



Past pandemic/s and their outcome/s

TOM BECKER, STILL IN HIS DINING ROOM 24/7

Game plan

- ▶ Consider non-Covid pandemics and how they changed societal and individuals' behavior....and what happened in their disease natural histories to alter their course/s
- ▶ I have spoken in more general terms about earlier pandemics...this time I will focus on one etiologic agent and the associated pandemics with multiple waves

Objectives

- ▶ Recite key features of some prior pandemics, related to risk of infection, origins, natural history
- ▶ List agent/host/environment factors that influenced the prior pandemic of interest today
- ▶ Pass a quiz at the end

Pre-presentation quiz

- ▶ Imagine the year is 2019, you are at a dinner party and someone asks you: “What is the worst infectious disease pandemic in human history?”
- ▶ Though you thought this was a trick question, you answer anyway. What was your answer? (go ahead and chat it to everyone)

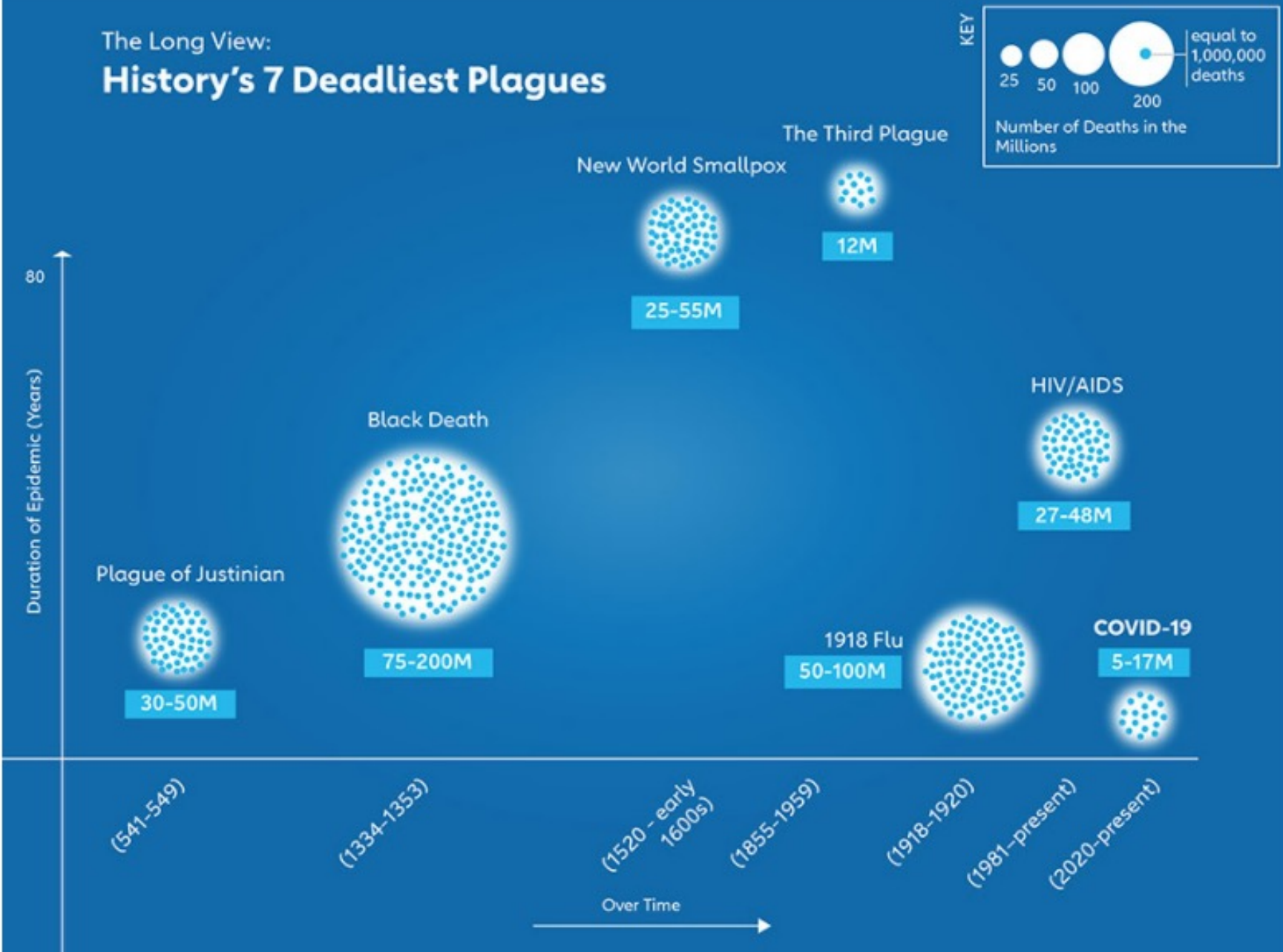
Widespread (deadly) epidemics that we do not seem to talk about much, although associated with significant mortality

- ▶ TB
- ▶ Diphtheria
- ▶ Mosquito-borne diseases (numerous)
- ▶ Tick-borne illnesses
- ▶ Syphilis
- ▶ Cholera, especially during periods of increased international trade

Seven deadliest pandemics for humans

- ▶ 1. Bubonic and pneumonic plague, estimated 50% mortality
- ▶ 2. ditto, second big wave in middle ages (the Black Death)
- ▶ 3. 'New world' small pox
- ▶ 4. Bubonic and pneumonic plague, this time establishing endemicity around the planet in this third wave
- ▶ 5. 1918 flu
- ▶ 6. HIV/AIDS
- ▶ 7. Covid-19

The Long View: History's 7 Deadliest Plagues



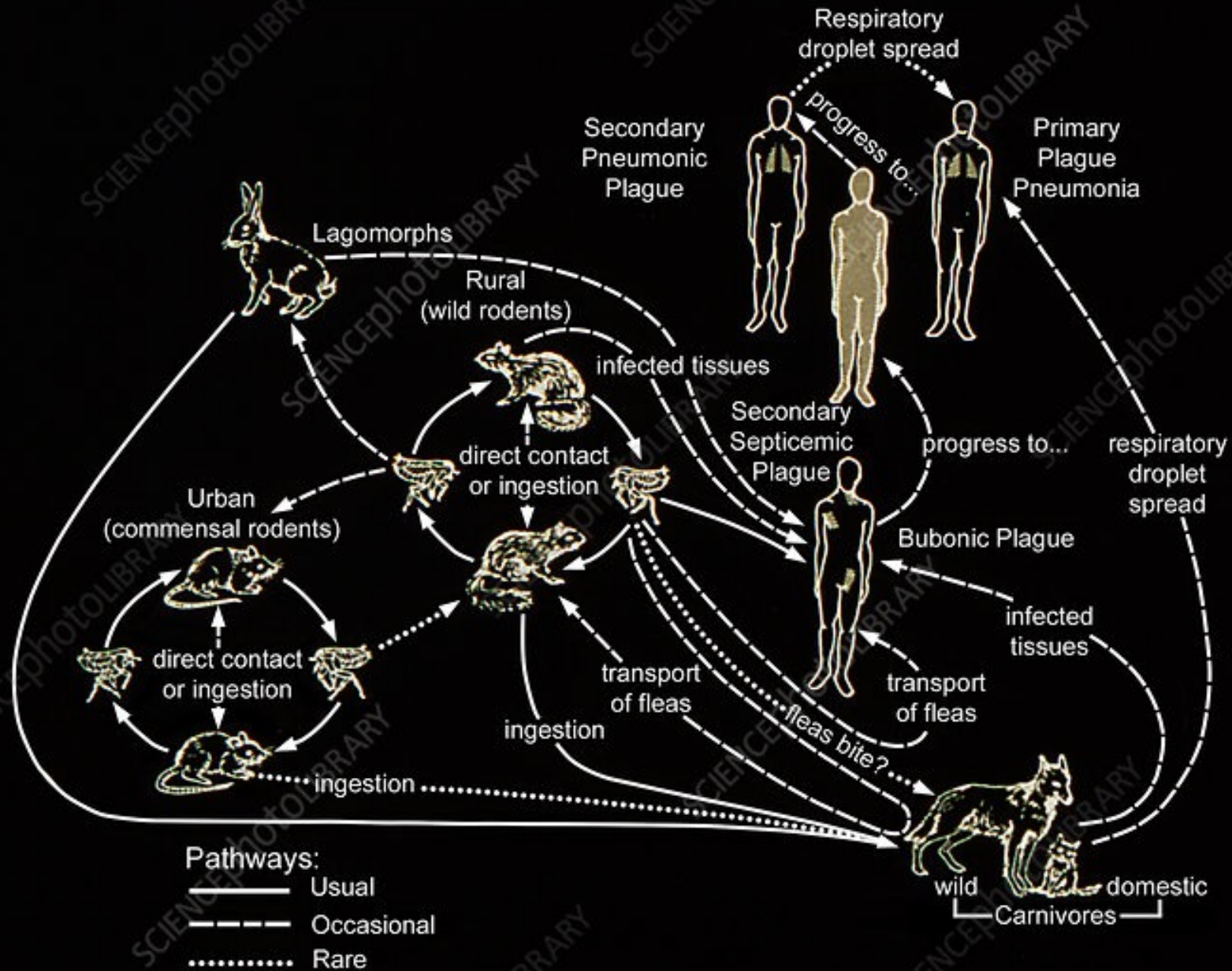
Plague History

- ▶ Philistines-Palestine - 1320 B.C. (1 Samuel v-vi)
- ▶ Rufis-Egypt - 100 A.D.
- ▶ Justinian-541-602 A.D., 1st pandemic
- ▶ Black Death in Europe beginning in 1300's with repeated outbreaks thru the 1600's
- ▶ Modern pandemic, 1896-present

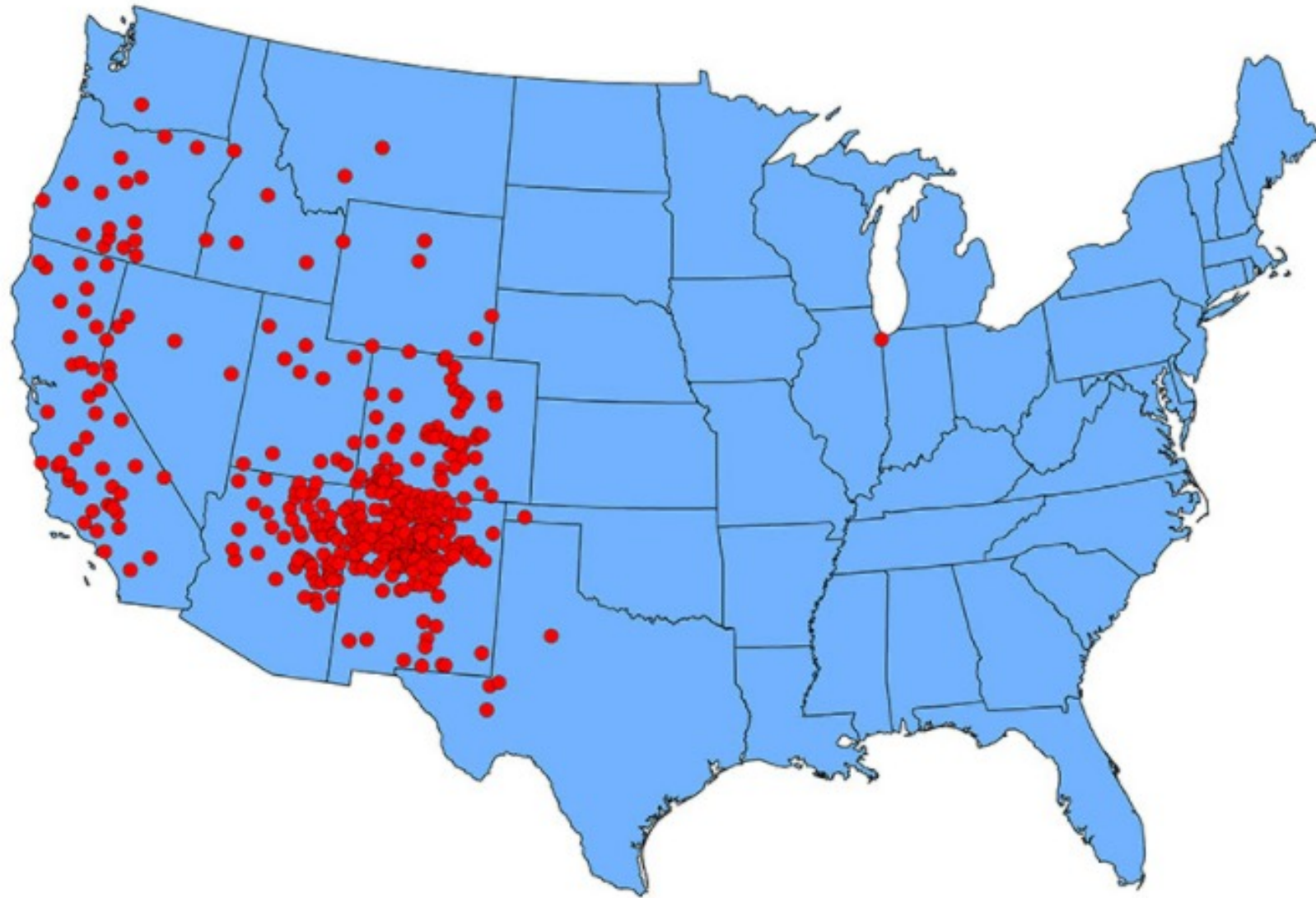
Cause of bubonic, pneumonic, and septicemic plague

- ▶ *Yersinia pestis*, a gram-variable rod-shaped bacterium
- ▶ Endemic in numerous animal populations
- ▶ Many species do not get sick when infected (dogs, coyotes), others succumb quickly to infection (cats, prairie dogs, ferrets)
- ▶ The bacterium is passed from animal to animal via a flea vector, that has *Y. pestis* blocking its GI track
- ▶ When a host animal dies, the fleas hunt for a new host, and try to feed
- ▶ Pneumonic spread is similar to Covid or influenza...droplets

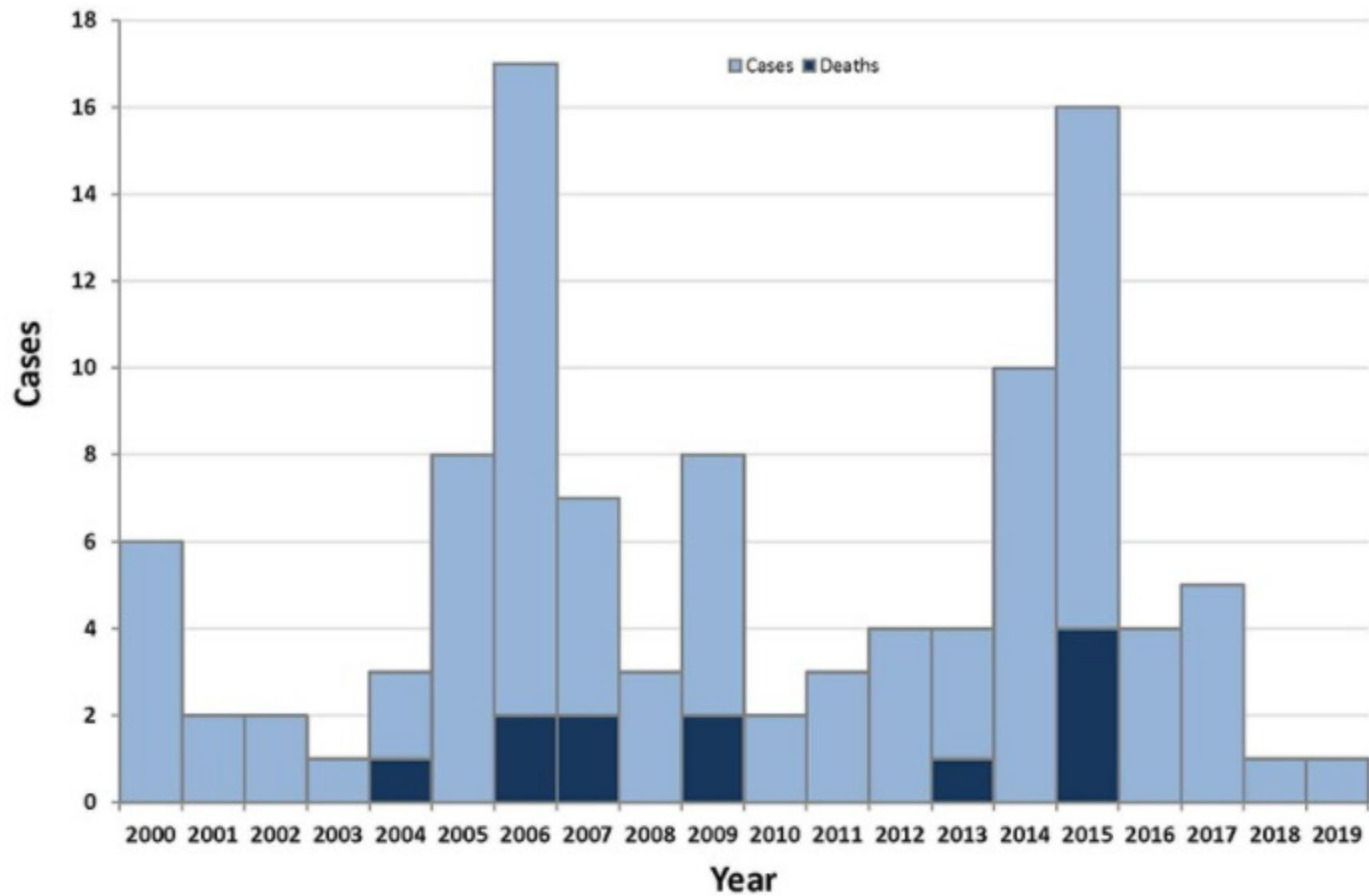
Plague Cycles in the United States



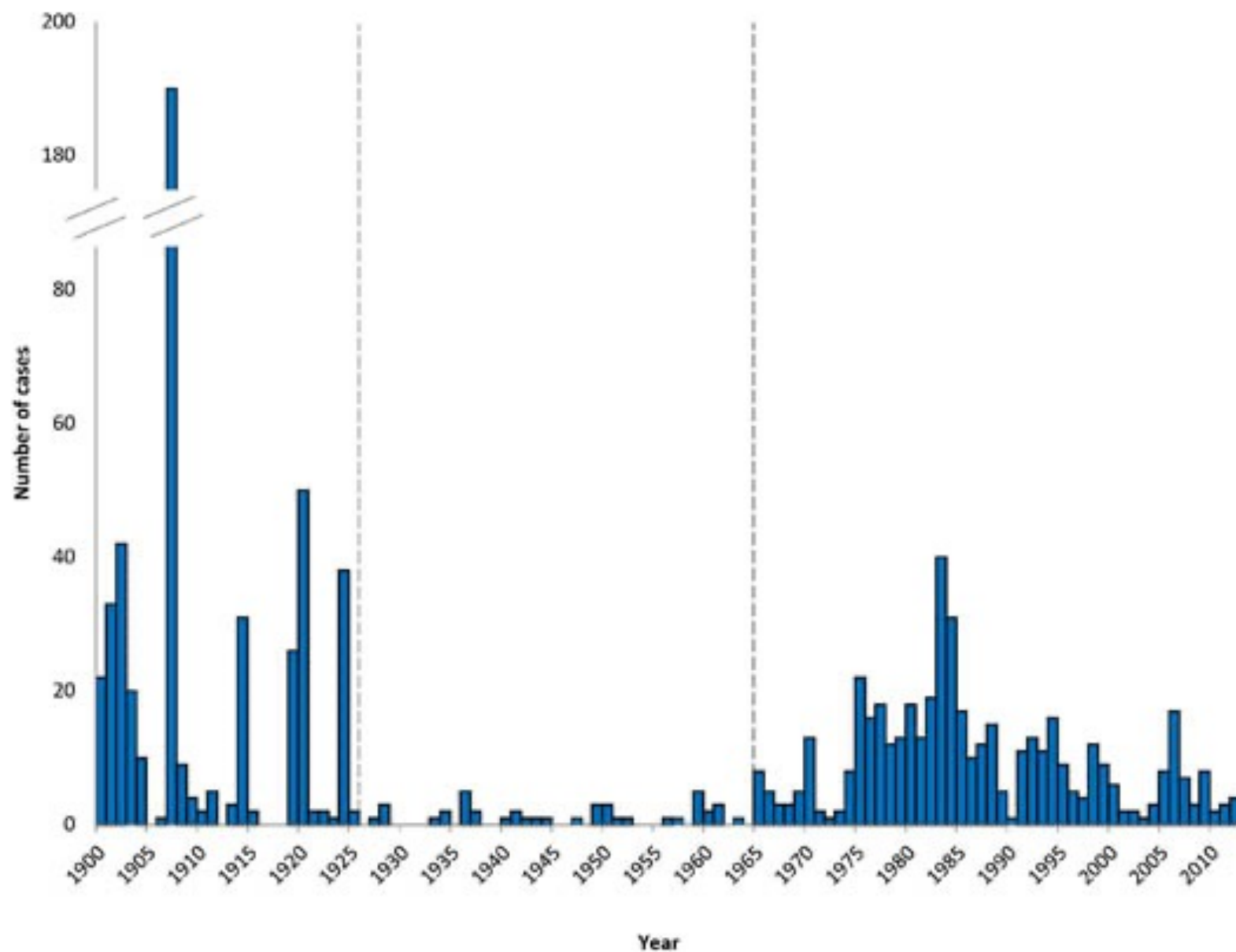
Reported Cases of Human Plague - United States, 1970-2019



Human Plague Cases and Deaths - United States, 2000-2019



Number of Reported Confirmed and Probable Plague Cases per Year in the United States: 1900-2012



Plague Worldwide

- ▶ Plague epidemics have occurred in Africa, Asia, and South America but most human cases since the 1990s have occurred in Africa.
- ▶ Almost all of the cases reported in the last 20 years have occurred among people living in small towns and villages or agricultural areas.
- ▶ Between 1,000 and 2,000 cases each year are reported to the [World Health Organization](#) (WHO), though the true number is likely much higher.
- ▶ WHO cites mortality of 8–10% of those infected, however some studies (WHO, 2004) suggest that mortality may be much higher in some plague endemic areas.

Plague Worldwide

Plague epidemics have occurred in Africa, Asia, and South America but most human cases since the 1990s have occurred in Africa. Almost all of the cases reported in the last 20 years have occurred among people living in small towns and villages or agricultural areas rather than in larger towns and cities.

Reported* Plague Cases by Country, 2013-2018



Clinical photos of plague infection





Animals involved in endemic and epidemic plague infections





Plague and Covid parallels (second pandemic)

- ▶ Supply chain disruptions
- ▶ Large numbers of people quit their jobs
- ▶ Religious fanaticism
- ▶ Finger pointing at who was to blame
- ▶ Overt discrimination against minorities
- ▶ Efficient transmission via droplets
- ▶ PPE for clinicians
- ▶ People avoiding one another
- ▶ Infection derived from animal host/s

THE PLAGUE DOCTOR'S MASK FEATURED A 'BEAK' HALF A FOOT LONG, STUFFED WITH SWEET FRAGRANT HERBS AND PERFUMES, TO BLOCK OUT THE OSTENSIBLY DANGEROUS 'MIASMA'

THE DOCTOR'S HAT WAS A SIGNIFIER OF HIS SOCIAL STATION

SPECTACLES COVERED THE EYES

BENEATH THE COAT, A SHIRT WAS TUCKED IN

GLOVES MADE OF GOAT LEATHER

A STICK USED TO PROBE PATIENTS

THE DOCTOR'S BOOTS CONNECTED TO HIS BREECHES, CREATING A SEAL

A LONG COAT REACHING FROM THE NECK TO THE ANKLE, MADE OF FLUID-RESISTANT, SCENTED WAXED LEATHER

A 17th Century plague doctor's outfit

Unanswered issues

- ▶ Where on the planet is plague occurring now, involving which mammals and which fleas?
- ▶ Why do canids not get sick with plague? What protective mechanisms do they have that we and other mammals lack?
- ▶ What is the role of specific elements of the immune system in recovery from plague?
- ▶ What is the Yp strain (or type) variability in other geographic areas, like South America, China, Madagascar, South Africa, etc?
- ▶ With ecologic disruption (like in Brazil and Madagascar), what is happening with plague distribution, plague cycles, etc?
- ▶ What public health messages would prove most effective re: plague education, without causing mass panic?

Some key take-home messages about plague

- ▶ Plague is primarily a disease of non-domestic animals, and we get infected when we get in the way
- ▶ Few diseases have affected the course of humankind as much as this one has done
- ▶ The waves of infections in humans mostly 'burned out', while animal populations are presumed to have kept the infection extant
- ▶ Easily treated, but untreated, very high fatality:case ratio, especially for pulmonary form (probably 100%)
- ▶ Highly contagious in pulmonary form

Take home messages more broadly

- ▶ The planet has experienced diverse pandemics in recent human history, and we made it through each of them at the species level
- ▶ Scientific observation and experimentation have helped humans to conquer many of these pandemics
- ▶ Prior to germ theory, these events must have been particularly terrifying since most theories of cause of widespread death were not borne out
- ▶ Human genetic diversity related to immune response has likely come to the rescue in the past to help the species survive, along with environmental changes

Quiz

- ▶ In the US, what cities were most affected by plague in the third pandemic?
- ▶ What were some of the societal and economic impacts of the second plague pandemic in Europe and Asia (the Black Death)
- ▶ Which infectious diseases in this country could become even more significant if we let our guards down? How about elsewhere on the planet?

References

- ▶ Great courses, Introduction to Infectious Diseases, Influenza.
- ▶ Morens and Fauci. Emerging pandemic diseases: How we got to Covid-19. Cell, 2020.08.021
- ▶ Gavi. The long view: History's seven deadliest plagues. Smithsonian on line, 15 Nov 2021