Preparing for the worst: Opportunities to prevent trans-boundary disease transmission in Uganda: A Case Study

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Abstract

On August 1, 2018, the Ministry of Health of the Democratic Republic of Congo (DRC) declared its tenth Ebola Virus Disease (EVD) outbreak in history, affecting North Kivu and Ituri provinces. The outbreak response was complicated due to insecurity and armed conflict in the region, and over the next 19 months, thousands of cases and deaths would occur, making this the world's second-largest outbreak of EVD to date. On 4 August 2018, the Uganda Ministry of Health (MoH) activated the national coordination mechanisms for public health emergencies. The National Rapid Response Team (NRRT) immediately mobilized and embarked on a preparedness assessment and risk mapping to inform the country's EVD reponse plan.

This case study describes the events that transpired from declaration, activation of the coordination mechanisms, preparedness and response to EVD. The cases study is meant to teach rapid responders, Incident Management Team members and the National and District Task Forces on how to prepare and respond to such outbreaks.

Key words: Case Study, Ebola Virus Disease, Cross-border transmission, Uganda

Participant Guide: Distribute to the students

Learning Objectives

After completing this case study, the participant should be able to:

- Describe the national coordination mechanisms for public health emergencies
- Apply WHO Ebola Virus Disease (EVD) Preparedness Assessment Checklist in preparation for contingency planning for Ebola outbreak response
- Describe how disease risk mapping can inform preparedness assessment
- Conduct contact tracing
- Discuss the importance of maintaining control strategies for malaria and other diseases during EVD outbreaks

This case study is based on preparedness and response to an outbreak in 2018-2019 by Fellows and alumni of the Uganda Public Health Fellowship Program, Ministry of Health. DOI for the 3 references.

This case study was developed by Ario A.R, Kadobera D, Bulage L, Kwesiga B, Kabwama N.S and Harris J.R in 2019.

Do not read this page aloud

How to use this case study: Case studies in applied epidemiology allow students to practice applying epidemiologic skills in the classroom to address real-world public health problems. The case studies are used as a vital component of an applied epidemiology curriculum, rather than as stand-alone tools. They are ideally suited to reinforcing principles and skills already covered in a lecture or in background reading.

This case study has a facilitator guide and a participant guide. Each facilitator should review the Facilitator Guide, gain familiarity with the outbreak and investigation on which the case study is based, review the epidemiologic principles being taught, and think of examples in the facilitator's own experience to further illustrate the points.

Ideally, participants receive the case study one part at a time during the case study session. However, if the case study is distributed in whole, participants should be asked not to look ahead.

During the case study session, one or two instructors facilitate the case study for 8 to 20 students in a classroom or conference room. The facilitator should hand out Part I and direct a participant to read one paragraph out loud, then progressing around the room and giving each participant a chance to read. Reading out loud and in turns has two advantages. First, all participants engage in the process and overcome any inhibitions by having her/his voice heard. Second, it keeps the all participants progressing through the case study at the same speed.

After a participant reads a question, the facilitator will direct participants to answer the question and perform calculations, construct graphs, or engage in a discussion of the answer. Sometimes, the facilitator can split the class to play different roles or take different sides in answering the question. As a result, participants learn from each other, not just from the facilitator.

After the questions have been answered, the facilitator hands out the next part. At the end of the case study, the facilitator should direct a participant to once again read the objectives on page 1 to review and ensure that the objectives have been met.

Prerequisites: For this case study, participants should have received instruction or conducted readings in:

- *National Multi-Hazard Preparedness and Response Plan for Public Health Threats and Emergencies in Uganda*
- *WHO Framework for a Public Health Emergency Operations Centre*

Target audience: Trainees in the Field Epidemiology Training Program / Public Health Fellowship Program, other Field Epidemiology and Laboratory Training Programs (FELTPs), public health students, public health workers who may participate in rapid needs assessments, and others who are interested in this topic.

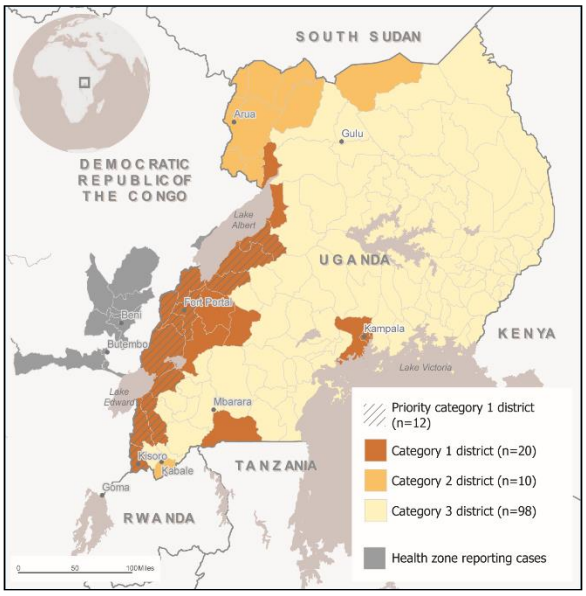
Level of case study: *Advanced*
Time required: Provide expected duration (e.g., approximately 3 hours)
Language: English

Part I.

On August 1, 2018, the Ministry of Health of the Democratic Republic of Congo (DRC) declared its tenth Ebola Virus Disease (EVD) outbreak in history, affecting North Kivu and Ituri provinces. The outbreak response was complicated due to insecurity and armed conflict in the region, and over the next 19 months, thousands of cases and deaths would occur, making this the world's second-largest outbreak of EVD to date [1].

North Kivu and Ituri provinces border the western side of Uganda and the northern side of Rwanda (map). On August 2, WHO listed Uganda among the four high-priority countries that urgently needed to enhance their preparedness activities, to ensure that they could effectively and safely detect, investigate, report, and contain any EVD cases that crossed over the border.

On 4 August 2018, the Uganda Ministry of Health (MoH) activated the national coordination mechanisms for public health emergencies. The National Rapid Response Team (NRRT) immediately mobilized and embarked on a preparedness assessment and risk mapping to inform the country's EVD reponse plan. Multiple fellows from the Uganda Public Health Fellowship Program joined the NRRT and began to ramp up the preparedness and reponse activities.



Question 1: As a class, discuss your understanding of the term "emergency preparedness and response". What does it mean, what does it comprise in Uganda, and why does it exist?

Answer

Question 2: What are the national coordination mechanisms, in the context of public health emergency preparedness and response?

Answer

Question 3: Why is coordination necessary when planning or implementing emergency preparedness and response activities?

Answer

Question 4: In the context of emergency response in Uganda, what is meant by 'activation of national coordination mechanisms? Who authorizes activation?

Answer

Activation of the national coordination mechanisms mobilizes financial and human resources to manage an emergency. The national coordination mechanisms themselves comprise the National Task Force (NTF) and its subcommittees, the Public Health Emergency Operations Centre (PHEOC), and the District Task Forces (DTFs) (Figure 1) [2].

When the national coordination mechanisms are not activated, staff assigned to these mechanisms concentrate on normal preparedness activities, including training of response teams, drafting and revising response guidelines and standard operating procedures, and conducting corrective actions derived from previous emergency after-action reports. To ensure they can detect events in real time, they also continuously monitor both Indicator-based Surveillance (IBS) and Event-based Surveillance (EBS) for any potential signals.

By activating the coordination mechanisms on August 4, the MoH indicated a shift for the staff working in the mechanisms from normal preparedness activities to enactment of response activities. The NTF and PHEOC began to plan, guide, and coordinate EVD

preparedness actions in the country, starting with the selection of an Incident Management Team (IMT). The IMT includes the NRRT and the Incident Commander (IC), and is responsible for the overall response to an emergency. The IC is responsible for all aspects of the emergency response, including quickly developing response objectives during an emergency, coordinating and managing the operations of all involved parties, making decisions about resource utilization, and being responsible for all response staff. The NRRT works under the IC and covers all aspects of the response on the ground.

On August 4, the NRRT were immediately deployed by the IC to high-risk districts. In these districts, they activated the DTFs, which then selected persons to staff the District Rapid Response Teams (DRRTs). Together, the NRRT and DRRTs assessed EVD preparedness in 30 high-risk districts, as well as assessing preparedness at the borders focusing on the response pillars. As they worked, they maintained regular communication with the IC, NTF and DTFs about their progress and planned next steps.

Question 5: Describe steps in activation of national coordination mechanisms.
Answer

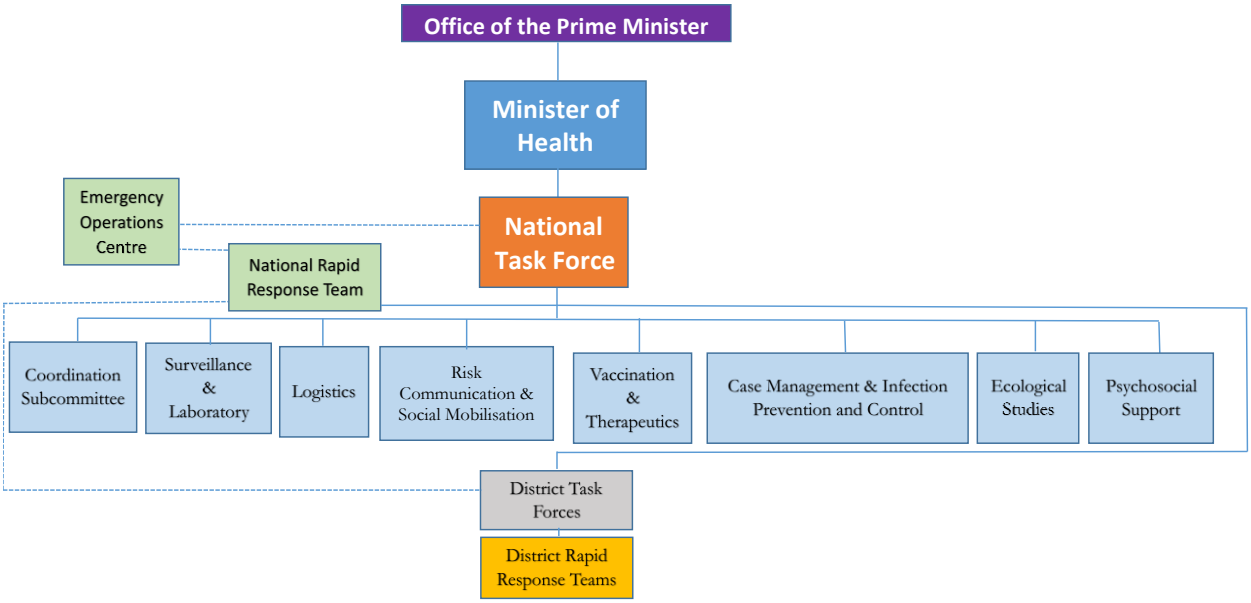


Figure 1: The NTF and relationship to subcommittees, NRRT, PHEOC and DTF

The WHO pillars were developed based on experience in previous EVD outbreaks and are meant to be comprehensive categories of activities that need to be addressed during an EVD outbreak. Very few areas in the world have experience with EVD, and even those that have recurrent outbreaks (such as Uganda) benefit from having a structured approach to response, to improve organization and maximize the response capacity using existing resources. The eleven response pillars on which EVD preparedness is based as outlined by WHO [3] include:

- Coordination
- Rapid Response Team (RRT)
- Public Awareness and Community Engagement
- Infection Prevention and Control
- Case Management – Ebola Treatment Unit (ETU) and Safe Burials
- Epidemiological Surveillance
- Contact Tracing
- Laboratory

- Capacities at Points of Entry
- Budget
- Logistics

Question 6: What do you think are major drawbacks in addressing these critical areas in a resource limited setting like Uganda?

Answer

Part II.

The team started their assessment with the WHO Consolidated EVD Preparedness Checklist. The checklist is structured around eleven key areas, called 'pillars,' for EVD response. It was developed to help teams quickly and systematically assess gaps in EVD readiness and identify concrete, standardized actions to strengthen the capacity for an EVD response. The checklist includes elements that national and subnational leadership and international partners need to implement within 30, 60, and 90 days from the date of assessment.

During August and September 2018, the border health team and NRRT worked to fill out the checklist. They traveled to the 30 priority districts to conduct face-to-face interviews and focus group discussions with District Health Officers (DHOs), Resident District Commissioners, health facility staff, community leaders, security personnel, and community health teams. Based on these interviews and on other observations, the team assigned binary scores to each element in the preparedness checklist: 1 for 'complete' and 0 for 'incomplete'. The team then computed the percentage of completed elements for each component. (For example, if four of eight elements for the 'Budget' category received a '1', while the rest received a '0', the score was 50%). The team aggregated, by district, the percentage complete for all components to gauge overall EVD preparedness.

The NRRT and DRRTs were also charged with assessing preparedness at the borders through border health capacity assessments and risk mapping. To do this, they used the US Centers for Disease Control and Prevention [CDC] Border Health Capacity Discussion Guide and the CDC Population Connectivity Across Borders [PopCAB] toolkits to understand population movements and the relationship to EVD risk [4,5]. The Guide is designed to facilitate qualitative information-gathering with national, district, and point-of-entry (PoE) stakeholders on International Health Regulations-relevant capacities for public health preparedness and response at ground crossings. Specifically, it focuses on evaluating border characteristics, availability of medical and public health services, response plans and trainings, surveillance systems, communication systems, social mobilization, and national and regional data-sharing. Stakeholders use the collected data to identify strengths and areas for improvement in public health aspects of border health systems.

On August 6, 2018, the team began risk mapping using the CDC PopCAB toolkit to identify geographic areas and specific locations with increased community connectivity to DRC through community-level qualitative data collection with participatory mapping. At each event, the border health team and district task force teams used PopCAB results to guide where to prioritize assessment and preparedness activities for the subsequent day. More specifically, the team consolidated the PopCAB results each evening after field work to help identify priority geographic areas and sites where public health preparedness measures should be strengthened based on a forecast of where EVD importation could occur. Additionally, they generated qualitative and spatial databases to analyze and visualize the

results.

Combining the qualitative results from the adapted Guide with the quantitative results from the checklist, the team developed an overall score for each district to assess their EVD preparedness (Figure 2).

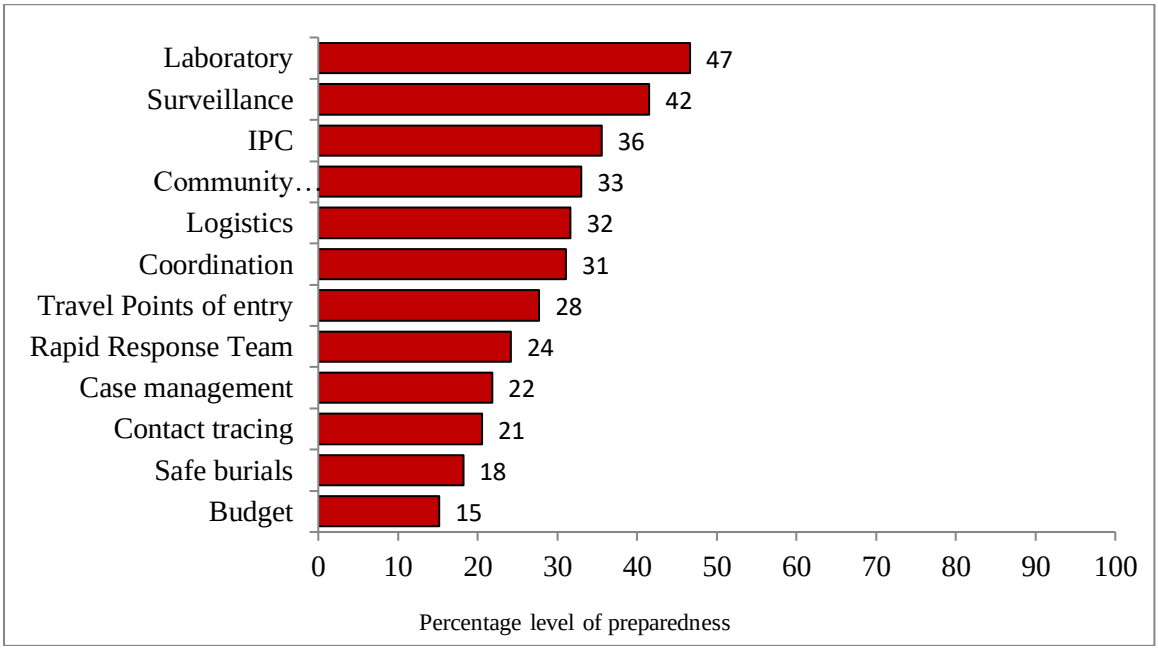


Figure 2: Levels of preparedness for EVD response, by core capacity, in the high-risk districts

Question 7: Comment on Figure 2 above. How prepared are the high-risk districts for a possible EVD case or outbreak? What are the limitations of showing preparedness data this way?

Answer

Overall, the team noted that the priority districts were more prepared in the laboratory, surveillance, and IPC than in other areas. However, while the districts were on average not prepared across all domains, there was much variation between districts. Of the 30 districts, 28 had at least one 'zero' in a core capacity area. The lowest scores across all districts were in the domains of budgeting, safe burial, contact tracing, case management, and rapid response teams.

Question 8: Based on the findings of the EVD assessment, which core capacities do you think the response plan should focus on?

Answer

The Uganda Multi-Hazard Plan for Preparedness and Response to Public Health Threats and Emergencies provides a mechanism for assessing and identifying risks and hazards that pose the greatest threat to health and property in Uganda using scientific and reliable methods and building the country's capacity and capability to detect public health threats early; and guide a coordinated, rapid, effective, and multi-sectoral response to public health threats and emergencies [6]. However, most times the country relies on passive surveillance which has weaknesses especially in continuous cross-border movements like in Uganda.

Most of the 'eleven pillars' focus on appropriate public health response to cases that have already occurred. However, relying on this passive type of surveillance can leave gaps in the identification of cases, allowing opportunities for cases to occur and spread undetected. The MoH realized that they needed to enhance community-based surveillance, as well as developing and disseminating risk communication messages and engaging with communities. They began working with partner organizations, such as Uganda Red Cross Society, UNICEF, WHO, World Food Programme and others to implement these activities. The partners met to discuss how to develop strong community-based surveillance for EVD or EVD-like symptoms, and what the best approach would be to promote risk communication messaging, including radio, TV, newspapers, and dissemination through local leaders.

Question 9: What is community-based surveillance? Why is community-based surveillance particularly necessary in EVD early detection and prompt response?

Answer

Question 10: What approaches might be considered to strengthen EVD risk communication messages? Which approach(es) do you think has/have the most impact in this setting?

Answer

While Uganda has had long experience with viral hemorrhagic fevers, including Marburg Virus, Crimean-Congo Hemorrhagic Fever, Rift Valley Fever, and others, infection prevention and control (IPC) practices at health facilities were not stringent enough for an EVD outbreak. To address this, the MoH conducted an assessment of IPC at health facilities and PoEs closest to the outbreak [7]

Question 11: What is meant by IPC? Who needs to know about IPC before or during an EVD outbreak?

Answer

Part III.

EVD outbreak response can stretch the limits of human health care resources in a country. Despite this, it is critical during an EVD outbreak response to ensure that other public health measures do not fall by the wayside. Healthcare-seeking behaviors change during an EVD outbreak for multiple reasons: the public becomes afraid of healthcare facilities and healthcare workers, who can serve as sources of infection if not properly prepared with IPC training and PPE; healthcare workers who would otherwise be engaged in activities such as indoor residual spraying or vaccination are instead being utilized for EVD response; and other diseases, such as malaria, may be mistaken for suspected EVD, leading to isolation and quarantine among patients who don't need these measures. When these patients are isolated together with persons who do have EVD, it puts them at high risk of infection.

Unfortunately, the early symptoms of EVD can look very similar to other diseases, particularly malaria. When an EVD outbreak occurs in areas at high risk for malaria infection, multiple actions should be taken to minimize the number of malaria cases and avoid the possibility of sending a person with malaria to an Ebola treatment center [8,9].

Uganda is a malaria-endemic country, with approximately 95% of the population living in high-risk areas. During outbreaks, half or more of the local population may be infected. To address the need to distinguish EVD from malaria in healthcare settings and reduce the overall malaria burden during the outbreak, the country sought guidance from WHO to develop a modified malaria control approach in the high-risk districts. The National Malaria Control Division of MoH developed a strategy incorporating critical components in the WHO Guidelines.

Question 12: How might you modify the approach to malaria control in high-risk districts for EVD?

Answer

In 2019, a vaccine called rVSV-ZEBOV, which had recently been shown to be safe and protective against the Zaire strain of the Ebola virus, was commercially licensed and began being recommended for persons at risk of an EVD exposure [10]. Although it was still considered 'investigative' in August 2018 and was not yet commercially licensed, WHO began securing some vaccine doses for use in Uganda.

Question 13: With the information available at the time, would you have recommended using a vaccine that was not yet licensed in this EVD outbreak? Who do you think should be prioritized for vaccination?

Answer

The country planned to vaccinate high-risk health and non-health workers, to protect them against cases they might unknowingly encounter. In addition, to maximize the utility of the relatively small number of vaccines available at that time, WHO recommended that Uganda plan for ring vaccination as needed.

Question 14: What is meant by 'ring vaccination'? Why might only a subset of persons be vaccinated in the 'ring vaccination' strategy during an EVD outbreak, rather than the entire population?

Answer

In September 2018, the NTF sought ethical and institutional approval for prophylactic use of the rVSV-ZEBOV vaccine in a vaccination campaign. The aim of the Ebola vaccination campaign was to protect frontline health and non-health workers in Uganda at potential risk for EVD in advance of an outbreak. On 31 October 2018, the NTF received approval to use the vaccine. The MoH, with support from the WHO, secured 3,000 vaccine doses. The team established and trained national vaccination teams, organized cold chain logistics, selected districts, and identified the highest-risk workers in health care facilities, PoEs, and other locations. On 07/11/2018, they began voluntary vaccination, ultimately vaccinating 7,945 persons.

Part IV.

On 10 June 2019, a 5-year-old boy travelled with six of his relatives from an Ebola-affected area of the DRC to Uganda through an undesignated border crossing at Mpondwe, Kasese District. The boy was ill with fever, bloody diarrhea and was vomiting blood. His family brought him to Kagando Hospital in Kasese District shortly after crossing the border to seek medical care.

Question 15: What possible differential diagnosis would you consider in this patient?

Answer

Question 16: From a public health perspective, what should be the next course of action with this patient?

Answer

Question 17: Is this an outbreak? Justify your answer.

Answer

Uganda has had multiple outbreaks of Viral Hemorrhagic Fevers in the last 2 decades, including in in 2000, 2007, 2011, and 2012. The largest documented EVD outbreak in Uganda occurred in 2000-2001 in Gulu District, with 425 cases and 224 deaths. Healthcare workers were heavily affected. Marburg Virus Disease, another haemorrhagic fever, also caused outbreaks in 2007, 2012, 2016, and 2017. The most recent Marburg outbreak, which occurred in Kween District, required cross-border surveillance with Kenya to trace contacts. Beyond this, there have been many outbreaks of other viral hemorrhagic fevers, including Crimean Congo Hemorrhagic Fever and Rift Valley Fever in multiple districts.

Suspecting EVD, the staff at Kagando Hospital transferred the 5-year-old boy to an Ebola Treatment Unit at Bwera Hospital in Kasese District on 10 June 2019, but he died the following day. Laboratory test results reported on 11 June 2019 confirmed that the patient had had EVD. Further questioning revealed that the boy and his family members had attended the burial of an EVD victim in DRC on 9 June 20.

Question 18: What should be the first action(s) of the NRRT in response to this suspected case?

Answer

Question 19: What actions might each of the pillars take in response to this report of suspected EVD?

Answer

On 12 June 2019, two of the six family members who had been traveling with the 3-year-old boy also developed bloody diarrhoea, muscle pain, headache, vomiting blood, fatigue, and abdominal pain and presented to Kagando Hospital for care. Both were referred to the ETU at Bwera Hospital, where they were confirmed positive for EVD. Unfortunately, they both died within 4 days of admission. They were all offered safe and dignified burials [11].

The NNRT with the help of VHTs and community leaders actively searched for cases and line listed case-patients. They did not identify any other case-patients apart from the three family members who all died. They then embarked on contact tracing [12].

Question 20: Define a contact for EVD. Differentiate primary and secondary contacts, and contacts of contacts.

Answer

Question 21: What is contact tracing in EVD? Why is it important?

Answer

The contact tracing team identified a total of 114 contacts, including family members, neighbors, and health workers in both Uganda and the DRC. All the contacts were immediately vaccinated against Ebola Virus using the rVSV-ZEBOV vaccine and followed up for 21 days. None of the 114 contacts developed EVD symptoms.

Conclusion

The 2018-19 Ebola outbreak in DRC was still ongoing at the time of the writing of this case study, with 3,416 cases and 2,238 deaths, and increasing every day. By 25 July 2019, Uganda had reported only the four cases described in this case study, all family members who entered Uganda from the DRC. There was no spread beyond the persons who entered Uganda with infection, likely largely due to the high levels of preparedness implemented before the outbreak.

Although, Uganda, unlike West Africa, had experience with EVD previously, even experienced countries may find it difficult to control hemorrhagic fever outbreaks. Challenges to control include difficulty isolating people, patients who flee, fear of health facilities and ETUs, rumors, use of traditional healers, and many others. This may be particularly difficult in rural areas or areas undergoing conflict, such as was happening in the affected area of DRC during this period.

On 26 July 2019, MoH declared an end of the first EVD outbreak associated with the DRC outbreak 42 days after the last contact with a confirmed case. Despite the declaration of the end of the 6th EVD outbreak in Uganda, the country remained in alert phase, with its national coordination mechanisms still activated.

Reading

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Competing interest

The authors declare they had no competing interest

Author's contributions

ARA - Led the writing process after collecting program data and drafted the case study; LB, DK, BK, SNK and JRH facilitated the case study development workshop, writing and revision of many drafts. All authors read and gave approval to the final case study for use and publication.

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Disclaimer

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