

Transcript

00:00:01 Nicole Marshall

Welcome to foodborne. I'm Nicole Marshall, and I'm an epidemiologist with the Washington Integrated Food Safety Center of Excellence, or COE. The Washington Integrated Food Safety Center of Excellence is a collaboration between the University of Washington and the Washington State Department of Health.

00:00:20 Nicole Marshall

A partnership that aims to support health departments by developing and providing online and in-person resources, training, and assistance for enteric disease surveillance and outbreak investigations.

00:00:33 Nicole Marshall

This is our first episode, and I'm super excited to be here.

00:00:36 Nicole Marshall

In our first season of this podcast, we follow the stories of historic and impactful foodborne and enteric disease outbreaks.

00:00:44 Nicole Marshall

As chronicled in the International Outbreak Museum located in Portland, OR.

00:00:50

OK, let's go into the museum.

00:00:59

This is our guest book. Make sure you sign it before you leave.

00:01:02 Nicole Marshall

The International Outbreak Museum began in the office of Dr. Bill Keene when investigating infectious disease outbreaks at the Oregon State Health Department. It now also exists as an online archive. The goal of the museum is to share the fascinating stories behind outbreak investigations and teach about the kinds of foods and products that can become contaminated and cause disease.

00:01:26 Nicole Marshall

As we step into this extraordinary museum where the memories of past outbreaks come alive and teach us lessons, we stumble upon intriguing and thought-provoking exhibits, tales of mystery, curiosity, and dedication. Join us as we unravel the story of the outbreak and trace the footsteps of those who worked towards investigating and stopping outbreaks of deadly pathogens.

00:01:50 Nicole Marshall

In today's episode, we will discuss an outbreak of listeriosis in 2011, which resulted in the identification of a brand new food vehicle for *Listeria monocytogenes* and the important implications for future public health work in this area. Now, you might be thinking, why is this important? What does *Listeria* have to do with me?

00:02:09 Nicole Marshall

Well, we have to remember that foodborne illnesses aren't selective when it comes to their impact.

00:02:14 Nicole Marshall

They cross borders and end up in our grocery stores, our restaurants, our care, home, dining facilities, our own home kitchens. And that means that these illnesses can affect anyone and everyone who participates in a universal activity, eating.

00:02:32 Nicole Marshall

In today's episode, we'll hear from people who are on the ground during the investigation, including Alicia Cronquist, the Colorado Foodborne Disease Program manager at the time, and Dr. Jeff McCollum, who is the Epidemic Intelligence Service officer in Colorado during this outbreak.

00:03:00 Nicole Marshall

Our story begins in the summer of 2011.

00:03:05 Nicole Marshall

In August, three people in Colorado got severely ill and were admitted to their local hospitals.

00:03:11 Nicole Marshall

What did they have in common? They were all diagnosed with a serious foodborne illness called listeriosis.

00:03:18 Nicole Marshall

Listeriosis is an infection caused by eating food contaminated with the bacterium *Listeria monocytogenes*. Each year, around 1,600 people get sick with listeriosis in the United States. Listeriosis can be especially serious for pregnant people, newborn babies, and adults over the age of 65, as well as people with weakened immune systems.

00:03:39 Nicole Marshall

In short, it can be a pretty serious illness. People often need to be hospitalized to treat their infections, and about one in five people will die from this infection.

00:03:50 Nicole Marshall

On August 29th, the Colorado Department of Public Health and Environment, who we will refer to as Colorado for short, was notified of these three cases. Now, before getting into the investigation, let's take a quick step back.

00:04:03 Nicole Marshall

For context, there were fewer than 10 cases of listeriosis diagnosed each year in Colorado from 2001 until 2010.

00:04:12 Nicole Marshall

So, as you can imagine, 3 cases reported in such a short period of time really raised alarm bells for Colorado, including one of our guests, Alicia Cronquist. She was Colorado's Foodborne Disease Program Manager at the time.

00:04:25 Alicia Cronquist

It started on a Monday at the end of August, and two cases of listeriosis were reported to the state Health department, and this in and of itself was unusual because we would average one or two cases of *Listeria* reported per month.

00:04:42 Alicia Cronquist

And this was case number two and three that month. And so already things seemed a little unusual.

00:04:49 Alicia Cronquist

So we asked the local public health agencies to interview those cases as soon as possible. Colorado is a decentralized state for public health activity, so most case investigation at that time was done by the local public health agency.

00:05:05 Alicia Cronquist

And while we were waiting for those interviews the next day, there were two more cases reported and then on Wednesday there were three cases reported, and I remember being off that Wednesday and our foodborne disease epidemiologist, who was like our outbreak epidemiologist, called me at home and said, I think we have a problem.

00:05:26 Alicia Cronquist

So it was really clear by Wednesday that something very unusual was going on. And it's worth pointing out that this was right before Labor Day weekend, as these things always are. So this was the Wednesday right before Labor Day weekend. So lots of people had plans that weekend that did not involve calling patients with Listeria.

00:05:46 Nicole Marshall

On September 2nd, Colorado notified the Centers for Disease Control and Prevention, or CDC, about the outbreak.

00:05:54 Nicole Marshall

Colorado then started to compare their cases to other reported listeriosis cases to see if any of them might be connected.

00:06:01 Nicole Marshall

To do this, they looked at Pulse Field Gel Electrophoresis, or PFGE, patterns of the individual bacteria found in each patient's sample.

00:06:12 Nicole Marshall

PFGE is a laboratory technique that separates pieces of DNA using an electrical current. Once separated, these pieces of DNA form a PFGE pattern, also called a DNA fingerprint.

00:06:28 Nicole Marshall

For humans, unless you're an identical twin, your DNA is slightly different from every other human.

00:06:34 Nicole Marshall

Similarly, for bacteria, different strains or types of bacteria also have different DNA from one another. One DNA fingerprint is unique to one strain of bacteria.

00:06:45 Nicole Marshall

Epidemiologists can use this fingerprint to their advantage when investigating outbreaks of foodborne illness suspected to be caused by bacteria like *Listeria Monocytogenes*.

00:06:56 Nicole Marshall

PFGE and currently whole genome sequencing are important laboratory tools that make early identification of potential clusters and outbreaks much easier to solve and respond to. This DNA evidence is usually a starting place for investigators to start digging deeper for a common exposure that could have made people ill.

00:07:16 Nicole Marshall

So what did Alicia find when she looked at this DNA fingerprint? Some things weren't quite adding up.

00:07:22 Alicia Cronquist

Well, it was still not entirely clear what was going on, because even when we had eight cases in a month, we got the Pulse Field Gel Electrophoresis results back. I think it was the Friday before that Labor Day weekend, and we had three different PFGE patterns. And so we really didn't know what to make of that, and it wasn't clearly all from a single source. We weren't even sure if we had one outbreak or two or three or what was going on. And so there was a lot of confusion, lack of a better term, because we just didn't know where we were going with this.

00:07:58 Alicia Cronquist

And so we were trying to interview everybody as fast as we could, and we called CDC at that point to let them know that we had this unusual number of cases, and also to ask them what they thought about having three PFGE patterns. So early on, it wasn't even clear that we should be looking at the food histories of all eight patients together.

00:08:21 Nicole Marshall

By now, there were three PFGE patterns of interest. Colorado uploaded these patterns to the national PulseNet database, so the CDC and other states could look for matches in their jurisdictions. On September 6th, the CDC shared some concerning news. Texas and Nebraska had reported listeriosis cases with PFGE patterns that were the same as the Colorado cases. Soon after, Indiana and Oklahoma followed with indistinguishable PFGE patterns.

00:08:49 Nicole Marshall

By September 11th, less than two weeks after the CDC was notified of the outbreak in Colorado, there were 15 cases across four states. The clock was ticking, and cases were set to continue rising. At this point, it was clear that a serious multi-state outbreak was underway. They needed to act fast to prevent more people from getting dangerously sick.

00:09:16 Nicole Marshall

Epidemiologists often act as detectives at the beginning of an outbreak investigation. First, they get to the basics. Who is getting sick? Where are they getting sick? When are they getting sick? And if investigators find similarities in the answers to these questions across cases, they're usually getting closer to the food culprit.

00:09:37 Nicole Marshall

The epidemiologists had their answer to the first question. People were getting sick with listeriosis caused by *Listeria monocytogenes*. They also knew what specific strains of *Listeria* were making people sick based on their PFGE patterns, and that was going to help them link more cases to the outbreak. Remember, matching DNA fingerprints means that two people likely became sick from the same source. The detectives had their work cut out for them.

00:10:03 Nicole Marshall

After answering the who, it's important to ask about the where and the when.

00:10:07 Nicole Marshall

The cases were first reported only in Colorado, but then other states quickly started having matching PFGE patterns. New patients were being discovered every day. That meant that whatever food was causing the outbreak was likely still being sold. Knowing the who, where, and when of an outbreak can often help shed light on the kinds of foods that may be higher risk.

00:10:31 Nicole Marshall

Investigators were able to hone in on the vehicle or cause of the outbreak with help from the *Listeria* initiative. The *Listeria* initiative is a CDC lead national surveillance system that identifies individuals who have been diagnosed with listeriosis. The program encourages health departments to conduct extended interviews with patients.

00:10:51 Nicole Marshall

In these interviews, they ask questions about high-risk foods and other exposures before their illness to try and narrow in on the culprit.

00:11:00 Nicole Marshall

Colorado investigators began interviewing sick patients to look for any potential foods that could have been contaminated with Listeria. They started with a questionnaire that contained common foods that had been linked to listeriosis in the past. Common culprits from previous outbreaks included things like deli meats and soft cheeses.

00:11:19 Nicole Marshall

Epidemiologists could then compare foods reported by these outbreak cases to foods reported by other listeriosis cases using the Listeria Initiative. This comparison can highlight foods that are being reported more frequently than expected from the background rates of routine consumption.

00:11:37 Nicole Marshall

Alicia was able to make use of this questionnaire as she worked to identify the culprit.

00:11:42 Alicia Cronquist

We had adopted the Listeria Initiative questionnaire several years before, and so all patients were routinely interviewed with the Listeria Initiative. At that time, they were done by the local public health agencies, and we were fortunate in that the initial cases were all in places where the local public health agencies could reach the patients quickly and had the capacity to do those interviews.

00:12:03 Alicia Cronquist

We have since centralized the process to standardize those rare, long interviews a little bit more. But at the time, it was done by local public health agencies, who did a fantastic job.

00:12:15 Alicia Cronquist

They were calling me on the weekend. I was at the grocery store shopping, and they were calling me with their updates about, you know, who ate what. And it was an amazing collaborative effort.

00:12:24 Nicole Marshall

After narrowing down their list of potential foods using interview data, investigators collected samples from sick patients' food items to test in the lab. They were looking for samples that tested positive for Listeria and tested positive for the specific strain they identified.

00:12:40 Alicia Cronquist

We had various foods that came in because again, it was a holiday weekend, so we were able to collect whole cantaloupe and cut cantaloupe and butter, and eggs. And I don't even remember what else from one patient and from various other patients as well. And all these foods went into the state public health lab.

00:13:00 Alicia Cronquist

The other thing to say is at the time, blindly testing food for pathogens was a pretty rare thing, and so there was a lot of discussion between EPI and the lab to help them to prioritize which things to culture. It's not a simple process to look for pathogens and food, and so it was an enormous effort on the part of the lab to do all of that.

00:13:22 Alicia Cronquist

Truly random testing from patient fridges, and then we did send a group out to the grocery store to buy a bunch of cantaloupes and test them as well.

00:13:31 Nicole Marshall

And what did they find? Well, a surprise.

00:13:35 Nicole Marshall

The food that tested positive for the strain of *Listeria* had never been linked to a listeriosis outbreak before; the food was none other than the humble cantaloupe.

00:13:47 Nicole Marshall

But the investigators weren't done. Now that they knew that cantaloupes were causing the outbreak, they needed to find out where these contaminated cantaloupes were coming from to prevent additional cases. Three of the ill people mentioned eating Rocky Ford cantaloupe. A widely distributed Colorado-grown brand of cantaloupe, before becoming sick.

00:14:05 Nicole Marshall

Now the investigators had to narrow down which specific farm was growing the contaminated melons.

00:14:11 Nicole Marshall

This can be a difficult part of the foodborne outbreak response. Once you identify the food item, then how do you find out exactly where it came from and how it got contaminated? This work often requires excellent documentation, coordination, and collaboration with farmers and partners along all steps of the field to fork timeline.

00:14:30 Alicia Cronquist

And the thing to know about Colorado in the summer is that cantaloupe is a really big deal here, and there's a growing region in Colorado that makes these amazing, sweet, delicious cantaloupes. And so I think that even in that first week, we had concerns that it was cantaloupe from Colorado.

00:14:51 Alicia Cronquist

And I'm sure you can think a lot about the political implications of having, you know, of having an iconic state food cause an outbreak, but we were very concerned very early on about cantaloupe.

00:15:11 Nicole Marshall

One farm that the investigators visited was located deep within Holly, Colorado, with fields stretching across acres of land and crops, basking in the warmth of the sun. Holly puts to mind peaceful scenery.

00:15:25 Nicole Marshall

It seems like the last place you'd think of as the cause of multiple fatalities and hospitalizations.

00:15:31 Nicole Marshall

Jeff McCollum was the Epidemic Intelligence Service, or EIS, officer, working with Alicia and other Colorado staff during this outbreak. He visited the farm, and what he observed offered an important clue to the source of the outbreak.

00:15:45 Jeff McCollum

This particular farm had two main growing fields, I think both of which were producing cantaloupes at the time.

00:15:52 Jeff McCollum

The processing was very minimal. Basically they they manually harvested the melons with, you know, basically people in hands, and they pulled them up, and they had a conveyor

system that put them into a dump trailer. The trailers were hauled into a central receiving processing plant, which is very basic, a small, pretty small L-shaped aluminum building.

00:16:11 Jeff McCollum

All the processing was actually done outside of the building; it was covered, but they actually had most of it outside. Basically, the melons are offloaded from these trailers. They rolled down onto a conveyor. They go up a short conveyor where they just get a pre-rinse, and then they entered a washing and drying machine. Basically, inside that machine, the melons were brushed and also with a constant spray of water. So they remove any gross contaminants and kind of just clean them off. And then they went through a felt roller setup that was supposed to absorb some of that extra moisture.

00:16:42 Jeff McCollum

And then they exited, went on to a conveyor, and then they were hand sorted. You know, melons that were too big or damaged or otherwise too small or whatever didn't meet their market standards, they were rejected. Those were put into a truck to be hauled out for cattle feed as a separate, you know, disposal. But once they've been, you know, washed, sorted, and then they're just boxed, placed in a cooler, held for shipment. So it's a pretty basic operation. These are whole cantaloupes; they're not cut or in any other way processed other than cleaning and storage.

00:17:13 Nicole Marshall

Remember, it was September when the CDC was notified of the outbreak. For those of you, like me, who don't have a cantaloupe growing season calendar memorized, September is the end of the growing season, and the farm in question was the only local farm still producing cantaloupes.

00:17:29 Nicole Marshall

While visiting the farm, investigators learned that the farm made some recent changes to their procedures, notably, one important step was missing from their new procedure, pre-cooling.

00:17:39 Nicole Marshall

The pre-cooling process involves immersing fruits into ice water at 7°C for 15 minutes. Afterwards, the fruits are air dried.

00:17:46 Nicole Marshall

Pre-cooling helps to remove what's called field heat. The heat that's left over from harvesting in hot weather. Removing this heat helps to preserve the fruit for longer, but it also helps reduce condensation buildup and the growth of bacteria. Bacteria such as *Listeria Monocytogenes*.

00:18:05 Nicole Marshall

In addition to the missing pre-cooling step, the farm also started using new equipment. This equipment couldn't be disassembled for cleaning. The equipment was typically used to clean potatoes, and it had a collection tray where chlorine could be sprayed onto the produce.

00:18:20 Nicole Marshall

However, that chlorine spray was never used. Here's Jeff on why studying the equipment and the production process on the farm across multiple site visits was so important in this investigation.

00:18:31 Jeff McCollum

But the takeaway from that second visit, all the sampling and testing done, and the in the fields themselves didn't yield any information that indicated a source or any positive specimens for *Listeria*.

00:18:43 Jeff McCollum

So that supported what we found on the first visit, that it appears to be something in the processing area that seems to be the culprit here. And I didn't mention before, but I'll add when the environmental sampling was done the first time, essentially, if you follow the process linearly, you know from when the melons came in and were dumped and moved through the processing, the samples were negative, negative, negative until you got to this one processing machine, the washing machine basically. And we got a first positive there, and you followed sequentially almost all the samples past that machine were positive.

00:19:12 Nicole Marshall

The investigators hypothesized that the equipment had become contaminated with *Listeria*.

00:19:17 Nicole Marshall

Since it couldn't be cleaned properly, the bacteria was sprayed onto the cantaloupe being processed with the missing pre-cooling step and condensation buildup that resulted. This

environment, with its high moisture, low salt, and low acidity, provided a really perfect condition for Listeria to thrive.

00:19:35 Nicole Marshall

Fun fact for those who are unfamiliar with Listeria and its common food sources, foods that are more likely to be contaminated tend to actually have a higher moisture content. So think cheeses like Brie or Queso Fresco.

00:19:48 Nicole Marshall

In the end, the contaminated cantaloupes ended up in grocery stores all across the country, and once eaten, made people extremely sick.

00:19:56 Nicole Marshall

While it was known that the contamination came from the farm, the exact source of the contamination wasn't initially clear.

00:20:03 Nicole Marshall

Eventually, investigators concluded that the contamination of the cantaloupes occurred after being processed by the new equipment.

00:20:10 Nicole Marshall

By the end of the outbreak, there were a total of 147 cases across 28 states, including 33 deaths.

00:20:19 Nicole Marshall

Listeria is a high-risk pathogen for pregnant people, and tragically, this outbreak also led to at least one known miscarriage.

00:20:27 Nicole Marshall

As a result of the investigation, the farm issued an immediate voluntary recall of Rocky Ford Cantaloupe, the cantaloupe variety that had previously been marketed from this farm. In response, other fruit companies also took action by issuing recalls for their cantaloupe products.

00:20:42 Nicole Marshall

Because of the outbreak, legal actions were taken against the owners of the farm in question. The brothers who owned the farm pled guilty to all counts based on the introduction of contaminated cantaloupe in six separate shipments across the country.

00:20:56 Nicole Marshall

As mentioned, cantaloupe is a beloved Colorado product. Many community members simply couldn't believe that this fruit was responsible.

00:21:04 Alicia Cronquist

One of the things that public health school doesn't prepare you for, of course, is talking to people who have caused this sort of illness. And of course, it wasn't intentional, but the community had a really hard time understanding how a food that is so tied to the community could possibly have become contaminated and made so many people ill. And something striking about the epidemiologic information is that if you think about Colorado, Colorado is a big rectangle, and this growing region is in the southeast corner of Colorado.

00:21:41 Alicia Cronquist

Most of the people in Colorado live in the line up and down, kind of the middle of Colorado, where Colorado Springs, where Collins, and Denver, so it's not too surprising to see the majority of cases in that area, not near the growing region, but there were no cases near the growing region.

00:22:01 Alicia Cronquist

And so the people in the community had a really hard time processing what happened and understanding how cantaloupes grown in their area could have caused illness in Denver, but no illness among anybody who lived in the area, and one of the things we learned, and I don't remember who figured this out. But if you live in the area, you go to the farm and you pick up a cantaloupe that's just kind of left by the side of the field for you to pick up. It doesn't go through the processing that Jeff just described.

00:22:24 Alicia Cronquist

The processing is so that the cantaloupe farmers can sell their cantaloupes to the big grocery store chains, and so we tried to talk about this in the community and help the community understand that, in fact, that is why they did not become ill. But people in Denver did, and it had to do with the processing of the cantaloupe.

00:22:45 Nicole Marshall

So what lessons can we learn from this case? What do we now know about Listeria that can help us prevent future incidents from happening?

00:22:53 Nicole Marshall

One, we learned about the importance of surveillance and the roles of those who participated in the outbreak investigation. Surveillance systems and the investigation teams were critical not only in identifying and tracing cases but in responding quickly and preventing further infections. These teams include, but aren't limited to, epidemiologists who work on identifying the source of the outbreak.

00:23:16 Nicole Marshall

Lab researchers who test collected samples to identify the strain of Listeria. Environmental health workers who analyze the environmental factors of the outbreak to pinpoint the source of contamination, and the local, state, and federal partners who share information.

00:23:33 Nicole Marshall

These, of course, are just short descriptions of the multifaceted roles that each of these actors played.

00:23:39 Nicole Marshall

And two, we learned about continuous learning, which leads to continuous improvement.

00:23:44 Nicole Marshall

Before this outbreak, Listeria hadn't been associated with cantaloupe. Now that we know that cantaloupe can be a vehicle for Listeria, we can use this information to inform our surveillance efforts and plan for prevention steps. As an example, the CDC now recommends that pregnant persons avoid cut melon products since this infection can be especially harmful during pregnancy.

00:24:06 Nicole Marshall

For Alicia and Jeff, there were personal reflections that came from their experience working on this case as well.

00:24:12 Alicia Cronquist

One, how useful the Listeria Initiative was, I think maybe we were a little skeptical before if that incredibly long questionnaire, but it really, really proved its worth, we doubled down, and we use it for all of our Listeria cases still.

00:24:26 Alicia Cronquist

Another thing though, that's important to note, is that the only reason we picked up on cantaloupe as quickly as we did was because it was on the questionnaire already, and so

the Listeria Initiative is only as good as the people who write it and who think to add foods that could potentially be contaminated.

00:24:46 Alicia Cronquist

And so we were so lucky that it was on there. I think this outbreak reinforced the value of rapidly collecting food from patients' refrigerators, and testing it even when we're not real sure. Or at least holding it for a little bit when we're not really sure what's going on, and we certainly do that with other things like Botulism, but that was an important takeaway.

00:25:08 Jeff McCollum

This is a multi-generational farm. They were devastated at what was happening. There's some important context too. Their father, I guess, had probably managed most of the farm operations for a long time, and he had passed. I don't know how soon before, but relatively recently prior to the outbreak, and you know, we didn't talk about the processing changes, but there's just the human factor here.

00:25:32 Jeff McCollum

I interpreted that they were trying to make change for the better, based on my interactions with them and what I saw, and they thought they were doing things right. The bottom line, the human effect, the farmers seemed to, what they emotionally conveyed thought they were doing things the way they were supposed to, and ended up in a place that they couldn't believe. And as was mentioned, we're completely devastated by, along with all the families impacted by this outbreak.

00:25:55 Nicole Marshall

This outbreak had serious impacts. Lives were lost. Widespread illness affected people and communities across the country, and business was lost. But the lessons in its aftermath offer us some hope.

00:26:08 Nicole Marshall

Hope that a more responsive food safety approach can bring us closer to one of our big goals in public health, to prevent foodborne illness and disease outbreaks. This outbreak shows us that foodborne illness can affect anyone, anywhere, at any time.

00:26:25 Nicole Marshall

And it tells us exactly why public health measures are needed to make sure that all people can be sure that their food is safe and ready to serve.

00:26:34 Nicole Marshall

Thank you for joining us on our journey through the Listeria cantaloupe outbreak of 2011. We would like to thank Alicia Cronquist and Jeff McCollum for sharing their expertise with us.

00:26:44 Nicole Marshall

Special thanks to the International Outbreak Museum for their partnership this season. I'm your host, Nicole Marshall. Foodborne is created and produced by Piper Brase and Nicole Marshall.

00:26:55 Nicole Marshall

Our producer and sound designer is Kevin DeVoss. This episode was researched and written by Sarah Garcia and Shivani Paudel with support from Erica Ellis.

00:27:06 Nicole Marshall

Foodborne is brought to you by the Washington Integrated Food Safety Center of Excellence, which is a collaboration between the University of Washington, the Washington State Department of Health, and the Northwest Center for Public Health Practice. For more information about the sources used in this episode, check out our show notes or visit foodsafety.uw.edu/foodborne