

## ZOONOTIC INFECTIONS

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Pandemics have been a recurring theme in the fabric of human history, with the deadliest since the Bubonic Plague being the 1918 Spanish flu pandemic, which killed up to 100 million people. This was prior to the advent of mechanical ventilation, seamless air travel as a mode of transoceanic disease transmission, and anti-vaccine culture. Amidst the coronavirus COVID-19 pandemic, I have taken an interest in how humans acquire diseases from animals. Namely, is there anything we can do to prevent the next outbreak?

Pandemic respiratory illness in humans is typically zoonotic, and differs from the common cold or seasonal flu due to a higher morbidity and mortality rate, largely due to pulmonary involvement. Certain animals are more implicated in zoonotic diseases than others. Birds and pigs are typically reservoirs for pandemic influenza. The risk of transmission is heightened when there is a high density of animals in a confined space, and animal caretakers are particularly vulnerable, as these pathogens are endemic on farms. Additionally, the migration of wild birds is a vector for long-distance spread. Often overlooked are bats—the only mammals that fly, known for their longevity, and hosts to numerous zoonotic pathogens. This includes deadly viruses such as Ebola, Marburg, rabies, Nipah, MERS and SARS.<sup>1</sup> For some of these viruses, disease is propagated via bodily fluids of animals or humans, making transmission slightly more difficult than airborne pathogens. Human encroachment into forests and other bat habitats is thought to play a role in the spread of these diseases, which is typically facilitated by bat hunting, or human contact with infected animals acting as intermediate hosts. Some diseases can also be transmitted by handling bat dung (also known as guano) or fomites such as fruit. Bats themselves are relatively unfazed by these diseases due to their enhanced macrophage and pro-inflammatory response to pathogens and quick ability to dampen inflammation thereafter.<sup>2</sup>

China has been a hotspot for virulent pathogens in recent years. Due to SARS-CoV-1 and avian influenza H7N9, the Chinese government temporarily shut down wild animal markets in 2003 and 2013-14, respectively. Key scientists agreed with this decision, including

Kwok-Yung Yuen, a virologist at the University of Hong Kong who co-discovered the SARS virus. In *Nature*, he stated that this “reinforces the notion that we should not disturb wildlife and never put wild animals into markets”.<sup>3</sup> “Respecting nature...is the way to stay away from the harm of emerging infections”.<sup>3</sup> Scientists also warned that a “deadly outbreak [such as SARS] could emerge again”.<sup>3</sup> After the outbreaks ended, the markets were re-opened. With suspicion that illegal trade of the endangered pangolin could be at the heart of the COVID-19 pandemic,<sup>2</sup> the wet markets have again been shut down—hopefully this will be permanent. Prior to this pandemic, I had never heard of the pangolin, which I learned to be the world’s most trafficked mammal. When I saw pictures online, I was immediately mesmerized by this majestic scaly creature which resembles a cross between an artichoke and a small dinosaur. In traditional Chinese medicine, the scales are thought to have therapeutic properties, and the meat is considered a delicacy. Interestingly, research has shown that the scales are mostly made of keratin, so one might wonder whether eating one’s own skin/hair/nails would have a similar effect. In certain African traditions and rituals, bushmeat consumption continues—this includes primates and pangolins. Pandemics are a reminder that our cultures are rich and beautiful, but all humans will be affected by pockets of unsafe practices. Furthermore, poverty may drive many of these behaviors.

We live in an age in which we are disconnected from our food sources, and food may now be obtained from across the globe. Few people raise their own animals, and even fewer people slaughter these animals for personal consumption. Mindful consumerism will require us to step away from the industrial meat model. Human touch is lost in automated, high-volume slaughterhouses. In some religious traditions (Islamic and Jewish), the slaughter must be done with a knife, and with a deep respect for the sacrifice of the animal’s life. Additional care is taken to ensure that the animal does not perceive its upcoming demise. The carotid arteries and jugular veins must be severed to promote complete exsanguination, as blood is considered inappropriate for ingestion.

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**PERSPECTIVE: PART IV** (continued from page 1)

Moreover, the spinal cord is not severed; this could theoretically prevent prion disease, which is rare but fatal. Prions may not be destroyed by normal sterilization techniques or cooking. The practice of using brain and spinal cord from cows and other animals as animal feed was banned by the US FDA in 1997,<sup>4</sup> thereby preventing transmission of bovine spongiform encephalopathy (also known as mad cow disease) and the human version, called variant Creutzfeldt-Jakob disease. However, this practice may still occur in other parts of the world. Additionally, the unsustainable worldwide demand for meat opens the door to many unethical and unsanitary animal husbandry practices. The requirement of land for animal grazing has compromised the world's forests. Setting fires to clear this land has had devastating consequences, and the Brazilian government's support for cattle ranchers is to blame for the Amazon forest fires of 2019.<sup>5</sup>

I can't help but wonder, if humans are more thoughtful about our interactions with wild and domesticated animals, can we prevent zoonotic infections? Furthermore, human interference in nature has resulted in a loss of biodiversity and unbalanced ecosystems—I wonder what repercussions this will have on the health of humanity? How can physicians educate themselves about ecological problems and advocate for safer environments?

**References**

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