. A person usually becomes infected with tetanus when dirt enters a wound or cut. Tetanus germs are likely to grow in deep puncture wounds caused by dirty nails, knives, tools, wood splinters, and animal bites.

Pertussis, or whooping cough, is a disease of the respiratory tract caused by bacteria that live in the mouth, nose, and throat. Many children who contract pertussis have coughing spells that last four to eight weeks. The disease is most dangerous in infants. Pertussis spreads very easily from child to child in droplets produced by coughing or sneezing.

Immunization is yet to realize its full potential, largely because success of an immunization program depends on high rates of acceptance and coverage. By the end of 2014, 18.7 million children under the age of 1 year had not received three doses of diphtheria-tetanus-pertussis (DPT3), a combination vaccine against three infectious diseases in humans (diphtheria, pertussis or whooping cough, and Tetanus). Three quarters of children who have not received DPT3 coverage are living in 15 countries, including Afghanistan.

Despite progress in recent years, Afghanistan is lagging behind in realizing the full potential of immunization. In addition, maternal and neonatal tetanus continues to threaten the lives of mothers and children, polio is still endemic, and measles outbreaks continue especially among groups of internally displaced persons (IDPs). In spite of significant reductions over the past decade, the mortality rate of children under 5 years of age continues to remain high at 91 per 1000 live births.

Ongoing conflict continues to cause widespread disruption to health services. While improvements in vaccination coverage are documented, there are large discrepancies
between the reported administrative coverage, individual survey results, and WHO/UNICEF estimates. Administrative data indicates that the immunization coverage for all antigens in Afghanistan has been increasing since 2001, though this is inconsistent with other estimates. For example, DPT3 was estimated at 48% coverage in 2002 and increased to 101% in 2013.

While the administrative data shows high rates of coverage, the Multiple Indicator Cluster Survey (MICS) 2010 showed DPT3 coverage of 31% and full immunization coverage of 16%.

One of the important shortcomings for calculating immunization coverage in Afghanistan is the absence of accurate population data and therefore the number of targeted children. The last census held in the country was in 1979. For the last 35 years, the Central Statistics Organization is using projected figures and there is a high degree of uncertainty for figures available.

Coverage levels for immunization are derived from administrative data and population estimates; wide-ranging population estimates present an enormous challenge for planning the immunization program in Afghanistan. Therefore, the MoPH, with support of UNICEF, developed and conducted a nationwide coverage evaluation survey to obtain reliable estimates of national and provincial level coverage of individual antigens and full immunization coverage.

Questions

Question 1. Discuss the epidemiology of diphtheria, pertussis and tetanus in your country.

Question 2. Comment on DPT3 coverage and full immunization coverage in your country.

Part 1: Story

In 2015, 46% of children aged 12-23 months in Afghanistan received all basic vaccinations—one dose of BCG and measles and three doses of DPT-containing vaccine and polio. Basic vaccination coverage varies by province; just 1% of children in Nooristan province had received all basic vaccinations, compared to 75% in Paktika province. Children whose mothers have secondary or higher education were more likely to be vaccinated than children whose mothers have no education or primary education.

Part 1 questions

Question 3. Review the available literature and country documents to determine the possible factors that might be associated with vaccine coverage in Afghanistan?

Part 2: Methods

A research team requested the data for Diphtheria, Tetanus and Pertussis in Afghanistan from 2017 and 2016. The data are routinely collected by the team of expanded program of immunization in Afghanistan. Data were entered into SPSS software and analyzed to estimate the levels of immunization coverage at national and provincial levels and determine the reasons why children are not immunized and make recommendations to enhance access and quality of immunization services in Afghanistan.

Part 2 Questions

Question 4. Develop a study proposal to conduct a study to estimate the levels of immunization coverage at national and provincial levels and determine the reasons why children are not immunized.

Part 3: Results

The number of children who received DPT3 doses have decreased from 2730776 in 2016 to 359310 in 2017. The data were not sufficient to determine the factors associated with DPT vaccine immunization coverage in Afghanistan.

Part 3 Questions

Question 5. What are the possible reasons for low coverage in Afghanistan in 2017.

Question 6. Analyze data in your country, if available, to estimate the DPT vaccine immunization coverage.

Part 4: Discussion

The findings of a report released by the WHO and the United Nations Children's Fund (UNICEF) revealed that in contrast to the estimates obtained in the year 2000, the number of member states reaching and maintaining 90% coverage of children with routine lifesaving vaccinations has doubled. In fact, in the year 2014, 129 nations across the world successfully achieved immunization rates of up to 90% with DPT3 vaccine (third dose) among infants.

Taking in to account all low and middle-income countries, the rates of DPT3 coverage has increased over time compared to Afghanistan.

Part 4 Questions

Question 7. Compare the DPT vaccine immunization coverage in your country with the estimates from the region.

Part 5: Conclusion

Afghanistan is war-turned country and most of its populations still have to walk for hours to access very primary health services. Children in under-served areas are not immunized against very common infections, which are eradicated in other countries. Among immunization coverage programs DPT3 trends show an ample fall in 2017 compared to previous years which need further attention and focus. Alternative coverage strategies, sufficient financing, recognition of at risk populations, raising awareness through social media, religious preachers, and sustaining a committed and active health workforce could benefit immunization programs in reaching international coverage target and eradication of common childhood infections.

Part 5 Questions

Question 8. Discuss evidenced-based intervention and recommendations to be implemented in Afghanistan to improve the DPT vaccine immunization coverage.

Summary of the case, actions taken and recommendations.

We found that the coverage trends have fallen tremendously in 2017 compared to 2018 while the coverage should have been raised and more children should have been vaccinated. Ministry of Public Health has its own measures and strategies for expansion of immunization services but are hard to be implemented in most far from capital areas. As previously mentioned, in some provinces, insecurity, and low awareness and other factors have caused lower coverage. Mothers need to be educated and overall awareness raising is of vital importance. Both impacting factors should be recognized and solved, whether it`s from government side or peoples` side in order to prevent further fall of the coverage trends in the coming years.

Case study 21

Case Study 22: Surveillance of Rickettsia in Jordan since 2013

Case study 22

Surveillance of Rickettsia in Jordan since 2013

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Goal of Case Study:

To simulate case detection, reporting, and analyses for routine surveillance of Rickettsia.

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. Apply the principals of outbreak investigation
2. Detect rickettsia
3. Analyze and use surveillance data to respond to an outbreak
4. Define the role of the community to prevent the disease
5. Share findings and recommendations with stakeholders
6. Consider the importance of early initiation of treatment

Introduction

Jordan is an Arab country, with a population of about 10 million and an area of 89000 square km. Directorate of Communicable Diseases at the Ministry of Health is the national authority responsible for communicable diseases in coordination with directorates of health affairs in governorates. Notification of communicable diseases is mandatory in Jordan. The list of notifiable diseases includes two categories of diseases: the first category includes diseases and events that should be notified within 24 hours and the other category includes diseases and events that should be notified on weekly basis. An important challenge for the surveillance system is the presence of about one and half million Syrian refugees.

Rickettsia is a zoonotic disease. Rickettsia genus is Gram-negative. Mammals constitute the principle reservoir with humans considered incidental hosts. Humans become infected by rickettsia bacteria by direct inoculation from infected ticks. The incubation period ranges from a few days to two weeks. Symptoms include fever, rash, headache, and myalgia.

There are over 30 different Rickettsia species. It is prevalent in many counties of the world. Rickettsia species in the Mediterranean region is Mediterranean spotted fever caused by Rickettsia conorii.

Disease responds dramatically to doxycycline when given early. The case fatality is about 3% in untreated patients. Diagnosis is based on epidemiological, clinical and laboratory criteria [1] In Jordan, it is diagnosed by positive IgM.

The first cases of the disease in Jordan were detected in summer 2013 and since then tens of cases are diagnosed annually. Most affected governorates are Alkarak, Madaba, and Mafrak. A study in Jordan showed that the disease is seen more in children than adults [2] Control of Rickettsia requires a multidisciplinary approach.

Part 1: Story

On 27 June 2013, Surveillance Department at Directorate of Communicable Diseases was notified about 4 cases with fever and rash, from different villages in Alkarak and Madaba governorates that were admitted to 2 public hospitals (one in Alkarak and the other one in Madaba). Media showed an interest in this event and started to talk about the unknown disease.

Question 1. What are the questions that you should ask the treating physician in both hospitals?

Question 2. Mention some diseases that cause fever and rash?

Question 3. What is the outbreak? is this an outbreak?

Question 4. How the directorate will respond to the queries of the Media?

Part 2: Methods

Next day a rapid response team went to Karak hospital and another team went to Madaba hospital. Line listing was developed and data were collected through interviewing parents of the patients, interviewing physicians taking care of the patients, and reviewing medical records. After data collection, the team visited the houses of cases

Question 5. Who should be included in the rapid response team?

Question 6. What preparations should the rapid response team do before departure?

Question 7. Define line listing. What are the elements of line listing?

Question 8. What should the rapid response team look for at the houses of cases?

Part 3: Results

Investigation forms were filled. Laboratory investigations were conducted and showed mainly thrombocytopenia. IgM for Measles and Rubella were negative. A pediatrician consultant suggested testing IgM for Rickettsia. Result was positive and diagnosis of Rickettsia was confirmed.

Question 9. What is epidemic curve?

Question 10. Given the data in the line listing (Table 1), draw an epidemic curve.

Question 11. What are the uses of epidemic curve?

Question 12. What are the types of epidemic curve?

Question 13. What is the case definition?

Question 14. Analyze cases regarding gender, age group, and residence?

Question 15. Does contact tracing is needed and why?

Table 22.1. Line listing

Rickettsia Cases 2013														
NO	Address	Sex	Ege	Date onset	Hospital	Symptoms							Lab	Out come
1	Karak	Male	16	02/06/2013	AL-Karak	Fevr	Rash	Maialgia			Vomiting	Positive	Positive	Cured
2	Karak	Female	5	02/07/2013	AL-Karak	Fevr	Rash		General weakness				Positive	Cured
3	Karak	Female	8	03/07/2013	AL-Karak	Fevr	Rash			Edema			Positive	Cured
4	Karak	Male	4	06/07/2013	AL-Karak	Fevr	Rash	Maialgia					Positive	Cured
5	Karak	Male	3	23/06/2013	Prince Ali	Fevr	Rash		General weakness	Edema			Negative	Cured
6	Karak	Male	0.6	06/07/2013	AL-Karak	Fevr	Rash						Negative	Cured
7	Karak	Male	2	25/06/2013	AL-Karak	Fevr	Rash	Maialgia	General weakness		Vomiting		Positive	Cured
8	Karak	Male	2	27/06/2013	Prince Ali	Fevr	Rash			Edema			Negative	Cured
9	Karak	Male	12	05/07/2013	AL-Karak	Fevr	Rash						Negative	Cured
10	Karak	Male	6	23/06/2013	AL-Karak	Fevr	Rash		General weakness				Positive	Death
11	Karak	Male	6	01/07/2013	Prince Ali	Fevr	Rash	Maialgia					Positive	Cured
12	Karak	Male	7	20/06/2013	AL-Karak	Fevr	Rash						Positive	Death
13	Maadaba	Male	3	04/07/2013	AL- Nadeem	Fevr	Rash	Maialgia		Edema			Positive	Cured
14	Maadaba	Male	1	01/07/2013	AL- Nadeem	Fevr	Rash					Photophobia	Negative	Death
15	Maadaba	Female	12	25/06/2013	AL- Nadeem	Fevr	Rash				Vomiting		Positive	Cured
16	Maadaba	Male	12	30/06/2013	AL- Nadeem	Fevr	Rash		General weakness				Negative	Cured
17	Maadaba	Male	17	15/06/2013	AL- Nadeem	Fevr	Rash						Negative	Cured
18	Maadaba	Male	11	22/06/2013	AL- Nadeem	Fevr	Rash						Negative	Cured
19	Maadaba	Male	3	08/07/2013	AL- Nadeem	Fevr	Rash	Maialgia					Positive	Cured

Part 4: Discussion

Rickettsia is a zoonotic disease that is transmitted to humans by ticks and does not transmit from person to person. The disease before this outbreak was not under surveillance in Jordan. So the surveillance system in Jordan did not immediately detect the disease, in part due to inexperience in clinically diagnosing this condition and the unavailability of a locally-based laboratory diagnostic system for this disease. This event revitalized decision makers to focus attention on the surveillance and response towards rickettsia in the country

The MoH implemented health education campaigns on the prevention of rickettsia, targeting the most affected areas as indicated by the surveillance information.

Based on outcomes of the investigation, Directorate of Communicable Diseases started surveillance for rickettsia and added it to guidelines of surveillance and to the list of communicable diseases

Question 16. What are the criteria for establishing surveillance for rickettsia?

Question 17. What type of surveillance that is appropriate to use for Rickettsia?

Question 18. What other authorities should be involved in the control of this disease?

Part 5: Conclusion

Emerging and re-emerging diseases are potential all over the world and public health officers must be aware all the time of this concept. So, surveillance system must be flexible to deal with new diseases. Rickettsia has a significant burden on morbidity and mortality in some regions in Jordan. Conducting surveillance for these diseases will certainly reduce both morbidity and mortality.

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Part III

Case studies in Field Epidemiology

Case Study 23: Stillbirth Risk Factors

Stillbirth Risk Factors

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Goal of Case Study

The goal of this case study is to consolidate the knowledge and improve practices of the participants to design, conduct, analyse, interpret and report findings from a field investigation.

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. State different types of study's designs and advantages and limitations of each as well as how to select the proper design for each specific research question.
2. Describe the details methodology for the selected study design.
3. Analyzing the collected data using proper statistical analysis methods proceeding from simple to advance analyses
4. Interpret and report the findings from the study in coherent way in order to put evidence-based recommendations.

Introduction

The stillbirth that has been referred to as the 'silent epidemic' with more than 7,178 deaths a day. The stillbirth rate in developing countries is approximately 10 times that of developed countries (29 vs. 3 per 1000 births). The United Nations' Every Newborn Action Plan has set a goal of 12 stillbirths per 1000 births by 2030 for all countries. Although, the causes of stillbirth are complex as there are many contributing and interacting factors, the majority of stillbirths are preventable. [1-4]

Yemen is the second-largest Arab country at the southern end of the Arabian Peninsula in Western Asia with a population of 29.2 million. However, it is one of the Arab world's poorest countries that put it in the low human development category at 177 out of 189 countries and territories. Four years into conflict, Yemen has become home to the worst humanitarian crisis in the world and health indicators are among the lowest in the region. An estimated two million pregnant and lactating women will be at risk of death if famine strikes where 1.1 million of them are already acutely malnourished, heightening the chance of miscarriage and stillbirth. Only 45% of all deliveries is attended by skilled personnel where the 164 Maternal Mortality Ratio per 100,000 live births is the leading cause of death among women of reproductive age in Yemen. Although the official stillbirth rate in Yemen is 29 per 1000 live birth which is the highest among the Arabic countries, a recent study showed a much higher rate of 46.2 per 1000 [5,6] Despite such high stillbirth rate there is scarcity of data from Yemen on stillbirth.

Stillbirth Fact Sheet

Definition

The definition recommended by WHO for international comparison is a baby born with no signs of life at or after 28 weeks' gestation.

Incidence

In 2015 there were 2.6 million stillbirths globally, with more than 7178 deaths a day. The majority of these deaths occurred in developing countries. Ninety-eight percent occurred in low- and middle-income countries. About half of all stillbirths occur in the intrapartum period, representing the greatest time of risk. Estimated proportion of stillbirths that are intrapartum varies from 10% in developed regions to 59% in south Asia.

Distribution

Three-fourths of the stillbirths occurred in south Asia and sub-Saharan Africa and 60% occurred in rural families from these areas. This reflects a similar distribution of maternal deaths and correlates with areas of low-skilled health professional attendants at birth. The stillbirth rate in sub-Saharan Africa is approximately 10 times that of developed countries (29 vs. 3 per 1000 births).

Trends

Worldwide, the number of stillbirths has declined by 19.4% between 2000 and 2015, representing an annual rate of reduction (ARR) of 2%. This reduction noted for stillbirths is lower than that noted for maternal mortality ratio (AAR=3.0 %) and under 5 mortality rate (ARR= 3.9 %), for the same period.

Causes of stillbirth

The major causes of stillbirth include:

- childbirth complications
- post-term pregnancy
- maternal infections in pregnancy (malaria, syphilis and HIV)
- maternal disorders (especially hypertension, obesity and diabetes)
- fetal growth restriction
- congenital abnormalities.

Almost half of stillbirths happen when the woman is in labour. The majority of stillbirths are preventable, evidenced by the regional variation across the world. The rates correlate with access to maternal healthcare.

Part 1: The Story

Yemen FETP resident was placed at the Reproductive Health (RH) Directorate. During her placement she analyzed the available data at the directorate. During her analysis, she noticed a high stillbirth rate of 41 per 1,000 birth compared to the 23/1000 national figure and the 14/1000 for Middle East and North Africa (MENA) region.

When she reported this finding to the RH director, she asked her to review the literature on the causes of stillbirth in Yemen. The resident reported back to the RH director the risk factors for stillbirth are complex as there are many contributing factors however, there are no previous studies on risk factors for stillbirth from Yemen.

Question1. While is the RH director spoke about "causes of stillbirth", the resident mentioned "risk factor for stillbirth" and "contributing factors"? Are the three terms are synonyms or different? Explain.

Question 2. Do you agree with what the resident reported to the RH director that "there are no previous studies on stillbirth from Yemen"? If not, why?

The resident deiced to investigate the risk factors for stillbirth at Al Sabeen Maternity Hospital which the largest and referral Maternity hospital in the Sana'a Capital.

Question 3. What should be the general and specific objectives that should be put for this study?

Part 2: Methods

Question 4. What are the study's designs usually used to investigate the risk factors? What? the advantages and disadvantages of each these designs?

The resident deiced to use the case control design.

Question 5. Do you agree with choosing such design? If Yes, why? If No, why not?

Question 6. What such design involves?

Question 7. What do you think the most important methodological issues that should be carefully considered in such design?

Question 8. How the sample size could be calculated for such study?

The resident recruited 101 stillbirths and 202 a live-born singleton neonate in the same period.

Question 9. Why the sample size for cases is different from control i.e. 101 vs 202?

Question 10. What are the variables that should be collected for this study?

Question 11. What is the strategy you should be followed in the analysis?

Part 3: Results

The resident accomplished her study and enter the data in excel format.

Question 12. Do you agree with the program and format the resident used for data entry? If "Yes", why? If "No", why not?

Step 1. Univariate analysis:

Question 13. Perform simple descriptive analysis for mothers' characteristics by cases and control.

Question 14. Perform simple descriptive analysis for babies' characteristics by cases and Control.

Question 15. Perform simple descriptive analysis for service's related factors by cases and control.

Step 2. Bivariate analysis:

Question 16. Considering the format provided and the result of the descriptive analyses what should you do before proceeding to bivariate analysis?

Question 17. After categorizing, re-categorizing and recoding, how to procced with analysis?

Question 18. At this stage, how to procced with bivariate analysis?

Question 19. Summarize only the mother's, baby's and service's variables that were found to be significantly associated with stillbirth.

Question 20. What is the meaning of odd ratio? How to calculate and interpret?

Step 3. Multivariate analysis

Question 21. How to procced further with your analysis to find out the significant risk factors for stillbirth?

Question 22. What is the difference between the previously calculated odd ratio through bivariate analysis and the adjusted odd ratio calculated here with logistic regression model?

Part 4 Conclusion

Question 23. Interpret your findings and make a conclusion?

Question 24. Depending on your findings, what are the recommendation you will give to the RH director?

Annexes

Annex 1: Stillbirth Case study Data-Participant.xls

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Case Study 24: What triggers dengue fever epidemics in Red Sea State, Sudan

What triggers dengue fever epidemics in Red Sea State, Sudan

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Goal of Case Study

The goal of this case study is to build the capacity of trainees to investigate outbreaks.

Learning Objectives

At the conclusion of the case study, participants will be able to:

1. Describe surveillance system including vector surveillance.
2. Discuss the WHO/ CDC/ Ministry of health recommended control measures for epidemic.
3. Calculate attack rate and case fatality rate.
4. Compare between affected areas in terms of cases, deaths, socio-demographic characteristics, and districts affected.
5. Assess contingency plan.
6. Critically appraise the epidemic reportVV

Introduction

Sudan is the largest country in Africa, covering an area of 1,882,000 square kilometres. The country shares international borders with 7 countries and is divided into 18 states and 189 localities (Figure 1). The total population of the country as projected from the 2008 census is estimated as 42,000,000 people, with an annual growth rate of 2.8%. Urban settlements, rural areas and nomads constitute 33%, 55% and 8% of the population, respectively. Internally displaced people (IDP) and refugee camps are distributed over many states. Although the country showed good progress towards achievement of Millennium Development Goals by 2015, the death rates among pregnant women and children are still high. Malaria and other vector-borne disease are among the commonest causes of death [1]

Sudan is affected by a heavy burden of vector-borne diseases, including malaria, visceral and cutaneous leishmaniasis, schistosomiasis, dengue, onchocerciasis and lymphatic filariasis. During the last ten years, dengue fever was reported from Sudan, Yemen and Pakistan [2]. Sudan has witnessed several outbreaks of zoonotic arbovirus diseases such as Rift-Valley fever (2007-2008), Crimean-Congo haemorrhagic fever (2008), yellow fever (2005, 2012) and dengue (2014-2018 [2]

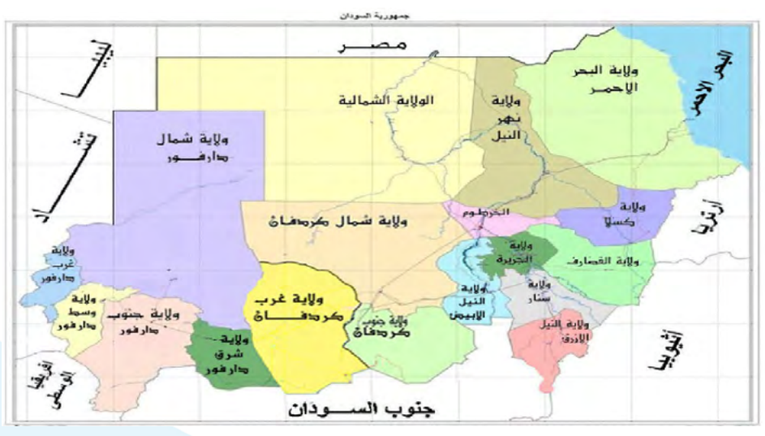

Figure 24.1: Sudan map showing states, 2018 (Source: Council of Ministers, Sudan, 2018)

Question 1. What is the burden of vector-borne diseases worldwide and in our region?

Part 1: The Story

"Many cases were admitted to hospitals in Port-Sudan city with fever and bleeding manifestation in the last 2 days" said the Director General of Health, Red Sea State, Sudan to a national newspaper (ElyoumEltaly, 2/6/2018). He added "the exact number is not known yet". A microbiologist in Red Sea University who are covering the main city hospital re-confirmed this. He added "the situation is serious". When asked by the media about the cause, he said "It seems like a mosquito-borne disease". The State Health Director worried about the situation and contacted the national level asking for help. You have been nominated to be a member of the outbreak investigation team formulated by Federal Ministry of Health to investigate the situation. The team leader asked you to collect and revise the available case-based and vector surveillance data which were sent to national level in the last 2 months.

Part 1 questions:

Question 2. What are the possible causes of this condition?

Question 3: What are the features that make case-based surveillance of good quality?

Question 4: What indices that could be generated from case-based surveillance?

Question 5: What is the role of vector surveillance?

Part 2: Methods

Next day, the outbreak investigation team moved to the Red Sea State by a plane. The team met with the State Director of Health. The director stated that "more cases are admitted yesterday and today early morning". The meeting discussed the situation based on the presentation from State Epidemiology Department. The team also informed about the control measures implemented so far. The team visited Port-Sudan Hospital and critically appraised the case management activities. The laboratory technician collected samples for investigation in the regional public health laboratory. The entomologist in the team conducted vector surveillance early morning next day. Part of the team visited next day the nearby localities. The state epidemiology department provided the team with the line list of cases. By the end of the second day, the team leader called for a meeting with state staff to discuss the findings and to decide about what to do to contain the epidemic.

Part 2 Questions:

Question 6. What are the samples you would recommend being collected by laboratory technicians, for what investigations and how samples can be processed for further investigations?

Question 7. What samples you expect to be collected by the entomologist? what are the indices that you can generate from?

Question 8. The team leader asked you to revise the WHO and CDC recommendations, what are the immediate measures you would recommend?

Part 3: Results

In the meeting, the laboratory report stated that 40 out of 62 blood samples tested for dengue were positive for dengue. The entomologist found Aedesaegypti in high density and all entomological indices were in favor of dengue fever. The team leader asked the Federal Ministry of Health to urgently send medical doctors, nurses and drugs and intravenous fluids to support case management at hospital level. The team also asked for vector control specialists, insecticides and fogging machines to start urgently vector control measures. The team asked the national level to consider that, the state total population (1,396,000) are distributed over 8 localities (Table 1). The team also stated that the state deeply suffers from lack of safe water supply and residents usually store water in-house for domestic use. This represents suitable breeding sites for dengue vector.

The national level support started to reach the state and control measures were intensified. Cases started to decrease towards the end of the month. By July 30, 2018 a total of 913 cases and 36 deaths were reported. Cases were reported from different localities. The Red Sea State authority provided the Federal Ministry of Health, Sudan with the line list of all cases and deaths on excel file (Annex 1) and promised to submit the final report soon.

The team leader (knowing that you are FETP resident) handled the data to you and asked you to provide answers to the following questions using Epi Info and/ or excel:

Table 1: Population per locality in Red Sea State, Sudan, 2018

Localities	Population
Port-Sudan	425,332
Swakin	72,150
Toker	131,000
Oseef	54,000
Hia	80,000
Halib	180,000
Jabeet	75,000
Ageeg	121,000
Durdeeb	65,000
Sinkat	128,230
Olieb	64,288
Total State population	1,396,000

Part 3 Questions:

Question 9. Draw Epi-curve. What you have learned from the curve?

Question 10. Calculate cumulative incidence rate for each locality. Which one is more affected?

Question 11. What are the socio-demographic characteristics of patients?

Question 12. Calculate the case fatality rate? What the outcome indicates?

Part 4: Discussion

During 2015 -2018 many epidemics were detected, investigated, and contained in Sudan. The recent epidemics in Sudan were devastating leading to many deaths and invading new areas. The disease is known endemic in Red Sea State. The state experienced many fatal epidemics since 1999. Unfortunately, there was no comprehensive epidemic report. By the end of the epidemic the national and state authority felt the need for documentation of this experience and having a well written epidemic report.

Part 4 Questions

Question 13. Being aware about the situation and thoroughly analyzed the data, please write an outline for the epidemic report covering the main contents.

Part 5: Conclusion

After reading the draft epidemic report and summarizing their findings using descriptive and inferential epidemiology, the investigating team stated the need for a contingency plan. Knowing that the state epidemic contingency plan needs an update, the national and state team developed a draft contingency plan (Annex 2) for dengue fever in the state. The team leader arranged a meeting to finalize the plan. The team leader asked you to be prepared to present answers to the following questions in the meeting:

Question 14. Define epidemic contingency plan, mention it contents and state why we need a contingency plan?

Question 15. Being thoroughly reading the epidemic contingency plan, and using the attached checklist (Annex 3), what are strengths and limitations of the plan?

Annexes

Annex 1: Dengue Fever in Red Sea State_Sudan-2018 (an excel file)
Annex 2: Dengue fever contingency plan
Annex 3: CDC_UP_Contingency_Planning_checklist

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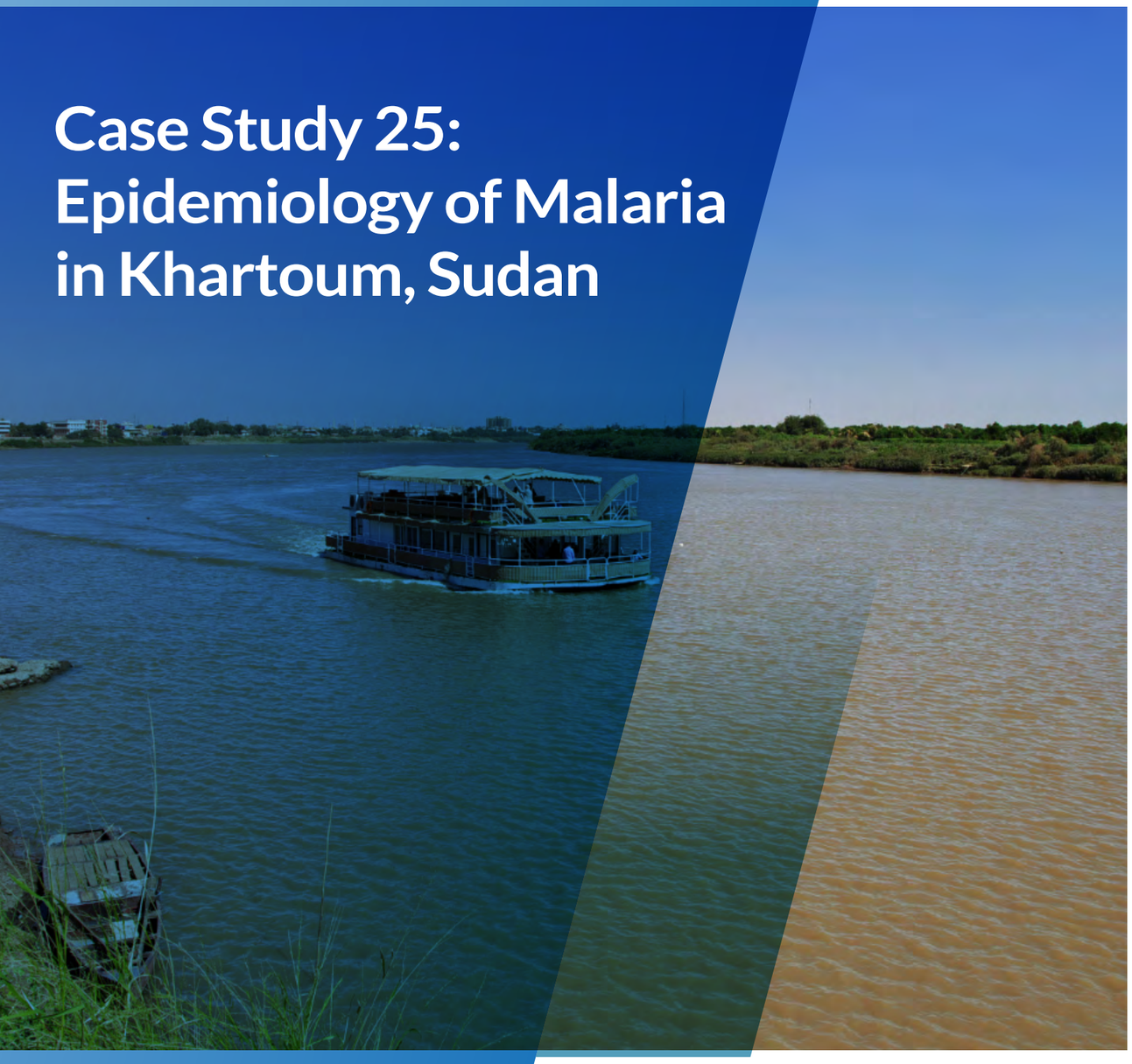
Case study 24

Case Study 25: Epidemiology of Malaria in Khartoum, Sudan



Epidemiology of Malaria in Khartoum, Sudan

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Goal of Case Study

The goal of this case study is to simulate developing risk reduction framework for Malaria in Sudan

Learning Objectives

At the conclusion of the case study, participants will be able to:

1. Analyze the trend of seasonal Malaria in Khartoum, Sudan through the period of 2006 to 2011
2. Assess the factors contributed to the change in the trend of Malaria
3. Identify relevant interventions to minimize the risk of seasonal Malaria

Introduction

Sudan is located in the northeastern part of Africa with a total area of 1,882,000 km^2 and a population of 33,419,625 (Figure 1). The annual growth rate in Sudan is 2.8 %, life expectancy is 59 years, and 18% of the population lies in the age group of under 5 years. Following 30 years of conflict and natural disasters, there are now 1,034,140 internally displaced persons (IDPs), 166,900 returned IDPs, 186,292 refugees, and 33,139 returned refugees. A significant number of those IDPs and refugees are in Khartoum, the capital state and city. It's located at the junction of the Blue Nile and White Nile, where they unite to run together as the River Nile. It's populated by 5,274,321 with active population movement to and from all other 17 states.

Annual precipitation ranges from close to zero to 1,600 mm. [1] However, rainfall is unreliable, the rainy season is mainly between May to October. Floods are a major threat to the country and damaging floods are becoming more numerous due to increasing occupation of flood plains, deforestation, lack of preparedness, and weak monitoring. It is caused by two different phenomena: localized exceptional heavy rainfall and run-off, and the River Nile system and Gash River. Epidemics and outbreaks of disease have had major impacts mainly high incidence of malaria, which affects 40% of the country's population, and has serious social and economic impacts.

Figure 25.1. Map of Sudan
(Source; Mapsofworld.com)

The three-level health system is composed of Federal Ministry of Health (FMOH), State Ministries of Health (SMoH) and Locality Health Management Authorities. The FMOH is responsible for formulation of the national health policies and strategic plans, human resources planning and development, health legislation, response to epidemics, and managing international health. State Ministries of Health are responsible for adopting and implementing policy, detailed health planning, and programming and project formulation [1]

Introduction questions

Question 1. What is the burden of Malaria in Sudan compared to the globe and the region?

Question 2. Malaria is endemic in Sudan. What is the difference between endemic and epidemic Malaria?

Part 1 The Story

"We are expecting above average rainfalls this year of 2012" Dr. Khyar from the National Meteorology Corporation, formally announced through the national media. Following that announcement, the Director General of Primary Health Care, called for an urgent meeting with all the concerned departments. The meeting discussed the situation and recommended to study the epidemiology of Malaria in the previous years to build on. As a result, you were assigned to study the situation and recommend relevant interventions.

Part 1 questions

Question 3. What are the factors that put the country at risk of Malaria?

Question 4. How can the health system monitor the occurrence of Malaria cases in order to control?

Question 5. Explain the concept of diseases occurrence taking Malaria as an example.

Part 2: Methods

Thanks to Ms. Hind, the surveillance officer who welcomed you to the office where you were going to do your task. She was assigned as your assistant to facilitate your assignment.

She asked what data you need.

Part 2 Questions

Question 6. What further information and type of data you need to execute your task?

Question 7. Develop your data analysis plan and identify the methods and tools you plan to use

Question 8. Develop the plan of action showing the timeline and steps to execute your task.

Part 3: Results

You had been provided with the set of Malaria surveillance data (Annex 1) for the period from 2006 to 2011.The data covered all the states in the country and presented by epidemiological weeks. The data were collected through the health workers in the selected sentinel sites. The Meteorology Cooperation had provided the ministry of health with the amount of rainfalls for the years 1970 to 2000 (Annex 2). Dr. Khyar had explained that the same trend of the rain falls noticed during the following years till 2011, with few exceptions.

Part 3 Questions

Question 9. What type of surveillance is this?

Question 10. Calculate the incidence rate of Malaria in Khartoum state for each of the specified years?

Question 11. Which age group is at most risk?

Question 12. Calculate the case fatality rate (CFR)?

Question 13. How can this type of surveillance affect the incidence rates and CFR?

Question 14. Aggregate the data by quarter for each year and present them in tables and graphs.

Question 15. Calculate the incidence rate of Malaria per quarter for each of the specified years.

Question 16. Link the quarterly incidence rate for all years to the quarterly amount of rainfall.

Part 4: Discussion

As a part of your progress report, you had successfully met your first milestone. The Director General of Primary Health Care went through the tables and graphs you developed. However, he was so busy to look at them in-depth. So, he asked you to help him by answering the following questions.

Part 4 Questions

Question 17. Were there noticeable changes in the trend of Malaria during the specified period in Sudan? If yes, describe those changes.

Question 18. Have you noticed any seasonal variations? Please justify your answer.

Question 19. Were there significant variations between the incidence of Malaria in the state over years? what could be the reasons for such variation

Part 5: Conclusion

Following the submission of your second progress report, the Director General of Primary Health Care called for a technical meeting to discuss your findings. The meeting concluded that there is a need to suggest intervention measures to reduce the risk of Malaria in the coming year of 2012. However, the risk of seasonal Malaria in Sudan is high and continue to be almost annually. So, the meeting recommended that there was a need to come up with an effective risk reduction strategy to control the disease in Sudan.

Question 20. Based on the findings and discussion of the previous years' data, what relevant prevention/mitigation measures you would have recommended to control the anticipated Malaria occurrence in 2012.

Question 21. Prepare a summary of your findings and recommendations to be shared with the Minister of Health

Case study 25

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Case Study 26: The trend of measles in Afghanistan

The trend of measles in Afghanistan

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Goal of Case Study

The goal of this case study is to develop the trainees' competencies in assessment of epidemiological trends.

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. Assess and interpret the trend of measles
2. Investigate the reasons for not reporting measles cases
3. Suggest measures to improve reporting of measles cases

Introduction

Islamic Republic of Afghanistan, is a landlocked country located within South Asia (Figure 1). Afghanistan is bordered by Pakistan in the south and east; Iran in the west; Turkmenistan, Uzbekistan, and Tajikistan in the north; and in the far northeast, China. Its territory covers 652,000 square kilometers (252,000 sq mi) and much of it is covered by the Hindu Kush mountain range, which experience very cold winters. The north consists of fertile plains, whilst the south-west consists of deserts where temperatures can get very hot in summers. Kabul is the capital and the largest city.

Measles is a highly contagious disease-prone vaccine-preventable disease characterized by maculopapular rash and still a common and sometimes fatal disease in developing countries [1]. It causes many outbreaks in areas with low vaccine coverage. Measles symptoms typically are high fever (may spike to more than 104° F), cough, runny nose, red, watery eyes, and rash breaks out 3-5 days after symptoms begin. Measles is still responsible for more than 100 000 deaths every year, down from more than 2 million deaths annually before the introduction and widespread use of measles vaccine [2].

Figure 26.1. Map of the Islamic Republic of Afghanistan

Question 1. What is the burden of measles diseases worldwide and in your region?

Part 1: Story

Three weeks after the roll out of IDSR, the district surveillance officer for District A received a report of suspected cases of measles in his district through the community event–based surveillance system. However, out of three health facilities located in District A, Facilities A and B submitted reports with no counts of priority disease cases (including measles), while Facility C submitted no report for the same week. An investigation team was dispatched to verify the reported cases and assess the three health facilities.

On arrival in the community, the team confirmed that the cases reported by community informants met the standard case definition for suspected measles. Additional cases were identified through active case finding by going from house to house, and to nearby communities. A master line list was shared with the County Health Officer. Samples were collected and transported to the reference laboratory for confirmation.

Next, the team visited the three health facilities to assess surveillance activities. On reviewing the medical records at Facility, A, the DSO noticed some cases which met the standard case definition for suspected measles but were not reported. The surveillance focal person at this health facility indicated that they were not able to collect specimens from the suspected cases, that why they did not report. Further review of medical records showed that suspected cases of other priority diseases were not reported over the past weeks for the same reason.

At facility B, none of the staff trained in IDSR was present. The facility was under the management of the laboratory aid, nurse aid, administrator, and pharmacist who were unfamiliar with IDSR guidelines. The IDSR guidelines were not readily available in the facility to serve as reference. Review of their medical records showed that some cases met the case definitions but were not diagnosed or reported as priority diseases.

Review of medical records at Facility C, which did not submit any report for the week, showed that none of the patients met the case definition for a priority disease. When the surveillance focal person was questioned as to why he did not report, he said, “No priority diseases were detected. That is why I didn’t submit a report.”

The DSO instructed the facilities to capture all priority diseases, including those previously missed or unreported, and classify them for reporting to the district surveillance office as per national IDSR guidelines. With support from the World Health Organization (WHO), MoH and other organizations, the DSO conducted a refresher training for IDSR for health workers at the three health facilities. During the training, it was observed that trainees were having challenges with identification and classification of priority diseases. After training, the DSO followed up with trainees at the health facilities to assess how the case definitions were applied.

Part 1 Questions

Question 2. What is community event-based surveillance?

Question 3. What is public health surveillance?

Question 4. What are the features that make case-based surveillance of good quality?

Question 5. Should the county disease surveillance coordinator report this occurrence? Justify your answer

Question 6. What actions should the DSO take to ensure health facilities have the capacity to report cases?

Question 7. Do you agree with the reasons given by Facility A and C? Justify your answer.

Question 8. What action will you take in Facility B as a DSO to ensure reporting of priority diseases?

Part 2: Methods

After training, the DSO instructed each health facility to submit their summary report on priority diseases for the week with a line list of all reported priority diseases over the past six weeks. This would enable the DSO to verify that the weekly summary report reflected an accurate count of priority diseases recorded in the line list. On receiving the reports and line list from the facilities in his district, the DSO analyzed the data and developed a district summary report. He then shared this report with the county health team as part of his routine feedback to the county on surveillance activities in his district.

Part 2 Questions

Question 9. What is line listing?

Question 10. What information should be included in the line listing?

Question 11. What type of surveillance would be most appropriate for use during the measles outbreak? Why?

Question 12. Suggest suspected, probable, and confirmed case definitions for a measles case.

Part 3: Results

In 2010, a total of 6415 cases of measles were reported affecting a wide geographical area and a high percentage of the cases (61.4%) was in those aged less than five years. Cases were reported from all provinces; twelve provinces reported between 102-500 cases, while Jawzjan and Kabul provinces reported more than 500 cases. In 2013, 1902 suspected cases of measles were reported, of which 378 cases were laboratory–confirmed. Most cases (1404) were reported in age less than five years. The cases reported from all provinces, with Helmand, Nangarhar, Kandahar, and Kabul provinces reporting majority of cases. In 2016, 4873 cases of measles were reported of which 674 were laboratory-confirmed. Majority of the cases (3453) were reported in age group less than 5 years. In July 2018, the Ministry of Public Health and WHO reported 6654 confirmed measles cases. The low immunization and poor public health service coverage contributed to the spread of Measles. Figure 2 shows the number measles outbreaks in Afghanistan, 2010-2018

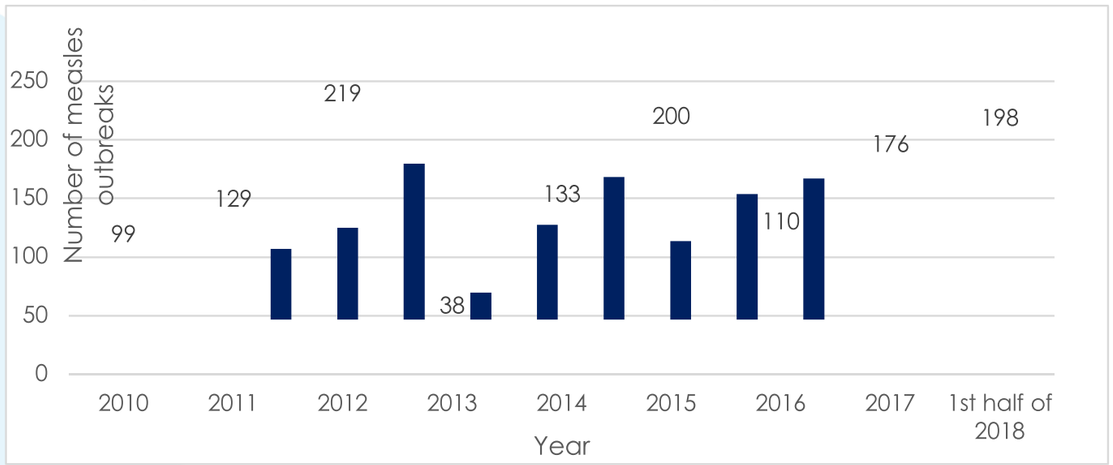

Figure 26.2. The number measles outbreaks in Afghanistan, 2010-2018

Part 3 Questions

Question 13. Please comment on the trend of measles outbreaks.

Question 14. How many confirmed measles cases are required for the County Director of Health (CDH) to declare the existence of a measles outbreak?

Part 4: Discussion

In addition to measles, major disease outbreaks included Crimean-Congo Hemorrhagic fever and pertussis. Measles is one of the leading causes of death among under five children world-wide.

In Afghanistan, measles is the first leading cause of outbreaks and epidemic. The main reason of increasing outbreaks and numbers could be due to low vaccination coverage against measles, low awareness of the community regarding vaccine preventable diseases, and insufficient information of the community on the days of measles routine vaccination services due to insecurity in many areas.

Part 4 Questions

Question 15. Explain the main reasons of increasing outbreaks and numbers in the first half of 2018?

Part 5: Conclusion

Despite the availability of safe and effective vaccine, measles with198 outbreaks and 6645 cases are the first disease with highest number of outbreaks in the first half of 2018.

Part 5 Questions:

Question 16. What control and prevention measures do you think the surveillance team should recommend?

Question 17. What actions would you take to engage the community while implementing prevention and control measures?

Question 18. As a member of the team, what forum/channels would you use to share findings with all the relevant partners?

Summary of the case, actions taken and recommendations

Cases of measles continue to rise with more than 6654 cases reported in the first six months of 2018. Continuing cases and outbreaks of measles indicates that vaccine coverage has not yet reached the desired level. Most countries have taken up measles for elimination. However, this will require strengthening of routine immunization including second dose of measles or MR vaccination.

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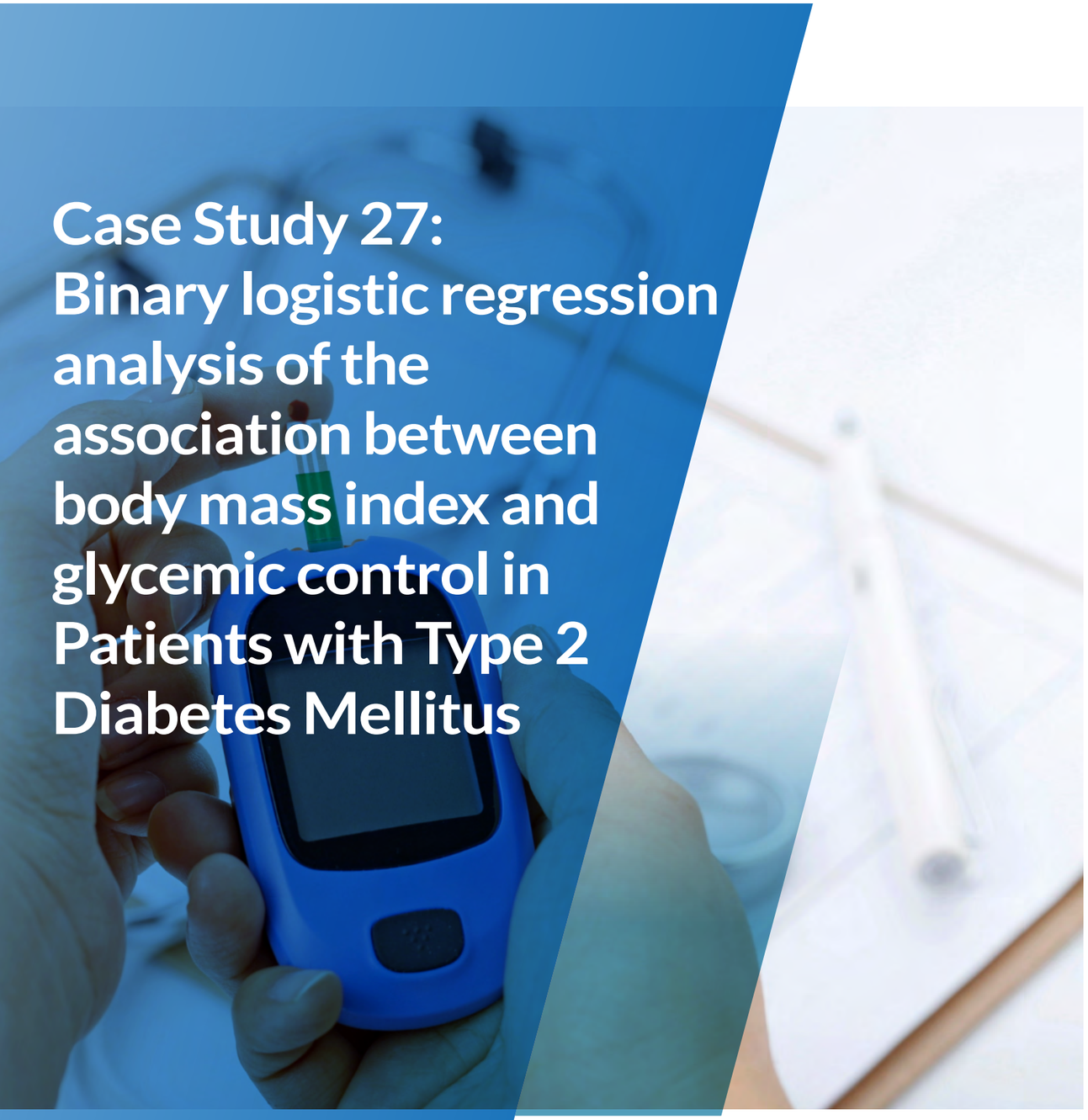

Case Study 27: Binary logistic regression analysis of the association between body mass index and glycemic control in Patients with Type 2 Diabetes Mellitus

Case study 27

Binary logistic regression analysis of the association between body mass index and glycemic control in Patients with Type 2 Diabetes Mellitus

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Goal of Case Study

This case study aims to demonstrate the practical application of basic and advanced statistical techniques to determine the association between independent and dependent variables.

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. Use a variety of basic and advanced statistical techniques to model data from secondary sources.
2. Perform univariate statistical analyses using independent t test and chi-square test.
3. Perform multivariate analysis using binary logistic regression to adjust for possible confounders.
4. Interpret results, draw conclusions, and prepare statistical report.
5. Use the statistical software (SPSS) to analyze the secondary data
6. Work effectively in a small team on computer-based projects.

Introduction

Type 2 diabetes mellitus (T2DM) is an increasing global health problem in both developed and developing countries, including Arab countries. The goal of T2DM management is to delay the onset of complications associated with the disease and impede disease progression; this is achieved mainly through glycemic control. Unfortunately, glycemic control remains poor, ranging between 40% and 60% worldwide. The United Kingdom Prospective Diabetes Study (UKPDS) showed that early intensive treatment of new onset diabetes mellitus, which strictly controls glucose levels, reduces the risk of microvascular and macrovascular complications. Reducing mean HbA1c by 1% was associated with a decrease of 21% for deaths related to diabetes, 14% for myocardial infarction, and 37% for microvascular complications. [1]

Research showed that around 50-90% of patients with type 2 diabetes are overweight (BMI > 25 kg/m^2) or obese patients (BMI > 35 kg/m^2). Patients with increased BMI are almost 20-fold more likely to develop T2DM as compared to individuals of normal weight (BMI = 18.5-24.9 kg/m2) [2-5].

Body Mass Index (BMI) is obtained by dividing the weight in kilograms by the square of height in meters and it is classified, according to World Health Organization (WHO). [6]

Table 27.1: BMI classifications

Classification	BMI
Normal weight	18.5-24.9 kg/m^2
Overweight	BMI 25-29.9 kg/m^2
Obesity	BMI ≥ 30 kg/m^2

Questions

Question 1. What are the cut-off values for defining BMI categories?

Part 1 The Story

Previous studies in Jordan showed a high rate of poor glycemic control among treated patients. The director of the King Abdulla University Hospital (KAUH) hypothesized that the high rate of poor glycemic control might be attributable to the high rate of obesity among patients seeking the treatment at KAUH. Before he decides on the proper intervention, the director asked the director of Information Technology Department to retrieve the necessary data from the electronic records of KAUH to determine the effect of body weight on glycemic control among patients with T2DM.

Part 1. Questions

Question 2. What are the limitations of using secondary data for analysis?

Part 2: Methods

The director of Information Technology Department at KAUH retrieved the dataset that included different variables including age, gender, weight, height, duration of diabetes mellitus, treatment modalities (oral antidiabetic medications and/or insulin), systolic and diastolic blood pressure, fasting plasma sugar, LDL-C, HDL-C, TG, and HbA1c. According to previous studies, he defined poor glycemic control as HbA1c level ≥ 7.0%.

Part 2. Questions

Question 3. Suggest and discuss the best study design to determine the association between BMI and glycemic control.

Part 3: Results

You are now provided with the data in SPSS format and you have been asked to work on the data set to analyze the association between body weight and glycemic control. Please use the SPSS file "Data for Case-Study 3" and analyze the data to determine the association between body weight and glycemic control.

Part 3. Questions

Question 4. Please define and categorize the dependent and independent variables as the followings:

- Glycosylated hemoglobin: According to the American diabetes association, glycemic control is judged to be good control if HbA1c <7% and poor control if HbA1c ≥7%.
- Age (years): < 40; 40-60; >60
- Duration of diabetes: ≤5 years; 6-10 years; >10 years.
- Hypertension: systolic blood pressure of 130 mmHg or greater and/or diastolic blood pressure of 85 mmHg or greater. Patients are considered hypertensive if they are diagnosed with hypertension or on antihypertensive agents.
- Body Mass Index (BMI): It is calculated as weight in kilogram (Kg) divided by height in meters square (m^2). According to the WHO international BMI classification: Normal weight (BMI 18.5-24.9 kg/m^2); overweight (BMI 25-29.9 kg/m^2); and obesity (BMI ≥30 kg/m^2).

Question 5. Conduct the frequency distributions for all studied factors (possible predictors of poor Glycemic control). Present the frequency and percentage for each category in the second column "N (%)" of Table 1.

Question 6. Conduct cross-tabulation for the dependent variable (good control vs. poor control) with other independent variables. Test for the differences in prevalence rates of poor Glycemic control for each independent variable using chi-square test and present the data in Table 1

Question 7. Comment on the findings in Table 1.

Table 27.1. The prevalence of poor Glycemic control according to demographic and clinical characteristics

Variable	N (%)	Good control n (%)	Poor control n (%)	P-value
Gender Male Female				
Age (years) < 40 40-60 >60				
Duration of Diabetes (years) ≤5 6-10 ≥11				
BMI (Body Mass Index) Normal weight Overweight Obesity				
Type of medication Oral hypoglycemic only Insulin only OHG + Insulin				
Hypertension No Yes				

Question 8. Compare the means of age, body mass index, duration of diabetes, TG, HDL, and LDL between the patients with good and poor glycemic control. Test for the differences between means using independent t test. Present the data in Table 2.

Question 9. Comment on the findings in Table 2.

Table 26.2. The differences in the means for selected variables between patients with good and poor glycemic control.

Variable	Good control mean (SD)	Poor control mean (SD)	P-value
Age			
Body Mass Index			
Duration of Diabetes			
Triglyceride			
HDL			
LDL			

Question 10. Conduct the univariate analysis using binary logistic regression to predict poor Glycemic control [remember to code poor glycemic control as "1" and good control as "0"] from BMI categories. Present the data in Table 3

Question 11. Comment on the findings in Table 3

Table 26.3. Binary logistic regression analysis of the association between body mass index and glycemic control

	Odds ratio (95% confidence interval)	p-value
BMI (Body Mass Index) Normal weight Overweight Obesity	Reference	

Question 12. Conduct the multivariate analysis using binary logistic regression to predict poor Glycemic control [remember to code poor glycemic control as "1" and good control as "0"] from all predictors in the full model. Present the data in Table 4

Question 13. Comment on the findings in Table 4

Table 27.4. Binary logistic regression analysis of the association between body mass index and glycemic control after adjusting for possible predictors and confounders

Variable	Odds ratio (95% confidence interval)	P-value
Gender Male Female		
Age (years) < 40 40-60 >60		
Duration of Diabetes (years) ≤5 6-10 ≥11		

Variable	Odds ratio (95% confidence interval)	P-value
BMI (Body Mass Index) Normal weight Overweight Obesity		
Type of medication: Oral hypoglycemic only Insulin only OHG + Insulin		
Hypertension No Yes		
Triglycerides		
HDL		

Question 14. Please write a report to present the findings of the study

Part 4: Discussion

Question 15. Compare the findings of the study with findings of another research in the EMR?

Question 16. What are the main limitations of the study?

Part 5: Conclusion

Question 17. What is the main conclusion of your study?

Question 18. What are your recommendations?

Annexes:

Annex 1: Logistic regression SPSS file

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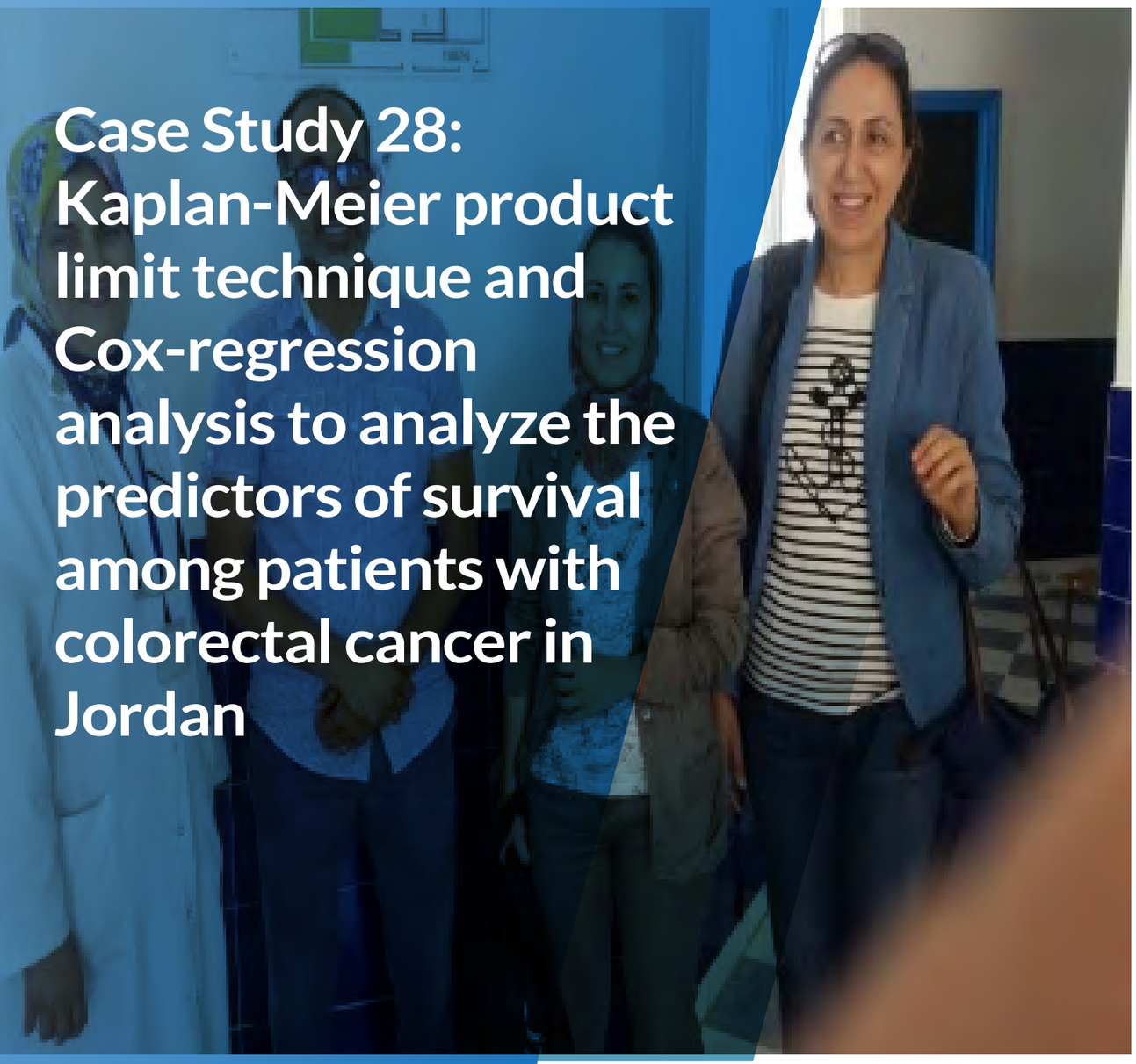

Case Study 28: Kaplan-Meier product limit technique and Cox-regression analysis to analyze the predictors of survival among patients with colorectal cancer in Jordan

Kaplan-Meier product limit technique and Cox-regression analysis to analyze the predictors of survival among patients with colorectal cancer in Jordan

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Goal of Case Study

This case study aims to demonstrate the practical application of basic and advanced statistical techniques to conduct survival analysis.

Learning Objectives:

1. Perform survival analysis to determine predictors of survival from colorectal cancer.
2. Identify suitable statistical techniques and justify their appropriateness to test specific hypothesis about survival data
3. Use the statistical software (SPSS) to analyze the secondary data using Kaplan Meyers and Cox-regression analysis.
4. Work effectively in a small team on computer-based projects.

Introduction

Colorectal cancer (CRC) is the third most common cancer in men and the second in women according to the latest GLOBOCAN worldwide estimation in 2012 (1). About 55% of the cases are reported in more developed countries. The highest rates were estimated to be in Australia/New Zealand (age standardized rate (ASR): 44.8, and 32.2 per 100,000 in men and women, respectively), and the lowest in Western Africa (ASR: 4.5 and 3.8 per 100,000). [1] In 2012, CRC was estimated to cause 694,000 deaths (8.5% of total cancer deaths) with more deaths (52%) occurring in the less developed countries [1]. In the United States, CRC is the third most common cancer, and the third leading cause of death due to cancer in both genders. [2]

In Jordan, the ASR has increased from 12.6 per 100,000 in 2005 to 17.2 per 100,000 in 2010. [3] According to the latest comprehensive cancer incidence report in 2012, CRC accounted for 11.3% of all newly diagnosed cases among Jordanians and ranked the second among all cancers in both genders. The overall crude incidence rate was 8.9 /100,000 population (8.6 and 9.2 /100,000 males and females, respectively). The overall ASR was 16.3/100,000 (15.9 and 16.6/100,000 males and females, respectively). [4] According to Jordan mortality registry in 2013, neoplasms were the second leading cause of death (16.4% of total deaths), and cancer of small intestine, colon, rectum, and anus accounted for 2% of total deaths [5]

Survival studies have yielded different findings about the survival rate and prognostic factors between countries (6-11). Different clinical and pathological prognostic factors have been proposed for CRC in the literature, including location of tumor, depth of invasion, tumor size, differentiation of tumor, tumor site, lymph node metastasis, and distant metastasis (9-12).

Question 1. What is the meaning of age standardized incidence? Explain how it is calculated.

Part 1 The Story

Data on the survival analysis of CRC are scant in the Eastern Mediterranean countries including Jordan. It is well established that CRC is one of those cancers that can largely be prevented by the early detection and removal of adenomatous polyps, and survival is therefore significantly better when colorectal cancer is diagnosed while being still localized. Screening strategies are needed for early detection of colon adenomas and colorectal cancer. To effectively plan and evaluate CRC preventive measures including screening and early detection programs, the director of the Department of Non-Communicable Diseases asked the Cancer Registry Manager to analyze the cancer registry data to estimate the survival rate of CRC, and determine its predictors among Jordanian patients who were diagnosed in the period between 2005 and 2010.

Part 1. Questions

Question 2. Discuss the trend of colorectal cancer in the Eastern Mediterranean Region.

Part 2: Methods

The Cancer Registry Manager retrieved all CRC cases among Jordanians who were registered in Jordan cancer registry during the period 2005-2010, with or without histopathology report. All cases died at the time of diagnosis, non-Jordanian patients, and patients with multiple cancers were not included in the data set. For each registered patient, demographic and clinical characteristics were obtained from the Jordan cancer registry files, and hospital medical records. Data about the type, and stage of cancer were obtained from histopathology reports from governmental and private laboratories in addition to the medical records of hospitals. Histopathology type was categorized according to cancer site. Cancer stage was classified according to Surveillance Epidemiology and End Results staging rules into: Localized, regional, distant metastasis, and unknown stage. To identify the vital status of these patients, date of last visit was obtained from medical records. Besides, the vital status was ascertained from the Civil Registration Department using a unique national identification number. Only cancer related deaths were recorded as “death” in the survival analysis. The few non-cancer-related deaths, as ascertained from the Civil Registration Department, were considered as censored cases.

A period of observation was set for the included patients from the date of diagnosis to the last date of observation if the patient was alive (1st Oct 2016), and to the date of death if the patient died during the observation period. The follow-up end point was death from cancer. Duplication of patients was excluded through verifying national identification number, the use of full four digits names, and matching the names and the addresses.

The Jordan cancer registry uses forms for data collection to collect data about socio-demograph-

ic characteristics including national identification number, name, age, marital status, and address and information related to cancer including histopathology, morphology, stage of cancer, location of tumor, date of diagnosis, date of last visit, and outcome. According to the registry, right-sided colon cancer is defined as cancer of the cecum and the ascending colon up to the hepatic flexure. Left-sided colon cancer comprises cancer of the splenic flexure and cancer in regions distal to the splenic flexure, including the rectum.

Part 2. Questions

Question 3. What are the variables that are necessary to conduct survival analysis?

Part 3: Results

You are now provided with the data in SPSS format "file name: Data for Case-Study 4" and you have been asked to work on the data set to analyze the cancer registry data to estimate the survival rate of CRC, and determine its predictors among Jordanian patients who were diagnosed in the period between 2005 and 2010. Use the Statistical Package for Social Sciences Software (SPSS) version (20 IBM) to estimate the overall survival using Kaplan-Meier product limit technique, compare survival rates between groups using Log rank test, and determine factors associated with the time to death Cox-regression analysis.

Part 3: Questions

Question 4. Summarize your results in the pre-structured tables 1-4.

Question 5. Please write a report to present the findings of the study

Table 28.1. The demographic and clinical characteristics of 3005 patients diagnosed with colorectal cancer during the period 2005-2010 in Jordan

	n	%
Age (year)		
<50		
50-59.9		
60-69.9		
70+		
Sex		
male		
female		
Year at diagnosis		
2005		
2006		
2007		
2008		
2009		
2010		
Region		
north		
middle		
south		
Smoking		
non smoker		
smoker		
Location		
anus		
colon		
rectum		
Grade		
well differentiated		
moderately differentiated		
poorly differentiated		
anaplastic		
unknown		
Stage		
localized		
regional		
distant metastasis		
unknown		

Table 28.2. Life table of colorectal cancer cases diagnosed in the period 2005-2010

Interval Start Time (year)	Number Entering Interval	Number With-drawing	Number Exposed to Risk	Number of Deaths	Proportion Surviving	Cumula-tive Pro-portion Surviving
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Table 28.3. The 5-year survival rate according to different prognostic factors for 3005 patients diagnosed with colorectal cancer during the period 2005-2010

	n	The 5-year survival rate	p-value <0.005
Age (year)			
<50			
50-59.9			
60-69.9			
70+			
Sex			
male			
female			
Region			
north			
middle			
south			
Smoking			
non smoker			
smoker			
Location			
anus			
colon			
rectum			
Grade			
well differentiated			
moderately differentiated			
poorly differentiated			
anaplastic			
unknown			
Stage			
localized			
regional			
distant metastasis			
unknown			

Table 28.4. The multivariate analysis of factors associated with the hazard of death from colorectal cancer in Cox-regression analysis

	HR	95.0% confidence interval for HR		p-value
Sex (female vs. male)				
Age (year)				
<50				
50-59.9				
60-69.9				
70+				
Smoking (yes vs. no)				
Location				
anus				
colon				
rectum				
Region				
north				
middle				
south				
Grade				
well differentiated				
moderately differentiated				
poorly differentiated				
anaplastic				
unknown				
Stage				
localized				
regional				
distant metastasis				
unknown				
Location of tumor				
Left				
Right				

Part 4: Discussion

Question 6. Compare the findings of the study with findings of another research in the EMR?

Question 7. What are the main limitations of the study?

Part 5: Conclusion

Question 8. What is the main conclusion of your study?

Question 9. What are your recommendations?

Case study 28

Annexes

Annex 1: Survival analysis SPSS file

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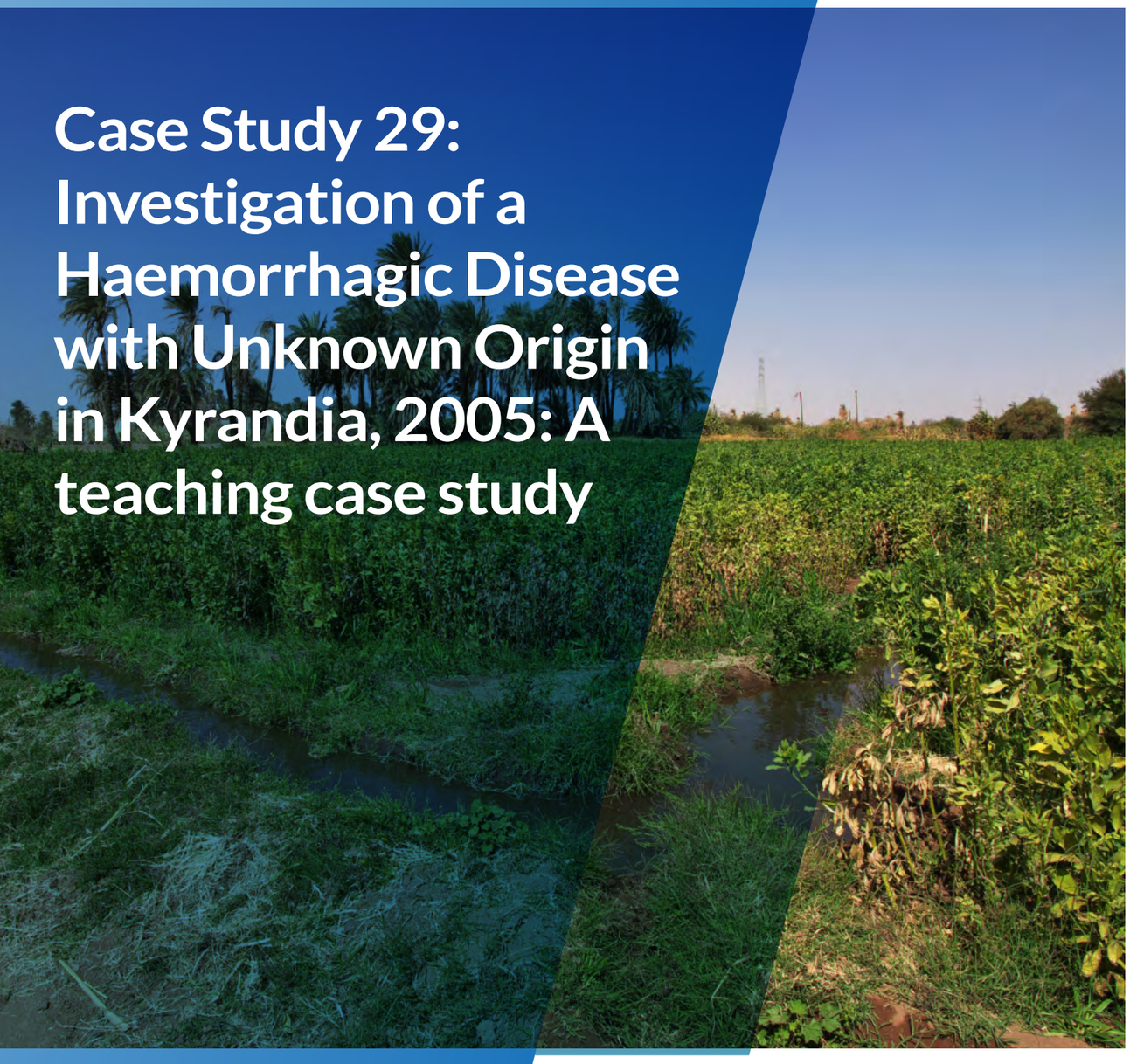
Case Study 29: Investigation of a Haemorrhagic Disease with Unknown Origin in Kyrandia, 2005: A teaching case study



Investigation of a Haemorrhagic Disease with Unknown Origin in Kyrandia, 2005: A teaching case study

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Goal of Case Study

The goal of this case study is to build the capacity of trainees to investigate hemorrhagic disease outbreaks of an unknown origin.

Learning Objectives

At the conclusion of the case study, participants will be able to:

1. Analyse and interpret data generated from a surveillance system in outbreak detection
2. Develop a case definition and discuss how to use it to conduct active case searches
3. Calculate attack rate and case fatality rate
4. Explain the process of notification to WHO
5. Discuss the measures associated with the collection of clinical specimens for the investigation of a suspected disease outbreak
6. Design an action plan for disease control and apply the appropriate measures for prevention and control

Introduction:

A haemorrhagic disease, i.e. a disease accompanied by abnormal bleeding, could manifest itself in any age group from infants to the elderly. The primary disease may involve any organ of the body or the body as a whole. A haemorrhagic disease usually has a severe course which is accompanied with high mortality.[1] A viral haemorrhagic disease outbreak is always an urgent public health event requiring immediate action. In the Eastern Mediterranean Region, a viral haemorrhagic disease was reported in more than 12 countries in the Region, yet most of the outbreaks in the region occurred in remote areas with limited or non-existent medical services.[2]

Kyrandia is located in the Eastern Mediterranean Region and has a land area of approximately 190,843 km^2, and a population of 1.6 million people. The country is divided into 7 states and 22 localities (Figure 1). Kyrandia is primarily a savannah, with the Preim Mountains (460 – 910 m elevation) comprising small, isolated ranges throughout the state. Travel within Kyrandia is difficult and limited, especially during the rainy season. The rainy season lasts from mid-May until October. The population of Kyrandia consists primarily of subsistence farmers, and many families own farm animals including cattle and goats. Several nomadic tribes migrate seasonally across the country.

The health care infrastructure is in Kyrandia is rudimentary or non-existent, and much of the population relies on traditional medical practices. Kyrandia is affected by a heavy burden of vector-borne diseases including malaria, schistosomiasis, dengue, onchocerciasis, and lymphatic filariasis.

Figure 1: Map of Kyrandia Showing Constituent States, 2005

Kyrandia has witnessed several outbreaks of zoonotic arbovirus diseases such as Rift-Valley fever, Crimean-Congo haemorrhagic fever, yellow fever, and dengue A large-scale Yellow Fever outbreak occurred in the Preim Mountains in the 1940's infecting over 15,000 people. Yellow fever vaccination has not been introduced into the routine immunization schedule, and before this outbreak, the population of Kyrandia had not been vaccinated against the Yellow Fever virus.

Part 1: Story

1st of October 2005, Federal Ministry of Health: This morning, the Federal Ministry of Health (FMH) notified you, a public health officer, that there are 16 cases of haemorrhagic illness, including 11 fatalities, registered in the state of Shanta since the 28th of September. According to routine surveillance previously carried out in this region, mass haemorrhagic diseases have not been registered in last 5 years.

Part 1 Questions

Question 1. What are the possible causes of this condition?

Question 2. Is this an outbreak? If yes, why?

Question 3. Do you consider this disease to be severe? Justify your answer.

Question 4. What additional information do you need? Which would help you to investigate this public health event?

Part 2: Methods

The next day, you decided to make a call to Shanta State Hospital. Following is a transcript of the communication between you and Doctor Mohamed Mehdi, Director of the Shanta State Hospital
You: Hello! Doctor Mohamed Mehdi? I am a public health officer from the Ministry of Health. I would like to ask you several questions about the cases of haemorrhagic fever you observed.
Dr Mohamed: All right, but let's talk as quickly as possible: there are many cases here, as you know...
You: What are the main symptoms of the disease?
Dr Mohamed: Mainly fever and bleeding. I have also observed jaundice in four patients.
You: Do you consider this disease severe?
Dr Mohamed: Oh, as I see, it is, many of the admitted patients have died.
You: Were there any cases of the disease in medical personnel?
Dr Mohamed: Thank God there weren't. We have no protective equipment except for gloves and masks.
You: Could you give me any information about age, sex ratio of your patients, and place of their residence?
Dr Mohamed: I do not remember these numbers; I will send you this info by email.
You: Did you perform any laboratory investigations to reveal a causative agent?
Dr Mohamed: No, we don't have such possibilities. We will send 11 blood samples to the National Public Health Laboratory; please, address them directly for results.

Part 2 Questions

Question 5. What samples should be collected for testing? What etiologic agent should the lab test for?

Question 6. You need to organize transportation of the blood samples for further serological investigations. How must they be packed and declared according the International Air Transport Association (IATA)? You can use (Annex1) to answer this question

Question 7. What do you think the biosafety level (BSL), it must be found it the national heath lab to investigate the samples?

Part 3: Results

You contacted the Shanta Hospital and the physician sent you information. Many of the patients were nomads of the Trury tribe (Table 1), and there did not appear to be any clustering of illness within families or transmission to health care workers.

According to the Shanta public health authorities the cases were presented with illness characterized by fever and severe headache and backache. Half of the patients had haemorrhagic signs, including gingival bleeding, epistaxis, hematemesis and melena, and 37.5% of them had jaundice. The Federal Ministry of Health, WHO, and the State Ministry of Health started initial investigations in the Shanta State

Question 8. How could you interpret the data obtained from the list? What risk factors do you suspect? (see Table 1)

Table 29.1: List of Patients from Shanta Hospital

ID #	Sex	Age	Onset	Residence	District	Fever	Jaun-dice	Haem-orrhage	Death
1	Male	60	05 Sep.	Permanent Resident	Shanta	+	-	+	+
2	Female	41	05 Sep.	Nomad	Shanta	NA	NA	NA	+
3	Female	8	05 Sep.	Permanent Resident	Didi	NA	NA	NA	-
4	Male	31	19 Sep.	Nomad	Shanta	NA	NA	NA	+
5	Female	17	19 Sep.	Nomad	Bulobazi	NA	NA	NA	+
6	Male	13	26 Sep.	Nomad	Shanta	+	+	+	+
7	Female	21	26 Sep.	Nomad	Shanta	+	+	+	-
8	Male	25	26 Sep.	Permanent Resident	Lodo	NA	NA	NA	+
9	Female	47	03 Oct.	Nomad	Shanta	+	-	+	-
10	Female	37	03 Oct.	Permanent Resident	Shanta	NA	NA	NA	+
11	Male	2	03 Oct.	Nomad	Lodo	+	+	-	+
12	Male	5	03 Oct.	Permanent Resident	Mini	+	-	-	+
13	Male	7	03 Oct.	Nomad	Shanta	NA	NA	NA	-
14	Male	33	03 Oct.	Nomad	Shanta	+	-	-	-
15	Male	2	03 Oct.	Permanent Resident	Lodo	+	-	-	+
16	Female	6	03 Oct.	Nomad	Lodo	NA	NA	NA	+
17	Male	21	03 Oct.	Nomad	Mpayi	+	-	-	-
18	Female	7	03 Oct.	Permanent Resident	Mpayi	+	-	-	+

NA – not available (no information available)

Eleven blood samples collected from patients with characteristic symptoms were submitted to the National Public Health Laboratory. Using a dengue virus (DENV) rapid strip test, IgM antibodies against DENV were detected in five (45%) of 11 blood samples.

Part 3 Questions

Question 9. List the steps needed to investigate an outbreak.

Question 10. What is the outbreak case definition to add new cases to a line list throughout the outbreak?

Question 11. What is your strategy to further follow up on this outbreak?

Question 12. Do you think the country should notify WHO about this event? Use Annex 2 of the International Health Regulations 2005 to answer these questions.

Part 4: Discussion

During the past 10 days, field teams interviewed village and nomad chiefs, health directors of state and districts ministries, physicians and medical assistants at the Shanta State.

The index case was a 60-year-old male resident of Yondo (Shanta district) who died on the 20th of September. The first case in the nomadic population was reported from the Shanta district with an estimated onset date of September 5, and it occurred in a 41-year-old female who died on September 23. The index patients had no history of travel in the week before their illness. Sporadic cases of the diseases occurred until early October when the number of reported cases increased rapidly, peaking on the 17th of October.

You received surveillance data from the Federal Ministry of Health sentinel surveillance system. During the period from September 5 (the outbreak's onset) to Octoberc31, the number of cases increased and amounted to 408 cases (see Figure 2, Table 2). Cases of haemorrhagic fever have been reported in States of the South Bulobazi and Didi

Figure 29.2. Kyrandia Haemorrhagic Fever Outbreak, Epidemic Curve by Date of Onset

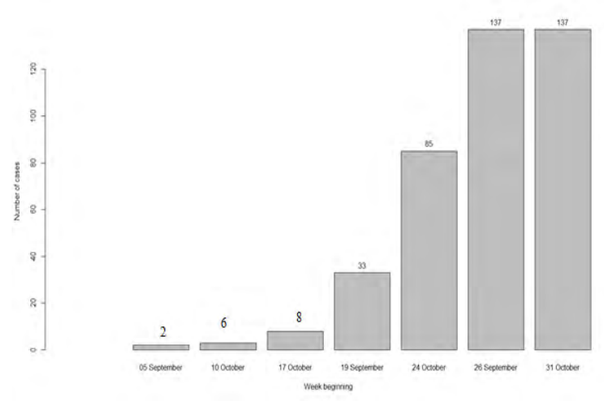


Table29.2: Characteristics of Outbreak-related Illness Cases

Characteristic	n (%)
Total reported cases	408 (100)
Deaths	292 (71.6)
Sex	
Male	233 (57.1)
Female	175 (42.9)
Age	
< 5	32 (7.8)
5 – 14	95 (23.3)
15 – 29	118 (28.9)
30 – 44	94 (23.0)
> 45	69 (16.9)
Residence	
Nomad	201 (49.3)
Permanent Resident	207 (50.7)

Further serological testing conducted at the Naval Medical Research Unit-3 (NAMRU-3, Cairo, Egypt) found IgM antibodies against the Yellow Fever virus in 13 (34%) of the 38 serum samples, and Chikungunya virus was isolated from two samples at the Centre for Disease Control and Prevention, Fort Collins, CO, USA. In addition, further Clinical information was obtained for 177 patients unvaccinated against Yellow Fever attending clinics in Didi and Lodo, and was used to classify patients into three categories [4] (see Table 3).

Table 29.3: Classification of 177 Patients with Illness Reported During the Outbreak and Results of their Serological Investigation

Classification	YF	DEN	YF + DEN	CHIK	YF + CHIK	None
Suspected yellow fever	10 (16%)	1 (2%)	1 (2%)	9 (15%)	6 (10%)	35 (56%)
Fever + jaundice + haemorrhage	4 (22%)	0 (0%)	0 (0%)	1 (6%)	3 (17%)	10 (56%)
Fever + jaundice + death (20 of them without any haemorrhage)	6 (14%)	1 (2%)	1 (2%)	8 (18%)	3 (7%)	25 (57%)
Severe illness	0 (0%)	0 (0%)	0 (0%)	3 (14%)	1 (5%)	18 (82%)
Fever + haemorrhage	0 (0%)	0 (0%)	0 (0%)	3 (15%)	0 (0%)	17 (85%)
Fever + jaundice	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Febrile illness	0 (0%)	0 (0%)	0 (0%)	2 (18%)	0 (0%)	6 (82%)

Part 4 Questions

Question 13. What is a new standard case definition? Suggest suspected, probable, and confirmed case definitions for a case for use in this investigation.

Question 14. According to the epidemic curve's shape, what do you assume was the pattern of infection spread in the population (point, intermittent, propagated)?

Part 5: Conclusion

From the 5th of September through the 31st of October, 408 cases of acute febrile illness, many with jaundice or haemorrhage, were reported from Kyrandia.

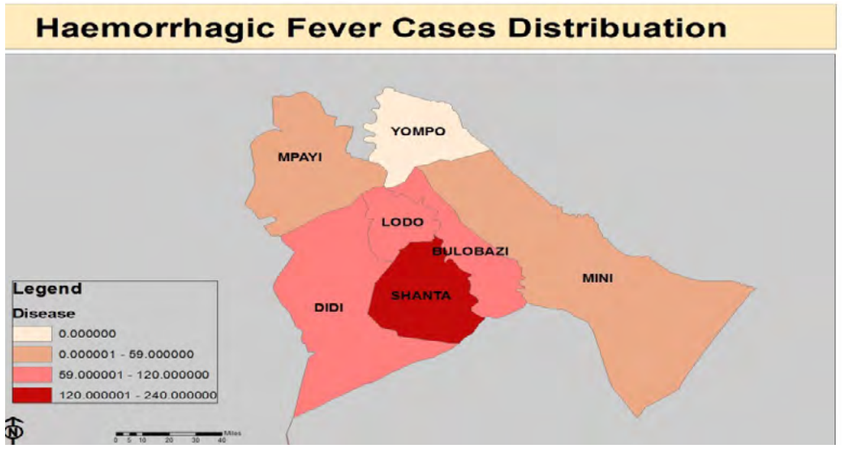
Results of serological investigation suggested that at least a portion of the outbreak was due to Yellow Fever Virus (YFV). This is evidenced not only by serological results of recent YFV infections in several unvaccinated persons, but also by the high case fatality rate and the clinical syndromes compatible with Yellow Fever.

In addition, the isolation of the Chikungunya virus, the serological evidence of recent Chikungunya infections, and the clinical syndromes compatible with Chikungunya suggest that this virus also contributed to the outbreak.

On the 1st of November, the Federal Ministry of Health officially declared an outbreak of Yellow Fever after which the Yellow Fever case definition mentioned above was adopted.

In response to a request from the Federal Ministry of Health, an international, multidisciplinary team (including yourself) carried out additional epidemiological and entomological investigations to confirm the cause and further describe the outbreak. Cases were reported from 6 States in Kyrandia (see Figure 3).

Figure 293: Haemorrhagic Fever Case Distribution by State, 2005



Part 5 Questions

Question 15. Look at the map. Discuss the infection spread. What additional investigations do you need to perform.

Question 16. Based on the preliminary findings mentioned above, what control and prevention measures should the investigating team recommend?

Question 17. The basic reproductive rate (R0) for Yellow Fever is about 4. How many people do you expect to be infected from one case if no measures are put in place?

Question 18. You need to write a final outbreak investigation report. What parts should be included in the report? Why is it important to write an outbreak report? Who should receive this outbreak report?

Summary of the Case, Actions Taken, and Recommendations

Vaccination against YFV is the most effective public health intervention to prevent and control epidemics in endemic regions. However, its impact on the control of this particular outbreak was likely limited. Despite achieving high vaccination coverage, the outbreak had largely waned by the time the campaign was organized and launched.

Nevertheless, the vaccination campaign was essential in preventing and limiting future outbreaks in this region. The impact of mosquito control on this outbreak is difficult to determine, and mosquito control has been limited to primarily larger towns while most cases were reported from smaller villages. Mosquito control efforts were conducted in some villages along the Trury migration route and efforts in larger towns might have helped prevent transmission in these areas. Also, mosquito control measures for YF outbreaks have generally had limited efficacy against sylvatic vectors, and control may be useful in limiting virus spread in urban areas until protection afforded by vaccination campaigns can be realised. Control operations were hampered by a number of technical constraints including lack of resources and personnel trained in mosquito control and entomologic assessments of control efficacy.

As with the 1940's outbreak, the end of this outbreak may be attributed to the end of the rainy season and the corresponding elimination of suitable mosquito breeding sites rather than either vector control or the vaccination campaign.

Prompt recognition and control of this particular outbreak was hampered by lengthy delays in recognition of the outbreak and in the time required for shipping and testing of diagnostic samples. Effective and timely responses to future outbreaks depend on improved surveillance and increased laboratory capacity in developing countries. Diagnosis of YF and other arboviral diseases relies on improving medical facilities and health care provision in endemic regions.

Source: The case study is based on real events [3] with some fictional elements. Details from the original outbreak investigation have been modified to enhance learning objectives and support the instructional goal. Persons that are only named “a case” in the scientific literature are sometimes given fictional features.

Annexes

Annex 1: The triple package layers (figure provided by IATA, Montreal, Canada)
Annex 2: Annex 2 of the International Health Regulations IHR (2005)

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Resources and reading materials

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Part IV
Teaching case studies in Infection control

Case Study 30: Infection control crisis due to methicillin-resistant Staphylococcus aureus (MRSA) in an intensive care unit at a Jordanian hospital, 2016

Infection control crisis due to methicillin-resistant Staphylococcus aureus (MRSA) in an intensive care unit at a Jordanian hospital, 2016

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Goal of Case study:

To understand the transmission of methicillin resistance staphylococcus aureus and apply appropriate infection control measures in intensive care units at Jordanian Hospitals

Learning Objectives:

At the conclusion of the case study, participants will be able to:

1. Recognize how antibiotic resistance happens.
2. Define the role of the infection control practitioner in the hospital
3. Design action plan for prevention control measures
4. Apply MRSA surveillance on residents and new admissions for all multidrug-resistant micro-organisms
5. List the risk factors of MRSA
6. Evaluate and interpret the results of MRSA.
7. Suggest recommendations for preventing MRSA
8. Use protective preventive measures (PPE, Disinfection)

Introduction

Antibiotic resistance is a worldwide problem. World health leaders have described antibiotic resistant microorganisms as “nightmare bacteria” that “pose a catastrophic threat” to people all over the world [1].

There are multiple bacteria living in this world. The commonest is Staphylococcus aureus. It is easy to find their habitats, such as hospitals, homes, parks, schools etc. Staphylococci are gram positive, non-motile, and perfectly spherical, measuring approximately 1 micrometer. Staphylococcus aureus grow in chains that resemble bunches of grapes, hence the unusual name derived from the Greek staphyle, meaning “‘bunch of grapes”. When observed microscopically in stained specimens taken from colonies grown on blood agar, S aureus strains grow out a hemolytic pattern. S aureus also display golden color of colonies when grown on agar aerobically. [2]

Methicillin resistant Staphylococcus aureus (MRSA), is a type of staph bacteria that is resistant to many antibiotics such as methicillin, oxacillin, penicillin, and amoxicillin, further facilitating their spread in healthcare setting, such as hospitals and nursing homes. They are responsible for high morbidity and mortality rates worldwide, causing bloodstream infections, pneumonia, and surgical site infections.

Studies show that MRSA in American and European Hospitals account for 29%–35% of all clinical isolates [3], for 57% of all Intensive Care Unit (ICU) acquired Staphylococcus aureus infections, and Carrier rates among hospital personnel were 25% [4] National Nosocomial Infections Surveillance System (NNIS) data analysis for 1992 to 2003 showed that the percentage of Staphylococcus aureus isolates that were methicillin-resistant increased from 35.9% to 64.4% in participating adult and pediatric ICUs. [5]

The major reservoir of MRSA in institutions are colonized and infected inpatients, while transient hand carriage of the organism by health care workers accounts for the major mechanism for patient-to-patient transmission, in addition to sharing contaminated items such as soap, towels, clothing, razors and other personal care items. Contaminated surfaces also share in transmission, since MRSA bacteria can survive for days to weeks on surfaces, with longer survival on dry rather than on moist surfaces.

Questions

Question 1: Define antimicrobial Resistance?

Question 2: How does antimicrobial resistance happen?

Question 3: What are the characteristics of Methicillin Resistance Staphylococcus aureus?

Part 1 The Story

In the year 2016, the laboratory at Governmental Hospital in Jordan reported increased incidence of staphylococcus aureus methicillin resistance from Intensive care units compared to similar times of the previous year. MRSA is a common and important cause of colonization and infection in surgical intensive care units. Overuse of antibiotics and jeopardized infection control practices triggered the rise of methicillin resistance.

Part 1 Questions

Question 4: What is the difference between colonization and infection?

Question 5: Can this be considered a MRSA outbreak?

Part 2: Methods

Epidemiological investigation: Study population and sources of data
Actions were immediately started, where the infection control officer together with FETP students started to investigate. Retrospective laboratory results between January 1st, 2016 and November 2016, proved MRSA collection, from the surgical intensive care unit in governmental hospitals in Amman. The team then moved to the intensive care unit to investigate the causes of infection control crisis there. Medical records for MRSA infections were reviewed to identify causes, sources of infection, and possible high-risk groups, in intensive care unit, the staffing patterns of nurses, doctors, hospital technicians, respiratory therapists, and visitors were observed.The population for this study included all patients admitted to surgical ICU in governmental hospital with over 500 beds, during the period from January–November 2016, who showed Staphylococcus aureus methicillin resistant MRSA. The incidence was calculated per 100 patients discharge.

The infection Control chairman called for a meeting with representatives from ICU, respiratory therapy, environmental services, laboratory, and nursing staff. The objective of their meeting was to identify risk factors, evaluate control measures used in intensive care units. The team decided to isolate the patients and environmental samples to be taken and close the ICU for two days

Cases were considered infected if MRSA had been isolated from a sterile site, the patient was exhibiting clinical signs and symptoms of infection with no other etiologic causes, and cultures were done more than 48 hours after patient admission.

Part 2 Questions

Question 6: List the steps you will follow to investigate this infection control crisis?

Question 7: In your opinion, was it a right action to close the unit? Justify your answer.

Question 8: What samples should be collected from intensive care unit? In your opinion was it needed?

Question 9: What role do you think the environmental services plays in this case?

Part 3: Results

Epidemiological and Laboratory Findings

A retrospective analysis of medical records revealed that from January to November of 2016, a total of 56 MRSA had been isolated from 27 surgical ICU patients out of 1103 patients discharged during this period. Some patients had multiple sites of infection i.e. had Urinary tract infection and bacteremia

After reviewing the patients' medical record, data revealed that five patients were colonized, and three patients had community MRSA and the rest were MRSA hospital acquired infections. All patients were exposed to invasive medical devices such as folly's catheter, central line, and ventilator, received antibiotic therapy, and stayed more than 5 days at the hospital.
Investigations also revealed shortage of ICU staff and provoking of the infection control precaution measures by healthcare workers. (List of MRSA isolated attached)

Table 30.1: Distribution of MRSA by Gender, Age group, and diagnosis

Gender	No.	%
Female	10	37%
Male	17	63%
Age group (years)		
10-19	2	7.0%
30-39	5	18.5%
50-59	5	18.5%
60-69	6	22.2%
70-79	6	22.2%
80-90	3	11.1%
Admission Diagnosis		
Acute pancreatitis	2	7.0%
Brain hemorrhage (craniotomy)	4	14.8%
Falling	3	11.1%
Fever for investigation	1	3.7%
Pneumonia	3	11.1%
CVA	2	7.0%
RTA	5	18.5%
UGIB	3	11.1%
Sepsis	2	7.0%
liver cirrhosis on hemodialysis	1	3.7%
Skull Fracture + pulmonary embolism	1	3.7%

Table 30.2: Distribution of MRSA source of isolate reported from ICU Governmental Hospital lab

Source of isolates	MRSA	
	No.	%
Skin	13	23.1
Urine	10	17.9
Ear	8	14.3
Wound	6	10.7
Blood	5	8.9
Pus	5	8.9
Sputum	4	7.2
Eye	3	3.4
Pleural Fluid	1	1.8
CSF	1	1.8
Total	56	100

Table 30.3: Distribution of MRSA reported from the laboratory by month, from ICU Governmental Hospital for the year 2016

Source of isolates year	MRSA	
	No.	%
January	2	3.6
February	10	17.9
March	15	26.8
April	10	17.6
May	5	8.9
June	2	3.6
July	2	3.6
August	0	0.0
September	4	7.2
October	3	5.4
November	2	3.6
December	1	1.8

Part 3: Questions

Question 10: Calculate the incidence of MRSA hospital acquired infection.

Question 11: List the infection control measures that should be taken?

Question 12: List the colonized risk factors associated with MRSA in Intensive care unit?

Question 13: What could be the environmental source of MRSA?

Question 14: Suggest the possible role played by the environment in transmitting MRSA

Question 15: From your previous observation, what could be the commonest cause for transmitting the infection in the ICU.?

Question 16: From table 4, Draw the Epi curve of MRSA in ICU. What do you learn from Epi curve?

Part 4: Discussion

MRSA is responsible for both nosocomial and community-based infections ranging from minor skin and soft tissue infections to life-threatening systemic infections. Contact spread of infection plays an important role in Intensive care unit, where a large use of invasive procedures such as ventilator, endotracheal tube, Central catheter, folly's catheter, the main sources are colonized, or infected patients introduced from another hospital, but occasionally by staff moving from one patient to another. Heavy dispersers are likely spread occur from staff or patient carriers. in the nose or on the skin that will transmit the MRSA to patients.

Infection Control team instructed ICU staff and visitors to take infection control precaution measures for all patients with MRSA, screened ICU patients for four weeks until no addition MRSA detected, and discharge. Subsequently the unit was closed for two days for appropriate disinfection.

From the full analysis, we found that nursing workload is one of the risk factors for occurrence of infection control crisis in intensive care units. Nursing staff provides care two to three patients per shift, patients were severe conditions require more care and need close monitoring, therefore, this impact the quality of care and occurrence of MRSA. Contaminated medical equipment such as stethoscopes may be responsible for transmission. Failures to change gloves between patients may lead to transmission. Also, we found the staffing patterns (respiratory therapist, nursing, technicians) from the weeks prior to the infection control crisis revealed no overlapping of a staff member who cared for all the cases of both colonized and infected patients.

Part 4 Questions

Question 17: suggest suitable infection control measures to apply to eliminate MRSA.

Question 18: Is screening a good action to eliminate MRSA? Justify your answer.

Question 19: What actions would you take to engage the visitors while implementing prevention and control measures?

Question 20: What is the advantage and disadvantage of screening all patients newly admitted to Intensive care unit?

Part 5: Conclusion

After summarizing their findings using descriptive epidemiology, the investigating team concluded that implementation of aggressive, multifaceted infection control measures was successful in controlling MRSA, despite the difficulty in tracing transmission routes in these cases due to the complexity of MRSA epidemiology. Community-associated MRSA, healthcare associated infection, cause different clinical syndromes and they frequently cause infection in health care environments. Moreover, routine screening of patients newly admitted to the ICU is costly. To reduce the transmission of MRSA, healthcare workers have to deal with each patient as "infected" and to follow proper precautions such as handwashing and using alcohol sanitizers.

Actions taken and recommendations

Comply with basic infection prevention and control strategies, i.e. handwashing, contact isolation, prevention of device-related hospital associated infections, equipment cleaning and decontamination.

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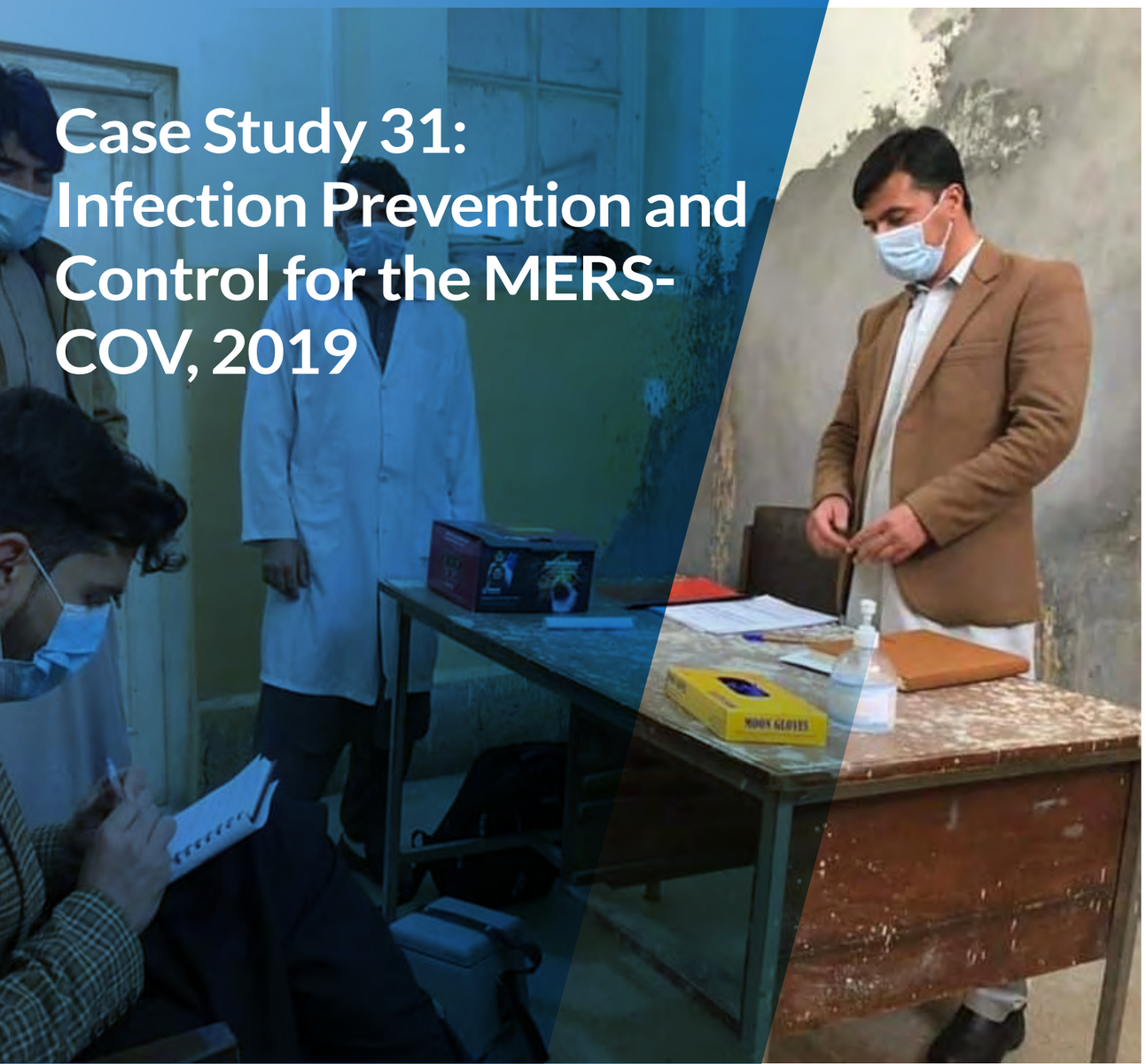
Case Study Related Readings

1. Guide AA. Guide to the Elimination of Methicillin-Resistant Staphylococcus aureus (MRSA) Transmission in Hospital Settings.
2. Blatnik J, Lesnicar G. Propagation of methicillin-resistant Staphylococcus aureus due to the overloading of medical nurses in intensive care units. J Hosp Infect [Internet]. 2006;63(2):162-66.
3. Centers for Disease Control and Prevention. Staphylococcus aureus in healthcare settings.
4. Ayliffe AJ, World Health Organization. Recommendations for the control of methicillin-resistant Staphylococcus aureus (RSA).
5. Centers for Disease Control and Prevention. Antibiotic Prescribing and Use in Doctor's Offices. Updated September. 2017;25.



Case Study 31: Infection Prevention and Control for the MERS-COV, 2019

Infection Prevention and Control for the MERS-COV, 2019

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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 case study, 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 prevention measures
5. Discuss infection control precautions

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 include: 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).

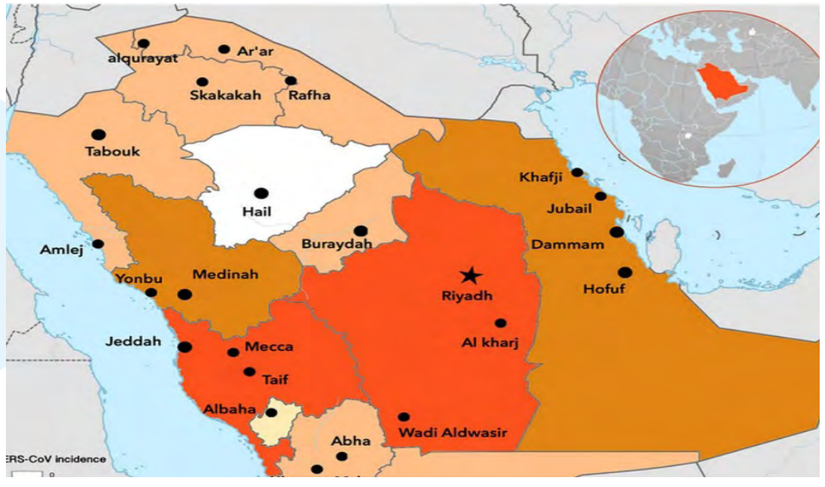

Figure 31.1. Incidence of MERS-CoV infections (1250 confirmed cases) across KSA from 2012 to 2015

Part 1: Story

MERS-CoV is a viral respiratory disease caused by a novel coronavirus that was first identified in KSA in 2012. 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%. 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. 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 included excel table)

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

Question 6. Calculate the case fatality rate. (Please refer to included excel table)

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 males, 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

MERS causes more severe disease in people with underlying chronic medical conditions such as diabetes mellitus, renal failure, chronic lung disease, and compromised immune systems.

Therefore, people with these underlying medical conditions should avoid close unprotected contact with animals, particularly dromedary camels, when visiting farms, markets, or barn areas where the virus is known to be potentially circulating. General hygiene measures, such as regular hand washing before and after touching animals and avoiding contact with sick animals, should be adhered to.

Food hygiene practices should be observed. People should avoid drinking camel's raw milk or camel urine or eating camel meat that has not been properly cooked.

WHO does not advise special screening at points of entry regarding this event nor does it currently recommend the application of any travel or trade restrictions. [1]

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

Annexes:

Annex 1: MERS COV cases

References:

1. World Health Organization. (2020). Middle East respiratory syndrome coronavirus (MERS-CoV) – The Kingdom of Saudi Arabia. [online] Available at: https://www.who.int/csr/don/24-April-2019-mers-saudi-arabia/en/ [Accessed 15 Feb. 2020].

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5. WHO, Norms and Standards in Epidemiology: Case Definitions https://www.paho.org/english/sha/be991norms.html

6. Middle east respiratory syndrome coronavirus; guidelines for healthcare professionals, moh https://www.moh.gov.sa/CCC/healthp/regulations/Documents/MERS-CoV%20Guidelines%20for%20Healthcare%20Professionals%20-%20May%202018%20-%20v5.1%20%281%29.pdf

7. WHO RISK ASSESSMENT Middle East respiratory syndrome coronavirus (MERS□CoV), 24 April 2014 https://www.who.int/csr/disease/coronavirus_infections/MERS_CoV_RA_20140424.pdf?ua=1

Further resources for reading

1. MOH, KSA
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/

Case study 31

GHD and EMPHNET: Working together for better health

Global Health Development (GHD) is a regional initiative created to support countries in the Eastern Mediterranean Region (EMR) and to strengthen their health systems to respond to public health challenges and threats. GHD was initiated to advance the work of the Eastern Mediterranean Public Health Network (EMPHNET) by building coordinating mechanisms with Ministries of Health, International Organizations and other institutions to improve population health outcomes. As an implementing arm to EMPHNET, GHD aligns its strategies with national policies and directions. Serving as a collaborative platform, GHD/EMPHNET is dedicated to serve the region by supporting national efforts to promote public health policies, strategic planning, sustainable financing, resource mobilization, public health programs, and other related services.

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