Need for a harmonised approach for surveillance of antimicrobial resistance (AMR) in animals – the Canadian experience

March 13, 2013

Carolee Carson, Rebecca Irwin, Brent Avery, Anne Deckert, David Leger, Rita Finley

PROTECTING CANADIANS FROM ILLNESS

Public Health Agency of Canada
Agence de la santé publique du Canada
Canada

SURVEILLANCE INFORMATION IS COMPELLING

…a need for a harmonized approach…

harmonization enables **comparisons & integration**

Outline

1. **Why** do you want surveillance information?

2. **Understand the system** (ecology, population distribution, stakeholders)

3. Canadian Integrated Program for Antimicrobial Resistance Surveillance **(CIPARS)**

Government of Canada | Gouvernement du Canada

Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

ANTIMICROBIAL RESISTANCE SHORT REPORT

2011

...working towards the preservation of effective antimicrobials for humans and animals...

Canada

Surveillance

- Ongoing analysis, interpretation & feedback of systematically collected data using methods distinguished by their practicality, uniformity & rapidity rather than total accuracy or completeness
- Main purpose is to detect changes in trends (*e.g.* time, space) in order to initiate investigative or control measures (Last, 1995)

Harmonization

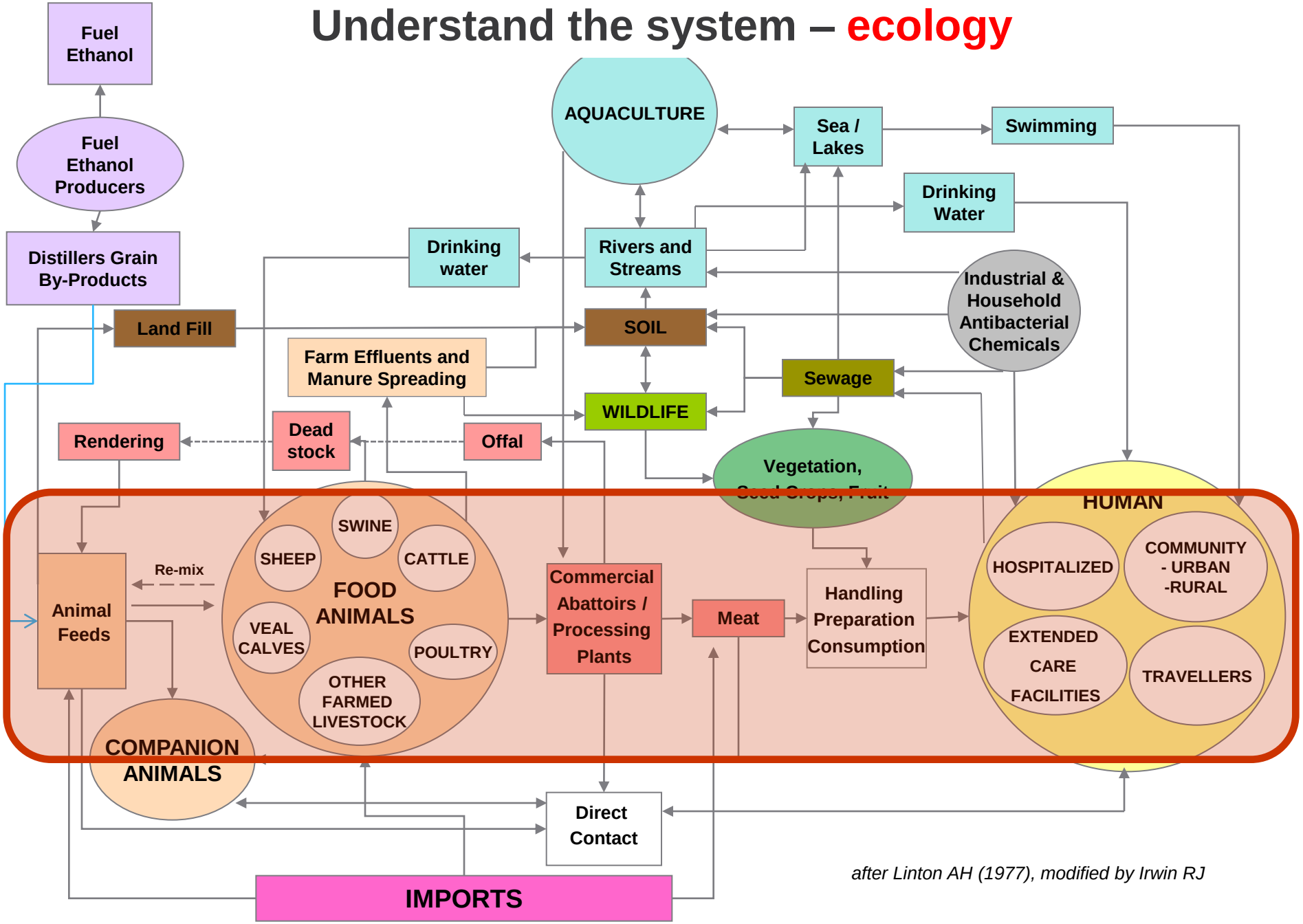
- Sample or data collection (AMR, antimicrobial use, animal, human)
- Laboratory methods
- Data analysis & metrics
- Communication

Why do you want surveillance information?

CIPARS Objectives

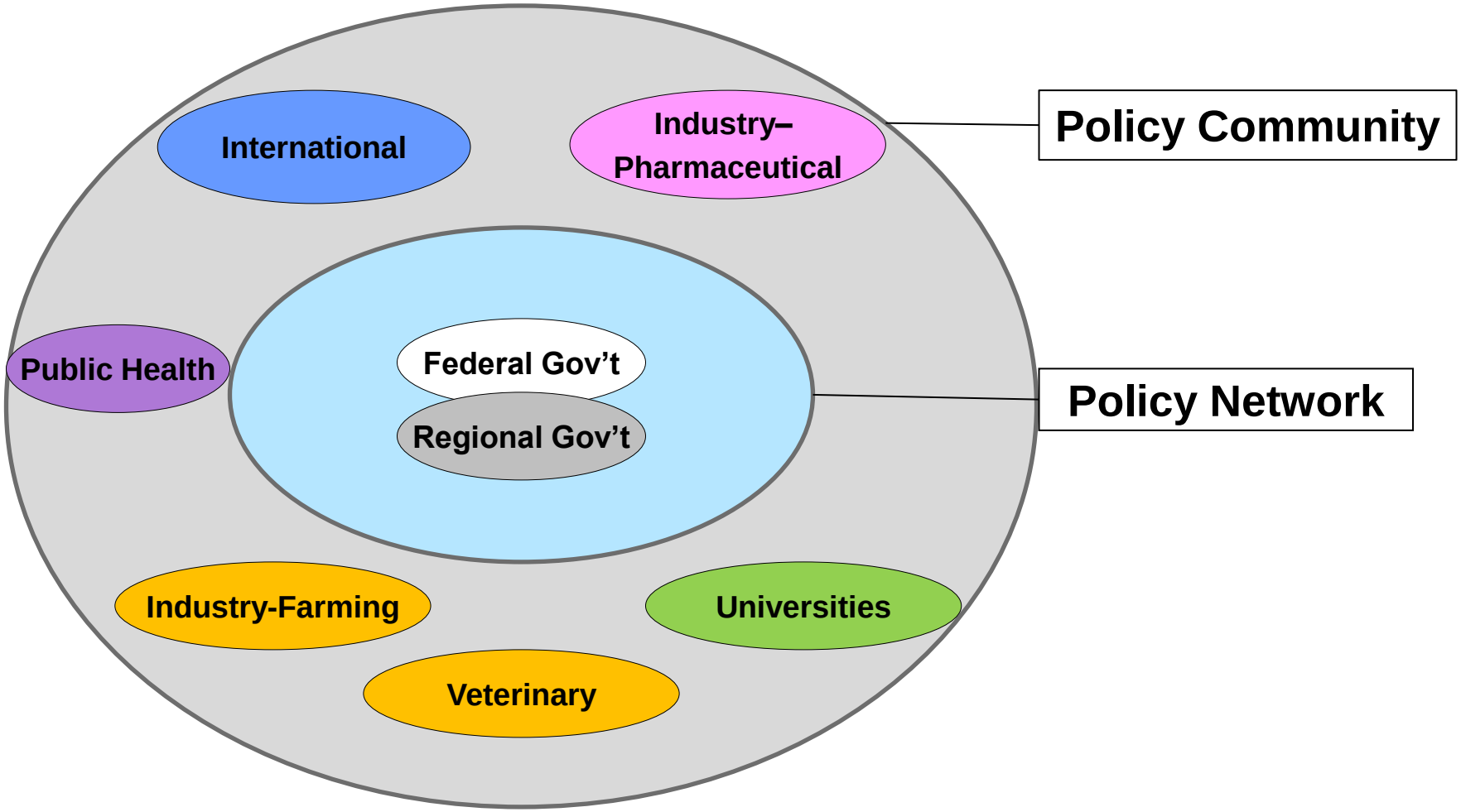
- Unified approach to monitor trends in AMR & antimicrobial use in humans & animals
- Generate timely reports
- Generate data to facilitate the assessment of the public health impact of antimicrobials used in human & agricultural sectors
- Allow accurate international comparisons with other countries that use similar surveillance systems

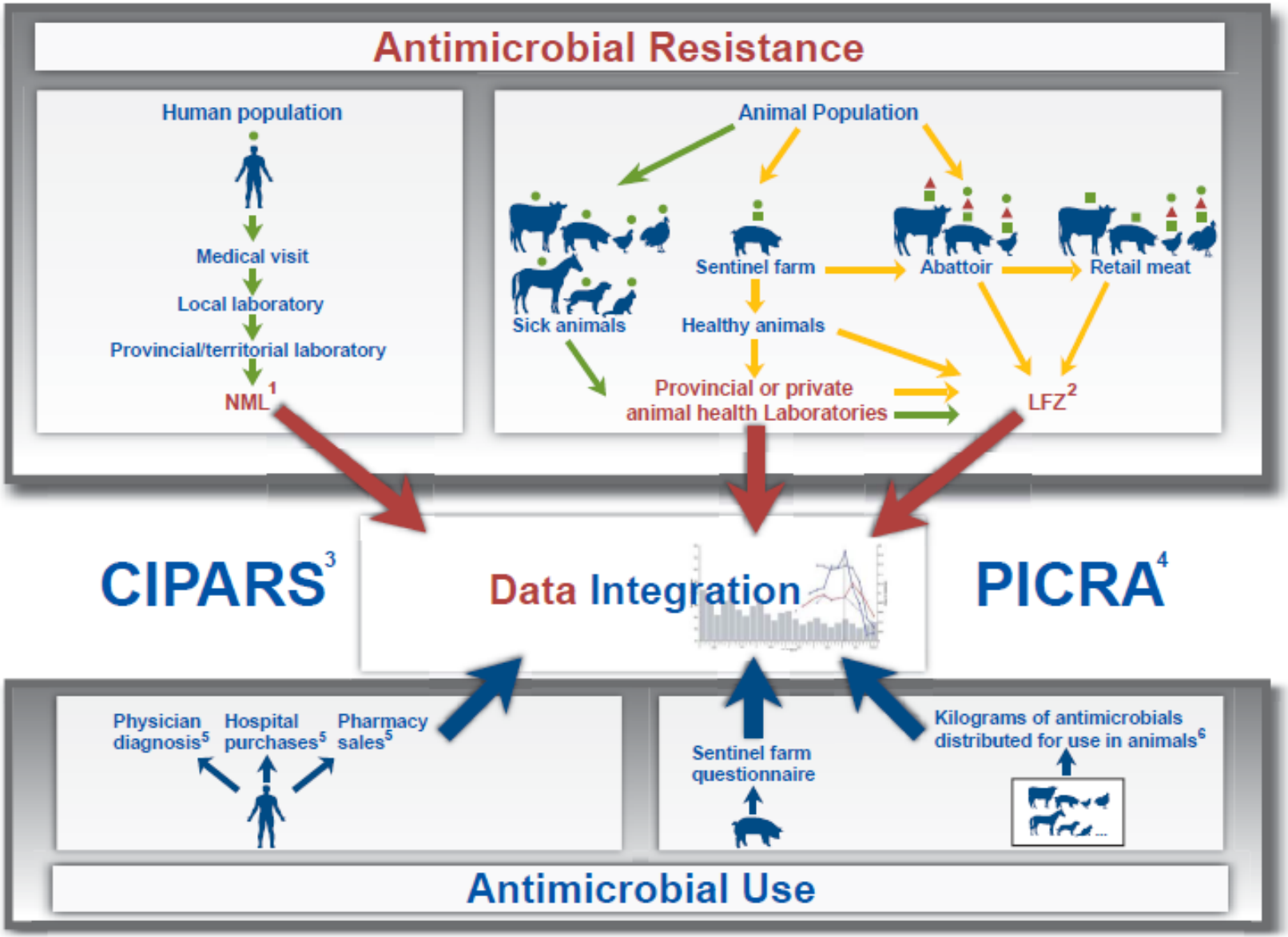
Understand the system – ecology



after Linton AH (1977), modified by Irwin RJ

Understand the system – stakeholders





[1] National Microbiology Laboratory, Winnipeg, MB
[2] Laboratory for Foodborne Zoonoses, Guelph, ON and Saint-Hyacinthe, QC
[3] Canadian Integrated Program for Antimicrobial Resistance Surveillance, Public Health Agency of Canada
[4] Programme intégré canadien de surveillance de la résistance aux antimicrobiens. Agence de la santé publique du Canada
[5] IMS Health Canada, Inc.
[6] Canadian Animal Health Institute (CAHI)

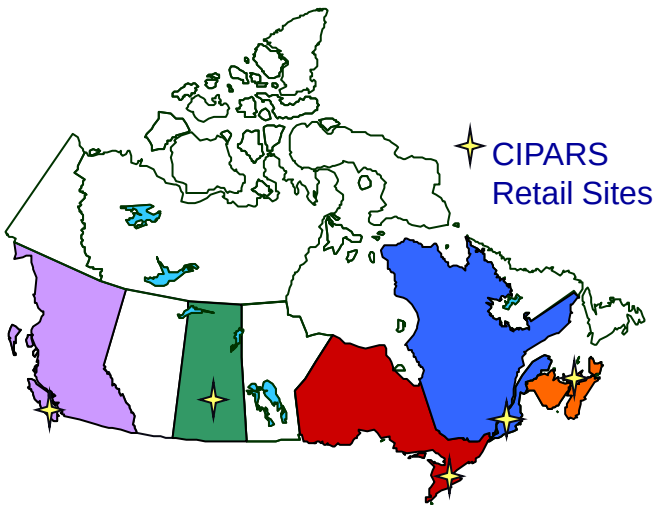
Active Surveillance
Passive Surveillance
Salmonella
Campylobacter
Escherichia coli

Retail Surveillance

- Chicken, pork, beef, & turkey
- *Salmonella*, generic *E. coli, Campylobacter*
- Implemented in different provinces, implementation date varied over time
- Provincial estimates
- Census division selection & sample allocation weighted by human population

Harmonization Considerations:

- Active or passive surveillance?
- Meat 'species'? Product?
- Bacterial species? Culture methods?
- Where geographically?
- Store types?

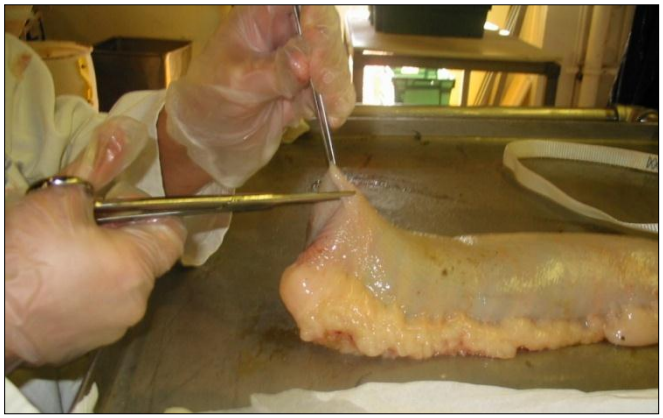


Abattoir Surveillance

- Cattle, pigs, broiler chickens
- *Salmonella*, generic *E. coli, Campylobacter*
- Implemented in fall of 2002
- National estimates, federally inspected abattoirs
- Abattoir selection & sample allocation weighted by slaughter volume
- Caecal samples

Harmonization Considerations:

- Active or passive surveillance?
- Animal species?
- *Animal origin (domestic or imported)?*
- Bacterial species?
- *Where geographically (raised or slaughtered)?*
- *Sample type?*



Farm Surveillance

- Pigs – grower-finisher hogs
- *Salmonella,* generic *E. coli*
- Implemented in 2006 (5 major pork producing provinces)
- Herds allocated per province proportional to number of grower-finisher units in each province
- Each herd sampled once per year
    - Herd questionnaire
- Broiler chickens in 2013

Harmonization Considerations:

- Active or passive surveillance?
- Animal species?
- *Animal production stage?*
- Bacterial species?
- Where geographically?
- *Sample type?*

More harmonization

Laboratory Methods

- Isolation, serotyping, phage typing, susceptibility testing
  - Sensititre™ (automated broth microdilution)
- **Data Management**
  - Centralized database – data integrity, access, timeliness
- **Breakpoints** - Clinical Laboratory Standards Institute (CLSI)

Harmonization Considerations:

- What type of testing?
- What antimicrobials?
- Data access & ease of changes?
- Breakpoints?

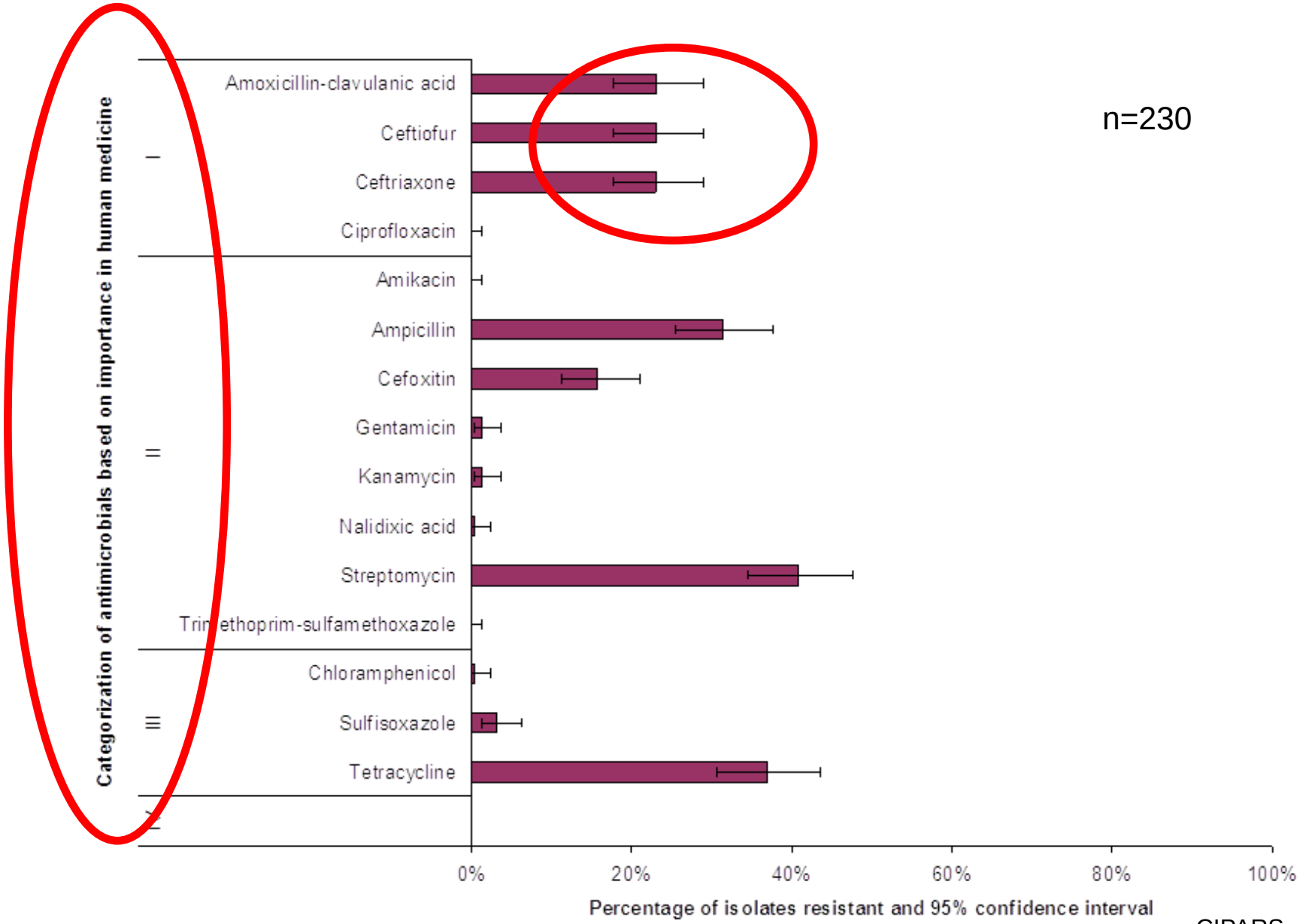
Antimicrobial	n	% R	Distribution (%) of MICs (µg/mL)									
			≤ 0.015	0.03	0.06	0.12	0.25	0.5	1	2	4	8
Ciprofloxacin	280	0.0	80.00	18.21	0.36	0.36	1.07					

1.43% above ECOFF

0% Resistant

0% Resistant

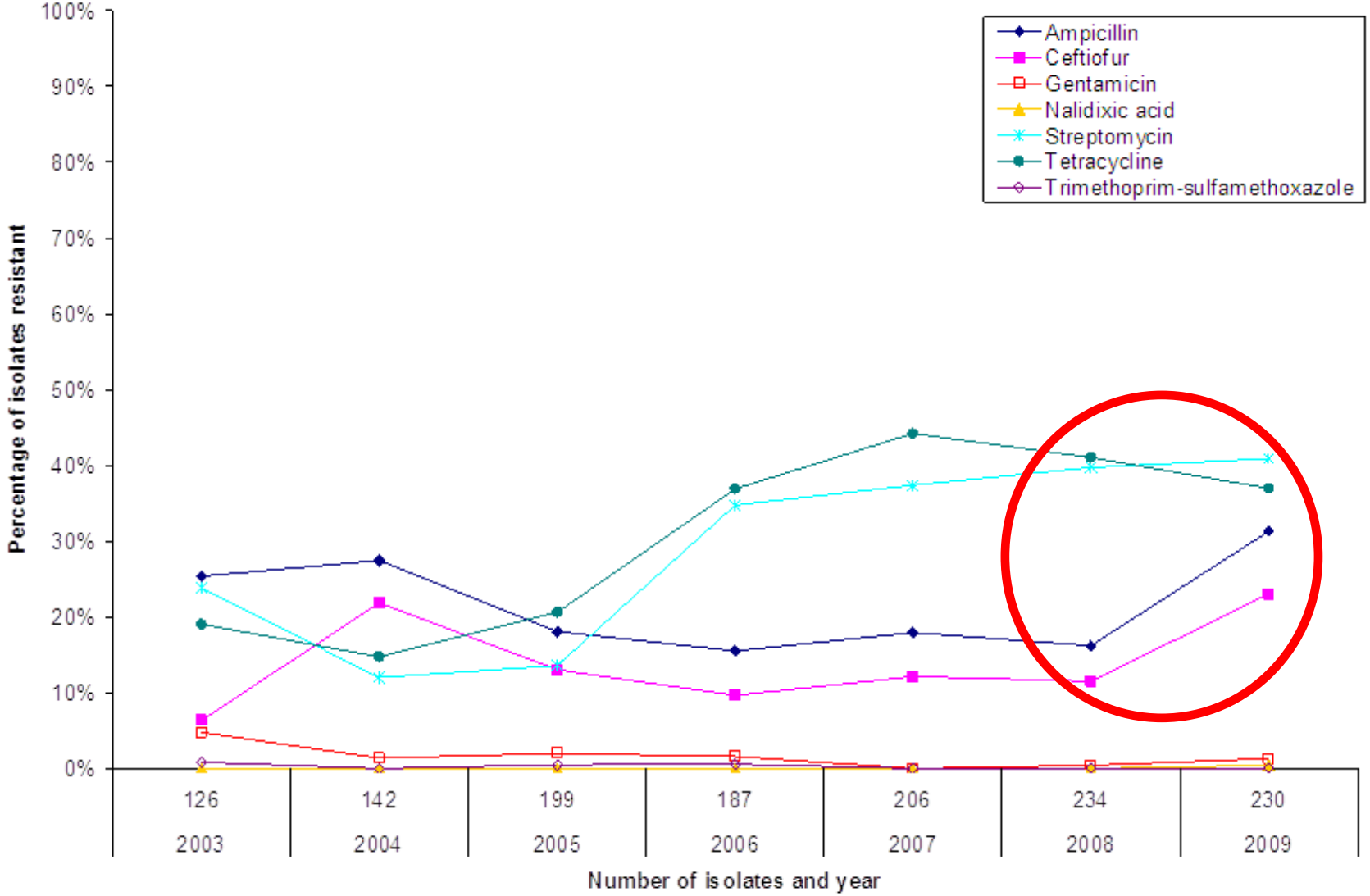
Reporting - examples



n=230

CIPARS

Reporting - examples



CIPARS

Reporting - examples

Serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial														
							Aminoglycosides				β-lactams					Folate pathway inhibitors		Phenicols	Quinolones		Tetracycli
		0	1	2–3	4–5	6	AMK	GEN	KAN	STR	AMP	AMC	CRO	FOX	TIO	SSS	SXT	CHL	CIP	NAL	TET
Kentucky	95 (41.3)	16	9	69	1					70	41	40	40	24	40					1	71
Heidelberg	50 (21.7)	23	18	9				2		8	27	10	10	9	10	2					
Enteritidis	44 (19.1)	43	1							1											
Hadar	9 (3.9)	2	1	6						7											6
Typhimurium	6 (2.6)	5			1					1	1					1		1			1
Less common serovars	26 (11.3)	17	1	8			1		3	7	3	3	3	3	3	4					7
Total	230 (100)	106	30	92	2		3		3	94	72	53	53	36	53	7		1		1	85

CIPARS

Bacterial species	Number (%) of isolates / serovar total Number (%) of isolates / *Salmonella* total							
	Susceptible to all antimicrobials	Resistant to A2C-AMP	ACSSuT	AKSSuT	ACKSSuT	A2C-ACSSuT	A2C-AKSSuT	A2C
Salmonella Enteritidis (n = 44)	43/44 (98%) 43/230 (19%)							
Salmonella Heidelberg (n = 50)	23/50 (46%) 23/230 (10%)	9/50 (18%) 9/230 (4%)						
Salmonella Typhimurium (n = 8)	5/8 (63%) 5/230 (2%)	1/8 (13%) 1/230 (< 1%)	1/8 (13%) 1/230 (< 1%)					
Other serovars (n = 128)	35/230 (15%)	26/230 (11%)						

CIPARS

Communication

- Annual Reports
- Short Reports
- Antimicrobial Use Reports
- Surveillance Bulletins
- *Ad hoc* Reports - stakeholders
- *Salmonella* Quarterly Reports
- Peer-reviewed papers
- Risk profile
- Multi-commodity stakeholder meeting

RESEARCH

Ceftiofur Resistance in *Salmonella enterica* Serovar Heidelberg from Chicken Meat and Humans, Canada

Lucie Dutil, Rebecca Irwin, Rita Finley, Lai King Ng, Brent Avery, Patrick Boerlin, Anne-Marie Bourgault, Linda Cole, Danielle Daignault, Andrea Desruisseau, Walter Demczuk, Linda Hoang, Greg B. Horsman, Johanne Ismail, Frances Jamieson, Anne Maki, Ana Pacagnella, and Dylan R. Pillai

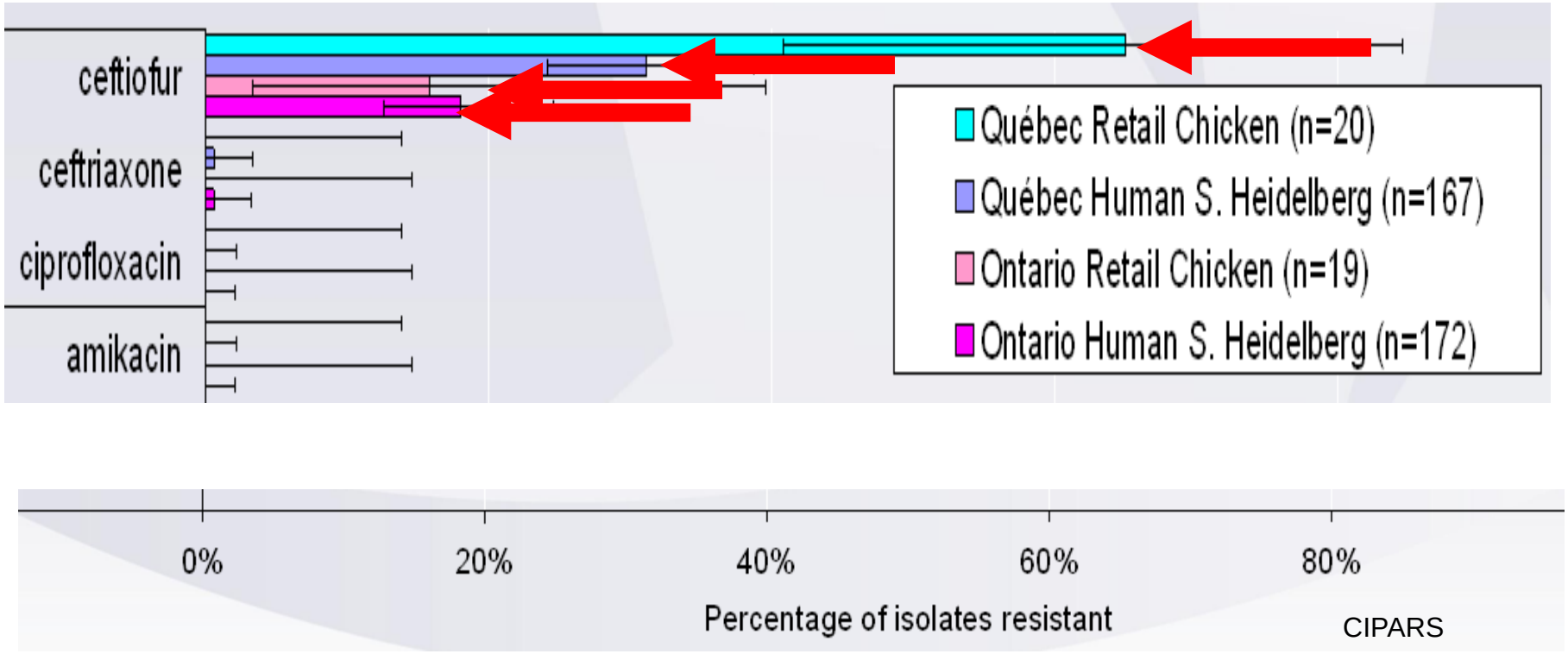
SURVEILLANCE BULLETIN

Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

Emergence of Ciprofloxacin-Resistant *Campylobacter* in Retail Chicken in British Columbia and Saskatchewan

CIPARS has identified an emerging trend (> 10% prevalence) in ciprofloxacin-resistant *Campylobacter* isolated from retail chicken in the provinces of British Columbia and Saskatchewan (Figure 1). This is in contrast to Canadian studies and CIPARS data from previous years and other provinces where the prevalence was less than 4% (1).

Ceftiofur resistance in *Salmonella* Heidelberg in 2003



CIPARS

Context

Ceftiofur (Category I)

- Can be used in many animal species, but NOT licensed for chicken in Canada
- Used extra-label for the control of *E. coli* omphalitis

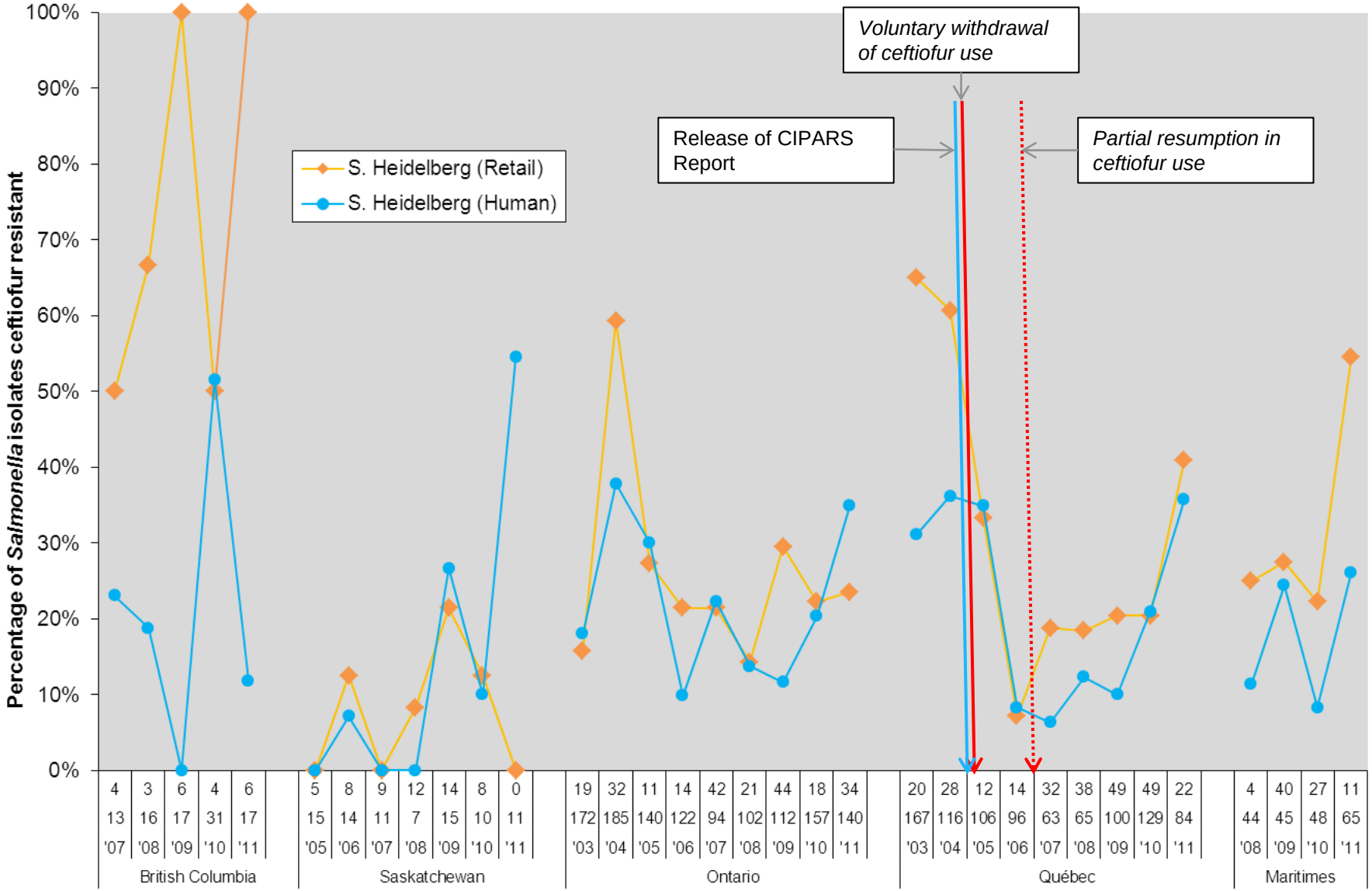
Salmonella Heidelberg

Frequent: Top 3 serovars in humans in Canada since 1995

Invasive: Can cause septicemia, myocarditis, extra-intestinal infections, & death

Treatment concern: Resistance to ceftiofur = resistance to ceftriaxone; a drug of choice for treatment of pregnant women & children

Ceftiofur resistance in *Salmonella* Heidelberg isolates from retail chicken & people



Number of *Salmonella* Heidelberg isolates from retail chicken, humans, year and province

CIPARS

Summary

- Surveillance information is compelling - need for harmonization
  - Need to understand **why** you want surveillance
  - Need to **understand the system**
  - Need commitment from funding agencies
- What to harmonize?
  - Sample & data collection, laboratory methods, data analysis & reporting metrics, communication
- CIPARS ceftiofur-resistant *Salmonella* Heidelberg data
  - Example of integration of harmonized regional & temporal data highlighting the effects of an intervention

Acknowledgements

CIPARS Program Coordinators
Rebecca Irwin (LFZ),
Rita Finley (CFEZID), Michael Mulvey (NML)

Public Health Agency of Canada, CIPARS
Agnes Agunos, LFZ
Brent Avery, LFZ
Jennifer Baker, LFZ
Louise Bellai, LFZ
Carolee Carson, LFZ
Linda Cole, LFZ
Danielle Daignault, LFZ
Anne Deckert, LFZ
Andrea Desruisseau, LFZ
Lucie Dutil, LFZ
Chad Gill, LFZ
Sheryl Gow, LFZ
Nicole Janecko, LFZ
Dolly Kambo, LFZ
David Leger, LFZ
Antoinette Ludwig, LFZ
Jane Parmley , LFZ
Richard Reid-Smith, LFZ
Michelle Tessier, LFZ
Virginia Young, LFZ

Stacie Langner , NML
Helen Tabor, NML
Rafiq Ahmed, NML
George Golding, NML
Laura Mataseje, NML

Canadian Food Inspection Agency
Health Canada - Veterinary Drugs Directorate
Agriculture and Agri-Food Canada

Abattoir-Industry Participants
Retail Meat Surveillance Participants
Farm Surveillance Participants

Canadian Animal Health Institute
Intercontinental Medical Statistics

Provincial Public Health Laboratories
Provincial Animal Health Labs
Other collaborating laboratories