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One Health: Zoonoses in the Exotic Animal Practice

Marcy J. Souza, DVM, MPH, Dipl. ABVP–Avian, Dipl. ACVPM

KEYWORDS

- Zoonoses
- Exotic pets
- Nontraditional pets
- Wildlife
- Disease prevention

Recent outbreaks in humans associated with nondomestic animal species include Sudden Acute Respiratory Syndrome (SARS), Ebola virus, salmonellosis, and monkeypox. Animals may act as sentinels for human health. Expanding human populations and encroachment on habitats may increase exposure to zoonotic agents. Education and preventive medicine practices can be applied to reduce the risk of contracting a zoonotic disease. The health of humans, animals, and the environment must be treated as a whole to prevent the transmission of zoonoses.

ZOOSESES

Zoonoses are estimated to make up 75% of today's emerging infectious diseases.¹ Many of these zoonoses are carried by exotic pets or wildlife species,² and recent outbreaks in humans associated with nondomestic species include Sudden Acute Respiratory Syndrome (SARS),³ Ebola virus,⁴ salmonellosis,⁵ and monkeypox.^{6,7} Some of these infectious agents can cause disease in animals, and these animals may act as sentinels for human health. Expanding human populations and subsequent encroachment on habitats of reservoir species of zoonoses, increased trade in and ownership of "exotic" pets, and changes in climate will likely lead to increased exposure to zoonotic agents. Veterinarians could be held legally responsible for the transmission of zoonoses to staff or clients. Education and preventive medicine practices can be applied to reduce the risk of contracting a zoonotic disease by veterinarians, their staff, or owners of exotic pets. The health of humans, animals, and the environment are linked and must be treated as a whole to prevent the transmission of zoonoses and increase our understanding of the concept of "One Health."

RECENT EPIDEMICS

Numerous recent epidemics have been associated with exotic pets or wildlife species including SARS, Ebola, salmonellosis, and monkeypox. Morbidity and mortality in humans varies with each etiologic agent; animals can sometimes also be affected

Department of Comparative Medicine, University of Tennessee College of Veterinary Medicine, Knoxville, TN 37996, USA

E-mail address: msouza@utk.edu

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with disease. More dangerous, though, reservoir species may be asymptomatic and provide no outward sign that they are potential sources of zoonotic agents. Transmission and case identification often results in large scale costly investigations to determine the source of an outbreak and apply steps to reduce further spread of disease.

In February 2003, an outbreak of respiratory disease was recognized in approximately a dozen people in a Hong Kong hotel. The infection, later determined to be caused by a novel coronavirus, eventually led to 8,096 human cases with 774 deaths in 26 countries worldwide.⁸ Many of the early cases occurred in the Guangdong province of China and were associated with animal or food handling; later cases were associated with direct contact with an infected human. Himalayan palm civets (*Paguma larvata*) found in live animal markets and wild fruit bats have both been implicated as possible reservoirs of SARS-like coronaviruses.^{3,9} There have been no reports of illness in civets or bats associated with these coronaviruses; however, nonhuman primates develop illness when experimentally infected.⁸

Numerous outbreaks of Ebola have occurred in humans in Central Africa since the 1970s; mortality is typically high, but variable.¹⁰ Many outbreaks have been associated with exposure to nonhuman primates, but Ebola virus also causes significant mortality in gorillas (*Gorilla gorilla*) and chimpanzees (*Pan troglodytes*).^{10,11} A few outbreaks were also associated with exposure to duikers and monkeys.¹⁰ Fruit bats have recently been implicated as reservoirs for Ebola virus but do not develop disease.⁴ Although Ebola virus infection is rare outside of Africa, quarantine procedures must still be followed to avoid the importation of infected animals such as occurred with imported primates for laboratories in Virginia and Texas.^{12,13} The Centers for Disease Control and Prevention (CDC) regulate importation and quarantine of all nonhuman primates, as well as any other animal that may carry zoonotic pathogens.¹⁴

Historically, salmonellosis from exotic animals has most commonly been associated with exposure to reptiles, but a recent outbreak in 2009 was associated with exposure to aquatic frogs.⁵ The outbreak was caused by *Salmonella* Typhimurium and the organism was isolated from 85 people in 31 states of the USA. No deaths were reported, but numerous people required hospitalization. An investigation determined that exposure to African dwarf frogs (*Hymenochirus spp*) was associated with infection, and the organism was isolated from animals, samples from tanks where pet frogs were housed, and breeder facilities. Similar to reptiles, amphibians can be asymptomatic carriers of *Salmonella*. The CDC concluded that educational material addressing *Salmonella* exposure from reptiles should also include amphibians as possible sources of the organism.¹⁵

In 2003, an outbreak of monkeypox (orthopoxvirus) was linked to exposure to pet prairie dogs (*Cynomys sp*) in the US. Eighty-one human cases were reported in 6 states.^{6,7} Numerous species of African rodents that had been imported for the pet trade were found to be positive for the monkeypox virus associated with the outbreak. Imported rodents had been commingled with prairie dogs that were eventually sold as pets. One study showed that prairie dogs do develop disease and suffer mortality when infected with monkeypox.¹⁶ CDC issued guidance on the quarantine and euthanasia of animals in the infected shipment as well as other exposed animals, particularly prairie dogs.¹⁷

CONTRIBUTING FACTORS

Numerous factors may contribute to the continued increasing exposure to zoonoses from wildlife and exotic pets.¹⁸ Some of these factors include: a continually growing

and globalized human population, increased exotic pet ownership, and changes in climate that affect wildlife and vector distribution.

As human populations continue to increase, more people will move into areas that have not previously been inhabited and alter the environment to suit their purposes, whether for housing or agriculture; interactions with native wildlife and invertebrate vectors of disease will increase as a result.^{19,20} One study found that increased interactions with wildlife occurred in suburban and exurban communities, while fewer interactions occurred in more densely populated communities.²¹ Interactions may lead to increased exposure to zoonotic pathogens through direct contact with animals, contact with infected urine, feces, pelts or a carcass, or exposure to vectors such as ticks or fleas. Zoonothonotic pathogen (those passed from humans to animals) exposure to animals may also increase with these interactions.²² Additionally, as humans move into previously uninhabited areas, consumption of native wildlife may increase leading to increased exposure to zoonotic agents. Historically, tularemia was associated with rabbit hunting, and now Ebola virus outbreaks are associated with the bush meat trade in Africa.²³ Larger human populations will require increasingly larger amounts of protein for sustenance, and some of this protein will undoubtedly come from wildlife. Finally, because of increased ease of international travel and globalization of cultures, humans, animals, and pathogens can travel the globe quickly allowing diseases to spread rapidly worldwide.²⁴

Although dogs and cats are still the largest population of pets in the US, the American Veterinary Medical Association reports that ownership has increased from 2001 to 2007 for the following other types of pets: fish, ferrets, rabbits, hamsters, guinea pigs, other rodents (not specifically identified), turtles, snakes, and lizards.²⁵ A category titled "all others" also increased from 2001 to 2007, but the specific animals included in this category were not listed. The total number of birds kept as pets has increased, but the number of households owning birds decreased in the same time period. In general, the number of households with pets other than dogs and cats is increasing. Depending on the country of origin of these exotic pets, and what importation and quarantine procedures are performed, exotic pets may carry zoonoses that have not previously been identified in that particular geographic area¹⁹; numerous outbreaks of zoonoses have been associated with the legal and illegal importation of animals in the pet trade.²⁰ The identification of monkeypox in a population of pet prairie dogs in the midwestern US is an excellent example of how non-native exotic rodents that were carrying a zoonotic agent uncommon to the US transmitted the virus to native rodents in the pet trade; no human cases were directly caused by the non-native exotic rodents.⁶

Global climate change is occurring and is unlikely to slow without significant measures by humans.²⁶ These climate changes are not only expected to directly affect humans through more severe and prolonged weather events, but also by changing the home range of wildlife species and vectors of disease, such as ticks, and altering the time when a disease can typically be transmitted to humans. One recent study predicts that the range of *Ixodes scapularis*, the primary tick that transmits the etiologic agent of Lyme disease in the US, will noticeably expand in the next two decades with the predicted rate of climate change; this change in range of the vector species will also affect the geographic distribution of the disease in humans and animals, such as dogs.²⁷ Another paper suggests that the current ranges of plague and tularemia are likely to shift north due to changes in range of host rodent species, although the changes will likely be subtle.²⁸ Prevalence, intensity, and geographic distribution of disease due to some helminths are also expected to change with changes in climate.²⁹ Finally, milder winters and earlier springs may lead

to alterations in the typical transmission period of some vector borne diseases. For example, West Nile virus, which typically peaks in late summer, could be transmitted earlier in the year leading to a higher incidence of disease in humans earlier in the year.²⁶ The total effects of climate change on zoonotic disease transmission and distribution is still unknown, and there are many factors that complicate predictions.²⁶ Regardless of the specifics, alterations in disease distribution and transmission are expected as a result of changes in climate.

LEGAL IMPLICATIONS

Veterinarians, as well as physicians and other health care professionals, have a responsibility to protect human health. A recent paper reports several scenarios where a veterinarian could potentially breach their professional duty and be subject to litigation.³⁰ These scenarios include: (1) failure to recommend preventive measures to owners of animals with zoonotic diseases, (2) failure to advise clients on the dangers of exotic pets, and (3) failure to advise clients to seek care from a physician when appropriate. Veterinarians, as members of any community's health care team, must not only treat animals, but also play a role in the prevention of zoonoses in humans. Educational materials and counseling should be provided to pet owners regarding zoonoses and how to prevent their transmission.

Veterinarians, physicians, and other health care professionals must also increase communication between each other regarding zoonoses. A recent study found that 97% of veterinarians rarely or never contacted physicians regarding animal aspects of zoonoses or transmission of zoonoses to an individual person with HIV/AIDS.³¹ In the same study, 100% of physicians rarely or never contacted a veterinarian regarding the animal aspects of zoonoses transmission or transmission of zoonoses to an individual HIV/AIDS patient. All health professionals must communicate and play a role in human and animal health in order to facilitate the concept of "One Health."

Finally, veterinarians must take steps to prevent zoonoses in the personnel under their supervision. These steps may include having standard operating procedures in place to prevent zoonoses, disinfecting contaminated areas, and providing education for staff regarding disease prevention. Specific guidelines regarding disease prevention are available in the Compendium of Veterinary Standard Precautions for Zoonotic Disease Prevention in Veterinary Personnel.³² Many of these recommendations can also be given to pet owners that are caring for a sick animal at home.

CONCLUSIONS

Human, animal, and environmental health are intertwined and must all be considered when dealing with zoonotic diseases. With expanding human populations, increased exotic pet ownership, and changes in climate, human exposure to zoonotic agents will continue and likely increase. Veterinarians must not only treat animals with zoonoses, but also play a role in the prevention of zoonoses in humans. Veterinarians should work with physicians to provide education and preventive measures to humans in order to reduce the likelihood of zoonoses transmission.

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