Review of Uganda´s high-risk Ebola preparedness activities enabling prompt control of imported Ebola Virus Outbreak from the Democratic Republic of Congo, June 2019

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ABSTRACT

Introduction: On 1 August 2018, the Democratic Republic of Congo declared its tenth Ebola Virus Disease (EVD) outbreak in North-Kivu province, 100 km from the Uganda border. Uganda immediately initiated activities to prepare for possible importation of cases. The capacity developed through these interventions was tested when three EVD cases entered Uganda through Kasese District on 10 June 2019. We describe how heightened preparedness efforts enabled prompt detection and control of the imported EVD cases within Uganda. **Methods:** To prepare for the spillover of EVD cases, Uganda Ministry of Health activated coordination mechanisms, conducted readiness assessments and a field simulation exercise, developed an EVD preparedness and response plan, enhanced surveillance, point of entry screening, trained health workers and community on detection, conducted laboratory investigations, established treatment units and vaccinated health care workers in high-risk Ugandan districts. EVD operational readiness was monitored regularly using the WHO checklist. We conducted desk reviews of all preparedness and response documentation. **Results:** During the preparedness period, 3 imported EVD cases were identified at a hospital in Kasese District on 10 June 2019 after entering Uganda through an undesignated border crossing near Mpondwe, Kasese District. All three patients died within a few days. Between 11-15 June 2019, 114 contacts were identified and followed up for 21 days. Of these, 78 (68%) were vaccinated with the Ebola rVSV-ZEBOV vaccine, and none developed EVD symptoms. The Ministry of Health declared the outbreak over in Uganda 42 days after the death of the last confirmed case. **Conclusion:** Preparedness activities in a high-risk district in Uganda enabled early detection, effective isolation, infection prevention and control, and efficient response coordination following importation of EVD cases into Uganda from DRC, resulting in its full containment and preventing further spread throughout the country. Preparedness activities implemented systematically could enable effective and efficient response to similar high-risk situations in the future.

KEYWORDS: Ebola Virus Disease, Preparedness, Cross-border, Uganda

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Introduction

Ebola Virus Disease (EVD) is a viral hemorrhagic fever (VHF) that affects humans and other primates, as well as bats, porcupines, and other mammals. The causative agent, the Ebola virus, is transmitted from wildlife to humans and then spreads from human to human through direct contact with blood, secretions, or bodily fluids from infected persons and contaminated materials [1]. Signs and symptoms of EVD include fever, fatigue, muscle pain, headache, sore throat, vomiting, diarrhea, rash and bleeding (internal and external) [2]. EVD is highly fatal, with a case fatality rate (CFR) ranging from 25-90%, depending on the strain [1].

Between 2000 and 2018, Uganda experienced five EVD outbreaks [3]. On 1 August 2018, the neighbouring Democratic Republic of Congo (DRC) declared its tenth EVD outbreak [4]. This became the largest EVD outbreak ever recorded in the DRC and the second largest EVD outbreak ever recorded anywhere, lasting for two years and resulting in nearly 3,500 confirmed cases and nearly 2,300 deaths between 2018 and 2020 [5]. The epicenter of the DRC outbreak was in North Kivu, approximately 100 kilometers (km) from the Uganda border. For socioeconomic and healthcare-seeking reasons, people frequently moved between the epicenter area and neighboring Ugandan districts, crossing through the designated and non-designated points of entry. Given these movements, the risk of EVD introduction into Uganda was considered very high, and Uganda embarked on an intensive EVD preparedness planning and extensive heightened preparedness activities to enhance readiness for a potential EVD spillover from DRC.

On 10 June 2019, a 5-year-old patient presented at Kagando Hospital, Kasese District. Health workers at this facility had undergone refresher training only weeks before on health facility-based surveillance for EVD and had also participated in a simulation exercise as part of preparedness efforts. Based on symptoms, staff immediately suspected EVD in the patient and referred him to the nearby Ebola Treatment Unit (ETU) that was set up during the preparedness period. On 11 June 2019, upon receiving laboratory confirmation of the case by PCR testing at the Uganda Virus Research Institute (UVRI) in Entebbe, 425 km away from the ETU, the Uganda Ministry of Health (MOH) declared the sixth EVD outbreak in the country. We describe the extensive preparedness activities and how they enabled prompt detection and control of imported EVD without further spread within Uganda.

Methods

We conducted a descriptive study using desk reviews of all reports related to preparedness and response activities including situation reports, risk assessment reports, simulation exercise reports, and minutes from the national and district task force meetings. We synthesized and categorized information based on the themes below:

Response coordination mechanisms

In Uganda, "response coordination mechanisms" refer to the multi-sectoral and multidisciplinary teams and structures involved in response to a public health emergency. In the case of an infectious disease outbreak, these include all the partners and coordination structures of the multidisciplinary response teams involved in preventing, detecting, and responding to the outbreak at national and sub-national levels. The coordination structures are the National and District Task Forces. At the time of the outbreak, Uganda was divided into 128 districts.

On 4 August 2018, coordination mechanisms, comprising the National and District Task Forces (NTF and DTF), the Incident Management System, and the Emergency Operations Center (EOC) were activated at national and district levels to effectively coordinate EVD preparedness interventions in high-risk districts [5, 6]. In Uganda, the NTF and DTF provide technical oversight and guidance to the public health response at their respective levels. The Incident Management System comprises health professionals to plan, organize and oversee the training of key responders on the ground during preparedness, and coordinate all areas of the response phase, including planning, logistics, situational awareness, resource management, risk communication and community mobilization. Lastly, the EOC is activated at different levels to respond to emergencies from a central operational platform and provide the human and physical resources to support the response through. Both the IMS and EOC report to the NTF which is chaired by Uganda MOH´s top leadership. On 11 June 2019, these mechanisms were quickly repurposed to coordinate the response to the EVD outbreak.

Risk mapping and readiness assessments

When the 2018 EVD outbreak in DRC began, Uganda conducted risk mapping and readiness assessment using the WHO EVD checklist [7]. Uganda received a readiness score of 50% on the initial (baseline) assessment. This prompted immediate action to heighten preparedness and improve readiness for an EVD response, starting with developing a holistic preparedness plan. The plan included strategies to: a) enhance surveillance in high-risk districts including border points, health facility and community levels in order to enable early detection of any imported EVD case through training of immigration and border patrol officers, health workers and village health teams as well as setting up sanitation check points at border crossings, b) train laboratory personnel on safety procedures and Infection Prevention and Control (IPC) for specimen collection, packaging, labelling, referral and transportation to UVRI, c) train and equip district contact tracing teams, d) establish treatment centers for EVD cases, e) broaden and deepen community engagement and public and health worker awareness about EVD and the necessary actions to detect timely any imported case and prevent its transmission, f) protect health workers against EVD through the full implementation of IPC measures and preventive Ebola vaccination, g) build logistics capacity to quantify, procure, pre-position, and manage stock of equipment and supplies required for preparedness and response to EVD, h) improve IPC practices at all health facility levels and in the community, and i) strengthen local capacity for case management, including physical and mental health care, and psychosocial support [8].

EVD response plan

In June 2019, after the detection of the first EVD case in Uganda, the preparedness plan was quickly transitioned into a response plan through a consultative, multisectoral and multidisciplinary development process. Planned activities were structured around twelve preparedness and response intervention areas (coordination, epidemiological surveillance, laboratory, points of entry, emergency response, contact tracing, IPC, case management, safe and dignified burials, risk communication and community engagement, vaccination, and logistics), Risk categorizations were re-evaluated, and these interventions were implemented in 24 high-risk districts.

Monitoring and accountability of the National Preparedness Plan

The Uganda MOH adopted the WHO operational readiness checklist [7], which included the minimum requirements per intervention area for a country or district to be ready to handle an EVD outbreak. From August 2018 to March 2019, the country's EVD operational readiness was monitored regularly using this checklist that was administered to district task forces in high-risk districts and at the national level during meetings. Later, in May 2019, the WHO key performance indicators were also adopted by the MOH to monitor the implementation of key activities under different intervention areas at the sub-national level [9].

On 11-12 April 2019, MOH, Uganda conducted a full-scale Ebola virus simulation exercise. This was conducted at national, district, and community levels to assess operational readiness in the event of an Ebola outbreak. The exercise simulated 3 suspected cases of Ebola virus infection at 2 points of entry (Mpondwe, Kasese district and Entebbe International Airport) and Kasindi village, Kasese. The exercise was coordinated by the national EOC and was organized and executed over a period of 6 weeks (**Figure 1**). Strengths identified included 1) proper coordination by the EOC and real-time information sharing, 2) high level of risk perception at Mpondwe border, Entebbe airport and in the community, 3) proper isolation of suspect at Mpondwe and Entebbe, 4) Bwera treatment unit was in place with prepositioned logistics to manage patients, 5) samples were quickly collected and 6) proper screening at the points of entry. Areas that were identified for strengthening included 1) communication between the community and district level, 2) alert management, 3) sample transportation, 4) IPC measures in the community, at points of entry and health facilities as there was improper donning and doffing procedures observed and poor hand hygiene, 5) stigma in the community, and 6) inadequate knowledge on patient management.

Recommendations were to 1) conduct continuous drills on patient management and enhancing IPC measures at all levels, 2) provide IPC mentorship

and conduct continuous drills, 3) train and deploy psychosocial staff in high-risk districts, 4) conduct drills on alert management, 5) print and disseminate information, education and communication materials and 6) provide stand by vehicles to support VHF sample transportation. Immediately after the exercise, the districts embarked on corrective measures and filling in the gaps. On 29 May 2019, an accountability forum was held at the national level to assess achievements and resources mobilized against the MOH national plan by the different stakeholders.

Capacities built during preparedness

Multiple actions were taken to build local and national capacities during preparedness activities. These activities are shown in (Figure 2).

Availability of data and materials

The data supporting our write-up belong to the Ministry of Health Uganda. For confidentiality reasons, the data is not publicly available. However, upon reasonable request to the corresponding author and with permission from the Ministry of Health Uganda, the data can be availed.

Ethical consideration

The Ebola preparedness, investigation and response activities were directed by Uganda´s MOH in response to a public health event and MOH directed and approved all the methods and procedures of this investigation. The IRB of CDC´s Center for Global Health in Atlanta determined that this activity was not human subject research, and that its primary intent was public health practice as an epidemic disease control activity. Verbal informed consent was sought from respondents supporting the response in Kasese district and at national level. They were informed that their participation was voluntary, and their refusal would not result in any negative consequences. Unique identifiers were used instead of real names to protect the confidentiality of the respondents and no names or personal identifiers of any respondents were disclosed in any verbal or written dissemination of the reports or investigations concerning this outbreak. Uganda´s MOH, CDC and Uganda´s Public Fellowship Program are aware of, approve and support the dissemination of the results of this investigation in any peer-reviewed journal.

Current status of knowledge

Preparedness

The enhanced surveillance system designed to strengthen VHF alerts detected 655 alerts between 1 August 2018 and 11 June 2019. All samples were tested at UVRI, of which 23 tested positive for Viral Hemorrhagic Fevers (VHF): eight for Rift Valley Fever, 14 for Crimean Congo Hemorrhagic Fever, and one for Ebola Zaire. As a result of the preparedness activities, the preparedness score for the country increased from 50% in June 2018 to 84% in June 2019. The accountability forum identified the following gaps: weak coordination of partners resulting in fragmentation and duplication of efforts in some pillars, weak framework for monitoring preparedness efforts, insufficient mentorship in some districts, delayed reporting of alerts from the community to the national level, inadequate quality of isolation facilities as most were temporary structures, as well as weak IPC practices in districts where trainings were conducted. The stakeholders began addressing several of the identified gaps to enhance readiness.

Outbreak detection and response, and international collaboration

On 27 May 2019, a funeral was held in DRC for a man who died of EVD. On June 9, the DRC Minister of Health notified the Uganda Minister of Health of the possibility of high-risk contacts from the funeral potentially crossing into Uganda. On 10 June 2019, all the 12 high-risk contacts tried crossing the border into Kasese District, Uganda. However, when they noticed ongoing entry screening on the Uganda side at Mpondwe, they turned back to remain in DRC. The DRC national hygiene program traced and isolated them at a transitional isolation unit at Kasindi Hospital in DRC, where blood samples were collected to test for EVD. Later that same day on 10 June 2019, before results were available, six members of this group, including a 5-year-old boy and five of his family members left Kasindi Hospital and crossed into Uganda through an undesignated border crossing near Mpondwe, Kasese District (Figure 3).

As the 5-year-old child was unwell, his mother brought him to Kagando Hospital in Uganda (27 km from the border crossing) on the evening of 10 June 2019 where he presented with bloody diarrhoea, muscle pain, headache, vomiting blood, fatigue, and abdominal pain. Prior to the EVD outbreak, Kagando Hospital staff had been trained and re-oriented on health facility-based surveillance to be able to quickly identify EVD suspects, basic management and IPC. Hospital staff had also received the Ebola vaccine in November 2018. In addition, Kagando Hospital participated in the functional district-level simulation exercise in April 2019. When the boy was admitted, Kagando Hospital health workers suspected EVD and referred him to an Ebola Treatment Unit (ETU) at Bwera Hospital that had been set up during the preparedness phase (**Figure 3**). There, a blood sample was collected for PCR testing and EVD was confirmed within 48 hours of collection by the Uganda Virus Research Institute (UVRI) VHF Laboratory in Entebbe (425 kms from Bwera Hospital).

On 11 June 2019, two of the boy´s five accompanying relatives also developed symptoms, sought care at Bwera Hospital, and were referred to the ETU where blood samples were collected for PCR testing at UVRI. EVD was confirmed in two of the boy´s relatives, including the boy´s mother, while the other three tested negative (**Figure 4**).

A high-level ministerial cross-border meeting between DRC and Uganda held in Kasese District on 11 June 2019 agreed on the repatriation of cases and family members, which occurred the next morning. In addition, the meeting participants prepared a bilateral Memorandum of Understanding on cross-border collaboration and established formal information-sharing mechanisms, including situation reports. As Uganda was still processing the importation of the EVD vaccine, DRC agreed to share 100 doses of vaccine to immunize high-risk contacts of the EVD patients. In total, 78 of the 114 contacts were vaccinated against EVD using the rVSV-ZEBOV vaccine (**Figure 5**). All healthcare workers who had exposure to the patients had already been vaccinated during the preparedness period except one who received the vaccine within five days of exposure.

All three EVD patients who crossed into Uganda died; the index and second case died and were buried in Uganda while the third case died in DRC during the process of repatriation. The three surviving family members were repatriated to DRC. In Kasese District, an emergency response team comprising national and local responders trained during preparedness identified and listed 114 contacts of the 3 EVD patients and followed them up with a 100% follow-up reporting rate for 21 days.

None of the contacts developed EVD symptoms after 21 days of observation. The outbreak was thus contained, with no transmission within the community in Kasese District, and declared over after 42 days on 28 October 2019 [10] (representing two incubation periods after the index cases exited Uganda). The outbreak response was district-led with support from the National Task Force and partners.

The response and preparedness plan was costed at USD 17.2 million by the Uganda MOH, of which USD 10 million (59%) was raised for its implementation by the partners.

Post-outbreak activities

Risk mapping was repeated on 12 June 2019, after confirmation of the outbreak, and districts were reclassified into 3 categories based on the level of risk (**Figure 6**): Category 1 (district with ongoing outbreak: Kasese District); Category 2 (10 high-risk districts bordering Kasese and/or with direct routes to/from DRC´s EVD outbreak epicenters), and Category 3 (13 moderate-risk districts that required enhanced preparedness due to population movements and/or refugee hosting).

Discussion

Sustained preparedness activities assessed by the simulation exercise in high-risk areas of Uganda may have enabled the containment of an Ebola outbreak at its importation site without further spread. This underscores the importance of investment in preparedness and a focus on operational readiness in high-risk areas. Implementing effective preparedness activities during the West Africa Ebola outbreak in the African region and countries with direct travel links could have significantly reduced the risk of global importation [11]. Additionally, prior vaccine

administration for frontline health workers may have protected health workers in Kagando Hospital who had close contact with the confirmed cases [12, 13].

Readiness at the hospital and community levels requires substantial effort and investment that may have prevented a much more widespread and costly EVD outbreak involving high morbidity and mortality [12].

Uganda experienced Ebola outbreaks in the past, which compelled the nation to improve its preparedness and response strategies to manage health crises [13]. Steps undertaken to bolster Ebola preparedness: 1) strengthened surveillance systems to ensure early detection of outbreaks including enhancing information systems and laboratory specimen referral networks for real-time reporting, 2) training health workers, 3) establishment of Public Health Emergency Operations Centres to coordinate and support for outbreak response activities 4) building trust and educating local communities to participate in surveillance and reporting, as well as understanding preventive measures. 5) Uganda works with international bodies such as WHO and CDC to improve its regulatory framework for managing infectious diseases and to access resources and expertise that aid in preparedness and response. 6) Uganda has learned the importance of allocating resources to prepare for health emergencies, which include both financial investment and human resources [13, 6].

While Uganda's efforts significantly improved its readiness to confront Ebola from a score of 50% in June 2018 to 84% in June 2019, maintaining and updating these health systems is crucial, especially considering evolving threats and the challenges posed by other concurrent health crises [14].Preparation is also about building resilient health systems that not only respond to outbreaks but also ensure the continuity of essential health services during crises [14].

Many of the lessons learned during the West Africa Ebola outbreak have been translated into improved preparedness measures: like capacity building for health workers, engaging local communities in surveillance, reporting and public health measures, establishing and equipping treatment centres, and improving the overall health infrastructure to manage potential outbreaks. Lessons include enhanced disease surveillance and availability of rapid response systems to quickly identify and isolate cases, trace contacts, and limit the spread of the virus. Advocating for financial and technical support from international and local organizations to support response efforts and vaccine stockpiling are also critical in Ebola preparedness [14, 15].

Despite the lessons West African countries learnt, they continue to face challenges in maintaining sustained funding, coordination, and political will to keep public health systems ready for Ebola and other infectious diseases. A continuous commitment to international cooperation and investment in healthcare infrastructure is necessary to maintain and further enhance preparedness levels [15, 16].

Wolicki also emphasizes strengthening cross border collaborations and information sharing to prevent infectious diseases spreading across boundaries [17]. Cross border collaboration between Uganda and DRC was a significant benefit in the quick detection of Ebola cases in Uganda following communication and information sharing from DRC. This was facilitated by prior cross border engagements between DRC, Uganda and other at-risk countries in October 2018 when a ministerial meeting was held to formalize cross border collaboration and information sharing. This was followed by a second bilateral meeting held in December 2018 that focussed on drafting a memorandum of understanding on information sharing and cross border collaboration between Uganda and DRC and formation of surveillance zones between the two countries [6].

The West Africa Ebola outbreak in 2014-2016 was costly and estimated that over $3.6 billion was spent by international donors and affected countries in response to the outbreak [18]. Response to an outbreak like Ebola can be vastly expensive due to the need for rapid mobilization of a large-scale, coordinated effort involving emergency medical care, deploying health workers, setting up isolation units and field hospitals, significant quantities of medical supplies and protective gear, logistical support, and public health interventions to control the spread. Additionally, there are indirect costs such as economic disruptions, trade restrictions, and decreased productivity [18]. While effective preparedness measures are much less costly; however, they require consistent investment and a

long-term outlook [19]. Although the cost of preparedness is substantial, the economic impact of an uncontained Ebola outbreak could be far more severe, with long-term detrimental effects on the national economy and public health systems. While a cost benefit analysis for preparedness has not been undertaken in Uganda, proactive investment in Ebola preparedness is both a necessary and cost-saving measure over the long term.

Preparedness is more cost-effective in the long term, as it can prevent epidemics that are both humanly devastating and economically disastrous [20].

The Government of Uganda was able to mobilize preparedness resources in cash, and in kind from partners due to the existing collaboration and continuous accountability for transparency. International and nongovernment partnerships facilitate joint advocacy and resource mobilization, hence pooling resources for broader funding streams.

Repeated risk mapping is a proactive process to preparedness and control of Ebola. This prevents Ebola from becoming a worldwide threat by deploying targeted interventions for affected areas. It is also used for strategically guiding allocation of limited resources to prevent Ebola spread and control transmission.

Uganda conducted repeated risk mapping which was informed by the dynamics of the geographical distribution of Ebola in DRC. District categorization in the preparedness phase was informed by proximity to hot spots in DRC while the recategorization was based on declaration of an outbreak in Kasese district which was previously identified as a high-risk district and preparedness measures had been deployed [6, 20]. Lesson learnt was that risk mapping contributes to better understanding of the geospatial distribution and aides in anticipation and mitigation of future outbreaks hence should be conducted repeatedly as the outbreak evolves.

Conclusion

Investing in and maintaining epidemic preparedness during Ebola response, especially in high-risk areas with potential importation, is crucial. This proactive approach can lead to rapid detection and an effective response when faced with an imminent threat.

What is known about this topic

- Ebola Virus Disease is a fatal illness that affects both humans and primates with an average case fatality of 50%.
- The Democratic Republic of Congo, which borders Uganda to the West, faces recurrent Ebola outbreaks and the risk of spillovers into Uganda is high.

What this study adds

- Investment in epidemic preparedness prevents widespread outbreaks. This limits the cost of response and high mortality.
- Timely response to infectious disease outbreaks is key to containment and avoiding further spread.

Competing interests

The authors declare no competing interests.

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Authors´ contributions

The Ministry of Health and partners responded to the EVD outbreak in Kasese District, Uganda. SN, ANM, IM, ARA, BK, AAK, LB, DNG, MN, PM, IK, FO, JH, JHo, VB, JO, DM, IMA, SK, and AM participated in data collection and management and manuscript writing and technical input. LB, AAR, JH, JHo, VB, HGM, and MN reviewed the manuscript for intellectual content. All authors

contributed to the writing and approval of the final manuscript.

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Figures

Figure 1: Planning and execution of the full-scale simulation exercise at two points of entry (Mpondwe, Kasese and Entebbe International), Kisinga community in Kasese district and at the national level, Uganda, April 2019

Figure 2: Capacities built/trainings conducted in high-risk districts during the EVD preparedness phase, Uganda 2018-2019

Figure 3: Movement of Ebola cases from Beni, DRC into Kasese District, Uganda, through an undesignated crossing point at Mpondwe, June 2019

Figure 4: Timeline of Ebola outbreak from alert identification to death of last imported case from DRC, Uganda, June 2019

Figure 5: Number of persons vaccinated during the Ebola outbreak in Kasese District, Uganda, June 2019

Figure 6: Map of Uganda showing Ebola Virus Disease district risk classification, June 2019

References

1. World Health Organization. Ebola virus disease. Geneva (Switzerland): World Health Organization; 2023 Apr 20 [cited 2024 Apr 30].

2. Jacob ST, Crozier I, Fischer WA, Hewlett A, Kraft CS, Vega MADL, Soka MJ, Wahl V, Griffiths A, Bollinger L, Kuhn JH.Ebola virus disease . Nat Rev Dis Primers [Internet]. 2020 Feb 20 [cited 2024 Apr 30];6(1):13. https://doi.org/10.1038/s41572-020-0147-3 PubMed | Google Scholar

3. Okware SI, Omaswa FG, Zaramba S, Opio A, Lutwama JJ, Kamugisha J, Rwaguma EB, Kagwa P, Lamunu M. An outbreak of Ebola in Uganda. Tropical Med Int Health [Internet]. 2002 Dec 11 [cited 2024 Apr 30];7(12):1068-75. https://doi.org/10.1046/j.1365-3156.2002.00944.x Google Scholar

4. Shears P, Garavan C.The 2018/19 Ebola epidemic the Democratic Republic of the Congo (DRC): epidemiology, outbreak control, and conflict . Infect Prev Pract [Internet]. 2020 Jan 24 [version of record 2020 Feb 8; cited 2024 Apr 30];2(1):100038. https://doi.org/10.1016/j.infpip.2020.100038 PubMed | Google Scholar

5. World Health Organization. Ebola - North Kivu/Ituri, Democratic Republic of the Congo, August 2018 - June 2020 [Internet]. Geneva (Switzerland): World Health Organization; 2020 Jul 3 [cited 2024 Apr 30].

6. Aceng JR, Ario AR, Muruta AN, Makumbi I, Nanyunja M, Komakech I, Bakainaga AN, Talisuna AO, Mwesigye C, Mpairwe AM, Tusiime JB, Lali WZ, Katushabe E, Ocom F, Kaggwa M, Bongomin B, Kasule H, Mwoga JN, Sensasi B, Mwebembezi E, Katureebe C, Sentumbwe O, Nalwadda R, Mbaka P, Fatunmbi BS, Nakiire L, Lamorde M, Walwema R, Kambugu A, Nanyondo J, Okware S, Ahabwe PB, Nabukenya I,

Kayiwa J, Wetaka MM, Kyazze S, Kwesiga B, Kadobera D, Bulage L, Nanziri C, Monje F, Aliddeki DM, Ntono V, Gonahasa D, Nabatanzi S, Nsereko G, Nakinsige A, Mabumba E, Lubwama B, Sekamatte M, Kibuule M, Muwanguzi D, Amone J, Upenytho GD, Driwale A, Seru M, Sebisubi F, Akello H, Kabanda R, Mutengeki DK, Bakyaita T, Serwanjja VN, Okwi R, Okiria J, Ainebyoona E, Opar BT, Mimbe D, Kyabaggu D, Ayebazibwe C, Sentumbwe J, Mwanja M, Ndumu DB, Bwogi J, Balinandi S, Nyakarahuka L, Tumusiime A, Kyondo J, Mulei S, Lutwama J, Kaleebu P, Kagirita A, Nabadda S, Oumo P, Lukwago R, Kasozi J, Masylukov O, Kyobe HB, Berdaga V, Lwanga M, Opio JC, Matseketse D, Eyul J, Oteba MO, Bukirwa H, Bulya N, Masiira B, Kihembo C, Ohuabunwo C, Antara SN, Owembabazi W, Okot PB, Okwera J, Amoros I, Kajja V, Mukunda BS, Sorela I, Adams G, Shoemaker T, Klena JD, Taboy CH, Ward SE, Merrill RD, Carter RJ, Harris JR, Banage F, Nsibambi T, Ojwang J, xyKasule JN, Stowell DF, Brown VR, Zhu BP, Homsy J, Nelson LJ, Tusiime PK, Olaro C, Mwebesa HG, Woldemariam YT.Uganda´s experience in Ebola virus disease outbreak preparedness, 2018-2019 . Global Health [Internet]. 2020 Mar 19 [cited 2024 Apr 30];16(1):24. https://doi.org/10.1186/s12992-020-00548-5 PubMed | Google Scholar

7. World Health Organization. Consolidated Ebola virus disease preparedness checklist [Internet]. Geneva (Switzerland): World Health Organization; 2015 Jan 15 [cited 2024 Apr 30]. 19 p. Download the pdf to view the full document.

8. Nanziri C, Ario AR, Ntono V, Monje F, Aliddeki DM, Bainomugisha K, Kadobera D, Bulage L, Nsereko G, Kayiwa J, Nakiire L, Walwema R, Tusiime PK, Mabumba E, Makumbi I, Ocom F, Lamorde M, Kasule JN, Ward SE, Merrill RD.Ebola Virus Disease Preparedness Assessment and Risk Mapping in Uganda, August-September 2018 . Health Secur [Internet]. 2020 Apr 17 [cited 2024 Apr 27];18(2):105-13. https://doi.org/10.1089/hs.2019.0118 Subscription or purchase required to view full article. PubMed | Google Scholar

9. World Health Organization Regional Office for Africa. Strategic EVD Operational Readiness [Internet]. Brazzaville (Republic of Congo): World Health Organization Regional Office for Africa; 2018 Jun 2 [cited 2024 Apr 30]. 14 p. Download WHO Regional Strategic EVD Operational Readiness.pdf.

10. World Health Organization Regional Office for Africa. Uganda declares end of Ebola outbreak [Internet]. Kampala (Uganda): World Health Organization; 2023 Jan 11 [cited 2024 Apr 30].

11. Heymann DL, Chen L, Takemi K, Fidler DP, Tappero JW, Thomas MJ, Kenyon TA, Frieden TR, Yach D, Nishtar S, Kalache A, Olliaro PL, Horby P, Torreele E, Gostin LO, Ndomondo-Sigonda M, Carpenter D, Rushton S, Lillywhite L, Devkota B, Koser K, Yates R, Dhillon RS, Rannan-Eliya RP.Global health security: the wider lessons from the west African Ebola virus disease epidemic. The Lancet [Internet]. 2015 May 9 [cited 2024 Apr 30];385(9980):1884-901. https://doi.org/10.1016/s0140-6736(15)60858-3 PubMed | Google Scholar

12. Shears P, O´Dempsey TJD.Ebola virus disease in Africa: epidemiology and nosocomial transmission . J Hosp Infect [Internet]. 2015 Jan 20 [cited 2024 Apr 29];90(1):1-9. https://doi.org/10.1016/j.jhin.2015.01.002 PubMed | Google Scholar

13. Centers for Disease Control and Prevention. Ebola Disease [Internet]. Atlanta (GE): Centers for Disease Control and Prevention; 2018 May 16. History of Ebola Disease Outbreaks; [last reviewed 2023 Aug 30; cited 2024 Apr 29].

14. United Nations. **Ebola 100 days on from advent of COVID-19, more action is needed: Tedros** [Internet]. Washington(DC): United Nations; 2020 Apr 9 [Cited 2024 Apr 29].

15. Aitsi-Selmi A, Murray V, Heymann D, McCloskey B, Azhar EI, Petersen E, Zumla A, Dar O.**Reducing risks to health and wellbeing at mass gatherings: the role of the Sendai Framework for Disaster Risk Reduction**. Int J Infect Dis [Internet]. 2016 Apr 7 [cited 2024 Apr 29];47:101-4. **https://doi.org/10.1016/j.ijid.2016.04.006 PubMed** | **Google Scholar**

16. Lal A, Ashworth HC, Dada S, Hoemeke L, Tambo E.**Optimizing Pandemic Preparedness and Response Through Health Information Systems: Lessons Learned From Ebola to COVID-19** . Disaster Med Public Health Prep [Internet]. 2020 Oct 2 [cited 2024 Apr 29];16(1):333-40. **https://doi.org/10.1017/dmp.2020.361 PubMed** | **Google Scholar**

17. Wolicki SB, Nuzzo JB, Blazes DL, Pitts DL, Iskander JK, Tappero JW.**Public Health Surveillance: At the Core of the Global Health Security Agenda** . Health Secur [Internet]. 2016 Jun 17 [cited 2024 Apr 29];14(3):185-8. **https://doi.org/10.1089/hs.2016.0002** Subscription or purchase required to view full article. **PubMed** | **Google Scholar**

18. Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), Division of High-Consequence Pathogens and Pathology (DHCPP), Viral Special Pathogens Branch (VSPB). **Ebola Disease** [Internet]. Atlanta (GE): Centers for Disease Control and Prevention; 2018 May 16. Cost of the Ebola Epidemic; [last reviewed 2019 March 8; cited 2024 Apr 28].

19. Ryan CS, Belizaire MRD, Nanyunja M, Olu OO, Ahmed YA, Latt A, Kol MT, Bamuleke B, Tusiime J, Nsabimbona N, Conteh I, Nyashanu S, Ramadan PO, Woldetsadik SF, Nkata JPM, Ntwari JT, Nzeyimana SD, Ouedraogo L, Batona G, Ndahindwa V, Mgamb EA, Armah M, Wamala JF, Guyo AG, Freeman AYS, Chimbaru A, Komakech I, Kuku M, Firmino WM, Saguti GE, Msemwa F, O-Tipo S, Kalubula PC, Nsenga N, Talisuna AO. **Sustainable strategies for Ebola virus disease outbreak preparedness in Africa: a case study on lessons learnt in countries neighbouring the Democratic Republic of the Congo**. Infect Dis Poverty [Internet]. 2022 Dec 2 [cited 2024 Apr 27];11(1):118. **https://doi.org/10.1186/s40249-022-01040-5 PubMed** | **Google Scholar**

20. Nzietchueng S, Kambarage D, Rwego IB, Mfinanga SG, Mbonye A, Mutonga D, Kaboyo W, Makumbi I, Muriuki S, Casimir N, Mduma S, Makasi C, Kitua AY. **Post-Ebola Awakening: Urgent Call for Investing in Maintaining Effective Preparedness Capacities at the National and Regional Levels in Sub-Saharan Africa**. East Afr. Health Res. J. [Internet]. 2019 Jul 30 [cited 2024 Apr 27];3(1):79-84. **https://doi.org/10.24248/eahrj-d-19-00019 PubMed** | **Google Scholar**

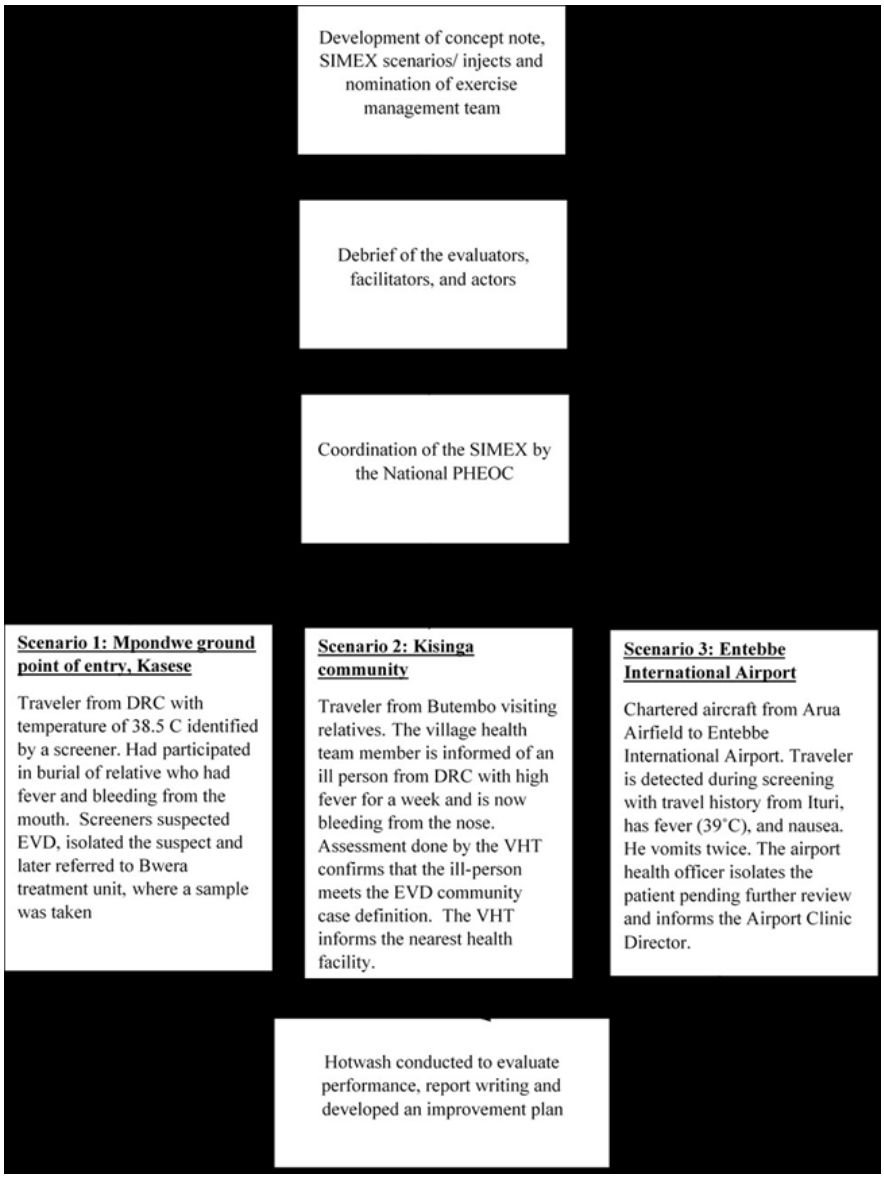

Figure 1: Planning and execution of the full-scale simulation exercise at two points of entry (Mpondwe, Kasese and Entebbe International), Kisinga community in Kasese district and at the national level, Uganda, April 2019

Capacities built/trainings conducted in high-risk districts during the EVD preparedness phase, Uganda 2018-2019

- General
  - Standard operating procedures (SOPs) for management of VHF outbreaks were distributed to all high-risk districts.
- Case detection
  - Training of health workers on active case surveillance and integrated disease surveillance and response; emphasis on active case search and regular supervision by district surveillance officers
  - Case definitions and other tools for investigation of suspected cases distributed
  - Contact tracing teams trained
  - 24 national and district rapid response teams trained/equipped to investigate alerts
- Laboratory
  - SOPs developed and 190 laboratory personnel trained in 24 districts and equipped for safe sample collection, packaging for shipment, and specimen transportation mechanism established
  - Specimen collection supplies pre-positioned in the high-risk districts.
- Point-of-entry interventions
  - Capacity for screening for EVD at points of entry was established in high-risk districts bordering DRC and at Entebbe international airport.
- Clinical preparedness
  - Eleven (11) Ebola treatment units established/ refurbished in Kasese, Entebbe, Fort Portal, Ntoroko, Bundibugyo, Kikuube, Kanungu, Naguru, Mbarara, Arua, and Gulu districts.
  - 526 health workers trained and mentored to manage EVD patients.
  - SOPs for case management and treatment guidelines were developed and disseminated to the high-risk districts.
  - IPC committees were established in high-risk districts and health facilities and IPC supplies provided.
  - At least one safe and dignified burial team of 10 personnel each was trained in each high-risk district.
- Risk communication
  - A national risk communication plan was developed.
  - District health educators were trained in risk communication and community engagement; and used to engage community, civic, traditional and religious leaders to mobilize communities to implement EVD prevention measures and to report any suspected cases.
- Vaccination
  - A vaccination protocol was developed for an experimental vaccine (rVSVΔG-ZEBOV-GP-Merck) approved for preventive vaccination of frontline workers and ring vaccination for outbreak response.
  - 6,805 frontline workers and high-risk health workers were vaccinated in Uganda.
- International collaboration
  - Between October 2018 and October 2019, eight cross-border meetings held between Uganda, Kenya, Rwanda, South Sudan, DRC, Tanzania, Zambia and Angola. The meetings focused on enhancing cross-border collaborations and real-time information-sharing for prompt action as well as signing of a Framework for Cross-border Collaboration for prevention and response to EVD and other public health events.

Figure 2: Capacities built/trainings conducted in high-risk districts during the EVD preparedness phase, Uganda 2018-2019

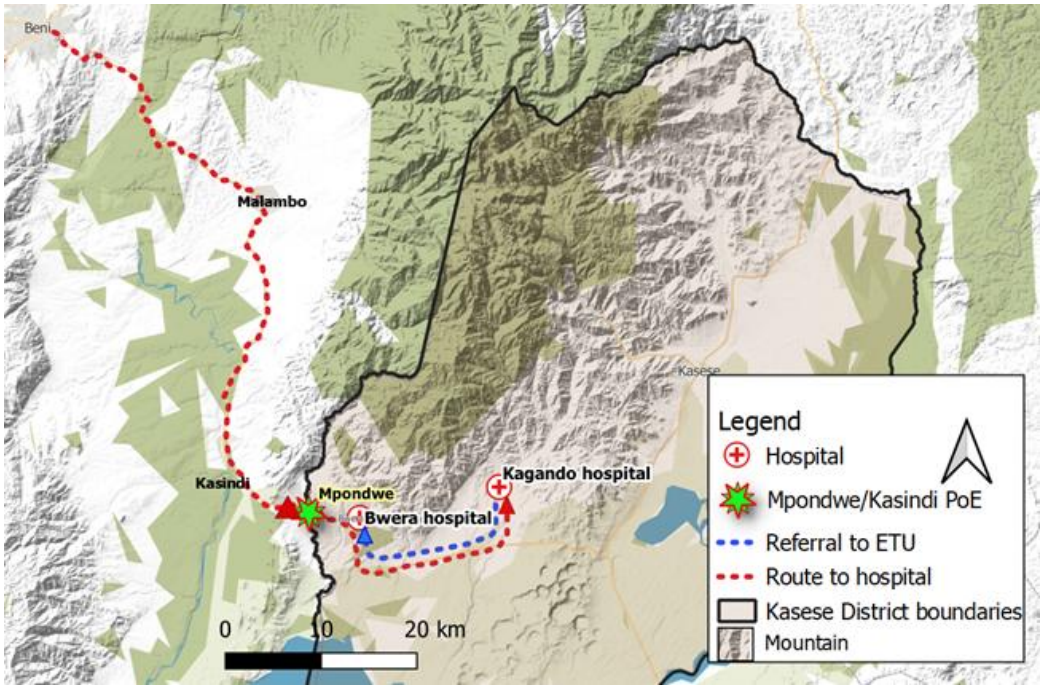

Figure 3: Movement of Ebola cases from Beni, DRC into Kasese District, Uganda, through an undesignated crossing point at Mpondwe, June 2019

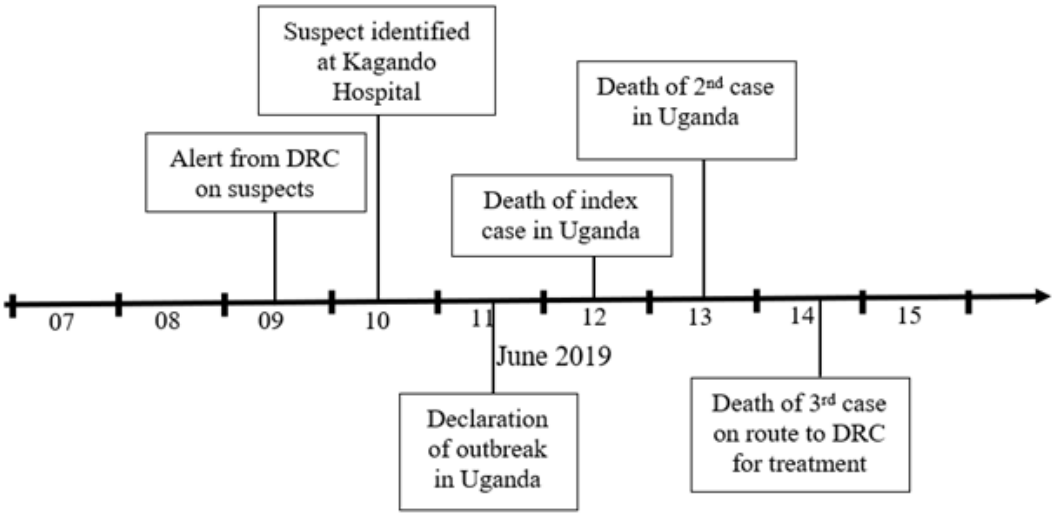

Figure 4: Timeline of Ebola outbreak from alert identification to death of last imported case from DRC, Uganda, June 2019

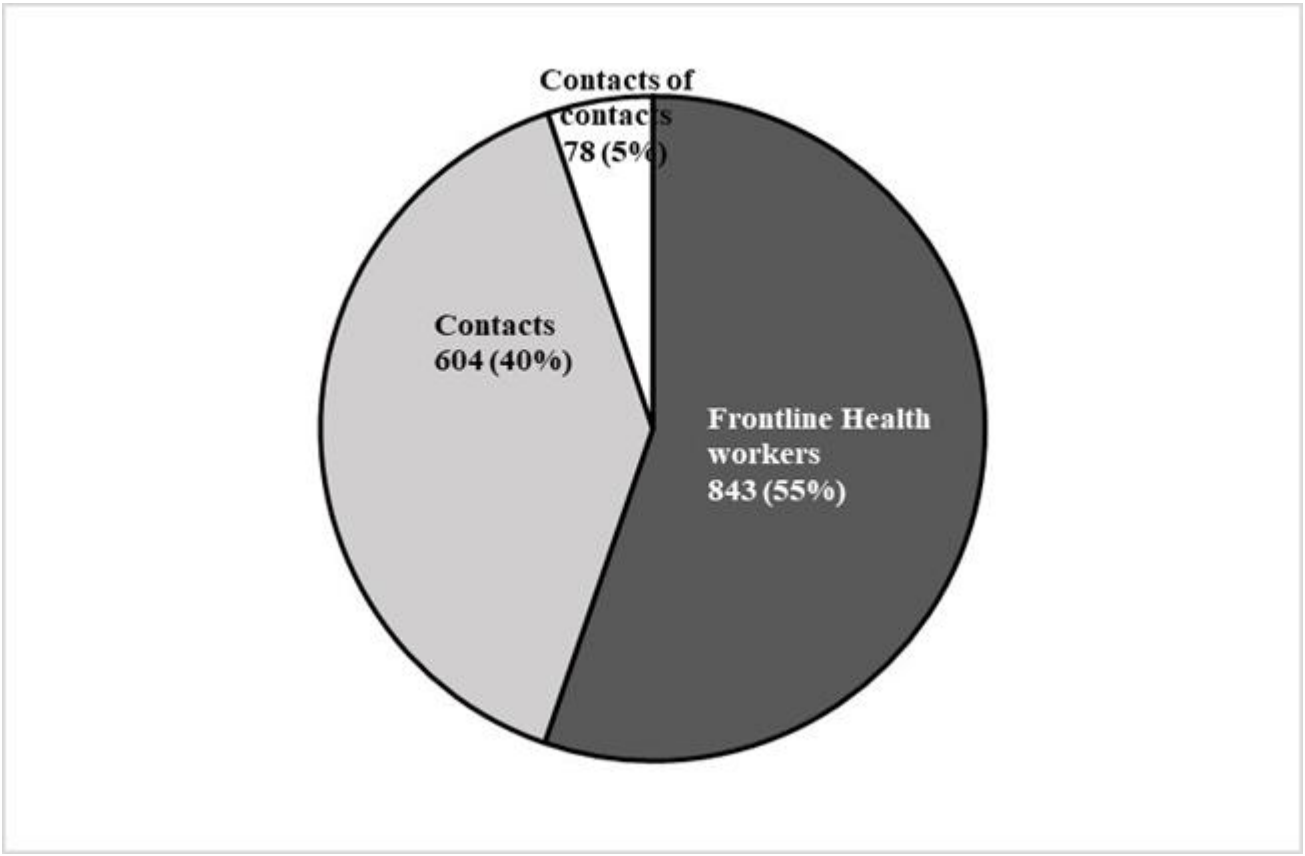

Figure 5: Number of persons vaccinated during the Ebola outbreak in Kasese District, Uganda, June 2019

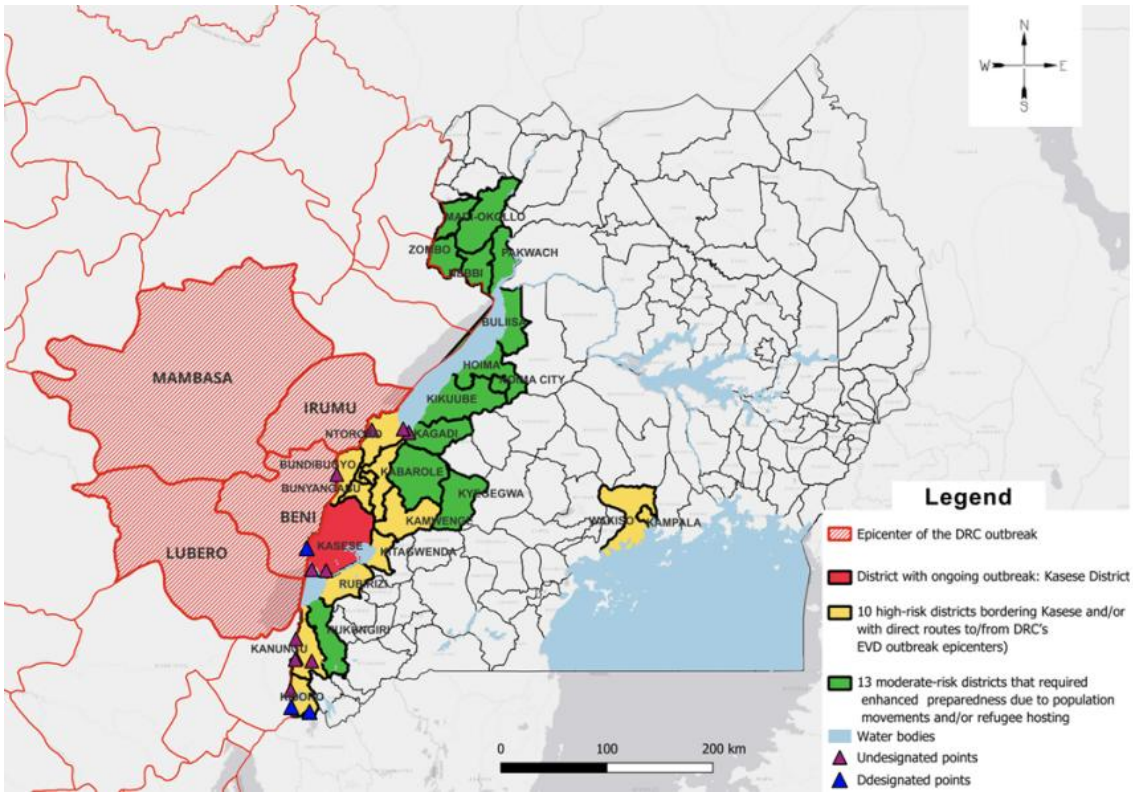

Figure 6: Map of Uganda showing Ebola Virus Disease district risk classification, June 2019