

Defining Moments in *MMWR* History: 1993 *E. coli* O157:H7 Hamburger Outbreak

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

[Dr. Rasmussen] Welcome to *Defining Moments in MMWR History*, a new podcast series from *MMWR*, the Morbidity and Mortality Weekly Report. In this series, we'll be taking a closer look at historic—and defining—moments in *MMWR* history. Times when *MMWR* was first to deliver scientific information that protected and improved the nation's public health. I'm your host, Dr. Sonja Rasmussen.

Today, we'll be talking about the 1993 *E. coli* O157 outbreak, caused by hamburgers served at fast food restaurants. During the outbreak, four children died and more than 700 people in four states got sick with severe, often bloody, diarrhea. *MMWR* was the first scientific publication to break the news of this deadly outbreak, as well as to present critical findings from the investigation.

Joining me today is Dr. Beth Bell, who served as a CDC Epidemic Intelligence Service officer—otherwise known as a boots-on-the-ground disease detective—in 1993. Dr. Bell was one of CDC's lead investigators for the outbreak. She went on to have a successful career at CDC, and from 2012 to January of 2017, served as Director of the National Center for Emerging and Zoonotic Infectious Diseases. Welcome to the show, Beth.

[Dr. Bell] Thanks so much for having me. It's really great to be here.

[Dr. Rasmussen] Beth, there are lots of foodborne outbreaks. What makes this one so important?

[Dr. Bell] Well, you know, at that time, infections caused by this bacteria called *E. coli* O157:H7 were not recognized very often and people really didn't know that much about them. This was really true, even in the medical community, and most laboratories didn't even have the ability to test for O157. In the outbreak, sadly, mostly children became ill and as the public learned about the terrible suffering caused by the outbreak, there was outrage and disbelief. The idea that you could take your child to a fast food restaurant for a hamburger and they could end up in the hospital or even dead was *completely* unbelievable to people. So there was a _____ cry and it really galvanized attention and, in the context, public health realized the importance of good surveillance, of being able to detect these infections really rapidly. And so, in many ways, this outbreak was a spark that galvanized improvements in food safety and set a forward trajectory that continues to this day.

[Dr. Rasmussen] How did you first hear about the outbreak?

[Dr. Bell] As you said, I was working in Seattle, representing the CDC as the EIS officer in Washington state. And we at the health department had a telephone call from a pediatric gastroenterologist at the children's hospital in Seattle. And what he said was, "I've just been talking to the kidney specialist and there are two children with a condition called hemolytic uremic syndrome, or HUS, on dialysis in the hospital and I think that both of these children had

O157 infections, which is the most common cause of HUS in children.” This was highly unusual and he went on to say that both he and his colleague, a pediatric gastroenterologist, had been getting telephone calls from pediatricians in Washington state saying that they were seeing lots of children with bloody diarrhea. So he was calling the health department to say, “There is something going on, what is it?” And that’s, really, how we started our efforts to, in fact, find out what was going on and how the outbreak was first detected.

[Dr. Rasmussen] As a CDC disease detective, what did you do to help with the outbreak investigation?

[Dr. Bell] Well, this is really our bread-and-butter, as CDC EIS officer disease detectives and so, we swung into action and, just to give a flavor of what this was like, we were hearing about more children in the hospital on dialysis; more and more cases were pouring in day-by-day so we were racing to find the cause of the outbreak so that we could stop it. So there’s a number of parts of this. The first thing is, you know, we called around to all the health departments in the state asking them, have they seen cases of bloody diarrhea, to please call us right away if they had cases of bloody diarrhea. We used lots of other ways to communicate with public health and the public, including the MMWR, which is one of the first publications that people go to to find out what’s breaking in public health. And then, we talked to a lot of patients, to a lot of family members. And so, we gathered all the information that we could that was going to help us figure out what was the source so that we could remove the source and stop the outbreak.

[Dr. Rasmussen] So how was the source of the outbreak identified?

[Dr. Bell] Well, in our preliminary conversations with the first cases that we identified, we put together what we call a hypothesis-generating questionnaire, and that’s a questionnaire that just helps you pick out clues to show you what direction to go in to find the source. And in the hypothesis-generating questionnaires, there were a lot of our cases that were reporting having eaten at this particular fast food restaurant during the time called the *incubation period* when the infection starts and people begin...before they begin to have symptoms. So, after we developed some sort of clues from the hypothesis-generating questionnaire, we then did what’s called a case control study, and this is sort of like the bread-and-butter of disease detective epidemiology where we talk to the patients and then we talk to people who are similar to the patients in every way, except they didn’t get sick. And with this case control study, we found that more than 75 percent of the cases reported eating at this fast food chain restaurant and none of the controls did. Now, as I said, this was a time when we were really racing to get the answers so that we could make an intervention. So I was sitting at the computer, entering data as it became available, and calculating what we call the odds ratio, which is the way that we evaluate how strong the association is between a particular exposure, in this case, eating at the fast food restaurant, and the outcome, or O157 infection. And as the odds ratio got higher and higher, which is the indicator of the strength in the association, we got to a certain point and we said, “Okay, we are convinced. This is it.” And, “We’ve identified the source of the outbreak.”

[Dr. Rasmussen] So, once you figured out the source, what was done to stop the outbreak?

[Dr. Bell] We did two very important things, in collaboration with the company. First we issued a press release, and in the press release, we identified the source of the outbreak as being *eating hamburgers at the fast food restaurant*, and, as I said, we had been keeping the company well informed in the course of our investigation and, at the same time, the company issued a press release and voluntarily recalled all of the hamburger meat that was currently in their warehouse and in the restaurants in Washington state, and this removed the source of the exposure and stopped the outbreak.

[Dr. Rasmussen] How did this outbreak lead to important changes in food safety practices in the United States?

[Dr. Bell] As I mentioned earlier, this outbreak was a water shed because it showed, first of all, how serious the outcomes of foodborne illness can be, that children can die, that people's lives can really be transformed in a very negative way. And so, we knew that there were a number of problems that caused the outbreak. There was meat that was contaminated at the time of production, in the slaughter house and then when it was ground up. And then the meat was not adequately cooked in the fast food restaurants, so that the bacteria that was in the hamburger meat was not killed by the cooking process. And we also saw with this outbreak the importance of surveillance; that you need to have the systems in place so that you can find these infections quickly, when they occur, identify clusters when they occur, so that you can jump on them and act. And so, these principles and these, sort of, deficiencies that were identified in the course of this outbreak, really spurred a lot of activity—improvements in surveillance—and it led to the birth of PulseNet, which is our genetic fingerprinting, laboratory-based cluster detection system that really revolutionized our ability to detect clusters of foodborne illness, it led to regulatory improvements by both the USDA and the FDA around practices in slaughter houses, practices in restaurants, and eventually has led to the passage of the Food Safety Modernization Act, just within the last few years, which really has transformed FDA's ability to track and regulate sources of foodborne illness

[Dr. Rasmussen] Thanks, Beth. I've been talking today with Dr. Beth Bell about her role and experience working on the historic *E. coli* O157 outbreak of 1993. *MMWR* is proud of its role in communicating critical findings of this investigation and response. It was a defining moment in *MMWR* history.

For more information about this outbreak, or to learn more about the latest in public health, visit cdc.gov/mmwr.

Until next time, this is Dr. Sonja Rasmussen for *Defining Moments in MMWR History*.

[Announcer] For the most accurate health information, visit www.cdc.gov or call 1-800-CDC-INFO.