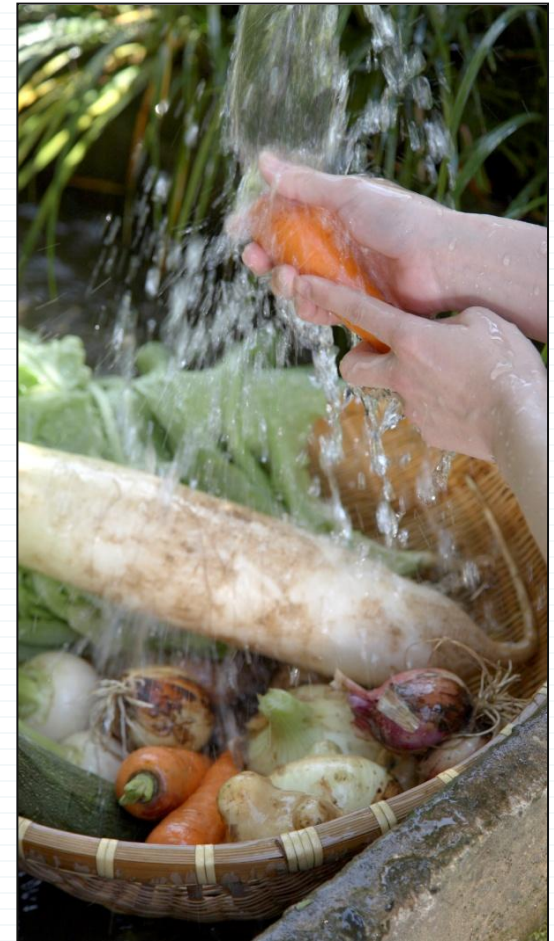
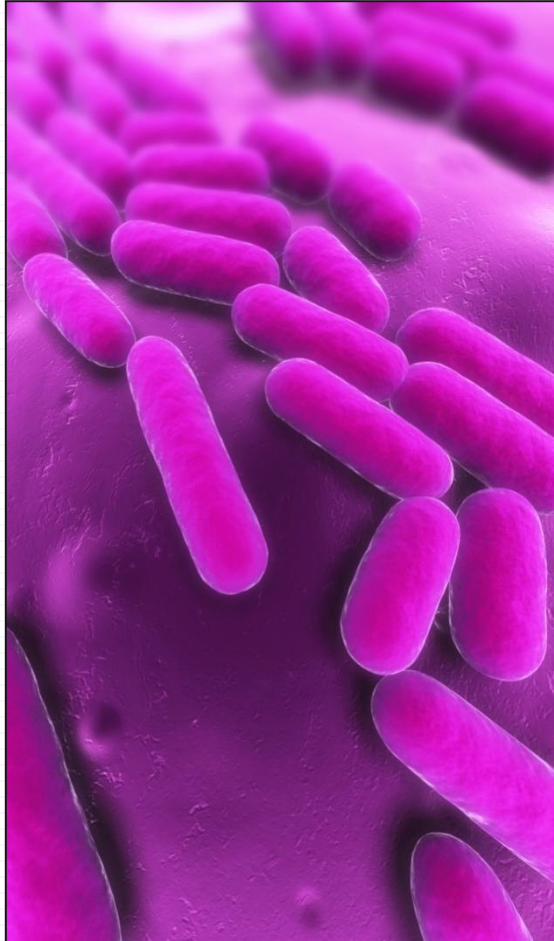


Food Safety | *Slides*



USDA. *USDA inspection of beef grinding*. 2006. Available at Wikimedia Commons. All other images copyright.



Overview

- **What is food safety?**
- **Foodborne pathogens from field to plate**
- **Outbreak investigation**
- **Chemical contaminants in food**
- **Prevention and education**
- **Reflection**

Essential questions

- What does it mean for our food to be “safe”?
How do we know when it is safe?
- Where, when and how is our food supply vulnerable to contamination?
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- What can be done to prevent contamination?
What should be done?
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- After a foodborne illness outbreak, how and why do public health professionals respond? What challenges do they face?



Overview

- **What is food safety?**

Foodborne pathogens from field to plate

Outbreak investigation

Chemical contaminants in food

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Reflection

What is food safety?

Definition

- Science of protecting our food supply from contamination by:
- Disease causing bacteria, viruses, chemicals and other threats to health



Greb P. *Fresh cut fruits and vegetables*. USDA ARS; 1999. www.ars.usda.gov/is/graphics/photos/. All other images copyright.

What is food safety?

Foodborne illness

- Contaminated food poses serious risks:
 - Fever
 - Nausea
 - Diarrhea
 - Chronic illness
 - Death
- 48 million people in the U.S. become sick each year; 3,000 die
- Vulnerable populations at greater risk



Overview

What is food safety?

- **Foodborne pathogens from field to plate**

Outbreak investigation

Chemical contaminants in food

Prevention and education

Reflection

Opportunities for contamination

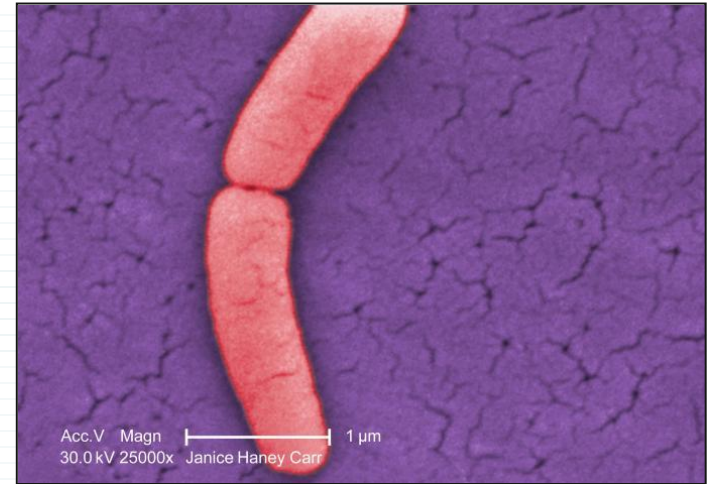


Production: Regis L.USDA ARS; 2006. www.ars.usda.gov/is/graphics/photos/.
Processing: USDA . *USDA inspection of beef grinding*. 2006. Available at Wikimedia Commons.
Consumption: Hmart. *Roland in Vancouver*. 2006. Available at Wikimedia Commons.
All other images copyright.

Foodborne pathogens from field to plate

Salmonella

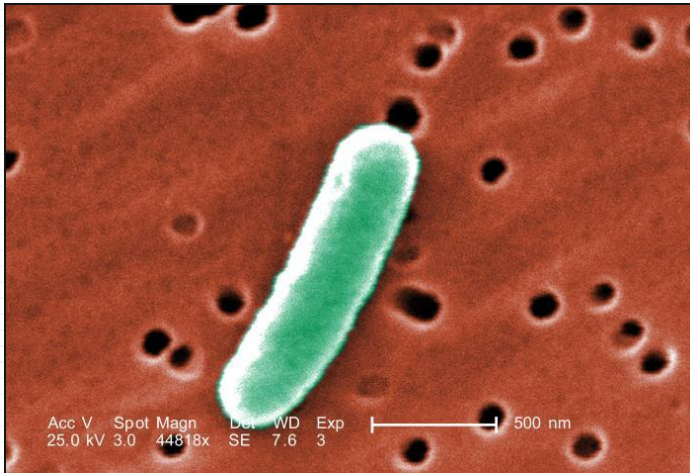
- Bacteria
- Lives in animal intestines
- Found in manure
- Spread by contaminated food, equipment



Salmonella: Carr JH. CDC; 2009. phil.cdc.gov/phil/.
Poultry: Ausmus S. USDA ARS; 2006. www.ars.usda.gov/is/graphics/photos/.

Foodborne pathogens from field to plate

E. coli



- Bacteria
- Found in manure
- Some strains cause illness



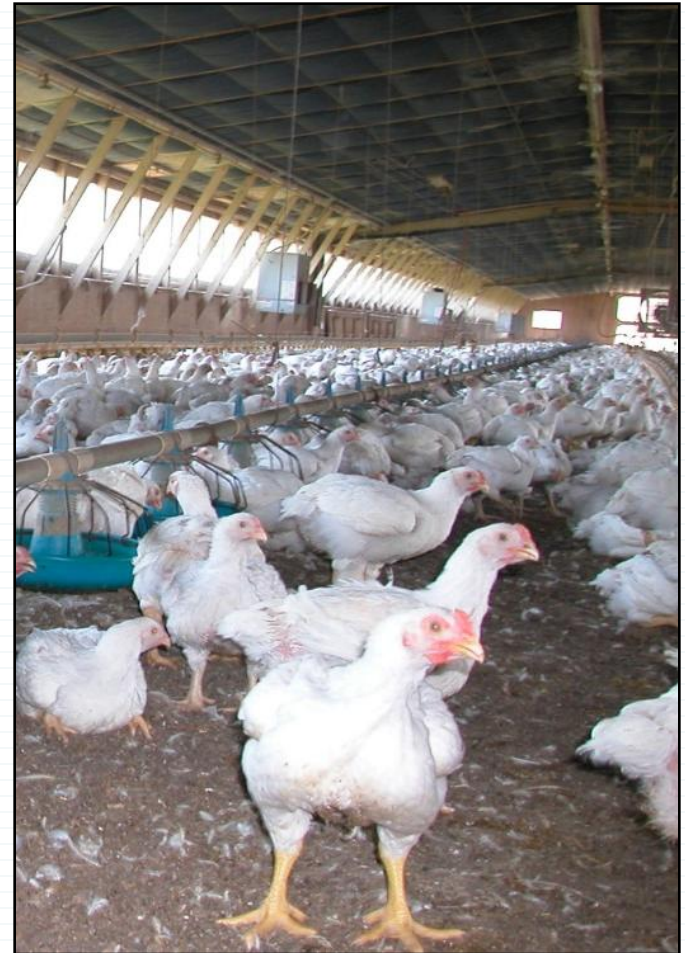
E. Coli : Carr J. CDC; 2008. phil.cdc.gov/phil/.

Swine: Lefebure R. USDA ARS; 2006. www.ars.usda.gov/is/graphics/photos/.

Foodborne pathogens from field to plate

Food production

- Exposure via farm workers
- Fertilizing crops with improperly treated manure
- Feeding grain to cattle may increase risk

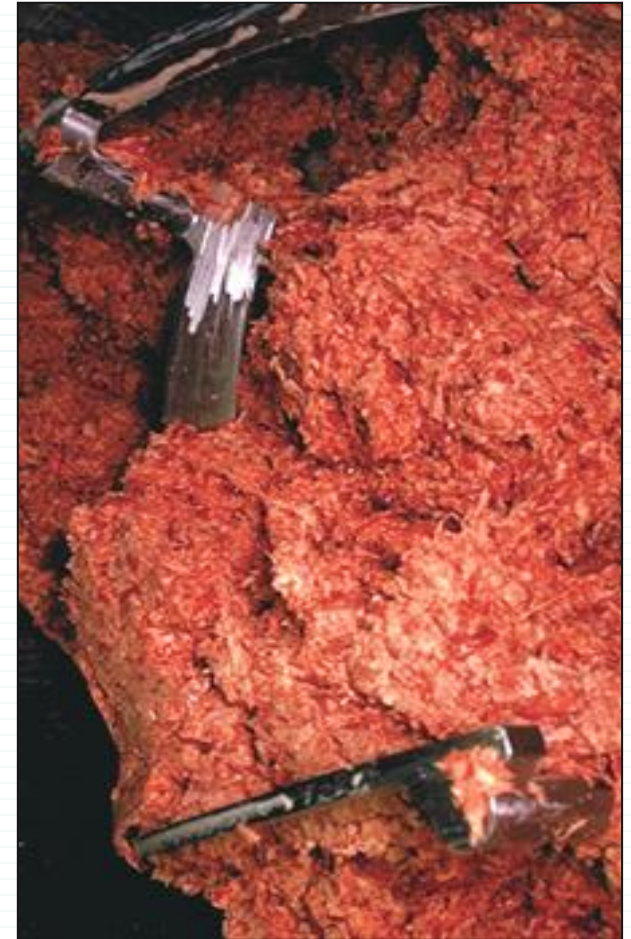


Socially Responsible Agriculture Project. *Chicken factory farm*. 2009. www.sraproject.org.

Foodborne pathogens from field to plate

Food processing

- Meat from many animals processed in single plant
- Contamination easily spread
- Tracing contamination is difficult, meat comes from many sources
- Large plants ship products over broad area, increasing risk of widespread exposure



USDA. *USDA inspection of beef grinding*. 2006. Available at Wikimedia Commons.

Foodborne pathogens from field to plate

Distribution

- Food vulnerable during transport, storage
- Must be kept under controlled conditions
- Containers may be source of contamination



Milk truck: Mabel J. Issaquah, WA - Darigold 03. 2009. Available at Wikimedia Commons. All other images copyright.

Foodborne pathogens from field to plate

Preparation and handling

- Bacteria (e.g. *Campylobacter*) can spread via contaminated cutting board
- Viruses (e.g. *Norovirus*, common cause of “stomach flu”) can spread via infected person preparing food



Image copyright.



Overview

What is food safety?

Foodborne pathogens from field to plate

- **Outbreak investigation**

Chemical contaminants in food

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Outbreak investigation

What is an outbreak?

- Two or more cases of foodborne illness caused by:
 - Same contaminant
 - Same food origin
 - Same illness
- Health departments across the U.S. report 400-500 outbreaks each year
- CDC conducts surveillance of foodborne outbreaks nationwide

Outbreak investigation

Your role

- You are an official from the local health department
- You will determine the food and the pathogen likely responsible for an outbreak of foodborne illness

Outbreak investigation Scenario

Wednesday, June 5:

A local community organization held a fundraising crab feast for cancer research.

Roughly 100 people attended the event.



Wpopp. *Blue crab on market in Piraeus*. 2008. Available at Wikimedia Commons.

Outbreak investigation

Scenario (continued)

CRAB FEAST MENU

FRESH STEAMED CRABS

EGG SALAD

MACARONI SALAD

CREAMY COLESLAW

ICE CREAM

Outbreak investigation

Scenario (continued)

Thursday, June 6:

A woman who had attended the crab feast woke up feeling ill.

She scheduled an appointment with her doctor.

She described her symptoms as nausea, fever, chills and body aches.

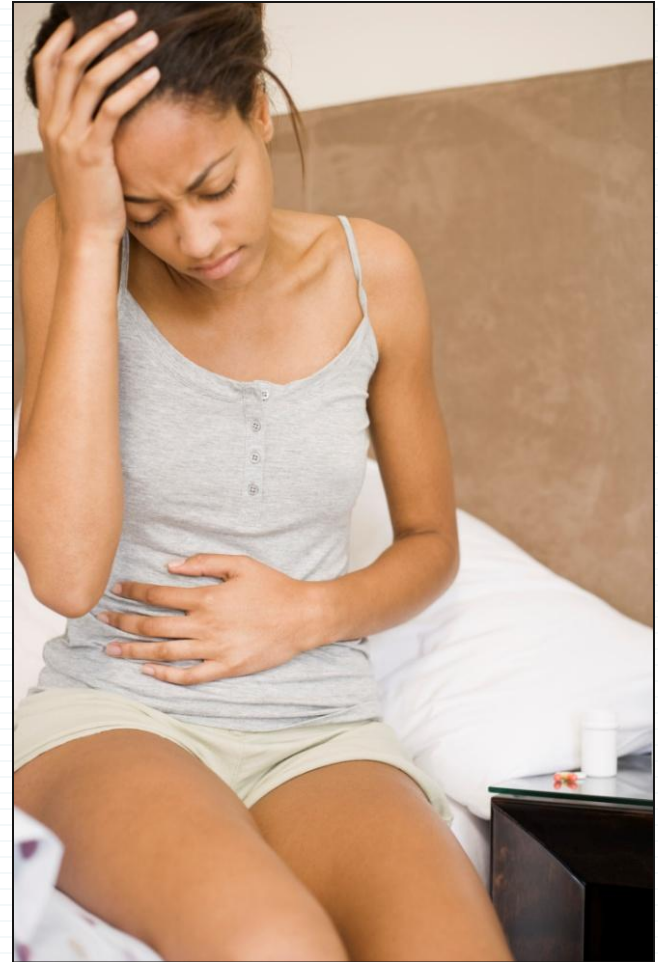


Image copyright.

Outbreak investigation Scenario (continued)

Friday, June 7:

The physician noticed that during the morning of her shift she had seen several people with similar symptoms.

She began asking questions about their previous activities, and found that they had all attended the crab feast.

The doctor called the local health department to report observations.

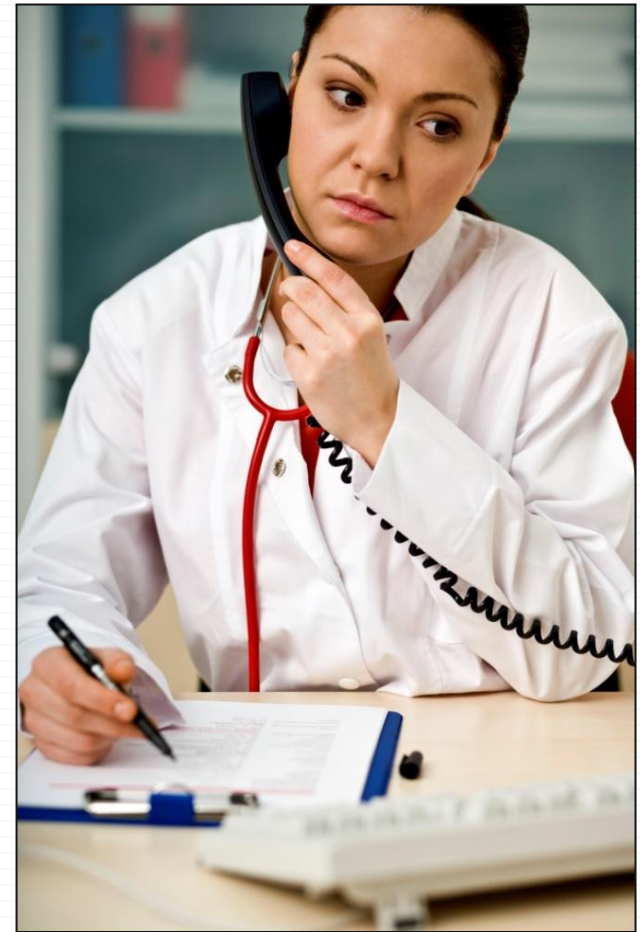


Image copyright.

Outbreak investigation

Start of the investigation

The health department immediately began an investigation...

(continue reading in your handouts)

Outbreak investigation

Attack rate

- *Calculate the attack rate among the people who attended the fundraiser.*

Number of people who got sick

Number of people who responded to the questionnaire

Outbreak investigation

Attack rate, by food

- *Calculate the attack rate, categorized by the food consumed, among the people who attended the fundraiser.*

Number of people who ate this food
and got sick

Number of people who ate this food

Outbreak investigation

Epidemic curve, incubation time

- Epidemic curve: Graph, over time, of how many people first reported feeling ill
- Incubation period: Time between exposure to a pathogen and the onset of illness
- *Graph the epidemic curve, then determine the mode and median incubation period*

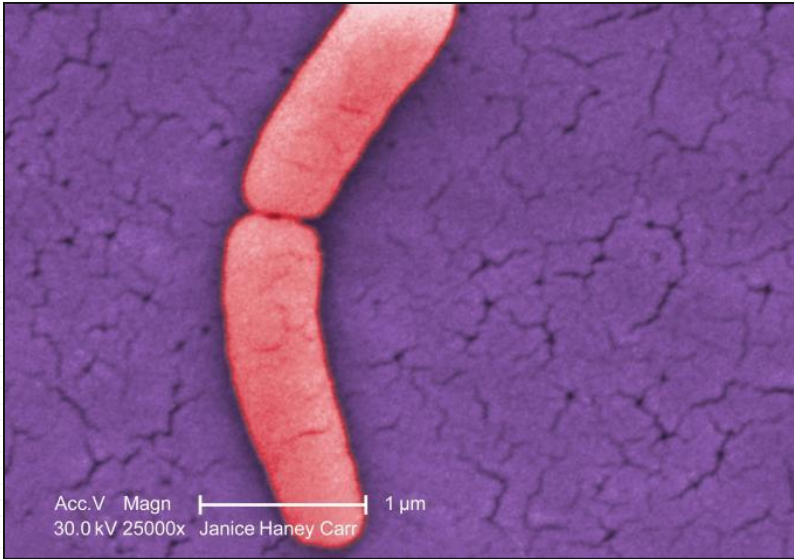
Outbreak investigation

Identifying the pathogen and contaminated food

- Which pathogen do you suspect caused the illness?
- Which food do you suspect was contaminated with the pathogen?
- Consider:
 - Symptoms of people who became ill
 - Attack rates by food consumed
 - Median incubation period
 - Descriptions of each pathogen

Outbreak investigation

Identifying the pathogen and contaminated food



Contaminated food:
Egg salad



Pathogen:
Salmonella

Salmonella: Carr JH. CDC; 2009. phil.cdc.gov/phil/.

Egg salad: Steiner N. *Egg salad*. 2005. Available at Wikimedia Commons.

Outbreak investigation

Reasons for uncertainty

- Inaccurate recall
- Stronger immunity
- Dose-response
- Incomplete data

Outbreak investigation

Conclusion

- Outbreaks end when exposure stops
- Results of the investigation used to prevent further outbreaks



OVERVIEW

What is food safety?

Foodborne pathogens from field to plate

Outbreak investigation

- **Chemical contaminants in food**

Prevention and education

Reflection

Chemical contaminants in food

Pathways of contamination

- Pollution from human, natural sources can contaminate food through air, water, soil
- Plants may absorb chemicals as they grow
- Food animals may ingest contaminants in feed and water

Chemical contaminants in food

Pesticides



Left: pmartins. 2009. Available at Flickr Commons.

Center: Image copyright.

Right: O'Rear C. *Spraying Pesticide in California*. 2008. Available at Wikimedia Commons.



Chemical contaminants in food

Highest pesticide levels: Top 12 foods

1. Apples
2. Celery
3. Strawberries
4. Peaches
5. Spinach
6. Nectarines (imported)
7. Grapes (imported)
8. Sweet bell peppers
9. Potatoes
10. Blueberries (domestic)
11. Lettuce
12. Kale / collard greens

Chemical contaminants in food

Mercury



- Heavy metal
- Contaminates seafood
- Causes long-term damage
- Major sources:
 - Burning coal
 - Mining
 - Incinerating waste
 - Natural events

Palmer A. *Smoke Stacks*. Library of Congress; 1942. Available on Flickr Commons.

Chemical contaminants in food

Arsenic

- Common IFAP practices can contaminate our food
- Animal manure containing arsenic can contaminate crops, groundwater
- Long-term exposure can increase risk of:
 - Cancer
 - Heart disease
 - Diabetes
 - Neurological deficits in children



Overview

What is food safety?

Foodborne pathogens from field to plate

Outbreak investigation

Chemical contaminants in food

- **Prevention and education**

Reflection

Prevention and education

Commercial practices: HACCP

- **Hazard Analysis and Critical Control Point** process
- Prevention-based approach
- Identifies and monitors food safety hazards at critical control points along supply chain
 - ❑ Checking temperature
 - ❑ Checking sanitary conditions
 - ❑ Testing for pathogens



USDA ARS. *Food safety inspectors at a poultry processing plant.*

Prevention and education

HACCP limitations

- Not a guarantee against contamination
- Must be used along with other food safety measures, e.g. employee training, sanitation, proper handling
- Difficult for small businesses to adopt HACCP
- HACCP only mandatory for meat, poultry, seafood and juice products

Prevention and education

Household practices: What can you do?

The USDA recommends four steps to help prevent foodborne illness at home:

- **Clean:** Wash hands, countertops, and utensils
- **Separate:** Keep raw meat separate from ready-to-eat food, such as salad or fruit, when cooking and when storing in the refrigerator
- **Cook:** Use a food thermometer to make sure food reaches the proper temperature and is heated thoroughly
- **Chill:** Within two hours of cooking, chill leftover food in the refrigerator; thaw meat in the refrigerator



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Reflection

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