Linking Science and Action – Decreasing the Burden of Foodborne Diseases

Annual Meeting
International Association of National Public Health Institutes
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National Center for Emerging and Zoonotic Infectious Diseases
Centers for Disease Control and Prevention

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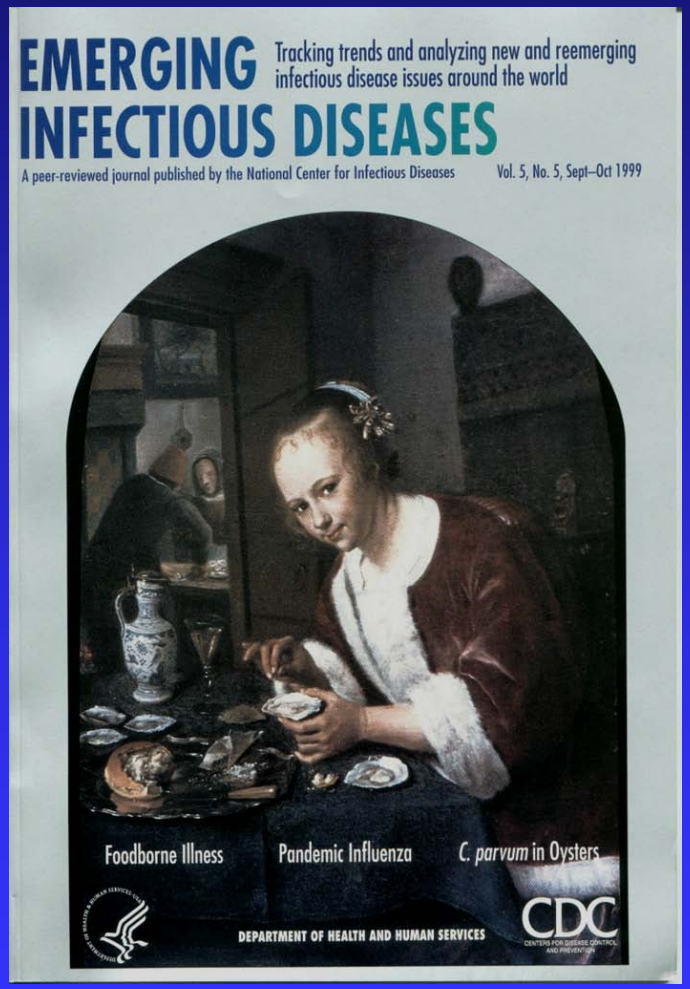
Burden of food-related infections and death in the United States



1999 estimate by CDC, made possible by improved surveillance and analysis

Each year
76 million illnesses
= 1 in 4 Americans
323,000 hospitalizations
= 1 in 1000 Americans
5,000 deaths

Mead et al., EID 5:707-25, 1999

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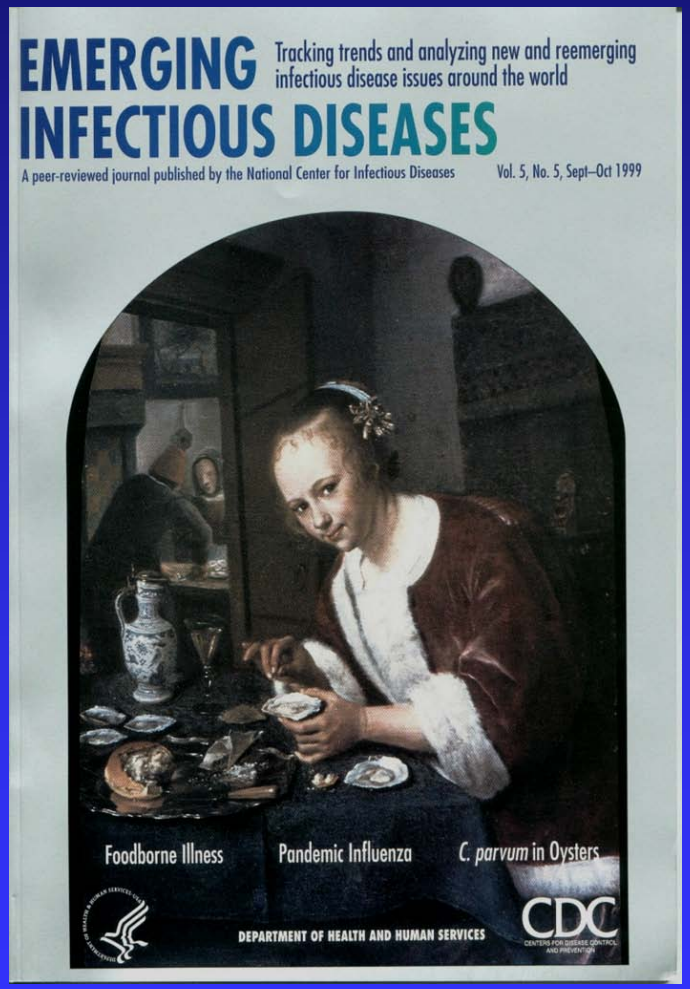

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Each year
76 million illnesses
= 1 in 4 Americans
323,000 hospitalizations
= 1 in 1000 Americans
5,000 deaths

1 in 100 persons making a 2 week visit to the United States may also get a foodborne illness

Mead et al., EID 5:707-25, 1999

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Major identified pathogens recognized as foodborne since 1970

- **Bacterial:**
  - ***Campylobacter jejuni***
  - ***Campylobacter fetus***
  - ***Cronobacter sakazakiii***
  - ***E. coli* O157:H7**
  - ***E. coli*, non-O157 STEC**
  - ***E. coli*, other diarrheagenic**
  - ***Listeria monocytogenes***
  - ***MDR Salmonella* Typhimurium, DT104**
  - ***Vibrio cholerae* O139, toxigenic**
  - ***Vibrio vulnificus***
  - ***Vibrio parahaemolyticus***
  - ***Yersinia enterocolitica***
  - ***Yersinia pseudotuberculosis***
- **Algal**
  - ***Pseudo-nitzschia pungens***
    - ***(domoic acid producing)***
- **Parasitic:**
  - ***Cryptosporidium***
  - ***Cyclospora***
  - ***Trypanosoma cruzii***
- **Viral:**
  - **Norwalk-like viruses**
  - **Rotavirus**
  - **Astrovirus**
  - **Hepatitis E**
  - **Nipah virus**
- **Fungal**
  - **Aflatoxin**
- **Prion**
  - **Transmissible nvCJD agent**

- Each one required a public health response somewhere
- Most identified in the course of public health investigations

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- **Parasitic:**
  - ***Cryptosporidium***

May 2010
Outbreak of *E. coli* O145:NM STEC infections
33 cases in 5 States, 3 with HUS
Linked to lettuce
Lettuce recalled
Field contamination investigated
New regulations on produce safety being drafted

- **Fungal**
  - **Aflatoxin**
- **Prion**
  - **Transmissible nvCJD agent**

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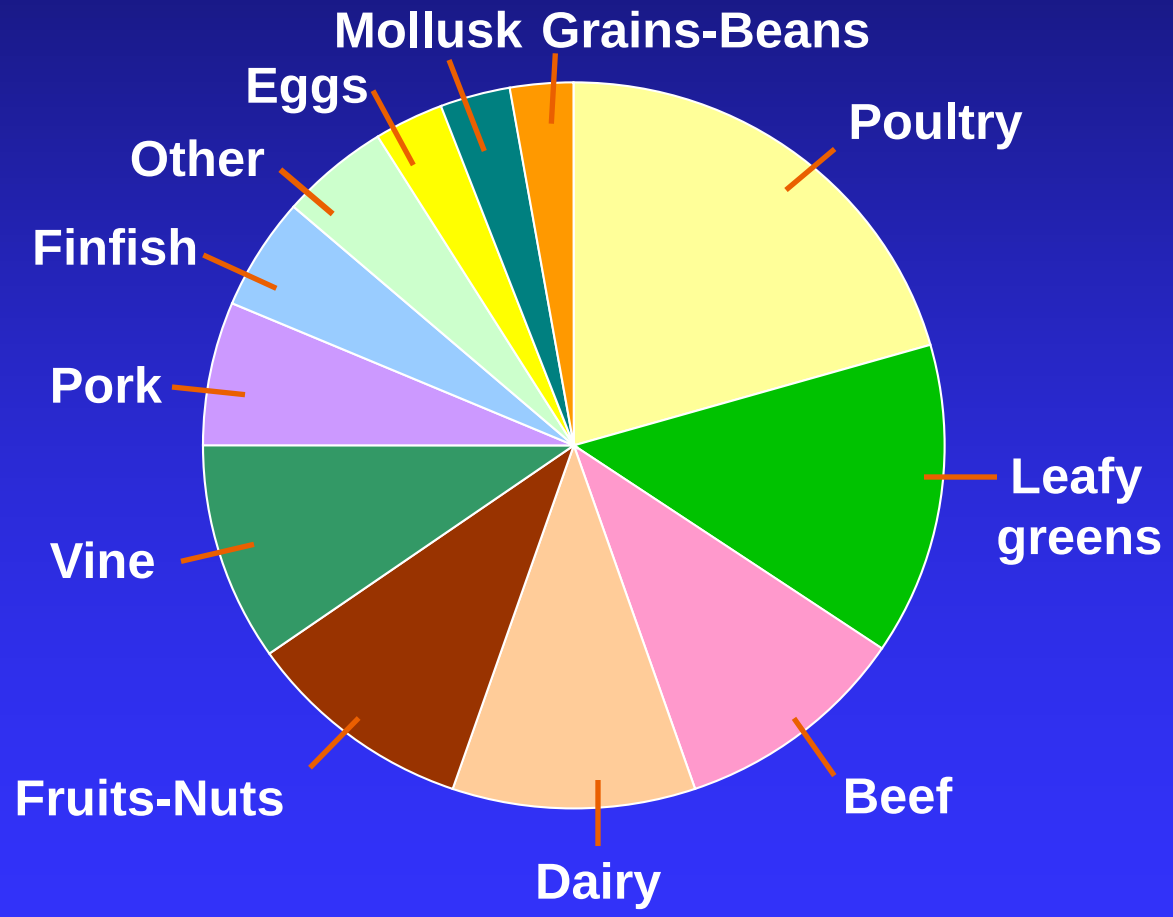
The food vehicles implicated in outbreaks

- 2003-2007: Illnesses in 1,355 outbreaks caused by single food, and reported to CDC



National Foodborne Outbreak Surveillance System

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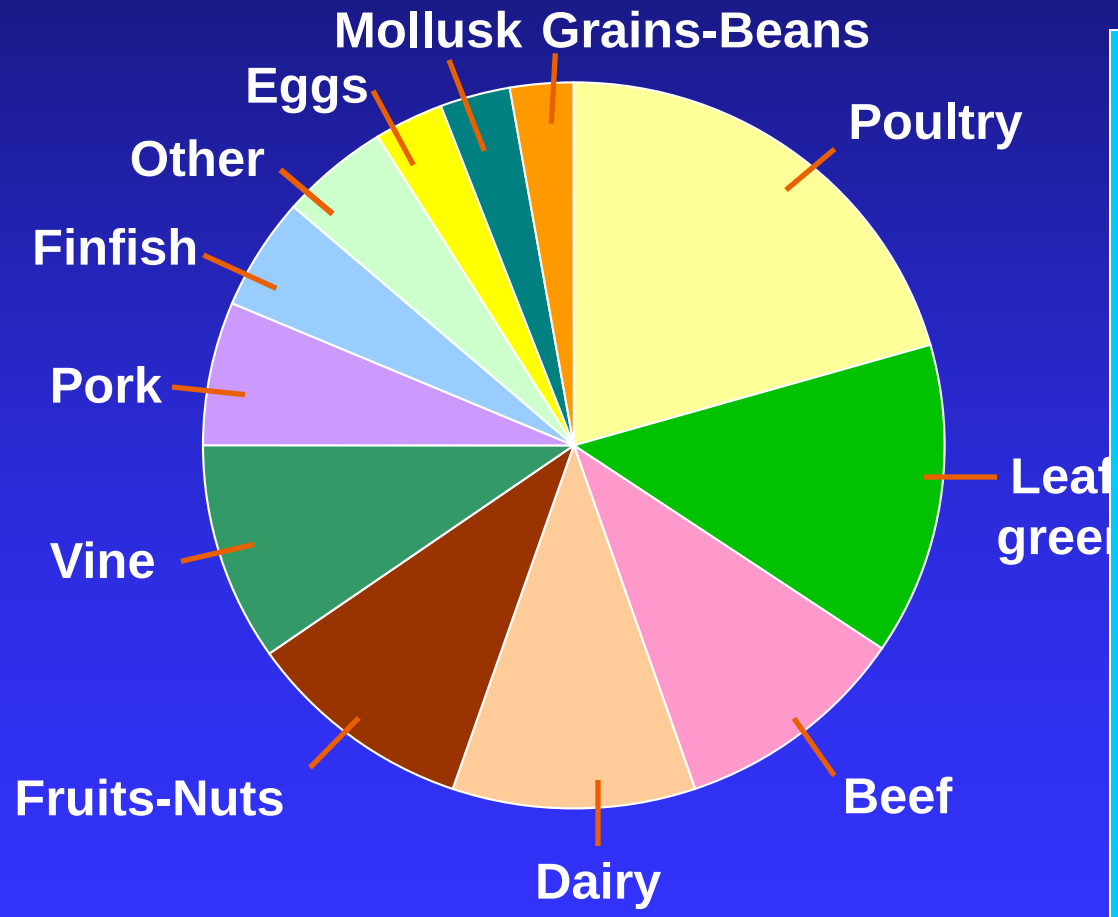

National Foodborne Outbreak Surveillance System

New foods identified since 2006

- Bagged spinach
- Carrot juice
- Peanut butter
- Broccoli powder on a snack food
- Dog food
- Pot pies
- Canned chili sauce
- Hot peppers
- White pepper
- Raw cookie dough

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Our public health infrastructure

- The county or city health department
  - The front line of public health
  - Investigate cases, small outbreaks, and regulate venues

- The state health department
  - Formal authority for surveillance, lead investigations
  - Epidemiologists, laboratorians, sanitarians

- The federal agencies:
  - Risk identification agency: CDC (surveillance and investigation)
  - Risk management/regulatory agencies: FDA, USDA, EPA (inspection and enforcement)

- Tiered response to emergencies:
  - CDC provides surge capacity to States: epidemiologists, laboratory support, consultation
  - CDC leads nationwide outbreak investigations

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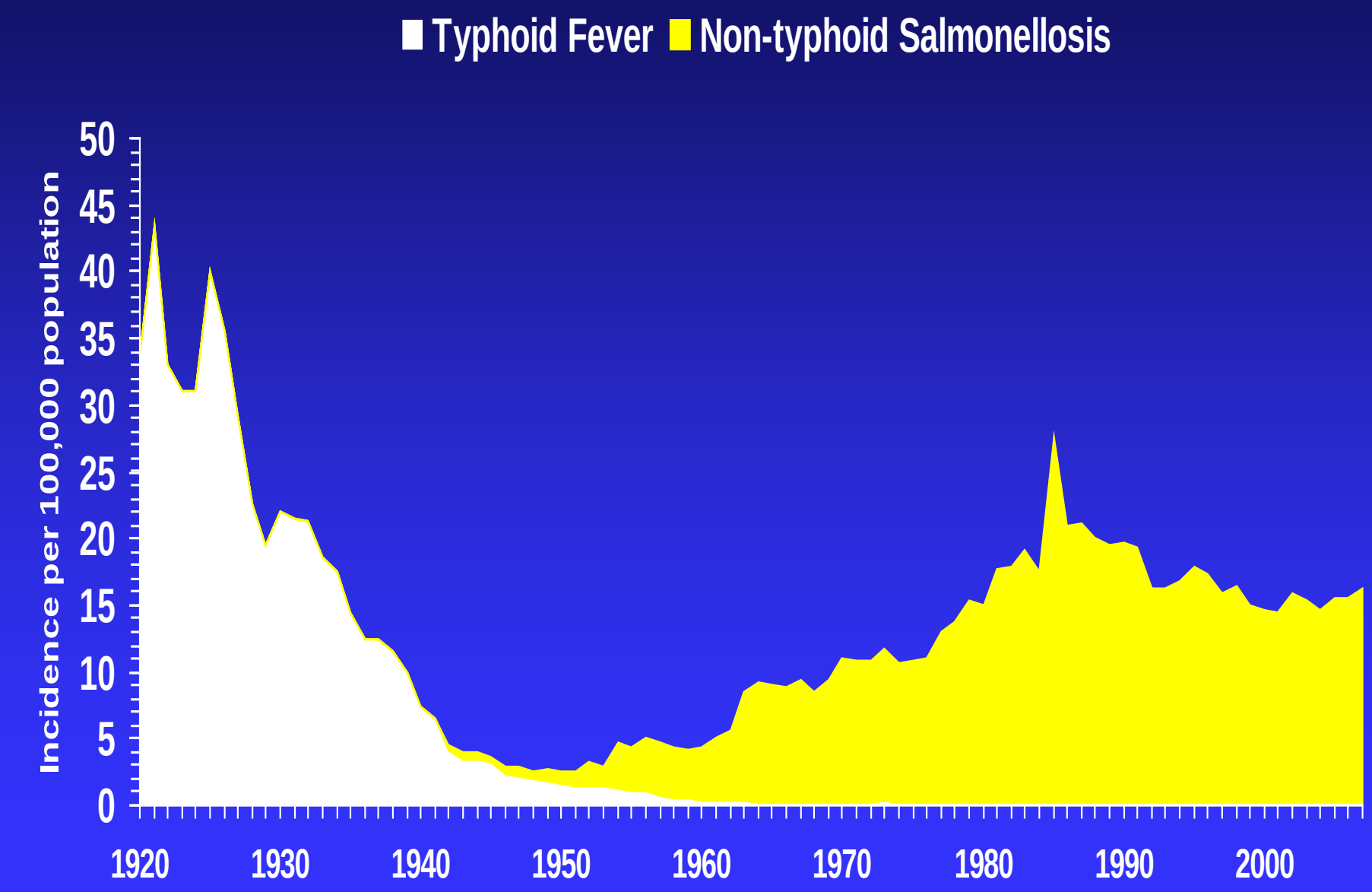
Theme 1: Surveillance evolves from syndrome to molecular subtype: *Salmonella* infections in the United States, 1920-2007



CDC, National surveillance data

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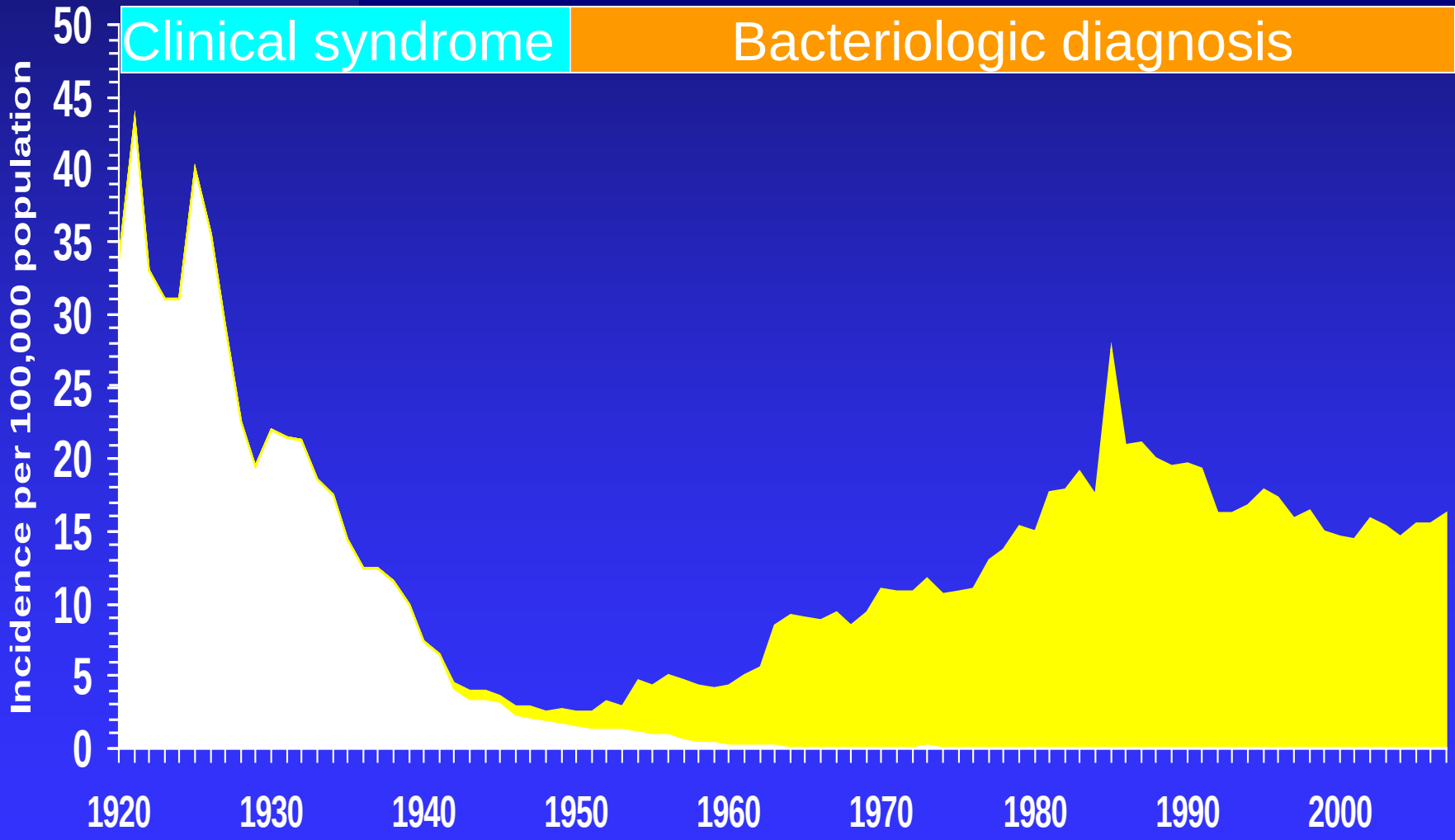

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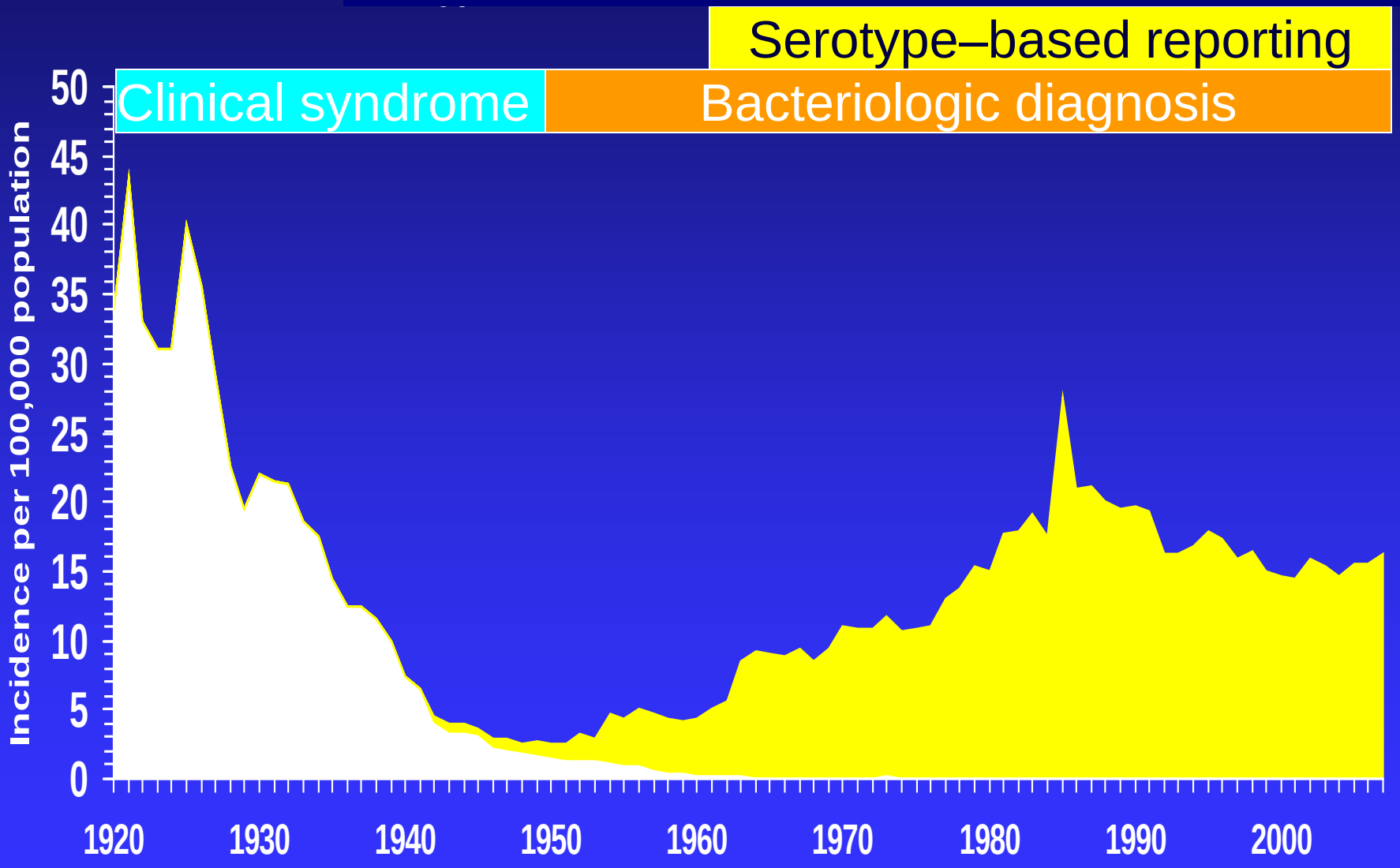

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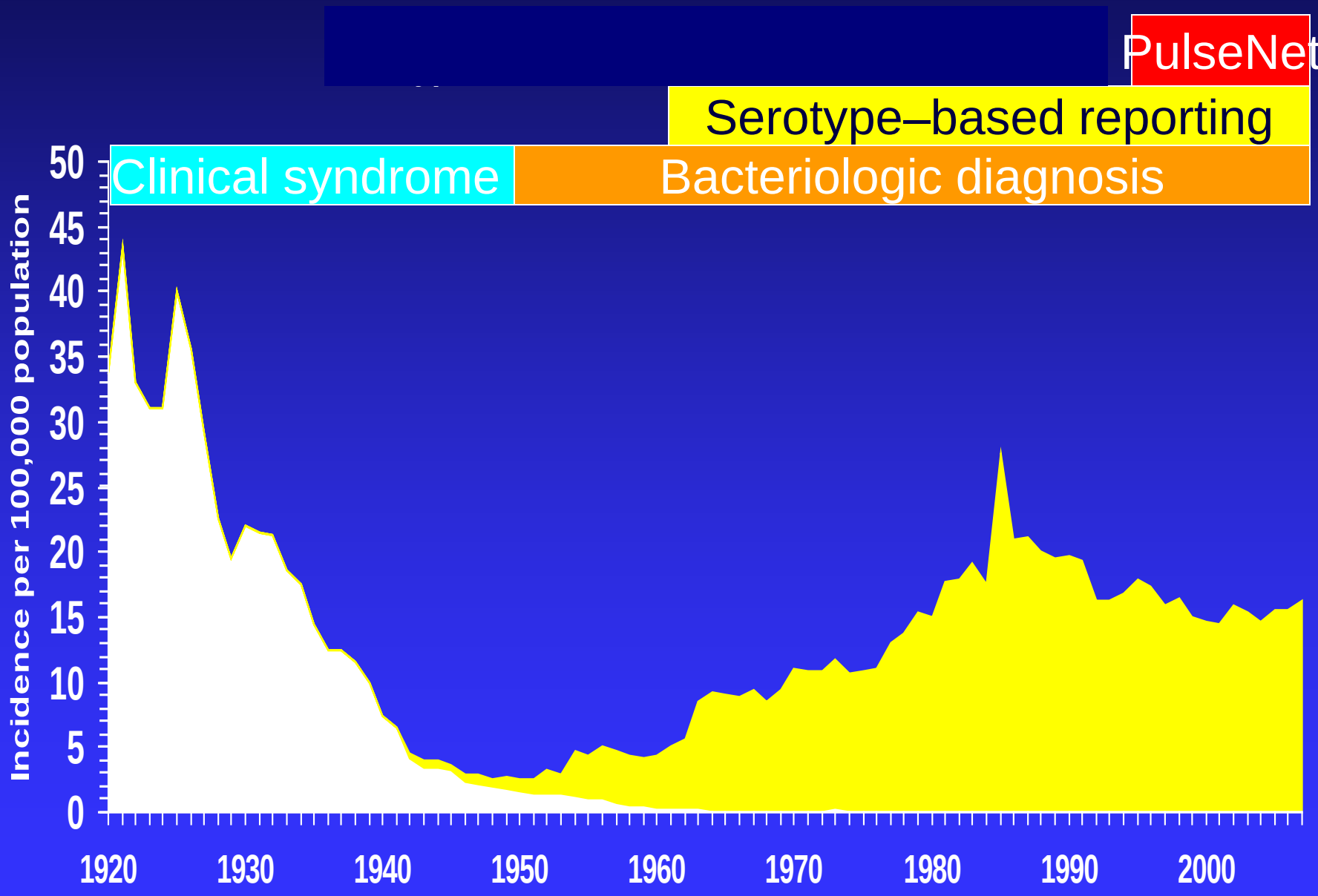

CDC, National surveillance data

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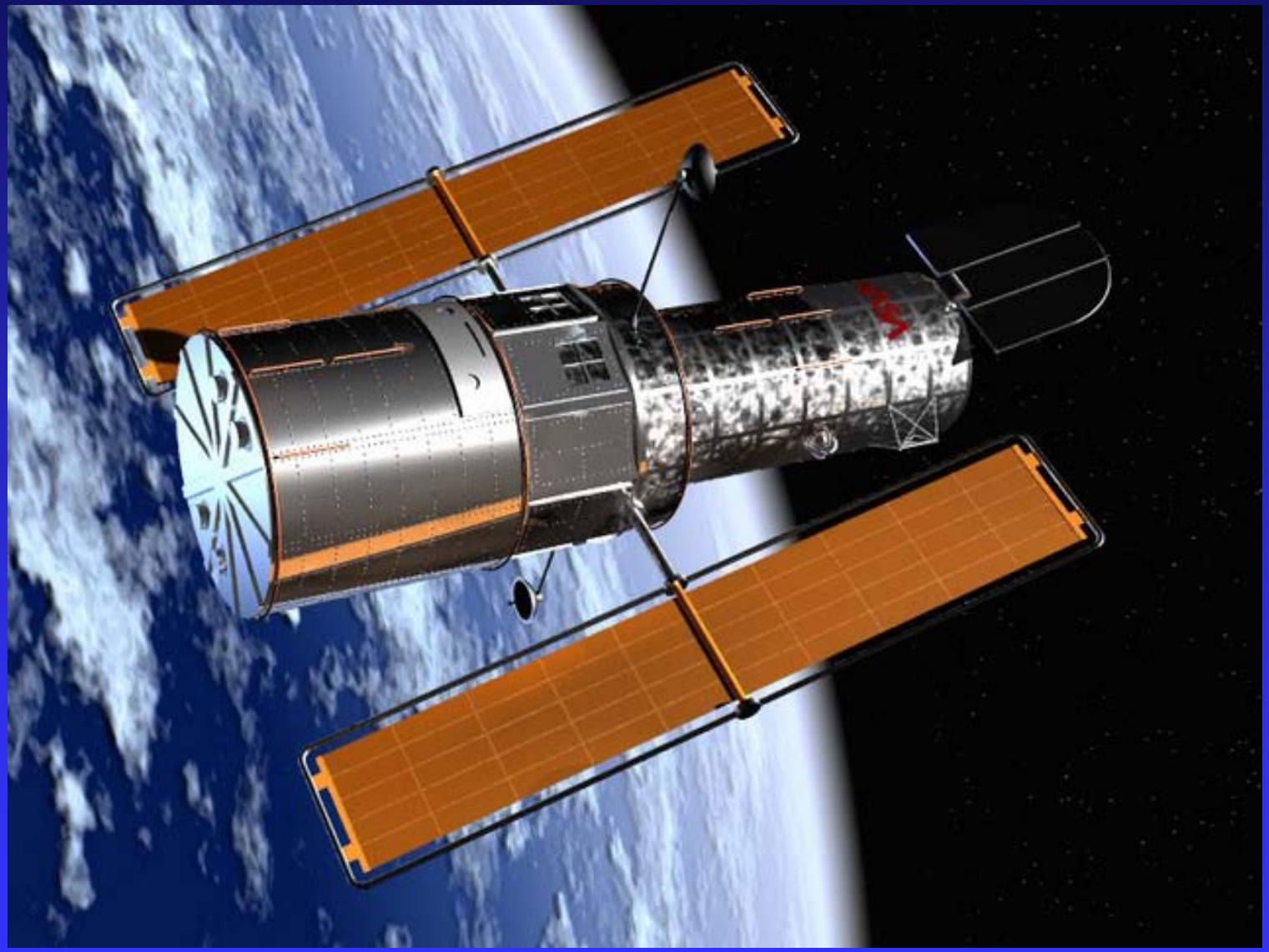
In 1995, Hubble telescope conducted the Deep Field Survey of the darkest region of the sky with fewest stars



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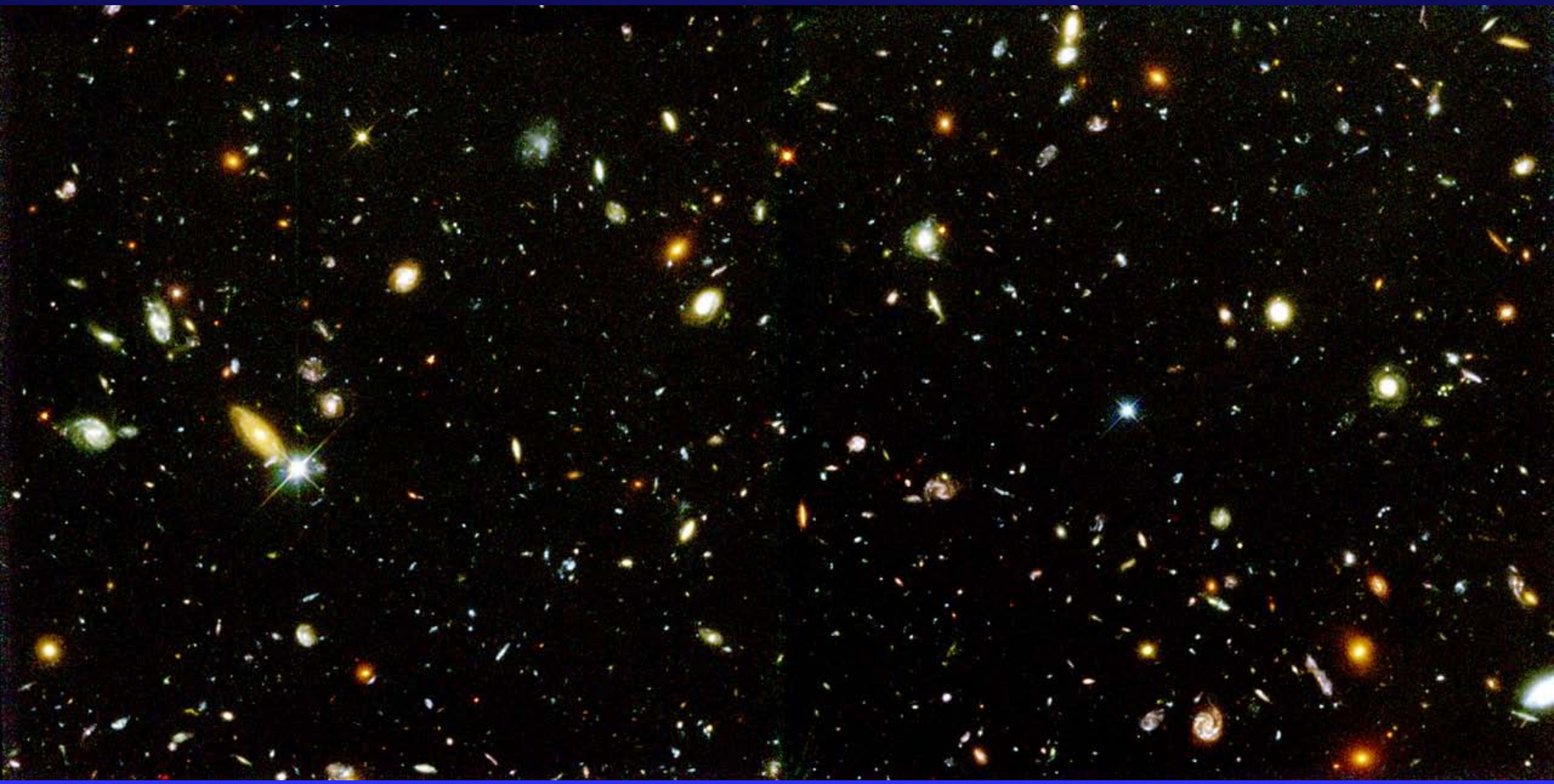
Hubble Deep Field survey: Myriad of previously unseen star clusters Transformed ideas about deep space



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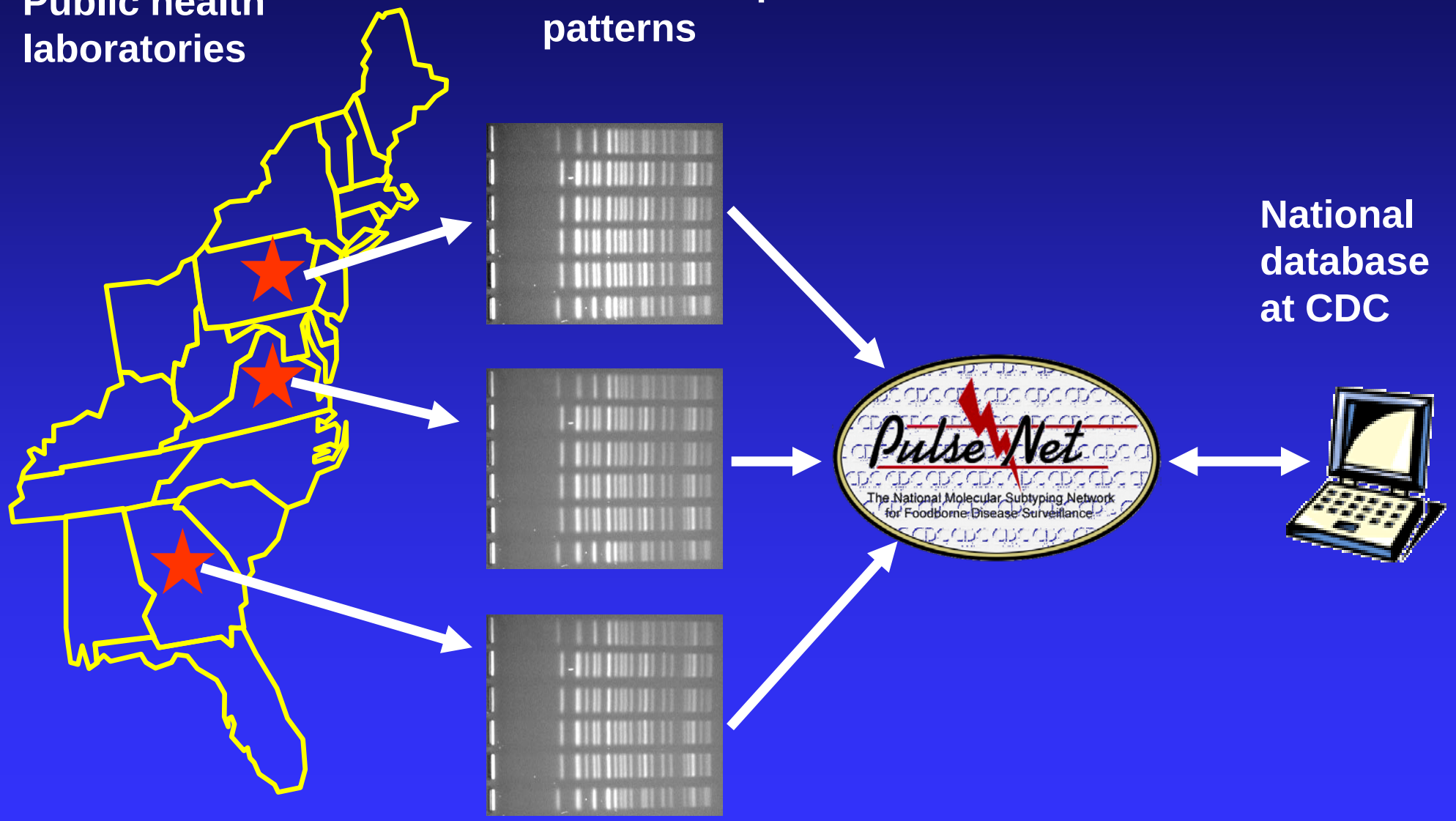
1996, PulseNet launched in United States

Public health laboratories

Pulsed Field Gel Electrophoresis patterns



National database at CDC

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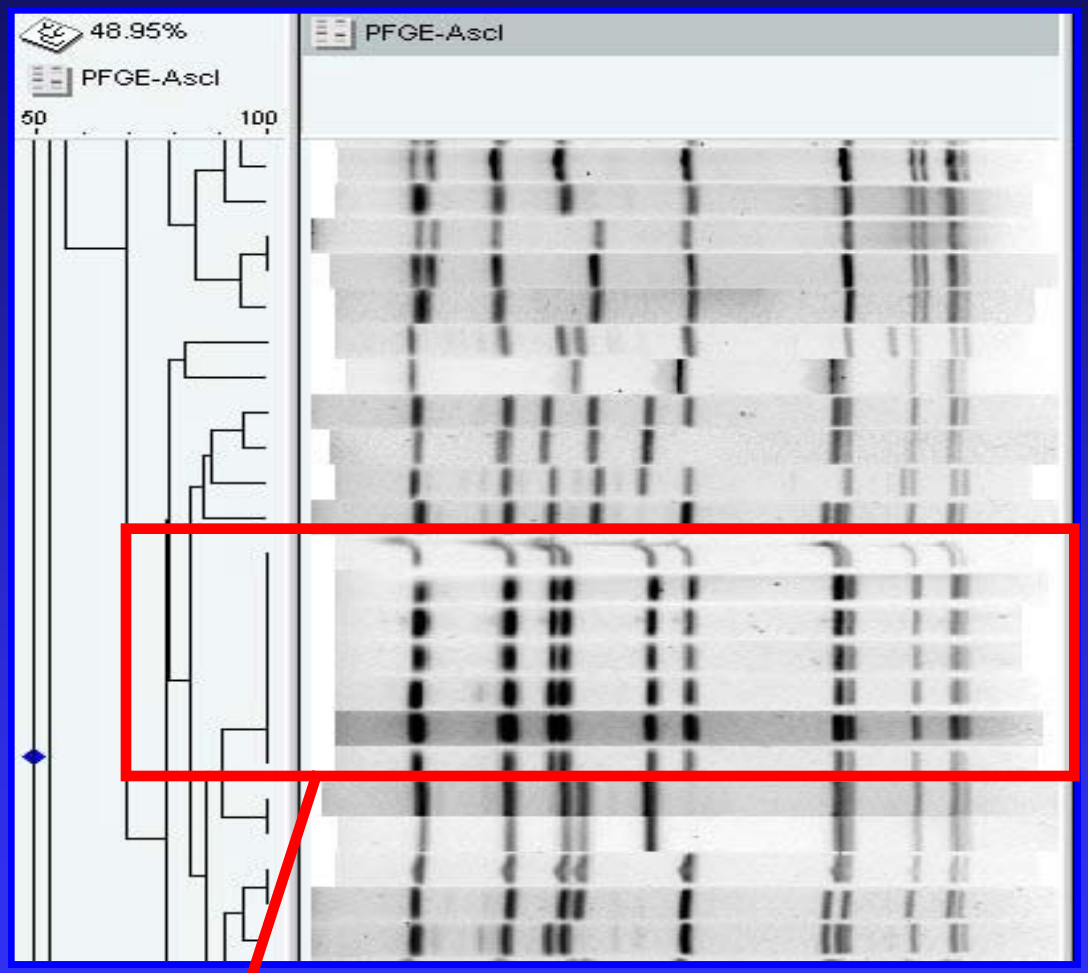
PulseNet Data Analysis: Searching for Clusters



Cluster of indistinguishable patterns

- State public health laboratories submit patterns electronically
- CDC and states search for similar patterns in past 2-4 months
- When cluster identified, PulseNet contacts epidemiologists

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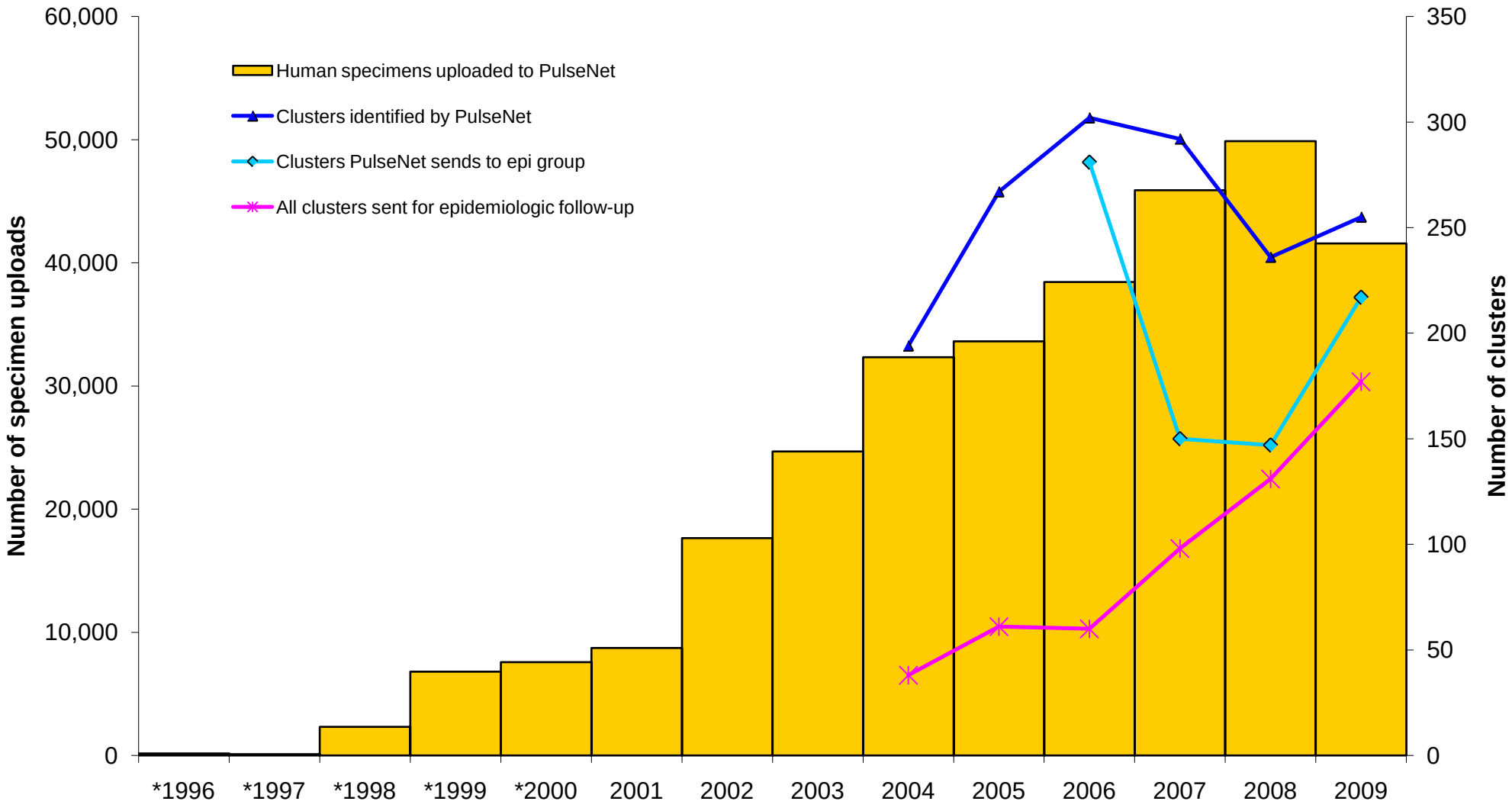
Human isolates uploaded to PulseNet USA and identified clusters, 1996-2009



* data type information may not be complete for these years

Department of Health and Human Services
Centers for Disease Control and Prevention

CDC en Español

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Salmonella

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Investigation Update: Multistate Outbreak of Human *Salmonella* Enteritidis Infections Associated with Shell Eggs

September 20, 2010

On This Page

Today's Highlights

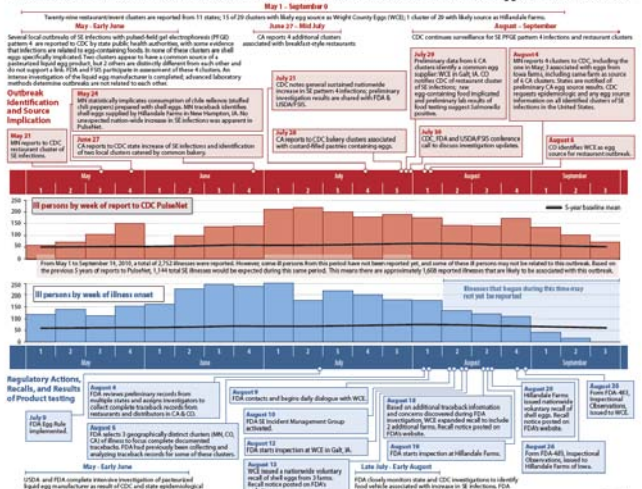
- From May 1 to September 14, 2010, approximately 1,608 illnesses were reported that are likely to be associated with this outbreak.
- **Now Available** - Timeline: Nationwide Outbreak of *Salmonella* Enteritidis (SE), Infections Associated with Shell Eggs, United States, 2010. (PDF - 427KB)

CDC continues to collaborate with public health officials in multiple states, the U.S. Food and Drug Administration (FDA), and the U.S. Department of Agriculture's Food Safety and Inspection Service to investigate a nationwide increase of *Salmonella* Enteritidis (SE) infections with an indistinguishable pulsed-field gel electrophoresis (PFGE) pattern JEGX01.0004. This is the most common PFGE pattern for SE in the PulseNet database. Investigators are using DNA analysis of SE bacteria obtained through diagnostic testing to identify cases of illness and restaurant or event clusters (where more than one ill person with the outbreak strain has eaten) that may be part of this outbreak. Because the SE PFGE pattern commonly occurs in the United States, some of the cases identified may not be related to this outbreak.

Investigation of the Outbreak

In July 2010, CDC identified a nationwide sustained increase in the number of *Salmonella* Enteritidis isolates with PFGE

Timeline: Nationwide Outbreak of *Salmonella* Enteritidis (SE) Infections Associated with Shell Eggs, United States, 2010



Quick Links
- Diseases & Conditions A-Z Index
- Report a Foodborne Illness
- DFBMD Home
- *Salmonella* Information

Contact CDC
CDC-INFO
800-CDC-INFO (232-4636)

The spectrum of foodborne disease outbreaks

➢Focal outbreak

- Large number of cases in one jurisdiction
- Detected by affected group themselves
- Local investigation
- Local food handling error
- Local solution

➢Dispersed outbreak

- Small numbers of cases in many jurisdictions
- Detected by lab-based subtype surveillance
- Multi-state investigation
- Industrial contamination event
- Broad implications

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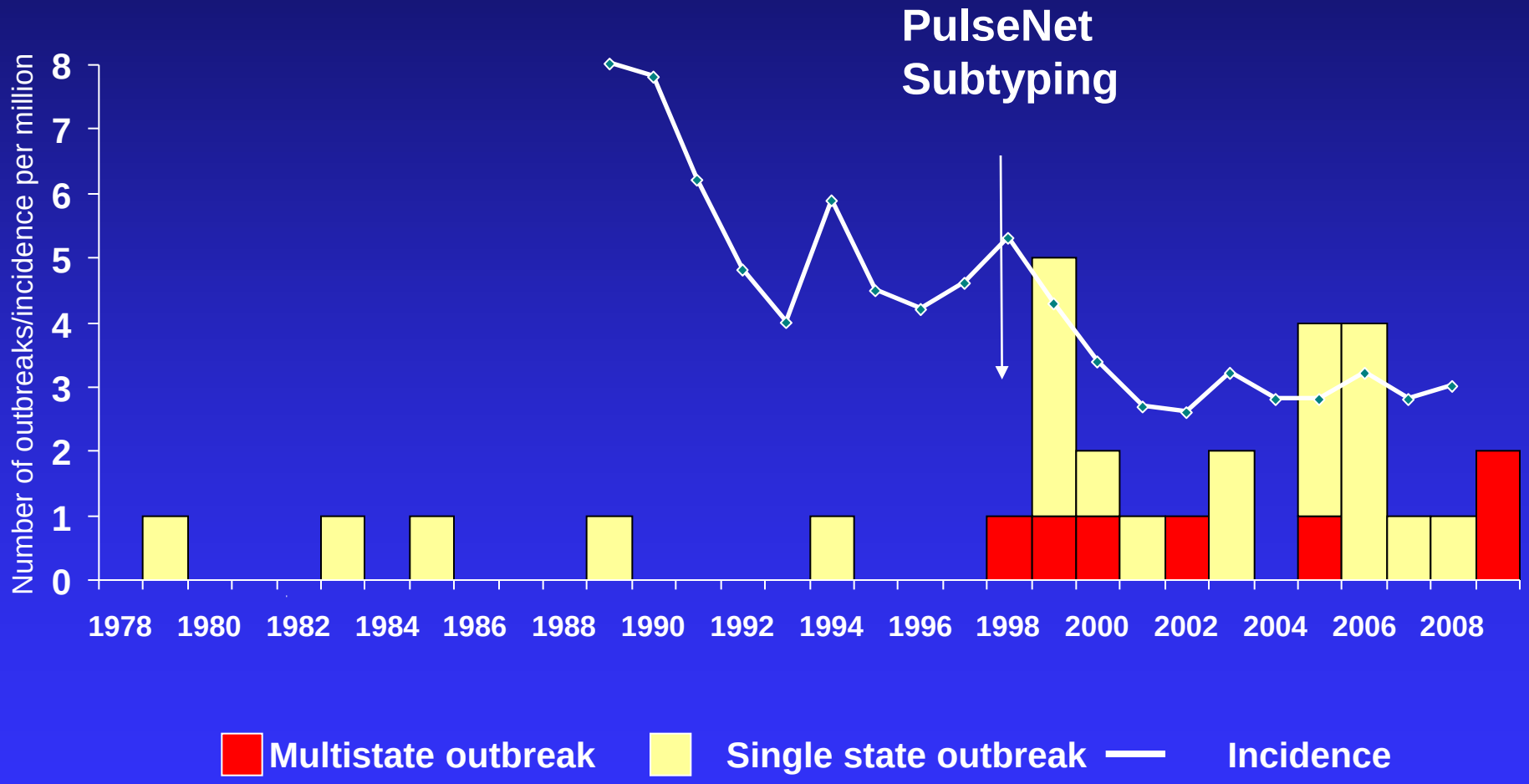
Outbreaks and incidence of reported cases of listeriosis, 1978-2008, United States



Incidence data from active surveillance systems (FoodNet since 1996)
Outbreaks of confirmed *Listeria monocytogenes* reported to CDC (eFORS)

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What makes PulseNet surveillance work?

- Central leadership and support
- Standardized methods across the entire system
- Real time subtyping in public health labs, useful at local, state and national level
- National database to which all partners have access 24/7
- Rapid linkage to epidemiologists at each level
- New methods are evaluated in state labs before adopting

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Theme 2: We nurture multidisciplinary and multiagency collaboration

- Epidemiologists, laboratorians and statisticians
- Physicians, veterinarians and PhDs
  - Train in same training programs
  - Hired into parallel staff positions
- Public health and regulatory partners (FDA, USDA)
  - Participate in PulseNet
  - Share priorities and research plans
  - Constant human interactions
    - Train each others' staff
    - Permanent liaison officers
    - Joint investigations
  - **Routinely take regulatory action based on strong epidemiological investigation, without waiting to find the pathogen in the food**

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A challenging outbreak of infections with *Salmonella* Montevideo

- 272 cases in 44 states, detected by PulseNet
- CDC led a complex multi-state investigation: case-control study, review of store records, culture of foods:
  - Salami meats from one company
- Investigation in factory by State, USDA, and FDA
  - Salami produced safely
  - Contaminated when rolled in black or red pepper
  - Point of contamination of pepper uncertain
- Recall of salamis, and of black and red pepper
- New concern about risk of dry spices
  - Should they all be irradiated or fumigated?

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Theme 3: Foster innovation at all levels

- New challenges require new solutions
- Need to innovate, to meet new challenges
- Federal structure means we have many “incubators”
- Networks for defining best practices, optimizing solutions

Fostering innovation with networked solutions

- **Problem:** Major variation in surveillance practices and reporting from states to state → FoodNet
  - Active surveillance network (Sites in 10 states)
  - Supported by CDC, USDA, FDA
  - Annual "report card" on progress in prevention

- **Problem:** Tracking antimicrobial resistance in enteric bacteria
  - National Antimicrobial Resistance Monitoring System (NARMS)
  - CDC, USDA, FDA and a panel of state health departments
  - Isolates from humans, animals and foods

- **Problem:** Growing challenge of large multistate outbreaks that need rapid coordinated investigation

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Starting in 2010: OutbreakNet Sentinel Sites:

- 5 sites (4 states and 1 city) selected
- New network for developing and assessing methods
- Improve public health methods for foodborne outbreak detection, investigation and control
  - Faster interview and other investigative methods
  - Faster and newer laboratory procedures
  - Standardized approaches
  - “Investigate more outbreaks faster”
  - Better IT tools to support investigations
- Replicate successful models across the country
- Supported by CDC and USDA

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Theme 4: Foodborne disease is a global problem

- Global outbreaks due to exported foods
- Detecting and investigating them requires international collaboration
- Molecular surveillance can work at the global level
- The network approach can work at the global level
- Partners around the world

PulseNet International

Molecular surveillance of infections at the global level by

- Partnering with reference laboratories throughout the world
- Building capacity for molecular surveillance of foodborne infections
- Collaborating on internationally standardized subtyping methods to be used in the networks
- Performing collaborative studies on the geographic distribution and spread of different clones of foodborne pathogens

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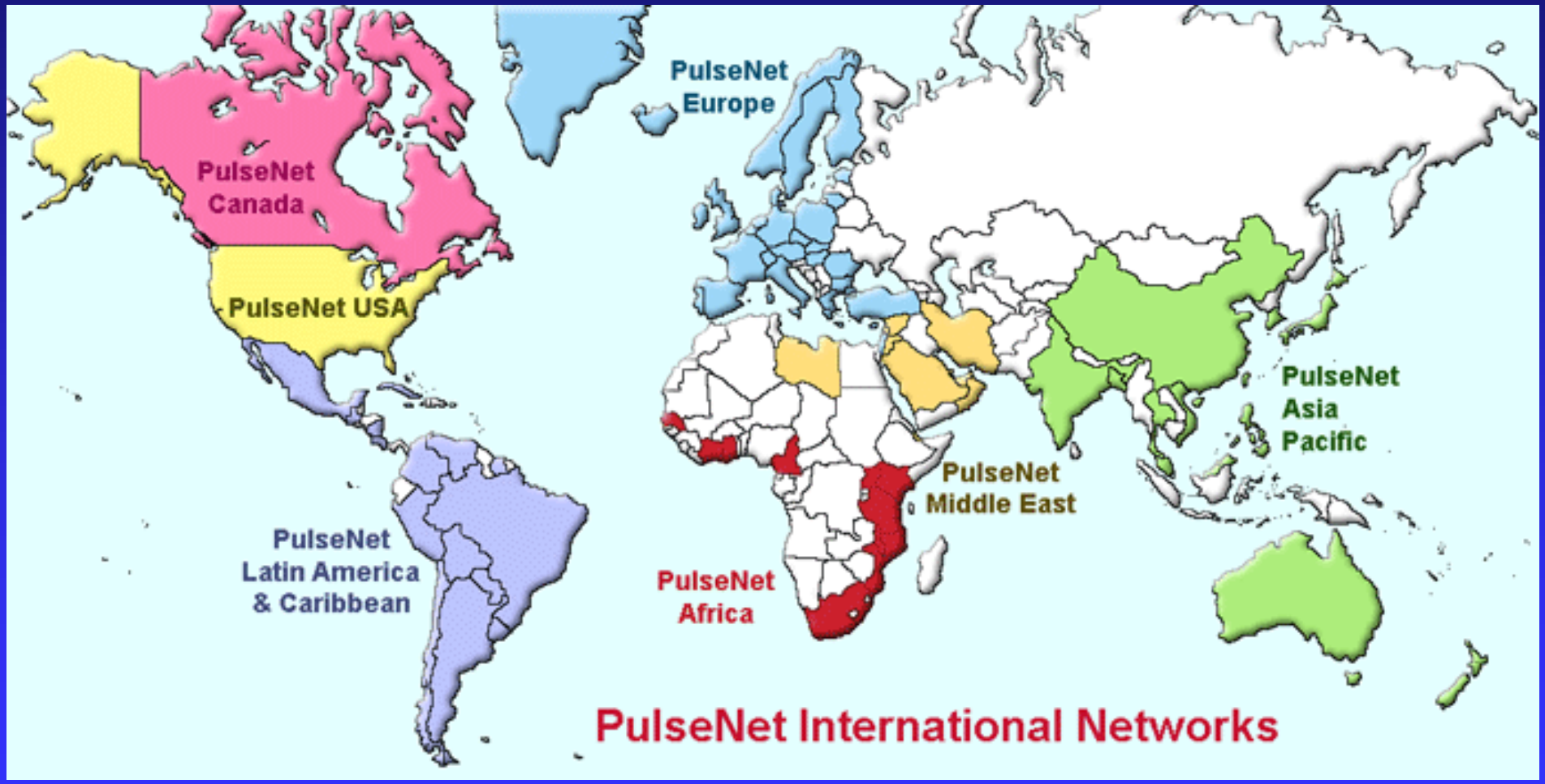
PulseNet International



www.pulsenetinternational.org

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WHO Global Foodborne Infection Network

- To strengthen capacities of national public health institutions
- To establish regional centers for specialized training and expand to new areas of need
- To foster interdisciplinary collaboration in national institutions working with foodborne disease and pathogens
- To foster global communication about foodborne disease and pathogen surveillance

http://www.who.int/gfn/en/

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WHO GFN: Building Capacity for Foodborne Disease Surveillance and Response

RÉSEAU INTERNATIONAL DES INSTITUTS PASTEUR

Institut Pasteur

World Health Organization

Danish Institute for Food and Veterinary Research

CDC

Centers for Disease Control and Prevention

Public Health Agency of Canada

FDA Center for Veterinary Medicine

ANIMAL SCIENCES GROUP
WAGENINGEN UR

Animal Sciences Group, Netherlands

ozfoodnet

OzFoodNet-Australia

ENTER-NET

Enter-net

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WHO GFN International training courses

- To date, 70 courses, in 19 sites, participants from 130 countries
- Microbiologists (human, veterinary, food) and epidemiologists

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Improving foodborne disease prevention is a "winnable battle": As a national public health institute, we

- Improve capacity in entire system with improved surveillance
- Work closely with our regulatory partners in prevention
  - Joint investigations
  - Helping them target prevention by defining high risk foods
- Build public health networks for innovation
- Work with international partners to improve efforts in many countries, identify problems before they become global, and make food safer everywhere

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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

Our websites

- PulseNet: www.cdc.gov/pulsenet
- FoodNet: www.cdc.gov/foodnet
- NARMS: www.cdc.gov/narms
- Foodborne Outbreaks: www.cdc.gov/outbreaknet
- PulseNet International:
  www.pulsenetinternational.org
- WHO Global Foodborne Infection Network
  www.who.int/gfn/en/

- General information: foodsafety.gov

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