AUSTRALIAN VETERINARY ANTIMICROBIAL STEWARDSHIP CONFERENCE 2018

SUNSHINE COAST
QUEENSLAND

WELCOME FROM THE CHAIR

Welcome to the Australian Veterinary Antimicrobial Stewardship conference (AVAMS)! This foundation conference is designed to provide Australian veterinary stakeholders the opportunity to contribute to, and learn about, the growing number of veterinary antimicrobial stewardship initiatives underway in Australia but also identify opportunities to collaborate to strengthen these initiatives and address barriers that might impede progress to further refinement of these antimicrobial stewardship efforts.

Australian approaches to the appropriate use of antimicrobials in animals have always had their basis in the principles of antimicrobial stewardship and lead the world in many of these initiatives. However, there is more that can be done to capture current efforts and clarify areas that require further progress. All industries have the dual responsibilities of minimising the development of antimicrobial resistance (AMR), while upholding our collective responsibility to ensure high standards of animal health and welfare are maintained.

I hope you enjoy the conference, expand your professional network and leave the conference with a clearer understanding of what antimicrobial stewardship is, and what it means for you and your industry.

Dr. Kylie Hewson
Assistant Executive Director; Australian Chicken Meat Federation
Chair, AVAMS 18 Organising Committee

ACKNOWLEDGEMENT

Organising Committee

Dr. Kylie Hewson
Australian Chicken Meat Federation
Chair

Dr. Lechelle Van Breda
Australian Pork Limited
Treasurer, Sponsorship

Dr. Sarah Britton,
NSW Department of Primary Industries
Program Sub-Committee

Dr. Ian Jenson,
Meat & Livestock Australia
Program Sub-Committee

Dr. Amanda Black
NSW Department of Primary Industries
Program Sub-Committee

Dr. Melanie Latter,
Australian Veterinary Association
Program Sub-Committee

Dr. Raana Asgar
Office of the Australian Chief Veterinary Officer
Program Sub-Committee

Georgie Townsend
AgriFutures Australia
Sponsorship Sub-Committee

Dr. Stephen Page
Advanced Veterinary Therapeutics
Program Sub-Committee

Kate Murphy & Jenny Lawler
YRD Event Management
Secretariat

CONTENTS

THANKYOU TO OUR SPONSORS

Platinum Sponsor

Animal Medicines Australia
Animal Medicines Australia represents the leaders of the animal health industry. Our member companies innovate, manufacture, formulate, register and supply veterinary medicine products that prevent, control and cure disease across the companion animal, livestock and equine sectors. In the livestock sector, member company products are improving productivity and promoting better environmental, health, safety and animal welfare outcomes. In the companion animal sector, veterinary medicines produced by member companies are facilitating longer, mutually beneficial partnerships between humans and animals.

Gold Sponsor

Australian Eggs
Australian Eggs is an industry owned not-for-profit company. It integrates marketing, research and development and industry services for the benefit of its stakeholders. It is mainly funded through statutory levies and Australian Government matching payments for the purposes of approved research and development. The company services Australian egg farmers, irrespective of their size, location or farming system. Australian Eggs' vision is to support egg farmers, to increase egg consumption and ensure industry sustainability.

Australian Pork Limited (APL)
Australian Pork Limited (APL) is a producer owned organisation promoting the Australian pork industry. APL is the service body for Australian pig producers, performing marketing activities to improve the demand for Australian pork, research and development to make the industry more competitive and providing industry representation ensuring government and regulators have all of the necessary information for successful policy outcomes. APL aims to enhance opportunities for the sustainable growth of the Australian pork industry by creating and fostering new innovations, technology and jobs in the agriculture sector.

Meat & Livestock Australia (MLA)
Meat & Livestock Australia Limited (MLA) delivers research, development and marketing services to Australia's cattle, sheep and goat producers. MLA has approximately 50,000 livestock producer members. Working in collaboration with the Australian Government and wider red meat industry, MLA's mission is to deliver value to levy payers by investing in initiatives that contribute to producer profitability, sustainability and global competitiveness. As the recognised leader in delivering world-class research and development outcomes, animal health and antimicrobial stewardship are a natural part of the portfolio.

Silver Sponsor

Australian Chicken Meat Federation
The Australian Chicken Meat Federation Inc. (ACMF) is the peak coordinating body for participants, including chicken growers and processors, in the chicken meat industry in Australia. Its main aim is to promote and represent the interests of the industry in matters including international trade, quarantine, animal health, biosecurity, food standards, food safety, and animal welfare. Its members are the five State Chicken Meat Councils, the Australian Chicken Growers' Council and the Australian Poultry Industries Association.

Bronze Sponsor

Australian Veterinary Association (AVA)
The Australian Veterinary Association is the national organisation representing veterinarians. Our 9,500 members come from all fields within the veterinary profession. Fighting antimicrobial resistance is one of the AVA's key strategic priorities. We develop policies and resources for the profession on best practice prescribing and infection prevention, and contribute nationally to the fight against AMR through ASTAG and the national AMR strategy.

Biomin
At BIOMIN we harness the power of science to support animal health and performance. By applying state-of-the-art and proprietary technology we deliver natural, sustainable and profitable solutions to the livestock industry. For over 30 years we have pioneered innovative solutions for mycotoxin risk management and gut performance. Our in-house R&D program at the BIOMIN Research Centre is staffed by 80 scientific researchers and 8 Centres for Applied Animal Nutrition and a research network of 150 academic and research institutions globally.

Bioproperties
Bioproperties is a leading vaccine manufacturing company supplying and developing products to replace antibiotics in intensive animal production. These products are live vaccines aiding in the control of Mycoplasma, Salmonella, Pasteurella and coccidiosis infections and diseases. These have helped Australian poultry industries to lead the world in decreasing antibiotic dependence for the last 25 years.

Elanco Animal Health
Elanco Animal Health is a global leader in the discovery and development of products that improve animal health, performance and well-being. In doing so, our products play a direct role in maximising the health and efficiency of livestock animals; ensuring consumers have access to an abundant, affordable and safe source of food and fibre. Likewise, our expanding range of innovative companion animal products enables veterinarians to help pets live longer, healthier and higher-quality lives.

Lallemand Animal Nutrition
Lallemand Animal Nutrition is committed to optimising animal performance and well-being with specific natural microbial product and service solutions. Using sound science, proven results and knowledge, Lallemand Animal Nutrition develops, manufactures and markets high value yeast and bacteria products - including probiotics, silage inoculants and yeast derivatives.

THANKYOU TO OUR SPONSORS

Speaker and Coffee Cart Sponsor

Feedworks
Feedworks is a partnership that markets products, services and technology to enhance the profitability and sustainability of animal production systems. Our key areas of operation include poultry, cattle, pigs, feed milling, sheep and forage production. Our approach is 'Performance through Science', delivering innovative solutions to our customers that are backed by science.

Speaker and Travel Fellowship Sponsor

NSW Department of Primary Industries
The NSW Department of Primary Industries (DPI) plays a crucial role in driving economic growth and increasing the value of primary industries in NSW. DPI does this by managing a broad range of initiatives; including natural resource management, research and development, pest and disease management, food safety, industry engagement, and market access and competition. As world leaders in food and fibre innovation we are ranked in the top 1% of research organisations around the globe and work closely and collaboratively with industry, and public and private organisations.

Speaker and Travel Fellowship Sponsor

Agrifutures Australian Chicken Meat Program
AgriFutures Australia is the research and development corporation responsible for managing the national chicken meat research, development and extension (RD&E) program. Through targeted high-impact RD&E projects, the AgriFutures™ Chicken Meat Program aims to achieve significant benefits to industry designed to maintain its position as the number one consumed meat in the country. Key components of the AgriFutures™ Chicken Meat Program are increasing productivity and efficiency of production, and delivering safe food and good animal welfare outcomes.

Coles
Coles is one of Australia's largest retailers and provides fresh food, groceries, general merchandise, financial and online services through more than 27 million weekly customer transactions on average, across the business network. We put our customers and team members at the heart of everything we do and are committed to working towards a sustainable future that supports farmers and food producers.

KEYNOTE SPEAKERS

Dr Mark Schipp

Mark Schipp was appointed Australian Chief Veterinary Officer in 2011. In 2012 he was elected to the OIE Council and in 2015 was elected Vice President of the OIE General Assembly and in 2018 became President. He is chair of Wildlife Health Australia management committee.

Together with the Chief Medical Officer, Dr Schipp chairs the Australian Strategic and Technical Advisory Group on Antimicrobial Resistance. Previously Dr Schipp has held positions responsible for animal derived food product inspection, market access and export certification.

Dr Schipp served two terms overseas as Agriculture Counsellor in Seoul, South Korea and in Beijing, China. Mark is a biology and veterinary graduate of Murdoch University. After graduation he worked with the Western Australian Department of Agriculture.

Professor Brendan Murphy

Professor Brendan Murphy is the Chief Medical Officer for the Australian Government and is the principal medical adviser to the Minister and the Department of Health. He also holds direct responsibility for the Department of Health's Office of Health Protection and the Workforce Division. Apart from the many committees he chairs, co-chairs and participates in, he is the Australian Member on the International Agency for Research on Cancer (IARC) Governing Committee and represents Australia at the World Health Assembly.

Prior to his appointment Professor Murphy was the Chief Executive Officer of Austin Health in Victoria.

Professor Murphy is a Professorial Associate with the title of Professor at the University of Melbourne and an Adjunct Professor at Monash University, a Fellow of the Australian Academy of Health and Medical Sciences, a Fellow of the Royal Australian College of Physicians and Australian Institute of Company Directors.

KEYNOTE SPEAKERS

Professor Marilyn Cruickshank

Professor Marilyn Cruickshank is the President of the Australasian College of Infection Prevention and Control (ACIPC) and Professor of Nursing Research at University of Technology Sydney. Prior to this Professor Cruickshank was Director of the national HAI program at the Australian Commission on Safety and Quality in Healthcare for a ten year period where she led work on national HAI surveillance, the national hand hygiene program, antimicrobial stewardship, national infection control guidelines. Professor Cruickshank led the development of Standard 3 of the National Safety and Quality Health Service Standards – Preventing and controlling healthcare associated infection standard which forms the basis for the hospital and dental accreditation scheme.

Professor John Prescott

John F. Prescott is a retired veterinary bacteriologist and University Professor Emeritus at the University of Guelph. He is best known for work on Rhodococcus equi pneumonia in foals, Clostridium perfringens enteritis in several species, and for promoting better use of antimicrobial drug use in animals. He is an editor and an author of the textbook “Antimicrobial Therapy in Veterinary Medicine”, now in its fifth edition. He has been active in promoting antimicrobial stewardship in Canadian agriculture and veterinary medicine for many years. He was elected a Fellow of the Canadian Academy of Health Sciences in 2008.

Sponsored by:

NSW GOVERNMENT | Department of Primary Industries

KEYNOTE SPEAKERS

Professor Luca Guardabassi

Luca Guardabassi is professor at the Faculty of Health and Medical Sciences, University of Copenhagen. He is an internationally recognised One Health microbiologist specialised in antimicrobial resistance with over 160 publications in peer-reviewed journals. As part of his honorary office, he chairs the ESCMID Study Group for Veterinary Microbiology (ESGVM) and the Therapeutic Guidelines Group in WSAVA, and is member of the WSAVA One Health Committee, the European veterinary subcommittee on antimicrobial susceptibility testing (VetCAST) and various national and international working groups for antimicrobial guidelines in veterinary medicine.

Sponsored by: coles

Dr Stephen Page

Stephen is a consultant veterinary clinical pharmacologist and toxicologist. He provides advice on appropriate use of veterinary medicines to veterinarians, veterinary organisations (Australian Veterinary Association, World Veterinary Association, World Organisation for Animal Health), state and national government departments and statutory bodies (APVMA, Department of Agriculture, Department of Health, US Environmental Protection Agency), and global organisations (OIE, FAO, Chatham House). He is a member of the AVA Committee on Antimicrobial Resistance, the ASTAG committee on antimicrobial prioritisation and the World Veterinary Association Pharmaceutical Stewardship Committee and is the President of the ANZCVS Chapter of Pharmacology.

He has more than 100 publications, including book chapters, on antimicrobial stewardship, clinical pharmacology, adverse drug reactions, use of antimicrobial agents in livestock, and antimicrobial drug discovery and models of infection. He has been a teacher and facilitator of courses at the University of Sydney on food safety, public health and antimicrobial resistance since 2003. He gave his first presentation on veterinary antimicrobial resistance and stewardship in 2000 and remains passionate about improving the use and effective life span of antimicrobial agents.

Sponsored by: AgriFutures Chicken Meat

Dr Matthew Stone

Matthew Stone is a veterinary epidemiologist from New Zealand, and the Deputy Director General – International Standards and Science at the World Organisation for Animal Health (OIE) at their Paris headquarters. After five years in mixed veterinary practice, Matthew worked for the next 20 years with the government veterinary authority of New Zealand, the Ministry for Primary Industries, serving in numerous veterinary and management roles, including as the New Zealand Delegate to the OIE. In that capacity he served as the Secretary General for the OIE Asia Far East and Oceania region.

Matthew has been President of the Epidemiology Branch of the New Zealand Veterinary Association; and a member of the Professional Standards Committee of the New Zealand Veterinary Council; the Stakeholder Council for the New Zealand Tb Free and National Animal Identification and Traceability programmes; and the Wellington SPCA Board. In OIE Matthew oversees the organisation's processes for setting international standards; the global strategies for FMD, PPR, Rabies and AMR; and represents OIE on the UN Inter-Agency Coordination Group for AMR.

ANTIMICROBIAL USE SESSION

Sunday 11th November

Surveillance of antimicrobial use tracks the what, when, why and how of antimicrobial use. An ideal One Health approach to the challenge of antimicrobial resistance would be able to identify not only what resistance is present but how antimicrobial use in the animal and human health sectors is contributing to this resistance.
Such a system needs to be able to integrate inputs from the veterinary and medical professions and their clients, government agencies, animal, food and related industries, and laboratories. The data gathered needs to be able to inform government policy and resource allocation for the future. Fundamental questions remain:

- What contribution does food make to AMR?
- Does the use of antibiotics in small animal practice have AMR consequences for the human population?
- What is the future of antimicrobial use in livestock production?

Come and hear from your colleagues as to the current state of play in the animal sector and future plans for tracking antimicrobial usage in animals in Australia.

NETWORKING FUNCTION

Sunday 11 November

6.00pm – 8.00pm (Following the Opening Session)
Trade Area. Novotel Twin Waters

Sponsored by:

CONFERENCE DINNER

Monday 12 November

7.00pm – 11.00pm
Lily's on the Lagoon, Novotel Twin Waters

Sponsored by:

VetEd CPD POINTS

We are pleased to advise that AVAMS has been approved and is eligible for a total of 17 VetEd points.

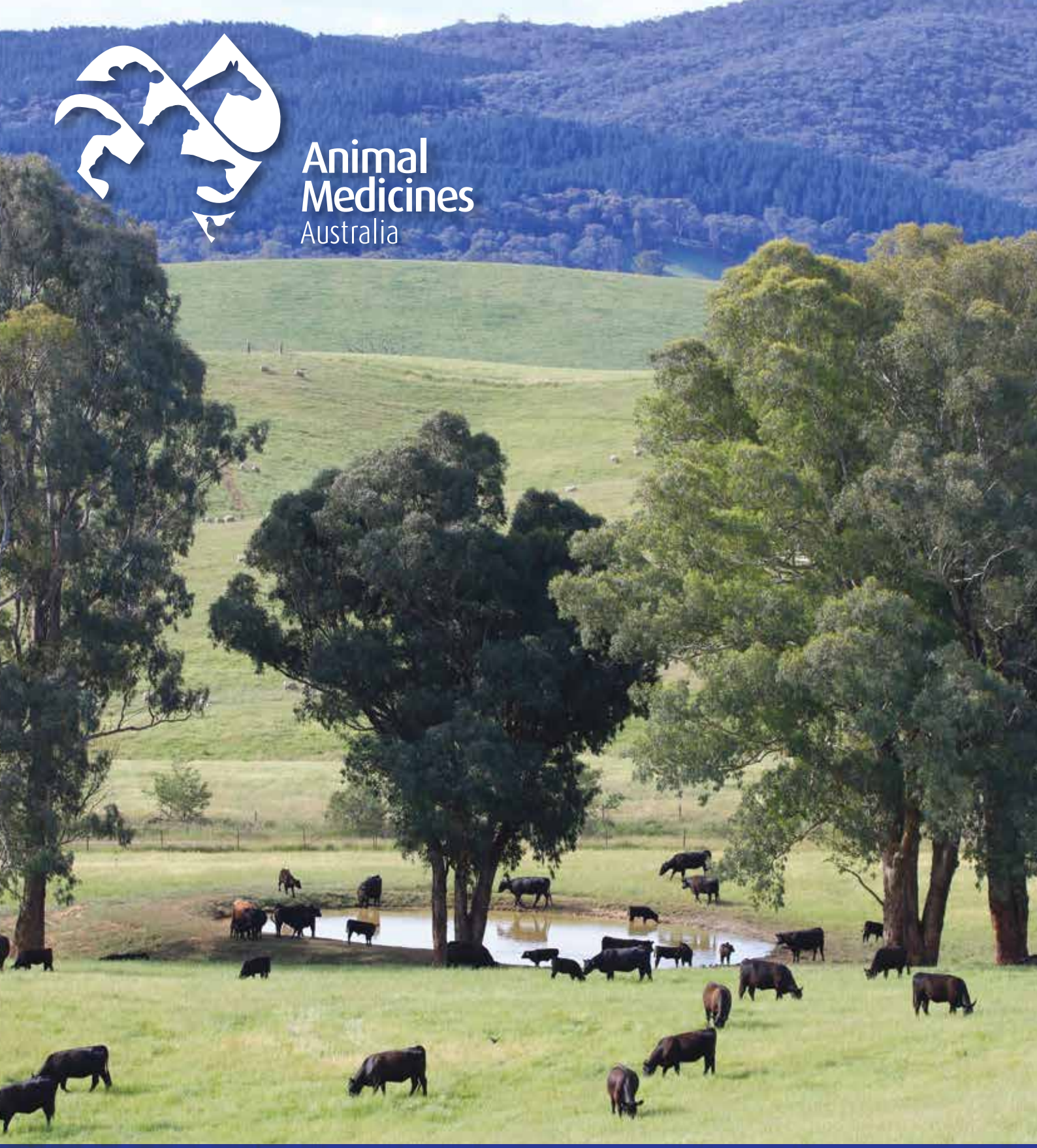
Full attendance (including workshop)	17 VetEd Points
Attendance: 11 November Workshop	4 VetEd points
Attendance: 11 November Session 1	1 VetEd point
Attendance: 12 November	6.75 VetEd Points
Attendance: 13 November	5.25 VetEd Points

Australian Veterinary Association
VetEd
Professional development for Australia's veterinarians

PRE CONFERENCE WORKSHOP

Sunday 11th November 2018

11.30am	Registration and Light Lunch	
12.00 pm	Welcome	**Facilitator - Ian Jenson**
12.05pm	The imperative for veterinary AMU data	**Raana Asgar** Department of Agriculture and Water Resources
12.15pm	Hot off the press - International trends in AMU	**Shabbir Simjee** Elanco
12.25pm	What AMU data looks like in the poultry industry	**Kylie Hewson** Australian Chicken Meat Federation
12.35pm	What about AMU in our four-legged family members?	**James Gilkerson** University of Melbourne
12.45pm	The red meat sector – what we know	**Ian Jenson** Meat and Livestock Australia
12.55pm	What can the animal feed industries contribute?	**Louise Edwards** **Ridley**
1.05pm	This is how we (humans) do it - National Antimicrobial Prescribing Survey	**Rod James** National Centre for Antimicrobial Stewardship
1.15pm	Surveillance of AMU in the animal sector	Facilitated Discussion
2.00pm	Afternoon Tea	
2.15pm	Challenges and opportunities - collecting, analysing and reporting veterinary AMU data	Facilitated Discussion
3.45pm	Wrap and Close	**Facilitator**



Animal Medicines Australia represents the leaders of the animal health industry. Our member companies innovate, manufacture, formulate, register and supply veterinary medicine products that prevent, control and cure disease across the companion animal, livestock and equine sectors. In the livestock sector, member company products are improving productivity and promoting better environmental, health, safety and animal welfare outcomes. In the companion animal sector, veterinary medicines produced by member companies are facilitating longer, mutually beneficial partnerships between humans and animals.

18 National Circuit, Barton ACT 2600 | Ph: +61 2 6257 9022 | E: enquiries@animalmedicines.org.au

PROGRAM

Sunday 11th November 2018

11.30am	Registration and Lunch
12.00 - 4.00pm	Session On Surveillance Of Antimicrobial Usage In Animals – All Welcome (afternoon tea break at 2.00pm)
4.00-5.00pm	Break
	Session 1 (S1) **CONFERENCE OPENING**
5.00 - 5.30pm	**Keynote** **Dr Mark Schipp**: Antimicrobial Stewardship in Animal Health
5.30 - 6.00pm	**Keynote** **Professor Brendan Murphy**: Antimicrobial Stewardship in Human Health
6.00 - 8.00pm	Networking Function in Trade Area Sponsored by Australian Pork Limited

Monday 12th November 2018

8.00 – 8.30am	Registration and Arrival Tea and Coffee
	Session 2 (S2) **GLOBAL PERSPECTIVES ON ANTIMICROBIAL STEWARDSHIP** **Chair: Dr Charles Milne**
8.30 - 8.40am	**Dr Kylie Hewson**: Origins of AVAMS18, Chair AVAMS18 Organising Committee
8.40 - 9.00am	**Keynote** Speaker Sponsored by Agrifutures Chicken Meat **Dr Stephen Page**: What Is Antimicrobial Stewardship?
9.00 - 9.20am	**Keynote** **Dr Matthew Stone**: Overview Of The World Organisation For Animal Health (OIE) Antimicrobial Resistance Work
9.20 - 9.40am	**Dr Leigh Nind**: International Trends Impacting Antimicrobial Stewardship In Animal Health
9.40 - 10.00am	**Ms Jessica Ramsden**: The Language Of Antibiotics: Global Perspectives On Consumer Conversations About Antimicrobial Resistance
10:00 – 10.30am	Morning Tea
	Session 3 (S3) Session Sponsored By MLA **UNDERSTANDING ANTIMICROBIAL RESISTANCE AND ANTIMICROBIAL STEWARDSHIP** **Chair: Mr Ben Stapley**
10.30 - 11.10am	**Keynote** **Professor Marilyn Cruickshank**: Antimicrobial Stewardship In Human Health Settings
11.10 - 11.30am	**Professor David Jordan**: Antimicrobial Ratings - The Importance Of Importance
11.30 - 11.50am	**Professor Mieke Van Driel** and **Dr Susan Bibby**: The 'Patient' Journey - A Comparison Of Human, Companion Animal And Livestock Antimicrobial Decision-Making In Clinical Practice
11.50 - 12.10pm	**Dr Helen Crabb**: A Review Of Factors Influencing Antimicrobial Prescribing In Food Production Animals
12.10 - 12.30pm	**Dr Shabbir Simjee**: The Urgent Need For Harmonised Definitions In Addressing Antimicrobial Resistance In Veterinary Medicine
12.30 – 1.15pm	Lunch

PROGRAM

Monday 12th November 2018

	Session 4 (S4) **ANTIMICROBIAL STEWARDSHIP INITIATIVES AND PERSPECTIVES** **Chair: Dr Sarah Britton**	
1.15 - 1.35pm	**Dr Louise Edwards**: What Are You Having For Dinner Tonight? AMS: A Stock Feed Millers Perspective	
1.35 - 1.55pm	**Ms Lauren Mackenzie**: Antibiotics And Agriculture – The Retail Customer Perspective	
1.55 - 2.15pm	**Dr Kylie Hewson** and **Professor Darren Trott**: Lessons Learned From Proof-Of-Concept Antimicrobial Resistance Surveillance Projects In Australian Intensive Livestock	
2.15 - 2.30pm	**Assoc Professor Jacqueline Norris**: Development Of An Online Antimicrobial Stewardship Training Program For Veterinarians: A National Collaborative Effort	
2.30 - 2.45pm	**Professor James Gilkerson**: Antimicrobial Prescribing Guidelines For Livestock Project	
2.45 - 3.00pm	**Dr Sam Abraham**: Are Humans And Wild Birds A Potential Risk For Transmitting Critically Important Antimicrobial Resistant Bacteria To Australian Livestock?	
3.00 – 3.30pm	Afternoon Tea	
	Concurrent Session 1 (CS1) **PRODUCTION ANIMALS** **Chair: Dr Vivien Kite**	**Concurrent Session 2 (CS2)** **COMPANION ANIMALS** **Chair: Assoc Professor Jacqueline Norris**
3.30 - 3.45pm	**Professor Darren Trott**: Surveillance For Antimicrobial Resistance Of Bovine Respiratory Disease Pathogens	**Dr Kirsten Bailey**: Population Wide Assessment Of Antimicrobial Use In Companion Animals Using A Novel Data Source – A Cohort Study Using Pet Insurance Data
3.45 - 4.00pm	**Dr Robert Barlow**: Antimicrobial Susceptibility Of Bacteria From Healthy Cattle And Sheep At Slaughter	**Dr Kanishka Kamathewatta**: Resistomes And Associated Risks In Environmental Sites Of A Veterinary Teaching Hospital Intensive Care Unit
4:00 - 4:15pm	**Dr Peter Johnston**: *Saccharomyces cerevisiae* Fermentation Metabolites - Potential Solution for Antimicrobial Stewardship In Food Animal Production Speaker Sponsored By Feedworks	**Dr Brian Hur**: Using Natural Language Processing And VetCompass To Understand Antimicrobial Usage Patterns In Australia
4:15 - 4.30pm	**Dr Chris Morrow**: Focused Antibiotic Stewardship For The Chicken Industries	**Dr Mike Mason**: Progress Towards A Point-Of-Management Diagnostic Platform Technology Suitable For Veterinary Applications
4.30 - 4.45pm	**Dr Richard Carter**: Change Management Reduces Antibiotic Use On Pig Farms	**Professor Glenn Browning**: Antimicrobial Susceptibility Testing By Australian Veterinary Diagnostic Laboratories
4.45 - 5.00pm	**Dr Mark Humphris**: Dairy Australia's Change Management Programs Supporting Improved Antimicrobial Stewardship	**Dr Kirsten Bailey**: Delayed Prescribing As An Antimicrobial Stewardship Tool In Veterinary Practice
5.00 - 6.00pm	Poster Session (P) with Drinks	
7.00 - 10.30pm	Conference Dinner	

Tuesday 13th November 2018

8.15 - 8.30am	Registration and Arrival Tea and Coffee
	Session 5 (S5) **WHAT DOES VETERINARY ANTIMICROBIAL STEWARDSHIP LOOK LIKE IN PRACTICE?** **Part 1** **Chair: Mr Christian Mulders**
8.30 - 9.30am	**Keynote** Speaker Sponsored by NSW Department Of Primary Industries **Professor John Prescott**: Veterinary Antimicrobial Stewardship In North America
9.30 - 9.50am	**Dr Stephen Page**: Veterinary Antimicrobial Stewardship In Australia
9.50 - 10.10am	**Dr Kev Sullivan**: Antimicrobial Stewardship Guidelines For The Australian Cattle Feedlot Industry
10.10 - 10.30am	**Dr Jo Coombe**: Overview Of The Australian Dairy Industry Approach To Antimicrobial Stewardship
10.30 - 10.50am	Morning Tea
	Session 6 (S6) **WHAT DOES VETERINARY ANTIMICROBIAL STEWARDSHIP LOOK LIKE IN PRACTICE?** **Part 2** **Chair: Dr Mark Schipp**
10.50 - 11.30am	**Keynote** Speaker Sponsored by Coles **Professor Luca Guardabassi**: Veterinary Antimicrobial Stewardship In The EU
11.30 - 11.50am	**Dr Alison Taylor**: Antimicrobial Stewardship In Small Animal Practice - A Pilot Trial In Canberra
11.50 - 12.10pm	**Dr Sheridan Alfirevich**: Antimicrobial Stewardship In The Australian Chicken Meat Industry
12.10 - 12.30pm	**Dr Lechelle Van Breda**: Antimicrobial Stewardship In Australian Pork
12.30 - 12.50pm	**Dr Paul Hardy-Smith**: Antimicrobial Stewardship In Australian Aquaculture– A Clinical Veterinarian's Perspective
12.50 - 1.10pm	**Dr Sharanne Raidal**: Antimicrobial stewardship in Australian equine practice: intentions, problems & realities
1.10 - 1.50pm	Lunch
	Session 7 (S7) **BARRIERS AND POTENTIAL OPPORTUNITIES TO PROGRESSING VETERINARY ANTIMICROBIAL STEWARDSHIP**
1.50 - 2.10pm	**Keynote** **Professor David Jordan**: Barriers And Potential Opportunities To Progressing Veterinary Antimicrobial Stewardship
2.10 - 3.00pm	**PANEL DISCUSSION ON THE WAY FORWARD** **Facilitator: Dr Ian Jenson** Panel: Dr Mark Schipp, Dr Stephen Page, Dr Matthew Stone, Professor Luca Guardabassi, Professor John Prescott, Professor David Jordan, Dr Rodney James
	Session 8 (S8) **CONFERENCE CLOSE**
3.00 - 3.15pm	**Dr Melanie Latter**: Key Messages and Wrap-Up

S1

ORAL PRESENTATIONS

KEYNOTE:

Antimicrobial Stewardship In Animal Health

Dr Mark Schipp

Notes:

KEYNOTE:

Antimicrobial Stewardship In Human Health

Prof Brendan Murphy

Notes:

S2

KEYNOTE:

What Is Antimicrobial Stewardship?

Dr Stephen Page[1]

1. *Drug Discovery, Research and Development, Advanced Veterinary Therapeutics, Newtown, NSW, Australia*

The function and responsibilities of the steward have evolved considerably since the term was first used in Old English to refer to the person ensuring the smooth management of a household. Wherever preservation of order and function were essential for efficient operation and survival stewards were appointed as critically important managers.

In recent times stewardship has gained massive momentum following the Earth Summit in Rio de Janeiro in 1992. For example, in response to major adverse events the Forest Stewardship Council was founded in 1993, the Marine Stewardship Council in 1996, and the Aquaculture Stewardship Council in 2010.

Alarms about suboptimal antimicrobial use and consequent selection and dissemination of antimicrobial resistance in both human and animal environments have been sounded since the 1940s but it was in 1996 that John McGowan and Dale Gerding from the USA first elevated the call to action with their now landmark paper which first described the need for a new and more effective approach to the control of antimicrobial use which they termed 'antimicrobial stewardship'.

This presentation will describe the key principles of antimicrobial stewardship (AMS) and the associated core elements of Good Antimicrobial Stewardship Practice (GSP). Without widespread adoption and implementation of AMS programmes and GSP principles will the forecast public health cataclysm become a reality?

Key Antimicrobial Stewardship Message

Preservation of the effectiveness of antimicrobial agents requires a commitment by everybody to the 5R principles of AMS.

Notes:

KEYNOTE:

Overview Of The World Organisation For Animal Health (Oie) Antimicrobial Resistance Work

Dr Matthew Stone[1]
1. OIE, Paris, France

Antimicrobial resistance (AMR) is a global challenge, and a One Health challenge. The challenge must be addressed through action at the front line, through changing the drivers of infectious disease, the behaviour of the prescribers, and the attitudes of the public. For this, National Action Plans play a key role in the international response.
So what is the role of international organisations, in particular the One Health Tripartite, being the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO) and the World Organisation for Animal Health (OIE)? The Global Action Plan developed and agreed in 2015 establishes the framework of objectives for both the international and national response.
The OIE's international standards address legislation in the veterinary domain; risk analysis of antimicrobials and the market authorisation process; surveillance programmes for resistance; monitoring programmes for usage in animals; responsible and prudent use in animals; and laboratory methods for susceptibility testing. They provide a harmonised regulatory model developed by experts and agreed through international consensus to guide the development of regulatory frameworks in our Members.
The OIE operates a capacity development programme of evaluations through the PVS Pathway, as well as specific support through training programmes. The OIE has established an international data collection and reporting effort on usage of antimicrobials in animals as a key performance indicator of progress in the animal sector.
The OIE uses its convening authority and communications platforms to drive advocacy, to mobilise resources, and to achieve coordination with our Members and partners, most recently through the 2nd OIE Global Conference on AMR and Prudent Use of Antimicrobials, in Marrakesh, Morocco, 29 October to 1 November 2018.

Notes:

S2

Latest International Thinking Impacting The Direction Of Antimicrobial Stewardship In Animal Health

Dr. Leigh Nind[1]
1. *Department of Agriculture and Water Resources, Canberra City, ACT, Australia*

Summary Outline
The Tripartite collaboration (WHO, OIE, FAO) produced two documents for consultation with Member Countries in 2017 - Monitoring and Evaluation of the Global Action Plan on Antimicrobial Resistance: Proposed approach and Global Framework for Development & Stewardship to Combat Antimicrobial Resistance: Draft Roadmap. These documents intend to support a strategic whole-of-system approach towards the World Health Organization's Global Action Plan on Antimicrobial Resistance (AMR).
This paper outlines the recent thinking in antimicrobial stewardship (AMS) being developed by the major international organisations involved with mitigating global AMR. The directions being set in key frameworks will need to be considered by Australian stakeholders, as their own AMS approaches and activities are formulated.

Key Antimicrobial Stewardship Message
Identified directions will need incorporation into future AMS work undertaken by stakeholders.

1. http://www.who.int/antimicrobial-resistance/global-action-plan/UpdatedRoadmap-Global-Framework-for-Development-Stewardship-to-combatAMR_2017_11_03.pdf?ua=1 (accessed 29 May 2018)
2. http://www.fao.org/3/a-i7711e.pdf (accessed 29 May 2018)

Notes:

The Language Of Antibiotics: Global Perspectives On Consumer Conversations About Antimicrobial Resistance

Ms. **Jessica Ramsden**[1]
1. *Elanco Australasia, West Ryde, NSW, Australia*

Summary Outline
While scientists, veterinarians, policy makers and producers focus on the intricacies of AMR and how to address it, we often wonder what consumers think. We also want to be able have conversations with consumers about AMR in a way that's open and frank about the issue, and positive about the work being done to address it, without getting lost in technical complexity. Elanco has been seeking answers to these questions since 2014, through social media monitoring and global consumer insights research.
A wide range of stakeholders are engaged in online conversation about the use of antibiotics in farm animals. With many differing voices, it can be difficult to pinpoint what is truly being said by whom and how these voices are shaping the concerns and expectations of consumers. Elanco uses social listening software to track conversations from social media, blogs, forums, and online news and publications. These are then analysed to determine key learnings, trends and other insights. Elanco has been following the global social media conversation about antibiotic use in food animals since 2014, collating insights that help to understand the views of consumers on the issue of AMR, how those views are shaped, and how the agricultural community can engage in a positive way in the online discussion.
The complexity of AMR is hard to overstate. What do consumers care about the most? How much detail do they want to know? Who do they want to hear from about these issues? Are there regional differences? Elanco has conducted a global language insights research to assess awareness, concerns, and perceptions regarding antibiotic use in farm animals. The research also developed new approaches for explaining why and how antibiotics are used in food animal production, and where the industry is going. The research provided practical recommendations for starting conversations about antibiotics, reasons why they should be effective, and where there are differences across countries and cultures.
This paper discusses the key leanings from Elanco's social media monitoring and consumer language research.
Acknowledgements: Elanco colleagues including social media analysts and consumer insights advisers

Key Antimicrobial Stewardship Message
Effective public engagement about antimicrobial stewardship will ensure consumer and trading partner confidence in our strategies and efforts to address AMR, while maintaining high levels of food safety, good animal welfare and international competitiveness.

Notes:

S3

KEYNOTE:

Antimicrobial Stewardship In Human Health Settings

Professor Marilyn Cruickshank[1]

1. *ACIPC, Hobart, TAS, Australia*

Antimicrobial resistance (AMR) is a critical health issue worldwide. Some resistant bacterial pathogens, originally the concern of hospitals are now seen in the community, with patients arriving in hospitals carrying resistant bacteria. These infections are difficult to treat and impact on clinical care, contributing to increased patient illness and death, the complexity of treatments, and the duration of hospitalisation.

There is clear evidence that the rate and extent to which AMR occurs, is dependent on the use of antibiotics. To address this in Australian hospitals, standards linked to hospital accreditation have been mandatory since 2013. These standards have ensured compliance with AMS programs, use of prescribing guidelines, monitoring of antimicrobial use and resistance, and, action taken to improve the effectiveness of AMS occurs at every public and private hospital across the country.

There is still room for improvement, most especially in general practice and in aged residential care facilities. So too, is there need for further national surveillance and reporting of AMR and antibiotic usage within a wider One Heath context. A central coordinating body that ensures consistency of action and improvement in safety with concerted intervention efforts in both human and animal health is justified as the current approach is proving inadequate.

Notes:

Antimicrobial Ratings: The Importance Of Importance

Professor David Jordan[1]

1. *New South Wales Department of Primary Industries, Wollongbar, NSW, Australia*

Summary Outline

Debate about antimicrobial resistance (AMR) in animals is often focused on the crude amount of antimicrobials used without deference to issues of "intensity of use", "quality of use" or differentiating the class of compounds being administered. As momentum for the reform of antimicrobial use has increased, so has the need for a basis for describing the risk to public health arising from the use of specific antimicrobial agents. Following Australia's 1999 review of antimicrobial use in animals (JETACAR), the notion was propagated that not all antibiotics are "created equally" in terms of the risk posed to public health. In 2001 this was formalised by the Expert Advisory Group on AMR (EAGAR) into a document inherited by the Australian Technical Advisory Group on AMR (ASTAG, 2018). The ASTAG document lists antimicrobials (grouped by class) according to either "low", "medium" or "high" importance to human health. From 2005 the importance ratings concept developed in Australia was adopted by the World Health Organisation to fill a void at the international level where many countries were not sufficiently advanced in the reform process to have their own list. Using somewhat different criteria (emphasising the use of antibiotics in agriculture), the WHO group classified antimicrobials as either "important", "highly important" or "critically important", with this being revised on multiple occasions (2007, 2009, 2011, 2013 and 2016), and inclusion of a new category of "highest priority critically important" in the most recent revision (WHO, 2017). The WHO document acknowledges that national versions of importance ratings may vary from country to country according to national considerations. Also in 2005, the World Animal Health Organisation (OIE) produced a complementary list prioritising antimicrobials with the focus on protecting the future availability of drugs for therapeutic uses in animals.

Importantly, the various lists were derived for somewhat different reasons and their applications continue to evolve. Nevertheless, all are seeking to support decision making in antimicrobial stewardship - increasingly so in the human health sector. For example, the original intent of the ASTAG list was to advise the national regulator of veterinary drugs in Australia (APVMA) but it is now being modified to be a more useful resource for education of medical and veterinary professionals. Regardless of which list is referred to, all the above lists have some key applications, including: informing regulators about constraints to apply to the use of antimicrobials, development of stewardship programs and therapeutic guidelines, defining drug-panels used in the surveillance for AMR, and informing priorities for developing alternatives to antimicrobials. Although these rating systems are all derived from a subjective, opinion-based process, they are being strongly endorsed as a valuable tool for managing risk of antimicrobial resistance in humans and animals.

Key Antimicrobial Stewardship Message

A working knowledge of antimicrobial importance ratings is a key element of stewardship efforts in humans and animals.

References

ASTAG. Importance ratings and summary of antibacterial uses in humans in Australia. Commonwealth of Australia; 2018.
WHO. Critically important antimicrobials for human medicine, 5th rev. Geneva: World Health Organization; 2017.

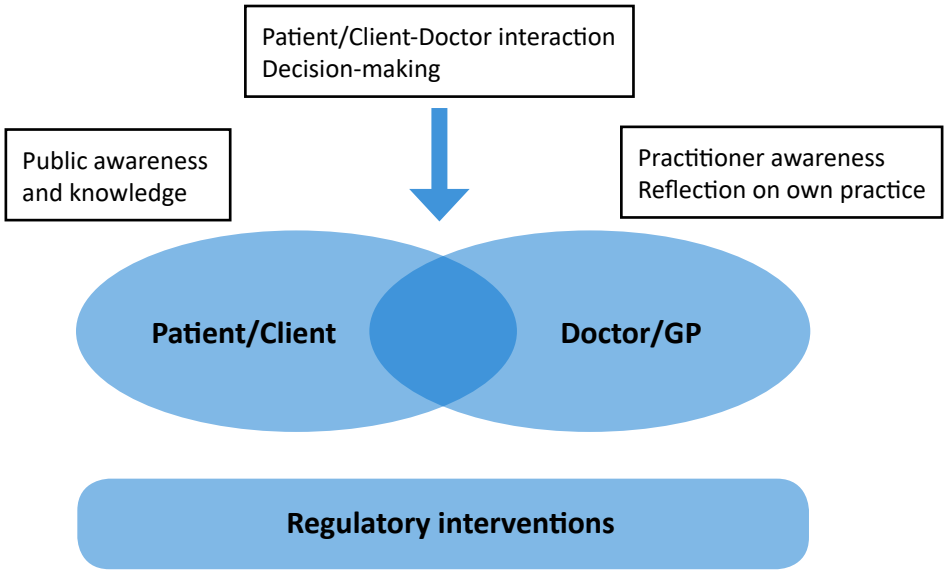
Notes:

S3

The 'Patient Journey' – A Comparison Of Human, Companion Animal And Livestock Antimicrobial Decision Making In Clinical Practice

Dr. Susan Bibby[1], Dr.Mieke van Driel[2]
1. 2Bridges Consulting, Strathfieldsaye, Victoria
2. University of Queensland, Brisbane, QLD, Australia

Summary Outline
The world is facing an antimicrobial resistance crisis, where soon simple infections may again be life threatening. Development of new antibiotics cannot keep up with the growing rate of resistance. An important driver of resistance is overuse of antibiotics. The need to be 'antibiotic wise' has made it to the top of the national agenda, with an emphasis on a 'one health' approach.
In this presentation, co-presented by a general practitioner and practicing veterinarian, we will compare the decision making process for antimicrobial prescription and use between humans, companion animals and livestock.
We will use a 'patient journey' model that highlights the different steps and decision making moments and compare these key points in the journey between the three patient groups.
By comparing and contrasting across human and animal health practice we aim to show the differences in antimicrobial prescription practices between the human and livestock species, provide clinicians with ideas and tools to implement in their own practice as well as formulate recommendations for research and policy.



Key Antimicrobial Stewardship Message
Antimicrobial Stewardship requires a 'One Health' approach that includes the clinical coalface where antibiotics are prescribed.

Notes:

A Review Of Factors Influencing Antimicrobial Prescribing In Food Production Animals

Dr. Helen Crabb[1], Laura Hardefeldt[1], Kirsten Bailey[1], Helen Billman-Jacobe[1], James Gilkerson[2], Glenn Browning[1]

1. *NCAS, Melbourne Veterinary School, Faculty of Veterinary and Agricultural Science, University of Melbourne, Melbourne, Victoria, Australia*
2. *APCAH, Melbourne Veterinary School, Faculty of Veterinary and Agricultural Science, University of Melbourne, Melbourne, VICTORIA, Australia*

Summary Outline

Background: Knowledge about the enablers of and barriers to antimicrobial stewardship in food production animals in Australia is limited. Key strategies for antimicrobial stewardship include reduction in use, refinement of treatments and replacement with alternatives. Simple application of the principals of stewardship from human to veterinary medicine is not possible without first understanding the most important barriers to stewardship, particularly within the food production industries.

Method: Deductive content analysis of the literature was performed to identify the key barriers to judicious antimicrobial use identified by veterinary and medical prescribers. A study was considered for inclusion in the analysis if the main objective of the paper was to explore perceptions of factors or behaviours influencing antimicrobial prescribing. Qualitative studies were included for analysis where key factors influencing prescribing were identified. Factors identified in medical and veterinary food animal publications were compared.

Results and Conclusions: Two key themes that differed between medical and veterinary prescribers were identified. Economic factors were important for both veterinarians and medical practitioners, but there were subtle differences. A key difference between medical and veterinary prescribers was the influence of the pharmaceutical company and sales pressure on the decision-making process. This was either rarely explored, or identified, as a factor in veterinary studies, whereas economic costs associated with the cost of production or loss in productivity to the producer/client were frequently described in veterinary studies. Time pressures, the complexity of the medical environment, hospital, intern and team management, and complex treatment or patient care were important in medical prescribing. Conversely, the availability of medications, or lack of choice of antimicrobials for prescribing, and complex regulations were considered important barriers to veterinary prescribing. Notably, hierarchies were identified as a barrier to appropriate prescribing for both medical and veterinary prescribers, with senior member(s) of a team reported to influence prescribing behaviours. A number of these factors have been identified as potential barriers to antimicrobial stewardship in Australia and require further exploration in food production animal medicine.

Key Antimicrobial Stewardship Message

Understanding the barriers to antimicrobial stewardship are crucial to improving the appropriate use of antimicrobials in both humans and animals.

Notes:

S3

The Urgent Need For Harmonised Definitions In Addressing Antimicrobial Resistance In Veterinary Medicine

Dr. Shabbir Simjee[1]
1. *Elanco Animal Health, Basingstoke, UK*

Summary Outline
Antimicrobial resistance is a global issue that has attracted attention across multiple stakeholders including medical professionals, global regulatory organisations, food brands, academics, policy makers and activist groups. The topic of antimicrobial resistance is both broad and extremely complex, with intricate terminology. A fundamental issue that arises in discussions between different stakeholders is how terms are defined and this leads to confusion and misinterpretation.
Multiple organisations have attempted to define terms related to antimicrobial resistance and this has only lead to further confusion. For example, the simple term 'prevention' is defined differently by the WHO, Codex and the OIE. In fact, the WHO and Codex confusingly interchange 'prevention' and 'control' of a bacterial disease whilst the OIE specifically addresses 'prevention' in the strictest sense. This has resulted in some cases where antimicrobials are administered under a 'prevention' label claim where it may not be appropriate to do so, and other cases where antimicrobials are not administered under the 'prevention' label claim even though it would be wholly appropriate.
At a fundamental level, there remains a great deal of confusion over even the basic of terms i.e. what is a 'non-medically important antibiotic' vs. 'medically important antibiotic'. Of greater concern is that a number of institutions are confusing 'medically important antibiotics' as being 'critically important antibiotics'.
One significant problem is the use of the term resistant to categorize bacteria whose susceptibility properties are determined using often incompatible laboratory parameters, namely, clinical breakpoints and ECVs. This confusion of terms often precludes a direct comparison of reported resistance patterns in different locales. This problem is further exacerbated by the use of different clinical breakpoints and ECVs in different countries. In addition, the term resistant often is used loosely to indicate decreased susceptibility, a non–wild type, increased MICs, or acquired genetic markers, or to designate a physiological change in the cell affecting antimicrobial metabolism. These factors confound data interpretation and comparison, and serve to highlight the need for harmonised terminology.
Confusion in having multiple definitions leads to confusion in drafting policy documents and interpretation of regulations. Such confusions can have detrimental effects when interpreting guidelines and legislations and indeed misinterpretation due to lack of clear definitions can, in some instances, lead to animal welfare issues.
This paper discusses the urgent need for clear definitions in regards to antimicrobial resistance and the international efforts currently being undertaken to harmonise definitions at a global level.

Key Antimicrobial Stewardship Message
There is an urgent need for clear (global) definitions in regards to antimicrobial resistance.

Notes:

What Are You Having For Dinner Tonight? AMS: A Stock Feed Millers Perspective

Dr. Louise J Edwards[1]
1. *Ridley, Melbourne, VIC, Australia*

Summary Outline
Antimicrobial resistance (AMR) is an urgent global health priority. The World Health Organisation has described AMR as a looming crisis in which common and treatable infections will become life threatening for both human and animal health. Antibiotics are a precious resource. It is imperative that antibiotics are protected with their responsible use being supported by the integrity of the feed to food supply chain (Australian Government, 2015).
Antibiotics are an important tool in the protection of animal health and welfare, typically being administered via injection, drinking water or in feed. At the time of writing, 397 antibiotic veterinary products were authorised for use in Australia with 37% being registered for oral or in feed administration (Australian Pesticides Veterinary Medicines Authority, 2018). As we strive towards using antibiotics "as little as possible, and as much as necessary" it is important that consideration is given to the most practical and efficacious method(s) of administration. This not only ensures the right outcome from an Antimicrobial Stewardship (AMS) perspective but also for the health and welfare of the animal(s) being treated. Market drivers are creating a shift towards a reduced reliance on antibiotics but, there is an expectation that food quality and safety will not be compromised at no additional cost to the end-consumer.
This paper seeks to explore the barriers to AMS within the animal feed industry sector and the unintentional consequences of antibiotic use. Areas explored include raw material security, manufacture critical control points, supply chain logistics and regulatory hurdles. Potential solutions to these barriers will be offered that support veterinary and industry AMS initiatives. A focus on the provision of safe, clean hygienic feeds of the optimal feed form, quality and nutritional feed signature will be paramount. As a result gut health, and in turn animal health and welfare, will be supported. Any reduced reliance on antibiotics must be supported by a strong integrated farm management approach and real-time monitoring to enable informed decision-making.
Whilst applauding the AMS initiatives being implemented across the Agricultural sectors, it is imperative that a cohesive and coordinated approach is taken supported by both local and global regulatory harmonisation. Only through a coordinated value-add supply chain will antibiotic use be protected for those times of need ensuring that what YOU are having for dinner tonight and in to the future remains nutritious, safe and affordable.

Key Antimicrobial Stewardship Message
Delivering successful AMS outcomes requires an aligned collaborative One Health Approach.

Australian Government 2015, Australia's First National Antimicrobial Resistance Strategy 2015-2019, accessed 17 May 2018,
Australian Pesticides and Veterinary Medicines Authority, accessed 16 May 2018,

Notes:

S4

Antibiotics And Agriculture – The Retail Customer Perspective

Ms. Lauren Mackenzie[1]
1. *Coles, Hawthorn East, VIC, Australia*

Summary Outline
Consumers increasingly care about where their food comes from and how it is produced. Coles believes that retailers play an important role in supporting the responsible use of antibiotics in agriculture by supporting antimicrobial stewardship in our supply chains, ensuring that the health and welfare of animals is never compromised, and increasing consumer understanding on antibiotics and agriculture.

Key Antimicrobial Stewardship Message
Coles is continuing to work with producers and industry stakeholders to ensure best practice in animal production and the responsible use of antibiotics in agriculture.

1. https://www.coles.com.au/corporate-responsibility/sustainability/responsible-sourcing

Notes:

Lessons Learned From The Dawr Sponsored Proof-Of-Concept Antimicrobial Resistance Surveillance Projects In Australian Intensive Livestock

Prof. Darren Trott[1], Sam Abraham[2], David Jordan[3], Mark O'Dea[2], Pat Mitchell[4], Raymond Chia[1], Kylie Hewson[5]

1. *The University of Adelaide, Roseworthy, ACT, Australia*
2. *Antimicrobial Resistance and Infectious Diseases Laboratory, School of Veterinary and Life Sciences, Murdoch University, Murdoch, WA, Australia*
3. *NSW Department of Primary Industries, Wollangbar, NSW, Australia*
4. *PICs, Melbourne, VIC, Australia*
5. *Australian Chicken Meat Federation, North Sydney, NSW, Australia*

Summary Outline

Between 2016 and 2018, the Department of Agriculture and Water Resources in partnership with Australian Pork Limited, the Australian Chicken Meat Federation and Australian Eggs funded antimicrobial resistance surveillance projects in the pork, chicken meat and layer industries. For pork and chicken meat, samples were obtained from the caeca of healthy animals using a random sampling method following slaughter and submitted to primary (industry based) veterinary diagnostic laboratories for culture of the four main surveillance organisms, *E. coli*, *Salmonella*, *Enterococcus* and *Campylobacter*. For the layer industry, *Salmonella* isolates from shed drag swab samples submitted to *Salmonella* reference and other specialist laboratories were also obtained using a random sampling approach. Antimicrobial susceptibility testing using OIE recommended international methodology was undertaken at The University of Adelaide (*E. coli* and *Salmonella*) and Murdoch University (*Enterococcus* and *Campylobacter*). Whole genome sequencing of selected isolates undertaken by Murdoch University complemented the AST data. Results were initially presented to Industry for comment and feedback and were approved by the Australian Strategic Technical Advisory Committee on Antimicrobial Resistance at its June 2018 meeting. Apart from a number of interesting findings, the results generally reflect the antimicrobial usage patterns within each sector, including restrictions on use in each animal species and are comparable with international data from European and North America countries. In this presentation the results will be presented and the major issues associated with delivery of each project will be discussed.

Key Antimicrobial Stewardship Message

Antimicrobial Resistance Profiles did not identify any major industry concerns and provide a baseline for measurement of current and future antimicrobial stewardship programs. Collaboration between Government, Industry and Universities ensured the overall success of the program. Valuable lessons were learnt that should improve future surveillance programmes, including the development of automated surveillance.

Notes:

S4

Development Of An Online Antimicrobial Stewardship Training Program For Veterinarians: A National Collaborative Effort

Dr. Jacqueline Norris[1], Jane Heller, Justine Gibson, Laura Hardefeldt, Tim Hyndman, Torben Nielsen, Michael Ward, Merran Govendir, Paul Chambers, Glenn Browning, Darren Trott, Jacqueline Picard, Sarah Britton

1. University Of Sydney, NSW, Australia

Summary Outline

An online Veterinary Antimicrobial Stewardship (AMS) training program was developed with the aim of assisting veterinarians to reduce and rationalise their use of antimicrobial agents in clinical practice, to address the spread of antimicrobial resistance. This was a collaborative project, with representation from all eight Australian and New Zealand Veterinary Schools, supported by the Veterinary Schools of Australia and New Zealand (VSANZ) and funded by the Department of Agriculture and Water Resources.

A panel was created, consisting of academics with expertise in veterinary microbiology, pharmacology, epidemiology, public health and clinical practice. Resources were developed by the panel that were integrated within an interactive online system (B Online Learning Systems) allowing scenario-centred learning for veterinarians across all areas of practice.

The modules that were developed cover the following topics:

Module A: Antimicrobial resistance as a societal problem.
Module B: How does antimicrobial resistance develop?
Module C: How do antibiotics work and what is their relative importance?
Module D: Biosecurity and infection control in veterinary clinical practice – how do we stop transmission?
Module E: What evidence supports the diagnosis of a bacterial infection?
Module F: Drug selection and regimen – which drug is best for the patient and society?
Module G: Implementing an antimicrobial stewardship program in your practice.

The training programme has a release date of 30th June, 2018 and will be based on a Moodle® learning management system. Uptake and impact of the program will be evaluated after its release. Active collaboration between academics across all veterinary schools in Australia and New Zealand, producing post-graduate teaching material in an area that requires strong veterinary engagement represents a unique outcome.

Providing consistent teaching of critical concepts to veterinarians in practice is a model that could be expanded to other areas. A learner-centred, clinically focused resource available to graduates, provides the necessary tools and processes for practitioners to instigate significant practical and cultural change in the veterinary use of antimicrobial agents.

Key Antimicrobial Stewardship Message

Collaborative teaching of antimicrobial stewardship allows consistent strong messaging for all veterinary prescribers.

Notes:

Antimicrobial Prescribing Guidelines For Livestock Project

Dr. Melanie Latter[1], Dr. James Gilkerson[2]

1. *Australian Veterinary Association, St Leonards, NSW, Australia*
2. *Centre for Equine Infectious Disease, Melbourne, VIC, Australia*

This project is a key component of the veterinary industry's response to the global threat of antimicrobial resistance (AMR). To address the growing threat to human and animal health, all prescribers, users and suppliers of antimicrobials (AM) need to work together to improve antimicrobial stewardship (AMS), fight resistance and extend the usefulness of our lifesaving antibiotics.

In June 2015, the Commonwealth of Australia released the National Antimicrobial Resistance Strategy 2015-19 (the 'Strategy') aimed at addressing the issues of AMR in Australia. In response to Objective 2.1 of the Strategy (i.e. - Ensure that tailored, evidence based antibiotic prescribing guidelines are available for all sectors), the Australian Veterinary Association (AVA) and Animal Medicines Australia (AMA) agreed to work together to develop a set of AM prescribing guidelines for the treatment of pigs, poultry, sheep, horses, and cattle in Australia.

The guidelines are to be free and without restriction available to all veterinarians in Australia.

Currently, there are no national AM prescribing guidelines for livestock. Recommendations in the developed guidelines will be based on best practice peer-reviewed evidence, augmented where necessary with the best clinical practices; they will be guided by responsible prescribing principles, the need to demonstrate the veterinary professions' responsible approach and the right of livestock to receive appropriate treatment when required.

The availability of consistent national AM prescribing guidelines that are easily accessible, widely used and clinically valuable to veterinarians will be an important step in demonstrating responsible use of AM in the livestock sector. This is just one part of promoting a culture of responsible AMS in the veterinary profession and the broader livestock industry.

Notes:

S4

Are Humans And Wild Birds A Potential Risk For Transmitting Critically Important Antimicrobial Resistant Bacteria To Australian Livestock?

Dr. Sam Abraham[1], Tanya Laird[1], Rebecca Abraham[1], Mark O'Dea[1]
1. Murdoch University, Murdoch, WA, Australia

Summary Outline
Antimicrobial resistance (AMR) is one of the most prominent biosecurity issues affecting animals and humans in modern society. Globally, there is much debate concerning antimicrobial usage in livestock and its proportional impact on public health.
In recent decades, we have seen the emergence of last line drug resistant *E. coli* and *Salmonella* in livestock production systems in Asia, Europe and North America. This predominantly includes resistance to critically important drugs such as fluoroquinolones and extended spectrum cephalosporins among *E. coli* and *Salmonella* from pigs, poultry and cattle. The emergence of resistance to critically important antimicrobials in these regions is largely attributed to the direct use of such antimicrobials in livestock production systems.
Recent studies have suggested that the ecology of critically important AMR among *E. coli* and *Salmonella* isolated from Australian food-producing animals differs from that in other parts of the world. Cross-sectional studies have demonstrated that Australian livestock has low levels of critically important antimicrobial-resistant Gram-negative bacteria. This is attributed to Australia's unique geography, quarantine restrictions (restrictions on importation of livestock and fresh meat), and more importantly the tight regulations governing the use of critically important antimicrobials in livestock. This multifaceted approach has delivered promising results in minimising the occurrence of critically important antimicrobial resistant Gram-negative bacteria in food producing animals.
So far in Australia, there are no reports of resistance to carbapenems amongst *E. coli* and *Salmonella* from livestock. Resistance to extended spectrum cephalosporins and fluoroquinolones is very low among Australian livestock. Genomic characterisation of some of these critically important resistant *E. coli* isolates demonstrated that the majority of the isolates have previously been reported in humans and wild birds overseas. These *E. coli* strains have not been identified previously in Australia either from humans or livestock. Their low frequency among clinical *E. coli* isolates from Australian livestock suggests that they have potentially been introduced via human carriers or migratory birds. These findings demonstrate that emergence of critically important antimicrobial resistant bacteria in Australian production systems is likely due to introduction of such resistant bacteria via humans and other wildlife. Once introduced, these resistant bacteria could be maintained in livestock systems by the use of first line antimicrobials registered for use in livestock. In this presentation, we review recent reports of critically important antimicrobial resistant bacteria emerging in Australian livestock and the potential origins inferred using genomic analysis. In addition, we provide an overview of emerging critically important antimicrobial resistant bacteria in wild birds.

Notes:

Surveillance For Antimicrobial Resistance Of Bovine Respiratory Disease Pathogens

Joseph McMeniman[1], Des Rinehart1, Prof. Darren Trott[2]
1. *Meat & Livestock Australia, Fortitude Valley, QLD, Australia*
2. *University of Adelaide, Adelaide, SA, Australia*

Summary Outline
Antimicrobials are important for feedlot producers to ensure the health and welfare of animals in their care. The term antimicrobial generally refers to medicines that act to selectively kill or inhibit the division and multiplication of bacteria. Antimicrobial resistance (AMR) refers to the acquired ability of bacteria to survive in the presence of an antimicrobial that previously was able to kill or inhibit the growth of the bacteria. Antimicrobial stewardship (AMS) describes all those practices designed to reduce the need for antimicrobial use and to ensure that when antimicrobials are needed they are used in a way that maximises efficacy while minimising adverse effects including the selection of antimicrobial resistance. AMS includes all those measures to refine, reduce and replace antimicrobial use. The Australian feedlot industry is committed to antimicrobial stewardship and is aligning with the Antimicrobial National Antimicrobial Resistance Strategy (Australian Government 2015).
Bovine respiratory disease is the leading cause of morbidity and mortality of Australian feedlot cattle. A number of bacterial species have been recognised as important to the BRD complex; these include *Mannheimia haemolytica*, *Pasteurella multocida*, and *Histophilus somni*. Antimicrobials are primary treatments against these pathogens. Antimicrobial resistance (AMR) monitoring and surveillance is the yardstick whereby the successful implementation of antimicrobial stewardship principles is effectively measured. It is important that surveillance of pathogens and the antimicrobial sensitivity of these pathogens are regularly assessed.
Aligned with the release of the Antimicrobial stewardship guidelines for the Australian cattle feedlot industry in March, 2018, Meat & Livestock Australia will commence antimicrobial resistance surveillance of bovine respiratory pathogens in 2018/2019. The research will be funded by grain-fed levies and matching Australian government R&D contributions in consultation with the Australian Lot Feeders Association. Key objectives of the project will include:

1. Develop guidelines for feedlots to ensure best practice collection of specimens for antimicrobial resistance surveillance of BRD pathogens.
2. Conduct case studies at commercial feedlots with different antimicrobial usage patterns of how surveillance can refine choice of treatment for BRD pathogens.
3. Determine antimicrobial resistance of bovine respiratory disease pathogens to antimicrobials used in beef cattle veterinary medicine.
4. Disseminate recommendations to each feedlot based on surveillance to refine antimicrobial use in consultation with each feedlot's consultant veterinarian.
5. Disseminate project outcomes to feedlot veterinarians and commercial feedlots to drive adoption of routine surveillance in their internal antimicrobial stewardship programs.

Key Antimicrobial Stewardship Message
A Meat & Livestock Australia project will commence surveillance for antimicrobial resistance of bovine respiratory disease pathogens across the Australian feedlot industry in 2018 & 2019.

Notes:

CS1

Antimicrobial Susceptibility Of Bacteria From Healthy Cattle And Sheep At Slaughter

Dr. Robert S Barlow[1], Kate E McMillan[1], Lesley L Duffy[1], Narelle Fegan[2], David Jordan[3], Glen E Mellor[1]

1. *Agriculture & Food, CSIRO, Brisbane, QLD, Australia*
2. *Agriculture & Food, CSIRO, Werribee, VIC, Australia*
3. *NSW Department of Primary Industries, Wollongbar, NSW, Australia*

Summary Outline

Australia ranks in the top three exporters of beef, veal and sheepmeat globally with a reputation for providing high quality, safe and wholesome foods. Continued access to preferred export markets for Australian beef and sheep producers is paramount and will rely on the industry's ability to provide internationally comparable data relating to the safety and quality of food. Antimicrobials are used in Australia's beef and sheep production systems, however the overall use is low by international standards and with low reliance on critically important antimicrobials. This reflects the low stocking densities in ruminant production systems, the use of preventative measures (e.g disease exclusion, vaccination and herd management) and conservative drug registration. Australia does not currently have an ongoing surveillance system for antimicrobial resistance (AMR) in cattle or sheep production systems or in foods derived from these animals, instead relying on point prevalence surveys to identify trends in the development of AMR. In the largest survey of bacteria from 1500 Australian beef cattle, dairy cattle and veal calves at slaughter conducted to date, a low level of AMR was observed and a general absence of resistance to antimicrobials of critical and high importance in human medicine was noted. Furthermore, there is minimal evidence that specific production practices, such as feedlotting, are responsible for disproportionate contributions to AMR development. A complimentary survey of AMR in bacteria from 800 Australian sheep is currently underway, with the outcomes expected to mirror the cattle survey and provide a baseline from which antimicrobial stewardship considerations can be formulated. Preliminary findings from the sheep AMR survey will be discussed. Additionally, Meat & Livestock Australia will oversee a repeat of the beef AMR survey with reporting expected in 2020. The investment by the industry into surveys for AMR in beef and sheepmeat production systems continues to support the premiumisation of Australian red meat products.

Key Antimicrobial Stewardship Message

Point prevalence surveys of AMR in beef and sheepmeat production systems allow the emergence of AMR to be identified and in conjunction with antimicrobial stewardship programs provide the basis upon which the quality of current antimicrobial use is enhanced.

Acknowledgments: The authors gratefully acknowledge funding from Meat & Livestock Australia and the Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Notes:

Saccharomyces Cerevisiae Fermentation Metabolites: Potential Solution To Antimicrobial Stewardship In Food Animal Production

Jared K. Serem[1], Faith Wakibia[1], George M. Kamande[1], Don R. McIntyre[2], Dr. Peter Johnston[1]

1. *Diamond V, Limuru, Kenya*
2. *Global Research & Technical Services, Diamond V Mills, Cedar Rapids, Iowa, USA*

Summary Outline

Antimicrobial resistance (AMR) is a severe risk to global health and food security. In 2013, the Centre for Disease Control (CDC) estimated that over 2,000,000 people get infected with drug resistant bacteria annually in the USA alone. One of the main causes of AMR is increased antibiotic use as growth permitters in animals at subtherapeutic doses for prolonged durations. National Antimicrobial Resistance Monitoring System (FDA) reported an increased multi drug resistance in pathogens of public health importance; *Salmonella* increased by 3% between 2014 and 2015. The snowballing trends of such resistance have prompted the American and European regulators to sternly control the conventional use of antibiotics as growth promoters in animal husbandry. Similarly, this has led to the advocation of effective antimicrobial stewardship programs through strict regulation of antimicrobials use, although this has been difficult to achieve. FDA in an effort to lessen the AMR, supports the use of antibiotics only when necessary to treat, prevent or control diseases. This can be accomplished through effective biosecurity and use of feed additives that offer alternative to antimicrobial use. Among the feed additives offering an alternative to antibiotics is the Yeast Culture (YC) (AFCO - 96.8). The objective of this paper therefore is to demonstrate how *Saccharomyces cerevisiae* (SC) derived fermentation metabolites potential to promote antimicrobial stewardship in food animal production. YC is a SC fermentation derived product with potent metabolites proven via peer-reviewed research to support animal health, production and food safety in all classes of animals. The metabolites when incorporated into animal diet positively impact their health by promoting gut microbiota, healthy intestinal morphology and balancing immunity enabling the animals realize their full genetic potential and enhanced animal product safety. For instance, dietary inclusion of the YC have been reported to reduce the Salmonella incidence by up to 60% in layers. There is also evidence of reduced shedding, virulence and reversal of antimicrobial resistance indicated by a 45% reduction of hilA gene in AMR pathogens thus potentiating antimicrobial stewardship.

Key Antimicrobial Stewardship Message

Yeast culture fermentation metabolites enhances animal health and increases pathogen susceptibility to antimicrobials thus potentiates Antimicrobial stewardship.

1. Centers for Disease Control and Prevention (CDC), 2014. Antibiotic resistance threats in the United States, 2013. Atlanta: CDC; 2013.
2. Gao, J., Zhang, H.J., Yu, S.H., Wu, S.G., Yoon, I., Quigley, J., Gao, Y.P. and Qi, G.H., 2008. Effects of yeast culture in broiler diets on performance and immunomodulatory functions. Poultry Science, 87(7), pp.1377-1384.
3. National Antimicrobial Resistance Monitoring System (NARMS)., 2015. Salmonella Prevalence and Resistance. 2015 Integrated Report. https://www.fda.gov/AnimalVeterinary/SafetyHealth/AntimicrobialResistance/NationalAntimicrobialResistanceMonitoringSystem/ucm059103.htm.
4. Rubinelli, P., Roto, S., Kim, S., Park, S.H., Pavlidis, H.O., McIntyre, D. and Ricke, S.C., 2016. Reduction of Salmonella Typhimurium by fermentation metabolites of Diamond V Original XPC in an in vitro anaerobic mixed chicken cecal culture. Frontiers in veterinary science, 3, p.83.

Notes:

CS1

Focused Antibiotic Stewardship For The Chicken Industries

Dr. Christopher J Morrow[1]
1. *Bioproperties, Ringwood, VIC, Australia*

Summary Outline
Antibiotic prophylaxis was common in intensive animal production soon after the beginning of the modern antibiotic era. The broiler industry became dependant on antibiotics for optimal economic production (probably induced by inclusion of antibiotics in selection diets)- so called antibiotic growth promoters. *Mycoplasma* effects in breeder, layer and broiler production were often prophylactically prevented by mediation (although this did not stop infection). Further use of antibiotics around hatch and the beginning of lay was often routinely done. Finally free range layers often need medication to prevent *Campylobacter hepaticus* disease. Broilers also were medicated with ionophores for coccidiosis control with the added effect of decreasing *Clostridium perfrigens* overgrowth in the gut and biliary tree (an antimicrobial effect). This paper focuses on how each of these uses of antibiotics has been phased out.
Reversal of genetic selection by removal of antibiotics occurred in the major broiler breeding companies before the turn of the mellenium. This rapidly lead to a decrease in necrotic enteritis in the old world when antibiotics were removed from feed diets. Also some breeding companies conducted selection on coccidiosis vaccinated elite broilers. It is self-evident to state that poultry perform best on the diets used for selection and this is what is being seen.
Control of *Mycoplasma* infections effects by vaccination (live vaccines) has decreased antibiotic dependence of the poultry industries especially the meat industry (and is a model for other animal industries). This is a massive decrease in total antibiotic usage. In Australia these vaccines have been available to the poultry industries for the last 20 years and sees us leading the world in *Mycoplasma* control in chickens. The vast majority of production in the traditional chicken based industries use no antibiotics at all (except for rare occasions where therapeutic intervention is needed). One factor that also helped is that veterinary income in the Australian chicken industries was not dependant on drug supply sales.
Coocidiosis control by vaccination also decreases ionophore use and this is being investigated by producers currently.
Some specific problems still remain. Multi-resistant plasmids in particular can have resistance determinants to heat, desiccation, disinfectants and heavy metals. The continued use of these interventions (hygiene and heavy metals in diets) would presumably continue to co-select for antibiotic resistance genes to some extent. Some novel solutions are appearing including some products claiming to decrease resistance element carriage in treated flocks.
Live bacterial vaccines have had some distinct advantages over killed vaccines including broader range of protection and less selective pressure for escape mutants in the field as well as being more welfare friendly. They are a logical choice when challenges can not be reliably excluded by biosecurity (especially with mycoplasma airborne challenges over 10km) at the commercial level. Availability of *Mycoplasma* free replacement stock is also a big advance making these results possible.

Key Antimicrobial Stewardship Message
By analysing existing antibiotic prophylaxis in an industry specific alternatives can be substituted to replace usage.

Notes:

Change Management Reduces Antibiotic Use On Pig Farms

Peter McKenzie[1], **Dr. Richard R Carter**[2]
1. *McSwine, Seymour, VIC, Australia*
2. *Kemin (Aust.) Pty. Ltd., Killara, NSW, Australia*

Summary Outline
A Clostridial syndrome in suckling & weaner pigs, with risk factors of high injectable ceftiofur use and poor hygiene, presented an opportunity to engage in management change to improve pig health and reduce ceftiofur use. The farms with successful outcomes had managers with above average ability to understand the background science, implement the changes, and revise the programme over time in consultation with the veterinarian. All managers also had experience in logistics and/or in a work environment with sound process control. We report on 4 farms ranging from 250 to 2,000 breeding sows.
Proposed management changes included moving from continuous flow to all-in-all-out from farrow to finish (AIAO), batch disinfection with biofilm control, pigs housed at the appropriate stocking density and between upper and lower critical temperatures as well as with adequate ventilation. Piggery staff were involved and engaged with the programmes. The anti-Clostridial action of Bacillus subtilisPB6 (CLOSTAT™, Kemin) was used on all farms.
The need to achieve results without the opportunity to scientifically test each variable, and in some cases without properly recorded farm data, meant that only estimates of management and response changes were available. The 4 farm managers were interviewed using a questionnaire to determine the extent of adoption of the management changes and the pig health and production responses from prior to, and subsequent to, the programme's introduction. Time on the programme varied from 18 months to 6 months.
Pig health and production responses included changes in day 1-7 diarrhoea, day 8 pasty diarrhoea, necrotic enteritis, injectable antibiotic use, pre-weaning mortality, proportion of ill-thrifty weaner pigs, post-weaning mortality, liveweight responses, in-feed antibiotic use, veterinary supply costs, and impact on piggery staff labour time.
The changes that could be made were dictated in part by facility capability and deficiencies. However, the health and production changes were positive across all farms and were associated with cost and labour savings. All farms remain on the programme, and all are working towards, or have implemented AIAO.
The conclusion is that provided there is a good relationship between a committed, competent veterinarian, and a committed, competent manager, the programme can be successfully effective. Programme failure relates to implementation failure. The programme is now being utilised in Asia.

Key Antimicrobial Stewardship Message
Provided there is a good relationship between a committed, competent veterinarian, and a committed, competent manager, change management programmes can be successfully effective. Programme failure relates to implementation failure.

Notes:

CS1

Dairy Australia's Change Management Programs Supporting Improved Antimicrobial Stewardship.

Dr. Mark Humphris[1]
1. *Dairy Australia, Southbank, VIC, Australia*

Summary Outline
Dairy Australia is the national service body for the Australian dairy industry investing across the dairy supply chain aiming to identify the best opportunities for collective action. Dairy Australia's first strategic priority is to support profitable farms. This priority has driven the development of a range of change management programs in the animal health and welfare to optimise the unit cost of production and dairy cattle welfare.
Countdown, Dairy Australia's national milk quality program, was the first industry backed, nationally based levy funded program. Since 1999, Countdown has developed training and resources for farmers and their advisers (veterinarians, field officers, and milking machine technicians) to build their capability to reduce mastitis and optimise milk quality on Australian dairy farms. Consultation with milk processors have also focused Countdown activities on the changing market and customer requirements with residues and food safety. Reducing clinical and sub-clinical mastitis reduces the need for antimicrobials. Recent investment in resources to support improved dry cow management further support improved decision making by veterinarians and farmers at this critical control point of the lactation process. A web-based dry cow consult tool, updated technotes, videos on dry cow management and discussion groups have been designed to optimise the use of antimicrobials at dry off and ultimately reduce the reliance on whole herd antibiotic therapy.
Other Dairy Australia change management animal health programs such as 'Rearing Healthy Calves', 'Healthy Hooves' and 'Transition Cow Management' have similarly supported improved health outcomes to reduce antimicrobial usage and improve stewardship. Investment in resources to support improved awareness and planning with Biosecurity are being developed and are critical elements underpinning higher level animal health planning and antimicrobial stewardship.
Dairy Australia's investment in improving productivity through optimising animal health and welfare has allowed the development of evidenced based, peer reviewed resources that support improved health outcomes. These change management programs now provide a great platform for more overt antimicrobial stewardship messaging to support industry and government AMR strategy. Maintaining investment is these programs and improving antimicrobial stewardship now strongly aligns with Dairy Australia's third strategic priority in having a 'Trusted Dairy Industry' which seeks to promote our longer term 'license to operate'. Despite historic and current investment to improve antimicrobial stewardship, there are still significant opportunities for improved AMR risk management.

Key Antimicrobial Stewardship Message
Dairy Australia invests in a range of animal health programs that significantly contribute to prudent antimicrobial stewardship, within a continuous improvement framework.

Notes:

Population Wide Assessment Of Antimicrobial Use In Companion Animals Using A Novel Data Source – A Cohort Study Using Pet Insurance Data

Laura Y Hardefeldt[1, 2], Joshua Selinger[3], Mark A Stevenson[1], James R Gilkerson[1, 2], Helen K Crabb[1, 2], Helen Billman-Jacobe[1, 2], Karin A Thursky[2], Kirsten E Bailey[1, 2], Magdoline Awad[3], Glenn F Browning[1, 2]

1. *Asia-Pacific Centre for Animal Health, Melbourne Veterinary School, University of Melbourne, Parkville, VIC, Australia*
2. *National Centre for Antimicrobial Stewardship, Peter Doherty Institute, Carlton, VIC, Australia*
3. *PetSure (Australia) Pty Ltd, Chatswood, NSW, Australia*

Summary Outline

Background: Antimicrobial use in veterinary practice is under increasing scrutiny as a contributor to the rising risk of multidrug resistant bacterial pathogens. Surveillance of antimicrobial use in food animals is extensive, but population level data is lacking for companion animals. The lack of census data restricts cohorts to those attending veterinary practices, precluding aggregation of data from large numbers of animals independent of their need for veterinary intervention. The objective of this study was to investigate the exposure of companion animals to antimicrobials at a population level.

Methods: A retrospective cohort study was performed using a pet insurance database. The rate of antimicrobial prescribing, and the rate of prescribing of critically important antimicrobials, was measured in a large population of dogs (813,172 dog-years) and cats (129,232 cat-years) from 2013 - 2017. Factors affecting the rate of prescription were explored using Poisson regression.

Results: There were 222,069 dogs and 37,732 cats registered in the database in 2013. This increased to 385,915 dogs and 60,807 cats over the study period to the end of 2016. A total of 611,788 courses of antimicrobial treatment were prescribed. The incidence rate of antimicrobial prescribing was 5.8 prescriptions per 10 dog years (95% CI 5.8-5.9 per 10 dog years) and 3.1 prescriptions per 10 cat years (95% CI 3.1-3.2 per 10 cat years). Claims were submitted on average for 35% of insured dogs and 21% of insured cats each year. Among animals that had an insurance claim submitted, other than for routine preventative health measures (vaccination, parasite control, desexing), 53% received systemic antimicrobials (48% of cats and 54% of dogs). Critically important antimicrobials accounted for 8% of all the antimicrobials prescribed over the 4-year study. With the exception of third-generation cephalosporins in cats, no other critically important antimicrobial represented more than 5% of the antimicrobial use in a species. Cats were 4.8-fold more likely than dogs to be prescribed third-generation cephalosporins. A seasonal influence on prescribing was seen for dogs and cats. There was a small, but significant, reduction in the year-on-year rate of exposure to antimicrobials, after adjusting for species (RR 0.99, 95% CI 0.986-0.997, P=0.002).

Conclusions: The level of antimicrobial exposure in dogs and cats was less than half that for the coincident human community. Data such as these provide a unique opportunity to monitor antimicrobial prescribing in veterinary medicine, which is a critical component of optimal antimicrobial stewardship. While restricting all off-label use of antimicrobials in animals in Australia is likely to be detrimental to antimicrobial stewardship measures, and animal welfare in general, it may be necessary to restrict the use of third-generation cephalosporins in this manner to reduce the inappropriate use of this antimicrobial.

Key Antimicrobial Stewardship Message

Prescribing rates of antibiotics in dogs and cats are less than half of that in humans.

Notes:

CS2

Resistomes And Associated Risks In Environmental Sites Of A Veterinary Teaching Hospital Intensive Care Unit

Kanishka I Kamathewatta[1], Rhys N Bushell[1], Neil D Young[2], Mark A Stevenson[2], Helen Billman-Jacobe[2], Glenn F Browning[2], Marc S Marenda[1]

1. *Asia-Pacific Centre for Animal Health, Department of Veterinary Biosciences, Faculty of Veterinary and Agricultural Sciences, The University of Melbourne, Werribee, VIC, Australia*
2. *Asia-Pacific Centre for Animal Health, Department of Veterinary Biosciences, Faculty of Veterinary and Agricultural Sciences, The University of Melbourne, Parkville, VIC, Australia*

Summary Outline

Emergence, persistence and circulation of drug-resistant pathogens and/or clinically important antimicrobial resistance genes (ARGs) in veterinary facilities pose major risks to animal and human health. Better understanding of environmental antimicrobial resistance (AMR) is necessary for controlling these risks. This study explored environmental resistomes and microbiomes associated with a veterinary teaching hospital intensive care unit (ICU), to improve current routine environmental surveillance programmes and biosecurity practices.

Environmental swabs from various ICU sites were plated on agar media containing antibiotics for selection and presumptive identification, or minimally enriched in broth for whole DNA extraction and metagenomic sequencing with an Oxford Nanopore MinION device. Taxonomic, ARG and mobile genetic element (MGE) assignments were performed with the metagenomic classifier Kraken and the searchable sequence databases Resfinder and ISfinder. ARGs were classified into potentially high-risk or low-risk groups, according to their association with pathogenic genera or MGEs.

The ICU cages (IC) and the laundry trolley (LT) that was used to collect dirty bedding from the IC contained the same most abundant taxa, which included the genera *Escherichia*, *Enterococcus*, *Bacillus* and *Enterobacter*. However, the mop bucket (MB) used to clean the ICU floor contained somewhat different populations, with more abundant *Serratia* and *Aeromonas* possibly due to the presence of diluted detergents. Potentially high-risk ARGs detected in IC, LT and MB included aminoglycoside transferases, extended-spectrum beta-lactamases (ESBL), sulphonamide resistance synthases, macrolide esterases and tetracycline efflux pumps. The IC shared 77% and 41% of these high-risk ARGs with the LT and the MB, respectively. Waste collection points (LT, MB) had much higher relative abundances of high-risk ARGs, suggesting amplification and selection of ARG-carrying bacteria in these environments. In contrast, a control floor surface from an office corridor that had no animal contact did not contain any of these ARGs. Multidrug resistance and ESBL genotypes detected by metagenomic analyses matched the phenotypes of microorganisms cultured on selective agar plates, suggesting that these resistances can be effectively expressed in the environment. In conclusion, we have documented the presence of clinically important and potentially transferrable ARGs in the veterinary ICU environment and identified waste collection points as significant reservoirs for these high-risk ARGs, which can aggravate infectious disease risks for hospitalised patients.

Key Antimicrobial Stewardship Message

Metagenomic analysis of environmental samples could be used to improve routine surveillance programmes and biosecurity practices in veterinary hospitals, ultimately helping to prevent overuse of antimicrobials in animals.

Notes:

Using Natural Language Processing And Vetcompass To Understand Antimicrobial Usage Patterns In Australia

Brian Hur[2, 1], Laura Hardefeldt[1], Karin Verspoor[2, 3], Tim Baldwin[2], James Gilkerson[1]

1. *Asia-Pacific Centre for Animal Health, Melbourne Veterinary School, University of Melbourne, Parkville, VIC, Australia*
2. *School of Computing and Information Systems, University of Melbourne, Parkville, VIC, Australia*
3. *Health and Biomedical Informatics Centre, University of Melbourne, Parkville, VIC, Australia*

Summary Outline

Background: There is currently little understanding of antimicrobial usage patterns in veterinary clinics in Australia. Knowledge of antimicrobial usage patterns are critical in the implementation and monitoring of antimicrobial stewardship programs. Natural Language Processing (NLP) of clinical texts and machine learning techniques have been used in other sectors to facilitate this process1.

Methods: VetCompass Australia2 collects medical records from 181 clinics in Australia (as of May 2018). These records contain detailed information regarding the medications dispensed in the form of unstructured medical text. We have collated and analysed the free text fields of 3,053,015 veterinary consultation records.

Results: Notes, written prescriptions, and inventory items dispensed were successfully extracted for each consultation from the VetCompass dataset. The data is, however, unstructured and accurate antimicrobial usage patterns cannot be directly queried in this format. Creating a structured dataset would enable the VetCompass data to be used to describe what is being prescribed in what quantities and how often in veterinary clinics in Australia. Automatic text analysis can overcome the challenges of manual labelling of such data, enabling large-scale extraction of key antimicrobial usage information accurately in a structured format to allow analysis. We approach this through application of machine learning methods, and train a model using a set of expert-annotated texts.

We bootstrap this by creating structured labels for inventory items which are mapped to various consultations, as annotating sufficient records by hand is time and cost prohibitive. Various machine learning models can then be tested compared and combined with rules-based approaches to extract and label the data from the text.

Producing adequate and appropriately labelled data enables training and testing of the accuracy from the automated extraction of the usage patterns. Using this information, algorithms can be optimised to achieve the highest-level accuracy possible before using the fine-tuned model on the remainder of the consultation records to assess antimicrobial use patterns.

Conclusion: While enough data exists to create algorithms to automatically extract the medications dispensed, continued work is needed to label sufficient data to train and test the accuracy of these models.

Key Antimicrobial Stewardship Message

Creating an NLP model using VetCompass can help monitor current and ongoing Antimicrobial usage patterns in near real time.

1. Tao C, Filannino M, Uzuner Ö. Prescription extraction using CRFs and word embeddings. J Biomed Inform 2017;72:60–66.
2. McGreevy P, Thomson P, Dhand NK et al. VetCompass Australia: A National Big Data Collection System for Veterinary Science. 2017;15.

Notes:

CS2

Progress Towards A Point-Of-Management Diagnostic Platform Technology Suitable For Veterinary Applications

Michael G Mason[1], Jillian Templeton[2], Yiping Zou[1], Conny Turni[3], Pat J Blackall[3], Jimmy R Botella[1]

1. *University of Queensland, St.Lucia, QLD, Australia*
2. *Department of Agriculture and Fisheries (Qld), EcoSciences Precinct, Dutton Park, QLD, Australia*
3. *Queensland Alliance for Agriculture and Food Innovation, University of Queensland, St.Lucia, QLD, Australia*

Summary Outline

This presentation covers work being undertaken in a series of collaborations involving researchers from the University of Queensland and the Department of Agriculture and Fisheries (Qld). We have focussed on the development of low-cost and easy-to-perform point-of-management (POM) tools that make powerful molecular biology methods accessible in non-laboratory settings such as abattoirs and intensive animal production facilities. Molecular biology tools offer sensitivity, specificity and rapidity over more traditional pathogen detection methods; however, to date, molecular biology-based pathogen detection systems typically require highly trained technicians, expensive equipment and involve many liquid-handling steps. Our work has sought to overcome these technical bottlenecks and produce platform technologies that are robust and suitable for in-the-field applications. We have already developed an easy-to-perform method to purify nucleic acids from complex samples that has just three steps and takes less than 30 seconds to perform. We have shown that this novel rapid extraction technology can successfully purify the DNA of *Actinobacillus pleuropneumoniae* from a lung swab collected from an infected pig. In our current work, we have validated the use of this dipstick extraction technology for chicken carcass rinse (a challenging matrix with a high load of problematic fats and proteins). By coupling our rapid nucleic acid purification technology with a simple centrifugation and heating step, we can reliably detect 12 cells/ml (or greater) of *Campylobacter jejuni* and *Campylobacter coli*. To complement the rapid nucleic acid technology, we have now developed a low-cost, easy-to-operate POM electronic device that will perform and monitor isothermal DNA amplification in real-time, interpret the data and send the result (positive or negative) to the user's phone. A key feature of this approach is that the automated reading removes the need for any human interpretation and therefore eliminates the possibility of user bias.

Key Antimicrobial Stewardship Message

We believe that these innovative platform technologies can be utilised to create rapid, specific and sensitive POM systems that will support antimicrobial stewardship.

Notes:

Antimicrobial Susceptibility Testing By Australian Veterinary Diagnostic Laboratories

Laura Y Hardefeldt[1, 2], Marc Marenda[1], Helen K Crabb[1, 2], Mark A Stevenson[1], James R Gilkerson[1, 2], Helen Billman-Jacobe[1, 2], Prof. Glenn F Browning[1, 2]

1. *Asia-Pacific Centre for Animal Health, Melbourne Veterinary School, University of Melbourne, Parkville, VIC, Australia*
2. *National Centre for Antimicrobial Stewardship, Peter Doherty Institute, Carlton, VIC, Australia*

Summary Outline

Background: The national strategy for tackling antimicrobial resistance highlights the need for antimicrobial stewardship in veterinary practice and for surveillance of antimicrobial susceptibility in veterinary pathogens. Diagnostic laboratories have an important role in facilitating both of these processes, but it is not clear whether data from veterinary diagnostic laboratories is similar enough to allow for compilation and if there is consistent promotion of appropriate antimicrobial use embedded in the approaches of different laboratories to susceptibility testing.
Methods: A cross-sectional study of antimicrobial susceptibility testing and reporting procedures by Australian veterinary diagnostic laboratories was conducted in 2017 using an online questionnaire.
Results: All veterinary diagnostic laboratories in Australia completed the questionnaire. Kirby-Bauer disc diffusion was the method predominantly used for antimicrobial susceptibility testing and was used to evaluate 86% of all isolates, although two different protocols were used across the 18 laboratories (CLSI 15/18, CDS 3/18). Minimum inhibitory concentrations were never reported by 61% of laboratories. Common isolates were consistently reported on across all species, except for Gram negative isolates in pigs, for which there was some variation in bacterial species identified. There was considerable diversity in the panels of antimicrobials used for susceptibility testing on common isolates, and no consistency was apparent between laboratories for any bacterial species.
Conclusion: We recommend that that nationally agreed and consistent antimicrobial panels for routine susceptibility testing should be developed and a uniform set of guidelines should be adopted by veterinary diagnostic laboratories in Australia.

Key Antimicrobial Stewardship Message

Nationally agreed guidelines and consistent panels for routine susceptibility testing are needed for surveillance and stewardship.

Notes:

CS2

Delayed Prescribing As An Antimicrobial Stewardship Tool In Veterinary Practice

Kirsten E Bailey[1, 2], Laura Y Hardefeldt[1, 2], Helen K Crabb[1, 2], James R Gilkerson[1], Helen Billman-Jacobe[1, 2], Glenn F Browning[1, 2]

1. *Asia-Pacific Centre for Animal Health, Department of Veterinary Biosciences, Melbourne Veterinary School, University of Melbourne, Parkville, VIC, Australia*
2. *National Centre for Antimicrobial Stewardship, Peter Doherty Institute, Carlton, VIC, Australia*

Summary Outline

The more antimicrobials are used the greater the selection pressure for resistant bacteria. An evidence-based strategy to reduce unnecessary antimicrobial prescribing in human medicine is delayed prescribing. This is a wait-and-see approach, where patients are asked to delay filling a prescription to see if symptoms improve or resolve without antimicrobials. Studies of barriers to antimicrobial stewardship in veterinary medicine have found that veterinarians feel pressured to prescribe antimicrobials because of client expectations of some form of treatment, competition between practices, the inhibitive cost of microbiological culture and sensitivity, or concerns about failure even when infection is unlikely. Delayed prescribing provides an alternative to immediate prescription, no antibiotics at all, or the time and cost of re-consultation. This study aimed to assess whether the use of delayed prescribing reduced the use of antimicrobials when implemented in veterinary medicine.

A delayed prescription template was developed and provided to companion animal practices participating in a veterinary antimicrobial stewardship trial in Australia. Guidelines for case selection were provided to the veterinarian and cases deemed appropriate for delayed prescribing included draining abscesses in cats, feline respiratory tract disease, feline urinary tract disease, kennel cough, ear infections, skin infections and cases of diarrhoea and vomiting. Where a suitable case was selected for delayed prescribing, the pet owner was provided with material about why antimicrobials are not needed immediately, information on the expected course and duration of disease, symptomatic and supportive treatment that can be provided at home, and advice on when to fill the antibiotic prescription or seek veterinary attention if symptoms are not improving. Outcomes that will be assessed are total antimicrobial usage, the provision of delayed prescriptions and whether delayed prescriptions were filled.

This is the first study to assess the use of delayed prescription in veterinary medicine as a method of reducing inappropriate antimicrobial use. Interpretation of these data will determine whether delayed prescription provides a useful strategy for reducing antimicrobial use in veterinary medicine.

Key Antimicrobial Stewardship Message

Delayed prescribing can be adapted for use in veterinary practice.

Notes:

KEYNOTE:

Veterinary Antimicrobial Stewardship In North America

Professor John Prescott[1]
1. *University of Guelph, Ontario, Canada*

Major changes are occurring in veterinary antimicrobial stewardship (AMS) in food animals in the USA and Canada. Advances have been the end of the use of medically important antimicrobials (MIAs) as growth promoters and bringing all MIAs for food animals under veterinary prescription in Canada (2018) or MIAs in feed or water under veterinary prescription (2017) in the USA. The USA proposes bringing all MIAs for food and companion animals under veterinary oversight, to target duration of preventive use for food animals, and to develop a strategy for companion animals. Both countries are taking a "One Health" approach as part of their national strategies on addressing AMS. Federal-state or -province jurisdictional issues have impeded development and implementation of regulation-based stewardship approaches. Veterinary regulatory bodies in some of the larger states and provinces are active in AMS. Both the voluntary-membership American and Canadian Veterinary Medical Associations independently are heavily engaged in promoting AMS as, variably, are the different veterinary "specialty" groups. Regulatory changes and market demand are markedly reducing use of antimicrobials in food animals. The promotion of veterinary AMS is happening at an increasing pace.

Notes:

S5

Veterinary Antimicrobial Stewardship In Australia

Dr Stephen Page[1]

1. *Drug Discovery, Research and Development, Advanced Veterinary Therapeutics, Newtown, NSW, Australia*

Although the value of antimicrobial stewardship (AMS) in veterinary practice was outlined at the Annual Conference of the Australian Veterinary Association in Perth in 2000, veterinary AMS practices had been progressively implemented by the Australian livestock industries since the 1970s.
Early drivers for veterinary AMS followed the clear recognition that animal health and welfare are directly related to productivity and enterprise survival. Preventing disease meant understanding the multitude of risk factors that predisposed to adverse health outcomes and developing and implementing a risk management plan – which is now an essential component of AMS.
Contrary to many prevalent beliefs, successful animal production relies on high standards of health and welfare, which in turn is dependent on continuous attention to infection prevention and control, resilient animals (ability to resist infectious disease challenge), nutrition, genetics, vaccination, external biosecurity – all elements requiring sophisticated management. Successful animal production does not depend on the routine use of antimicrobial agents.
This presentation will describe the 5R (responsibility, review, reduce, refine, replace) framework of AMS and highlight the importance of everybody accepting their responsibilities as antimicrobial stewards, the key value of measurement, and the essential contribution of continuous improvement.

Key Antimicrobial Stewardship Message
Effective antimicrobial stewardship requires a culture of continuous improvement within a 5R framework.

Notes:

Antimicrobial Stewardship Guidelines For The Australian Cattle Feedlot Industry

Dr. Kev Sullivan[1]
1. *Bell Veterinary Services , Bell, QLD , Australia*

Summary Outline

The Australian feedlot industry is committed to promoting responsible use of antimicrobials that maximise animal health and welfare outcomes, whilst preserving effectiveness of antimicrobial classes in human medicine. Antimicrobial stewardship describes practices designed to reduce the need for antimicrobial use and to ensure that when antimicrobials are required, they are utilised in a way that maximises efficacy while minimising adverse effects including the development of antimicrobial resistance. Thus antimicrobial stewardship includes all those measures to refine, reduce and replace antimicrobial use.

Meat & Livestock Australia in consultation with the Australian Lot Feeders Association published Antimicrobial stewardship guidelines for the Australian cattle feedlot industry in March, 2018. The guidelines were written by leading antimicrobial stewardship experts, microbiologists and feedlot veterinarians. The release of these guidelines aligns with national initiatives to preserve the effectiveness of antimicrobials for people and animals, and specifically Australia's First National Antimicrobial Resistance Strategy (2015-2019) that encourages animal industries to develop stewardship programs. The guidelines have been distributed to all National Feedlot Accreditation Scheme (NFAS) feedlots and are designed for use by veterinarians and feedlot producers.

The '5R' framework of antimicrobial stewardship is the central core of the guideline (Responsibility, Review, Reduce, Refine, Replace). Several key recommendation are involved in developing an antimicrobial stewardship plan for commercial feedlots:

- Engage a veterinarian who has expertise in feedlot production and medicine and develop an
- antimicrobial stewardship plan for your feedlot.
- Ensure that a 'prescribed drug list' and 'documented treatment protocol' has been developed by the veterinarian.
- Have an antimicrobial stewardship team. Include feedlot management and staff, the consulting veterinarian, feedlot nutritionist and stock feed manufacturer on this team. Inform and educate everyone about the importance of stewardship and their specific roles and responsibilities.
- Decisions on use of medically important classes of antimicrobials must be risk and science-based and discussed between the feedlot and the consulting veterinarian.
- Follow the 5Rs (responsibility, review, reduce, refine, replace)
    - develop a method of calculating the quantity of use of each antimicrobial
    - develop a method of measuring compliance with treatment protocols
      use antimicrobials judiciously
    - adopt preventative practices and review alternatives that will reduce the need to use medically
    - important antimicrobials
    - review the program regularly.
- Develop a plan for monitoring the level of resistance in the feedlot, including treatment success and antimicrobial response.

Key Antimicrobial Stewardship Message

The Australian feedlot industry has developed and implemented Antimicrobial stewardship guidelines for the cattle feedlot industry.

Notes:

S5

Overview Of The Australian Dairy Industry Approach To Antimicrobial Stewardship

Susannah Tymms[1], Dr. Jo Coombe[1]
1. *Dairy Australia, Southbank, VIC, Australia*

Summary Outline

Key drivers: The dairy industry recognizes four key drivers for continuous improvement in antimicrobial stewardship:

- Market and customer requirements: residues and impacts on food safety are a key priority for milk companies. As well, global food companies have announced their desire to reduce antibiotic use in their supply chains.
- Government requirements: animal industries are increasingly under scrutiny for the type, amount and indication of antimicrobials used.
- Animal health: maintaining access to effective drugs is critical to cow and calf health & welfare and therefore dairy farming livelihoods.
- Community health: routine human infections are increasingly at risk of becoming untreatable as microorganisms develop resistance to today's antimicrobials, so this affects us all.

Monitoring use: While the Australian dairy industry is arguably in an enviable position globally in relation to development of antibiotic resistance and typical usage, Dairy Australia has been monitoring antibiotic use through surveys of vet sales data based on aggregated quantity (kg) of actives sold. These surveys provide a 'snap shot' of antibiotic use administered via injection, intra-mammary route (lactating and dry cow) and orally. Key findings relate to:

- The proportion of antimicrobials used by class over two time periods.
- Indicative use of antimicrobials given a 'high' risk rating by global and Australian agencies (due to their importance in human medicine).
- Identification of gaps in antimicrobial use metrics, for further investigation.

Long history of prudent antimicrobial management: A 'stocktake' undertaken in 2018 provides an extensive timeline of activities undertaken by the Australian dairy industry to optimise the use of antimicrobials over the past forty years. This includes leading the development of the International Dairy Federation's (IDF) Guide to Prudent Use of Antimicrobial Agents in Dairy Production.[1] It also includes extensive milk and meat residue monitoring programs, such as the Australian Milk Residue Analysis Survey,[2] as well as significant investment in farm extension programs focused on animal health and prudent antibiotic use, such as Countdown, Healthy Hooves, Rearing Healthy Calves and Transition Cow Management. Key areas for further investment going forward have been identified.

1. Guide to prudent use of antimicrobial agents in dairy production 2013 https://store.fil-idf.org/product/guide-to-prudent-use-of-antimicrobial-agents-in-dairy-production-in-english-3/
2. Australian Milk Residue Analysis annual survey https://www.dairyaustralia.com.au/industry/food-safety-and-regulation/regulatory-framework/australian-milk-residue-analysis-survey

Key Antimicrobial Stewardship Message

The Australian dairy industry has a long history of prudent antimicrobial management and key areas for further investment have been identified.

Notes:

KEYNOTE:

Veterinary Antimicrobial Stewardship In The EU

Professor Luca Guardabassi[1,2]

1. *Department of Veterinary and Animal Sciences, University of Copenhagen, Copenhagen, Denmark*
2. *Department of Pathobiology and Population Sciences, Royal Veterinary College, London, United Kingdom*

The term “antimicrobial stewardship” refers to a multifaceted and dynamic approach to measure and improve antimicrobial use including drug choice, dosing, duration and route of administration. The ultimate goal is to improve patient care while minimizing the risks associated with antimicrobial resistance and the costs connected to overuse of antimicrobials and therapy failure. As compared to human medicine, this term is used in a broader sense in veterinary medicine to include regulatory interventions imposed by national authorities to restrict or ban specific drugs, and to limit profit derived from antimicrobial dispensation by veterinarians. This lecture provides an overview of the main antimicrobial stewardship interventions that have been used successfully in some countries (e.g. Netherlands and Scandinavian countries) for reducing antimicrobial consumption in food-producing animals. The overall strategy is based on benchmarking of antimicrobial use at the herd and veterinary practice levels, and definition of reduction targets for antimicrobial consumption within a given timeframe. Notably, this approach requires sophisticated antimicrobial use surveillance systems to be in place and implies clear responsibilities for veterinarians, who in turn require guidance and access to appropriate diagnostic protocols to accomplish the reduction targets adopted by national authorities without negatively affecting animal health and welfare.

The application of regulatory interventions is less frequent in companion animal medicine, mainly due to the different ethical implications and public health risks associated with the use of antimicrobials in this veterinary sector. Here, ongoing education accompanied by availability and implementation of clinical practice guidelines is a cornerstone of antimicrobial stewardship. Unfortunately, national species- and disease-specific guidelines are only available in a minority of EU countries. Data from Denmark and Sweden on the effects of national guidelines on antimicrobial consumption in companion animals will be presented and discussed, underlining the increasing demand for national guidelines that take into account national legislation, local patterns of antimicrobial resistance and antimicrobial use, and availability of drugs in the market.

Notes:

S6

Antimicrobial Stewardship In Small Animal Practice - A Pilot Trial In Canberra

Dr. Alison Taylor[1], Michael Archinal[1], Jane Heller[2], Melanie Latter[3], Stephen Page[4]

1. *Kippax Veterinary Hospital, Holt, ACT, Australia*
2. *School of Animal and Veterinary Sciences, Charles Sturt University, Wagga Wagga, NSW, Australia*
3. *Australian Veterinary Association, Canberra, ACT, Australia*
4. *Advanced Veterinary Therapeutics, Newtown, NSW, Australia*

Summary Outline

An antimicrobial stewardship (AMS) pilot trial was initiated in the ACT with the aim of identifying whether clinicians in small animal practice can and will improve their approach to prescribing antimicrobials.

Enrolment in the trial was voluntary. Questionnaires were utilised to quantify individual and practice-based antibiotic usage and attitudes surrounding AMS prior to and at the conclusion of the trial period. The trial consisted of receipt of a weekly newsletter which provided information specific to AMS (e.g. articles on rational antibiotic use and how to use the AIDAP guidelines), access to an online training program and the provision of interactive educational workshops that ran every 6 – 8 weeks across the year. These workshops focused on common companion animal medicine issues and integrated teaching about AMS to ensure continued interest from participants.

Excellent uptake of this AMS trial was obtained from clinical veterinarians across Canberra, with 14 of the 24 clinics and 69 individuals signing up to the trial. Results of the questionnaires identified that, while a broad range of confidence with respect to decision-making surrounding antimicrobial usage in clinical practice was present in local veterinarians, the vast majority of participants (86.8%) identified a wish to increase their knowledge to enable greater confidence. The post-trial practice questionnaire identified a reduction in overall usage in antibiotics by the participating practices by up to 18%.

The results of this pilot study shows that there is an appetite for formalised local AMS training. Our recommendations include utilising face to face education where possible, although improving the online education to ensure that it is able to capture and speak to local issues will also assist for areas where face to face meetings are not possible. Ideally the findings form this pilot study will lead to a more official program which will allow the program to become sustainable and more widely implemented.

Key Antimicrobial Stewardship Message

It is possible to formally support AMS in small animal practice but work is required to identify how best to proceed nationally.

Notes:

Antimicrobial Stewardship In The Australian Chicken Meat Industry

Sheridan Alfirevich[1]
1. Baiada Poultry, Pendle Hill, NSW, Australia

Summary Outline
The Australian chicken meat industry has implemented the principles of good antimicrobial stewardship for decades, but there is still progress to be made. This presentation covers a brief history of AMS in the Australian chicken industry from development and adoption of antibiotic use guidelines in the 1980s to development of vaccines in the 1980s and 1990s and adoption of a formalised antimicrobial stewardship programme in 2017; an update on current initiatives and outline perceived barriers to progressing AMS in the industry further such as a sustainable national AMR surveillance system.

Notes:

Industry Update: Antimicrobial Stewardship In The Australian Pork Industry

Dr. Lechelle van Breda[1]
1. *Australian Pork Limited, Barton, ACT, Australia*

The Australian pork industry has been practicing antimicrobial stewardship (AMS; the judicial use of antimicrobials) for several decades with support from pig veterinarians. The preservation of antimicrobials for future use is very important to ensure that pig health and welfare can be effectively managed. The Australian pork industry believes that antimicrobials should be used "as little as possible, as much as necessary".
An integrated approach to herd health management is supported by many pig veterinarians. Antimicrobials alone will not improve animal health without addressing other contributing factors. The four golden rules of pork production include: 1) Biosecurity and limiting pig-to-pig contact; 2) Good hygiene; 3) Good nutrition and 4) Management practices that reduce stress. These rules enable a holistic approach to herd health management.
The Australian Pork Industry AMS Programme addresses Australia's First National Antimicrobial Resistance Strategy 2015-2019 and is built on the 5R AMS framework, which includes five essential components: Responsibility, Review, Reduce, Refine and Replace. The aims of the Australian Pork Industry AMS Programme are to:

- increase producer awareness of antimicrobial resistance (AMR);
- enhance the reputation of the Australian pork industry as a steward of judicial antimicrobial use;
- increase consumer demand for Australian pork products; and
- optimise pig welfare.

AMS plans have already been voluntarily adopted by a number of producers and integrated into their standard business operations. The development of an industry-wide AMS plan is expected to support the wider industry to undertake similar endeavours. Considerable progress in this area is being made. These are being further enhanced through the use (and ongoing development, where required) of diagnostic assays to confirm disease treatments, recording tools for antibiotic use, consistencies between laboratory techniques and methodologies for AMR, increased vaccine use and implementation of alternative treatment options. In addition, the Australian pork industry continues to invest in ongoing research and development, most notably the development of cost-effective robotic laboratory protocols to measure the AMR status of faecal commensal bacteria in individual herds and establish an AMR index to support surveillance, testing and/or monitoring activities.

Notes:

Antimicrobial Stewardship In Australian Aquaculture – A Clinical Veterinarian's Perspective

Dr. Paul Hardy-Smith[1]
1. *Panaquatic Health Solutions Pty Ltd, Hawthorn, VIC, Australia*

Over half the world's fish that are consumed by humans are now farmed. While much of fish that are farmed are still grown in extensive systems, there is an increasing amount of intensification happening in aquaculture and such intensification places increased stressors on both the systems and the fish and shellfish being farmed.
While by far the largest producers of farmed fish and shellfish are countries such as China, aquaculture is increasing in Australia in both production volume and number of species being cultured. While the farming of fish and shellfish is traditionally not an area that veterinarians would be involved in, increasingly it is veterinarians who are being called in to investigate health problems in these systems and providing diagnostic, health management and treatment advice to farmers.
This presentation will provide an insight into the veterinarian's role in modern aquaculture in Australia and will discuss the issue of antimicrobial use in those industries with which the author is familiar and has personally consulted to. Due to a number of reasons, the use of antimicrobials in these industries is generally avoided and certainly not as prevalent as sometimes is portrayed.

Notes:

S6

Antimicrobial Stewardship In Equine Practice

Dr. Sharanne Raidal[1]

1. *Charles Sturt University, Wagga Wagga, NSW, Australia*

Antimicrobial stewardship in equine practice is based on the same mandate and principles as in human medicine and other veterinary disciplines. Client education, confirmation of sepsis prior to treatment, appropriate prophylactic (and metaphylactic) antimicrobial use, planning of first line and alternative antimicrobial therapy for common clinical scenarios based on best available evidence, collation of local culture and sensitivity results, and restricted use of agents of veterinary and human medical importance are commonly incorporated into antimicrobial use protocols. Challenges in equine practice include the size and value of the patient, appropriate sample collection and submission, correct and timely identification and sensitivity testing of equine isolates, the risk of antimicrobial associated typhylocolitis and consequent limitations on available agents and routes of administration, lack of development of novel agents, indiscriminate use of antimicrobials by clients (particularly large scale commercial operations), and high rates of carriage of multidrug-resistant organisms (MRSA) by equine practitioners. Core principles for effective use of antimicrobial agents, such as decreasing bacterial load prior to and during treatment (eg. lavage of septic joints, drainage of abscesses, debridement of necrotic tissue), culture and confirmation of sepsis, sensitivity testing, appropriate dose and duration of treatment, are used in equine practice. Additional strategies well suited to equine patients include local delivery methods (for example, regional perfusion techniques, intra-articular administration) and continuous infusion of time dependent agents, the later offering economic as well as pharmacodynamic advantages. There is a need for improved client and veterinarian awareness of the emergence of antimicrobial resistance in bacterial isolates from horses, better communication of sensitivity results between practices, availability of faster and more accurate techniques for identification and sensitivity testing of bacterial pathogens, and the development of novel agents or techniques for the management of septic disease.

Notes:

KEYNOTE:

Barriers And Potential Opportunities To Progressing Veterinary Antimicrobial Stewardship

Professor David Jordan[1]

1. *New South Wales Department of Primary Industries, Wollongbar, NSW, Australia*

Successful implementation and operation of antimicrobial stewardship (AMS) programmes in veterinary practice, be it livestock or companion animal-focused, requires knowledge of the barriers and enablers of adoption. The literature in this area has grown substantially in the last decade, most prodigiously in the human medical area, with more recent veterinary investigations of barriers and enablers adding to the accumulating knowledge. It has become clear that the availability of evidence of the appropriate use of antimicrobial agents is insufficient alone to drive appropriate use. This may seem obvious as guidelines have been available for decades yet antimicrobial use has grown substantially and much of the use may be unnecessary. The barriers that have prevented the adoption of the key elements of AMS are now known to be complex, involving a mixture of clinical, behavioral and social factors combined with resource, education and other limitations. Knowledge of barriers often allows enabling factors to be identified and this talk will provide an introduction and overview of the findings of recent studies, including the importance of leadership commitment to AMS success, and the role of such factors as diagnostic uncertainty, cost of microbiology testing, client expectations, risk perception by prescriber and client, prior prescribing history and beliefs, time pressure, competitive and financial considerations, community expectations, and the need for continuing professional education.

Notes:

POSTERS

Antimicrobial Susceptibility Of Equine Bacterial Isolates To Inform Equine Antimicrobial Use Guidelines

Kirsten E Bailey[1,2], Laura Y Hardefeldt[1,2], Helen K Crabb[1,2], James R Gilkerson[1], Helen Billman-Jacobe[1,2], Rhys N Bushell[3], Marc S Marenda[1], Glenn F Browning[1,2]

1. *Asia-Pacific Centre for Animal Health, Department of Veterinary Biosciences, Melbourne Veterinary School, University of Melbourne, Parkville, VIC, Australia*
2. *National Centre for Antimicrobial Stewardship, Peter Doherty Institute, Carlton, VIC, Australia*
3. *Department of Veterinary Biosciences, Melbourne Veterinary School, University of Melbourne, Werribee, VIC, Australia*

Summary Outline

Antimicrobial use guidelines are a key component of antimicrobial stewardship in both human and veterinary medicine. Guidelines assist practitioners in deciding on the best approach for diagnosis and treatment of common infectious diseases. Therefore, these guidelines should be evidence-based and dynamic, with recommendations being updated as new information becomes available. While the best method of antimicrobial selection is based on culture and sensitivity of bacteria isolated from the individual to be treated, there are some clinical situations where empirical choice is required. It is essential that empirical antimicrobial choices are informed by local trends in antimicrobial resistance.

A common first line empirical antimicrobial choice for equine infectious diseases is a combination of penicillin and gentamicin. In recent years, international trends in antimicrobial susceptibility patterns of bacterial isolates from septic foals have led to advocacy of the use of third and fourth generation cephalosporins and amikacin for empirical treatment. These antimicrobials have a higher importance rating in human medicine than those recommended for first line treatment.

This study evaluated the antimicrobial susceptibility profiles of bacteria isolated from horses admitted to the UVet Werribee Equine Centre at the University of Melbourne over a 12-year period. Antimicrobial susceptibility testing of the isolates was performed using the calibrated dichotomous susceptibility method. Culture and susceptibility results were available for 761 bacterial isolates during the study period. The five most commonly tested isolates were *Streptococcus* spp., *Staphylococcus* spp., *Escherichia coli*, *Actinobacillus* spp. and *Enterococcus* spp. Of 128 *Escherichia coli* isolates, 67% were susceptible to gentamicin and 99% of *Streptococcus equi* subspecies *zooepidemicus* isolates were susceptible to penicillin. The antimicrobial susceptibility results of this study will be used to inform development of local empirical antimicrobial treatments for equine infections.

A mechanism to enable surveillance of antimicrobial susceptibility patterns of equine bacterial isolates from veterinary laboratories around the country is required to provide evidence for national equine antimicrobial use guidelines. Ideally, this surveillance would be ongoing to monitor changes in resistance patterns and allow regular updates of guidelines.

Key Antimicrobial Stewardship Message

Ongoing surveillance of Australian equine bacterial isolates is vital to support evidence-based empirical antimicrobial choices and stewardship efforts.

Introducing Herd Level Antimicrobial Susceptibility Data Into The Veterinarian – Dairy Farmer Relationship.

Dr. Ray D Castle[1]

1. Bayer New Zealand Ltd, Manukau City, NZ, New Zealand

Summary Outline

Antimicrobial resistance is a phenomenon with significant implications for the future of both human and animal health. Wherever antibiotics are used, there is the potential for contributions to the development of antimicrobial resistance. This includes use on dairy farms. DAIRYANTIBIOGRAM is a diagnostic programme adapted from a methodology previously commercialised by GD in the Netherlands, which provides farm level information about antimicrobial sensitivity of mastitis pathogens found in the bulk milk tank. The DAIRYANTIBIOGRAM programme addresses the strategies outlined in the WHO's Global Action Plan on AMR which, among other points, calls for

improved awareness and understanding of AMR, improved surveillance, and optimised use of antimicrobials through the use of effective, rapid, low cost diagnostic tools. This presentation describes the introduction of this programme to NZ. A novel results reporting format is presented, along with the strategies adopted to educate vets and farmers around the use of MIC data, and to achieve engagement from these parties in adopting judicious use principles.

Key Antimicrobial Stewardship Message
The Dairyantibiogram is an example of how creative and lateral thinking created an initiative which provides direct value to industry, and as a result, became a "user paid" antimicrobial resistance surveillance programme.

Surveillance Of Salmonella Antimicrobial Resistance In A Poultry Population With No Antimicrobial Selection Pressure

Dr. Helen Crabb[1], Joanne Allen[1], Joanne Devlin[1], James Gilkerson[1]
1. *APCAH, Melbourne Veterinary School, Faculty of Veterinary and Agricultural Science, University of Melbourne, Melbourne, VIC, Australia*

Summary Outline
The use of antimicrobials in food producing animals in Australia is strictly regulated and few antimicrobial classes are available for use in poultry. It is currently unknown what the long term reduction in the use of antimicrobials will have on antimicrobial resistance in specific pathogens. An ongoing longitudinal study investigating the transmission of *Salmonella* within an "antibiotic free" vertically integrated chicken meat enterprise has been conducted. This ongoing study includes evaluating the impact of antimicrobial prescribing on the prevalence of antimicrobial resistance in *Salmonella* isolates in this poultry population.
Methods: No antimicrobials have been used in the studied population for a period of 5 years.; A minimum of 100 *Salmonella* samples were tested per annum. Four hundred *Salmonella* isolates were screened for antimicrobial susceptibility using the calibrated dichotomous sensitivity test (CDS) method. Five hundred isolates were whole genome sequenced and sequence reads were screened for the carriage of known antibiotic resistance genes using SRST2.
Results: The first sampling event (2013 - 2015) identified 16.5% of isolates susceptible to all antimicrobials tested and three resistant phenotypes; sulphafurazole (68.5%), streptomycin (56.5%), and ampicillin (10.1%). Genotyping identified four TEM ß-lactamase resistance genes in 11 isolates (3.4%). Nine of the 11 isolates were resistant to ampicillin (MIC ≥ 8mg/L).
The most recent sampling event (2017 - 2018) identified no isolates susceptible to all antimicrobials tested and an increase in the proportion of samples resistant to sulphafurazole (100%), but a reduction in streptomycin (24%) and ampicillin (2.4%) resistance phenotypes. No fluoroquinolone, cephalosporin or ESBL producing phenotypes were identified in any sampling events. No transmissible genes conferring resistance to sulphonamides or streptomycin were identified in any isolates.
Conclusion: The presence of phenotypic resistance, in the absence of use, ramifications to the current drive for in the use of antimicrobials in food producing animals. The presence of phenotypic resistance and a change in the resistance profile over time requires careful interpretation of surveillance results. Resistance profiling on its own cannot be used in isolation without understanding antimicrobial useage and other drivers for maintaining phenotype presence within bacterial populations, and subsequently the effects on antimicrobial stewardship. Whole genome sequencing allowed the absence of known genes to be confirmed and demonstrated that different isolates were entering the poultry population rather than being maintained within the population.

Key Antimicrobial Stewardship Message
Factors other than antimicrobial use maintain resistance phenotypes in *Salmonella* in poultry populations.

A Survey Of Veterinary Prescribing For Poultry Disease

Dr. Helen Crabb[1], Laura Hardefeldt[1], Kirsten Bailey[1], James Gilkerson[2], Helen Billman-Jacobe[1], Glenn Browning[1]
1. *NCAS, Melbourne Veterinary School, Faculty of Veterinary and Agricultural Science, University of Melbourne, Melbourne, VIC, Australia*
2. *APCAH, Melbourne Veterinary School, Faculty of Veterinary and Agricultural Science, University of Melbourne, Melbourne, VIC, Australia*

Summary Outline
Background: Improved antimicrobial stewardship can only be achieved when there is a clear understanding of current patterns of prescribing behaviour and the reasons antimicrobial drugs are prescribed. A prescribing guideline - Recommended Best Practice for Prescribing - developed by Australian Poultry Veterinarians has been in place for some years. However, this guideline does not detail treatments for the common bacterial diseases of commercial poultry.
Method: An online survey was developed, using expert elicitation, to identify prescribing behaviours for the most frequently observed bacterial diseases of poultry. The survey was available to all registered veterinarians and sent to members of the Australian Veterinary Poultry Association.
Results: A total of 39 survey responses were received. Most surveys were started but not completed; only 13 (33%) were complete, but 18 (46%) contained some information on prescribing.
The most frequent treatment responses were for *E.coli* in both layers and broilers, chronic respiratory disease, fowl cholera and spotty liver in layers, and necrotic enteritis in broilers. Treatments described were for products registered for poultry use, and were within the dose ranges and durations of treatment recommended on the label. Unsurprisingly, tetracyclines and amoxycillin, followed by lincomycin and trimethoprim/sulphonamide products were the most frequently reported treatment options. One treatment described was inappropriate in Australia. A number of responses were provided for treatment of salmonellosis in both layers and broilers. A key gap identified was the inclusion of a survey question about the treatment of erysipelas in layers.
Conclusion: The limited number of completed responses to the survey precludes full analysis or interpretation of the data. However the information obtained by the survey provides some information to initiate the development of prescribing guidelines for both commercial and small flocks of poultry. Critically, the survey identified that there are limited treatment options for bacterial disease in poultry. Most traditional bacterial diseases of poultry remain the same and effective alternatives for antimicrobial treatment are required. A number of diseases that had been eliminated in intensively managed farms, are re-emerging as free-range production becomes more prevalent.

Key Antimicrobial Stewardship Message
Surveys of prescribing behaviours are essential for identifying diseases of high priority, areas for targeted antimicrobial stewardship, and research needs.

What's On Your Dinner Plate Tonight? – The Complexity Of Decision Making For Antimicrobial Stewardship For Food Production Veterinarians

Dr. Helen Crabb[1], Laura Hardefeldt[1], Kirsten Bailey[1], Helen Billman-Jacobe[1], James Gilkerson[2], Glenn Browning[1]
1. *NCAS, Melbourne Veterinary School, Faculty of Veterinary and Agricultural Science, University of Melbourne, Melbourne, VIC Australia*
2. *APCAH, Melbourne Veterinary School, Faculty of Veterinary and Agricultural Science, University of Melbourne, Melbourne, VIC, Australia*

Summary Outline
Background: The role of the veterinarian in food production extends beyond the responsibility for care of an individual animal to accountability for a population of animals. This requires an understanding of veterinary medicine and the economics of food production, and extends from the farm to the dinner plate. Nowhere is this responsibility more critical than when providing sound advice for disease treatment and prevention, and consequently antimicrobial stewardship. Responsible risk assessment should ensure that decision making is evidence-based, defensible and ethical, and, in food production particularly, economically justifiable.
Method: Using a HACCP based process, the hazards associated with veterinary prescribing within a food animal production system were identified. Using expert elicitation and a review of the literature, the factors associated with each decision step were identified and the number of factors influencing each decision quantified. The critical control points where the veterinarian has either direct or indirect control over the outcome were identified.
Results and Conclusion: A simplified HACCP plan identified 6 major steps from farm to plate where the veterinarian is responsible for the care of a food producing animal. Within the disease event plan seven major steps and eight sub-steps were identified in the decision path prior to a treatment decision. Forty factors (4 to 8 at each decision point) were identified in the simplest tree that influenced the decision to treat or the method of treatment. Two critical control points were identified where the veterinarian had indirect control over the application of treatment to food animals; provision of medication via feed and the time of marketing. Both critical control points require trust between the veterinarian and either the client or the feed manufacturer that the instructions provided are adhered to. However, it is the responsibility of the veterinarian to ensure that their instructions are followed. Three gaps in the decision tree were identified that may have a significant impact on the provision of sound technical advice or treatment failure; availability of a pharmacologically suitable choice, availability of information on products to

facilitate treatment decisions, including development of appropriate withholding periods, and the failure of the client to recognise the veterinarian's legal responsibilities from paddock to plate. The failure of clients to recognise the veterinarians' responsibility does not release veterinarians from their legal obligations.

Key Antimicrobial Stewardship Message
The responsibility of the veterinarian in food production requires trust at critical control points outside of their direct control.

Number Needed To Eat?: Causal Web Analysis By Source, For Colonisation Of Multi-Resistant Organisms In Australia

Dr. Helen Crabb[1], Laura Hardefeldt[1], Kirsten Bailey[1], Helen Billman-Jacobe[1], James Gilkerson[2], Glenn Browning[1]
1. *NCAS, Melbourne Veterinary School, Faculty of Veterinary and Agricultural Science, University of Melbourne, Melbourne, VIC, Australia*
2. *APCAH, Melbourne Veterinary School, Faculty of Veterinary and Agricultural Science, University of Melbourne, Melbourne, VIC, Australia*

Summary Outline
Background: The call for antimicrobial stewardship in veterinary medicine have stemmed from concerns that community acquired antimicrobial resistance (AMR) is driven by the use of antimicrobials in food production animals. Evidence to support this varies by study and a current focus is on the reduction in resistance rather than the use of antimicrobials.
Method: Using causal web analysis, the risk of exposure in humans from a range of food sources was assessed. The ABARES data was used to find the baseline average Australian protein intake, and from this we calculated the number of meals of pork, beef or poultry consumed for each using a standard 60g per meal. Meat AMR surveillance data, both at retail and the abattoir, were used to estimate the number of meals the average Australian would need to consume to be exposed to a multi-drug resistant organism (MRO) (*Escherichia coli*) of animal origin. The antimicrobial resistance patterns of MROs observed in human E. coliinfection was used for comparison.
Results: Without taking into account the reduction in risk by cooking, the number of meat meals required for exposure to an MRO was estimated as 76 for beef, 32 for pork and 15 for poultry meals. However, only a single MRO pattern observed in the human population matched that observed in any animal surveillance data (either source), namely beef meat at retail. A total of 379 beef meals must be consumed to be potentially exposed to an MRO observed in the human population. Surveillance data on the prevalence of MROs in beef, pork or poultry caeca estimates a prevalence of 0.0, 0.40 and 0.18, whereas the risk of exposure from meat sold at retail was calculated as 0.014, 0.039 and 0.015 respectively.
Conclusion: Australia is in an enviable position where the risk associated with animal product consumption for community acquired MRO appears low. Identification of an apparently low risk should not hinder progress towards improved antimicrobial use in food producing industries. The lack of data on antimicrobial use exposure in food production animals means the accuracy of quantifying this risk is low. Strengthening the confidence in estimating this risk requires a co-operative effort by all sectors. Transparency in antimicrobial use, prescribing behaviours, and an increased understanding of the factors influencing prescribing to food production species is essential. Without this data food animal industries remain exposed to criticism.

Key Antimicrobial Stewardship Message
The exposure risk of MRO to humans from animal food sources exist, but the risk is low.

Antimicrobial Labelling In Australia: A Threat To Antimicrobial Stewardship?

Laura Y Hardefeldt[1, 2], James R Gilkerson[1, 2], Helen Billman-Jacobe[1, 2], Mark A Stevenson[1], Karin Thursky[2], Kirsten E Bailey[1, 2], Glenn F Browning[1, 2]
1. *Asia-Pacific Centre for Animal Health, Melbourne Veterinary School, University of Melbourne, Parkville, VIC, Australia*
2. *National Centre for Antimicrobial Stewardship, Peter Doherty Institute, Carlton, VIC, Australia*

Summary Outline
Background: Antimicrobial resistance is a public health emergency, placing veterinary antimicrobial use under growing scrutiny. Antimicrobial stewardship, through the promotion of the appropriate use of antimicrobials, is one response to this threat. An understanding of prescribing behaviour and the drivers of these are required

to understand the factors required to improve the appropriate use of antimicrobials. The need for antimicrobial stewardship in Australian veterinary practices has had limited investigation.
Methods: A survey was undertaken to investigate antimicrobial prescribing behaviours by Australian veterinarians. Potential reasons for inappropriate antimicrobial dose regimens were also explored.
Results: Varying, and often inappropriate, antimicrobial dose rates were reported by veterinarians and were found on labels.Label dose rates for penicillin, gentamicin and amoxycillin were incorrect on all registered products for horses, cattle and companion animals. Reported doses of procaine penicillin administered to horses and cattle were low, with 68% and 90% of respondents, respectively, reporting doses unlikely to result in plasma concentrations above minimum inhibitory concentrations for common equine or bovine pathogens. The reported frequency of penicillin administration was also often inappropriate (with 26% of respondents reporting once daily dosing for horses). Gentamicin doses in horses were largely appropriate (89% of dose rates appropriate), but 9% of respondents reported twice daily dosing. Amoxycillin and amoxycillin/clavulanate were administered at the appropriate doses, or above, to dogs and cats by 54% and 70% of respondents, respectively.
Conclusions: Antimicrobial labels often recommend incorrect dose rates, and thus may be contributing to poor prescribing practices. Mechanisms should be adopted to ensure that antimicrobial drug labels are regularly updated to reflect the dose needed to effectively and safely treat common veterinary pathogens. This is particularly important where legislation restricts antimicrobial use by veterinarians to the uses and doses specified on the label. This change would enhance the current momentum towards improved antimicrobial stewardship.

Key Antimicrobial Stewardship Message
Inappropriate dose rates on labels are causing under-dosing of veterinary antimicrobials and may promote the development of resistance.

Development Of An Antimicrobial Stewardship Programme For Veterinary Practice In Australia.

Laura Y Hardefeldt[1, 2], Kirsten E Bailey[1, 2], Helen K Crabb[1, 2], James R Gilkerson[1, 2], Helen Billman-Jacobe[1, 2], Glenn F Browning[1, 2]

1. *Asia-Pacific Centre for Animal Health, Melbourne Veterinary School, University of Melbourne, Parkville, VIC, Australia*
2. *National Centre for Antimicrobial Stewardship, Peter Doherty Institute, Carlton, VIC, Australia*

Summary Outline
Background: In the medical profession, antimicrobial stewardship programmes are generally a set of interventions at a hospital level aimed at improving compliance with guidelines, reducing antimicrobial use, reducing resistance and improving clinical outcomes at a local level. While many professional and industry organisations have created judicious use policies for antimicrobials, there are no reports of medical-style antimicrobial stewardship programmes being developed or implemented in veterinary practices.
Methods: The purpose of the programme was to facilitate compliance with evidence-based guidelines or best practices for antimicrobial prescribing and promote rational and appropriate antimicrobial therapy, while improving clinical outcomes and minimising unintentional side-effects of antimicrobial use, including emergence of resistant microorganisms, in companion animal veterinary practices. Guidelines produced by the Australian Commission for Safety and Quality in Health Care, and findings from a systematic review of antimicrobial stewardship in outpatient settings[1], were used as the basis for a programme that reflected the practicalities of veterinary practice in Australia.
Results: Four key components were identified; resources, education, active interventions and measurement. Resources included antimicrobial use guidelines with the flexibility to create clinic-level guidelines and judicious use principles. An education program was developed that included 7 webinars on appropriate antimicrobial use for common syndromes in companion animal practice, delayed prescribing and infection prevention and control. Finally, active interventions were designed. Firstly, a traffic-light system for informing veterinarians of the importance of veterinary antimicrobial agents in human medicine was developed and antimicrobials were restricted on the basis of this system. Diagnostic testing guidelines were also developed. Thirdly, audit and feedback procedures were adapted from medical practice to suit the veterinary general practice environment. Finally, a delayed prescription template was developed, with guidelines for case selection. Measurement of antimicrobial use is using VetCompass software and an application was developed to monitor antimicrobial resistance and provide benchmarking feedback on antimicrobial resistance and antimicrobial use.
Conclusion: This programme provides detailed guidelines for veterinary practices to implement antimicrobial stewardship programs. Assessment of the effectiveness and implement ability of the program is ongoing.

Key Antimicrobial Stewardship Message
Antimicrobial stewardship programs can be implemented in veterinary practices using the tools developed.

1. Drekonja DM, Filice GA, Greer N et al. Antimicrobial stewardship in outpatient settings: a systematic review. Infect Control Hosp Epidemiol 2015;36:142-152.

Barriers To, And Enablers Of, Implementing Antimicrobial Stewardship Programmes In Veterinary Practices.

Laura Y Hardefeldt[1, 2], James R Gilkerson[1, 2], Helen Billman-Jacobe[1, 2], Mark A Stevenson[1], Karin A Thursky[2], Kirsten E Bailey[1, 2], Glenn F Browning[1, 2]
1. *Asia-Pacific Centre for Animal Health, Melbourne Veterinary School, University of Melbourne, Parkville, VIC, Australia*
2. *National Centre for Antimicrobial Stewardship, Peter Doherty Institute, Carlton, VIC, Australia*

Summary Outline
Background: Antimicrobial stewardship programmes are yet to be widely implemented in veterinary practice. An in-depth understanding of the factors that influence effective antimicrobial stewardship in veterinary practices in Australia is required to inform the development of stewardship programmes.
Methods: A concurrent explanatory mixed methods design was used. The quantitative phase of the study comprised an online questionnaire to assess veterinarians' attitudes to antimicrobial resistance and antimicrobial use in animals, and the extent to which antimicrobial stewardship is currently implemented (knowingly or unknowingly). The qualitative phase used semi-structured interviews to gain an understanding of the barriers to and enablers of antimicrobial stewardship in veterinary practices. Data were collected and entered into NVivo v.11, openly coded and analysed using mixed methods data analysis principles.
Results: Veterinary practices rarely had antimicrobial prescribing policies. The key barriers were a lack of antimicrobial stewardship governance structures, client expectations and competition between practices, the cost of microbiological testing, and a lack of access to education, training and antimicrobial stewardship resources. The enablers were concern for the role of veterinary antimicrobial use in development of antimicrobial resistance in humans, a sense of pride in the service provided, and preparedness to change prescribing practices.
Conclusion: This study can guide the development and establishment of antimicrobial stewardship programmes in veterinary practices, by defining the major issues that influence the prescribing behaviour of veterinarians.

Key Antimicrobial Stewardship Message
The key barriers were a lack of antimicrobial stewardship governance structures, client expectations and competition between practices, the cost of microbiological testing, and a lack of access to education, training and antimicrobial stewardship resources.

Determining Withholding Periods For Off-Label Antimicrobial Drug Use: A Content Analysis Of Veterinary Information Sources

Laura Y Hardefeldt[1, 2], Helen K Crabb[1, 2], Kirsten E Bailey[1, 2], James R Gilkerson[1, 2], Helen Billman-jacobe[1, 2], Glenn F Browning[1, 2]
1. *Asia-Pacific Centre for Animal Health, Melbourne Veterinary School, University of Melbourne, Parkville, VIC, Australia*
2. *National Centre for Antimicrobial Stewardship, Peter Doherty Institute, Carlton, VIC, Australia*

Summary Outline
Background: Off-label drug use is common in veterinary practice in Australia because of outdated labelling of antimicrobial agents[1]. Off-label prescribing is critical for antimicrobial stewardship, but estimation of appropriate withholding periods is necessary in food animal species to comply with prescribing legislation and ensure safe food.
Method: Information sources on veterinary antimicrobial prescribing in Australia were identified. Content analysis was performed to identify resources that allowed the estimation of withholding periods for antimicrobials used in an off-label manner.
Results: Australian information sources identified included the Australian Veterinary Association (AVA) and AVA special interest group websites, the Australian Pesticides and Veterinary Medicines Authority, the Public Chemical Registration Information System, federal and state Departments of Agriculture, industry websites, state veterinary boards and pharmaceutical company websites.

We found that no source had information that would guide estimation of withholding periods when antimicrobials were used in an off-label manner.
A review of the scientific literature identified limited pharmacokinetic information on selected antimicrobials in selected species, providing a weak scientific basis for the estimation of appropriate withholding periods.
Conclusions: Off-label drug use is critical for appropriate use of antimicrobials in veterinary medicine. Pharmaceutical companies and the Australian Pesticides and Veterinary Medicines Authority need to publish much more information to assist veterinarians to estimate withholding periods for off-label antimicrobial drug use.

Key Antimicrobial Stewardship Message
Additional resources are needed to assist veterinarians to estimate withholding periods for off-label antimicrobial drug use.

1. Hardefeldt LY, Gilkerson JR, Billman-Jacobe H et al. Antimicrobial labelling in Australia: a threat to antimicrobial stewardship? Aust Vet J 2018;96:151-154.

Validation Of The Australian Veterinary Prescribing Guidelines For Antimicrobial Prophylaxis For Companion Animal Surgery; A Framework For Future Guideline Validation

Laura Y Hardefeldt[1, 2], Helen K Crabb[1, 2], Kirsten E Bailey[1, 2], James R Gilkerson[1, 2], Helen Billman-Jacobe[1, 2], Glenn F Browning[1, 2]

1. *Asia-Pacific Centre for Animal Health, Melbourne Veterinary School, University of Melbourne, Parkville, VIC, Australia*
2. *National Centre for Antimicrobial Stewardship, Peter Doherty Institute, Carlton, VIC, Australia*

Summary Outline
Background: The Australian veterinary prescribing guidelines are evidence-based guidelines that have been created in a collaborative effort between the University of Melbourne's Asia-Pacific Centre for Animal Health (APCAH) and the National Centre for Antimicrobial Stewardship.These have been created to serve as an independent source of guidelines for the practitioner, and the veterinary profession, with the overall goal of improving appropriate antimicrobial use, and reducing pressure on development of antimicrobial resistance, in veterinary practice. Validation of the guidelines is necessary to ensure quality and implementability.
Method: A review of the medical guideline appraisal tools was undertaken. Two validated and widely used tools were chosen - the GuideLine Implementability Appraisal (GLIA) and the Appraisal of Guidelines for Research and Evaluation version 2 (AGREE II) - and the terminology adapted for use by veterinarians. In the first phase of the evaluation, the GLIA tool was used by 2 specialist surgeons to assess the implementability of the guideline in clinical surgical practice. The results of this phase were then used to modify the guideline. In the second phase, the AGREE II tool was used by a wider population of veterinarians to appraise the guideline.
Results: The GLIA tool had 7 broad areas of evaluation; executability, decidability, validity, flexibility, process of care, measurability and novelty/innovation. The specialist surgeons either agreed or strongly agreed that the guideline was executable, decidable, valid and novel, and that the guideline would fit within the process of care. The surgeons were neutral on flexibility, and requested extra clarity around one common surgical procedure, which was added to the guideline, after which they agreed that the guideline was flexible. The surgeons were also neutral on the measurability of the change in practice, reflecting the wider challenge of monitoring antimicrobial stewardship in veterinary practices. In phase 2 of the appraisal, 9 veterinarians completed the AGREE II tool (6 general practitioners and 3 specialists with an interest in antimicrobial stewardship). The AGREE II tool had 6 broad areas of evaluation; scope and purpose, stakeholder involvement, rigour of development, clarity of presentation, applicability and editorial independence. The tool also allowed for an overall evaluation. A Likert scale of strongly disagree-strongly agree (1-7) was used. In all sections the average appraisal was greater than 5. The overall quality of the guidelines was scored an average of 6/7.
Conclusion: The guidelines for antimicrobial prophylaxis for companion animal surgery are valid and appear implementable when tested by a range of specialist and general practice veterinarians using tools validated for medical guidelines.

Key Antimicrobial Stewardship Message
Guidelines for antimicrobial prophylaxis in companion animal surgery have been validated and should now be implemented.

Snapshots Of Amr Carriage In Australian Pigs And Poultry Reveal Strengths And Opportunities For Promoting Stewardship Efforts

Steven P Djordjevic[1]
1. UTS , Ausgem, Sydney, NSW, Australia

In the last five years, the Ausgem research partnership, initiated between the University of Technology Sydney and NSW Department of Primary Industries has sought to understand and characterise antimicrobial resistance (AMR) in food-producing animals in Australia through the use of whole genome sequencing (WGS). Focusing primarily on *E. coli* as an indicator organism, we have sequenced hundreds of genomes from healthy and diseased poultry and pigs in intensive food-production farm systems. Whole genome sequencing allows complete and rapid characterisation of antimicrobial resistance gene carriage, the evolutionary background of strains and identification of mobile genetic elements that facilitate the spread of resistance between different bacteria. We now have a wealth of baseline information about antimicrobial resistance in Australian farms that can be compared with data generated in the future as farming practices change to meet consumer demands. While our research has shown that there is antimicrobial resistance in poultry and porcine production systems, we have not identified resistance to critically important antibiotics for human medicine such as carbapenems, cephalosporins and colistin. This is in stark contrast with many other countries where animals carry resistance to these drugs. Taken together, the limitations on the import of live animals, our geographic isolation as an island nation, and restricted animal antibiotic prescribing practices reveals that Australia has a competitive advantage when it comes to food provenance. This can and should be promoted to trade partners, whilst producers and industry need to ensure there is continuous and transparent AMR surveillance as well as robust mitigation strategies should circumstances change.

Key Antimicrobial Stewardship Message
Snapshots of AMR carriage in Australian pigs and poultry reveal strengths and opportunities for promoting stewardship efforts

Animal Medicines Australia's Top Ten Recommendations For Antimicrobial Stewardship By The Owners Of Food Producing And Companion Animals

Shabbir Simjee, Charmian Bennett, Ben Stapley

Summary Outline
Antimicrobial drugs are essential tools for the management of infectious diseases in both animals and humans. In food producing animals, antimicrobials are used for disease treatment, control and prevention as well as for protozoal disease control (substances with antibiotic activity fed to livestock to control protozoal diseases such as coccidiosis). Antimicrobial use in companion animals is primarily for therapeutic use and surgical prophylaxis. Responsible antimicrobial use guidelines recognise the importance of antimicrobials in animal health, while ensuring sustainability by maximising their therapeutic effect and minimising the development of AMR through more rational and targeted use. The outcome of responsible use should be an overall reduction in the use of antimicrobials, and to prevent the overuse and misuse of antimicrobials, in particular, the classes of antimicrobials that are critically important to human health.
Responsible use extends beyond the careful selection and administration of antimicrobials to animals. It includes implementing practical measures involving all stakeholders to improve animal health and welfare, ensuring the quality and effectiveness of antimicrobials when used, and reducing the need for antimicrobials through improving husbandry, preventive care and biosecurity.
Animal Medicine Australia's 'Top Ten recommendations on responsible use of antibiotics' inform animal owners on how they can also contribute to containing the development of AMR. The recommendations provide targeted advice that reflects the different uses of antibiotics, and the different contexts in which companion animals and livestock/horses are kept.
The general principles for both groups of animals are the same, such as only using 'shared class' antibiotics under veterinary supervision, following dose advice and not sharing antibiotics with other animals. Specific recommendations for livestock (that are less relevant to pet owners) include the observance of withholding periods and slaughter intervals, use of protective clothing and cleaning equipment when moving between groups of animals, and requirements for safe on-farm storage of medicines.
For all animals, the recommendations emphasise the importance of preventive health measures (appropriate nutrition, exercise, housing, vaccination, parasite control and biosecurity practices) to support healthier animals, provide animals with a better quality of life and reduce the need for antibiotic use.

P

Key Antimicrobial Stewardship Message
Responsible antimicrobial use guidelines recognise the importance of antimicrobials in animal health, while ensuring sustainability by maximising their therapeutic effect and minimising the development of AMR through more rational and targeted use.

Improvement Of Microbial Ecosystem In Livestock Animal Environment: Concept Of Positive Microbial Biofilm, An Example In Swine Farrowing

Dr. Alex J Turney[1], Julia Plateau-Gonthier[2], Andrea Bazzoli[3]
1. *Lallemand Animal Nutrition, Maroochydore, QLD, Australia*
2. *Lallemand Animal Nutrition, Toulouse, France*
3. *Lallemand Animal Nutrition, Milan, Italy*

Summary Outline
Over the years, little attention has been given to biofilm management in animal production. Most of the research is geared toward human biofilm diseases although biofilms result in high economic losses in the livestock industry[1]. Farm buildings and animal housing is a desirable location for high biofilm development due to the environmentally favourable conditions and highly developed surface structures. Nowadays, regular cleaning, disinfection processes and technologies allow elimination of most bacteria. However the biofilm community is considered one of the major factors that increase the resistance of bacteria. Studies show that bacteria under biofilm form are 10 to 1000 times more resistant to antimicrobial agents as antibiotics [2,3] and disinfectants [4] compared to planktonic bacteria.
An emerging preventive approach to improve the microbial environment in farm buildings is to create a positive biofilm after disinfection and before starting a new batch of production. The applied beneficial microorganisms rapidly develop on farm building surfaces after disinfection and prevent or limit the development of undesirable biofilm. This results in a better balance of the microbial environment surrounding livestock and less risk of pathogenic bacteria re-contamination during production cycles.
This study aimed to test the effects of a mix of positive bacteria on biofilm development and re-contamination in a farrowing building. A total of 40 environmental swabs were taken to screen the presence of: Pediococcus spp., E. coli, Enterobacteria, Streptococcus spp. and Staphylococcus spp. in one treated room and one control room, on two different surfaces at 3 different times: before animal entrance, 24h after animal entrance and 4 days after animal entrance. The results indicate a limiting of negative microbial development. For example, in the control room, *Streptococcus* spp. concentration increases from 1.1 log/cm^2 at D1 to 2.2 log/cm^2 at D4 whereas it stops at 1.7 log/cm^2 for the treated room at D4 showing a significant reduction compared to the control room ($p = 0.029$). Other trials indicate a positive effect on piglet mortality [5].
Positive Biofilms are a viable integrated methodology to manage the microbial environment in livestock production, as they have an influence on disease, disease persistence and / or circulation and the associated antimicrobial use and resistance patterns that develop. A natural proactive solution exists and warrants inclusion into modern cleaning and disinfection programs in livestock production.

Key Antimicrobial Stewardship Message
Positive microbial biofilms reduce the potential use and subsequent resistance of antimicrobials in livestock production

1. Clutterbuck A.L., Woods E.J., Knottenbelt D.C., Clegg P.D., Cochrane C.A., Percival S.L. (2007) “Biofilms and their relevance to veterinary medicine”. Vet. Microbiol. 121, 1–2, 1–17.
2. Olson, M. E., Ceri, H., Morck, D. W., Buret, A. G., Read, R. R. (2002), “Biofilm bacteria: formation and comparative susceptibility to antibiotics”. Can J Vet Res. 66, 86–92.
3. Tremblay Y. D., Hathroubi S., Jacques M. (2014). Bacterial biofilms: their importance in animal health and public health. Can. J. Vet. Res. 78 110–116
4. Sanchez-Vizuete P., Orgaz B., Aymerich S., Le Coq D., Briandet R. (2015), “Pathogens protection against the action of disinfectants in multispecies biofilms”. Front. Microbiol. 6, 705.
5. Lallemand Internal research report. “Lalfilm effects positive biofilm development in piglet environment and on mortality. 2017. Available on request.

THE 5 Rs FOR SUCCESSFUL AMS

Antimicrobial stewardship (AMS) is part of our duty of care for the world around us.

AMS is about ensuring the Quality Use of antimicrobials, including antibiotics. Good antimicrobial stewardship means using “as little as possible, as much as necessary” to ensure that high levels of health and welfare are present throughout the entire life of all humans and animals who might require antimicrobials to treat infection.

Successful AMS requires recognition of its importance and a partnership approach with high level support. We need AMS to ensure we will always have effective antimicrobials, so that all humans and animals can live in a world where microbial infections can be managed successfully.