

# Top Outbreaks of 21st Century: A Review



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## Abstract

The Ebola virus (EBOV) was named after the Ebola River in the Democratic Republic of Congo (DRC) (previously Zaire). All afflicted nations reported a total of 27,741 EVD cases and 11,284 deaths as of July 22, 2015. Prior to the 2013-2016 EBOV epidemic, the number of confirmed human cases in EBOV outbreaks was very low, with no more than 425 cases each outbreak between 1976 and 2009, compared to an estimated 28,646 cases between 2013 and 2016. Monkey pox was initially found in 1958, when two outbreaks of a pox-like disease occurred in research colonies of monkeys, hence the name. SARS is predominantly a respiratory disease, with the maximum concentration of SARS-CoV found in the respiratory tract, though this virus is also identifiable in other organs and tissues, as well as in stool. COVID-19 affected almost all countries altogether and numerous innovative and developing technologies are mandatory to tackle various complications caused by the extent of the epidemic in the health organizations.

**Keywords:** Ebola; Monkey pox; SARS-CoV; COVID-19; Outbreaks

## Introduction

In the past, substantial populations in West Africa were impacted by the Ebola virus disease (EVD). The Ebola virus (EBOV) was named after the Ebola River in the Democratic Republic of Congo (DRC) (previously Zaire), which was the site of the first Ebola virus disease (EVD) outbreak in 1976 [1]. All afflicted nations reported a total of 27,741 EVD cases and 11,284 deaths as of July 22, 2015. In 1976, an outbreak of (EVD) was discovered. West African countries, particularly Guinea, Liberia, and Sierra Leone, have been experiencing the worst EVD pandemic in their history since March 2014. EVD epidemics have been reported virtually every year, with morbidity and case fatality rates ranging from 24% to 80%. The WHO declared the epidemic a Public Health Emergency of International Concern (PHEIC) on August 8, 2014, after the disease had spread swiftly from Guinea to neighbouring countries Sierra Leone and Liberia, resulting in an unprecedented number of cases and deaths. According to the WHO Ebola Response Team, based on data from 4507 probable and confirmed cases as of September 14, 2014, the number of infected individuals would increase from hundreds to thousands each week by November 2, 2014 if the global community did not respond with more effective methods to contain and control the disease [2]. Prior to the 2013-2016 EBOV epidemic, the number of confirmed human cases in EBOV outbreaks was very low, with no more than

425 cases each outbreak between 1976 and 2009, compared to an estimated 28,646 cases between 2013 and 2016 [3]. EBOV produced the greatest outbreak to date, which extended from Guinea to other Western African nations, resulting in 28,652 human infections and 11,325 deaths between late 2013 and early 2016. In addition to the Western African outbreak, a current outbreak in the Democratic Republic of the Congo's Ituri, Nord-Kivu, and Sud-Kivu provinces has resulted in 3,418 infections and 2240 deaths, making it the second greatest in terms of cases and deaths (as of 28 January 2020) [4].

## Virology

Viral hemorrhagic disease produced by previously unknown viruses, such as Marburg virus and Ebola virus, began to occur around 50 years ago. Within the genus Marburg virus, there is just one species of Marburg virus. The Marburg virus is the family's most dangerous virus, whereas the Ceuva virus, the family's third member, has only been found in bats native to Spain [5]. When viewed under an electron microscope, the viral particles appear to be long stretched filaments, with some particles curving into the shape of the number 6. EBOV, Sudan ebola virus (SUDV), Tai forest ebola virus (TAFV), Bundi bugyo ebola virus (BDBV), and Reston ebola virus (RESTV) are the five species of Ebola virus. Ebola virus

and Marburg virus are two of the three genera in the Filoviridae family. Cueva virus is the third genus in the Filoviridae family, and it does not appear to cause human disease. The Filoviridae family belongs to the Mono negavirales order [6]. The Filoviridae family includes the Ebola virus. The name comes from the Latin word "filum," which means "thread." The filamentous virus has a twisted thread-like appearance. Filoviridae viruses are RNA viruses with a negative strand. They are the most prevalent to infect people and primates, causing hemorrhagic fever, which is usually fatal [7].

### Symptoms

Patients with EVD usually appear after a 4-10 day incubation period, with a range of 2-21 days. After a sudden onset of flu-like symptoms (fever, myalgia, chills), as well as vomiting and diarrhoea, the disease can quickly deteriorate into a severe state with rapid clinical decline [8,9].

### Mode of Action of EBOV

There is a 2-21 day incubation phase after the virus infects the host (human/people). After penetrating the host cell membrane, the virus replicates through attaching to glycoprotein spikes and clathrin-mediated endocytosis. The virus then releases its nucleocapsid into the cytoplasm of the host cell, where it replicates [10].

### Treatment

When patients present with EVD-related symptoms and an Ebola virus exposure history, personnel in frontline facilities (e.g., hospital-based emergency departments, critical-access hospitals, and urgent-care clinics) should be trained to quickly detect and isolate patients, as well as notify local and state public health departments [11]. Patients who tested presumptively positive for EVD would have their samples forwarded to the CDC for confirmation testing [12]. Due to the high rates of fluid loss in the fulminant stages of the disease, patients with EVD become critically ill many days into their illness, necessitating high levels of supportive care, including extensive intravenous fluid resuscitation and electrolyte control [13,14]. A complete blood cell count, measurement of basic electrolyte levels, liver function tests, coagulation studies, blood cultures, urinalysis, and tests for the presence of other infectious diseases such as malaria and influenza are all recommended by the CDC for hospitals caring for a PUI and/or a patient with confirmed EVD [15].

### Monkey Pox

Monkey pox was initially found in 1958, when two outbreaks of a pox-like disease occurred in research colonies of monkeys, hence the name. During a period of increased effort to eradicate smallpox, the first human case of monkey pox was discovered in the Democratic Republic of Congo in 1970. Human cases of monkey pox have been documented in several Central and Western African nations since then.

### Cause

Monkey pox is a rare disease caused by an infection with the monkey pox virus. The monkey pox virus is a member of the Pox viridae family and belongs to the Ortho poxvirus genus. The Ortho poxvirus genus includes the Variola virus (which causes smallpox), vaccinia virus (which is used in the smallpox vaccine), and cowpox virus. Monkey pox was first found in 1958, The name was given after two outbreaks of a pox-like disease in monkey study colonies. The first human case of monkey pox was detected in the Democratic Republic of Congo in 1970, during a period of heightened efforts to eradicate smallpox. Monkey pox has been reported in humans in additional countries in Central and Western Africa since then. Outside of Africa, human monkey pox infections have only been reported six times: in the United States in 2003 (47 cases), the United Kingdom (3 cases) and Israel (1 case) in 2018, Singapore in 2019 (1 case), and the United Kingdom (3 cases) and the United States (1 case) in 2021.

Monkey pox's natural reservoir has yet to be discovered. African rodent species, on the other hand, are suspected of being involved in transmission. Monkey pox virus is divided into two genetic groupings (clades): Central African and West African. Human infections with the Central African monkey pox virus clade are often more severe and have a greater fatality rate than those with the West African virus clade. The Central African monkey pox virus has a well-documented person-to-person dissemination, but West African monkey pox has a restricted spread.

### Symptoms

Monkey pox symptoms in people are similar to, but less severe than, smallpox symptoms. Fever, headache, muscle aches, and tiredness are among symptoms of monkey pox. The fundamental distinction between smallpox and monkey pox symptoms is that monkey pox causes swollen lymph nodes (lymphadenopathy), but smallpox does not. Monkey pox has a 7-14 day incubation period (from infection to symptoms), although it can be as short as 5-21 days.

### The Disease Starts With

Fevers, Headache, Muscle pain, Backache, Lymph nodes swollen, Chills/Exhaustion, Rash is a general term for a variety of skin conditions. Acne is a term that refers to any sort of inflammation and/or discolouration that alters the skin's normal appearance. Rashes can be caused by fungal, bacterial, parasitic, or viral illnesses. Eczema, poison ivy, hives, and athlete's foot are all examples of common rashes. The patient develops a rash 1 to 3 days (sometimes longer) following the onset of fever, which usually starts on the face and spreads to other regions of the body.

### Before Falling Off, Lesions Go Through the Following Stages

Macules, Papules, Vesicles, Pustules, Scabs The disease lasts about 24 weeks on average. Monkey pox has been shown to kill up

to one out of every ten people who develop it in Africa.

### Transmission

The monkey pox virus is spread when a person comes into contact with it from an animal, another person, or contaminated materials. Broken skin, the respiratory tract, or mucous membranes are all places where the virus can enter the body (even if they are not apparent) (eyes, nose, or mouth). Bite or scratch, bush meat preparation, direct contact with bodily fluids or lesion material, or indirect contact with lesion material, such as through contaminated bedding, are all possible methods of animal-to-human transmission. Large respiratory droplets are assumed to be the primary mode of human-to-human transmission. Because respiratory droplets can only travel a few feet, it's critical to maintain continuous face-to-face contact. Human-to-human transmission pathways include direct contact with body fluids or lesion material, as well as indirect contact with lesion material, such as through contaminated clothing or linens.

Monkey pox's reservoir host (primary disease carrier) is unknown, while African rodents are thought to play a role in transmission. Only twice in nature has the virus that causes monkey pox been retrieved (isolated). The virus was first discovered in 1985 in the Equateur Region of the Democratic Republic of Congo, in an apparently unwell African rodent (rope squirrel). The virus was recovered from a deceased infant mangabey found in Cote d'Ivoire's Tai National Park in the second study (2012).

### Prevention

There are several steps that can be taken to avoid becoming infected with the monkey pox virus. Avoid coming into contact with animals that may be infected with the virus (including animals that are sick or that have been found dead in areas where monkey pox occurs), Avoid touching any objects that have come into contact with a sick animal, such as bedding, Separate infectious patients from those who could become infected, Wash your hands properly after coming into contact with infected animals or humans. Two examples are washing your hands with soap and water or using an alcohol-based hand sanitizer. Wear personal protection equipment when caring for patients (PPE).

### Treatment

Monkey pox virus infection presently has no effective or safe treatment. A monkey pox outbreak in the United States can be controlled with smallpox vaccine, antivirals, and vaccinia immune globulin (VIG). Coronaviruses belong to a family of viruses that cause animal and human diseases [16]. Seven coronaviruses can cause infection in people in the world but usually people get infected with these four human coronaviruses: NL63, 229E, HKU1 and OC43. They commonly cause a respiratory infection which ranges from the common cold to more severe diseases such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) and the most recently discovered

coronavirus (COVID-19) causes infectious disease [17]. This zoonotic illness caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The WHO originally called this infectious disease Novel Coronavirus-Infected Pneumonia (NCIP) and the virus had been named 2019 novel coronavirus (2019-nCoV). On 11th Feb 2020, the (WHO) officially renamed the clinical condition COVID-19. The pandemic of COVID-19 produced by the 2019 novel coronavirus (SARS-CoV-2) began in Wuhan, Hubei Province, China in December 2019, the current outbreak is officially an outbreak [18].

### SARS Coronavirus

The severe acute respiratory syndrome (SARS) is a fevered respiratory disease mostly spread by respiratory droplets or close personal contact. SARS is predominantly a respiratory disease, with the maximum concentration of SARS-CoV found in the respiratory tract, though this virus is also identifiable in other organs and tissues, as well as in stool [19]. A worldwide epidemic of SARS between March 2003 and July 2003 triggered over 8,000 confirmed cases and 774 deaths [20]. The causative pathogen has been recognized as a novel coronavirus [21]. The total of death rate during the epidemic was projected at 9.6% [22]. The prevailing clinical aspect of SARS is rapid with which many patients develop symptoms of acute respiratory distress syndrome. This complication occurred in approximately 16% of all patients with SARS, and when it occurred was associated with a mortality rate of 50% [23].

When the epidemic of SARS started, it was not recognized which treatments would reduce SARS-related ailment and deaths. Because the urgency of the international outbreak did not let time for effective studies, doctors in Canada and Hong Kong cured the earliest patients with intravenous ribavirin, which was based on its broad-spectrum antiviral activity. Corticosteroids and immunomodulating agents were frequently suggested empirically. Shortly after SARS-CoV was recognized as the relevant pathogen, antiviral screening platforms were started; these programs described numerous antiviral agents that inhibited SARS-CoV replication in vitro. These results directed to the experimental use of protease inhibitors and interferon alpha (IFN- $\alpha$ ) in the cure of patients [23].

Numerous viral and bacterial vaccine platform expertises have been used to encode S protein for SARS-CoV vaccine production. Monkeys vaccinated intranasally with parainfluenza that encodes the SARS-CoV S protein formed neutralizing antibodies and had considerably reduced viral residues in the respiratory tract after experiment [24]. Parainfluenza virus encoding the S protein was also protecting from SARS-CoV test. Recombinant adeno-associated virus encoding SARS-CoV S protein vaccine made SARS-CoV neutralizing antibodies, T-cell responses, and reduced viral titers and lung damage in mice. Intranasal administration led to IgA manufacture and better defense from SARS-CoV infection. Newcastle disease virus, an avian-tropic virus that shows restricted replication in primate respiratory tissues, was also used for SARS-

CoV vaccination. Monkeys vaccinated with Newcastle disease virus expressing S protein had up to 1000-fold fewer viruses in the lung tissue after SARS-CoV infection. A replication-defective vesicular stomatitis virus recombinant expressing the SARS-CoV S protein induced neutralizing antibodies and T-cell responses, and provided protection of immunized mice from SARS-CoV [25].

### COVID-19

The outbreak of a distinctive and person-to-person communicable pathogen which produced severe acute respiratory syndrome coronavirus 2 (SARS-COV-2) was first informed in Wuhan City, Hubei province, China in December 2019 [26]. Later on, the pathogen was recognized as novel coronavirus 2019-nCoV, which is renamed to COVID-19. Ongoing epidemic of COVID-19 lasts reducing the global population and astounded health organizations worldwide. Internationally, the medical industry continues to be overwhelmed by the COVID-19 pandemic as cases increases exponentially. As of August 10, 2021, there were about 204,469,679 people infected with COVID-19 and 4,322,202 deaths worldwide [17]. There has been confusion on how COVID-19 is spread in people without symptoms irrespective of WHO recommendations. Due to increasing number of COVID-19 cases, the World Health Organization (WHO) announced a public health emergency in February, 2020, which led to the closing of unnecessary facilities, schools, travelling limitations and recursive national lockdowns [16]. These precarious measures are severely affected with limited information on how COVID-19 spreads during the incubation period especially in people without symptoms. Some scholars stated that COVID-19 could be spread through contact, droplets, fomite, airborne, blood borne, mother-to-child, fecal-oral, and animal-to-human spread [27]. The lack of trustworthy evidence on how COVID-19 is transferred fluctuates from area to area which has caused harmful effects on world economies, education, businesses and health structures worldwide.

The virus is usually quickly spread from one individual to another via respiratory droplets formed during coughing and sneezing. It is reported most contagious when individuals are symptomatic, although transmission may be possible before symptoms show in patients. Time from contact and symptom onset is usually between two and 14 days, with an average of five days. Common symptoms include temperature, cough, sneezing and rapid breath. Severities may include pneumonia, throat pain and acute respiratory distress syndrome.

Covid-19 vaccines that produce immune responses that is protective and important for preventing in addition its decrease the Covid-19 infection-related death rates. Live-attenuated and killed (Inactivated) immunization Various SARS-CoV-2 vaccine types, nucleic acid, killed or inactivated, recombinant subunit, adenovirus-based vector vaccines are among the vaccines currently being produced to control on coronavirus

19 [28]. AstraZeneca and Oxford University have developed an adenovirus-vectored experimental vaccine for chimpanzees against SARS-CoV-2 glycoprotein spikes. Vaccine by Moderna is also called mRNA-1273. This vaccine is a novel nucleoside-modified, messenger RNA vaccine that encodes a membrane-anchored, full-length SARS-CoV-2 spike protein with two-point mutation proline swaps to specially lock the protein in an antigenic perfusion conformation. COVID-19 vaccines based on mRNA have also been formed by Pfizer and BioNtech. Pfizer is lipid nanoparticle-formulated, nucleoside-modified mRNA vaccine; prompt RBD-binding IgG and neutralizing antibodies with mainly mild side effects. Johnson Pharmaceutical Companies have initiated with the Ad26- SARS coronavirus vaccine, which states glycoprotein spikes form (replication-defective vaccine). The Chinese company "CanSino" has produce anew COVID-19 vaccine created adenovirus recombinant serotype 5-vectored vaccine that expresses the whole spike glycoprotein for SARS-CoV-2 that also called Wuhan-Hu-1 virus strain. Biotech Sinovac is vaccine for coronavirus and was chemically deactivated entire virus induction that is given in 2 doses 28 days apart. Sino pharm has manufactured and is assessing two alum-adjutant inactivated whole-virus vaccines. Wuhan Institution of Biological Products is a Wuhan-based research institute.

### Discussion and Conclusion

COVID-19 affected almost all countries altogether and numerous innovative and developing technologies are mandatory to tackle various complications caused by the extent of the epidemic in the health organizations. COVID-19 is severe in states that experience a great deficiency of reverse transcription-polymerase chain reaction (RT-PCR) COVID-19 testing kit, screening, detection, and tracking tools which raise the hazards of spreading the disease. Entirely, social distancing, regular temperature testing, hands sanitization, wearing of nose and face mask, as well as hand washing, have been applied as intrusions to fight the extent of COVID-19 but the main challenge lies on the poor health-care schemes, overcrowding, financial burden, community behavior, poverty, and COVID-19 preparedness and response [29].

All afflicted nations reported a total of 27,741 EVD cases and 11,284 deaths as of July 22, 2015. In 1976, an outbreak of (EVD) was discovered. West African countries, particularly Guinea, Liberia, and Sierra Leone, have been experiencing the worst EVD pandemic in their history since March 2014 The monkey pox virus is spread when a person comes into contact with it from an animal, another person, or contaminated materials. Broken skin, the respiratory tract, or mucous membranes are all places where the virus can enter the body (even if they are not apparent) (eyes, nose, or mouth). Hence, most of the outbreaks are emerged through any kind of virus and the disease remains until you be vaccinated [30-36].

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