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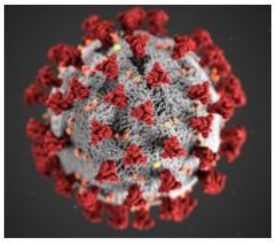
Pandemics in History

Since the first cases were reported December 31, 2019, a new coronavirus has caused a worldwide outbreak. Almost all countries have been affected by COVID-19, with health systems overwhelmed. Other pandemics occurring in the past impacted societies of their times.



SARS-CoV2 (CDC)

Origins of Pandemics

While the viruses causing colds and seasonal influenza may have global spread, they are not considered to be pandemics. Several characteristics are needed for an agent to be able to cause a pandemic. These include: infections resulting in high levels of severe or fatal outcome, the agent has sustained person-to-person spread, and global distribution of cases.

To achieve these characteristics, other factors must be present. Absence of readily available treatment or prevention such as vaccine could support the rapid spread of an agent. A sufficient population density is needed to sustain effective transmission of an agent among people. The time course of the illness and sources of agent must fit with the available travel options; an agent with no other reservoir than humans and both short incubation and short communicable periods would not have spread globally until the advent of modern forms of transportation.

Historical agents with pandemic potential likely originated in animals that form large groups can sustain transmission of the agent within those populations. Such reservoirs include herd and agricultural animals (swine influenza), rodent pests (plague), wild and domestic fowl (avian influenza), and bats (Ebola virus disease.) Bats species which form huge dense colonies are considered the likely sources for the coronaviruses SARS and MERS, and may have been the point of origin for SARS-CoV-2, the agent causing COVID-19 disease.

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Pandemics in History

Over the past two thousand years, writers described pandemics of their time, although the agents and diseases cannot always be distinguished in the absence of modern case definitions or medical terminology. A number of these recorded pandemics had significant impacts on civilizations.

The Plague of Justinian (CE 541-542) was likely a bubonic plague pandemic that affected Europe, Asia, and North Africa. It is estimated that up to 25 percent of the population died in various regions. The Byzantine Empire was weakened by the plague and never fully recovered.

Rat flea, a vector of plague
Centers for Disease Control and Prevention

Bubonic plague, returning in 1346-1353, was known at the time as the Black Death. In those years a third or more of the people in Europe may have died of plague, and the population took an estimated 200 years to rebound to pre-plague levels. The result was severe disruption of existing political and religious social systems. As a disease control effort, Italy imposed a 40 day forced isolation of incoming ships, a 'quarantino.' This was the origin of the modern concept and term for quarantine.

For centuries, bubonic plague outbreaks continued in Europe. John Graunt documented the plague year of 1665 in mortality records he compiled for London. He noted 9,967 births and 87,326 deaths of which 68,595 were attributed to plague, giving a net population loss of 77,359. In contrast, the prior year there had been 8,097 deaths reported, only five due to plague.

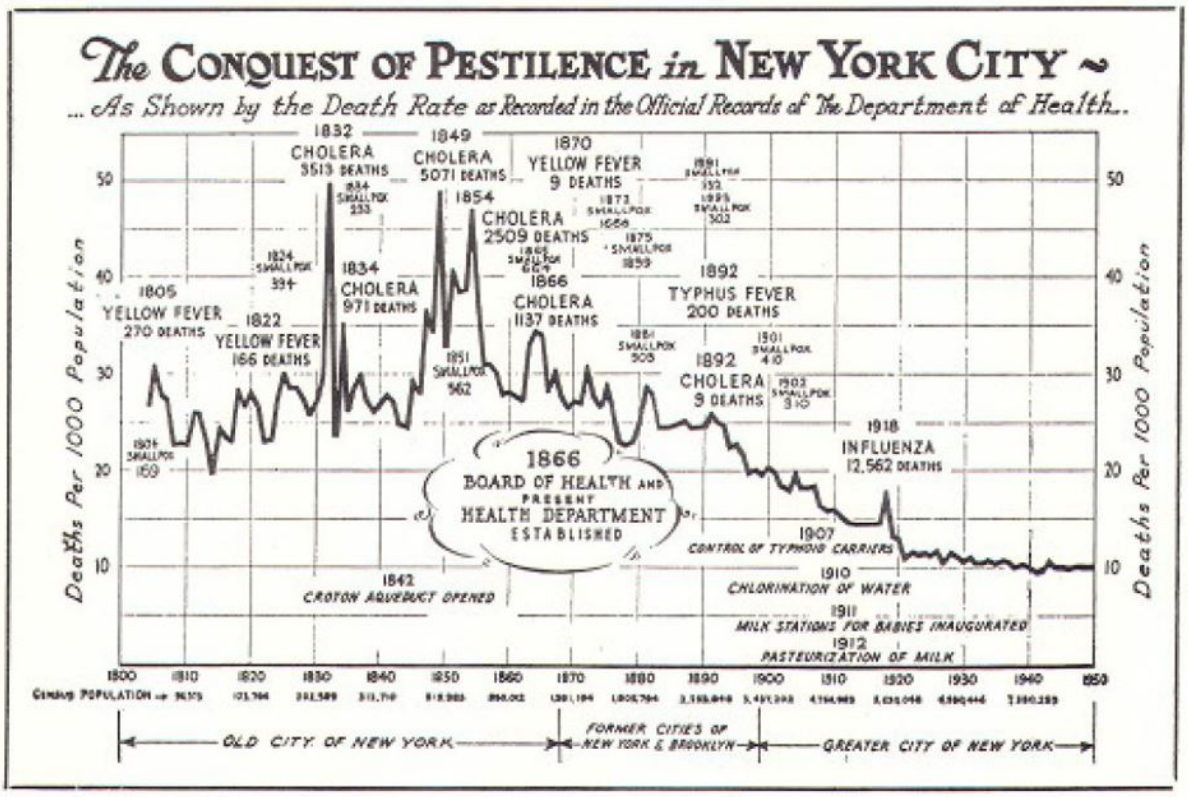
Centers for Disease Control and Prevention

Seven cholera pandemics occurred starting in 1817. During the 1854 cholera outbreak in London, John Snow identified Broad Street as a center of exposure and implicated its public water pump. He famously removed that pump handle to stop further cases but did note that deaths in the neighborhood had already dropped due to people fleeing a recognized focal point.

The United States was affected by the second cholera pandemic (1829-1837), the third pandemic (1846-1860) which was spread along travel routes to the California Gold Rush and along the Oregon Trail, the fourth pandemic (1863-1875) particularly along the Mississippi River including New Orleans, and the sixth pandemic (1899-1923) which during 1910-1911 caused a small number of cases in New York City and resulted in use of a quarantine facility there. During the second pandemic, there were riots in the United States and Europe attacking suspected source populations, government agencies, and quarantine restrictions.

Less than a decade later an influenza pandemic swept the globe, likely amplified by troop and civilian population movements during World War I. The disease was misnamed Spanish Influenza because first reports came from Spain, which was the only western country not under censorship and therefore able to report the outbreak. Healthcare facilities were inundated. Many areas including Seattle shut down entertainment sites, restaurants, libraries, and other congregate

settings, resulting in economic disruption. The estimated mortality due to influenza was around 2.5 percent of the global population, varying widely among countries. A vital statistic summary for New York City shows the death rate spiking due to the 1918-1919 influenza pandemic, but that peak is entirely overshadowed by deaths during cholera pandemics occurring in the preceding century (note the scale is deaths per thousand population):



https://www1.nyc.gov/assets/doh/downloads/pdf/vs/1980sum.pdf

While not pandemics, continent-wide epidemics occur. In the 16th century ships brought a variety of diseases to the Americas where the populations had no previous exposures to communicable conditions that were circulating in Europe. Lacking herd immunity, the populations experienced successive epidemics of smallpox, measles, and other diseases that may have reduced the Native American populations by 90 percent as of 1620, the year of the Mayflower landing.

More recent major infectious causes of death may be considered endemic rather than pandemic. Only in the past few years have the global deaths from HIV/AIDS fallen below a million a year. Endemic worldwide diseases such as hepatitis C and malaria also claim millions of lives annually. Other major causes of deaths globally include pneumonia and diarrheal diseases.

On March 11th, 2020, WHO declared COVID-19 to be a pandemic. Global cases topped two million by mid-April with over 125,000 associated deaths. One concept is certain. Outbreaks and pandemics will continue. The global population will be shaped by these infectious diseases and their outbreaks. What we have learned from plague, cholera, influenza, and COVID-19 will inform our response to the epidemics to come. In fact, what we learn today may help us detect, treat, and prevent outbreaks like hepatitis C and tuberculosis, and a future as yet unknown agent.