

***E. coli* O157:H7 --
Illness trends and recent data from outbreak
investigations, United States**

**Shiga Toxin –Producing *E. coli*
Addressing the Challenges, Moving Forward with
Solutions. USDA/FSIS
April 9, 2008**

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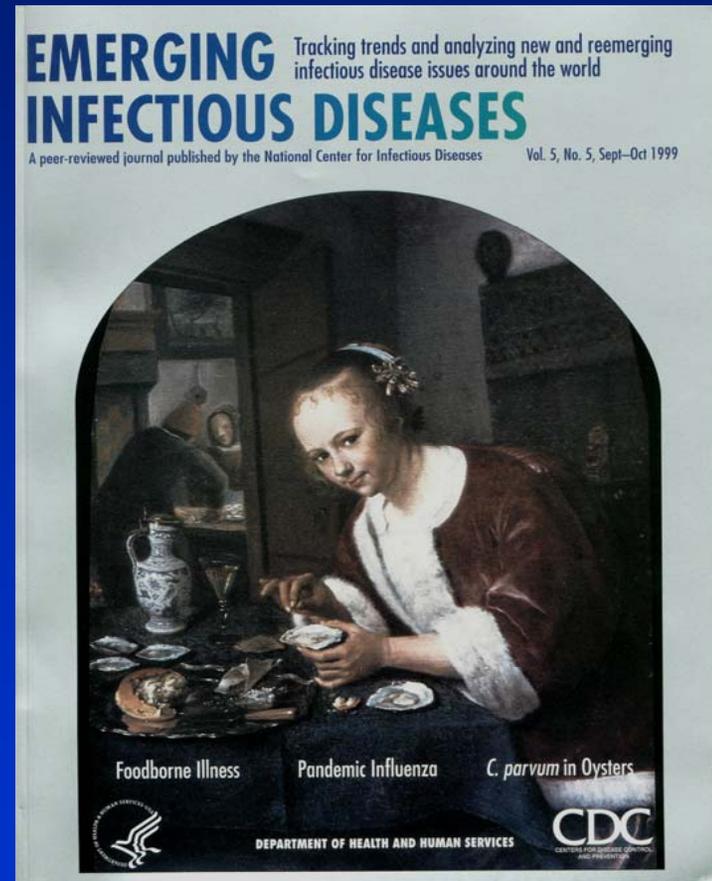


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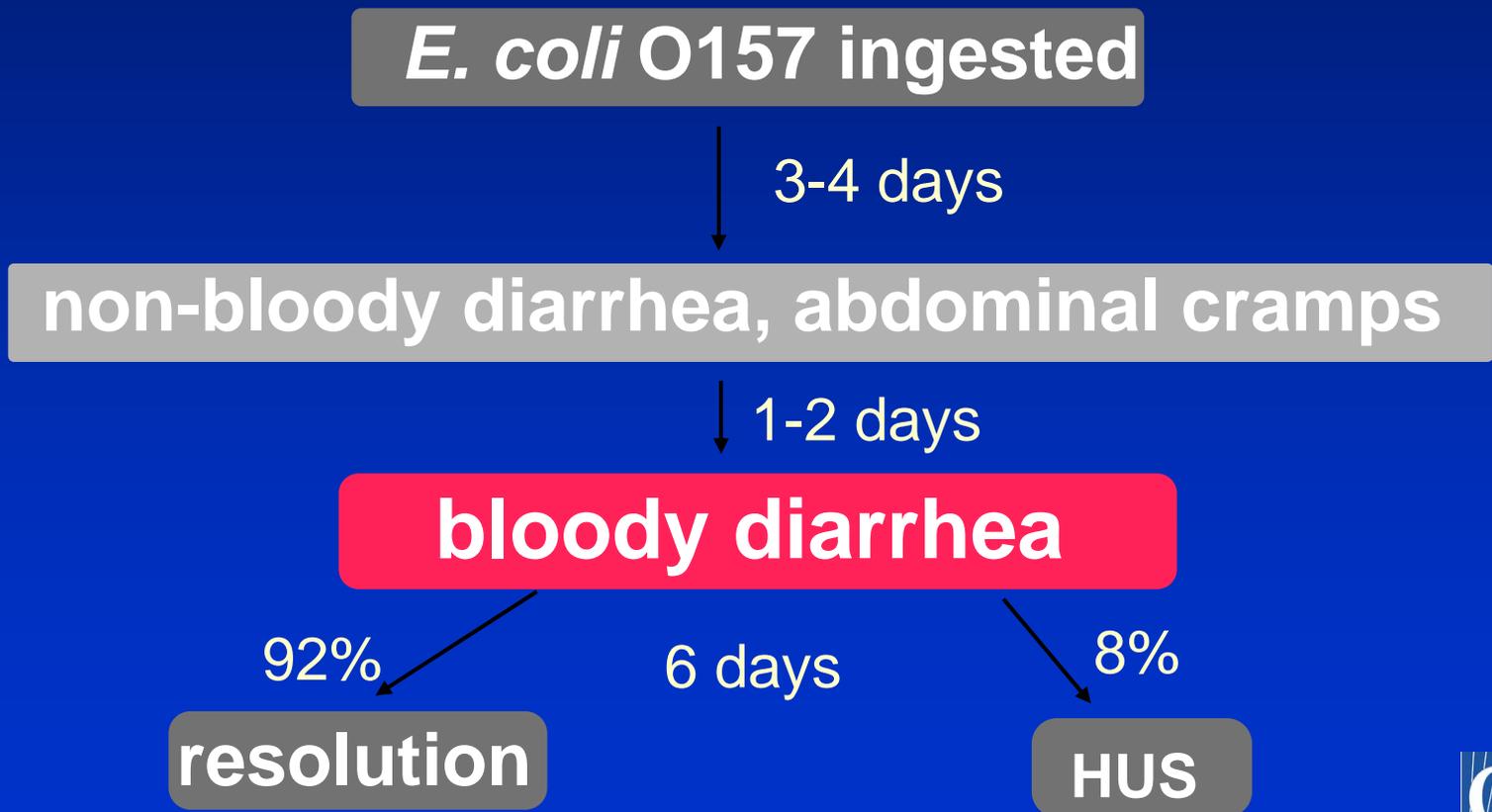
Estimated annual number of *E. coli* O157 infections, United States

- 73,000 infections
- 2,000 hospitalized
- 60 deaths



Mead et al. EID 1999

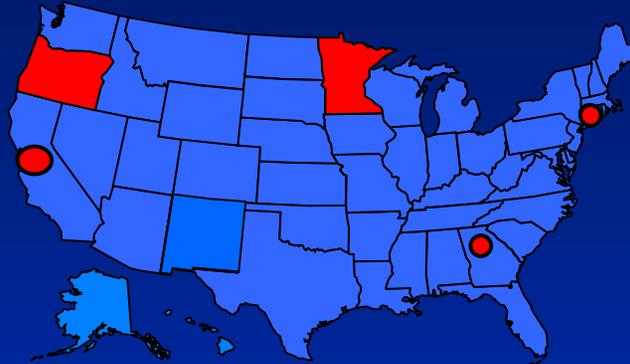
Sequence of events in *E. coli* O157:H7 infection



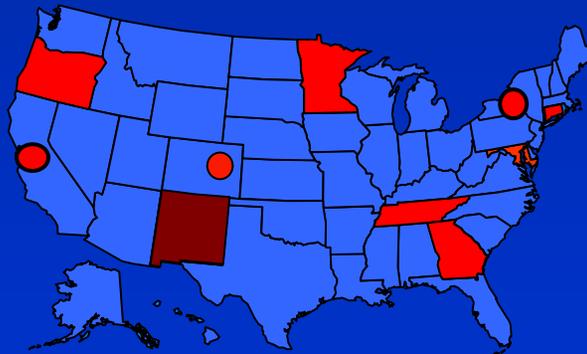
Public health surveillance for foodborne diseases: FoodNet

- **FoodNet: The sentinel site surveillance system for foodborne diseases.**
 - **Active surveillance - contact all labs in area**
 - **Diagnoses of major foodborne infections**
 - **Survey population for illness and exposures**
 - **Provides our best data on burden of illness, trends**
 - **Useful information for risk assessment**
- **10 state health departments, CDC/USDA/FDA**
- **Annual report a benchmark for food safety**

Expansion of FoodNet sites: 1996 - 2007



1996 – 14 million -- 5% of U.S. population

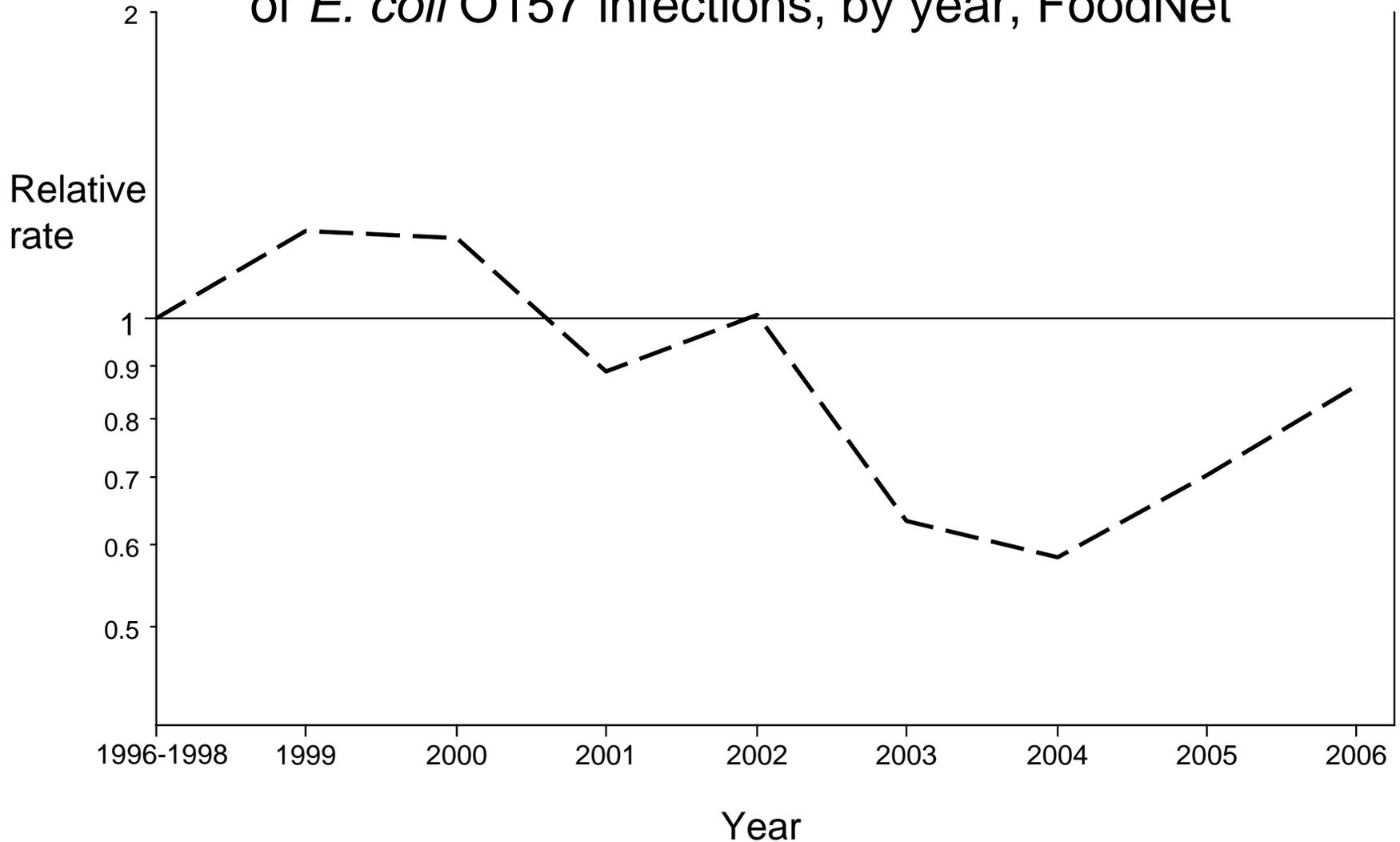


2007 – 46 million -- 15% of U.S. population

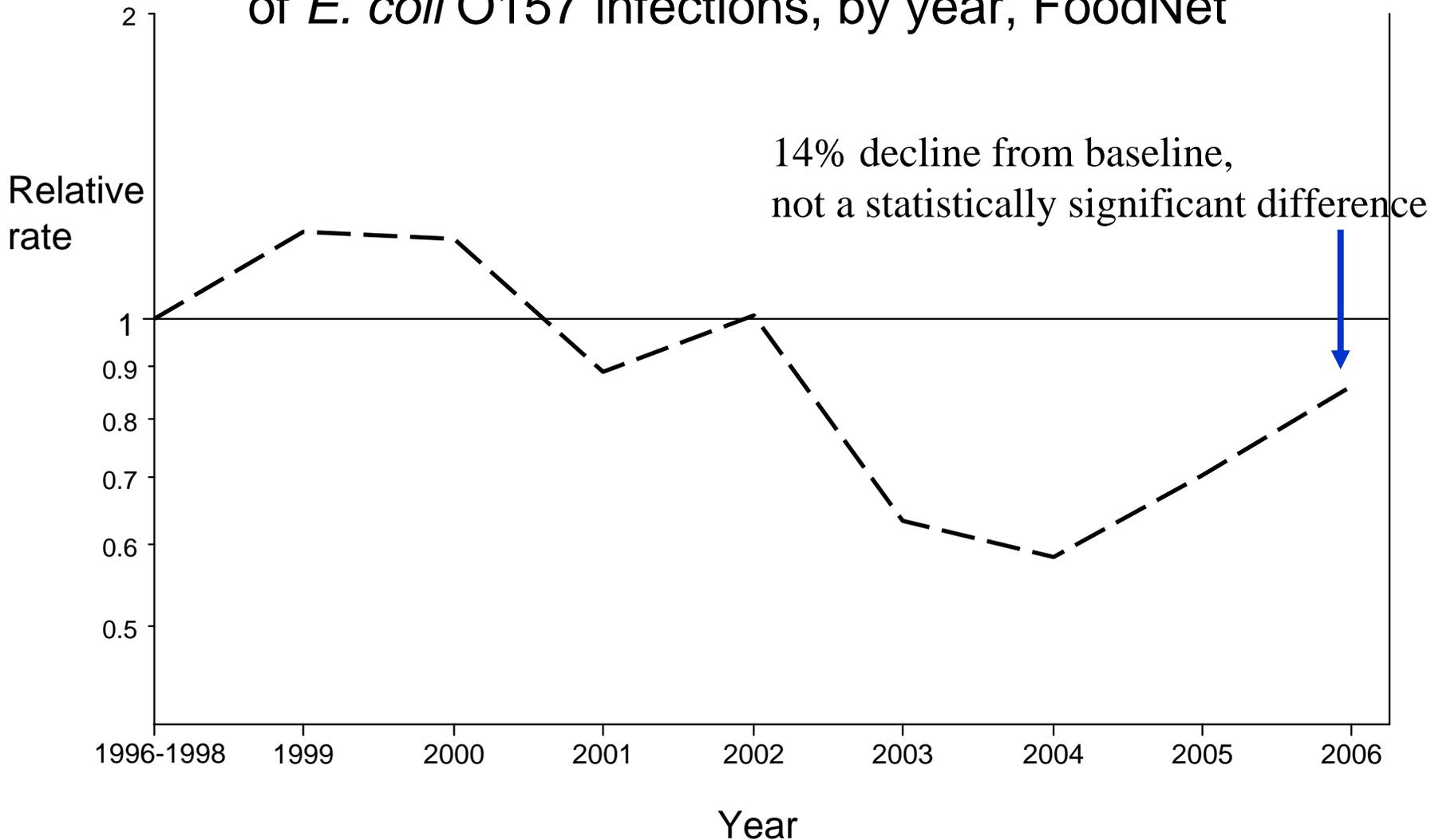
Incidence of *E. coli* O157 infections, FoodNet

- Incidence = # illnesses per 100,000 persons per year
- Baseline 1996-98: 2.4 per 100,000
- Healthy People 2010 objective: **1.0**
- Recent years
 - 2003: 1.06
 - **2004: 0.90**
 - 2005: 1.05
 - 2006: 1.31
 - 2007: See MMWR April 11, 2008

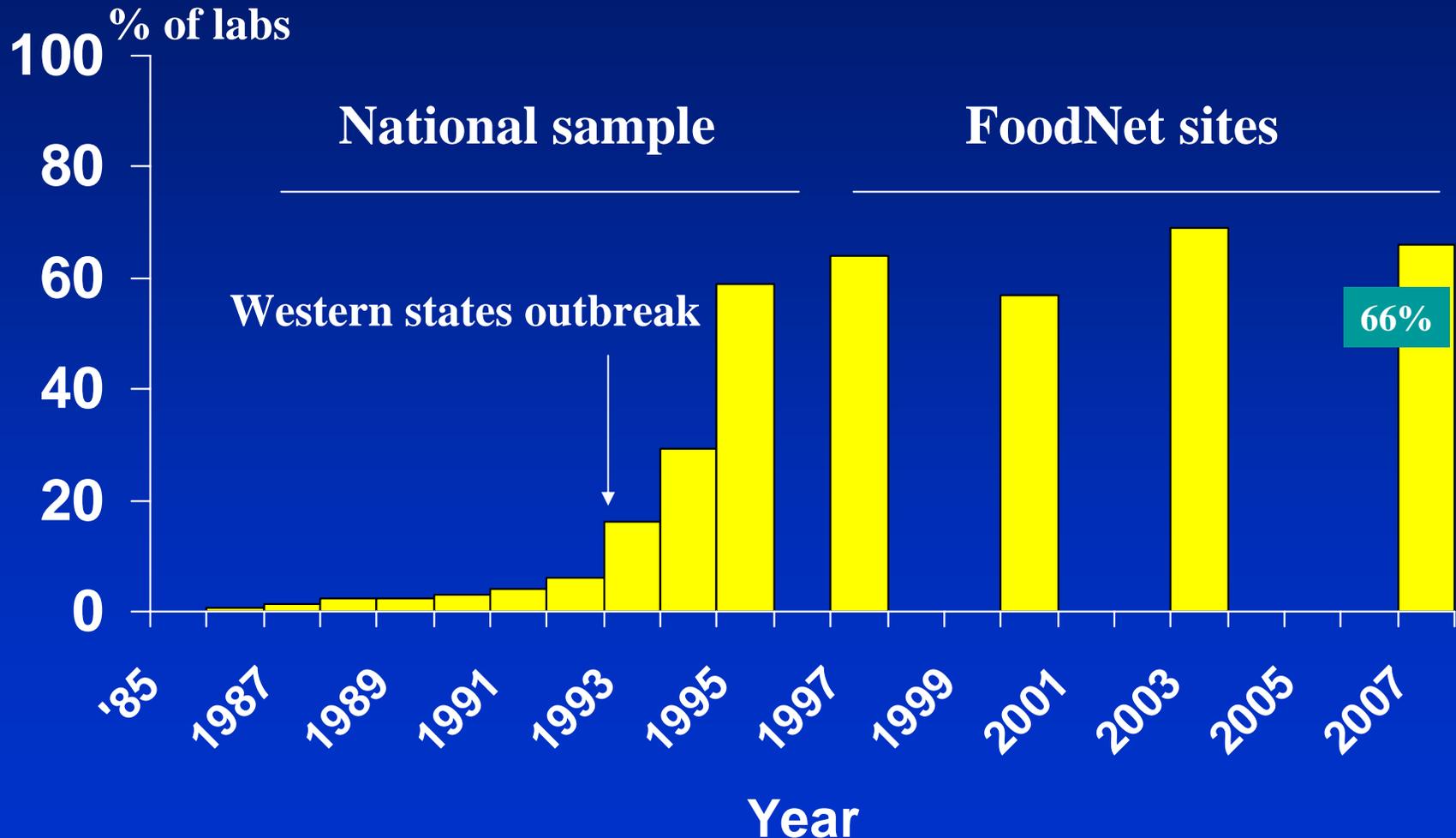
Relative rate
(compared with 1996–1998 baseline period)
of *E. coli* O157 infections, by year, FoodNet



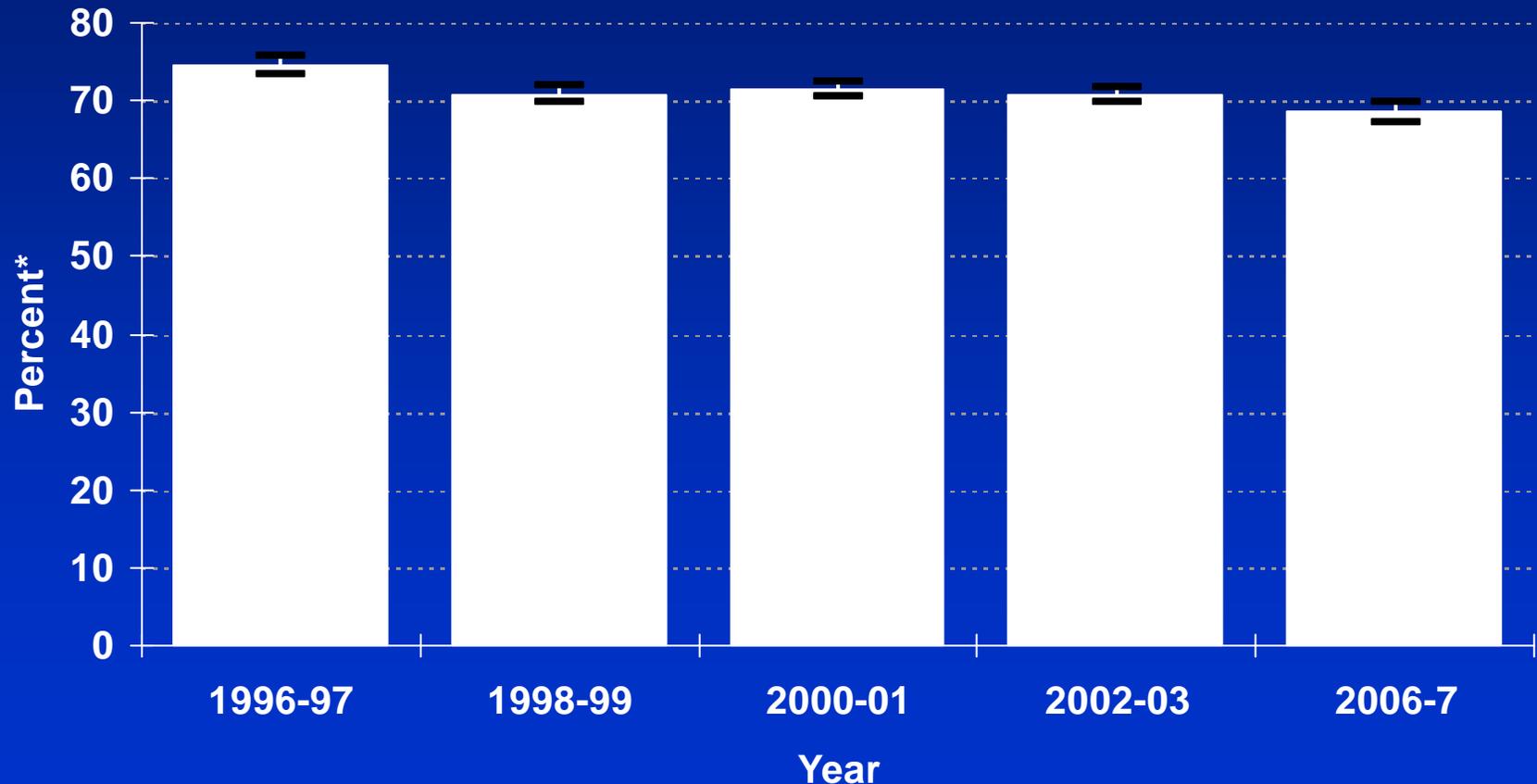
Relative rate (compared with 1996–1998 baseline period) of *E. coli* O157 infections, by year, FoodNet



Percent of clinical labs screening all diarrheal stools for *E. coli* O157

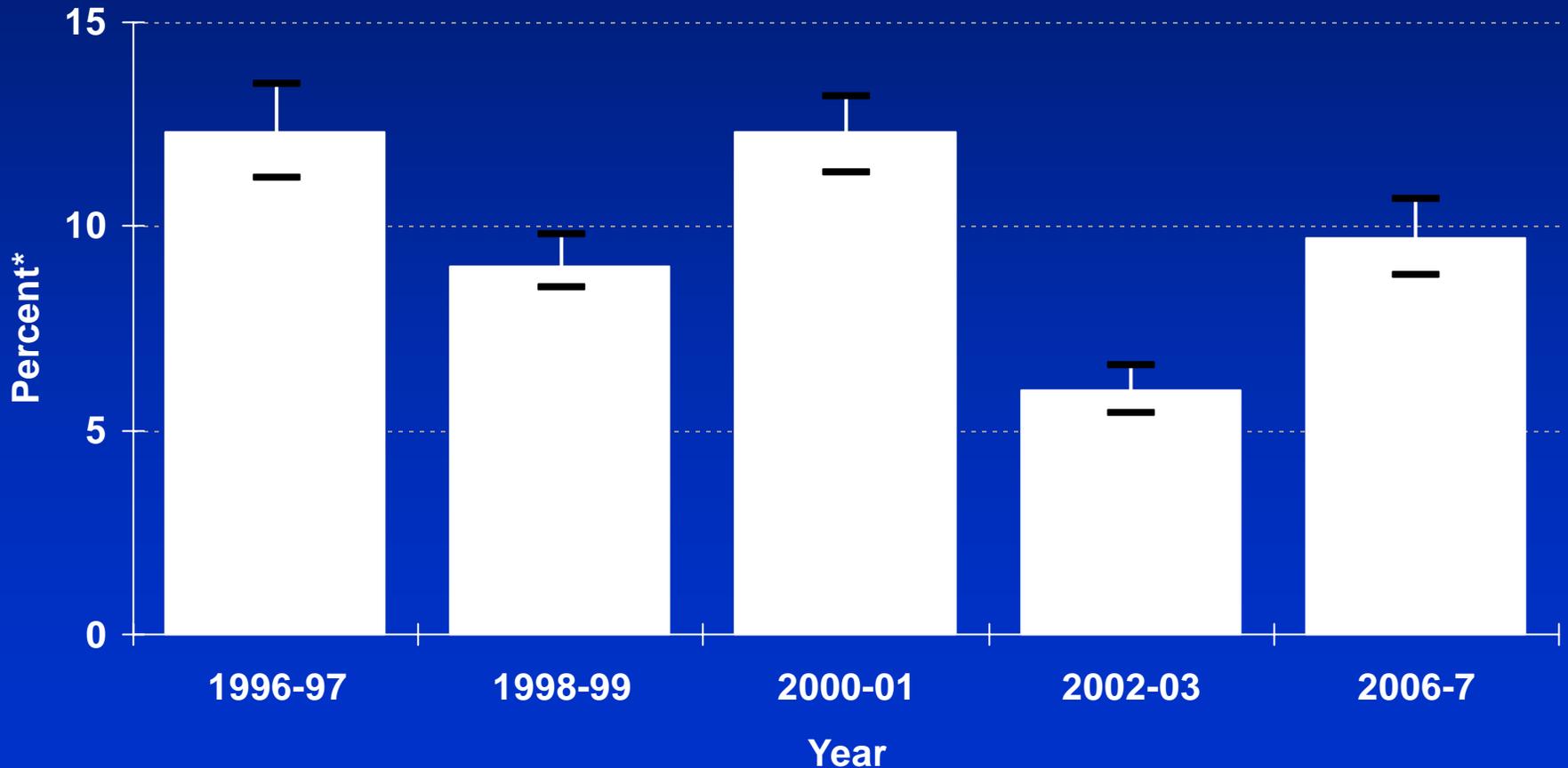


Percent of people reporting consumption of ground beef in the 7 days before interview, FoodNet Population Surveys, 1996-2007



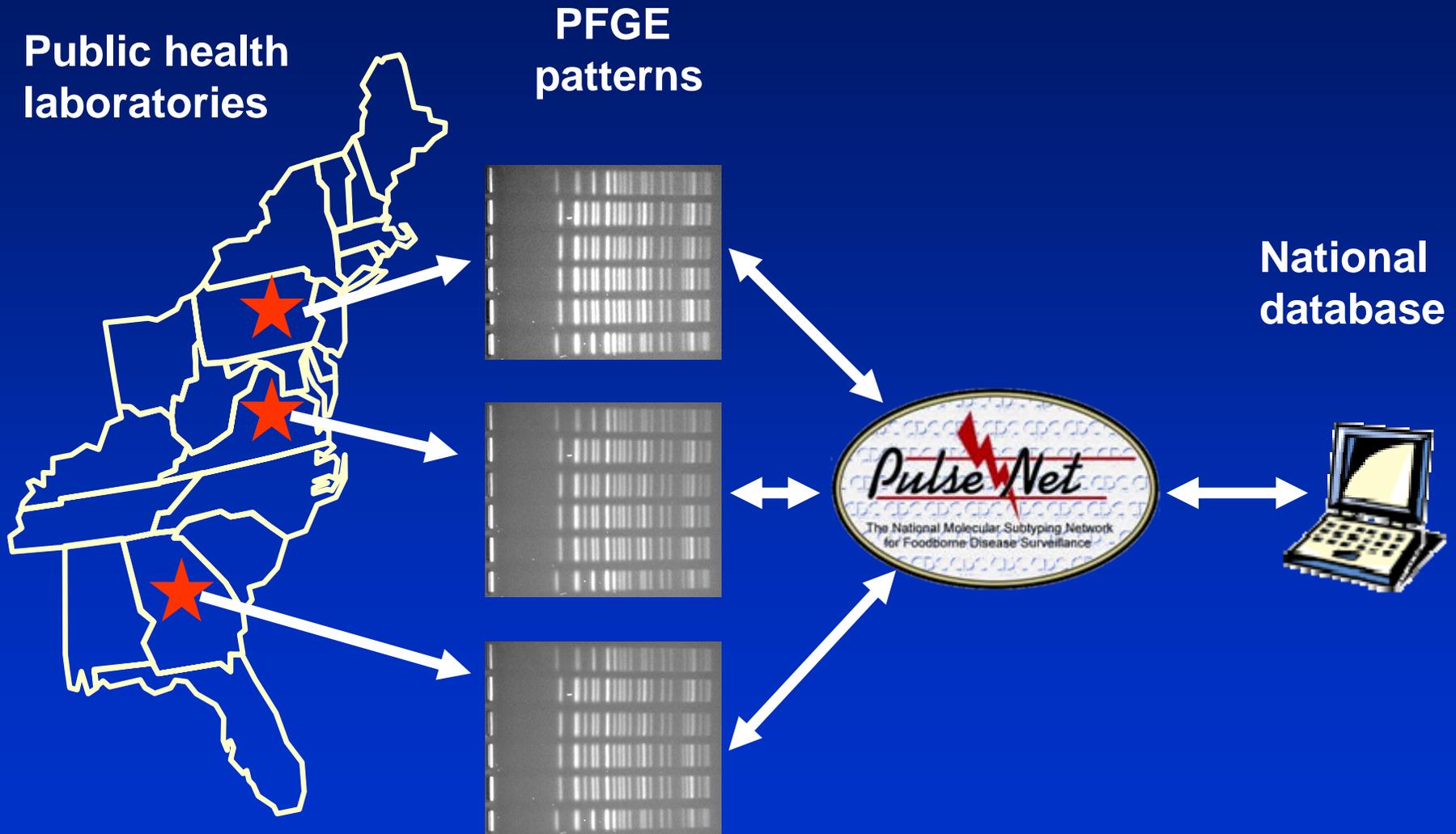
Based on weighted estimates

Percent of ground beef consumers reporting consumption of undercooked (pink) ground beef, in the 7 days before interview, FoodNet Population Surveys, 1996-2007



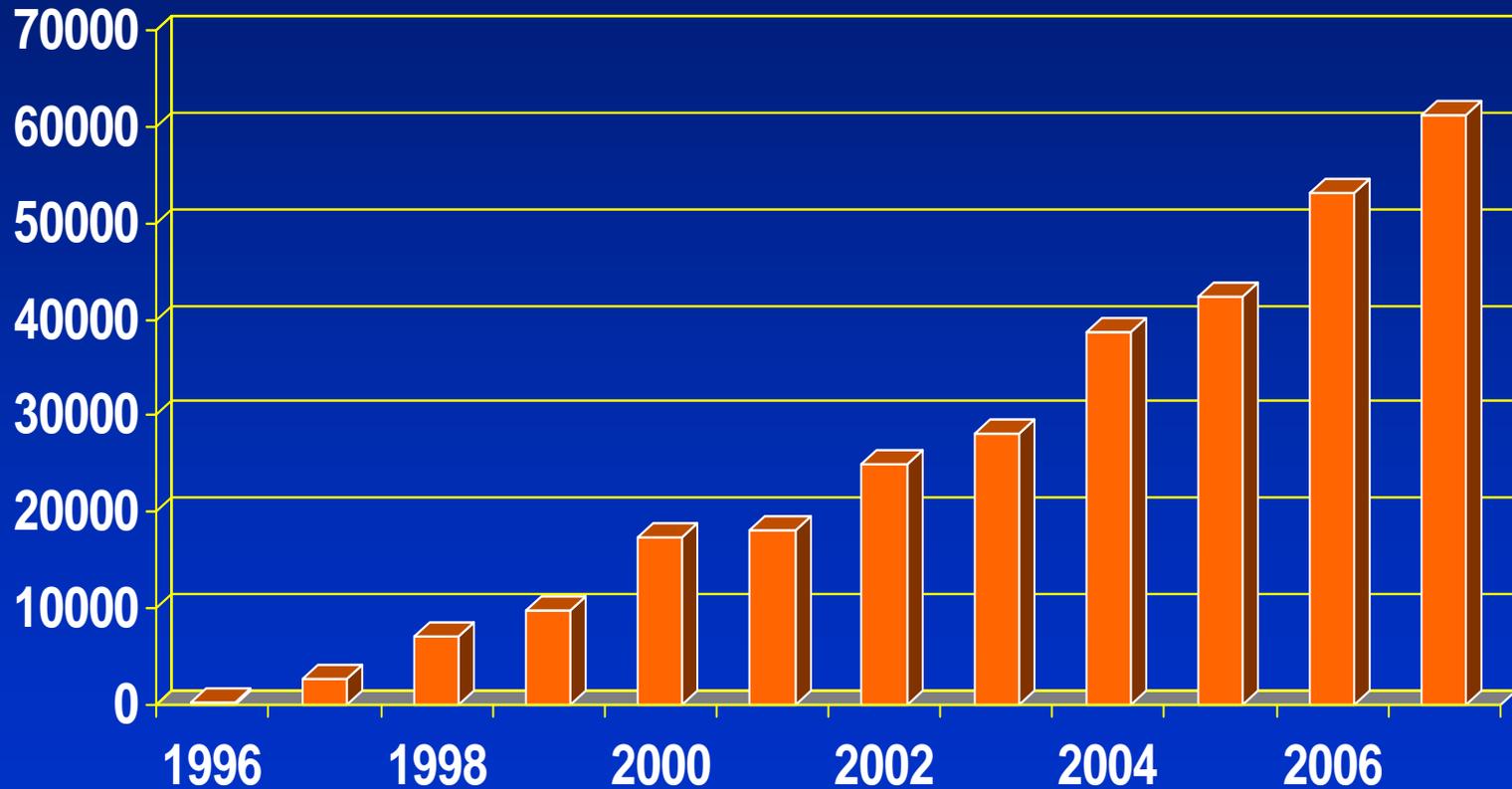
* Based on weighted estimates

Laboratory communication network in PulseNet



Submissions to PulseNet of all pathogens continue to rise

PFGE patterns submitted to PulseNet Databases 1996- 2007



In 2007, ~ 30,000 patterns in *E. coli* O157 database

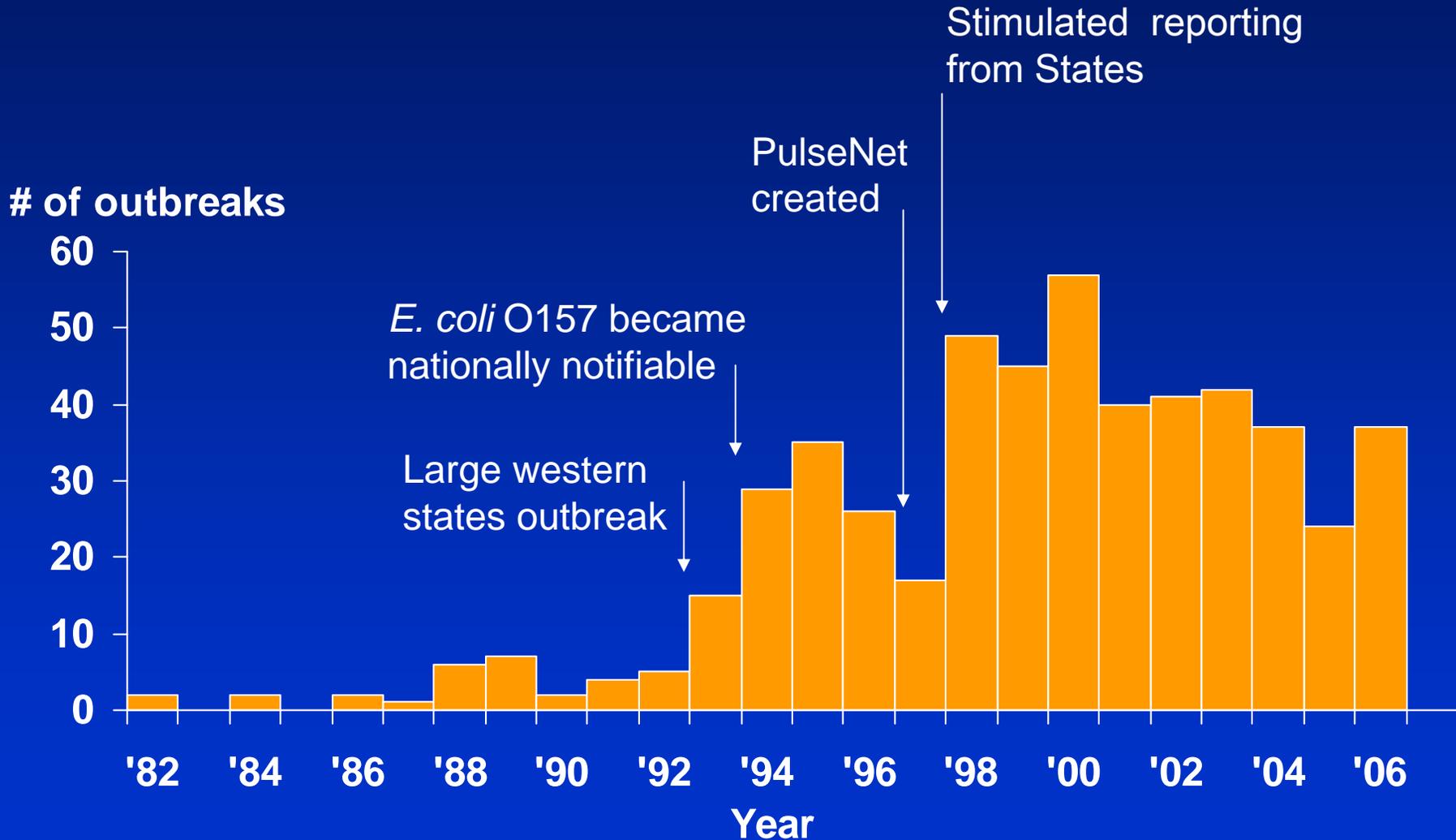
Role of PulseNet

- **Detects clusters of illness with matching DNA “fingerprints”**
 - A match suggests that the infections might have a common origin
 - facilitates early identification of outbreaks
- **Assists epidemiologists in investigating outbreaks**
 - persons with the outbreak “fingerprint” are likely to be part of the outbreak
 - A match between an isolate in a suspect food and a patient can help confirm an outbreak

Coordinating multi-state investigations - “OutbreakNet”

- **PulseNet: Clusters of possibly linked infections**
- **Outbreak coordination team at CDC in regular communication with counterparts in every state**
- **Goal:**
 - **systematic investigation of cases**
 - **coordinated investigation of multi-state outbreaks**
- **Working relationships with FSIS and with FDA, as well as with States**
- **Systematic collection and review of foodborne outbreaks reported by state health departments (~1200 investigated per year)**

E. coli O157 outbreaks, U.S., by year, 1982 – 2006 (N = 525 outbreaks)



Proportion of illnesses due to each mode of transmission in 350 *E. coli* O157 outbreaks, U.S., 1982-2002

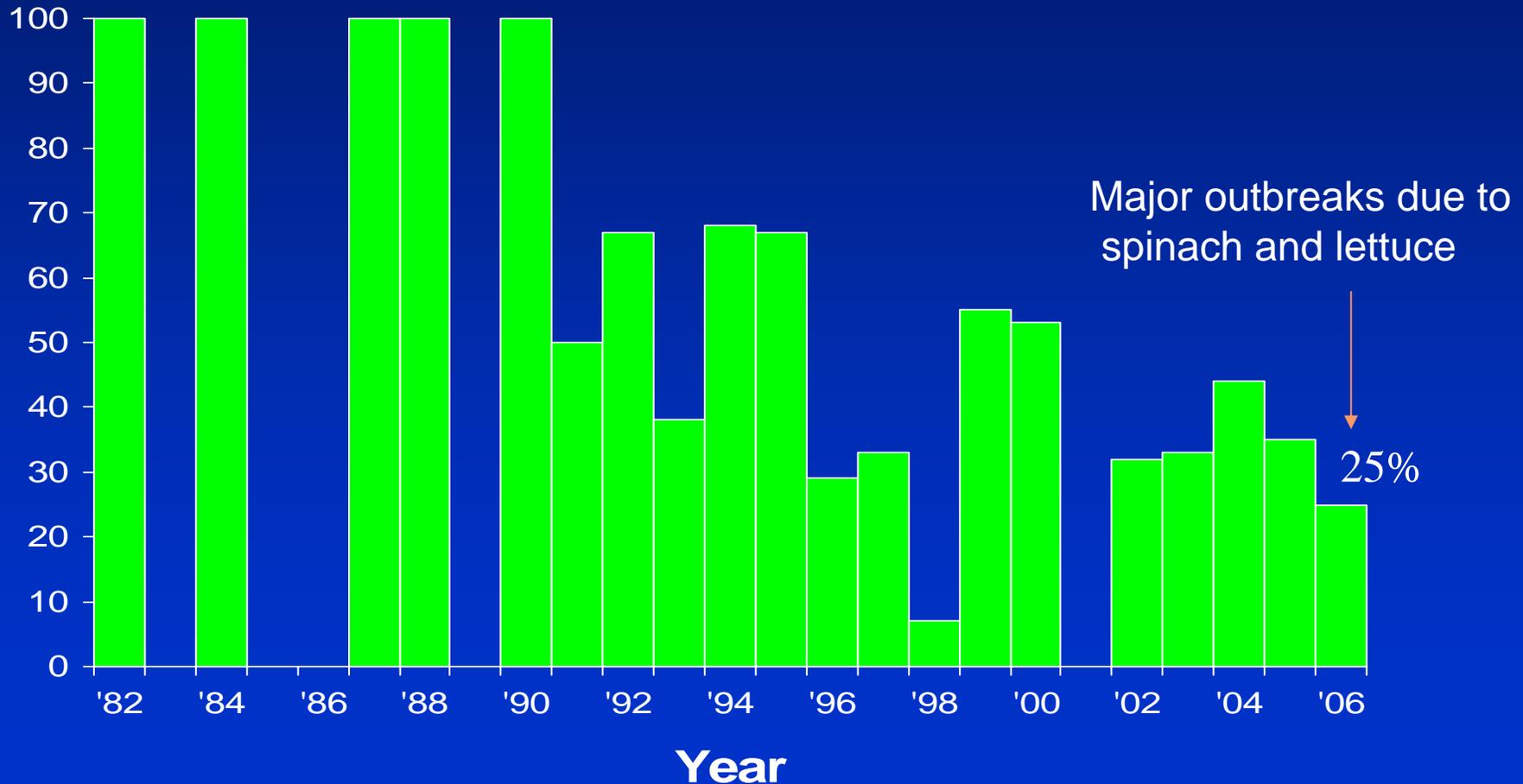
Mode	Illnesses in outbreaks (N=8,598 illnesses)
	%
Foodborne	61
Drinking water	15
Unknown	9
Person-to-person	8
Animal contact	4
Recreational water	3
Lab acquired	<1

Proportion of illnesses in foodborne *E. coli* O157 outbreaks due to various foods, 1982-2002

Vehicle	illnesses in foodborne outbreaks (N=5,269 illnesses)
	%
Ground beef	33
Other beef	11
Produce	34
Other	4
Dairy products	6
Unknown	12

Percent of foodborne *E. coli* O157 outbreaks due to beef, 1982 - 2006

% of outbreaks



Rangel EID 2005, and CDC unpublished data



E. coli O157:H7 and baby spinach - 2006



Traceback to four farms
One farm environment had
outbreak strain of *E. coli* O157
Beef cattle, stream, wild pigs, soil



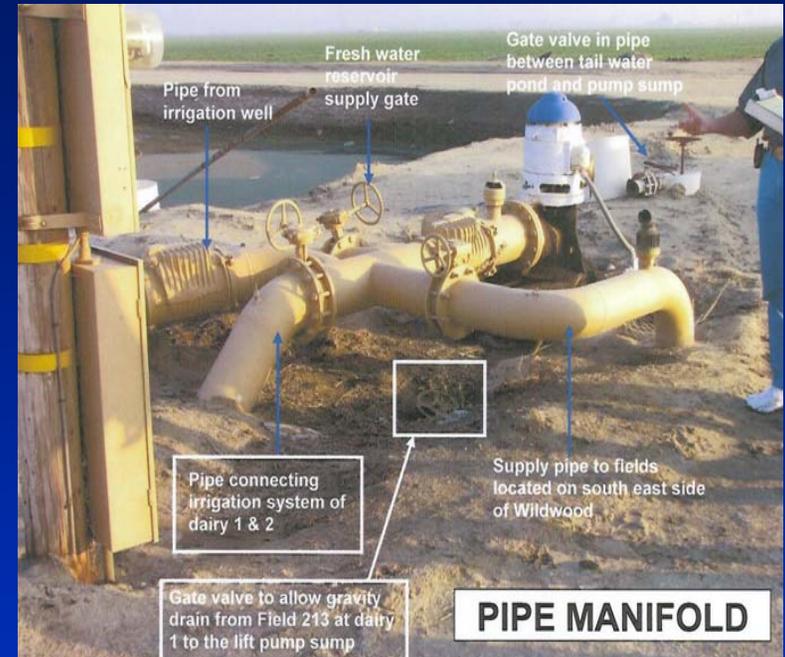
Cattle 0.5 mile from field
? Spring flooding into irrigation wells
? Wild pigs traversing spinach fields



<http://www.dhs.ca.gov/ps/fdb/>

E. coli O157:H7 and shredded lettuce - 2006

2006 outbreak: 36 cases, 2 states
Taco Chain Y
Shredded lettuce from California farm



Fields adjacent to two dairy farms

10 samples with outbreak strain of O157

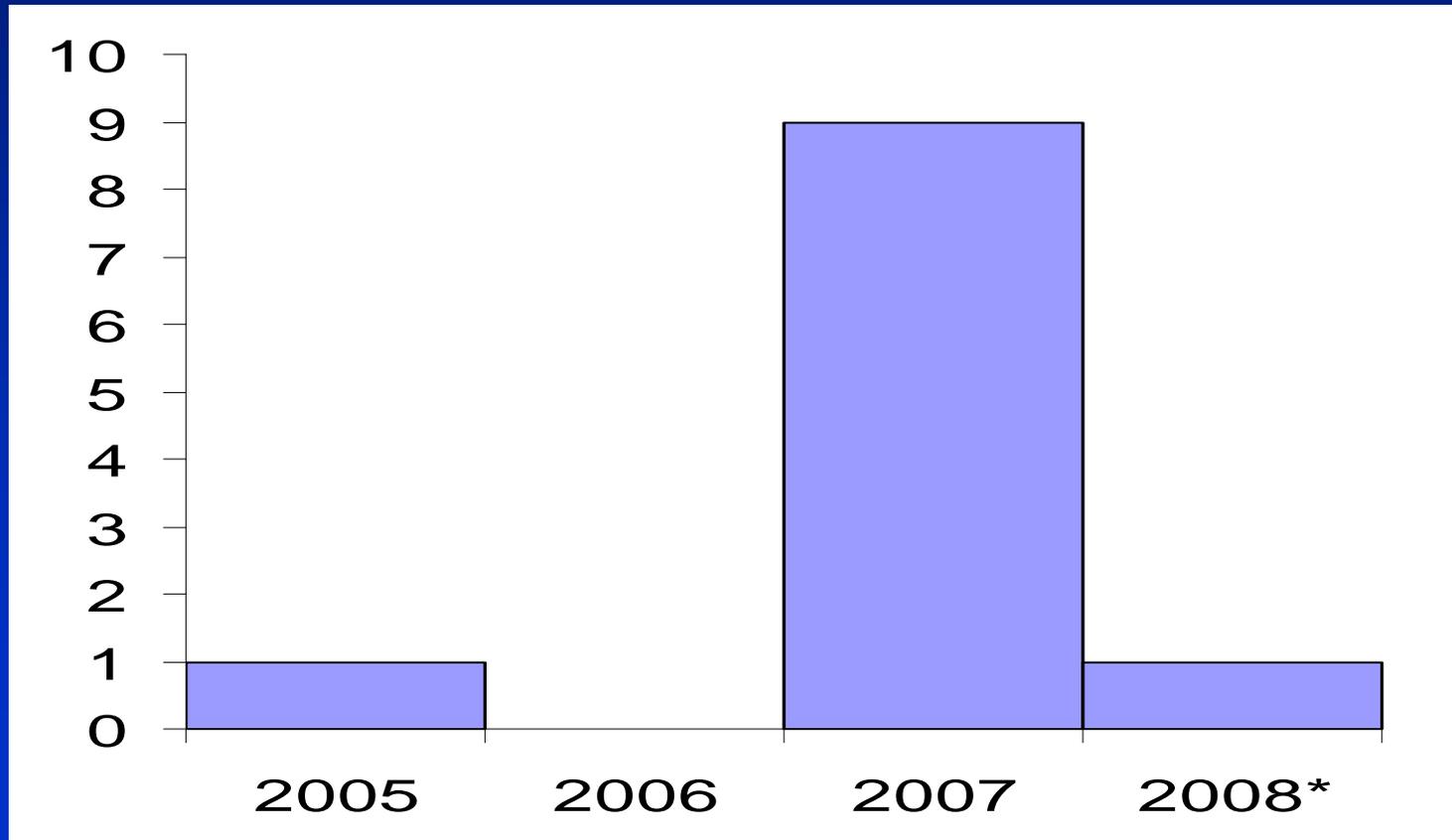
- from both dairies
- from three fields

Pipes could connect manure lagoons and irrigation system

<http://www.dhs.ca.gov/ps/fdb/>

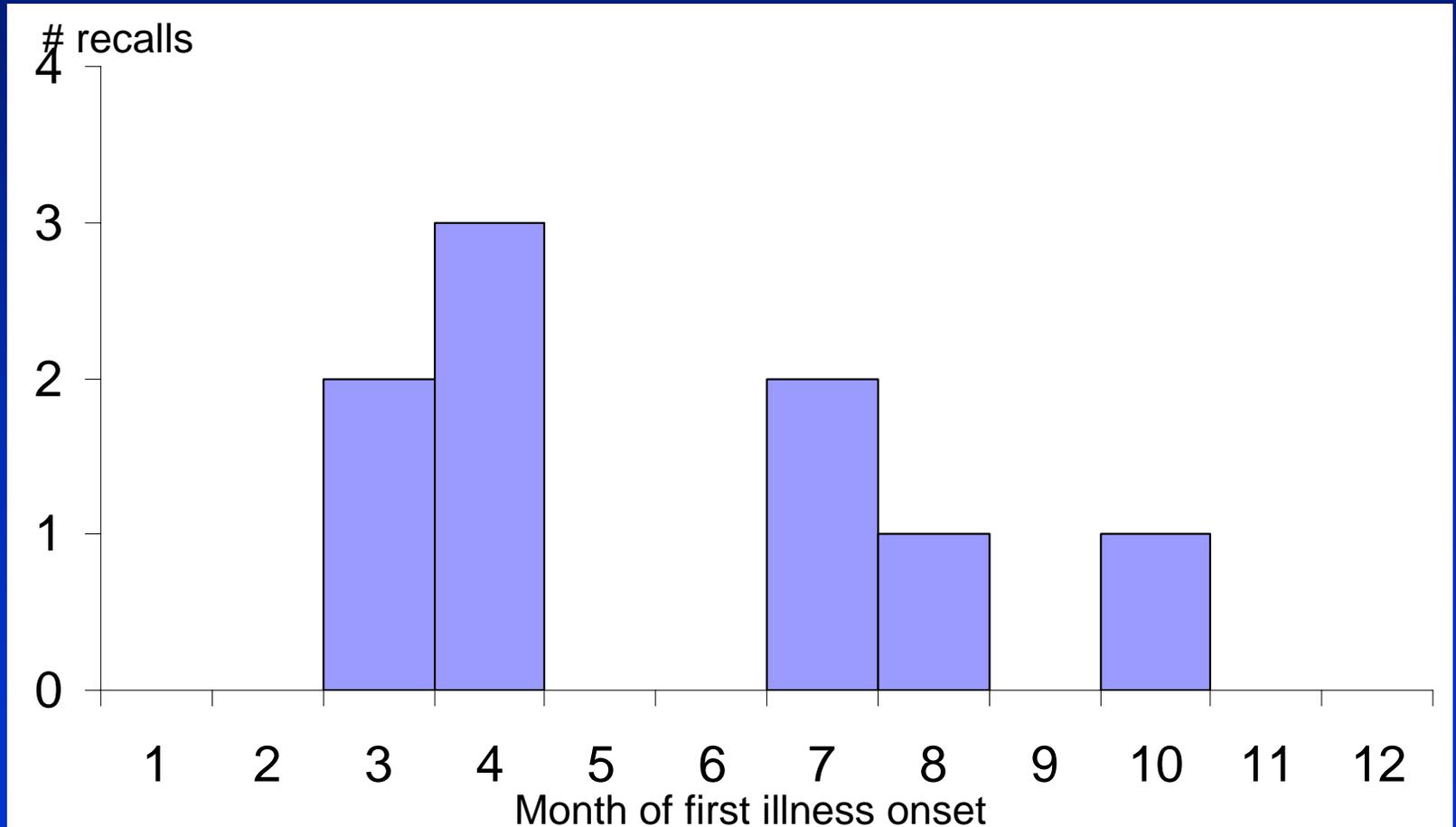
Number of *E. coli* O157 outbreaks associated with beef recalls, 2005-2008

recalls



*as of January 16, 2008

E. coli O157 outbreaks associated with beef recalls, by month of onset, 2007



***E. coli* O157 outbreaks associated with beef recalls, 2007**

(N = 9 outbreaks)

- **5 multi-state, 4 single state (PA, CA, MN, IL)**
- **Location of exposure**
 - **home (7 outbreaks)**
 - **restaurant (1)**
 - **concession stand (1)**
- **Average # persons ill: 10 (range, 2-45)**
- **Age of ill persons: <1 to 85 years**

2 more recalls were related to 1 ill person

***E. coli* O157 outbreak in United States and Canada - 2007**

- **September 2007: PulseNet in several states finds a cluster of pattern X**
- ***E. coli* O157 identified in frozen ground beef patties from patients' freezers, and from retail samples**
- **More than one pattern in the meats sampled**
- **6 different PFGE patterns in meat and in humans**
- **43 cases in 10 states with one of those patterns from July 5 – October 29**
- **88% reported they consumed ground beef**
- **92% reported Brand X frozen ground beef patties**
- **Beef from Producer A in Canada**
- **Large scale recall all Brand X for 2007**

* Preliminary information



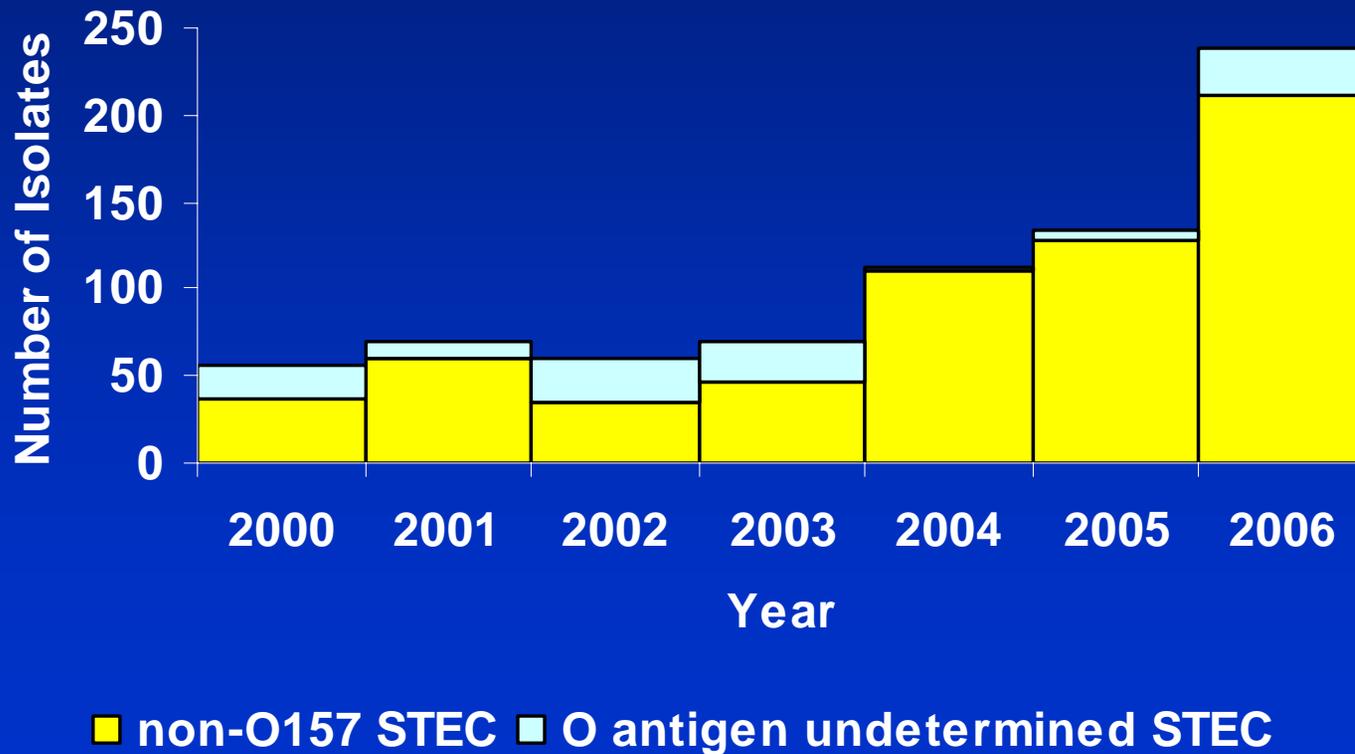
***E. coli* O157 outbreak in United States and Canada – 2007 (continued)**

- **September 2007: PulseNet Canada found 4 cases with Pattern X**
- **Did not import frozen beef patties from the US source**
- **Identified same Pattern X in meat from producer A, along with other patterns**
- **Ultimately: 47 cases (30 with Pattern A)**
- **Eating ground beef, other cuts from Producer A**
- **Recall of all production of Producer A for 1 month**

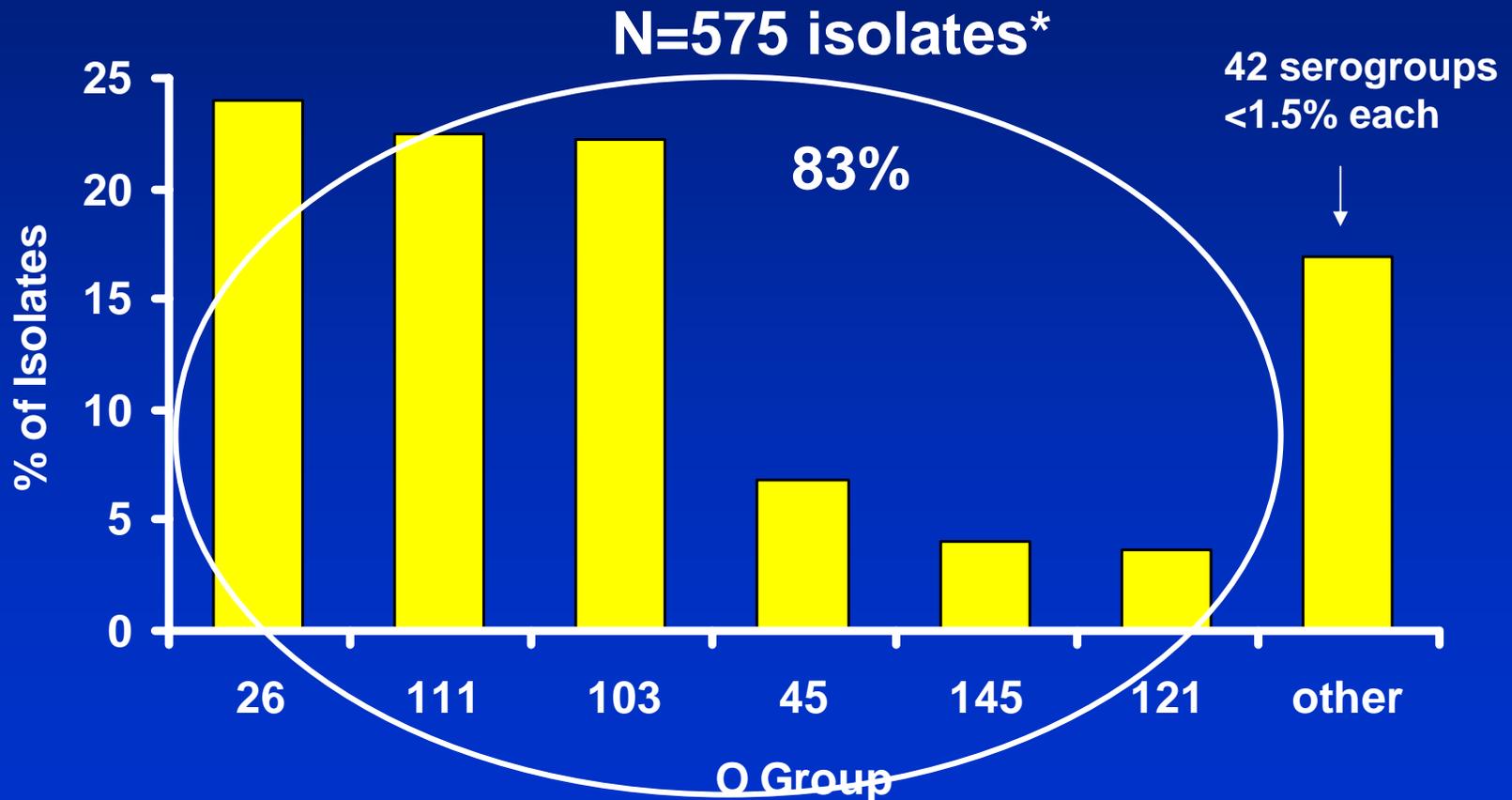
* Preliminary information



Number of non-O157 STEC identified in FoodNet sites, 2000-2006



Human isolates of non-O157 STEC, by serogroup, FoodNet sites, 2000-2006



*preliminary data; an additional 54 isolates had missing O group information



Shigatoxin producing *E. coli* other than O157

- Increasing diagnosis with a new test
- Illness similar to, though milder than O157
- 6 serogroups account for
 - 70% of strains referred to CDC reference laboratory
 - 83% of cases in FoodNet
 - 95% of 22 outbreaks 1990- 2007
- 10 of those outbreaks were foodborne
- O26, O45, O103, O111, O121, O145

***E. coli* O157 epidemiologic observations: Conclusions**

- **Recent trends in surveillance**
 - **Earlier decline reversed in 2005-6**
 - **Not accounted for by change in lab practices or consumption patterns**
 - **Outbreaks have continued at same level**
 - **Beef and produce are main sources, varying by year**
 - **More recalls associated with outbreaks in 2007**

- **Outbreak investigations**
 - **Complex pre-harvest ecologies**
 - **Linkages between reservoirs in beef and produce**
 - **Can have an outbreak with multiple patterns**
 - **Multinational outbreak: North American market**



Thank you

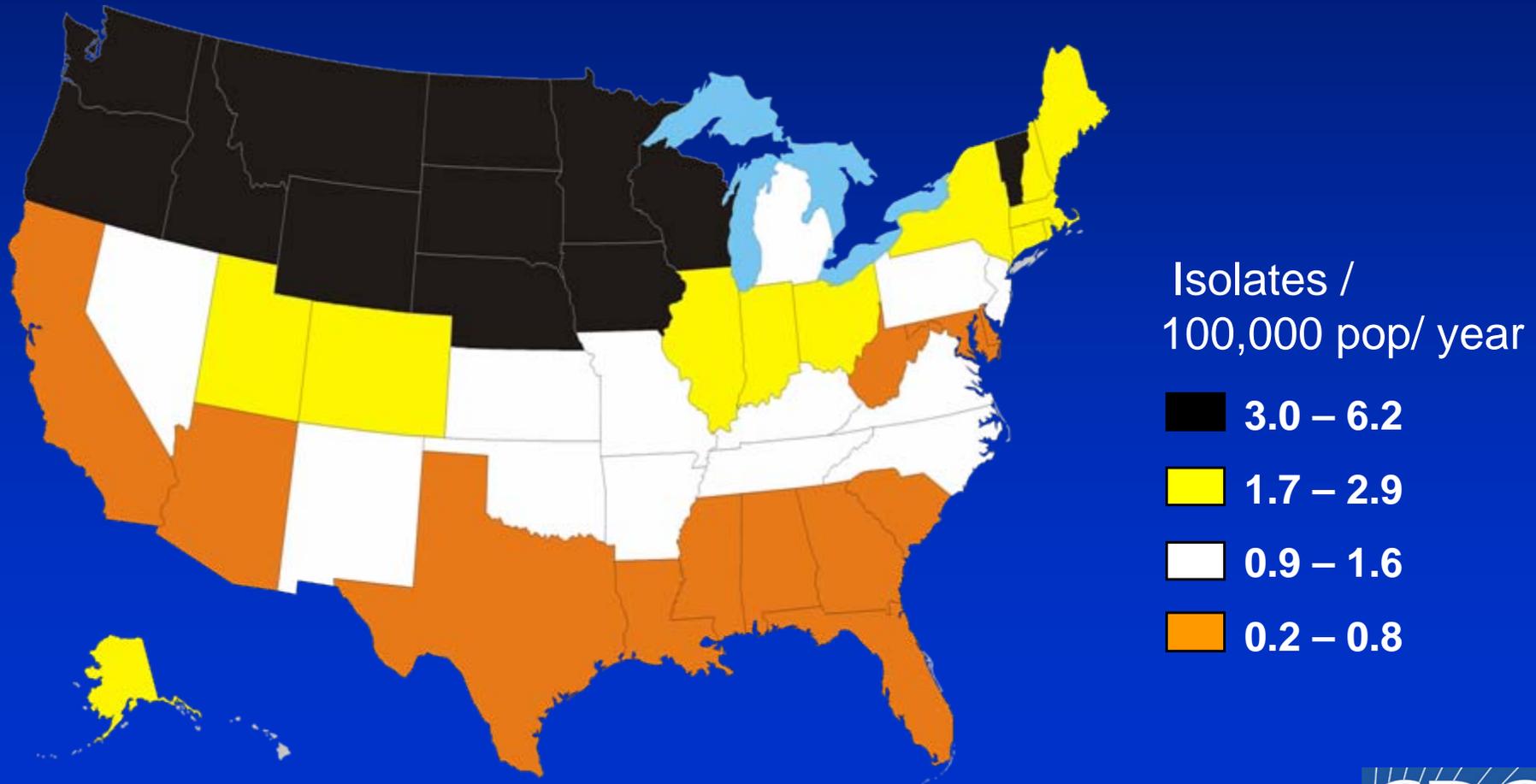
The findings and conclusions in this presentation are those of the author and do not necessarily represent the views of the Centers for Disease Control and Prevention



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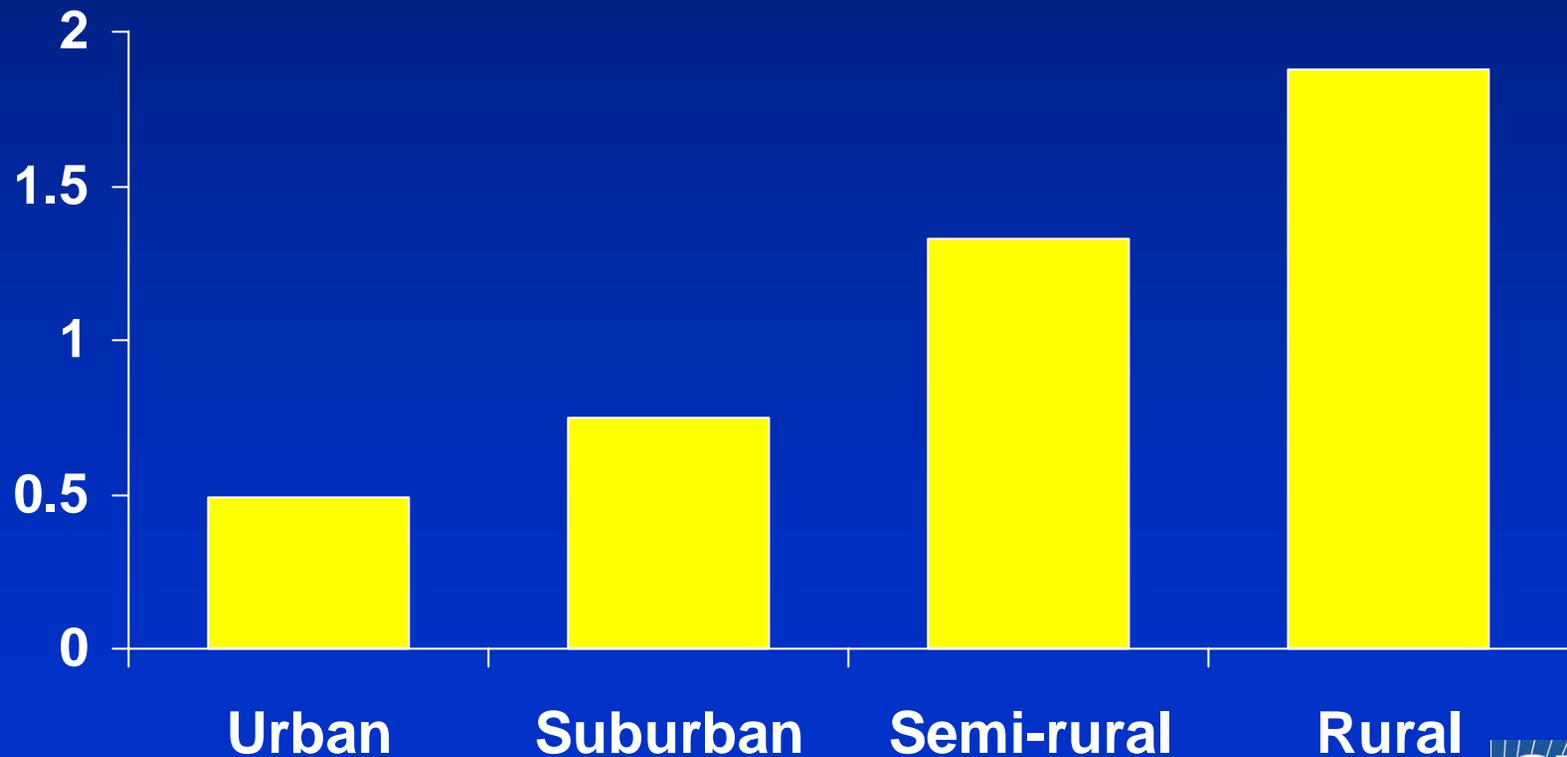


Incidence of *E. coli* O157 infections, by state, 1999-2002



Incidence of *E. coli* O157 infections, by setting, United States, 1993-1996

Cases/ 100,00 persons/ year



CDC, National Surveillance Data, unpublished