

# Listeriosis in Leafy Greens

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

[Sarah Gregory] Hi everyone, this is Sarah Gregory, and today I'm talking with Dr. Julie Self, an epidemiologist at CDC. We'll be talking about an outbreak of listeriosis spread through leafy green salads. Welcome, Dr. Self.

[Julie Self] Thank you for having me.

[Sarah Gregory] Unfortunately, many of us know about food poisoning from personal experience. What is listeriosis and what makes it different from other types of food poisoning?

[Julie Self] Listeriosis is an infection caused by the bacteria *Listeria monocytogenes*. The incidence of listeriosis is lower than it is for many other foodborne illnesses, but listeria often causes more severe illness, including sepsis and meningitis. It's associated with fetal loss in pregnant women, as well.

[Sarah Gregory] What types of food carry the listeria bacteria? In the past, it seemed like it was mostly processed deli products, like ready-to-eat meats and cheeses, but recently we've been hearing more about contaminated produce. What's going on with that?

[Julie Self] Outbreaks of listeriosis in the United States have historically been associated with ready-to-eat deli meats and dairy products. And we do still see outbreaks with those products now. We've seen a lot of improvement in food safety efforts to control listeria in deli meats. More recently, we have seen several outbreaks associated with fresh produce, and those include sprouts; celery; stone fruits, like peaches; caramel apples; and now leafy green salads. We're not entirely sure why we're seeing more outbreaks of listeria associated with produce. It is commonly found in the environment, but it also may be related to improved methods to detect and investigate the outbreaks

[Sarah Gregory] Okay, I think you mentioned this already, but who is most vulnerable to listeriosis infections?

[Julie Self] Listeria is most likely to sicken pregnant women and their newborns, adults age 65 and older, and anyone with weakened immune systems. Other people can be infected with listeria, but they rarely become seriously ill.

[Sarah Gregory] What's most concerning about it? It has some unique features, right?

[Julie Self] There are several things that make listeria unique, compared with other foodborne illnesses. Listeria is often associated with more severe illness, and most cases are actually hospitalized. Listeria can grow at cooler temperatures, as well, so even if a food is contaminated with listeria and it's refrigerated, the bacteria can still grow while it's refrigerated. And the third thing that makes it unique is that it has a long incubation period, which is the time from exposure to the bacteria and developing symptoms. And the average for listeria is about eleven days.

[Sarah Gregory] I've also heard that it can contaminate other food while it's in your refrigerator growing this bacteria, is that right?

[Julie Self] That's true. Any type of bacteria that's on food when it's in your refrigerator can contaminate other things, so, it is important to store things carefully and appropriately so that food that is contaminated, the contamination doesn't spread to other foods.

[Sarah Gregory] So, if you had something that turned out to have listeriosis in your refrigerator and didn't know it, potentially you should just throw everything else out?

[Julie Self] That is a recommendation if you have a product that you know has been contaminated with listeria due to it being announced related to an outbreak or a recall. You can remove it from your refrigerator and discard it and clean the area very thoroughly.

[Sarah Gregory] Public health experts started to worry when an outbreak of listeriosis hit the U.S. and Canada in 2015 and '16. Tell us about this outbreak and when did researchers begin to suspect that all the cases were connected?

[Julie Self] Yeah, CDC began to investigate a multistate outbreak in September 2015, when we first determined that several illnesses were likely linked to a common source. So, what we did is use whole-genome sequencing to determine that the listeria isolates from people who had become sick with listeriosis were highly related genetically. And we know that patients whose listeria isolates are closely related genetically are likely linked to a common source. So, that's when we started investigating, along with our state and local health departments.

[Sarah Gregory] Okay. So, would you continue with that a little bit and tell us how you, using these genomes, traced the source of the infection and...sort of explain the whole process to us.

[Julie Self] So, once we determined that several cases were likely linked by a common source, we began reviewing the data that had already been collected about their food exposures to see if there was any particular food that all of the cases or most of the cases had reported eating. And we were able to review those data, from a standard questionnaire that had been collected by state and local health departments, but we weren't able to identify any particular foods that were common among all of the patients or even most of the patients, based on the questions that were included in that questionnaire.

So, next we began open-ended interviews, in which we were able to interview the patients again, with a more flexible type of...with a more flexible script. We had specific questions that we needed to ask but we were also able to be a little bit more flexible and react to the things that they mentioned and ask for additional details. And we were able to kind of see where the conversation led and collect a lot more...a lot greater variety of data than what the original standard questionnaire provided. And we were able to collect additional details. So, when someone mentioned that they ate a specific food, we could ask a lot more information about the brand or where it was purchased or the variety that was there. And that's when we really started to get enough information to identify that leafy green salads were a common exposure among all of the people who had become ill.

[Sarah Gregory] What was the most challenging part of this research? I know that there's always some stumbling block, it seems.

[Julie Self] Sure. One of the most challenging issues here, in this research, was getting enough detailed dietary information to identify a potential source. So, foodborne outbreak investigations and the interviews that are a part of that often take place many days to even weeks after the people have consumed whatever it was that made them ill. And it's very difficult to recall with certainty all of the foods that you ate during the time that you were likely exposed. And sometimes with the long incubation period, it can actually be unclear exactly when you might have been exposed to listeria. So, you might have to recall all the foods that you ate for an entire

week about a month ago. And that can be really challenging, I probably couldn't tell you many of the foods that I ate just last week.

[Sarah Gregory] No, I mean it's...unless you basically like I do, eat almost always the same thing all of the time, it's...I would think it would be almost impossible sometimes, you know. Especially if you had some random thing you don't normally eat but didn't even remember you ate.

[Julie Self] Right and recall can be fairly poor, especially for things that you don't eat on a usual basis.

[Sarah Gregory] Mmm-hmm.

[Julie Self] But also the amount of detail that we need in order to identify commonalities can be really challenging. So, even if you remembered that you ate leafy greens, you might not really remember which kind they were, or where you got them. And that's the kind of information that we really have to have in order to identify a specific product and then work with FDA or USDA or the regulatory partners to do something about it and further investigate.

[Sarah Gregory] Yeah, I've actually worked on a couple of these. One was salsa and boy, we called people from the EOC and it was, yeah, people were just like...hard going, felt bad for them. So, you kind of talked about this a little bit, but when it came to tracing patient history and diet, you found that the interviews were more effective than the original questionnaire. Again, go over why this is.

[Julie Self] So, in the United States we have a standard questionnaire for any patients that have had listeria, and this is used by local and state health departments to collect data from all patients who have had listeriosis. And it collects information on clinical, laboratory, demographic information, and food exposures. And this is a really efficient way to collect routine and consistent information for all patients that have had listeriosis. However, at the time of the outbreak, that standard questionnaire did not have questions about leafy greens on it.

[Sarah Gregory] Ooh.

[Julie Self] And so, the produce questions that were included in the questionnaire included just a few items like melons, sprouts, fruit salad, coleslaw, and some other ready-to-eat deli-style salads, like pasta salad. And so, we weren't able to identify the source of the outbreak because those particular questions did not cover that type of food. But then previous outbreak investigations, when there's been a challenge in identifying a food from a standard questionnaire, have used open-ended interviews, so we decided to give that a try, to give us the flexibility to ask about additional foods that were of interest, and use the information that was shared from one interview to think about how we might change the questions and ask for additional information from the person that we interviewed next.

[Sarah Gregory] Can you give us an example of one of those open-ended questions?

[Julie Self] Sure. So, often we would begin by talking through the regular diet or the things that you likely ate in the timeframe of interest. And then we might ask specifically, by food category...so, we'll talk through what kinds of meat did you eat? Was it deli meat? Was it pork...pork chops? Something like that. And then we might ask about specific fruits and vegetables and herbs and other food categories. And if somebody mentions a food that's either rare or they mention that, for example, one patient reported that they ate...they had tried to

have...begin a healthier diet, and they were eating salads every day. And so, when you get that kind of information from one patient, you can actually ask a little bit more specifically about some of those things that you noticed in the previous interview. So, you could ask more information, more detailed information about the foods that were mentioned in a previous interview, and begin probing a little bit more deeply.

[Sarah Gregory] I see—okay. Your study traced the source of infection to a food-processing facility in the U.S. Why were people in Canada getting sick?

[Julie Self] Well that food-processing facility actually was distributing products in several states of the United States, as well as the eastern regions of Canada.

[Sarah Gregory] So, if the same contaminated food-processing facility distributed these salads to a lot of different places, why didn't more people get sick? Surely many more people were exposed to listeria bacteria than those who actually got sick from it.

[Julie Self] Yeah. So, it's possible that more people were exposed to listeria. Like I mentioned earlier, listeria is most likely to sicken pregnant women, adults age 65 and older, and others who have a weakened immune system. So, other people might be infected with listeria and develop some gastrointestinal symptoms, but they rarely become seriously ill. And the way we operate multistate foodborne investigations is we use laboratory-confirmed cases in order to follow up with those patients and get more information. So, we only are following up with patients who have had a specimen submitted that grew a culture, and that culture, had similar...was genetically related to others in the same outbreak. We only interview laboratory-confirmed cases. And therefore, some cases who did not have medical care and did not submit a specimen wouldn't be included.

[Sarah Gregory] Your study also noted that the U.S. facility detected listeria species eleven times from July 2014 to January 2016. Is this normal? How did the facility not realize that some of its products might be contaminated?

[Julie Self] It's important to remember that you can't taste, smell, or see the germs that cause listeria illness, as well as most other foodborne illnesses. So, it's important to remember that you can't taste, see, or smell the germs that cause most foodborne illness, like listeria. So, the foods are likely to look and smell completely normal, so you don't realize that foods are contaminated. Another important thing to remember about listeria is that it can grow at cooler temperatures, so it actually might take additional steps to reduce the risk of listeria contamination compared with what's needed for other foodborne illnesses. So, there were observations from the inspection that suggested that the environmental sampling plan may not have been adequate or it might have limited the ability of the facility to identify the listeria contamination.

[Sarah Gregory] Okay. So, what can listeners do to protect themselves against the disease? Are there any practical preventions since you can't taste or smell it, that actually work for vegetables?

[Julie Self] So, I think it's important to remember that vegetables and fruits are a fundamental part of a healthy diet. And the USDA actually recommends that half of your diet be composed of fruits and vegetables. And many foods can be contaminated by listeria because it is common in the environment, so the CDC and FDA really recommend that consumers follow general food safety practices. And those are things like carefully storing and refrigerating your foods; avoiding cross contamination, both in storage and in food preparation; and then to wash

thoroughly to remove surface contamination for anything that...where the packaging doesn't indicate that they're prewashed or ready-to-eat. You can also keep in mind that pasteurization and cooking does kill harmful bacteria, although that's not usually something that we do with many types of produce.

[Sarah Gregory] CDC has recently come out with recommendations that you don't bother washing chicken because you're just spreading the salmonella about, and not really getting rid of it, and cooking it is what gets rid of it, so now I'm feeling like, well, if you've got leafy greens with listeria on them, is washing them actually going to do anything?

[Julie Self] Well, leafy greens that come prepackaged often are labeled as ready-to-eat. So, in that situation, the CDC and FDA don't recommend washing products that are labelled as prewashed or ready-to-eat.

[Sarah Gregory] You were in the Epidemic Intelligence Service at the time of this investigation. What is the EIS and what was your experience like with them?

[Julie Self] The Epidemic Intelligence Service is a two-year post-doctoral training program in epidemiology and applied public health work. So, EIS officers work throughout CDC, as well as some state and local health departments, to respond to common, as well as new and emerging, public health issues. So examples include food and waterborne diseases, Ebola, smoking and vaping, lead exposure, obesity, seasonal flu, and Zika virus. I had a great experience, I learned a lot. It was a great opportunity to learn more about epidemiology and take what you learned in school and apply it to the practical, day-to-day decisions that are made at CDC.

[Sarah Gregory] You guys are sort of informally known as the "disease detectives." I always think that would just have been so cool to have done that. Okay, what...I understand that you are no longer in foodborne illnesses, so what do you do now at CDC?

[Julie Self] I now work as an epidemiologist in the Division of Tuberculosis Elimination, and in the U.S., we often think of tuberculosis as a problem of the past or something that just happens in other countries. But actually, people in the U.S. still suffer from tuberculosis disease. So TB is preventable and treatable, and similar to the foodborne outbreak investigations, we use molecular techniques, like whole-genome sequencing, to help us target our public health work to prevent the disease.

[Sarah Gregory] And you find this enjoyable?

[Julie Self] I do, it's very interesting. I really enjoy the combination of epidemiology and laboratory information that is used to respond to several different diseases. There are many areas within CDC where whole-genome sequencing is really helping take public health measures to the next level.

[Sarah Gregory] A lot of people I interview have hobbies that are somehow kind of related to their work. Do you have any hobbies that you want to tell us about? Or they don't even have to relate.

[Julie Self] Sure. I love to garden, actually, it's something that I've enjoyed doing with my children, and for years as they're little they can help put the seeds in and they always put extra seeds where you don't want them, but...it's just part of it, but we really enjoy gardening and growing food.

[Sarah Gregory] So you have your own leafy greens to harvest.

[Julie Self] We do.

[Sarah Gregory] Thank you so much for joining us today, Dr. Self.

[Julie Self] Thank you for having me, it was a great time to be here.

[Sarah Gregory] And thank you listeners, for joining us. You can read the August 2019 article “Multistate Outbreak of Listeriosis Associated with Packaged Leafy Green Salads, United States and Canada, 2015–2016” online at [cdc.gov/eid](https://www.cdc.gov/eid).

I’m Sarah Gregory for Emerging Infectious Diseases.

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