

Campylobacteriosis Outbreak Linked to Municipal Water, Nebraska, USA, 2021

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[Candice Hoffmann] Welcome to the *Emerging Infectious Diseases* podcast. I'm Candice Hoffmann. In this episode we'll be discussing the article "Campylobacteriosis Outbreak Linked to Municipal Water, Nebraska, USA, 2021" which was published in the October 2024 issue.

The article we are discussing in this episode follows the investigation of a campylobacteriosis outbreak that occurred in a small town in Nebraska in 2021. We talked to two authors who worked on this outbreak investigation. Dr. Lauren Janssen was an Epidemic Intelligence Service officer at the time of the outbreak.

[Lauren Jansen] Hi, I'm Dr. Lauren Jansen, and I served as a CDC Epidemic Intelligence Service officer at the Nebraska Department of Health and Human Services. I currently serve as an Assistant Professor of Preventive Medicine at the University of Massachusetts Chan Medical School.

I trained as a family physician first but found that I wanted to have a greater impact than I could have working with patients one-on-one. So, I decided to move my career into more of a public health space. I did training in preventive medicine and public health at the University of Massachusetts, and then really dreamed of being a CDC Epidemic Intelligence Service officer. So, fortunately I applied to and was accepted to that program and had just an incredible experience serving two years in the state of Nebraska.

[Candice Hoffmann] Brianna Loeck, an epidemiologist with the state of Nebraska, also worked on this investigation.

[Brianna Loeck] Hi there, my name is Brianna Loeck. I'm an infectious disease epidemiologist at Nebraska Department of Health and Human Services.

Since I've been at the Nebraska Department of Health and Human Services, I've been in a variety of roles. I actually started as an administrative assistant in the epidemiology unit and then progressed to a health surveillance specialist and then the enteric disease epidemiologist. And now I serve as an infectious disease epidemiologist overseeing healthcare-associated infections and respiratory diseases now.

[Candice Hoffmann] In 2021, people in a small town in Nebraska started getting sick with campylobacteriosis.

[Brianna Loeck] Campylobacteriosis is actually the most common cause of food poisoning worldwide. It's caused by a bacteria called *Campylobacter* and you can get it in a couple different ways: from undercooked chicken, unpasteurized milk, and even contaminated water. The symptoms you would typically see associated with this would be diarrhea (and it can

sometimes be bloody), stomach cramps, and fever and nausea. And typically, those would show up a few days after you have been exposed to that bacteria.

[Candice Hoffmann] In many cases, people recover from campylobacteriosis without knowing *Campylobacter* bacteria caused their illness. In cases where patients' symptoms are severe enough to seek medical attention, healthcare providers may run tests to confirm campylobacteriosis.

[Brianna Loeck] How it's diagnosed is with a stool test. If you're sick enough to go to the doctor, you would provide that stool sample and they would test it at their lab and look for the bacteria's DNA to see if it was positive. Now there's PCR tests out there that are super quick, and you know, it can take up to less than an hour to run and you can have results super quickly. And they'll look for parasites, viruses, and bacteria. So, there's kind of a broad spectrum of what you can look for in a stool sample.

[Candice Hoffmann] Most people recover from campylobacteriosis without antibiotics.

[Brianna Loeck] Fortunately, most people don't need any antibiotics; you really just need rest and fluids to stay hydrated, especially from diarrhea. You can get dehydrated a lot. But in more serious cases, you may need antibiotics, but again, fortunately, most people recover without any antibiotics.

[Candice Hoffmann] In response to the unusual number of cases of campylobacteriosis occurring in the same town in the same time frame, a local health department alerted the Nebraska state health department.

[Brianna Loeck] In this specific situation, the local health department...it oversees a small town where this outbreak occurred and there's only about 300 people that live in this town. And within a week's timeframe, there were eight people who tested positive for *Campylobacter* and that was reported because *Campylobacter* is a reportable disease, so that is required to get reported to us. The local health department notified us as soon as possible, which makes great communication. That's what makes a successful outbreak investigation when all partners are communicating. So, they notified Nebraska Department of Health and Human Services, and we immediately began an outbreak investigation. She said, "This is unheard of. We do not see eight cases within a week." We even looked back at the data and she was absolutely right. We see maybe one case a year from this small town of *Campylobacter*. So very unusual, very alarming. So, to see this type of situation, we knew something was wrong.

[Candice Hoffmann] The state and local health officials knew right away this was an unusual situation. These eight cases turned out to be the tip of the iceberg. Dr. Jansen and her colleagues got to work to investigate the outbreak and find out how many more people were affected and how they became ill. They began with a questionnaire that asked about multiple possible ways people could have gotten infected.

[Lauren Jansen] So, one of our first steps in the epidemiologic portion of the investigation was to create a broad hypothesis-generating questionnaire. So, for that, we wanted to know what foods people were eating, what water sources people drank from, whether people treated their water at home, if people had attended any large community gatherings or if they had had recent animal contact. And so, to distribute those questionnaires, we used a lot of different methods. We used social media, we used the local health department's website, email, and door-to-door canvassing. Then we needed to analyze the results of our questionnaire, and we calculated odds ratios for the

different possible exposures. So, we had 138 questionnaires come back to us. And from those, we identified 64 cases of campylobacteriosis. And even that is probably a bit of the tip of the iceberg because obviously we weren't able to reach everybody in the town, and some people might have had more mild illnesses that they didn't recognize or report. Even as it was, 64 people...that's a huge percentage of a town of only about 330. And we found from that, that municipal water exposure was strongly associated with illness. No other exposures had statistically significant associations.

[Candice Hoffmann] Drinking water is not a common source of outbreaks like this, as Dr. Jansen notes.

[Lauren Jansen] So, most campylobacteriosis outbreaks are eventually linked to food, usually dairy and poultry. So, water was a surprising cause. Then, our investigation used both epidemiologic and environmental methods. So, as part of the environmental investigation, the town's water system was evaluated, and water testing was done. And that testing was positive for coliforms, which suggested possible water contamination. The town issued a boil water advisory and then there was a request for specialized *Campylobacter* testing.

Now, that's not normally available in Nebraska. So, we had to reach out to CDC for that testing. So, CDC was able to guide our colleagues at the Nebraska Department of Environment and Energy through the collection of these samples. So, six large volume dead-end ultrafiltration water samples. And those were collected from the two active town wells and some other important sites in the town's water distribution system. And then CDC was able to perform the *Campylobacter*-specific DNA testing and culture on those samples, as well as the microbial source tracking.

[Candice Hoffmann] This microbial source tracking was a unique and important part of this investigation.

[Lauren Jansen] So, microbial source tracking is a PCR technique that can identify bacteria molecular markers that are unique to humans, ruminants like cows and deer, and bird feces. And we were interested in those because humans, ruminants and birds, those are known environmental fecal shedders of *Campylobacter*. So, there were six samples, and one was positive by PCR for presence of *Campylobacter* DNA. And then the microbial source tracking detected avian-specific fecal RNA genomic material. So those findings together suggested that the water contamination likely came from bird feces. And microbial source tracking proved to be tremendously helpful because it allowed us to link the contamination specifically to bird feces. And that led us right to the source and enabled us to take that action to stop the contamination.

[Candice Hoffmann] Knowing that bird feces was the likely source of contamination, the investigators then looked into how bird feces could have entered the water system.

[Lauren Jansen] So, we wanted to know where the bird feces could be entering the water system. So, we started to think about where birds could intrude in that way. So, birds like to roost on water towers. And so that led our investigation towards the water tower. So, our water colleagues in the Nebraska Department of Environment and Energy, they did the initial inspections of the water system, looking for backflow and doing the coliform testing and things like that. They also used a drone to fly over the water tower and inspect the water tower, but that inspection...the drone inspection was not revealing. But when we learned that bird feces was responsible for the contamination, then the town was able to bring in an external water tower expert who could do

an internal inspection, which is costly and difficult. But that inspector was able to take actually pictures of the inside of the tower where you can see the gap and the light coming through.

[Candice Hoffmann] Armed with the knowledge of how the water became contaminated, the town took action to prevent future cases of campylobacteriosis.

[Lauren Jansen] Once we knew there was a water contamination problem, the town was able to initiate water chlorination, which was maintained until the tower repair was able to be completed. And then after that, fortunately, no campylobacteriosis cases attributable to water were reported once the tower was repaired and after initiation of the chlorination.

[Candice Hoffmann] This outbreak investigation highlights the importance of drinking water safety, particularly in communities with aging infrastructure.

[Lauren Jansen] Untreated groundwater systems are common in the United States. In fact, more than 20 million U.S. residents were served by non-disinfected water in 2006. We know that untreated groundwater systems with aging infrastructure are vulnerable to fecal intrusion, and this increases the risk for large outbreaks of enteric disease. So, with that in mind, public health professionals can encourage communities and managers of aged water systems to increase scrutiny of system components to help ensure drinking water safety. I'll also share that water towers are a common method of storing but also pressurizing water and they can often be more than 100 years old.

[Candice Hoffmann] Looking back at this investigation, Brianna Loeck and her coauthors stressed the importance of collaboration between community, state, local and federal partners in solving this and other outbreaks.

[Brianna Loeck] Outbreak investigations, they really work best when everyone is involved. Like, no single group can solve it alone. It takes a lot of manpower and a lot of expertise in other areas to make it work. Local health departments...they're usually the first ones to notice unusual illness in their communities. And those are reported by multiple sources. So, disease surveillance, providers, and even complaints in the community. The state health department (so us), we can then step in and support them and help connect dots across multiple jurisdictions if that's needed.

[Candice Hoffmann] Federal partners, including CDC, FDA, and EPA also play a role.

[Brianna Loeck] They can track things across states and do specialized testing like the CDC did for us. So, when all these groups share information and move quickly together, the source gets identified quicker and fewer people get sick, which is the goal. So, teamwork is what turns an outbreak response into a public health success.

[Lauren Jansen] Yeah, and I would add too that we'd be remiss not to mention the partners that we had in the community. We had some really enthusiastic and tireless community members who really helped get the word out about our questionnaire, who distributed stool test kits to people who couldn't leave home. We really benefited from the help of the community in solving this outbreak.

[Candice Hoffmann] This investigation, highlighted in EID, shows how community engagement, interagency collaboration, and proactive public health measures are important in safeguarding community health.

[Lauren Jansen] I think the high points of the investigation were that we were able to identify that the water was the problem. And specifically, probably the most exciting thing was that we were able to use the technique microbial source tracking to link the contamination to birds specifically. And that led us to be able to know that the water tower was the problem because birds like to roost on water towers. And so, with that knowledge, we were able to help the town really target their investigation in the right direction and be able to take the action to stop the contamination.

[Brianna Loeck] We investigated this pretty big outbreak for such a small town in Nebraska, and it was super striking that we received eight positive *Campylobacter* tests within a week. And in this town that is pretty much unheard of, I believe they typically have about one case of *Campylobacter* annually. So, to have eight in a week was alarming. And the local health department in that area who oversees that small town alerted us right away. And thankfully for their due diligence and monitoring their cues, their investigation disease cues, we were able to act on it very quickly and put up a response and work with all of our partners. And I just think that, you know, working together quickly and having strong communication, we were really able to succeed in this outbreak investigation because I think water outbreaks can be really difficult. But I think with just like having our communication, working with multiple teams...even CDC we worked with, we worked with the local health department, our water division, even the media and the small town we were working with, I believe the mayor and everybody. You know, it was...these don't come up too often and when they do, we do the best that we can to stop the outbreak and stop getting people from getting sick.

[Candice Hoffmann] We hope that you enjoyed listening to this podcast and that you'll become a regular reader of EID, where you will find more articles like this one.

[Lauren Jansen] We thought that *Emerging Infectious Diseases* was the perfect journal to help us share this knowledge of this really powerful technology that folks could be using in outbreak response. Campylobacteriosis is not exactly an emerging infectious disease, you know, I mean, it's not Ebola, you know, but the use of that technique, the microbial source tracking technique, that was fairly novel. And we thought that was something that belonged in *Emerging Infectious Diseases* because the technique has gone on to be used in other outbreaks since and it's a really powerful technique.

[Candice Hoffmann] Thanks for listening to our podcast. You can read the *Emerging Infectious Diseases* journal and subscribe to our email list at cdc.gov/eid.

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