

REVIEW ON RECENT PANDEMICS, CAUSES AND RESEARCH PERSPECTIVES

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Abstract

For a moment, the globe has shut down for novel Corona virus (COVID 19) outbreak and made the human stuck with their regular life. Human has evolved with various epidemics and diseases since ages. These kinds of novel diseases/ virus are being spread from animals/birds to human. Spread is vital due to the technological and transportation advancements. The cause of virus not only infects living beings but also produce major decline in economic growth of entire world. This article focuses on the discussion of viruses which causes major impact during last century in terms of origin, symptoms, causes and medications. Impacts on social and economic aspects are also analyzed and suggested future needs and research perspectives to prevent, control and tackle these kinds of pandemic spreads.

Keywords: *Pandemic, Virus, Covid'19, SARS, MERS*

INTRODUCTION

Wide spread of new disease across the globe is pandemic [1]. It can be caused by any virus, outbreaks around the world, and easily affects people who have less immunity. Past pandemics history shows that most of the viruses are originated from animals and birds. Easy portability of human and animals throughout world is the big obstacle for early detection and prevention of pandemic diseases.

Most of the acute viral diseases are controlled and prevented through anti-viral drugs, vaccination and also by social and public health measures. Disease like yellow fever, measles, rabies and poliomyelitis are drastically reduced. HPV (human papilloma virus) and Hepatitis B infections can be easily controlled via vaccination. These are all achieved by the

continuous studies on nature and root cause of virus, its replication, transmission possibilities and pathogenesis.

Despite the medico technology advancements new viruses are periodically emerging and cause severe impact on humans, animals and society. AIDS is one such dangerous disease induced by HIV-1 threatens the world and its true impact not been calculated. Although the Middle East Respiratory Syndrome (MERS) and severe acute respiratory syndrome (SARS) are caused by corona virus, dengue fever from dengue virus, West Nile viruses, Chikungunya virus, H5N1 avian influenza virus, Ebola virus, hemorrhagic fever viruses, monkey pox virus are made significant hit. Either the occurrence of a new influenza pandemic or a bioterrorism attack using virus can have consequences on not only in public health but also in economic, social and political state.

Normally pandemics can cause significant effect in morbidity and mortality on low and middle income countries (LMICs)[2]. But the fact is broken by Covid-19 virus which affects high income and developed countries. It leads to the implementation of social distancing among people, isolation of infected people and prohibition of portability. Due to Covid'19 outbreak the short-term and long term economic growth of the entire world is under stress. Countries may instable due to political and social stress caused by the pandemic.

In this paper, recent pandemic threats are analyzed in terms of cause, symptoms, medications and its economic and social impacts. Then their issues are shortlisted with possible research directions. Section 2 lists the recent pandemic threats with origin, symptoms and causes. Section 3, analyses the lessons learnt from those virus in terms of health, economic and social factors. Section 4, consolidates existing methodologies to prevent and treat the pandemics and also suggests possible directions. Section 5 concludes our work.

LITERATURE REVIEW

Throughout the history, there have been a number of pandemics diseases such as Plague, Spanish flu, Chicken box, tuberculosis and HIV/AIDS. Here recent pandemics are reviewed to get the insight of its origin, symptoms, causes, medications and threats.

A. Swine Flu caused by H1N1 virus

The H1N1 virus (Spanish Flu) started spread during 1918 to 1919. Researchers called these as the mother of all pandemics. Nearly 50 crore people were affected and death toll reached more than 5 crores. Most of the studies show that this virus is transmitted through droplet infection. In March 2009, World Health Organization declared its first ever Public Health Emergency of International Concern (PHEIC), specific to the H1N1 virus outbreak [3]. According to 2012 report in The Lancet, the pandemic killed an estimated 284,500 people and may have led to the deaths of as many as 579,000.

B. SARS caused by the SARS Corona virus

In 2002 November, Severe Acute Respiratory Disease (SARS) caused by the SARS CoV came into light from china. Within few weeks the virus is spread to nearly 37 countries. The dumping of animals in crowded cages and the poor biosecurity indices are thrown the new virus from animals to people [4][5]. SARS-CoV is also transmitted from affected person to others through respiratory droplets. According to WHO reports, above 8000 people are affected by this virus with 10% mortality rate (from china) during July 2003.

C. Avian Flu caused by H5N1 virus

H5N1 is a type of influenza virus with high pathogenic nature. It causes heavy spread to the poultry farms all over the world. This avian flu virus is reported from Hong Kong animal market in 1997[6]. The spread of this virus from human to human is very difficult. Humans not much affected by this virus. But the spread happen from birds or avian flu virus contaminated area. In 2003, more cases are reported from Asian countries. According to WHO report 667 cases are infected and death toll reaches 393 from 2003 to 2014. The impact of the outbreak is not much on death rate but on economic terms like closing poultry farms and hitting exports.

D. Ebola caused by the Ebola virus

In 1976, Ebola Virus Disease known as Ebola fever reported in Africa. The name came from the Ebola river which is closest to the affected area. According to the WHO, “the fruit bats of the Pteropodidae family are natural Ebola virus hosts. Ebola is introduced into the human population through close contact with the blood, secretions, organs or other bodily fluids of infected animals such as chimpanzees, gorillas, fruit bats, monkeys, forest antelope

and porcupines found ill or dead or in the rainforest. The virus transmission is through direct contact of blood and body fluids of affected people or contaminated material and surface with the fluids [7]. Who reports average death rate of Ebola virus is 50%.

E. MERS caused by the MERS-CoV

The Middle East Respiratory Syndrome causes serious respiratory issues. In 2012, MERS-CoV was reported from Saudi Arabia. The virus is a type of corona virus declared as severe but less transmittable than SARS corona virus by an AFP report [8][9]. According to the report, MERS virus has affected hundreds of people and killed more than 284 people since 2012 to 2014.

F. Marburg caused by the Marburg virus

MARV is a severe pathogenic virus with high mortality rates up to 90% [10]. This virus was first noticed in Frankfurt and Marburg cities of German in 1960s. Afterwards it was reported in 1998 and 2000 with 128 and 154 cases respectively. The Marburg virus mainly hits the vascular system of the body then significant internal bleeding and it leads to organ failure. Its outbreak is known widely in 2004 with 227 fatalities among 252 reported cases. The virus transmission is via direct contact with body fluids, tissues and the blood of affected persons. Their spreads also occur through virus infected and dead animals.

G. Covid-19 caused by the SARS-CoV-2

SARS CoV-2 is the type of corona virus that causes the disease named COVID-19. It has been reported from china in December 2019. The virus is spread rapidly throughout the world from its origin. In March 2020, WHO declared COVID-19 outbreak is a pandemic. The medical research shows this is the seventh coronavirus came from animals to humans, and the fifth to persist as an endemic human coronavirus [11]. More than three and a half million laboratory-confirmed COVID-19 cases had been recorded around the world by early May 2020. Early diagnosis has been critical for successful contact tracing, isolation, and quarantining measures, and the impact of inadequate testing capacity. This Individuals with corona virus may be asymptomatic or pre symptomatic [12].

After the discussion of recent major pandemic viruses around the world which are categorized according to its disease, origin country, root cause of the animal or bird, symptoms which cause in humans, available treatment and test methods are shown in Table

TABLE 1: Illustrates various pandemic viruses, its disease, causes, origin, symptoms, testing method and medications

Disease	Virus	Symptoms	Cause	Transmission	Country (Origin)	Testing Method	Medication
Swine flu	H1N1	Fever, Chills, Cough, Sore throat, Runny or stuffy nose, red eyes, Body aches, Headache, Fatigue, Diarrhea, Nausea and vomiting	Pigs	Droplet infection	Spain	Rapid flu test	Flu vaccine
SARS (Severe Acute Respiratory Syndrome)	Corona Virus (SARS-CoV)	Fever over 100.4°F, dry cough, sore throat, problems in breathing, headache, body aches, loss of appetite, malaise, night sweats and chills, confusion, rash, diarrhea	Bat	Respiratory droplets of an infected person coughs or sneezes	Southern China	Polymerase chain reaction (PCR), Antibody tests, Cell culture	Antiviral medications and steroids are given to reduce lung swelling
Avian Flu	H5N1 virus	High fever and malaise, cough, sore throat, and muscle aches. Early symptoms are abdominal pain, chest pain and diarrhoea. It leads to severe respiratory illness and neurologic changes (altered mental status or seizures).	Birds	Through infected birds or virus-contaminated environments to people.	China	Reverse Transcription-PCR and others methods	Antiviral medicine oseltamivir can reduce the severity of illness and prevent death
Ebola	Ebola virus	High fever, Headache, Joint and muscle aches, Sore throat, Weakness, Stomach pain, Lack of appetite. As the disease gets worse, it causes bleeding inside the body, as well as from the eyes, ears, and nose. Some people will vomit or cough up blood, have bloody diarrhea, and get a rash.	Monkey, chimp, or fruit bat	Human-to-human via direct contact with the blood, secretions, organs or other bodily fluids of infected people, and Contaminated surfaces and materials (with these fluids)	Africa	Molecular testing and antigen ELISA	Rehydration, Symptomatic treatment Vaccine, called rVSV-ZEBOV
Middle East respiratory syndrome coronavirus (MERS-CoV)	Coronavir us	Fever, cough and shortness of breath. Pneumonia is common, but not always present. Gastrointestinal symptoms, including diarrhoea, have also been reported. Some laboratory-confirmed cases of MERS-CoV infection are reported as asymptomatic, meaning that they do not have any clinical symptoms	Camels	Close contact with infected person	Saudi Arabia	RT-PCR testing of blood and respiratory samples	Supportive treatment
Marburg	Marburg virus	Fever and body aches, it can quickly lead to severe bleeding, shock, and death	Rousettus aegyptiacus, fruit bats of the Pteropodidae family	Via direct contact with the blood, bodily fluids and tissues of infected persons. Also occur by handling ill or dead infected wild animals	Germany	PCR and enzyme-linked immunosorbent assays (ELISA), antigen-capture detection tests, serum neutralization test, electron microscopy, virus isolation by cell culture.)	No specific treatment. Supportive treatment to balance oxygen. Blood pressure and body fluids.
Covid-19	Corona Virus (SARS-CoV 2)	Asymptomatic or symbiotic (Fever, tiredness, and dry cough. Some patients may have aches and pains, nasal congestion, runny nose, sore throat or diarrhea, Unable to find Smell and taste)	Bats	Droplets of saliva or discharge from the nose of an infected person coughs or sneezes	China	PCR	Vaccine under development. preventive and control measures and supportive care

I. LESSONS LEARNT FROM PANDEMIC DISEASES

Throughout the history, humans came across variety of pandemics. Some influenza pandemics can appear similar to seasonal influenza but few characteristics may be different. Such seasonal and some pandemic influenza can affect all age groups, in which the person recovers automatically using immunity without any treatment. However, most of the seasonal influenza causes deaths among the elderly and also the people with various medical complications. The shortage of adequate testing facilities, medicines, medical personnel, protective equipment and infrastructure delayed the prevention and mitigation of pandemic spread.

The direct fiscal impacts of pandemics generally are small, however, relative to the indirect damage to economic activity and growth [13]. Negative economic growth stocks are driven directly by labor force reductions caused by sickness and mortality and indirectly by fear-induced behavioral changes. Fear manifests itself through multiple behavioral changes. As an analysis of the economic impacts of the 2014 West Africa Ebola epidemic noted, “Fear of association with others . . . reduces labor force participation, closes places of employment, disrupts transportation, motivates some governments to close land borders and restrict entry of citizens from affected countries, and motivates private decision makers to disrupt trade, travel, and commerce by canceling scheduled commercial flights and reducing shipping and cargo services” (World Bank 2014). These in turn reduces participation of labors. The entire economy including agriculture, manufacturing are getting affected while a severe pandemic period. This leads to hasty increase of staples price or shortages of them which leads to economic stresses for household, private firms, and government sectors.

Technological and transportation advancements made easy exchange of goods, animals, birds between countries and also improve people travel all around the world. It increases the cause and spread of the disease. Four levels of virus spread are shown below in Figure 1.

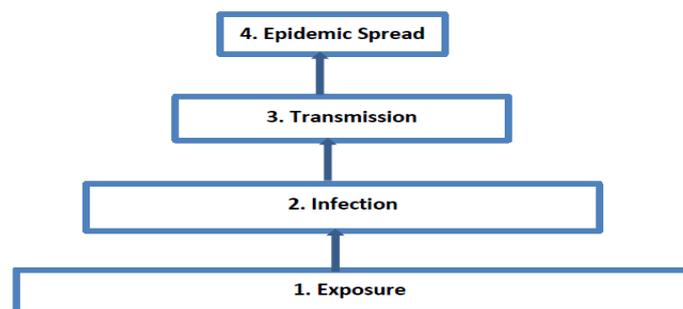


Fig 1: Four levels of virus spread

Previous similar coronavirus outbreaks MERS affected 2500 cases with above 850 death cases [14][15] and SARS affected about 8,000 cases with nearly 800 deaths [16]. As of September 20, 2020 report more than 3 crore 16 lakhs 5 thousand and 656 cases are

infected by Covid'19 and death toll crosses 9 lakhs 70 thousand 9 hundred and 34. The comparison chart is shown in Table 2.

TABLE 2: Comparison of MERS, SARS and Covid '19 Infected and Death Cases

Disease	No. of Infected Cases	No. of Deaths
MERS	2500	850
SARS	8000	800
Covid'19 (Status on Sep 20, 2020)	31,605,656	970934

II. AVAILABLE PRACTICES AND FUTURE RESEARCH DIRECTIONS

So far pandemic are treated through anti-viral drugs, vaccines and through some social, health precautions. Most of the viruses are come from animals or birds. The big challenge for pharmaceutical scientist is the emerging virus is changes its structure and symptoms drastically. Medical personnel felt difficult to identify proper medicines and treatment. The spread is also vital.

Collaborative effort from allopathy and traditional medicines like siddha, homeopathy, acupuncture, acupressure, and naturopathy, Chinese or oriental medicine is the need of an hour. The siddha medicine called nilavembu kudineer acted as an antiviral against dengue and chikungunya virus [17]. Kabasura kudineer choornam (AEKKC) has significant anti-inflammatory, antipyretic and antimicrobial activity[18]. The preventive system is to improve the immunity power of the body. Zinc is a general stimulant of antiviral immunity. It is required for function of over 300 enzymes, and repairs body tissues. Vitamin C can reduce lung inflammation and an anti-oxidant critical for skin health and immune system.

The practice of Yoga Breathing (Pranayama) improves lung function. It includes Asana's postures, controlled breathing, and stress reduction through meditation [19]. This helps the person to improve his life-style which ultimately reduces prevalence of psychological, neurological , metabolic disorders etc.

World Health Organization is associated with 194 Member States spreads through 6 regions, and having more than 150 offices. WHO developed three phase plan for pandemic influenza ie i) Preparation and situation analysis ii) developing or updating a plan iii) Evaluating, finalizing & disseminating the plan [20]. Normally vaccine from laboratory to actual market takes place in six stages ie. Exploratory, pre-clinical, clinical development,

regulatory, review and approval, manufacturing and quality control. During pandemic outbreak, World Health Organization should fasten the process to save life.

There is a detailed analysis between severely affected, normally affected and less affected regions in terms of season, health condition of people and their DNA structure against the virus, receptor of the virus, food habits and age. Recent pandemic spread are controlled through self-quarantine, social distancing and lock down of the entire region.

In order to speed up the testing and medication process, countries jointly develop rapid testing kits or techniques, medicines and vaccines. The pandemic viruses severely affect medical personnel. In order to avoid spread, check the possibility of using telemedicine and treatment through robots for possible cases. It leads to the development of supporting software and tools.

III. CONCLUSION

The pandemic viruses which affect the humans are in different forms, symptoms, characteristics throughout the world. The impact of the virus is based on origin, weather, immune system of the people and medication used. Among which social distancing plays a major role to prevent and mitigate the virus spread. It is not only locks or life threat to people but also have vital impact in social, economic, political life of the world. In this paper we have reviewed recent virus with its various factors. Also analyzed the causes of the virus and suggested some remedial actions, research directions. People can maintain cleanliness and improve immunity power until the proper vaccine or medicine is identified.

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