Pennsylvania integrated surveillance for antimicrobial resistance in foodborne pathogens

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Lead Epidemiologist AR Program
Pennsylvania Department of Health
• Welcome and Introduction
• NARMS Overview
• Meat and Human testing
• Molecular Epidemiology
• Antimicrobial Susceptibility Testing
• Collaboration on Environmental Sources
• Ongoing research and wrap up
NARMS Collaborators

- FDA
  - Heather Tate
  - Emily Crarey
- USDA
  - Wu San Chen
- Chester County
  - Jan Achenbach
- PA Department of Health
  - Kim Warren
Pennsylvania Department of Health—Role

- Board of Health and Vital Statistics established in 1885\(^1\)
  - Monitor mortality, morbidity, births and marriages

- Pennsylvania Department of Health created in 1905
  - Monitor the health status of the population;
  - Identify and eliminate preventable illness and accidents;

- Disease Prevention and Control Law of 1955
  - Established current reporting requirements in chapter 27
    - Surveillance for foodborne pathogens (e.g., *Salmonella*) is mandated

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Growing threat of antimicrobial resistance
Aim of the Collaboration

• Strengthen public health response to antimicrobial resistance in foodborne pathogens
Specific objectives

- Monitor trends in resistance among bacteria from animals, food and humans
- Conduct studies to elucidate on antibiotics use and emergence of resistance in food animals and clinical isolates

Figure 1. Percentage of nontyphoidal *Salmonella* isolates with resistance to nalidixic acid compared non-susceptibility to ciprofloxacin, 1996-2013
Source: CDC, NARMS 2013 Report
Specific objectives (continued)

• Compare isolates from humans and retail meat to facilitate timely investigations of outbreaks
• Guide selection of isolates for further study

Specific objectives (continued)

• Disseminate findings to strengthen antimicrobial stewardship efforts in clinical and agricultural settings

• Inform research to support communication and public policy on judicious antibiotics use
A Comparison of Non-Typhoidal Salmonella from Humans and Food Animals Using Pulsed-Field Gel Electrophoresis and Antimicrobial Susceptibility Patterns

Carol H. Sandt, Paul J. Fadok-Cray, Deepankar Tewari, Stephen Ostroff, Kevin Joyce, Nkuchia M. M'Kanatha

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NARMS Retail Meat Testing

- PA is one of 14 states that participate in this program
- Location: catchment area in zip codes within 2-hour driving distance from the Bureau of Laboratories
  - Chester, Delaware, Lancaster, and Philadelphia counties
- Store sample takes into account population density
  - Collection by contractor
  - Frequency: 40 samples bimonthly
- Sample types: Delivered to lab at 2-5°C
  - Chicken breasts
  - Ground turkey
  - Ground beef
  - Pork chops
• Standard Culture protocol for Salmonella and Campylobacter

• Salmonella identification – biochemical and bacterial serotyping

• Campylobacter – gram stain, growth characteristics and PCR speciation

• Salmonella and Campylobacter bacterial isolates shipped monthly to FDA laboratory for antimicrobial susceptibilities studies.

• Quarterly teleconferences with FDA
Salmonella, Shigella and E.coli O157

- Clinical microbiology labs are required to send all Salmonella, Shigella and Shiga Toxin E. coli (STEC).

- Confirm identification with biochemicals and perform bacterial serotyping, Shiga Toxin PCR.

- 1/5 (20%) non-typhoid Salmonella, Shigella and E. coli O157, all Typhi are shipped quarterly to CDC for antimicrobial studies.

- Import data into CDC website.

- Quarterly teleconferences with CDC
Molecular Epidemiology
# Salmonella PFGE: Meat and Humans

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## Meat Sources

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### Automated Report

<table>
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<th>NARMS Sample #</th>
<th>Coll Date</th>
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<th>Establ. County</th>
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<td>P-7903</td>
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**Serotype**

S. Enteritidis

**Xbal Pattern Name**

Xbal#JEGX01.0023

**Frequency**

1.21%

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**Human Samples w/ Matching Patterns:** 4

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*Frequency is the number of occurrences of this particular pattern divided by the number of occurrences of this pattern prefix (left of the decimal point), expressed as a percentage.*
Animal Laboratory

Laboratory

Deepanker Tewari
Animal Laboratory

- Pennsylvania Veterinary Lab (PVL), Harrisburg

- Participate with national veterinary labs
  - (NAHLN, FERN, VET LIRN)

- Examples of tests performed
  - Influenza
  - Brucellosis
  - Salmonellosis
  - Rabies
  - WNV

Rabies
- Collaboration with NARMS

- Antimicrobial resistant testing using NARMS protocol
  - Susceptibility testing (MIC determination)
  - Disk diffusion (Breakpoint analysis)

- Special studies
  - Listeria monocytogenes (food and human – PA & NY)
  - Salmonella cerro (cattle - PA)
### Salmonella Serotype % rate in PA Cattle over 10 years

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<th>Year</th>
<th>Typhimurium (including var 5-)</th>
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<th>Montevideo</th>
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Environmental Collaboration
David Hewitt
Ongoing Research
Molecular biology and genomics of foodborne pathogens

• Primary Investigator: Edward Dudley, Penn State; Dept. of Food Science, CoAS/CIDD

• Studying genomics for tracking foodborne pathogens – Part of FDA GenomeTrakr

• Understanding the impact of microbiome on toxins expression by E. coli O157:H7
Collaboration on Environmental Sources

Drug resistant bacteria in the environment

David Hewitt, in collaboration with Jeff Townsend (Yale University) and Ryan Kerney (Gettysburg College)
Collaboration on Environmental Sources (cont’d)

An additional concern in urban areas

Combined sewer systems

Images from US EPA, Google Maps, and Vanessa Couvreur
Ongoing Research

Consumer perspectives on antibiotic usage in retail meats

- Primary Investigator: Rachel Smith, PhD, Penn State; CASHDF & CIDD
- Studying psychosocial determinants of consumers’ behaviors, and their intentions to encourage other people’s consumption.
There are in fact two things, science and opinion; the former begets knowledge, the latter ignorance.

- Hippocrates (c460-c.377 BCE)
  Greek physician. Law

Source: Science Blog