Farm-level drivers of antimicrobial use and resistance in livestock: An evidence synthesis

Application

A sector-wide synthesis of literature was used to identify predictors of antimicrobial use and resistance in European livestock, with the design of visualisations for each livestock production system highlighting critical control points and research gaps in the field.

Introduction

Antimicrobial resistance is a major threat to health globally and a key One Health issue impacting humans, animals, and the environment. Livestock have been highlighted as a target for moderation of antimicrobial use (AMU), which is considered an important driver of resistance (AMR). Some studies have assessed AMU and AMR in individual production systems, but there is a significant research gap in identifying the key drivers of AMU and AMR across farming systems. The objective of this study was to address this research gap by synthesising the evidence across the European livestock sector.

Materials and methods

Commissioned by the UK Veterinary Medicines Directorate, this study reviewed existing English-language literature describing original peer-reviewed research to identify critical control points in farm animal husbandry and management in the UK and Europe. AMU and AMR predictors were identified for pigs, layer and broiler hens, beef and dairy cattle, sheep, turkeys, and farmed salmon. These were synthesised into a series of conceptual models of the farm-level predictors of AMU and AMR throughout the production cycle for each livestock type. For species for which peer-reviewed literature was scarce, grey literature was used to identify additional possible risk factors for further investigation.

Results

The review revealed significantly unequal representation of livestock types among analyses in peer-reviewed literature (X^2 test, $p < 0.001$). Sheep, laying chickens, broiler turkeys and salmon were underrepresented, with under 5% of total analyses addressing AMU/AMR risk factors for each of these categories. Across systems, important tools to mitigate AMU/AMR included biosecurity and herd health plans; organic production typically showed significantly lower AMU but even in antibiotic-free systems, varying levels of AMR were identified in livestock microflora. The impacts of vaccination on AMU and AMR in livestock were unclear and require further research. The AMU/AMR impacts of intensive versus extensive systems varied between species. For example, free-range pigs showed lower AMR than those raised in indoor systems, while this effect was not demonstrated in broiler chickens and some studies showed the opposite pattern.

Conclusions

The quality and quantity of available evidence differed dramatically between livestock types and even in the more extensively researched species, important knowledge gaps were apparent. The differing effects of production systems between species highlight the importance of researching these further rather than extrapolating between livestock types.

Further investigation of the impacts of vaccination on AMU and AMR is needed across species. This study synthesises a broad body of research, filling a conspicuous gap in the existing AMR literature.

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