Final report

Final Report: Antimicrobial usage – development of data collection and metrics for beef

Abstract

In 2020, the Australian Government launched Australia's National Antimicrobial Resistance Strategy. In response DAFF worked with the Australian livestock industries to develop Australia's Animal Sector Antimicrobial Resistance Action Plan 2023 to 2028. Activity 5.2.1 of the plan seeks to "Develop a robust national animal health AMU Monitoring program". At this point in time, the system had yet to be co-designed or implemented by the animal industries. This project initiates animal industry discussions on this key gap.

The Australian beef industry is currently unable to provide credible estimates of its AMU on a national scale. In the absence of a system to monitor AMU, there is no evidence to underpin the antimicrobial stewardship initiatives of the industry, in the face of public opposition, and global competition.

The Australian Government (DAFF) reports national antimicrobial use to the World Organisation for Animal Health (WOAH), via aggregating disposals (sales data) reported by the APVMA, and desktop estimation by department personnel of percentage use in food and non-food animal species. Given many antimicrobials are shared between these two categories, a multi food animal, industry wide approach is required to accurately apportion food animal use.

This project investigated five options to generate industry-level AMU estimates before selecting a top-down approach to estimating antimicrobial usage from sales data. The project team worked with the Australian Government (DAFF) and the other key livestock industries, on a single national approach that can generate national veterinary AMU estimates for food and non-food animal species (as required by WOAH) and species/sector estimates for individual livestock industries. Importantly the system protects the confidentiality of the source data and allows each industry to maintain control on whether data is generated for their industry and how it is reported.

The outputs from this project include a Business Case and Methodology (reported separately) which will be used by the beef industry and other organisations to determine whether they wish to participate in the implementation of the national veterinary AMU measurement system.

This project sets the Australian beef industry on a path towards generating credible and robust AMU estimates which it can use for both internal and external audiences. It also provides the beef industry with a central role in the design and implementation of the national veterinary AMU measurement system.

Executive summary

Background

In 2020, the Australian Government launched Australia's National Antimicrobial Resistance Strategy. In response DAFF worked with the Australian livestock industries to develop Australia's Animal Sector Antimicrobial Resistance Action Plan 2023 to 2028. Activity 5.2.1 of the plan seeks to "Develop a robust national animal health AMU Monitoring program". At this point in time, the system had yet to be co-designed or implemented by the animal industries. This project initiates animal industry discussions on this key gap.

The measurement of AMU has already become a regulatory requirement in some countries (i.e. EU Member States) and Australia reports annually to the World Organisation for Animal Health (WOAH) on the quantities of antimicrobials used (AMU) as a part of a global strategy to tackle antimicrobial resistance. The Australian Government uses data sourced from product registration holders to address this reporting requirement for food and non-food animal categories. Given many antimicrobials are used in multiple (food and non-food animal) species, a multi-food animal, industry wide approach is required to accurately apportion use.

Recently, some international beef customers have made policy announcements committing to a reduction in the use of antimicrobials of importance to humans in their beef supply chains. In the absence of an industry-wide system to collate data and monitor AMU the Australian beef industry is currently unable to provide credible estimates of its AMU on a national scale. Consequently, there is a lack of data to underpin the antimicrobial stewardship initiatives of the industry, in the face of public interest and global competition.

This project follows previous MLA work[1] to investigate and design a feasible system to generate industry-level AMU estimates.

Objectives

(1) Produce a framework for an AMU reporting system that has integrity for both internal and external beef industry stakeholders.
(2) Define suitable metrics to report beef AMU to both internal (beef supply chain) and external (customer) audiences.
(3) Develop solution options for method and business case development to collect AMU from the beef supply chain (including dairy beef) for consideration by the project steering committee.
(4) For each selected solution option, establish methodologies to determine aggregated estimate of usage for the beef supply chain.
(5) For each selected solution option, establish a business case.
(6) Present the methodologies and business case to the project steering committee to seek feedback on interest in any future piloting or development.

The project's objectives have been met.

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[1] V.MFS.0442 Enterprise level antimicrobial usage measurement - pilot

Methodology

This was a desk-top study.

The Business Case and Methodology were developed based on industry knowledge, discussions with relevant internal and external organisations and reference to other AMU measurement systems being used by other countries.

The calculation of AMU estimates using a top-down approach and reporting in common weight-based metrics is described in the Methodology. Where possible, aspects of the methodology which have not previously been tested, were piloted using a real data set.

The method described is reliant on data sources and input from organisations outside of the direct control of the Australian beef industry. It also requires a reasonable degree of cooperation and collaboration between different livestock industries and government to implement.

Results/key findings

The Business Case and Methodology documentation has been delivered separately from this Final Report.

The Business Case describes the key characteristics, resources and considerations in establishing a national system to collate and estimate AMU for all food and non-food animal species. These include the structure, governance arrangements, reporting, confidentiality and resources required.

The Methodology describes a top-down approach to estimating AMU based on product 'disposals' and population data collected by the Australian Government as per the following steps:

- o The quantities of antimicrobial actives from products registered and approved for use in a single 'host' species are allocated for use in that species.
- o The quantities of antimicrobial actives from products registered for multiple species are allocated based on the estimated proportion used in each host species. An Expert Panel determines the proportions allocated to each species, based on a mix of empirical (survey) data and industry expert knowledge.
- o The above process provides the total quantity in weight (kgs) of each antimicrobial active supplied annually to animals, with these quantities split between the major food animal species (pigs, poultry, beef and dairy cattle, sheep/goats and aquaculture) and non-food animals (horses, dogs & cats).
- o The annual animal biomass (kgs liveweight) of each food animal species/sector is estimated from data sourced from the Australian Government (Australian Bureau of Statistics and/or Australian Bureau of Agricultural and Resource Economics) with input from experts familiar with livestock production systems.
- o Estimates of annual AMU are expressed as a rate – milligrams of antimicrobial active used per kg liveweight for the year (mg/kg) – so trends in supply can be compared over time.

It is envisaged that the implementation of the system will require significant support initially but will become much less resource intensive as the systems and processes become established and automated. As such, beef industry AMU estimates could be generated at a very low cost and at a frequency dictated by the industry.

Benefits to industry

This project sets the Australian beef industry on a path towards generating credible and robust AMU estimates which it can use for both internal and external audiences. It also provides the beef industry with a central role in the design and implementation of the national veterinary AMU measurement system.

Future research and recommendations

The beef industry needs to consider the Business Case and Methodology and decide on whether to progress with the implementation of the national veterinary AMU measurement system. Other livestock industries and DAFF also need to determine whether they want to participate.

Longer term the beef industry should consider whether developing a bottom-up AMU measurement system, based on data collected from vets and producers, will be required to meet government and customer requirements.

List of acronyms and abbreviations

AMS	Antimicrobial stewardship
AMU	Antimicrobial usage
APVMA	Australian Pesticides and Veterinary Medicines Authority
ASTAG	Australian Strategic and Technical Advisory Group
DAFF	Department of Agriculture, Fisheries and Forestry
ECED	European Centre for Disease Prevention and Control
ESVAC	European Surveillance of Veterinary Antimicrobial Consumption
EU	European Union
MLA	Meat & Livestock Australia
PCU	Population-corrected unit
PubCRIS	Public Chemical Registration Information System
WHO	World Health Organization
WOAH	World Organisation for Animal Health

Table of contents

1. Background

1.1 Rationale

The Australian Government reports the volume of veterinary antimicrobial medicines used in agriculture to the international community annually via the World Organisation for Animal Health (WOAH) and uses data on the quantity of products disposed[2] to achieve this requirement. The data reported to WOAH is high level and aggregated with the data of other countries before being published by WOAH. As such it is not useful for beef industry needs.

In 2020, the Australian Government launched Australia's National Antimicrobial Resistance Strategy (Australian Government 2020). In response DAFF worked with the Australian livestock industries to develop Australia's Animal Sector Antimicrobial Resistance Action Plan 2023 to 2028 (Department of Agriculture, Fisheries and Forestry, 2023). Activity 5.2.1 of the plan seeks to "Develop a robust national animal health AMU Monitoring program". Accurate estimates of the amount and type of antibiotics being used are required, so that risks can be identified, priorities set and improvements tracked over time.

The measurement of AMU has already become a regulatory requirement in some countries (i.e. EU Member States) and some international beef customers have made policy announcements committing to a reduction in the use of antimicrobials of importance to humans in their international beef supply chains.

In the absence of a system to monitor AMU, there is little evidence to underpin the antimicrobial stewardship initiatives of the industry, in the face of public interest, and global competition.

The beef industry is seeking an AMU measurement system that is feasible to implement and produces AMU estimates that:
- Are presented in metrics suitable for customers, government and international trading partners;
- Are derived via scientifically defensible methodology (with limitations described);
- Control for bias as best achievable; and
- Preserve the confidentiality of individual (data) contributors.

2. Objectives

(1) Produce a framework for an antimicrobial use reporting system that has integrity for both internal and external beef industry stakeholders.
(2) Define suitable metrics to report beef AMU to both internal (beef supply chain) and external (customer) audiences.
(3) Determine the feasibility of data sources for a top-down approach using APVMA [Australian Pesticides and Veterinary Medicines Authority] sales data, and a bottom-up approach from on-farm usage. Develop solution options for method and business case development to collect antimicrobial use from the beef supply chain (including dairy beef) for consideration by the project steering group.
(4) For each selected solution option, establish methodologies to determine aggregated estimate of usage for the beef supply chain considering:

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[2] The AgVet Code Act requires registration 'holders' to report the 'quantities of products disposed' to the APVMA annually (i.e. the quantity of each registered product supplied each financial year).

- Sampling frame for unbiased estimates of antimicrobial usage
- Standards for data collection
- 3rd party auditing procedures to ensure accurate data provision
- Competency list for training of auditors
- Confidentiality requirements

(5) Establish a business case for selected solutions options considering:
- Governance structure
- Software or database development costs
- 3rd party auditing process
- Potential revenue sources
- Reporting requirements

(6) Present solution options to project steering committee to seek feedback on interest in any future piloting or development.

These project objectives have been met, with a Business Case and Methodology developed and delivered for the selected solution option to the Steering Committee. The documents are suitable to support decision-making within MLA and for other organisations involved in delivering the national veterinary AMU measurement system.

The project team also made progress on several areas that are required to implement the AMU measurement system for the beef industry:

- Expanding the scope of the methodology to generate estimates for red meat (to include sheep and goat industries);
- Expanding the scope of the methodology to generate AMU estimates for Government reporting to WOAH (food and non-food animal species);
- Expanding the scope of the methodology to generate estimates for other livestock species/sectors;
- Undertaking preliminary work to clean up source data (the APVMA's Public Chemical Registration Information System; PubCRIS) required to generate the AMU estimates;
- Testing integral aspects of the methodology with real data sets; and
- Building relationships and the principles whereby government and the livestock industries can work together to generate the AMU estimates using a single national measurement system.

3. Methodology

3.1 Developing the Business Case

The Business Case has been developed based on industry knowledge and discussions with representatives from the beef industry, Department of Agriculture, Fisheries and Forestry (DAFF), other key livestock industries. It is built around implementing the Methodology.

Although many of the views and issues put forward by these organisations have been addressed in the Business Case, it should be understood that each organisation brings its own perspectives and needs regarding the reporting of AMU, some of which conflict with those of other organisations. As such the Business Case should be regarded as a starting point which organisations can use as a platform for future discussion and refinement.

3.2 Developing the Methodology

The Methodology has been developed based on knowledge of different AMU measurement systems and how they might apply to Australia. Guidance was sought from the project's Steering Committee in selecting the most feasible approach to use for the beef industry. The Steering Committee determined that Solution Option 1 (a top-down approach based on national disposals data) with some additional elements (see below) was the preferred approach that should be developed to generate AMU estimates for the beef industry.

DAFF and other key livestock industries were consulted during the development of the methodology and the scope of the system was subsequently broadened to include the capability to generate both national veterinary AMU estimates for food and non-food species, as well as estimates for each animal species/sector.

Having the beef industry, DAFF and other key livestock industries working together in a single national veterinary AMU measurement system provides assurance that the system will be supported by both government and other industries during implementation. This lowers the cost for the beef industry and improves the credibility of AMU estimates generated by the system.

4. Results

4.1 Business Case

The Business Case is delivered as a stand-alone document and describes the key issues for beef and other livestock industry decision-makers to consider when determining whether the AMU measurement system (as described) should be implemented.

4.2 Approach options considered

Five different approach options were investigated for their potential to estimate beef industry AMU, based on sourcing data at different points in the antimicrobial supply chain. These included:

Option 1: Annual quantity of antimicrobial actives supplied

A 'top-down' approach where data held by the APVMA/DAFF is used to estimate the total quantity of antimicrobial actives supplied and an expert panel determines the proportion of each active used in cattle. This is used with national cattle population statistics to estimate beef industry AMU.

Option 2: Survey of antimicrobial wholesalers

An 'intermediate' approach where data held by wholesalers of antimicrobial products supplied to vets is used to estimate the total quantity of (mostly parenteral) antimicrobial actives supplied to cattle in a particular region. This data is used with surveys of feedlot antimicrobial use and regional cattle population statistics to estimate total beef industry AMU.

Option 3: Survey of vets and stockfeed manufacturers

An 'intermediate' approach where data held by a representative sample of veterinarians and stockfeed manufacturers is used to estimate the total quantity of antimicrobial actives supplied to the population of cattle under their care.

Option 4: Survey of end users

A 'bottom up' approach where a representative sample of farms & feedlots provide their annual antimicrobial use data, and this is used with national cattle population statistics to estimate beef industry AMU.

Option 5: Census of end users

A 'bottom up' approach where every beef and dairy enterprise is required to enter AMU and herd size data annually into a centralised data base to enable beef industry AMU estimates to be calculated.

4.3 Selection of the preferred approach option

Based on the perceived feasibility of implementing each system within reasonable timeframes the project's Steering Committee decided to progress with Option 1 with some additional aspects of Options 2 and 3 – dubbed 'Option 1 plus'.

The additions introduce some empirical (survey) data which is used by the Expert Panel as they estimate the proportion of active that should be allocated to each species for those actives that are included in products that have been approved for use in multiple host species.

The top-down approach selected (Option 1 plus) enables AMU estimates to be generated for other livestock species from the same data set and methodology used to generate beef industry estimates. It can also be used to meet the Australian Government's annual AMU reporting commitments to the World Organisation of Animal Health (WOAH). Consequently, a single, national veterinary AMU measurement system is proposed.

4.4 Methodology – a national veterinary AMU measurement system

The Methodology for the Australian veterinary AMU measurement system is delivered as a stand-alone document and describes in detail the approach to generate national veterinary AMU estimates, as well as estimates for each animal species/sector.

The 'top-down' approach selected (Option 1 plus) significantly simplifies the data collection process as it predominantly uses antimicrobial supply data held by DAFF. The research team worked with DAFF to explore various ways that AMU estimates could be generated from this data without compromising the confidentiality of the data supplied to DAFF.

In determining the quantity of antimicrobial actives supplied to each animal species, the quantities of antimicrobial actives from products registered and approved for use in a single 'host' species are allocated for use in that species.

The quantities of antimicrobial actives from products registered for multiple species are allocated based on the estimated proportion used in each host species. An Expert Panel determines the proportions allocated to each species, based on empirical (survey) data and industry expert knowledge. Several different methods for generating the data required by the Expert Panel have been described in detail in the Methodology.

The above process provides the total quantity in weight (kgs) of each antimicrobial active supplied annually to animals, with these quantities split between the major food animal species (pigs, poultry, beef and dairy cattle, sheep/goats and aquaculture) and non-food animals (horses, dogs & cats).

The annual animal biomass (kgs liveweight) of each food animal species/sector is estimated from data sourced from the Australian Government (Australian Bureau of Statistics and/or Australian Bureau of Agricultural and Resource Economics) with input from experts familiar with livestock production systems.

Estimates of annual AMU are expressed as a rate – milligrams of antimicrobial active used per kg liveweight for the year (mg/kg) – so trends in supply can be compared over time.

In addition, principles guiding the generation and reporting of livestock AMU estimates were discussed with representatives of DAFF and the key livestock industries that use antimicrobials (pork, chicken meat, eggs and aquaculture) as these organisations would be involved with the generation of AMU estimates through their involvement in the Expert Panel.

All see merit in the principles and general approach and are currently socialising the concept within their respective organisations. Each industry will provide a formal response once MLA has supplied them with a finalised Methodology and Business Case to consider.

Whilst the Methodology will need to be refined and validated when used for the first time, the regression methodology used to estimate the proportion of actives used in different species (for parenteral products registered for use in multiple species) from veterinary wholesaler data has been piloted on a data set and shows potential for inclusion as a key component of the national veterinary AMU measurement system.

Subject to the source data being available and the key livestock industries and DAFF being actively involved, the methodology described is a low cost and robust system for generating AMU estimates for the Australian livestock industries.

5. Conclusion

5.1 Key findings

- This project delivered a Business Case for beef industry decision-makers to consider when determining whether the national veterinary AMU measurement system should be implemented.
- A low-cost, feasible Methodology has been developed, based on a top-down approach using antimicrobial supply data held by DAFF. This ensures beef industry AMU estimates will be consistent with national estimates reported by the Australian Government.
- There is considerable interest from DAFF and other livestock industries to contribute to a single national system to estimate veterinary AMU and generate species/sector estimates from that system.
- A draft set of principles underpinning the partnership to develop veterinary/livestock AMU estimates between DAFF and the livestock industries has been developed and socialised with these organisations, for determination of support.
- The methodology described will be complex to implement as it relies on access to different data sets from different sources and contributions from several organisations. These data sources and organisations are not under the direct control of the beef industry. It also must cater for data confidentiality provisions in legislation.

- It is envisaged that the implementation of the system will require significant resources and support initially but will become much less resource intensive as the systems and processes become established.
- As such, beef, red meat and livestock industry AMU estimates could be generated at a very low cost annually or less frequently as dictated by that industry.
- In the future, AMU estimates based on data collected closer to the point of treatment (from the producer or vet) may be required to drive antimicrobial stewardship (AMS) at the enterprise level and/or satisfy international customers or governments. However, this system can help to address the AMU data gap until more sophisticated systems are developed.

5.2 Benefits to industry

This project sets the Australian red meat industry on a path towards generating credible and robust AMU estimates which it can use for both internal and external audiences. In doing so, it addresses a potential threat to market access and enables the industry to demonstrate its responsible use of antimicrobial medicines.

It also provides the beef industry with a central role in the design and implementation of the national veterinary AMU measurement system, providing some defence against more onerous systems being legislated or forced on the industry by customers.

6. Future research and recommendations

6.1 Next steps

6.1.1 Finalising the Business Case & Methodology

The Business Case and Methodology documents were considered by the project Steering Committee in June 2024 and will be finalised for distribution in July 2024.

6.1.2 Distribution and discussion with DAFF and key livestock industries

The Business Case and Methodology documents will be distributed to DAFF and the key livestock industries (dairy, pigs, eggs, chicken meat and aquaculture) for their consideration. A workshop will be convened in August 2024 to discuss any issues involved in implementing the system. Organisations will be asked to provide a formal commitment to participate in the system following the meeting (October 2024).

6.1.3 Commitment from participating industries

The Business Case and Methodology documents and resolutions to the issues discussed at the workshop will be presented to the Supply Chain Taskforce requesting a decision on whether the red meat industry should participate (November 2024).

6.1.4 Implementation of the national veterinary AMU measurement system

Subject to the beef industry, DAFF and enough of the other livestock industries committing to participate in the system, a detailed implementation plan to establish and generate the first year's

estimates based on FY 2023/24 data should be developed. This includes setting up appropriate beef industry and cross-industry governance structures and the implementation team.

6.2 Longer term goals

6.2.1 Updating the Beef Sustainability Framework to report on industry AMU

Once the national veterinary AMU measurement system is established and is generating stable estimates for the beef industry, consideration should be given to how this data is to be reported. An obvious vehicle for reporting is through the Beef Sustainability Framework, using metrics of interest to both internal and external audiences.

6.2.2 Replacing the measurement system

Although the top-down approach is adequate to estimate beef industry AMU in the short to medium term, most European countries have introduced systems to capture AMU data at the farm or vet level.

Collecting data at the bottom end of the antimicrobial supply chain provides clarity on the types and classes of livestock being treated with the antimicrobial products. This data is needed by vets and producers to drive improvements in AMS practices at the farm/enterprise level. Improvements in AMS at this level are required to address potential antimicrobial resistance risks.

Over the longer term the beef industry may need to introduce a bottom-up AMU measurement system to align with international competitors and/or market requirements.

7. References

Australian Government. (2020, March 13). Australia's National Antimicrobial Resistance Strategy – 2020 and beyond. Canberra: Australian Government.

Department of Agriculture, Fisheries and Forestry. (2023). Australia's Animal sector Antimicrobial Resistance Action Plan 2023 to 2028. Commonwealth of Australia.