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# If something goes wrong in the food chain, how do we investigate?

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## Introduction

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Between 1993 and 1997 the Centers for Disease Control (Olsen, et al.) reported that there were 2,751 outbreaks of foodborne disease recognized in the United States. There were 86,048 cases of illness and 29 deaths attributed to the consumption of contaminated food in these outbreaks. The questions that I will attempt to answer here are the following:

- What is an outbreak?
- How are foodborne illness outbreaks detected?
- Why should we investigate?
- How do the results get to CDC?

## Materials and methods

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In Minnesota a confirmed foodborne outbreak is defined as an incident in which two or more persons experience a similar illnesses after ingestion of a common food or meal and epidemiologic evaluation implicates the food or meal as the source of illness. Similar illnesses can be based on similar clinical presentations, isolation of the same pathogen from the cases, or through molecular subtyping of pathogens. Confirmed outbreaks may or may not be laboratory confirmed. Other states may use different definitions of a foodborne outbreak.

Foodborne outbreaks are identified through several methods. Acute, local outbreaks are often identified by victims or their healthcare providers. They may inform local or state public health officials of their suspicions. In Minnesota, the Minnesota Department of Health (MDH) has a toll-free hotline for individuals with complaints about a restaurant or food item. Individual complaints to the hotline about a restaurant or food item may precipitate restaurant notification or an immediate health inspection. All complaints are recorded and maintained in an electronic format which allows epidemiologists to recognize multiple complaints about a restaurant or food item. For example, in the summer of 1998, several calls to MDH led to the identification of two restaurant-associated outbreaks which ultimately led to the recognition of an international outbreak of *Shigella sonnei* infections associated with parsley imported from Mexico.

In addition, a single report of illness among two or more persons in different households may prompt an outbreak investigation. Many outbreaks have been detected from a single complaint reporting illness among a group of co-workers or friends who shared a common meal.

It is often difficult to identify possible causes of a person's foodborne illness because many people assume that their foodborne illness was caused by the last meal they ate or the last meal that they ate away from home. This is usually not the case. Foodborne illness often has an incubation period of 24 hours to 4 days. Also, because infection may occur at home or at a restaurant, it is difficult to identify the source of an individual's illness without an epidemiologic investigation.

Outbreaks may also be detected through laboratory surveillance. In Minnesota all *Salmonella*, *Campylobacter*, *E. coli* O157:H7, *Shigella*, and *Yersinia* that are isolated in medical clinic and hospital laboratories by law must be sent to the MDH Public Health Laboratory. The MDH laboratory then confirms the identity of the isolate, serotypes the isolate (if appropriate), and, in most, cases conducts pulsed-field gel electrophoresis (PFGE) molecular subtyping tests on the isolate.

An attempt is made to interview all cases of enteric illness identified through laboratory surveillance by staff from the MDH Foodborne, Vectorborne, and Zoonotic Diseases Unit. A standardized questionnaire is utilized. A five-day food history is obtained, as well as information on other possible exposures such as the following:

- Consumption of untreated water
- Animal contact
- Manure contact
- Travel
- Daycare

When multiple cases of the same PFGE subtype are identified through laboratory surveillance, a longer questionnaire may be administered. An epidemiologist from MDH will look for common exposures among the cases. The information gathered will be entered into a database and analyzed for statistical significance. If a common source is identified, other government agencies may become in-

volved in the investigation. Agencies such as the Minnesota Department of Agriculture (MDA), the United States Department of Agriculture (USDA), and the Food and Drug Administration (FDA) have regulatory authority over many of the products that may be identified by an epidemiologic investigation of a foodborne illness outbreak. These agencies are able to conduct traceback investigations of products to identify a source, as well as initiate recalls of products that may be implicated in a foodborne illness outbreak. If a restaurant is implicated, the Environmental Health Division of MDH and/or local public health agency sanitarians become involved in conducting restaurant inspections and interviews of foodhandlers.

Multi-state outbreaks of foodborne illness may be identified through the efforts of the Centers for Disease Control and Prevention (CDC). The Foodborne and Diarrheal Branch of CDC is involved in the investigation and prevention of foodborne illness. CDC's Emerging Infections Program Foodborne Diseases Active Surveillance Network (FoodNet) collects data about nine foodborne diseases in eight US sites to quantify and monitor foodborne illnesses.<sup>2</sup>

FoodNet is a sentinel network with the goal of producing more stable and accurate national estimates of the burden and sources of specific foodborne diseases in the United States through active surveillance and additional studies.<sup>3</sup> FoodNet also maintains a Foodborne Outbreak electronic mailing list that informs the foodborne investigators in state health departments of foodborne outbreaks identified in other states that have the potential to be multi-state outbreaks.

Another important tool that CDC provides for the identification of multi-state foodborne outbreaks is PulseNet. PulseNet is used to identify isolates with identical PFGE subtypes. Computer images of PFGE gels from suspected outbreaks are submitted to PulseNet and are posted on the PulseNet electronic mailing list. This allows the laboratories in other states to look for isolates with similar patterns to those identified as part of an outbreak within a state. When a multi-state outbreak is detected, epidemiologists from CDC may coordinate investigation efforts within and between the states involved.

## Results

In 1999 MDH confirmed 40 foodborne illness outbreaks. Of these, an etiology was identified 38 times. A food vehicle was identified 32 times (pork was identified three times, once as bacon, twice in deli sandwiches). The etiology of the pork-associated outbreaks included viral gastroenteritis, *Listeria monocytogenes*, and an outbreak of unknown etiology. Two of the 40 outbreaks were multi-state outbreaks. Seven hundred and seventy two com-

plaints were received at MDH or other agencies regarding possible foodborne illness within Minnesota. A total of 148 foodborne outbreaks were identified in the seven active FoodNet sites in 1999.

## Discussion and practical implications

In Minnesota and nationally, many resources are devoted to investigating foodborne illness. The justification for this effort is twofold: First, by investigating foodborne illness outbreaks, it is sometimes possible to recall a contaminated product and prevent additional illnesses or deaths. Second, only by conducting active surveillance and investigation will it be possible to determine the burden of illness caused by foodborne pathogens.

In Minnesota outbreaks of foodborne illness are primarily investigated by epidemiologists from MDH and environmental health specialists from local public health agencies or MDH. Additionally, the involvement of Minnesota medical providers and laboratories in the reporting of enteric pathogens is exemplary. This results in Minnesota having a strong centralized and standardized foodborne illness surveillance system. Even so, there are numerous reasons that foodborne illness can be undetected. These include, but are not limited to, the following:

- Ill persons may not seek medical attention.
- Medical providers may not order stool cultures.
- Medical laboratories may not be able to isolate pathogens from the stool.

Nationwide the surveillance system for foodborne illness varies widely among states. Even within FoodNet sites there is considerable variation in the ability to detect and investigate outbreaks of foodborne illness. Thus, it is difficult to provide accurate national estimates of the burden of foodborne illness.

## References

1. Olsen, SJ, et al., *Surveillance for foodborne disease outbreaks – United States, 1993-1997*. MMWR. 2000; 49(SS01):1-51.
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