

Foodborne Illness Outbreaks Reported to National Surveillance, United States, 2009–2018

[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 Alice White, a senior research instructor of epidemiology at the Colorado School of Public Health. We'll be discussing foodborne outbreaks reported to a national surveillance system in the United States.

Welcome, Alice.

[Alice White] Hi, thanks for having me.

[Sarah Gregory] What constitutes a foodborne illness outbreak?

[Alice White] Well, there's actually a specific definition that CDC has. So it's an incident in which two or more persons experience similar illness resulting from the ingestion of a common food. So in addition to that definition, many jurisdictions also require that the two or more people are from separate households.

[Sarah Gregory] Your article is about foodborne outbreaks being reported to a national surveillance system. Are there many that aren't reported?

[Alice White] Yeah. There's potentially a lot of outbreaks that go unreported. Foodborne outbreaks must be detected, investigated, and then reported to this national surveillance system. So there's a lot of complexity that goes into detection and investigation, and there are many reasons why an outbreak might not be reported.

[Sarah Gregory] And why would one outbreak be reported and not another?

[Alice White] In our study, we found that states that reported fewer outbreaks were more likely to report larger outbreaks and outbreaks related to pathogens that are more severe. So what we concluded from that is that there are probably many outbreaks that are smaller and caused by outbreaks that are less severe that don't get reported. So these outbreaks are often harder to detect...it's harder to detect an outbreak with just two or three people, for example. And it's also harder to detect outbreaks caused by pathogens that are less severe, like, for example norovirus, because many of those pathogens are not reportable. So public health agencies aren't notified of illnesses caused by those pathogens. They have to do a little bit more work to go into the community to find those outbreaks.

[Sarah Gregory] So speaking of public health, what difference does it make to public health if an outbreak is reported or if it isn't reported?

[Alice White] Sometimes this idea is a bit counterintuitive, that the more outbreaks that are reported, the better. So that means that we're catching outbreaks and then investing the time to investigate and report them. So it's actually a really good thing if a state is reporting a lot of outbreaks. That means they're putting a lot of resources and time and effort into detecting those outbreaks and reporting them. So the importance of doing this detection investigation and then reporting is that our national outbreak data provides really critical information on pathogens that cause illness and, most importantly, on the foods that cause illness. And this allows researchers and CDC to monitor trends over time and what types of foods are causing illness. So foodborne

outbreak data at a national level is really crucial, so it's really important that states are reporting these outbreaks.

[Sarah Gregory] It seems that different states have varying levels of reporting. Is this accurate?

[Alice White] Yeah. We found a huge difference in our study. So the highest reporting state reported more than 18 times as many outbreaks per year as the lowest reporting state. And the top 10 states reported four times as many outbreaks as the lowest 10 reporting states.

[Sarah Gregory] Why would this be?

[Alice White] They each have different public health priorities and different resources available to them. So the main thing that we found that was associated with higher reporting was funding to do this work. The top 10 states doing a good job reporting outbreaks were the highest 10 reporters. They also received three times as much funding to specifically do this work. So states with less funding were less likely to report outbreaks. And like all public health work, outbreak investigations... they take time, and they require having people with expertise and a lot of training.

[Sarah Gregory] Were the types of foodborne outbreaks different in the different states?

[Alice White] Yeah. So we did find that the types of outbreaks that were recorded were different. So we don't think that the total picture or the true picture of foodborne outbreaks—so not just the ones that get reported, but all foodborne outbreaks—that's probably not that different from state to state. There are some exceptions. So for example, fish outbreaks are a lot more likely to happen in coastal regions, which makes sense (there's more fish consumption there). But again, the type of outbreaks that get reported were different, and these likely reflect priorities and resources. For example, lower reporters were more likely than higher reporters to report large outbreaks that were associated with reportable diseases or more severe pathogens. So these outbreaks are easier to detect as well as a higher priority when it comes to investigation.

[Sarah Gregory] Going back to the fish, that's interesting. I would have thought that the outbreaks would be more likely in the middle states, because the fish wasn't right there on the coast and fresh. But apparently, not the case, huh?

[Alice White] Yeah, we see completely more fish outbreaks happening in coastal regions where consumption is just higher than in non-coastal regions.

[Sarah Gregory] What system did you look at?

[Alice White] The surveillance system that we looked at is called a National Outbreak Reporting System, or NORS for short. And that is a central system that CDC manages, and that states and territories report their foodborne outbreaks to. So it's a really interesting system, and there's actually a... CDC has a dashboard that's publicly available that people can Google and look at some of the different trends in foodborne outbreak reporting.

[Sarah Gregory] How many outbreaks have been reported in this system?

[Alice White] Over the 10 years that we've looked at, there have been 8,131 foodborne outbreaks reported to the system.

[Sarah Gregory] What time period did that 10 years cover and why then?

[Alice White] We looked at 2009 to 2018. And we looked at that time period because starting in 2009, there were some changes to the surveillance system. So while the system itself goes back all the way to 1998, we started in 2009 because there were some changes around then, so that made sense. And then we looked through 2018 because when we started this project, that's the data that was currently available.

[Sarah Gregory] This system must have different kinds of data. Are some of the data better than others?

[Alice White] There is only one national system for reporting foodborne outbreaks (this NORS system), although states do maintain their own systems for tracking outbreaks. We did use different data sources for this project. So we used NORS to look at outbreak data, but then we wanted to look at some of the factors that might be associated with the reporting more or less outbreaks—so some of the state characteristics, like whether they have a more centralized state-run public health system or a more decentralized system where local public health agencies do more the lead in the work. We also looked at funding. So those different state characteristics came from several different data sources (mostly survey data sources), and some of them are better than others. Some of the surveys were older than others and could definitely use updating.

[Sarah Gregory] Were there particular types of outbreaks that you looked at, such as, single state versus multi-state?

[Alice White] Yeah. We did just look at single-state outbreaks, and single-state outbreaks actually represent the vast majority of all outbreaks. We typically hear more about multi-state outbreaks in the news, but single-state outbreaks are more common. And we decided to focus on single state because they are more common and also because those outbreaks are probably more reflective of individual state resources and characteristics and capacity, which is what we really wanted to focus on for this project, as opposed to multi-state outbreaks. Those often involve CDC and multiple states, so it's harder to figure out which resources and capacities from which state contribute to that outbreak.

[Sarah Gregory] What about food? You mentioned fish, are there some foods that are more culpable than others?

[Alice White] Yes. So we did just focus on foodborne outbreaks for this study, and there are differences in the types of food that cause outbreaks. So some foods are more likely to cause outbreaks than other foods. So we didn't restrict our study, we looked at all foodborne outbreaks.

[Sarah Gregory] Right. But were there particular foods that seemed to show up more, I guess is what I'm asking?

[Alice White] We didn't focus on that for this study. We did compare whether some states were more likely to report certain types of foods than other states, and we did not find differences there. So that was actually a good thing because this surveillance system... the data that comes from NORS is used to look at trends over time and the types of foods. So one reason we did this study is because we wanted to see if there were biases some states are more likely to report than other states. We wanted to see if that was true for different types of foods, so we could tell if there were any issues using this data to look at trends over time and what types of foods cause illness. And we did not find differences... we did not find substantial differences in the types of

food reported by states. So even though they are reporting different numbers or different rates of outbreaks, we did not find that they were reporting different types of foods. So that was actually a good finding.

[Sarah Gregory] Yes, and interesting.

So you mentioned bias. What other reasons did you want to do this study?

[Alice White] Well, we had an idea that they have very different reporting practices and very different priorities when it comes to foodborne outbreak investigations. So we wanted to quantify what those differences are and start asking why some of those differences exist and what some of the reasons are for those differences.

[Sarah Gregory] How did you structure the study?

[Alice White] We used outbreak data from NORS, and then we used outbreak characteristics associated with reporting (we looked at pathogen, setting, size). And then we also looked at state characteristics—so multiple different funding sources, the size of the public health work force, participating in different public health programs (different CDC-funded public health programs). And then we looked at differences between states and their outbreak reporting rates to see if any of these state characteristics (like funding) explains the differences that we see in outbreak reporting rates across states.

[Sarah Gregory] Is there anything else about your study you want to tell us?

[Alice White] I think the important thing is that outbreak investigations provide really critical information about the epidemiology of foodborne diseases, and by that in which foods cause illness. And there are a lot of opportunities to improve outbreak investigation. So funding is really, really important. As we know, public health funding is often not what it could be or what it needs to be. And even during times when we do see an increase (like now, for COVID), often that doesn't end up being sustainable in long-term funding.

So then there's other things that are also important to improve outbreak investigation, and not just the funding. So that includes supporting...support between states and collaboration between states (which happens a lot) and also between local and state agencies and maybe some mentorship programs, so that states that are high reporters and low reporters are working together a little bit more. And of course continuing education and more research and more studies to learn about outbreak investigation methods and what works and what doesn't, and some of the different processes that are happening within states that might explain some of the differences we found.

[Sarah Gregory] What do you think is the most interesting thing you found in your study?

[Alice White] I think the most interesting and the most important thing we found is this really clear relationship between funding and outbreak reporting, where higher reporters received three times the amount of funding as low reporters. I think that's important because sometimes... even though that might seem obvious—well, you're getting more funding, therefore you're able to do more work and more outbreak investigations—I think it's really important to be able to document that finding, and that supports other evidence that shows that sending money (specifically, sending federal money) to states to do public health work has measurable outcomes, and ultimately leads to improved public health.

[Sarah Gregory] What were the challenges? There must have been many.

[Alice White] There are a lot of challenges, especially when it comes to working with this type of data. Sometimes it's messy and complicated. I think the biggest challenge is that we didn't know what we didn't know, so we only have outbreaks that are reported from this NORS system. So there's not really an alternative way to figure out what outbreaks don't get reported and why they don't get reported. So we had to work with just the outbreaks that do get reported and try to answer some of those questions. But it's hard to tell what doesn't get reported if it's because it wasn't detected or because it wasn't investigated.

[Sarah Gregory] You've mentioned funding several times now, and we'd all like to see more funding for public health. How do you see your study advancing this?

[Alice White] Yeah. So as I said, I hope that it adds to other existing evidence and investing in public health infrastructure, and not just when there's a large incidence but also the long-term and sustainable funding has direct measurable benefits. Also, we have plans to do other work around this, which will hopefully answer more of those questions about what happens at the state level that allows them to detect outbreaks and investigate them and then report them. For example, we're doing some interviewing of states and we're looking at some CDC-funded programs and how receiving or participating in those programs impacts outbreak reporting. I hope that this asks more questions...that leads to asking more questions about not just how funding can help, but how other strategies for outbreak investigation such as, perhaps different interview techniques could lead to a more efficient outbreak investigation.

[Sarah Gregory] Alice, tell us about your job and why you like it.

[Alice White] I really love my job. I'm a research epidemiologist. I work at a university doing research, and I get to work on lots of different projects. So there's always something new and I find that really, really interesting. I also get to work on problems in which research has very practical applications, such as this work. So I get to see my work potentially have an impact (a direct impact) on how public health works. And I find that to be very rewarding. Plus, I'm just a data and math nerd. So working with data and figuring out what data tells you I think is a lot of fun.

[Sarah Gregory] What's the most interesting thing you've ever worked on in your career, then?

[Alice White] I find working with outbreaks and looking at outbreak data and how public health investigate outbreaks is fascinating. There's some really interesting challenges that we've talked about in this work and using this data. One other thing that we're working on now is trying to figure out the impact of COVID on the ability of public health (the capacity of public health) to do these outbreak investigations, and that's really interesting too.

[Sarah Gregory] And huge. Good luck with that.

[Alice White] Yes, thank you. It's very complicated.

[Sarah Gregory] Yes. Well, thank you so much for taking the time to talk with me today, Alice.

[Alice White] Thank you so much for having me. This was fun.

[Sarah Gregory] And thanks for joining me out there. You can read the June 2022 article, *Foodborne Illness Outbreaks Reported to National Surveillance, United States, 2009–2018*, online at [cdc.gov/eid](https://www.cdc.gov/eid).

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

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