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PANDEMICS THEN AND NOW: A STUDY ON THEIR SCIENTIFIC DEVELOPMENT

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ABSTRACT

With respect to the worldwide panic and bamboozlement regarding the Covid-19 sway from early 2020 experts in the fields of science, medicine and technology were searching day in and day out for a suitable, effective remedy to this highly infectious viral disease that had taken the shape of an unyielding pandemic. With reference to Covid-19, the present study attempts to find out the inner scientific causes and developmental strategies of some other notable pandemics in recent and old history. With the bibliographical and historical research method - what is the underlying cause or what uniqueness do such diseases were attributed to, as well as the remedy out of – are the questions that the study attempts to find answers to.

1. INTRODUCTION

The rampage of Covid-19 from the beginning of 2020 has baffled scientists and medical professionals across the planet. The rapid and multiple mutations the virus leading to various new strains has flabbergasted the scientists. What are the causative factors and what are the steady remedies - the present study seeks answers to those questions. It refers to some earlier pandemics and the underlying scientific facts that have been steadily discovered in modern time.

Objectives of the study

The present study has following objectives:

- To study the growth of historic pandemics and their effect on the society.
- To find out the genetic configuration and mutational evolution of the causative pathogens.
- To find out the reason behind the recurrence of some pandemics.
- To study the positive impact of pandemic on the education system.

Delimitations of the study

The obligatory home-confinement during the pandemic situation played a significant part in restricting the movement and therefore the physical access to libraries and books. The online resources like books, journals, newspaper reports, research papers and WHO and UNICEF newsletters came to aid to go on with this study.

2. METHODOLOGY

Bibliographical and historical research methods have been adopted for this study. Books, research articles, online journals, newspaper reports, podcasts and video resources mostly from the World Wide Web have been accessed to undertake this study.

Table1: Epidemiology of Some Notable Pandemics

Pandemics	Year	Symptoms	Cause of Transmission	Developmental Findings
Black Death	1346 - 1353	High fever, aching joints, headache, vomiting and eventual development of characteristic buboes (swollen lymph nodes) in the armpits, neck and groin often to the size of an apple or egg.	Bacteria Yersinia pestis, transmitted through the oriental rat flea that carries the bacteria from the infected rat or human to the new host causing Bubonic plague.	The 4th human chromosome has three immune system genes that are responsible for anchoring to bacteria and initiate host-immune response. These, along with three other genes responsible for skin pigmentation, auto-immune response and inflammation respectively have shown genetic marks that were left by Bubonic Plague during Black Death. Descendants of European population surviving the Black Death have revealed to have modifications in these genes testifying to the positive natural selection which have made them more immune to this plague, not found elsewhere in the world.
The Great Plague	1665 – 1666	- Do -	- Do -	-
Small Pox	1837 – 1838	Fever, Severe back pain and fatigue followed by rash and numerous clear fluid filled pustules within 2 to 3 days that develop crust eventually. Lesions develop in mucous membranes that turn ulcerous soon.	Smallpox caused by either of the two viruses Variola Major and Variola Minor. Transmitted through close contact with the patients and droplets.	Earliest evidence of Small Pox has been found in as early as 1500 BC from India and Egypt (the mummies) and 1100 BC in China. This is the only viral disease that has been reportedly eradicated from the face of earth in 1980's through rapid vaccination. The only two samples are preserved in two laboratories across the world, CDC in Atlanta, USA, and VECTOR in Novosibirsk, the Russian Federation, for research purpose. But any event of bioterrorism could breach this restrictive security and the world might face the trauma of Small Pox again.

Spanish Flu	1918 - 1920	Fever, sore throat, headache followed by gradual darkening and turning blue of the face and fatal bacterial pneumonia.	H1N1 or Swine Flu virus that chiefly transmitted through infected soldiers travelling worldwide and returning from World war I.	In addition to the Hemagglutinin gene, responsible for coding for proteins to anchor onto the host cell surface, scientists have discovered a cluster of three more genes that were responsible for the increased virulence of this virus during Spanish Flu. This cluster of genes codes for RNA Polymerase that not only helps the virus to reproduce inside the host cell, but also to infect the lung tissues, not usually seen in the non-virulent strains of this virus. Perhaps this had caused this virus to turn that much violent during 1918.
AIDS	1981 - present	Initially flu like symptom followed by no symptom that eventually turns into tuberculosis and gradually depressed immune system.	HIV (Human Immunodeficiency Virus) transmitted through unprotected physical union, blood transfusion and congenitally.	HIV has still been continuing its reign throughout the world although awareness campaigns and medication have been able to restrict its spread considerably. What is most alarming is its incurable status. Scientists has discovered that a mutation in the CCR5 delta 32 gene in the white blood corpuscles can keep the HIV from docking onto it since it disables the receptor of HIV. 10% of the European and American population have this mutation and they are 100 times more immune to AIDS. The even strange discovery is that this mutation existed 2500 years before, which predates the virus itself.
SARS (Severe Acute Respiratory Syndrome)	2002 – 2004	High fever, shortness of breath, rigor, malaise, chills and other flu like symptoms.	SARS-Cov contracted from horseshoe bat and human to human infection is through the droplets or saliva of infected patients. It is air-borne and can spread through contact surface.	SARS is the first of the three Corona viruses. The horseshoe bats inhabiting in Yunnan province of China generally do not contain the virulent strain's gene of the SARS Corona virus. The virulent gene was identified from 11 new strains of horseshoe bats which contained all other genetic blocks like the other strains of horseshoe bats. The similarity in the configuration of the S gene identified from the specific strains with the SARS Corona virus strain reveals that genetic recombination of earlier bat genes followed by evolutionary pressure gave rise to the virulent new SARS Corona virus strains.
Zika Virus Disease	2007 - 2015	Fever, rash, muscle pain, conjunctivitis, some patients remain symptomless. Infection during pregnancy leads to microcephaly (smaller head), Guillain-Barré syndrome and neuropathy in foetuses.	Zika virus transmitted through Aedes aegypti mosquito. Human to human transmission occurs through body fluids.	First extracted in 1947 from a Rhesus Macaque monkey in Uganda, Zika never bothered human society until recently when it turned extremely virulent. Like other RNA viruses, its RNA dependent RNA Polymerase is very much error-prone without the proof-reading property and thus leads to multiple mutations that make it virulent. But the large scale occurrences of microcephaly and fatality pointed to the possibility of a previous virulent strain. The NS3 protein had mutated in various regions in 2015 and had interfaced NS5 Polymerase protein to affect replication.
Ebola	2007 - 2016	Fever, fatigue, headache, muscle pain, rash, diarrhoea followed by kidney and liver failure, internal and external haemorrhage.	Ebola virus virion, which is transmitted through the body fluids and blood of infected persons. Originated from wild fruit bats, Chimpanzees and gorillas in the rain forest.	Ebola virus belongs to filovirus family that has five members - Ebola virus, Sudan virus, Reston virus, Tai Forest virus and Bundibugyo virus. Unlike most other NNS (Non-segmented Negative Strand) RNA viruses that have complementary 3' and 5' nucleotide sequences at their genomic and antigenomic ends, Ebola virus has an additional non-template 3' nucleotide at the genomic end that renders it immune against host antiviral recognition thus capable of turning it severely virulent.
Swine Flu or H1N1	2009 - 2010	Like usual Flu, fever, dry cough, breathing difficulty, runny nose and diarrhoea.	H1N1Influenza A showing zoonosis through three hosts from bird to swine to human.	Studies reveal that the 2009 Swine Flu was caused because of a strain that had accidentally leaked out from a laboratory in 1970's. This strain was similar to a strain from 1950's. While the infamous 1918 Spanish Flu virus had hopped from human to pigs as revealed

				by studies in 1930's, the 1918 human strain had evolved rapidly in human host, making it different from then swine strain. Human H1N1 virus sample collected from 17 countries between 1918 and 2006 revealed this. From 1957, H1N1 had apparently vanished, replaced by an Avian combined H2N2 strain. The reappearance of the Swine Flu virus (S-OIV) in the form of a pandemic in 2009 revealed less similarity with the 1918 strain suggesting extensive genetic mutation.
MERS (Middle east Respiratory Syndrome)	2012 - present	Fever, cough, respiratory distress, diarrhoea, may have pneumonia. Often symptomless.	MERS-Cov contracted from direct or indirect contact with dromedary camels.	Second Corona virus. With symptoms slightly different from SARS and Covid-19, MERS also originated from bats. Since Corona viruses hop through multiple hosts, MERS-Cov showed zoonosis from bats to dromedary camels and then to humans. Also unlike SARS and Covid-19, MERS only spread through close contact with the infected camel or human. While there have been no new cases of SARS, MERS is still being reported in local level.
Covid-19 or Corona Virus Disease	2019-present	Fever, dry cough, breathing difficulty, hypoxia, headache, loss of smell and taste, diarrhoea.	SARS-Cov 2 contracted from wild fruit bat from wet market in Wuhan, China. Human transmission through droplets of infected persons.	Third Corona virus disease has shaken the whole world throughout 2020. It has been found from studies that a gene cluster on 3rd chromosome is responsible for respiratory failure and severe symptoms of Covid-19. This gene cluster has a 50 kb long sequence and contained by 50% population in South Asia and 16% in Europe. More interestingly, this gene cluster had been inherited from the Neanderthals, close kin to prehistoric humans 400,000 to 28,000 years ago.

3. RESULTS AND DISCUSSIONS

The causative reasons of the pandemics and their underlying scientific and genetic evolution have made it convenient for scientists and doctors to research on the recent outbreak of Covid-19.

- It has also contributed in proposing suitable measures to tackle the situation and find out a cure to the health related issues.
- Comprehensive information about various pandemics has increased knowledge-base regarding the socio-economic situations around the globe down the ages.
- The overall knowledge building has significantly catered to increasing awareness, developing hygienic habits and an overhaul of the present socio-economic-educational scenario – switching to the neo-normal way of life.

4. CONCLUSION

The constant genetic mutations and regular arrival of new variants is posing new challenges before the medical practitioners and scientists almost every day leaving very thin chance of relaxation, despite the fact that vaccination has been around almost everywhere in the world. The current study has put forward some similar pandemics of yester-year and their causative factors that indicate to the peculiarities of their development.

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