Comparative epidemiology of clinical *E. coli resistance* to third-generation cephalosporins in animal health

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Context & Interest

E. coli = one of the most frequently isolated pathogens in food-producing animals and also a major infectious agent for Humans

Third-generation cephalosporins (3GC) = critically important antibiotics and last resort agents for some severe human diseases

Antimicrobial resistance (AMR) surveillance = essential to identify resistance trends and help in the design of effective and efficient control strategies and policies

Objective

Characterize the resistance dynamics of clinical *E.coli* isolates to 3GC in seven animal production categories, and thereby discuss the potential impact of changes in practice

Materiel

74,674 antibiograms collected between 2006 and **2016** by the French surveillance network for AMR in diseased animals referred to as **RESAPATH**

Method

- Time series analysis

→ **Generalized additive models (GAM)** allowing non-linear analysis
→ Independent models for each animal category
→ Modelling the monthly number of resistant *E. coli* strains with a quasi-Poisson regression, with an offset equal to the log of the total number of strains collected monthly
→ Estimation of smoothing parameters using cross-validation

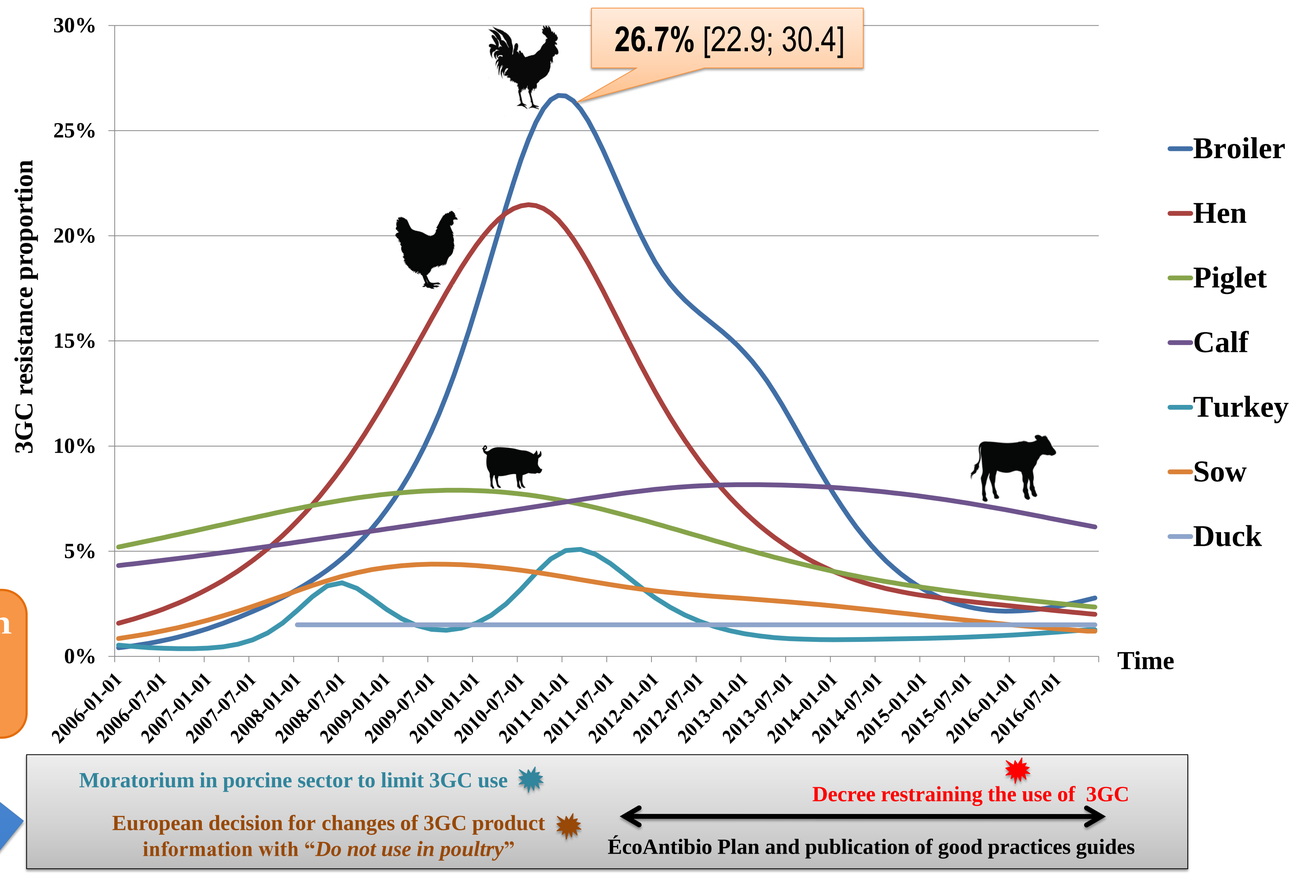
Results & Discussion

Evidence that *E. coli* resistance could increase very quickly : a major concern because 3GC are last-generation antibiotics

Resistances of clinical *E. coli isolates* to **3GC calculated over the whole period were all below 8% …**

Animal category	Pathology	Resistance
Calf	Digestive disorder	**7.0%** [6.7; 7.3]
Sow	Genitourinary infection	**2.7%** [2.3; 3.2]
Piglet	Digestive disorder	**5.6%** [5.0; 6.2]
Hen	Septicemia	**6.8%** [6.3; 7.3]
Broiler	Septicemia	**7.8%** [7.3; 8.3]
Duck	Septicemia	**1.4%** [1.1; 1.8]
Turkey	Septicemia	**1.6%** [1.3; 1.8]

… But time series analysis revealed **significant fluctuations of** resistance trends and **differences between the animal categories**



Parallel with control measures

Resistance dynamics:

→ No seasonal cycle
→ **Non-linear trends o**f resistance, except for duck
→ **Peaks** in resistance up to high level of resistance for broilers and hens, and subsequent rapid decrease
→ **Emergence** of resistance in turkeys, broilers and sows in 2006

→No available data to make a parallel with 3GC use in France
→Stabilisation and decrease in 3GC resistance proportion began before the implementation of the **ÉcoAntibio Plan** in poultry and swine sectors
→Inflection of resistance trends in calves and turkeys is consistent with the implementation period of the ÉcoAntibio plan and the publication of **Good practice guides**
→Except for calves, the drop in 3GC resistance of *E. coli* strains began before the publication of the **decree** (March 2016) restraining use of 3GC in veterinary medecine

Conclusion

- Our results are essential, especially for vets and regulatory authorities

→ To guide the use of antimicrobial agents in animals
→ To estimate the magnitude of the public health threat
→ To evaluate the efficacy of control measures implemented
→ To design efficient control strategies and policies in the future

Our findings highlight the need to set up in every country a national surveillance network (such as RESAPATH) able to monitor antibiotic resistance of pathogens in food producing animals, especially resistance to critically important antibiotics:

SURVEILLANCE MUST CONTINUE

We would like to thank all the voluntary laboratories members of RESAPATH, which collected and transmitted antibiograms' results over several years