Investigation and Control of Measles Outbreak in Puli-Khumri and Baghlan-Markazi Districts, Baghlan province, Afghanistan: A Teaching Case-Study

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Abstract

Measles is a highly contagious viral disease that remains a significant cause of death among young children globally despite the availability of a safe and effective vaccine. Measles is transmitted via droplets from the nose, mouth, or throat of infected persons, and initial symptoms include a high fever, 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. 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. In Afghanistan, 25,000 cases were reported in 2017 of which 85% were among children under the age of 10. These cases span over 20 of the 34 provinces across Afghanistan, with the worst affected provinces being Kabul, Paktika, Kunar, Badghis, and Ghor. The majority of outbreaks are reported, investigated, and responded to throughout recent years in the country. This current outbreak of measles with an almost two-year duration is investigated and reported from Baghlan province.

The goal of this case study is to develop competencies and consolidate understanding of participants to investigate and control outbreaks. This case study stimulates the students to investigate and control a measles outbreak and critically appraise an epidemic report. The case study is designed for training novice field epidemiology trainees. The case study can be administered in 3-4 hours. Used as adjunct training material, the case study provides the trainees with competencies in investigating outbreaks and identifying factors affecting outbreaks.

Keywords: Measles, outbreak, vaccination

How to Use the Case Study

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

Audience: This case study was developed for novice field epidemiology students. These participants are commonly health care workers working in the 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.

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

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

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

Time required: 3-4 hours

Language: English

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

By the end of the teaching session, 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

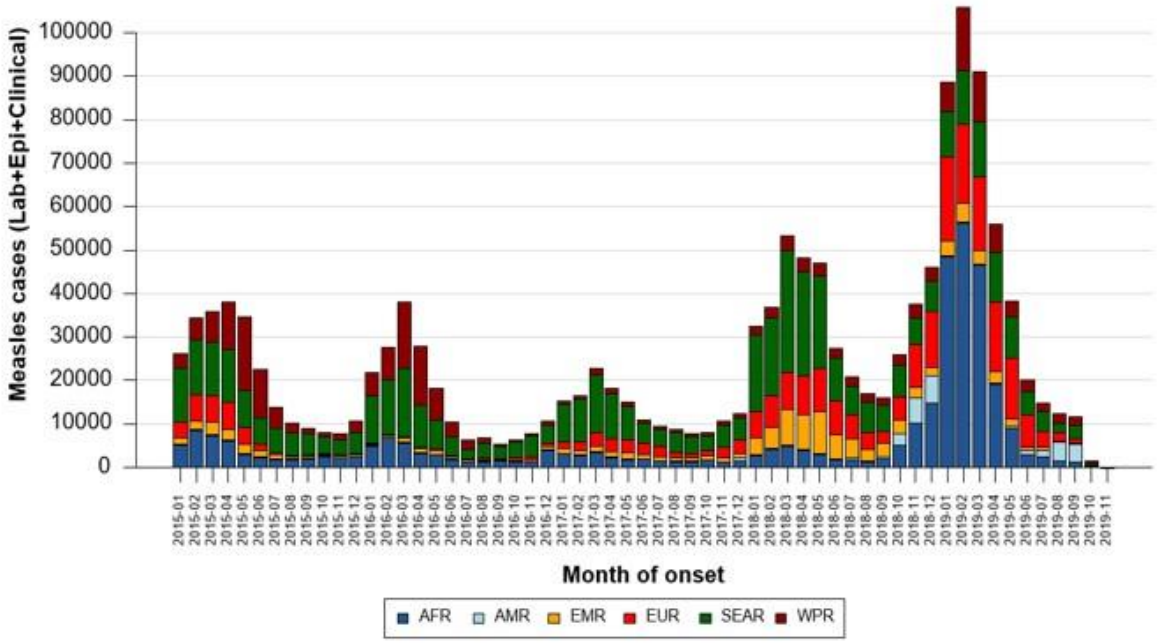
Introduction

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.

Figure 1: Measles case distribution by month and WHO Region (2015-2019), Data as of 8 November 2019



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

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 km^2, 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 15°C, and winter temperatures below zero [3]. 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].

Figure 2: Map of Afghanistan

Source: https://commons.wikimedia.org/w/index.php?curid=16493127

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 childhood 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.

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?

Annex 1: Data: Investigation and Control of Measles Outbreak in Puli-Khumri and Baghlan-Markazi Districts, Baghlan province, Afghanistan

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