Food Safety Is a Winnable Battle

Patricia M Griffin, MD
Chief, Enteric Diseases Epidemiology Branch
Consumer Food Safety Education Conference
Arlington, Virginia
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Public Health Winnable Battles, United States

- **Food safety**
- Healthcare-associated infections
- HIV
- Motor vehicle injuries
- Nutrition, physical activity, and obesity
- Teen pregnancy
- Tobacco
CDC Is a Non-Regulatory Agency

Non-regulatory agency

- Tracks human illness
- CDC

Regulatory agencies

- FDA
- USDA

- Regulate food and food animals
CDC provides the vital link for improving food safety by linking practices on farms, in production plants, and in kitchens to ill people.
Food Safety Is a Winnable Battle

- **CDC’s role**
  - Providing data and analyses to guide policy
  - Advancing technology for faster, better control and prevention
  - Detecting, investigating, and stopping outbreaks

- **Food safety challenges**
  - *Salmonella*
  - Norovirus
  - Antibiotic resistance
  - Poultry
  - Produce
  - Raw dairy products

- **Food safety successes that inspire and guide**
  - *Vibrio vulnificus*
  - *E. coli O157*
  - *Listeria*
FoodNet
(Foodborne Diseases Active Surveillance Network)

48 million people (15% of US population)

10 sites: states of Connecticut, Georgia, Maryland, Minnesota, New Mexico, Oregon, and Tennessee, and parts of California, Colorado, and New York
## Food Safety Progress Report for 2013

<table>
<thead>
<tr>
<th>Disease Agents</th>
<th>Percentage change in 2013 compared with 2006–2008</th>
<th>2013 rate per 100,000 Population</th>
<th>2020 target rate per 100,000 Population</th>
<th>CDC estimates that...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter</td>
<td>![Sad] 13% increase</td>
<td>13.82</td>
<td>8.5</td>
<td>For every Campylobacter case reported, there are 30 cases not diagnosed</td>
</tr>
<tr>
<td>Escherichia coli O157</td>
<td>![Neutral] No change</td>
<td>1.15</td>
<td>0.6</td>
<td>For every E. coli O157 case reported, there are 26 cases not diagnosed</td>
</tr>
<tr>
<td>Listeria</td>
<td>![Neutral] No change</td>
<td>0.26</td>
<td>0.2</td>
<td>For every Listeria case reported, there are 2 cases not diagnosed</td>
</tr>
<tr>
<td>Salmonella</td>
<td>![Neutral] No change</td>
<td>15.19</td>
<td>11.4</td>
<td>For every Salmonella case reported, there are 29 cases not diagnosed</td>
</tr>
<tr>
<td>Vibrio</td>
<td>![Sad] 75% increase</td>
<td>0.51</td>
<td>0.2</td>
<td>For every Vibrio parahaemolyticus case reported, there are 142 cases not diagnosed</td>
</tr>
<tr>
<td>Yersinia</td>
<td>![Neutral] No change</td>
<td>0.36</td>
<td>0.3</td>
<td>For every Yersinia case reported, there are 123 cases not diagnosed</td>
</tr>
</tbody>
</table>
Estimated Annual Number of Foodborne Illnesses
Caused by Known Pathogens
Acquired in the United States

- 9.4 million illnesses
- 56,000 hospitalizations
- 1,300 deaths

Emerg Infect Dis 2011
Foodborne Disease Outbreaks, United States, 1973–2013

~500 outbreaks per year

~1,100 outbreaks per year

~800 outbreaks per year
Attribution: Estimated Percentage of Foodborne Illnesses Caused by Known Pathogens Due to Each Food Category, 1998–2008

- Produce: 46% Illnesses, 23% Deaths
- Meat and Poultry: 29% Illnesses, 22% Deaths
- Dairy and Eggs: 20% Illnesses, 15% Deaths
- Fish and Shellfish: 6% Illnesses, 6% Deaths

Emerg Infect Dis 2013
Connects cases of illness nationwide to quickly identify outbreaks, including many that would otherwise not be detected.

PulseNet
National Molecular Subtyping Network for Foodborne Disease Surveillance
PulseNet Helps Detect Outbreaks

Public health laboratories analyze bacterial DNA from ill patients

PFGE patterns

National database at CDC

PFGE = pulsed-field gel electrophoresis
PulseNet Data Analysis Involves Searching for Clusters

- PulseNet teams at CDC and in states search for similar PFGE patterns
- When a cluster is identified, they report it to epidemiologists
  - who look for a common source

Each row is PFGE pattern from one isolate. Box shows cluster of 4 rows with same pattern.
Detecting, Investigating, and Responding to Multistate Outbreaks

- Multistate outbreaks detected more frequently

- Median number of illnesses per multistate outbreak
  - peaked at 69 in 1990s
  - declined to 35 in 2000s

Number of illnesses per outbreak is declining because of rapid detection coupled with rapid public health action.
22 New Food Vehicles Identified in US Multistate *Salmonella* Outbreaks Since 2006

- bagged spinach
- carrot juice
- peanut butter
- broccoli powder on a snack food
- dog food
- pot pies/frozen meals
- canned hot dog chili sauce
- fresh hot chili peppers
- black pepper
- tahini sesame paste
- raw cookie dough
- fresh papaya
- frozen mamey fruit pulp
- bologna
- in-shell hazelnuts
- pine nuts

- par-cooked, broiled chicken livers
- scraped tuna
- cashew cheese
- cucumbers
- sugar cane juice
- chia powder
Multistate Outbreak Investigations, 2014

Peanut, Almond Butters Recalled for Possible Salmonella Contamination After Four Sickened
BY NEWS DESK | AUGUST 19, 2014
Six brands of peanut butter and almond

Salmonella Stanley Outbreak Linked to Raw Cashew Cheese
January 4, 2014 by Linda Lanier

The Centers for Disease Control and Prevention are investigating a Salmonella Stanley outbreak linked to raw cashew cheese produced by The Cattared Kitchen of West Sacramento, California. Cashew cheese is a non-dairy product made from raw cashews. The product has been recalled.

Salmonella Outbreak Linked To Chia Seed Powders, CDC Says

E. Coli Cases Prompt Massive Ground Beef Recall
BY JONEL ALECCIA

E. coli outbreak linked to sprouts sickens 17 people
By CNN Staff
updated 1:17 PM EDT, Wed June 11, 2014
Multistate Outbreaks Have Major Impact

- Many require national-level response
- Often reveal important gaps in food safety systems
  - result in system-wide improvements
- Major implications for food safety policy in government and industry
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- **Food safety challenges**
  - *Salmonella*
  - *Norovirus*
  - Antibiotic resistance
  - Poultry
  - Produce
  - Raw dairy products

- **Food safety successes that inspire and guide**
  - *Vibrio vulnificus*
  - *E. coli O157*
  - *Listeria*
The Fall and Rise of Reported *Salmonella* Infections, United States, 1920–2012

- Decreased partly because we separated human feces from food and water
- Increased partly because agriculture became industrialized

*CDC, National surveillance data*
Nontyphoidal *Salmonella* Infection

- **95%**: diarrhea (sometimes bloody), fever, abdominal pain
  - Incubation period typically 8-48 hours
  - Ill ~1 week

- **5%**: invasive disease
  - Bacteria in the blood (sepsis), or
  - in usually sterile sites, e.g., lining of brain (meningitis), bones (osteomyelitis)

*Salmonella* invading cultured human cells
Incidence of *Salmonella* Infections, by Year, FoodNet, 1996–2013

Many more illnesses occur than are reported
Norovirus

- Estimated to be #1 cause of foodborne illness in United States
  - Causes vomiting with diarrhea
  - Ill for 2 days

- Carried by humans (not animals)

- Most common source of foodborne norovirus outbreaks is foods eaten raw, contaminated by an ill food handler
  - Survey of ill restaurant workers found that 1 in 5 reported working while sick with diarrhea and vomiting

Scallan EID 2011, Hall MMWR 2014, Carpenter JFP 2013
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Data on 18 antibiotic resistance threats
- 2 transmitted commonly by food and with animal reservoirs

ANTIBIOTIC RESISTANCE THREATS in the United States, 2013
Major Antibiotic Resistant Threats in Foodborne Bacteria

- *Salmonella* resistant to ceftriaxone or ciprofloxacin or ≥5 classes of antibiotics
- *Campylobacter* resistant to ciprofloxacin or azithromycin
Major Antibiotic Resistant Threats in Foodborne Bacteria

- **Salmonella** resistant to ceftriaxone or ciprofloxacin or ≥5 classes of antibiotics

- **Campylobacter** resistant to ciprofloxacin or azithromycin
The use of antibiotics is the single most important factor leading to antibiotic resistance around the world.
Antibiotics in Food Animals

- A large proportion of antibiotics sold in the United States are used in food animals

- FDA-approved to
  - Treat disease
  - Prevent infection
  - Promote growth

- Most have been used to promote growth, not animal health
  - This purpose is no longer allowed in EU countries
  - In December 2013, FDA issued guidance intended to voluntarily phase out use for promoting growth by 2017
Ceftriaxone Resistance Among *Salmonella* Heidelberg from Humans, Chickens, Retail Chicken, and Retail Ground Turkey, United States, 1996–2013
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Poultry Is the Food Most Commonly Implicated in Foodborne Disease Outbreaks

In the past decade, poultry has been responsible for about a quarter of outbreak-associated illnesses, hospitalizations, and deaths.
Percentage of Retail Meat Samples Yielding *Campylobacter*

Source: NARMS Retail Meat 2011 Annual Report
Percentage of Retail Meat Samples Yielding Salmonella

Retail chicken: 12%
Ground turkey: 12%
Ground beef: 2%
Pork chop: 1%

Source: NARMS Retail Meat 2011 Annual Report
Multistate Outbreak of *Salmonella* serotype Heidelberg Infections from Chicken, 2013–2014

- 634 sickened
  - 29 states
- 38% hospitalized

[Graph showing number of persons by week of illness onset for 2013 and 2014, with states color-coded for cases.

[Map showing states with cases, color-coded for case numbers: 1-4 cases, 5-9 cases, 10-19 cases, 20 or more cases.

[CDC website link: www.cdc.gov/salmonella/heidelberg-10-13/index.html]
Multistate Outbreak of *Salmonella* serotype Heidelberg Infections from Chicken, 2013–2014

(continued)

- **Outbreak strain found on**
  - Chicken from 3 slaughter/processing facilities of same producer
  - Breast, wings, and whole birds

- **Improvements needed at many levels**
  - Farms
  - Processing plants
  - Warehouse store that roasted whole birds
  - Food handlers in restaurants
  - Consumers
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- Meat and Poultry: 22% (22% illnesses, 29% deaths)
- Dairy and Eggs: 20% (15% illnesses, 5% deaths)
- Fish and Shellfish: 6% (6% illnesses, 6% deaths)

Emerg Infect Dis 2013
# Listeria Infection by Risk Group

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<th>Risk Group</th>
<th>Typical illness</th>
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<td>Elderly</td>
<td>Bloodstream infection or meningitis</td>
</tr>
<tr>
<td>Persons with immunocompromising conditions</td>
<td>Bloodstream infection or meningitis</td>
</tr>
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</table>
| Pregnant women and their newborn infants             | Pregnant women: Flu-like illness with fever, then miscarriage or stillbirth  
Newborns: Bloodstream infection or meningitis        |
Listeria Outbreak from Cantaloupe, 2011

- Largest U.S. outbreak of listeriosis
- 147 sickened, 33 died, 1 miscarried
- Rapid identification of food source using PulseNet and the Listeria Initiative questionnaires prevented ~36 illnesses and 7 deaths

Patients in 28 states
Environmental Assessment at Farm, Cantaloupe Outbreak, 2011

- Processing facility most likely source of contamination

- *Listeria* outbreak strains were found on cantaloupes and surfaces at the facility

- **Deficiencies**
  - cantaloupes not cooled after harvest
  - equipment designed and used improperly
  - sanitation inadequate
Multistate Outbreak of *Salmonella* serotype Enteritidis Infections Linked to Mung Bean Sprouts

- 68 people sickened
  - 10 states

- 26% hospitalized
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Outbreaks due to Nonpasteurized Dairy Products, United States, 1993–2006

- 56 milk outbreaks
  - 82% associated with raw milk

- Compared with pasteurized milk outbreaks, raw milk outbreaks had
  - 11x higher hospitalization rate (because all caused by bacteria)

- Estimated risk of outbreak is ~150x higher per pound for raw than pasteurized dairy products

Langer, Emerg Infect Dis 2012; 18:385-91
Average Annual Number of Outbreaks Due to Raw Milk, United States, 1993–2012

Langer, et al, EID 2012 and unpublished data
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Foodborne *Vibrio vulnificus* Infection

- **Rare disease**
  - But ~50% of patients die

- **Signs**
  - Fever
  - Sepsis (very low blood pressure)
  - Skin lesions

- **High risk conditions**
  - Liver disease
  - Alcoholism
  - Diabetes

- **Raw oysters are most important source**
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Sequence of Events in *Escherichia coli* O157 Infection

- E. coli ingested
  - 3-4 days
  - non-bloody diarrhea, abdominal cramps
    - 1-2 days more
      - bloody diarrhea
        - 5-6 days more
          - resolution
          - HUS

Mead, Lancet 1998; HUS = hemolytic uremic syndrome
Hemolytic Uremic Syndrome (HUS)

- Anemia (low red blood cell count)
  - with fragments of red blood cells
- Low platelet count
- Kidney failure

*Shiga toxin-producing* Escherichia coli (STEC)
E. coli O157 Infections Have Declined

- **1994**: Declared an adulterant in ground beef
- **1996-2000**: Meat inspection system overhauled
- **2002**: Large ground beef recall; many companies began testing all lots of beef trim for E. coli O157

Incidence data is from FoodNet
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Listeria Incidence, 1983–2012

Incidence (per million pop)
Listeria Incidence and Percentage of Ready-to-Eat Meats Positive, 1983–2012

% Processed Meat

Incidence (per million pop)

% processed meat positive

incidence

1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011

0 1 2 3 4 5 6 7 8 9

0 1 2 3 4 5 6 7 8 9
Listeria Foodborne Illness

What foods are risky?

When it comes to *Listeria*, some foods are more risky than others. Meet some of the other foods where *Listeria* is known to hide.

- Raw Sprouts
- Soft Cheeses
- Raw Milk (unpasteurized)
- Deli Meats and Hot Dogs (cold, not heated)
- Smoked Seafood
Progress in Reducing Foodborne Illness, 1996-2012

Progress in Reducing Foodborne Illness, 1996 - 2012

- **Listeria**: 42% decrease
- **E. coli: 0157**: 30% decrease
- **Campylobacter**: 22% decrease

Result of decreases in 2010 alone =
- Over 500,000 illnesses averted
- About $100 million in direct medical savings
Summary

- **CDC**
  - Analyzes data to guide policy
  - Advances technology for prevention
  - Finds outbreaks that identify food safety problems

- **Food safety challenges**
  - *Salmonella*
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- **Food safety successes that inspire and guide**
  - *Vibrio vulnificus* in California
  - *E. coli* O157
  - *Listeria*
“In 2015, the World Health Organization will dedicate World Health Day to food safety, to catalyse collective government and public action to put measures in place that will improve safety of food from farms, factories, street vendors, and kitchens.”

– Dr. Margaret Chan, Director-General of WHO, Lancet, November 19, 2014
“It’s only the Ericksons, so why don’t you just use the recalled hamburger meat.”
For more information please contact Centers for Disease Control and Prevention
1600 Clifton Road NE, Atlanta, GA 30333
Telephone, 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348
E-mail: cdcinfo@cdc.gov Web: www.cdc.gov

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.