Strategy for antimicrobial resistance surveillance in Australia

Introduction

The importance of surveillance* in combating and managing antimicrobial† resistance (AMR) is recognised as an important component of the *World Health Organization (WHO) Global Strategy for Containment of Antimicrobial Resistance*, 2001. There is good evidence that surveillance is a cost-effective infection control strategy.[1,2] Appropriate surveillance provides vital information for the targeting of interventions, and measures success or failure of these interventions. Surveillance enables early detection and intervention, and can therefore reduce the extent and severity of outbreaks. This in turn should reduce infection-related costs, making funds available for other healthcare activities. Short-term investment, therefore, leads to longer-term gains and overall savings.

Many healthcare facilities, professional groups, networks and surveillance programs already have extensive experience from which other parties can learn. Sharing of experiences and knowledge of successful interventions (e.g. improved infection control practices; antibiotic restriction policies; new methods and techniques; and surveillance findings) allows institutions to build upon the successes of others and avoid duplication. Better mechanisms are needed for reporting surveillance information at local, state/territory and national levels that will increase awareness and access to information. It is also vital that surveillance information is incorporated into updates of best practice guidelines and adopted by medical and veterinary prescribers.

A national surveillance strategy provides an opportunity for consolidating and building upon existing, high quality, surveillance activities in Australia. This requires strengthening of existing networks and systems, and a re-focusing of priorities towards data for action at the local, state/territory and national levels.

While controlling antimicrobial resistance impacts human health, control requires a cross-sectoral approach, engaging human and animal health, industry and a range of other stakeholders. This Strategy provides a framework for how these diverse groups can provide evidence for action to control AMR.

Background

Joint Expert Technical Advisory Committee on Antibiotic Resistance

The Joint Expert Technical Advisory Committee on Antibiotic Resistance (JETACAR) was established in April 1998 to provide independent expert scientific advice on the threat posed by antimicrobial resistant bacteria. The JETACAR released its report in September 1999, making 22 recommendations for an antimicrobial resistance management program covering:

- regulatory controls;

- monitoring and surveillance;

- infection prevention strategies;

- education; and

- research.

The Australian Government released its response to recommendations of the JETACAR report in August 2000. The government response strongly supported the intent of the JETACAR report and outlined the mechanisms for implementing the recommendations.

Coordination and implementation

To facilitate the implementation of the JETACAR recommendations the Commonwealth Government established the Commonwealth Interdepartmental JETACAR Implementation Group (CIJIG) comprising technical experts and senior representatives from:

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* Surveillance in a broad sense, and for the purpose of this document, is defined as the ongoing and systematic collection, analysis and interpretation of outcome-specific data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know. The final link of the surveillance chain is the application of these data to the control and prevention of human disease and injury.[3]

† For the purpose of the surveillance strategy, the term antimicrobial resistance (AMR) will be used however it will specifically refer to resistance to antibiotics. Antibiotics are defined as antibacterial agents (including ionophores) but not including antiprotozoals, antifungals, antiseptics, disinfectants, antineoplastic agents, antivirals, immunologicals, direct-fed microbials or enzyme substances.[4] Notwithstanding this, similar considerations about monitoring utilisation and surveying resistance may be applied appropriately to other antimicrobial agents.

- the Australian Government Department of Health and Ageing (DoHA);

- the Australian Government Department of Agriculture, Fisheries and Forestry;

- the Australian Pesticides and Veterinary Medicines Authority (APVMA, formerly known as the National Registration Authority for Agricultural and Veterinary Chemicals);

- the Therapeutic Goods Administration (TGA);

- Food Standards Australia New Zealand; and

- the National Health and Medical Research Council (NHMRC).

The Australian Health Ministers' Conference (AHMC) and the Primary Industries Standing Committee each appointed a taskforce to facilitate and monitor the implementation of the JETACAR recommendations and to provide policy advice to CIJIG.

The AHMC JETACAR Taskforce released its final report in November 2000. In summary, it recommended that:

- the Expert Advisory Group on Antimicrobial Resistance continue to provide scientific and policy advice on antimicrobial resistance issues;

- an AMR surveillance network implements a national surveillance strategy; and

- ongoing implementation of all JETACAR recommendations, including those related to surveillance, to be coordinated by CIJIG.

Expert Advisory Group

The Expert Advisory Group on Antimicrobial Resistance (EAGAR) was established under the auspices of the NHMRC to provide independent scientific and policy advice on antimicrobial resistance and related matters to national, state and territory governments and regulatory authorities.

A strategy for AMR surveillance in Australia

This document is a national Surveillance Strategy to address both JETACAR recommendations relating to monitoring and surveillance and an additional recommendation relating to surveillance of antibiotic usage (Table 1).

A key component in the development of a cross-disciplinary coordinated approach to antimicrobial resistance in Australia is the development of a central coordinating unit (CCU), at DoHA. Project officer(s) will work as part of the Surveillance and Epidemiology Section, DoHA on the CCU development project. Following the development project, the CCU functions will be absorbed into the normal business of the Surveillance and Epidemiology Section, Australian Government Department of Health and Ageing.

The CCU will act as a central site for the collation of national surveillance data (Figure). A variety of agencies will engage in the development and implementation of specific action plans. It is the responsibility of each sector and agency to examine the Strategy and decide how best to meet the national objectives by building upon current initiatives and refining these to allow best possible utilisation of data and information.

Figure.   Areas of surveillance collated by the Central Coordinating Unit
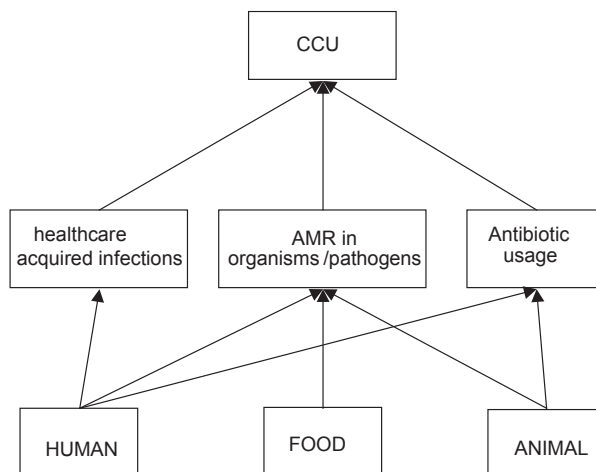
A number of overarching principles will guide the strategic approach taken when establishing a national network of surveillance activities. The CCU will:

1. recognise and build on existing local, state and territory, and national surveillance and monitoring systems rather than establish new ones;

Table 1.   JETACAR recommendations addressed in the Strategy

No.	Recommendation
10	Development of a comprehensive surveillance system for antimicrobial resistant bacteria and resistance genes in humans and animals. The surveillance system should include medical (including nosocomial), food-producing animal and veterinary areas with particular emphasis on the establishment of food-chain and environmental connections.
11	Monitoring and audit of antibiotic usage
14	Surveillance of hospital acquired infections

Table 2.   Agencies involved in surveillance activities

Area of surveillance activity	Primary agency
Antimicrobial resistance in community-acquired infections (humans)	Australian Government Department of Health and Ageing (Communicable Diseases Branch).
Antimicrobial resistance in animals	Australian Government Department of Agriculture, Fisheries and Forestry — Australia
Antimicrobial surveillance in animal-derived foods	Australian Government Department of Health and Ageing (Food and Environmental Health Branch) through OzFoodNet
Surveillance of antimicrobial resistance in healthcare acquired infections	Australian Government Department of Health and Ageing (Communicable Diseases Branch) with the Safety and Quality Council.
Surveillance of antibiotic usage in humans and animals	Australian Government Department of Health and Ageing through the Therapeutic Goods Administration and Australian Pesticides and Veterinary Medicines Authority.

2. work towards nationally consistent standards for national AMR surveillance data; and

3. ensure security and confidentiality of data, and not identify individuals, companies or healthcare establishments. This will be guided by the Australian Health Ministers' Advisory Council National Health Privacy Code.

Aim

This Strategy aims to address recommendations 10, 11 and 14 of the JETACAR report. More specifically, the Strategy aims to:

1. identify priorities for action that will strengthen surveillance at the local, state/territory and national levels;

2. outline surveillance needs;

3. strengthen communication and reporting mechanisms to ensure maximum utilisation of information; and

4. raise awareness of surveillance and antimicrobial resistance.

Strategy outcomes

The surveillance data generated will provide evidence to evaluate policies and set priorities to manage antimicrobial resistance, including:

· antibiotic therapeutic and prudent use guidelines and treatment regimes to improve public health outcomes;

· assessment of risks to public health to form the basis of risk management policy;

· infection control guidelines, hygiene measures and antibiotic restriction policies; and

· the cost-effectiveness of these interventions.

The surveillance data generated will provide data to inform:

· education strategies for medical and veterinary prescribers, hospital staff, food-animal producers, food handlers, industry and consumers;

· risk assessments of new and existing antibiotics for use in humans and animals; and

· prudent use of antimicrobials by medical practitioners, veterinarians and industry, to prolong the efficacy of these products.

Implementation of the Strategy

Introduction: a staged approach

Establishing a comprehensive surveillance system across the human and animal sectors is not a task that can be fully implemented immediately. The plan therefore sets out a staged approach for implementation. Stage 1 and 2 will incorporate the CCU development project.

Stage one – Consultation, planning and implementation

Stage one is intended to acknowledge and draw upon the work that is taking place at the state/ territory and local level. Stage one will include:

· implementation of a central coordinating unit that will be responsible for collection and consolidation of nationally consistent information encompassing the areas of antimicrobial resistance in humans, animals and food, including healthcare acquired infections and antimicrobial usage;

- consultation with key stakeholders to identify and evaluate existing antimicrobial resistance surveillance systems and making recommendations for developing longer term mechanisms to acquire national data on antimicrobial resistance;

- reporting on existing systems;

- identifying local and state/territory activities that can serve as models or developmental projects for possible linking and/or adoption nationally; and

- development and implementation of pilot surveillance programs for antimicrobial resistance, as appropriate.

Stage two – Correlation and improving data systems

It is proposed that stage two focus on:

- correlation of data from the diverse surveillance systems;

- assessment of the surveillance activities to identify gaps and make recommendations for improvement;

- achieving national consensus on national minimum datasets and consistent standards, definitions and methodology; and

- collecting antimicrobial usage data at the state/territory and national level.

Stage three – Evaluation and future planning

It is expected that stage three will involve:

- full implementation and establishment of an ongoing, national surveillance program incorporating local and state/territory surveillance data and data from established surveillance schemes;

- integration of human and animal surveillance systems;

- evaluation of the integrated national surveillance program;

- production and supply of data and information to users to provide a clearer national view of national antimicrobial resistance trends; and

- using the data collected to inform future policy and strategic development and interventions.

Aims

The overall aim is to develop a national surveillance system utilising, where available, existing programs to provide reliable information on antimicrobial resistance in Australia. Antimicrobial resistance surveillance will provide information on the magnitude and distribution of resistant organisms in Australia to identify changing trends and emerging resistance.

Goals

1. Bring together national data collected by existing systems to meet immediate data needs.

2. Develop appropriate pilot programs where systems do not exist.

3. Develop nationally consistent standards of data quality.

4. Develop and implement protocols for appropriate data collection for national antimicrobial resistance surveillance.

5. Report on national prevalence of and trends in antimicrobial resistance.

Processes

The CCU will facilitate the establishment of both a Human Health and an Animal Health Reference Network, and articulate the role of these networks across the four areas of surveillance.

Membership of the Human Health Reference Network may include:

- federal, state and territory health department representatives;

- Communicable Diseases Network Australia;

- Public Health Laboratory Network; and

- representatives from existing surveillance networks.

Membership of the Animal Health Reference Network may include:

- federal, states and territories Primary industry representatives;

- food-animal producer representatives;

- veterinary testing laboratories; and

- individuals with specific expertise.

The CCU development project will proceed in implementing stages 1 and 2 of the Strategy by:

Stage one of Strategy: Consultation, planning and implementation

· developing relationships with key stakeholders in AMR surveillance;

· developing draft surveillance action plan for AMR in humans, and working with other agencies to further develop plans for AMR in animals, healthcare acquired infections, and antimicrobial usage;

· identifying, strengthening and working with existing surveillance networks;

· identifying data gaps to be filled by pilot surveillance programs; and

· collating and reporting on existing antimicrobial resistance data (as appropriate).

Stage two of Strategy: Correlation and improving data systems

· developing consistency in data formats;

· developing consistent case definitions;

· developing consistent laboratory methods and diagnoses;

· developing protocols for data reporting, analysis and interpretation;

· evaluating existing AMR surveillance systems; and

· evaluating the need for a comprehensive surveillance system for AMR in humans and animals.

Surveillance of antimicrobial resistance in community acquired infections

Background

Surveillance of antimicrobial resistant organisms in community-acquired infections is essential to provide insight into the levels of resistant bacteria and their trends. Australia already has many systems in place at the local, state, and national level for the surveillance of antimicrobial resistant organisms in humans. The data collected via these systems are collected for many different purposes, however, much of the data remains at the local level. There is no coordination of these programs, but they form a solid basis for an integrated national program for surveillance of antimicrobial resistance in bacteria of medical importance.

Some of the more well established surveillance systems currently collecting antimicrobial resistance data nationally from hospitals and the community include: the Australian Group on Antimicrobial Resistance (AGAR), the Australian Gonococcal Surveillance Programme, the Australian Meningococcal Surveillance Programme, the Australian Mycobacterium Reference Laboratory Network (AMRLN) and the National Enteric Pathogen Surveillance Scheme (NEPSS).

Aim

To measure the prevalence of and trends in antimicrobial resistance in community-acquired organisms causing significant human diseases in Australia.

Primary agency

Communicable Diseases Branch, Population Health Division, Department of Health and Ageing

Stakeholders

State and territory health department representatives and Communicable Diseases Network Australia

Australian Group on Antimicrobial Resistance

National Enteric Pathogens Surveillance Scheme

National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases

National Neisseria Network (NNN), incorporating the Australian Meningococcal Surveillance Programme and the Australian Gonococcal Surveillance Programme

OzFoodNet

Australian Mycobacterium Reference Laboratory Network

National Notifiable Diseases Surveillance System

Goals

1. Create links with key data collections of antimicrobial resistance in human pathogens.

2. Evaluate data quality in national data collections and identify deficiencies.

3. Estimate the prevalence of resistant bacteria in human pathogens and detect the emergence of new antimicrobial resistance patterns with assistance of surveillance networks and EAGAR.

4. Report national data on the prevalence of antimicrobial resistance in humans.

Processes

Table 3.   Processes for reaching goals of AMR surveillance in human pathogens

Goal	Process
1. Establish links with data collections	Identify stakeholders; CCU coordinator to visit stakeholders and attend meetings, where appropriate.
2. Improve data quality	Evaluate data quality; identify gaps and deficiencies and work with stakeholders to improve data quality.
3. Estimate AMR prevalence	Summarise AMR prevalence for key diseases and antimicrobials from existing data.
4. Reporting	Produce reports in consultation with stakeholders on trends in AMR in pathogens of interest and establish a reporting cycle and format.

Organisms and antimicrobials for surveillance

Table 4.   Organisms and antimicrobials proposed as national priorities for human antimicrobial resistance surveillance in human pathogens

Organism	Passive surveillance	Targeted surveillance (current group)	Minimum antibiotics or classes*
Streptococcus pneumoniae	Yes	Invasive only i.e. blood/ cerebrospinal fluids (none)	Benzylpenicillin, 3rd generation cephalosporins, erythromycin, tetracycline, cotrimoxazole/ trimethoprim
Haemophilus influenzae	Yes	Invasive type b only i.e. blood/ cerebrospinal fluids (none)	Ampicillin, cefaclor, tetracycline, cotrimoxazole
Moraxella catarrhalis	Yes	No	Ampicillin, erythromycin, tetracycline, cotrimoxazole
Staphylococcus aureus	Yes	Yes (AGAR)	Benzylpenicillin, methi/oxacillin, erythromycin, tetracycline, gentamicin, cotrimoxazole/ trimethoprim (plus vancomycin, rifampicin, fusidic acid if methi/oxacillin resistant)
Streptococcus pyogenes	Yes	No	Benzylpenicillin, erythromycin
Escherichia coli	Yes	Yes (AGAR)	Ampicillin, 1st generation cephalosporins, 3rd generation cephalosporins, amoxycillin-clavulanate, gentamicin, fluoroquinolones, cotrimoxazole/trimethoprim
Salmonella species	No	Yes (NEPSS)	Ampicillin, 3rd generation cephalosporins, fluoroquinolones, cotrimoxazole/trimethoprim, chloramphenicol
Campylobacter species	No	Yes (NEPSS)	Fluoroquinolones, gentamicin
Neisseria gonorrhoeae	No	Yes (NNN)	Benzylpenicillin, 3rd generation cephalosporins, fluoroquinolones, tetracycline, spectinomycin
Neisseria meningitidis	No	Yes (NNN)	Benzylpenicillin, 3rd generation cephalosporins, fluoroquinolones, rifampicin
Mycobacterium tuberculosis	No	Yes (AMRLN)	Isoniazid, rifampicin, ethambutol, pyrazinamide

Outcomes

- Estimation of the prevalence and detection of trends of AMR in invasive pneumococcal disease, *Haemophilus influenzae* type b, *Salmonella* causing gastroenteritis, meningococcal disease, gonorrhoea, *Campylobacter* and tuberculosis.

- Improvement in data quality on AMR infections in humans and the development of a national data set on the prevalence of AMR in humans.

- Regular reporting of data on AMR infections in humans.

- To have a national data set on the prevalence of AMR in humans. These data can be used:

  - in risk analysis to determine the risk to human health;

  - to detect the emergence of particular phenotypes of AMR;

  - to detect trends in AMR;

  - to identify the need for particular interventions and to assess the impact of interventions; and

  - to provide a basis for policy recommendations for public health.

Surveillance of antimicrobial resistance in healthcare acquired infections

Background

The incidence of healthcare acquired infections (HAIs) in Australia is high, estimated to be 150,000 per year. These infections cause significant mortality, possibly contributing to as many as 7,000 deaths per year.[5] It is recognised that HAIs compromise patient safety and the quality of care provided, and add a significant resource burden to the health system. A proportion of HAIs involve antimicrobial resistant organisms, and these increase costs even further and often result in increased morbidity and mortality and even higher hospital and post-hospital care costs. HAI surveillance provides important information to hospital staff. It increases awareness of: the organisms present within the hospital and those entering the hospital; the risk of infection associated with a particular procedure; and appropriate and successful interventions. HAI surveillance can highlight deficiencies in infection control or faults in procedures and can assist in changing attitudes. HAI surveillance, including surveillance of antimicrobial resistant infections, better positions hospital staff to implement appropriate population health action to ensure improved patient outcomes.

The Strategy supports the development of a national minimum dataset and consistent case definitions for antimicrobial resistant HAIs, advocates wide participation, and aims to promote timely reporting and communication of successful interventions.

Aims

To measure the prevalence of and trends in antimicrobial resistance in HAIs (both inpatient and outpatient) in Australia.

Primary agency

Communicable Diseases Branch, Australian Government Department of Health and Ageing (with Safety and Quality Council)

Stakeholders

State and territory health departments

Australian Infection Control Association

Australian Group on Antimicrobial Resistance

Health care facilities and laboratories

Goals

1. Identify national and state-based HAI surveillance systems, which collect AMR data as well as laboratory networks, which report AMR data on key pathogens and seek cooperation in the development of a national surveillance system.

2. Evaluate data quality in available data collections and identify deficiencies.

3. Estimate the prevalence of AMR in HAI and emerging issues.

4. Report national data on the prevalence of AMR HAI.

Processes

Table 5. Processes for reaching goals of surveillance of AMR in healthcare acquired infections

Goals	Processes
Identify national and state-based surveillance systems	Establish contacts with existing surveillance systems; CCU to visit and/or attend meetings of surveillance groups as appropriate
Evaluate data quality	In discussion with established surveillance systems, identify gaps and deficiencies and work with stakeholders to improve data quality
Estimate AMR prevalence	In collaboration with existing groups, estimate the prevalence of AMR in HAI in a variety of settings from existing data
Reporting	In collaboration with stakeholders produce reports on prevalence and trends in AMR HAI

Organisms and antimicrobials for surveillance

Table 6. Organisms and antimicrobials for surveillance priority in the healthcare setting

Organism	Passive surveillance	Targeted surveillance (current group)	
Staphylococcus aureus	Yes	Yes –multi-resistant *Staphylococcus aureus* (AGAR)	Benzylpenicillin, methi/oxacillin, erythromycin, tetracycline, gentamicin, cotrimoxazole/trimethoprim, vancomycin, rifampicin, fusidic acid
Enterococcus species	Yes	Yes –vancomycin resistant enterococci (AGAR)	Ampicillin or benzylpenicillin, vancomycin (plus quinupristin-dalfopristin and linezolid if vancomycin resistant)
Escherichia coli	Yes	Yes (AGAR)	Ampicillin, 1st generation cephalosporins, 3rd generation cephalosporins, amoxycillin-clavulanate, gentamicin, fluoroquinolones, cotrimoxazole/trimethoprim
Klebsiella species	Yes	Yes (AGAR)	Ampicillin, 1st generation cephalosporins, 3rd generation cephalosporins, amoxycillin-clavulanate, gentamicin, fluoroquinolones, cotrimoxazole/trimethoprim
Enterobacter species	Yes	Yes (AGAR)	Ampicillin, 1st generation cephalosporins, 3rd generation cephalosporins, amoxycillin-clavulanate, gentamicin, fluoroquinolones, cotrimoxazole/trimethoprim, carbapenems
Acinetobacter species	Yes	Yes –multi-resistant (SA only at present)	Ampicillin, 1st generation cephalosporins, 3rd generation cephalosporins, amoxycillin-clavulanate, gentamicin, fluoroquinolones, cotrimoxazole/trimethoprim, carbapenems (plus amikacin if gentamicin-resistant)
Pseudomonas aeruginosa	No	Yes –multi-resistant (SA only at present)	Ticarcillin/piperacillin, gentamicin/tobramycin, fluoroquinolones, carbapenems
Clostridium difficile	Yes	No	Nil

Outcomes

To obtain an accurate estimate of the problem of antimicrobial resistance in Australian hospitals and healthcare facilities and to establish a network of surveillance systems which can provide on-going nationally representative data to inform those responsible for management of HAI in Australia.

Surveillance of antimicrobial resistance in animals

Background

There is general agreement in the international literature with the JETACAR report finding that there is qualitative evidence that antimicrobials fed to animals leads to resistant bacteria and that these bacteria or their resistance genes can be passed to humans, principally via the food chain. There is little systematic surveillance of antimicrobial resistance in animals in Australia that is relevant and accessible to public health. A national system of surveillance is needed to monitor antimicrobial resistance in animals. Currently, most data are derived from individual veterinary investigations and are not collected in a routine and specified manner nor aggregated and analysed further. Some molecular studies of antimicrobial resistance genes are currently underway in Australia but these are generally conducted as research projects rather than surveillance programs.

Monitoring and surveillance of antimicrobial resistance derived from the veterinary and agricultural use of antimicrobials in Australia will require a new approach. The most relevant guide in the development of a program for Australia is the international standard developed by the world organisation for animal health, the Organization International des Epizooties (OIE).[6] The OIE is the international standards setting organisation recognised by the World Trade Organization.

Aim

To measure the prevalence of and trends in antimicrobial resistance (that is of public health significance) in bacteria from animals.

Primary agency

Product Integrity Animal and Plant Health, Australian Government Department of Agriculture, Fisheries and Forestry.

Stakeholders

Federal, state and territory primary industry departments

Australian Veterinary Association and veterinarians in food animal practice

Livestock industries

Animal Health Laboratories

National Enteric Pathogen Surveillance Scheme

Australian Salmonella Reference Centre

OzFoodNet

Commercial companies and industry

Processes

Table 7.   Processes for reaching goals of AMR surveillance in animals

Goals	Processes
Prevalence of AMR in animals – public health focus	Develop and implement an active surveillance program for commensals that has a public health focus.
	Summarise data on AMR prevalence for commensal bacteria and antimicrobials from the active surveillance program.
Prevalence of AMR in bacteria in animals	Identify sources of passive surveillance data for zoonotic bacteria.
	Summarise data on AMR prevalence for zoonotic bacteria and antimicrobials from existing data.
Prevalence of AMR in animals – animal health focus	Identify stakeholders.
	Evaluate data quality from passive surveillance.
	Identify gaps and deficiencies and work with stakeholders to improve data quality.
	Summarise AMR prevalence for key diseases and antimicrobials from existing data.
Data analysis	Identify any trends in AMR prevalence.
	Identify any associations, if any, between AMR and use patterns of antimicrobials.
	Identify associations, if any, between AMR in animals and AMR in humans.
Reporting	Establish a reporting cycle and format in conjunction with stakeholders.
	Produce reports in consultation with stakeholders on trends in AMR in commensals, zoonotic agents and animal pathogens.

Goals

1. Determine the prevalence of antimicrobial resistant bacteria in animals and their environment and detect the emergence of new antimicrobial resistance patterns.

2. Investigate any association there might be between emergence of resistance and the pattern of use of antimicrobials in animals.

3. Identify circumstance where antimicrobial resistance in animals is related to resistance patterns and trends in humans.

4. Report national data on the prevalence of antimicrobial resistance in animals.

Organisms and antimicrobials for surveillance

Table 8.   Organisms and antimicrobials proposed as national priorities for animal antimicrobial resistance surveillance

Antimicrobial class	Animal pathogens Gram –ve	Animal pathogens Gram +ve	*Salmonella/ E. coli*	*Campylobacter*	*Enterococcus*
Aminoglycosides					
Apramycin	√	√	√		√
Gentamicin	√	√	√		
Neomycin	√		√		
Streptomycin			√		
Amphenicols					
Chloramphenicol*	√	√	√		
Florfenicol			√		
Beta-lactams					
Ampicillin	√	√	√		√
Oxacillin/cloxacillin		√			
Penicillin					
Cephalosporins					
Ceftiofur	√		√		
Glycopeptides					
Vancomycin*		√			√
Lincosamides					
Lincomycin		√			
Macrolides					
Erythromycin	√	√		√	√
Tylosin					√
Quinolones					
Enrofloxacin*	√	√	√	√	√
Ciprofloxacin*			√		
Streptogramins					
Virginiamycin					√
Sulfonamides					
Trimethoprim/ sulphamethoxazole	√	√	√		
Tetracyclines					
Tetracycline	√	√	√	√	√

*   Not registered for use in food animals in Australia.

Outcomes

To obtain objective data on the prevalence of AMR in bacteria of animal origin that have the potential to transfer to humans and cause public health concerns. These data can be used:

- in risk analysis to determine the risk to human and animal health;

- to detect the emergence of particular phenotypes of AMR;

- to detect trends in AMR;

- to identify the need for particular interventions and to assess the impact of interventions; and

- to provide a basis for policy recommendations for public and animal health.

Surveillance of antimicrobial resistance in foods

Background

There is sufficient evidence in the literature to suggest a link between the use of antimicrobials in food producing animals and the emergence of antimicrobial resistant organisms and their spread to humans. Therefore surveillance for antimicrobial resistant organisms of public health importance in foods needs to be addressed. In Australia, there is little systematic surveillance of antimicrobial resistance in bacteria contaminating foods, including animal derived foods. Some data are collected by individuals states, however there is no integration of this data to determine trends in AMR at a national level. Data collected from existing food surveillance activities should form part of the overall resistance surveillance system. A possible future initiative includes the collection of resistance data on *Salmonella, E. coli* and *Campylobacter* in foods through OzFoodNet and Australian Quarantine Inspection Service Imported Foods Inspection Scheme (formerly the Imported Foods Program).

Aim

To measure the prevalence of and trends in antimicrobial resistance in bacteria recovered from food.

Primary agency

Food and Environmental Health Branch, Australian Government Department of Health and Ageing, with OzFoodNet

Stakeholders

Federal, state and territory primary industry and health departments

Food Standards Australia New Zealand

Australian Quarantine Inspection Service Imported Food Inspection Scheme

Livestock industries

Veterinarians in food animal practice

Animal Health Laboratories

National Enteric Pathogen Surveillance Scheme

Australian Salmonella Reference Centre

Goals

1. To evaluate the prevalence of antimicrobial resistant bacteria in food at various stages of production and processing.

2. To investigate any association there might be between emergence of resistance and the pattern of antimicrobial use in food production.

3. To identify circumstances where antimicrobial resistance in foods is related to resistance patterns and trends in animals and humans.

4. To report national data on the prevalence of antimicrobial resistance in bacteria recovered from food.

Processes

Table 9.   Processes for reaching goals of AMR surveillance in foods

Prevalence of AMR in animal-derived food	Identify stakeholders.
	Evaluate data quality from passive surveillance, if any.
	Identify gaps and deficiencies and work with stakeholders to improve data collection and quality.
	Summarise AMR prevalence for key organisms and antimicrobials from existing data.
	Develop and implement a program of active surveillance in foods that has a public health focus.
Data analysis	Identify any trends in AMR prevalence.
	Identify any associations, if any, between AMR and use patterns of antimicrobials.
	Identify associations, if any, between AMR in foods and AMR in humans.
Reporting	Establish a reporting cycle and format in conjunction with stakeholders.
	Produce reports in consultation with stakeholders on trends in AMR.

Organisms and antimicrobials for surveillance of AMR in foods

Table 10. Organisms and antimicrobials proposed as priorities for AMR surveillance in food

Organism	Antimicrobials for surveillance.
Salmonella	Multi-resistance, including fluoroquinolones and 3G cephalosporins.
Campylobacter	Ciprofloxacin, erythromycin, tetracycline.
Enterococcus	Ampicillin, vancomycin, erythromycin, ciprofloxacin, tetracycline, streptogramins.
Escherichia coli	Gentamicin, ampicillin, co-trimoxazole.

Outcomes

1. Systematic surveillance system that generates high quality data on the presence of AMR in food.

2. Effective mechanisms for collating, interpreting and reporting data at a national level.

3. Standardised documentation of trends in food AMR.

4. Data to inform risk assessment and that can be used to develop risk management measures for AMR in food.

Monitoring of antimicrobials used in people and animals

Background

Over the past 20 years there has been increasing concern about the overuse or inappropriate use of antimicrobials in human medicine and a general recognition that over use of antimicrobials can lead to rapid establishment of large pools of antimicrobial resistant pathogens. Surveillance of antimicrobials from the time they enter Australia to the time of their consumption in either animals or humans has to become an accepted component of the total surveillance system. Action is being undertaken through CIJIG and EAGAR to improve usage data. National data on antimicrobial use needs to include total antimicrobials imported, how much is used in humans (including community and hospital use) and animals, and what these antimicrobials are used for. The two regulatory bodies that approve antimicrobials for humans and animals, TGA and APVMA respectively, are already working towards enhancing the quality of antimicrobial import and supply data. Antimicrobial import data are currently collected by TGA, and this includes antimicrobials for human, veterinary and stockfeed use.

The use of antimicrobials in humans is monitored through the Pharmaceutical Benefits Scheme (PBS) and pharmacies. The Drug Utilisation Sub-committee collates and reports on usage data collected by these two bodies. Few hospitals have usage surveillance in place, although a statewide antimicrobial use surveillance system across 15 public and private hospitals has recently commenced in South Australia. There is no comparable system for collecting data on antimicrobial use in the agricultural sector.

Aim

To provide reliable data on the volume of antimicrobials consumed by humans and animals in Australia and their patterns of use.

Primary agency

Australian Government Department of Health and Ageing through the Therapeutic Goods Administration and Australian Pesticides and Veterinary Medicines Authority

Stakeholders

Health care facilities

Australian Infection Control Association

Australian Customs Service

Pharmaceutical Benefits Scheme and Pharmacy Guild

Therapeutic Goods Administration

Australian Pesticides and Veterinary Medicines Authority

State and territory health and primary industries departments

Australian Veterinary Association

Drug Utilisation Sub-committee

Goals

1. Reliable and accurate antimicrobial import, supply and end-use data collected and provided nationally, involving the national collation of human antimicrobial use data from community and hospital pharmacies, PBS and veterinary sources.

2. Aggregated state/territory antimicrobial utilisation information provided to the CCU for inclusion in the national annual publication.

3. Human and Animal Health Reference Networks, the Australian Infection Control Association and other relevant groups, to refine the definition for antimicrobial-use in the context of national surveillance.

Processes

Table 11. Processes for reaching goals of monitoring antimicrobial use in humans and animals

Goals	Processes
Collation of data on antimicrobials imported for use in humans, animals and animal-derived food.	Conduct evaluation sessions to determine that importers define who has requested import and that import request tallies with registered product registers.
	Evaluate existing sources of antimicrobial import data (e.g. TGA import data) and make recommendations for improvement.
Collation of data on regulatory authority supply of antimicrobials for use in humans, animals and animal derived foods.	Evaluate existing sources of regulatory supply data and make recommendations for improvement, including improving the review and follow-up of antimicrobial supply data.
	Obtain cooperation from the pharmaceutical companies to facilitate collection of regulatory authority supply data.
Collation of end-use data on antimicrobials used in humans, animals, and animal derived foods.	Evaluate existing sources of end use data and make recommendations, including methods for development of better data on antimicrobials consumption in food producing animals.
	Determine optimal mechanism for obtaining end use data in animal health and human health sectors.
	Identify financial infrastructure for collection of end-use data.
Data analysis	Reconciliation of import, regulatory authority and end use antimicrobial usage data.
	Identify trends in antimicrobial usage among humans and animals, for example in humans, by age group, setting, and indication, and in animals, by species and setting.
Reporting	Establish a reporting format in conjunction with stakeholders.
	Produce a report on findings and trends in antimicrobial usage in humans, animals, and animal derived food.

Antimicrobials for surveillance in humans and animals

Table 12. Antimicrobials proposed as priorities for surveillance of usage

Settings	Antimicrobials to be considered for surveillance.
Community	Third-generation cephalosporins, first-generation cephalosporins, penicillins, tetracycline, fluoroquinolones, rifamycins, spectinomycin, erythromycin, tetracyclines, co-trimoxazole/trimethoprim, gentamicin, vancomycin, fusidic acid, fluoroquinolones, chloramphenicol, isoniazid, spectinomycin, ethambutol, pyrazinamide.
Hospitals	Penicillins, erythromycin, tetracycline, gentamicin, cotrimoxazole/trimethoprim, glycopeptides, First and third generation cephalosporins, rifampicin, fusidic acid, fluoroquinolones, carbapenems, amikacin, macrolides, linezolid, quinupristin-dalfopristin.
Animals	Aminoglycosides, amphenicols, bambermycins, cephalosporins, lincosamides, macrolides, orthosomycins, penicillins, polyethers, polypeptides, quinolones, streptogramins, sulfonamides, tetracycline.

Outcomes

- To improve existing collection of antimicrobial usage data, including the provision of import supply and end-use data for national surveillance reporting. The data collected will:

  - facilitate risk analysis for registration applications, extensions of use application, and Pharmaceutical Benefits listing.

  - be used in formal reviews of antimicrobials by regulatory authorities;

  - enable evaluation of the effectiveness of prudent use efforts and mitigation strategies;

  - enable trends in antimicrobial usage to be studied; and

  - enable international reporting and comparisons.

- To facilitate the development of prescribing and regulatory interventions that would improve the prudent use of antimicrobials.

Monitoring and evaluation of the Strategy

An ongoing evaluation process should monitor progress against the Strategy. The performance of the strategy will be monitored against performance indicators that will be outlined in the detailed action plans for each of the four surveillance areas. Progress against the Strategy will be regularly reported by CIJIG on the Implementing JETACAR website, to the Communicable Diseases Network Australia, the Public Health Laboratory Network and other relevant bodies including the Australian Health Ministers' Conference and the Primary Industries Standing Committee, as required.

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