

CIPARS – 15 YEARS OF SURVEILLANCE ALONG THE FOOD CHAIN

Anne Deckert¹, Sheryl Gow^{1,2}, David Léger¹, Agnes Agunos¹, Carolee Carson¹, Richard Reid-Smith¹

¹Food-borne Diseases and AMR Surveillance Division, Centre for Food-borne Environmental and Zoonotic Infectious Diseases, Public Health Agency of Canada, Saskatoon, Saskatchewan/Guelph, Ontario ²Department of Large Animal Clinical Sciences, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, Saskatchewan

What is CIPARS?

The Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

- Monitors trends in antimicrobial use (AMU) and antimicrobial resistance (AMR) in selected bacteria from humans, animals, and retail meat
- Active surveillance of beef cattle, pigs, chickens, and turkeys and Passive surveillance of *Salmonella* from ill humans and animals
- Retail, abattoir, and farm level sampling.
- Antimicrobial use data collected at the national distribution and farm levels
- Bacteria of interest: *Salmonella*, generic *E. coli*, and *Campylobacter*. *Enterococcus* until 2011
- Antimicrobial susceptibility testing and reporting protocols standardized across all program components
- CIPARS provides information that can be used to contain the emergence and spread of AMR in order to maintain the effectiveness of antimicrobials for use in both animals and people



CIPARS Surveillance in Pigs and Broiler Chickens

Antimicrobial Use Metrics: Units of measure and indicators

- Multiple units of measure and indicators are used to report antimicrobial use data in order to facilitate comparisons between:
 - Species
 - Regions
 - Time periods at risk
 - Antimicrobials with differences in dose
 - And overall provide a more comprehensive picture of antimicrobial use

Indicators of AMU Used:

Mg = mg of antimicrobial active ingredient

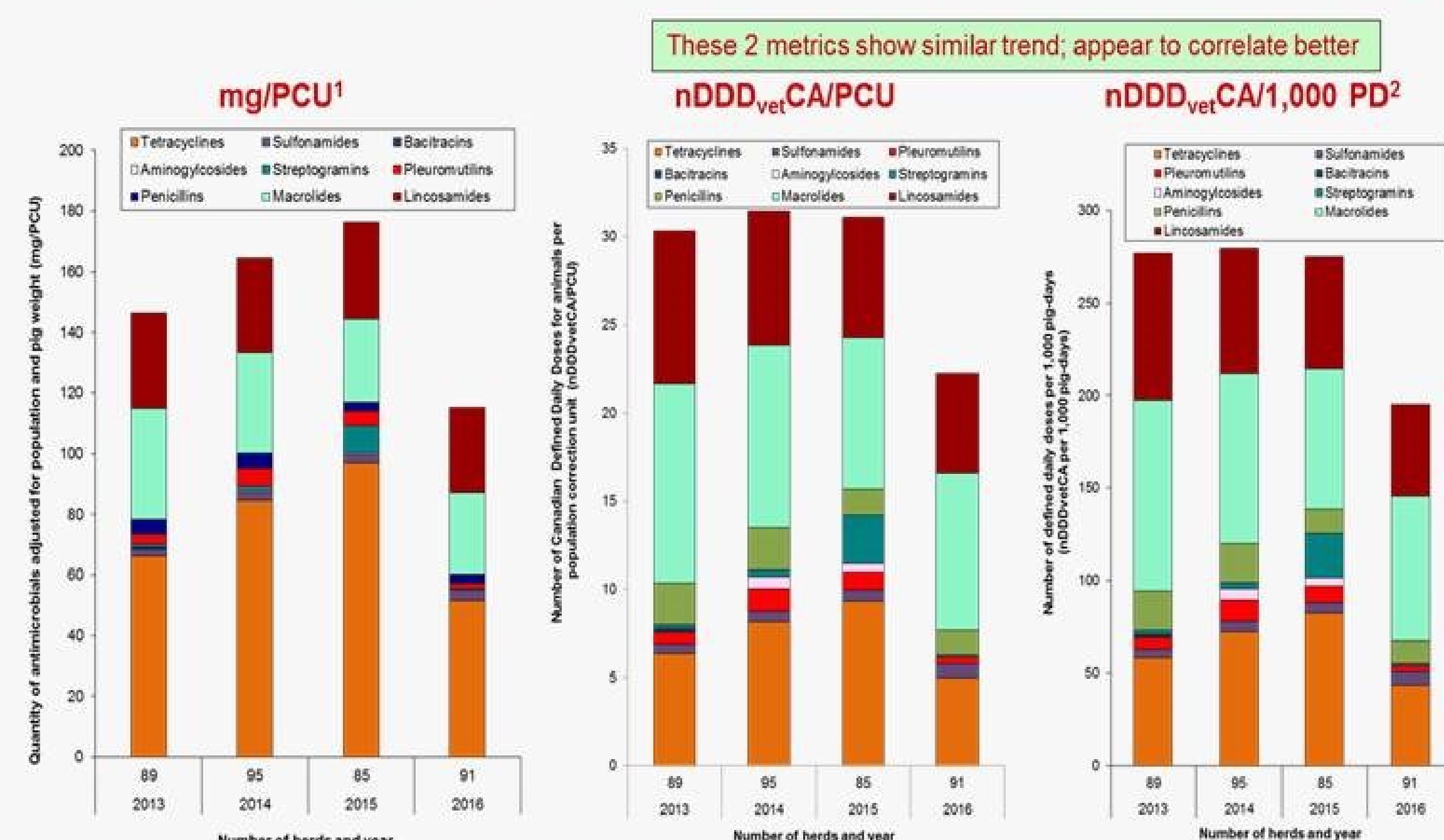
PCU (kg) = number of animals × average weight at treatment (kg)

Average daily dose = $\frac{\sum(\text{all unique doses})}{\text{number of unique doses}}$

DDD_{vet}CA = average daily dose × species specific conversion factor

DDD_{vet}CA/1,000 PD = $\frac{\text{grams of active ingredient/DDD}_{\text{vet}}\text{CA}}{\left(\frac{\text{total pigs} - \frac{1}{2} \text{mortality rate}}{1,000} \times \text{days exposed}\right)}$

Choice of indicator affects interpretation: G-F pigs



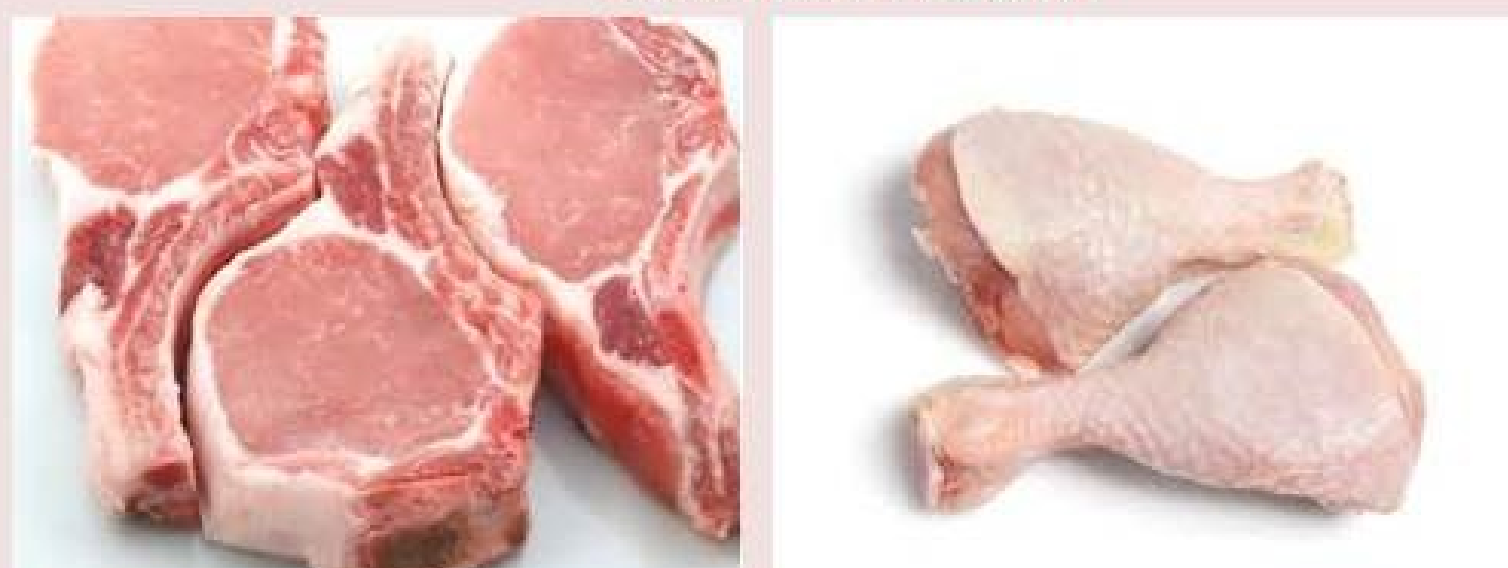
↓ Overall: 35% change,
Top 3: Tetracycline, Tylosin & Lincomycin

↓ Overall: 29% change,
Top 3: Tylosin, Lincomycin & Tetracycline

¹ESVAC recommended for farm-level data collection. ² Denominator to better describe sample survey (e.g., CIPARS farm program framework)

- Overall, between 2015 and 2016, the mg of drug per kilogram of animal declined
 - this was achieved by a decrease in the number of doses administered per animal day.
- The top three drugs regardless of indicator remain the same, but the relative importance of them changes.

CIPARS Retail



Grocery stores and independent butchers, began in 2003

Pork chops and chicken legs

representative sampling plan in selected provinces

CIPARS Abattoir



Caecal samples

Federal abattoirs across Canada, began in 2002

Sampling proportional to slaughter volume

Voluntary participation

CIPARS Farm



Grower-Finisher farms in the 5 major pork producing provinces, began in 2006

Broiler chicken flocks in the 5 major chicken producing provinces, began in 2013

Number of participating herds/flocks in each province proportional to the number of herds/flocks in that province

Voluntary participation

Distribution Data



Voluntarily provided by Canadian Animal Health Institute

Kg of active ingredient distributed for sale, currently not broken down by species

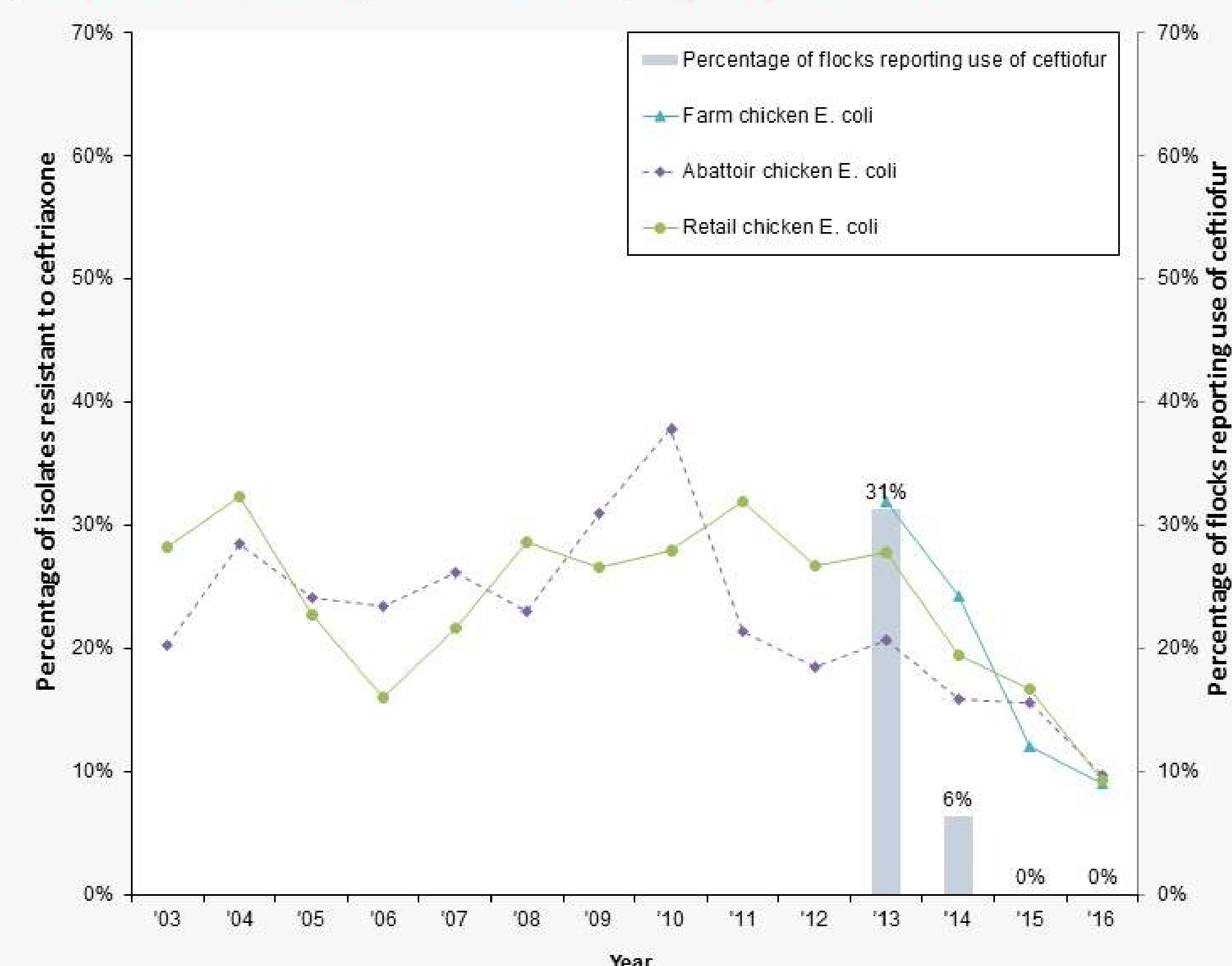
Integrated Antimicrobial Use and Resistance data

- Ceftriaxone is considered to be an antimicrobial of Very High Importance to human medicine (Category I) by the Veterinary Drugs Directorate of Health Canada
- This antimicrobial is used to treat a variety of serious human infections
- Although ceftriaxone is not used in animals, other similar drugs (e.g., ceftiofur) are used to treat and prevent a range of animal infections
- In most situations, there is cross-resistance between ceftiofur and ceftriaxone and others in this antimicrobial class

Broiler Chicken

- Mid-2014, the poultry industry implemented a national ban on the preventative use of antimicrobials considered Very Important for Human Medicine (VDD - Category I)
- Consistent with the timing of this ban, reported ceftiofur use in broiler chickens decreased, dropping to 0% among participating flocks in 2015 and remaining at 0% in 2016
- Over the same time period, CIPARS surveillance data showed that ceftriaxone resistance in *Salmonella* declined in humans, chickens and chicken meat.
- Similar trends were observed in *E. coli*.
- Most ceftriaxone resistance in humans in Canada has been observed in *Salmonella* Heidelberg
- Ceftriaxone resistance in *Salmonella* Heidelberg isolates from humans dropped significantly from 27% in 2015 to 16% in 2016

Impact of Broiler Industry elimination of preventive ceftiofur use



- The industry-led initiative to eliminate the use of ceftiofur, and all other Category I antimicrobials, in poultry for disease prevention is appearing to have the desired effect
- CIPARS will continue to assess the impact of this important intervention on resistance in *Salmonella* from humans

Vancomycin-Resistant Enterococci

- Vancomycin-resistant enterococci (VRE) are an issue of public health concern
- Typically there is cross-resistance between vancomycin and avoparcin
- CIPARS monitored enterococcus in over 9000 isolates from farms and retail meat until 2010 but did not find any VRE
- Surveillance data was critical in demonstrating that although agri-food sources may have played a role in vancomycin resistance in humans in Europe, that this was unlikely to be the situation in Canada

References:

Van den Bogaard et al. The effect of banning avoparcin on VRE carriage in The Netherlands. J Antimicrob Chemother 2000; 46:146-148
Vancomycin-Resistant Enterococci Infections in Canadian Acute-Care Hospitals: Surveillance Report January 1, 1999 to December 31, 2011
Accessed at 2011 http://publications.gc.ca/collections/collection_2013/aspc-phac/HP40-85-2013-eng.pdf

Vancomycin and Avoparcin use and resistance in Europe & North America

	Europe	N. America
Avoparcin GP	Used until 1990's	Not used
VRE in healthy animals and humans	Common	Rare or non-existent
Vancomycin in hospitals	Limited use	Extensively used
VRE in hospitals	Uncommon	Increasingly common

CIPARS Data supports these findings in animals

Summary & Conclusions

- The use of multiple AMU indicators and measures provides a more comprehensive picture of trends in AMU
- Integrated surveillance data demonstrated the impact in both the human and veterinary sectors, of initiatives implemented by the Canadian chicken industry to address antimicrobial resistance
- VRE was not identified in Canadian pigs, chickens, or cattle through routine CIPARS surveillance from 2003-2011
- The CIPARS program continues to provide useful data for the agri-food industry and for human health decision makers.

Acknowledgements

We would like to acknowledge the abattoirs, veterinarians and producers that participate in the CIPARS program, the Canadian Food Inspection Agency, and the CIPARS Advisory Group including the Canadian Pork Council, provincial pork boards, Canadian Association of Swine Veterinarians, and provincial ministries of agriculture, as well as the Public Health Agency of Canada
Funding: the Public Health Agency of Canada, Alberta Agriculture and Forestry, the Saskatchewan Ministry of Agriculture, and the Ontario Ministry of Agriculture Food and Rural Affairs