MONTHLY SCIENTIFIC REVIEW ON FILOVIRUS
(Marburg & Ebola Sudan virus)

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The content of this document is subject to change as the health situation evolves. All informations comes from a valid and credible source.

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Situation at a glance

- On January 14, 2025, an outbreak of Marburg virus disease was declared in Tanzania, with 10 reported cases (2 confirmed, 8 probable) and a case fatality rate of 100%. After 42 days without new cases, the Ministry of Health officially declared the end of the outbreak on March 13, 2025.
- On January 30, 2025, Uganda reported an outbreak of Sudan virus disease (SVD), with 14 cases (12 confirmed, 2 probable) and a case fatality rate of 29%. In response, an emergency vaccine trial (*TOKOMEZA SVD*) was launched to assess the efficacy of the *rVSV-SUDV* vaccine among identified contacts.

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Scientific articles

This section presents relevant articles published on peer-reviewed scientific journals or pre-print platforms.

This week, explore groundbreaking advancements in public health, surveillance, pathogen characterization, treatments, and vaccines for Marburg and Sudan viruses.

Public health

Implementation of an infection prevention and control response strategy to combat the Sudan Virus Disease outbreak in an urban setting, the Kampala Metropolitan area, Uganda, 2022.

Nanyondo SJ, Nakato S, Franklin J, Kwiringira A, Malikisi M, Kesande M, Wailagala A, Suubi R, Byonanebye DM, Katwesigye E, Katongole P, Kasule J, Bayo LB, Kasendwa M, Musisi D, Hunter J, Oakley LP, Dennison C, Ndegwa L, Tompkins LK, Gupta N, Bahatungire R, Willet V, Kolwaite AR, Zalwango S, Bancroft E, Mearns S, Lamorde M.

Published in BMC Infect Dis on March 2025.

The 2022 outbreak of Sudan virus disease in Uganda caused 142 cases and 55 deaths, including 19 infections and 7 deaths among health workers. It has spread to nine districts, including the Kampala Metropolitan Region (KMA). An infection prevention and control (IPC) strategy was put in place, involving the coordination of interventions, the evaluation of health facilities and the training of 2,235 professionals. 790 health facilities were assessed, and their CPI scores increased from 59.2% to 65.5% after intervention. The CPI has been strengthened through targeted measures, including the Ring IPC, which has enabled rapid action around outbreaks. The response reduced transmission and improved infection management. The study recommends sustained investment in the IPC to strengthen preparedness and response to future outbreaks.

Stigma among ebola disease survivors in Mubende and Kassanda districts, Central Uganda, 2022 .

Zalwango MG, Paige S, Migisha R, Nakafeero Simbwa B, Nsubuga EJ, Asio A, Kabami Z, Zalwango JF, Kawungezi PC, Wanyana MW, King P, Naiga HN, Agaba B, Zavuga R, Earle-Richardson G, Kwesiga B, Bulage L, Kadobera D, Ario AR, Harris JR.

Published in PLoS Global Public Health on December 2024.

The 2022 Sudan Virus Disease (SVD) outbreak in Uganda resulted in 142 confirmed cases and 22 deaths. Survivors experienced severe stigma, including social isolation, restricted access to education, and economic discrimination. This stigma was exacerbated by persistent symptoms such as pain and fatigue, as well as certain public health interventions, including highly visible medical visits and public aid distribution. Efforts to mitigate stigma, such as psychosocial support and awareness campaigns, were insufficient to counter these negative effects. The study recommends a more integrated and discreet approach to supporting survivors and facilitating their community reintegration.

Epidemiology and Surveillance

2022 Sudan virus disease outbreak in Uganda: temporal variations in transmission.

de Padua B, Akhmetzhanov AR, Thompson RN.

Published in Lancet Global Health on February 2025.

The 2022 Sudan Virus Disease outbreak in Uganda affected 164 individuals, with severe cases predominantly observed in children under 10 years old. The infection was characterized by symptoms such as fever, vomiting, weakness, and diarrhea. The basic reproduction number (R_0) was estimated at 1.25, though transmissibility analysis using the EpiEstim tool revealed significant temporal variations. Before the intervention of health teams, the effective reproduction number (Rt) reached 2–3, indicating high transmission. Following the implementation of control measures in September 2022, transmission temporarily declined before resurging and subsequently stabilizing in late October 2022 (Rt < 1). These fluctuations highlight the critical importance of rapid intervention to contain the outbreak. The authors emphasize the need to strengthen surveillance and response capacities to limit virus spread.

Genomic and transmission dynamics of the 2024 Marburg virus outbreak in Rwanda

Butera Y, Mutesa L, Parker E, Muvunyi R, Umumararungu E, Ayitewala A, Musabyimana JP, Olono A, Sesonga P, Ogunsanya O, Kabalisa E, Adedokun O, Gahima N, Irankunda L, Mutezemariya C, Niyonkuru R, Uwituze A, Uwizera I, Kagame J, Umugwaneza A, Rwabuhihi J, Umwanankabandi F, Mbonitegeka V, Ntagwabira E, Kayigi E, Izuwayo G, Murenzi H, Mukankwiro T, Tuyiringire N, Uwimana JMV, Gasengayire A, Sindayiheba R, Onyeugo GU, Aragaw M, Gitundu L, Bigirimana R, Fallah M, Ejikeme A, Sembuche S, Kabanda A, Mugisha JC, Francis EES, Gashema P, Ndayisenga J, Rugamba A, Kanyabwisha F, Murenzi G, Happi A, Ngabonziza JCS, Gashegu M, Ahmed A, Bigirimana N, Rwagasore E, Semakula M, Rwabihama JP, Musanabaganwa C, Seruyange E, Nkeshimana M, Twagirumugabe T, Turatsinze D, Remera E, Gahamanyi N, Tessema SK, Mukagatare I, Nsanzimana S, Happi C, Muvunyi CM.

Published in Nat Med on February 2025.

The 2024 Marburg outbreak in Rwanda affected 66 individuals, with a case fatality rate of 23%. The origin was traced to a single zoonotic transmission event from Egyptian fruit bats (*Rousettus aegyptiacus*) in a mining site. Genomic analysis revealed low genetic diversity, suggesting limited human-to-human transmission, primarily among healthcare workers. The virus, a single-stranded RNA Filovirus, is closely related to a strain identified in Uganda in 2014. Transmission occurs through direct contact with bodily fluids. The outbreak was centered around Kigali, with potential links to bat colonies in Uganda. A rapid public health response, including isolation measures, antiviral treatments, and monoclonal antibodies, helped contain the spread. This study highlights the importance of genomic surveillance in preventing future outbreaks. Moreover, this case underscores the need for regional cooperation in Africa to combat emerging infectious diseases.

Pathogen characterization

Decoding the blueprint of receptor binding by filoviruses through large-scale binding assays and machine learning

Lasso G, Grodus M, Valencia E, DeJesus V, Liang E, Delwel I, Bortz RH 3rd, Lupyan D, Ehrlich HY, Castellanos AA, Gazzo A, Wells HL, Wacharapluesadee S, Tremeau-Bravard A, Seetahal JFR, Hughes T, Lee J, Lee MH, Sjodin AR, Geldenhuys M, Mortlock M, Navarrete-Macias I, Gilardi K, Willig MR, Nava AFD, Loh EH, Asrat M, Smiley-Evans T, Magesa WS, Zikankuba S, Wolking D, Suzán G, Ojeda-Flores R, Carrington CVF, Islam A, Epstein JH, Markotter W, Johnson CK, Goldstein T, Han BA, Mazet JAK, Jangra RK, Chandran K, Anthony SJ.

Published in Cell Host Microbe on February 2025.

In this study, the authors conducted combinatorial binding studies with seven filovirus glycoproteins (GPs) and Niemann-Pick C1 (NPC1) receptor orthologs from 81 bat species. They found that GP-NPC1 binding correlated poorly with phylogeny. By integrating binding assays with machine learning, the authors identified genetic factors influencing virus-receptor-binding and predicted GP-NPC1-binding avidity for additional filoviruses and bats. In addition, combining receptor-binding avidities with bat geographic distribution and the locations of previous Ebola outbreaks allowed ranking bats by their potential as Ebola virus hosts. This study is the largest initiative to experimentally characterize receptor binding in filoviruses and represents a comprehensive investigation of filovirus-receptor binding in bats (1,484 GP-NPC1 pairs, 11 filoviruses, and 135 bats) by describing a multidisciplinary approach to predict susceptible species and guide filovirus host surveillance.

Cryo-EM structure of single-layered nucleoprotein-RNA complex from Marburg virus

Zinzula L, Beck F, Camasta M, Bohn S, Liu C, Morado D, Bracher A, Plitzko JM, Baumeister W.

Published in Nat Com on November 2024.

In this study, the authors determined by cryogenic electron microscopy (cryo-EM) the Marburg virus (MARV) helical ribonucleoprotein (RNP) complex structure in single-layered conformation, which differs from the previously reported structure of a double-layered helix. These findings expand the current knowledge about MARV genome packaging and nucleocapsid assembly by providing an alternative structural framework of the RNP complex that may guide the development of structure-based antivirals against MARV disease. In this regard, subdomains responsible for the interactions between NP protomers and NP with ssRNA represent promising antiviral targets, as validated by the identification of chemical ligands capable of destabilizing or disrupting such interactions.

Treatments

Oral obeldesivir provides postexposure protection against Marburg virus in nonhuman primates.

Cross RW, Woolsey C, Prasad AN, Borisevich V, Agans KN, Deer DJ, Harrison MB, Dobias NS, Fenton KA, Cihlar T, Nguyen AQ, Babusis D, Bannister R, Vermillion MS, Chu VC, Geisbert TW.

Published in Nat Com on January 2025.

This study assessed the antiviral efficacy of obeldesivir (ODV), an orally administered nucleoside analog prodrug, against the Marburg virus (MARV). The research was conducted in Cynomolgus Macaques, which received a 10-day regimen of once-daily ODV starting 24 hours post-exposure, achieving an 80% protection rate. The oral administration of ODV offers a significant advantage, enabling easier delivery and broader contact coverage in the event of an outbreak. These findings underscore the potential of ODV as a broad spectrum, oral post-exposure prophylactic treatment for filoviruses.

Discovery of Nanosota-EB1 and -EB2 as Novel Nanobody Inhibitors Against Ebola Virus Infection

Bu F, Ye G, Morsheimer K, Mendoza A, Turner-Hubbard H, Herbst M, Spiller B, Wadzinski BE, Eaton B, Anantpadma M, Yang G, Liu B, Davey R, Li F.

Published in PLoS Pathog on December 2024.

In the pursuit of therapeutics for Ebola virus (EBOV) infection, the authors identified two anti-EBOV nanobodies, Nanosota-EB1 and Nanosota-EB2, which specifically target the EBOV glycoprotein (GP). Their findings revealed that Nanosota-EB1 binds to the glycan cap of GP1, blocking protease cleavage essential for viral infection, while Nanosota-EB2 interacts with GP2, stabilizing it in the pre-fusion state and preventing membrane fusion with host cells. Additionally, their study demonstrated that Nanosota-EB2 exhibits strong neutralizing activity against EBOV, whereas Nanosota-EB1 provides moderate neutralization and protection. As the first nanobodies shown to be effective against authentic EBOV, Nanosota-EB1 and Nanosota-EB2 establish a foundation for nanobody-based therapies targeting EBOV and related filoviruses.

Vaccines

Safety and immunogenicity of a bivalent Ebola virus and Sudan virus ChAdOx1 vectored vaccine in adults in the UK: an open-label, non-randomised, first-in-human, phase 1 clinical trial

Jenkin D, Makinson R, Sanders H, Sampson A, Platt A, Tran N, Dinesh T, Mabbett R, Lawrie A, Quaddy J, Poulton I, Berrie E, Cicconi P, Lambe T.

Published in Lancet Microbe on Fabruary 2025.

In the pursuit of therapeutics for Ebola virus (EBOV) infection, the authors identified two anti-EBOV nanobodies, Nanosota-EB1 and Nanosota-EB2, which specifically target the EBOV glycoprotein (GP). Their findings revealed that Nanosota-EB1 binds to the glycan cap of GP1, blocking protease cleavage essential for viral infection, while Nanosota-EB2 interacts with GP2, stabilizing it in the pre-fusion state and preventing membrane fusion with host cells. Additionally, their study demonstrated that Nanosota-EB2 exhibits strong neutralizing activity against EBOV, whereas Nanosota-EB1 provides moderate neutralization and protection. As the first nanobodies shown to be effective against authentic EBOV, Nanosota-EB1 and Nanosota-EB2 establish a foundation for nanobody-based therapies targeting EBOV and related filoviruses.

Vector induced humoral responses after rVSVΔG-ZEBOV-GP immunization identify vaccinated individuals and correlate with Ebola virus glycoprotein antibodies

Chandrasekaran P, Berry IM, Callier V, Anthony SM, Hensley K, Kuhn JH, Shaw-Saliba K, Kennedy SB, Kieh M, Browne SM, Crozier I, Davey RT, Lane HC, Hensley LE, Follmann DA.

Publié dans J Infect Dis, on December 2024

In this research, authors asses the kinetics of immunoglobulin (IgG) responses against the vector (vesicular stomatitis Indiana virus [VSIV]) nucleoprotein (N) and the inserted antigen (Ebola virus [EBOV]) glycoprotein (GP1,2) components of the rVSV-ZEBOV vaccine and evaluate their use as biomarkers to confirm self-reported vaccination status. They basically provide a reliable assay to measure humoral responses after rVSV-ZEBOV vaccination and demonstrate the assay's utility to confirm vaccination status.

A Phase 1 randomized trial of homologous and heterologous filovirus vaccines with a late booster dose. Rostad CA, Yildirim I, Kao C, Yi J, Kamidani S, Peters E, Stephens K, Gibson T, Hsiao HM, Singh K, Spearman P, McCracken C, Agbakoba V, Tomashek KM, Goll JB, Gelber CE, Johnson RA, Lee S, Maner-Smith K, Bosinger S, Ortlund EA, Chen X, Anderson LJ, Wrammert J, Suthar M, Rouphael N, Anderson EJ.

Publié dans NPJ Vaccines, on December 2024

Filoviruses, such as Ebola, Marburg, Sudan, and Taï Forest viruses, can lead to severe hemorrhagic fevers and even death. Creating vaccines that offer broad protection against multiple filoviruses is a key global health goal. In this Phase 1 trial, 60 healthy U.S. adults were tested to assess the safety, side effects, and immune response of two different vaccine regimens (Ad26.ZEBOV followed by MVA-BN®-Filo, and vice versa). The findings showed that both regimens were safe and triggered a strong immune response. The mixed vaccine approach generated a more effective immune reaction against Ebola, including both antibodies and cellular responses. A booster shot given one year later demonstrated that immunity lasted for at least six months. Overall, the Ad26.ZEBOV/MVA-BN®-Filo combination proved to be safe, effective, and capable of preparing the immune system for future exposures.

Relevant news

This section presents official reports from health agencies, manufacturers and press releases with reliable sources.

Government of Sweden announces funding of US$2 million to UNICEF for Sudan Ebola Virus Disease response in Uganda

Published by UNICEF on 18 March 2025.

The US$2 million contribution will be utilized by UNICEF over five months to support the immediate priorities of the Government of Uganda's national Sudan EVD plan.

Obeldesivir Pill Offers New Hope Against Ebola and Marburg Viruses, Gilead Leads Development

Published by UniversityCube on 17 March 2025.

Scientists have developed a groundbreaking antiviral pill, Obeldesivir, that has demonstrated remarkable success in protecting against the Ebola virus during animal trials. With its ability to block viral replication and trigger immune responses, the drug represents a potential turning point in the battle against one of the world's deadliest diseases. Unlike existing treatments, which require cold storage and are limited to targeting specific Ebola species, Obeldesivir offers broader protection and a more accessible method of administration, raising hopes for its deployment in resource-strapped regions where the virus has wreaked havoc for decades. However, further testing is needed to determine its effectiveness in humans and its potential to combat related viruses like Marburg.

Tanzania declares end of Marburg virus disease outbreak

Published by Afro WHO on 13 March 2025.

Tanzania today declared the end of Marburg virus disease outbreak after recording no new cases over 42 days since the death of the last confirmed case on 28 January 2025. The outbreak, in which two confirmed and eight probable cases were recorded (all deceased), was the second the country has experienced. Both this outbreak, which was declared on 20 January 2025, and the one in 2023 occurred in the north-eastern Kagera region.

Providing mental health care in the wake of Marburg virus disease outbreak

Published by Afro WHO on 13 March 2025.

Mental health challenges are exacerbated during health emergencies, with recovered patients, community members and health workers facing vulnerabilities. To help with these mental health challenges, a World Health Organization (WHO) expert, working with a psychiatrist, Ministry of Health social welfare officers and UNICEF, has been providing counselling and psychosocial support to around 280 people.

Scenario Assessment: Ebola Outbreak Caused by Sudan Virus in Uganda

Published by CDC on 13 March 2025.

CDC outlined three plausible scenarios for the outbreak in Uganda over the next three months, including U.S. implications. Modeling can be used to assess how active case detection can impact the outbreak. As of Feb. 27, 2025, most indicators suggest that we are currently in the optimistic scenario.

WHO shares more details about Uganda's second Ebola Sudan cluster

Published by CIDRAP on 10 March 2025.

In an update on March 8 the World Health Organization (WHO) shared new details about a second clusterof cases—three confirmed and two probable—in Uganda's Ebola Sudan outbreak, which have raised concerns about undetected transmission and have led to ramped up surveillance.

WHO engages partners to support Uganda's fight against Ebola disease

Published by WHO on 6 March 2025.

Today marks 35 days of response since Uganda declared an outbreak of Sudan virus disease, from the same family as Ebola virus disease on 30 January 2025. To strengthen coordination and resource mobilization efforts, the Ministry of Health (MoH), with support from the World Health Organization (WHO), organized a strategic partners' meeting.

Fast facts about IAVI's contributions to the 2025 Sudan virus disease outbreak in Uganda

Published by IAVI on 26 February 2025.

IAVI has provided an investigational Sudan virus (SUDV) vaccine candidate for use in an efficacy ring vaccination trial in Uganda led by the World Health Organization (WHO) that started on Feb. 3. The ring vaccination trial is part of a comprehensive public health response to Uganda's outbreak of Sudan virus disease (SVD).

Guidelines and practical information

This section lists official manuals of recommendations for clinical practice or public health policy published by leading health organizations.

WHO	Diagnostic testing for Ebola and Marburg virus diseases (December 2024)
WHO	Risk communication and community engagement for Marburg virus disease outbreaks (November 2024)
WHO	Ebola and Marburg virus disease epidemics: preparedness, alert, control, and evaluation (August 2024)
CDC	Public Health Management of People with Suspected or Confirmed VHF or High-Risk Exposures (May 2024)
WHO	Contact Tracing During an Outbreak of Ebola Virus Disease (January 2024)
WHO	Country Readiness Strengthening workshop on infection prevention and control for Ebola and Marburg disease outbreaks (December 2023)
WHO	Infection prevention and control guideline for Ebola and Marburg disease (August 2023)
WHO	Clinical management of patients with viral haemorrhagic fever: A pocket guide for front-line health workers (January 2016)
WHO	Case definition recommendations for Ebola or Marburg virus diseases: interim guideline (August 2014)

Fact sheet on Marburg virus

Phylogeny

The Marburg virus (MARV) belongs to the Filoviridae family and is responsible for Marburg virus disease (MVD). Since its identification in 1967, it has caused 14 outbreaks over 50 years, primarily in Africa. The most severe outbreak occurred in Angola in 2005, with 252 cases and a case fatality rate (CFR) of 90%.

Transmission

MARV is a zoonotic hemorrhagic fever transmitted by *Rousettus aegyptiacus* fruit bats. Other bat species and certain non-human primates can also be infected, acting as intermediate hosts. Human-to-human transmission occurs through direct contact with bodily fluids from infected individuals or contaminated surfaces. Healthcare workers and close contacts, especially during funeral rites, are at high risk. Vertical transmission has not been demonstrated, but the virus can persist in semen for up to three months after recovery.

Diagnosis

The incubation period ranges from 2 to 21 days. Initial symptoms include fever, headache, and muscle pain, followed by skin rashes around day 7. The disease often leads to rapid multi-organ failure, with death occurring between days 8 and 9. Due to symptom overlap with other viral hemorrhagic fevers like Ebola, clinical diagnosis is challenging and requires confirmation by RT-PCR. IgG testing is used for late-stage confirmation. Samples must be handled in biosafety level 4 (BSL-4) laboratories.

Symptoms

The disease begins with fever, headache, and muscle pain. Around day 7, patients develop skin rashes, followed by multi-organ failure, which frequently leads to death between days 8 and 9. The CFR ranges from 24% to 90%, depending on the quality of supportive care.

Treatment

There is currently no specific antiviral treatment for MVD. Management is primarily supportive. Research is ongoing on several antiviral agents, including galidesivir, favipiravir, and remdesivir, which have shown promising results in animal models. The monoclonal antibody MBP091 demonstrated 100% efficacy in non-human primates and successfully completed a phase 1 clinical trial confirming its safety. The WHO has launched the SOLIDARITY PARTNERS clinical trial to assess these treatments during successive outbreaks.

Vaccination

Currently, 28 vaccine candidates are under development. The MARVAC consortium has prioritized four vaccines, focusing on two main platforms:

• rVSV-MARV: The VSVΔG-MARV-GP (Musoke) vaccine, developed since 2005, has shown 100% protection in non-human primates after a single intramuscular injection, with durable neutralizing antibody responses lasting up to 14 months. The rVSVΔG-MARV-GP (Angola) or PHV01 vaccine has demonstrated rapid protection within three days post-vaccination, making it a potential candidate for post-exposure prophylaxis.

• ChAdV: The ChAd3-Marburg vaccine, developed by the Sabin Vaccine Institute, has shown rapid and long-lasting protection in non-human primates and was deployed during the 2024 Marburg outbreak in Rwanda. The ChAdOx1 Marburg vaccine, developed by the Oxford Vaccine Group, entered a phase 1 clinical trial in July 2024 to assess its safety and immunogenicity.

The WHO has rapidly implemented a ring vaccination protocol in Tanzania to evaluate these vaccines in an emergency setting.

Fact sheet on Sudan virus

Phylogeny

The Sudan virus (SUDV) belongs to the *Orthoebolavirus* genus and causes Sudan virus disease (SVD). Since its identification in 1976, eight outbreaks have been attributed to SUDV, with a total of 956 cases and 503 deaths (case fatality rate of 53%). Unlike Zaire ebolavirus (EBOV), which accounts for most Ebola outbreaks, no specific vaccines or treatments have been approved for SUDV.

Transmission

SUDV is a zoonotic disease whose natural reservoir is the fruit bat of the *Pteropodidae* family. Transmission to humans occurs through contact with infected animals, either alive or dead. Human-to-human transmission is also possible through bodily fluids, contaminated objects, or unsafe medical practices. Sexual transmission has been observed but remains rare. The lack of herd immunity and the persistence of the virus in its animal reservoir make control measures challenging.

Diagnosis

Diagnosis primarily relies on RT-PCR and serological tests (ELISA). Rapid diagnostic tests exist but do not differentiate SUDV from EBOV. Biological samples must be handled with extreme caution due to the high risk of infection.

Symptoms

After an incubation period of 2 to 21 days, the disease progresses in two phases. The dry phase includes fever, severe fatigue, muscle pain, and headaches. The wet phase is characterized by vomiting, diarrhea, internal and external hemorrhages, and multi-organ failure. Contagiousness is highest during this stage.

Treatment

There is no specific treatment approved for SVD. Management is based on supportive care, including rehydration and symptomatic treatment. Several antivirals, such as galidesivir and obeldesivir, have shown efficacy in preclinical studies. Monoclonal antibodies, including Inmazeb and Ebanga—both approved for EBOV—are being evaluated for SUDV.

Vaccination

Two EBOV vaccines, Erbevo® and Zabdeno®/Mvabea®, are approved but provide limited cross-protection against SUDV. Specific vaccine candidates, such as *rVSV-SUDV* and *ChAd3-SUDV*, have shown promising immune responses in clinical trials. The *TOKOMEZA SVD* vaccine trial was launched in Uganda to evaluate the efficacy of *rVSV-SUDV* during an ongoing outbreak