Linking Science and Action – Decreasing the Burden of Foodborne Diseases



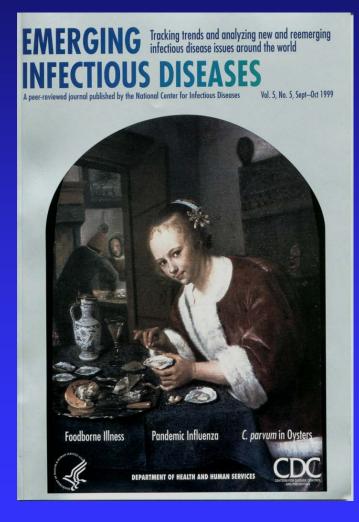
Annual Meeting International Association of National Public Health Institutes November 1, 2010, Atlanta, GA

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Deputy Director, Division of Foodborne, Waterborne and Environmental Diseases National Center for Emerging and Zoonotic Infectious Diseases Centers for Disease Control and Prevention



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



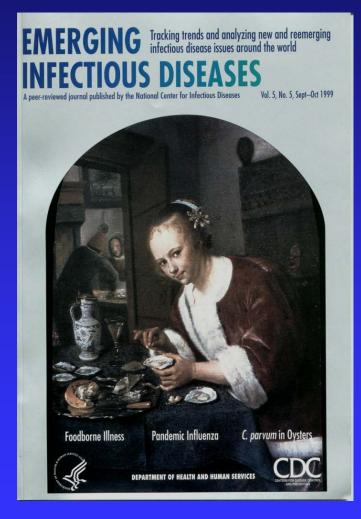
1999 estimate by CDC, made possible by improved surveillance and analysis

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

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

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

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



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 O145 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:

May 2010

Outbreak of *E. coli* O145:NM STEC infections 33 cases in 5 States, 3 with HUS Linked to lettuce

Lettuce recalled

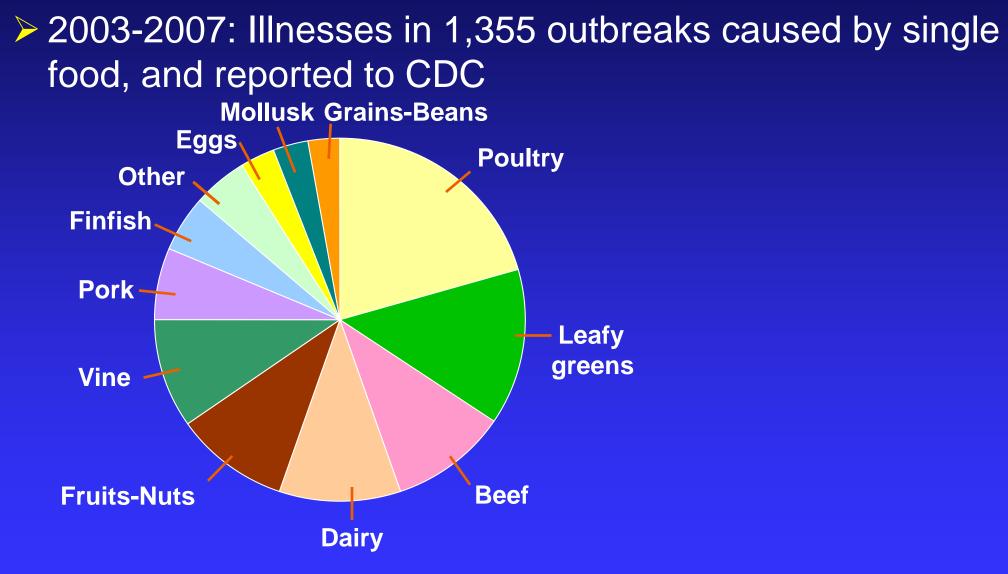
Field contamination investigated

New regulations on produce safety being drafted

- Fungal
 - Aflatoxin
- Prion
 - Transmissible nvCJD agent



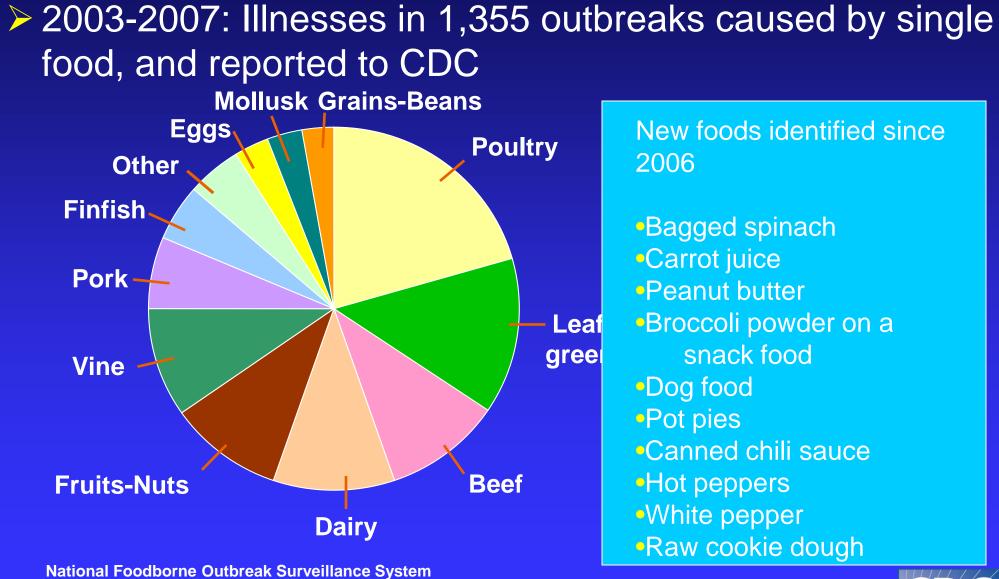
The food vehicles implicated in outbreaks



National Foodborne Outbreak Surveillance System



The food vehicles implicated in outbreaks



CDC CENTERS FOR DISEASE

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:

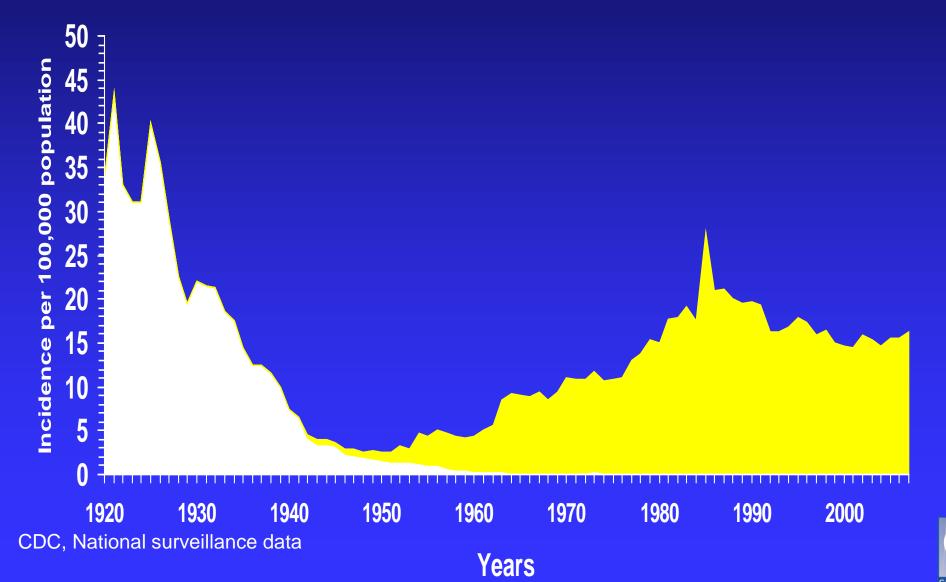
- Risk identification agency: CDC (surveillance and investigation)
- Risk management/regulatory agencies: FDA, USDA, EPA (inspection and enforcement)

Tiered response to emergencies:

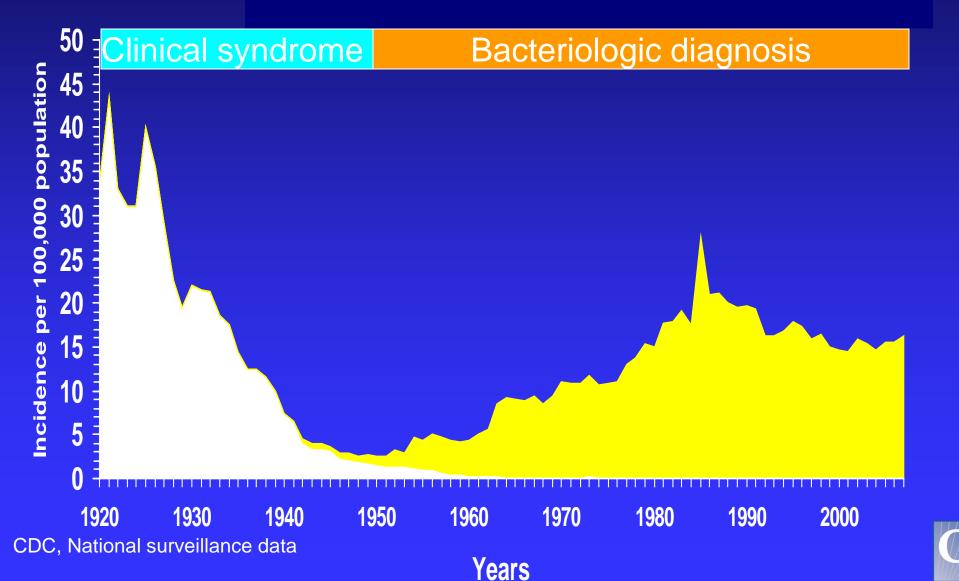
- CDC provides surge capacity to States: epidemiologists, laboratory support, consultation
- CDC leads nationwide outbreak investigations



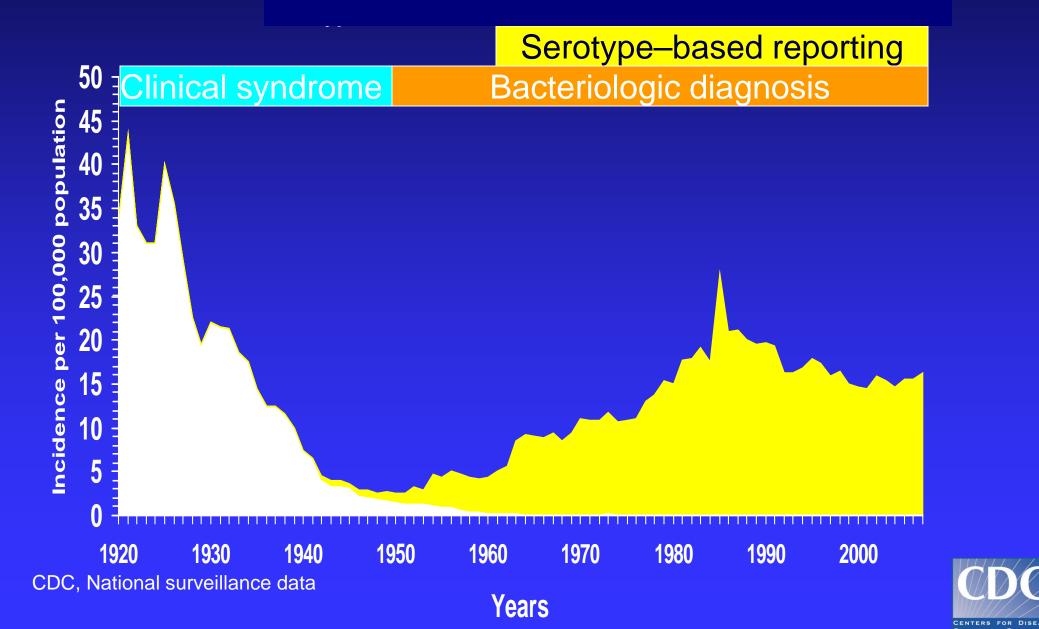
■ Typhoid Fever ■ Non-typhoid Salmonellosis

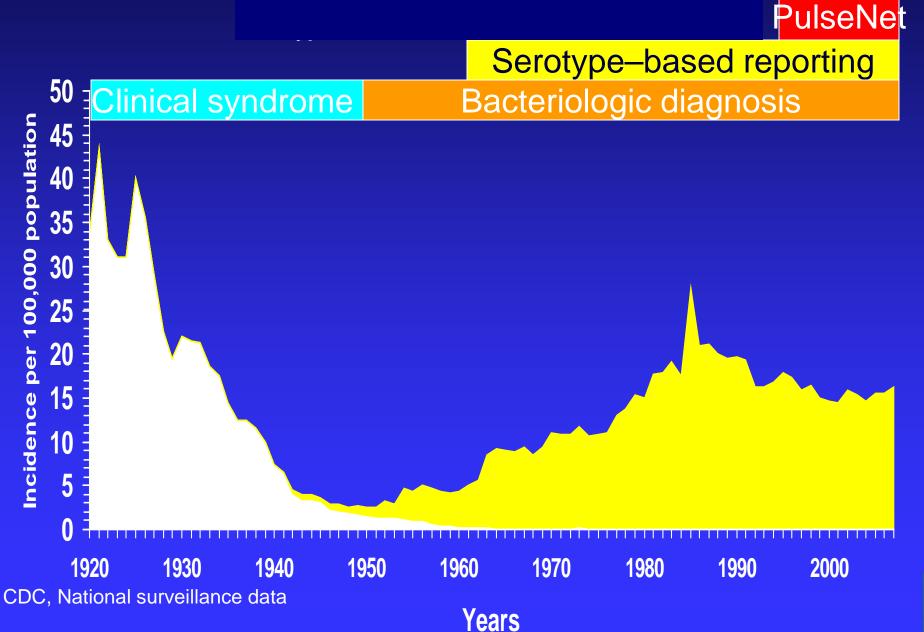






CENTERS FOR DISEASE CONTROL AND PREVENTION







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



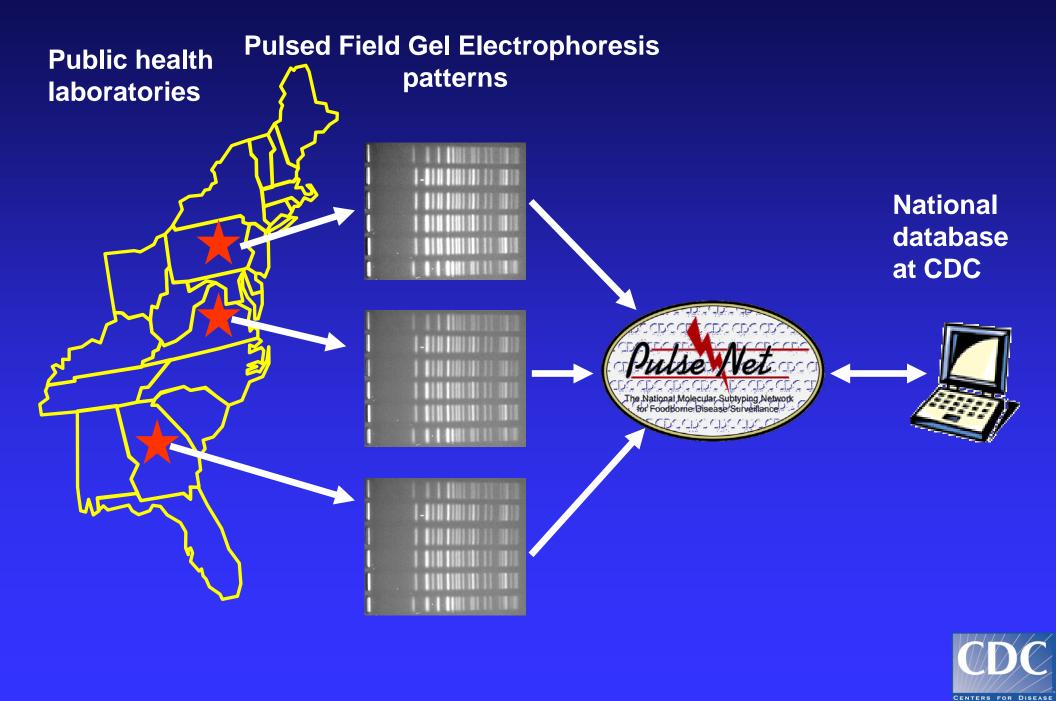


Hubble Deep Field survey: Myriad of previously unseen star clusters Transformed ideas about deep space

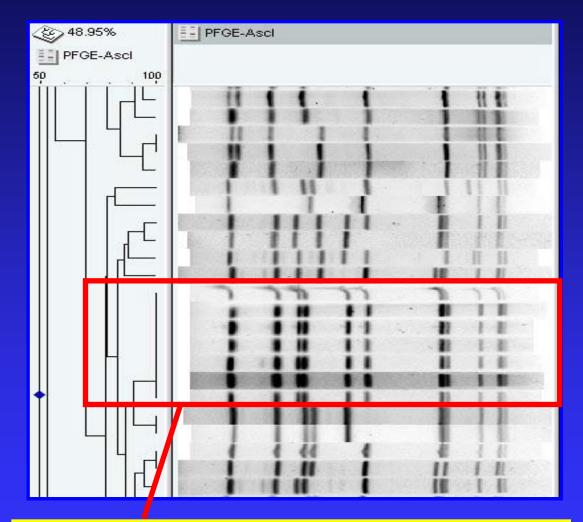




1996, PulseNet launched in United States



PulseNet Data Analysis: Searching for Clusters



•State public health laboratories submit patterns electronically

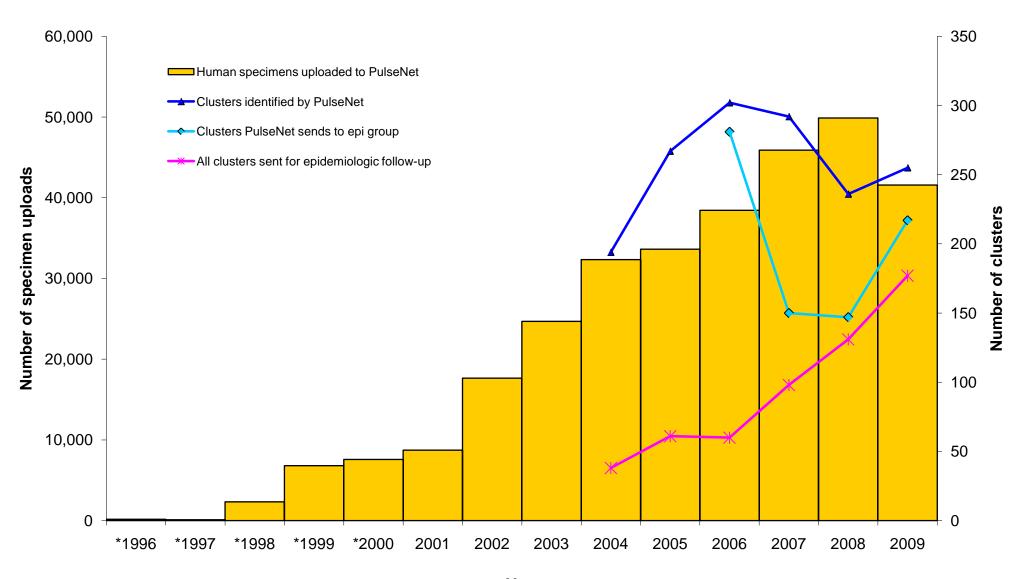
•CDC and states search for similar patterns in past 2-4 months

•When cluster identified, PulseNet contacts epidemiologists

> CDCC CENTERS FOR DISEASE CONTERI AND DEFENSION

Cluster of indistinguishable patterns

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



* data type information may not be complete for these years Year

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CENTERS FOR DISEASE CONTROL AND PREVENTION

The spectrum of foodborne disease outbreaks

➢Focal outbreak

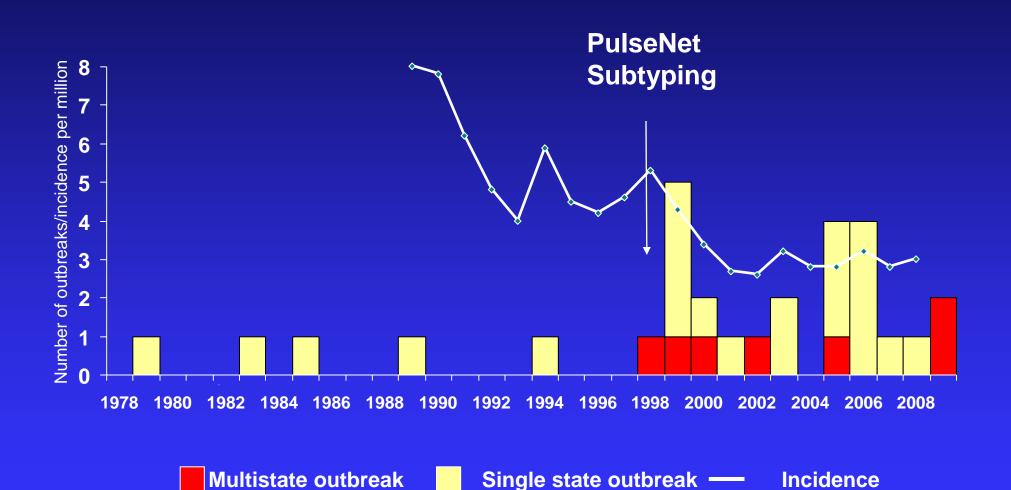
- Large number of cases in one jurisdiction
- Detected by affected group themselves
- Local investigation
- Local food handling error
- Local solution

Dispersed outbreak

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



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)



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



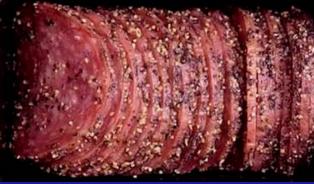
Theme 2: We nurture multidisciplinary and multiagency collaboration

- 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



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?



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

- 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



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



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



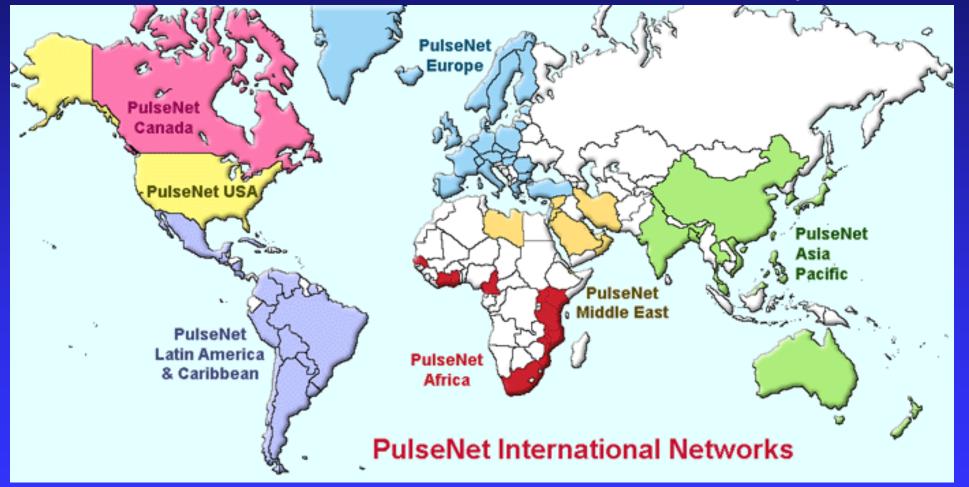
Molecular surveillance of infections at the global level by

- > 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



PulseNet International





www.pulsenetinternational.org



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/



WHO GFN: Building Capacity for Foodborne Disease Surveillance and Response





RÉSEAU INTERNATIONAL DES INSTITUTS PASTEUR

Institut Pasteur



Centers for Disease Control and Prevention



Animal Sciences Group, Netherlands



World Health Organization



Public Health Agency of Canada



OzFoodNet-Australia



Danish Institute for Food and Veterinary Research



FDA Center for Veterinary Medicine



CDC CENTERS FOR DISEASE

WHO GFN International training courses

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



CENTERS FOR DISEASE

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





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

