

Ebolavirus: A Brief Introduction

Mr. Shyam Hari

*The author is Research Intern
at IDSA, New Delhi.*

Summary

This paper gives a short brief on Ebolavirus, which is becoming a point of concern for many around the globe. It recounts the advent of the disease, the timeline of attacks till 2014, areas affected, human fatality percentage and concludes by emphasizing on the need to eradicate the disease from the face of earth.

2^{1st} century scientific advancement in the healthcare sector seems to be helpless in front of a viral disease that is spreading terror in Africa and in the minds of global community. The terror factor is none other than the 'Ebola Virus Disease' which was once known as the 'Ebola haemorrhagic fever'.¹ It was discovered in 1976 during two coinciding outbreaks, in Democratic Republic of Congo and in Sudan.² 'Ebola Virus' got its name from Ebola, the headstream of Mongala River (tributary of former Zaire River, Presently Congo River) in Zaire (Presently Democratic Republic of Congo).³ The new viruses which were similar to Ebola also inherited the name which was initially used to describe the virus discovered in Zaire. Sometime in the early 2000 the name 'Ebola Virus' got contracted and became a genus by the name Ebolavirus.⁴ This name contraction did create confusion as the name 'Ebolavirus' refers to a genus in the Filoviridae family and 'Ebola Virus' is a species within the genus which is popularly known as 'Zaire Ebolavirus'.⁵

Virus Categories:

Ebolavirus is among the only three known viruses in the 'Filoviridae' virus family, the other two being the Marburgvirus and Cuevavirus.⁶ The virus is categorized into 5 distinct species based on their endemic nature, gene overlaps and genomic sequences.⁷ Below is the categorisation of the virus along with the region in which they are active.⁸

1. Bundibugyo Ebolavirus: Endemic to Republic of Uganda
2. Reston Ebolavirus: Endemic to Republic of the Philippines

3. Sudan Ebolavirus: Endemic to the Republic of Sudan and the Republic of Uganda
4. Tai Forest Ebolavirus: Endemic to Republic of Côte d'Ivoire/Ivory Coast
5. Zaire Ebolavirus or Ebola Virus: Endemic to Democratic Republic of the Congo, Gabonese Republic, and Republic of the Congo.⁹

Characteristics:

The virus is notorious for its contagious nature, fatality rate and for the absence of a cure vaccine.¹⁰ Ebolavirus causes severe immunosuppression and haemorrhagic fever; the body's blood vessels are damaged leading to multiple organ failure during the

infection.¹¹ Although several species of fruit bats are suspected to be the main intermediary host, the exact host of the virus is not known but majority of the cases are of infection of humans from primates and human to human transfers.¹² Aerosolized organisms in short doses are sufficient to cause human infection. The general incubation period of the virus is 4-9 days. It can survive in dry or liquid materials for a long time, which is also a cause for worry. The virus's infectious property can be preserved by freeze-drying or lyophilisation.¹³

Figure 1 highlights Sudan, Ebola and Reston species of the virus can be noted to have attacked the same location more than once. The 5 locations which reported the attack

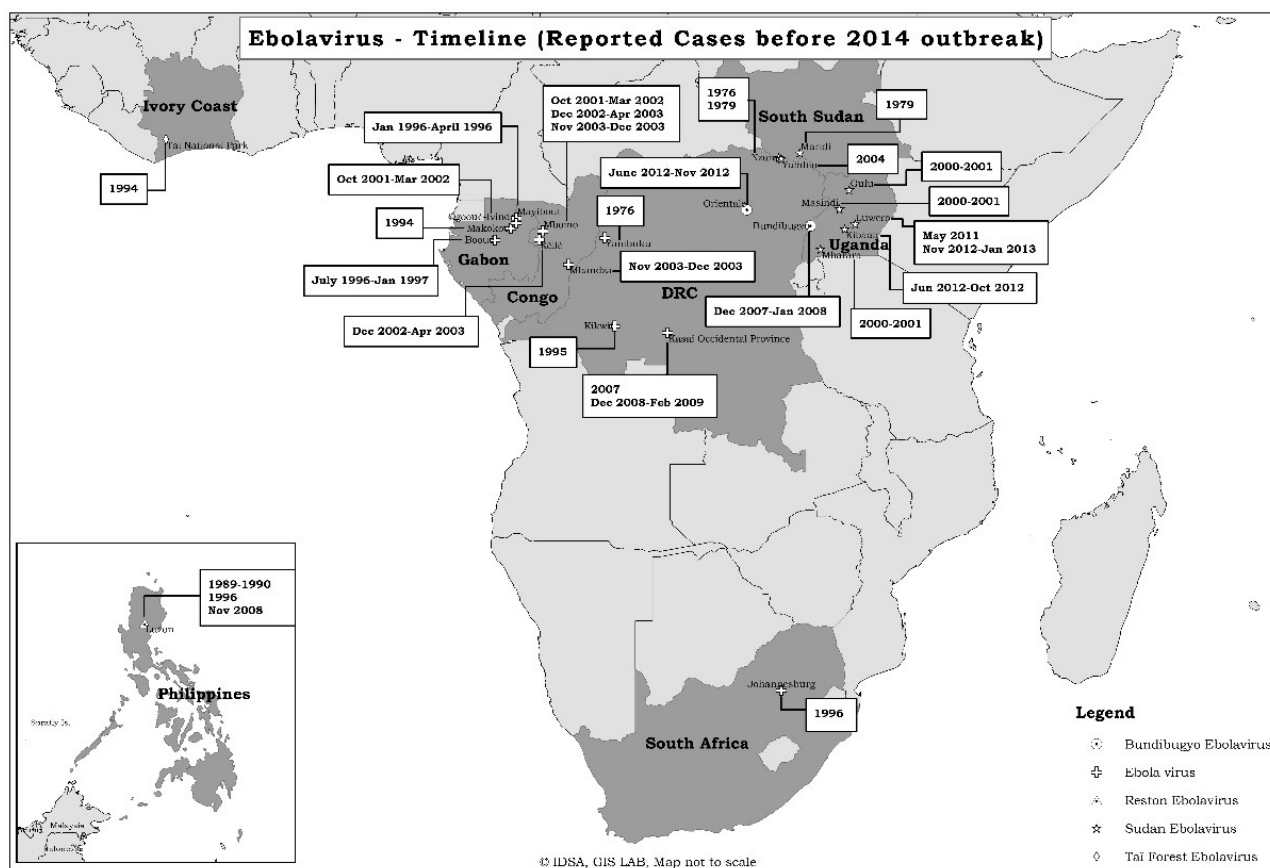


Figure 1: Timeline of the reported attacks of the distinct species of Ebolavirus before the 2014 outbreak¹⁴

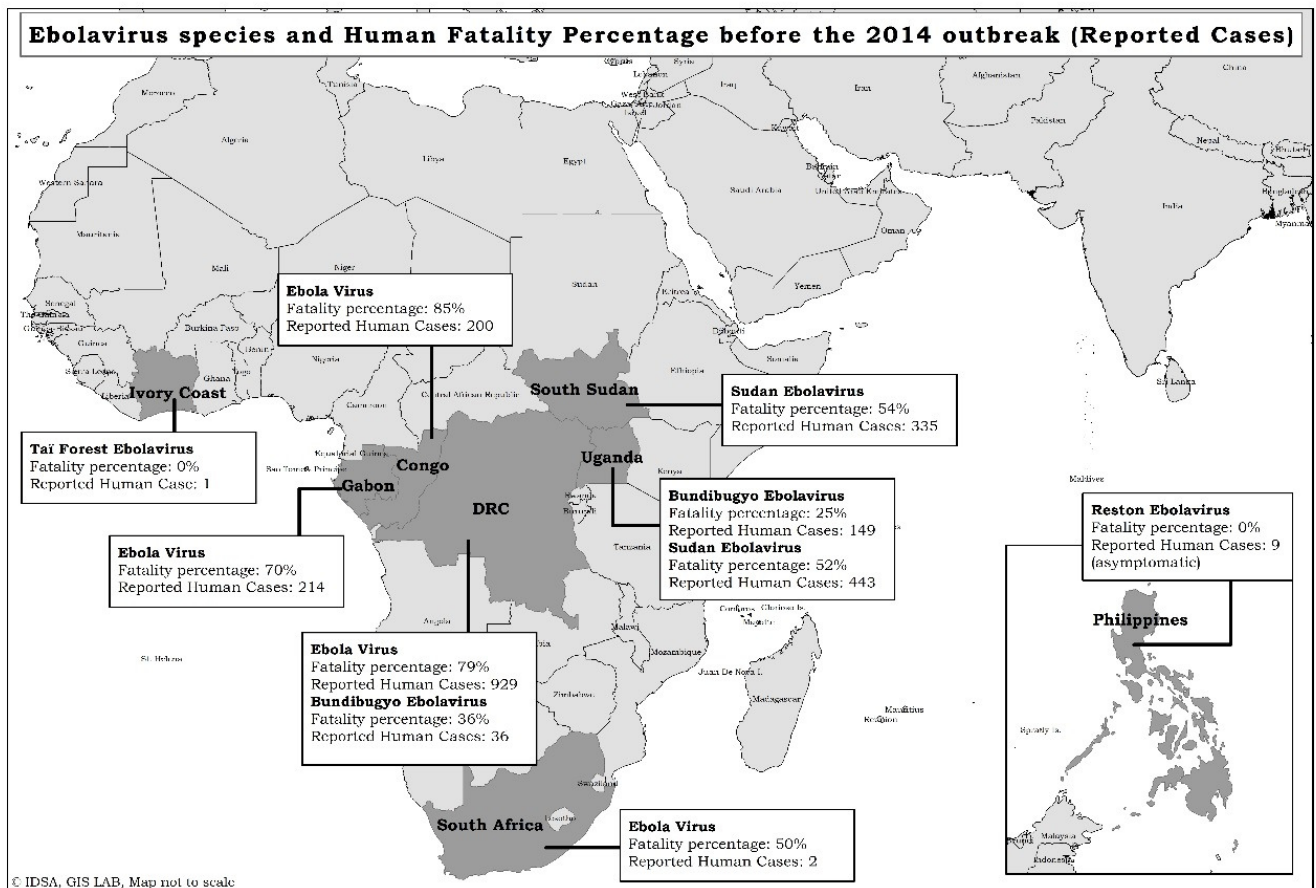


Figure 2: Human fatality percentage of the distinct species of Ebolavirus.

by the same species of virus although in different time periods are 'Kasai Occidental Province' in Democratic Republic of Congo, Mbomo in Republic of Congo, Luwero in Uganda, Nzara in South Sudan and Luzon in Philippines. It can also be seen that the same species of virus have attacked more than one location in the same time period. For example, Gulu, Masindi and Mbarara were affected during the 2000-2001 epidemics of Sudan Ebolavirus. with some other examples, but, it is thought-provoking to observe that different species of Ebolavirus attacks were reported in Orientale (DRC) and Kibaale (Uganda) during the same time period and so was the case in Tai National Park (Ivory Coast) and Makokou (Gabon).

The 2014 outbreak occurred in Guinea and Liberia where there was no prior history of

Ebola attacks. Ivory Coast, a neighbouring state of both Guinea and Liberia had an attack of Tai Forest Ebolavirus in 1994, but the recent attacks in Guinea and Liberia are by 'Ebola Virus' which is a different species from 'Tai Forest Ebolavirus'. This also does not leave a solid pattern to understand the spread of the virus.

It can be observed from figure 2 that 'Ebola Virus' had the maximum fatality percentage of 85% in Republic of Congo. Based on the reported cases, the average fatality percentage of Ebola Virus is 78%, Sudan Ebolavirus has an average fatality percentage of 53% and Bundibugyo Ebolavirus has a comparatively low fatality percentage of 27%. Reston and Tai Forest Ebolavirus have no human deaths out of the total 10 reported cases, in which some are

asymptomatic. The main culprit behind the deaths in 2014 outbreak in Guinea and Liberia is the ‘Ebola Virus’. The virus suppression had faced issues in Guinea because of mob attacks on virus containment centres due to anxiety and misinformation among people.¹⁵

Various studies explain how Ebola virus being a member of the ‘Filoviridae’ virus family is a “Category A” biological weapon.¹⁶ There are also some references that Aum Shinrikyo, the Japanese cult infamous for the 1995 chemical attack in Tokyo subway had sent their representatives to collect Ebolavirus samples in 1993.¹⁷ All the reasons mentioned so far cements the theory that Ebolavirus is a true fear factor. It may or may not be used as biological weapon but exercising caution would be a wise decision. The virus needs to be eradicated from the face of the biosphere as early as possible. Awareness, joint effort and cooperation among states and non-state bodies will be crucial to achieve this objective.

Endnotes:

- ¹ World Health Organization. “Ebola virus disease.” Accessed April 21, 2014. <http://www.who.int/mediacentre/factsheets/fs103/en/>.
- ² Ibid
- ³ Mentioned under ‘Zaire Ebola Virus’ in article by Kuhn, Jens H., Stephan Becker, Peter B. Jahrling, Et al. “Proposal for a revised taxonomy of the family Filoviridae: classification, names of taxa and viruses, and virus abbreviations.” National Center for Biotechnology Information. Accessed April 22, 2014. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3074192/>.
- ⁴ Racaniello, Vincent. “Is it Ebolavirus or Ebola virus?” Virology blog. Accessed April 22, 2014. <http://www.virology.ws/2012/08/07/is-it-ebolavirus-or-ebola-virus/>.
- ⁵ Ibid
- ⁶ International Committee on Taxonomy of Viruses (ICTV). “Virus Taxonomy 2011, Taxa Name Search: Ebola.” Accessed April 22, 2014. <http://ictvonline.org/virusTaxonomy.asp?version=2011>.
- ⁷ Kuhn, Jens H., Stephan Becker, Peter B. Jahrling, and Et al. “Proposal for a revised taxonomy of the family Filoviridae: classification, names of taxa and viruses, and virus abbreviations.” National Center for Biotechnology Information. Accessed April 22, 2014. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3074192/>. Ibid
- ⁸ Ibid
- ⁹ The name Ebola originated from Zaire as explained in the introduction paragraph. An official proposal from the US National Centre for Biotechnology Information aims to revise the taxonomy of the ‘Filoviridae’ family, whereby the name ‘Zaire Ebolavirus’ is to be reverted back to ‘Ebola Virus’.
- ¹⁰ Public Health Agency of Canada (PHAC). “Ebola virus - Pathogen Safety Data Sheets.” Accessed April 25, 2014. <http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/ebola-eng.php>.
- ¹¹ Ibid
- ¹² Refer the situation in the table, Centers for Disease Control and Prevention. “Outbreak Table, Ebola Hemorrhagic Fever.” Accessed April 22, 2014. <http://www.cdc.gov/vhf/ebola/resources/outbreak-table.html#eleven>.
- ¹³ Public Health Agency of Canada (PHAC). “Ebola virus - Pathogen Safety Data Sheets.” Accessed April 25, 2014. <http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/ebola-eng.php>.
- ¹⁴ Figure 1 and 2 are prepared using the detailed chronology of Ebolavirus attacks listed in the official website of the United States ‘Centers for Disease Control and Prevention’. The figures are prepared excluding the events post January 2014 and the 8 events reported at controlled laboratories/quarantine facilities, where the infection was either a clerical accident or was a contamination by ‘Reston Ebolavirus’ having its source traced back to Luzon, Philippines, from where the infected primates and pigs were imported has been marked in both the figures.

- ¹⁵ TIME. "Crowd Attacks Ebola Treatment Center in Guinea." Accessed April 26, 2014. <http://time.com/50628/crowd-attacks-ebola-treatment-center-in-guinea/>.
- ¹⁶ Bray, Mike. "Defense against filoviruses used as biological weapons." *Antiviral Research* 57 (2003) 53-60 <http://courses.washington.edu/eh451/articles/filoviruses.pdf>.
- ¹⁷ Fletcher, Holly. "Backgrounder: AumShinrikyo." Council on Foreign Relations. Accessed May 1, 2014. www.cfr.org/japan/aum-shinrikyo/p9238.