

**What's for dinner?
Current issues in foodborne
illness**

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Today's Goals

- **What's new in foodborne disease epidemiology**
- **Understand some of the forces that cause epidemiology of foodborne illness to be constantly changing**

Changing epidemiology of foodborne disease

- **Developments in lab techniques**
 - **New pathogens; new ways to detect outbreaks**
- **Antibiotic use (humans and animals)**
- **Changes in human population**
- **Food safety regulation changes (HACCP)**
- **Globalization of food supply**
- **Centralized production**
- **Changing food preferences**

What is foodborne disease?

- Infections
 - Intoxications
 - Nutritional deficiencies
 - Obesity?
-
- “Enteric illness” = diarrheal disease; can be from food, water, animal contact, person to person transmission

Types of foodborne / enteric illness

Infection

Bacteria:

Campylobacter,
Listeria, Salmonella,
STEC (O157 and non-
O157), *Vibrio, Yersinia*

Viruses:

Norovirus,
Hepatitis A virus

Parasites:

Cryptosporidium,
Giardia

Intoxication

Clostridium

botulinum

C. perfringens

Staph. aureus

Bacillus cereus

More than vomit and diarrhea

- *Listeria monocytogenes* – miscarriage, 20% mortality in immunocompromised
- STEC O157 (aka E. coli O157)– Hemolytic uremic syndrome
- *Campylobacter* – Guillian-Barré syndrome
- *C. botulinum* – respiratory failure, death
- *Vibrio vulnificus* – amputations, death

Determining the source of illness: “Foodborne” Diseases???

STEC O157/non-O157

Salmonella

Campylobacter

Giardia

Cryptosporidium

Shigella*

Norovirus*

Food?

Water?

Person to person?

Animal contact?

*Shigella and norovirus do not have animal reservoirs

Non-foodborne outbreaks that looked like foodborne outbreaks

- ***Salmonella* Montevideo and contact with baby birds in 2005 and 2006 and 2007 !**
 - mostly kids < 5 yrs
- **Prolonged norovirus outbreak at hunting lodge due to faulty well/septic system**
- **Hepatitis A cluster in Garfield County**
 - Play equipment at fast food restaurant?

Reported Cases of Enteric Pathogens – Colorado, 2005-7

Organism	2005	2006	2007
<i>Campylobacter</i> species	868	830	817
<i>Salmonella</i> species	582	624	563
<i>Giardia lamblia</i>	534	554	580
<i>Shigella</i> species	170	238	122
Shiga-toxin <i>E. coli</i>	83	119	165
<i>Cryptosporidium</i>	50	77	216
Hepatitis A	49	44	27
<i>Listeria monocytogenes</i>	6	13	11
<i>Cyclospora</i>	1	0	1
<i>Clostridium botulinum</i>	0	0	5

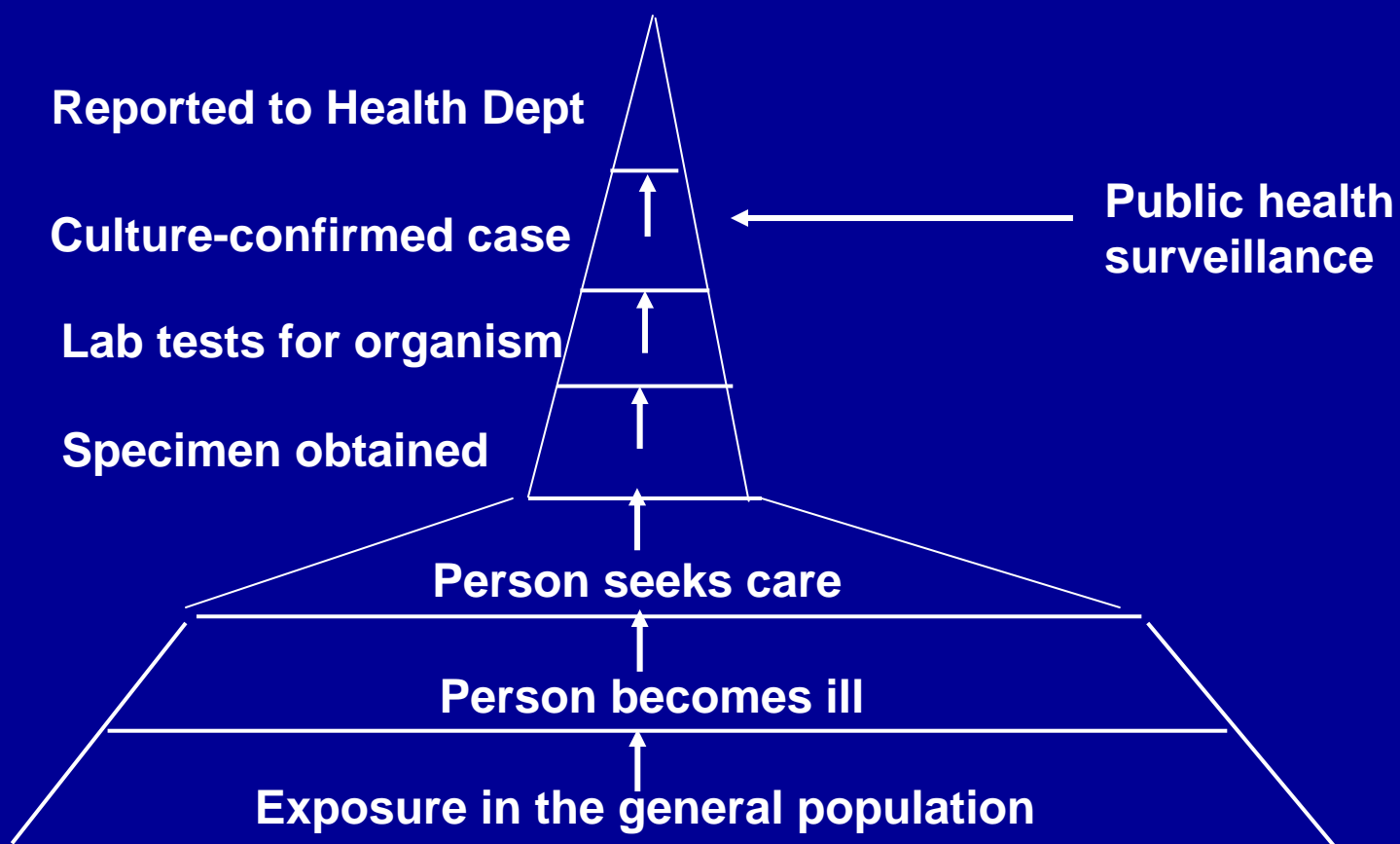
Note:

Individual cases of illness caused by the following organisms are NOT reportable (but outbreaks are):

- *Bacillus cereus*
- *Clostridium perfringens*
- *Staphylococcus aureus*
- Norovirus

Source: CEDRS database

Pyramid of reporting

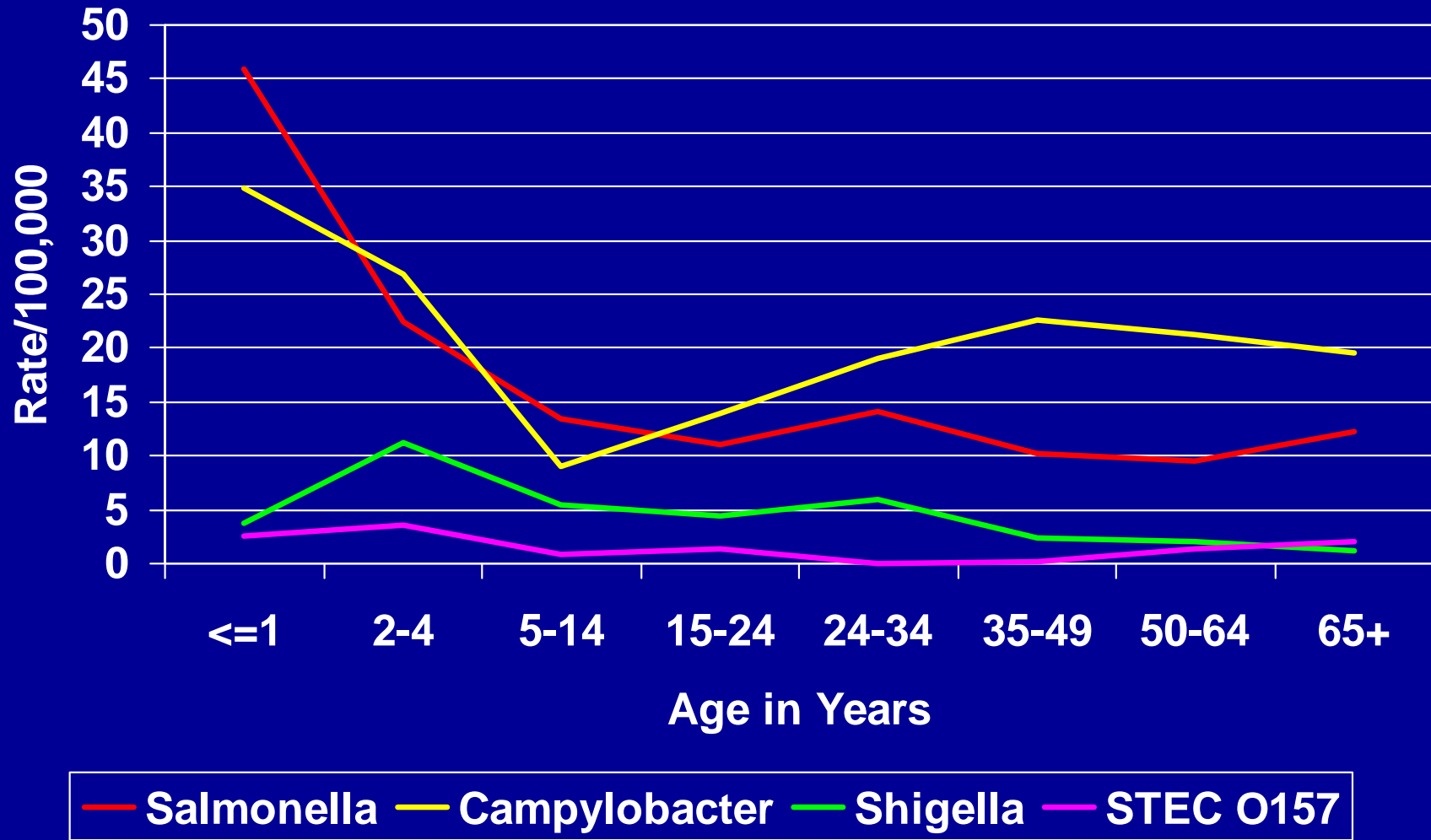


Foodborne illness in the U.S.

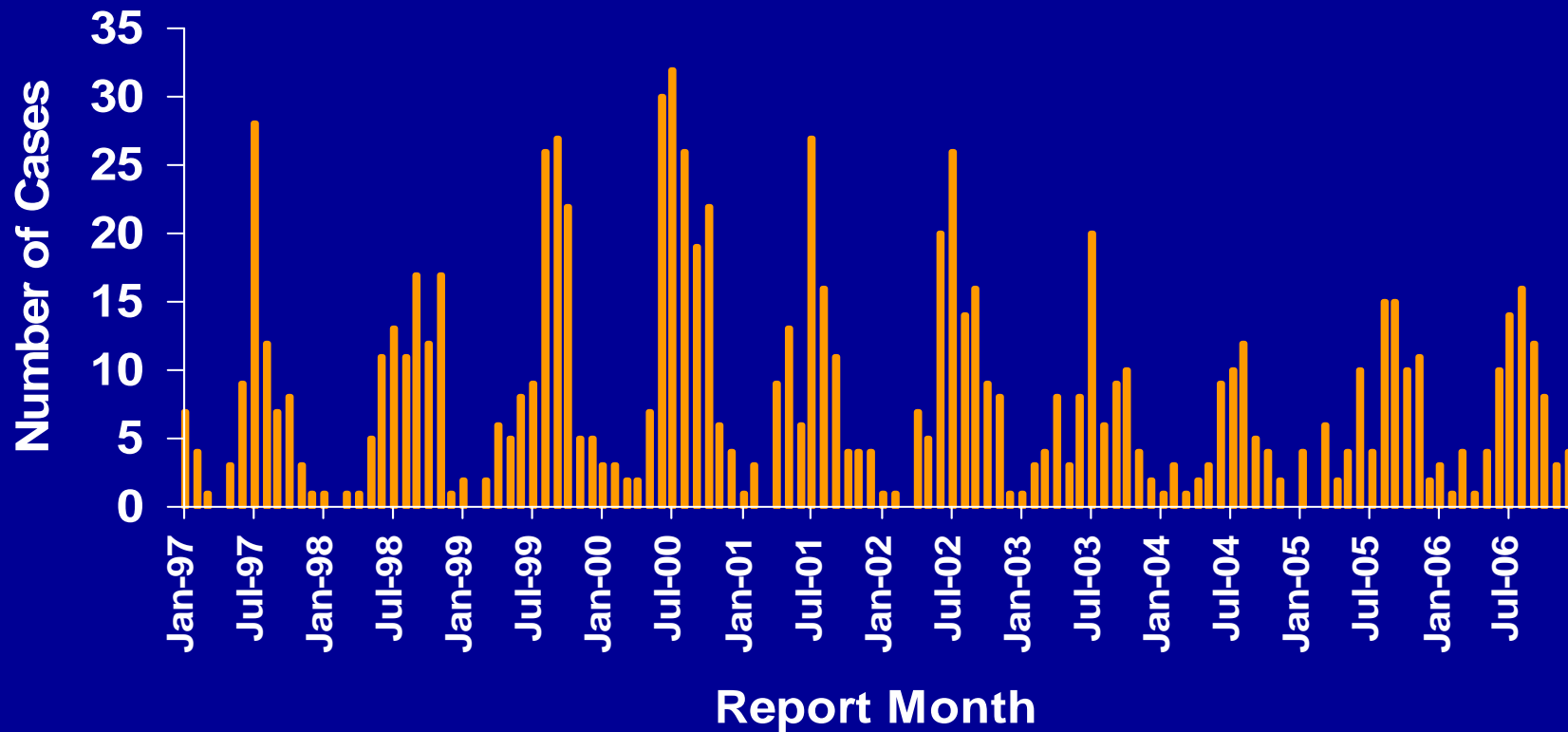
- **Estimates of morbidity/mortality**
 - 76 million cases/yr
 - 5,000 deaths
- **Costs incurred: \$7.7 - 8.4 billion**
 - Ill persons
 - Food producers
 - National economy

Recommended: Mead et al, Food-Related Illness and Death in the US. Emerg Inf Dis 1999; 5(5),607-625.

Rates of Enteric Illness by Age Group Cases Reported in Denver Metro Area, 2005



Reported Cases of STEC O157 in Colorado



Hepatitis A Rates, Colorado, 1983-2007

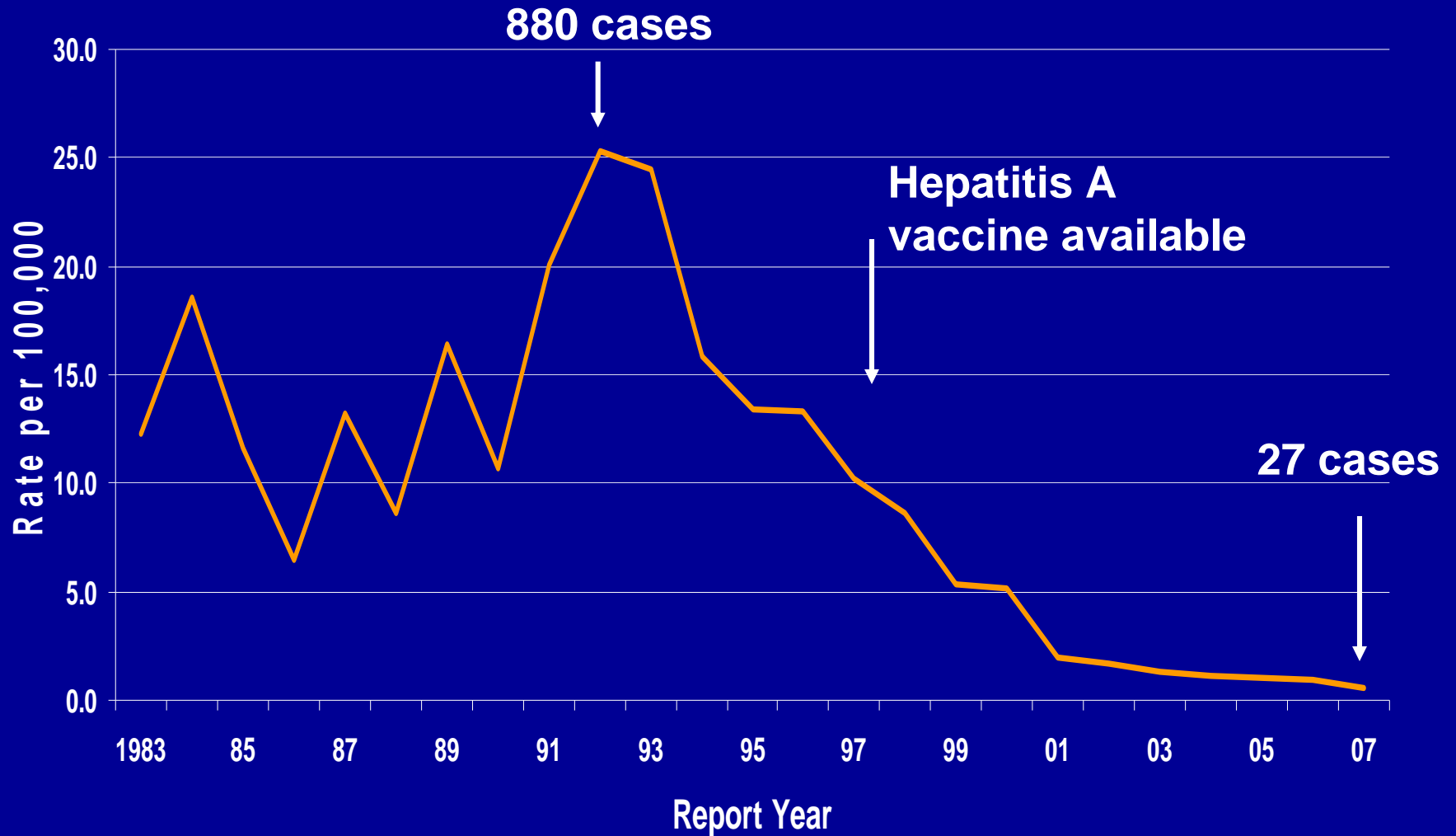
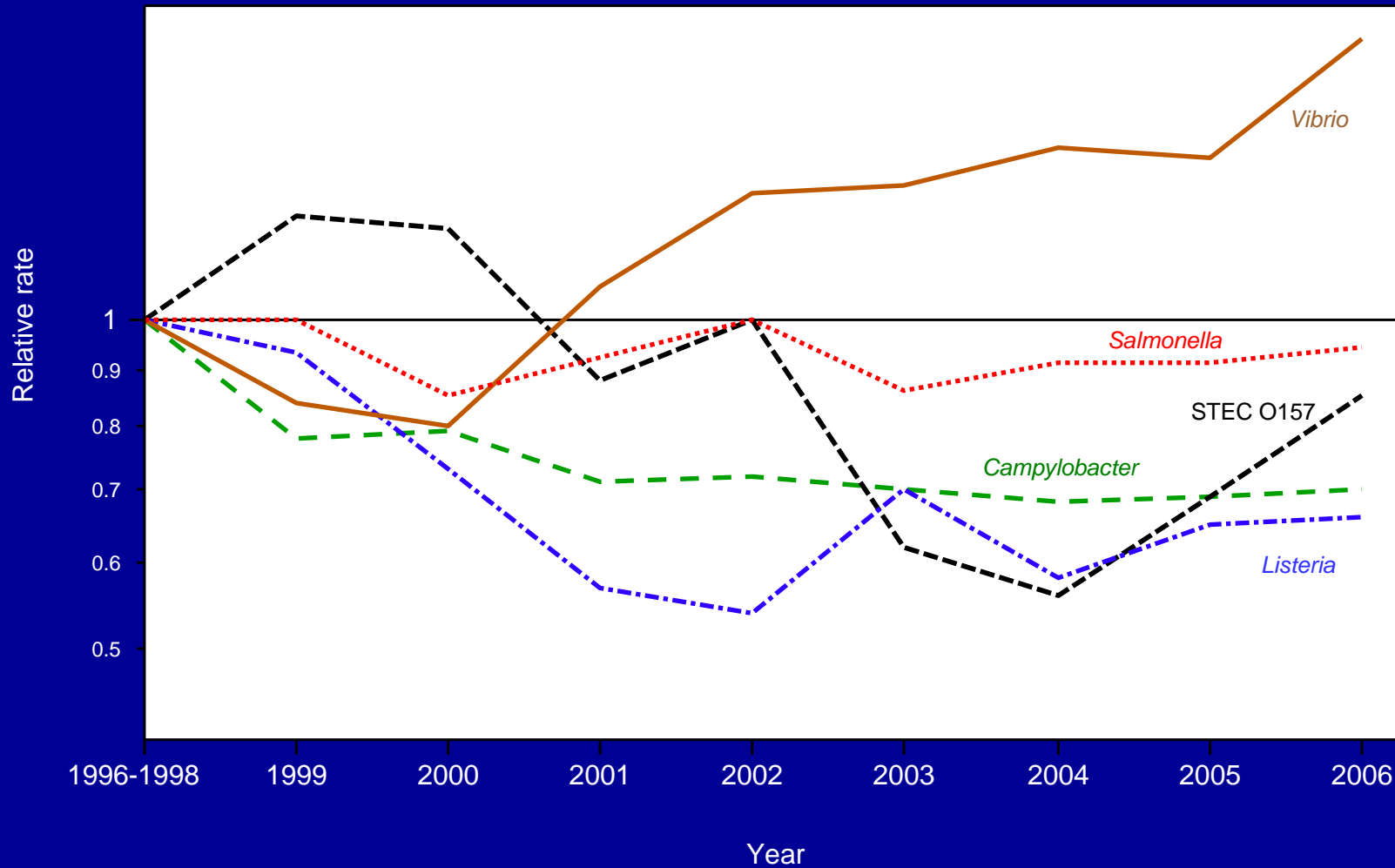
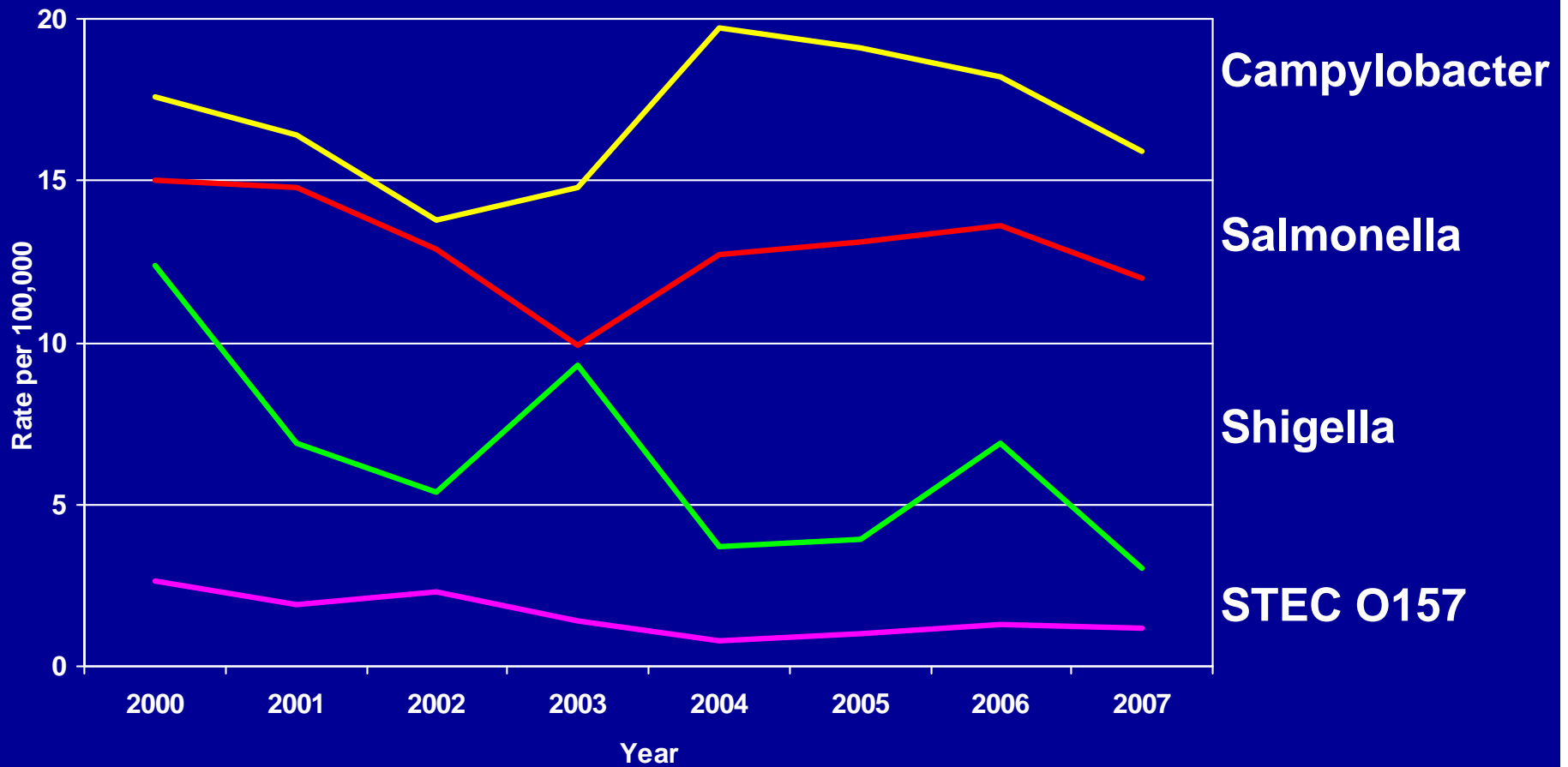


Figure 1. Relative rates compared with 1996–1998 baseline period of laboratory-diagnosed cases of infection with *Campylobacter*, STEC O157, *Listeria*, *Salmonella* and *Vibrio*, by year



Incidence of Infection with FoodNet Pathogens, Metro Denver* (2000-2007)



*Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson Counties; 2000 rates annualized

Detecting and investigating outbreaks

- **“Complaint call” outbreaks**
 - Often a defined cohort (e.g. wedding party)
 - Defined exposure period
 - May not know disease agent
 - Reported by providers, public, schools, employers, child care centers...
- **“Surveillance” outbreaks**
 - Agent is known
 - Rarely a defined cohort
 - Any exposure possible, ask about all exposures during incubation period

Why investigate foodborne / enteric illness?

- **Remove an ongoing source of infection**
 - (foodhandler/ contam. food / water / animal)
- **Correct faulty food prep practices**
- **Prevent further person-person spread (health care, child care, food workers, etc)**
- **Educate to prevent spread /new outbreaks**
- **Understand enteric illness better**
 - New vehicles
 - New routes of transmission
- **Drive regulatory change**

What is an outbreak?

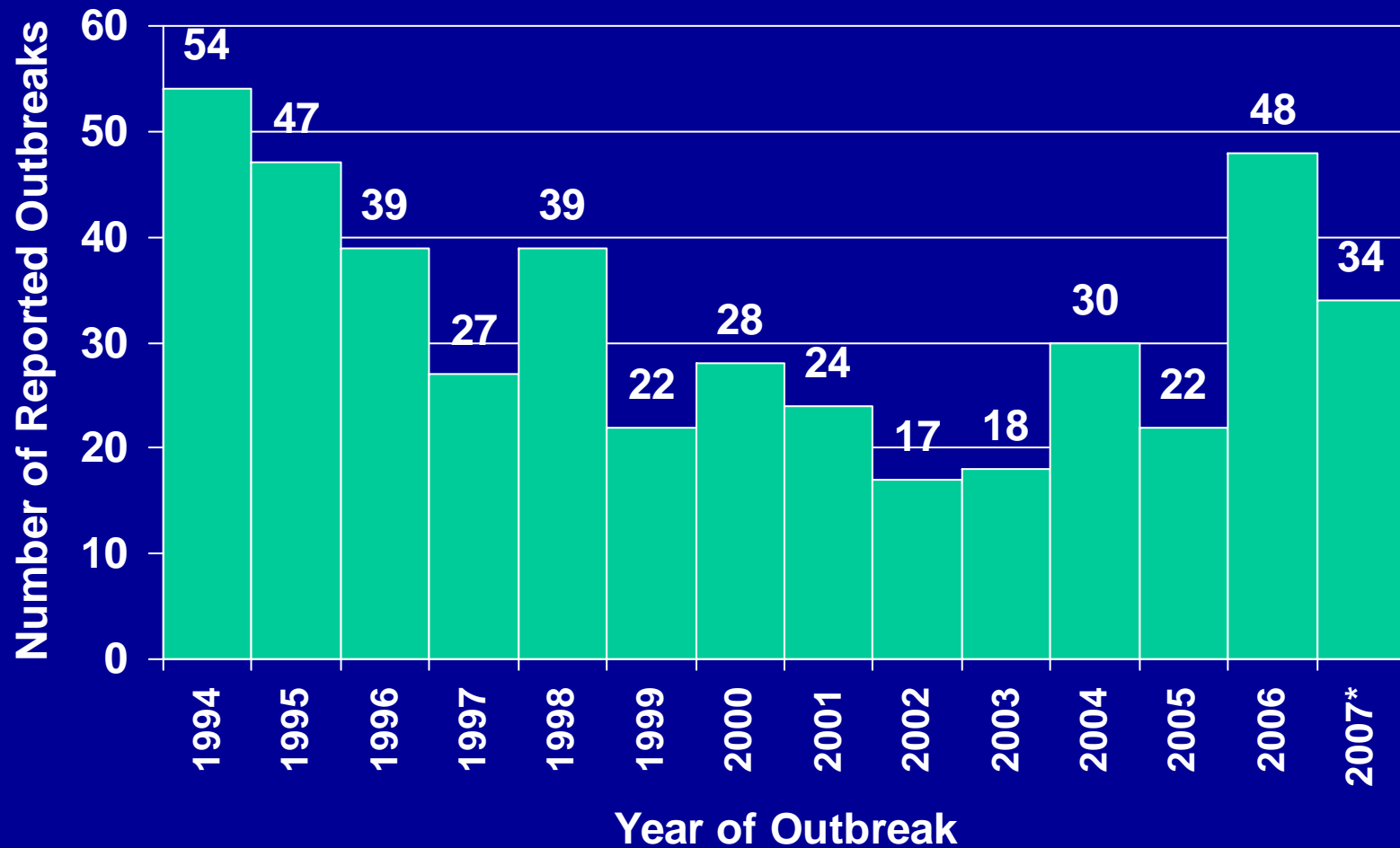
CDC definition of a foodborne outbreak:

“Two or more cases of a similar illness resulting from the ingestion of a common food in the United States”

Operationally:

- Priority on commercially prepared foods**
- Priority when 2 or more people from different households**
- Priority when illness more severe (e.g. bloody diarrhea)**

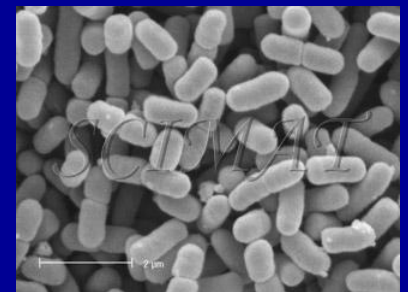
Reported FB Outbreaks in Colorado, by Year



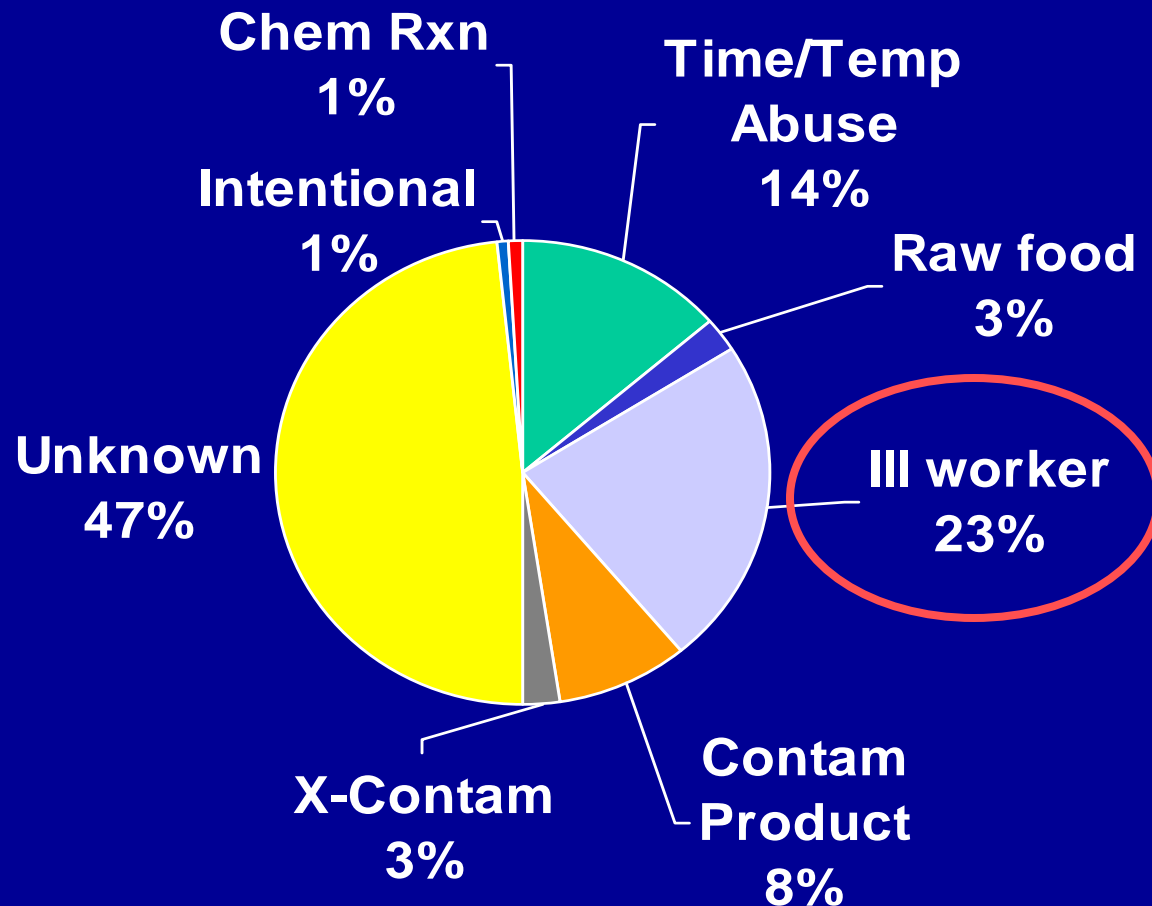
*2007 data preliminary

Agents causing foodborne outbreaks in CO, 2003-2006 (N=118)

Viral (norovirus)	45% (53)
Bacterial infection	27% (32)
11 Campylobacter, 11 Salmonella	
6 STEC O157, 4 Shigella	
Bacterial intoxication	12% (14)
Other	5% (6)
5 Scombroid	
1 chemical?	
Unknown	11% (13)



Errors Causing Colorado Foodborne Illness Outbreaks (2003-6, N=118)



Norovirus Outbreaks due to Ill Workers

- **Michigan, 2006**
 - Worker vomited into kitchen waste bin
 - Kept working
 - ~360 illnesses
- **Data mounting about persistence of virus and duration of viral shedding**
- **Need to exclude ill workers for longer (72hrs?)**
- **Surface decontamination with bleach in 25ft radius of vomiting**
- **May need to close restaurant for cleaning**



Eat your veggies?

Recent Produce-associated Outbreaks

- **Tomatoes**
 - At restaurants, Roma, sliced on sandwiches
- **Lettuce**
 - Bagged lettuce, shredded on tacos
- **Spinach**
- **Scallions**
- **Sprouts**



Why produce?

- **Many opportunities for contamination**
 - lots of handling; irrigation water; fertilizer; grown near animals
- **Changes in food processing / distribution**
 - Shipping longer distances
 - Produce from multiple sources mixed together
- **Nature of produce itself**
 - Good growth medium; low salt; high sugar
- **More and more produce imported**

2007: Year of the Food Recall

- Peanut butter ~425 cases
- Veggie Booty ~65 cases, mostly kids
- Turkey pot pies >300 cases to date
- Ground beef
 - Cargill ~45 cases + 2 CO
 - Topps (21.7 million lbs) ~40 cases
- Frozen pizza at least 21 cases

What is going on here?

- **Changes in food processing / food preferences**
- **Better surveillance**
- **Regulatory issues**
- **???**

Result of Increased Centralization of Food Processing

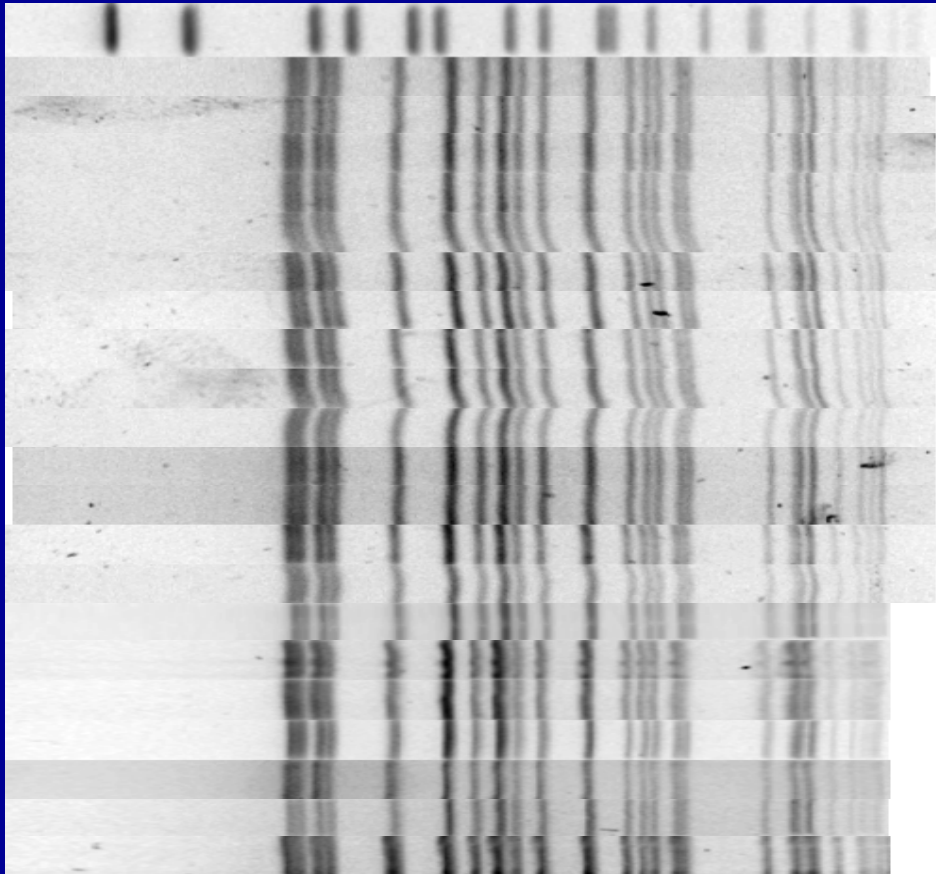
- **Small deviations from good food handling practices may have large implications**
- **Results in a “new” kinds of outbreak:**
 - **Large number of dispersed victims**
 - **Lower attack rates (< 5% of those who eat the contaminated food)**
 - **Larger proportion of cases among the elderly and immune-compromised**

New Methods in Outbreak Detection

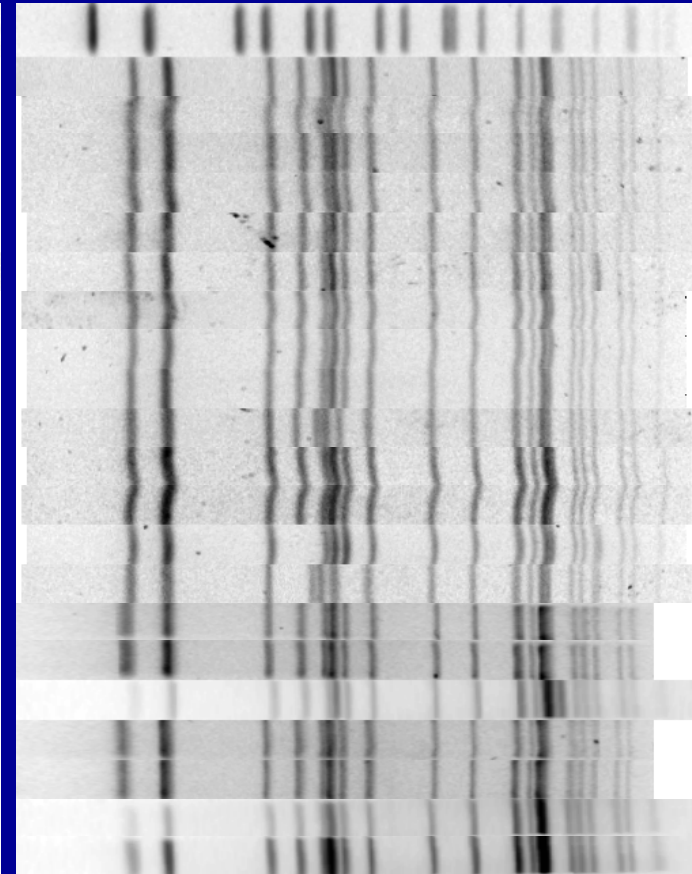
- **Lab techniques**
 - **PFGE (pulsed field gel electrophoresis)**
 - **Genetic sequencing: used for primarily for viruses (norovirus and hepatitis A)**
- **PulseNet: National databases for sharing PFGE patterns between states and CDC**
- **Allow epidemiologists to recognize that geographically separated cases may have common source**
- **Greater efforts to coordinate multi-state investigations**

Matching PFGE Patterns for Colorado and Minnesota Case-Isolates of *Escherichia coli* O157

PFGE: *Xba* 1



PFGE: *Bln* 1

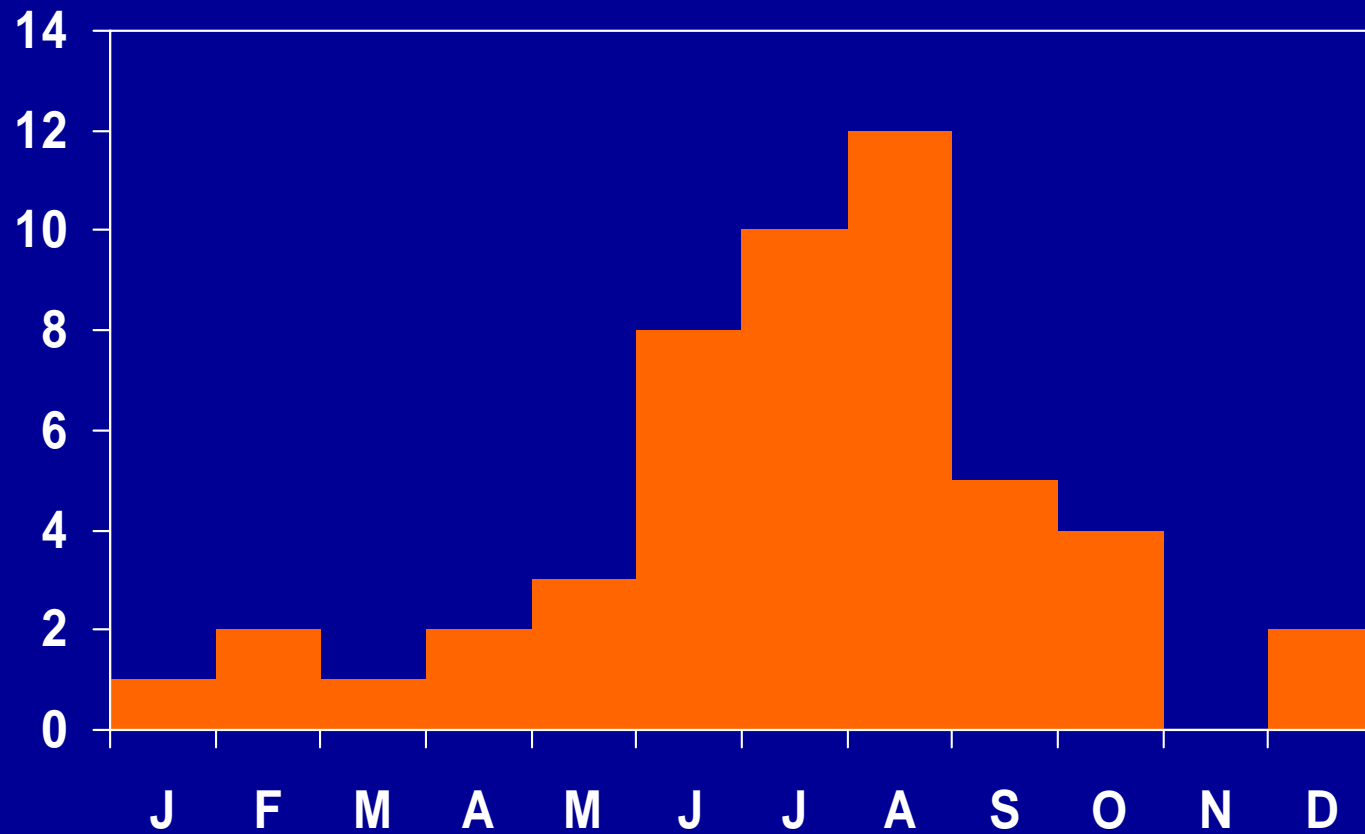


Case

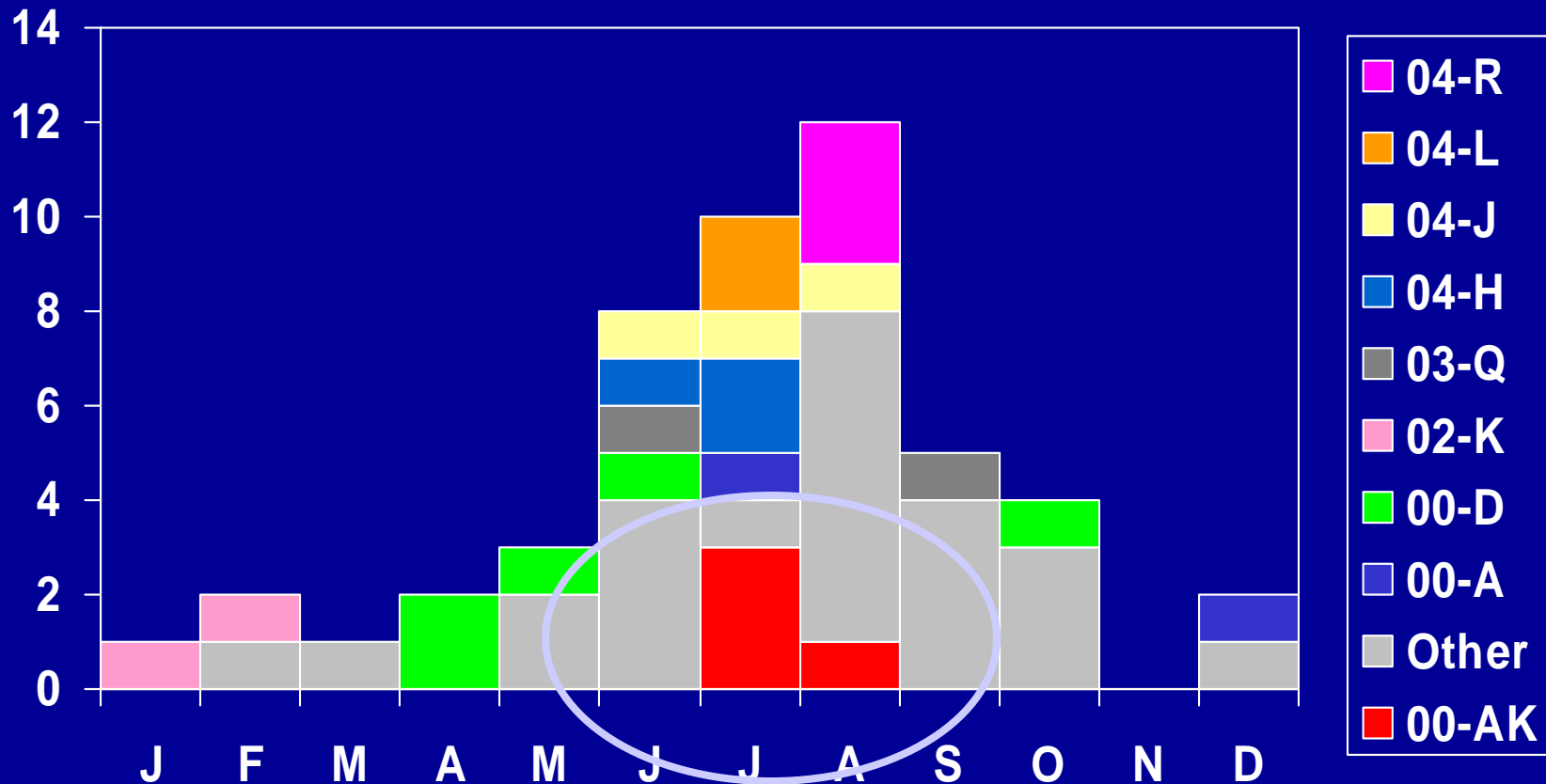
- CO 1
- CO 2
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- CO 10
- CO 11
- CO 12
- CO 13
- MN 1
- MN 2
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- MN 4
- MN 5
- MN 6

MN 7

Colorado *E. coli* O157 cases in 2004



PFGE Patterns of Colorado *E. coli* O157 cases in 2004

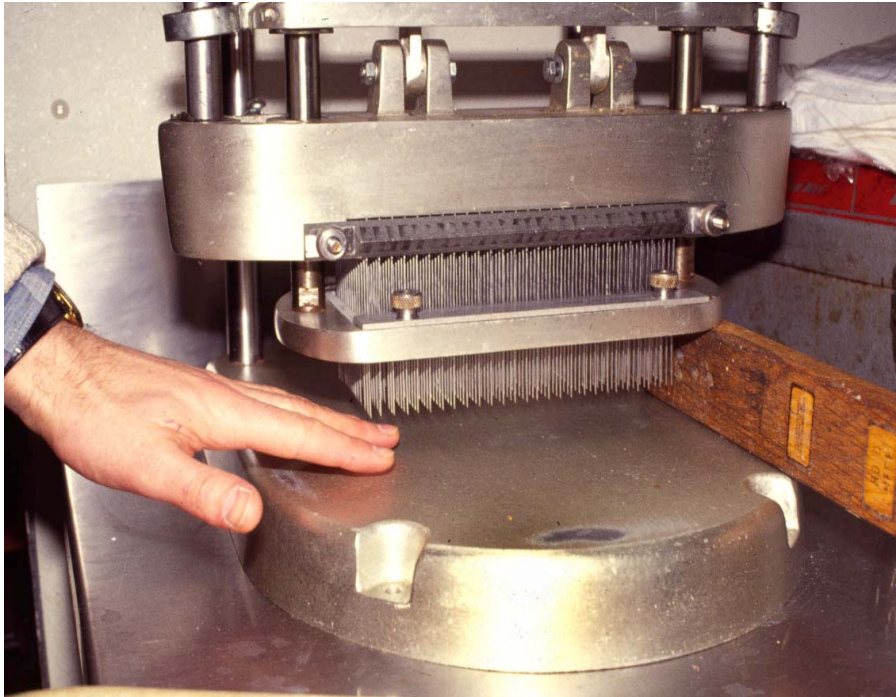


Regulatory Issues

- **Increased collaboration between FDA, USDA, CDC and states**
- **FDA/USDA regulation is complex**
- **Agencies severely under-funded**
- **Recall authority not strong**
- **Little ability to track products**
- **Inability to share detailed info with public health**

Other new (and not so new) vehicles

- **“Needled meat”**
 - **Needles or blades used to inject meat with tenderizers or flavorings**
 - **STEC O157:H7 Outbreak in Metro Denver Associated with Consuming Needled Steak – July 2004**
 - **Investigation led to recall of meat**
 - **Changes in labeling and cooking regulations in progress by USDA**



Other new (and not so new) vehicles

- **Unpasteurized milk**
 - “Cow share” programs
 - Belief that raw milk is healthier
- ***Campylobacter* outbreak, Dec 2005**
 - 22 cases, 6 lab confirmed
 - No evidence of any problems at dairy
 - Milk testing found milk very low bacterial counts
 - People still became ill

So, what is for dinner?

Individual consumers:

- **Handwashing, handwashing, handwashing**
- **Cook, Clean, Separate, Chill**
- **Buy pasteurized milk/juice or consume at own risk**
- **Consider avoiding certain foods if in a high risk group**
- **Washing produce may not help**

So, what is for dinner?

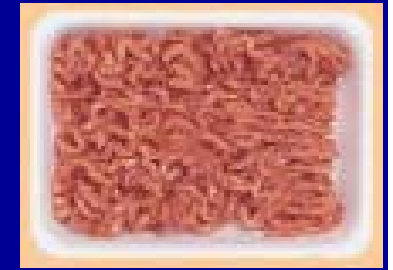
State/federal level

- **Enhanced recall authority**
- **Better product tracking**
- **Leafy greens action plan / other produce safety initiatives**
- **Possible single food safety agency?**
- **Allow reg agencies to share findings with public health**

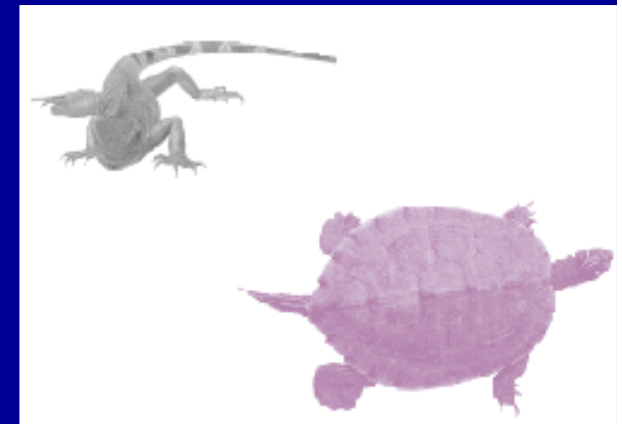


Alfalfa Sprouts

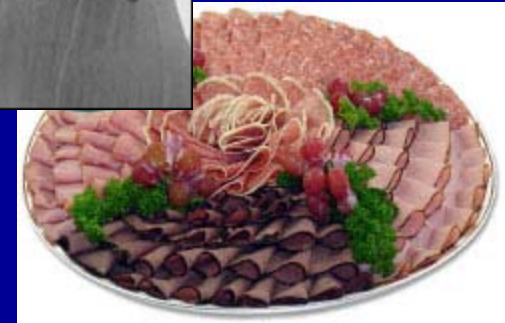
Risky Foods/ Risky Critters



- Sprouts
- Undercooked meats
- Raw shellfish/seafood
- Undercooked eggs
- Any unpasteurized milk/juice
- Reptiles
- Other animals (cattle, chicks...)



Groups at Risk for Particular Pathogens



Pregnancy and *Listeria*

- Deli meats
- Unpasteurized milk/cheese

Liver Disease and *Vibrio*

- Raw oysters
- Seawater contact with bare skin



THANK YOU!

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