



# NATIONAL VETERINARY LABORATORY

P.O. Box 239, 1Tice Road  
Franklin Lakes, NJ 07417  
877-NVL-LABS (877-685-5227)  
[www.natvetlab.com](http://www.natvetlab.com)

## NEWSLETTER

### Zoonoses and Pandemics: Veterinarians Roles<sup>©</sup>

Evelyn E. Zuckerman, Editor

Spring 2021

Vol. 20, Number 2

#### In This Issue:

In the Spring 2021 issue of the NVL Newsletter, the zoonotic COVID-19 pandemic is still with us although we are beginning to get control. Dr. Hardy will discuss zoonoses and pandemics and the role of veterinarians in the One Health Approach for mitigation and prevention.

#### Infectious Diseases:

##### Level of disease occurrence:

**Sporadic:** occur infrequently or irregularly.

**Endemic:** occur constantly or usually in a geographically defined area.

**Hyperendemic:** occur persistently at high level.

**Epidemic:** sudden increase in cases above normal for that population.

**Outbreak:** Same as endemic, but in a more limited geographic area.

**Cluster:** aggregation of cases occurring in a place and time greater than number expected.

**Pandemic:** an epidemic that has spread into several countries or continents.

#### Zoonoses:

A zoonotic disease is any infectious disease (infectious organism) of animals that can be naturally transmitted to humans. There are 200 known types of zoonotic diseases. Six of 10 human infectious diseases originate in animals and 3 of 4 emerging infectious diseases come from animals.<sup>1</sup>

#### History (Heirloom) Zoonotic Diseases:

Approximately 12,000 years ago, mobile hunter-gatherers migrated out of African homelands and dispersed around the world. Small groups of these mobile humans settled in the world's first villages. There they domesticated valuable wild plants and animal species for food and for feed production.<sup>2</sup>



Village and villager herding his goats in the Rift Valley, Africa  
Photos by Dr. WD Hardy, Jr.

This new lifestyle spread throughout the world and agriculture replaced most hunter gatherer societies. This so-called Neolithic Revolution was the beginning of domestication of animals

and agriculture which brought animal and human species close together. This dramatic transition caused emergence of novel human and domestic animal pathogens such as the mumps and smallpox viruses, and *Bordetella* which emerged in humans soon after. The prehistoric and historic development continues and changes with domestication, agriculture, intensive farming which congregate people and animals together is accompanied by increased risks for cross-species (zoonotic) transmission of pathogens.

Emerging zoonotic infectious diseases in humans can be divided into: 1) pathogens that repeatedly cross species barriers into humans, but only result in sporadic cases of infection without further human spread and, 2) pathogens, that after crossing the species barrier into humans, adapt and spread efficiently in people resulting in epidemics and even pandemics. Only a few mutations in zoonotic viruses may be sufficient to allow these pathogens to acquire very efficient transmissibility and pathogenicity within its new host. These "heirloom pathogens" are those that were transmitted to the early *Homo* genus, and cospeciated with humans and are still with us to the present day.<sup>2</sup>

Smallpox, caused by the heirloom zoonotic pathogen *variola virus*, was one of the most-deadly pathogens ever, probably arose from a *poxvirus* of rodents.



Smallpox

CDC/James Hicks - This media comes from the [Centers for Disease Control and Prevention's Public Health Image Library](#) (PHIL), with identification number #3265

The history of smallpox extends into pre-history, with the disease probably emerging in humans about 10,000 BC. It is suspected that smallpox was responsible for killing nearly all of the native inhabitants of the Americas.<sup>3</sup> The WHO certified the global

eradication of smallpox in December 1979.<sup>4</sup> Smallpox is one of two infectious diseases to have been eradicated from the world, the other being animal rinderpest, which was declared eradicated in 2011.<sup>5</sup>

The adaptation to village living allowed for pathogens to spread from animals to humans and vice-a-versa. This also enabled animal-to-animal cross species transmission with commensal rodents and cats living together, now in villages.



FeLV arose from an ancestral rat retrovirus

The result was cross-species transmission of a rodent retrovirus into cats and subsequent horizontal transmission of the new feline leukemia virus ever since in cats.

Feline panleukopenia virus is a known pathogen of cats and is now found as a natural pathogen in wild carnivores such as mink, foxes and raccoons. Canine parvovirus emerged in dogs in the 1970's following cross-species transmission of the feline panleukopenia virus and adaptation in this new novel canine host. It then spread worldwide and represents a major pathogen in dogs. These examples highlight the continued cross-species transmission of pathogens among animal species and humans at the domestic animal-human interface.

#### Contemporary Zoonotic/Pandemic Diseases

Cross-species transmission of pathogens is still occurring and there will certainly be another pandemic in our future. To prevent these occurring we have to address the methods of spread.<sup>1</sup>

**Direct contact zoonoses spread:** Present day zoonotic diseases spread by contact with the saliva, blood, urine, mucus, feces, or other body fluids of infected animals.

## Examples include:

**Wet Markets:** Crowded markets sell many different wild and domestic animals for food.



Live animal wet market in China

Wikipedia By FuriousGeorge1 from Flickr, CC BY2.0, <https://commons.wikimedia.org/w/index.php?curid=2488362>

**Hunting & Bushmeat:** SARS-CoV-2 (COVID-19), SARS-CoV-1 and HIV. HIV evolved from a simian immunodeficiency virus (SIVcpz) found in chimpanzees in central Africa and entered humans via preparation of bushmeat for food.



**Chimpanzee Pan troglodytes troglodytes** By Afrika Expeditionary Force - <https://www.flickr.com/photos/afrikaforce/5155384054/in/photostream/>, CC BY 2.0, <https://commons.wikimedia.org/w/index.php?curid=14976848>

SARS-CoV (SARS) and SARS-CoV-2 (COVID-19) also arose from bushmeat/wet market environments, transmitted from masked palm civets and horseshoe bats respectively. The SARS pandemic of 2002-2004 resolved without a major pandemic whereas the SARS-CoV-2 COVID-19 disease pandemic has swept the world for more than a year. Like SARS-CoV-2, with SARS-CoV, a small number of cats and dogs tested positive for the virus during the outbreak. Since the viruses are so similar, was it fortuitous, or was it from the lack of good political leadership in much of the world, for COVID-19 not to obtain rapid containment?

**Foodborne:** Each year, about 15% of Americans are sickened from eating contaminated food or drinking- unpasteurized (raw) milk, undercooked meat or eggs, or raw fruits and vegetables that are contaminated.

**Waterborne:** Drinking or coming in contact with water that has been contaminated with urine or feces from an infected animal can transmit zoonoses such as Leptospirosis and Giardiasis.

**Pets:** Cats and dogs can be direct conveyors of zoonotic microorganisms such as rabies, *Bartonella* (cat scratch disease and bartonellosis) and ringworm to name a few.

### Farming, ranching, animal husbandry:

The Neolithic age, which began in the Middle East in about 9500 BC, was a time when humans became farmers. Factory, industrial overcrowded feedlot farming is common today and leads to enabling zoonotic microorganisms, such as *Salmonella*, and *E. coli*, to contaminate the food supply and farm environment.

**Wild and Pet Animal Attacks:** Rabies kills more than 50,000 people worldwide each year, mostly due to unvaccinated stray dogs and cats.

**Indirect contact zoonoses spread:** Contact with areas where animals live and roam, or objects or surfaces (fomites) that have been contaminated. Examples include pet habitats, chicken coops, barns, bird feeders, plants, and soil, as well as pet food and water dishes.

**Vector-borne:** Being bitten by a tick, or an insect like a mosquito or a flea, is an indirect transmission route. Some of the most devastating diseases the world has ever seen, such as the Plague, have been transmitted indirectly by vectors. Other vector-borne zoonotic disease are bartonellosis, Lyme disease, malaria, West Nile Disease, Zika Fever and Eastern Equine Encephalitis.

**Deforestation, biodiversity loss and environmental degradation:** Zoonotic diseases have become more common recently due to the changing spatial relationship between animals and humans through the loss of habitat for animals. My friend, and long-time scuba diving buddy, Jim Sterba, in his excellent 2012 book *Nature Wars*, published by Crown Publishers New York, is about how wildlife comebacks turned backyards into battlegrounds. I highly recommend this book for veterinarians and animal lovers.



Jim Sterba (left) & Dr. Hardy, Fiji 1983

Jim describes how wildlife and people are becoming close neighbors which increases zoonoses such as Lyme Disease.

**Climate Change:** Due to a warming earth, animals have been forced to look for food and shelter closer to human habitats causing the spread of zoonotic pathogens into human populations more readily.

### Plague, The Black Death, Pestilence

The bubonic plague pandemic occurred in Afro-Eurasia from 1346 to 1353. It was the most fatal human pandemic, causing the death of 75–200 million people.<sup>6</sup> The disease is caused by the bacterium *Yersinia pestis* transmitted by the Oriental rat flea vectors from reservoir infected black rats and, probably originally arose from rodents.



**Influenza pandemics** Except for smallpox, most pandemics are caused by newly evolved viruses. Influenza pandemics have occurred worldwide for centuries and are related to farming pigs and birds. The Spanish flu, also known as the 1918 influenza, was an unusually deadly influenza pandemic caused by the H1N1 influenza A virus. It lasted from February 1918 to April 1920, and infected

500 million people, about a third of the world's population at the time. The death toll is estimated to have been between 20 million and 50 million people.<sup>7</sup>

### Herd Immunity

Herd immunity occurs only with contagious diseases when a sufficient percentage of a population has become immune to infection, whether by vaccination or by previous infections, thereby reducing the likelihood of infection for individuals who lack immunity. When veterinarians first coined the term, it was clear that many of the first reports were about vaccine-induced herd immunity. Adolph Eichhorn and George M. Potter used the term in *The Journal of the American Veterinary Medical Association* in 1916. Immune individuals are unlikely to contribute to disease transmission, disrupting chains of infection, which stops or slows the spread of disease. The greater the proportion of immune individuals in a community, the smaller the chance that non-immune individuals will be infected by contact with an infectious individual.

### SARS-CoV-2 COVID-19 Pandemic

The World Health Organization declared the 2019–20 coronavirus **outbreak** a Public Health Emergency of International Concern on January 30, 2020 and a **pandemic** on March 11, 2020, exactly 14 months ago. Since then, many countries have failed to control the pandemic, many because of misinformation, poor leadership and people unwilling to accept science recommendations.

**Commentary: The SARS-CoV-2- induced COVID-19 coronavirus pandemic is truly a One Health veterinary crisis of unprecedented proportions involving humans and animals. Fortunately, we now have multiple SARS-CoV-2 vaccines available with excellent, 90%+ effectiveness. As of this writing, 34% of Americans are fully vaccinated and another 25% have had at least 1 shot. Unfortunately, there is now a slowing down of people willing to be vaccinated and there are terrible resurgences of COVID-19 in India, Brazil and other countries. These resurgences threaten the world with the likely generation of SARS-CoV-2 vial variants. In addition, there are not enough vaccine doses available now for many of the countries who desperately need and want them. What is needed now is effective, science-based leadership, and an effective anti-viral therapy to help eliminate the pandemic, much like has occurred with AIDS.**

### References:

1. Wikipedia: [www.wikipedia.org/wiki/coronavirus](http://www.wikipedia.org/wiki/coronavirus)
2. Reperant, LA and Osterhaus, ADME. The human-animal interface. One Health: Animals and the Environment, pp 33-52, Ed. RM Atlas & S. Maloy. ASM, Wash, DC 2014.
3. Henderson D. Smallpox: the death of a disease. Prometheus Books. p.12. ISBN 978-1-61592-230-7, 2009.
4. Fenner F, et. al. Smallpox and its Eradication. Geneva: World Health Organization. ISBN 92-4-156110-6, 1988.
5. Normile D. "Rinderpest. Driven to extinction". Science. 319 (5870): 1606–9. doi:10.1126/science.319.5870.1606. PMID 18356500. S2CID 46157093. March 2008.
6. World Health Organization. "Plague Fact sheet N°267". Archived from the original on 24 April 2015. Retrieved 10 May 2015, 2014.
7. P. Spreuwenberg; et al. "Reassessing the Global Mortality Burden of the 1918 Influenza Pandemic". Amer. J. Epid. 187 (12): 2561–2567. 2018.

[www.natvetlab.com](http://www.natvetlab.com)

©National Veterinary Laboratory, Inc., 2021