REVIEW ON EBOLA VIRUS DISEASE

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ABSTRACT
Ebola virus disease (EVD) is an acute viral syndrome that presents with fever and an ensuing bleeding diathesis that is marked by high mortality in human and nonhuman primates. Fatality rates are between 50% and 100%. Due to its lethal nature, this filo virus is classified as a biological class 4 pathogen. The natural reservoir of the virus is unknown. A variety of tests have proven to be specific and useful for Ebola virus identification. Patient who are able to mount an immune response to the virus will begin to recover in 7 to 10 days and start the period of prolonged convalescence. Supportive management of infected patients is the primary method of treatment, with particular attention to maintenance of hydration, circulatory volume, blood pressure, and the provision of supplemental oxygen. Since there is no specific treatment outside of supportive management and palliative care, containment of this potentially lethal virus is paramount. In almost all outbreaks of EVD, the fatality rate among health care workers with documented infections was higher than that of non-health care workers.

KEYWORDS: EBV: Ebola Virus Disease, hemorrhage, fever, deadly virus.

INTRODUCTION
Ebola virus disease (EVD; also Ebola hemorrhagic fever, or EHF), or simply Ebola, is a disease of humans and other primates caused by ebolaviruses. Signs and symptoms typically start between two days and three weeks after contracting the virus with a fever, sore throat, muscle pain, and headaches. Then, vomiting, diarrhea and rash usually follow, along with decreased function of the liver and kidneys. At this time some people begin to bleed both internally and externally. The disease has a high risk of death, killing between 25 percent and 90 percent of those infected with an average of about 50 percent. This is often due to
low blood pressure from fluid loss, and typically follows six to sixteen days after symptoms appear.\[^2\]

The virus spreads by direct contact with body fluids, such as blood, of an infected human or other animals.\[^1\] Spread of the disease through the air between primates, including humans, has not been documented in either laboratory or natural conditions.\[^3\] Semen or breast milk of a person after recovery from EVD may still carry the virus for several weeks to months.\[^1\][^4\] Fruit bats are believed to be the normal carrier in nature, able to spread the virus without being affected by it. Other diseases such as malaria, cholera, typhoid fever, meningitis and other viral hemorrhagic fevers may resemble EVD. Blood samples are tested for viral RNA, viral antibodies or for the virus itself to confirm the diagnosis.\[^1\]

Prevention includes limiting the spread of disease from infected animals to humans.\[^1\] This may be done by handling potentially infected bush meat only while wearing protective clothing and by thoroughly cooking it before eating it.\[^1\]

No specific treatment or vaccine for the virus is available, although a number of potential treatments are being studied. Efforts to help those who are infected are supportive. This includes either oral rehydration therapy or giving intravenous fluids as well as treating symptoms.

**SIGNS AND SYMPTOMS**

![Symptoms of Ebola](image)

Fig.1. Signs and symptoms of Ebola\[^5\]

The length of time between exposure to the virus and the development of symptoms (incubation period) is between 2 to 21 days.\[^1\][^5\] Most often this is between 4 to 10 days.\[^6\]
Symptoms usually begin with a sudden influenza-like stage characterized by feeling tired, fever, weakness, decreased appetite, muscle pain, joint pain, headache, and sore throat.[1][6][7][8] The fever is usually higher than 38.3 °C (100.9 °F).[9] This is often followed by vomiting, diarrhea and abdominal pain.[8] Next, shortness of breath and chest pain may occur, along with swelling, headaches and confusion.[8]

In some cases, internal and external bleeding may occur.[1] This typically begins five to seven days after the first symptoms.[10] All infected people show some decreased blood clotting.[9] Bleeding from mucous membranes or from sites of needle punctures has been reported in 40–50 percent of cases.[11] This may result in the vomiting of blood, coughing up of blood, or the presence of blood in stool.[12] Bleeding into the skin may create petechiae, purpura, ecchymoses or hematomas.[13] Bleeding into the whites of the eyes may also occur. Heavy bleeding is uncommon, and if it occurs, it is usually located within the gastrointestinal tract.[9][14]

Recovery may begin between 7 and 14 days after the start of symptoms.[8] Death, if it occurs, follows typically 6 to 16 days from the start of symptoms and is often due to low blood pressure from fluid loss.[2] In general, bleeding often indicates a worse outcome, and this blood loss may result in death.[7] People are often in a coma near the end of life.[8] Those who survive often have ongoing muscle and joint pain, liver inflammation, decreased hearing, and may have constitutional symptoms such as feeling tired, continued weakness, decreased appetite, and difficulty returning to pre-illness weight.[8][15] Additionally they develop antibodies against Ebola that last at least 10 years but it is unclear if they are immune to repeated infections.[16] If someone survives Ebola, they can no longer transmit the disease.[16]

CLASSIFICATION

The genera *Ebolaviruses* and *Marburgviruses* were originally classified as the species of the now-obsolete *Filovirus* genus. In March 1998, the Vertebrate Virus Subcommittee proposed in the International Committee on Taxonomy of Viruses (ICTV) to change the *Filovirus* genus to the *Filoviridae* family with two specific genera: *Ebola-like viruses* and *Marburg-like viruses*. This proposal was implemented in Washington, D.C., as of April 2001 and in Paris as of July 2002. In 2000, another proposal was made in Washington, D.C., to change the "-like viruses" to "-virus" resulting in today's *Ebolaviruses* and *Marburgviruses*.[18][19]
The five characterised species of the *Ebolaviruses* genus are

**Zaire Ebolavirus (ZEBOV)**

Also known simply as the *Zaire virus*, ZEBOV has the highest case-fatality rate, up to 90% in some epidemics, with an average case fatality rate of approximately 83% over 27 years. There have been more outbreaks of *Zaire Ebolavirus* than of any other species. The first outbreak took place on 26 August 1976 in Yambuku.\(^{[20]}\)

**Sudan Ebolaviruses (SUDV)**

Like ZEBOV, SUDV emerged in 1976; it was at first assumed to be identical with ZEBOV.\(^{[21]}\) SUDV is believed to have broken out first amongst cotton factory workers in Nzara, Sudan (now in South Sudan), in June 1976, with the first case reported as a worker exposed to a potential natural reservoir. Scientists tested local animals and insects in response to this; however, none tested positive for the virus. The average fatality rates for SUDV were 54% in 1976, 68% in 1979, and 53% in 2000 and 2001.

**Reston Ebolaviruses (RESTV)**

This virus was discovered during an outbreak of simian hemorrhagic fever virus (SHFV) in crab-eating macaques from Hazleton Laboratories (now Covance) in 1989. Since the initial outbreak in Reston, Virginia, it has since been found in nonhuman primates in Pennsylvania, Texas, and Siena, Italy. In each case, the affected animals had been imported from a facility in the Philippines,\(^{[22]}\) where the virus has also infected pigs.\(^{[23]}\) Despite its status as a Level4 organism and its apparent pathogenicity in monkeys, RESTV did not cause disease in exposed human laboratory workers.\(^{[24]}\)

**Taï Forest Ebolaviruses (TAFV)**

Formerly known as “Côte d'Ivoire Ebolaviruses”, it was first discovered among chimpanzees from the Tai Forest in Côte d'Ivoire, Africa, in 1994. Necropsies showed blood within the heart to be brown; no obvious marks were seen on the organs; and one necropsy displayed lungs filled with blood. Studies of tissues taken from the chimpanzees showed results similar to human cases during the 1976 Ebola outbreaks in Zaire and Sudan. One of the scientists performing the necropsies on the infected chimpanzees contracted Ebola. She developed symptoms similar to those of dengue fever approximately a week after the necropsy, and was transported to Switzerland for treatment. She was discharged from hospital after two weeks and had fully recovered six weeks after the infection.\(^{[25]}\)
Bundibugyo Ebolaviruses (BDBV)

On November 24, 2007, the Uganda Ministry of Health confirmed an outbreak of Ebola in the Bundibugyo District. After confirmation of samples tested by the United States National Reference Laboratories and the CDC, the World Health Organization confirmed the presence of the new species. On 20 February 2008, the Uganda Ministry officially announced the end of the epidemic in Bundibugyo, with the last infected person discharged on 8 January 2008.[26] An epidemiological study conducted by WHO and Uganda Ministry of Health scientists determined there were 116 confirmed and probable cases the new Ebola species, and that the outbreak had a mortality rate of 34% (39 deaths).[27]

CAUSE

EVD in humans is caused by four of five viruses of the genus Ebolaviruses. The four are Bundibugyo virus (BDBV), Sudan virus (SUDV), Taï Forest virus (TAFV) and one simply called Ebola virus (EBOV, formerly Zaire Ebola virus).[28] EBOV, species Zaire Ebolaviruses, is the most dangerous of the known EVD-causing viruses, and is responsible for the largest number of outbreaks.[29] The fifth virus, Reston virus (RESTV), is not thought to cause disease in humans, but has caused disease in other primates.[30][31] All five viruses are closely related to marburgviruses.[28]

Transmission

Between people, Ebola disease spreads only by direct contact with the blood or body fluids of a person who has developed symptoms of the disease.[32][33][34] Body fluids that may contain Ebola viruses include saliva, mucus, vomit, feces, sweat, tears, breast milk, urine and semen.[16] The WHO states that only people who are very sick are able to spread Ebola disease in saliva, and whole virus has not been reported to be transmitted through sweat. Most people spread the virus through blood, feces and vomit.[35] Entry points for the virus include the nose, mouth, eyes, open wounds, cuts and abrasions.[16] Ebola may be spread through large droplets;

The Ebola virus may be able to persist for up to 8 weeks in the semen of survivors after they recovered, which could lead to infections via sexual intercourse.[1] Ebola may also occur in the breast milk of women after recovery, and it is not known when it is safe to breastfeed again.[4] Otherwise, people who have recovered are not infectious.[36]
Dead bodies remain infectious; thus, people handling human remains in practices such as traditional burial rituals or more modern processes such as embalming are at risk.\textsuperscript{[37]}

**Airborne transmission:**

Human to human transmission of EBOV through the air has not been reported to occur during EVD outbreaks\textsuperscript{[3]} and airborne transmission has only been demonstrated in very strict laboratory conditions, and then only from pigs to primates but not from primates to primates.\textsuperscript{[32][38]}

The apparent lack of airborne transmission among humans is believed to be due to low levels of the virus in the lungs and other parts of the respiratory system of primates, that are insufficient to cause new infections.\textsuperscript{[39]} A number of studies examining airborne transmission broadly concluded that transmission from pigs to primates could happen without direct contact, because unlike humans and primates, pigs with EVD get very high Ebolavirus concentrations in their lungs, and not their bloodstream.\textsuperscript{[40]} Therefore pigs with EVD can spread the disease through droplets in the air or on the ground when they sneeze or cough.\textsuperscript{[41]} By contrast, humans and other primates accumulate the virus throughout their body and specifically in their blood, but not very much in their lungs.\textsuperscript{[41]} It is believed that this is the reason researchers have observed pig to primate transmission without physical contact, but no evidence has been found of primates being infected without actual contact, even in experiments were infected and uninfected primates shared the same air.\textsuperscript{[40][41]}

**Initial case**

Bushmeat being prepared for cooking in Ghana. In Africa, wild animals including fruit bats are hunted for food and are referred to as bushmeat.\textsuperscript{[42][43]} In equatorial Africa, human consumption of bushmeat has been linked to animal-to-human transmission of diseases, including Ebola.\textsuperscript{[44]}

Although it is not entirely clear how Ebola initially spreads from animals to humans, the spread is believed to involve direct contact with an infected wild animal or fruit bat.\textsuperscript{[36]} Besides bats, other wild animals sometimes infected with EBOV include several monkey species, chimpanzees, gorillas, baboons and duikers.\textsuperscript{[45]}

Animals may become infected when they eat fruit partially eaten by bats carrying the virus.\textsuperscript{[46]} Evidence indicates that both domestic dogs and pigs can also be infected with
EBOV. Dogs do not appear to develop symptoms when they carry the virus, and pigs appear to be able to transmit the virus to at least some primates.

Virology

Ebolaviruses contain single-stranded, non-infectious RNA genomes. Ebolaviruses contain seven genes including 3'-UTR-NP-VP35-VP40-GP-VP30-VP24-L-5'-UTR. The genomes of the five different ebolaviruses (BDBV, EBOV, RESTV, SUDV and TAFV) differ in sequence and the number and location of gene overlaps. As all filoviruses, ebolavirions are filamentous particles that may appear in the shape of a shepherd's crook, of a "U" or of a "6," and they may be coiled, toroid or branched. In general, ebolavirions are 80 nanometers (nm) in width and may be as long as 14,000 nm.

Their life cycle is thought to begin with a virion attaching to specific cell-surface receptors such as C-type lectins, DC-SIGN, or integrins, which is followed by fusion of the viral envelope with cellular membranes. The virions taken up by the cell then travel to acidic endosomes and lysosomes where the viral envelope glycoprotein GP is cleaved. This processing appears to allow the virus to bind to cellular proteins enabling it to fuse with internal cellular membranes and release the viral nucleocapsid. The Ebolaviruses structural glycoprotein (known as GP1,2) is responsible for the virus' ability to bind to and infect targeted cells. The viral RNA polymerase, encoded by the L gene, partially uncoats the nucleocapsid and transcribes the genes into positive-strand mRNAs, which are then translated into structural and nonstructural proteins. The most abundant protein produced is the nucleoprotein, whose concentration in the host cell determines when L switches from gene transcription to genome replication. Replication of the viral genome results in full-length, positive-strand antigenomes that are, in turn, transcribed into genome copies of negative-strand virus progeny. Newly synthesized structural proteins and genomes self-assemble and accumulate near the inside of the cell membrane. Virions bud off from the cell, gaining
their envelopes from the cellular membrane from which they bud from. The mature progeny particles then infect other cells to repeat the cycle. The genetics of the Ebola virus are difficult to study because of EBOV's virulent characteristics.\textsuperscript{55}

**PATHOPHYSIOLOGY**

![Fig.3.Pathogenesis schematic](image)

Similar to other filoviridae, EBOV replicates very efficiently in many cells, producing large amounts of virus in monocytes, macrophages, dendritic cells and other cells including liver cells, fibroblasts, and adrenal gland cells.\textsuperscript{56} Viral replication triggers the release of high levels of inflammatory chemical signals and leads to a septic state.\textsuperscript{15}

EBOV is thought to infect humans through contact with mucous membranes or through skin breaks.\textsuperscript{32} Once infected, endothelial cells (cells lining the inside of blood vessels), liver cells, and several types of immune cells such as macrophages, monocytes, and dendritic cells are the main targets of infection.\textsuperscript{32} Following infection with the virus, the immune cells carry the virus to nearby lymph nodes where further reproduction of the virus takes place.\textsuperscript{32} From there, the virus can enter the bloodstream and lymphatic system and spread throughout the body.\textsuperscript{32} Macrophages are the first cells infected with the virus, and this infection results in programmed cell death.\textsuperscript{51} Other types of white blood cells, such as lymphocytes, also undergo programmed cell death leading to an abnormally low concentration of lymphocytes in the blood.\textsuperscript{32} This contributes to the weakened immune response seen in those infected with EBOV.\textsuperscript{32}

Endothelial cells may be infected within 3 days after exposure to the virus.\textsuperscript{51} The breakdown of endothelial cells leading to vascular injury can be attributed to EBOV glycoproteins. The
widespread hemorrhage that occurs in affected people causes edema and hypovolemic shock.[57] The damage to human cells, caused by infection of the endothelial cells, decreases the integrity of blood vessels. This loss of vascular integrity increases with the synthesis of GP, which reduces the availability of specific integrins responsible for cell adhesion to the intercellular structure and causes damage to the liver, leading to improper clotting. The dysfunction in bleeding and clotting commonly seen in EVD has been attributed to increased activation of the extrinsic pathway of the coagulation cascade due to excessive production of tissue factor by macrophages and monocytes.[6]

After infection, a secreted glycoprotein, small soluble glycoprotein (sGP) (or Ebola virus glycoprotein [GP]), is synthesized. EBOV replication overwhelms protein synthesis of infected cells and the host immune defenses. The GP forms a trimeric complex, which tethers the virus to the endothelial cells. The sGP forms a dimeric protein that interferes with the signaling of neutrophils, another type of white blood cell, which enables the virus to evade the immune system by inhibiting early steps of neutrophil activation. The presence of viral particles and the cell damage resulting from viruses budding out of the cell causes the release of chemical signals (such as TNF-α, IL-6 and IL-8), which are molecular signals for fever and inflammation.

**Immune system evasion**
Filoviral infection also interferes with proper functioning of the innate immune system.[52][54] EBOV proteins blunt the human immune system's response to viral infections by interfering with the cells' ability to produce and respond to interferon proteins such as interferon-alpha, interferon-beta, and interferon gamma.[53][58]

**TREATMENT**
Symptoms of Ebola and complications are treated as they appear. The following basic interventions, when used early, can significantly improve the chances of survival:

- Providing intravenous fluids (IV) and balancing electrolytes (body salts).
- Maintaining oxygen status and blood pressure.
- Treating other infections if they occur.

Experimental vaccines and treatments for Ebola are under development, but they have not yet been fully tested for safety or effectiveness.
Recovery from Ebola depends on good supportive care and the patient’s immune response. People who recover from Ebola infection develop antibodies that last for at least 10 years, possibly longer. It is not known if people who recover are immune for life or if they can become infected with a different species of Ebola. Some people who have recovered from Ebola have developed long-term complications, such as joint and vision problems.\[^{69}\]

**Living Drug**

*A Permanent Cure for Ebola*

Currently when the world is passing through the deadliest Ebola epidemic ever, we are introducing Living drug, a permanent cure for Ebola.

“Living Drug cures an Ebola Infected Person by actively immunizing against Ebola Virus”

**Cure:**

Living Drug contains perfect neutralizing antibody for Ebola Virus.

1 ml of living drug injection is enough to cure a Ebola patient for life time. Patient’s immune system starts a rally against the Ebola virus and the body starts curing itself.

A freshly infected person gets cured in less than 13 days and a severe infection takes around 2 to 3 months for complete cure. Test for Viral infection turn negative for the patient after complete cure. Completely Cured Person is already immunized against the Ebola Virus and any further exposure to Ebola virus, immune system actively neutralizes the Ebola Virus before it develops the disease.

**Immunize**

Ebola Virus which can cause disease in humans, when treated with Living Drug (in a suitable medium) becomes completely inactive and is the perfect Vaccine candidate for humans.
Any vulnerable patient treated with this vaccine becomes completely immune to Ebola infection.

Vulnerable Host + Ebola Virus + Living Drug results in a Healthy Host and also perfectly immune to Ebola Infection.

Ebola virus already exists inside a Ebola infected patient.

On exposing the patient with 1 ml of Living drug injection, living drug forms Inactive Ebola Virus inside the body(as active Ebola virus is already present in the body), which creates immune memory and immunize the immune system of the patient against the Ebola virus, and his/her immune system starts curing the body by itself.

In this way, both Cure and Immunization follow the same process.

**Prevent**

If a Person is cured with living drug or Immunized with Ebola Living Drug Vaccine, he/she is always protected from future infections from Ebola Virus, as his/her immune system actively defends the Ebola Virus from developing the disease.⁷⁰
DIAGNOSIS
When EVD is suspected in a person, his or her travel and work history, along with an exposure to wildlife, are important factors to consider for possible further medical examination.

Nonspecific laboratory testing
Possible laboratory indicators of EVD include a low platelet count; an initially decreased white blood cell count followed by an increased white blood cell count; elevated levels of the liver enzymes alanine aminotransferase (ALT) and aspartate aminotransferase (AST); and abnormalities in blood clotting often consistent with disseminated intravascular coagulation (DIC) such as a prolonged prothrombin time, partial thromboplastin time, and bleeding time.\(^7\)

Specific laboratory testing
The diagnosis of EVD is confirmed by isolating the virus, detecting its RNA or proteins, or detecting antibodies against the virus in a person's blood. Isolating the virus by cell culture, detecting the viral RNA by polymerase chain reaction (PCR)\(^72\) and detecting proteins by enzyme-linked immunosorbent assay (ELISA) are methods best used in the early stages of the disease and also for detecting the virus in human remains. Detecting antibodies against the virus is most reliable in the later stages of the disease and in those who recover.\(^73\) IgM antibodies are detectable two days after symptom onset and IgG antibodies can be detected 6 to 18 days after symptom onset.\(^72\)

During an outbreak, isolation of the virus via cell culture methods is often not feasible. In field or mobile hospitals, the most common and sensitive diagnostic methods are real-time PCR and ELISA.\(^74\) In 2014, with new mobile testing facilities deployed in parts of Liberia, test results were obtained 3–5 hours after sample submission.\(^48\)

Filovirions, such as EBOV, may be identified by their unique filamentous shapes in cell cultures examined with electron microscopy, but this method cannot distinguish the various filoviruses.\(^49\)

Differential diagnosis
Early symptoms of EVD may be similar to those of other diseases common in Africa, including malaria and dengue fever.\(^75\) The symptoms are also similar to those of Marburg virus disease and other viral hemorrhagic fevers.\(^50\)
The complete differential diagnosis is extensive and requires consideration of many other infectious diseases such as typhoid fever, shigellosis, rickettsial diseases, cholera, sepsis, borreliosis, EHEC enteritis, leptospirosis, scrub typhus, plague, Q fever, candidiasis, histoplasmosis, trypanosomiasis, visceral leishmaniasis, measles and viral hepatitis among others.\cite{51}

Non-infectious diseases that may result in symptoms similar to those of EVD include acute promyelocytic leukemia, hemolytic uremic syndrome, snake envenomation, clotting factor deficiencies/platelet disorders, thrombotic thrombocytopenic purpura, hereditary hemorrhagic telangiectasia, Kawasaki disease and warfarin poisoning.\cite{74, 52, 53, 54}

**PREVENTION**

**Infection control**

People who care for those infected with Ebola should wear protective clothing including masks, gloves, gowns and goggles.\cite{76}

The infected person should be in barrier-isolation from other people.\cite{76} All equipment, medical waste, patient waste and surfaces that may have come into contact with body fluids need to be disinfected.\cite{77} During the 2014 outbreak, kits were put together to help families treat Ebola disease in their homes, which include protective clothing as well as chlorine powder and other cleaning supplies.\cite{78} Education of those who provide care in these techniques, and the provision of such barrier-separation supplies has been a priority of Doctors Without Borders.\cite{79}

Ebola viruses can be eliminated with heat (heating for 30 to 60 minutes at 60 °C or boiling for 5 minutes). To disinfect surfaces, some lipid solvents such as some alcohol-based products, detergents, sodium hypochlorite (bleach) or calcium hypochlorite (bleaching powder), and other suitable disinfectants may be used at appropriate concentrations.\cite{45, 80} These measures include avoiding direct contact with infected people and regular hand washing using soap and water.\cite{81}

If a person with Ebola disease dies, direct contact with the body should be avoided.\cite{76} Certain burial rituals, which may have included making various direct contacts with a dead body, require reformulation such that they consistently maintain a proper protective barrier
between the dead body and the living.\textsuperscript{[82][83][84]} Social anthropologists may help find alternatives to traditional rules for burials.\textsuperscript{[85]}

**MANAGEMENT**

**Standard support**

No specific treatment is currently approved.\textsuperscript{[86]} Treatment is primarily supportive in nature.\textsuperscript{[87]} Early supportive care with rehydration and symptomatic treatment improves survival.\textsuperscript{[1]} Rehydration may be via the oral or by intravenous route.\textsuperscript{[87]} These measures may include management of pain, nausea, fever and anxiety.\textsuperscript{[87]} The World Health Organization recommends avoiding the use of aspirin or ibuprofen for pain due to the bleeding risk associated with use of these medications.\textsuperscript{[88]}

Blood products such as packed red blood cells, platelets or fresh frozen plasma may also be used.\textsuperscript{[87]} Other regulators of coagulation have also been tried including heparin in an effort to prevent disseminated intravascular coagulation and clotting factors to decrease bleeding.\textsuperscript{[87]} Antimalarial medications and antibiotics are often used before the diagnosis is confirmed,\textsuperscript{[87]} though there is no evidence to suggest such treatment helps. A number of experimental treatments are being studied.

It is also recommended that the caregivers wash hands with bleach solutions and cover their mouth and nose with a cloth.\textsuperscript{[89]}

**Intensive care**

Intensive care is often used in the developed world.\textsuperscript{[13]} This may include maintaining blood volume and electrolytes (salts) balance as well as treating any bacterial infections that may develop.\textsuperscript{[13]}

**Alternative medicine**

The Food and Drug Administration (FDA) advises people to be careful of advertisements making unverified or fraudulent claims of benefits supposedly gained from various anti-Ebola products.\textsuperscript{[90]} The FDA has already sent out at least one letter of warning to a seller of colloidal silver who made unverified claims of Ebola related benefits, supposedly derived from the use of their products.\textsuperscript{[91]}
PROGNOSIS
EVD has a high risk of death in those infected which varies between 25 percent and 90 percent of those infected.\(^1\)\(^{92}\) As of September 2014, the average risk of death among those infected is 50 percent.\(^1\) The highest risk of death was 90 percent in the 2002–2003 Republic of the Congo outbreak.\(^93\)

Death, if it occurs, follows typically six to sixteen days after symptoms appear and is often due to low blood pressure from fluid loss.\(^2\) Early supportive care to prevent dehydration may reduce the risk of death.\(^94\)

If an infected person survives, recovery may be quick and complete. Prolonged cases are often complicated by the occurrence of long-term problems, such as inflammation of the testicles, joint pains, muscle pains, skin peeling, or hair loss.\(^6\) Eye symptoms, such as light sensitivity, excess tearing, iritis, iridocyclitis, choroiditis, and blindness have also been described.

EPIDEMIOLOGY

**Sudan outbreak**
The first known outbreak of EVD was identified only after the fact, occurring between June and November 1976 in Nzara, South Sudan,\(^{28}\)\(^{95}\) (then part of Sudan) and was caused by Sudan virus (SUDV).

**Zaire outbreak**
On 26 August 1976, a second outbreak of EVD began in Yambuku, a small rural village in Mongala District in northern Zaire (now known as the Democratic Republic of the Congo).\(^96\)\(^97\) This outbreak was caused by EBOV, formerly designated *Zaire Ebolavirus*, which is a different member of the genus *Ebolavirus* than in the first Sudan outbreak.

During this outbreak, Dr. Ngoy Mushola recorded the first clinical description of EVD in Yambuku, where he wrote the following in his daily log: "The illness is characterized with a high temperature of about 39 °C (102 °F), hematemesis, diarrhea with blood, retrosternal abdominal pain, prostration with "heavy" articulations, and rapid evolution death after a mean of 3 days."\(^98\)
1995 to 2012

The second major outbreak occurred in Zaire (now the Democratic Republic of the Congo) in 1995, affecting 315 and killing 254.[1]

2013 to 2015 West African outbreak

![Graph showing increase in cases and deaths during the 2013-2014 outbreak.](image)

**Fig. 4. Increase over time in the cases and deaths during the 2013–2014 outbreak**

In March 2014, the World Health Organization (WHO) reported a major Ebola outbreak in Guinea, a western African nation.[99] Researchers traced the outbreak to a two-year old child who died December 2013.[100][101]

**TEN REASONS THAT MAKE THE EBOLA VIRUS DEADLY FOR HUMANS**

Various infectious diseases like tuberculosis, AIDS and dengue have killed millions of people all over the world but what distinguishes Ebola from others, is that is highly mysterious. Here’s some interesting facts about the Ebola virus that make it so deadly.

**It can kill within seven days:** Unlike other viruses (like HIV) that can remain dormant in a person for years without causing the disease, Ebola violently multiplies until the viral particles are amplified to about 100 million viral particles in a droplet of blood. Further, without resting in a dormant stage the virus kills the host to find a new one. The fatality rate of the disease is 60 percent.

**There is no vaccine or treatment available:** What makes this virus deadly is the fact that researchers have not been able to find an effective treatment or preventive technique to combat the virus and the spread of the disease. The experimental drug Zmapp has shown promising results but the safety and efficacy of the drug are to be evaluated. So, as of now, neither do we have an effective form of therapy nor do we have a vaccine to prevent the disease.
Attacks every part of the human body: Ebola only needs a host cell that can help it produce multiple copies of itself. What worsens the condition is the fact that the virus does not need a specific type of cell to multiply (unlike other deadly diseases). According to studies, except for skeletal muscles and bones, the virus is known to infect every part of the human body. Connective tissues, the ones that hold your internal organs in place, are primary targets of the virus.

Disrupts your immune system: Viral proteins present on the outer surface of the Ebola virus are what destroy the immune system. VP35, one of those proteins, interferes with the production of some important components of the human immune system, like interferons. Another protein traps the white blood cells inside the circulatory system by limiting their movement. As a response to the virus, whatever molecules the immune cells release are used by the virus to devastate the vascular system and activate blood clot formation.

We don’t know where it came from: First of all, scientists have not been able to identify the original reservoir of the virus yet. Bats have been the suspected source but the results are inconclusive. Since a major part of its life cycle remains a mystery, the threat of its recurring outbreak will persist.

We don’t know all the different ways it can spread: The Ebola virus certainly spreads through direct contact with infectious body fluids and secretions including blood, semen, stool, mucus, saliva and sweat. But there is a possibility that it could spread through other modes, increasing the chances of the disease spreading.

The virus manipulates your immune system: Once the virus enters the body, it attacks your immune cells, namely macrophages and monocytes. The immune cells get fooled and release large amounts cytokines that instead facilitate the entry of the virus into endothelial cells easily. These cytokines alarm other immune cells to reach the site of infection, exposing them to the virus. While the immune system is still being attacked by the virus, some viral particles that reach the liver start destroying the liver cells to ensure that cell signals are not cleared from the bloodstream.

Multiplies rapidly: Once inside the body, the virus’s genetic material (single-stranded RNA) begins to multiply rapidly into the host cell. The genetic material is translated to produce viral proteins that form an outer covering of the viral particles protecting its genetic material.
Releases hundreds of viruses at a time: Within no time, the infected cells become packed with blocks or crystals of viral particles. They move towards the cell wall of the infected cell and finally burst the cell releasing hundreds of new viral particles that travel through the blood, attacking healthy cells.

Destabilises the vascular system: When the new virions are on their way outside the infected host cell, the host cell detaches from its neighbouring cell and loses its contact with the membrane it is rested upon. The viral particles ultimately leave the cell destabilised, causing massive blood loss or hemorrhage.\[102\]

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