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Covid-19 And Ebola: Deadly Viruses Threatening The World

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***ASTRACT*:** The destructive effects of these newly developing infectious illnesses on public health systems, economics, and global health are highlighted by the COVID-19 pandemic and EVD. Despite being viral infections, they differ in terms of epidemiology, clinical appearance, and mode of transmission. In contrast to the Ebola virus, which is spread by direct contact with infected human or animal bodily fluids and causes an acute hemorrhagic fever with high mortality rates, COVID-19 droplet infection has caused a pandemic situation worldwide. Because COVID-19 will continue to be endemic, next-generation vaccine development, genomic surveillance, and booster vaccination campaigns will be necessary. Long COVID is still a huge challenge with economic implications. As preventive measures, we have vaccines, improved ventilation, and adaptable public health strategies.

Keywords: **Emerging infectious diseases, global health, economies, public health systems, viral infections, transmission, epidemiology, global pandemic, acute hemorrhagic fever, endemic phase, booster vaccines, genomic surveillance, preventive measures, vaccination, and public health strategies**.

INTRODUCTION

well-being in one quick swoop[1]. Out of all such outbreaks, COVID-19 and the Ebola virus are perhaps the most widespread Emerging infectious diseases threaten global health by crippling the Public Health system, economy, and human with the least point of origin in modern history [2]. The commonality between the two: they're both viral pathogens; however, they differ with respect to transmission routes, clinical features, and epidemiological characteristics [3].

COVID-19 emerged in late 2019 in Wuhan, China, SARS-CoV-2 is the infectious agent that causes it, and it rapidly escalated into a full-blown pandemic [4]. The disease varies on a spectrum from mild respiratory illness to acute febrile illness with severe pneumonia and multiple organ failure [5]. The high transmissibility of COVID-19, combined with asymptomatic carries-the driving force behind the uncontrolled outbreaks[6], while at the same time incurring staggering management cost, valuing public health's credibility through accelerated vaccine development and public mobilization[7].

EVD, on the other hand, is a virus infection that originated from the known family of viral pathogens called Filoviridae [8]. It was established in the 1970-1977 era bursting into the knowledge of the scientific community

after several outbreaks that took place in sub-Saharan Africa near the bank of an ebela river in central Africa [9]. Unlike COVID-19, Direct contact with an infected person's infectious bodily fluids or surface contamination involving those fluids are the two ways that EVD is spread[10].Acute onset, headache, muscle soreness, sore throat, exhaustion, and diarrhea are the symptoms of charmed fever [11]. Death arising fromaEVD infection may occur due to an acute hemorrhagic fever with generally quite high mortality rates unless treated. Infectious Ebola, although not nearly as contagious as COVID-19, remains a significant public health challenge owing to the great fatality rates and difficulties they bring about in preventing outbreaks[12].

IMPORTANCE OF STUDYING EBOLA AND COVID 19:

Ebola and COVID-19 have provided unique lessons on health interventions and future preparedness efforts for similar outbreaks[13].Apart from having a different biology, they have left grim imprints on the health and social fronts[14].

Through the ages, the realm of biology and pathophysiology of all species has developed with insights from studies undertaking to unravel the various road maps and mechanisms of infection of Ebola and COVID-19[15]. All this information is expected to come in handy in developing an immune-based remedy and help find useful attributes for assessing the relative contribution of Ebola to morbidity as well as the spatial distribution of COVID-19 in relation to modes of transmission and perhaps immune responses[16].

The most fundamental foundation for a set of procedures aimed at ensuring that instances and responses are reported accurately and promptly is surveillance[17]. The incessant refrains have called for global surveillance, ushering in an evolutionary change in sharing information towards a fourth approach of pandemic preparedness[18].

The Finnish Institute of Health and Welfare surmises mRNA vaccine and rVSV-ZEBOV Ebola have sped up the flow of vaccine development[19]. All these modern vaccines, antimicrobials, and breakthrough research are considered points in the outbreak for an utter decimation of hardship[20].

Public health strategies: hence, the two diseases have been pretty much accepted as exemplary offers for grounding a coordinated response in stark contrast to each other[21]. Most importantly, the models of response that were employed were those that would have led to the initiation of ring vaccination, contact tracing[22], and quarantines, in opposition to those that should have been employed to counter COVID-19[23], which embraced global solidarity and began reinstating various forms of normalcy into health approaches[24].

VIROLOGY OF COVID-19:

The largest group of viruses in the Nidovirales order, which comprises the Coronaviridae, Arteriviridae, and Roniviridae families, are called coronaviruses (CoVs).[25].Within the Coronaviridae family, there are two subfamilies: the Coronavirinae and the Torovirinae. [26].Alpha, beta, gamma, and delta coronaviruses are the four groups into which the coronavirinae are further split. [27]. Originally grouped according to serology, the viruses are now separated by phylogenetic grouping.[28].The Gammacoronavirus infects birds, whereas viruses in the genera Alphacoronaviruses and Betacoronaviruses primarily infect mammals.[29]The Deltacoronavirus genus members have been discovered in both avian and mammalian hosts. [30].

Seven human coronaviruses have been identified in total, including the beta-coronavirus SARS-CoV-2, the alpha-coronavirus 229E and NL-63, and the beta-coronavirus HKUL and OC43-SARS-MERS. [31].The enveloped ribonucleic acid (RNA) genome of the coronavirus COVID-19 is 29.8 k[32]. There are 14 Open Reading Frames (ORF) in the virus's genome, which encode 27 proteins[33].The new coronavirus genome in some areas is significantly different from the SARS coronavirus genome [34].For instance, the SARS coronavirus has protein 8a, while the novel SARS-CoV-2 coronavirus does not[35].According to phylogenetic study, the two bat SARS-like coronaviruses, bat-SL-COVZC45 and bat-SL-COVZXC21, and the new SARS-CoV-2 coronavirus have a close relationship (88–89%), whereas the MERS coronovirus (about 50%) and the SARS coronovirus (almost 79%) are less simila [36].

Furthermore, 99% of the nucleotide similarities between the new SARS-CoV-2 coronavirus and the coronaviruses isolated from the anteater[37]. Consequently, the likelihood of transmission from the anteater to humans as the intermediate host appears to be high[38]is not just bats. Coronaviruses'surface spike (S) glycoproteins are essential for attaching to cell surface receptors and controlling tissue orientation[39]. Additionally, recent research has demonstrated that the novel SARS-CoV-2 coronavirus enters cells by using the angiotensin-converting enzyme type 2 receptor[40].

EPIDEMIOLOGY OF COVID-19:

The spread, distribution, and calculation of the incidence among the different groups are the focus of COVID-19 epidemiology. Here is a brief assessment[41]. The causative agent of COVID-19, SARS-CoV-2, is a recently isolated coronavirus strain that was initially discovered in Wuhan, China, in December 2019[42].It is primarily transmitted by respiratory droplets released by infected people when they cough, sneeze, or speak[43]. While aerosol transmission in close-contact situations has also been recorded, other evidence indicates that the virus can be transmitted by contact with contaminated surfaces-but this is considered to be rare[44]. The incubation period for the virus is usually two to fourteen days, with an average of about four to five days for symptoms to develop in most patients[45].

Clinical presentation of COVID-19 is a vast spectrum, with mild symptoms of low-grade fever and cough to severe symptoms involving pneumonia or ARDS[46]. Many more may be asymptomatic yet able to transmit the disease to others[47].Older age and the existence of long-term underlying diseases including diabetes, heart disease, lung illnesses, or a compromised immune system are risk factors for severe disease [48]. COVID-19 impacted the world exceedingly, with the pandemic's vast loss of lives and many healthcare systems being overwhelmed in various regions[49]. The virus continued to mutate, whereby many new variants, Delta and Omicron being prominent examples, culminated in the bulk of cases being reported in subsequent waves of the pandemic[50].

Preventive approaches for COVID-19 largely revolved around vaccination, masking, social distancing, hand hygiene, and routine testing[51]. Accordingly, it has been demonstrated that vaccination considerably lowers the incidence of fatalities and the severity of illness[52]. Nevertheless, the unpredictable emergence of variants continues to prove challenging to control efforts worldwide[53].World real-time epidemiological data is collected to keep track of the ongoing situation[54].With this knowledge, the virus's chain of transmission, the appearance and dissemination of novel varieties, and the effectiveness of immunization will all be clarified[55].This information is then used to adapt public health strategies in real time according to current findings and trends in perspective case numbers, transmission rates, and other desirable outcomes[56].

VIROLOGY OF EBOLA VIRUS:

Very pathogenic viruses like the Ebola virus have a family in Filoviridae and are close to Marburg virus[57]. Innumerable deadly outbreaks among humans were caused by this virus especially in Africa with a distinctive feature of a very high incidence of mortality associated with it[58]. Ebola virus is an enveloped filamentous virus, under microscope appearance showing long, thread-like structures[59]. About 19 kb of single-stranded, negative sense RNA make up the genome, which encodes various proteins necessary for replication and, consequently, the development of disease in the host[60]. The lipid bilayer membrane that envelops the virus is derived from the membrane of the host cell[61]. Glycoproteins (GP), which are present in this envelope, are necessary for the virus to enter host cells[62]. These glycoproteins interact with cell surface receptors such as NPC1 (Niemann-Pick C1) to initiate the viral entry process[63].

When the virus attaches itself to a host cell through GP-receptor contact, the replication cycle begins[64]. The process of endocytosis is how this internalization takes place. When the endosome becomes acidic, the viral envelope fuses with the host cell membrane, releasing its RNA cargo into the cytoplasm[65]. The host RNA polymerase machinery transcribes and translates the viral RNA, which then releases the viral mRNA and proteins[66]. The viral genome is replicated for production of more genomes, and new particles are assembled out from the cytoplasm, which will be packaged and transported to the cell surface for budding where they will take part of the host cell membrane with them[67].

Most important would be that Ebola can evade host immune system, one of the mechanisms by which it does this is interferon inhibition[68]. The state of immunosuppression potently tends to give rise to the so-called "cytokine storm" phenomenon, where the immune system bombards the body with huge volumes of inflammatory cytokines[69]. Such things lead to extensive damages of tissues, organ failure, and finally death. Important viral proteins are glycoprotein (GP), required for virus entry and fusion of cells to form a multinucleated cell called syncytia[70]; L (RNA-dependent RNA polymerase), which is in charge of transcription and replication of the viral genome; VP40, which assembles and budding viral particles; and NP (nucleoprotein), which coencapsulates the viral RNA genome[71].

Direct contact with infected human or animal bodily fluids—such as blood, saliva, vomit, or feces—can spread the virus [72]. The average onset of symptoms for Ebola virus disease (EVD) after exposure is from 2 to 21 days: Fever, fatigue, and muscle aches by sore throat[73]; and in some situations, internal and external bleeding happens, along with nausea, vomiting, diarrhea, rashes, and liver and renal malfunction[74]. Advanced care may result in serious side effects such hemorrhagic shock and multi-organ failure, which have a 25–90% death rate[75].

Fruit bats are thought to be the vectors of zoonoses, which are spread from animals to people through meat intake or contact (sometimes inhalation) with diseased humans[76]. This kind of infection can spread from person to person through direct contact with bodily fluids, contaminated objects, needles, or other items like hands[77].

No specific antiviral treatment is available for Ebola; however, supportive care, such as rehydration, electrolyte replacement, and treatment of secondary infections would be beneficial in improving survival rates[77]. rVSV-ZEBOV vaccine which depends on The Ebola virus glycoprotein is expressed by a recombinant vesicular stomatitis virus is one such therapeutic development for the prevention of infection[78]. Preventive measures in health care such as strict isolation of infected persons and personal protective equipment (PPE) are also important[79].Even with preventive vaccination of high-risk populations, the Ebola virus still remains a public health risk in endemic countries[80]. Because of its outbreak potential, constant surveillance and preparedness are necessary[81]. The lethality associated with Ebola imparts a dangerous profile, and the present research is aimed toward developing better therapeutics and vaccine options against the virus[82].

EPIDEMIOLOGY OF EBOLA VIRUS :

The epidemiology of Ebola virus describes the study of its transmission pathways, geographical distribution, the influence of the outbreak, and the public health consequences following the outbreak[83]. The virus exists primarily in its endemic regions in sub-Saharan Africa: Guinea, Liberia, Sierra Leone, the DRC, and Uganda, where wildlife hosts that are mainly fruit bats act as major reservoirs[84]. There have been a few isolated outbreaks, the biggest of which took place in Guinea, Liberia, and Sierra Leone in West Africa between 2014 and 2016 and claimed over 28,000 lives[85]. Human-to-human transmission of this virus happens by direct contact with blood and bodily fluids like saliva, vomit, and feces of certain infected individuals, but it is spread as a zoonotic disease[86]. This puts an extra burden on the healthcare worker and/or family members, especially while working under poor infection control conditions[87]. The virus can also survive for a few days on contaminated surfaces and there arise chances of being indirectly transmitted[88].

The incubation period may vary from two to twenty-one days, and this means that transmission of the virus can occur once symptoms start appearing in an infected individual[89]. Exposure to infected animals, intimate contact with an infected individual, and inadequate healthcare infrastructure are risk factors[90]. Ebola outbreaks are more frequent in areas with a lot of human-wildlife interactions, often very low in healthcare capacity[91]. Though outbreaks may occur in urban and rural settings, higher cases would be expected in the DRC and other regions of central Africa[92].

The virus has a high mortality rate that varies between 25% and 90% based on severity and/or availability of health answers during the outbreak[93].Between 2014 and 2016, the West Africa outbreak was thought to have a case fatality rate (CFR) of roughly 40%[94]. The vaccination intervention using the rVSV-ZEBOV vaccine, stringent isolation, the use of personal protective equipment, and surveillance techniques like contact tracing all played a significant role in the control of the Ebola virus[95]. Despite efforts to control the virus, the

zoonotic character of Ebola, recurrent outbreaks, and the potential to spread across borders with travel, make it an emerging threat[96]. The possibility of a worldwide public health impact became evident with the global spread of cases similar to those in the U.S. and Europe during the 2014 outbreak[97]. Vigilance through research, surveillance, and preparedness is required to avert any further outbreaks as their control relies principally on rapid detection, quarantine, and international collaboration[98]. Though the incidence of major outbreaks has declined, Ebola remains a continuing threat, mainly in areas with a feeble healthcare framework[99].

MECHANISMS OF INFECTION AND DISEASE PROGRESSION OF COVID 19:

Entry into the Body:

Transmission: When an infected person breathes, speaks, coughs, or sneezes, respiratory droplets are the primary way that the virus spreads. Additionally, it can spread by contact with aerosols and contaminated surfaces (fomites), especially indoors[100].

Initial Site of Infection: The upper respiratory tract (nose, throat, and sinuses) is where the virus mainly enters the body, but if the illness worsens, it can also travel to the lower respiratory tract (lungs).

Virus Entry into Host Cells:

ACE2 Receptor and SARS-CoV-2 Spike Protein: By attaching its spike (S) protein to the angiotensin-converting enzyme 2 (ACE2) receptor found on the surface of host cells, especially in the blood vessels, lungs, and respiratory epithelium, SARS-CoV-2 enters human cells [101].

By binding to ACE2, the virus's spike protein (S) enables the virus to enter the host cell by endocytosis or membrane fusion.TMPRSS2 (Protease) Spike protein activation, which facilitates virus entrance, depends on the host cell TMPRSS2 enzyme [102].

Replication and Spread: The virus releases its RNA genome into the cytoplasm of the host cell after entering it. The viral genome is then replicated to create other viral genomes once the viral RNA is converted into viral proteins [103].The virus spreads to nearby cells and tissues once the host cell ruptures and releases the newly constructed viral particles.The lungs and upper respiratory tract, as well as perhaps other organs like the heart, kidneys, intestines, and brain, can experience this duplication [104].

Immune Response Activation:

Innate Immunity:The body's first line of defense is the innate immune response, which is triggered when cells like neutrophils, dendritic cells, and macrophages detect viral RNA.Interferons get released that signal nearby cells to ramp up their antiviral defenses.But SARS-CoV-2 can suppress certain immune pathways, leading to unchecked viral replication in some people.This leads to the type of immune response termed adaptive immunity: Over days to weeks, The immune system creates antibodies that attach to the virus and activates T cells, including helper and cytotoxic T cells. These reactions aid in containing and getting rid of the pathogen[105].

Disease Progression:Mild to Moderate Disease:The majority of people, especially younger, healthy individuals, will experience a minor case, which includes fever, coughing, loss of taste or smell, exhaustion, and body aches. The immune system can usually wipe out the virus.

Severe Disease: In some people,COVID-19 can progress to more serious illness, particularly in older adults and those with underlying medical disorders (such as heart disease, diabetes, or obesity).

Viral Pneumonia: The infection may get into the lungs, causing inflammation and pneumonia, which can cause difficulty breathing and lead to low blood oxygen levels.

The severity of acute respiratory distress syndrome (ARDS), pneumonia, particularly in the context of a viral illness such as COVID-19, may progress to ARDS, a condition where the lungs become stiff and filled with fluid, resulting in a failure of gas exchange and often requiring mechanical ventilation.

Cytokine Storm: In some people,A cytokine storm, or exaggerated immune response, happens when too many and/or too powerful immunological signals (cytokines) are generated, leading to extensive inflammation and damage to many organs (lung, blood vessels, heart, kidney, etc.).

Thrombosis (Blood Clots): There have been reports of blood clots (thrombosis) in COVID-19 patients, which are associated with hypercoagulability (increased clotting) and a higher risk of stroke, pulmonary embolism, deep vein thrombosis (DVT), and other clotting diseases[106].

MECHANISMS OF INFECTION AND DISEASE PROGRESSION OF EBOLA VIRUS :

Ebola virus disease (EVD), a serious and potentially lethal illness, is caused by the Ebola virus (EBOV), a highly pathogenic viral type that belongs to the Filoviridae family. Disease development and infection are intricate processes that may require multiple steps.(e.g., cell entry, immune evasion, widespread tissue damage) . Here's a brief overview of the steps involved:

How It Spreads and How It Gets Inside Your Body:

Transmission: The virus that causes Ebola spreads through direct contact with the blood or other bodily fluids (for example, vomit, diarrhea, sweat, saliva, semen) of an infected human or animal. It can also spread through contaminated surfaces or objects.

Entry: The virus sweeps into the body via mucous membranes (the lining that covers the eyes, nose and mouth), through broken skin or through the inhalation of aerosolized particles.

Entering Host Cells Virally:

Ebola GP initiates cellular entrance by binding to host cells. On the surface of host cells, the GP binds to certain receptors such as NPC1 (Niemann-Pick C1) and DC-SIGN (dendritic cell-specific intercellular adhesion molecule-3 grabbing nonintegrin).

Endocytosis: The virus is absorbed into an endosome after cell attachment. The virus's lipid envelope fuses with the endosomal membrane due to the low pH conditions inside the endosome, allowing the viral DNA to enter the cytoplasm of the host cell.

Viral assembly and egress:

Genome: Negative perception genome of single-stranded RNA The viral RNA-dependent RNA polymerase (L protein) converts the virus's RNA genome into positive-sense RNA once it has entered the host cell. (that can be translated to produce viral proteins).

Replication: Replication of viral RNA to a new viral genome in the cytoplasm of the host cell The next stage is to take over the machinery of the host cell, which is employed to create and assemble new viral proteins.

NP Viral proteins: The viruses encode many proteins that are involved in several aspects of the viral replication, assembly process, namely the nucleoprotein (NP), VP40, VP35, VP24, and glycoprotein (GP).

Immune Evasion and Spread:

This is a Section of Evasion of the Immune System: Ebola virus mutates. Such mechanisms include inhibition of interferon (IFN) , production need to activate the innate immune system. The virus also suppresses immune cells, such as dendritic and macrophage cells from properly presenting viral antigens, preventing the body from mounting an adaptive immune response.

Continual Spread to New Tissue & Organ (by Fusion) Areas: Infected cells undergo viral replication, and newly generated viral particles are extruded out of cell, typically resulting cell death. The virus is present in the blood (viremia) that infects macrophages, Hepatocytes (liver cells), endothelial cells (blood vessel lining cells), and immunological cells.. This common infection resulting in multiorgan involvement[107].

Disease Course and Symptoms :

Incubation Period:8–10 days on average, but 2–21 days; the period from exposure to when symptoms aretherange.

Early Symptoms like Fever, tiredness, muscle aches, headache, sore throat and weakness are early symptoms. Such early symptoms, which are also seen with other viral infections, can delay [108].

SYMPTOMS OF COVID-19:

symptoms of COVID-19 can be mild, moderate, or serious and can appear 2-14 days after the infection. The following are some common symptoms:

1. Chills or fever
2. Cough (mostly dry)
3. Inability to breathe or trouble breathing
4. Weariness
5. Pain in the muscles or body
6. A headache
7. Sore throat
8. Loss of taste or smell perception (rarely symptomatic)
9. Coolness or runniness in the nose
10. Vomiting or feeling queasy
11. Having diarrhea[109].

SYMPTOMS OF EBOLA VIRUS:

Symptoms can develop 2 to 21 days from time of exposure, with most cases being 8-10 days. Early symptoms resemble many other viral infections and may include:

1. A fever
2. Weariness
3. Headache
4. Pain in the muscles
5. A sore throat
6. Vomiting
7. Diarrhea
8. Abdominal pain.

As the disease progresses, symptoms become more severe. These may include: 1. Rash 2. Internal bleeding, which may come from the gums or nose or appear in stools and vomit 3. External bleeding, such as from injection sites and cuts 4. Organ failure, particularly liver and kidney failure[110].

DIAGNOSTIC METHODS FOR COVID-19:

1. PCR:PCR tests are divided into molecular tests, which include the following: PCR, or polymerase chain reaction, is the most popular and reliable form of diagnosis for COVID-19 as it detects the viral RNA and considered as the gold standard. Usually, samples are collected by swabbing from the nose or throat. One type of PCR is reverse transcription (RT-PCR) modified PCR technique that serves to identify genetic material of the virus. Results usually take a couple of hours to a few days.

2. Antigen Tests: A rapid test that is designed to identify the virion surface proteins or antigens. A speedier test than PCR (usually it takes about 15-30 minutes to process a result) but less sensitive, particularly in symptom-free patients, and could also fail to detect early-stage infections. Most often, there are the point-of-care tests or screenings but negative results in the presence of symptoms will need to validate by PCR[111]. .

3. Molecular Testing (CRISPR-based tests): The newer experimental test types are employing the CRISPR technology to serve as viral genetic material detectors. They were quicker and had results in less than an hour, but very few tests are yet being approved to be out in widespread use. 5. Chest Imaging (CT Scan/X-ray): Chest image: CT scan or X-ray may be used to show abnormalities in the lungs that are indicative of COVID-19, for example, pneumonia or ARDS; however, it is not a primary diagnostic tool. It may be used, however, in severity assessments and complication evaluations[112].

DIAGNOSTIC METHODS FOR EBOLA VIRUS:

1.Polymerase Chain Reaction (PCR) Test:The Reverse Transcription Polymerase Chain Reaction known as RT-PCR serves as a diagnostic test whereby the most common application of this test is detecting Ebola virus, wherein it extracts viral RNA from blood or saliva or any other form of bodily fluid. It provides high sensitivity and specificity results, thus being considered the gold standard for testing of Ebola.

2.Antigen-Capture Enzyme-Linked Immunosorbent Assay (ELISA):It can identify Ebola antigens in blood or tissue samples. It is usually done field-wise for rapid detection. ELISA is very specific, and results are available in a few hours.

3.Virus Isolation:Virus isolation is the technique by which the virus is grown in a cell culture from the sample from the patient. This technique is very accurate but slow and requires a very specialized laboratory, hence not commonly used for rapid diagnosis[113].

4.Complete Blood Count (CBC) and Other Blood Tests:Blood tests do not diagnose without further assistance but together are suggestive-e.g., both a low platelet count and low white blood cells are indicators for the diagnosis of Ebola. There can also be deranged liver and renal function tests indicative of Ebola infection[114].

PUBLIC HEALTH INTERVENTIONS FOR COVID-19:

1. Testing and Surveillance: The symptomatic and asymptomatic do undergo testing in the general population for case identification and isolation. Heightened surveillance is activated for the purposes of identifying the transmission of the virus, tracking variants, and managing newly emerging outbreaks.

2. Vaccination Campaigns: In order to lessen the virus's intensity and spread, as many people as possible should develop herd immunity, mass vaccinations would be carried out. The major target of these campaigns would be health-care providers, the elderly, and people with other comorbidities.

3. Quarantine and Isolation: It means taking care of infected individuals in such a manner that they do not carry the infection to discourses. A quarantine visa records the symptoms of confirmed contacts and restricts them from further spread of the disease among those contacts.

4. Contact Tracing: Identifying and warning close contacts from confirmed cases for the purpose of limiting any secondary exposure and ensuring prompt testing.

5. Social Distancing and Restriction: The aim is to introduce physical distance for public places or venues where such close contact could normally take place and where limitations might be applied. Restrictions

include limitations on mass gatherings, the shutdown of all non-essential businesses, and restriction of movement in high-risk areas[115].

PUBLIC HEALTH INTERVENTIONS FOR EBOLA VIRUS :

1. Candidate identification and case monitoring: This will consist of early detection of case surveillance and monitoring of symptoms followed by isolation of suspected patients and confirmed cases of Ebola as a precautionary measure to prevent transmission. Contact tracing of exposed individuals will be done and monitored for other possible contacts.

2. Infection Control: Strict hygiene and PPE (personal protective equipment) surveillance and usage as measures against infection for healthcare workers. Ended in waste places contaminated syringes and gloves but then put into a safe disposal site to avoid accidental contaminating the environment.

3: Isolation and Quarantine: Quarantine for obvious symptomatic cases for Ebola-afflicted individuals. Speedy transfer between the infected patient and the exposed individual should be curtailed. Immediate arrangement for isolation of infected patients should be made to ensure prevention of contact until they are no longer able to transmit.

4. Vaccination: During outbreak periods of the disease, the vaccine should protect populations at risk hence it should be applied on rVSV-ZEBOV vaccine. Targeted vaccination of health workers and those exposed in incendiary locations[116].

COVID-19 VACCINATION EFFORTS :

1.Vaccine Development: Rapid development and emergency-use authorization were granted to mRNA, viral vector, and protein subunit vaccines (e.g., Pfizer-BioNTech, Moderna). Copies of the products for distribution were produced very early, and the trial data were sufficient for the purpose.

2.Global Rollout: Among the first patients favoring vaccination were healthcare workers and other persons at high risk. Equitable distribution was aimed at places not well endowed.

3.Booster Shots: The concept of booster vaccination was put forth to curb the appearance of variants (e.g., Delta or Omicron) before impeding one's immune response.

4.Vaccine Coverage: Many doses being provided to various nations, while most high-income countries spread the vaccine far and wide, though low-income countries were relegated to such an extent that access became an all-out war[117].

VACCINATION EFFORTS:

Some of the notables include

Merck rVSV-ZEBOV Vaccine Development: Between 2014 and 2016, during the Ebola crisis, this vaccine was studied in clinical development studies and found to be both safe and effective against Ebola infection.

Ring Vaccination: The ring-vaccination strategy also involved administering vaccinations to close contacts of the infected individuals, as well as other healthcare workers who cared for the infected individuals.

International Pertinence: The training was imparted through WHO and the rest for a part of the logistics both in policy and supply chain support for the logistics part in places The Democratic Republic of Congo (DRC) is one example.

Research: This means research on the safety, immunogenicity, and long-term impacts of these vaccines, as well as the potential for developing more vaccines to combat the remaining Ebola strains [118].

TREATMENT STRATEGIES OF COVID 19 :

The way COVID-19 is managed is achieved by employing some approaches such as antiviral therapy, immunomodulatory treatment, supportive care, and prevention. Antivirals are crucial in the treatment of COVID-19 because they prevent the virus from replicating and/or lessen the severity of the illness. An FDA-approved medication called Ramdesivir is used to treat hospitalized COVID-19 patients because it stops the viral RNA polymerase from replicating.Paxlovid is an oral antiviral that, in combination with Adults who have mild to moderate COVID-19 and are thought to be at high risk of developing a severe case can be treated with nimmatrelvir and ritonavir. Molnupiravir is another oral antiviral treatment option indicated for use among patients who are not in hospitals but are at danger of getting serious illness.Favipiravir is given for pharmacological treatment of mild infections in some countries. This particular antiviral acts on the replication of the viral RNA synthesis and thereby contributes to the controls placed on the virus within the body. These antiviral medicines are essential with other treatment modalities and contribute notably towards the management of COVID-19 cases and their outcomes. [119].

Comprehensive supportive therapy is generally indicated for such critically ill patients. Oxygen therapy is now primarily reserved for that small fraction of patients requiring high flow rates of oxygen and/or mechanical ventilation. ECMO, or extracorporeal membrane oxygenation is a lifesaving procedure for patients with failed respiratory function to support them beyond the what can already be provided with conventional oxygenation support. In addition, anticoagulation therapy is offered in hospitalized patients for prevention of thrombosis to lower the chance of side effects like pulmonary embolism or deep vein thrombosis.. We have quite all therapies that comprise a complete package within which COVID management falls, especially in severe cases. [120].

COVID-19 prevention strategies include immunization, which has proven to be the most effective and main preventive strategy. A number of vaccinations were created, such as vector-based vaccines (AstraZeneca and Johnson & Johnson), protein-based vaccines, and mRNA-based vaccines (Pfizer and Moderna), all of them contributing to the prevention of infection and reduction of disease severity. In some cases, post-exposure prophylaxis with monoclonal antibodies has been administered, but effectiveness considerably wanes with variants. Measures of public health will still be needed: masking, social distancing, and hygiene practices [121].

TREATMENT STRATEGIES OF EBOLAVIRUS :

1.Antiviral therapies target the Ebola virus to decrease replicationEbanga (ansuvimab) is a monoclonal antibody that selectively binds to the glycoprotein of Ebola, preventing it from infecting cells; Inmazeb (REGN-EB3) is a cocktail of three monoclonal antibodies (atoltivimab, maftivimab, and odesivimab) that neutralize the virus; remdesivir was first trialed for Ebola, later being repurposed for COVID-19, is not as effective for EVD as monoclonal antibodies; favipiravir was developed as an experimental antiviral with some promise, but not for primary treatment.

Immune-based treatments, convalescent plasma therapy that is the transfusion of antibodies from Ebola survivors, cannot be ascertained for their efficacy, and interferons studied could work against Ebola virus-by it has not found widespread use in current clinical practice.

The most effective means of stopping an Ebola outbreak is vaccination. rVSV-ZEBOV (Ervebo) - A Merck-developed single-dose vaccine with a very high efficacy against Ebola; ZEBOV/MVA-BN-Filo Ad26. - J&J two vaccination doses.Experimental &adjunct therapy: small molecule inhibitors-Repurposed drugs in the research targeting Ebola's replication mechanisms; gene silencing therapy(siRNA-based drugs)-leads to possible strategies to stop viral replication; hyperimmune serum-trialed out with outbreaks, but not much use in practice[122].

COMPARISON: COVID-19 VS. EBOLA'S ECONOMIC IMPACT

Category	COVID-19	Ebola Virus Disease (EVD)
Scale of Economic Impact	Global recession	Regional economic collapse (West Africa)
GDP Decline	-3.4% (global)	-2% to -4% in affected countries
Job Losses	400 million+ jobs lost	Localized unemployment increase
Supply Chain Disruptions	Global shortages of goods	Regional trade disruptions
Government Debt	Trillions spent on stimulus	Emergency aid from IMF/World Bank
Impact on Trade & Tourism	Global trade fell 9.2%, tourism collapsed 74%	Trade restrictions in affected regions
Healthcare Costs	Billions spent on hospitals, PPE, vaccines	High costs for outbreak containment
Some sectors thrived (tech, pharma)	Investors withdrew from affected regions	

LESSONS LEARNED FROM COVID-19

Public health initiatives are vital in managing and controlling pandemics. Early detection and rapid response (EDR and RR) would have played a role in stopping the infectious outbreak from venturing outside borders. Precautions like early closures, massive testing, and the like have been important steps in containing all these microorganisms. All these require international cooperation notwithstanding the fact that equity in distribution of vaccines has been another hurdle. However, pooled efforts in the distribution of vaccines and in real-time data sharing can lead to better responses to future pandemics. Other important interventions that contained outbreaks include mass testing and contact tracing. Yet, chronic under-funding of public health surveillance delayed serious containment efforts.

Strengthening healthcare systems is really an important component for the improvement and furtherance of preventive health measures. Most of the hospitals were not ready for the surge of new ICU admissions, where many had limited bed capacities and many ventilators were insufficient. Such points continue to rationalize investments in hospitals by securing funds for building their infrastructures and having emergency stockpiles of essential supplies in future demand situations. Mental health services should prioritize the caregivers providing care during this time, as there has been massive burnout as well as PTSD in frontline care providers, demonstrating the clear need for comprehensive mental health programs. In addition, strengthening the medical supply chain is very necessary as the pandemic showed many risks having to be confined to few suppliers.

The other type of preparedness relates to the economy and society. Some pre-planned financial packages such as direct stimulus payments and improved unemployment benefits have softened economies from serious injury. Therefore, companies should develop their contingency plans to adapt very quickly to remote working as well as to supply chain disruptions. However, misinformation and vaccine hesitancy are issues to be tackled through open communication and public education that promote public trust in science. Accessing communities with correct information is key in building vaccine uptake and hindering the propagation of dangerous myths during health emergencies[123].

LESSONS LEARNED FROM EBOLA VIRUS DISEASE (EVD)

If health systems respond in a timely and adequate manner, outbreaks can then be contained. Community participation becomes very important because mistrust of the intervention efforts by health and governmental agencies has derailed many gains in favor of infected communities, as in the case of Ebola. Public messaging that complements local activities may be as important in controlling outbreaks as any other measure. Stringent isolation and quarantine measures save lives because if early intervention works in tandem with contact tracing, transmission can be nipped in the bud. Cultural awareness plays a vital role in the control of an outbreak. Traditional burial practices can prolong these infections, and they float in the face of public health recommendations in the very localities where outbreaks take place. Any response in the future must include cultural health education and involve traditional leaders, so safety measures are respected.

Building health systems is crucial, especially in those settings with limited resources. The Ebola emergency showed that there has been an acute insufficiency of ICU beds and protection gear, and building the infrastructure has drastically been hampered by training medical personnel in disadvantaged countries. In tandem with making sure that healthcare workers themselves are safe, many Physicians and nurses lost their lives as a result of the lack of PPE and training. Future outbreaks have to set up much stricter protection, so those on the front line can protect themselves.

Preparedness for the economic and social arena is equally important for achieving recovery. The very communities affected will further suffer from economic misfortune and the stigma of being an orphan or a survivor. Post-pandemic recovery must provide economic aid and reintegration programs to support rebuilding their lives. A health crisis plan must adopt emergency funding mechanisms that allow immediate responses during future health threats. Slow international financing mechanisms have delayed far too long, and the point has surely been made for the establishment of health emergency funds so that immediate response during crises will be coordinated[124].

COMPARATIVE CHALLENGES: COVID-19 VS. EBOLA

Challenge	COVID-19	Ebola Virus Disease (EVD)
Transmission Mode	Airborne, rapid global spread	Direct contact with bodily fluids
Response Time	Delayed in many countries	Often slow in low-resource settings
Healthcare System Strain	ICU shortages, overwhelmed hospitals	Lack of medical facilities and staff
Vaccine Challenges	Delayed production, hesitancy, inequity	Limited availability during outbreaks
Community Resistance	Lockdown fatigue, misinformation	Quarantine resistance, burial disputes
Economic Impact	Global recession, unemployment	Localized economic collapse
Healthcare Worker Risks	High exposure, burnout, PTSD	Extreme risk, high mortality

FUTURE STRATEGIES FOR PANDEMIC PREPAREDNESS IN COVID-19 AND EBOLA VIRUS DISEASE (EVD)

This kind of infrastructure would allow early disease threat detection through advanced AI-based data analytics, which is critical in preparing for global health challenges. Examples of such AI platforms are BlueDot and HealthMap, which can scan global news and social media as well as medical reports for viral threats. Continuous symptoms monitoring through mobile apps and wearables provides an alternative avenue for scanning the health trends. There are genomic surveillance platforms, such as GISAID and Nextstrain, for monitoring virus mutations, but global gene sequencing networks will be enhanced, particularly in developing countries, to augment the capability of monitoring emerging variants. The One Health approach that follows zoonotic diseases can further enhance early detection of such outbreaks by accessing wildlife, livestock, domestic animal, and human population data, especially for rural areas[125].

As the data-sharing agreements on a global scale are facilitated for real-time outbreak information through mandatory outbreak alert to the World Health Organization under International Health Regulations, such transparency will allow countries to promptly respond to the growing threats related to epidemiology. In light of this, governments would need to revisit their health system resilience strategies by increasing standard ICU and modular emergency facilities at hospitals during pandemic surges. Those will include decentralizing medical stockpiles like PPEs, vaccines, and ventilators from the central hub of stockpiling down to regions for timely delivery. Rapid-response teams must also be set up, as well as the establishment of mental health programs to combat burnout at the frontlines while preparing the workforce[126].

This can thus be suited with proof for equality in the access of vaccines and treatments vital for intervention in saving the lives of every given state. Such interventions go a long way in terms of tackling vaccine access disparity as well as allow for fairly wider distribution of resources through supportive initiatives like COVAX with investments for local production of vaccines in regions like Africa, Asia, and Latin America. These comprehensive approaches build a resilient global health infrastructure; disease surveillance and health system strengthening will certainly need equitable access in this regard[127].

FUTURE PROSPECTS OF COVID 19 AND EBOLA VIRUS :

Future projections of COVID-19 are believed to follow an endemic transition, during which the virus will continue to circulate at manageable levels like flu. However, the emergence of new variants will demand booster vaccines and treatments while keeping continuity of genomic surveillance. The further development of next-generation vaccines-such as pan-coronavirus and nasal vaccines-would eventually lead to prolonged immunity and better protection. In addition, long COVID would be quite challenging, currently involving millions and threatening to destabilize economies and poverty levels. Preventive strategies may include booster vaccination approaches, reduced mask wearing in other conditions, and improved ventilation in public places[128].

Like wise with the Ebola virus, its future also depends on advancements in vaccinations and therapeutics. Even though those got their part in rVSV-ZEBOV and Ad26.ZEBOV/MVA-BN-Filo, among others, controlled future outbreaks, research continues in search of better treatments. One will further rapid outbreak response through better surveillance and containment to prevent any future outbreak from becoming a widespread pandemic. Ebola is zoonotic; therefore, improved surveillance within animal reservoirs is also relevant to foreseeing and dealing with spillover events. Finally, global preparedness remains an even greater common good, especially for African regions, so as to strengthen conventional healthcare systems and reduce mortality from disease. Finally, there is worry about the bioengineering-related risks, where measures surrounding virulence should be stringent in biosafety to prevent any unintended consequences because of either natural and nonnatural viral modification[129].

CONCLUSION

The COVID-19 pandemic and Ebola virus disease (EVD) demonstrate how emerging infectious diseases may destroy global health, economy, and public health systems. First, although they both are viral infections, these two differ vastly from one another when it comes to transmission, clinical picture, as well as epidemiological patterns. The SARS-CoV-2 viral infection that causes COVID-19, was transmitted by respiratory droplets from infected patients and asymptomatic carriers as an event in global pandemic germane to health and economy. However, close touch with an infected person's or animal's bodily fluids was how Ebola was spread. The filoviruses that cause it are known to induce severe hemorrhagic fever with extremely high death rates.

These future sights for disease would include the ongoing development of vaccination and therapeutic modalities, and genomic surveillance. COVID-19 would most likely turn endemic, necessitating continued booster vaccination and improved treatment protocols to achieve effective management of emerging variants and the long-term complications. Efforts at controlling Ebola would also follow this track of increasing vaccine efficacy, rapid outbreak response, and surveillance for animal reservoirs to halt any such zoonotic spillover events. Meanwhile, preparedness at the global level should also be scaled up to bring down the impact of these diseases, with a particular focus on vulnerable regions. The biosafety lapses are strictly avoided in such a requirement with no room for either natural or engineered viral modification. A concerted and integrated approach would then be employed in facing these challenges aimed at cushioning public health from emerging viral threats.

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