Evaluating antimicrobial usage in German broiler farms 2014 – 2017

Matthias Flor, Bernd-Alois Tenhagen, Annemarie Käsbohrer

German Federal Institute for Risk Assessment, Unit Epidemiology, Zoonoses and Antimicrobial Resistance, Berlin

Presented at AACTING 2nd International Conference, 2–3 July 2019, Bern, Switzerland

Bundesinstitut für Risikobewertung

Take a picture to download the full evaluation report

1 Introduction

Since 1st July 2014, due to an amendment of the **German Medicinal Products Act (AMG)** keepers of meat production animals have to report all veterinary treatments with antimicrobial substances to a central database. This addresses calves for meat production after weaning up to 8 months, beef cattle above 8 months, piglets after weaning up to 30 kg body weight, pigs above 30 kg, broilers and turkeys. The law also specifies that separately for each production type the Federal Office for Consumer Protection and Food Safety (BVL) publishes two national indicators: the median (K1) and the 3rd quartile (K2) twice a year based on farm-level total treatment frequencies. Animal keepers above K2 are considered high-users and are required to present a written plan to the competent authority in order to reduce their usage of antimicrobials.

Here, we present results from the evaluation of the antimicrobial use data for **broiler farms**.

2 Materials & methods

Data collected within the framework of the AMG comprises both **data on antimicrobial usage (AMU)** as well as notifications about animal keeping. We were granted access to these data in anonymised form:

- **7** half-year periods from 1st July 2014 to 31st December 2017 (i.e. 14/2 to 17/2)
- **2,053** broiler farms (all German broiler farms housing at least 10,000 birds)
  - **1,308** farms with data for all periods
- **84,011** plausible treatments
  - median # animals treated per treatment: **29,000**
  - median # treatment days per treatment: **3**

We used EMA's defined daily doses for animals to estimate treatment weights of the animals as **plausibility checks** for the individual treatments.

For each plausible treatment administered on a farm in a given half-year period, the number of animals treated is multiplied by the number of treatment days. For each antimicrobial class, the **farm-level antimicrobial class-specific treatment frequency** (TF) is then calculated by summing up all respective treatments and dividing by the average number of animals in the given period on the farm:

$$TF_{farm}\ (class) = \sum_{\substack{\text{treatments on } farm \text{ with} \\ \text{antimicrobial substance} \\ \text{belonging to } class}} \frac{\#\text{ animals treated} \times \#\text{ treatment days}}{\text{average }\#\text{ animals}} \qquad (1)$$

Summing over all antimicrobial classes yields the **farm-level total treatment frequency** for the given half-year period:

$$TF_{farm} = \sum_{\substack{\text{antimicrobial} \\ \text{classes}}} TF_{farm}\ (class) \qquad (2)$$

We also defined the **population-level antimicrobial class-specific treatment frequency** in which the denominator is the sum of all average numbers of animals over all farms, i.e. the whole broiler population is considered:

$$TF_{population}\ (class) = \sum_{\substack{\text{treatments in } population \\ \text{with antimicrobial sub–} \\ \text{stance belonging to } class}} \frac{\#\text{ animals treated} \times \#\text{ treatment days}}{\sum_{farms} \text{average }\#\text{ animals}} \qquad (3)$$

[Note: Farms that did not administer any antimicrobials in a given half-year period were not required to report on numbers of animals kept (but could do so voluntarily). Farm-level treatment frequencies are not affected but population-level treatment frequencies are biased towards larger values.]

3 Results

For broilers, the national indicators K1 and K2 decreased from 14/2 to 15/2 but subsequently increased again and in 17/2 were back at levels similar to their respective 15/1 values (Fig. 1).

Antimicrobial class	Farms w/o treatment		Farms w/ at least one treatment		
	Count	(Prop.†)	Count	Median TF change	P value
Aminoglycosides	394	(30.1 %)	914	0.61	0.00215 **
Fluoroquinolones	638	(48.8 %)	670	0.02	0.81743
Trimethoprim and derivatives	739	(56.5 %)	569	-1.23	< 2e-16 ***
Lincosamides	400	(30.6 %)	908	0.61	0.00234 **
Macrolides	812	(62.1 %)	496	-0.80	1.0e-15 ***
Penicillins	299	(22.9 %)	1,009	-0.87	2.7e-13 ***
Polymyxins	335	(25.6 %)	973	-0.23	0.04621 *
Sulfonamides	725	(55.4 %)	583	-1.24	< 2e-16 ***
Tetracyclines	1,120	(85.6 %)	188	-0.53	0.01989 *

Tab. 1: Antimicrobial class-specific treatment. Comparison of farm-level frequency from the first year under consideration (combined half-years 14/2 and 15/1) to the last year (combined 17/1 and 17/2) using a Wilcoxon signed rank test (green – significant reduction, red – significant increase, grey – non-significant change). Not included in the tests were broiler farms without treatment using the respective antimicrobial class.
† proportion of the 1,308 farms with data for all seven half-years.

Treatment frequencies in broiler farms were highest for aminoglycosides, lincosamides, penicillins, and polymyxins (Fig. 1). The trends described above for K1 and K2 were best reflected in the population-level frequencies of treatments with aminoglycosides and lincosamides both of which showed statistically significant increases when comparing the first vs the last year of the period under consideration (Tab. 1). Conversely, treatment frequencies of fluoroquinolones did not change, and all other substance classes exhibited statistically significant reductions in treatment frequencies.

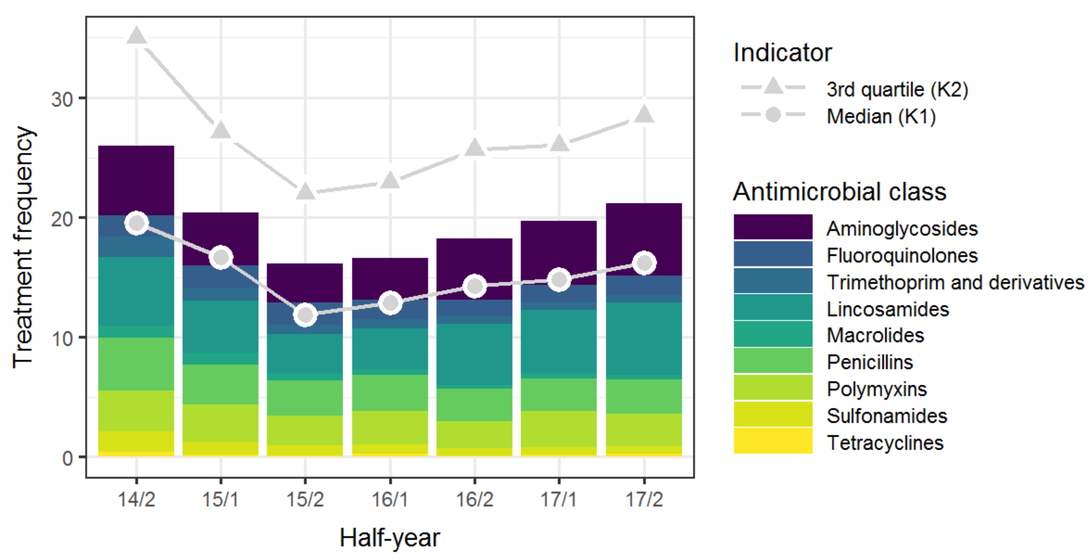

Fig. 1: Trends of the national AMU indicators (median and 3rd quartile of all farm-level total treatment frequencies) and of the population-level antibiotic class-specific treatment frequencies in German broiler farms from half-year periods 14/2 to 17/2.

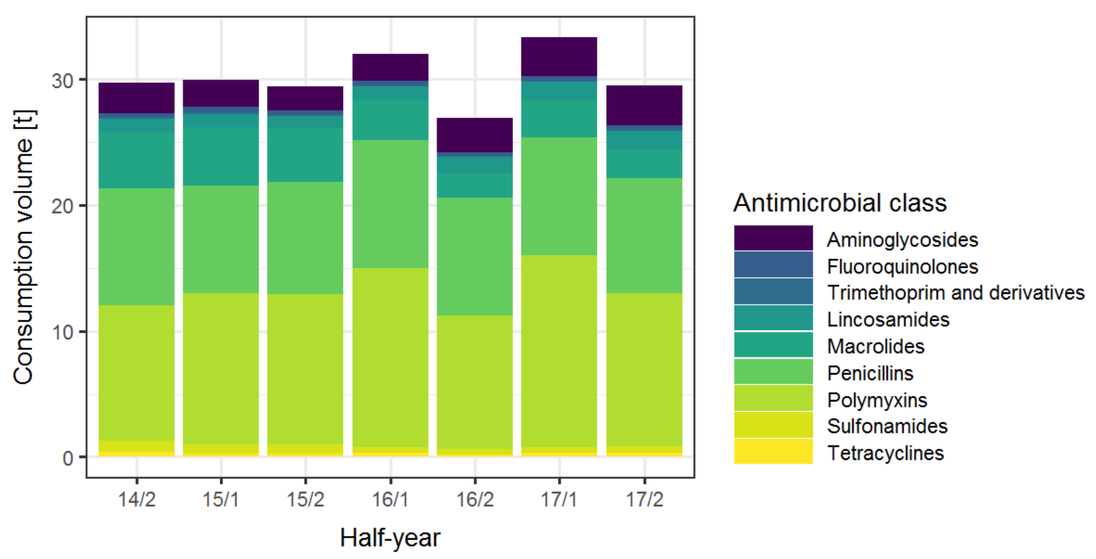

Fig. 2: Trends of antibiotic class-specific consumption volumes in tonnes [t] in the German broiler population from half-year periods 14/2 to 17/2.

In contrast to treatment frequency trends as depicted by K1 and K2, consumption volumes per half-year did not show a clear trend (Fig. 2). Volume-wise, AMU was dominated by polymyxins, penicillins, macrolides, and aminoglycosides. Aminoglycoside and lincosamide volumes indeed mirrored to some extend the trends of K1 and K2 but showed overall increases from 14/2 to 17/2. The raised consumption volumes of aminoglycosides and lincosamides can be attributed to an increased use of medicinal products combining both substance groups.

4 Conclusion

The revised legislation allowed to collect high-quality data on AMU in Germany which also support analysis on antimicrobial class-level. In broiler farms, treatment frequencies and consumption volumes show some specific differences in trends between 2014 and 2017. The detailed analysis of these patterns will support scientific discussion on the pros and cons of different procedures for calculating indicators and to frame the benchmarking system.

German Federal Institute for Risk Assessment • Max-Dohrn-Str. 8-10 • 10589 Berlin, GERMANY • Phone +49 30-18412-0 • Fax +49 30-18412-99 0 99 • bfr@bfr.bund.de • www.bfr.bund.de/en