

Rising Incidence of Legionnaires' Disease, United States, 1992–2018

[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 Albert Barskey, an epidemiologist at CDC in Atlanta. We'll be discussing the increase of Legionnaires' disease within the United States.

Welcome, Al.

[Albert Barskey] Hi Sarah, how are you? Thank you for having me.

[Sarah Gregory] I'm doing well, and it's such a pleasure to have you.

What is Legionnaires' disease? How is it different from other respiratory diseases?

[Albert Barskey] Legionnaires' disease is a serious type of pneumonia caused by *Legionella* bacteria. Unlike other respiratory pathogens that typically spread from person to person, *Legionella* spreads through water. You can get it from sources like cooling towers, hot tubs, decorative fountains, sink faucets, or shower heads that aren't adequately maintained.

[Sarah Gregory] What are the symptoms of infection?

[Albert Barskey] Like with other types of pneumonia, Legionnaires' disease symptoms usually include like, cough, shortness of breath, fever, muscle aches, or headaches. And these typically begin about five days after being exposed to the bacteria. It could be as soon as two days or as long as two weeks after the exposure, too.

[Sarah Gregory] How dangerous is it? Do many people need hospitalization or even die?

[Albert Barskey] So Legionnaires' disease is really serious. About 95% of people who get it are hospitalized. Most people fully recover with treatment, but unfortunately about 10% of patients die.

[Sarah Gregory] So does viral load make a difference? Like, we hear so much about viral load with COVID now—if you get a little viral load, you're not so sick; if you get a lot, you're really sick. Is that the same thing with Legionnaires'?

[Albert Barskey] There is no safe level of *Legionella* bacteria in a building water system. So if you're sampling and you find, like, a very low concentration, that does mean that there is risk of Legionnaires' disease in that building. Obviously, we suppose that if the pipes are chock-full of *Legionella*, then yeah, that's a bigger risk. But we haven't really found that there's a safe threshold that under a certain concentration of bacteria in the building that, that's okay, that's safe.

[Sarah Gregory] When was it first identified and why is it called Legionnaires' disease?

[Albert Barskey] So there was an outbreak of severe pneumonia at the American Legion convention held in Philadelphia in 1976. About 200 people got sick, and about 30 people died. What caused the outbreak was a big mystery, and it wasn't until the following year when the bacterium that caused the outbreak was discovered. The bacterium was named *Legionella pneumophila* and the disease was named Legionnaires' disease, for those who attended the American Legion convention.

[Sarah Gregory] Al, Dr. Joseph McDade was the first person to identify it. He was also the founder of the *Emerging Infectious Diseases* journal. Did you know him?

[Albert Barskey] I wasn't fortunate enough to meet Dr. McDade, but I did get to hear him tell his story about how he discovered *Legionella pneumophila* at CDC's We Were There seminar in 2016.

[Sarah Gregory] He has since retired, sadly. He's a very interesting man.

Where is the bacteria mostly found or harbored?

[Albert Barskey] Low numbers of *Legionella* bacteria are found naturally in freshwater environments, like lakes, rivers, and streams. When the bacteria get into building plumbing systems, they can multiply to higher concentrations, especially if the water is warm, stagnant, or lacking disinfectant, like chlorine.

[Sarah Gregory] And how do people get sick from it?

[Albert Barskey] So people can get Legionnaires' disease when they breathe in mist containing the bacteria. Cooling towers, hot tubs, decorative fountains, sink faucets, shower heads...these are some common devices that can make mist. If the building those devices are in has *Legionella* growing in the pipes, the bacteria can be part of the mist those devices produce. Then, people in or near the building can breathe in that mist containing *Legionella* and could become infected.

[Sarah Gregory] Can you get it from drinking water from a contaminated source?

[Albert Barskey] So you don't get Legionnaires' disease just by simply drinking water that contains *Legionella*. However, if water accidentally "goes down the wrong pipe"(like that expression) and into your lungs, you could get it that way. This is called aspiration, and it's not the most common way to get Legionnaires' disease, but it has happened, usually among people with swallowing difficulties.

[Sarah Gregory] Interesting. I actually hadn't heard that before. I have my whole life—my daughter does it too—always aspirating things, especially water. Yikes, okay. Good to know.

Your article says that cases were highest among White people, but incidence was highest among Black or African Americans. What's the difference between cases and incidence?

[Albert Barskey] So cases—that's the number of people who got sick, or the number of infections. Incidence is the number of cases per population. It's kind of like the percent of people who got sick. So for example, if there's 100 cases in New York City where there's a lot of people, and there's 100 cases in a small town in upstate New York where there's a lot fewer people, the percent of people who got sick in that small town is higher than the percent of people who got sick in New York City. So we would say that the incidence is higher in that small upstate town than in New York City. So in our article, even though we found that there were more cases of Legionnaires' disease among White people, a higher percent of Black or African American people got Legionnaires' disease.

[Sarah Gregory] Apparently, cases the 10 years prior to 2003 were pretty stable numbers but then rose pretty dramatically after that. Tell us about that.

[Albert Barskey] Yeah. So from 1992 through 2002, there was an average of about 1,200 cases reported each year. Sometimes there were a couple 100 more, sometimes there were a couple

fewer. But beginning in 2003, the number of cases reported each year steadily increased to 10,000 cases in 2018. That's about eight times more cases.

[Sarah Gregory] So why? Do we know why these increases are occurring? That's a tremendous increase.

[Albert Barskey] Yeah. So we don't know for sure why the number of cases reported each year has been increasing. That's one reason why we did this study. We wanted to look for clues that might help explain the rising number of cases.

[Sarah Gregory] Are there specific geographic regions that have higher numbers?

[Albert Barskey] So in the US, the area around Ohio, Pennsylvania, New York, and Maryland usually has the highest incidence of Legionnaires' disease. As you get a little further from this focal point into New England, around the Great Lakes, and the mid-South, incidence becomes more moderate. And once you get west of the Mississippi River, that's where incidence is usually the lowest.

[Sarah Gregory] Do we know why?

[Albert Barskey] We don't know for sure, but it seems like there's something that's common to geographic areas that must be promoting *Legionella* growth. And one thing that tends to be common to geographic regions is weather and climate. So we think that perhaps that might have something to do with why there's a higher incidence of Legionnaires' disease in these areas. Other studies have found an association between more cases of Legionnaires' disease and warm, humid weather with a lot of precipitation. We don't really understand exactly why, but that association has been found. So maybe that's a reason why...maybe it has something to do with that kind of weather in those areas—in, like, the mid-Atlantic, around the Great Lakes, New England area—something to do with their weather that promotes cases of Legionnaires' disease.

[Sarah Gregory] Yeah, that's what I was thinking. But it's counter intuitive, because actually you would think it would be the southeast then, that would have the most cases where it's the warmest and the most humid. Huh, interesting.

What about seasonality? Does seasonality play a part?

[Albert Barskey] Yup. So Legionnaires' disease is a seasonal disease, meaning that more cases occur during certain times of the year than others. And for Legionnaires' disease, most cases occur during the summer and early fall. The warmer temperatures promote *Legionella* growth and also increase cooling tower use.

[Sarah Gregory] Ah. So then back to our regionality—so if it's in the summer, then the cold weather of the northeast doesn't really impact it as much.

Okay. What about economic status? Does that impact who gets it?

[Albert Barskey] Right. So other studies have found that living in areas of poverty was associated with a higher risk for acquiring Legionnaires' disease. Living in areas with more vacant housing, more renter-occupied homes, more older homes, and areas with lower education levels were also found to be risk factors.

[Sarah Gregory] Are there particular health risk factors for individuals?

[Albert Barskey] Yeah. So *Legionella* is an opportunistic pathogen, meaning that susceptible people are most affected. And health factors that would make a person vulnerable to infection include smoking, chronic lung conditions like COPD, and anything that might weaken the immune system, like cancer or certain treatments for cancer, medication taken after an organ transplant, or diabetes. So these are just some things that could weaken a person's immune system and make people more susceptible to Legionnaires' disease.

[Sarah Gregory] What about age or gender? We hear often that people's immune systems start to weaken as they age. So do either of those play a part in who is more susceptible?

[Albert Barskey] Yup, you're absolutely right. Aging is another thing that weakens the immune system. About 2/3 of Legionnaires' disease cases occur in people 55 and older. Also, as age increases, so does incidence, which means that the risk of getting Legionnaires' disease increases as you get older. And then, about 60% of Legionnaires' disease cases occur in men, and the reason for this difference is probably a combination of health factors and lifestyle.

[Sarah Gregory] Does travel play a part in any of this? Is it a global bacteria?

[Albert Barskey] Yup, yup. So travel is another risk factor for Legionnaires' disease. About 10-20% of people who got Legionnaires' disease reported an overnight stay outside their home during the time when they would have been exposed to the bacteria. And the reason travel is a risk factor really has to do with staying in a public accommodation, like a hotel or a resort. Because hotels tend to have lots of devices that can produce mist – like hot tubs, decorative fountains, cooling towers, sink faucets, shower heads. And when a hotel has periods of low occupancy, water for the unused rooms or unused floors can become stagnant in the pipes and then the chlorine levels can drop, which could promote *Legionella* growth.

So, if the building's plumbing system and devices aren't properly maintained, *Legionella* could grow and be expelled in the mist produced by these devices, putting people in and around the building at risk. And then for your second question, is it a global bacteria, although some parts of the US have higher rates of Legionnaires' disease than others that we discussed earlier, *Legionella* can be found in virtually all freshwater environments. So the risk of infection is probably global.

[Sarah Gregory] Going back to the hotels and stagnant water in all those pipes and things, it makes me wonder now, like the last two years where people weren't very much traveling, is there. Do you think there will be a spike in these incidences as people go back to these hotels that haven't had all their water pipes in use for a long time?

[Albert Barskey] During 2020, we really did see a drop in the number of nationally reported cases of Legionnaires' disease. And we suspect that one reason may be that people weren't traveling and staying in hotels. But we don't know this for sure, and we are excited to look into this and really study this. And as people are returning to hotels and businesses and schools that have been sitting vacant and unused for a while, the stagnant water is a big concern. And we really did try to promote safe building reopenings to building owners and managers so that we wouldn't see a huge spike in Legionnaires' disease cases because of all of the water that had been sitting stagnant.

[Sarah Gregory] Well, maybe this podcast will help with that. It does get a lot of listeners, so hopefully anybody responsible for water in buildings will be aware of it. Are there variations on the theme—other related syndromes?

[Albert Barskey] Yeah. So although Legionnaires' disease is the most common—and most serious—illness caused by *Legionella* bacteria, the same bacteria can cause two other illnesses. Pontiac fever is a milder illness, without pneumonia, that goes away on its own. Although Pontiac fever is reported only about 2% of the time, and it is a less serious health condition, it's still important because it means that *Legionella* is growing in the pipes wherever the person got it from, and those bacteria could cause Legionnaires' disease (the much more serious condition) in other people who are exposed. And then, extrapulmonary legionellosis is an infection with *Legionella* somewhere other than the lungs. It could be a wound infection, maybe, or heart valve infection, for example. And only a few cases are reported every year, so this is rare.

[Sarah Gregory] Al, how did you go about this study?

[Albert Barskey] The goal of the study was to look for clues that might explain why cases started rising after 10 years of the same number of cases being reported. We broke the study into two time periods: baseline years is the period when about the same number of cases were reported each year, and then the years of increase—the period when the cases were rising. Then we compared patterns and trends between the two periods. We looked at things like demographic groups and which parts of the country were most affected, and also seasonality, as well as how those things might have changed when cases started rising.

[Sarah Gregory] And what did you discover?

[Albert Barskey] So when we looked at age, incidence increased in every age group older than 14, and the largest increases occurred in people older than 45. By race, as we said before, most cases occurred in White people, but incidence was highest among Black or African American people. Also, the largest increase in incidence occurred in Black or African American people. And then, geographically, the highest incidence was focused around the area of Ohio, Pennsylvania, New York, and Maryland. And incidence increased more in this area and the surrounding Great Lakes, New England, and mid-South regions than in other parts of the country. For seasonality, most cases occurred in the summer and early fall. And then, when cases were rising, an even higher percent of cases occurred during the summer and early fall.

[Sarah Gregory] What do you consider the most important points of your study?

[Albert Barskey] Yeah. So the most important points are that even though incidence increased in almost every segment of the populations that we looked at—different age groups, men and women, different races, and different parts of the country. But what surprised us a little was that the increases weren't the same in every group—incidence increased more in some parts of the country than in others, incidence increased more in Black or African American people. So that was a little surprising to us.

The groups that were more affected to begin with, those are the groups that tended to have the higher increases in incidence, too. So that was interesting to find. And then other key findings that were associated with the rising cases—kind of going off of that—was that racial disparities between White and Black or African American people widened, the geographic distribution became more focused, and seasonality became more pronounced.

[Sarah Gregory] You mentioned reaching out to hotel infrastructure managers and that sort of thing. But what else can public health be doing to help mitigate this increase?

[Albert Barskey] So public health really plays two roles: preventing cases to begin with, and curbing outbreaks when they do occur. And prevention really focuses on reducing the risk of *Legionella* growth and spread by increasing uptake and implementation of these water management programs for buildings. So public health can really try to raise awareness among building owners and managers that they should have a water management program in place for preventing the growth and spread of *Legionella* in their buildings. And then, when cases or outbreaks do occur, public health investigates to try to figure out where the people were exposed to *Legionella* and then make recommendations to remediate the bacteria and sources and control its growth and spread going forward.

[Sarah Gregory] What about water parks and places like that, that aren't actually buildings that people take showers in or have fountains they pass, but that are just nothing, basically, but water spraying about?

[Albert Barskey] Yeah. So theoretically, any device that sprays water and makes that mist could potentially be spreading the *Legionella* bacteria if the plumbing system and the devices are not properly maintained.

[Sarah Gregory] Are there precautions that individuals can take to protect themselves?

[Albert Barskey] So staying healthy and not smoking are the best ways individuals can protect themselves. And if you have a hot tub at your home, follow the manufacturer's recommendations on cleaning and maintenance. But what's really key to preventing Legionnaires' disease is reducing *Legionella* growth and spread in buildings with complex water systems and devices. Building owners and managers should implement an effective water management program with this goal in mind to keep building occupants safe. And more information about water management programs can be found on CDC's website.

[Sarah Gregory] Al, tell us about your job at CDC and how you ended up here.

[Albert Barskey] So I'm an epidemiologist at CDC. I collect and analyze data, and then I look for patterns and trends in the data. The patterns and trends can tell us about where a disease is getting better or worse, which of our prevention strategies are working or not working, and what new actions we might take to reduce cases of a disease. The data also tell us when an outbreak is happening and help us try to figure out ways of controlling that outbreak.

Ever since I was early in grade school, I've been fascinated with how germs try to make us sick and how our bodies try to fight off these invaders. And then, as I grew older, I kept studying bacteria and viruses and the immune system and became interested in outbreaks and how diseases spread in a population. I got really excited when I saw the movie *Outbreak* with Dustin Hoffman, and I think that's kind of what inspired me to work at CDC.

[Sarah Gregory] Oh my goodness. Did you ever read the book *Ghost Map*? It's about Dr. Snow and how they figured out the cholera outbreak in the 1600s, I think it was, that turned out to be from just one water pump in a sort of neglected area that a lot of people were using.

[Albert Barskey] I haven't read that book, but it is a fascinating story. And I love maps and I love, like, seeing...I need to physically see where the cases are occurring. And it was amazing that partly by mapping where the cases occurred, he was able to figure out that it was related to this water pump. And I enjoy maps and incorporating maps in my everyday work at CDC.

[Sarah Gregory] Well, I highly recommend that book. Outside of work, do you have any hobbies or interests you'd like to tell us about, besides mapping germs?

[Albert Barskey] Yeah. So besides that, I like cooking, trying new recipes. It's sort of like being in the lab, but you're in the kitchen. So I enjoy doing that. I like outdoor activities like walks or running through the park, hiking, and then just kind of relaxing and, you know, watching movies, reading books.

[Sarah Gregory] Relaxing is a good thing these days, isn't it?

[Albert Barskey] Yeah. Yeah, definitely.

[Sarah Gregory] Well, thank you for taking the time to talk with me today, Al.

[Albert Barskey] Well, thanks for having me here, Sarah. I really enjoyed this.

[Sarah Gregory] And thanks for joining me out there. You can read the March 2022 article, *Rising Incidence of Legionnaires' Disease and Associated Epidemiologic Patterns, United States, 1992–2018*, online at [cdc.gov/eid](https://www.cdc.gov/eid).

I'm Sarah Gregory for *Emerging Infectious Diseases*.

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