Australian Government

**Department of Agriculture
and Water Resources**

RESPONDING TO ANTIMICROBIAL RESISTANCE

AUSTRALIAN ANIMAL SECTOR
NATIONAL ANTIMICROBIAL RESISTANCE PLAN
2018

NOVEMBER 2018

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FOREWORD

Antimicrobial resistance (AMR) is no longer an emerging issue, but a current threat to human and animal health. Antimicrobials are a precious resource used all over the world to protect human health and animal health and welfare, and every effort must be made to preserve their effectiveness.

Substantial work has already been undertaken in Australia since the launch of our First National Antimicrobial Resistance Strategy 2015-2019 (National AMR Strategy)[1], through collaborative efforts between human and animal health, and the food and agriculture sectors. An impressive number of Focus Areas for activities for the animal sector outlined in the Strategy's Implementation Plan[2] are well under way. These activities are important in building an evidence base on AMR in our sector, and to further inform our national efforts to address this multifaceted issue. Many of these activities could not have been undertaken successfully by sectors acting independently of each other. I have been impressed with the levels of cooperation, collaboration and collegiality I have seen across the animal sector. This is illustrated in the Progress Report on the Strategy[3]. However, this report also highlights the challenges and gaps that remain, with a number of significant activities contained in the Implementation Plan yet to be addressed.

Early in 2018, an *Animal Sector National AMR Plan,* drafted by the department, was circulated to stakeholders for comment. The aim of the AMR Plan was to align with, and support, the National AMR Strategy and provide a strategic and coordinated animal sector approach to national One Health efforts towards addressing AMR. To address stakeholder comments on the draft AMR Plan, the department established a Focus Group[4] to revise the plan. The revised AMR Plan was circulated to major animal sector stakeholders before a workshop was held to obtain in-principle agreement for the AMR Plan. This final AMR Plan is the result of the work of the Focus Group, and I would like to acknowledge their valuable contributions.

While the First Strategy will extend to 2019, planning has now commenced on drafting Australia's second National Antimicrobial Resistance Strategy. It is therefore timely that our sector comes together to coordinate and prioritise our activities through this AMR Plan. This AMR Plan aims to support the second National AMR Strategy—and the One Health approach—and safeguard our sector's distinct needs and objectives.

I thank you for your active engagement and valued contributions to limit the spread of AMR and to preserve antimicrobials for future generations through judicious stewardship. I look forward to your continued support to address AMR in animals in delivering this AMR Plan through a national animal sector action plan.

Dr Mark Schipp
Australian Chief Veterinary Officer
OIE Delegate (Australia)
President OIE Assembly

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[1] https://www.amr.gov.au/resources/national-amr-strategy

[2] https://www.amr.gov.au/resources/national-amr-implementation-plan

[3] https://www.amr.gov.au/resources/australias-first-national-antimicrobial-resistance-strategy-2015-2019-progress-report

[4] Focus Group members are listed in Appendix A

INTRODUCTION

Antimicrobials are a precious resource. It is essential that their effectiveness is maintained for both human and animal health. Through a collaborative approach, the Australian animal sector[5] has recognised that it has a shared responsibility in the appropriate use of antimicrobials to address resistance. The Australian food animal sector has a strong international reputation for food safety. Positioning the Australian animal sector to enhance visibility of their leadership, innovation and contributions to address antimicrobial resistance (AMR), and to influence the national and international direction of AMR efforts, is a priority for the Australian Government Department of Agriculture and Water Resources (the department).

AMR remains a significant threat to Australian animal industries through its potential impact on public health, animal health and welfare, and trade. Many contagious and infectious diseases cause morbidity, suffering and mortality in animals, resulting in poor animal health and welfare, decreased production and economic losses.

Therapeutic failure due to AMR adversely impacts animal health, welfare, productivity and in turn, food safety. Similarly, withholding antimicrobial therapy without sound basis or alternatives can also have adverse effects. AMR results in financial losses directly through higher mortality or morbidity and premature culling of animals. This can potentially compromise food safety, and ultimately lead to higher costs for farmers and consumers of animal products. AMR in zoonotic bacteria also endangers public health.

The Australian animal sector has a shared responsibility to ensure that antimicrobials are used appropriately. The alternative is to risk compromising animal health and welfare, food safety and consequently, Australia's domestic and global reputation. Since the animal sector is often cited internationally as major contributors to the cause of, and increase in, AMR, the Australia animal sector needs to be well positioned to address this perception by demonstrating and promoting appropriate use of antimicrobials and antimicrobial stewardship (AMS) activities.

VISION

The Australian animal sector is a respected contributor to national and global efforts to address AMR, and a recognised leader in the appropriate use of antimicrobials to preserve their effectiveness to protect human and animal health.

SCOPE

The *Animal Sector National Antimicrobial Resistance Plan 2018* (the AMR Plan) includes the following terrestrial and aquatic animal species:

- ❖ aquatic animals
- ❖ companion animals
- ❖ food and fibre-producing animals
- ❖ performance animals and
- ❖ wildlife.

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[5] Australian animal sector stakeholders are listed in Appendix B

PURPOSE

The aim of the AMR Plan is to support implementation of the National AMR Strategy. Planning for the second National AMR Strategy (starting in 2020) is in progress. This AMR plan, developed in consultation with major animal sector stakeholders in 2018, provides an avenue for the animal sector to articulate its priorities for the second National AMR Strategy.

WHO Global Action Plan On AMR	**OIE** Strategy on AMR & Prudent Use of Antimicrobials	**Australia's** 1st National AMR Strategy 2015-2019	**Australian Animal Sector** National AMR Plan 2018	**Australian Animal Sector** National AMR Action Plan

The AMR Plan will allow the animal sector to achieve its strategic objectives in a coordinated manner. There is broad acknowledgment of the need to communicate the direction of the animal sector in addressing AMR, share information and provide consistent messaging.

There is increasing recognition that AMR will affect exports of food-animals and food-animal products to international markets. In December 2017, the livestock, veterinary pharmaceutical and animal feed industries voluntarily agreed to the removal of label claims for growth promotion from antimicrobials of importance to human health. The AMR Plan will facilitate the promotion of such positive initiatives (and counter misinformation), and facilitate the planning and conduct of further actions to reduce the spread of AMR.

The AMR Plan will also support Australian influence in the international arena by providing tangible evidence of the sector's activities. Australia needs to collect additional data to provide evidence of activities the animal sector is undertaking to address AMR. While there is limited data on prescribing practices in companion animals, the sector has shown leadership by developing therapeutic guidelines and stewardship programs to address AMR.

The second National AMR Strategy will focus on an integrated One Health surveillance system, through comprehensive human surveillance and regular and strategic sampling of the animal sector. The AMR Plan will help inform the animal sector's input into this surveillance system through the second National AMR Strategy.

OBJECTIVES

The objectives and priority areas for action, gaps and challenges, and next steps of this AMR Plan mirror those of the National AMR Strategy. The Glossary (Appendix C) also mirrors the National AMR Strategy, and a list of acronyms and abbreviations are in Appendix D.

1. **Increase awareness and understanding of antimicrobial resistance, its implications, and actions to combat it through effective communication, education and training.**

Priority Areas for Action
1. Initiatives to strengthen public awareness to improve understanding of AMR and the importance of using antimicrobials appropriately, to ensure public health and animal health and welfare.
2. Develop a stakeholder engagement and communication plan to support whole-of-society awareness of, and participation in, implementing the AMR Plan.
3. Strengthen communication and on-going education initiatives for veterinary surgeons boards, veterinarians (under-graduate and post-graduate, potentially as part of mandatory continuing professional development) and allied health professionals (including the veterinary pharmaceutical industry).
4. Development of coordinated messaging for the animal sector on current low rates of AMR, proactive approaches to combat AMR and appropriate AMU.

Gaps and Challenges
1. Options for improving AMR-related education of animal health professionals throughout their career (e.g. analysis of course content offered by universities, colleges and professional bodies to identify gaps and the need for new and/or revised content on AMR).
2. Identify further opportunities to improve education and training provided to prescribers in relation to appropriate antimicrobial prescribing, such as the delivery of continuing professional development programs.
3. Develop options to ensure pet owners, farmers and general community have access to relevant, reliable and targeted information about AMR, including risks and their roles and responsibilities.

Next Steps
1. Develop a communications plan with identification of target audiences (e.g. companion animal sector, performance animal sector, livestock sector, aquatic and marine animal sectors, retailers and general public); key and sector-specific messages.
2. Develop a stakeholder engagement plan and develop a narrative for social licence on the appropriate use of antimicrobials.
3. Develop a register of activities underway or completed (including in wildlife) to raise awareness of these activities and to avoid duplication.
4. Develop and implement programs to encourage ongoing stakeholder engagement.
5. Ensure ongoing engagement and feedback to ensure that there is undergraduate training AND on-the-job training.

2. **Implement effective antimicrobial stewardship practices across animal care settings to ensure appropriate and judicious prescribing, dispensing and administering of antimicrobials.**

Priority Areas for Action
1. Ensure that tailored, evidence-based, nationally-consistent antimicrobial prescribing guidelines—underpinned by harmonised legislation and regulations—are developed.
2. Nationally consistent, evidence-based, best-practice approaches to AMS across components of the animal sector.
3. Review existing accreditation and quality assurance programs across sectors to ensure they appropriately support and encourage compliance with best practice AMS approaches, and identify gaps where programs do not exist.

Gaps and Challenges
1. The availability of evidence-based and standardised best practice prescribing guidelines for the use of antimicrobials in animal health in Australia to complement other AMS initiatives.
2. Clear guidelines to ensure responsible use and provide a framework for auditable record keeping, aligned with OIE data reporting requirements to demonstrate responsible use.
3. Establishing AMS programs for those sectors that do not have one.
4. Incentivising the implementation of AMS programs by veterinary practices to ensure widespread uptake.
5. Accreditation of veterinary practices to demonstrate how they are implementing the Codes of Practice and appropriate use of antimicrobials. Challenges include: determining how compliance would be enforced; how stewardship would be measured; identifying the accrediting authority; identifying triggers for investigating individuals or practices; determining how would non-compliance be measured.

Next Steps
1. Explore options to support the implementation of AMS programs and best-practice AMU policies through accreditation of and developing standards for veterinary practices and supporting animal industries.
2. Encourage the adoption of electronic reporting systems that will enable the collection and analysis of antimicrobial prescribing data, to identify variation from recommended guidelines and inform areas for improvement. Explore options to incentivise adoption of a reporting system. Explore data mining from existing software.
3. Apply data from research relating to the sale of antimicrobials, their consumption and usage patterns and interventions to change prescribing behaviour to inform the development and implementation of AMS initiatives.
4. Support current efforts to harmonise national veterinary compounding and prescribing rights to enable more effective regulation of AMU.

3. Develop nationally coordinated One Health surveillance of antimicrobial resistance and antimicrobial usage.

Priority Areas for Action
1. Establish the foundations for national animal sector surveillance for AMR and AMU to facilitate a nationwide program for transparent surveillance, reporting and data analysis.
2. Agree on the objectives of surveillance for each component of the animal sector, to align with the overarching objectives for the national One Health surveillance system.
3. Develop animal sector list of priority organisms and associated antimicrobials for national reporting.
4. Agree and implement a uniform standard for laboratory testing of antibacterial susceptibility.
5. Improve surveillance of AMR and AMU in animals.

Gaps and Challenges
1. Establishing a national, integrated, funded, sustainable and ongoing One Health AMR and AMU surveillance system that also caters for the notification of AMR isolates from all components of the animal sector.
2. Lack of quantitative data on AMU for each animal species, including objectives of data collection, agreement on what data to collect, means to collect the data, etc.
3. Ongoing and strategic (rather than ad hoc) surveillance of AMR and AMU in animals, including companion and performance animals.
4. Options for all diagnostic laboratories to apply uniform antibacterial susceptibility testing methods and reporting standards to facilitate data comparison.

5. Options for fit-for-purpose IT infrastructure to deliver real-time data integration and sharing across sectors (human health, food and animal health) to enable appropriate interventions and responses.
6. Potential privacy issues and commercial sensitivities which could affect some data.

Next Steps
1. Use recommendations from recent reviews and reports to inform AMR and AMU surveillance.
2. Progress the establishment of nationally consistent antimicrobial susceptibility testing methods and data reporting standards.
3. Conduct stakeholder consultations on a surveillance system for the animal sector.
4. Define the use of the term 'appropriate' in context of AMU.
5. Explore funding options and governance arrangements for a surveillance system.
6. Explore the veterinary antimicrobial supply chain as a source of surveillance data.

4. Improve infection prevention and control and biosecurity measures across components of the animal sector to help prevent infections and the spread of antimicrobial resistance.

Priority Areas for Action
1. Ensure the availability of evidence-based, best-practice and nationally consistent standards for infection prevention and control (IPC)—hygiene and biosecurity—across animal care settings.
2. Review existing accreditation and quality assurance programs to ensure they appropriately support and encourage compliance with best practice IPC/biosecurity measures (including companion, performance and food-producing animals).
3. Explore alternatives to antimicrobials (e.g. vaccination and vaccine development to reduce and prevent infections).

Gaps and Challenges
1. Lack of substantial progress in applying existing initiatives used in human healthcare settings to animal care, and vice versa, to enhance current IPC/biosecurity approaches.
2. Australia's small animal population limits potential revenue generated from vaccine sales, impacting the development and availability of vaccines.

Next Steps
1. Conduct a stocktake of current initiatives/programs supporting the implementation of animal sector specific IPC/biosecurity measures to prevent disease (e.g. national feedlot accreditation scheme; quality assurance programs for feedlot cattle and pigs).
2. Explore incentives for greater access to, and manufacture of, vaccines.
3. Develop/strengthen communications messages on genetic selection of animals that have higher resistance to diseases/infections.
4. Explore incentives for the development and uptake of early diagnostics by identifying and addressing diagnostic challenges.
5. Develop communications strategy for IPC standards for the animal sector.
6. Explore accreditation of veterinary practices, animal shelters, wildlife hospitals.

5. Agree on a national research agenda and promote investment in the discovery and development of new products and approaches to prevent, detect and contain antimicrobial resistance.

Priority Areas for Action
1. Identify national research priorities.

2. Collate current activities to identify gaps and to agree on national research and development priorities of animal sector stakeholders.
3. Identify mechanisms for improved coordination of national research activities and sharing of research information, such as a broad-based research forum.
4. Explore opportunities to increase support for research and development, including incentives for greater private sector investment
5. Explore avenues to translate promising research findings into new products, policies and approaches.

Gaps and Challenges
1. Australia lacks a national AMR research agenda that identifies agreed research and development priorities to which institutes lend their expertise and work collaboratively to fill knowledge gaps.
2. Mapping research and development needs against current activities to provide guidance on gaps and identify where the greatest impacts of new research and development investment could be achieved.
3. A national framework for improved collaboration and information and data sharing to promote efficient use of resources and minimise duplication within and across sectors.

Next Steps
1. Explore funding models to secure dedicated funding.
2. Use this AMR Plan as a mandate for research institutes, centres of research excellence and national research funding bodies (e.g. Australian Research Councils, National Health and Medical Research Council and Medical Research Future Fund) to work collaboratively with the Australian animal sector to establish agreed national AMR research priorities.
3. Explore a national framework for improved communication (e.g. the One Health AMR website) to provide information about projects and initiatives undertaken by the animal sector to support Australia's response to AMR.
4. Establish a forum to present results and report on progress against the AMR Plan and agree on future activities.
5. Continue international collaboration and coordination of research and development initiatives to maximise efficiency and minimise duplication of global AMR research.

6. **Strengthen international partnerships and collaboration on regional and global efforts to respond to antimicrobial resistance.**

Priority Areas for Action
1. Active engagement with multilateral organisations and relevant forums to contribute to regional and global action on AMR.
2. Engagement with regional and international commercial industries to strengthen food-animal and allied industries' international engagement.
3. Lead regional initiatives to increase capacity to prevent and respond to AMR.
4. Lead and learn from international best practice while recognising regional differences in animal health, welfare, food safety and trade requirements.
5. Participate in international surveillance initiatives.
6. Establish closer ties with international collaborators to link Australia's national research agenda with what is happening internationally.

Gaps and Challenges
1. Australia has limited resources to directly invest in the development and implementation of AMR National Action Plans in countries in our region. However, our in-kind contributions of best-practice resources and expertise are highly valued.

2. There are many international groups showing significant interest in AMR, with many initiatives progressing in parallel. The challenge is to ensure duplication of effort is minimised and make appropriate links to maximise effort.
3. The OIE's requirement for AMU data in animals will be ongoing. Australia needs to meet these international reporting obligations to support global AMR mitigation. A national animal health approach is needed to collate and analyse AMU and AMR surveillance data to contribute to the OIE global surveillance system.

Next Steps
1. In 2017 Australia undertook a self-assessment and external evaluation of its implementation of the core capacities established under the International Health Regulations 2005 and the Joint External Evaluation process[6]. AMR is one of 19 capacities assessed. The findings on AMR are currently being addressed.
2. Australia will continue active engagement with the WHO, OIE and the Food and Agriculture Organization of the United Nations, including in the development of a Monitoring and Evaluation Framework for the WHO Global Action Plan[7], and other multi-lateral forums to progress global and regional action.
3. Continue contributions, support to and collaboration with, regional governments on capacity building and development of policies, AMS and surveillance programs to address AMR in animal sectors. This will help with addressing international trade and market access issues, and create opportunities for education and training.
4. Identify additional forums to share activities and initiatives at the international level.

7. Establish and support clear governance arrangements at the local, jurisdictional, national and international levels to ensure leadership, engagement and accountability for actions to combat antimicrobial resistance.

Priority Areas for Action
1. Provide effective leadership, coordination and resource use, including prioritisation of activities.
2. Identify, establish and maintain linkages across all sectors.
3. Establish baseline measures to inform monitoring and evaluation of the Strategy.
4. Review regulation (legislated and other) relevant to AMR and AMU.

Gaps and Challenges
1. Implementing appropriate governance arrangements, which manage commercial sensitivities and harness the breadth and depth of expertise across sectors to create linkages with key groups and organisations.
2. Changes in government priorities require revisions of governance arrangements to ensure effectiveness in driving change and supporting the implementation of priority AMR activities.
3. Develop a better understanding of how regulatory arrangements might be improved. The effectiveness and appropriateness of AMR regulatory arrangements have not been systematically evaluated across the Australian animal sector supply chain.
4. There is a need to map the current regulatory framework against the antimicrobial supply chain and AMU/AMR trends in human and animal health to identify areas where regulation could be applied or streamlined to support efforts to reduce AMR and promote appropriate use of antimicrobials.
5. Inconsistent jurisdictional legislation.

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[6] http://www.who.int/ihr/publications/WHO-WHE-CPI-REP-2018.8/en/

[7] http://www.who.int/antimicrobial-resistance/global-action-plan/en/

Next Steps
1.   Consult and inform stakeholders when the Australian Strategic and Technical Advisory Group (ASTAG)[8] progresses drafting the second National AMR Strategy.
2.   Explore establishment of targets, monitoring and evaluation requirements.
3.   ASTAG working groups may be established to drive specific actions in areas of highest priority, with ad hoc working groups established as required.
4.   Communicate the outcomes of a review—commissioned by the Department of Health—on Australian regulation relevant to AMR and the antimicrobial supply chain across human and animal health, agriculture and food sectors, which are currently being assessed. The aims of the review were to identify gaps, overlaps, inconsistencies and inefficiencies in current regulatory arrangements. Review how the current regulatory system drives and supports current and future use of veterinary antimicrobials.
5.   Reconvene the Focus Group to develop an Implementation Plan to support this AMR Plan.

FUTURE PLANS

Planning for the second National AMR Strategy starting in 2020 is in progress. This AMR Plan provides an avenue for the animal sector to develop its approach to inform the second strategy. This would ensure the animal sector's interests are well-represented and allow the sector to take stock of what is working well, what changes need to be made, what further actions are required, and to prioritise these.

There is a need to identify and agree on the sector's research priorities. The livestock industries have undertaken a significant amount of work in this area. Funding organisations need to work more closely with these industries to identify their priorities and gaps that could be addressed through a national approach. Importantly, there is a need to more closely involve the aquatic, companion and performance animal sectors and to identify their research gaps and priorities.

Much work, some undocumented and unpublished, has been undertaken by the animal sector to address AMR over the years. This AMR Plan provides an avenue for the sector to document and promote their achievements and results of stewardship activities in a publicly available document. It would allow stakeholders to identify areas for collaboration and avoid duplication. The animal sector AMR action plan, to be drafted by the Focus Group in consultation with animal sector stakeholders, will address details of reporting on these activities.

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[8] https://www.amr.gov.au/australias-response/objective-7-governance/amr-advisory-group.

APPENDIX A FOCUS GROUP MEMBERS

	MEMBER	EXPERTISE/AFFILIATION
1.	Raana Asgar	Veterinary Public Health Veterinarian & Australian Government Department of Agriculture and Water Resources
2.	Tony Batterham	Feedlot Veterinarian & Australian Lot Feeders Association
3.	Charmian Bennett	Animal Medicines Australia
4.	Jo Coombe	Dairy Veterinarian & Dairy Australia
5.	Louise Edwards	Animal Feed Industry
6.	Bernie Gleeson	Pig Veterinarian
7.	James Gilkerson	Equine Veterinarian & University of Melbourne
8.	Kylie Hewson	Australian Chicken Meat Federation
9.	Rod Jenner	Poultry Veterinarian
10.	Ian Jenson	Meat and Livestock Australia
11.	David Jordan	Veterinary Microbiologist & NSW Department of Primary Industries
12.	Melanie Latter	Animal Welfare Veterinarian & Australian Veterinary Association
13.	John Messer	Veterinary Pharmaceutical Industry Veterinarian
14.	Charles Milne	Victorian Chief Veterinary Officer
15.	Debbie Neutze	National Animal Health Policy Veterinarian
16.	Jacquie Norris	Small Animal Veterinarian & University of Sydney
17.	Stephen Page	Veterinary Pharmacologist & AMR Expert

APPENDIX B ANIMAL SECTOR STAKEHOLDERS

Australian Government Department of Agriculture and Water Resources
Australian Government Chief Medical Officer
Australian Government Department of Health
Animal Feed Industry Organisations
Aquatic Animal Organisations
Chief Veterinary Officers (Australian, state and territory governments)
Companion Animal Organisations
Food Animal Producers
Laboratories
Livestock Industry Organisations
Performance Animal Organisations
Regulators
Research Institutes
Veterinarians
Veterinary Faculties/Schools
Veterinary Pharmaceutical Industry
Veterinary Pharmaceutical Manufacturers and Distributors
Veterinary Professional Organisations
Veterinary Students
Veterinary Surgeons Boards
Wildlife

APPENDIX C GLOSSARY

Antibiotic resistance

A property of bacteria that confers the capacity to grow in the presence of antibiotic levels that would normally suppress growth or kill susceptible bacteria.

Antimicrobial

A medicine that, on application to living tissue or by systemic administration, will selectively kill or prevent or inhibit growth of susceptible organisms.

Antimicrobial resistance

A property of organisms, including bacteria, viruses, fungi and parasites that confers the capacity to grow or survive in the presence of antimicrobial levels that would normally suppress growth or kill susceptible organisms.

'Critical' antibiotics (human use)

'Critical' antibiotics are those used to treat serious or life-threatening infections in humans for which there are very limited or no alternative antibiotics that can be used to treat the infections if antibiotic resistance develops. The antibiotics that are in this critical class change from time to time and are influenced by the availability of newer antibiotics and the resistance rate of bacteria causing serious human infections.

Food-producing animals

Animals reared for the production of meat or other food products (e.g. milk, eggs).

Growth promotion

The use of substances (growth promotants) that increase the rate of weight gain and/or the efficiency of feed utilisation in animals by other than purely nutritional means. The term does not apply to the use of antibiotics for the purpose of inhibiting specific pathogens even when an incidental growth response may be thus obtained.

One Health

Describes a coordinated, collaborative, multidisciplinary and cross-sectoral approach to the development of health strategies for people, animals and the environment.

Prophylaxis

The use of treatment e.g. the administration of an antibiotic, in advance of an actual infection or disease condition because such a condition is expected to occur if treatment is withheld.

Surveillance - Targeted

Targeted surveillance involves a prospective study of resistance directed at specific pathogens.

Surveillance - Passive

Passive surveillance is the collection of routine analytical data from diagnostic laboratories.

APPENDIX D ACRONYMS AND ABBREVIATIONS

ACVO	Australian Chief Veterinary Officer
AMS	Antimicrobial stewardship
AMR	Antimicrobial resistance
AMU	Antimicrobial usage
ASTAG	Australian Strategic and Technical Advisory Group on AMR
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
IPC	Infection prevention and control
OECD	Organisation for Economic Cooperation and Development
OIE	World Organisation for Animal Health
RDCs	Research and Development Corporations
WHO	World Health Organization