A One Health Approach to Surveillance for Multistate Enteric Disease Outbreaks linked to Food and Animal Contact

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Outbreak Response and Prevention Branch

- Multistate Enteric Outbreak Investigations
  - Foodborne
  - Zoonotic (Animal Contact)
- Coordination with state and federal partners
- Consultations with state partners on single state investigations
- Consultations with other groups at CDC outside of the branch for outbreak response practices
What is an Outbreak?

- When two or more people get the same illness and investigation shows it came from the same contaminated food or drink, or contact with the same species of animal, the event is called a disease outbreak.
Multiple Types of Data Collected during an Investigation
Epidemiologic Evidence

Patterns in where and when people got sick, and past outbreaks caused by the same germ

Interviews with sick people to look for foods or other exposures occurring more often than expected

Discovery of clusters of unrelated sick people who ate at the same restaurant, shopped at the same grocery store, or attended the same event
Traceback Evidence

A common point of contamination in the distribution chain from farm to fork, identified by reviewing records collected from restaurants or stores where sick people ate or shopped.

Inspections in food production facilities, on farms, and in restaurants that identify food safety risks.
Laboratory Evidence

**FOOD & ENVIRONMENTAL TESTING**

The germ that caused illness is found in a food item collected from a sick person’s home, a retail location, or in the food production environment.

The same DNA fingerprint linking germs found in foods or production environments to germs found in sick people.
How much illness is attributable to animal contact?

- CDC illness estimates
  - *Campylobacter* species, *Cryptosporidium* species, Shiga toxin-producing *Escherichia coli* (O157, and non-O157), *Listeria monocytogenes*, nontyphoidal *Salmonella* species, and *Yersinia enterocolitica*

- Estimated proportion of illness caused by animal contact
  - Outbreak reports
  - FoodNet case-control studies

CID 2012:54 (Suppl 5) Hale et al
Illnesses attributable to animal contact

- 14% of all illnesses caused by 7 groups of pathogens were attributable to animal contact
- Estimated 445,213 illnesses annually for the 7 groups combined

![Bar chart showing the percentage of illnesses attributable to different pathogens.](chart.png)
Zoonotic Salmonellosis

- 1.2 million illnesses annually in the US
  - 11% of all *Salmonella* infections are attributable to animal contact
- Among enteric zoonoses, non-typhoidal *Salmonella* infections result in the highest morbidity and mortality
  - 48% of hospitalizations
  - 62% of deaths
- Children disproportionately affected

Hale et al., 2012
Detecting Outbreaks with PulseNet

- Subtyping enteric bacteria is essential to identifying highly disseminated outbreaks
- PulseNet laboratory network established in 1996
  - Over 80 participating laboratories in the US
  - 60,000+ isolates subtyped annually
- Bacteria collected from ill people undergo DNA “fingerprinting” using pulse-field gel electrophoresis (PFGE)

Bacteria with the same “fingerprint” are more likely to come from a common source
Detecting Outbreaks with PulseNet

- PFGE data from illness-causing bacteria are transmitted to CDC by states
- Monitored for temporal clusters
- When a cluster is identified, PulseNet notifies epidemiologists to investigate
Reporting Lag Time and Under-Reporting Multiplier

WGS Provides a Higher Resolution View of the Bacterial Genome

PFGE only gives information at a “cut” site via the banding pattern

WGS has the ability to give us information at nearly every position in the genome

Serotype, virulence, and resistance can be identified in one workflow

WGS allows us to assess genetic relatedness
Inclusion of Animal Isolates in Outbreak Investigation

- No systematic national surveillance for enteric pathogens in animals
- Animals may be tested during outbreak investigations
  - Isolates sequenced and compared to outbreaks-associated clinical isolates
Example: WGS Tree *Salmonella* Pomona Illness Outbreak

- Turtle farm A isolates (n=3)
- U.S. Clinical isolates (n=12)
- Chile isolates (n=2)
- Turtle water isolate (n=1)
- Turtle isolate (n=1)

SNP = single nucleotide polymorphism
Communication

- CDC makes the decision to communicate about a multistate outbreak with input from multiple partners
  - Consistent process for evaluating the need to warn consumers about ongoing multistate foodborne outbreaks.
  - CDC warns consumers when the investigation identifies a specific food/animal linked to illness, and there is a continuing risk to public health
  - Specific, clear, and actionable steps for consumers to take to protect themselves
Factors CDC Considers when Deciding on Communication

- Some factors CDC considers when deciding to warn consumers:
  - Illnesses continue to be reported (an outbreak is ongoing)
  - The data have identified a specific brand or type of food linked to illness
  - The number of new illnesses is increasing rapidly
  - Illnesses are unusually severe
  - A specific group of people is at higher risk for illness

- Informing the Public
  - If the decision is made to notify the public of an outbreak, CDC posts on their website
  - This announcement tells people what they can do to protect their health
Thank you!

For more information, contact CDC
1-800-CDC-INFO (232-4636)

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.