**Modelling the effects of livestock antibiotic usage on human foodborne disease**

Alex L.K Morgan1, Mark E.J Woolhouse2, and Bram A.D van Bunnik2

1Centre for Immunity, Infection & Evolution and School of Biological Sciences, University of Edinburgh, Edinburgh, United Kingdom

2Usher Institute, University of Edinburgh, Edinburgh, United Kingdom

**LAY SUMMARY**

Antibiotics are commonly used in livestock food animals to both prevent and treat disease, but also to promote growth. However, the overuse of antibiotics in livestock can drive the spread and evolution of bacterial pathogens that are no longer treatable using antibiotics. This has a direct impact on human health, as these bacterial pathogens may potentially spread from livestock to human populations. This has led to the implementation of policy to restrict the usage of antibiotics in livestock, to slow the spread of so-called antibiotic-resistant bacteria. However, the consequences of these policies are poorly understood. In particular, the restriction of antibiotics, which are commonly used to prevent disease in livestock, may have negative consequences for both livestock and human health. In this study, we use a mathematical model, which uses mathematical concepts to represent real life systems, to explore the effects of withdrawing livestock antibiotic usage on human foodborne disease. To ensure that the model was realistic and grounded in reality, we used real-life data on antibiotic usage and antibiotic resistance from agricultural settings in the European Union.

The mathematical model identified that restricting livestock antibiotic usage would decrease antibiotic resistance in both livestock and humans. However, we also identified negative consequences following withdrawal of livestock antibiotics. Specifically, an increase in the level of foodborne disease in humans. However, these increases were found to be mild and were controllable by introducing separate policies to ensure that food products are kept clean throughout the food processing steps.

This work explores one of the potential scenarios following a restriction of livestock antibiotic usage. By ensuring good hygiene practices during food processing and maintaining good livestock health, negative human health consequences after livestock antibiotic restriction can be avoided.