A Brief history of Pandemics

Rudrajit Paul, Jyotirmoy Pal

Keywords : Pandemic; Europe; Plague; History; Mortality; Global

Introduction:

Pandemics or epidemics are a recurrent scourge of the human civilization. The battle between the humans and the microbial world has always been a difficult proposition. Just as humans have invented ways to beat the plagues, the microbial world has also responded with changes to bypass the human armamentarium and invade the society repeatedly. As the recent coronavirus pandemic has shown, invasion by the microbes can always test the limits of human resourcefulness. Each epidemic leaves its indelible mark on the collective consciousness of a country and impacts the culture. Thus, the study of epidemics is an indispensable part of the study of human history and lessons learnt in the past can be invaluable for the future.

In this treatise, we will describe the history of five major diseases that have afflicted human civilization: Plague, Small pox, Cholera, Influenza and HIV. The discussion will cover the timelines of these epidemics/pandemics, the approximate mortality and the significant changes that these epidemics ushered in the contemporary society. Thus, this article will describe not only the epidemics but also how the contemporary humans, physicians and non-medicos alike, responded to those catastrophes.

Plague :

Plague, caused by the gram negative bacilli, *Yersinia pestis*, was once a great menace of the human civilization. The causative organisms are carried by fleas, which reside on the skin of rodents like mouse and Marmots. The history of the human civilization is the history of food grain production, grain storage and infestation of that storage with rats. Thus, man and rodents have always been in close contact throughout history and consequently, the zoonotic disease, plague has also been lurking in the wings of human society. While innumerable localized outbreaks have occurred in all parts of the world, plague have also often crossed continents and given rise to mayhem.

Plague was not unknown in ancient India. InSusrutaSanhita, in the chapter Nidansthana, there is mention of a disease called *agnirohini*. The symptoms are described as "deep hard swellings in the armpit, violent fever like burning fire. It kills the patient in seven or ten days." It is described as an incurable disease (asadhyamsannipatatas). But there is no mention of any epidemic in ancient Indian texts.

Bubonic plague has had three pandemics till now in recorded history. The first was the Justinian plague (541-542 C.E.), which was mainly concentrated in and around Europe. Its main devastating effect was on the Byzantine Empire and the port cities around the Mediterranean Sea. The contemporary emperor was Justinian I and historians named the epidemic after him. Justinian himself was said to have contracted the disease during the epidemic, but survived after a protracted illness. But the epidemic did not end after two years. Frequent recurrences of the disease were recorded in Europe upto the eighth century. Recently, skeletons of Justinian plague victims were excavated in Germany and the DNA of *Yersinia pestis* was isolated from those remains. Later genomic analysis from those remains suggests that the Justinian plague may have originated in Central Asia.

The plague may have arrived in Constantinople, the capital of the Byzantine Empire, via ships carrying grain from Egypt. As the Byzantine Empire expanded, North Africa became its main source of food-grain, ivory, slaves and oil. The weather in southern Italy and surrounding regions in that period was unusually harsh and cold, leading to severe crop failure. This led to more import of food grains from North Africa and with this, the black rats carrying the fleas also travelled to Europe. Procopius was a famous Byzantine historian, who recorded details of the epidemic in 541 C.E. and said that at its peak, the disease was killing around 10000 people daily in the city (figure 1). However, this figure is thought to be an exaggeration and is hotly debated; the true estimate may never be known. Whatever may be the death toll, the Justinian plague caused huge political and economic impact in Europe. It was a crucial factor in weakening of the Byzantine Empire and rise of independent forces like the Goths in Western Europe.

Procopius also described the symptoms and signs of the plague (figure 2). He described that the victims suffered from delirium, hallucinations, nightmares, fevers and swellings in armpits, groins and behind the ears. Many people died immediately after the onset of symptoms (probably Septicaemic plague). The disease continued to spread along with the soldiers of the empire. However, neither northern Europe (Scandinavia north of Denmark)

nor the countryside was affected. This led to the conclusion by modern historians that probably the black rat, a species which is concentrated near ports and docks, was the sole reservoir of the disease and not the usual country rats. The plague is said to have killed between 25 and 100 million humans over two to three centuries. That would equate to one-third to half of the population of Europe at that time. In many places there was no space to bury the dead and corpses were thrown into the sea.The emperor Justinian had to arrange for special boats to take the corpses deep into the sea. Based on descriptions of the illness by contemporary writers, modern medical historians think that all three forms of plague, bubonic, pneumonic and septicemic were present, although the bubonic plague was the predominant form.

The medical system of Europe was not prepared for the pandemic and physicians had almost nothing to offer. Most famous physicians of that era were trained at the famed Alexandria medical school but there was hardly any knowledge of infectious diseases back then. Thus, they tried to treat the disease with water, vinegar or bloodletting. Some tried lucky charms, witchcraft or other similar remedies. Some physicians tried lancing the buboes. It was thought that if pus and blood could escape through the wound, then the disease would leave the body. Sometimes a mixture of tree resin, flowers and human faeces would be applied to the wound. Some others made a concoction consisting of roasted shells of newly laid eggs, treacle, ale and marigold petals. Patients were asked to drink this mixture every morning. Dust or soil touched by a holy person or a hermit was thought to be a remedy or lucky charm. Amulets bearing the image of biblical king Solomon were worn as protection against the disease.

Some communities were thought to be responsible for this epidemic and the emperor enacted laws against these communities. This included Jews, Samaritans, pagans and heretics. The movement of these people in public places was restricted. Such racist measures were naturally failures but this attempt by Justinian may be considered an early example of isolation.

Public health measures like isolation were known in 6th century Europe (the term quarantine had not yet been coined). During the Justinian plague, this was practiced by many local administrators. However, since the mode of spread of the disease was unknown, effective isolation was not possible and man-animal contact remained high around the granaries and ports. Constantinople had large hospitals. But those centres soon became overcrowded and patients mostly waited for death in their crowded wards. The streets were deserted and people went out of their homes with name tags on their body. As many patients of plague had sudden death, these name tags were used to identify the corpses on the streets in the morning.

Figure 1: A medieval painting showing mass burial of corpses during the Justinian plague

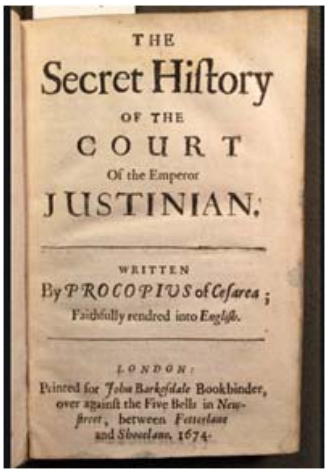

THE
Secret Hiſtory
OF THE
COURT
Of the Emperor
JUSTINIAN.
WRITTEN
By PROCOPIUS of Cæſarea;
Faithfully rendred into Engliſh.
LONDON:
Printed for John Barkſdale Bookbinder, over againſt the Five Bells in New-ſtreet, between Fetterlane and Shoreditch, 1674.

Figure 2: "Secret history": The book by Procopius which gives detailed accounts of the Justinian plague

The second pandemic of plague was the most infamous; it was called the *Black Death*.

This pandemic swept over a wider area than the Justinian plague, including Europe, central Asia, West Asia and Africa. Origin of this pandemic is a matter of debate. Modern scientific analysis has revealed that the epidemic probably originated in Asia. The exact date of origin of the pandemic is unknown but historical estimates have put the date of commencement somewhere around the beginning of fourteenth century in Asia. By 1340, the disease had spread to China, India, Persia and Egypt. Probably, the epidemic started from the Gobi desert with Mongol invasion of China. As Mongol invaders blazed

their way into the steppes of Central Asia, they may have unleashed the epidemic from some natural focus. The invasion caused high levels of human migration and along with this, the rodents also made their way into human settlements. But the same epidemic may also have heralded the end of Mongol rule in china.

The Egyptian scholar Al-Mazriqi has claimed that numerous tribes of central Asia were completely wiped out by the epidemic without trace. The silk route from China was a convenient route of spread of the disease throughout Asia. In 1335, the Mongol ruler of Persia died from plague. IssykKul is a lake in present Kyrgyzstan. It was an important stopover point in the silk route. Recent excavations in the shores of that lake have revealed evidences of plague in 1338 and 1339. Different countries in central Asia may have suffered mortality ranging from 40—70% of the population.

In 1344, the Mongol rulers of the Golden Horde laid siege to Kaffa, a port city of Crimea which was under control of Genoese traders from Italy. The siege lasted till 1347. But then, as new soldiers coming from the east along with reinforcements and food supply joined the Mongol lines in Kaffa, they brought the plague with them. Thousands of soldiers started dying. One military leader then ordered the corpses to be placed on catapults and thrown over the walls into the city. This is probably the first recorded instance of biological warfare in history. Whether this warfare had its intended effect is not known but as the siege continued, many people boarded ships from Kaffa and fled to Europe. These refugees may have been the source of the subsequent epidemic in Europe which we will describe next.

But before starting the description of Europe, we need to mention the chronicles of one more person. *IbnBatuta* was one of the most famous travellers and historians of the middle ages. He travelled extensively in Asia and recorded his findings. In 1348, he was travelling across Syria. He has recorded details of the plague epidemic in Damascus, where more than 2000 people died per day. Another famous historian in Damascus at that time was IbnKathir. He has also documented the plague in Damascus in vivid details. On a particular day, July 21, 1348, the religious leaders asked the people of the city to fast for three days and pray to god for deliverance from the plague. IbnBatuta continued his journey to Cairo, where he chronicled an even higher death rate. He subsequently went to Mecca where there was death all around. Thus, different parts of West Asia suffered endlessly in the epidemic. But instead on going into further descriptions of the Asian epidemic, we will now describe the situation in Europe.

When did the black plague arrive in Europe? The exact date is unknown but there is one account of October 1347 when 12 ships from the black sea docked at the Sicilian port of Messina. People at the docks noted that most people aboard the ships were dead and those who were still alive had horrible black boils oozing blood. The authorities immediately ordered the ships out of the harbour but it was probably too late by then. The disease had already spread to the people on land. The Italian poet Giovanni Boccaccio wrote that,

"…..at the beginning of the malady, certain swellings, either on the groin or under the armpits…waxed to the bigness of a common apple, others to the size of an egg, some more and some less, and these the vulgar named plague-boils."

Sicily was ravaged by the epidemic. Ships from Sicily took the illness to the nearby trading towns like Sardinia. Then, along the trading routes and the routes of travellers, the disease spread to nearly half of Europe by June 1348. Ships from Kaffa, the city that had been infected with plague through biological warfare, carried the illness to Genoa, France and Valencia of Spain.

North Africa was also affected via the port of Tunis. In Italy, the disease was creating havoc. By February 1348, it had spread to Pisa, Florence and Rome. The Archbishop of Milan took a horrible measure to contain the pestilence. When the first cases were reported in Milan, the first three houses where cases were reported were just walled up with all the inhabitants inside and they were left to die. But due to this drastic measure and other factors, Milan suffered much less compared to other Italian cities. As Florence was affected, the famous poet Boccaccio wrote the "Decameron" which describes a group of people fleeing the city from the plague. He describes the swellings that appeared on the body of the victims (plague boils) and once black patches developed on the skin, it was a certain sign of death. Physicians were powerless to cure any of the patients.

In France, the plague entered through the port city of Marseilles in February 1348, where the Genoese ships had docked. By March, the disease spread to Avignon and by June, it spread to Paris. The pope, the spiritual leader of Christendom, was staying in Avignon at that time. To keep him alive, he was completely isolated and was made to sit between two raging fires throughout the day. People were dying very quickly and even the priests were dead; thus there was no one to perform the last rites. The disease also arrived in the South of England by June 1348. In the war at Granada in Spain, soldiers of both sides were struck down with plague. King Alfonso of Spain, who was leading the siege of Gibraltar, died of plague in 1350.

After the first year of mayhem, the rate of infection began to slow by 1349. The wealthy people in Europe fled

to the countryside. But others, who were living in crowded places like Paris, were dying in large numbers. By this time, the disease spread to northern Europe. As per anecdote, the disease spread to Norway via a ship full of wool from Britain. The ship set sail from Britain and by the time it reached Norway, all the sailors on board were dead. The ship ran aground at Bergen and the local people went up to see. Thus, they got infected.

By 1349, the disease had spread to Ireland and by 1350, it spread to the Baltic states and Russia. Between 1347 and 1352, somewhere between 24 and 30 million people in Europe is said to have died. Many worst affected cities lost more than 50% of their population to the plague. In absence of rational scientific explanations for the disease, rumours and myths were ubiquitous (figure 3). In some places, Jews were accused of polluting the waters, in some places the disease was thought to be a result of air over the swamps and many people also thought this to be a divine punishment.

In the UK, the disease entered through the port of Dorset in 1348. It ravaged cities and villages alike throughout Britain. By September 1348, it had reached London. The disease devastated the length and breadth of the country before dying out in December 1349. Many affected villages lost 80-90% of their population. However, the term "black death" was not used then. The epidemic was known as "the great mortality". The term "black death" was coined later, only in the 17th century.

According to the contemporary British physicians, major symptoms included blotches on the skin, lymphadenopathy and dementia. Major treatment modalities were sweating, bloodletting and forced vomiting. Usually, bloodletting was done on the same side as appearance of the buboes. The patients were made to sweat with medicines like Venice-Treacle and bezoar water. Another method used was rupturing the buboes. Once the glands became red and fragile, they were pierced with a feather from a young pigeon's tail. Then sometimes, a young pigeon would be cut from breast to back and the innards would be applied over the swelling. This was also known as *pigeon therapy*. Since the Christian clergy were the main caregivers in most communities, they had a high rate of mortality. Some estimates put the mortality among clergy at 50%.

Throughout Europe, the government officials and administrators hired people known as *plague doctors* (Figure 4). These were not always qualified physicians but sometimes even lay persons. They were paid huge amounts of salary by the state to attend plague victims. In absence of a proper medical knowledge, they often failed to cure patients. Sometimes they even offered false cures. These doctors often wore a special costume with a beak-like projection over the face. But this costume was designed in France only in 1630 and thus, it was not present during the Black Death period. This beak like projection contained aromatic herbs and essential oils to purify the air. The plague doctors usually carried a stick to examine patients and had no direct patient contact. These "doctors" were required to count and document the number of deaths and perform autopsies.

Towards the end of this pandemic, in 1377, the republic of Rasuga in modern Croatia enacted a law that required the newcomers to stay outside the city for thirty days before they were allowed to go inside. This was called trentino. During this period, they would be observed for appearance of any symptoms of bubonic plague. This public health measure was done at the suggestion of the famous physician, Jacob of Padua. There were four tenets of this law: -

- No one to enter the city until after 1 month of isolation
- No one from the city could visit anyone in the isolation area
- No one to bring food to the isolated persons, except those appointed by the city council
- Whoever broke these rules would be subject to isolation for 1 month

In 1448, Venice of Italy prolonged this period of isolation to 40 days. This gave rise to the term" quarantine" in Italian language (meaning 40).Now the question is why 40? The origin of this particular number is probably based on biblical inspiration. Many of the major events in the Bible, like the great flood of Noah or Moses' stay on Mount Sinai lasted for forty days. Usually, small islands near the port city would be demarcated for temporary stay of the travellers. A similar measure would be used by the British administration much later (1897) in Rangoon port of Burma for immigrant labourers from India.

Now, another question which has dogged scholars for long is the fate of India during this epidemic. It is known that the second plague epidemic started from central Asia and spread all over the world. But was India affected? Many European scholars are of the opinion that millions of people died in India from this epidemic. But there is no convincing proof. The period of Black Death was the time of reign of Muhammad bin Tughlaq (reign 1325-51). There is no mention of any great epidemic in this period. He was an atrocious ruler who completely destabilized the kingdom. But he encouraged scholarship and had written accounts; and there is no proof that plague was present in his time. IbnBatuta has described the daily life of India in great details. He had also described the great famines. But there is no mention of the plague during his stay in India. Thus the European view of Indian plague epidemic is probably

erroneous.

Although the main wave of death from plague was between 1347 and 1352, the disease lingered on in Europe for the next 300 years and caused frequent outbreaks including the great London plague of 1665. The total number of deaths in this pandemic over the whole period was close to 200 million.

One particular incident which has an important lesson for current pandemic is the plague of Marseilles in 1720. The second pandemic lingered on in Europe after the Black Death period. In 1720, a merchant ship named Grand-Saint-Antoine with plague outbreak on board came to the port of Marseilles. The ship was promptly placed in quarantine. But the ship had a valuable cargo of silk and cotton, which the city merchants wanted for business. Overruling the public health caveats, these merchants forced the city administration to deliver the goods for their profit. With that, the plague spread into the city, killing 50000 over the next two years. A further 50000 died in the surrounding areas. The streets were just filled with heaps of dead bodies and all public health efforts failed. This historical anecdote is a warning for anyone who wants to open the country for business too soon in the current pandemic.

In Russia, Plague struck Moscow in 1770. This led to the plague riots of 1771. The archbishop of Moscow was killed by rioters. The outbreak continued till October 1771. A total of more than 100 000 people died in the epidemic.

Figure 3: The "dance of death": a medieval illustration inspired by events of the Black Death

Figure 4: The "plague doctor": from a seventeenth century roman copper engraving

The third plague pandemic is a contemporary event, beginning in China around 1855 and continuing till 1960. Unlike the other two pandemics, India was massively hit by this pandemic. In fact, as the subsequent discussions will show, the lion's share of global mortality was from India and China. Due to advancements in education and printing technology, this was also the best documented plague epidemic.

To understand the origin of this third pandemic, we have to delve a little into the history of China in the nineteenth century. The Yunnan province in china was opened up for mineral exploration (mainly copper) in the middle of nineteenth century. By 1850, the population had risen to almost 7 million in that province. The indigenous rats and other rodents of Yunnan were already zoonotic reservoirs of Plague but in absence of significant human contact, it remained confined. But this sudden increase in human activity caused the disease to spread among humans quickly. The people brought the disease back to the growing urban areas and coastal settlements. Another factor which contributed to quick spreading of the disease was the growing opium trade in China which picked up momentum after 1840. Finally, the Panthay rebellion (1856-73) in Yunnan caused a lot of civil unrest, human migration and movement of imperial troops in the region. This also led to quick spread of the disease.

The disease slowly spread from Yunnan to the surrounding provinces. By 1894, the disease had spread to Canton, killing around 60000 people within a few weeks. Canton had regular water traffic with HongKong and the plague quickly spread to HongKong. The first case in HongKong was reported in May 1894. The patient was a clerk at the Hong Kong national hospital. From May to October 1894, more than 2000 people died in the city and a large part of the population fled. There was another reason for quick spread of the disease in Hong Kong. In April, the Chinese Han people celebrate the Qing Ming festival when they go to the countryside to sweep the tombs of their ancestors. That year, in 1894, the countryside was already having local plague epidemics. The disease was transmitted to visitors from Hong Kong, and when they returned to Hong Kong, they took the disease back with them. In 1894, Dr AlexandreYersin identified the plague bacillus in Hong Kong.

Hong Kong was an important maritime business centre and from there, the disease spread via merchant ship all over the world. However, the country where it really caused widespread destruction was the neighbouring country of India. The first place of India where plague struck was Bombay. Probably, the disease came with rats in opium merchant ships from HongKong. In September 1896, the first case was detected in Mandvi of Bombay by Dr

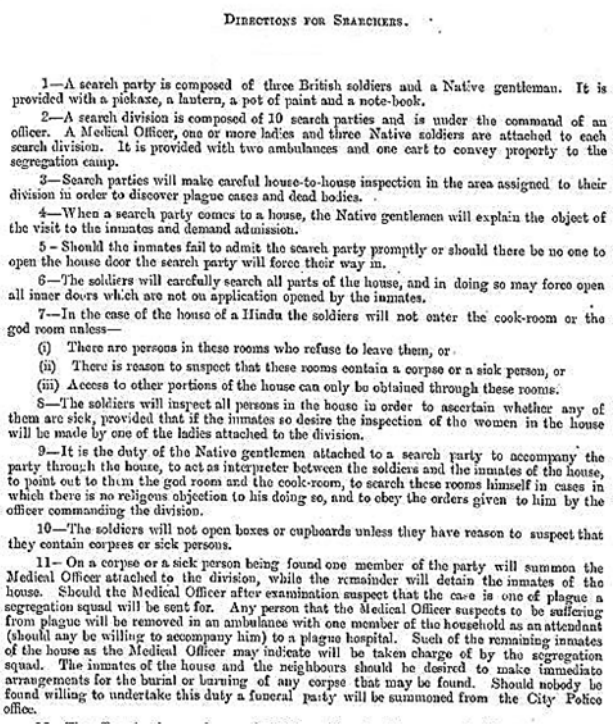
AcacioViegas. Then, the disease was reported from other parts of the city rapidly and death toll was recorded at 1900 people per week for the rest of 1896. The population of Bombay in 1891 was 820000. But in the census of 1901, the population was 780000. However, this decrease in population was not only due to death from the disease but also mass emigration of people out of the urban area. The British government took drastic measures for control of the epidemic like random police searches, forced evacuation of some residential areas and detention of travellers. This led to considerable resentment among the common Indians who found the measures offensive. There were many protests against the British government, culminating in the murder of WC Rand, the British chairman of the special plagues committee, in Pune by the Chapekar brothers.

In 1896, Bombay was a city of thousands of migrant workers living in "chawl"s, which were thatched roof houses. These houses attracted the rats and fleas. These densely populated communities already had high levels of other infectious diseases like typhus and malaria. So, when the fever of plague first started, it was mistaken for these other diseases. Later, appearance of swelling in groin and armpits and quick death (usually within 48 hours) led to proper identification of the epidemic. Mortality rate was close to 60%. When normal public health measures failed, the colonial government enacted a highly authoritarian act: the Epidemic Diseases Act of 1897. This act gave the colonial government sweeping powers to do anything to stop the epidemic. The government also set up a plague research committee consisting of, among others, Dr WaldemarHaffkine from Ukraine. The committee first started working in JJ hospital of Bombay and then moved to another building in Parel. However, initial attempts at finding a drug were unsuccessful. Then, Dr Haffkine started his work on a vaccine. He produced a vaccine but initially many people rejected this new vaccine. The first experiments were conducted among prison inmates at Byculla(probably at that time, medical experiments among prisoners was not unethical) and the vaccine was shown to be highly effective. However, some serious side effects were also reported. By 1900, millions of people were vaccinated throughout India.

Waldemar Wolff Haffkine was a Jewish scientist from Ukraine. Due to the anti-Jewish sentiments in Russian government, he was forced to leave his country and started working first in Geneva and then in Paris, at Pasteur institute. He is credited with discovering vaccines for both cholera and Bubonic plague. It is said that he tested the first vaccines on himself. He came to India in 1893 and worked till 1914. The last years of his life were spent in Calcutta. He was conferred the knighthood by the Queen and in 1925, the plague laboratory in Bombay was renamed, the Haffkine institute.

The government in Bombay also took other measures like demolition of "infected" houses, washing streets with lime, pumping sea water through the sewage channels and advising people to expose household objects to sunlight daily. Disposal of dead bodies was also planned and carbolic powder was sprinkled over corpses. Quarantine camps were set up to move the household members of the patients. Due consideration was given to keep the various castes of the Hindu society in separate camps. But the government measures often enraged the people severely (Figure 5). For example entry of soldiers inside houses were thought to be an affront to the modesty of women and people shifted to quarantine camps often found their houses looted on return. In some places, government doctors would strip suspected patients in public to check for buboes. Moreover, the government efforts were not very successful. More than 50000 people died in Bombay but the British officials often suppressed those records to present a favourable picture of their colony to the world (Figure 6).

From Bombay, the disease spread to other parts of north and west India. Punjab and United provinces were hard hit. Later, it also spread to Bengal and Burma. However, the mortality in eastern India was much lower. By 1905, more than 1 million people in India had died from plague. Over the next thirty years, there were repeated outbreaks with more than 10 million more deaths.



DIRECTIONS FOR SEARCHERS.

1—A search party is composed of three British soldiers and a Native gentleman. It is provided with a pickaxe, a lantern, a pot of paint and a note-book.

2—A search division is composed of 10 search parties and is under the command of an officer. A Medical Officer, one or more ladies and three Native soldiers are attached to each search division. It is provided with two ambulances and one cart to convey property to the segregation camp.

3—Search parties will make careful house-to-house inspection in the area assigned to their division in order to discover plague cases and dead bodies.

4—When a search party comes to a house, the Native gentlemen will explain the object of the visit to the inmates and demand admission.

5—Should the inmates fail to admit the search party promptly or should there be no one to open the house door the search party will force their way in.

6—The soldiers will carefully search all parts of the house, and in doing so may force open all inner doors which are not on application opened by the inmates.

7—In the case of the house of a Hindu the soldiers will not enter the cook-room or the god room unless—

(i) There are persons in these rooms who refuse to leave them, or

(ii) There is reason to suspect that these rooms contain a corpse or a sick person, or

(iii) Access to other portions of the house can only be obtained through these rooms.

8—The soldiers will inspect all persons in the house in order to ascertain whether any of them are sick, provided that if the inmates so desire the inspection of the women in the house will be made by one of the ladies attached to the division.

9—It is the duty of the Native gentlemen attached to a search party to accompany the party through the house, to act as interpreter between the soldiers and the inmates of the house, to point out to them the god room and the cook-room, to search these rooms himself in cases in which there is no religious objection to his doing so, and to obey the orders given to him by the officer commanding the division.

10—The soldiers will not open boxes or cupboards unless they have reason to suspect that they contain corpses or sick persons.

11—On a corpse or a sick person being found one member of the party will summon the Medical Officer attached to the division, while the remainder will detain the inmates of the house. Should the Medical Officer after examination suspect that the case is one of plague a segregation squad will be sent for. Any person that the Medical Officer suspects to be suffering from plague will be removed in an ambulance with one member of the household as an attendant (should any be willing to accompany him) to a plague hospital. Such of the remaining inmates of the house as the Medical Officer may indicate will be taken charge of by the segregation squad. The inmates of the house and the neighbours should be desired to make immediate arrangements for the burial or burning of any corpse that may be found. Should nobody be found willing to undertake this duty a funeral party will be summoned from the City Police office.

Figure 5:A document showing the directions given to "searchers" during plague epidemic in Pune, 1897

However, the plague epidemic also gave rise to mass movements in India, which would later metamorphose into anti-colonial revolts. In 1897, BalgangadharTilak published a his opinion against thedraconian measures taken by the government in his paper, Kesari. This may have influenced the Chapekar brothers in Pune to retaliate against the actions of WC Rand. After hanging of the Chapekar brothers, the British government started a country wide crackdown. Many people were interred in the name of "libel", an infamous colonial act. BalGangadharTilak was also imprisoned and he famously said during his trial, "Swaraj is my birth right". *This sentence is considered a milestone in Indian freedom movement*. Thus, it was an epidemic which gave rise to the first nationalist movement in colonial India. An epidemic was a more important catalyst (compared to literature or religion) in giving rise to the independence movement in India.

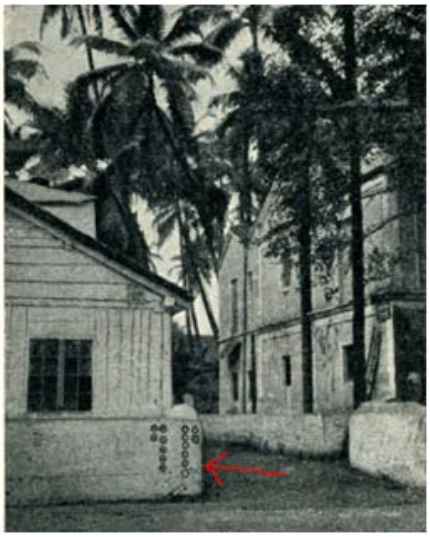


Figure 6: A house in Bombay during the plague pandemic showing (red arrow) number of dead and number of infected with symbols

The pandemic also spread to other parts of the world. In Europe the earliest known cases occurred in September 1896, when two sailors in a ship from Bombay died at the London port. Compared to the earlier two pandemics, the number of cases in Europe was much less. It mainly was concentrated in the port cities. The Nordic countries reported no cases. Total number of reported deaths in Europe up to 1947 was only 457. One reason for this paucity of cases in Europe in this period was the phenomenal improvement in public health measures. There were regular sanitary conferences. Just after the report of cases in London in 1896, a sanitary conference was held in Venice in 1897 where specifically the spread of plague was discussed. Also, from 1899, regular public health reports were published in Europe which compiled the cases and deaths from plague. This led to a good alert system for all countries. Also, many European ports introduced a "certificate of health" for ships coming from Asia. Before being allowed to dock, the ships were inspected for any suspected human case or unexplained rat mortality. Also, in port areas, there were special "rat catchers". These workers were required to catch rats and dip them in petrol to kill fleas (Figure 7).

Figure 7: Liverpool port rat catchers dipping rats in buckets of petrol before killing them

Also, if plague broke out in a city, the local authorities would examine local rats for evidence of carriage of the bacilli. This method was recorded in Glasgow in 1900 C.E. On the Eastern front, Russia was also affected by the epidemic. In 1899, plague was reported in areas ruled by the Astrakhan government. According to current reports, it was probably pneumonic plague and spread quickly among close contacts of the first victim. Many of them suffered from hemoptysis. Although number of cases was small, mortality was 96% and most people died by day three of onset. The government took public health measures like covering the ground with lime and cordoning off the villages with reported cases. Houses with plague cases were sealed off and later, burnt.

An offshoot of this third pandemic was the Manchurian plague of 1910-11. This was a devastating epidemic of pneumonic plague which killed around 60000 people. Mortality was almost 100%. This plague was spread through marmot hunting activity in north east China. Dr Wu Lien Teh was a Chinese physician who used quite revolutionary measures to control this epidemic within a very short time. He was the first to advocate for the use of cloth face masks by healthcare workers while attending patients. The Chinese government also took the help of foreign doctors. Dr Teh's promotion of face mask use by

healthcare workers was an important milestone in public health and this would later become more popular during the influenza pandemic of 1918. This also gave rise to the concept of hazmat suits (figure 8). After this third pandemic, the intensity of plague outbreaks has been very low till now. But the disease is by no means eradicated. As a later section of this article will show, local plague epidemics are still reported frequently.

Figure 8: Plague workers wearing protective clothing during Manchurian plague of 1910

Small Pox :

Small pox was one of the major causes of widespread mortality throughout the human history. It is one of the oldest known killers of mankind. The earliest known example of small pox victim was probably Pharaoh Ramesis V of Egypt, who died in 1157 B.C.E. Examination of his preserved mummy has revealed skin lesions similar to small pox. However, other researchers have refuted this claim as it was impossible to isolate the virus from the skin of those mummies. Ancient Chinese texts have also described small pox like the text of Wan Quan (1495-1580). He is known to have written at least ten treatises, two of which deal with small pox. He described the contagious nature of the disease and its treatment.

In SushrutaSamhita (compiled between 100-400 C.E.), there is mention of skin diseases "Masurika" which modern researchers equate with small pox. But other Vedic Scholars like Y.L. Nene assert that small pox was known in India much before that time. In Rigveda book 7, chapter 50, verse 4, there is mention of a disease called "Shipada". Many researchers argue that this was a reference to pox. Madhavakara, writing in the eighth century C.E. has also described small pox in great details.

In Europe, small pox was probably brought to Greece in 430 B.C.E. during a war. The prosperous city state of Athens was devastated with estimated mortality of 75 000-100 000. This is known as the plague of Athens. There were two further epidemics in 429 and 426 B.C.E. The leader of Athens, Pericles perished in the epidemic. Thucydides, a contemporary historian, has described the disease symptoms and the social upheaval resulting from the epidemic (figure 9). In his words,

"..the body externally not so hot to the touch, nor yet pale; a livid color inkling to red; breaking out in pustules and ulcers." The pain in the skin was so intense that people preferred to lie naked or be immersed in cold water.

People started ignoring the law and dead bodies were dumped in mass graves. Even the carrion eating birds refused to feed on the dead bodies. Now, recently historical scholars have cast a doubt whether this epidemic was small pox. They have suggested that this epidemic may also have been due to typhus, measles or even an ancient form of Ebola. Description of symptoms of the illness are varied and Titus Lucretius, writing in the 1st century BCE described that the victims had bloody discharges from bodily orifices. Some scholars have also suggested that this disease may have resulted from a virus which is now extinct. Some authors have suggested that this epidemic may be the result of two simultaneous pathogens. Whatever may be the reason, this epidemic dealt a severe blow to the city state of Athens which could never recover its previous glory.

Figure 9: Manuscript of Thucydides on the Peloponnesian War, which describes the small pox epidemic of Athens [Dorieo, Wikimedia Commons (License CC-BY-SA 4.0)]

A similar epidemic struck Rome in 167-68 CE, called Antonine plague. The term "plague" here is used in the generic sense to mean an epidemic. The epidemic continued till 180 CE. The famous Greek physician, Galen lived in Rome at that time and he has given detailed descriptions

of the epidemic. The disease probably came to Rome along with the troops returning from the East after invasion of the city of Seleucia. At that time in Rome, there were two emperors (co-regents): Lucius Verus and Marcus Antoninus. The former died from the illness in 169 CE. The disease was named after Antoninus. The epidemic came in a second wave nine years later. The mortality in Rome was recorded at around 2000/day and a large part of the population perished. The Roman army also suffered heavy losses. Indo-Roman trade relations in the Indian Ocean were severely reduced. Total number of deaths is estimated at 5 million.

Galen has described the disease symptoms as "fever, diarrhoea, pharyngitis and skin eruptions". Most scholars believe that this illness was small pox although some historians are of the opinion that this was an epidemic of measles. Galen also described:

"Of some of theses which had become ulcerated, that part of the surface called the scab fell away and then the remaining part nearby was healthy and after one or two days became scarred over. In those places where it was not ulcerated, the exanthem was rough and scabby and fell away like some husk and hence all became healthy."

He said that those who survived got well by roughly two weeks. Also the survivors developed lasting immunity to the infection and thus, cared for subsequent victims.

Modern historians argue that the Antonine plague, along with similar other disease outbreaks was one of the factors which initiated the downfall of the Roman Empire. There is archaeological evidence that the roman government invested heavily in building places of worship during the epidemic. If this epidemic started the downfall, the Justinian plague, which was described earlier, dealt a death blow to any hope of Roman comeback (Figure 10).

As the army became depleted and the farmlands went uncultivated, the emperor Antoninus freed slaves and gladiators to fill the army. Also, he invited outsiders from Germany or Gaul to settle inside the empire for cultivation.

Figure 10: Angel of death at a door in Rome during the Antonine plague: Medieval painting

Small pox did not break out as a distinct pandemic but there were several devastating epidemics in all the continents throughout history. For example, in Africa there was smallpox epidemic in South Africa in 1713 and 1755 and multiple epidemics in Ethiopia and Sudan throughout the nineteenth century. Sometimes whole tribes were wiped out in some parts of Africa. But the part of the world where small pox really changed history for good was the Americas. As invaders and travellers came to the Americas from the "old world" they brought with them the deadly diseases to which the indigenous people were not exposed. The chief among them was small pox. The disease destroyed two of the greatest empires of the Americas:Aztec and Inca and also caused high mortality among the Cherokee Indians and other indigenous North American tribes.

The small pox virus was introduced into the Aztec empire of Mexico by Spanish soldiers. At first the Aztecs chased the Spaniards away. But by 1520, the disease had spread and Aztecs were dying in millions. Their army was in ruins and administration was effectively paralyzed. Thus, when Hernan Cortes returned in 1521, he easily captured the Aztec city of Tenochtitlan. The Spanish soldiers found heaps of dead bodies inside the city and streets were full of small pox victims. Toribio, a Spanish Monk has described the epidemic thus:

"It became such a great pestilence among them throughout the land that in most provinces more than half the population died; in others the proportion was less. They died in heaps, like bedbugs."

It is estimated that around half the population in Central America died from the illness within a very short time. Many of the military leaders were dead and thus, the borders were effectively left unguarded(figure 11). This small pox was the "secret weapon" which enabled a group of around 500 Spanish conquerors to capture the Aztec empire of more than 16 million people.

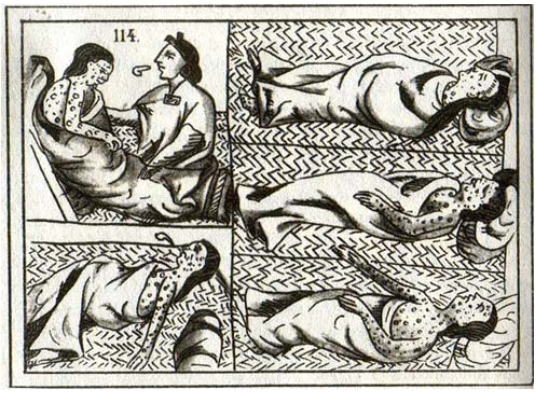


Figure 11: Aztec small pox victims, Medieval painting. An inhabitant of Tenochtitlan has described the disease:

"It began to spread…striking everywhere in the city and killing a vast number of our people. Sores erupted on our faces, our breasts, our bellies; we were covered with agonizing sores from head to foot. The illness was so dreadful that no one could walk or move. The sick were so utterly helpless that they could only lie on their beds like corpses, unable to move their limbs or even their heads. They could not lie face down or roll from one side to the other. If they did move their bodies, they screamed with pain."

Further south, in the Inca Empire, the effects were even more devastating. Small pox killed the Inca emperor HuaynaCupac suddenly in 1524, leaving his prosperous kingdom in tatters. Among the common people, more than 200 000 died quickly. This left the empire considerably weakened and Francisco Pizarro was able to conquer the empire in Peru with less than 200 soldiers. Small pox arrived in Brazil in 1563 with Portuguese colonizers and devastated many indigenous tribes. Thus small pox wiped out whole segments of the human civilization in three places: Mexico, Brazil and Africa.

Small pox was also raging in Europe at that time. Queen Mary II of England died of small pox in 1694. In some cities of Britain, mortality from only small pox was one-sixth of the birth rate. It is estimated that small pox caused around 400 000 deaths per year in Europe and was responsible for one-third to half of all blindness. Among the other royalty who succumbed to the disease were Peter II of Russia and Joseph I of Germany in the eighteenth century. In 1721 in Boston, out of 10700 citizens of that city, 5889 contracted the disease and 855 died (figure 14). During the Franco-Prussian war of 1870-71, more than 23 000 french soldiers died from small pox. In America, there is account of the British soldiers using small pox as a bio-weapon. Local Indian chiefs would be gifted with clothes earlier used by small pox victims. These clothes were the source of the virus and many tribes were simply wiped out. As Europe increased the rate of vaccination despite religious antagonism (figure 12), incidence of the disease decreased but other parts of the world still suffered violently.

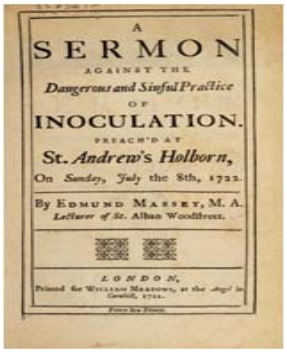

A
SERMON
AGAINST THE
Dangerous and Sinful Practice
OF
INOCULATION.
PREACH'D AT
St. Andrew's Holborn,
On Sunday, July the 8th, 1722.
By EDMUND MASSEY, M. A.
Lecturer of St. Alban Woodstreet.
LONDON,

Figure 12: Sermon against small pox vaccination in London, 1722

India was another country where small pox had devastating effects on the population. Small pox was present during the mediaeval times. The 11th century text of "kitab-ul-Hind" by Al-Beruni mentions this disease. The contemporary Indians believed that the disease was caused by a particular wind blowing from the south. The Mughal prince Khurram, who would later become famous as Shah Jahan, was affected by small pox in his childhood. But he survived. Medieval India was a time when slaves were sent to various parts of the world by European colonial powers. In such an account, it is written that out of 600 slaves who reached Batavia (present Jakarta) from Masulipatnam, 135 died on the way due to small pox. Thus, such localized epidemics were frequent. Contemporary Dutch records have documented small pox epidemics in Cochin and Malabar in 1718-1726. Stavorinus, a Dutch naval commander in Chinsura, recorded a severe epidemic in the city in 1770.

There is very little mention of treatment, except fresh food, rest or isolation. In 1722, the Mughal physician Muhammad Akbar Arzani tried to treat patients by piercing their blisters with gold needle. Gold dust and clove were also used in medicines for small pox.

During the British colonial rule, there are numerous accounts of small pox epidemics in different parts of India. in Bengal, small pox epidemics occurred in 1832-33, 1837-38, 1843-44, 1849-50, 1878-79 and 1894-95. While in 1832-33, smallpox killed 2,814 in sixteen months in Calcutta, in 1837-38 it killed 1548, in 1843-44, there were 2949 deaths, and in 1849- 50 it killed 6,100 (Report of Smallpox Commissioner, 1850). This record includes only urban Calcutta and the mortality is rural areas was largely unrecorded. In 1849, nearly 13% of deaths in Calcutta were due to small pox. In 1875, the death from small pox peaked between February and April with the highest death rate in March (6.5 per 1000). Most of the dead were locals with very few of the European immigrants suffering from the disease. Between 1868 and 1907, there were 4.7 million small pox deaths in India. In the nineteenth century, 75% of the blindness in India was due to small pox. The British surveyors often recorded the death rate of small pox as "per mile". Thus, between 1869 and 1879, small pox death rates were between 10—32 per mile per year in many Indian villages. In 1895, the deaths from small pox in Calcutta ranged from 140-230 weekly. As the rate of vaccination rose, the mortality from small pox decreased proportionately. The table 1 below gives an account of small pox mortality and vaccination coverage in British India (excluding native states) : -

Table 1 : Table showing mortality from small pox in British India over 80 years

Period	Small pox deaths/ year	Vaccination coverage(in million)
1868-77	1436890	?
1878-87	1460890	4.75
1888-97	961424	6.75
1898-1907	832165	8.75
1908-17	851999	9.5
1918-27	832477	14.5
1928-37	763279	19.1

**Adapted from Rogers L., 1944*

In Kochi, the modern Mattancherry Ayurveda hospital was then an isolation hospital in an island away from the main city. The bodies of the dead were laid out on banana leaves and very few people agreed to perform the last rites.

In 1944, there was another small pox epidemic in Calcutta. Contemporary physicians felt that inadequate vaccination was the main reason as large sections of the population still resisted vaccination. 40% of the mortality was in children 1—5 years of age, and this indicated lack of vaccination coverage. In Calcutta city hospitals, a total of 120 beds were demarcated for small pox patients. Also, one author in "Indian medical Gazette" notes that many convalescent patients of small pox were allowed to roam in the crowded streets, thereby increasing the risk of spread. Goddess Sitala was worshipped by many citizens in the hope of warding off the disease (figure 15).

In 1974, the worst small pox epidemic of the 20th century occurred in India (figure 13). There were 61482 cases in India between January and May 1974. Over 15000 people died. The main focus of infection was the three eastern states of West Bengal, Bihar and Orissa. The highest case load was in the first week of May, 1974 with 11000 new cases in one week. A lot of people were permanently blinded. The case load represented almost 90% of the total number of cases all over the world. But this was the final epidemic before small pox was eradicated from India in May, 1975.

Figure 13: A poster distributed by the Indian government during small pox eradication campaign in 1974 (public domain document)

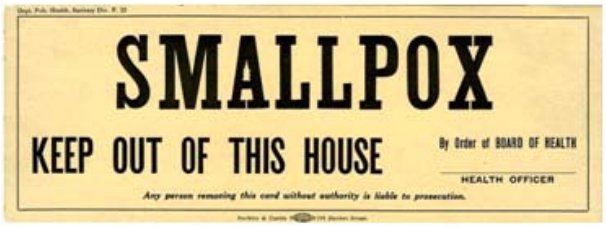


Figure 14: Signs posted in front of houses with small pox patients in the USA (before 1924)

Figure 15: A Kalighat pat of 19th century depicting goddess Sitala, the reigning goddess of pox

A recent archaeological find has cast doubt on the origin of small pox. In 2016, from the body of a mummified child in Lithuania, researchers extracted the DNA of small pox. DNA analysis reveals this to be the oldest specimen of small pox and those researchers are of the opinion that modern small pox, which was eradicated in 1980, was probably originated sometime in the 16th century. The earlier descriptions of the disease may be some different virus which is not present now. However, this view is not widely accepted.

Cholera :

The disease which caused frequent pandemics within a very short period of time was cholera. The disease was probably present from ancient times but it generally caused localized outbreaks.The quick succession of pandemics occurred only in the nineteenth and twentieth centuries with improvement in ocean trade and European colonization.

In the nineteenth and twentieth centuries, seven cholera pandemics occurred and there were numerous other local epidemics. The dates of the seven pandemics were 1817-24, 1829-37, 1846-60, 1863-75, 1881-96, 1899-1923 and 1961-75. As these dates make clear, the pandemics were not short-lived but each one lingered on for ten to twenty years. Some authors are of the opinion that the seventh pandemic is still in vogue.

The first pandemic of cholera started in 1817 in British presidency of Bengal and spread to rest of India by 1820. The disease then spread to China, East Asia and Asia Minor upto the Caspian Sea. The epidemic is thought to have started from Jessore in East Bengal. Then it spread quickly to Calcutta and from there, to other ports of India and Sri Lanka. By 1820, the disease had spread to Thailand, Indonesia and Philippines. By 1821, it had spread to the Muscat in the Persian Gulf along with the British troops and Astrakhan port in southern Russia; by 1822, it reached Japan. The notorious slave trading post of Zanzibar in Africa was also affected via trade routes from the Persian Gulf. It raged on till 1823-24 after which the severe winter may have killed the bacteria in water supplies. From this first Pandemic, the British colonists named the disease "Asiatic Cholera" or "Indian cholera" although the bacteria were the same as earlier European strains. Thus, Bengal gained infamy as the birthplace of cholera, although this was mainly a colonial construct.

Now the question is, was cholera present in India before this pandemic? Definitely. In 1781-83, the new British settlement of Calcutta was severely affected by a cholera epidemic. In 1814, there was an epidemic of cholera among the European troops in Fort William. In contrast to small pox epidemics where native population was far more affected than the European immigrants, cholera killed both the demographic groups equally.

In 1817, a government doctor in Jessore reported high mortality among the townspeople from a diarrhoea like illness. Jessore at that time was the centre of textile and indigo trade and a lot of migrant labourers were employed in the town. These labourers may have been the source as well as vehicles of the epidemic. At first the epidemic in Jessore did not raise much alarm. But after March 1817, it spread to Calcutta and within two months, there were 727 deaths in Fort William. This first raised alarm among the British administrators.

The disease then spread to the native population and between September 1817 and July 1818, there were 36, 945 cases in Calcutta and its surroundings. From august 1818 to February 1819, there were 24, 227 cases in Bombay. In Calcutta, there was a register at the KashiMitraGhat for Hindu cremation. There, it is seen that out of 3559 bodies brought there in 1817, 1323 (37%) were due to cholera and a further 1269 (36%) were due to "diarrhoea", which may or may not mean cholera. This data is from one cremation site of one religion in one city. Thus the actual extent of the mortality was much higher. People started fleeing the epidemic hotspots. Charles Chapman, the magistrate of Jessore wrote a letter to Calcutta describing the exodus from the town of both European and Indian officials. Similar report was sent by the magistrate of Balasore. The epidemic was seen by the common people in Bengal as divine punishment and worshipping of Ola Bibi and goddess Kali increased manifold. On 17 September, 1817, the magistrate of Calcutta wrote of the disease that:

"….of late been far more fatal than at any former period within the recollection of the oldest inhabitants, running its course generally in a few hours and sometimes in a few minutes."

Since the germ theory of disease was still unknown, the medical men of that age did not attribute the disease to water and thought it was not contagious. In fact, when the first news of the Jessore epidemic came, it was put down to seasonal illness. Many of them thought that since Calcutta was not situated in the humid part of Ganges delta, cholera epidemic would not occur here. Dr Tytler, the assistant surgeon in Jessore in 1817, thought the disease was the usual seasonal outbreak and treated it with calomel and opium. He, along with the local people, thought that the disease has resulted from consumption of newly harvested rice (morbusoryzeus). When the disease broke out in Travancore in 1818, the traditional physicians or vaidyas just fled the city and could not offer any hope. However, the Europeans studied the Indian texts to find any mention of treatment of the disease. As both European and traditional Indian physicians failed to provide any remedy, the common people in many places tried to find divine or supernatural explanations. For example, in one place of Bundelkhand, the outbreak was attributed to killing of cow by the British. In some places, some people in the society were demarcated as witches responsible for the disease.

The total mortality from this pandemic may never be known. In India, the total mortality over 8 years was somewhere around 8.75 million. But famous historian David Arnold thinks this to be an over-estimation and in his estimate, the total mortality was around two million all over India. Outside India, around 30000 people may have died in Bangkok and more than 100 000 in Java. In Basra, around 18000 people perished and in Mauritius, around 6000 (mostly slaves). Figure 16 shows a rare map of the pathway of spread of cholera in 1817 (an early example of medical cartography)

The second pandemic occurred between 1829 and 1837. The second pandemic is also thought to have started from the Ganges delta. However, some historians are of the opinion that vestiges of the first pandemic lingered in Indonesia and Philippines till 1830 and from this focus, the second pandemic arose. Whatever may be the source, the disease reached Japan by 1831. By 1829, it had already reached the Ural mountains. At Orenburg, a city at the border of modern Kazakhstan, there were 3500 cases in 1829. The disease then spread to whole of Russia by 1831 and in February 1831, the Russian soldiers brought the disease to Poland. More than 100, 000 deaths occurred in Russia alone.

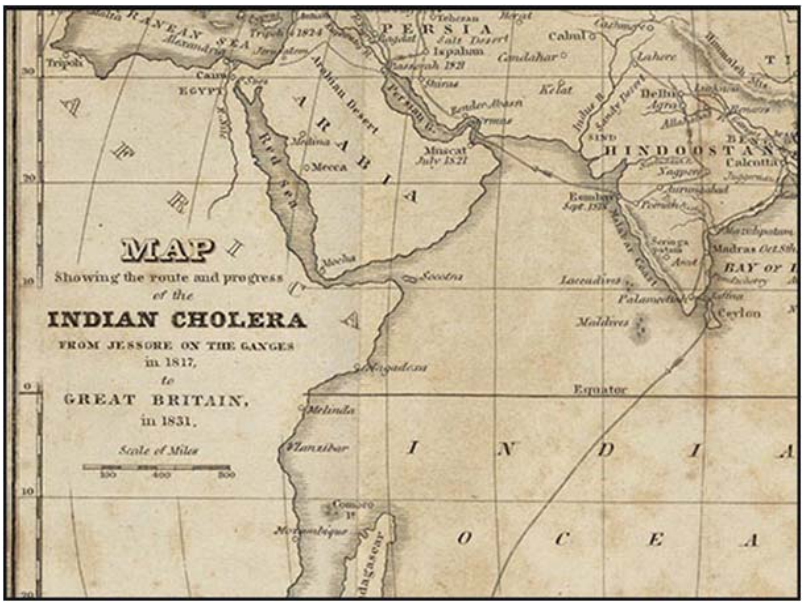
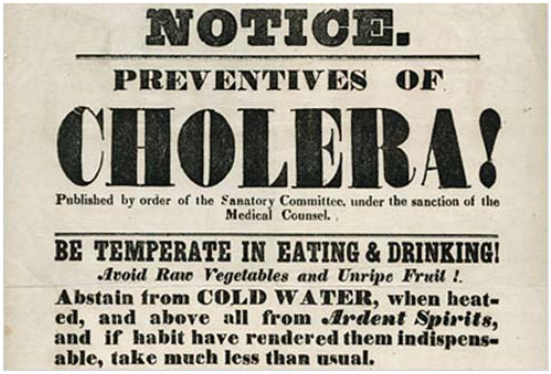


Figure 16: The first cholera pandemic in map

By December 1831, the disease reached Britain. In London, there were 6536 deaths, in Paris 20, 000 and in Belgium around 8000 deaths. The disease spread via ships to Canada and America. In America, the disease spread from Atlantic to the Pacific coast (figure 17). A little later, the Scandinavian countries of Norway and Sweden were ravaged. In 1831, Cholera reached Mecca, killing about 12, 000 pilgrims. Pilgrims returning from Mecca carried the disease back to Egypt and Tunisia. While the disease died down somewhat in India after 1835, there were two more violent recurrences in lower Bengal in 1837 and 1840.


NOTICE.

PREVENTIVES OF

CHOLERA!

Published by order of the Sanatory Committee, under the sanction of the Medical Counsel.

BE TEMPERATE IN EATING & DRINKING!

Avoid Raw Vegetables and Unripe Fruit !.

Abstain from COLD WATER, when heated, and above all from *Ardent Spirits*, and if habit have rendered them indispensable, take much less than usual.

Figure 17: Public health notice in New York, 1832 (showing inadequate understanding of the disease)

Scientists were still trying to establish the cause of cholera. The French thought that the disease was a result of habits of poor communities. In America, the disease was associated with Irish immigrants. In Edinburgh, Dr Thomas Latta first established intravenous saline drip and showed that this drip could improve the condition of cholera patients. However, sadly, Dr Latta himself died from the disease. But before death, he published his observations in the Lancet journal in 1832 (figure 18). Extracts from that article are given below:

"Shortly after the commencement of the injection the pulse which was not ok, gradually returns; the eyes, which were sunk and turned upwards, are suddenly brought forward, and the patient looks round as if in health, the natural heat of the body is gradually restored, the tongue and breath, which were in some cases at the temperature of 79 and 80, rise to 88 and 90, and soon become natural, the laborious respiration and oppression of weight of the chest are relieved ..."


SALINE VENOUS INJECTION

IN CASES OF

MALIGNANT CHOLERA,

PERFORMED WHILE IN THE

VAPOUR-BATH.

By Thomas Latta, M.D., Leith.

To the Editor of The Lancet.

Sir,—If you have a corner in your valuable paper to spare, please give publicity to what follows.

Hitherto those who have deemed the saline venous injection a remedy worthy of trial in the stage of collapse in cholera, have often been disappointed in consequence of the evanescent nature of the good symptoms produced by it. To render these more permanent appeared to me a mighty desideratum. Hitherto such has been aimed at chiefly by a repetition of the remedy. Incredible quantities have been used, and, I have no doubt, sometimes evil consequences have been the result. I have, therefore, been anxiously in quest of some remedial agent capable of supplying this deficiency, being convinced that in desperate cases of collapse, when the evacuations have been profuse, nothing can be done in a very great majority of cases, without restoring to the blood its lost principles;

* There are some passages in Dr. Cheney's letter which we do not understand, but we have followed the M.S. with exactness.—Ed.

Figure 18: Lancet article of 1832 by Dr.Thomas Latta, which is the first description of intravenous fluid therapy in cholera (since 70 years have passed after death of the authors, this work is copyright free)

The third pandemic continued for a long one, from 1846 to 1860. According to Sticker (1912), it continued till 1864. This time also, Europe suffered heavily, with more than a million deaths in Russia and more than 50000 deaths in England and Wales. But the most remarkable feature of this epidemic was a discovery by Dr John Snow. In 1853-

54, Cholera claimed 10, 739 lives in London. On 31st august 1854, cholera outbreak started in Broad Street of London. Over the next three days, 127 people in the area died. Over 10 days, more than 500 people were dead. Florence Nightingale started working in the nearby Middlesex hospital to help with the epidemic. Dr John Snow was working in the area and after talking with the local people he realized that a public water pump on Broad Street was the chief source of the outbreak. He did chemical and microscopic analysis of water from the pump but did not find anything to suggest a cause of the disease. But still he was convinced about the source of the disease and persuaded the St. James parish authorities to remove the handle of the pump. This action caused a significant decline in cholera cases in the area. Although the germ for cholera would be discovered much later, this event is considered as a milestone in public health in the world (Figure 19 and 20).

There was one more observation. None of the workers in the nearby Broad street brewery contracted cholera. Dr Snow saw that the beer was boiled for adding hop. This step may have killed the germs. Thus, it was proven that boiling water can kill germs of Cholera. In Tokyo the epidemic killed between 100, 000 and 200, 000 people. In this pandemic, the remote islands like Puerto Rico and Gran Canaria were also affected by marine routes. Between November 1855 and December 1856, more than 25000 people in Puerto Rico were killed.

Just as Irish immigrants were blamed for the second pandemic in the Americas, in the third pandemic they blamed the African-Americans. There was a lot of mortality from Cholera during the American civil war. Still the etiology of the disease was unknown and it was blamed on miasma, wrath of God or filthy living habits.

Figure 19: A newspaper caricature showing the broad street pump as source of cholera(since 70 years have passed after death of the authors, this work is copyright free)

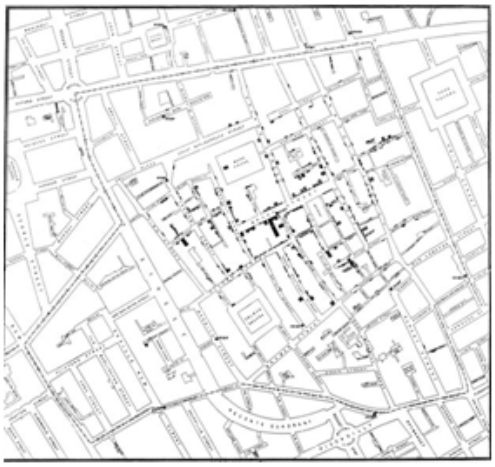


Figure 20: The map by Dr John Snow showing clustering of cases around that water pump

So, till the third pandemic, there was only rudimentary medical knowledge about cholera and people were still groping in the dark. In 1854, an Italian doctor named FilippoPacini did histological study of intestine of a patient dying from cholera. In that intestinal mucosa, he noticed certain comma shaped organisms, which he called "vibrio". He published his work in 1854 itself but because of the prevailing belief in the "miasma" theory, this research was ignored in his lifetime (figure 21). It would be another three decades before this bacteria would be recognized as the cause of cholera and Pacini's contribution would be recognized. Pacini published further observations on the cholera organism in 1865, 1866 and 1871.

So, in hindsight, the cholera bacilli were discovered


GAZZETTA MEDICA ITALIANA

TOSCANA

ANNO VI. SERIE II.

Num. 51 Firenze, 19 Dicembre 1854. Tomo Quarto

SOMMARIO

Osservazioni microscopiche e Deduzioni patologiche sul Cholera Asiatico; Memoria del Dott. FILIPPO PACINI, *Publico Professore di Anatomia Topografica e di Anatomia Microscopica normale, nella Scuola Universitaria Medico-Chirurgica dell' I. e R. Arcispedale di Santa Maria Nuova di Firenze, e Socio di diverse Accademie italiane e straniere*

Figure 21: The 1854 publication by Pacini in Italian Medical Gazette(since 70 years have passed after death of the authors, this work is copyright free)

during the third pandemic, although its importance would be realized much later.

The fourth pandemic occurred between 1863 and 75. This one also originated in Bengal and spread elsewhere. Calcutta was recognized as the epicentre of the outbreak and in 1866, an article in Indian Medical Gazette called the Calcutta port the "Maelstrom of death". Although the "poison" of Cholera was still unknown, the pollution of Ganges River has been discussed and there is some mention of the connection between human sewage and the disease. It is documented that out of all the cholera patients in Calcutta medical College, half were sailors from the port area. Drinking of river water by sailors in the ships docked at the Calcutta port is discussed as a reason for frequent outbreak of the disease among the sailors.

With a bunch of Muslim pilgrims from Bengal, the disease spread to Mecca and it killed around 90, 000 pilgrims in the first year of its arrival. Large religious congregations were always a source of the cholera epidemic, as we will see later in more examples from India.From Mecca, the disease spread to other cities in the Middle East. Iran was a highly prosperous kingdom at that time and cholera attacked its cities like Tehran and Shiraz (figure 22). In the 1870s, the epidemic killed around 50000 people in North America and it spread along the inland waterways. A region, which was newly affected this time, was sub-Saharan Africa and more than 70 000 people were killed at Zanzibar alone. In Italy between 1865 and 1867, there were 113, 000 deaths from Cholera. Physicians in Italy tried several bizarre remedies. Alcohol and distilled water were injected into the veins of patients. One doctor injected strychnine (Faustino Gamba, 1867). Dr Rodolfi tried oral ammonium citrate and even intravenous air. Such experiments were often conducted on "mental" patients in asylums. Cholera also wreaked havoc in Hungary in 1872-3 and Syria in 1875. However, the effect on England was much less, mainly due to the earlier work of John Snow.

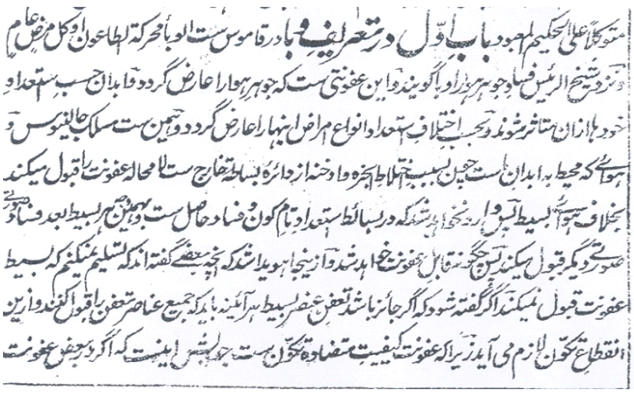


Figure 22: An Iranian medical script from 1866, which was a translation of an Indian book on cholera

The fifth and sixth pandemics occurred in the periods 1881-96 and 1899-1923 respectively. The fifth pandemic is notable for the first official characterization of the germ, Vibrio cholerae, by Robert Koch. Dr Koch also established that the disease was spread by faeces of the infected person, in water and that it was contagious. The origin of the fifth pandemic is doubted but probably it originated in Lahore area, from where pilgrims carried it to Mecca. From Mecca it spread to Egypt, where is claimed more than 58 000 lives. In 1884, the disease spread to Europe. Italy had already started the quarantine measures, which were highly successful in limiting the epidemic in all places except Naples. Spain suffered severely in the summer of 1885 with more than 60 000 deaths. Great Britain was able to contain the epidemic successfully and in 1887, when the disease appeared in New York, quick testing and isolation also succeeded in containing the spread.

However, the disease came to Afghanistan and from there, via Persia, it went to Russia, where more than 800, 000 people were killed in the epidemic. In one German city, Hamburg, the disease became particularly severe. The American author, Mark Twain, was in Hamburg during the epidemic. He has described that at the height of the epidemic in 1892, the poor people with the disease would be forcibly taken from their houses to isolation camps and most of them died unseen. He also found that the local newspaper often downplayed the death toll. There were many reasons for the severity of the epidemic in Hamburg. Firstly, it was a prosperous port and the local administration valued the economy over human lives. Thus, they did not ensure proper isolation. Secondly, although many European cities like London were investing in water purification and showing good results, Hamburg authorities refused to invest in water filtration systems. Finally, when 10 000 people died within six weeks, they had to call in Dr Robert Koch for advice.

The sixth pandemic began in 1899 from Calcutta, Bombay and Madras presidencies. This pandemic was particularly severe in India, while in Europe or USA, its effect was much less. This was a triumph of western public health system (figure 23). But other areas of the world suffered haplessly.

In Russia, more than 500, 000 people died between 1900 and 1925. In Philippines, more than 200, 000 people died in three years, including their first prime minister. In India, more than 800, 000 people died. There were repeated epidemics in two major religious gatherings, Kumbh Mela and Mecca. The table 2 below gives the mortality at Kumbh Mela in this sixth pandemic

Figure 23: A French map of 1911 showing the pathway of the pandemic from India

Table 2 —Table showing cholera mortality at Kumbh Mela during sixth cholera pandemic

Year	Mortality
1897	44208
1903	47159
1909	21823
1915	90508
1921	149667
1927	28285

As the readers have realized, the sixth pandemic overlapped with the First World War. There was a lot of cholera mortality among the soldiers and prisoners of War. But other diseases like Typhus and of course, the Influenza, were far greater killers.

In India, cholera was already rampant after 1900, but during the war years, it became even more virulent, probably due to lack of doctors in the country, all of whom had gone for war service (table 3).

Table 3 — Table showing annual cholera mortality in India in select years

Year	Mortality
1904	189855
1906	682649
1908	579814
1918	556533
1919	565166

In the decade starting 1890, there was a lot of mortality among the pilgrims of Mecca from cholera. So, returning pilgrims were kept at a quarantine station at Jebb el Tor in Egypt before being shipped back. The pilgrims were kept in tents widely separated in the desert and there was no flowing river nearby. Infected parties were kept separate from others (figure 24).

Figure 24: Mecca pilgrims in quarantine camp, early 1900s

The seventh pandemic was a recent phenomenon. In started somewhere around 1961 and continued till 1975. It started from Indonesia and spread to India and East Pakistan. Then, it spread to west Asia up to Turkey. Whether it involved the former Soviet Union is unknown. In 1971, total worldwide cases was 155, 000. This pandemic was different from those before it because the strain of bacteria was new: El Tor. However, by this time, public health measures were far advanced and local outbreaks were quickly controlled.

One important historical event in this period was the Bangladesh war of liberation. During the war, an influx of refugees occurred along the border into India and in these refugee camps, there were frequent outbreaks of Cholera. Many people perished overnight (figure 25). But this epidemic also saw the first large scale use of the ORS solution for dehydration and it was highly successful.

Figure 25: A refugee camp at Bongaon; similar camps were the epicentres of cholera outbreaks: Source: Bangladesh Genocide Archive

Influenza :

Influenza was known as a mild illness for many centuries. In the middle ages in Europe, there are accounts of epidemics of respiratory infections. However, there is no way to be sure whether this was influenza.In 1580, the Italian doctor, Buoninsegni coined the term "una influenza di freddo" to mean that all respiratory infections result from cold. This gave rise to the term "influenza" in English and the notion among the common public that cold weather is the cause of respiratory infections. In 1889-90, there was a large scale outbreak of influenza, known as the "**Russian Flu",** which killed around one million people. However, later research has cast doubt on the aetiology of this epidemic and some researchers are of the opinion that it may have been a strain of coronavirus also. But in 1918 there was no doubt: a new mutated strain of the influenza virus caused a pandemic and led to large scale loss of human lives.

Flu pandemic of 1918 :

The 1918 influenza pandemic lasted between 1918 and 1920. Earlier, it was estimated that between 20 to 50 million people were killed. But recent historical revision puts the mortality figure close to a 100 million worldwide. The disease had high secondary attack rate and a quick stormy course. More than 40% of the world population were infected including population in remote places like Greenland and Pacific Islands. Mortality was very high.

The pandemic is known as the "Spanish flu" although this was a misnomer. The disease did not originate in Spain. The disease is likely to have originated among the troops of the First World War. But the countries kept the news a secret to avoid breaking the morale of the countrymen and the military. Since Spain was a neutral country during that war, the Spanish media was free to report on any public health event. Thus, the Spanish media was the first European source of news about the epidemic. In this way, the term "Spanish Flu" was coined in Europe and America. The king of Spain, Alfonso XIII also got infected and this increased the frenzy of coverage in the media. While the rest of Europe thought that the flu had originated in Spain, the Spanish people called it the "French Flu".

But where did the flu pandemic actually originate? Scientists have been divided in their opinion with potential suggestions being Britain or Russia. But recent data suggest that the pandemic may have originated from the USA. On March 4, 1918, more than 100 soldiers at Fort Riley in Kansas reported to the hospital with fever, headache and sore throat. These are now thought to be the first cases of the flu. As American soldiers crossed the Atlantic to join the battlefield in France, they carried the disease with them. The disease affected both sides in the conflict with numerous cases among both British and German troops. In fact, the flu epidemic may be a major reason for the eventual defeat of the Germans. The disease spread with the returning soldiers to all parts of the world.

In the USA, the disease affected nearly 30% of the population. The cause of the disease was still unknown. In the December 28, 1918 issue of JAMA, there is mention of attempts to isolate the "influenza bacillus". In the same issue, there is detailed description of clinical course of a patient, given by an US army doctor. He describes that the patient was admitted with fever, body ache and cough. Soon, the chest was full of ronchi and the patient had severe tachypnea. By day 5, the patient was cyanotic and had clinical features of bilateral lobar pneumonia. Within three days, the patient passed away. In Omaha, following the Aksarben festival, there was a sudden outbreak of the flu. Similar outbreaks occurred in many US army camps. There was high mortality among the young adult and again, very old age groups (figure 26).

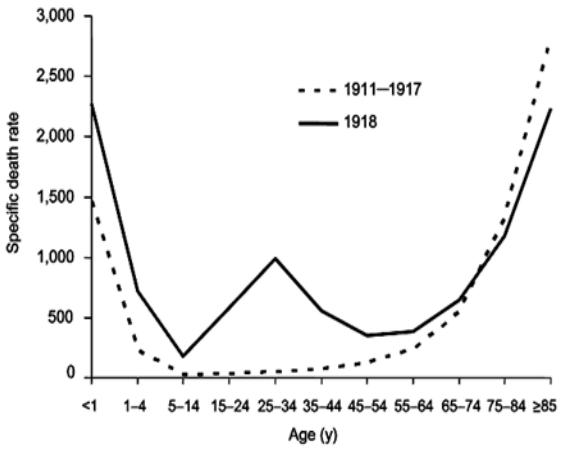


Figure 26: The age-wise mortality in 1918 flu pandemic (solid line) vs usual flu (dotted line) in USA

The mortality of the disease varied from region to region but in many places it was above 10%. A letter from a physician in US army makes the face of the disease clearer:

"These men start with what appears to be an ordinary attack of LaGrippe or Influenza, and when brought to the Hosp. they very rapidly develop the most vicious type of Pneumonia that has ever been seen … and a few hours later you can begin to see the Cyanosis extending from their ears and spreading all over the face, until it is hard to distinguish the colored men from the white. It is only a matter of a few hours then until death comes…. It is horrible."

In Europe, the picture was no different. But at first many physicians in Europe did not understand the nature of the illness. Even after the pandemic had started, doctors in Italy and Britain were arguing that this was not influenza.

On July 13, 1918 an Article in the Lancet was published where Little et al opines that this was a mild illness. There were a lot of unusual features of the illness which made initial identification difficult. In words of one author,

"One of the most striking of the complications was hemorrhage from mucous membranes, especially from the nose, stomach, and intestine. Bleeding from the ears and petechial hemorrhages in the skin also occurred.." Another one wrote, "paresis or paralysis of either cerebral or spinal origin … impairment of motion may be severe or mild, permanent or temporary … physical and mental depression. Intense and protracted prostration led to hysteria, melancholia, and insanity with suicidal intent."

The disease was particularly virulent in pregnant women with high rates of death and miscarriage. In isolated places like islands, the disease was even more virulent. In Fiji, it killed 14% of the population; in Alaska, it killed around 30% of the native population. According to US army records, more than half the deaths were due to "atypical pneumonia", a term which has changed over the years to mean ARDS in modern times.

The scientists and physicians tried everything they knew but to no avail. They tried to develop vaccines against Hemophilus influenza as it was initially thought to be the aetiological agent. Sera from recovered patients showed some benefit only. The public tried various home remedies. Public health measures like isolation were successful, *only if started early and implemented strictly*. Such success stories included Gunnison, a town in Colorado, Fairbanks in Alaska and the American Samoa. The disease came in three waves. Doctors and nurses fell ill in large numbers and later in the epidemic, many patients went unattended.

The management of the epidemic was utterly chaotic in USA and Europe. During the First World War, the USA government had put a lid on freedom of speech and the press obeyed. Thus, news about the epidemic was at first hidden from the public. The public health officials often gave the people false assurance, every day they put out the news that the worst was over and they often said that it was just mild seasonal influenza. This attitude is best exemplified by the words of Chicago public health commissioner, "It is our duty to keep the people from fear. Worry kills more people than the epidemic" (Robertson, 1918). However, some public health measures were taken. In Philadelphia, the city closed all schools, churches, theatres and other public places. The city of San Francisco implemented strict lockdown and made mask wearing in public compulsory. But this was during the first wave of the flu. By November 1918, the restrictions were relaxed and the second wave of the pandemic hit the city with more than 3000 victims. This story makes it clear that putting down the guard prematurely can be counterproductive.

In other parts of Europe, the situation was similar. In July 1918, Sir Arthur Newsholme of UK had written a public guideline urging the sick people to home and avoid public places. But the government buried the memo. Thus, there was free mingling of people, especially with the troops returning from war and the disease spread quickly. The messages from the government in UK were confusing. Some people used masks in public places but there was no central lockdown on pubs or football matches. There were a lot of half-baked ideas in the press like this one from November 1918:

"…wash inside nose with soap and water each night and morning; force yourself to sneeze night and morning, and then breathe deeply. Do not wear a muffler; take sharp walks regularly and walk home from work; eat plenty of porridge."

Buses and public places were sprayed with antiseptic solutions.

In India, the disease struck viciously. The disease probably entered India with British troops returning to Bombay port. Police constables and clerks at the telegraph office of the port were the first victims. This was quickly followed by rapid spread of the epidemic among the population. At its peak, the flu was killing around 200 people per day in Bombay. From there, the epidemic spread to north and east India. After the monsoon season, the disease came back in a second wave, killing even more. In India, women were more affected than men. In many cases, whole families were wiped out. The GangaRiver was full of dead bodies. This is the situation similar to Philadelphia, where corpses were just loaded in carts without coffin and dumped in mass burial grounds.

Dr JA Turner, working in Bombay at that time, wrote that,

"Bombay during the month of June may be compared to a huge incubator with suitable media already prepared for the insemination of germs of disease; the temperature, moisture and material in suitable conditions, an overcrowded city with a large working class population living in conditions which lend themselves to the rapid spread of disease, either insect-borne or from personal contact, should it be introduced."

In Bombay, the secondary attack rate was so high that the incubation period was thought to be hours, not even days. Physicians, both Indian and British, had no remedies to offer. They tried unconventional drugs like Thymol with guaiacol. Many traditional Indian herbal remedies were tried. At Shantiniketan, the famous poet, Rabindranath Tagore advised everyone to drink a concoction made of five bitter herbs. An Indian doctor writes thus:

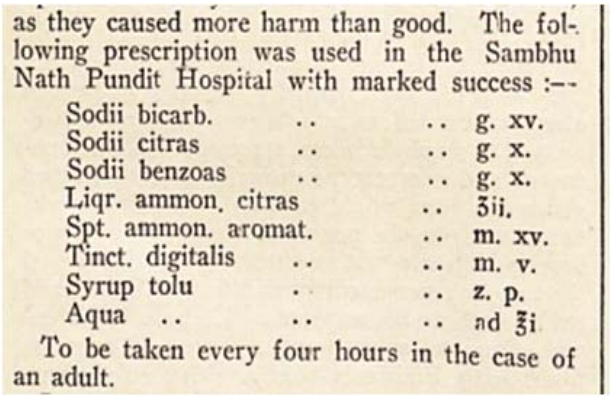
"If infection reached a certain house all the inmates

were down in twenty-four to forty-eight hours, leaving the household in a helpless condition;"

Many physicians were still trying to isolate the "influenza bacillus" from clinical specimens and there were many Indian publications on characteristics of the "bacilli". Common complications of the disease included proteinuria and septicaemia. Autopsy of the lung showed involvement of all lobes in different stages of evolution of the pneumonia. The spleen was red and enlarged.

Treatment consisted of placing patients in well-ventilated rooms away from the draught. They were given liquid diet. They were to drink plenty of water but avoid cold water. Aspirin was used. A mixture of salicylate with ipecac, digitalis and ammonium citrate was used. Some physicians used quinine mixture. The chest had to be massaged with some liniments.

There is a record of cases admitted at SambhuNathPandit hospital in Calcutta. There, it is seen that majority of cases were between 10 and 40 years of age. Out of 710 admitted cases, 214 died. The disease was more lethal during the second wave. After recovery, there were sequelae like debility and prostration for a long time. Treatment was based on local protocol (figure 27).


as they caused more harm than good. The following prescription was used in the Sambhu Nath Pundit Hospital with marked success :—

Sodii bicarb.	..	g. xv.
Sodii citras	..	g. x.
Sodii benzoas	..	g. x.
Liqr. ammon. citras	..	℥ii.
Spt. ammon. aromat.	..	m. xv.
Tinct. digitalis	..	m. v.
Syrup tolu	..	z. p.
Aqua ..	..	ad ℥i

To be taken every four hours in the case of an adult.

Figure 27: Treatment Protocol in Calcutta during flu pandemic of 1918 (Ind. Med. Gazette)

The flu pandemic of 1918 killed more than 10 million Indians and led to a marked fall in GDP.

Other influenza pandemics:

Although this "Spanish Flu" pandemic was the largest and most lethal one, there have been other influenza pandemics in the last 100 years. These were not as virulent as the 1918 one but still, there were considerable upheavals. A brief mention will be made here of these subsequent pandemics.

In 1957-58, there was the "Asian Flu" pandemic which originated from China and killed around 1 million people globally. It was caused by **H2N2** strain. In February 1957, the virus originated, probably from Geese virus in China and by April, it had spread to Hong Kong and Singapore. By May, it reached Taiwan and by June, India was hit very hard. In contrast to the Spanish flu, case fatality rate in Asian flu was less than 1%. The vaccine was available very soon and it helped contain the epidemic. But still, in the USA, total mortality was close to 100, 000. In South America, the disease also caused a lot of mortality. Similar to the current coronavirus epidemic, this Asian flu also caused excess mortality in elderly and those with pre-existing conditions.

The virus soon entered a latent phase but it did not go away. By 1968, it had mutated and come back to cause the 1968 pandemic. The strain responsible was **H3N2**. The first case probably was in Hong Kong on 13 July, 1968. Thus, the moniker coined for this flu was "Hong Kong Flu". By end of the same month, extensive outbreaks were reported in Vietnam and Singapore. Vietnam was important in the geological spread of the virus as the Vietnam War was going on. The American troops carried this virus back home. Total number of deaths globally was around 1 million. This flu was also more deadly in the elderly population. In the USA, one of the most iconic cultural events of modern history, The Woodstock festival, occurred during the pandemic. The organizers kept a few doctors ready for an outbreak, which thankfully, did not happen. The clinics in USA were overcrowded but most people recovered without complications. There was no public lockdown although many industries were affected due to sickness of the workers. Doctors did not offer any specific medicine although many remedies were advertised by pharmacies (figure 28).

Figure 28: An advertisement in South China Morning Post about miracle cures for the Hong Kong Flu

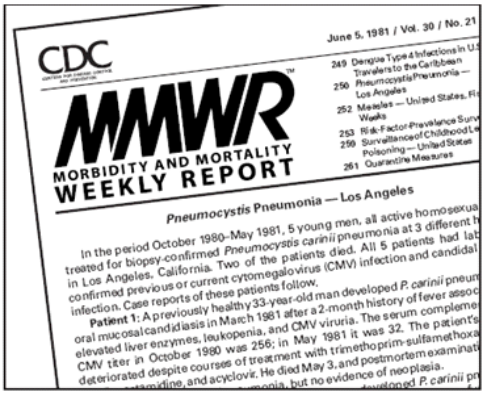
Compared to these previous epidemics, the 2009 Swine flu pandemic was much milder. This was again caused by the **H1N1** strain, similar to the 1918 pandemic. This pandemic was known as "swine flu". But in spite of being so recent an episode, there is a lot of confusion regarding the number of cases and number of deaths. Number of cases could have been anywhere between 1.6 million and 700 million. Similarly, number of deaths could have been between 18449 and 284, 000. Where did the virus originate? The source was definitely pigs. At first it was thought that the epidemic started from factory farms in Mexico. Then some researchers said that the virus came from pigs in Asia. But again in 2016, it was found that the virus probably originated from pigs in central Mexico. Mexico City was put under lockdown and public were instructed to wear masks. But elsewhere in the world, public lockdown was not done. Since it was called "swine flu" there was a general antipathy towards eating pork. But the virus did not spread by food. It came from virus strains found in pigs. But it is a respiratory virus and is spread by droplets only. Also, during this pandemic, Oseltamivir was recommended for the first time. Countries like China imposed travel restrictions. On 10 August 2010, WHO officially declared end of the pandemic. Vaccine became available very soon and vaccine guidelines were also published.

HIV pandemic :

The last important pandemic of the twentieth century was the HIV pandemic. Unlike the other epidemics, which began either in Asia or Europe, the HIV pandemic started from Africa. When did the HIV epidemic start? It is very difficult to point at one particular date when the first case was recorded. But generally it is believed that the first cases of HIV infection occurred in Kinshasa of Congo sometime around 1920. The virus probably jumped species from chimpanzee to humans in this period. But for the first few decades, the virus remained confined to some of the communities in Africa and clinical features of those cases are not known. From Africa, the disease probably spread to Haiti and then to the western world. The disease entered USA sometime in 1968 but for the next decade, it was largely unknown. In 1976, a Norwegian family died of the illness (diagnosed later). But it was only in 1980 that the infection first caught the attention of scientists and the public in the Western world.

In 1980, a number of events occurred simultaneously. On April 24, in man in San Francisco reported to the CDC with Kaposi's sarcoma. In Copenhagen, a 36 year old man passed away with pneumocystis pneumonia. On October 31, a Brooklyn schoolteacher died of an unknown illness. And in Paris, a woman died, again of Pneumocystis pneumonia. The new virus had arrived.

In May 18, 1981 the New York Native, a newspaper dedicated to the gay community, ran a headline, "Disease Rumors Largely Unfounded". In this article, it was mentioned that a "gay cancer" was being talked about in the society but it assured the readers that the rumours were false. So, this reporter missed the chance to be the first to report HIV in the world. On July 3, 1981, the New York Times ran a headline, "Rare Cancer seen in 41 homosexuals". The first reported cases were from New York and California. It was reported that eight of these 41 men died within 2 years of diagnosis of the cancer. At first, it was thought to be a disease of homosexual males only. The condition was thought to be non-contagious. At around the same time, the CDC also reported Pneumocystis pneumonia in five gay men in Los Angeles (figure 29). It was commented in this report that this infection in extremely rare in healthy persons.


CDC

June 5, 1981 / Vol. 30 / No. 21

MMWR

MORBIDITY AND MORTALITY WEEKLY REPORT

249 Dengue Type 4 Infections in U.S. Travelers to the Caribbean
250 Pneumocystis Pneumonia — Los Angeles
252 Measles — United States, First Weeks
253 Risk-Factor-Prevalence Surv
256 Surveillance of Childhood Le
Poisoning — United States
261 Quarantine Measures

Pneumocystis Pneumonia — Los Angeles

In the period October 1980–May 1981, 5 young men, all active homosexua
treated for biopsy-confirmed *Pneumocystis carinii* pneumonia at 3 different h
in Los Angeles, California. Two of the patients died. All 5 patients had lab
confirmed previous or current cytomegalovirus (CMV) infection and candidal
infection. Case reports of these patients follow.

Patient 1: A previously healthy 33-year-old man developed *P. carinii* pneum
oral mucosal candidiasis in March 1981 after a 2-month history of fever assoc
elevated liver enzymes, leukopenia, and CMV viruria. The serum complem
CMV titer in October 1980 was 256; in May 1981 it was 32. The patient's
deteriorated despite courses of treatment with trimethoprim-sulfamethoxa
dine, and acyclovir. He died May 3, and postmortem examinati
monia, but no evidence of neoplasia.
prolonged *P. carinii* pn

Figure 29: The CDC weekly report of June 5, 1981, mentioning pneumocystis pneumonia

The same year (1981), the disease was reported from UK and Spain. By the end of the year, 337 people were reported to have this disease with 130 of them dead. At first the disease was called GRID (Gay related immunodeficiency). But in 1982, the CDC proposed the term AIDS. By 1982, the disease had been reported from South America, Canada and Australia.

By 1983, the retrovirus had been discovered in Paris. It was called by various names like HTLV-III before being finally named as HIV in 1986. By 1984, the first case in Asia was reported (Philippines). By this time, the PCR was available and widespread HIV testing was started.

Death of prominent people like Rock Hudson, Michael Foucault and Freddie Mercury made the HIV a well-known entity all over the world. *HIV is a slow but steady epidemic*. By 1983, the number of cases in USA was 3064 and in 1984, it was 7699. By 1985, all regions of the world had reported at least one case of HIV infection and by 1986, there were a total of 38, 000 cases reported globally.

However, the region where AIDS caused a disaster was sub-Saharan Africa. Countries like South Africa and Botswana suffered pathetically. In 1997, 50% of all deaths in Botswana were due to HIV while for South Africa, this was 13%. Later, in 2010, still 50% of all deaths in Botswana were due to HIV while in South Africa, this percentage had risen to 43%. In Mozambique, in 2012, 32% of all deaths were due to HIV. Kenya reached the same figures in 2004. In absolute numbers, the infection rate was also staggering. In South Africa, 20% of all adults are HIV infected. Up to 2000 C.E., half a million people were getting newly infected each year in that country. Now, the annual figures have reduced somewhat to half that number. In Botswana, there are around 400 000 people living with HIV presently.

However, now with better awareness and use of effective ART, the number of new infections has reduced a lot. In most of Europe, the incidence is on the decline except Russia. Russia now has over one million PLHA. In India, HIV infection is mainly limited to certain key population groups. Globally, till now, about 32 million people have died from HIV.

Epidemics of the 21st century :

So, after describing all the epidemics of the last two millennia, we have now come to the twenty first century. Science has progressed a lot, new drugs have been discovered and public health measures are also in place in most of the world. So, we would like to think that epidemics are a thing of the past and something to be read only in history books. *But we would be wrong*. Epidemics are as common as before.

The table below (Table 4) will mention some of these recent disease outbreaks. As this table makes clear, various types of diseases, from vector borne (like Plague) to contact-dependent infections (like Ebola) have been the scourge of mankind in this century. So, has things changed for better or for worse? Epidemics are flaring up with ominous regularity at some corner or another. Earlier, such disease outbreaks remained localized. But with marked improvement in international travel, a disease outbreak anywhere in the world can now spread within days to remote corners. So, now is the time to remain extra vigilant and never lower the guard against these microbes. Is climate change to blame? Is increased consumption of exotic meat the reason? We are still speculating (Table 4).

Conclusion :

As this article makes clear, epidemics have struck mankind periodically with lethal force. The more we try to get rid of these bugs, the more they find ways to circumvent all human innovations and sneak into our bodies. The coronavirus pandemic is just another event in the long history of human struggle against microbes and this struggle will continue for ever. While mutation in the microbial world is a natural phenomenon and can cause new disease outbreaks at any time, man-made calamities like **climate change** are also important factors in causing epidemics.

Table 4 — Epidemics after 2000 C.E.

Disease	Time	Regions affected	Number affected	Casualties
SARS	2002-3	26 countries including China	8098	774
MERS	2012	27 countries including UAE and Korea	2494	858
Ebola	2014-16	West Africa, including Liberia	28, 652	11325
Swine Flu	2009-10	Global	1.6 million+	18449
Plague	2017	Madagascar	2119	171
Cholera	2010	Haiti	665, 000	8183
Dengue	2006	India	3163+	50+
Coronavirus	2020	Global	More than 4.2 million	293 000 (Till May 13/2020)