AMR – three deadly letters

Drug resistance is a global problem in human and animal health. A TEAGASC team has studied antimicrobial drug usage in calves on commercial beef and dairy farms in Ireland.

While antimicrobial usually has a broader definition, in this article it means antibiotics (and their chemical derivatives) with an antibacterial range of action. Antimicrobial resistance (AMR) is the ability of bacteria (or microbes) to resist the effects of an antibiotic and is one of the leading health concerns in human and veterinary medicine worldwide. AMR occurs when bacteria change in a way that reduces the effectiveness of drugs, chemicals, or other agents designed to cure or prevent infections. Antimicrobial resistance (AMR) may cause treatment failure, both in humans and animals. This treatment failure results in a higher morbidity and mortality.

Monitoring antimicrobial usage

In Europe, various monitoring programmes have summarised antimicrobial consumption for animals through annual antimicrobial sales data. These programmes are structured to observe trends at the national level and for comparison of data between years and countries. However, a limiting factor is that they are unable to provide more precise information, such as usage at farm level, variability between farms, etc.

Teagasc study on antimicrobial drug usage in calves

The main objective of the study was to quantify antimicrobial drug usage in calves using health treatment records from Irish suckler beef and dairy farms. In this study, antimicrobial usage refers to the exposure of a given animal or group of animals over a period of time to the active substance in each antimicrobial that was administered.

Data source

Data were obtained from a large-scale study on herd-level factors associated with the health and survival of calves on Irish farms. Farmers enrolled in this herd-level study recorded birth, disease and health treatment, and death information on their calves using standardised recording sheets. Case definitions were provided to the farmers to assist with the classification of disease. Farmers completed and submitted the project recording sheets on a monthly basis. All health treatment data were reviewed. Long-acting antimicrobials administered more than seven days apart, or other medications administered more than three days apart, were classified as separate disease events. Crude morbidity was defined as calves being treated for at least one disease event, attributed to any cause, excluding injury. Calves treated for illnesses other than diarrhoea, pneumonia, navel infection, or joint infection/lameness were categorised as receiving treatment for 'other' disease events. The data collected were the antimicrobial trade name, the pharmaceutical form (oral solution, oral powder, parenteral solutions, tablets, bolus, etc.), the pack size (in L or mL for liquids, in g or kg for solids, in unit number for bolus or tablets, etc.), the total number of packages prescribed and dispensed to the farm, and the prescribed therapy (dose, administration frequency, duration).

Antimicrobial usage

Defined daily dose for animals (DDDvet) (mg/kg animal/day) and used daily dose (UDDvet) (mg/kg animal) were the technical units used to measure antimicrobial consumption. The DDDvet is defined as the average maintenance dose for the main indication in a specified species and it is provided by the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project for veterinary antimicrobial usage (European Medicines Agency), whereas the UDDvet is calculated

Actions farmers can take to keep antimicrobials working

- Only give antimicrobials to animals under veterinary supervision.
- Always give the right dose, and the number of treatments, as prescribed by the vet.
- Do not use antimicrobials for growth promotion or disease prevention in healthy animals.
- Do not use antimicrobials to treat viral disease.
- Do not use a stronger antimicrobial as first-line treatment.
- Vaccinate animals to reduce the need for antimicrobials and use alternatives when available.
- Improve biosecurity on farms and prevent infections through improved hygiene and animal welfare.
- In the case of medicines used in food-producing animals, ensure that the Animal Remedies Record is updated on each occasion that a veterinary medicine is administered.

Table 1. Antimicrobial drug classes administered to suckler beef (n=654) and artificially reared dairy calves (n=795) from birth to six months of age.

Antimicrobial class	Number of antimicrobial treatments		TIddd mean		TIudd mean	
	Beef	Dairy	Beef	Dairy	Beef	Dairy
Tetracyclines	97	160	0.70	0.60	4.46	28.9
Amphenicols	128	159	0.48	0.45	3.81	19.1
Penicillins	210	164	1.12	0.65	10.2	9.4
1st and 2nd GC[1]	0	1	0	0.02	0	15.3
3rd and 4th GC[2]	4	3	0.02	0.07	0.023	0.21
Sulfonamides	94	161	0.31	0.78	1.78	23.4
Macrolides	38	20	0.525	0.59	0.49	0.89
Lincosamines	2	0	0.002	0	0.014	0
Fluoroquinolones	202	181	0.93	1.29	13.13	26.5
Aminoglycosides	63	79	0.15	0.37	1.42	17.8
Spectinomycin	3	1	0.002	0	0.012	0.011

[1]First and second generation cephalosporins; [2]third and fourth generation cephalosporins.

as the amount of an antimicrobial drug administered during a given period (days) divided by the number of calves at risk and their average liveweight at the beginning of a treatment. In this way the UDDvet reflects the dose truly administered by the producer. Treatment incidence (TI) was the indicator used to quantify antimicrobial usage. The TI provides a standardised technical unit of measurement that quantifies how many animals out of a theoretical group of 1,000 animals receive a daily antimicrobial treatment. The population correction unit (PCU) is a measurement developed by the European Medicines Agency (EMA) and takes into account the animal population as well as the estimated weight of each particular animal at the time of treatment with antimicrobials. The milligrams (mg) of antimicrobial used per PCU was calculated.

Results

This study provides the first detailed information pertaining to on-farm usage of antimicrobials in suckler beef and artificially reared dairy calves from birth to six months of age, in Ireland. A total of 123 farms (79 beef and 44 dairy), comprising 3,204 suckler beef calves and 5,358 dairy calves, representing 540,953 and 579,997 calf-days at risk, respectively, were included in the study. All calves were raised on farm of origin and most of the studied herds were closed herds. In this study, only animals showing signs of disease were treated with antimicrobials and no mass administration of antibiotics was practised. The highest risk period for disease in the present study was between birth and one month of age, with approximately two-thirds of all disease events occurring during this time period. This is reflected in the proportion of antimicrobials administered to calves at this time (**Figure 1**). The classes of antimicrobials most frequently prescribed for beef and dairy calves were: tetracyclines; amphenicols; penicillins; first and second generation cephalosporins (GC); third and fourth GCs; sulfonamides; macrolides; lincosamines; fluoroquinolone; aminoglycosides; and, spectinomycin (**Table 1**).
A total of 1,770 antimicrobial treatments were prescribed and administered to suckler beef (n=841) and dairy calves (n=929) between birth and six months of age.
Fluoroquinolones were the most prescribed antimicrobials with 383 treatments, followed by penicillins (n=374), amphenicols (n=287) and tetracyclines (n=257). The third and fourth GC accounted for a total of seven treatments (**Table 1**). The average cost of veterinary services was €41.25 and €43.37 per calf for beef and dairy calves, respectively; corresponding antimicrobial costs were €11.58 and €11.51 per calf.

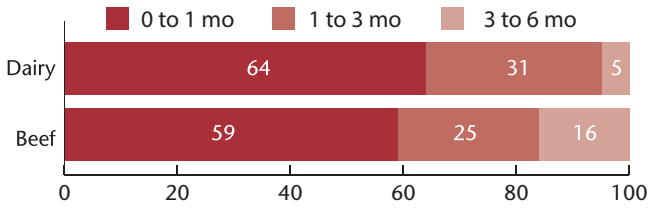

Figure 1. Proportion of antimicrobial treatments (%) for suckler beef and artificially reared dairy calves from birth to six months of age.

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