

HEALTHCARE

# Visualizing the History of Pandemics



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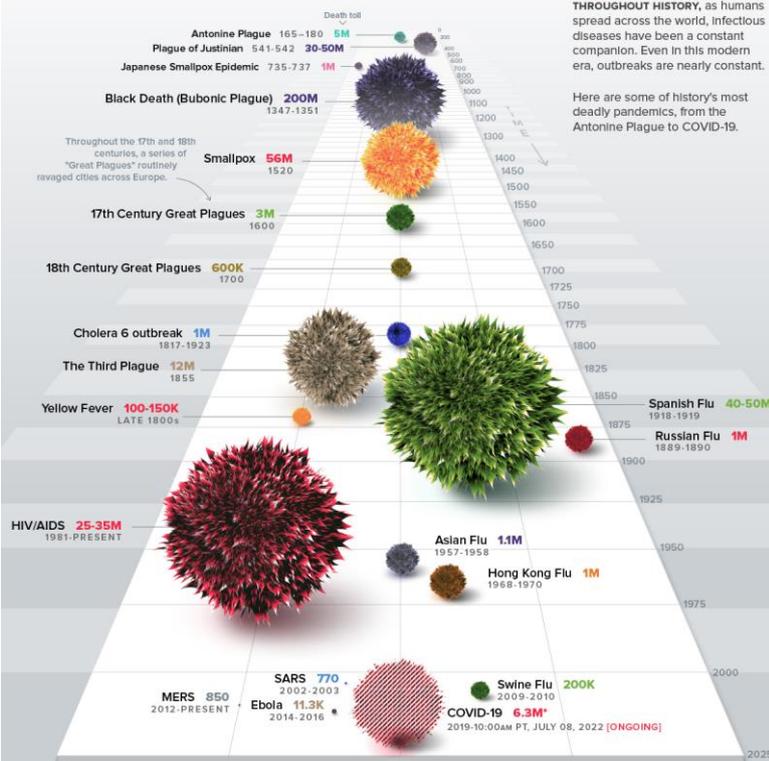
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# HISTORY OF PANDEMICS

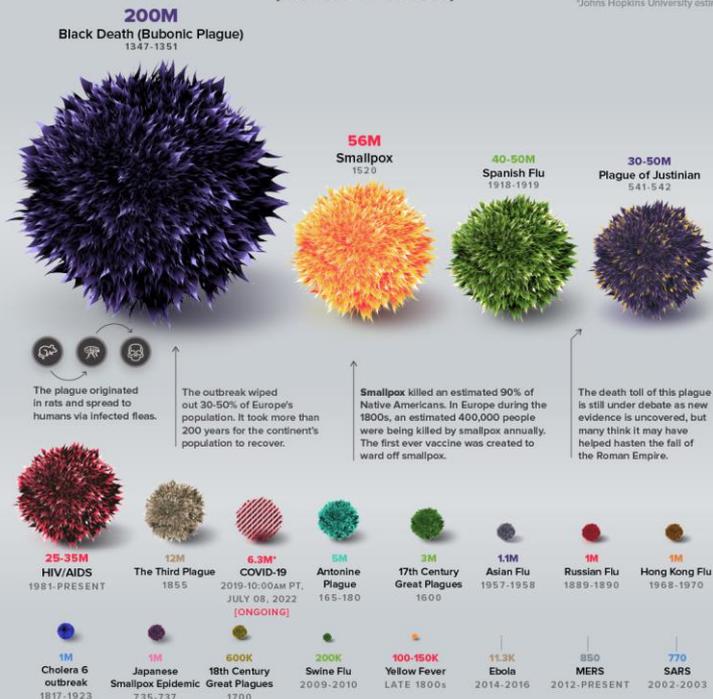
PAN-DEM-IC (of a disease) prevalent over a whole country or the world.



THROUGHOUT HISTORY, as humans spread across the world, infectious diseases have been a constant companion. Even in this modern era, outbreaks are nearly constant.

Here are some of history's most deadly pandemics, from the Antonine Plague to COVID-19.

## DEATH TOLL [HIGHEST TO LOWEST]



WHO officially declared COVID-19 a pandemic on Mar 11, 2020. It is hard to calculate and forecast the impact of COVID-19 because the disease is new to medicine, and data is still coming in. \*Johns Hopkins University estimates

The plague originated in rats and spread to humans via infected fleas.

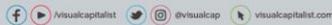
The outbreak wiped out 30-50% of Europe's population. It took more than 200 years for the continent's population to recover.

Smallpox killed an estimated 90% of Native Americans. In Europe during the 1800s, an estimated 400,000 people were being killed by smallpox annually. The first ever vaccine was created to ward off smallpox.

The death toll of this plague is still under debate as new evidence is uncovered, but many think it may have helped hasten the fall of the Roman Empire.

\*Johns Hopkins University estimates

Sources: CDC, WHO, BBC, Wikipedia, Historical records, Encyclopedia Britannica, Johns Hopkins University



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## ▼ Use This Visualization

# The History of Pandemics

*Pan·dem·ic /pandemik/ (of a disease) prevalent over a whole country or the world.*

As humans have spread across the world, so have infectious diseases. Even in this modern era, outbreaks are nearly constant, though not every outbreak reaches pandemic level as COVID-19 has.

Today's visualization outlines some of history's most deadly pandemics, from the Antonine Plague to the current COVID-19 event.

## A Timeline of Historical Pandemics

Disease and illnesses have plagued humanity since the earliest days, our mortal flaw. However, it was not until the marked shift to agrarian communities that the scale and spread of these diseases increased dramatically.

Widespread trade created new opportunities for human and animal interactions that sped up such epidemics. Malaria, tuberculosis, leprosy, influenza, smallpox, and others first appeared during these early years.

The more civilized humans became – with larger cities, more exotic trade routes, and increased contact with different populations of people, animals, and ecosystems – the more likely pandemics would occur.

Here are some of the major pandemics that have occurred over time:

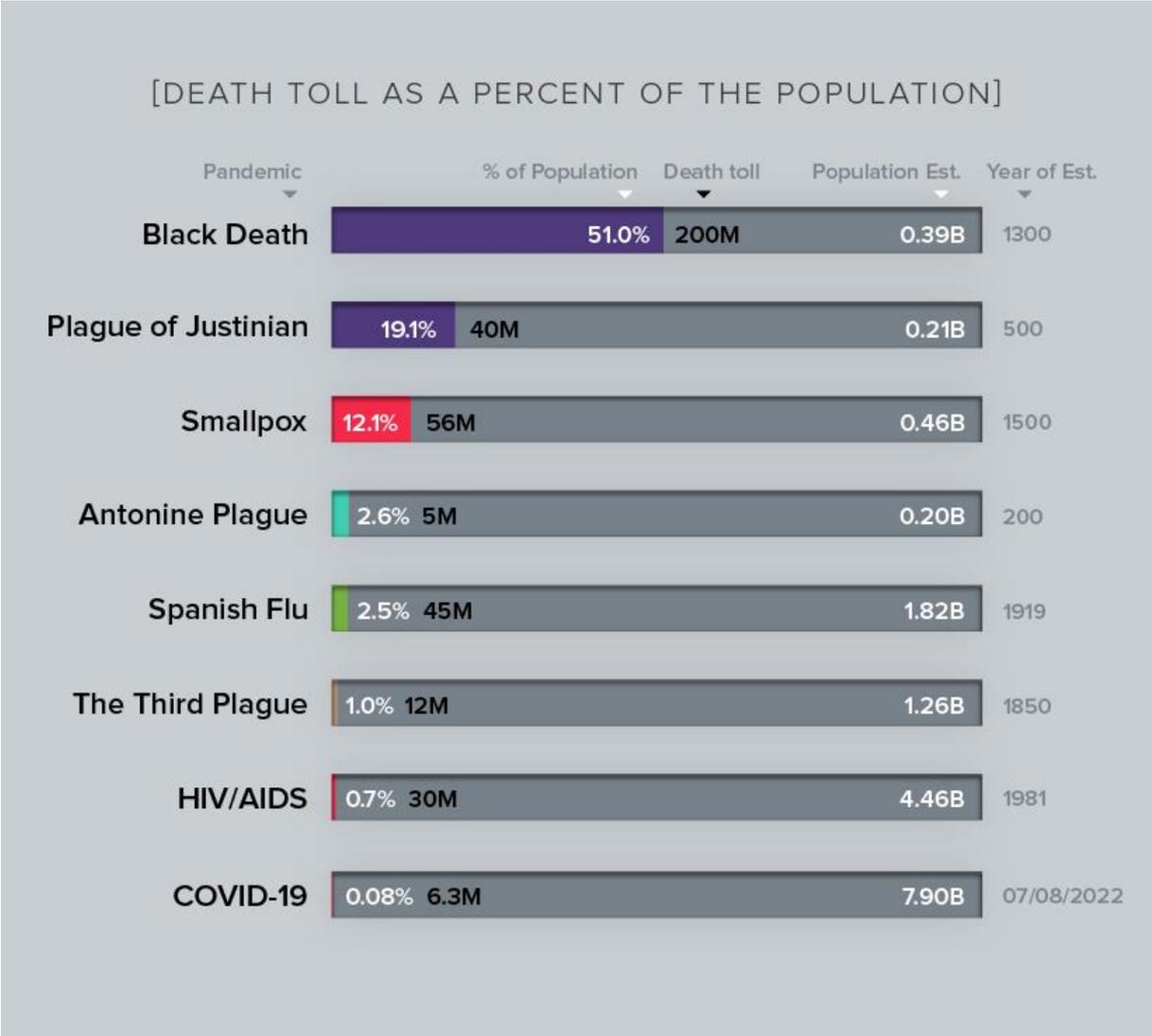
Name	Time period	Type / Pre-human host	Death toll
Antonine Plague	165-180	Believed to be either smallpox or measles	5M
Japanese smallpox epidemic	735-737	Variola major virus	1M
Plague of Justinian	541-542	Yersinia pestis bacteria / Rats, fleas	30-50M
Black Death	1347-1351	Yersinia pestis bacteria / Rats, fleas	200M
New World Smallpox Outbreak	1520 – onwards	Variola major virus	56M
Great Plague of London	1665	Yersinia pestis bacteria / Rats, fleas	100,000
Italian plague	1629-1631	Yersinia pestis bacteria / Rats, fleas	1M
Cholera Pandemics 1-6	1817-1923	V. cholerae bacteria	1M+
Third Plague	1885	Yersinia pestis bacteria / Rats, fleas	12M (China and India)

Name	Time period	Type / Pre-human host	Death toll
Yellow Fever	Late 1800s	Virus / Mosquitoes	100,000-150,000 (U.S.)
Russian Flu	1889-1890	Believed to be H2N2 (avian origin)	1M
Spanish Flu	1918-1919	H1N1 virus / Pigs	40-50M
Asian Flu	1957-1958	H2N2 virus	1.1M
Hong Kong Flu	1968-1970	H3N2 virus	1M
HIV/AIDS	1981-present	Virus / Chimpanzees	25-35M
Swine Flu	2009-2010	H1N1 virus / Pigs	200,000
SARS	2002-2003	Coronavirus / Bats, Civets	770
Ebola	2014-2016	Ebolavirus / Wild animals	11,000
MERS	2015-Present	Coronavirus / Bats, camels	850
COVID-19	2019-Present	Coronavirus – Unknown (possibly pangolins)	6.3M (Johns Hopkins University of July 8, 2022)

*Note: Many of the death toll numbers listed above are best estimates based on available research. Some, such as the [Plague of Justinian](#) and [Swine Flu](#), are subject to debate based on new evidence.*

Despite the persistence of disease and pandemics throughout history, there's one consistent trend over time – a gradual reduction in the death rate. Healthcare improvements and understanding the factors that incubate pandemics have been powerful tools in mitigating their impact.

*July 8, 2022 Update: Due to popular request, we've also visualized how the death tolls of each pandemic stack up as a share of total estimated global populations at the time.*



## Wrath of the Gods

In many ancient societies, people believed that spirits and gods inflicted disease and destruction upon those that deserved their wrath. This unscientific perception often led to disastrous responses that resulted in the deaths of thousands, if not millions.

In the case of Justinian’s plague, the Byzantine historian [Procopius of Caesarea](#) traced the origins of the plague (the *Yersinia pestis* bacteria) to China and northeast India, via land and sea trade routes to Egypt where it entered the Byzantine Empire through Mediterranean ports.

Despite his apparent knowledge of the role geography and trade played in this spread, Procopius laid blame for the outbreak on the Emperor Justinian, declaring him to be either a devil, or invoking God’s punishment for his evil ways. Some historians found that this event could have dashed Emperor

Justinian's efforts to reunite the Western and Eastern remnants of the Roman Empire, and marked the beginning of the Dark Ages.

Luckily, humanity's understanding of the causes of disease has improved, and this is resulting in a drastic improvement in the response to modern pandemics, albeit slow and incomplete.

## Importing Disease

The [practice of quarantine](#) began during the 14th century, in an effort to protect coastal cities from plague epidemics. Cautious port authorities required ships arriving in Venice from infected ports to sit at anchor for 40 days before landing — the origin of the word quarantine from the Italian “quaranta giorni”, or 40 days.

One of the first instances of relying on geography and statistical analysis was in mid-19th century London, during a cholera outbreak. In 1854, Dr. John Snow came to the conclusion that cholera was spreading via tainted water and decided to display neighborhood mortality [data directly on a map](#). This method revealed a cluster of cases around a specific pump from which people were drawing their water from.

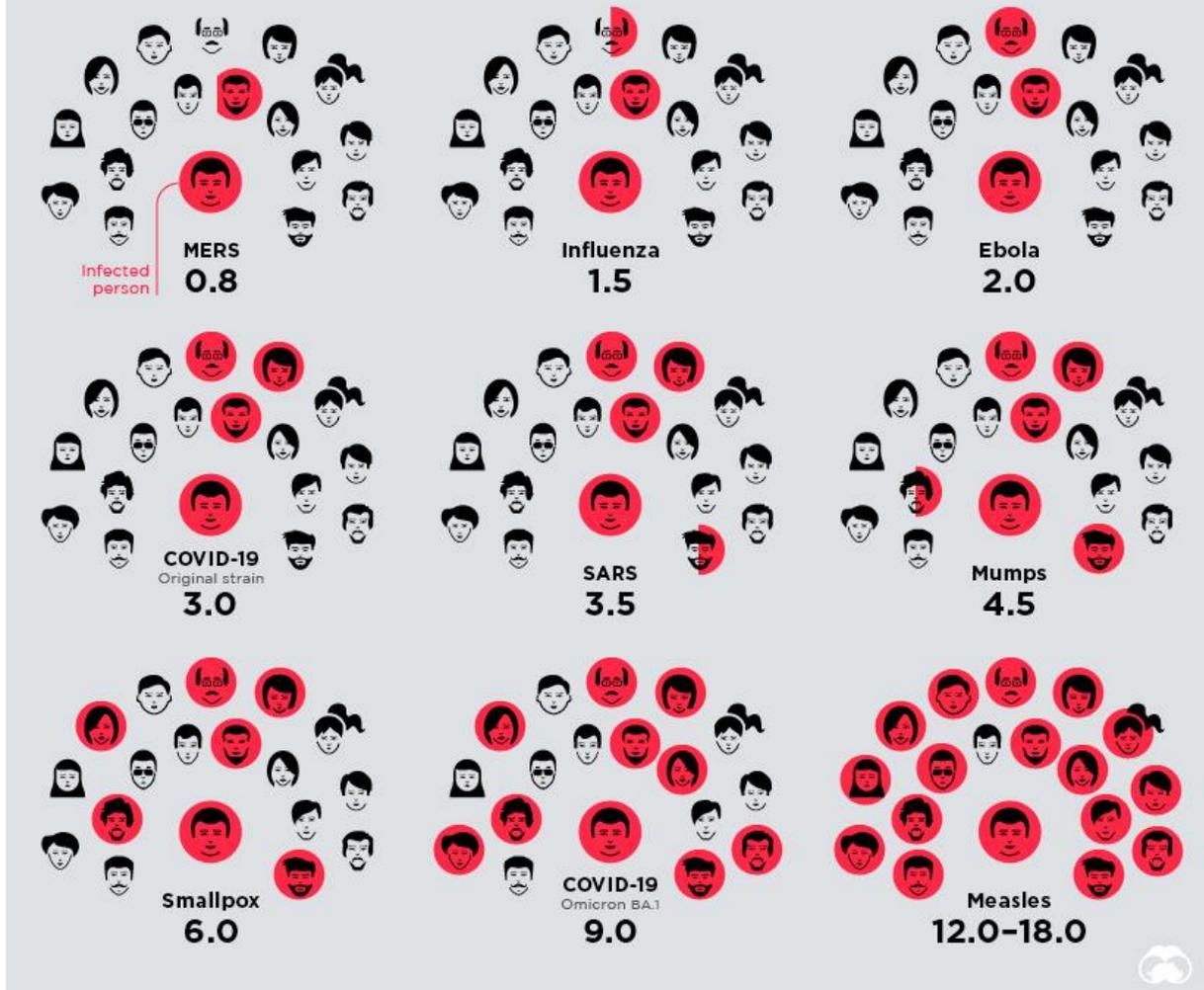
While the interactions created through trade and urban life play a pivotal role, it is also the virulent nature of particular diseases that indicate the trajectory of a pandemic.

## Tracking Infectiousness

Scientists use a basic measure to track the infectiousness of a disease called the reproduction number — also known as  $R_0$  or “R naught.” This number tells us how many susceptible people, on average, each sick person will in turn infect.

## R0 (basic reproduction number) of diseases

A measure of how many people each sick person will infect on average



Measles tops the list, being the most contagious with a R0 range of 12-18. This means a single person can infect, on average, 12 to 18 people in an unvaccinated population.

While measles may be the most virulent, vaccination efforts and [herd immunity](#) can curb its spread. The more people are immune to a disease, the less likely it is to proliferate, making vaccinations critical to prevent the resurgence of known and treatable diseases.

It's hard to calculate and forecast the true impact of COVID-19, as the outbreak is still ongoing and researchers are still learning about this new form of coronavirus.

## Urbanization and the Spread of Disease

We arrive at where we began, with rising global connections and interactions as a driving force behind pandemics. From small hunting and gathering tribes

to the metropolis, humanity's reliance on one another has also sparked opportunities for disease to spread.

Urbanization in the developing world is bringing more and more rural residents into denser neighborhoods, while population increases are putting greater pressure on the environment. At the same time, passenger air traffic nearly doubled in the past decade. These macro trends are having a profound impact on the spread of infectious disease.

As organizations and governments around the world ask for citizens to practice social distancing to help reduce the rate of infection, the digital world is allowing people to maintain connections and commerce like never before.

*Editor's Note: The COVID-19 pandemic is in its early stages and it is obviously impossible to predict its future impact. This post and infographic are meant to provide historical context, and we will continue to update it as time goes on to maintain its accuracy.*

*Update (July 8, 2022): We've adjusted the death toll for COVID-19, and will continue to update on a regular basis.*