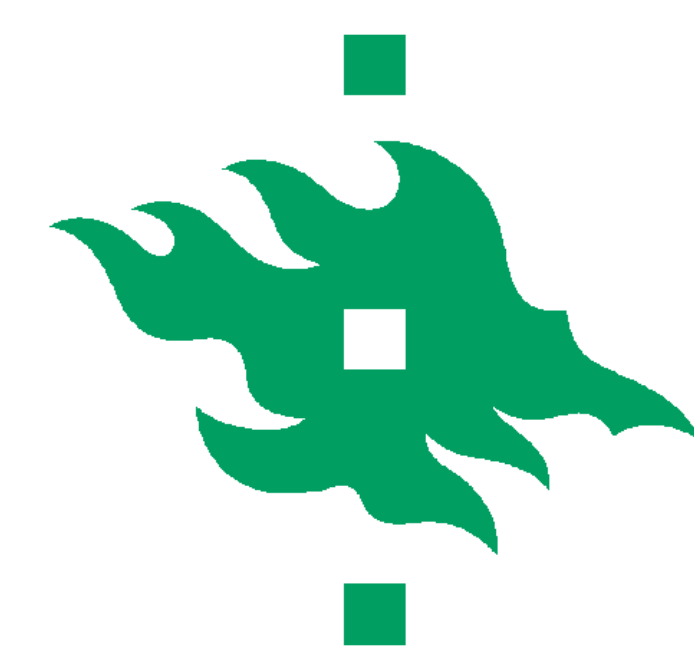


Antimicrobial usage and resistance in Finnish swine farms: associations with biosecurity and management



UNIVERSITY OF HELSINKI
FACULTY OF VETERINARY MEDICINE

Johanna Muurinen¹, Leena Seppä-Lassila¹, Jinhyeon Yun², Johanna Suomi¹, Pirkko Tuominen¹, Merja Hämäläinen³, Suvi Nykäsenoja³, Satu Olkkola³, Anna-Liisa Myllyniemi³, Virpi Sali², Olli Peltoniemi², Mari Heinonen²

¹ Finnish Food Safety Authority Evira, Risk Assessment Research Unit, Helsinki, Finland ² Department of Production Animal Medicine, Faculty of Veterinary Medicine, University of Helsinki, Finland ³ Finnish Food Safety Authority Evira, Microbiology Research Unit, Helsinki, Finland

Project workflow

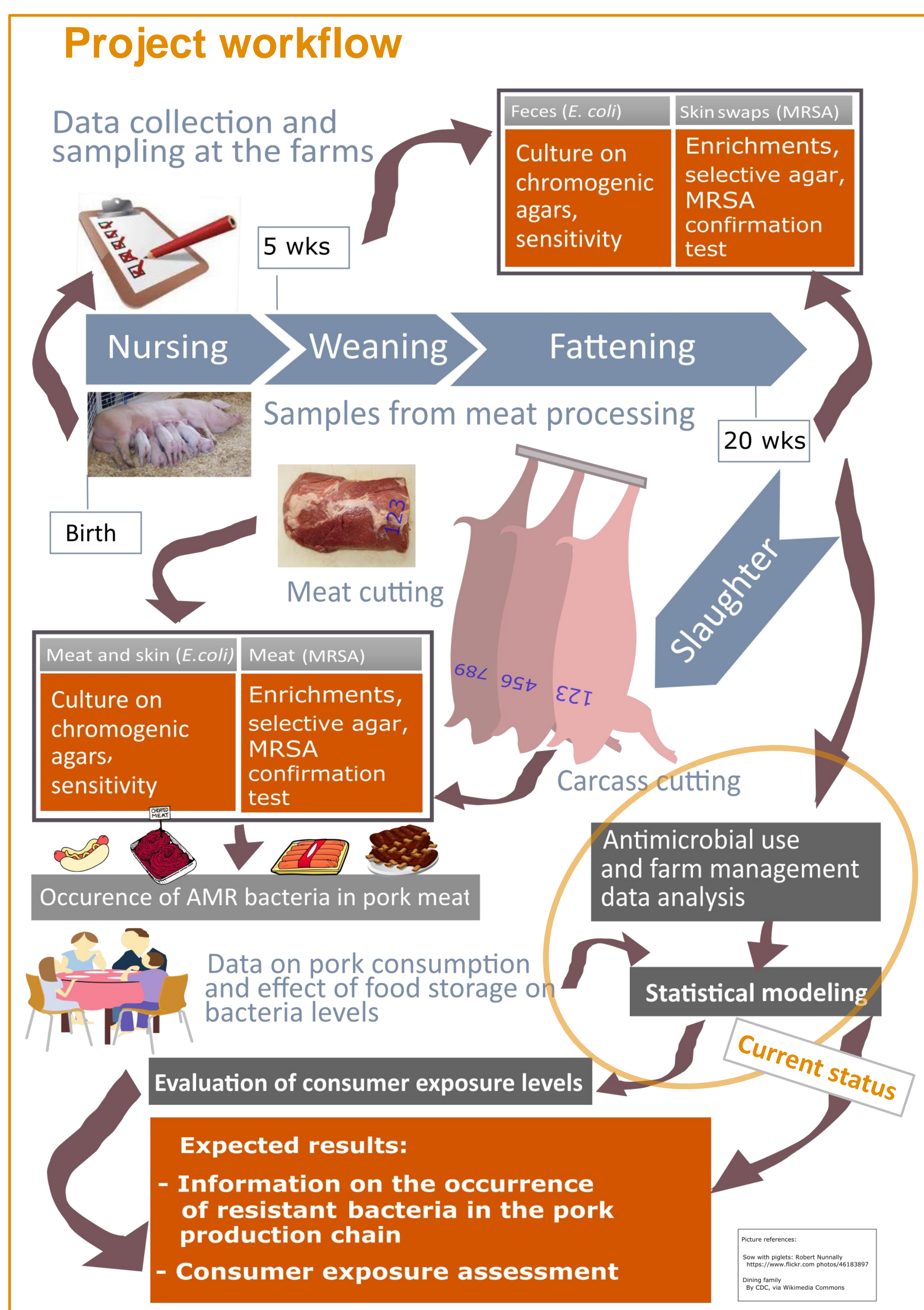


Figure 1. Project workflow. Ten farms (A-I) participated the study. The farm mean sow number varied between 45 and 380 (average 196 sows). On each farm twenty pigs were sampled at 0, 5 and 20 weeks of age; pigs were assigned to two groups: medicated (ANT) and control (CON; non-medicated before slaughter). The recordings of the used drugs and treatment codes on the farms were collected from national health registry for pigs (SIKAVA) between December 2015 and June 2017. BioCheck results collected from the farms are shown below.

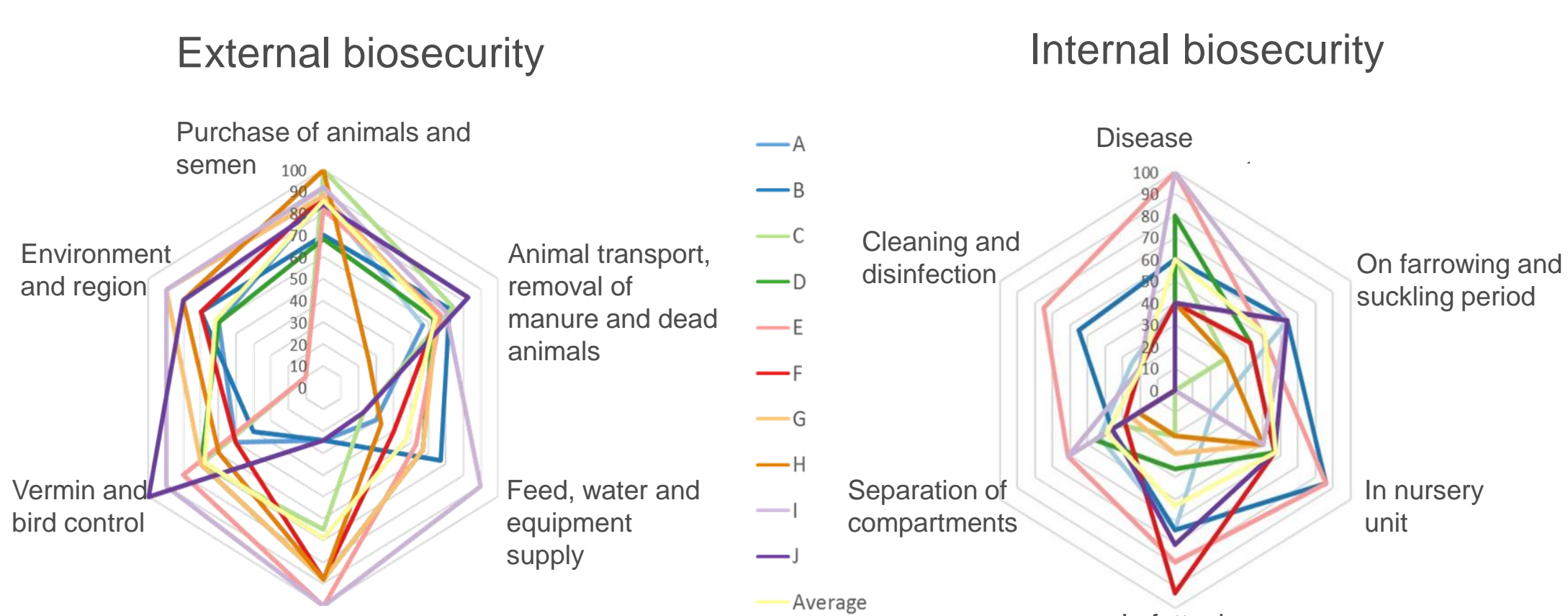


Figure 2. The scores of external and internal biosecurity of the farms according to the BioCheck.UGent™ scoring system.

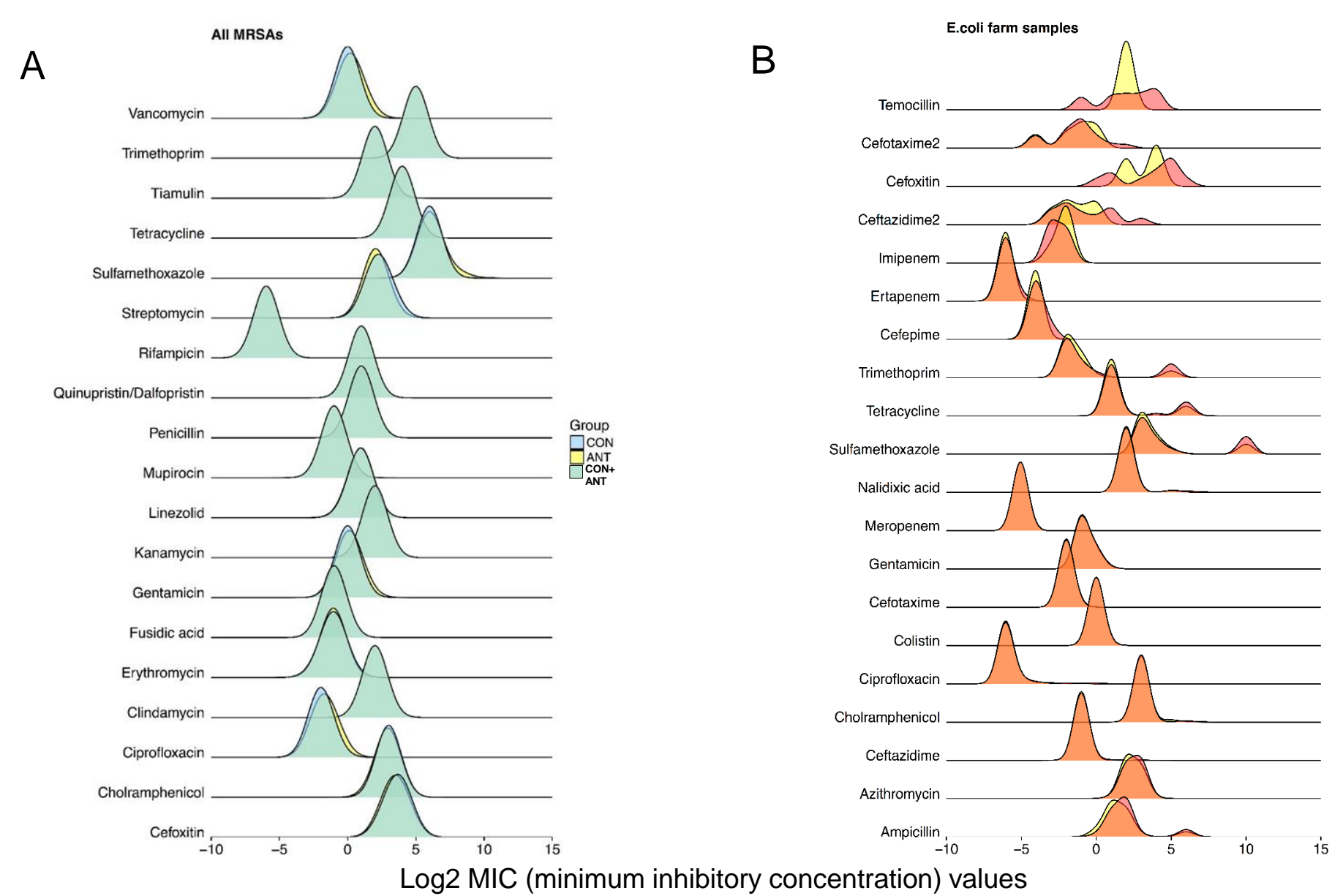


Figure 4. Density plots showing the distributions of MIC (minimum inhibitory concentration) values in CON and ANT groups. The x-axis is scaled with Log2 of MIC. A) All detected MRSA B) *E. coli* isolated from farm samples. B) Antibiotics Temocillin–Cefepime (7) were tested only with those *E. coli* strains that showed resistance to Cefotaxime and Cefazidime in the first test; some of them were sensitive in the second test.

Use of antimicrobials in treatment

In Finland swine farmers can use antimicrobials restrictedly, guided by the herd veterinarian, however, the treatment of the animals is based on their own observations. Results show clear differences between the farms in the use of treatment codes and antimicrobials. Some choices for treatment also revealed a need for education and understanding the indication of each drug. The choice of antimicrobial was almost unanimous for e.g. tail biting, but in e.g. diarrhea in piglets the number of active ingredients varied considerably. Farms B and E had high scores on cleaning and disinfection and also high usage of antimicrobial agents. The statistical significance of biosecurity scores and antimicrobial use needs to be explored further.

This dataset on antimicrobial usage on specific conditions, biosecurity and antimicrobial resistance is interesting and extensive, despite it is collected only from ten farms. Based on the visualization of the data, some interesting associations may exist (e.g. antimicrobial usage and disinfection BioCheck score, ANT groups seem to have somewhat increased resistance in *E. coli*). The demonstrating of the associations or differences demands advanced statistical methods and more work.

Laboratory results

Observed resistance features are shown in Figure 4. MRSA was found from pigs in three farms (A, F, H), and in one carcass and one meat sample. Twelve phenotypically AmpC strains were found in pigs from farms F and H (10) and from carcass slaughterhouse (2). These results will be analyzed statistically and the aim is to find associations between the antimicrobial use, farm management and resistance phenotypes. Results of the slaughterhouse samples will be used for consumer exposure assessment.

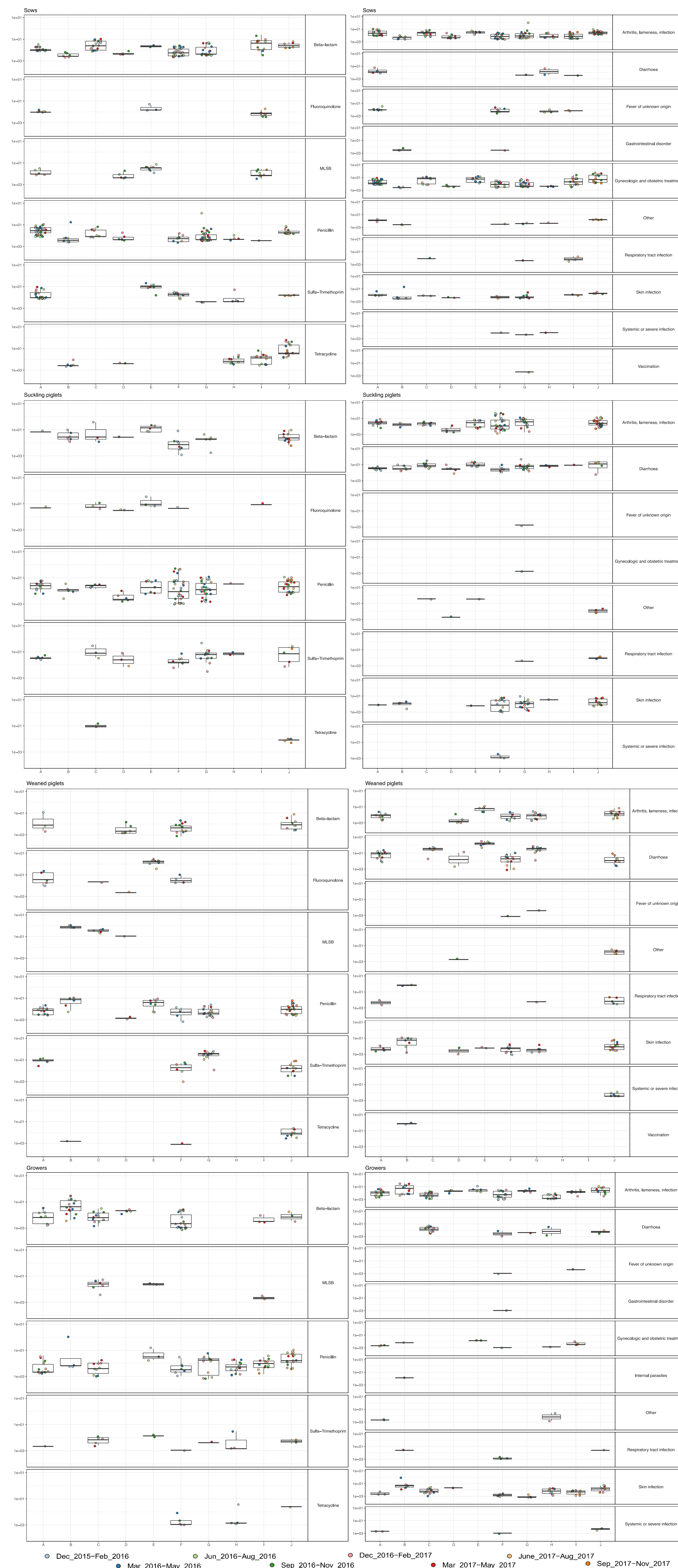


Figure 3. Boxplots showing the used antimicrobials (left panel) and treated conditions (right panel) on farms (x-axis) and in different age groups during different seasons. The treated animals are normalized against the number of animals in corresponding age group during the season and the relative numbers (y-axis) are log10 transformed for the sake of comparison.

Acknowledgements

The authors wish to thank the farms and slaughterhouse for collaboration and allowing sampling and data collection. We are also thankful to Dr. Jonna Kyyrö for this brilliant research idea and planning the project workflow. This project is co-funded by Finnish Ministry of Agriculture and Forestry from the National Development Funds for Agriculture and Forestry (Makera).