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**Epidemiology, Public Health** **Antimicrobial use and resistance**

# Antimicrobial usage and resistance in food animals - temporal trends and relevance for Public Health

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**Key words**
Antimicrobial use, antimicrobial resistance, food-producing animals, international comparison

**Aim of the study**
The objectives of this project were (1) to quantify antimicrobial consumption per species in Switzerland based on sales data; (2) to better understand antimicrobial consumption patterns and the factors influencing the use of these substances.

**Material and methods**
Approaches for quantifying antimicrobial consumption per animal species based on national sales data: a Swiss example (2006−2013)
To explore potential methods to stratify antimicrobial sales per species three approaches were investigated using Swiss sales data (2006-2013): (1) Equal Distribution allocated antimicrobial sales evenly across all species each product was licensed for; (2) Biomass Distribution stratified antimicrobial consumption, weighting the representativeness of each species' total biomass; and (3) Longitudinal Study Extrapolation assigned antimicrobial sales per species based on a field study describing prescription patterns in Switzerland.

Comparison of antimicrobial consumption patterns in the Swiss and Danish cattle and swine production (2007−2013)
A comparison between the antimicrobial consumption in cattle and pigs for Denmark and Switzerland (2007-2013) was stablished to investigate possible differences in terms of consumption patterns. For Switzerland, results from the study presented above were used; for Denmark, DANMAP's reports were used.

Cross-European expert elicitation study on veterinary practitioners' use of antimicrobials
In order to better understand the factors influencing antimicrobial use, as well as the best strategies to further reduce the use of these substances, an expert opinion study was conducted with veterinarians from Denmark, Portugal and Switzerland. Participants were selected based on their experience or on peer recommendation. A questionnaire was sent to practitioners from four different production types: broilers, swine, dairy, veal/fattening calves.

**Results and significance**
Approaches for quantifying antimicrobial consumption per animal species based on national sales data: a Swiss example (2006−2013)
Although it is not possible to validate the models, we are convinced that the Longitudinal Study Extrapolation approach provided the best estimates. In this approach, input data for the model are derived from a longitudinal field study. These data are closer to the actual usage of antimicrobials than sales data and are therefore more likely to reflect reality. The Longitudinal Study Extrapolation model estimated a decrease in antimicrobial consumption both for cattle and pigs: the estimated consumption by cattle dropped from 81.6 mg per kg of biomass (mg/BM) [47.1−103.3 mg/BM] in 2006 to 67.4 mg/BM [38.7−85.4 mg/BM] in 2013; for pigs, consumption estimates went down from 102.5 mg/BM [54.9−178.6 mg/BM] to 76.4 mg/BM [34.0−143.8 mg/BM] in the same time period. Consumption estimates for poultry, small ruminants (goats and sheep), horses and pets (cats and

dogs) were also computed. These methods might represent a tool for other countries to quantify antimicrobial consumption per species using sales data.

Comparison of antimicrobial consumption patterns in the Swiss and Danish cattle and swine production (2007−2013)
Antimicrobial consumption patterns for cattle and pigs varied between Denmark and Switzerland. This is: the relative consumption of antimicrobial classes was different between the countries. Both for cattle and pigs, the largest difference was related to a higher relative consumption of penicillins in Denmark; while in Switzerland, tetracyclines and sulfonamides had a higher relative consumption. These findings stress that differences in antimicrobial consumption do not only exist in terms of amounts used, but also regarding the patterns of use; the factors behind these differences should be further investigated.

Cross-European expert elicitation study on veterinary practitioners' use of antimicrobials
Antibiograms are seldom used, mainly due to the time lag between testing and obtaining the results. The percentage of treatment failures varied between countries, but differences throughout time (2005-2015) were limited. Practitioners from different countries tended to agree on the animal health problems of each production type that most frequently lead to the use of antimicrobials. Concerning the opportunities to change, "mandatory interventions from national or European authorities" were highlighted as being the most impactful. Differences were observed on the scoring of feasibility and impact of interventions to reduce antimicrobial use. Nevertheless, "improving biosecurity" and "education" (of farmers and veterinarians) scored high across countries and production types. The vast majority of practitioners believed that antimicrobial use can be reduced, with median potential reduction varying from 1% in Swiss broilers to 50% in the Portuguese broiler industry and in the veal/fattening calves system of the three countries. Factors influencing antimicrobial use, as well as efficient interventions to mitigate their consumption vary between countries and productions sectors. These differences should be taken into account when developing measures to reduce antimicrobial consumption.

**Publications, posters and presentations**

Carmo, L.G.; Schüpbach-Regula, G.; Müntener, C.; Chevance, A.; Moulin, G.; Magouras, I. Approaches for quantifying antimicrobial consumption per animal species based on national sales data: a Swiss example (2006−2013) [in press]
Carmo, L.P.; Nielsen, L.R.; Alban, L.; Müntener, C.; Schüpbach-Regula, G.; Magouras, I. Comparison of antimicrobial consumption patterns in the Swiss and Danish cattle and swine production (2007−2013)
Carmo, L.P.; Nielsen, L.R.; Alban, L.; da Costa, P.M.; Schüpbach-Regula, G.; Magouras, I. Cross-European expert elicitation study on veterinary practitioners' use of antimicrobials.

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