

Ebola Disease: An Updated Review and the 2026 Bundibugyo Virus Disease Outbreak

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Abstract

The 2014-2016 Ebola virus disease epidemic exposed major weaknesses in global preparedness for emerging infectious diseases, revealing critical gaps in outbreak response, coordination, and clinical management. The COVID-19 pandemic subsequently accelerated advances in diagnostics, therapeutics, vaccine development, and public health preparedness, thereby improving the management of high-consequence viral infections. Despite these advances, Orthoebolaviruses continue to cause recurrent outbreaks in Africa, with occasional international spread. Ebola disease (EBOD) is a severe viral haemorrhagic disease caused principally by Ebola virus, Sudan virus, or Bundibugyo virus, with an average case fatality rate of approximately 50%, although rates have ranged from 25% to 90% in previous outbreaks. Early intensive supportive care, including prompt rehydration, correction of electrolyte abnormalities, and symptomatic treatment, remains the cornerstone of management and significantly improves survival. Licensed vaccines and targeted monoclonal antibody therapies are currently available only for Ebola virus disease caused by Ebola virus, whereas effective countermeasures against Sudan virus disease and Bundibugyo virus disease remain under development. Successful outbreak control depends on rapid case detection, laboratory confirmation, infection prevention and control, surveillance and contact tracing, safe and dignified burials, vaccination where appropriate, and sustained community engagement. This review summarizes current evidence on the virology, pathogenesis, transmission, diagnosis, clinical management, prevention, and evolving epidemiology of Ebola disease, with particular emphasis on the ongoing Bundibugyo virus disease outbreak.

Keywords: Ebola Disease; Bundibugyo Virus; Filoviridae; Viral Haemorrhagic Fever; Pathogenesis; Diagnosis; Therapeutics; Vaccination

Introduction

Viruses of the genera *Orthoebolavirus* and *Orthomarburgvirus* are enveloped, negative-sense, single-stranded RNA viruses belonging to the family Filoviridae. Six species of the genus *Orthoebolavirus* are currently recognized and include Bombali virus, Bundibugyo virus, Reston virus, Sudan virus, Taï Forest virus, and Ebola virus. The genus *Orthomarburgvirus* includes Marburg virus and Ravn virus. Bundibugyo virus, Sudan virus, Taï Forest virus, Ebola virus, Marburg virus, and Ravn virus have been associated with human disease, whereas Bombali virus and Reston virus have not been conclusively linked to symptomatic human illness to date [1]. Infection with an *Orthoebolavirus* causes Ebola disease (EBOD), whereas infection with an *Orthomarburgvirus* causes Marburg virus disease (MVD) [2,3]. The incubation period of Ebola disease ranges from 2 to 21 days, most commonly approximately 3 - 10 days [4]. Clinical manifestations include fever, headache, fatigue, myalgia, gastrointestinal symptoms, and, in severe cases, haemorrhage, shock, and multiorgan failure [4-].

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6]. Licensed vaccines and virus-specific therapeutics are currently available only for Ebola virus disease caused by Ebola virus. Because vaccines, therapeutics, and several diagnostic assays are species-specific, accurate identification of the causative virus is essential for appropriate clinical management and outbreak response [7,8]. This review summarizes current evidence on the virology, pathogenesis, transmission, diagnosis, treatment, prevention, and evolving epidemiology of Ebola disease, with particular emphasis on the current Bundibugyo virus disease outbreak.

Viral genome and virus life cycle

Ebola virus is an enveloped filovirus possessing an approximately 19-kb linear, non-segmented, negative-sense, single-stranded RNA genome encoding seven structural genes [9,10]. Each gene contains a single open reading frame, except the glycoprotein gene, which generates several products through transcriptional RNA editing [11,12]. The viral RNA associates with nucleoprotein, the RNA-dependent RNA polymerase, VP30, VP35, and VP24 to form a helical ribonucleoprotein complex constituting the nucleocapsid. This structure protects the viral genome from degradation and recognition by host immune mechanisms [13,14]. Ebola virus attaches to host cells through several attachment factors and lectin receptors, including T-cell immunoglobulin and mucin domain 1 and dendritic cell-specific intercellular adhesion molecule-3-grabbing non-integrin. Viral entry occurs predominantly through macropinocytosis. Within the endosome, the viral surface glycoprotein is proteolytically cleaved by host cathepsins, exposing a binding site for the essential intracellular receptor Niemann-Pick C1. Interaction with Niemann-Pick C1 subsequently triggers GP2-mediated membrane fusion and releases the viral ribonucleoprotein complex into the cytoplasm [15,16]. Transcription and replication occur in cytoplasmic inclusion bodies, where the nucleoprotein-encapsidated genome serves as the template for RNA synthesis by the viral polymerase complex. RNA editing of the glycoprotein gene produces several glycoprotein isoforms, including soluble glycoprotein, full-length GP1,2, and small soluble glycoprotein, which contribute to viral replication, immune modulation, and pathogenesis [17,18]. During assembly, the ribonucleoprotein complex, viral glycoprotein, and VP40 are transported to the plasma membrane. The glycoprotein undergoes glycosylation, proteolytic processing, and cleavage into GP1 and GP2 through the secretory pathway, whereas VP40 serves as the principal matrix protein and orchestrates virion assembly and budding [19-21]. Over the past several decades, ebolavirus outbreaks have occurred predominantly in Africa and have caused more than 15,000 deaths [22]. The increasing frequency and magnitude of outbreaks have accelerated advances in diagnostics, clinical management, vaccine development, and therapeutic research [23,24]. On 19 December 2019, the United States Food and Drug Administration approved Ervebo®, a recombinant vesicular stomatitis virus-based vaccine expressing the Ebola virus glycoprotein, as the first licensed vaccine for the prevention of Ebola virus disease [25,26]. Nevertheless, logistical constraints, cold-chain requirements, production costs, limited access, and the absence of cross-protection against other Orthoebolaviruses continue to restrict the wider impact of existing vaccination strategies [27,28].

Transmission

Orthoebolaviruses, are zoonotic viruses that are thought to be transmitted initially to humans through contact with infected wildlife. Fruit bats of the family Pteropodidae are considered likely natural hosts, although the ecology and precise reservoir dynamics of individual Orthoebolaviruses remain incompletely defined [29].

Human-to-human transmission

Occurs through direct contact, via broken skin or mucous membranes, with the blood or other body fluids of a symptomatic or deceased infected person, or through contact with contaminated objects, equipment, or environmental surfaces [30]. Infected individuals are not considered contagious before symptom onset.

Sexual transmission

From survivors has been documented because infectious virus may persist in semen after recovery. Evidence suggesting sexual transmission was first reported during follow-up of survivors of the 1995 Ebola virus disease outbreak in Kikwit, Democratic Republic of the Congo [31].

Vertical and breastfeeding transmission

Vertical transmission is strongly supported by the detection of viral RNA and infectious virus in the placenta, amniotic fluid, fetal tissues, and pregnancy-related specimens. Transmission through breastfeeding is also possible because infectious virus has been isolated from breast milk [32].

Airborne transmission

There is no confirmed evidence that airborne transmission represents a natural or important route of Ebola disease transmission in humans. Although experimental transmission through aerosols has been demonstrated under specific laboratory conditions, such findings do not indicate that Ebola disease ordinarily spreads through the airborne route [33]. Healthcare settings with inadequate infection prevention and control and burial practices involving direct contact with deceased individuals represent particularly high-risk environments for transmission.

Clinical manifestations

Following an incubation period of 2-21 days, Ebola disease generally presents with the sudden onset of fever, fatigue, malaise, myalgia, headache, and sore throat. These manifestations are frequently followed by vomiting, profuse diarrhoea, abdominal pain, anorexia, rash, and impaired hepatic and renal function. Severe disease may progress to profound intravascular volume depletion, electrolyte disturbances, metabolic abnormalities, shock, coagulopathy, and multiorgan failure. Haemorrhagic manifestations are less common than initially assumed and usually occur in advanced or severe disease. When present, they may include mucosal bleeding, gastrointestinal bleeding, bleeding from venepuncture sites, or other internal and external haemorrhage.

Neurological manifestations, including confusion, encephalopathy, irritability, agitation, seizures, or reduced consciousness, may also develop, particularly in patients with severe disease [34].

Specimen collection, storage and transport

Clinical specimens obtained from patients with suspected Ebola disease should be considered Category A infectious substances, classified as UN2814, and handled using strict biosafety precautions and appropriate personal protective equipment. Whole blood collected during the acute phase is the preferred specimen for molecular diagnosis, whereas serum collected during convalescence may be used for serological testing. Specimens should generally be maintained at 4-8°C during short-term storage and transport. For prolonged storage, they should be frozen at -70°C or below, with repeated freeze-thaw cycles avoided. Each specimen must be accurately labelled with a unique patient identifier and accompanied by relevant clinical and epidemiological information. Packaging and transport should comply with applicable World Health Organization, International Air Transport Association, and national regulations using the triple-packaging system. The receiving reference laboratory should be informed before specimens are dispatched [35,36].

Diagnosis, differential diagnosis and clinical testing

Ebola disease is a non-specific acute febrile illness that must be differentiated from other endemic or epidemic infections, including malaria, typhoid fever, bacterial sepsis, meningitis, leptospirosis, rickettsial infections, dengue, yellow fever, Rift Valley fever, Lassa fever, and Crimean-Congo haemorrhagic fever. Diagnosis integrates clinical manifestations, epidemiological exposure, and laboratory confirmation. Common laboratory abnormalities include leukopenia followed by leukocytosis, thrombocytopenia, elevated aminotransferase concentrations, renal impairment, metabolic and electrolyte abnormalities, and coagulation disturbances.

Laboratory confirmation relies primarily on species-specific reverse transcription polymerase chain reaction or a pan-filovirus nucleic acid amplification test followed by species identification. A negative result obtained early in the clinical course does not necessarily exclude infection. Repeat testing after approximately 72 hours may therefore be required when clinical and epidemiological suspicion remains high. Antigen-detection assays may support diagnosis in outbreak settings, while serological testing is mainly used for retrospective

diagnosis, survivor studies, or epidemiological investigations. Virus isolation requires maximum-containment facilities equivalent to Biosafety Level 4.

Asymptomatic contacts should generally undergo active monitoring for 21 days rather than routine virological testing. Patients with negative filovirus testing should be evaluated for alternative or concurrent infections. Clinical laboratory monitoring should include electrolytes, renal and hepatic function, haematological parameters, glucose, acid-base status, and coagulation tests as clinically indicated [37].

Treatment

The World Health Organization recommends optimized supportive care for all patients with filovirus disease. Management includes prompt oral or intravenous fluid replacement, correction of electrolyte and metabolic abnormalities, maintenance of oxygenation and haemodynamic stability, symptom and pain management, nutritional support, and timely diagnosis and treatment of concurrent infections. For Ebola virus disease caused by Ebola virus, WHO strongly recommends either ansuvimab, also known as mAb114 and marketed as Ebanga®, or the monoclonal antibody combination atoltivimab, maftivimab, and odesivimab, marketed as Inmazeb®. These treatments should be administered as early as possible following laboratory confirmation or according to applicable outbreak protocols. No approved virus-specific therapeutic is currently available for Sudan virus disease or Bundibugyo virus disease. Investigational therapeutics may be evaluated during outbreaks through ethically approved clinical trials, including studies conducted under the WHO CORE clinical trial protocol [38,39].

Vaccination

Ervebo® is a live recombinant vesicular stomatitis virus vaccine expressing the glycoprotein of Ebola virus. It is licensed and WHO-prequalified for the prevention of Ebola virus disease caused by Ebola virus. The vaccine is recommended during outbreaks, particularly through ring-vaccination strategies targeting contacts, contacts of contacts, healthcare workers, and frontline response personnel. It is also available through the International Coordinating Group emergency vaccine stockpile, with Gavi supporting access and preventive vaccination programmes for healthcare and frontline workers in countries at risk [40,41]. The heterologous Zabdeno®/Mvabea® prime-boost regimen was also licensed and WHO-prequalified for protection against Ebola virus disease. However, its European Union marketing authorisations were withdrawn in May 2026 at the manufacturer's request for commercial reasons [40,42]. No licensed vaccine is currently available for Sudan virus disease or Bundibugyo virus disease. Candidate vaccines may nevertheless be evaluated during outbreaks under WHO-coordinated clinical trial protocols and emergency regulatory mechanisms [43].

Infection prevention and control

The primary objective of infection prevention and control is to prevent transmission through the consistent application of standard and transmission-based precautions. Core measures include early identification and isolation of suspected cases, appropriate use of personal protective equipment, hand hygiene, safe injection practices, safe handling of sharps, environmental cleaning and disinfection, infectious-waste management, laboratory biosafety, contact tracing and 21-day monitoring, safe and dignified burials, and meaningful community engagement [44,45].

All clinical specimens should be considered potentially infectious and handled by trained and competency-assessed personnel according to locally developed risk assessments and validated standard operating procedures. Appropriate personal protective equipment, certified biological safety cabinets for specimen manipulation, and validated inactivation and decontamination methods should be used [44]. Healthcare workers with a suspected occupational exposure should receive immediate medical evaluation, documentation of the exposure, active symptom monitoring, and appropriate psychosocial and occupational support. Post-exposure vaccination may be considered for Ebola virus exposures according to national recommendations and the availability of an appropriate vaccine [45].

Additional preventive measures include reducing exposure to infected or dead wildlife and avoiding unprotected contact with infected individuals, their body fluids, contaminated materials, or deceased persons [46]. Ebola disease survivors require structured follow-up because the virus may persist in immune-privileged sites, including the testes, eyes, central nervous system, placenta, and mammary glands. Sexual transmission through semen has been documented months after clinical recovery. WHO therefore recommends safer sexual practices, including consistent condom use and, where available, periodic semen testing until two consecutive negative results are obtained. When semen testing is unavailable, safer sexual practices should be continued for the duration recommended by the applicable WHO guidance. Appropriate counselling and follow-up should also be provided for pregnant and breastfeeding survivors because viral persistence has been reported in the placenta, amniotic fluid, fetus, and breast milk [46].

Current epidemiology of Ebola virus disease, July 2026

The current Ebola virus disease (EVD) outbreak, caused by Bundibugyo ebolavirus, was first confirmed in the Democratic Republic of the Congo (DRC) and subsequently spread to Uganda in May 2026. The outbreak remains active, particularly in eastern DRC, and continues to be complicated by armed conflict, population displacement, cross-border movement, restricted access to healthcare, and gaps in surveillance, infection prevention, and control (IPC) [47,48]. As of 30 July 2026, the DRC had reported 3,442 laboratory-confirmed cases, including 1,521 deaths, making this the fastest-growing Ebola outbreak ever recorded in the country. The rapid increase in reported cases reflects both sustained transmission and the progressive clearance of previously unconfirmed suspected cases through expanded laboratory testing. More than 60% of recent deaths have occurred outside Ebola treatment centres, highlighting ongoing delays in case detection, limited healthcare access, and unsafe community care and burial practices. Case and mortality data remain subject to revision as surveillance systems and diagnostic capacity continue to improve [47].

Confirmed cases have been reported across multiple health zones in five provinces, with Ituri Province remaining the epicentre of the outbreak and accounting for nearly 90% of all confirmed cases. Continued transmission has also been documented in North Kivu, South Kivu, Haut-Uele, and Tshopo, including the city of Kisangani, raising concerns because of its role as a major regional transport hub. Response activities continue to include active case finding, contact tracing, isolation of confirmed cases, safe and dignified burials, community engagement, and strengthened infection prevention and control measures. However, these efforts continue to be hampered by insecurity, attacks on healthcare facilities, population displacement, and interruptions to humanitarian operations in conflict-affected areas [47]. Uganda reported 20 confirmed cases, including two deaths, all epidemiologically linked to imported infections from the DRC. Fifteen cases were imported, while five represented secondary transmission among contacts or healthcare workers. Following the identification of the last confirmed case on 21 June 2026, no additional cases were detected during the subsequent 42-day enhanced surveillance period. Consequently, Uganda officially declared the outbreak over on 28 July 2026, while maintaining heightened surveillance because of the continuing epidemic in neighbouring DRC [48]. Limited international spread has also occurred. In May 2026, a United States citizen infected while working in the DRC was medically evacuated to Germany and subsequently recovered. France reported an imported case on 24 June 2026; the patient recovered after two consecutive negative polymerase chain reaction (PCR) test results, with no evidence of secondary transmission. A second United States humanitarian worker infected in the DRC was medically evacuated to Germany on 13 July 2026 for specialized treatment. No sustained transmission has been documented outside the affected African countries [47,48]. Despite ongoing transmission and the continuing increase in confirmed cases in the DRC, the European Centre for Disease Prevention and Control (ECDC) continues to assess the likelihood of Ebola virus infection among people living in the European Union and European Economic Area (EU/EEA) as very low. Nevertheless, continued preparedness remains essential because imported cases may occur, particularly among healthcare workers, humanitarian personnel, laboratory staff, and travellers with direct exposure in affected areas [47].

Conclusion

This review summarizes current evidence on the virology, pathogenesis, transmission, diagnosis, clinical management, prevention, and evolving epidemiology of Ebola disease, with particular emphasis on the ongoing Bundibugyo virus disease outbreak.

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