

# Antimicrobials and the cattle industry

## Introduction

In April 2014, the World Health Organization (WHO) released its new global report — *Antimicrobial resistance: global report on surveillance*<sup>1</sup> — which states ‘... this serious threat is no longer a prediction for the future, it is happening right now in every region of the world and has the potential to affect everyone.’

The Australian Government and other international governments have already identified antimicrobial resistance (AMR) as a high-priority issue. In 2013, consultations were convened jointly by the Department of Agriculture and the Department of Health (via the Australian Commission on Safety and Quality in Health Care) to discuss AMR arising from antimicrobial use in animal agriculture and culminated in the Australian One Health Antimicrobial Resistance Colloquium.<sup>2</sup> One Health is an international approach to harmonise antimicrobial prescribing practices and reduce AMR, and to develop and promote prudent use guidelines and antimicrobial stewardship.

The WHO global report reaffirmed the need for data on antimicrobial use in food-producing animals, and on the occurrence of AMR in bacteria in livestock. These data are needed to allow comparisons between countries, inform risk assessment, identify areas for intervention and to monitor the success of risk management measures.

The cattle industry has collaborated with the Australian Government and the research sector to commission and fund studies of antimicrobial use and AMR in the industry. **A one-day symposium, hosted by Meat & Livestock Australia (MLA), was held in May 2014, to provide a forum for cattle industry representatives and stakeholders to present the results of their studies and to take a close look at antimicrobial resistance in the cattle industry.** The symposium

addressed animal management, prevention and control of infectious diseases, antimicrobial use and AMR in the industry, particularly in relation to risks to human health. Risks to human health can be assessed against internationally accepted ratings of antimicrobials based on their importance for use in humans and the likelihood of spread and transfer of genes from animals to humans. Most concern is attached to agents considered critically important for human uses and for which there are no or few alternative treatments. The use of such agents in the livestock industry would attract criticism and risk trade partnerships.

The picture that emerged from this workshop was a good one — with infectious diseases specialist, Professor Peter Collignon concluding:

**“In terms of cattle, Australia is doing really well, which is good for trade and human health,” and “Australia is in a position to have the ‘safest meat in the world’.”**

This summary highlights key outcomes and discussion from the symposium.



1 [www.who.int/mediacentre/news/releases/2014/amr-report/en/](http://www.who.int/mediacentre/news/releases/2014/amr-report/en/)  
2 [www.health.gov.au/internet/main/publishing.nsf/Content/1803C433C71415CACA257C8400121B1F/\\$File/Colloquium-Report-Final-Feb2014.pdf](http://www.health.gov.au/internet/main/publishing.nsf/Content/1803C433C71415CACA257C8400121B1F/$File/Colloquium-Report-Final-Feb2014.pdf)

## Infectious disease prevention and management in cattle

The **cattle grazing** industry has low rates of infectious diseases because of the low stocking rates and use of preventive measures (including vaccination, stock handling, insect control, biosecurity, herd management and infection control). Antibiotic use is also low.

In **feedlots**, bovine respiratory disease (BRD) is the most common infectious disease; musculoskeletal, foot and gastrointestinal problems are also common. Feedlot vets and other staff inspect cattle every day to identify early signs of disease. Feedlot cattle treatment programs are highly sophisticated, treatment compliance is high and management of cattle withholding periods and export slaughter intervals are effective and accurate.

In **dairy cattle**, the major infectious disease is mastitis. Intramammary preparations are used to treat clinical and subclinical cases during lactation, and long-acting intramammary products (dry cow treatments) are used to prevent new infections in nonlactating cows. Other infections include gastrointestinal diseases, lameness, reproductive and low levels of respiratory disease.

All cattle industry sectors actively support prudent use of antimicrobials and are pursuing preventative strategies such as vaccination, individual animal monitoring and improved technology. A number of common antibiotics (penicillins, *tetracyclines*, sulfonamides) are widely used in the industry for treatment of infectious conditions; macrolides are also used for treatment of BRD, as well as small quantities of the third generation *cephalosporin* (3GC) ceftiofur (particularly in feedlots). Animals being processed for food have low antibiotic residues, and this is extensively monitored. Increased use of vaccination in recent years has reduced BRD (especially in feedlots) and gastrointestinal infections (particularly in calves).

Oral and in-feed antimicrobials are used in specific segments of the cattle industry. In grazing cattle, procaine penicillin is used to prevent or treat pasture bloat, and in dairy cattle, virginiamycin is used to reduce the risk of ruminal acidosis. Ionophores are used widely for bloat prevention, as rumen modifiers where grain is fed and anticoccidials in feedlots and dairies. The dairy industry uses the macrolide tylosin in feed to control liver abscess.

## Antimicrobials used in cattle

The main source of information about quantities of antimicrobials used in livestock has been voluntarily supplied industry sales data collated by the Australian Pesticides and Veterinary Medicines Authority (APVMA). Data from 2005-10 (reported March 2014) showed little change in antimicrobial sales or use over this time (although total growth promotant use decreased). About three-quarters of all antimicrobial use was in feed, with the bulk of use in poultry. Third generation cephalosporins (ceftiofur) accounted for less than 0.1% of total antimicrobial use.

APVMA data has some limitations and, at the request of the Cattle Council of Australia and with support of the

Australian Lot Feeder's Association, MLA commissioned a more detailed survey of the volume and indications for use of antimicrobials in beef cattle production in 2011-12. The researchers surveyed a representative sample of registrants, feed manufacturers vets and producers. The study showed that **the use of agents that are rated as important or critically important for human health is very low in the cattle industry** with only two uses relevant to human health:

- Virginiamycin (a streptogramin) is used in feed to prevent acidosis due to grain feeding. This antibiotic was previously classified as 'critically important' for human health but WHO has recently reduced the importance rating because currently streptogramins have little or no medical use. This use is therefore now a less significant concern for the industry.
- Ceftiofur (a 3GC) is used in feedlots (and also at lower levels in other cattle) to treat BRD. 3GCs are rated as critically important by WHO because of their role in treating severe pneumonia and meningitis in humans. This means that ceftiofur must be used very cautiously in the cattle industry and there should be targeted monitoring of extended-spectrum beta lactamase (ESBL) resistance.

Macrolides are also listed as critically important human antimicrobials by the WHO but this rating is related to their use in chickens where there is a propensity to select for resistance in *Campylobacter* spp (a major cause of foodborne illness in humans). Beef products are not recognised as an important source of *Campylobacter* infection for humans; therefore, judicious use of macrolides by the cattle industry represents a small risk to human health.



*The absolute quantities of antimicrobials used in grazing systems are quite low. I would estimate that in our practice (and practices like ours) there would be far less than one course of antimicrobials used per animal per year.' Scott Parry, Coonamble Veterinary Surgery, NSW.*

Dairy Australia commissioned a study of antibiotic use in dairy cattle in 2012-13. Most of the antibiotics have been in use in dairy industry for at least 30 years with very low resistance rates. Milk can only be harvested from cows with nil or low antibiotic residues so antibiotic use is minimised and carefully controlled and milk is extensively monitored. Ceftiofur is used sparingly in the dairy industry and not as a drug of first choice.

## Antimicrobial resistance in cattle

### Survey of AMR in commensal bacteria of cattle at slaughter

An emerging concern for the Australian red meat trade arises from a petition in the United States to declare that four specific serovars of *Salmonella* with multidrug resistance are adulterants in ground beef and poultry products. MLA and CSIRO funded a project in which faecal samples were collected at slaughter from 910 beef cattle, 290 dairy cattle and 300 veal calves and *Salmonella*, *Escherichia coli* and *Enterococcus* isolates were tested against a suite of antimicrobial agents. Very low levels of AMR were detected and there was minimal evidence that specific production practices contribute to AMR development.



*Samples were collected from across the industry and very low levels of AMR were detected with minimal evidence that specific production practices contribute to AMR development. Dr Robert Barlow, CSIRO.*

### Survey of AMR in animal pathogens

The first national survey of AMR in animal pathogens (*Salmonella*, *Staphylococcus aureus* and *E. coli*) has been completed by the University of Adelaide (funded by Zoetis). All veterinary diagnostic labs in Australia took part and all isolates handled over one year were tested (2600 isolates). The results showed a complete absence of carbapenem resistance among clinical *E. coli* isolates, absence of fluoroquinolone (FQ) resistance, very low levels of 3GC resistance, and virtually no resistance in mastitis staphylococci.

### A new issue — *Clostridium difficile*

*Clostridium difficile* infection (CDI) is the most common cause of infectious diarrhoea in human hospital patients. Until recently, it was thought that human CDI was restricted to health care settings but since the mid-2000s, community CDI has also been recognised. At the same time, *C. difficile* has become found in animals and some strains are associated with disease in humans. These findings have drawn attention to the

potential for foodborne transmissibility of *C. difficile* and the bacterium has been isolated from a high proportion of food items in Europe and North America. In Australia, results of an MLA-funded *C. difficile* prevalence study showed a low prevalence in adult cattle but high prevalence in very young calves. Further research is needed and the cattle industry is monitoring developments in relation to how this bacterium spreads among human and animal populations.

## International comparisons

In all countries where AMR has been measured (eg Canada, Denmark, European Union, Japan, United States, ) most AMR has been found in chickens, with slightly less in pigs and much less in cattle. Faecal samples from the CSIRO study (see left) showed that **Australian cattle have one of the lowest rates of multidrug resistant *Salmonella* spp. in the world.** Although cefiofur resistance is currently negligible in Australian cattle, the industry is aware of the need to be extremely cautious with the use of ceftiofur to avoid reproducing the escalation of resistance experienced in the United States.

## Australian framework

The AMR Prevention and Containment Steering Group (set up by the secretaries of the Departments of Health and Agriculture) is developing a National AMR Strategy and AMR Work Program for Australia. The Department of Agriculture has contracted a team of AMR experts from the University of Adelaide to provide a report on options for establishing a **nationally coordinated approach to antibiotic usage monitoring and antibiotic resistance surveillance** in the animal/agriculture sector (following publication of a similar report for humans ) appropriate for the Australian context with input from the industry sectors.

### Significance for human health

The potential for AMR bacteria to spread via the food chain and be ingested with food, or for AMR genes to be transferred from animal to human pathogens, are real and critical issues. The levels of bacteria with AMR in humans and animals are much higher in developing countries and travellers to developing countries often acquire AMR-resistant bacteria.

In Australia, of the critical antimicrobial agents for human health, carbapenems and FQs are not used in livestock. However, as noted above, 3GCs are critically important human antibiotics (they are the drugs of choice for a variety of infections of pregnant women and children) raising a concern that use of 3GC in animals could result in resistance coming through the food chain. As noted above, macrolide use in cattle does not represent an important risk to human health.



*'My view has always been – our cattle industry is amongst the safest in the world. But I am concerned that 3rd generation cephalosporin resistance could come through the food chain. If ceftiofur is not indispensable in cattle, change to something else.'* Professor Peter Collignon, infectious disease specialist

For a 'win-win' situation for humans and animals, Professor Collignon suggested the following **prudent antibiotic use in production animals**:

- Do not use antibiotics as growth promoters.
- Use antibiotics for prophylaxis sparingly – find alternatives (diet, vaccines etc.).
- Although antibiotic therapy of sick animals is not an issue overall, do not use 'critically important' or 'last line' human antibiotics (glycopeptides, FQs, 3GCs).

## Key messages

A key message from the day was that the data collected in the past couple of years revealed a very positive picture of antimicrobial use and the occurrence of bacteria with AMR in cattle in Australia. But the mantra of 'measure, measure, measure' still applies and systematic and regular data collection is needed. It was also clear that the Australian cattle industry has a clear advantage compared with the rest of world in relation to AMR.

Participants agreed that it would be valuable to develop a strategy for how to build on the cattle industry's good record and current international AMR approaches. A number of issues from the day were relevant for such a strategy, including reducing or replacing 3GCs use in cattle; ensuring that prophylactic uses of antimicrobials are judicious and integrated into a disease prevention program; increasing vaccination wherever possible to reduce the burden of disease; monitoring and, if possible, reducing growth promotant use; and monitoring the emergent issues of *C. difficile* infection.

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