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Canada

Farm-level antimicrobial use surveillance in a FoodNet Canada-CIPARS sentinel site; application of several antimicrobial use indicators to monitor industry interventions

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Quantification, Benchmarking and Stewardship of Veterinary Antimicrobial Usage
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PROTECTING AND EMPOWERING CANADIANS TO IMPROVE THEIR HEALTH

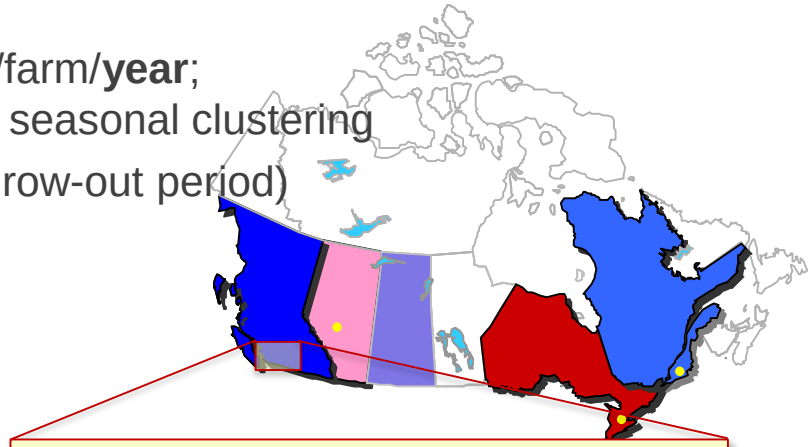
Objectives

- **The objectives of CIPARS Farm Surveillance are to**:
  - Describe temporal-spatial trends in AMU at the farm level
  - Integrate AMU and AMR data across populations
  - Validate National pharmaceutical company sales data (CAHI)
  - Measure the impact of industry and government interventions

- **The objectives of this presentation are to**:
  - To demonstrate how integrated surveillance can inform and motivate stewardship, pre- and post-intervention
  - Compare different quantitative AMU indicators for broiler chicken and turkey data collected from farms in one province.

CIPARS Farm Surveillance Methods Summary

- **Resolution**
  - Spatial: Provincial/National; **sample of farms** in the major poultry producing provinces*
  - Temporal: One data and sample collection visit/farm/**year**; vets to distribute sampling of farms to minimize seasonal clustering
  - Specificity: Broiler chicken and turkey **flocks** (grow-out period)



** Data for this presentation are from farms located in the Fraser Valley of **British Columbia only***
- *30 broiler chicken flocks*
- *30 turkey flocks*

- **Sample size and representativeness**
  - Convenience sample
  - Vets recruit farms in major poultry producing provinces*, **inclusion/exclusion criteria**
  - **30 farms/species/province**, (n =136 broiler chicken and 72 turkey farms nationally)

- **Data collection – questionnaire**
  - Farm level information, management factors, biosecurity, animal health and disease
  - Antimicrobials used: reason, route and dosage, duration and % flock exposed
    - Feed dose based on inclusion rate and estimated consumption (breed growth curves)
  - # Animals at risk and exposed, and duration at risk

Why we use different antimicrobial use metrics… indicators

Units of Measure

- **# (%) Farms, finisher periods, rations**
  - How extensive is an AMU practice in a province or across Canada
- **% animals exposed**
  - How intensively a drug may be used on farm
- **Kilograms of active ingredient**
  - The raw quantity used
- **nDDDvet**
  - To account for differences in dosages

Denominators

- **Population Correction Unit (PCU)**
  - To account for variation in populations and the size of animals
- **Animal-Time denominator**
  - To account for variation in a sample population and time at risk
    e.g. a finisher period… per 1000 chicken-days

WEIGHT BASED INDICATOR

1. Total quantity of AMU adjusted for the animal population and weight

$$\frac{\text{Antimicrobials in feed (mg)} + \text{water (mg)} + \text{injection (mg)}}{\text{PCU(Total population} \times \text{standard weight in kg)}} = {}^{\mathbf{mg}}/_{\mathbf{PCU}}$$

DOSE-BASED INDICATORS for data from sample survey

2. #Defined Daily Doses adjusted for the animal population and weight

$$\frac{\text{Total antimicrobials (mg)}/\text{DDD}_{\text{vet}}\text{CA Std}}{(\text{Total broiler population} \times \text{Std Wgt (1 kg)})} = {}^{\mathbf{nDDDvetCA}}/_{\mathbf{PCU_{Chicken}}}$$

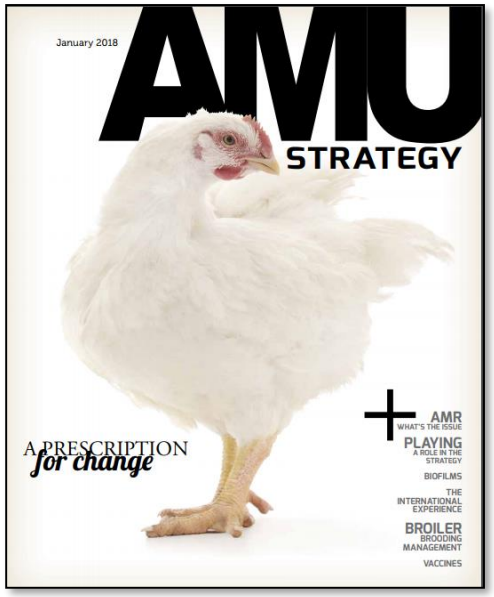
3. #Animal Daily Doses adjusted for the animal population and time at risk

$$\left(\frac{\text{Total antimicrobials (mg)}/(\text{DDDvetCA Std} \times \text{Std Wgt})}{\text{Total broilers} \times \text{Days @ risk}}\right) \times 1{,}000 = {}^{\mathbf{nADDvetCA}}/_{\mathbf{1,000\ Chicken-days@\ risk}}$$

Where

- 'DDDvetCA Std' = Average of all unique labelled dosages, for treatment and prevention indications only; GP dosages excluded
- 'Std Wgt' for broiler chicken = 1 kg; 'Std Wgt' for Turkey = 6.5 kg

ESVAC, 2017. 2015 Report; ECDC/EFSA/EMA. 2nd JIACRA Report, 2017; Timmerman et al. 2006; Collineau et al, 2017 (Treatment Incidence)
DDDvetCA-defined daily doses in animals using Canadian standards, mg/kg/day ;(Modified from EMA, 2015, Principles of assignment of DDDvet and DCDvet)

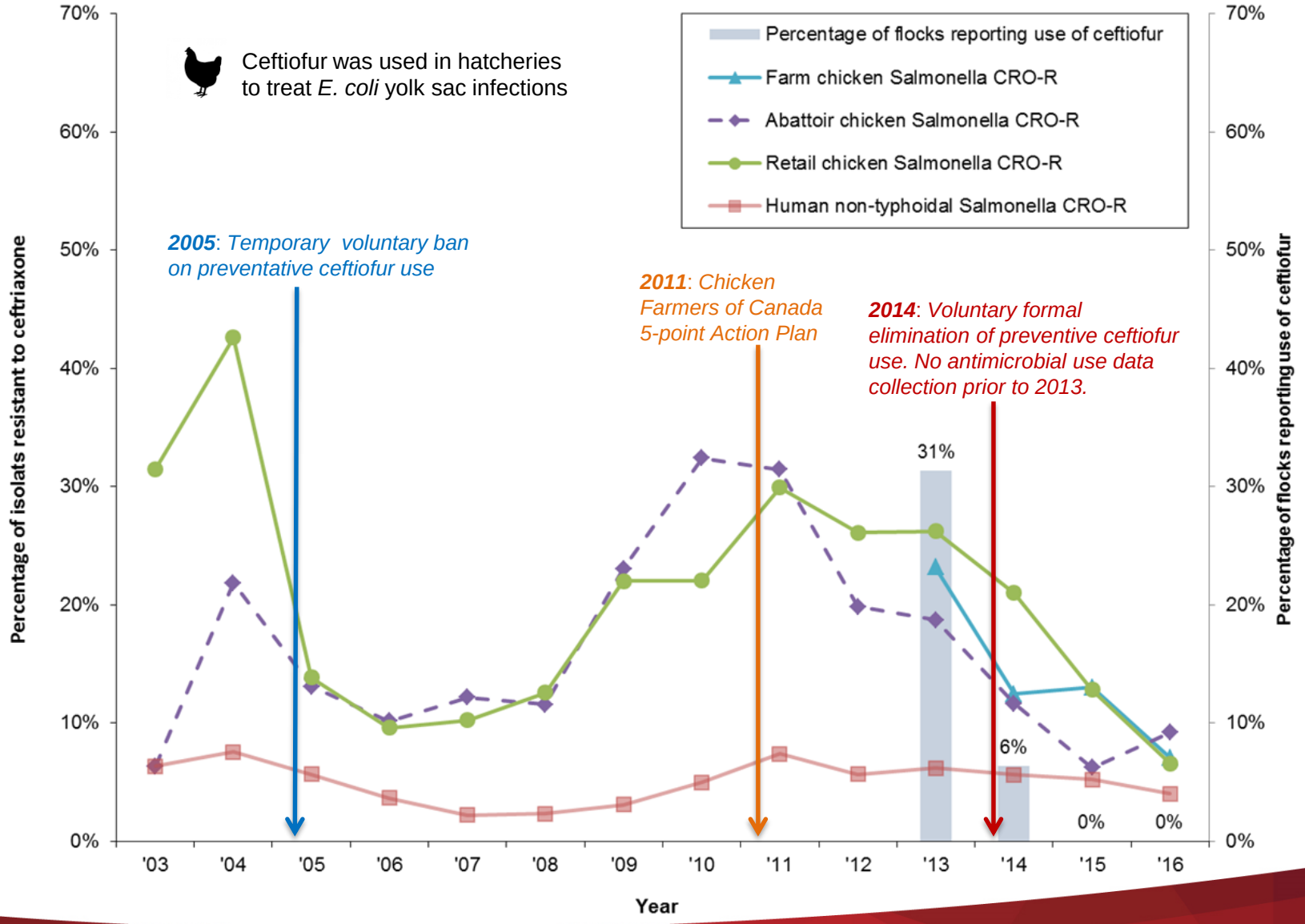


http://www.chickenfarmers.ca/resources/

Surveillance informing stewardship

RESULTS

Reported ↓ in frequency of ceftiofur use at the hatchery coincided with ↓ ceftriaxone resistance in *Salmonella* from broiler chickens and humans



2013-2015 CIPARS Farm data by poultry species

	BROILER CHICKENS	TURKEYS
Total flocks	78	88
Total birds	1,765,933	791,907
ESVAC average weight at treatment	1 kg	6.5 kg
Biomass (population correction unit)	1,765,933	5,147,396
Days at risk (average age at day of sampling)	33	86*
Total quantity of antimicrobial use (kgs)	176.21	344.44

**Note:*

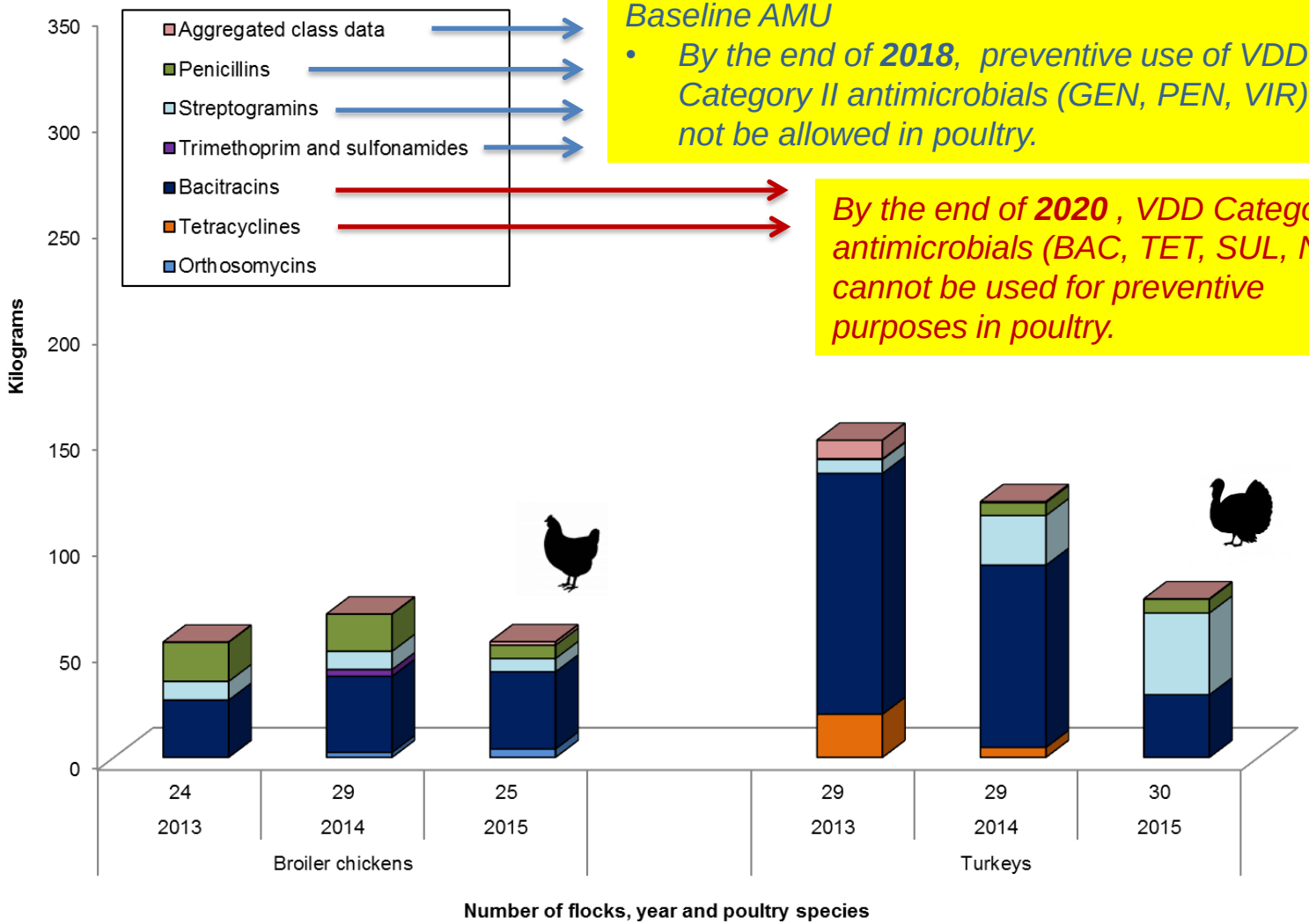
- *Although the average days at risk for **turkeys** is much longer than broiler chicken, finisher/developer turkey rations are often not medicated;*
- *In conventional **broiler chicken** production all feed rations are medicated*

Kilograms: decreasing trend in both species; higher use in turkeys (larger birds and longer grow-out period)

Baseline AMU

- *By the end of **2018**, preventive use of VDD Category II antimicrobials (GEN, PEN, VIR) will not be allowed in poultry.*

*By the end of **2020** , VDD Category III antimicrobials (BAC, TET, SUL, NEO) cannot be used for preventive purposes in poultry.*

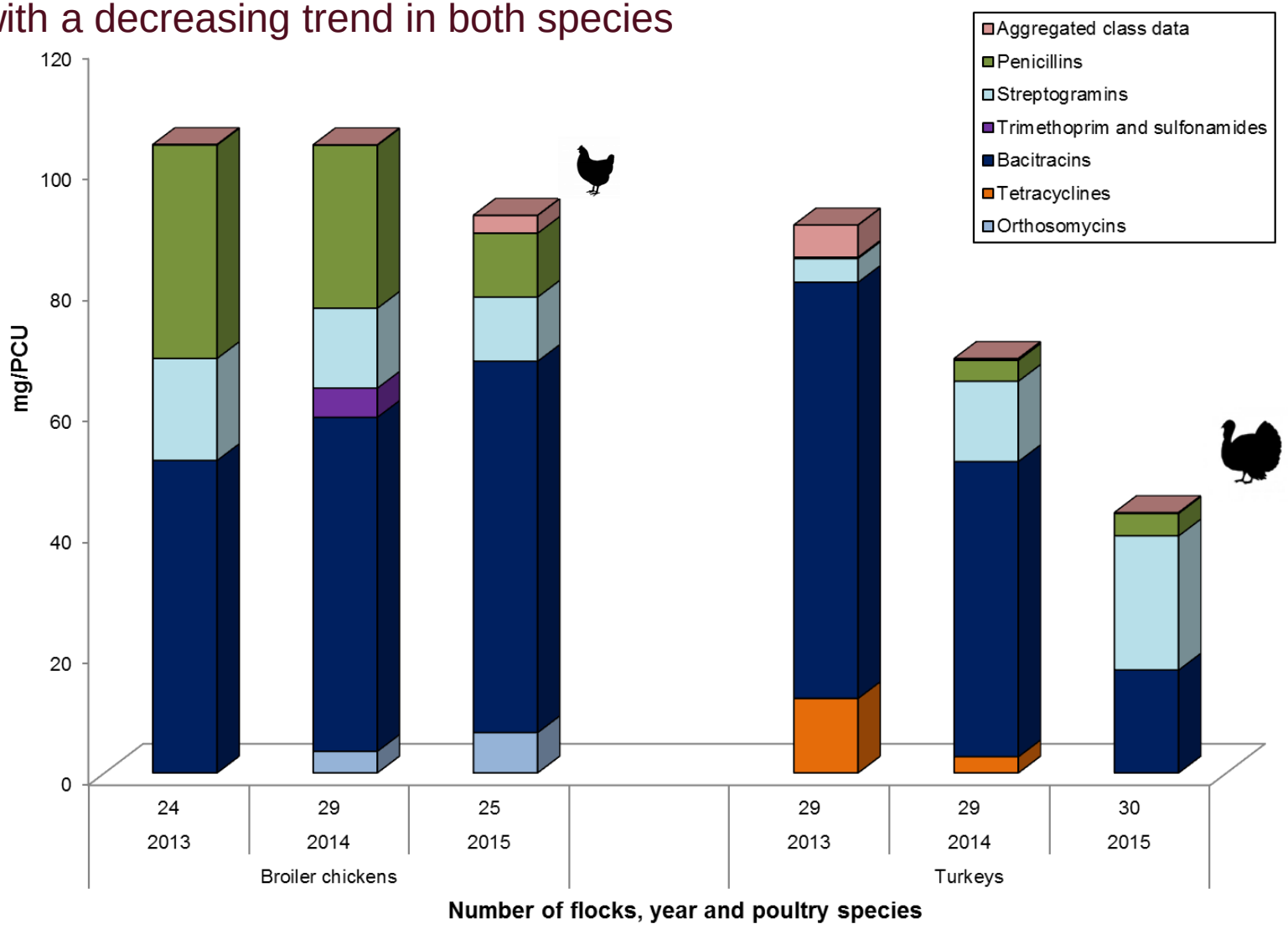


Top 3: BAC>PEN>STR_{VIR}

Top 3: BAC>STR_{VIR}>TET

Aggregated class data: 3rd gen. cephalosporins, fluoroquinolones, aminoglycosides, lincosamides-aminocyclitols

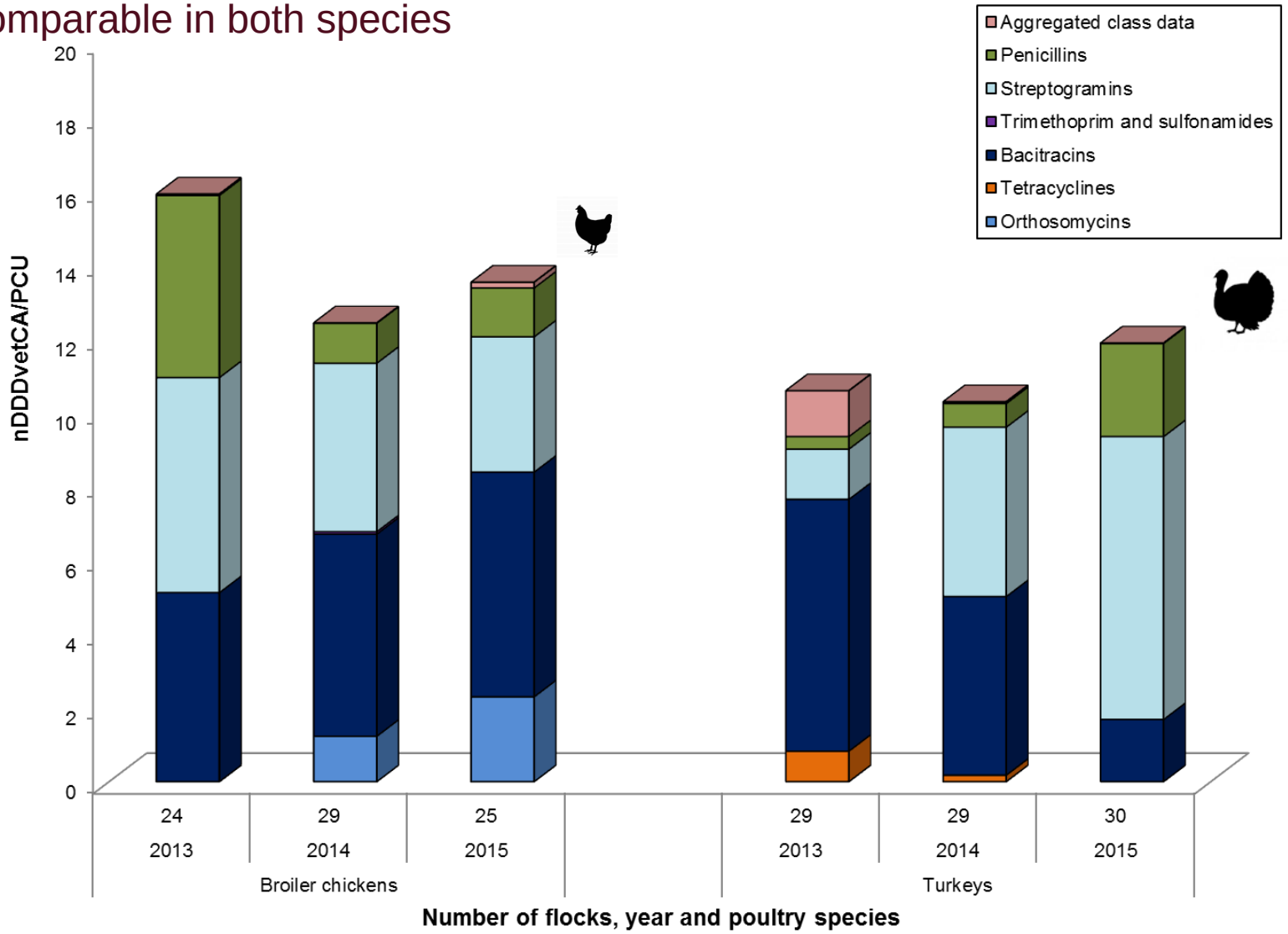
Overall in 2015, higher in broilers (96 mg/PCU) compared to turkeys (43 mg/PCU), with a decreasing trend in both species



Top 3: BAC>STR_{VIR}>PEN

Top 3: BAC>STR_{VIR}>TET

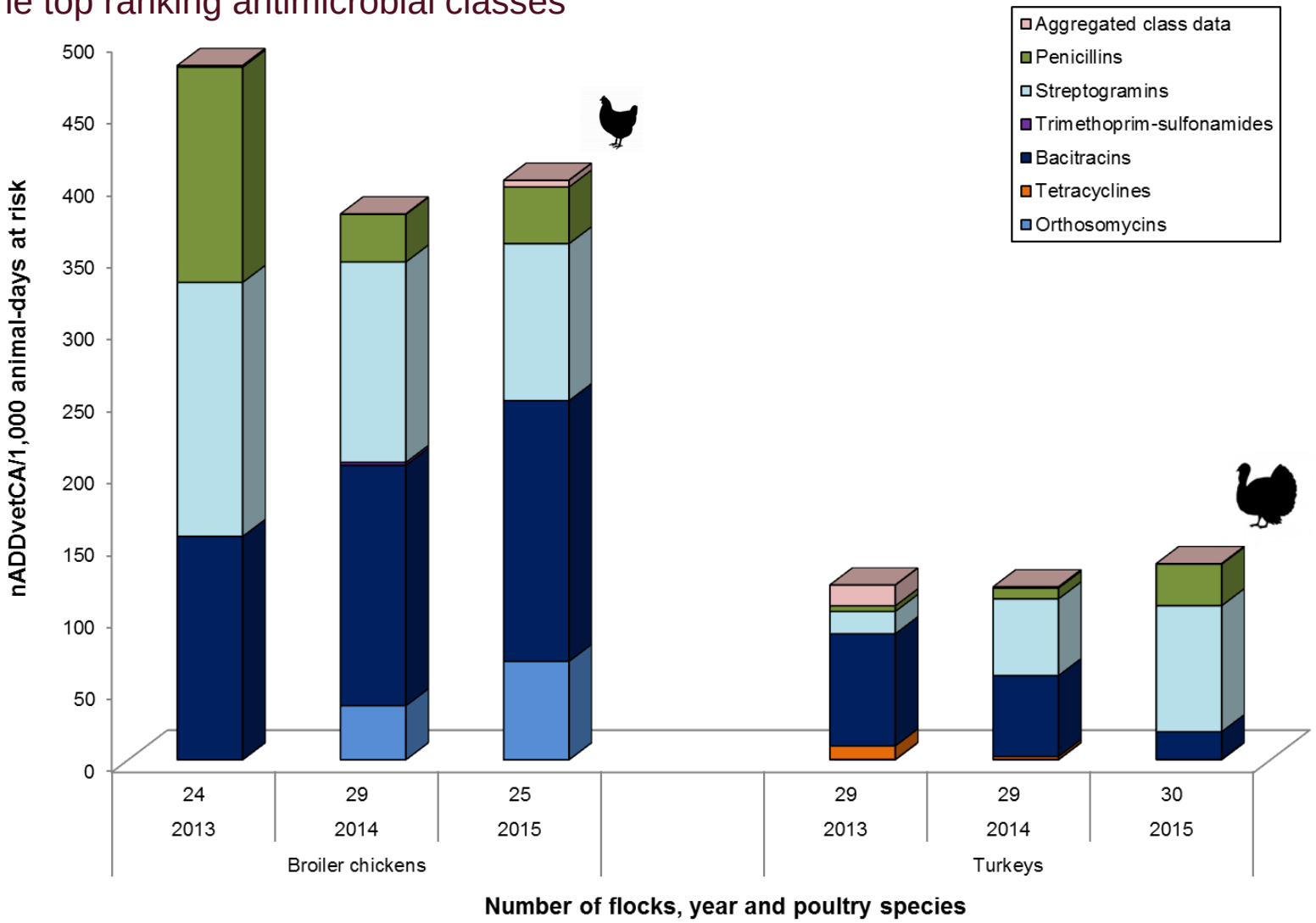
Dose based indicator, now shows an increasing trend 2014-2015; quantities are comparable in both species



Top 3: BAC>STR$_{VIR}$>PEN

Top 3: STR$_{VIR}$>BAC>PEN

Trends are correlated with the nDDDvetCA/PCU with lower use in turkeys and a change in the top ranking antimicrobial classes



Top 3: BAC>STR_{VIR}>PEN

Top 3: STR_{VIR}>BAC>PEN

*Based on Timmerman et al, 2006 (Treatment Incidence)

The declining trend in the weight-based metrics has been achieved through switching to different products, as indicated by the dose-based metrics

- Use of antimicrobials with low feed inclusion rate which impacts the dose-based metrics, e.g., emerging use of avilamycin
- Change in overall quantity of use in certain classes (e.g., ↑virginiamycin, ↓bacitracin)
- Shift in route of administration: Injectable antimicrobials (e.g., gentamicin/lincomycin-spectinomycinin, aggregated class in figure) and water antimicrobials (feed to water)
- Differences in populations, animal size (‘Std Wgt’) and time at risk

- A well constructed surveillance program using a sample of farms, as part of a multi-component integrated program, can indeed show changes in trends in both AMU and AMR, which can inform and motivate stewardship interventions

- Multiple indicators are needed for different purposes
  - Provides a more comprehensive understanding of AMU
  - Comparisons between species, regions, over time
  - Ability to measure the impact of specific stewardship interventions
  - Communication; contributes a dashboard of indicators

Acknowledgements

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- National and Provincial Turkey Marketing Boards
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Thank you!