

Knowing Which Foods Make Us Sick Will Help Guide Food Safety Regulations

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

[Mike Miller] Hello, I'm Dr. Mike Miller and today I'm talking with Dr. John Painter, an epidemiologist with the Centers for Disease Control and Prevention. Our conversation is based on his study about which foods can make us sick, which appears in CDC's journal, *Emerging Infectious Diseases*. Welcome, Dr. Painter.

[Dr. Painter] Thank you. Good to be here.

[Mike Miller] Dr. Painter, tell us, is food safety a real problem or is it just something the media likes to blow out of proportion?

[Dr. Painter] Food safety really is an important issue. In fact, about one in six people get a foodborne illness each year. That's a lot of people. CDC estimates that roughly 48 million people get sick each year from food eaten in the United States, 128,000 are hospitalized, and about 3,000 die of foodborne diseases. So CDC and our partners are working hard to address this issue.

[Mike Miller] Well, why do you think the number of cases of foodborne illnesses is so high?

[Dr. Painter] Well, the number of cases of foodborne illness is high because there are many different contaminants that can cause illness and they can contaminate a wide variety of foods. Contamination on farms and in processing facilities from bacteria, such as *Salmonella*, *E. coli*, and *Listeria* are often behind the large foodborne outbreaks and recalls, but food contamination can occur anywhere along the way from the farm to the fork. For example, contamination can occur in the field, or if foods are washed with contaminated water during harvest or processing, or even during preparation. As an example of contamination in the kitchen, consider norovirus infection, the most common foodborne illness. It causes diarrhea and vomiting that typically lasts two days and if a food handler in a restaurant kitchen or at home is sick with norovirus and doesn't wash his or her hands after going to the toilet and before preparing or serving food, those invisible noroviruses on hands can easily contaminate the food.

[Mike Miller] Why did you do this study?

[Dr. Painter] We did this study to answer the important question: which foods make us sick? This is the first time CDC has attempted such a comprehensive set of estimates to answer this question. In the past, we estimated the number of illnesses linked with each contaminant—like bacteria and viruses—but have not estimated the number of illnesses from each type of food. All *E. coli* illnesses do not come from one type of food—it could contaminate a wide variety of foods—beef and lettuce, for example—so knowing the amount of *E. coli* illnesses didn't tell us which foods caused those illnesses. It's the same problem for norovirus, *Salmonella*, etc. Each food category is linked to some illnesses, but which ones are linked to the most illnesses?

In large part, we did this study to help food safety officials, such as the Food and Drug Administration and the US Department of Agriculture, and food industry. This study will help them prioritize their efforts on preventing food contamination.

Now, this study is not meant to tell people to avoid certain foods. In fact, keep eating your vegetables. As it turns out, many foodborne illnesses are attributed to vegetables, but one reason for that is that we eat so many of them. Fruits and vegetables are linked to a lower risk of heart attacks, stroke, and cancer. CDC wants this study to guide policymakers in preventing the foods that we love to eat from getting contaminated.

[Mike Miller] Well, is it really that hard to figure out what foods are making people sick?

[Dr. Painter] It may seem like it should be straightforward, but it's a lot more complicated than you'd think to attribute illnesses to different foods. For instance, there are hundreds of different types of foods, and we eat many different kinds and combinations in a week—even in a day. It would be simpler if we ate them one at a time, like eating an apple by itself. But we often mix many different ingredients together, from many different food categories, and then we eat that as one dish, perhaps, such as an apple pie.

Moreover, it's usually not possible to know which food made a person sick, or even which meal. Let's go back to norovirus, as an example. It's the most frequent cause of foodborne illness and it may take one to three days after being exposed before symptoms start. For other foodborne illnesses the timing's different, so it's almost impossible for a person to correctly guess which food made him or her sick. Now outbreaks, when many people get sick at once, provide a really good opportunity for public health officials to figure out the source. The CDC, state and local health departments investigate thousands of foodborne outbreaks each year and the results of these investigations gave us the data for this study.

There are challenges to using outbreak data, though. The investigations can sometimes link illnesses to a particular food or a single food ingredient. Other times, the investigation can link illness to eating what we call a “complex,” food, one that contains several ingredients, but investigators may not determine which ingredient was the actual source of illness. For example, if a person got sick from eating a hamburger, we want to know if it was the ground beef patty, the lettuce, or maybe the tomato. For this study, we developed a method for using data from both simple and complex foods to make our best estimates.

[Mike Miller] Well, how did you conduct the study? Were all foodborne outbreaks from 1998 to 2008 included in the study?

[Dr. Painter] The study used data from over 4,500 foodborne disease outbreaks that occurred between 1998 through 2008 in order to estimate the number of illnesses caused each year by each category of food. State and local health departments collected outbreak data and reported them to CDC. We included all the outbreaks in which the health department determined the cause of the illness.

For the 17 food categories that we looked at and 40 different foodborne illnesses, there are 680 possible combinations. So having a large number of outbreaks was really helpful. With this

amount of data, we were able to calculate the most probable estimate for each food category.

We also made a high and low estimate for each category, which reflects the uncertainty in the estimates. And while the statistical details won't be all that helpful to consumers, it's really essential for government agencies and the food industry, as they work to make our food safer.

[Mike Miller] Well, how did you classify the sources of foodborne illness in your study?

[Dr. Painter] We organized a wide variety of foods implicated in US outbreaks into, as you said, 17 mutually exclusive categories. We grouped them into three broad areas: aquatic animal foods, land animal foods, and plants. For some analysis, we grouped the categories. For instance, the group “Meat and Poultry” included beef, pork, game, and poultry.

We divided foods based on the number of categories they contained. A “simple” food contained a single ingredient from one category; for instance, a steak is in the Beef category. A “complex” food contained more than one ingredient from multiple commodities; for instance, apple pie contains ingredients like flour, from the Grains and Beans category, sugar, from the Oils and Sugar category, and apples, of course, from the Fruit and Nuts category.

[Mike Miller] So, now the big question: which food categories accounted for the highest number of cases of foodborne illness and hospitalizations?

[Dr. Painter] Produce, which is a combination of fruits, nuts, and all five categories of vegetables, accounted for 46 percent of all illnesses. Meat and poultry, which is a combination of four categories, accounted for 22 percent of all the illnesses. Leafy vegetables, such as lettuce and spinach, accounted for 23 percent, the most illnesses for any one of the food categories. This does not mean that they are risky foods, though. In fact, most vegetable meals are safe and healthy. They account for many illnesses, in part, as I said, because we eat lots of vegetables.

For hospitalizations, dairy products were responsible for 16 percent, leafy greens for 14 percent, and poultry 12 percent. There were a large number of raw milk outbreaks in our data. The large number of hospitalizations attributed to dairy was partly due to outbreaks of *Campylobacter* bacteria diarrhea among people who drank raw milk.

Red meat was once seen as the leading cause of foodborne illness, partly because of outbreaks of *E. coli* infection associated with ground beef. But beef is now less contaminated to start with and most fast-food restaurants are cooking burgers well, so beef was the source of fewer than seven percent of food-related illnesses and fewer than four percent of deaths.

[Mike Miller] Are different types of food more responsible for deaths than other types?

[Dr. Painter] Poultry accounted for 19 percent of deaths—about one in five. This category had the largest number of foodborne illness deaths. Many of those were caused by *Listeria* and *Salmonella* infections. It's partly due to three large *Listeria* outbreaks that were linked to sliced processed turkey that occurred in the last decade, though fewer have occurred in recent years, thanks to safer production practices.

[Mike Miller] Well, what kind of germs in food cause illness or death?

[Dr. Painter] Several kinds of bacteria, including *Listeria*, *Salmonella*, *E. coli*, and *Campylobacter*, can cause illness, and, rarely, death, when they contaminate food. In our study, we found that *Listeria* and *Salmonella* infections caused many of the deaths attributed to poultry. Viruses can also contaminate food; norovirus caused 46 percent of illness attributed to the leafy vegetables.

[Mike Miller] Do you think this study will lead to new food safety measures that could reduce the number of foodborne illnesses?

[Dr. Painter] That's the key question. We want to increase the safety of foods we need and love to eat. And our public health partners, regulators, food industry, consumers, and the media have greatly anticipated the release of these findings. We think these study findings can help prioritize prevention measures, policy, and research.

[Mike Miller] Will CDC continue to make these sorts of estimates?

[Dr. Painter] Yes, these are initial estimates, and CDC is already working on more. Attributing illness to foods can be done in several ways. Some ways are highly specific for one type of contaminant or one type of food, and others are more general. An example of another way of making estimates is that by comparing the molecular characteristics of *Salmonella* found in foods and animals with those found in people, we can attribute *Salmonella* infections back to specific animal sources. A working group of scientists from CDC, FDA, and USDA's been collaborating on projects like that to improve attribution estimates.

One issue will be how often to repeat these analyses. We expect that illnesses from various foods will change over time, because of changes in food industry practices, regulations, and what consumers do. For example, in the early part of the study time period, *Listeria* outbreaks due to sliced deli turkey meat and hot dogs were more common, as were outbreaks due to unpasteurized fruit juice and cider. Both of those have become less frequent in more recent years because of safer food production practices. However, to have enough information for meaningful analysis, several years of data are needed.

[Mike Miller] Well, what can people do to protect themselves and their families from food contamination?

[Dr. Painter] There are several things that people can do. People can prevent foodborne illness by not preparing food for others when sick with diarrhea or vomiting; by preparing food especially carefully for young children, pregnant women, and those in poor health, and the frail elderly; and by avoiding consumption of raw foods of animal origin, including raw, unpasteurized milk and other dairy products that are made with raw milk. Raw meat and poultry are commonly contaminated with disease-causing bacteria. Those bacteria are easily killed by cooking, but the bacteria on raw meat and poultry can get onto other foods that may not get cooked before eating. That's what we call cross-contamination, and it can be prevented through thoroughly cleaning hands, knives, cutting boards, counters, and sinks after working with raw meat and poultry. People can also support government efforts to improve the safety of foods, especially those that are eaten without cooking.

You can learn more about foods to avoid and how to safely prepare and store food by visiting CDC's website: cdc.gov/foodborneburden/attribution.

[Mike Miller] Well, thank you, Dr. Painter. I've been talking with Dr. John Painter about his study, *Attribution of Foodborne Illnesses, Hospitalizations, and Deaths to Food Commodities by using Outbreak Data, United States, 1998 to 2008*, which appears in the March 2013 issue of CDC's journal, *Emerging Infectious Diseases*. The article is available at cdc.gov/eid.

Now, if you'd like to comment on this podcast, send an email to eideditor@cdc.gov. I'm Dr. Mike Miller, for *Emerging Infectious Diseases*.

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