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

Canada

CIPARS Surveillance and Research Highlights

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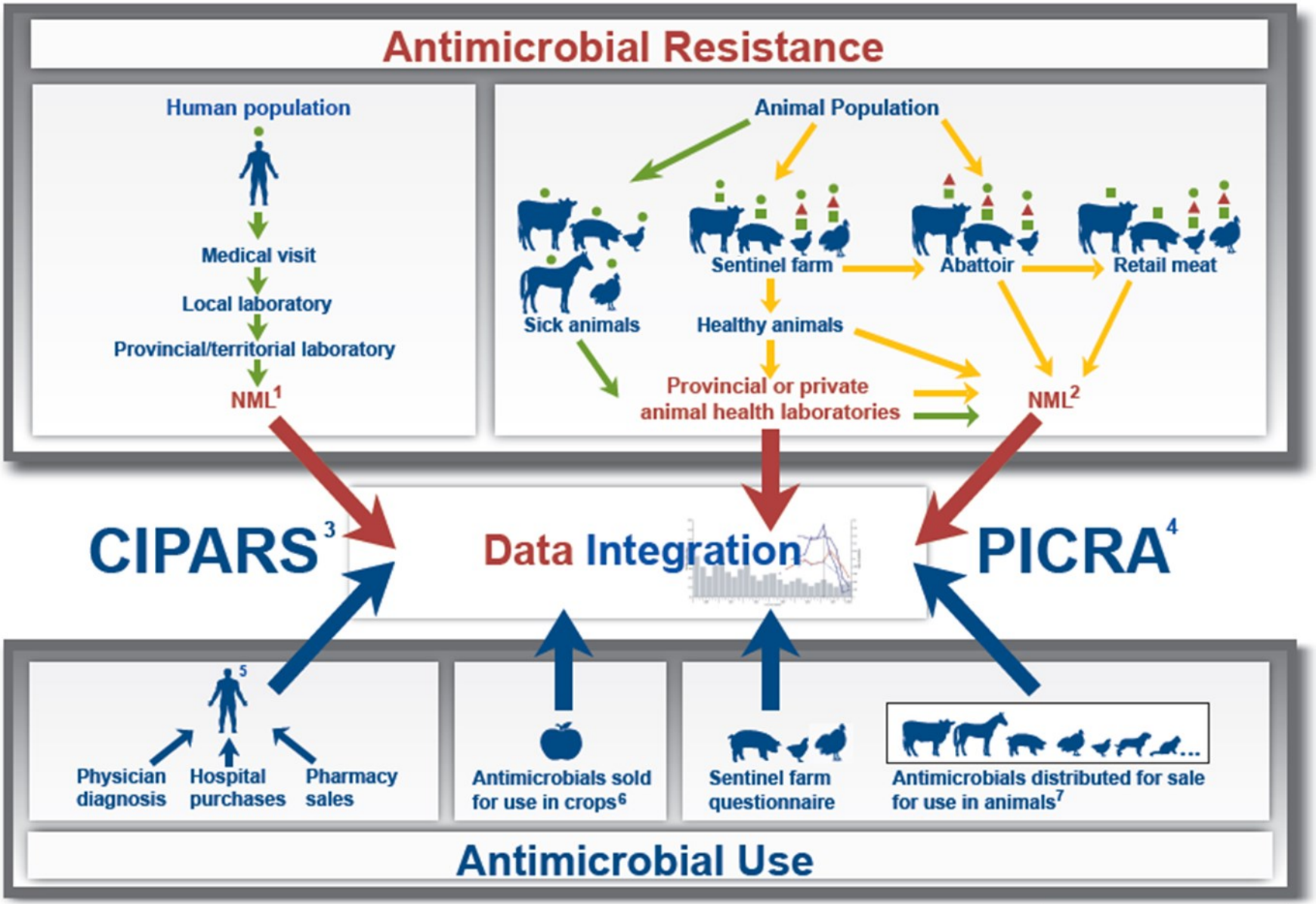
ISDS Webinar

August 3, 2018

PROTECTING AND EMPOWERING CANADIANS
TO IMPROVE THEIR HEALTH

PROGRAM OVERVIEW



1 National Microbiology Laboratory, Winnipeg, Manitoba, Public Health Agency of Canada (PHAC)
2 National Microbiology Laboratory, Guelph (Ontario) and Saint-Hyacinthe (Québec)
3 Canadian Integrated Program for Antimicrobial Resistance Surveillance, PHAC
4 Programme intégré canadien de surveillance de la résistance aux antimicrobiens, Agence de la santé publique du Canada
5 Canadian Antimicrobial Resistance Surveillance System (CARSS), PHAC
6 Pest Management Regulatory Agency, Health Canada
7 Canadian Animal Health Institute (CAHI)

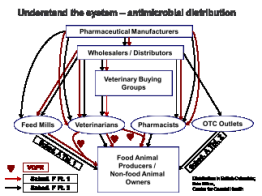
Active Surveillance
Passive Surveillance
Salmonella
Campylobacter
Escherichia coli

CIPARS Timeline

WHO Global Strategy for the Containment of Antimicrobial Resistance

Health Canada Advisory Committee Report: Animal Uses of Antimicrobials and Impact on AMR and Human Health

- **AMU - Human** National
- **AMU - CAHI Antimicrobial Distribution/Sales data**
- **AMU - Farm Pigs** National
- **AMU - Farm Chicken** National
- **AMU - Metrics WG**



2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016

1997: National Consensus Conference, Montréal

- **AMR - Farm FL Beef** AB
- **AMR - Farm Chicken** National
- **AMR - Retail Chicken Nuggets** (FNC SS)
- **AMR - Retail Turkey** National
- **AMR - CFIA Retail Produce** National
- **AMR - Retail Fish/Shrimp**
- **AMR - Retail Meat** Maritimes
- **AMR - Retail Meat** British Columbia
- **AMR - Farm Pigs** National
- **AMR - Retail Meat** Saskatchewan
- **AMR - Human Clinical (Enhanced Passive)** National
- **AMR - Retail Meat** Ontario & Québec
- **AMR - Abattoir Beef Cattle, Chickens, Pigs** National
- **AMR - Animal Clinical (Passive)** National

ACKNOWLEDGEMENTS

We would like to thank all those who contribute to CIPARS:

- Human (AMR)
  - Provincial Public Health Laboratories
- Farm (AMR and AMU):
  - The veterinarians, producers and commodity groups who participate in the farm program, Alberta Agriculture and Saskatchewan Agriculture, Ontario Ministry of Agriculture, Food and Rural Affairs, and Canadian Poultry Research Council
- Abattoir:
  - The CFIA, abattoir operators, samplers and personnel
- Retail:
  - All the participating health units and institutions, particularly the University of Prince Edward Island
- Clinical Animal Isolates:
  - Provincial Animal Health Laboratories
- Antimicrobial Use - distribution in animals:
  - Canadian Animal Health Institute, Impact Vet
- Antimicrobial Use - distribution in humans:
  - Centre for Communicable Diseases and Infection Control, PHAC
- Antimicrobials Sold as Pesticides for use in Crops
  - Health Canada

2016 HIGHLIGHTS

Integrated AMU

Data on antimicrobials intended for use in/on:

Inter-sectoral comparisons (quantities, trends, antimicrobial classes, reasons for use)

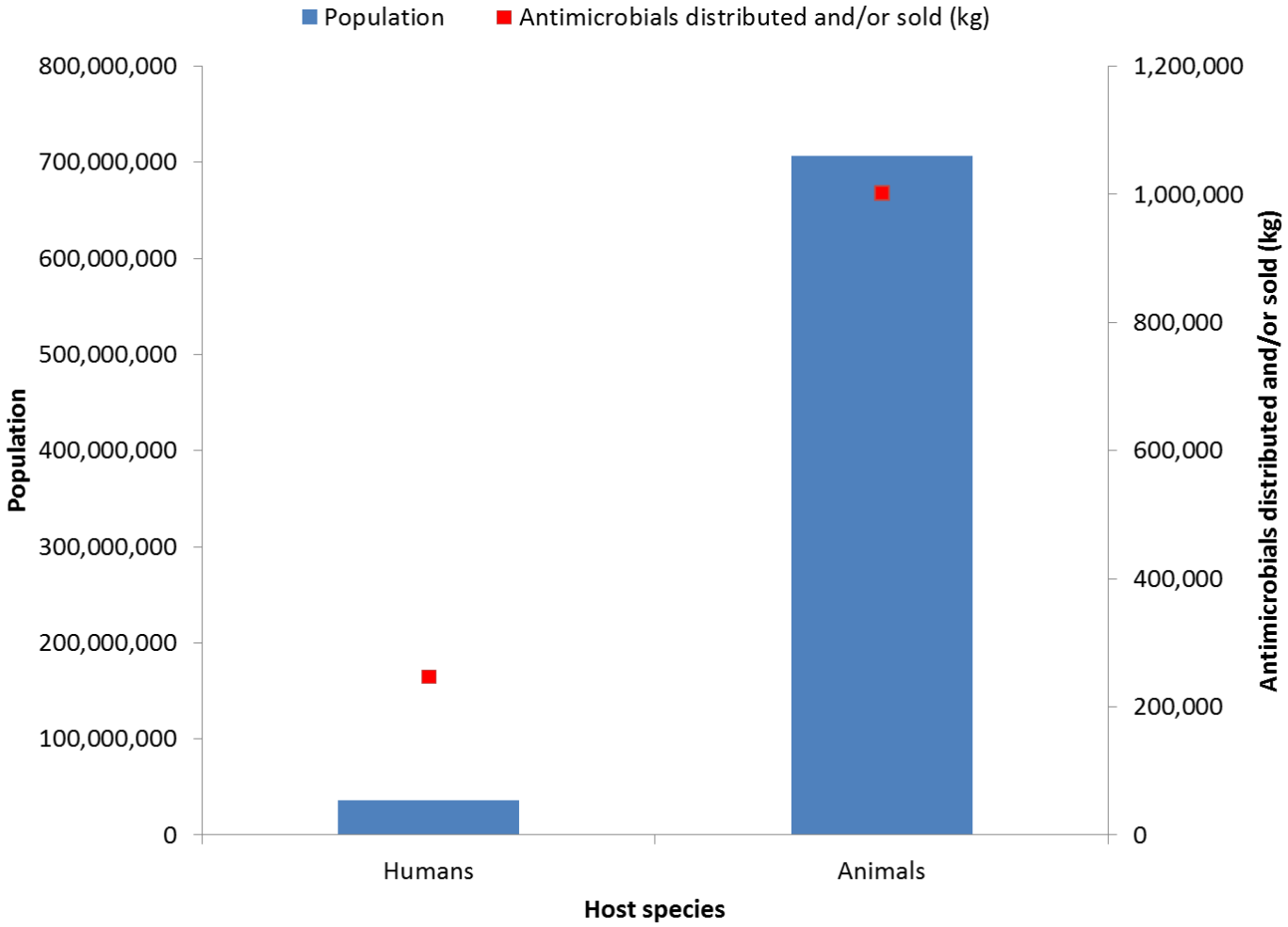
- People
- Production animals
- Companion Animals
- Grower-finisher pigs
- Broiler chickens
- Turkeys
- Crops

Intra-sectoral comparisons (different metrics)

Need to consider the size of the population to understand the quantities of antimicrobials

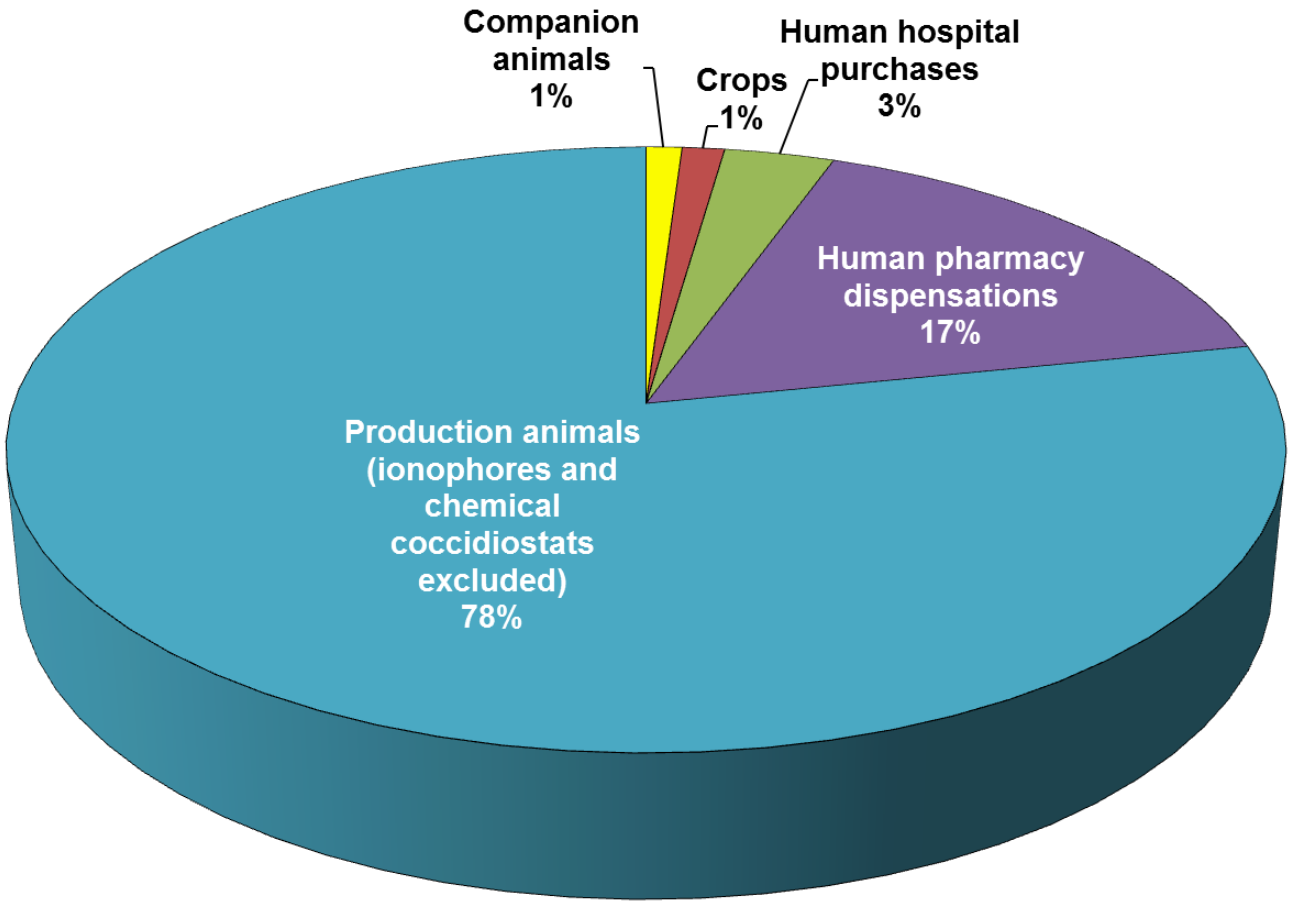
~ 1.5 times more antimicrobials were distributed for use in animals than humans on a per kg host basis

(European standard weights of animals)



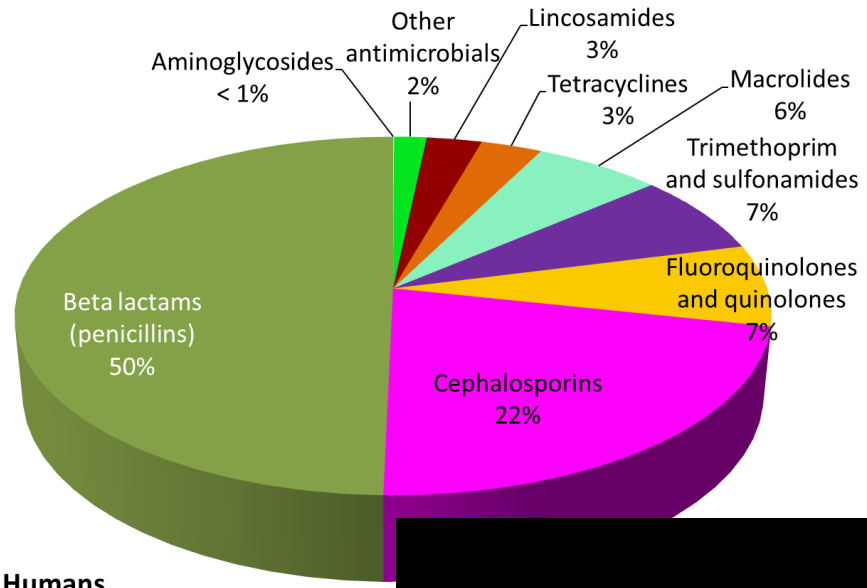
- Data sources: CAHI, IQVIA via CARSS, Statistics Canada, Ag Canada, Equine Canada
- Animal distribution data does not include own use imports or active pharmaceutical ingredients used in compounding.

The predominant sector to which antimicrobials are sold/distributed (kg) is production animals

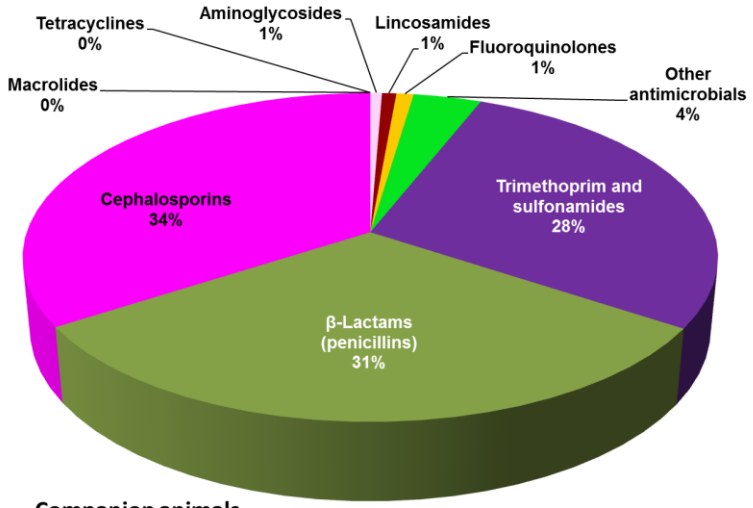


- Data sources: CAHI, IQVIA via CARSS, Health Canada
- Animal distribution data does not include own use imports or active pharmaceutical ingredients used in compounding; hence are underestimates of total quantities used.

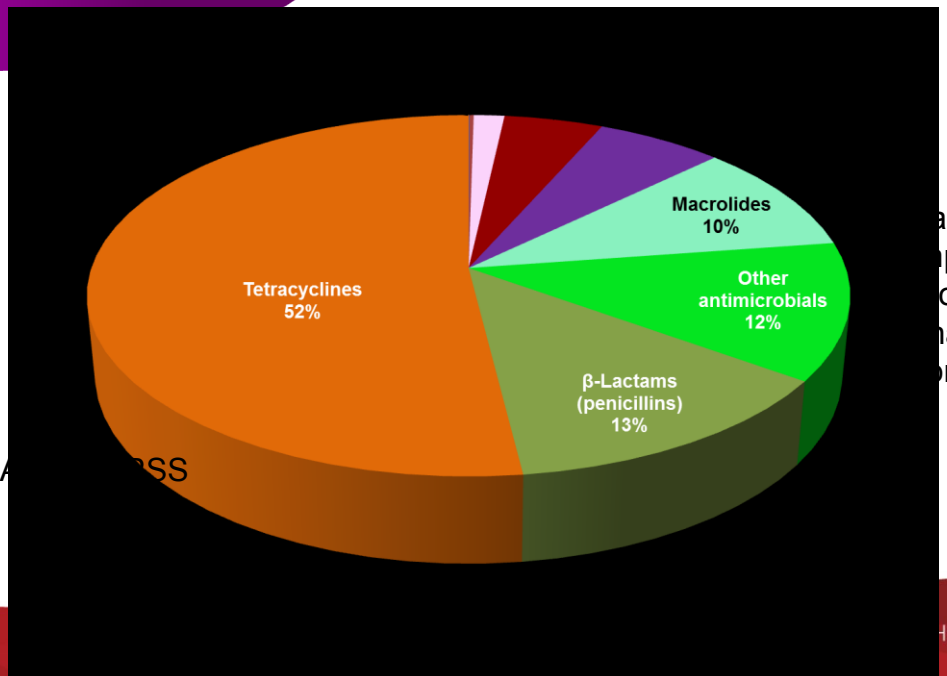
The relative proportions of antimicrobial classes differ between animals and people (kg)



Humans



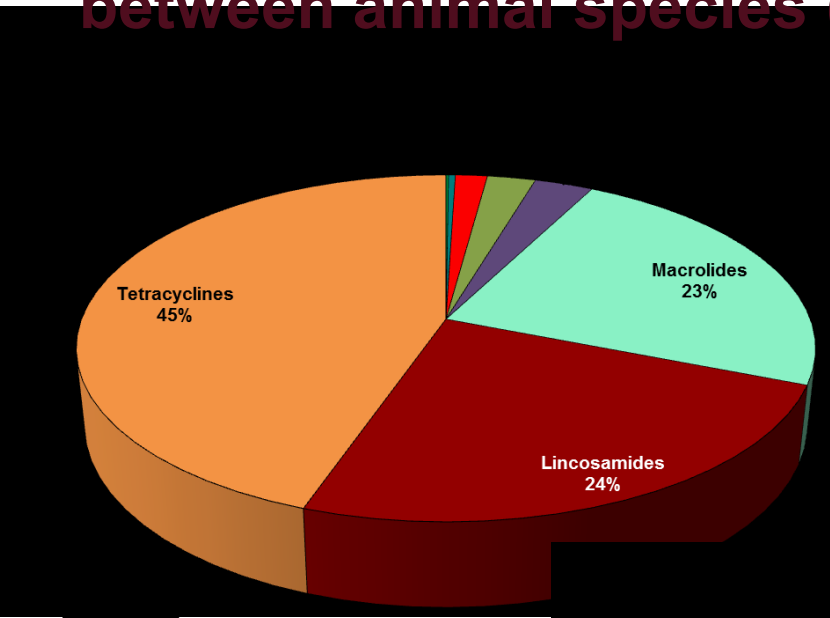
Companion animals



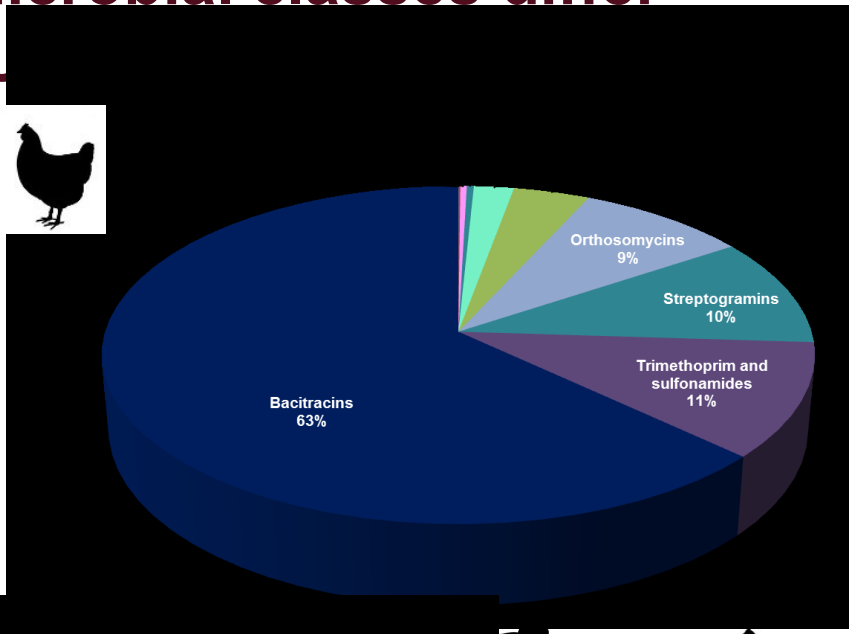
alues do not include antimicrobials
ported under the "own use"
ovision or imported as active
armaceutical ingredients used in
mpounding.

- Data sources: CAHI, IQVIA SS

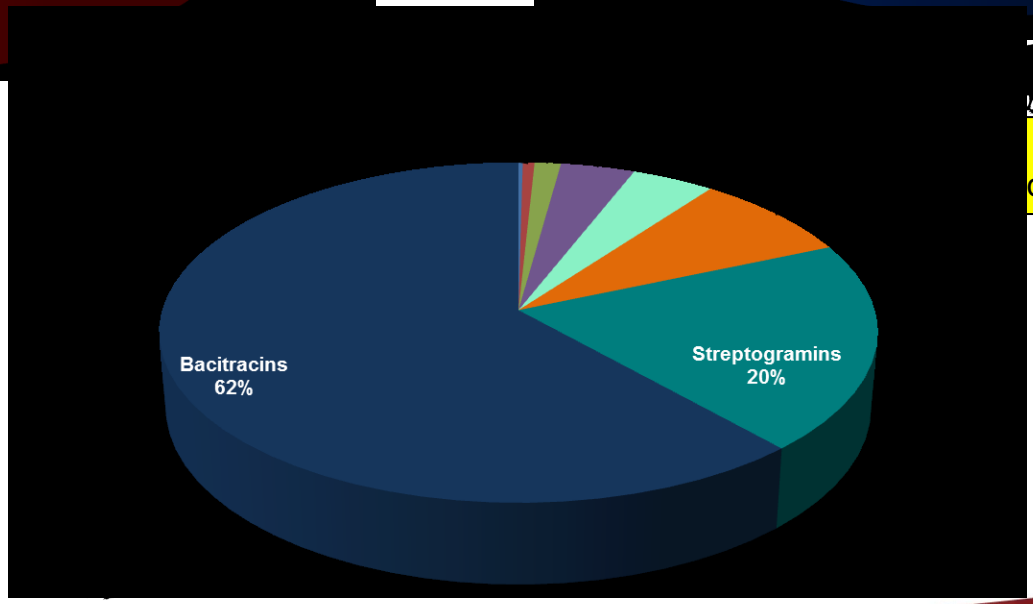
The relative proportions of antimicrobial classes differ between animal species (mg/PCU



Feed AMU only

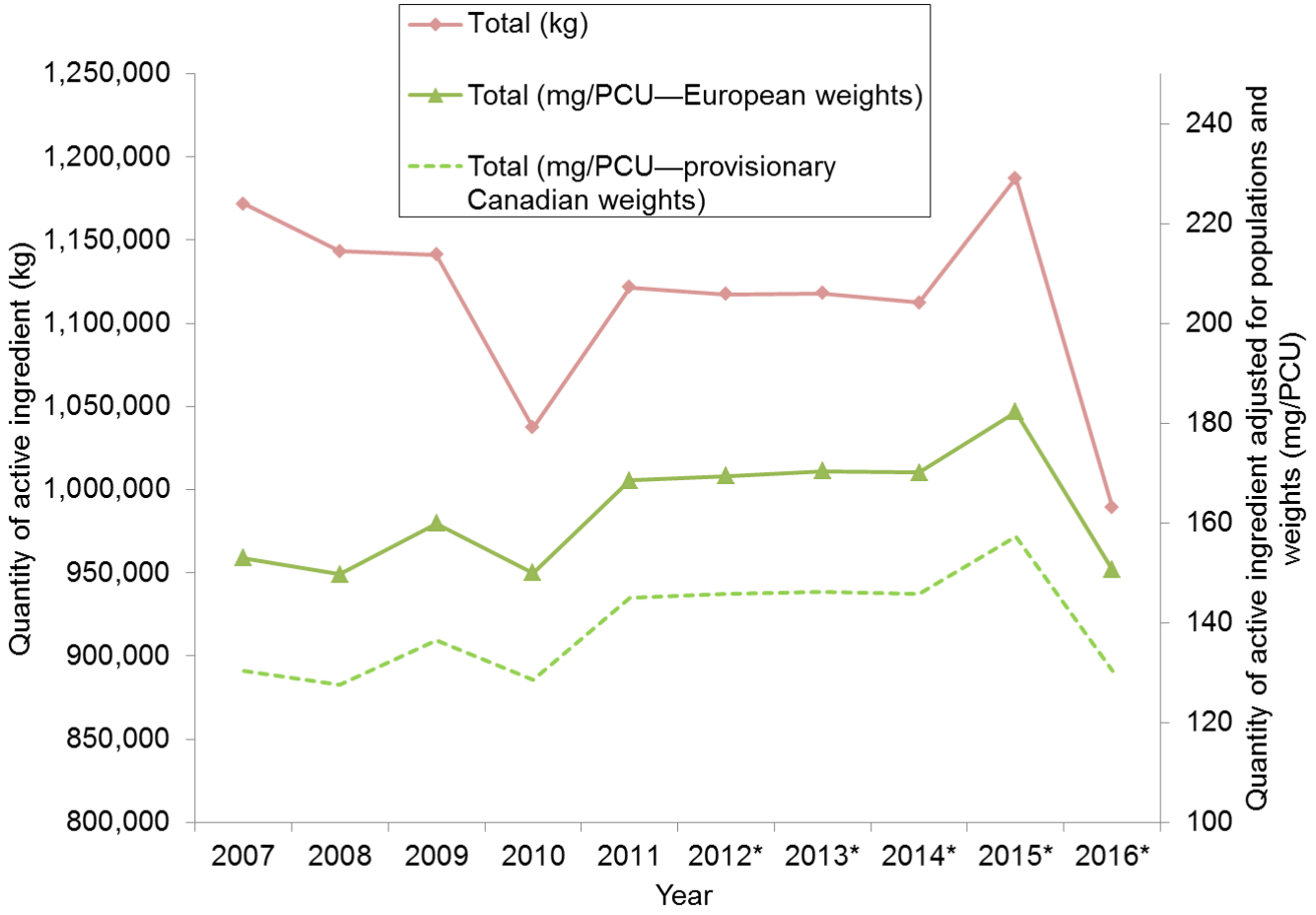


All AMU:
d, water and injection



- Data sources: CIPARS Farm

Quantities distributed for sale have declined – in what sector(s) is this occurring?

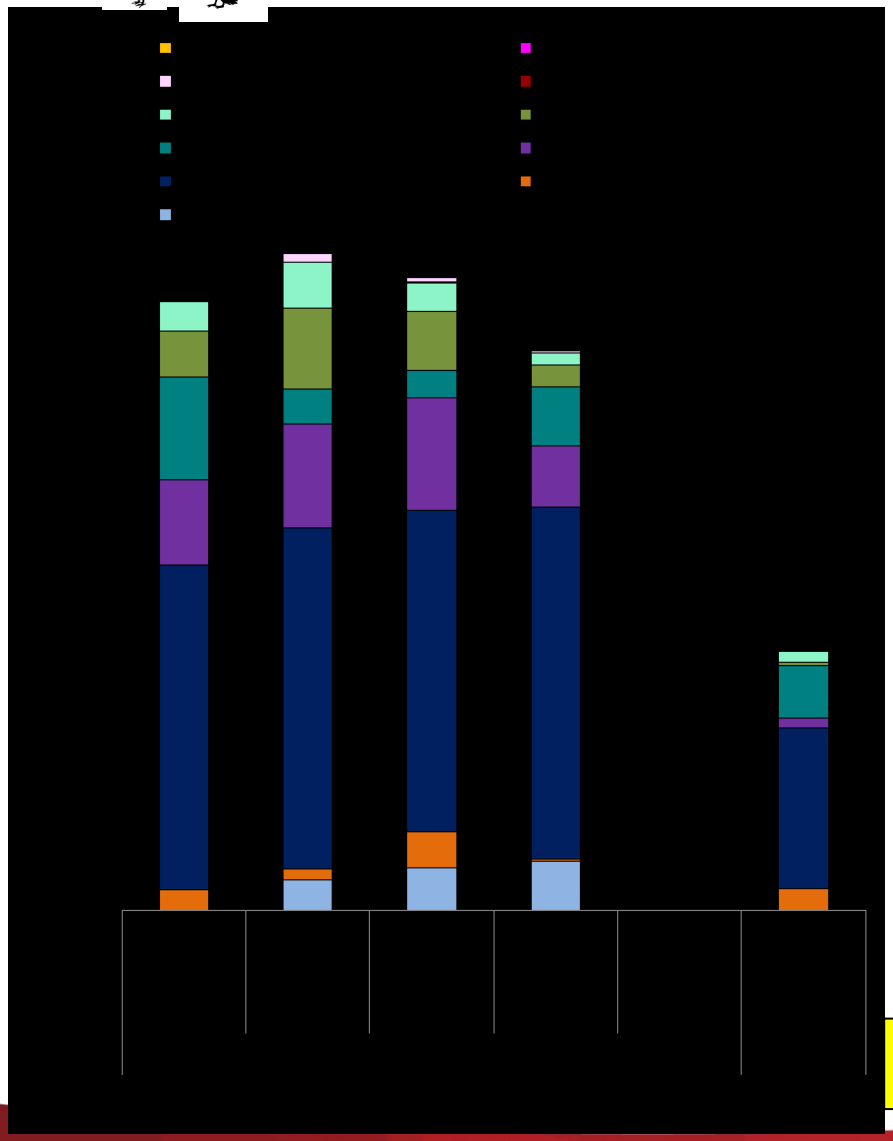


*antimicrobials intended for use in companion animals excluded

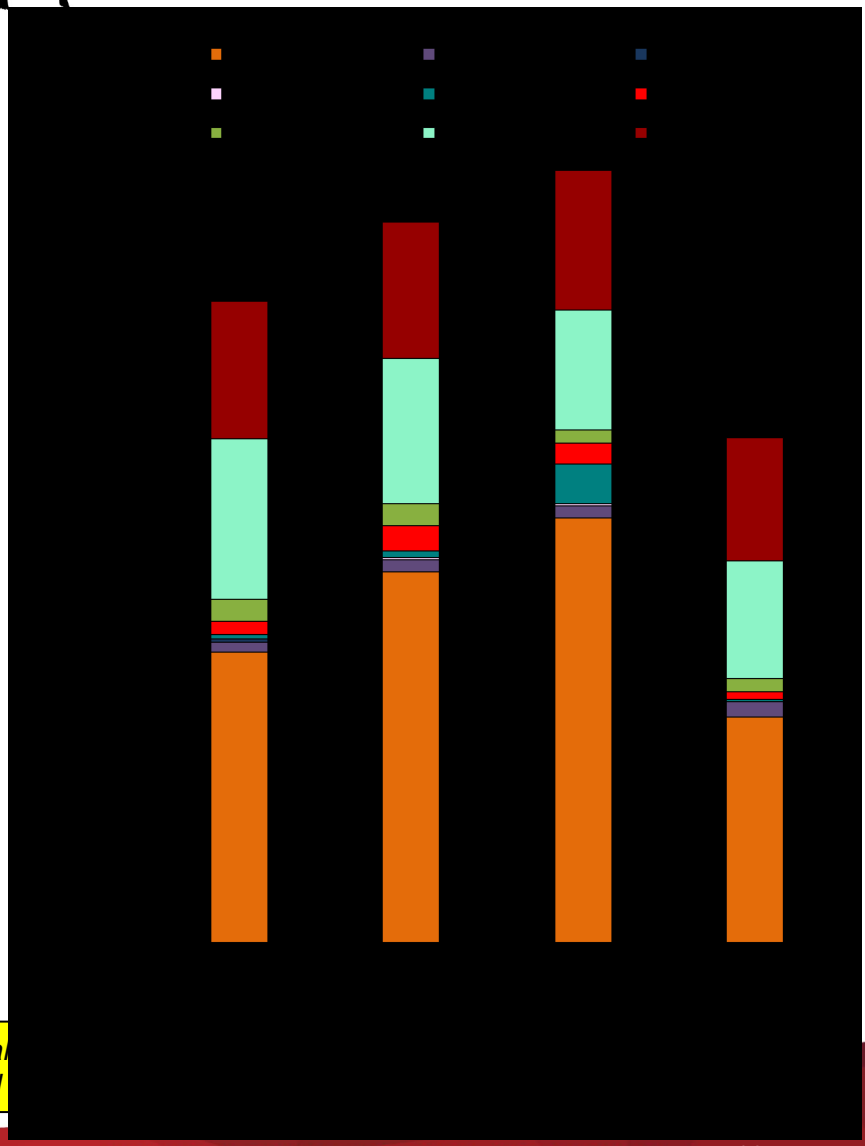
- Data sources: CAHI, Statistics Canada, Ag Canada, Equine Canada, ESVAC
- Animal distribution data does not include own use imports or active pharmaceutical ingredients used in compounding.

The mg/PCU was lowest in 2016 and varies across species

BROILERS AND TURKEYS



GROWER-FINISHER PIGS



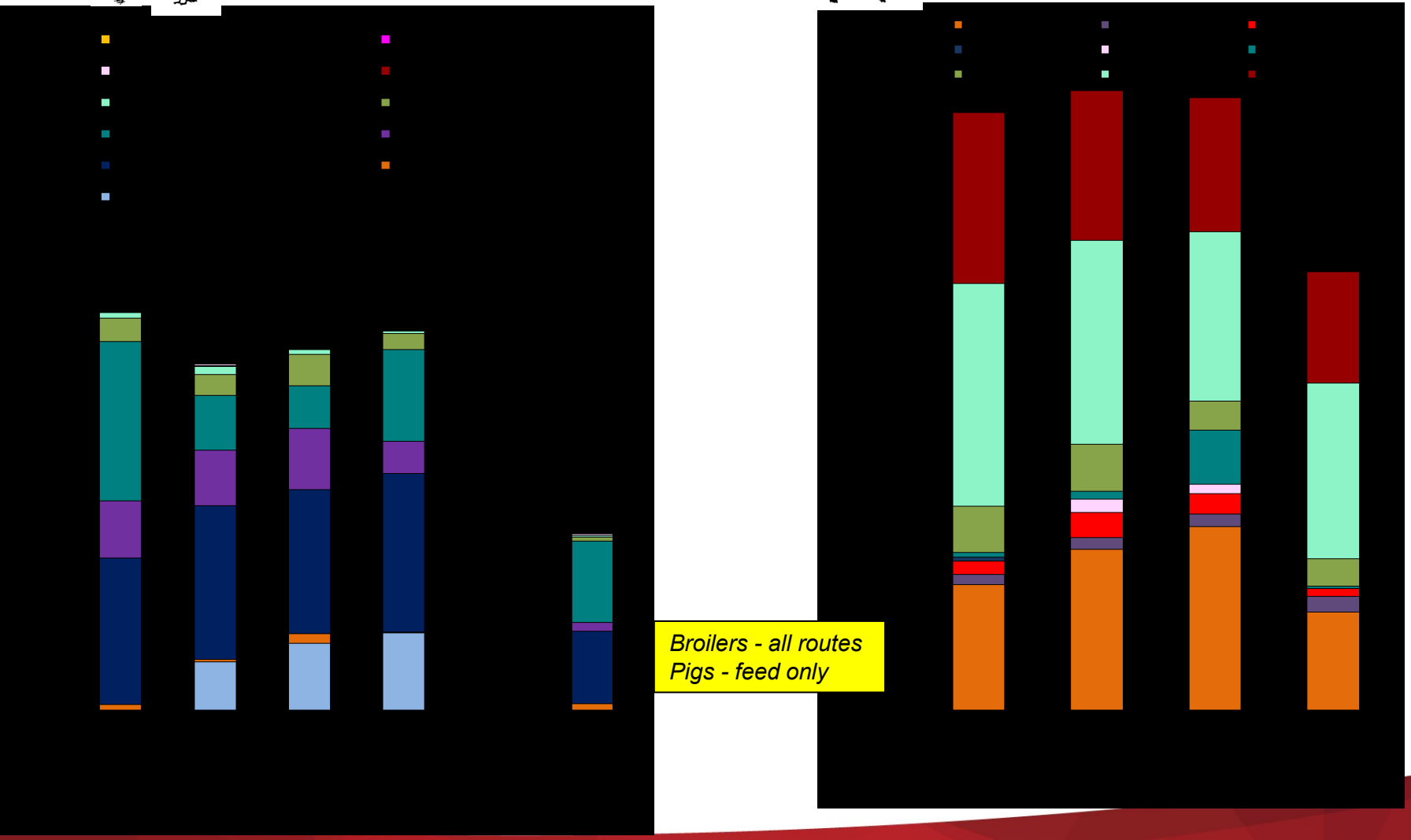
Broilers - a
Pigs - feed

- Data sources: CIPARS Farm

However when adjusting for the average daily dose, this changes (nDDDvetCA/PCU)

BROILERS AND TURKEYS

GROWER-FINISHER PIGS



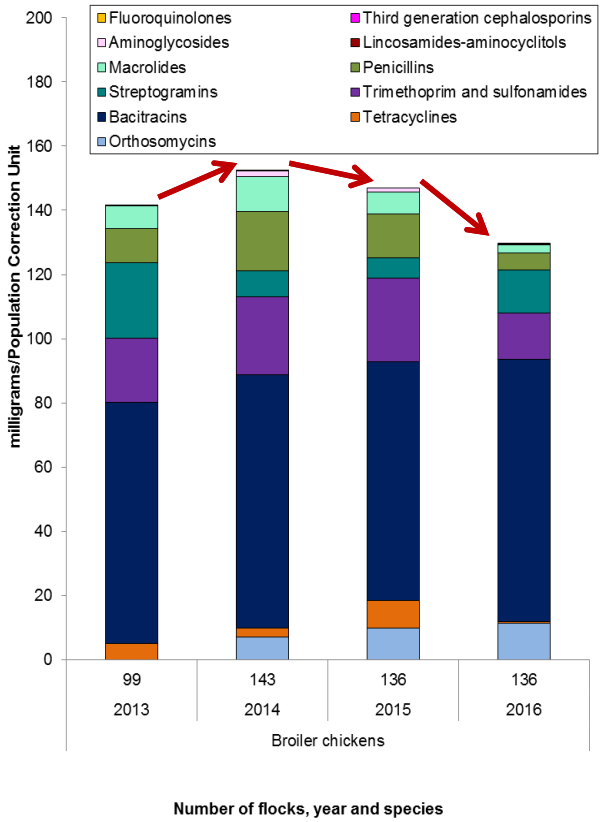
Broilers - all routes
Pigs - feed only

- Data sources: CIPARS Farm

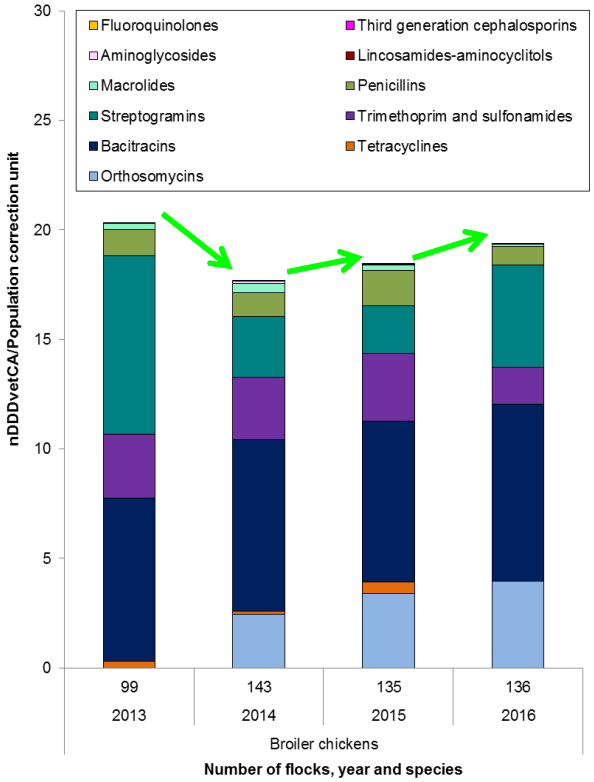
Trends in AMU metric - broiler chicken - different

These 2 metrics show similar trend; appear to correlate better

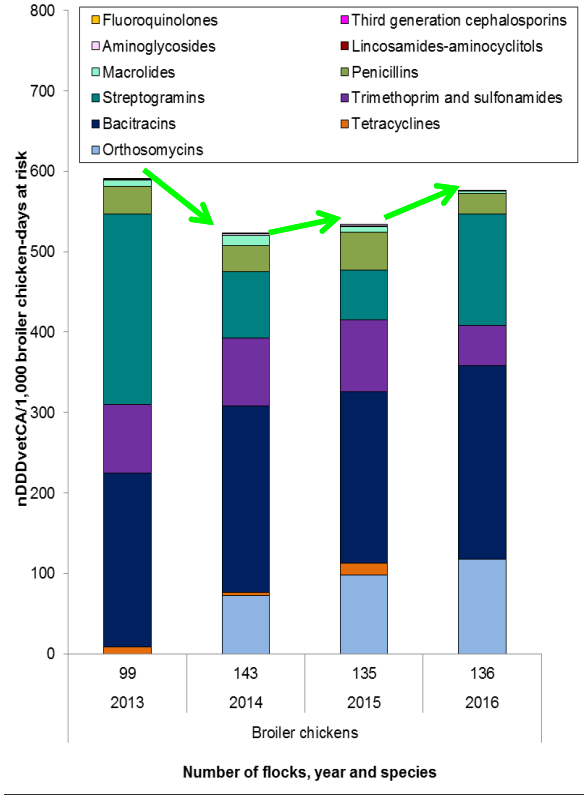
mg/PCU



$nDDD_{vet}CA$/PCU



$nDDD_{vet}CA$/1,000 CD



↓ overall

Top 3: Bacitracins>Trimet.-sulfa>streptogramin

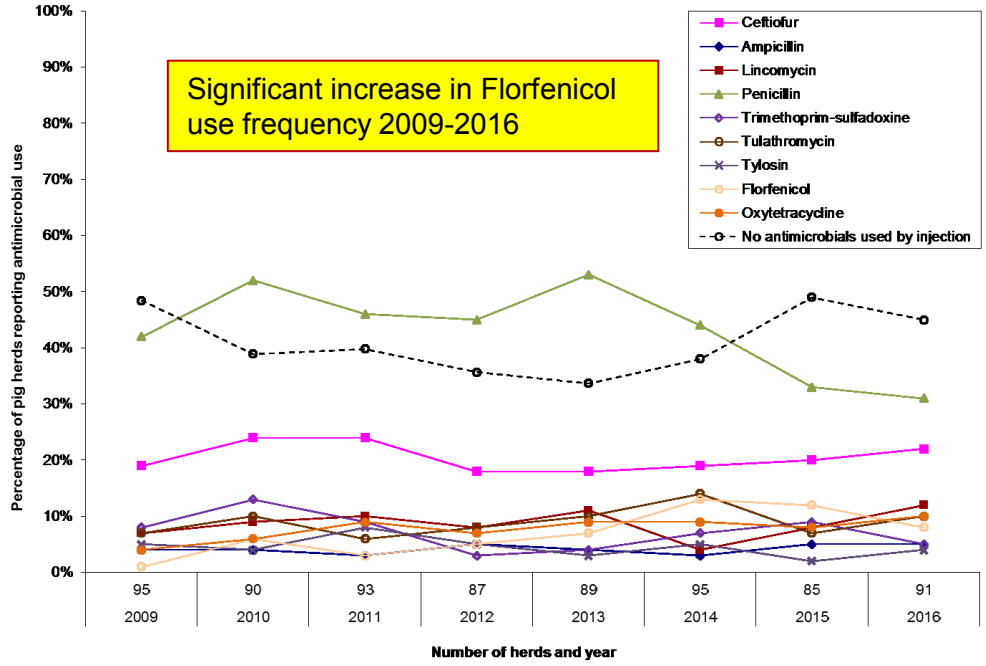
↑ overall

Top 3: Bacitracins>streptogramin>orthosomycin

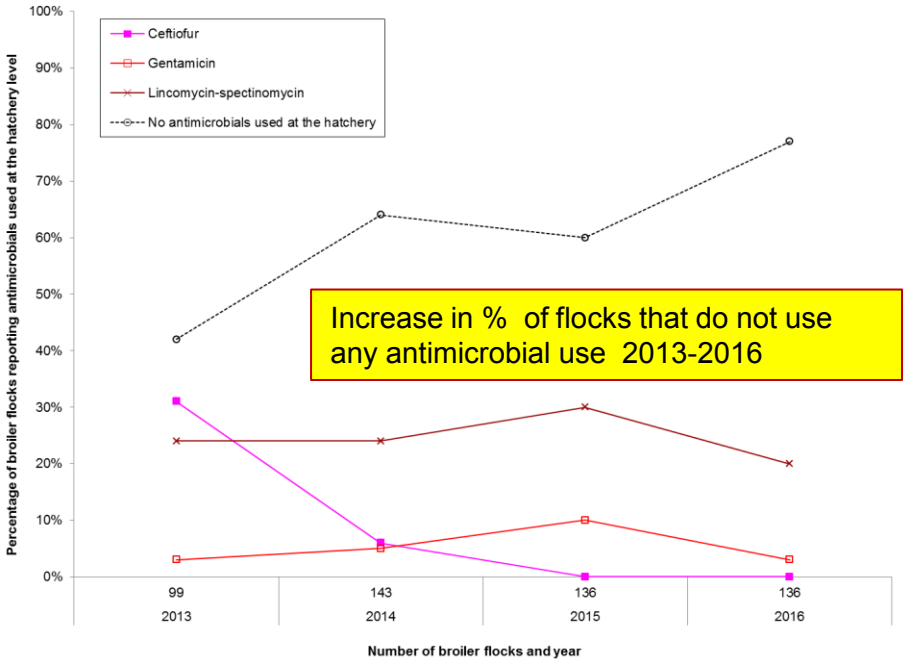
- Data sources: CIPARS Farm

The frequency of AMU by injection changes over time

Grow-finisher pigs

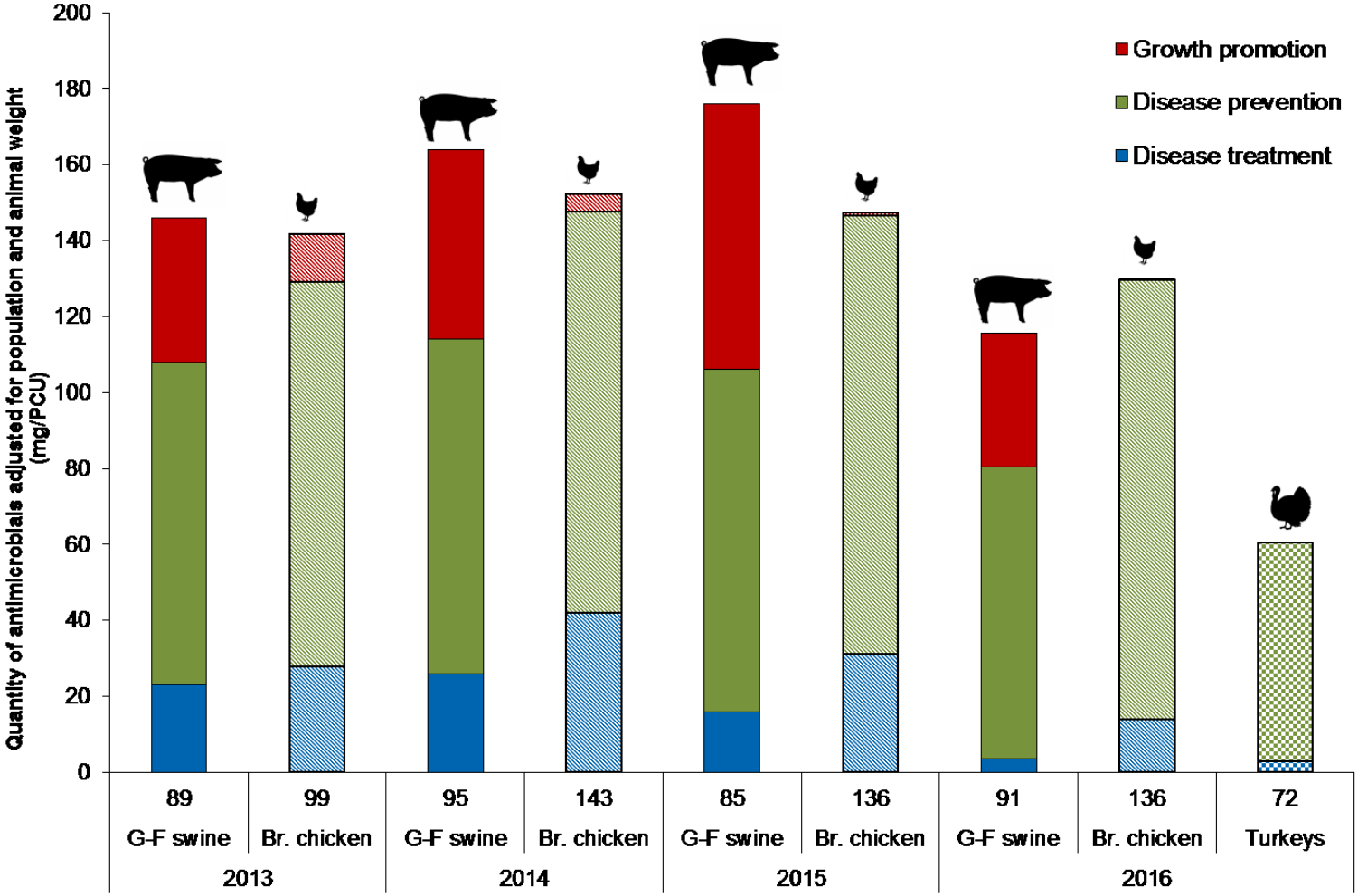


Broiler chickens



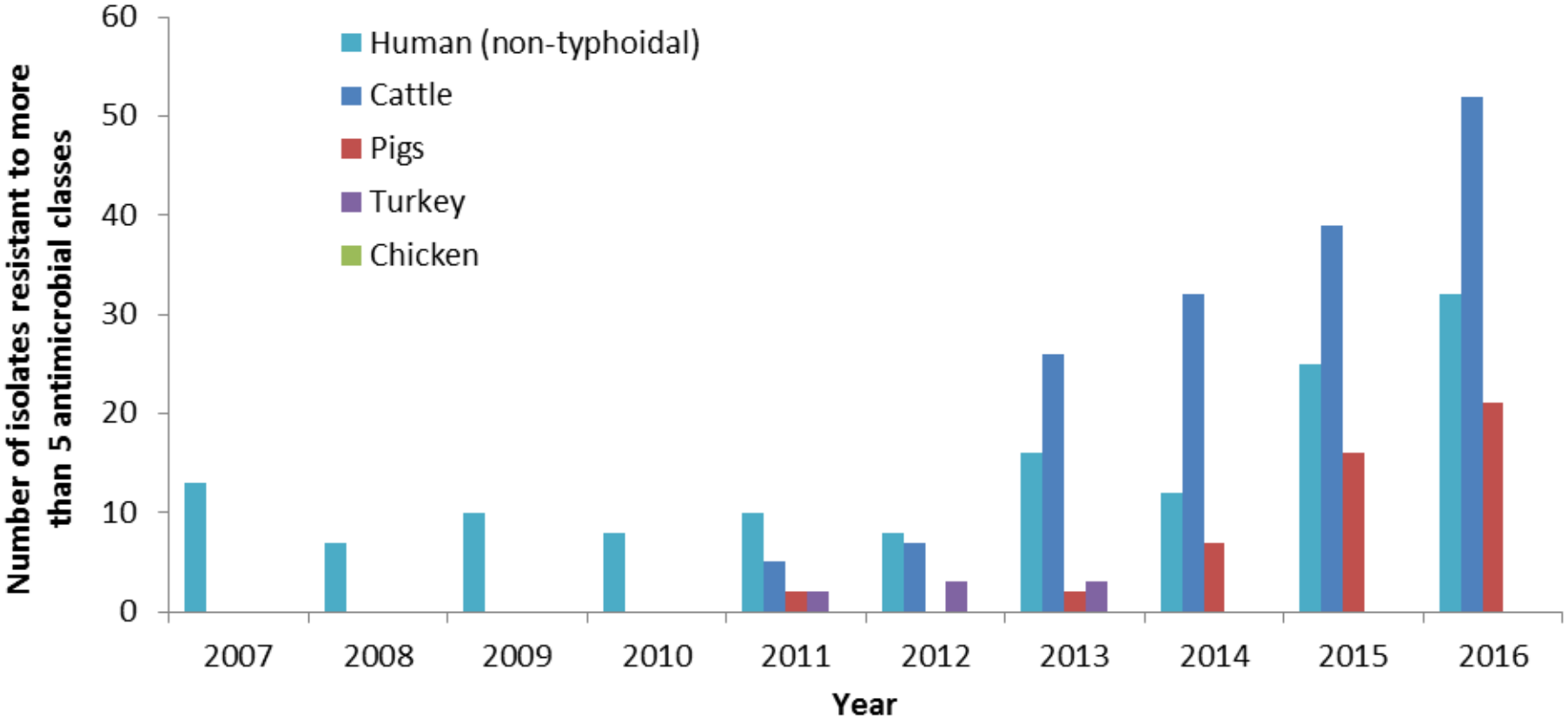
- Data sources: CIPARS Farm

Quantities have declined in grower-finisher pigs and broiler chickens in 2016 (mg/PCU); particularly for growth promotion



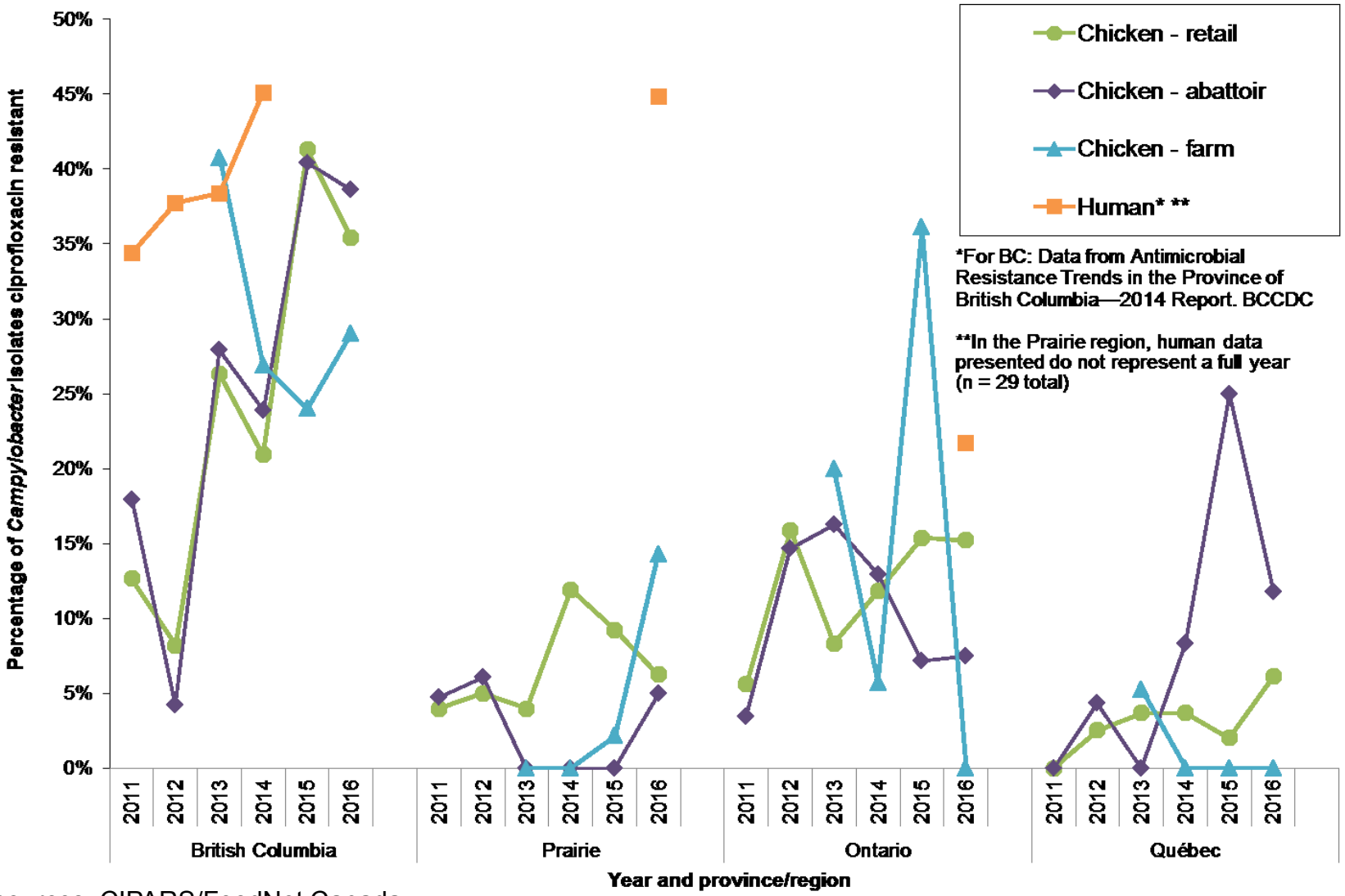
- Data sources: CIPARS Farm

Increasing numbers of highly drug resistant *Salmonella* isolates from humans and animals, 2007-2016



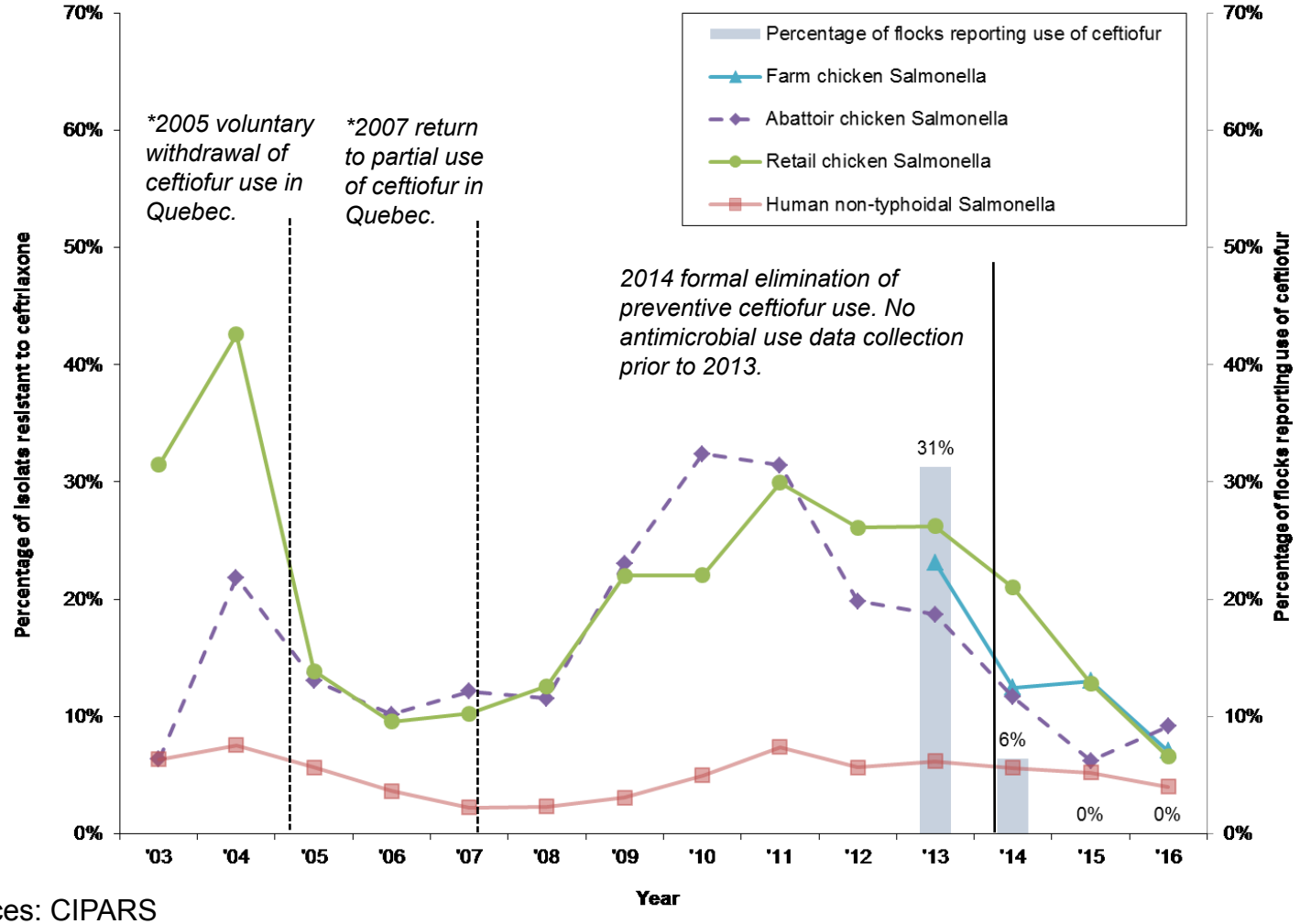
- Data sources: CIPARS

Ciprofloxacin resistance in *Campylobacter*



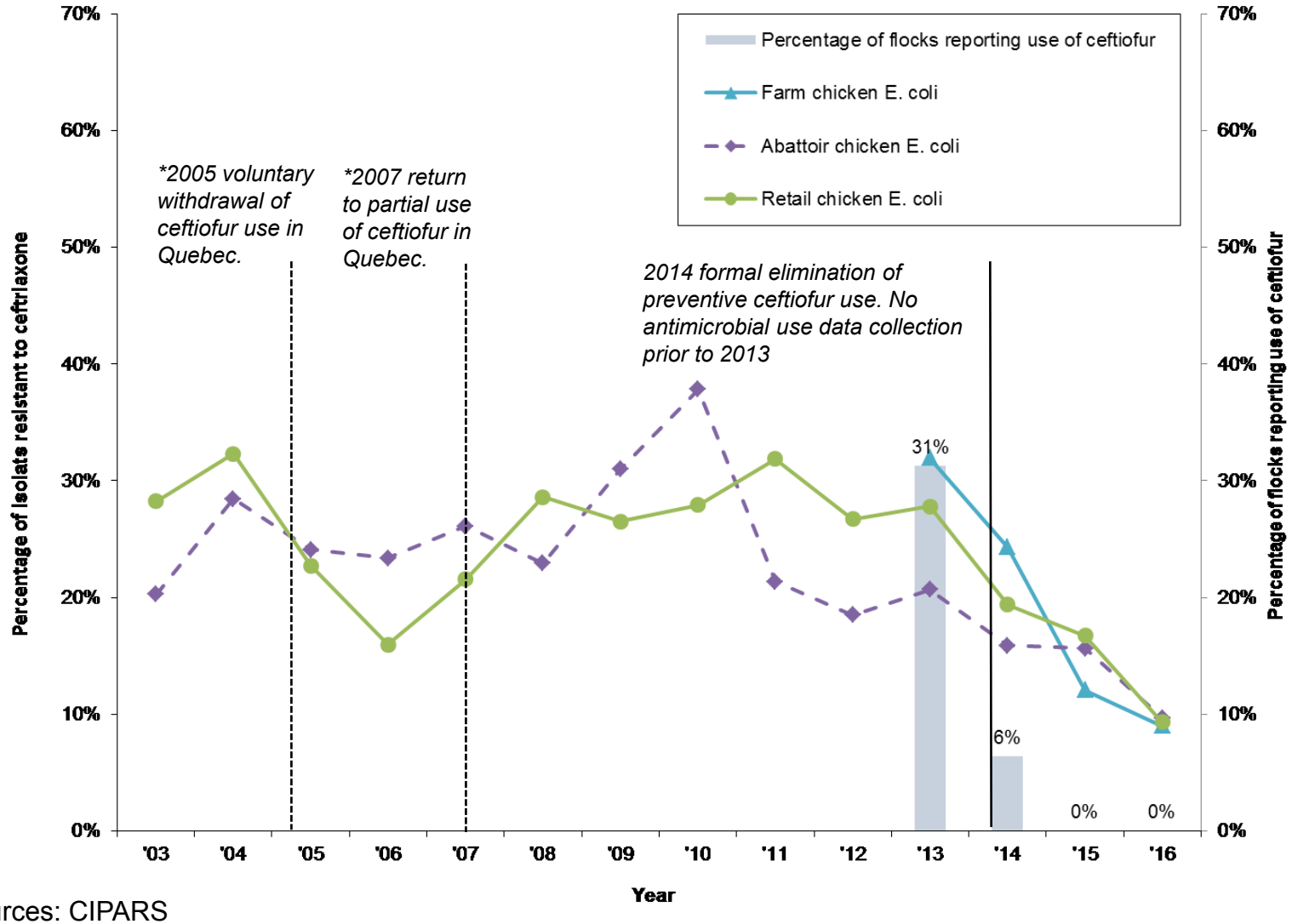
- Data sources: CIPARS/FoodNet Canada

Reduction in reported use of ceftiofur on farm and changing resistance to ceftriaxone in *Salmonella* from humans and chicken



- Data sources: CIPARS

Declining resistance to ceftriaxone in *E. coli* from chicken and reported decrease in use of ceftiofur



- Data sources: CIPARS

Conclusions

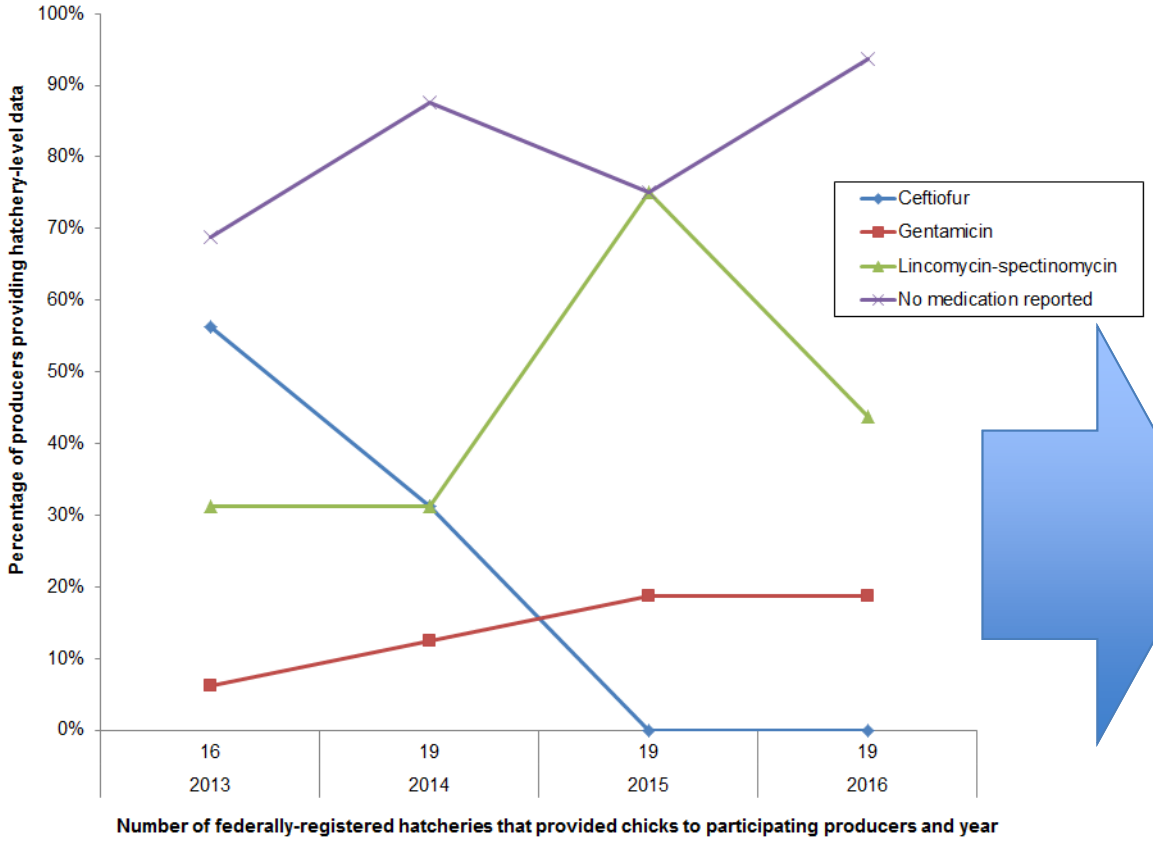
- The industry-led initiative to eliminate use of ceftiofur, and all other Category I antimicrobials, in poultry for disease prevention is appearing to have the desired effect

- CIPARS data show a reduction in reported use of ceftiofur in broiler chickens (measured as % farms) as well as reduced resistance in both *E. coli* and *Salmonella* from chickens and chicken meat

- CIPARS will continue to assess this trend in coming years and the impact of this important intervention on resistance in *Salmonella* from humans will also continue to be monitored

- **This is a good news story but…. has this change led to other issues?**

Gentamicin and lincomycin-spectinomycin use - hatcheries

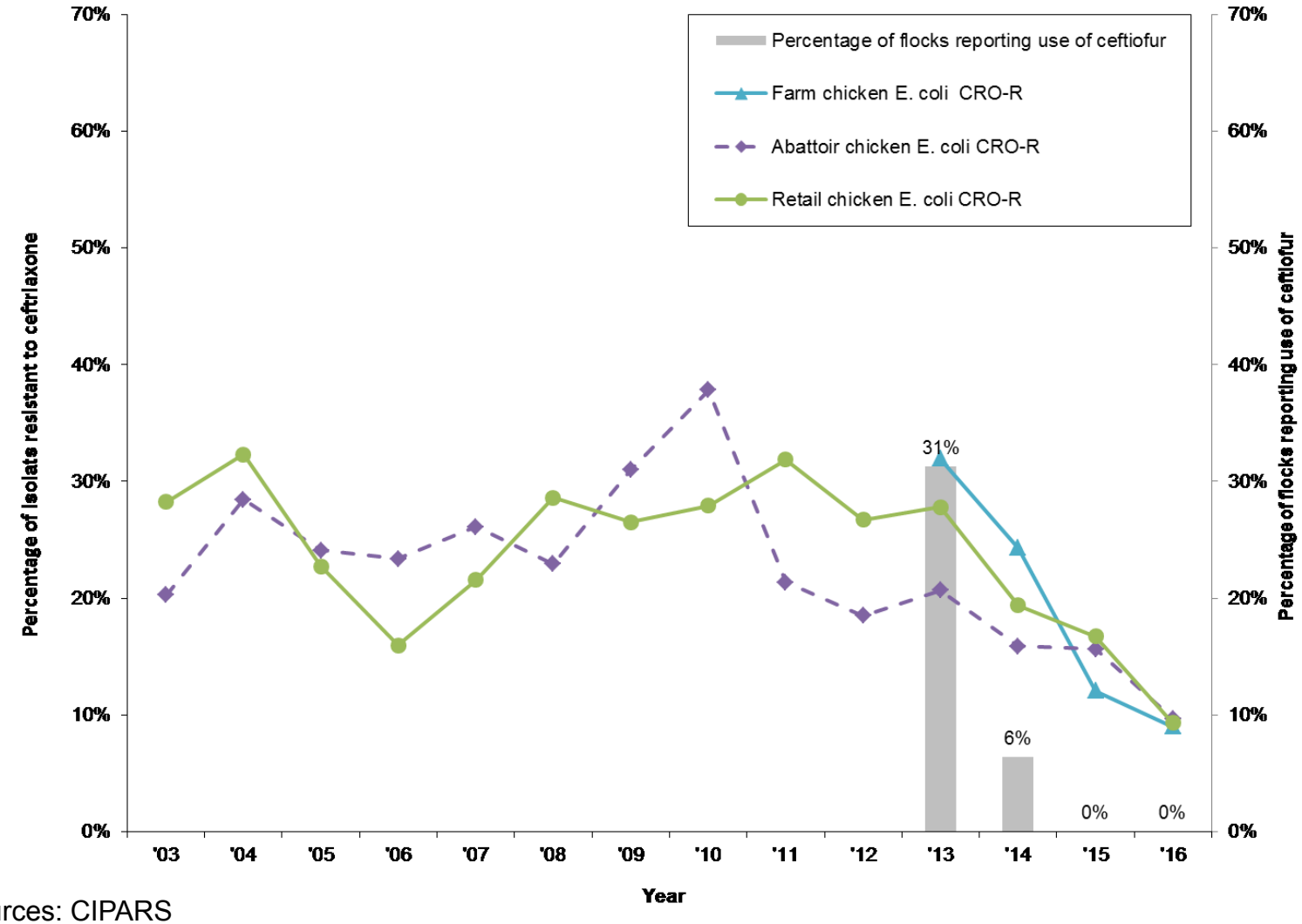


Use in 2016:

- Gentamicin:
  - 3 hatcheries (1 each ON, BC, SK)
  - 4 flocks (1 ON, 2 BC, 1 SK)
- Lincomycin-spectinomycin:
  - 6 hatcheries (1 AB, 2 BC, 3 QC)
  - 27 flocks (1 AB, 2 BC, 2 ON, 22 QC

- Data sources: CIPARS

Moving from ceftriaxone resistance to gentamicin resistance and into the future….



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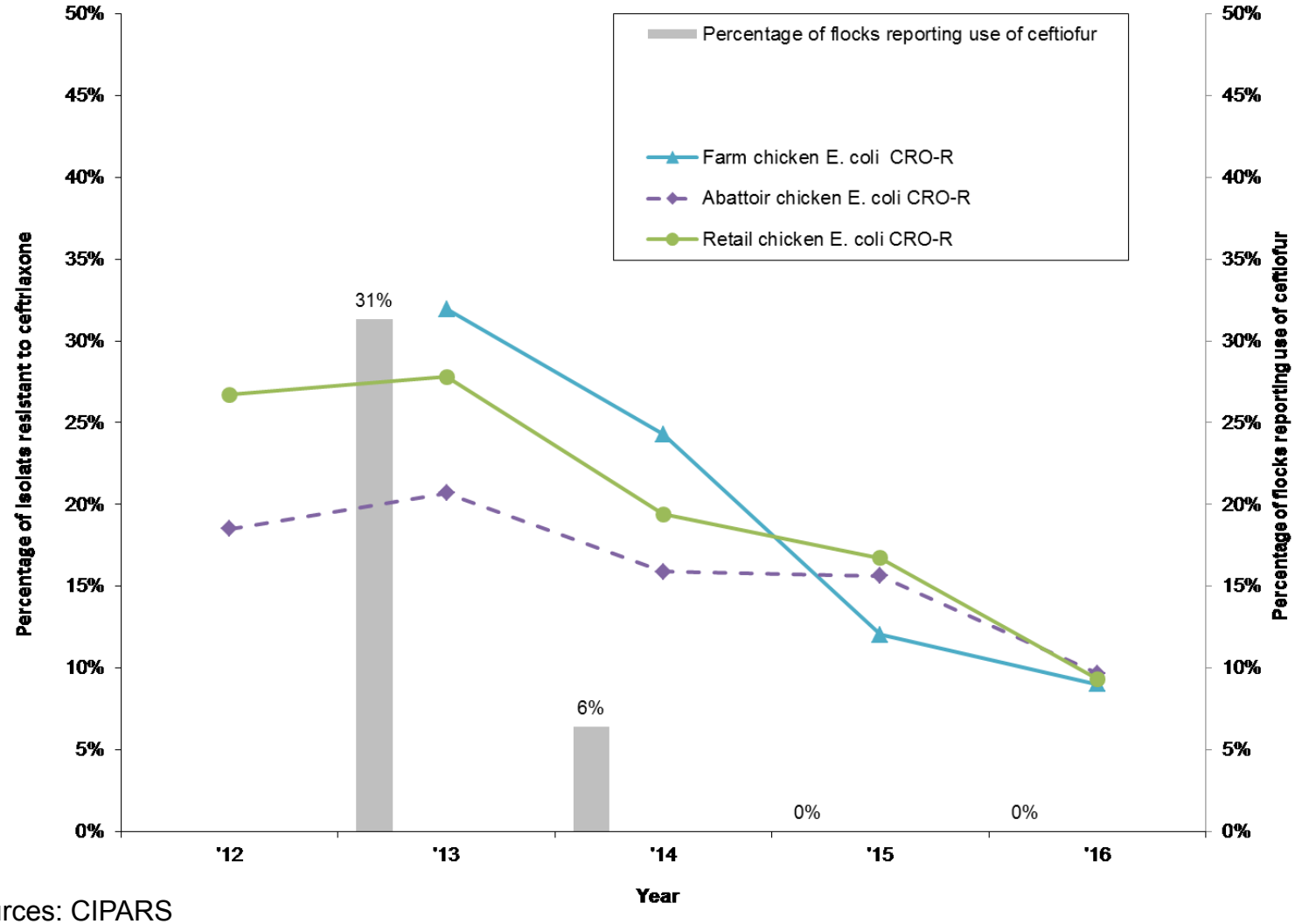

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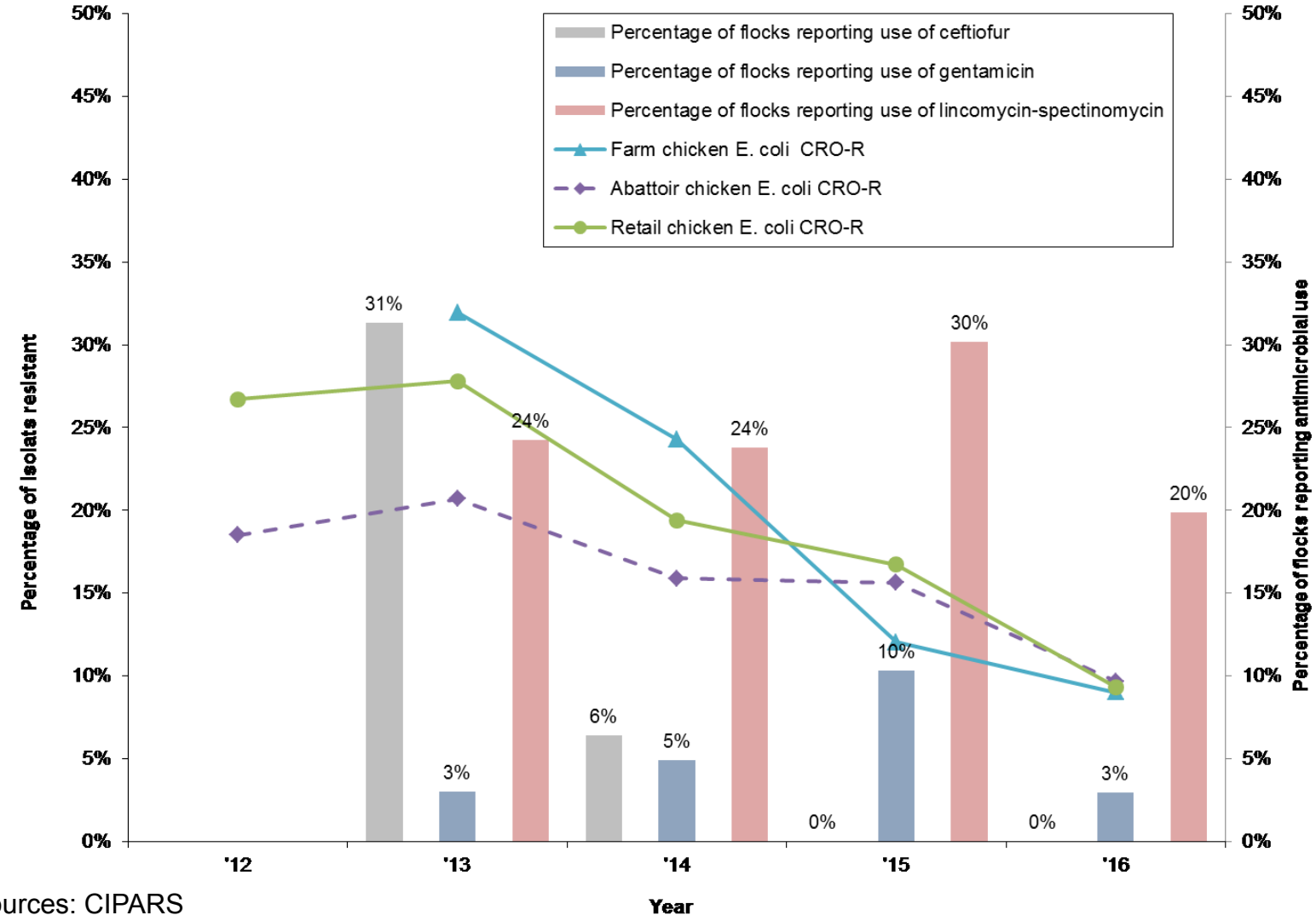
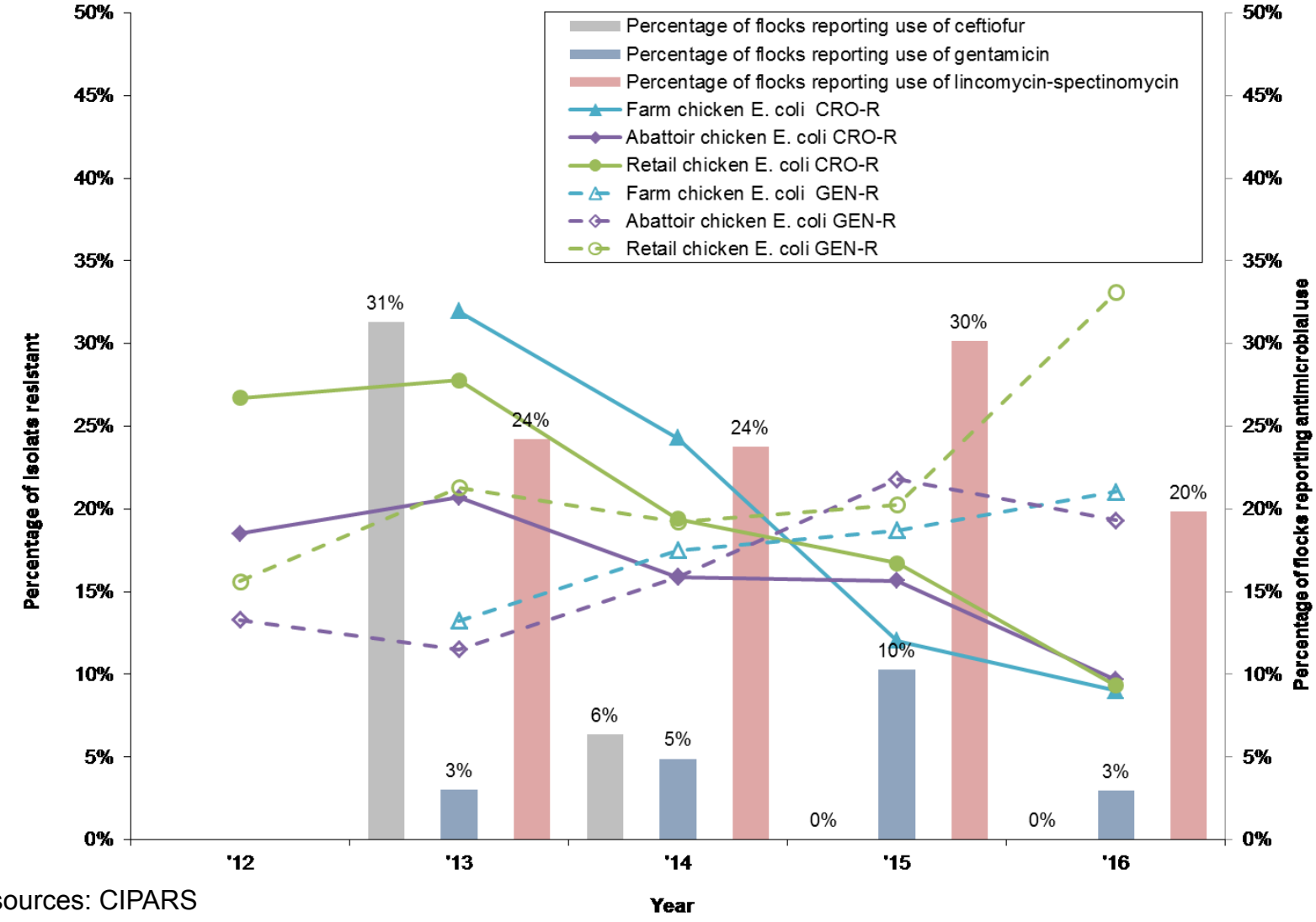
Moving from ceftriaxone resistance to gentamicin resistance and into the future….



- Data sources: CIPARS

Emerging gentamicin resistance in chicken *E. coli* and changing use of gentamicin/lincomycin-spectinomycin



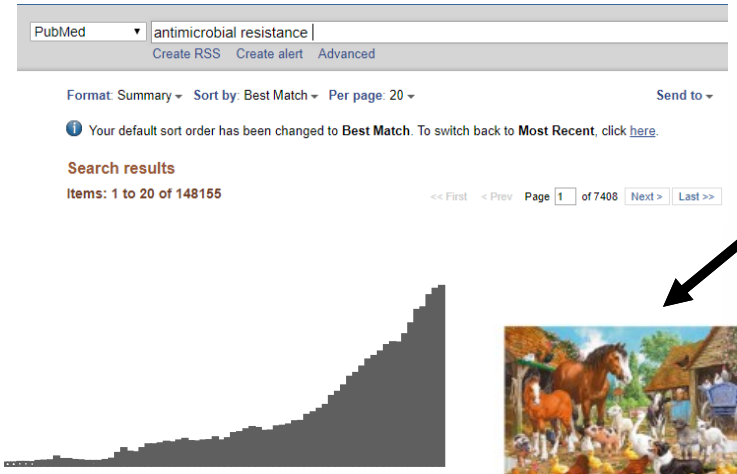
- Data sources: CIPARS

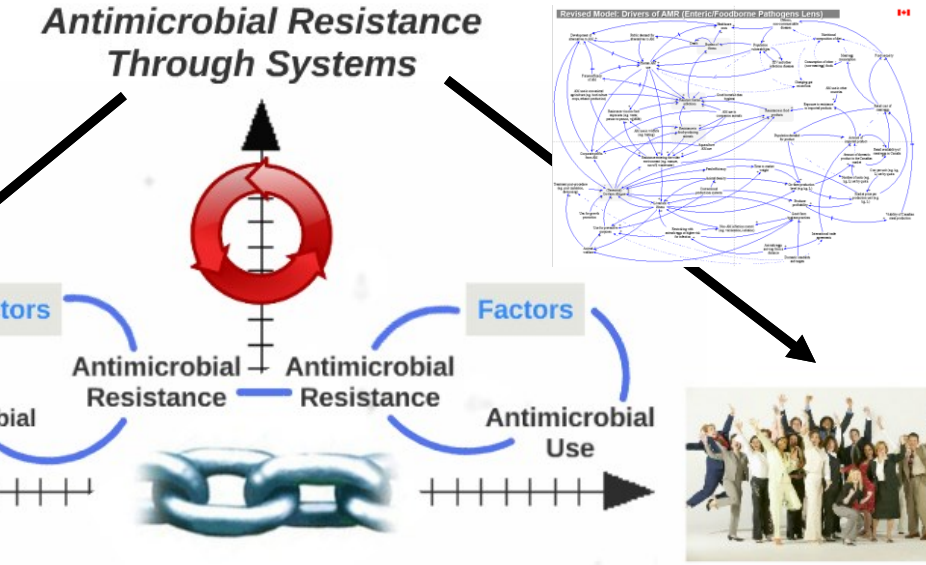
RESEARCH

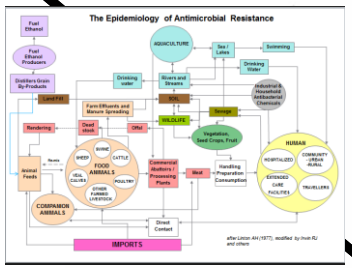
Need for more and better integration

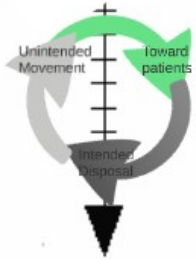
Ontario
Ministry of Agriculture, Food and Rural Affairs

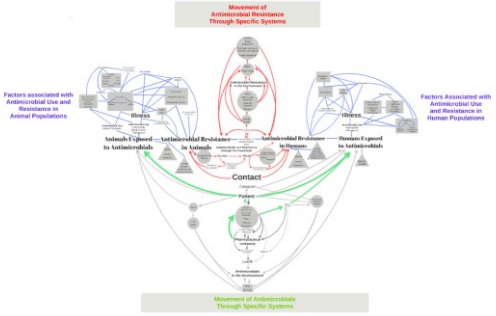
- Widely studied, complex system









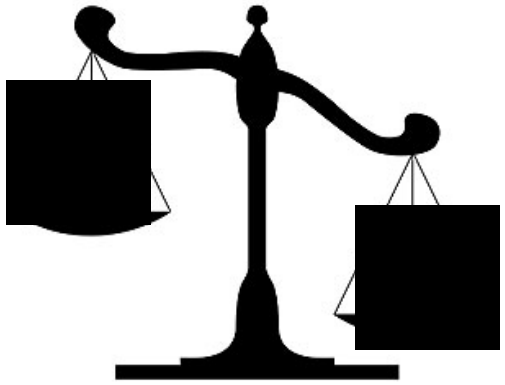


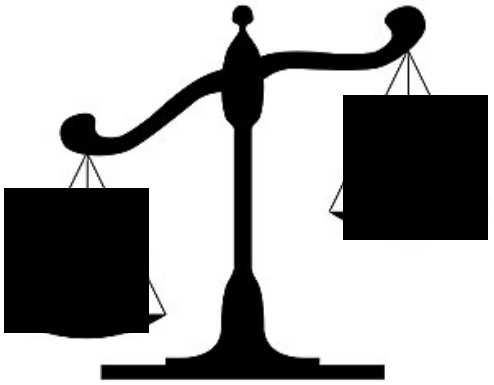
Antimicrobials through Systems

- Multiple bacteria
- Multiple antimicrobials
- Multiple populations
- Many routes of exposure

This is what we wanted to do

Integrated Assessment Models





Agri-food chain focus

Farm

Abattoir

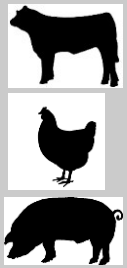
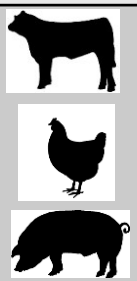
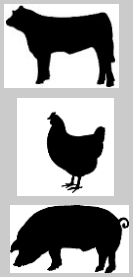
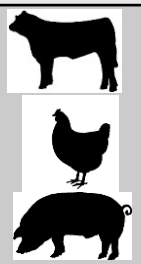
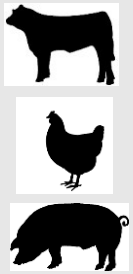
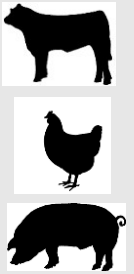
Retail

KEY NODES

Scenarios

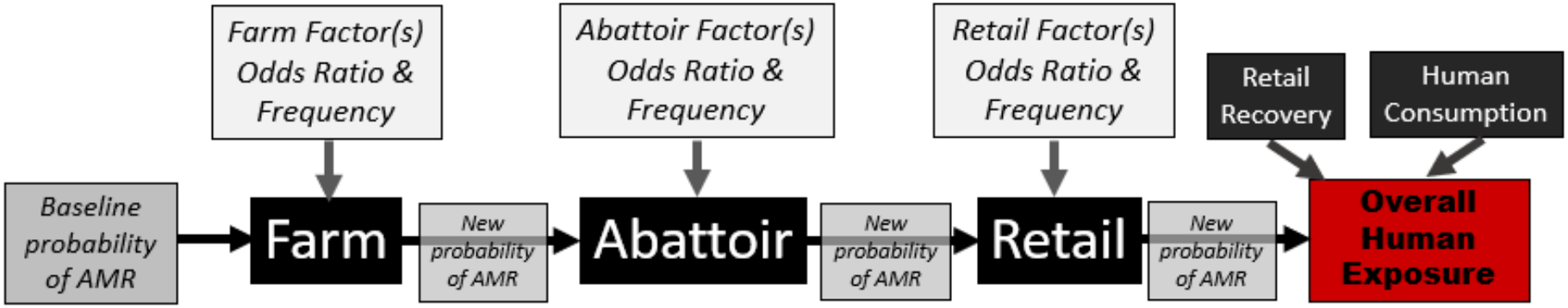
analytica®
Beyond the Spreadsheet

Specific “bug-drug-population” combination

Resistance to:	Extended spectrum cephalosporins	Fluoroquinolones	Macrolides	Tetracyclines
Escherichia coli/ Salmonella enterica				
Campylobacter coli/jejuni				

Base Model Structure

Specific “bug-drug-population” combination

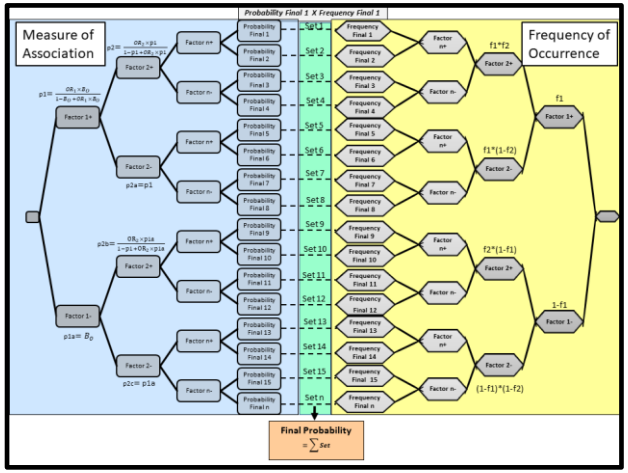


Odds Ratio

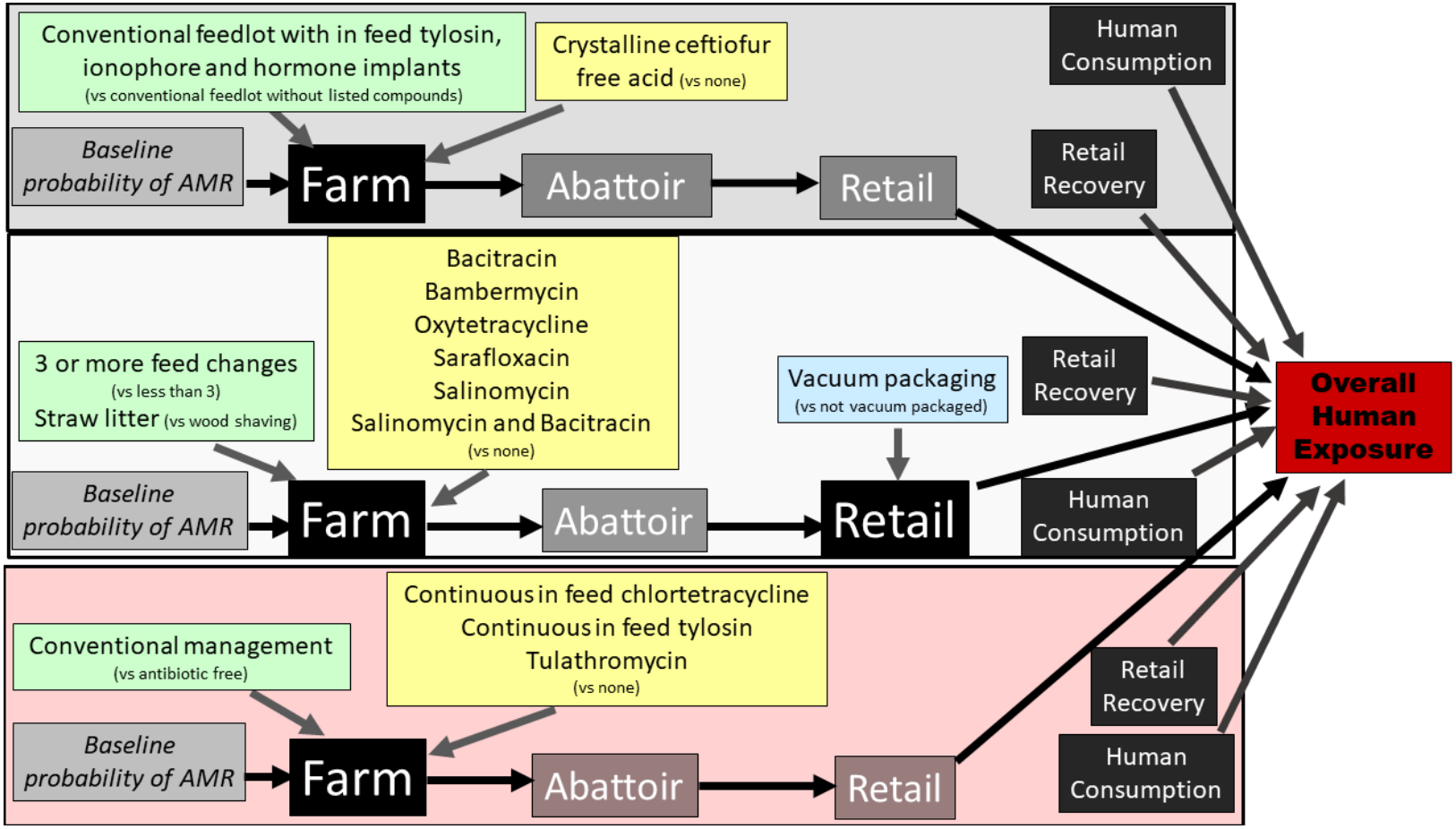
Common measure

Many study designs

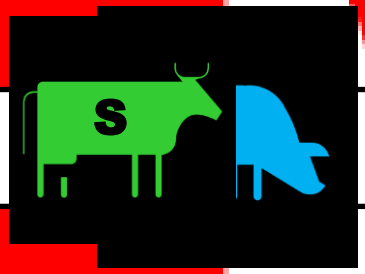
Bounded: $p_1=OR*p_0/(1-p_0)+(OR*p_0)$

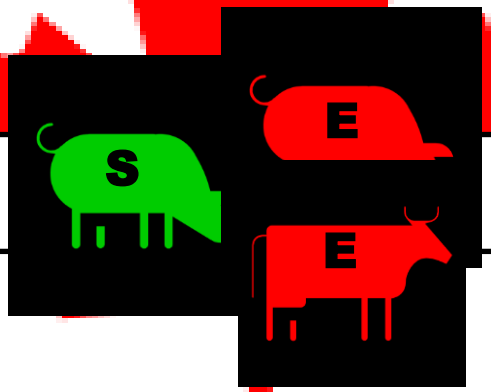


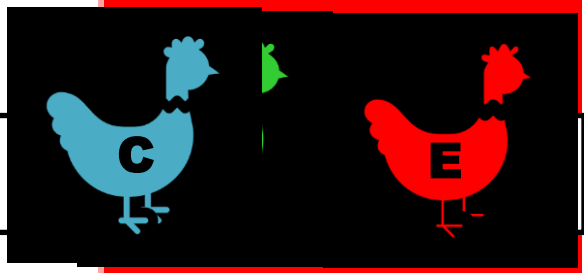
Extended spectrum cephalosporin resistant *E. coli/Salmonella*



Exposures per 7 days

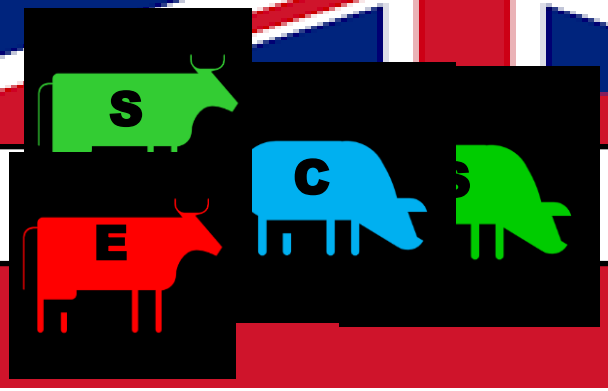


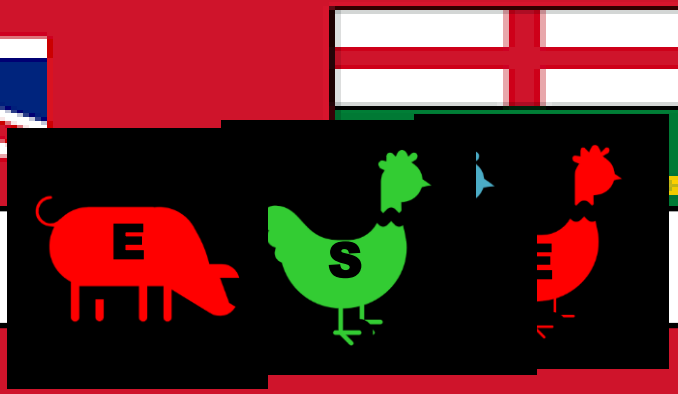




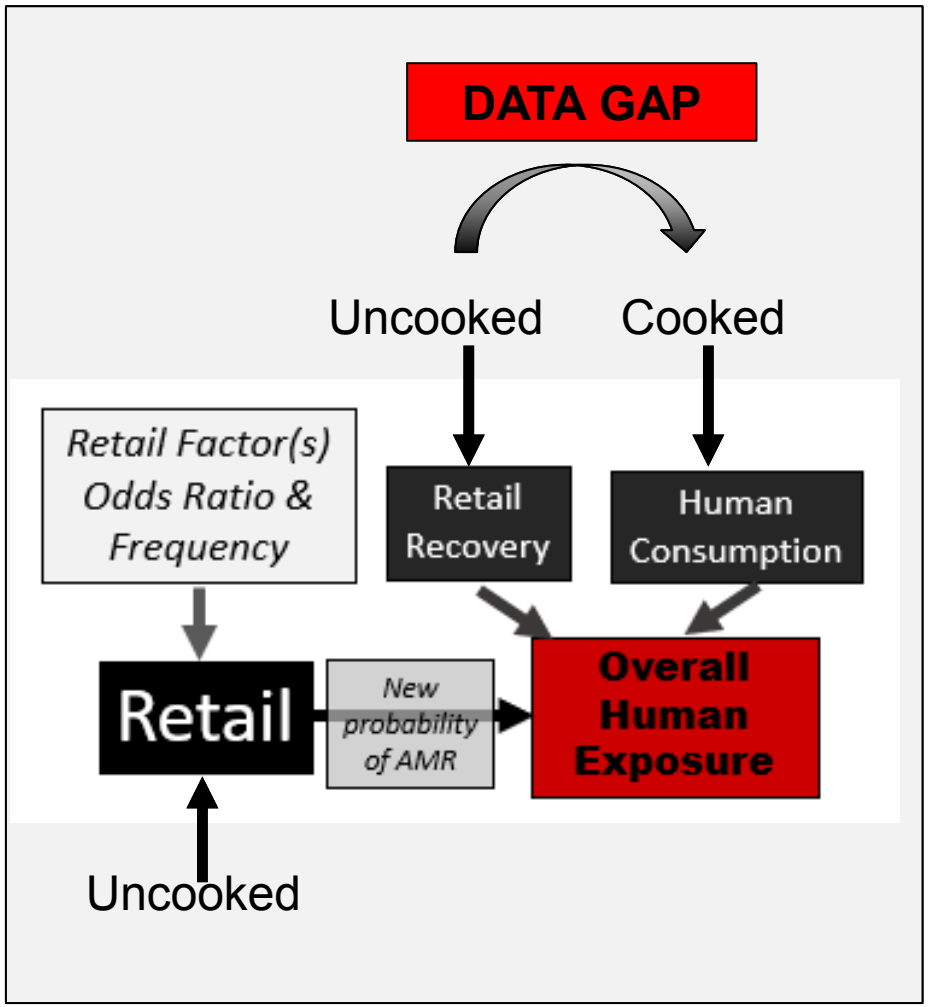
Lower

Higher





Interpretation of Results



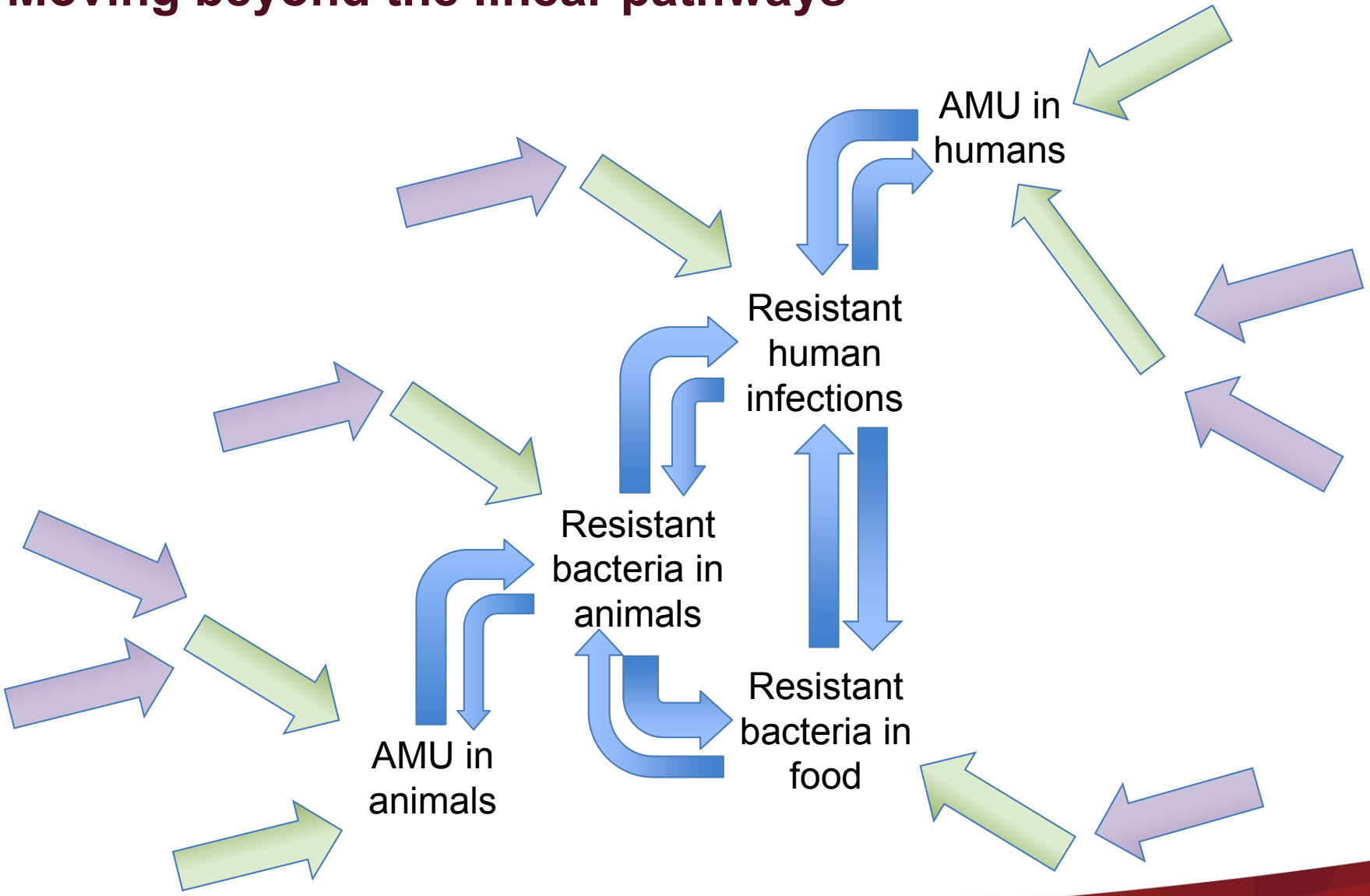
Highest exposures through chicken

- High recovery rates
- High consumption patterns

Other considerations

- Many relevant Canadian/regional factors absent (e.g., vaccination, animal/farm density, biosecurity)
- Few references in each model
- Little Canadian literature

Moving beyond the linear pathways



Creating a visual model of AMR in Canada

Funded by: Canadian Safety and Security Program (Defence Research and Development Canada)

Project objectives were :

A) To describe how the actions of different people and organizations relate to AMR

B) To describe the factors that can influence antimicrobial use in humans and animals

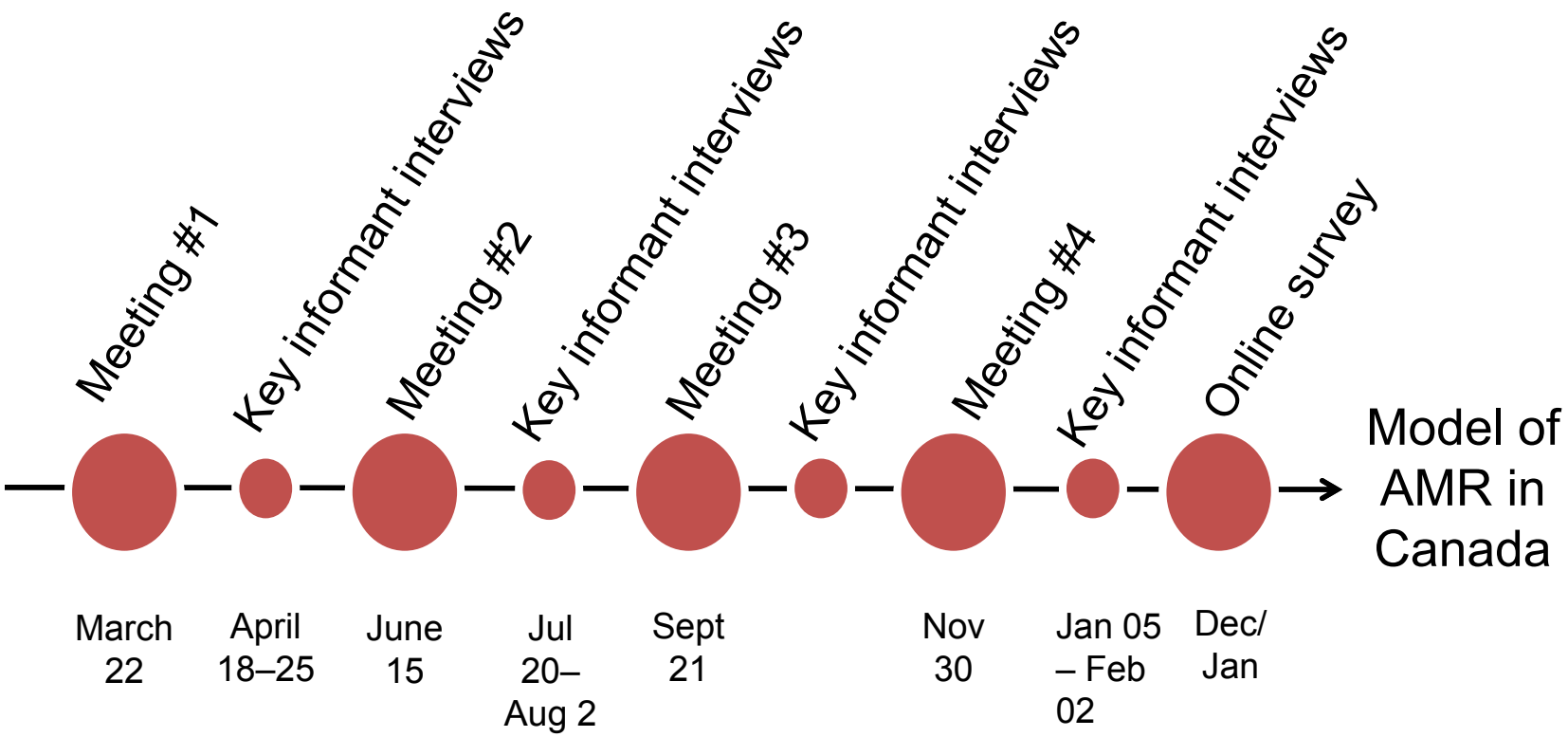
C) To identify key drivers of AMU and AMR (leverage points)

D) To identify ways that diverse individuals, groups and organisations might work together

Ultimately, our goal was to contribute to:

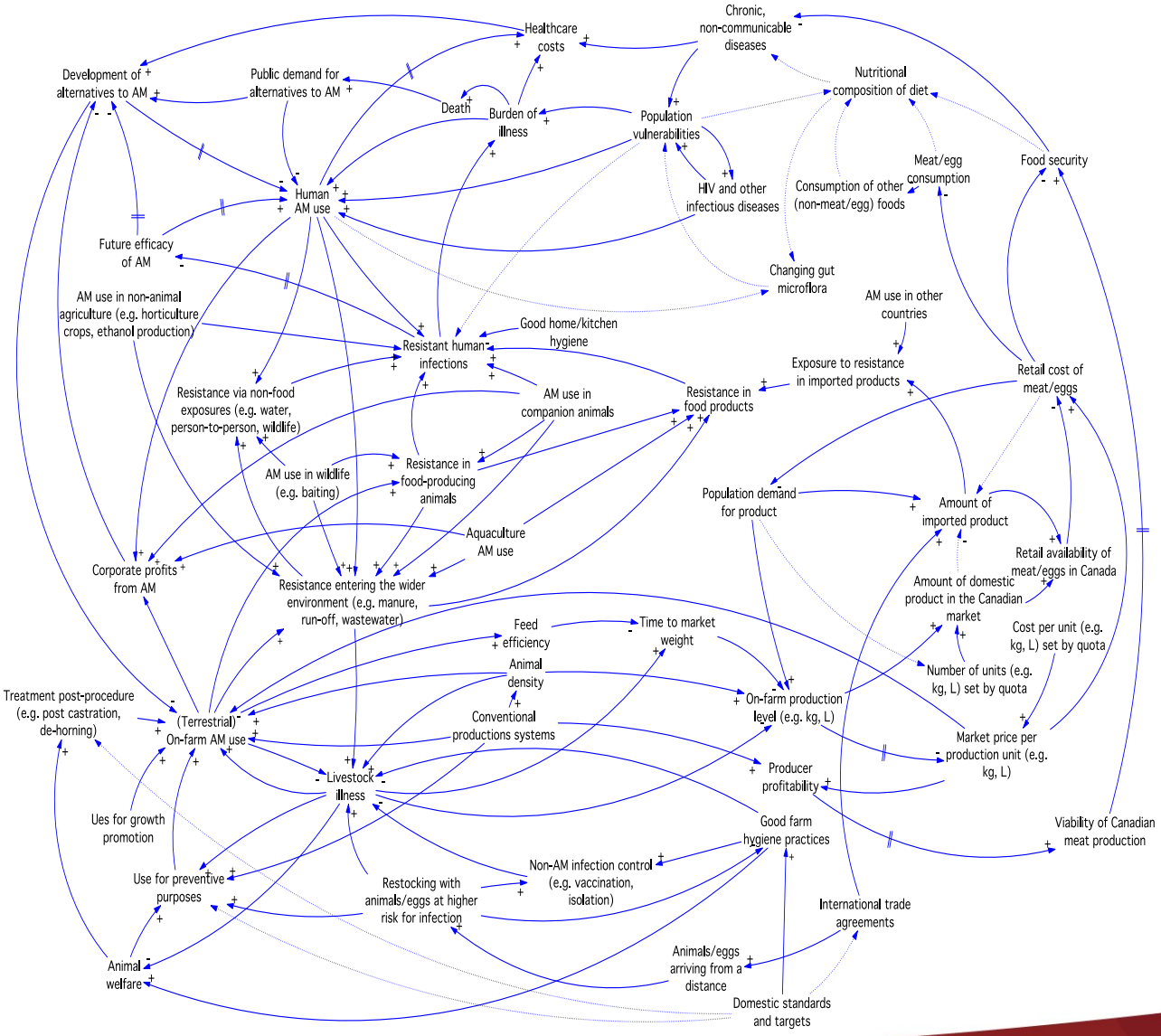
- Development of a common language and understanding of AMR so that communication among all stakeholders is made easier
- Recognition and understanding of the shared (collective) responsibility across agencies for the AMR issue

Methodology - overview

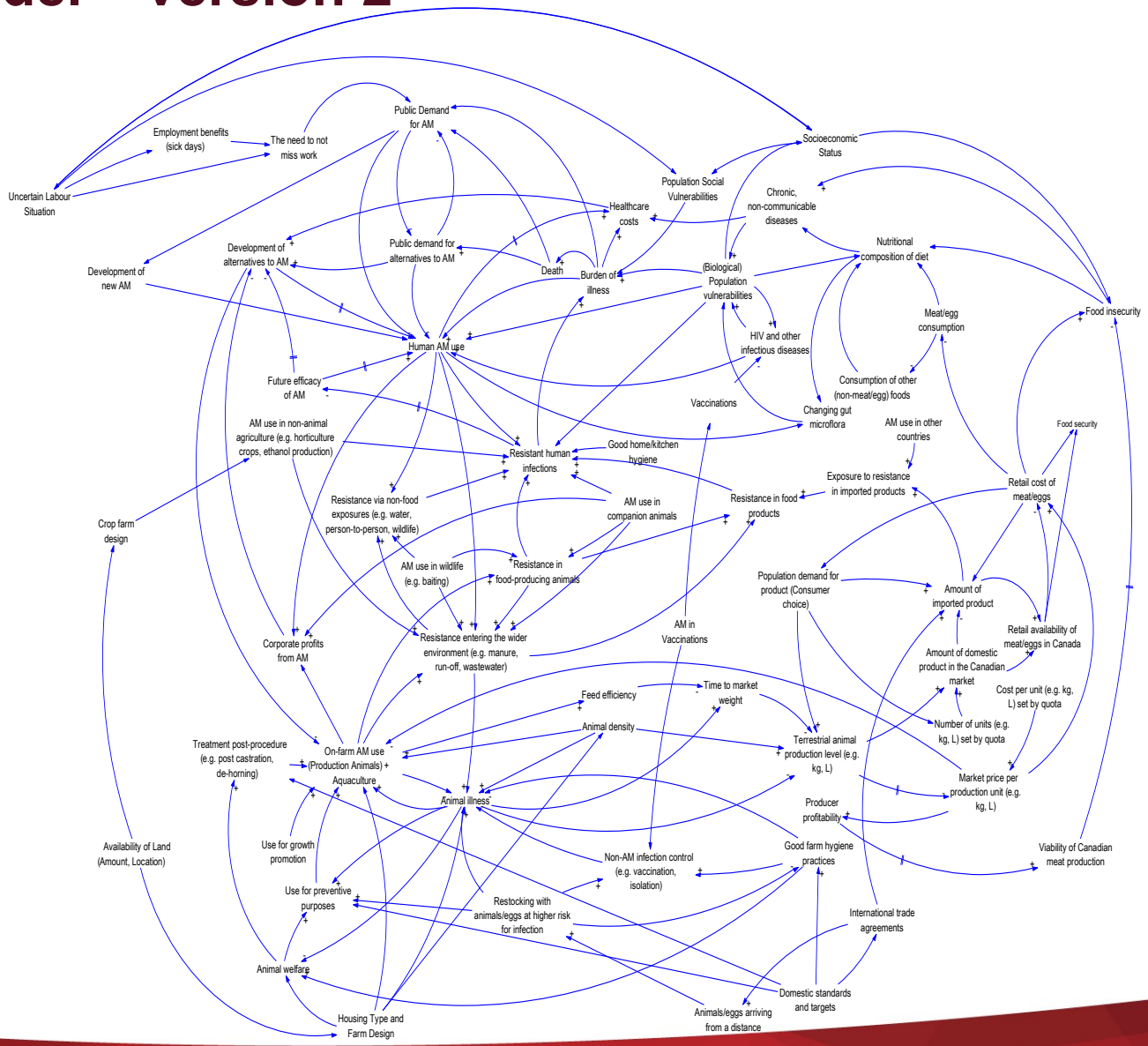


**This study received ethics clearance through Health Canada and the Public Health Agency of Canada's Research Ethics Board (REB #2015-0019) and a University of Waterloo Research Ethics Committee (ORE #21148)*

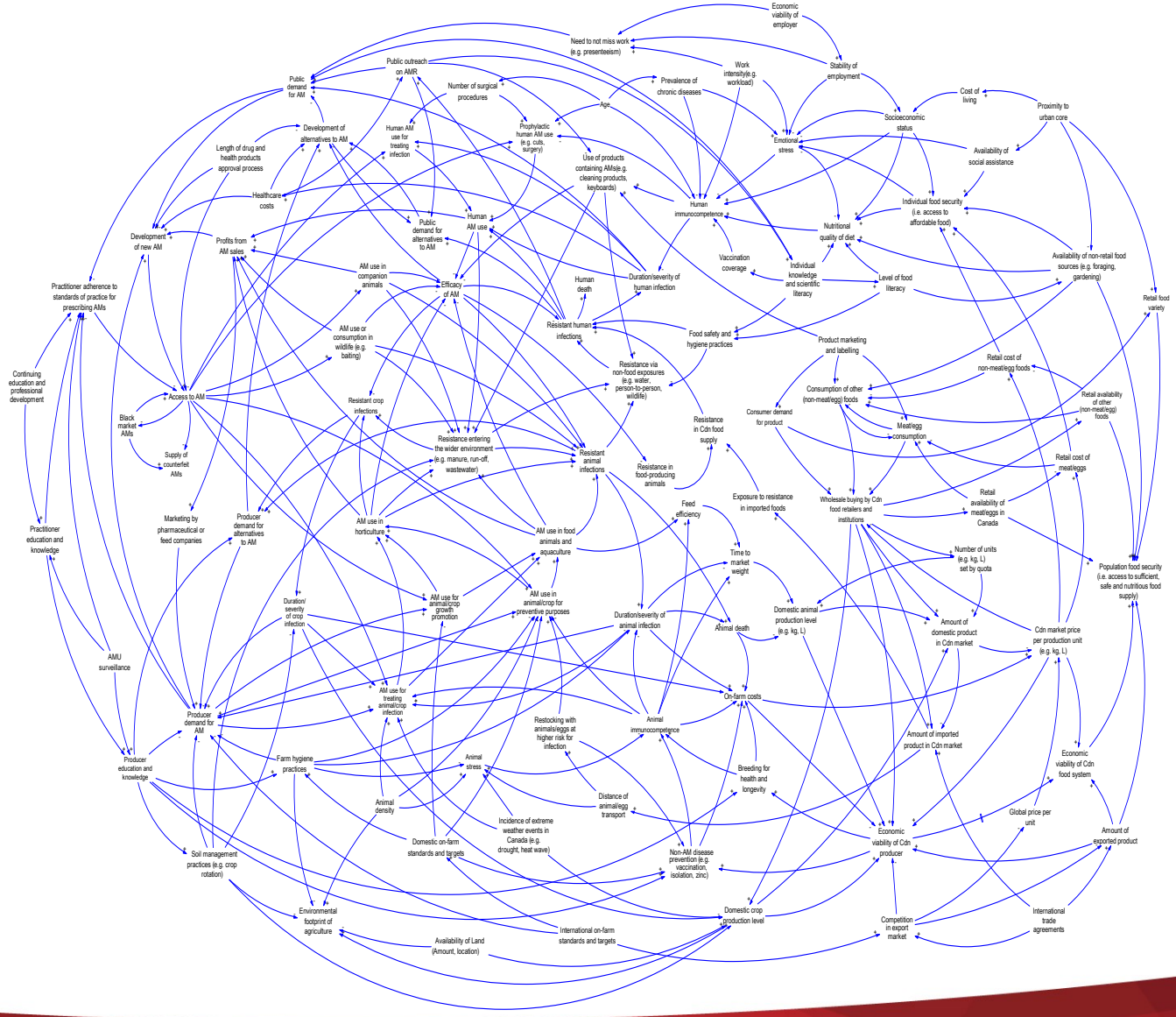
The model – version 1



The model – version 2



The model – version 8



Overall Themes

- Participants noted the need for greater education / transparency
- Elaborated the challenges associated with information sharing
- Expressed the notion that AMU and AMR is a complicated system with numerous interests, leverage points, weak spots, barriers, facilitators, and moving targets

Conclusions

A common language and understanding of AMR so that communication among all stakeholders is made easier

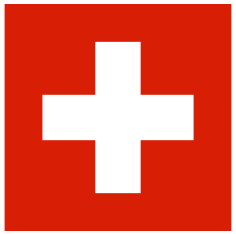
- Started the conversation – negotiating a new language
  - What is sustainable? What is risky?
- Importance of a safe space for meaningful dialogue

A recognition and understanding of the shared (collective) responsibility across agencies for the AMR issue.

- Not the same as agreement on roles and responsibilities

JPI-AMR project

- Comparative assessment of social-ecological resilience and transformability to limit AMR in one health systems
- https://amresilience.wordpress.com/



AMResilience


ANSWERS
SIMPLE BUT WRONG
COMPLEX BUT RIGHT
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