Marburg outbreak
Factsheet and news

UPDATE OF 26 MAY 2023

This document is composed of 3 different tabs: General information, Relevant news, and Scientific articles

The content and presentation of this document are subject to change as the situation evolves.
Every information presented comes from a valid and credible source.

The redaction of this document is coordinated by:

Nicolas Pulik, Nathan Claveau and Emeline Simon (ANRS | Emerging Infectious Diseases)

with the participation of : *Erica Telford, Eric Rosenthal, Rachel Bellone and Sandrine Halfen (ANRS | Emerging Infectious Diseases)*

The "General information" tab presents an overview, case definitions, guidelines, reported cases

Overview

https://www.who.int/health-topics/marburg-virus-disease/#tab=tab_1

Timeline	- On 7 February 2023, WHO was notified by the Ministry of Health and Social Welfare of Equatorial Guinea of the deaths of 9 individuals with suspected hemorrhagic fever associated with Marburg Virus Disease (MVD) in the district of Nsock Nsomo, Río Muni Region. - On 12 February 2023, one of the reported case was confirmed positive for Marburg virus (MARV) by the Institut Pasteur in Dakar, Senegal. The other eight collected samples were tested negative for both Ebola and Marburg viruses by the Centre Interdisciplinaire de Recherches Médicales de Franceville (CIRMF) in Gabon and Institut Pasteur Dakar. - On 21 March 2023, the Ministry of Health of the United Republic of Tanzania reported an outbreak of MVD in two villages within the same district (Bukoba, Kagera region), with a total of eight cases, including five deaths.Two patients are currently undergoing treatment and one was discharged. Two hundreds and twelve contacts are currently under follow-up. - On 2nd April 2023, 13 additional cases were confirmed positive for MARV in 4 distinct provinces in Equatorial Guinea (Kie Ntem, Centro Sur, Wele-Nzas and Litoral). Five hundreds and thirthy-five contacts are currently under follow-up. - On 15th April 2023,WHO has initiated a local public health response to assist the Ministry of Health in Equatorial Guinea. The WHO emergency operational plan consists in training health workers for field surveillance activities, epidemiological data collection, decontamination procedures and cases screening, in setting up a safe specimen transportation system; in the establishment of laboratories with RT-PCR capacities and isolated treatment centers in the most affected areas, in providing essential medicines, supplies and vehicles; in raising public awareness and organizing technical support for preparadness in border countries, Gabon and Cameroon. The average follow-up rate of contacts according to the WHO is 80-90%. - On 18th April 2023, one more Marburg virus case has been confirmed in Equatorial Guinea's outbreak, involving a healthcare worker from Bata who was under monitoring after exposure to a previous patient. - On 23th April 2023, one suspected Marburg virus case has been confirmed in the region of Bata, rising the total confirmed cases to 17 and 12 deaths in Equatorial Guinea. The additional case was a first-order relative of another confirmed case previously reported. - On 24th April 2023, one more Marburg virus case has been confirmed in the Bukoba rural district in Kagera region, rising the total confirmed cases to 9 and 6 deaths in Tanzania. Among the 212 contacts under follow-up since the outbreak's statement, 206 have completed their monitoring period. - As of 10th May 2023, two provinces in Equatorial Guinea has conluded follow up after not reporting any new cases or contacts for 42 days. Bata district in Litoral province has a remaining 21 days to complete. In Tanzania, all 212 contacts have completed their monitoring period. - On 15th May, the government of Equatorial Guinea declared the end of Marburg disease outbreak after not registering new infections in all affected districts during the 42 days period stipulated by the WHO. WHO declared that this the first MVD outbreak reported in Equatorial Guinea and United Republic of Tanzania. WHO advises against restrictions to international travel and/or trade in Equatorial Guinea.

Epidemiology	- MVD is a highly lethal hemorrhagic fever caused by Marburg virus (MARV) infection in humans and non-human primates (NHPs). MARV is an **animal-borne** virus represented by a single species (*Marburg Marburgvirus*) belonging to the mononegaviral family *Filoviridae*. The natural host is presumed to be the Egyptian fruit bat (*Rousettus aegyptiacus*) mainly located in arid woodlands of Equatorial Africa. - **Transmission** to humans likely occurs through sporadic contacts with bats or an unindentified intermediate host (such as NHPs), but route and specific body fluid involved is unknown. - **Human-to-human** transmissions result from direct contacts with contamined body fluids such as blood, saliva, faeces or semen, or indirect contacts with contaminated surfaces and materials, usually in the household or healthcare settings. Airborne transmission has not been demonstrated in human outbreaks yet. - **Incubation period** ranges from 3 to 21 days (typically 5-10 days). - **The disease** is associated with non-specific symptoms such as fever, chills, headaches, myalgia, vomiting and diarrhea in early stages. Patients may develop bleeding manifestations typically in the conjunctivae or venipuncture sites, along with sudden bruising and macoluopapular rashes. Late stages often result in prostration, hypotension, shock, neurological dysfunction, multiorgan failure and death. Survivors have experienced prolonged convalescence and numerous sequelae and Marburg virus has been found to persist in body fluids > 2 months after recovery. Asymptomatic cases of Marburg infection have not yet been documented. - **Reported fatality cases** varies from 24 to 88% in past outbreaks, depending on virus and strain patient care management. The most virulent outbreaks in DRC and Angola had a 83% and 88% mortality rate respectively, making MVD more deadly than Ebola Virus Diseases (EVD). **Risk factors** for severe clinical outcomes or death have not been documented for MVD. - There are **no vaccines** or **antiviral treatments** approved for MVD. However, supportive care – rehydration with oral or intravenous fluids – and treatment of specific symptoms, improves survival. The Marburg glycoprotein (GP) is the only viral protein exposed to cell surface and has been the primary target for investigational viral vaccines and monoclonal antibody therapeutics. As of 13 February 2023, twenty-eight Marburg vaccine candidates and thirty-one therapeutical molecules are in pre-clinical trials. Three vaccine candidates (cAd3, MVA-BN-Filo and VRC-EBODNA023-00-VP) and three therapeutical molecules (AVI-7288, AVI-6003, galidesivir) have completed phase I clinical trials. One vaccine candidate (MVA-BN-Filo) is scheduled for a Phase 2/3 clinical trial. - MARV is classified as a **risk group 4 (RG-4**) pathogen and requires stringent containment and barrier protection measures for laboratory personnel. - WHO assesses the risk posed by the outbreak as *high* (Equatorial Guinea) and *very high* (United Republic of Tanzania) at the national level, *moderate* at the regional level and *low* at the global level.

WHO surveillance case definitions for the current Marburg outbreak in Central and Austral Africa (2023)

Source : https://www.who.int/emergencies/outbreak-toolkit/disease-outbreak-toolboxes/ebola-and-marburg-virus-ou

Confirmed	Any person, alive or dead, meeting the case definition for a suspected or probable case and is laboratory confirmed for Marburg virus using several diagnostic procedures -- antibody-capture enzyme-linked immunosorbent assay (ELISA), antigen-capture detection tests, serum neutralization test or reverse transcriptase polymerase chain reaction (RT-PCR) assay -- from blood or other body fluids and tissue obtained at biopsy/autopsy.
Probable	Any person, alive or dead, meeting the case definition for a suspected case AND one or more of the following : - evaluated by a clinician. - has an epidemiological link with a confirmed case ; direct physical contact with blood or body fluids during the illness; or contact with contamined materials such as clothes or linen; or contact with the body at the funeral of a confirmed case within 21 days before symptoms onset - has been exposed to biological material in a laboratory such as specimens collected from suspected or confirmed Marburg patients and/or animals within 21 days before symptoms onset - has been exposed to a sick or dead animal (direct physical contact with the animal's blood or body fluids, consumption of raw bushmeat) within 21 days before symptoms onset
Suspected	- Any person, alive or dead, suffering or having suffered from sudden onset of high fever, and had contact with a suspected, probable, or confirmed Marburg case, or a dead or sick animal. - Any person, alive or dead, suffering or having suffered from sudden onset of high fever AND three or more of the following signs or symptoms: headache, lethargy, anorexia/loss of appetite, aching muscles or joints, stomach pain, difficulty swallowing, vomiting, difficulty breathing, diarrhoea, hiccups. - Any person with inexplicable bleeding. - Any sudden, inexplicable death.
Discarded	Any suspected or probable case for which laboratory testing by PCR and/or serology is negative for MARV antigens, MARV-RNAs, or anti-MARV antibodies.

CDC Case definition

Source : https://ndc.services.cdc.gov/case-definitions/viral-hemorrhagic-fever-2022/

Confirmed	Any person, alive or dead, which is laboratory confirmed for Marburg virus through detection of viral antigens in blood by enzyme-linked immunosorbent assay (ELISA) or in tissue by immunohistochemistry ; detection of Marburg-specific genetic sequence by reverse transcription polymerase chain reaction (RT-PCR) from blood or tissues ; or viral isolation in cell culture for blood or tissues.

Suspected	Any person, alive or dead, suffering or having suffered from acute fever (> 38°C/100.4°F) AND one or more of the following clinical signs : - severe headache, muscle pain, erythematous maculopapular rash on the trunk with fine desquamation 3–4 days after rash onset, vomiting, diarrhea, abdominal pain, bleeding not related to explainable injury, thrombocytopenia AND one or more of the following exposures within the 3 weeks before onset of symptoms : - direct physical contact with blood or other body fluids of a confirmed case - residence in—or travel to—a Marburg endemic area or area with active transmission - work in a laboratory that handles specimens collected from confirmed Marburg patients and/or animals - work in a laboratory that handles bats, rodents, or primates from a Marburg endemic area or area with active transmission - Sexual exposure to semen from a confirmed acute or clinically recovered case of Marburg infection

Guidelines and practical information from French authorities, CDCs, and WHO

May, 2023	US CDC Page on Marburg	https://www.cdc.gov/vhf/marburg/
April, 2023	WHO Technical Advisory Group – candidate vaccine prioritization. Summary of the evaluations and recommendations on the four Marburg vaccines	https://www.who.int/publications/m/item/who-technical-advisory-group---candidate-vaccine-prioritization.--summary-of-the-evaluations-and-recommendations-on-the-four-marburg-vaccines
April, 2023	Ebola and Marburg virus outbreak toolbox	https://www.who.int/emergencies/outbreak-toolkit/disease-outbreak-toolboxes/ebola-and-marburg-virus-outbreak-toolbox
April 3, 2023	Ebola Disease Information for Clinicians in U.S. Healthcare Settings	https://www.cdc.gov/vhf/ebola/clinicians/evd/clinicians.html
March, 2023	Fiches pratiques de prise en charge Ebola et Filovirus	https://www.infectiologie.com/UserFiles/File/emergences/fiche-reb-ebolavirus-mars-2023docx.pdf
January 12, 2023	Infection Prevention and Control Recommendations for Hospitalized Patients Under Investigation (PUIs) for Ebola Virus Disease (EVD) in U.S. Hospitals	https://www.cdc.gov/vhf/ebola/clinicians/evd/infection-control.html
October 20, 2022	Guidance for Confirmed Ebola Patients or Clinically Unstable PUIs	https://www.cdc.gov/vhf/ebola/healthcare-us/ppe/guidance.html
November 19, 2015	Viral haemorrhagic fever: ACDP algorithm and guidance on management of patients	https://www.gov.uk/government/publications/viral-haemorrhagic-fever-algorithm-and-guidance-on-management-of-patients
December 1, 2014	Interim infection prevention and control guidance for care of patients with suspected or confirmed filovirus haemorrhagic fever in health-care settings, with focus on Ebola	https://www.who.int/publications/i/item/WHO-HIS-SDS-2014.4-Rev.1
August 6, 2014	Ebola and Marburg virus disease epidemics: preparedness, alert, control, and evaluation	https://www.who.int/publications/i/item/WHO-HSE-PED-CED-2014.05

Confirmed cases and deaths (May 8th, 2023)

	Source: https://www.who.int/emergencies/disease-outbreak-news/item/2023-DON467	
Country	Cases confirmed	Deaths confirmed
Equatorial Guinea	17	12
United Republic of Tanzan	9	6

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The "Relevant news" tab presents official reports from health agencies and rapidly reported information from reliable news sources

Date	Source	Type of publication	Title	Key facts	Link
17/05/2023	ECDC	Report	Communicable disease threats report, 7-13 May 2023, week 20	As of 16 May 2023 and since the previous update, no relevant epidemiological updates were available in both countries.	https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-7-13-may-2023-week-20
12/05/2023	ECDC	Report	Communicable disease threats report, 7-13 May 2023, week 19	Equatorial Guinea: As of 10 May 2023 and since the previous update, no relevant epidemiological updates were available. The total number of confirmed MVD cases since the beginning of the outbreak is 17, with 12 deaths. Tanzania: According to the latest WHO Disease Outbreak News, published on 8 May 2023, as of 30 April 2023 no new MVD cases have been reported in the country since 11 April 2023. Since the beginning of the outbreak, there have been eight confirmed cases and one probable case, including six deaths (case-fatality rate (CFR) 66.7%) from Marburg virus disease (MVD) in Tanzania. All cases have been reported from the Kagera region.	https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-7-13-may-2023-week-19
09/05/2023	CIDRAP	News	Probes continue into Africa's Marburg outbreaks as recent patients discharged	The most recently confirmed patients in Marburg virus outbreaks in Equatorial Guinea and Tanzania were discharged from treatment at the end of April, with efforts under way in both countries to shore up responses and investigate the source of the virus and earlier transmission links.	https://www.cidrap.umn.edu/marburg/probes-continue-africas-marburg-outbreaks-recent-patients-discharged
08/05/2023	WHO	News	Marburg virus disease - Equatorial Guinea and the United Republic of Tanzania	Update on the epidemiological situation of Marburg disease outbreak, cases, public health response, and WHO risk assessment in United Republic of Tanzania and Equatorial Guinea.	https://www.who.int/emergencies/disease-outbreak-news/item/2023-DON467
05/05/2023	ECDC	Report	Communicable disease threats report, 23-29 April 2023, week 18	According to the most recent epidemiological report by health authorities, there are no relevant epidemiological updates. As of 4 May 2023, no new MVD cases have been reported in Equatorial Guinea and in Tanzania since 20-21 April 2023. Active surveillance continues and the outbreak will be declared over 42 days after the last case as per WHO guidelines.	https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-23-29-april-2023-week-17
28/04/2023	ECDC	Report	Communicable disease threats report, 23-29 April 2023, week 17	According to the most recent epidemiological report by the Ministry of Health of Equatorial Guinea, as of 24 April 2023, the total number of confirmed Marburg virus disease (MVD) cases since the beginning of the outbreak is 17, with 12 deaths. On 24 April 2023, the World Health Organization (WHO) reported that as of 16 April 2023, there are nine confirmed cases and six deaths (case fatality rate (CFR) 66.7%) from Marburg virus disease (MVD) in Tanzania.	https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-23-29-april-2023-week-17
25/04/2023	CIDRAP	News	Tanzania reports another Marburg virus infection, death	The latest case raises the country's outbreak total to nine cases, and the death lifts the fatality count to six, for a case-fatality rate of 66.7%.	https://www.cidrap.umn.edu/marburg/tanzania-reports-another-marburg-virus-infection-death
24/04/2023	CIDRAP	News	New fatal Marburg case reported in Equatorial Guinea	The latest case lifts Equatorial Guinea's number of confirmed infections to 17, which includes 12 deaths.	https://www.cidrap.umn.edu/marburg/new-fatal-marburg-case-reported-equatorial-guinea
21/04/2023	ECDC	Report	Communicable disease threats report, 16-22 April 2023, Week 16	As of 18 April 2023, there are 16 laboratory-confirmed and 23 probable Marburg virus disease (MVD) cases reported in Equatorial Guinea. As of 8 April 2023, there have been eight confirmed MVD cases in the country, including five deaths.	https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-16-22-april-2023-week-16
19/04/2023	CDC US	Report	Marburg Virus Disease Outbreaks	Update on Tanzania and Equatorial Guinea outbreaks	https://www.cdc.gov/vhf/marburg/outbreaks/chronology.html
18/04/2023	CIDRAP	News	Marburg virus confirmed in another Equatorial Guinea health worker	One more Marburg virus case has been confirmed in Equatorial Guinea's outbreak, involving a healthcare worker from Bata who was under monitoring after exposure to a previous patient.	https://www.cidrap.umn.edu/marburg/marburg-virus-confirmed-another-equatorial-guinea-health-worker

17/04/2023	CIDRAP	News	Equatorial Guinea's Marburg outbreak expands further	In an update today, the health authorities of Equatorial Guinea reported that the number of confirmed cases is 15, of which 11 were fatal. Earlier in the outbreak, 20 probable cases were reported, all fatal. The epidemiologic links aren't clear for patients in multiple areas, which could be fueling undetected transmission chains.	https://www.cidrap.umn.edu/marburg/equatorial-guineas-marburg-outbreak-expands-further
14/04/2023	ECDC	Report	Communicable disease threats report, 9-15 April 2023, Week 15	Update on communicable diseases, including MVD outbreak (23 cases confirmed, including 18 deaths and 1371 contacts in Equatorial Guinea and in United Republic of Tanzania)	https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-week-15-9-15-april-2023
06/04/2023	CDC US	Report	Marburg Outbreaks	Update on Tanzania and Equatorial Guinea outbreaks	https://www.cdc.gov/vhf/marburg/outbreaks/chronology.html
05/04/2023	ECDC	Report	Communicable disease threats report, 2-8 April 2023, Week 14	Update on communicable diseases, including MVD outbreak (22 cases confirmed in Equatorial Guinea and in United Republic of Tanzania)	https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-2-8-april-2023-week-14
03/04/2023	CIDRAP	News	Equatorial Guinea confirms another Marburg virus case	Equatorial Guinea's health ministry on Mar 31 reported 1 more Marburg virus case, raising the outbreak total to 14. In an update today, the ministry today said 10 people are hospitalized, including 2 of the confirmed patients and 8 who have suspected infections. Officials also reported one more death raising the total in the confirmed cases to 10.	https://www.cidrap.umn.edu/marburg/equatorial-guinea-confirms-another-marburg-virus-case
31/03/2023	ECDC	Report	Communicable disease threats report, Week 13, 26 March - 1 April 2023	Update on communicable diseases, including MVD outbreak (13 total laboratory-confirmed cases in Equatorial Guinea and no new relevant epidemiological updates in Tanzania)	https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-week-13-26-march-1-april-2023
25/03/2023	WHO	News	Marburg virus disease - United Republic of Tanzania	First WHO alert describing the situation at a glance, cases, epidemiology of the disease, public health response, and WHO risk assessment in United Republic of Tanzania.	https://www.who.int/emergencies/disease-outbreak-news/item/2023-DON451
24/03/2023	ECDC	Report	Communicable disease threats report 19 - 25 March, Week 12	Update on communicable diseases, among which a MVD outbreak occured in United Republic of Tanzania (8 confirmed cases and 161 contacts were being followed up) along with 8 additional laboratory-confirmed cases in Equatorial Guinea	https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-19-25-march-week-12
24/03/2023	UKHSA	Guidance	Ebola and Marburg haemorrhagic fevers: outbreaks and case locations	Information about incidents and outbreaks of Ebola and Marburg, both viral haemorrhagic fevers (VHF).	https://www.gov.uk/guidance/ebola-and-marburg-haemorrhagic-fevers-outbreaks-and-case-locations
24/03/2023	UKHSA	Guidance	Marburg virus disease: origins, reservoirs, transmission and guidelines	Marburg virus is a Filovirus which, along with Ebola virus, can cause a severe and often fatal viral haemorrhagic fever (VHF).	https://www.gov.uk/guidance/marburg-virus-disease-origins-reservoirs-transmission-and-guidelines
22/03/2023	ACDC	Press	Republic of Tanzania declares Marburg Virus Disease (MVD) Outbreak	On 21 March 2023, the Ministry of Health of Republic of Tanzania declared an outbreak of Marburg virus disease (MVD) in Bukoba district, Kagera region, north western Tanzania with 8 confirmed cases and 5 deaths.	https://africacdc.org/news-item/republic-of-tanzania-declares-marburg-virus-disease-mvd-outbreak/
22/03/2023	WHO	News	Equatorial Guinea confirms eight more Marburg cases	Equatorial Guinea's Ministry of Health has confirmed eight more cases of Marburg, bringing the number of confirmed cases to nine since the outbreak of the viral haemorrhagic fever was declared on 13 February.	https://www.afro.who.int/countries/equatorial-guinea/news/equatorial-guinea-confirms-eight-more-marburg-cases
21/03/2023	WHO	News	Tanzania confirms first-ever outbreak of Marburg Virus Disease	Tanzania today confirmed its first-ever cases of Marburg Virus Disease after laboratory tests were carried out following reports of cases and deaths in the country's north-west Kagera region.	https://www.afro.who.int/countries/united-republic-of-tanzania/news/tanzania-confirms-first-ever-outbreak-marburg-virus-disease
21/03/2023	CIDRAP	News	Tanzania declares Marburg virus outbreak	Following the investigation of five undiagnosed deaths from a hemorrhagic illness, Tanzania's health minister today said tests have confirmed Marburg virus, a close relative of Ebola, according to Agence France-Presse (AFP).	https://www.cidrap.umn.edu/marburg/tanzania-declares-marburg-virus-outbreak
03/03/2023	ECDC	Report	Communicable disease threats report, week 9, 27 February - 5 March 2023	Update on communicable diseases, including MVD outbreak (epidemiological alert system was activated by the Ministry of Health in Equatorial Guinea and 48 contacts cases were being followed up).	https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-week-9-27-february-5-march-2023
27/02/2023	ACDC	News	Africa CDC in collaboration with Institut Pasteur de Dakar (IPD) organized a training on Molecular Diagnosis of Marburg Virus	Launch of a three-day workshop designed to train health workers from 5 African Union Member States on molecular diagnosis of Marburg Virus Disease (MVD)	https://africacdc.org/news-item/africa-cdc-in-collaboration-with-institut-pasteur-de-dakar-ipd-organized-a-training-on-molecular-diagnosis-of-marburg-virus/
25/02/2023	WHO	News	Marburg virus disease - Equatorial Guinea	First WHO alert describing the situation at a glance, cases, epidemiology of the disease, public health response, and WHO risk assessment in Equatorial Guinea.	https://www.who.int/emergencies/disease-outbreak-news/item/2023-DON444

17/02/2023	ECDC	Report	Communicable disease threats report, week 7, 12-18 February 2023	Update on communicable diseases, among which a Marburg virus disease (MVD) outbreak occured in Equatorial Guinea (1 case confirmed and 8 suspected cases)	https://www.ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-week-7-12-18-february-2023
14/02/2023	ACDC	Press	Press Release on Marburg Virus Disease in Equatorial Guinea	On 13 February 2023, the Ministry of Health and Social Welfare of Equatorial Guinea reported a confirmed Marburg virus disease (MVD) outbreak in the Kie Ntem province in the North Western part of the country with one confirmed cases and nine deaths due to hemorragic fever.	https://africacdc.org/news-item/press-release-on-marburg-virus-disease-in-equatorial-guinea/

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The "Scientific articles" tab presents relevant articles published on peer-reviewed scientific journals or pre-print platforms since May 2022

Date	Source	Type of publication	Title	Key facts	Link
15/05/2023	Journal of Infectious Diseases	Point of view	Marburg Virus Disease: Global Threat or Isolated Events?	This view point written by researchers from the National Institute of Allergy and Infectious Diseases (NIAID) and the National Institute of Health (NIH) briefly summarises the current status of the Marburg virus disease outbreak response and countermeasure development, relying on 10 relevant references.	https://doi.org/10.1093/infdis/jiad161
12/05/2023	Journal of Infectious Diseases	Research article	A highly attenuated pan-filovirus VesiculoVax vaccine rapidly protects nonhuman primates against Marburg virus and three species of Ebolavirus	The authors tested the ability of a highly attenuated, quadrivalent pan-filovirus Vesiculovax vaccine to elicit fast-acting protection against MARV, EBOV, SUDV and BDBV in cynomolgus monkeys. Their results demonstrate multivalent Vesiculovax vaccines are suitable for filovirus outbreak management.	https://doi.org/10.1093/infdis/jiad157
01/05/2023	Lancet Infectious Diseases	News	Marburg virus outbreak in Equatorial Guinea	The emergence of Marburg virus outbreaks in Equatorial Guinea and Tanzania highlights the need to develop vaccines and therapies for this disease.	https://doi.org/10.1016/S1473-3099(23)00221-9
29/04/2023	The Journal of infectious Diseases	Research Article	Structural and energetic basis for differential binding of Ebola and Marburg virus glycoproteins to a bat-derived Niemann-Pick C1 protein	Both ebolaviruses and marburgviruses use the same endosomal protein as their essential receptor, suggesting similar cell tropism. However, susceptibility to these filoviruses was demonstrated to differ between cell lines due to unique amino acid sequences in endosomal receptors and viruses surface glycoprotein. The present study investigates the role of these amino acid differences in the molecular interactions between the receptor and the viral glycoprotein. By performing molecular dynamics simulations and binding free energy calculations, the authors provided new insights into cell susceptibility to Ebola and Marburg viruses.	https://doi.org/10.1093/infdis/jiad120
26/04/2023	PLOS Neglected Tropical Disease	Research Article	Marburg virus in Egyptian Rousettus bats in Guinea: Investigation of Marburg virus outbreak origin in 2021	The first outbreak of Marburg virus disease in West Africa was reported in 2021 in Guinea. The origin of the outbreak was not identified. In this work, authors studied Rousettus aegyptiacus fruit bats as the possible source infection. They confirmed the presence of Marburg virus in fruit bats in Guinea. Their findings suggest that Marburg virus is more widely distributed in Guinea than in just a single location and provide the basis for preventive measures against new outbreaks in Guinea.	https://doi.org/10.1371/journal.pntd.0011279
19/04/2023	Frontiers in Pharmacology	Research Article	Modified coptisine derivatives as an inhibitor against pathogenic Rhizomucor miehei, Mycolicibacterium smegmatis (Black Fungus), Monkeypox, and Marburg virus by molecular docking and molecular dynamics simulation-based drug design approach	Coptisine, a molecule with antimicrobial, antiviral, and antifungal properties, was modified to obtain stable derivatives, then tested through molecular docking against Back fungus, mpox and Marburg virus proteins. In silico investigation provided a preliminary report that coptisine derivatives are safe and potentially effective against the three tested pathogens.	https://doi.org/10.3389/fphar.2023.1140494
18/04/2023	NMNI	Letter	Marburg Virus Disease in Tanzania: The most recent outbreak	This letter to the editor follows the recent outbreak of Marburg virus disease in Tanzania. It briefly summarizes the epidemiology, symptoms, transmission modes and preventive measures of the disease. The letter ends with an update on available treatment modalities and future scopes for research.	https://doi.org/10.1016%2Fj.nmni.2023.101123
17/04/2023	BioMed Research International	Research Article	Computational Modeling and Evaluation of Potential mRNA and Peptide-Based Vaccine against Marburg Virus (MARV) to Provide Immune Protection against Hemorrhagic Fever	This study was conducted by authors from the Middle East. Using immunoinformatics tools, the authors evaluate the prediction of linear B and T cell epitopes obtained from viral proteins and their potential interest for the construction of two vaccine candidates. The results suggest the interest of this reverse vaccinology approach to guide the development of future vaccines.	https://doi.org/10.1155/2023/5560605
10/04/2023	Microbiol Spectrum	Research Article	Computed Tomography Imaging for Monitoring of Marburg Virus Disease: a Nonhuman Primate Proof-Of-Concept Study	This pilot "proof of concept" study was conducted by teams from NIAID and NIH. It evaluates the value of whole body CT imaging in 6 Rhesus monkeys. The results suggest that this technique provides information on disease pathogenesis that could reduce the need for routine euthanasia of the animals.	https://doi.org/10.1128/spectrum.03494-22
10/04/2023	Microbiology Spectrum	Research article	Computed Tomography Imaging for Monitoring of Marburg Virus Disease: a Nonhuman Primate Proof-Of-Concept Study	Multimodality imaging readouts can be leveraged to provide organ-level information on changes in morphology and function during the natural history of diseases caused by high-consequence pathogens, such as MVD, included here in an animal model of disease.	https://doi.org/10.1128/spectrum.03494-22
24/03/2023	International Journal of Surgery Open	Correspondence	Marburg virus disease outbreak amid COVID-19 pandemic: an emerging concern in Ghana, West Africa	On 7 July 2022, the Ghanaian Ministry of Health reported two incidences of MVD in the Ashanti Region. It was the first outbreak of MVD in Ghana.	http://dx.doi.org/10.1097/JS9.0000000000000190
02/03/2023	International Journal of Infectious Diseases	Editorial article	The re-emergence of Marburg virus Disease in West Africa: how prepared is the sub-region for preventing recurrent zoonotic outbreaks?	Note about how the current infrastructures, health institutions and policies in West African regions has and still need to be improved to strengthen clinical management and limit further spread of emerging and re-emerging filoviruses.	https://doi.org/10.1016/j.ijid.2023.03.001
01/03/2023	Virological.org	Report	First emergence of Marburg virus in Equatorial Guinea, 2023	Both epidemiology and phylogenetic history argue for a zoonotic transmission event from a reservoir, presumably a bat.	https://virological.org/t/first-emergence-of-marburg-virus-in-equatorial-guinea-2023/924
23/02/2023	MedRxiv	Pre-print	Assessing the feasibility of Phase 3 vaccine trials against Marburg Virus Disease: a modelling study	The authors adapted a mathematical model of Marburg virus disease (MVD) transmission to simulate a Phase 3 individually randomised placebo controlled vaccine trial, assuming predetermined vaccine efficacy and public health interventions timing. They conclude that the efficacy of any candidate vaccine can be calculated before more MVD outbreaks have occured than they have been recorded to date.	https://www.medrxiv.org/content/10.1101/2023.02.22.23286294v1
21/02/2023	MedRxiv	Pre-print	Modelling Vaccination Strategies for the Control of Marburg Virus Disease Outbreaks	The authors developed a branching process model of Marburg virus transmission and used this model to investigate potential prophylactic and reactive vaccination strategies in settings driven primarily by multiple spillover events as well as human-to-human transmission. Of the six vaccination strategies explored, they demonstrate that a combination of ring and targeted vaccination of high-risk groups was generally most effective compared with no vaccination to control potential outbreaks,	https://www.medrxiv.org/content/10.1101/2022.06.17.22276538v3
10/02/2023	eBioMedicine	Research article	Rapid protection of nonhuman primates against Marburg virus disease using a single low-dose VSV-based vaccine	Previous research showed that vaccination with VSV-based vaccine expressing the MARV-Angola glycoprotein (VSV-MARV) as the viral antigen resulted in protection from disease in cynomolgus macaques. Here, a lower vaccination dose (single dose, 1 × 105 or 1 × 103 PFU 14 days or 1 × 103 PFU 7 days before challenge) resulted in uniform protection with no detectable viremia in the same model. Antigen-specific IgG responses were induced sustained, neutralizing antibody responses and antibody-dependent cellular phagocytosis were observed, as well as early induction of NK cell activation and antigen-specific memory T cell subsets. VSV-MARV is a viable and fast-acting MARV vaccine candidate suitable for deployment in emergency outbreaks and supports its clinical development.	https://doi.org/10.1016/j.ebiom.2023.104463
07/02/2023	Ann Med Surg	Letter	Marburg virus disease treatments and vaccines: recent gaps and implications	In this study, we aimed to summarize the recent evidence in addition to literature gaps about available treatments and vaccines against MVD.	https://doi.org/10.1097%2FMS9.0000000000000163
28/01/2023	Lancet	Research article	Safety, tolerability, and immunogenicity of the chimpanzee adenovirus type 3-vectored Marburg virus (cAd3-Marburg) vaccine in healthy adults in the USA: a first-in-human, phase 1, open-label, dose-escalation trial	This first-in-human trial of this cAd3-Marburg vaccine showed the agent is safe and immunogenic, with a safety profile similar to previously tested cAd3-vectored filovirus vaccines. 95% of participants produced a glycoprotein-specific antibody response at 4 weeks after a single vaccination, which remained in 70% of participants at 48 weeks. These findings represent a crucial step in the development of a vaccine for emergency deployment against a re-emerging pathogen that has recently expanded its reach to new regions.	https://doi.org/10.1016/S0140-6736(22)02400-X
28/01/2023	Lancet	Comment	Developing a vaccine against Marburg virus disease	No specific treatments or approved vaccines exist for Marburg virus disease. Outbreak control strategies rely on early case identification and isolation, contact tracing and monitoring, safe burials, and community awareness of transmission risk factors. An effective vaccine for the vaccination of health-care workers or ring vaccination of contacts of cases could be an important addition to the available tools to control Marburg virus outbreaks.	https://doi.org/10.1016/S0140-6736(23)00169-1
01/01/2023	Int J Surg	Correspondence	Epidemiology, pathophysiology, transmission, genomic structure, treatment, and future perspectives of the novel Marburg virus outbreak	More studies on MARV are still needed to provide exact guidance for the therapeutic care of patients and the creation of vaccines, which could help health professionals and policy makers to prevent and effectively manage future outbreaks. The virus is being studied on a variety of animal models, including NHPs, mouse models, guinea pigs, and hamsters, as part of long-term vaccine testing. Vaccine development should continue until human vaccinations are authorized and made accessible.	https://doi.org/10.1097/js9.0000000000000096
13/10/2022	Plos Path	Research article	An introduction to the Marburg virus vaccine consortium, MARVAC	We highlight the need for global research coordination, including sharing of assays and continuous efforts on capacity building among private and public sectors. Increased surveillance and diagnostics are also required for early detection of future outbreaks as well as rapid deployment of vaccines and therapeutics.	https://doi.org/10.1371/journal.ppat.1010805
18/08/2022	Annals of Medicine and Surgery	Review	Marburg virus outbreak in Ghana: An impending crisis	Overview of first-ever MVD outbreak in Ghana on 19 July 2022 -- in which 2 patients were tested positive with unknown epidemiological link or events involving dead animals -- and passed efforts to limitate the dissemination of Marburg virus.	https://doi.org/10.1016/j.amsu.2022.104377
23/05/2022	JCI	Research article	Combination therapy with remdesivir and monoclonal antibodies protects nonhuman primates against advanced Sudan virus disease	Our results suggest that combination therapy may be a viable treatment for patients with advanced filovirus disease that warrants further clinical testing in future outbreaks.	https://doi.org/10.1172/jci.insight.159090
30/04/2022	J Infect Dis Epidemiol	Review	Emergence of Marburg Virus Disease in West Africa amid COVID-19 and Ebola: Efforts, Challenges, and Recommendations to Prevent the Next Public Health Crisis	In this article, we aimed to discuss the origin and transmission of the Marburg virus along with the history of MVD, related challenges and efforts during the COVID-19 pandemic, and recommendations to prevent future epidemics considering the most recent outbreak in West Africa. Hopefully, through this manuscript, MVD can gain appropriate focus so that any unwanted epidemic due to this deadly virus can be avoided.	https://doi.org/10.23937/2474-3658/1510259
01/04/2022	Virulence	Review	Pathogenicity and virulence of Marburg virus	An overall review may contribute to minimizing the limitations associated with future medical research and improve the clinical management of MVD. In this review, we sought to analyze and amalgamate significant information regarding MARV disease epidemics, pathophysiology, and management approaches to provide a better understanding of this deadly virus and the associated infection.	https://doi.org/10.1080/21505594.2022.2054760
08/12/2021	Clinical Epidemiology and Global Health	Research article	Marburg virus disease outbreak amidst COVID-19 in the Republic of Guinea: A point of contention for the fragile health system?	This commentary discusses the available evidence regarding the epidemic of MVD in Guinea amid the COVID-19 pandemic, and highlights the efforts, challenges to be prioritized, and provides evidence-based recommendations.	https://doi.org/10.1016/j.cegh.2021.100920
30/11/2021	Viruses	Review	Systematic review of Marburg virus vaccine nonhuman primate studies and human clinical trials	In human trials, two Marburg DNA vaccines provided either low immunogenicity or a failure to elicit durable immunity. A variety of NHP candidate Marburg vaccines demonstrated favorable survival and immunogenicity parameters, to include VSV, VLP, and adenoviral vectored vaccines. Elevated binding antibodies appeared to be consistently associated with protection across the NHP challenge studies. Further human trials are needed to advance vaccines to limit the spread of this highly lethal virus.	https://doi.org/10.1016/j.vaccine.2020.11.042
27/11/2021	Viruses	Research article	Marburg Virus Persistence on Fruit as a Plausible Route of Bat to Primate Filovirus Transmission	Marburg virus RNA was repeatedly detected on fruit in the food bowls of the infected bats and viable MARV was recovered from inoculated fruit for up to 6 h.	https://doi.org/10.3390/v13122394
31/03/2021	J Clin Lab Anal	Research article	Simultaneous detection of Marburg virus and Ebola virus with TaqMan-based multiplex real-time PCR method	The TaqMan probe-based multiplex fluorescence quantitative PCR assays could detect EBOV and MARV sensitively specifically and simultaneously.	https://doi.org/10.1002/jcla.23786
23/08/2020	International Journal of Infectious Diseases	Review	Marburg Disease : A summary for clinicians	This review summarizes a practical list of countermeasures available for Marburg virus disease. There is an emphasis on diagnostics, existing preventive measures to reduce transmission risk as well as therapies and vaccines that have demonstrated, through their evaluation in nonhuman primates and/or in humans, potential use in an emergency situation.	https://doi.org/10.1016%2Fj.ijid.2020.07.042

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04/05/2020	Nat Rev	Review	Viral genomics in Ebola virus research	We highlight how genomics extends beyond consensus-level sequencing of the virus to include intra-host viral transcriptomics and the characterization of host responses in acute and persistently infected patients. Similar genomics techniques can also be applied to the characterization of non-human primate animal models and to known natural reservoirs of filoviruses, and metagenomic sequencing can be the key to the discovery of novel filoviruses. Finally, we outline the importance of reverse genetics systems that can swiftly characterize filoviruses as soon as their genome sequences are available.	https://doi.org/10.1038/s41579-020-0354-7
20/02/2020	Scientific Reports	Research article	Immune correlates of postexposure vaccine protection against Marburg virus	These results suggest dysregulated immunoregulation is associated with poor prognosis, whereas early innate signaling and Th1-skewed immunity are important for survival.	https://doi.org/10.1038/s41598-020-59976-3
30/12/2019	Virology Journal	Review	Marburg virus pathogenesis – differences and similarities in humans and animal models	This review will compare various animal models to the available descriptions of human pathogenesis and aims to evaluate their effectiveness in modeling important aspects of Marburg virus disease.	https://doi.org/10.1186/s12985-019-1272-z
10/01/2019	Nat Comms	Research article	Post-exposure immunotherapy for two ebolaviruses and Marburg virus in nonhuman primates	These findings provide a solid foundation for clinical development of broadly protective immunotherapeutics for use in future filovirus epidemics.	https://doi.org/10.1038/s41467-018-08040-w
29/01/2018	Nat Rev Drug Discov	Review	Post-exposure treatments for Ebola and Marburg virus infections	This review briefly summarizes the most promising treatments for post-exposure use against Ebola viral strains (EBOV, SUDV) and Marburg virus (MARV) tested during the 2013-2016 outbreak of Ebola virus. Despite a demonstrated efficacy in the gold-standard NHP models of filovirus diseases, there was no statistically significant protection in patients infected with Ebola virus. Only patients taken in charge at a very early stage showed remarkable survival. Recombinant VSV-MARV and VSV-EBOV vaccines seemed a promising lead, as they induced 100% protection in NHP models.	https://doi.org/10.1038/nrd.2017.251