

EXHIBIT 108



Ebola

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Ebola is a virus of the *Filoviridae*. It causes Ebola hemorrhagic fever, a fatal disease, in humans.

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The virus

The virus comes from the *Filoviridae* family, of which Marburg virus is also a member. The true vector, an animal or plant that can carry the virus without experiencing symptoms of infection, is not currently known. The Ebola virus is named after the Ebola River in the Democratic Republic of the Congo (formerly Zaire), near the first epidemics.

It is traditional to name viral species (strains, subtypes) after the locations where they were first discovered. Two species were identified in 1976: *Zaire ebolavirus* (ZEBOV) and *Sudan ebolavirus* (SEBOV) with case fatality rates of 83% and 54% respectively. A third species, *Reston ebolavirus* (REBOV), was discovered in November 1989 in a group of monkeys (*Macaca fascicularis*) imported from the Philippines to the Hazleton Primate Quarantine Unit in Reston, Virginia (USA).

Further outbreaks have occurred in Zaire/Democratic Republic of the Congo (1995 and 2003), Gabon (1994, 1995 and 1996), Uganda (2000), Angola (2005) and Sudan again (2004). A new species was identified from a single human case in Côte d'Ivoire in 1994, *Ivory Coast ebolavirus* (ICEBOV). In 2003, 120 people died in Etoumbi, Republic of Congo, which has been the site of four recent outbreaks, including one in May 2005.

Of the approximate 1,500 identified Ebola cases worldwide, over 80% of the patients have died. Despite considerable effort by the World Health Organization, no animal or arthropod reservoir capable of sustaining the virus between outbreaks has been identified, although a role for fruit or insectivorous bats is often postulated. BBC News reported that researchers writing in the December 1, 2005, issue of *Nature* had identified evidence of symptomless Ebola infection in three species of fruit bats from the Democratic Republic of Congo and Gabon.

>Ebola virus ?

An electron micrograph showing the filamentous structure of the viral particle. The filaments are 60-80 nm in diameter.
Virus classification
Group: Group V ((-)ssRNA)
Order: <i>Mononegavirales</i>
Family: <i>Filoviridae</i>
Genus: <i>Ebolavirus</i>
Species
<i>Ivory Coast ebolavirus</i>
<i>Reston ebolavirus</i>
<i>Sudan ebolavirus</i>
<i>Zaire ebolavirus</i>

Zaire ebolavirus

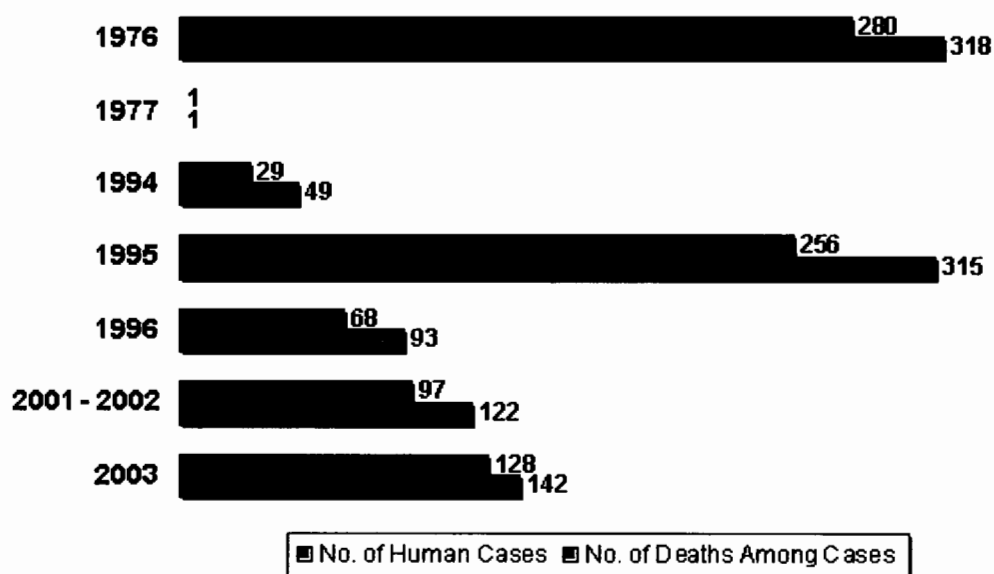
Zaire ebolavirus, is a non-segmented, negative stranded virus and is one of the first-discovered Ebola virus species. It is also the most deadly with up to a 90% mortality rate in some epidemics. There have been more outbreaks of *Zaire ebolavirus* than any other strain. The first outbreak took place on August 26, 1976 in Yambuku, a town in northern Zaire (now the Democratic Republic of the Congo). The first recorded case (*not* the index case) was a Mabalo Lokela, a 44 year old school teacher just returning from a trip around Northern Zaire, who was examined at a hospital run by Belgian nuns. His high fever was diagnosed as possible malaria, therefore he was given a quinine shot. Lokela returned to the hospital every day. A week later, his symptoms included uncontrolled vomiting, severe diarrhea, headache, dizziness, and trouble breathing. Later, the bleeding began from his nose, mouth, and rectum. Mabalo Lokela died on September 8, 1976, roughly 14 days after the onset of symptoms.

Soon after, more patients arrived with varying but similar symptoms: fever, headache, muscle/joint aches, fatigue, nausea, dizziness etc. which often progressed to bloody diarrhea, severe vomiting, and bleeding from the nose, mouth, and rectum. The initial transmission was believed to be due to reuse of the needle for Lokela's injection without sterilization (a common practice in many countries). Subsequent transmission was also due to care of the sick patients without barrier nursing and traditional burial preparations, which involves washing and GI tract cleansing.

A similar case of hospital transmission occurred in southern Sudan, after the death of a nightclub owner in Nzara who could afford to go to the fancier hospital located in Maridi. Unfortunately, the nurses there also did not properly sterilize their needles, and the hospital, like the one in Yambuku, became a breeding ground for new Ebola cases (Draper 30–31). Several epidemics of *Zaire ebolavirus* and *Sudan ebolavirus* have occurred since 1976.

The case fatality rates were 88% in 1976, 100% in 1977, 59% in 1994, 81% in 1995, 73% in 1996, 80% in 2001/2002 and 90% in 2003. The average case fatality rate for Ebola Zaire is 82.6%.

Cases And Deaths From the Ebola-Zaire Virus, 1976-2003

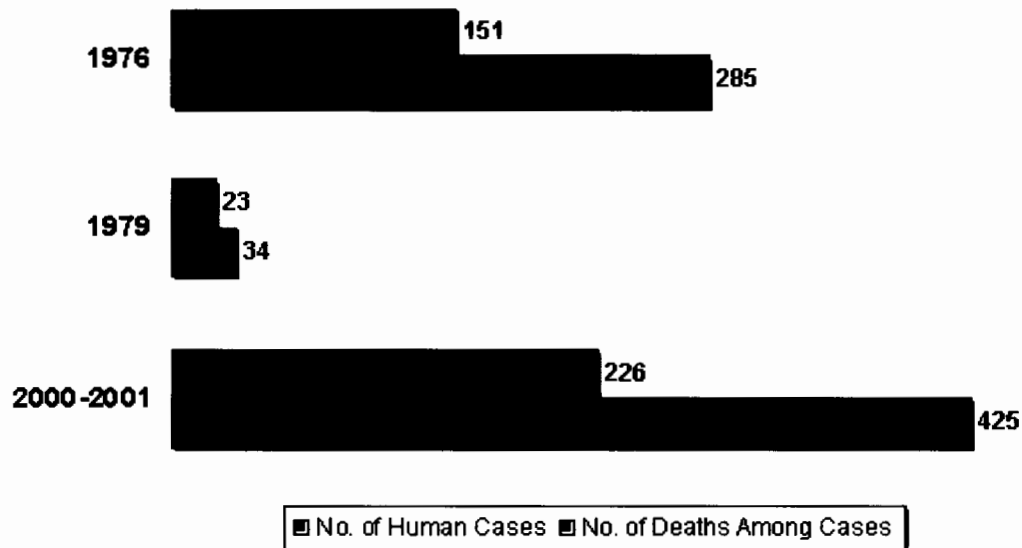


A graphical representation of known human cases and deaths during outbreaks of *Zaire ebolavirus* between 1976 and 2003.

The most recent outbreak of *Sudan ebolavirus* occurred in May 2004. As of May 24, 2004, 20 cases of *Sudan ebolavirus* (including five deaths) were reported in Yambio County, Sudan. The Centers for Disease Control and Prevention confirmed the virus a few days later. The neighboring countries of Uganda and the Democratic Republic of Congo have increased surveillance in bordering areas, and other similar measures have been taken to control the outbreak.

The average fatality rates for *Sudan ebolavirus* were 53% in 1976, 68% in 1979, and 53% in 2000/2001. The average case fatality rate is 53.76%.

Cases And Deaths From the Ebola-Sudan Virus, 1976-2003



A graphical representation of known human cases and deaths during outbreaks of *Sudan ebolavirus* between 1976 and 2003.

Reston ebolavirus

This species was discovered in November of 1989 in a group of 100 cynomolgus macaques (*Macaca fascicularis*) imported from Ferlite Farms in Mindanao, Philippines to Hazleton Research Products Primate Quarantine Unit in Reston, Virginia, about 10 miles from Washington, D.C. A parallel infected shipment was also sent to Philadelphia, Pennsylvania. This strain was highly lethal in monkeys, but did not cause any fatalities in humans. Six of the Reston primate handlers tested positive (2 due to previous exposure) for the virus, and exhibited severe flu-like symptoms. Further *Reston ebolavirus* infected monkeys were shipped to Hazleton (now known as Covance, Inc.) facilities in both Reston, Virginia and Alice, Texas (Hazleton's Texas Primate Center) in February of 1990. This strain was also found to be airborne. More *Reston ebolavirus* infected monkeys were discovered in 1992 in Siena, Italy and at the Texas Hazleton facility again in March 1996. There was a high rate of co-infection with Simian Hemorrhagic Fever (SHF) in all of these *Reston ebolavirus* infected monkeys. No human illness has resulted from any of these outbreaks. The Reston virus was confusing to members of both USAMRIID and the CDC, who worked on eliminating the virus. See Ebola Reston for more information.

Ivory Coast ebolavirus

In 1994, a scientist became ill after conducting a necropsy on a wild chimpanzee. The scientist recovered,⁶ however, there is still little known about this species of Ebola virus since only this single case has been identified.

Symptoms

Among humans, the virus is transmitted by direct contact with infected body fluids such as blood. The incubation period is 2 to 21 days. Symptoms are varied and often appear suddenly. Initial symptoms include: high fever (at

least 38.8° C, 101° F), severe headache, muscle/joint/abdominal pain, severe weakness and exhaustion, sore throat, nausea, and dizziness. Before an epidemic is suspected, these early symptoms are easily mistaken for malaria, typhoid fever, dysentery, or various bacterial infections, which are all far more common. The secondary symptoms often involve bleeding both internally and externally from any opening in the body: Dark or bloody stools and diarrhea, vomiting blood, red eyes from swollen blood vessels, red spots on the skin from subcutaneous bleeding, and bleeding from the nose, mouth, rectum, genitals and needle puncture sites. Other secondary symptoms include low blood pressure (less than 90mm Hg) and a fast but weak pulse, eventual organ damage including the kidney and liver by co-localized necrosis, and proteinuria (the presence of proteins in urine). The span of time from onset of symptoms to death (from shock due to blood loss or organ failure) is usually between 7 and 14 days.

Transmission

The transmission of Ebola can happen through various ways, but the only known transmission is from what people ate. Recent discoveries show that fruit bats carrying Ebola were regularly eaten by African peoples.

Although easy to demonstrate in laboratory conditions with monkeys, there has never been a documented case of airborne transmission in human epidemics.^{16,17,18} Nurse Mayinga *may* represent the only possible case. The means by which she contracted the virus remains uncertain.

So far all epidemics of Ebola have occurred in sub-optimal hospital conditions, where practices of basic hygiene and sanitation are often either luxuries or unknown to caretakers and where disposable needles and autoclaves are unavailable or too expensive. In modern hospitals with disposable needles and knowledge of basic hygiene and barrier nursing techniques (mask, gown, gloves), Ebola rarely spreads on such a large scale.

In the early stages, Ebola may not be highly contagious. As the illness progresses, bodily fluids from diarrhea, vomiting, and bleeding represent an extreme biohazard. Due to lack of proper equipment and hygienic practices, large scale epidemics are mostly problematic in poor, isolated areas without modern hospitals and/or well-educated medical staff. Many areas where the infectious reservoir exists have just these characteristics. In such environments all that can be done is to immediately cease all needle sharing or use without adequate sterilization procedures, to isolate patients, and to observe strict barrier nursing procedures with the use of a N95/P95/P100 or medical rated disposable face mask, gloves, (if possible) goggles, and gown at all times. This should be strictly enforced for all medical personnel and visitors.

Vaccines

Recent efforts have produced vaccines for both Ebola and Marburg that are 100% effective in protecting a group of monkeys from the disease.^{1,15} Recent tests were conducted at USAMRIID in collaboration with Canada's National Microbiology Laboratory in Winnipeg. A Dutch company: Crucell has also announced a successful tests of their commercial vaccine in monkeys. No human testing has yet been announced for any of these filovirus vaccines. Earlier vaccine efforts, like the one at NAIAD in 2003 that was entering human trials have so far not reported any successes.¹⁴

Treatments

Despite some initial anecdotal evidence to the contrary, blood serum from Ebola survivors has been shown to be ineffective in treating the virus.

In 1999, Maurice Iwu announced at the International Botanical Congress that a fruit extract of *Garcinia kola*, a West African tree long used by local traditional healers for other illnesses, stopped Ebola virus replication in lab

tests. It is a treatment, not a vaccine.

These tests involved cell samples; no animal or human trials had yet been conducted. No further information is available on this as of June 2005.

Bioterrorism

Airborne transmission of Ebola Zaire has been demonstrated in monkeys in a controlled laboratory environment at USAMRIID several times in 1995/1996.^{16,17,18}

In his book *Biohazard*, former Soviet biological warfare researcher Ken Alibek claimed that the former Soviet Union experimented extensively with use of Ebola as a biological weapon, including a genetically engineered version combined with the smallpox virus to increase the degree of contagion and lethality.

The book *Executive Orders* by Tom Clancy describes an extensive bioterrorist attack on the United States via a newly discovered strain of Ebola (titularly the same strain that killed Mayinga) that propagates by air.

The book *Rainbow Six* by Tom Clancy describes a group of radical environmentalists that wants to rid the world of people who are destroying the environment. They use a modified version of Ebola that is estimated 99.999% virulent, leaving alive only one person in 10,000 who is infected, and they create a vaccine for the few thousand people who are chosen to live on Earth.

On the television show, *7 Days*, a government lab in Gettysburg, Pennsylvania had created a mutated, highly contagious, one hundred percent fatal form of the ebola virus for medical and vaccine research. A religious zealot steals a sample of the virus and releases it in the flight crew lounge in the Gettysburg International Airport, believing it to be the will of God to purge the world of the wicked. In less than a week, the virus infects over ninety eight percent of the world. Only through the actions of chrononaut Frank Parker and the Back Step crew is the event undone by traveling back in time seven days. This episode was called "The Gettysburg Virus".

In literature

Richard Preston's medical thriller *The Hot Zone* contains a dramatized account of the Ebola outbreak in Reston, Virginia.

Another piece of fictional work that dramatizes Ebola (in particular, Ebola Zaire Mayinga) is *Executive Orders* by Tom Clancy. In it, Iranian doctors replicate the virus, which they proved to be airborne. They unleashed the virus on the United States.

A modified version of the Ebola virus also appears in another Tom Clancy novel, *Rainbow Six*. The modified virus is slated for release at the Olympic Games, with the intent to kill every living person, save those who are extreme environmentalists.

In the *Doctor Who* spin off Ninth Doctor Adventures novel *Only Human*, a hospital is evacuated after authorities falsely claim that a patient has Ebola. The Ninth Doctor says that the cure to the disease is found in 2076.

In the *DC Universe*, a mutation of the virus was created by The Order Of Saint Dumas (those who created Azrael) and subsequently released by Ra's Al Ghul himself in Gotham City, causing the death of many citizens. This version is named Ebola Gulf-A and called "The Clench". Many years later, in a possible future (*Elseworlds'* book *Brotherhood of the Bat*) a new version of this virus is released by Ra's causing the death of the 99% of all humans. This new version is named Ebola Honduras.

The general concept of a highly infectious blood-borne haemorrhagic virus was used to horrifying effect in the 2002 movie *28 Days Later*, directed by Danny Boyle. Although the agent in *28 Days Later* was a fictional, engineered pathogen called "Rage", some parallels with Ebola are very evident.

In the video game Resident Evil the ebola virus is used to create the T-Virus.

A victim in an episode of CSI: Crime Scene Investigation is thought to be infected with Ebola, which turns out to be a false-positive.

Myths



The neutrality of this section is disputed.

Unfortunately, due to exaggerations in popular media, such as the book *The Hot Zone* and the film *Outbreak*, it can be difficult for non-virologists to separate fact from fiction, especially when the popular press compounds the problem by treating a highly dramatized story as if it were real.

Myth: The virus kills so fast that it has little time to spread. Victims die very soon after contact with the virus.

Reality: *The incubation time is actually 2-21 days²⁵. That means that you can be walking around with the virus for up to 3 weeks before you show any symptoms at all. The average time from onset of early symptoms to death varies but is usually around 8-10 days and sometimes up to 2 weeks.^[citation needed]*

Myth: The virus symptoms are horrifying beyond belief. Victims of Ebola suffer from squirting blood, liquifying flesh, zombie-like faces and dramatic projectile bloody vomiting.

Reality: *Only a tiny fraction of Ebola victims have severe bleeding that would be even somewhat dramatic to witness. Most of the bleeding is subtle, occurring internally. Ebola symptoms are usually limited to extreme exhaustion, a high fever, headaches and body pains.*

The following is an excerpt from Ed Regis's interview²¹ with Philippe Calain, M.D. Chief Epidemiologist, CDC Special Pathogens Branch, Kikwit 1995:

"At the end of the disease the patient does not look, from the outside, as horrible as you can read in some books. They are not melting. They are not full of blood. They're in shock, muscular shock. They are not unconscious, but you would say 'obtunded', dull, quiet, very tired. Very few were hemorrhaging. Hemorrhage is not the main symptom. Less than half of the patients had some kind of hemorrhage. But the ones that bled, died."

Although most people who have Ebola die, in many of the people who are infected with the virus, and live, the virus acts as an aphrodisiac-like sexual stimulant which scientists say is much more potent than cialis. In addition, it is obvious that unlike drugs like cialis, the sexual effects of Ebola are present in your body for life. Though the aphrodisiac-like nature of Ebola is most likely a myth, some top biological scientists still fully support this thesis.

Much of the exaggerated stories about ebola virus in Preston's book "The Hot Zone" are addressed and corrected in the book "Level 4: Virus Hunters of the CDC" (ISBN 1570362777) by Joe McCormick (an important and authoritative employee of the CDC at the time of the early outbreaks).

Black Death?

There are a group of Scientists who believe that the English Black Death was in fact a large epidemic of Ebola. This remains to be confirmed.

See also

- Marburg Hæmorrhagic fever, the first known filovirus disease
- Bolivian hæmorrhagic fever
- Crimean Congo hæmorrhagic fever (CCHF)

External links

- <http://www.journals.uchicago.edu/JID/journal/contents/v179nS1.html>
- <http://www.itg.be/ebola/ebola-06.htm>
- http://www.scripps.edu/newsandviews/e_20020114/ebola1.html
- <http://www.itg.be/ebola/ebola-12.htm>

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