The Salmonella story by Integrated Surveillance

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Katarina Pintar, Jane Parmley and Barb Marshall

Laboratory for Foodborne Zoonoses
CFEZID
Surveillance Systems

• Core public health goals and objectives
  – Monitor spatial and temporal trends in disease
  – Identify new or emerging disease issues
• Surveillance actions/outcomes:
  – Initiate interventions
  – Measure the success of an intervention
  – Guide research
Enteric disease surveillance at PHAC

- Many programs focus on enteric disease:
  - Many gather data about human cases only
    - National Notifiable Disease (NND)
    - National Enteric Surveillance Program (NESP)
- Integrated enteric surveillance programs:
  - Collect data along the food chain continuum
    - C-EnterNet
    - CIPARS
CIPARS and C-EnterNet

- Together provide a holistic approach to enteric disease and antimicrobial resistance
  - Transmission of zoonotic enteric pathogens
  - Risk factors for infection
  - Emergence of antimicrobial resistance (AMR)
  - Trends related to antimicrobial use (AMU)
- Critical support platforms for research
  - Livestock husbandry and production methods
  - Environmental sources of enteric pathogens
  - Socio-economic factors and vulnerable populations
Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

- Established in 2002
  “To preserve the efficacy of antimicrobials for humans and animals”
- Provides a unified approach to track temporal and regional trends in AMU, and AMR in selected species of enteric bacteria obtained at different points along the food chain
- Nation-wide data are generated and collected:
  - Farms
  - Abattoirs
  - Retail stores
  - Human and animal diagnostic health laboratories
C-EnterNet

- Implemented in 2005
- Sentinel site design
- C-EnterNet’s primary objectives
  
  - To detect changes in trends in human enteric disease and in levels of pathogen exposure from food, animal and water sources in defined populations;
  
  - To strengthen source attribution efforts in Canada

- C-EnterNet works with partners to identify and subtype 10 enteric pathogens in each sentinel site area, on farms, in the watershed, at retail stores and within the human cases. Molecular subtyping allows for the comparison of the pathogens that cause disease in humans and the potential sources.
C-EnterNet Exposure Assessment

Human case information and enhanced risk factor information collected through standardized questionnaires

Enhanced Lab Testing

Retail sampling
- raw pork chops
- ground beef
- chicken breasts
- bagged lettuce

Enhanced Lab Testing

Animal / Farm sampling
- Beef
- Swine
- Dairy
- Poultry

Enhanced Lab Testing

Surface Water testing
- 5 sites
- Physical parameters and pathogens

Enhanced Lab Testing
Surveillance Design

PHAC
C-EnterNet
Central

Sentinel Sites across Canada

Continuous
Episodic

Human
Food
On-farm
Water
Digging Deeper: the *Salmonella* story

- 2nd most common cause of human, bacterial enteric illness
- Many exposure sources:
  - Animals
  - Humans
  - Food
  - Water
## Integrated *Salmonella* Surveillance

<table>
<thead>
<tr>
<th>Component</th>
<th>Species</th>
<th>C-EnterNet</th>
<th>CIPARS</th>
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<tbody>
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<td>* (2002-present)</td>
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<td>All animal species</td>
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<tr>
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<td>Cattle (dairy)</td>
<td>* (2006-present)</td>
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<td>X</td>
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<tr>
<td>Monitoring</td>
<td>Feed and Ingredients</td>
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<td>* (2002-present)</td>
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</table>
Salmonella Enteritidis

• Most commonly reported serotype in Canada (increase in incidence since 2005)

• Limited discriminatory power of molecular techniques

• Value of the enhanced human surveillance provided by C-EnterNet
  – Majority of S. Enteritidis are not associated with an outbreak
  – Certain subtypes associated with travel, and some are domestically acquired

• S. Enteritidis is frequently recovered from chicken.
CIPARS and C-EnterNet Together

- Different scales of data
  - CIPARS – National in scope, broader
  - C-EnterNet – Sentinel Site based, to represent 10% of Canadian population when fully implemented
- Leveraging the costs and benefits of national scope and rich community-level perspectives
- Multi-dimensional picture
Multi-dimensional Picture

C-EnterNet Sentinel Site

Future C-EnterNet Sentinel Site?

C-EnterNet Sentinel Site

Future C-EnterNet Sentinel Sites?
Missing data

- Neither CIPARS nor C-EnterNet routinely capture *Salmonella* data from the layer sector
  - Pilot surveillance project sampling spent layer hens at slaughter
  - Prevalence of *Salmonella* at egg breaking stations
Conclusions

• Public health happens at the individual level
• In an increasingly global world, the individual may have less control over some of these decisions

• How CIPARS and C-EnterNet support each other:
  – Common issues identified
  – Broad lens permits comparisons across regions that may provide insight into disease exposures and incidence
  – Policy and intervention happen along a spectrum
  – Various levels of surveillance data, shared and unique stakeholders, and collaborators form important network across Canada to inform, prevent and control enteric disease and antimicrobial resistance emergence.
Two perspectives are better than one

• Looking at human disease without including the context in which human illness occurs will not inform our decision-making ability.

• Enteric disease and AMR are complex issues that demand an integrated and flexible approach that is able to capture information from a variety of sources and adapt to ever-changing local and global animal, environment and public health systems.

• CIPARS and C-EnterNet together provide Canada with a national structure that is able to meet these challenges in foodborne enteric disease and AMR.

• This approach is based on successful model in the US, Australia, and parts of the European Union.
CIPARS, Public Health Agency of Canada

Agnes Agunos
Brent Avery
Carolee Carson
Linda Cole
Danielle Daignault
Anne Deckert
Andrea Desruisseau
Chad Gill
Rita Finley
Sheryl Gow
Rebecca Irwin
Nicol Janecko
David Leger
Antoinette Ludwig
Michael Mulvey
Jane Parmley
Richard Reid-Smith
Michelle Tessier
Technicians, Filed Staff, Administrative Staff

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