

TB in Wild Asian Elephants

[Announcer] This program is presented by the Centers for Disease Control and Prevention.

[Sarah Gregory] I'm talking today with Dr. Susan Mikota about TB found in wild Asian elephants. She's a veterinarian and the co-founder of Elephant Care International. Welcome, Dr. Mikota.

[Susan Mikota] Hi Sarah. Thanks for inviting me.

[Sarah Gregory] Tell us about Elephant Care international and your work with them. Between poaching and habitat restrictions and now TB, elephants are having a pretty rough time.

[Susan Mikota] Sure Sarah. Elephant Care International is a non-profit organization; it's dedicated to the health, welfare, and conservation of elephants. I serve as the Director of Veterinary Programs and Research. We work primarily with Asian elephants and currently have projects in Nepal, Vietnam, Sri Lanka, and Myanmar. In addition to direct care, we conduct workshops and train veterinarians to better care for elephants. We often work collaboratively with other organizations. For example, this summer we will be working with the Sri Lanka Wildlife Conservation Society's EleVet Project. And we also have an extensive website that's a resource of information for people who work with elephants.

Elephants are indeed facing hard times and Asian elephants don't receive nearly as much media attention as African elephants, even though Asian elephants are far more endangered. In Vietnam, for example, there are fewer than 100 elephants in the wild and only about 50 in captivity.

[Sarah Gregory] *Mycobacterium tuberculosis* in elephants seems to be a case of reverse zoonoses. Would you explain what that means?

[Susan Mikota] Sure. Zoonotic diseases are diseases that are transmitted from animals to humans. A reverse zoonosis is when humans transmit diseases to animals. And this topic hasn't received a lot of attention, but in 2014, there was a study published in PLOS, which is the Public Library of Science, and it reported reverse zoonoses of bacteria, viruses, fungi, and parasites in 56 countries and on every continent except for Antarctica. And interestingly, 50 percent of the cases were diseases that were transmitted from humans to wildlife, so maybe it is no surprise that we're now finding wild Asian elephants with the human form of TB.

[Sarah Gregory] Can people get TB from infected elephants?

[Susan Mikota] Yes. And there are several published reports. In 2009, nine people at the Elephant Sanctuary in Tennessee became infected. And then, more recently at Oregon Zoo, seven people were diagnosed with TB and four staff members at an Australian zoo became infected. There's some other reports, as well, and there's some additional cases that have occurred but were never really made public.

[Sarah Gregory] I understand there are reports of TB from as early as the 1920s in captive elephants. But your study is about wild elephants. What's the difference?

[Susan Mikota] Actually, a disease resembling tuberculosis was described in captive elephants over 2000 years ago in ancient documents in Asia. But our awareness of TB among captive elephants didn't emerge until 1996 when two circus elephants here in the U.S. died of TB only three days apart. This raised public concern and the United States Department of Agriculture formed a team to investigate the rest of that herd. I was a member of that team and I have been involved with TB in elephants ever since.

TB is the perfect example of a One-Health disease. One-Health is the concept that the health of humans, animals, and the environment are all connected. TB can infect humans, domestic livestock, and wildlife. Now in captivity, elephants are in close contact with humans so we can easily see how they could become infected with human TB. But until recently, only the bovine—the cow form of TB— has been found in any animal in the wild. These cases in elephants are different because it is the human strain of TB occurring in wild Asian elephants.

[Sarah Gregory] Tell us a little bit about your study.

[Susan Mikota] Dr. Arun Zachariah, the lead author, and I have been collaborating with other colleagues in India for many years on the subject of TB in elephants. Dr. Zachariah is a—he's a forest veterinarian, and he works in southern India. He conducts postmortem examinations of all the wildlife that die in the sanctuary where he works. And when he found the first case of TB in an elephant in 2007, he initiated a comprehensive surveillance program and then he found two other cases. So this was a great cause for concern and difficult to explain. There were no known captive elephant releases. Tourists can only visit the park under supervision and they can't stay overnight. Now native tribes do live within the park and human-elephant conflict occurs, so elephants do enter human settlements and that's perhaps how these transmissions occurred.

[Sarah Gregory] Have elephants in other countries been infected?

[Susan Mikota] Yes. The first reported case was in 2013. It was in an African elephant that had been raised at an orphanage and later released. And then two years later, in 2015, the next case was reported and that was in a wild elephant in Sri Lanka, and now we have these four cases from India—our report of three cases and then a single case report that was published in the same issue of *Emerging Infectious Diseases*.

We know that the human form of TB occurs among captive elephants in India and in the other elephant range countries, but finding it in wild elephants is alarming.

[Sarah Gregory] Do you have an idea as to how the elephants are getting TB?

[Susan Mikota] We don't really. TB bacteria are transmitted on respiratory droplets and it's generally thought that close contact is required for transmission, at least from human-to-human. Wild elephants, especially the bulls, commonly raid villages for food. So they do come into human habitations, but whether they come into contact that's close enough for transmission via respiratory droplets is questionable.

I really think we need to consider that other routes may be possible—fomites for example, or wind, maybe even vectors might be involved in some of the cases. These cases in wild elephants raise a lot of questions.

Even where TB has occurred in captive situations there have been unanswered questions regarding transmission. There have been outbreaks in several zoos where, in spite of very comprehensive investigations, it could never really be determined how TB moved from point A to point B. And there was one situation in an Australian zoo, where TB moved from an infected elephant to chimps that were housed 360 feet away.

Now there have been some studies that show that *M. tuberculosis* can survive on surfaces for up to four months. And *M. tb* has even been isolated from formalin-fixed autopsy tissues up to 45 days after fixation and interestingly from cockroach fecal pellets after they've been stored for eight weeks at room temperature.

Once an elephant has TB it can, of course, spread to other elephants. Elephants have these long trunks. They use them for eating, drinking, and communication. And that communication can include one elephant putting her trunk into another elephant's mouth. They can exhale forcibly. They can spray respiratory secretions some distance away. If this disease becomes established in the wild it could have devastating consequences for elephants and other species.

[Sarah Gregory] Are there any solutions? Or at least next steps in addressing the problem?

[Susan Mikota] Well, TB in humans has been under scientific investigation for well over 150 years. And we've spent billions of dollars trying to control it, but it's still the number one cause of death in humans from a single infectious agent. We've only been studying TB in elephants from a scientific standpoint for maybe 20 years. So we need to do more research and we need the funding to do that research.

We don't know what could happen if human TB became established in wild elephants or in other species. It might mutate into a more virulent form. It would certainly be impossible to treat. And in South Africa, the bovine form of TB in African buffalo has spread throughout Kruger National Park and has spilled over into 10 other mammalian species. The Asian elephants are far less plentiful than African buffalo and many are in these small fragmented populations which could succumb to a disease like TB.

I think increased surveillance of wild populations for all diseases is essential—especially in this era we're living in where a pandemic among humans seems increasingly likely. It's especially critical to establish TB surveillance and control programs in areas where captive elephants interface with the wild populations of elephants or rhinos, putting these populations at risk. We have a TB program in Nepal, and it was established with the collaboration of the Government of Nepal and the National Trust for Nature Conservation, which is a Nepal NGO. The goal of that program is to “prevent TB transmission to the wild by controlling TB at the captive-wild interface.” There used to be one to two deaths every year from TB among the captive elephants in Nepal, but now there has not been a TB-related death since 2013 and no *M. tuberculosis* has been found in the wild there—at least not yet.

[Sarah Gregory] Thank you so very much for talking with me today, Dr. Mikota. Listeners can read the entire March 2017 article, *Mycobacterium tuberculosis* in Wild Asian Elephants, Southern India, online at cdc.gov/eid. I'm Sarah Gregory for *Emerging Infectious Diseases*.

[Announcer] For the most accurate health information, visit cdc.gov or call 1-800-CDC-INFO.