

Human Salmonellosis Outbreak Linked to *Salmonella* Typhimurium Epidemic in Wild Songbirds, United States, 2020–2021

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

[Sarah Gregory] Hello, I'm Sarah Gregory, and today I'm talking with Dr. Megin Nichols, a veterinary epidemiologist at CDC in Atlanta. We'll be discussing *Salmonella* in songbirds and its effect on people.

Welcome, Dr. Nichols.

[Megin Nichols] Thank you so much. It's great to be here, Sarah.

[Sarah Gregory] Your article is about *Salmonella* in songbirds and its effect on people, as I said. Is this the same kind of *Salmonella* people get from raw eggs and raw poultry?

[Megin Nichols] It's similar. In this investigation, it was *Salmonella* serotype Typhimurium that affected songbirds and people. And this serotype of *Salmonella* is common in the United States. People can get this type of *Salmonella* from many sources including those that you mentioned, such as contaminated food and contact with animals. In fact, what many people didn't know and something that is a bit of a fact that you can share at any of your upcoming holiday events is that *Salmonella* results in more than one million illnesses in people each year, and about 11% of these illnesses are attributed to contact with animals, such as songbirds and other pets.

[Sarah Gregory] And what's considered a songbird?

[Megin Nichols] Well, the term is often used to describe birds that we hear singing in nature. However, not all birds that sing are truly songbirds. So for scientists, "songbird" has a more detailed meaning: it refers to a specific suborder of birds. And all songbirds are perching birds in an order called passerines that share a distinct toe arrangement that helps them to grasp onto branches. And really despite their variety in size and musical talent, all songbirds do have something in common which is precise control of a vocal organ that these birds have called a syrinx, and almost all birds use the syrinx to produce sound. So a little bit more information about what we actually consider a songbird.

[Sarah Gregory] Okay. So corvids like crows and ravens, those aren't songbirds? And what about pigeons?

[Megin Nichols] Nope, you are correct. Those are not songbirds.

[Sarah Gregory] What effect does *Salmonella* have on the birds?

[Megin Nichols] Well, unlike some of our other animal species that can get *Salmonella* and still look healthy, songbirds are affected with *Salmonella* and the signs that you might see include a reluctance to fly, anorexia (meaning they are not eating as much as normal), abnormal mentation (meaning they might seem confused). Some of them have diarrhea or might develop an inability to swallow their foods. One of the most common things we see reported when there is *Salmonella* in songbirds is sudden death—so someone walking outside looking at their

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birdfeeder or finding dead birds in their yard. So *Salmonella* does cause illness in these songbirds.

[Sarah Gregory] Okay, but a dead bird could also be West Nile or some other things, right?

[Megin Nichols] That is true. There are other causes of sudden death or sudden mortality in birds.

[Sarah Gregory] Do a lot of birds die from it? And do they die in clusters or is it sort of just a continuous thing?

[Megin Nichols] There are a few colleagues in the wildlife arena that have been looking into this for some time. Among wild songbirds, particularly those in the family Fringillidae (or finches), *Salmonella* can cause periodic and widespread deaths. This typically occurs during the winter, which can result in the deaths of hundreds to even thousands of birds. And among the types of *Salmonella* that we see cause deaths found in songbirds, *Salmonella* Typhimurium, which we found in our investigation, is the most common serotype identified in these death events among songbirds.

[Sarah Gregory] Have there been many of these outbreaks associated with birds and *Salmonella*?

[Megin Nichols] There have not been very many *Salmonella* outbreaks of illness in people that have been linked to songbirds that we found in the literature. Indeed, when we were doing our investigation, we found three outbreaks of *Salmonella* infection that were published in the literature, including in the United Kingdom, Norway, and New Zealand, and these outbreaks were linked to handling ill or dead birds or touching surfaces that had been contaminated with bird poop, such as birdfeeders.

[Sarah Gregory] I'm so conscious of my birdfeeder now. It's actually a birdfeeder tray, and when I go to refill it or pour the rainwater off it or something, I use gloves. It's probably a good idea, right?

[Megin Nichols] I think handwashing and hand hygiene, as you mentioned, is one of the most important ways that we can protect ourselves from *Salmonella*, including *Salmonella* that might be on birdfeeders.

[Sarah Gregory] How many birds have been known to die in a single outbreak?

[Megin Nichols] In outbreaks that have been reported, hundreds, even thousands of birds can die as a result of *Salmonella*. So the *Salmonella* outbreak in migratory songbirds during the winter of 2020 to 2021 was one of the largest events on record for the state of California—and this is a state that has good data—they indicated to us they had received nearly 20 times more reports from the public of sick or dying birds than they had in the previous winter outbreak they had among birds in 2015 to 2016. To give you an idea of the numbers that have been reported out of California as just an example of how many birds can die in these events, in California over 2,000 individual reports of sick and dead birds were provided by the public and wildlife rehabilitation centers during November 2020 to May of 2021. And in these over 2,000 individual reports, the reports included 2,440 sick and dead birds, and that includes nearly half of them were identified as pine siskins (so a songbird, in this case). So that's just an example of how many birds can die as a result of *Salmonella* during an outbreak.

[Sarah Gregory] That's actually pretty shocking to me.

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Are there environmental factors that play into these outbreaks?

[Megin Nichols] Yes. Various host and environmental factors can contribute to the risk for wild bird *Salmonella* outbreaks. Gatherings in large numbers at specific locations such as birdfeeders can lead to an increased density of birds and increased fecal contamination of the birdfeeders and surrounding area, which increases the chance that these songbirds might get infected. The type of birdfeeder also can play into these outbreaks. Platform feeders can result in fecal contamination of food and the potential risk for transmission to increase versus other types of birdfeeders that might not have as much fecal buildup on them.

[Sarah Gregory] Is there a seasonal component to these outbreaks?

[Megin Nichols] Yes. There's a strong seasonal component to outbreaks of *Salmonella* in songbirds. Most appear in the winter when these birds might become more reliant on birdfeeders and are more physiologically stressed by colder temperatures. And in addition, severe weather events have affected seasonal migration patterns, which can affect the birds' ability to find high-quality food sources, and that can also introduce or exacerbate any of the existing environmental stressors that can change or alter the birds' immune systems, making them more susceptible or more likely to develop disease. These factors collectively really contribute to our concern for the conservation of some wild birds and also increases the possibility that infection could spill over to people, although we don't always know exactly how people get the infections from birds. So there is a seasonal component and it's something that when you see a change in nature and food sources for the birds, it can actually have impact on human health.

[Sarah Gregory] Well, that was my very next question—how do people get it from these birds? So we don't exactly know?

[Megin Nichols] Germs like *Salmonella* can be transmitted from wild birds to people through many different routes. This includes direct contact with sick birds or dead birds or contact with bird feces such as on birdfeeders. People can also get *Salmonella* through indirect contact, meaning they have contact with, say, a companion animal like a dog or a cat, that bridge the connection between the human and the wild bird. This is especially common in cats that hunt and a human that might need to care for a sick animal or pick up and handle a dead bird. So cats and dogs can serve as a source for human illness in that instance. There's also instances where people might be exposed to the environment where there's a large buildup of bird feces, cleaning birdfeeders or cleaning up decks, porches, and other areas that might have bird feces on them. And as people, if we don't effectively wash our hands and then we touch our mouth or our face, we could potentially become infected with this germ.

[Sarah Gregory] Is it possible to sort of breathe in the bird poop dust? Does that make sense—if, like, if there's a large buildup and somebody's scraping it off or something?

[Megin Nichols] Yeah. There are a variety of illnesses, especially if you talk to some of my colleagues that work on fungal diseases, that people can get from inhaling the dust of bird poop. But for *Salmonella*, it really is more about the germ getting on our hands and then into our mouths (so ingesting it). It's not really known to be a germ that it airborne or one that we breathe in and subsequently get infected. But if we touch the bird poop or touch something that has had, like a dead bird that has been infected, and then touch one of our mucus membranes like our mouths, we can get sick.

[Sarah Gregory] I see. So what effect does it actually have on people then?

[Megin Nichols] Most people who are infected with *Salmonella* can develop signs like diarrhea, fever, or abdominal cramps. And those symptoms might be very mild, or they can be severe, especially if it's somebody who is a young child (so younger than the age of five), older adults over the age of 65, or someone with a weakened immune system. The illness usually lasts four to seven days among people who get sick, and most people do recover from *Salmonella* without treatment. It's only in very severe cases of illness that someone might need to be hospitalized, or in some cases, people can die from this infection.

[Sarah Gregory] You've mentioned the thousands and thousands of birds that have died from it during outbreaks. Have there been outbreaks of *Salmonella* among people getting it, which started with these bird outbreaks?

[Megin Nichols] There have been outbreaks of *Salmonella* among people. So looking at the literature and our CDC data, we...prior to the investigation that we're discussing today, we actually hadn't seen this here in the United States. We didn't have the concrete data and information. However, there were other instances in the literature where people had been reported to get sick from contact with wild birds, especially when there were events that were causing *Salmonella* infection-related deaths in birds in very large numbers.

[Sarah Gregory] Are there geographic regions of the United States that are more prone to this songbird *Salmonella* than others?

[Megin Nichols] Really, anywhere there are songbirds there can be *Salmonella*—pine siskins specifically (this is a type of bird), and other birds that are what we call irruptive migrants. This is when a species of bird migrates to an area in very large numbers based mainly on the food supply. These types of birds can vary their migration patterns partially in response to seasonal availability of food. And for pine siskins specifically, their natural wintering grounds is in Canada. So when we saw this outbreak, what we saw was actually some of the illnesses that began in the Pacific Northwest and then spread from there. These migratory patterns can also contribute to increased congregation of birds around birdfeeders during some winters, which again can result in some of the buildup of fecal material and spread of *Salmonella*. And the presence of a large number of pine siskins at feeders has been reported to be linked to outbreaks of *Salmonella* in birds in the past, and we call pine siskins a very gregarious species, which means that that can play an important role in transmission of *Salmonella* at feeders. They move from place to place in large numbers and feed.

[Sarah Gregory] Dr. Nichols, what prompted you to do your study?

[Megin Nichols] Well, this is where we really appreciate the work of our public health colleagues. In February of 2021, public health officials in Oregon and Washington reported to us at CDC that they had seen eight people that were infected with a very specific strain of *Salmonella* Typhimurium, and these people had gotten sick between December 2020 and the reports we were receiving in February 2021. And when the health departments ran whole-genome sequencing, basically to get the DNA fingerprint of the bacteria, it was determined that the bacteria collected from the eight people were really genetically related to each other and they were also related to a *Salmonella* bacterium that had come from a pine siskin. And when we see that type of relatedness in bacteria or germs in people and ones from animals, we believe there might be a common link. So to help identify the source of human illnesses and do further

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investigation, our public health partners initiated a multi-state outbreak investigation in conjunction with CDC.

[Sarah Gregory] And how did you go about conducting it?

[Megin Nichols] This was a really unique investigation because we needed to better understand what was happening among wild songbirds to really understand what we were seeing in terms of the illnesses in people. So we used what we call a One Health approach that recognizes that the health of humans, animals, and the environment is all interrelated. So we worked very closely with our state and animal state and national animal health partners. This included partners at the state and local health departments as well as those who were familiar with wildlife, and partners in the academic realm.

In the United States, our state and local health officials routinely interview those people who are infected with *Salmonella* with a standard questionnaire. And in this particular outbreak, when we noticed that there were...the *Salmonella* from people was related to the *Salmonella* that was found in a wild songbird, we also asked additional questions of the people who got sick, including questions about exposure to songbirds, to birdfeeders, to bird feed and seed, and any exposure to pets like dogs and cats that might hunt. Our partners at the state also collected songbirds that had died when they received those reports and tested them for *Salmonella*. So for example, in Oregon and Washington, dead songbirds were actually identified by members of the National Audubon Society, and with the assistance of the state public health veterinarian they were submitted to the Oregon State Veterinary Diagnostic Lab. And songbirds that were identified in Washington by veterinarians, they were submitted to the Washington State University Animal Disease Diagnostic Laboratory. And in California, those that were reported to the California Department of Fish and Wildlife's Wildlife Health Laboratory by the public and others were also collected for testing. So this allowed us not only to look at the *Salmonella* that was affecting people, but also the *Salmonella* that was affecting the animals. And when we found the *Salmonella* that was isolated or that was identified in some of the birds that had died, we did the genetic testing of that *Salmonella* and found that it was actually highly related to the *Salmonella* that we were finding in people.

[Sarah Gregory] So after all this investigation, is there anything else you found you want to tell us about?

[Megin Nichols] Yeah. Overall, we identified 30 people with *Salmonella* Typhimurium across 12 different states. Twenty of these people (so over half) resided in the western United States, which was really consistent with the migration pattern of the pine siskins and other birds that we believe were related to this outbreak. Illnesses actually lasted from or ranged from December 26, 2020, to May 19, 2021. So we saw illnesses in people occur over a period of several months. And people who got sick in this outbreak ranged in age from less than one to 89 years old, and ten patients (or about 33%) were under the age of one. Of the 28 people who were sick with information that we received, about half of them were hospitalized. No deaths among people were reported. And we interviewed these people about whether or not they had exposure, as I mentioned, to birdfeeders, and many of those (over half) did report having contact with a birdfeeder on their property or having contact with dead or living songbirds in the week before their illness, or potentially owned a pet who had contact with wild birds.

[Sarah Gregory] How does a one-year-old have contact with the birds or the birds' poop?

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[Megin Nichols] That's a very good question. In some of these instances, people actually owned or kept birds in their home. So one patient owned a pet sparrow, and another person reported owning a wild finch. Often times parents also are very eager for their young children to participate and learn a little bit more about nature and wildlife, which is a really, really great thing. One of the things we just want to make sure if there is a child who is included in these types of activities, whether it's refilling a birdfeeder or having contact with animals, is that they wash their hands, because we know young children are more likely than adults to actually put their hands into their mouths. And so, keeping those hands clean and handwashing can help prevent those illnesses.

[Sarah Gregory] I see. So back to the pets...okay, now we know that pets can get this *Salmonella* from these birds. But how exactly is it transmitted to people from the pets?

[Megin Nichols] Well, animals can get sick with *Salmonella*. So if a cat hunts a bird and the bird is infected with *Salmonella*, the cat can actually get sick and the cat can have fever and diarrhea or vomiting. And you can imagine if that happens, then there's probably an owner that is cleaning up after the cat. In this instance, we also had a pet in Oregon (a pet dog) that a veterinarian had attended to, and this dog had stick fragments in its mouth, and had done a procedure to remove the stick fragments and actually submitted a test that came back positive for *Salmonella* for the dog. And the dog's owner reported that dead birds had been observed on their property and neighboring properties. So there's a chance that the dog actually had exposure to those dead birds, and that might be how they developed *Salmonella*. However, in that instance, there were no people who got sick as a result of contact with the dog, but it's always good for us pet owners to keep in mind if our pet hunts or goes outside, they could potentially have exposure to birds. And especially if you see dead birds, it's something to keep in mind that your pet could become sick with *Salmonella*.

[Sarah Gregory] Oh yes, definitely. What public health needs does your study demonstrate?

[Megin Nichols] This outbreak of *Salmonella* Typhimurium demonstrated an ongoing need to really raise awareness that *Salmonella* can have impact on multiple species, not just people, but also our songbirds and our pets. So it's a really good idea to think about the different ways that we can keep all species healthy.

[Sarah Gregory] We've already talked about hand washing, but are there any other steps people should take to protect themselves from getting sick from these birds?

[Megin Nichols] I think it's really important for people to keep bird feeders clean and to wash their hands after having contact with any bird feces. So we recommend that if somebody has a bird feeder or a bird bath, they clean that at least monthly, and they might need to clean more often if bird poop or other dirt builds up. We also want people to clean those feeders outside of their house when possible, or if you clean it indoors, use a laundry sink or a bathtub. Don't use the sink in your kitchen where you might prepare food. And it's really important we have some great information on our website where people can find instructions as to how to clean bird feeders.

We also recommend that people not touch or hand-feed wild birds with bare hands. And if you find a sick or dead bird, there are often resources at your states that you can call to report that. But it's something that we identified in this outbreak, as some people who got sick were touching some of the dead birds to dispose of them. You want to be careful with that. And then, of course,

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as you mentioned, always washing hands with soap or water right after touching bird feeders, bird baths, or handling any birds, and after touching pets or pet supplies. We think that's also important.

[Sarah Gregory] I know that hand sanitizer doesn't work with some infectious diseases, like *C. diff*. Does it work for this? Would it work if people didn't have access to water immediately?

[Megin Nichols] In the case of *Salmonella*, hand sanitizer is a great tool to use to sanitize hands if you don't have access to water to wash your hands. And it is effective in killing the *Salmonella* germ.

[Sarah Gregory] And a minute ago, you mentioned the CDC website having great advice. You want to give us that URL?

[Megin Nichols] Sure. Information regarding how to keep your family and your pets safe from *Salmonella* can be found at cdc.gov/salmonella.

[Sarah Gregory] Okay, thank you for that. Are there any other things veterinarians should be aware of or advice pet owners should know about?

[Megin Nichols] Well, during a veterinary exam of a pet, if the owner tells the veterinarian that their pet hunts, the veterinarian can provide information about the different diseases that pets can catch from wild animals and how to best prevent those diseases, such as through vaccination or even using flea control. They can also advise about the signs that a person should look out for if their pet becomes sick and what to do if the pet becomes sick. So veterinarians can share this information to make people aware that they too can actually get sick from contact with wildlife or, in some cases, their pets who are sick, and how to protect themselves through simple steps like hand washing.

[Sarah Gregory] It sounds like these outbreaks are getting worse. Is that true and are they more frequent?

[Megin Nichols] This is something that we're continuing to discuss with our partners in wildlife health, and we're very grateful that we have this ongoing collaboration that is very robust in the wildlife community because we really need more information to determine if these outbreaks are getting worse or more frequent. So we're continuing to partner together to continue to monitor for outbreaks that may have a similar pattern, and our wildlife colleagues are continuing to watch for any die-offs or outbreaks in birds and share that information with us. And we're continuing to monitor for these types of outbreaks in people and share that information with them.

I think it's also been really important for us to keep an eye on any changes in weather and temperature and things that might affect the food supply for these birds, because we know that that can also impact *Salmonella* and any bird die-offs that we might see.

[Sarah Gregory] So looking at it from a One Health perspective, what do you think the future holds for songbirds?

[Megin Nichols] Well, severe weather events or changes in temperature and climate can change the availability for food for migratory songbirds and make them more likely to seek other food sources or migrate to new geographic areas. That might also mean they're more likely to frequent bird feeders. So being aware of how feeding birds can actually spread *Salmonella* among the birds and doing our part to keep the bird feeders clean or removing them and taking them down

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if there's a *Salmonella* outbreak among birds can really help to prevent birds from getting these types of infections.

[Sarah Gregory] This may be sort of a strange question, but do you have a favorite infectious disease—one that fascinates you the most? Mine has always been *Yersinia pestis*, you know, plague, ever since I was an adolescent.

[Megin Nichols] You know, that's something you and I actually have in common. I am originally from the state of New Mexico and worked at the health department there for many years, and it was really interesting to me to see that this disease that had been around for quite some time was actually endemic in nature in New Mexico. And as we saw people move in from urban areas to more sub-urban or rural environments and their pets would hunt, the pets would be exposed to fleas that were actually carrying *Yersinia pestis* or plague, and then the animals, if they weren't on flea control, could bring those fleas into the house where the fleas might bite people and result in infection with plague. So that was something that I really was surprised to learn about more while I was working at the New Mexico Department of Health, but also really glad that we have tools that we can use such as flea control to keep our pets and our family members safe. And I think that's one reason I also like *Salmonella*, is that there are some tools that we can use to keep pets and people healthy and safe.

[Sarah Gregory] It is comforting to think that there are tools to help us. Yes, that's interesting about New Mexico. The first time... I was already aware of plague and very interested in it—but I was traveling, and I was in New Mexico—I think I was 19, so quite a while ago—and there was a plague outbreak. And that was the first time I'd ever heard that it still existed, you know? I just always thought of it as a, like you said, ancient disease—the Black Plague in the Middle Ages and before that, so. Very interesting.

Well, thank you for taking the time to talk with me today, Dr. Nichols. This has been very informative, and I think helpful.

[Megin Nichols] Thank you again for the opportunity, and I really appreciate this opportunity to speak with you.

[Sarah Gregory] And thanks for joining me out there. You can read the November 2023 article, Human Salmonellosis Outbreak Linked to *Salmonella* Typhimurium Epidemic in Wild Songbirds, United States, 2020–2021, 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.