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Deadly Sudan virus reemerges in Uganda after 10 years – a potential public health threat in the COVID-19 era: a situational analysis

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Dear Editor,

The Ugandan health authority declared the Ebola outbreak in the country on September 20, 2022, the first reported outbreak in Uganda since 2012. As per the laboratory confirmation of a 24-year-old male patient from Mubende district of central Uganda, this outbreak was caused by Sudan virus (SUDV)[1]. As of September 25, 2022, there were 23 fatalities, 18 confirmed infected, and 18 suspected cases reported from three districts there[1]. A patient with multiple symptoms like high fever, dry cough, tonic convulsions, loss of appetite, pain in swallowing, chest pain, blood-stained vomit, diarrhea, and bleeding eyes visited two private clinics without improvement. He was referred to the Regional Referral Hospital (RRH) on September 15. Blood samples drawn on September 17 were tested at the Uganda Virus Research Institute in Kampala. RT-PCR test of the sample on September 19 revealed the presence of SUDV[1]. The patient passed away the same day.

Preliminary investigations revealed numerous community deaths in the first 2 weeks of September in the Mubende district of Uganda due to 'unknown illnesses.' The fatalities are now thought to be due to SUDV-caused Ebola. Twenty-three deaths were recorded by September 25, 2022, of which five were confirmed as Ebola cases. Overall, 223 contact cases had been traced thus far. In total, 62% of the confirmed and suspected cases were female and 38% male. Thirteen confirmed cases are still being treated in hospitals. The average age of the cases ranging from 1 to 60 years is 26 years.

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According to the International Classification of Disease for filoviruses (ICD-11), based on the causative virus, Ebola is subcategorized as Sudan Virus Disease (SVD). All the viruses causing Ebola were grouped together before 2019. There are numerous strains of the Ebola virus, including Zaire, Sudan, Bundibugyo, Ta Forest, Reston, and Bombali variants causing Ebola virus disease (EVD)[2]. The Zaire, Sudan, Ta Forest, and Bundibugyo pathogenic strains infect humans. Bats in Sierra Leone reportedly carry Bombali strain[3]. Although whether it may infect humans or other animals is currently unknown, but another virus strain Reston is reported to sicken pigs and nonhuman primates. The latter was reported in imported Filippino monkeys in 1989, and it transmitted the disease across the monkey population through aerosols. Such aerosolized transmission in humans seems little[2]. Reston Ebola virus found in the imported Filipino monkeys proved that Ebola also existed in Asia and was no longer just an African disease. Further, the United states also has reported four EVD instances thus far. Owing to the current SVD outbreak, all air travelers returning from Uganda are being screened in the United states. The world needs to be vigilant and take the necessary steps to combat the global spread of SUDV.

Ebola virus was first discovered in 1976 after one fatal hemorrhagic fever case followed by another. The first outbreak was in a community in the Democratic Republic of the Congo (formerly Zaire) along the Ebola River, whereas the second was reported from southern Sudan. River Ebola was an inspiration for the virus's moniker[2]. Two genetically distinct strains, the Sudan Ebola virus and the Zaire Ebola virus, caused the outbreaks. SVD, affecting humans and other primates, is a severe and often fatal illness. SUDV has sporadically reappeared since then, and seven (four in Uganda and three in Sudan) SUDV outbreaks are documented as this article goes to the Press. In previous epidemic cases, the estimated percent fatality for SVD ranged from 41 to 100%[1]. The origin of the virus is yet to be ascertained. It is thought to have been introduced into the human population through close contact with the infected or dead rainforest animals like fruit bats, chimpanzees, monkeys, gorillas, forest antelope, or porcupines with their blood, secretions, organs, or other body fluids[1]. Researchers are working on conclusive evidence of the role of the bat in transmitting the virus[4]. The virus spreads through human–human transmission through direct contact (chapped skin or mucous membranes) with the body fluids (blood, feces, urine, or vomit) of an SVD-infected person[1]. The virus also spread by sharing utensils and food with infected persons, and through sexual intercourse with them. Direct wildlife interaction like eating bush meat, might also contribute to the transmission. As Ebola (SVD) patients increase in number, the current SVD outbreak is said to be linked to a local gold mine.

SUDV is endemic in the African continent as the virus is harbored by the animals in the region, which makes occasional

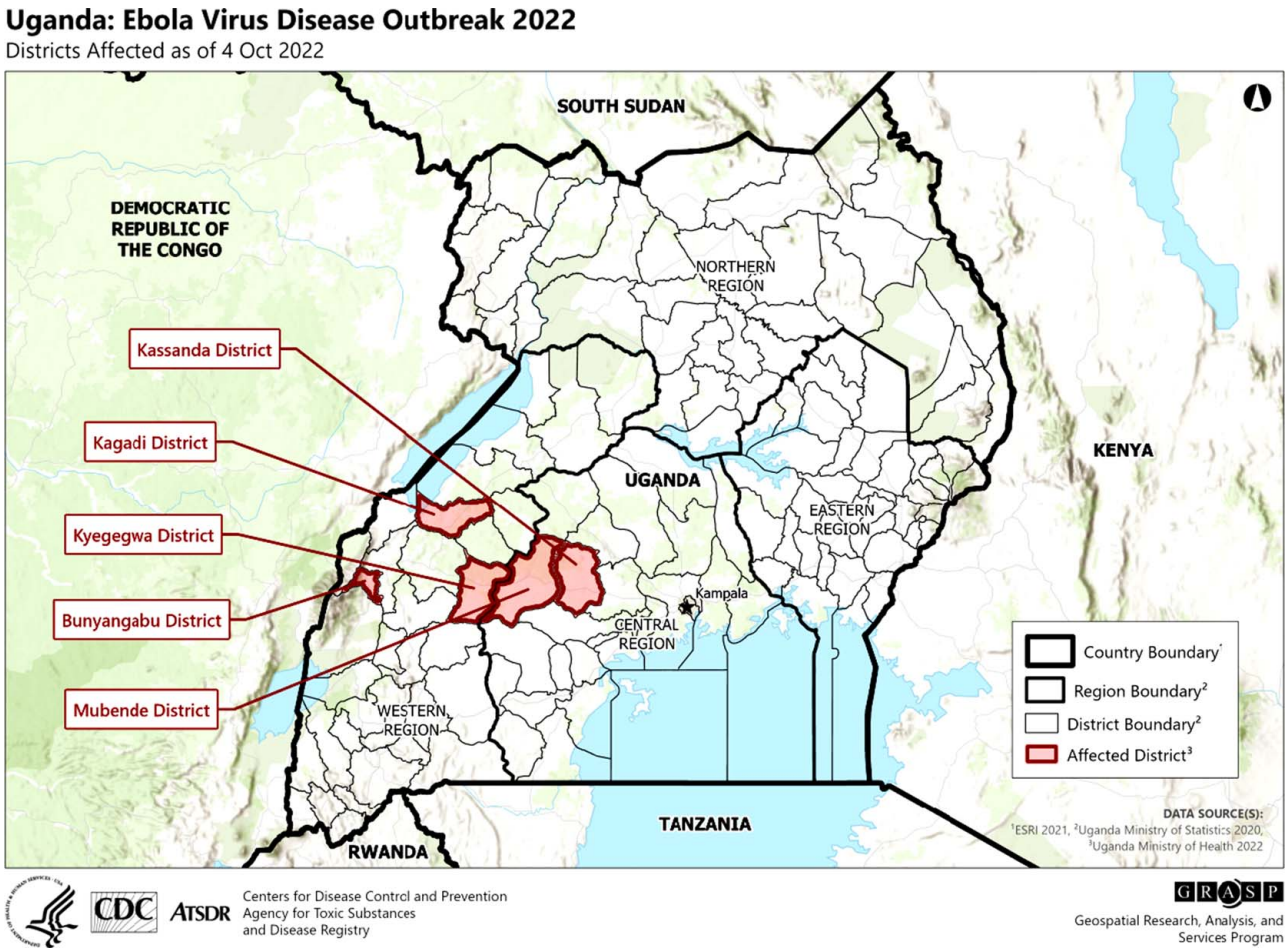

Figure 1 . Reported confirmed and suspected cases of Ebola by Sudan virus from various Ugandan districts[8].

outbreaks in this region. The virus persisting in the body fluids of the human survivors may further lead to secondary transmissions. The recent Ebola outbreak is a major public health concern in Africa, and the yawning gap in preparedness, particularly in the face of the coronavirus disease-2019 pandemic makes it hard for the countries there. The incubation period in SVD is 2–21 days. The initial fever, exhaustion, muscular discomfiture, headache, and sore throat, later followed by diarrhea, vomiting, rash and signs of compromised kidney and liver function are signs and symptoms of SVD. Internal and exterior bleeding (like gum bleeding or bloody stool) are extended indications. Acidosis, sepsis, renal failure, and neurological complications like memory impairment, seizures, and cranial nerve abnormalities are potential complications. The final outcome of the virus attack could be death, and the cases of in-hospital death are significant in the elderly with comorbidity like diabetes[5]. The SVD-infected human reportedly could not transmit the illness until the symptoms were manifested, and contagiousness was imminent as the virus reached the bloodstream[1]. As most symptoms are close and similar to infections like influenza (flu), malaria, typhoid, or meningitis, initial SVD diagnosis may confuse. As observed, the human–human transmission was primarily triggered by close contact with infected blood, reuse of contaminated needles and syringes, and improper nursing practices to manage Ebola[6]. Thus, its transmission was higher among healthcare workers and family members. SUDV was challenging to isolate in cell culture compared to the easier-to-isolate Zaire strain[7].

Uganda has a relatively good track record of SVD outbreak management. The country reported four SVD outbreaks in 2000 and 2011, and two in 2012. Uganda experienced the Bundibugyo outbreak in 2007 and the Ebola outbreak in 2019. In the absence of licensed vaccine and therapeutics to prevent and treat SVD, the potential risk of serious impact on the public health is high. The possibility of the cases spreading to elsewhere, including neighboring countries may not be ruled out. The overall national level risk for SVD is high due to numerous reasons. These are (i) the lack of authorized vaccine, (ii) several transmission chains not tracked as the event started three weeks before identifying the indexed case, (iii) patients at private facilities initially presented with limited infection, prevention and control practice, (iv) dead patient was buried in large gatherings as per tradition, (v) the country's healthcare system is overwhelmed with multiple emergencies including anthrax, coronavirus disease-2019, Rift valley fever and yellow fever, and food insecurity[1].

If SVD cases increase and the outbreak spreads to other regions, it will be difficult to respond robustly. People living close to the gold mine in issue experienced SVD outbreak. An outbreak announcement could prompt miners who are disease carriers to

leave, and the dealers of this commodity may migrate elsewhere. Thus, the risk of international spread cannot be entirely ruled out due to the cross-border migrating population. Studies to identify transmission chains are on as the *modus operandi* of the widespread outbreak is yet to be revealed. As of October 4, 2022, the outbreak has reached five districts (Mubende, Kassanda, Kyegegwa, Kagadi, and Bunyangabu) in a quick time (Fig. 1)[8]. Activating robust response, including investigating the unexplained deaths and contact tracing, is an urgent need to address.

Survival can be improved by implementing supportive care, including rehydration with oral or intravenous fluids early[9]. There are no approved medicines or vaccines to prevent and treat SVD[10]. Ring vaccination of high-risk individuals with Ervebo (rVSV-ZEBOV) vaccine, approved by the USFDA against the Zaire virus only, was effective in controlling Ebola in recent outbreaks in the Democratic Republic of Congo and elsewhere[9]. Ervebo vaccine which was found effective against the Ebola outbreak may not cross-protect against SVD. It has not been tested on SVD. The European Medicines Agency has authorized Johnson & Johnson's Zabdeno/Mvabea against Ebola only[1]. Two doses of it must be administered with 56-day interval. The first dose allegedly protects against the Zaire Ebola virus and the second one protects against other Ebola virus strains, such as the SUDV, there is no clinical evidence to support this multiantigen protection though. Although the vaccine was successfully tested against the Sudan Ebola virus, the protection will not kick off until few days after the second dosage was administered. It indicates that its vaccination may not be suitable as a quick response to the outbreak[1]. For EVD by the Zaire Ebola virus, there are now two licensed medications (Inmazeb and Ebanga). Ebanga is a single mAb, whereas Inmazeb is a mixture of three mAbs. Their efficacy against Ebola virus strains other than the Zaire strain is yet to be validated[11].

To provide technical support in coordination with the WHO, the Ministry of Health, Uganda, established a National Task Force. The WHO also supports the district-level health team and the RRH to identify and manage case early. The response plan is being developed after identifying priority actions, and active case discovery and contact tracing are going on. The WHO has also set up an expert technical team to support surveillance structures and establish treatment units in the affected districts, and has provided Ebola disease kit and tent to isolate the patient at RRHs[1]. The infection prevention and control teams were deployed to support healthcare personnel and establish screening at the health facilities in the affected districts. Community involvement is crucial to successfully control epidemics. Releasing the review data of risk mitigation activities to disseminate to the general public is recommended. Case management, surveillance, contact tracing, state-of-art laboratory services, implementing prevention, and control measures in healthcare and community settings, safe dignified burial practises, community engagement, and social mobilization are essential components of effective control measures. An efficient method to reduce human–human transmission is to increase public awareness about the risk factors for Ebola infection, and protective measures that each individual could practise. Surveillance and other response measures must be strengthened to stop a potential exponential spread. While supporting the efforts towards quickly rolling out effective control measures, closely investigating the source of the SVD outbreak is highly recommended.

Ethical Approval

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Author contribution

R.K.M. conceptualized and made the first draft. L.V.S.K., V.K., A.K.S., and R.N.S. updated the manuscript; S.M. edited the manuscript. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

Conflicts of interest and disclosure

The authors declare that they have no financial conflicts of interest with regard to the consent of this report.

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References

[1] WHO. Ebola Disease caused by Sudan virus – Uganda. September 26, 2022. Accessed November 7, 2022. https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON410

[2] CDC. Ebola (Ebola Virus Disease). 2022. Accessed August 30, 2022. https://www.cdc.gov/vhf/ebola/index.html

[3] Goldstein T, Anthony SJ, Gbakima A, *et al*. The discovery of Bombali virus adds further support for bats as hosts of ebolaviruses. Nat Microbiol 2018;3:1084–9.

[4] Baseler L, Chertow DS, Johnson KM, *et al*. The pathogenesis of Ebola virus disease. Ann Rev Pathol Mech Dis 2017;12:387–418.

[5] Radinsky O, Edri A, Brusilovsky M, *et al*. Sudan ebolavirus long recovered survivors produce GP-specific Abs that are of the IgG1 subclass and preferentially bind FcγRI. Sci Rep 2017;7:6054.

[6] Amundsen S. Historical analysis of the Ebola Virus: prospective implications for primary care nursing today. Clin Excell Nurse Pract 1998;2:343–51.

[7] McCormick JB, Bauer SP, Elliott LH, *et al*. Biologic differences between strains of Ebola virus from Zaire and Sudan. J Infect Dis 1983;147:264–7.

[8] CDC. September 2022 Uganda, Mubende District. October 4, 2022. Accessed November 10, 2022. https://www.cdc.gov/vhf/ebola/outbreaks/uganda/2022-sep.html

[9] WHO. Uganda declares Ebola Virus Disease outbreak. September 20, 2022. Accessed November 7, 2022. https://www.afro.who.int/countries/uganda/news/uganda-declares-ebola-virus-disease-outbreak

[10] Adepoju P. Experts hopeful about Ebola control in Uganda. Lancet 2022;400:1184.

[11] Mohapatra RK, Mishra S, Kandi V, *et al*. Deadly endemic zoonotic disease Ebola re-emerges in the Democratic Republic of Congo amid the ongoing COVID-19: are we prepared from lessons learnt? Int J Surg 2022;106:106945.