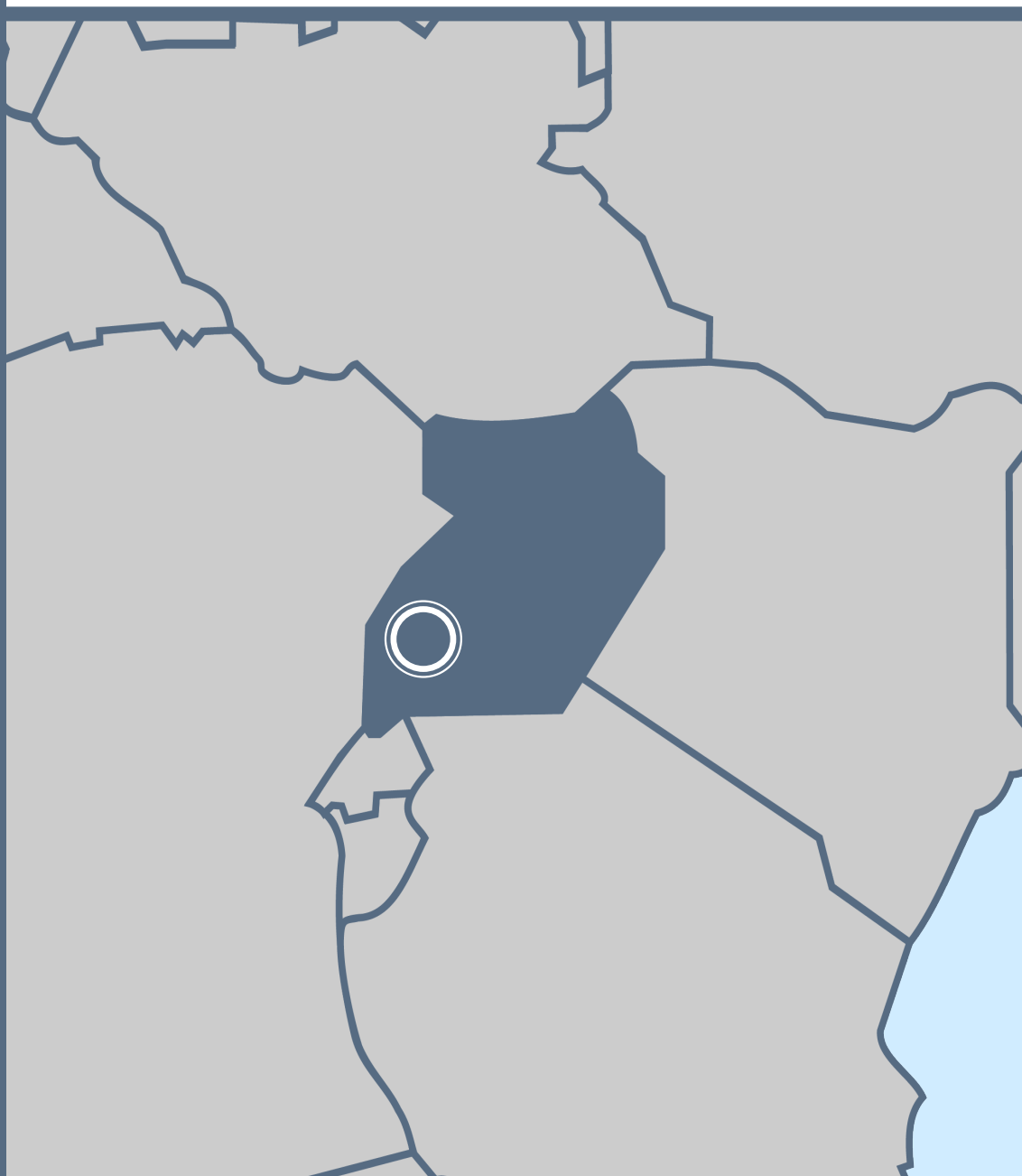


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Investigating an Outbreak of Measles in Kamwenge District, Uganda, July 2015

Participant Guide

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Investigating an Outbreak of Measles in Kamwenge District, Uganda, July 2015

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Abstract

Globalization has opened many fronts for disease outbreaks because of the quick movement of people and porous borders around the world. The emergence of zoonotic diseases and other communicable diseases highlights the need for implementation of the Global Health Security Agenda packages if countries are to achieve compliance with International Health Regulations (IHR 2005). Health workforce development is one of the critical components that must be addressed with utmost urgency if gaps in early disease detection and response are to be addressed. In this regard, this case study is based on a measles outbreak investigation in Uganda simulating a real-life outbreak investigation by field epidemiologists and seeks to demonstrate the principles of applied epidemiology outlining the critical steps in outbreak investigations and generation of evidence for decision making. It aims to shore up the health workforce capacity by providing practical training for field epidemiology students and professionals that builds their skills in outbreak investigation. This case study can be completed in less than three hours.

How to Use the Case Study

General instructions: The participants will read the paragraphs in the participant's guide in turns as guided by the instructor. One instructor will facilitate the case study for a class of 10 – 15 students/residents. The instructor may ask for group discussion of an answer or direct a question to one particular participant. For questions that require calculations, the instructor will allow each participant to participate to maximize learning. The instructor may ask for a role play as necessary and also split the class into groups to generate brainstorming. The instructor's guide provides sufficient background materials to facilitate learning without review of further references.

Audience: Residents in Intermediate and Advanced Field Epidemiology Training Programs

Prerequisites: Before using this case study, case study participants should have received lectures in defining outbreaks, conducting basic outbreak investigations, and basic biostatistics. Participants should have a basic science degree or equivalent knowledge of science.

Materials needed: Flipchart or white board, markers, laptop with Microsoft Excel and Epi Info™ packages

Level of training and associated public health activity: Intermediate outbreak investigation

Time required: 2-3 hours

Language: English

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Goal of Case Study: To simulate a real-life investigation of a measles outbreak

Learning Objectives: After completion of this case study, the participants should be able to:

1. Recognise the occurrence of an outbreak and plan an appropriate response
2. List the steps in an outbreak investigation
3. Apply the principles of descriptive epidemiology (time, place, person) in the investigation of a disease outbreak
4. Characterize the epidemiology of a disease with appropriate tables, graphs, and charts to generate hypotheses related to aetiology
5. Calculate measures of association in appropriate analytical study
6. Describe measures to control an outbreak
7. Communicate information on an outbreak to relevant stakeholders

Introduction

On 1st July 2015, the Ministry of Health was notified of a suspected outbreak of measles in Kamwenge District by the District Health Officer. The initial report showed that there had been sporadic cases and outbreaks of measles reported in other districts of Western Uganda since April 2015. On 2nd July, a preparatory planning meeting was held at the Ministry of Health where the decision to conduct an investigation and respond to the outbreak was made. [3]

Kamwenge district is located in Western Uganda and bordered by six other districts. The district has an administrative measles vaccination coverage of 80% (compared to 96% national coverage). It also has a refugee settlement, with an estimated population of 57,000, of which 10,000 are children under five. [4] Table 1 displays the population distribution of Kamwenge by age and sex groups.

Measles is a highly contagious viral infection characterized by a generalized rash. Measles outbreaks are a major cause of morbidity and mortality especially among undernourished children. The virus is transmitted via the respiratory route through direct or indirect contact with secretions of an infected person. It is preventable through vaccination and usually presents with fever, coryza and conjunctivitis. The characteristic maculopapular rash appears on the face and later becomes generalized. Measles is endemic in Uganda. [1, 2]

Table 1: Kamwenge District Population by Age & Sex

Age (years)	Sex		Population
	Male	Female	
0-4	28,824	67,256	96,080
5 – 17	40,055	102,998	143,053
18+	54,488	133,402	187,890
Total Population	123,367	303,656	427,023

Part 1

The preliminary report which was submitted by the District Health Officer indicated that 11 cases were reported to two health centres within the district showing symptoms of fever, rash, and cough. Based on the available information, a plan and protocol for the investigation were developed.

Question 1. List the key sections of an outbreak response plan.

Question 2. What would be a good composition of a field team for this outbreak investigation?

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Question 3. Outline the components of an outbreak investigation protocol.

Question 4. What would be your objectives for this investigation?

Question 5. What are the steps in an outbreak investigation? Describe the activities carried out in each step of the investigation.

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Question 6. Develop case definitions for this investigation. Explain the difference between sensitivity and specificity of a case definition.

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Question 7. What would be the content of your case investigation form?

On 30th June 2015, five blood samples were taken by the District Laboratory Focal Person and sent to the EPI Lab at the Uganda Virus Research Institute (UVRI) Reference Laboratory and 3 tested positive for measles Igm. The team also analysed DHIS2 measles data for Kamwenge District and obtained the results in Table 2 below:

Table 2: Measles Cases from Jan-June 2015

Month	Jan	Feb	March	April	May	June	Total
Suspected Cases	0	0	0	9	24	52	85
Lab confirmed cases	0	0	0	5	0	3	8

Question 8. Was this an outbreak? Please justify your answer.

Part 2

The investigating team held a meeting at Kamwenge District Headquarters where the purpose of the visit was explained to the district leadership. The District Health Team also briefed the visiting team about the situation of the measles outbreak and the response so far and presented the preliminary line list. The epidemiology team proceeded to the affected sub-counties to find cases.

Question 9. How do you conduct active case finding? Why is case finding important?

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Question 10. How would you use a line list in this outbreak investigation?

Question 11. List key variables that a line list in this outbreak should capture.

Question 12. How do you determine the effective exposure period in measles transmission?

Part 3

Continued active case finding revealed that three sub-counties were affected and a total of 215 suspected and confirmed cases were line-listed by 14th July 2015. While in the field, additional blood samples from 23 case-patients were collected by the investigating team, 15 of which turned positive for measles IgM. From the data available, descriptive epidemiologic analysis was done and hypotheses generated.

Table 3: Population by Sub-county disaggregated by sex

Sub-county	Sex		Population
	Male	Female	
Biguli	10,368	24,192	34,560
Nkoma	10,347	26,608	36,955*
Bwizi	13,885	33,994	47,879
Total	34,600	84,794	119,394

*Note - This population of Nkoma sub-county does not include the Rwamwanja refugee population, which was 57,473. [7]

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Table 4: Total number of cases by sub-county, age-group and sex

Category	No. of Cases
Sub-county	
Biguli	110
Nkoma	56
Bwizi	10
Rwamwanja Refugee Settlement	39
Age (years)	
0 – 4	108
5 – 17	88
18+	19
Sex	
Male	115
Female	100

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Table 5: The abridged line list of under-fives for measles outbreak in Kamwenge District

ID	Age	Sex	S/county	Rash date of onset	Visit to health facility	Visit to social gathering	Going to school	Going to church	Not vaccinated
1	4.6	F	Biguli	05-06-15	Y	N	N	N	Y
2	1.5	M	Biguli	08-06-15	Y	N	N	Y	Y
3	1.0	F	Biguli	09-06-15	N	N	N	Y	N
4	3.0	M	Biguli	09-06-15	Y	Y	N	Y	Y
5	1.4	F	Biguli	11-06-15	Y	Y	N	Y	Y
6	1.5	F	Biguli	12-06-15	Y	N	N	Y	Y
7	0.42	F	Nkoma	14-06-15	Y	N	N	Y	N
8	0.58	M	Nkoma	15-06-15	Y	N	N	Y	Y
9	1.0	M	Nkoma	15-06-15	N	N	N	N	Y
10	0.83	M	Nkoma	15-06-15	Y	N	N	N	Y
11	0.67	F	Biguli	18-06-15	Y	N	N	Y	Y
12	2.0	F	Nkoma	18-06-15	Y	N	N	Y	Y
13	2.5	M	Nkoma	21-06-15	Y	N	N	Y	Y
14	1.0	M	Nkoma	22-06-15	Y	N	N	N	Y
15	5.6	F	Biguli	22-06-15	Y	N	Y	Y	N
16	2.0	F	Nkoma	26-06-15	Y	N	N	Y	Y
17	1.3	M	Nkoma	29-06-15	Y	N	N	Y	Y
18	4.3	M	Biguli	03-07-15	Y	N	N	N	Y

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ID	Age	Sex	S/county	Rash date of onset	Visit to health facility	Visit to social gathering	Going to school	Going to church	Not vaccinated
19	2.5	M	Nkoma	04-07-15	Y	N	Y	Y	Y
20	1.2	M	Nkoma	05-07-15	Y	N	N	Y	Y
21	2.0	F	Biguli	06-07-15	Y	N	N	Y	Y
22	5.6	F	Biguli	06-07-15	Y	N	Y	Y	Y
23	1.0	F	Nkoma	06-05-15	Y	N	N	Y	N
24	0.58	M	Nkoma	08-07-15	Y	N	N	Y	Y
25	1.2	M	Nkoma	08-07-15	N	N	N	N	Y
26	0.75	M	Nkoma	08-07-15	Y	N	N	Y	N
27	4.0	F	Biguli	08-07-15	Y	N	N	Y	Y
28	4.7	F	Biguli	08-07-15	Y	N	N	Y	Y
29	2.3	F	Biguli	09-07-15	Y	Y	N	Y	Y
30	5.5	F	Nkoma	09-07-15	Y	N	Y	Y	N
31	0.75	M	Nkoma	09-07-15	Y	N	N	N	Y
32	0.92	F	Nkoma	10-07-15	Y	N	N	Y	Y
33	1.9	F	Nkoma	11-07-15	Y	N	N	Y	Y
34	3.3	F	Biguli	11-07-15	Y	N	N	N	N
35	2.2	M	Nkoma	13-07-15	Y	N	N	Y	N
36	2.0	F	Nkoma	15-07-15	Y	N	N	Y	Y

Question 13. What types of graphics and measures would be useful to characterise an outbreak?

Question 14: Using the data in Table 5, draw and interpret the epidemic curve for this outbreak.

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Question 15. From tables 1, 3, and 4 calculate attack rates by age group, sex, and sub-county. Interpret your results.

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Question 16. From the data in table 5, determine the potential risk factors in this outbreak and state your hypotheses.

To test the hypotheses, the team conducted an analytical study in the three affected sub-counties of Biguli, Nkoma, and Bwizi.

Question 17. Which type of analytical study would you apply in this investigation? Explain why.

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The investigating team collected data using the standard questionnaire focusing on the major factors that emerged during hypothesis building. The data collected was entered into a Microsoft Excel spreadsheet and cleaned. Analysis was done using Epi Info™ 7.1.5.

Table 6: Results of the analytical study

Exposure	Diseased		Not diseased	
	Yes	No	Yes	No
Visiting Health facility	38	12	40	160
Visiting church	32	18	116	84
No vaccination	34	16	56	144

Question 18. Using data in table 6, calculate the appropriate measures of association and their corresponding confidence intervals. Interpret the results.

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Following the findings, the task team wrote a report and made recommendations that were translated into public health actions by stakeholders.

Question 19. Based on the results, what control measures would you recommend?

Question 20. What would be the outline of your outbreak investigation report?

Question 21. How would you communicate your findings and to which stakeholders?

Conclusion

[The conclusion will be distributed separately.]

Background Reading

Centers for Disease Control and Prevention. Section 2: Steps of an Outbreak Investigation. Principles of Epidemiology in Public Health Practice. 3rd ed. Atlanta, GA: CDC; 2012

Ministry of Health (Uganda). National Guidelines for Integrated Diseases Surveillance and Response. Kampala, Uganda; 2012

Michael B. Gregg. Field Epidemiology. 3rd ed. Oxford University Press, New York; 2008

Competing Interests

The authors declare no conflicting interests.

Author's Contributions

The case study was developed by Alex Riolexus Ario. Most authors participated in the actual field study. Others contributed to the design of the case study, have read and edited various parts of the document, and have approved it for publication.

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Appendices

Appendix 1: Outbreak Investigation Protocol for Measles Outbreak Investigation in Kamwenge District

Title: Risk factors for measles outbreak in Kamwenge district in western Uganda Investigators:
Background - justification • Measles is a highly infectious, epidemic-prone disease. • In recent months, Uganda has been experiencing outbreaks in the west and central districts. • Kamwenge District has been reporting measles cases consistently for the past 7 weeks especially in the sub-counties of Buguli and Nkoma. • Risk factors for measles transmission in this outbreak are unknown.
Goal • To provide epidemiologic evidence for effective measles control in Uganda.
Objectives • To identify risk factors for measles transmission during this outbreak. • To assess vaccine effectiveness. • To recommend evidence-based control measures for stopping the outbreak. • To estimate the vaccination coverage in the area of this outbreak investigation.
Proposed methods • Case definitions: Suspected case: Any person with fever and maculopapular generalized rash and cough, coryza or conjunctivitis. Confirmed case: A suspected case with laboratory confirmation (positive IgM antibody) or epidemiological link to confirmed cases in an outbreak. • Finding cases systematically by reviewing clinical records. Community case finding using VHTs and local council leaders. • Laboratory confirmation methods: Using IgM positive samples through Uganda Virus Research Institute. • Descriptive epidemiology to form hypothesis. • Case-control study to identify risk factors (e.g. hospital transmission, school transmission, gathering, etc.). • Estimation of vaccination coverage based on the vaccination rate in case-patients.
Human Subject Protection • Informed consent/ Assent: This shall be sought from respondents or caretakers of children who are affected/infected in a language which they understand. • Protection of confidentiality: Data shall not be shared with anyone outside of the investigation team. All data shall be kept on the hard drives of computers that are password protected.

Expected benefit

- To provide evidence for the containment and control of measles in Uganda.
- To provide assurance of the effectiveness of measles vaccine and identify potential problems (e.g. cold-chain), if any.

Appendix 2: Case Investigation Form for Measles Outbreak Investigation in Kamwenge District

Questionnaire for Measles Outbreak Investigation: Kamwenge District, 2015

Case-patient's No: _____ Name: _____ Sex : M [☐] F [☐] Case-patient's date of birth: _____ (If birth date unknown, Age: _____ Years _____ Months) Case-patients' residence: District _____ County _____ Sub-county _____ Parish _____ Village _____ If case-patient is child, caretaker name: _____ Head of Household _____ Phone Contact of case-patient or caregiver: _____ Number of occupants in the household _____
Clinical Data
1. Fever: Yes [☐] No [☐] Date of fever onset: _____ 2. Rash: Yes [☐] No [☐] Date of rash onset: _____ 3. Cough: Yes [☐] No [☐] 4. Coryza (running nose): Yes [☐] No [☐] 5. Conjunctivitis (red eyes) Yes [☐] No [☐] 6. Any other symptoms (specify) _____ 7. Are there any other persons with similar symptoms in the household? Yes [☐] No [☐] (If yes, please fill in separate questionnaires)
Measles Vaccination History
8. Has the case-person been vaccinated for measles? Yes [☐] No [☐] Don't know [☐] If yes, obtain a copy of the vaccination record and complete table below: Dose 1 date: _____ OR: Date unknown (check here) [☐] Dose 2 date: _____ OR: Date unknown (check here) [☐]
Risk Factors
9. Interviewer: Use a calendar to find the effective exposure period as follows: Date of rash onset: _____ 23 days before rash onset (beginning): _____ 9 days before rash onset (ending): _____ 10. Has the case-person visited any health centre during the outbreak? Yes [☐] No [☐] If yes (check medical records book, if available): _____ 11. Did the case-person go to church during the outbreak? Yes [☐] No [☐] Don't know [☐] If yes, Name of the Church: _____

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12. Did the case-person go to school during? Yes[☐] No[☐] Don't know [☐] If yes, did any person (child or staff) have similar symptoms in the school? Yes[☐] No[☐] Don't know [☐] Name of the school_____
13. Did the case-person go to **any** vaccination campaign during? Yes[☐] No[☐] If yes, at the immunization campaign did anyone have similar symptoms? Yes[☐] No[☐] Don't know [☐] Name of the health centre/outreach_____