Containment of a fatal and highly infectious disease outbreak

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Disclaimer

Acknowledgement

Abstract

This case study was designed based on actual experience several Viral Haemorrhagic Fevers (VHFs) outbreaks that occurred in Uganda between 2000 and 2016. Fictitious scenarios have been included to facilitate learning of the users. The major goal of the case study is to facilitate learners appreciate incident detection and the incident management processes for control and containment of a fatal and highly infectious viral disease outbreak. This case study is targeted towards health scientists of medicine, nursing, biomedical laboratory and public health background. We specifically orient learners on clinical presentation of viral infections and laboratory tests considered for incident detection, conducting a risk assessment for an infectious disease, Infection Prevention and Control in the outbreak setting, skills of incident management, analysis and interpretation of epidemiological data to aid epidemic response and control decisions.

How to Use the Case Study

General Instructions: This case study is best used as adjunct training materials to bolster concepts taught to learners during in-person training sessions. During the implementation of this case study 15 learners should be matched to one facilitator in a training room preferably at a round table. Each participant should be issued a copy of the case study prior to its implementation. The facilitator guide remains with the facilitator and should only be availed to the participants at the end of the case study implementation. The facilitator introduces the case study including learning objectives and makes mention of the requisite materials that participants should have at hand before starting the case study implementation. These materials will include the reference epidemic curve and calendar in Annex 1 of the case study, a note book, pen and calculator. Participants should take turns to read the case scenario and the questions or tasks that immediately follow the scenario paragraphs. The reader on each turn should attempt to provide the answer or solution to the task. The task should then be opened up to the discussion of the rest of the group for concurrence on the most correct answers. The facilitator should make probes to stimulate participants to elucidate and arrive at the correct responses. Hints and facilitator notes are provided for use by the facilitator to steer the discussion in the direction which unlocks the puzzle. In the event that the solutions are not forthcoming the facilitator should provide them to the participants with reference to the facilitator's guide.

Audience: This case study has been designed to foster capacities among public health scientists including epidemiologists, doctors, nurses, biomedical laboratory scientists working at national departments of surveillance and public health emergencies, district surveillance departments and training institutions of field epidemiology programs.

Prerequisites: By the time of implementing this case study, participants should have undergone training in Integrated disease surveillance and response, outbreak investigations, Incident management processes and epidemiological data analysis and interpretation.

Materials: Pen, notebook, calculator, epi-curve in annex 1 and calendar in Annex 2

Level of training and associated public health activity: Intermediate public health surveillance officers in national, regional and or provincial public health surveillance departments and residents in Field Epidemiology Training Programs.

Time required: Approximately 3.5 hours

Language: English

Participant's Guide

Goal of the Case Study: The goal of this case study is to appreciate principles of infectious disease detection and control; and Incident management processes

Learning Objectives: At the end of implementing this case study, participants should be able to:

1. Identify the clinical presentation of fatal viral infection.
2. Select laboratory tests to consider in the investigation of infectious disease outbreaks.
3. Enumerate key aspects in conducting a risk assessment for an infectious disease in an outbreak setting**.**
4. Outline Infection Control and Prevention measures to consider during an infectious disease outbreak.
5. Appreciate the processes and skills of incident Management.
6. Apply epidemiological data analysis and interpretation skills during an outbreak.
7. Apply IHR measures for Infection Prevention and Control at Points of Entry.

Introduction

Uganda is a tropical country located along the equator in Eastern Africa. The country is located in the region which is endemic and a hot spot for numerous viral pathogens and outbreaks. The country shares a long border with the Democratic Republic of Congo in the West and South Sudan in the north, countries that invariably experience outbreaks involving these pathogens. The country has large water bodies including lakes and rivers. Uganda has rich biodiversity of tropical rain forests and numerous species of large mammals that serve as reservoirs to the numerous viral pathogens. This context perpetuates the risk frequent of zoonotic disease outbreaks due to the intimate interactions of humans through various activities including travel, tourism, hunting and reclamation of the physical features by humans. The northern part of the country is partly located in the African meningeal belt and thus prone to rampant meningitis outbreaks. Uganda is host to millions of refugees from the east and central parts of Africa which is afflicted by armed conflict. This makes the country vulnerable to importation of infectious pathogens. Over the last 20 years Uganda has experienced numerous outbreaks including pathogens causing Viral Haemorrhagic Fevers (VHFs) such as Ebola, Marburg, Yellow Fever, Crimean Congo Haemorrhagic Fever, other viruses including Measles, Wild Polio Virus, Rift Valley Fever, Hepatitis B and outbreaks due to bacterial pathogens including Cholera, Anthrax, Pneumococcal meningitis etc. Uganda experienced over seven Viral Haemorrhagic Fever outbreaks between 2000 and 2017.
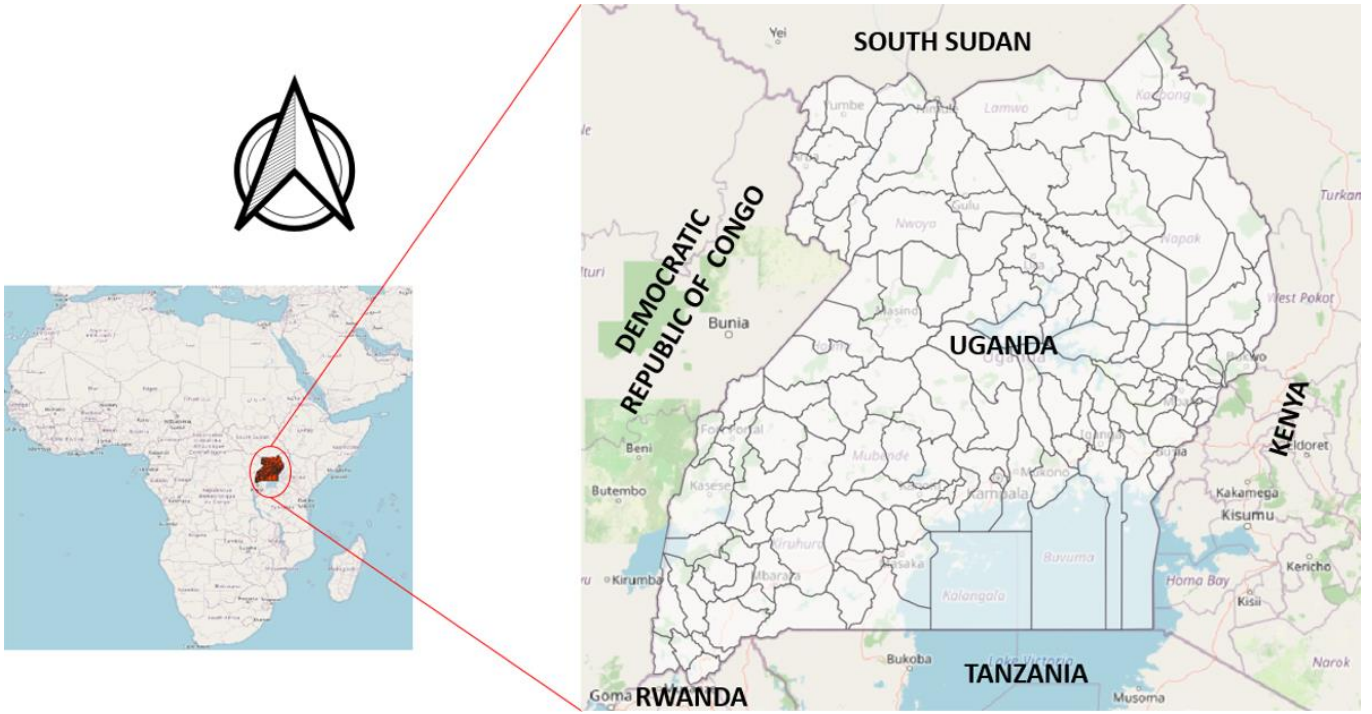
Figure 1. Map of Africa showing location of Uganda

Part 1: Main section
Introduction

Gulu District, Uganda 8th October 2016.
The District Health Officer (DHO) of Gulu received two concurrent reports concerning an unusual illness and deaths in the community and at Lacor Hospital, a non-governmental hospital. The community report attributed the illness and death to poisoning at a funeral in the remote village of Rwot Obilo, in the far north of Gulu. The second report concurrently conveyed to both the DHO and to the Ministry of Health (MoH), came from the Medical Superintendent (MS) of Lacor Hospital. The MS reported a clustering of cases and deaths, which included two dead student nurses and three others who were critically ill. Most of the cases in the hospital reported a history of deaths with similar manifestations in their households. Cases manifested symptoms among others including acute onset of fever, headache, malaise, myalgia, sore throat followed by diarrhoea and vomiting. All the cases presented variously with bleeding tendency that manifest either as epistaxis, conjunctival haemorrhage or the combination of the three.

Question 1_: What disease is the likely cause of such symptoms?_ (5 min)

Answer:

Question 2: _If you are working at the Uganda Ministry of Health as the Commissioner for infectious disease control._ What additional information will you need to guide your response actions? *(2 min)*

Answer:

Question 3: What *strategic actions should be taken to obtain such information that will inform your control measures? Who constitutes a Rapid Response Team and what are their roles? (10 minutes)*

Answer:

On October 9th 2016, it is still unknown how serious this event is. A national rapid response team was dispatched to support in preliminary rapid investigations. Anonymous reports in the electronic medicines tracking (mTRAC) reporting system indicate that several deaths are occurring and government authorities are being accused for not doing enough to control the outbreak. The minister of health is under pressure by parliamentarians and local politicians for failure of his duties as he could not provide any reports regarding the seriousness of this matter. The NTF has on the same day dispatched a National Rapid Response Team (NRRT) to support in outbreak investigation and confirmation. The NRRT has been tasked to rapidly carry out a rapid investigation and provide feedback on the seriousness of this event which has been escalated politically.

Question 4: What aspects are important in measuring the magnitude of an outbreak? State the importance of such aspects in measuring infectious disease outbreaks. What actions should the National Rapid Response Team (NRRT) take to enable them provide a sound report on the magnitude of this outbreak? (10 minutes)

Answer:

Question 5: In quantifying the magnitude of this outbreak, what important epidemiological tool will the NRRT have to put in place and what aspects do they have to you consider? How could these be measured and reported to the NTF? (3 minutes)
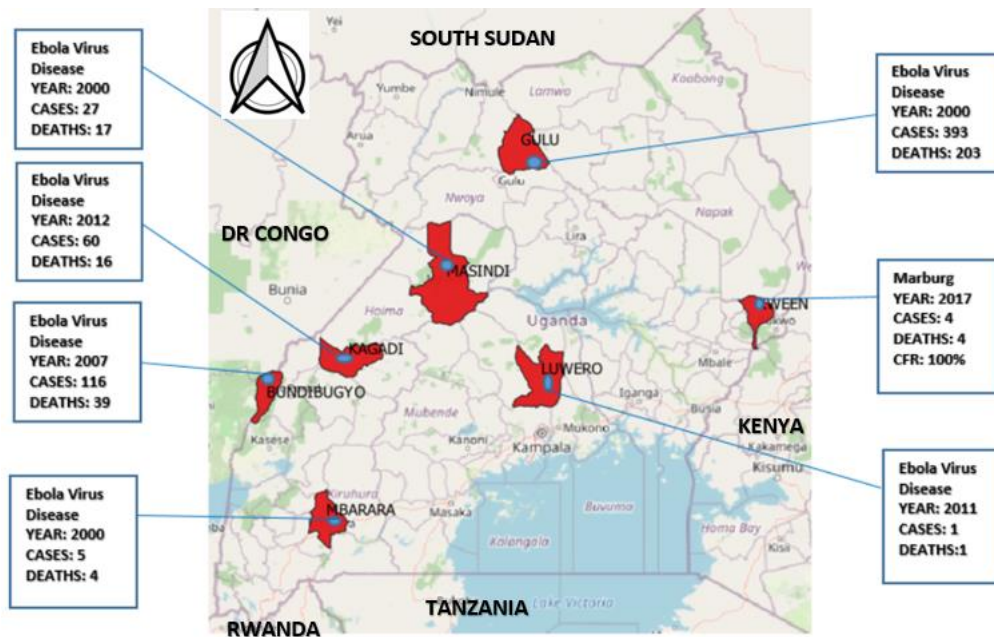
Answer:

It is the morning of October 11th, 2016 the NRRT team on their second field day sends the following information to the NTF that they reviewed 17 cases, eleven had died and six were still hospitalised. Each of the patients had a history of having attended a burial in the few days before the onset of fever. Some of the patients had lost one or more family members with similar symptoms, within a short interval. Investigations by the local laboratory indicated a threefold increase in the level of transaminase (SGOT). The team suspected Marburg or Ebola. The commissioner proposes to ship samples to South Africa National Institute of Virology (NIV) but the NTF hold the view that response should proceed using the non-specific antibody tests locally available. The incident manager for this outbreak proposes to conduct a risk assessment for Viral Haemorrhagic Fever (VHF) in Uganda so as to consolidate the thinking that Ebola or Marburg is the likely cause of this outbreak.

Question 6: Suggest approaches, which members of the NRRT should consider during the execution of the risk assessment exercise? (25 minutes)

Answer:

Figure 2: Map of Uganda showing districts with past Viral Haemorrhagic Fever Outbreaks between 2000 and 2017

Ebola Virus Disease
YEAR: 2000
CASES: 27
DEATHS: 17

Ebola Virus Disease
YEAR: 2012
CASES: 60
DEATHS: 16

Ebola Virus Disease
YEAR: 2007
CASES: 116
DEATHS: 39

Ebola Virus Disease
YEAR: 2000
CASES: 5
DEATHS: 4

Ebola Virus Disease
YEAR: 2000
CASES: 393
DEATHS: 203

Marburg
YEAR: 2017
CASES: 4
DEATHS: 4
CFR: 100%

Ebola Virus Disease
YEAR: 2011
CASES: 1
DEATHS:1

Figure 3: L: Carcasses of monkeys were found in gameparks located in the neighborhood R: Scientists obtaining samples from dead monkeys and conducting their burial (Ekwaro et al, 2015)

Question 7: What is a Case Fatality Rate (CFR) in an outbreak? Compute the CFR in this outbreak. Suggest a range of strategic actions that the NTF should now consider to better manage this outbreak. (15 minutes)

Answer:

One death has been reported in the southern district of Bundibugyo. This was a male adult who fell ill briefly with symptoms similar to those of the cases in Gulu. The NTF is considering implementing the same control activities in more districts besides Gulu but they cite inadequate resources.

Question 8: Advise the NTF with rationale on the scope and geographical coverage of interventions to undertake. (10 minutes)

Answer:

Question 9: How would you convince the NTF to adopt your idea of conducting more tests in an accredited reference lab? What are the alternative ways to test for Ebola Virus? Comment on the pros or cons of each method. (10 minutes)

Answer:

The laboratory is key in infectious disease detection but laboratory capacity for detection may not always be available in many Low- and Middle-Income Countries (LMIC). Often samples are shipped to reference

laboratories in the region, at CDC or WHO with the implication of long turnaround time and delayed diagnosis. This affects timeliness of decisions for control measures.

Question 10: Develop an 'operational' case definition to guide the response teams in the management of cases in this outbreak. What are the other ways to describe a case of Ebola? (20 minutes)

Answer:

Based on the recommendation of the NTF, an isolation unit was set up at Lacor Hospital on 12 October 2016. Limited protective materials for barrier nursing were mobilised on 14 October 2016. The team also recommended alerting the public about the risk of infection especially during funerals, training a burial team for safe disposal of bodies, the provision of information and training on VHF to the affected area, the provision of a technical back up team from the centre to assist the health staff in the district, and the mobilisation of more supplies and logistics for barrier nursing. On 13 October a team comprising senior MoH staff and the WHO country office re-verified the existence and assessed the magnitude of the epidemic. They helped the district set up a district task force for co-ordination purposes and prepared a preliminary district budget for the response. The National Ebola Task Force (NETF) was constituted on 14 October 2016 to co-ordinate and mobilise resources for the outbreak. Following confirmation by NIV on 14 October that the outbreak was due to a strain of Ebola known as *Ebola Sudan* virus. An 'Alert' was sent to all districts of Uganda for epidemic preparedness and response. MOH appealed to the international community and WHO to coordinate the response and staff. The Global Alert and Outbreak Response Network (GOARN) a body recently launched to coordinate resources towards outbreaks of such a magnitude for the first time had their first task to coordinate the response in Uganda.

The NTF and GOARN resolve to undertake a comprehensive outbreak response. They seek your expertise and guidance on a set of interventions and actions to control this outbreak.

Question 11: List the appropriate strategies and actions that the NTF may adopt to achieve in order to affect a quality outbreak response (*10 minutes).*

Answer:

Communication & socio mobilisation

It is now evident the case numbers are on the increase; 38 deaths have occurred both at health facilities and within the communities. A significant number of the deaths are health staff. There is worry that not all the cases in the community are being captured.

Question 12: Discuss strategies to increase case detection at community level and referral to health care points. Develop a community case definition for the current outbreak in Gulu district (5 minutes)

Answer:

In Bundibugyo district located in Midwestern Uganda and at the border of Democratic Republic of Congo nearly 600km from Gulu district where the outbreak is confirmed 2 suspect cases were admitted at the district hospital. Preliminary laboratory results from the 2 suspect cases showed negative for Ebola or Marburg. These cases however died few days following their hospitalisation. The Ministry of Health provided guidance for supervised burial even in the context of negative results for the outbreak in question. Health workers are in fear that the Ministry is concealing the true findings of the lab investigations. Local communities are also jittery for being denied their right to bury their loved ones in a culturally acceptable manner.

Question 13: What explanations would you provide to the health workers and communities in Bundibugyo districts to remain on high alert and follow the MOH recommendations? (5 minutes)

Answer:

It is now several weeks into the outbreak. Although the ministry of health has deployed some rapid response teams to the affected districts, district authorities and communities continue to express anguish that no official information has been provided to the community and health staff. The NTF decides that a media briefing on the outbreak is inevitable. The Minister of Health shall lead the team which shall provide the media brief.

Question 14: Take role plays and conduct a press briefing on the current situation as part of a delegation accompanying the minister of health. (30 minutes)

Answer:

We now provide you with the epidemic curve extract of this outbreak in Figure 2 Annex 1. Refer to the epi-curve provided to answer question 15.

Question 15: a) What is an epidemic curve and how useful is it in epidemiological investigations of infectious disease outbreaks? What major information can be inferred from the epidemic curve? (5 minutes)

Answer:

b) Describe the types of epidemic curves and explain their significance in epidemiological investigations.

Answer:

Table 1: Bivariate Risk Factors for Ebola, Gulu, Uganda, 2016

Potential Risk factor	Probable Case N=74	Confirmed Case N=42	Probable/ Confirmed case, n=116	Non-case N=76 (ref)
Hospitalized/visited hospital three weeks prior illness,				
Number (%)	38 (51.40)	36(85.70)	74 (63.79)	31 (40.80)
OR (95%CI)	1.5 (0.8 -3.1)	8.7 (3.0-26.3)	2.6 (1.4-4.9)	1
Consulted traditional healer,				
Number (%)	1(1.4)	0	1(0.9)	4(5.3)
OR (95%CI)	0.25 (0.01-2.4)	Undefined	0.2 (0.01-1.5)	1
Participated in funeral rituals,				
Number (%)	43(58.1)	32(76.2)	75(64.7)	23(30.2)
OR (95%CI)	3.2 (1.6-6.6)	7.4 (2.9-9.3)	4.22 (2.2-8.2)	1
Traveled before illness,				
Number (%)	29(39.20)	11(26.20)	40(34.50)	15(19.74)
OR (95%CI)	2.62 (1.2-5.8)	1.4 (0.5-3.8)	2.1 (1.0-4.5)	1
Had contact with known suspected case, number (%)	48(64.90)	42(100.00)	90(77.60)	43(56.58)
OR (95%CI)	1.4 (0.7-2.9)	Undefined	2.7 (1.35-5.24)	1
Had contact with wildlife number%	1(1.4)	0	1(0.9)	1(1.3)
OR (95%CI)	1.0 (0.0-38)	Undefined	0.7 (0.02-24)	1
Male sex,				
Number (%)	40(54.00)	25(59.52)	65(56.00)	37(29.31)
OR (95%CI)	1.2 (0.6-2.5)	1.6 (0.7-3.6)	1.3 (0.7-2.5)	1
Age 41 to 60years,				
Number (%)	18(24.30)	16(38.10)	34(0.90)	18(1.32)
OR (95%CI)	1.0 (0.5-2.3)	2.0 (0.8-4.9)	1.3 (0.7-2.7)	1

The table above was extracted from a dissertation report of Dr. Nsegulamirambo Sebastian Kiryaatabala a graduate of the Uganda CDC-MakSPH-MOH Public health fellowship training program. Dr. Nsegulamirambo Sebastian Kiryaatabala worked at the Uganda Ministry of Health and studied the Ebola outbreaks that Uganda has experienced since the year 2000.

Question 16: Study the table and identify the risk factors that possibly perpetuated this Ebola outbreak in Gulu. Which risk factors had the strongest association with EVD? From the factors identified, propose the most important public health action that should be employed to reduce the magnitude of future outbreaks. (10 minutes)

Answer:

It is now February 2017 and the outbreak is nearing the end, no case has been identified 42 days since the last seen case in Masindi district. Some member countries in the European Union (EU) are concerned that Ebola might erupt in the EU which funds various activities in Uganda and other countries in the region.

Question 17: Is Ebola in the EU likely? Justify your answer? What steps would you advise the EU to undertake in order to control the situation? (15 minutes)

Answer:

*Question 18: What Conclusions could be drawn from this case study?*

Answer:

End

Part 3: Final section

References

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ANNEX 1

Figure 4: Epi-curve of new Ebola Virus Disease cases (n=425) in Gulu, Uganda 29th September 2016 to 15th January 2017.
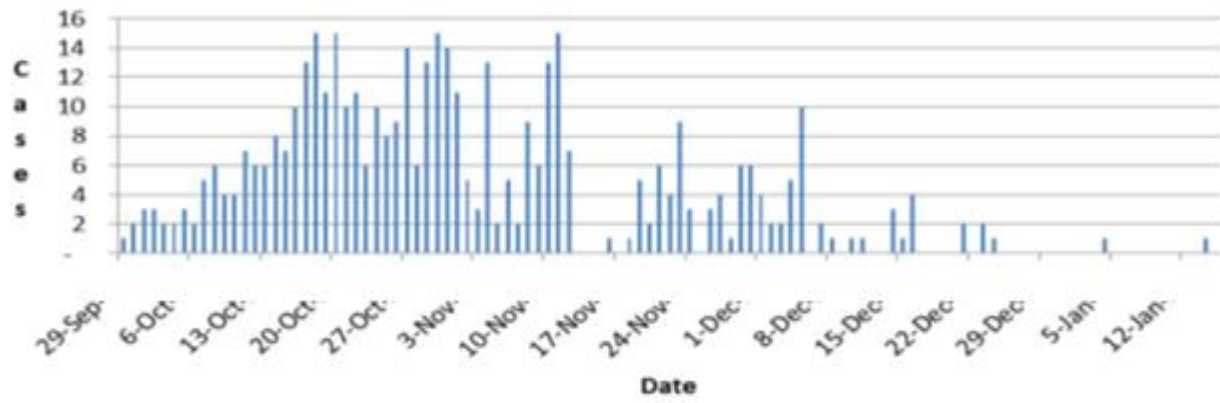
ANNEX 2
Calendar (September- October 2016)

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
35				1	2	3	4
36	5	6	7	8	9	10	11
37	12	13	14	15	16	17	18
38	19	20	21	22	23	24	25
39	26	27	28	29	30	1 OCT	2 OCT
40	3 OCT	4 OCT	5 OCT	6 OCT	7 OCT	8 OCT	9 OCT