

A COMPREHENSIVE INTEGRATED SURVEILLANCE PROGRAM TO IMPROVE AUSTRALIA'S RESPONSE TO ANTIMICROBIAL RESISTANCE

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A report prepared for the NHMRC's Expert Advisory Group on
Antimicrobial Resistance (EAGAR)

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SUMMARY

Antimicrobial resistance (AMR) is a major global public health problem and has been prioritised for international action by the World Health Organisation. New strains of antimicrobial-resistant bacteria have emerged in Australia in recent years and overseas experience suggests that, if high rates of consumption continue, the levels of AMR will increase in coming years.

Surveillance has an important role in combating and managing AMR. 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. Therefore short-term investment leads to longer-term gains and overall savings.

A cross-disciplinary, nationally coordinated approach to AMR surveillance is proposed for Australia. This will consolidate and build upon existing surveillance systems and initiatives, identify where existing systems could be modified to provide the desired outcomes, and pinpoint new initiatives that could be taken where gaps exist. The surveillance program has two components:

- a) Surveillance of antimicrobial use.
- b) Surveillance of antimicrobial resistance.

Within each component are a series of discrete projects whose aim is to deliver a specific sub-component of the overall national surveillance program (Figure 1). These together with the priority for implementation are outlined in this report.

The proposed program will deliver improved health outcomes for patients through the development and implementation of:

1. A coordinated nationally representative program for the surveillance of antimicrobial use in hospitals, the community, veterinary medicine and agricultural production.
2. Active and passive surveillance programs to determine the prevalence of AMR in pathogens causing serious health problems in hospital- and community-acquired infections.
3. Targeted active surveillance programs to determine the prevalence of AMR of animal and public health significance in key indicator and zoonotic bacteria found in food and in the digestive tract of food animals.
4. A system of regular collection, collation, interpretation and reporting of national antimicrobial use data and AMR surveillance data to stakeholders.

Recommendations

That the Australian Government

1. Accept and implement the framework of this comprehensive integrated surveillance program to improve Australia's response to AMR in order to improve health outcomes for the Australian population, reduce health care costs and meet the Government commitment to AMR surveillance given in the Commonwealth Response to the JETACAR Report and to fulfil international obligations under the World Health Organisation.
2. Establish and resource an AMR surveillance capability within the Office of Health Protection in the Australian Government Department of Health and Ageing (DoHA) to coordinate the national AMR Surveillance Program, and to analyse and report the results to stakeholders and the international community.
3. Resource the individual projects that make up this national integrated AMR surveillance Program.
4. Appoint an AMR Technical Advisory Working Group to provide input and advice to DoHA with membership drawn from infectious disease physicians, clinical microbiologists, pharmacists, state special interest groups, therapeutic advisory groups or appropriate professional bodies.
5. Liaise with the Expert Advisory Group on Antimicrobial Resistance (EAGAR) and stakeholders to confirm priorities for action.

A COMPREHENSIVE INTEGRATED SURVEILLANCE PROGRAM TO IMPROVE AUSTRALIA'S RESPONSE TO ANTIMICROBIAL RESISTANCE

The problem of antimicrobial resistance.

Antimicrobial resistance (AMR)¹ is a major global public health concern and has been prioritised for international action by the World Health Organisation (WHO) through the *WHO Global Strategy for Containment of Antimicrobial Resistance* (2001) and the 58th World Health Assembly Resolution WHA58.27 *Improving the containment of antimicrobial resistance* (May 2005). Australia consumes high levels of antimicrobials by world standards both for human health and in agricultural production.

New strains of antimicrobial-resistant bacteria have emerged in Australia in recent years and there is clear evidence from overseas experience that, if high rates of consumption continue, this can lead to rapid establishment of large pools of antimicrobial-resistant pathogens and the levels of AMR will increase in coming years. Multiresistant strains of *Staphylococcus aureus* (methicillin resistant *S. aureus* or MRSA) have been well established in hospital practice for many years, extending hospital stays and causing ongoing morbidity in those who contract the infection. Recent additions to hospital-acquired resistant pathogens include gram-negative bacteria harbouring extended-spectrum β -lactamases (ESBL), vancomycin resistant enterococci (VRE), MRSA with reduced susceptibility to vancomycin and multiple antimicrobial-resistant *Acinetobacter*. In the Australian community, resistant respiratory pathogens and *Escherichia coli* are now common, driving general practitioners to choose broad-spectrum antimicrobials for common and minor conditions. More worrying is the recent establishment of MRSA in the community (caMRSA).

Whilst most resistance affecting human health is fuelled by antimicrobial use in hospital and community medical practice, there is evidence that antimicrobial use in food animals can lead to resistance in zoonotic pathogens and commensals and that this resistance can be transferred through the food chain and have an impact on human health.

AMR has significant social and health costs. In the community it leads to failed antimicrobial treatments, prolonged recovery from illness, more time away from work, an increasing need for broader-spectrum antimicrobials and more hospitalisations. In hospitals, AMR leads to prolonged admissions, unplanned re-admissions, treatment failure leading to more demanding care or death and increased infection control measures. All these factors impact greatly on patients and health care workers.

AMR also has major economic costs. It is estimated that the total economic effect of AMR on Australia's health care budget may be in excess of \$250 million per year; as resistance rises in an exponential manner, so too will the health costs.

Hospitals: Estimates of the economic impact of AMR in United States hospitals were of the order of US\$1.3 billion per year (1992 dollars) for hospital-acquired bacterial infections. Australia has similar resistance rates in hospital to those in the USA, and therefore the comparable health care cost in Australia may be more than \$200 million per year. These figures do not include the economic effects of lost productivity due to prolonged hospital stays.

¹ For the purpose of this surveillance program, the term antimicrobial resistance (AMR) will be used. It specifically refers 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 (*The Commonwealth Government Response to the Report of the Joint Expert Technical Advisory Committee on Antibiotic Resistance (JETACAR)*, 2000).

Community: The economic effects of AMR in the community have also been estimated. Australia spends in excess of \$500 million a year on antimicrobials for infections treated in the community. It is estimated that emerging resistance in the community could result in general practitioners writing 10% of all scripts for antimicrobials that cost twice as much as conventional treatment. This translates to an additional cost to the taxpayer of \$50+ million per year.

Antimicrobial resistance surveillance.

Increasing or high levels of resistance to antimicrobials used for therapeutic or prophylactic treatment of certain diseases of public health importance pose the very real prospect of increased morbidity and mortality and prolongation of disease outbreaks. Antimicrobial treatment alone is not the sole or major intervention required, but rather it is one component, albeit a key one, of an integrated public health approach to infectious disease management and control.

The importance of surveillance² in combating and managing AMR is recognised as an important component of the *WHO Global Strategy for Containment of Antimicrobial Resistance* (2001). AMR surveillance for public health purposes should be based on certain ‘triggers’ including among others, the importance of the disease in terms of morbidity and mortality, the disease incidence in Australia, and the potential for disease transmission in Australia. The diseases involved should be those where the public health response is important and where therapeutic options and disease control are affected by AMR.

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. Therefore short-term investment leads to longer-term gains and overall savings.

Many healthcare facilities, professional groups, networks and surveillance programs already have extensive experience with AMR surveillance in Australia. 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 AMR Surveillance Program provides an opportunity for consolidating and building upon some existing and proposed 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.

Controlling AMR requires a cross-sectoral approach, engaging human and animal health, industry and a range of other stakeholders. This Program outlines a framework for how these diverse groups can provide evidence for action for the management and control AMR in Australia.

While the focus of this AMR Surveillance Program is on resistance developed by bacteria to antibacterial agents and monitoring the use of these drugs, the same principles and infrastructure proposed can be readily adapted, at relatively minimal cost increase, to surveillance and monitoring of antiviral and antifungal resistance and the volumes of antiviral and antifungal agents used.

² **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 (Thacker, 1996).

Antimicrobial resistance management in Australia

The seriousness of AMR came into national focus in April 1998 when the then Commonwealth health and agriculture ministers established the Joint Expert Technical Advisory Committee on Antibiotic Resistance (JETACAR) 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 AMR management program covering:

- regulatory controls;
- monitoring and surveillance (see Table 1);
- infection prevention strategies;
- education; and
- research.

Table 1: JETACAR recommendations that relate to antimicrobial resistance surveillance.

No.	Recommendation
10	<p>That a comprehensive surveillance system be established incorporating passive and active components measuring incidence and prevalence of antibiotic-resistant bacteria and resistance genes, covering all areas of antibiotic use. To achieve this aim, it is further recommended that a multidisciplinary taskforce of relevant experts be formed by the federal ministers of health and agriculture to design, cost and recommend funding mechanisms and management systems for reporting and analysis of antibiotic resistance data in Australia.</p> <p>The overall surveillance system should include medical (including nosocomial), food-producing animal and veterinary areas, with particular emphasis on the establishment of food-chain (including imported food) and environmental connections, and include molecular studies of resistance genes. The efforts of the taskforce should be directed at adopting a uniform, systematic and synergistic approach across all areas by utilising, enhancing and extending currently available systems and organisational structures.</p>
11	<p>That a comprehensive monitoring and audit system for antibiotic usage be established that covers all areas of antibiotic use. To achieve this aim, it is recommended that the federal ministers of health and agriculture form a multidisciplinary taskforce of medical, veterinary, industry and regulatory experts (including Customs, TGA, Department of Health and Ageing (DoHA), NRA and Department of Agriculture, Fisheries and Forestry – Australia) to refine the current antibiotic import data collection and audit process, and make recommendations to relevant authorities for developing methods of monitoring and audit usage.</p>
14	<p>That DoHA examine current surveillance activities for hospital-acquired (nosocomial) infections, particularly for antibiotic-resistant strains, and that the department work with stakeholders (including the States and Territories) to further develop a comprehensive and standardised national system for monitoring nosocomial infections that will facilitate:</p> <ul style="list-style-type: none"> - earlier recognition of a public health problem; - improvements in infection control and hygiene measures; and - the timely development of national standards, guidelines and practices for both surveillance and infection control in the health care setting.

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. To facilitate the implementation of the JETACAR recommendations the Commonwealth Government established two effector groups:

1. The Commonwealth Interdepartmental JETACAR Implementation Group (**CIJIG**) comprising technical experts and senior representatives from:
 - the Australian Government Department of Health and Ageing (DoHA);
 - the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF);
 - the Australian Pesticides and Veterinary Medicines Authority (APVMA);

- the Therapeutic Goods Administration (TGA);
 - Food Standards Australia and New Zealand (FSANZ); and
 - the National Health and Medical Research Council (NHMRC).
2. The Expert Advisory Group on Antimicrobial Resistance (**EAGAR**) under the auspices of the NHMRC to provide independent scientific and policy advice on AMR and related matters to national, State and Territory Governments and regulatory authorities.

Most of the regulatory controls identified for action in the JETACAR Report have been implemented or are well down the track of implementation. Some elements of the comprehensive strategy for AMR surveillance in Australia developed by DoHA and DAFF are already in place with a number of surveillance activities initiated in the past three years. These include:

- a one-off survey of AMR in livestock (funded by DAFF);
- an active surveillance program has been run by the Australian Group on Antimicrobial Resistance (AGAR) since 1986. Aspects of this program have been funded by DoHA for the past two years;
- a pilot program for national surveillance of the use of antimicrobials in hospitals (funded by DoHA);
- a survey of AMR in *Campylobacter* isolates (funded by DoHA);
- retrospective analysis of *Salmonella* AMR data (funded by DoHA & DAFF).
- collection, collation and reporting of sales volumes of antimicrobials used in veterinary practice and agriculture (undertaken by APVMA).

At the time the JETACAR Report was published in 2000, Australia was at the forefront of developed nations in addressing the national management of AMR. While Australia may have dropped off the pace a little in recent years, the framework for a comprehensive AMR surveillance program is in place. The purpose of this document is to draw together those elements that are already in place, to identify gaps and to set priorities for action and implementation to take Australia the next step to a comparable position to other developed countries in Europe and North America in implementing national AMR surveillance programs and programs to monitor antimicrobial use. Appendix 1 contains a summary of AMR Management programs in other countries that can be used as a benchmark for Australia.

Background to this proposal

The EAGAR terms of reference include:

To provide strategic, independent, expert advice and timely scientific and technical analysis to Commonwealth, State and Territory Governments and Commonwealth Statutory organisations on a range of activities, including the monitoring of antimicrobial use in medical and veterinary science (including agriculture) and surveillance and monitoring of antimicrobial resistance.

In the absence of comprehensive Australian data on antimicrobial use and AMR, EAGAR's ability to provide the appropriate level of scientific advice to government(s) is compromised.

The Program outlined in this submission was commissioned by the NHMRC at the instigation of EAGAR and outlines the framework for a national surveillance program for AMR in Australia.

Specifically, the Program addresses the recommendations made by the JETACAR relevant to monitoring and surveillance, and antimicrobial usage (recommendations 10, 11 and 14). As the program is progressively implemented, it will:

- provide information for action to improve public health outcomes and savings to the national health budget by providing linkages between AMR surveillance data and disease control functions;
- satisfy the Australian Government's response to the JETACAR Report;
- enable the Expert Advisory Group on Antimicrobial Resistance (EAGAR) to perform its role in providing expert advice to Government and the National Health and Medical Research Council (NHMRC);
- enable Australia to comply with WHA Resolution 58.27 to ensure '*development of a coherent, comprehensive and integrated national approach to implementing the strategy for containment of AMR and to monitor effectively nosocomial infections and the use of antimicrobial agents and the level of antimicrobial resistance in all relevant sectors*'.

Program objectives

The proposed program will develop and implement:

1. A coordinated nationally representative program for the surveillance of antimicrobial use in hospitals, the community, veterinary medicine and agricultural production.
2. Active and passive surveillance programs to determine the prevalence of AMR in pathogens causing serious health problems in hospital- and community-acquired infections.
3. Targeted active surveillance programs to determine the prevalence of AMR of animal and public health significance in key indicator and zoonotic bacteria found in food and in the digestive tract of food animals.
4. A system of regular collection, collation, interpretation and reporting of national data to stakeholders.

Program outcomes

The program will provide information for public health action by providing linkages between AMR surveillance data, antimicrobial usage data and disease control functions with consequent flow-on of social and economic benefits for the Australian community through the following three key elements: -

1. Nationally consistent, validated and cost-effective methods for determining and reporting the prevalence and incidence of antimicrobial-resistant bacteria will
 - Give an estimate of the burden of AMR that can be used as a benchmark to define the size of the problem and once established, can provide accurate estimates of the costs associated with AMR;
 - Determine trends in AMR and the need for particular interventions; and enable assessment of the impact of those interventions;
 - Detect the emergence of new strains of AMR bacteria;
 - Provide reliable data to underpin basic research, inform therapeutic guidelines and raise professional and public awareness; and
 - Provide a basis for policy recommendations for public health.
2. A nationally representative program that estimates antimicrobial use in hospitals, the community, veterinary medicine and agricultural production will enable:

- Examination of trends in antimicrobial use at state and national levels that can be correlated with AMR data, and form the basis for larger scale interventions to rationalise antimicrobial prescribing;
 - Evaluation of the impact of interventions at local, state and national level;
 - Provision of data that will facilitate risk analysis for new registration applications, extensions of use application, Pharmaceutical Benefits listing and reviews of antimicrobial registration by regulatory authorities;
3. Vesting of responsibility for the implementation and co-ordination of the national AMR Surveillance Program within a single agency will allow:
- Correlation of usage data with interventions and with prevalence of AMR to measure performance and refine further interventions (such as revisions to guidelines for clinical, veterinary and agricultural practice and scheduling decisions); and
 - Provide an Australian dataset on antimicrobial use and resistance for comparison with international data.

Potential outcomes if the comprehensive Program is not implemented

Emerging AMR over the past twenty years has become a serious and increasingly expensive problem in Australia. Optimal antimicrobial use is the cornerstone in limiting development of AMR. Infection control and prevention provides a mechanism to limit the spread of AMR. Surveillance of AMR is the key to determining whether current safeguards are too stringent, too lax or cost-effective. If the proposed comprehensive program is not implemented, the implications are:

- rapid escalation of the economic impact above the current estimated \$300+ million per annum;
- the quality of life will be further diminished by AMR.

Program outline and budget

A cross-disciplinary, coordinated approach to AMR surveillance is proposed. This will consolidate and build upon existing surveillance systems and initiatives, identify where existing systems could be modified to provide the desired outcomes, and identifies new initiatives that could be taken where gaps exist.

The surveillance project has two components:

- a) Surveillance of antimicrobial use.
- b) Surveillance of antimicrobial resistance.

Within each component are a series of discrete projects whose aim is to deliver a specific sub-component of the overall national surveillance program. These together with the priority for implementation are outlined in Figure 1 and Table 2.

Figure 1: The Australian Antimicrobial Resistance Surveillance Program

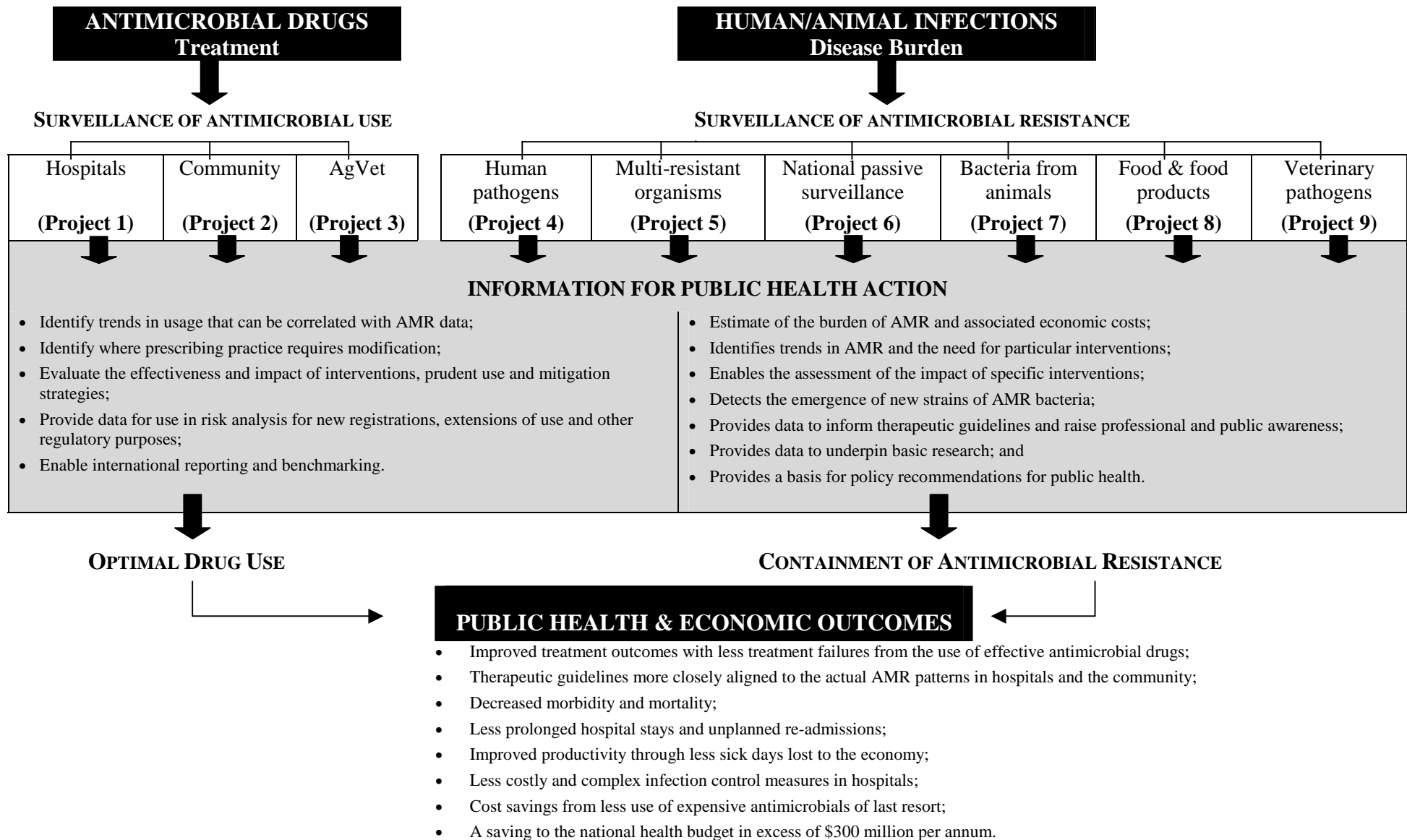


Table 2 Preliminary cost estimates and priority for action for a comprehensive integrated surveillance program to improve Australia's response to antimicrobial resistance.

Surveillance of antimicrobial use		Year 1 already funded	Year 1 new funding	Year 2 Ongoing funding	Year 3 Ongoing funding	Priority
1	Surveillance of the use of antimicrobials in hospitals	160,000		160,000	160,000	1
2	Surveillance of the use of antimicrobials in the community	0 ¹		0 ¹	0 ¹	1
3	Surveillance of the use of antimicrobials in food animals.	0 ¹		0 ¹	0 ¹	2
Surveillance of antimicrobial resistance (AMR)						
4	Active surveillance of AMR in pathogens of importance in human health.	280,000		300,000	300,000	1
5	Surveillance of multi-resistant organisms					2
6	Passive surveillance of AMR in bacteria of importance in human health		600,000	500,000	300,000 ²	1
7	Active surveillance of AMR in bacteria isolated from food animals and aquaculture		385,000	385,000	385,000	4
8	Surveillance of AMR in bacteria isolated from food and food products	340,000		Review when pilot program completed		3
9	Surveillance for AMR in animal pathogens with implications for public health.	Not costed				5
		780,000	985,000	\$1.345 m	\$1.145 m	
Total additional funding for 3 years.			\$3.475 m			

NOTE:¹ Costs absorbed within existing budget.² Data will be captured as part of Project 6 once the AMR data capture program is deployed nationally.

Projects have been prioritised on the basis of perceived need and importance from a public health perspective, taking into account existing infrastructure and resources.

Program leadership and coordination

The WHO “*Global Strategy for Containment of Antimicrobial Resistance*” Recommendation 5 sets out the role of national government health policies and health care systems in determining the efficacy of interventions to contain AMR. National commitment to understand and address the problem and the designation of authority and responsibility are prerequisites.

Australia needs persistent, co-ordinated leadership and support for efforts consistent with current national and international action plans against the growing global public health threat of AMR. In this context, it is critical to the implementation of this national program that responsibility is vested within a single agency. Most appropriate would be the establishment of an AMR surveillance capability within the Office of Health Protection (OHP) of DoHA to drive the implementation of a comprehensive AMR surveillance program for Australia. The proposed Australian AMR Surveillance Program has direct relevance to all three Branches of the OHP:

- The Health Protection Policy Branch is responsible for the development, implementation and management of national communicable disease control policies including AMR;
- The Surveillance Branch is responsible for strengthening disease surveillance systems and contact tracing capacity; and
- The Health Emergency Planning and Response Branch is responsible for effective risk assessment and coordination of national health responses to naturally occurring or introduced biological and emerging threats to the population.

Staffing within the OHP with responsibility for the AMR Surveillance Program should include microbiologists with a clinical background and experienced epidemiologists. An expert technical panel drawn mainly from health practitioners, who generate, analyse and report AMR data together with some veterinary input, would be best placed to guide the activities of the Program. This management process should ensure adequate opportunity for planning and coordination of surveillance, provide true integration of the component projects and realise economies of scale where possible. It is essential that an ongoing evaluation process monitor and report progress against the agreed program objectives, outcomes, budget and timelines.

Recommendations

That the Australian Government

1. Accept and implement the framework of this comprehensive integrated surveillance program to improve Australia's response to AMR in order to improve health outcomes for the Australian population, reduce health care costs and meet the Government commitment to AMR surveillance given in the Commonwealth Response to the JETACAR Report and to fulfil international obligations under the World Health Organisation.
2. Establish and resource an AMR surveillance capability within the Office of Health Protection in the Australian Government Department of Health and Ageing (DoHA) to coordinate the national AMR Surveillance Program, and to analyse and report the results to stakeholders and the international community.
3. Resource the individual projects that make up this national integrated AMR surveillance Program.
4. Appoint an AMR Technical Advisory Working Group to provide input and advice to DoHA with membership drawn from infectious disease physicians, clinical microbiologists, pharmacists, state special interest groups, therapeutic advisory groups or appropriate professional bodies.
5. Liaise with the Expert Advisory Group on Antimicrobial Resistance (EAGAR) and stakeholders to confirm priorities for action.

References

1. Joint Expert Advisory Committee on Antibiotic Resistance (JETACAR). *The Use Of Antibiotics In Food-Producing Animals: Antibiotic-Resistant Bacteria In Animals And Humans*. Commonwealth Department of Health and Aged Care, Commonwealth Department of Agriculture, Fisheries and Forestry - Australia. September 1999. <http://www.health.gov.au/internet/wcms/Publishing.nsf/Content/health-pubhlth-strateg-jetacar-index.htm>
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Project 1: A national surveillance system for the use of antimicrobials in hospitals

Objectives

1. Develop and implement a coordinated nationally representative program for the surveillance of antimicrobial utilisation in Australian hospitals.
2. Develop and implement a suitable database to accept and process diverse datasets from contributing hospitals.
3. Establish a system of regular reporting to individual contributing hospitals to enable those institutions to examine their own antimicrobials usage rates over time and identify areas of high usage as targets for local and/or national intervention programs.
4. Provide an Australian peer group benchmark for comparison, and enable comparison with international data.

Rationale

The increasing incidence of antimicrobial resistance (AMR) and the association with high antimicrobial usage rates in hospitals has been widely reported around the world. Published data suggest that concomitant surveillance of both AMR and antimicrobial usage is helpful in interpreting AMR in the hospital setting. It can provide objective and quantitative data to evaluate usage patterns and can assist in the ability to respond to problems of AMR in a precise and targeted way.

Background

A national program of surveillance of antimicrobial use in hospitals exists but requires further development and support. The national system is based on a surveillance program to provide ongoing information on in-patient antimicrobial utilisation in metropolitan hospitals in South Australia. This program commenced in 2001 as an initiative of the Infection Control Service (ICS) of the South Australian Department of Human Services. In August 2004, the ICS was provided with a grant by the Australian Government to establish a pilot national surveillance program modelled on the existing South Australian surveillance program, to include data from selected hospitals in other states.

When the pilot national program was completed in 2005, 22 principal referral hospitals were participating, with 15 submitting monthly data and 7 in the process of having data submission standardised before full participation. Data were processed using the South Australian database. Reports distributed to participating hospitals provided monthly utilisation rates for six antimicrobial classes for the individual hospital and a comparative national rate calculated from pooled data. The pilot program has laid the groundwork and identified areas for further development and refinement in order to establish an efficient and comprehensive national surveillance program.

Outcomes and Deliverables

1. A national program will have as its centrepiece a generic computer program that is capable of accepting antimicrobial utilisation data from individual hospitals.
2. Automated analysis of the data will produce reports and charts that provide individual hospital, state and national utilisation rates. These data can be used to:

- facilitate risk analysis for new registration applications, extensions of use application, Pharmaceutical Benefits listing and reviews of antimicrobial registration by regulatory authorities;
- enable examination of trends in hospital antimicrobial use at state and national levels as the basis for larger scale interventions to rationalise hospital antimicrobial prescribing;
- evaluate the impact of interventions in the hospital setting at local, state and national level;
- produce longitudinal antimicrobial usage data that may be used to demonstrate a link between antimicrobial use and resistance in the future, both at local hospital and national level; and
- provide an Australian peer group benchmark for comparison, and enable comparison with international data.

Work Program

Goal	Process	Tasks
1.	Establish a committee or working group to provide a more formal structure for implementation of the project and to provide on-going leadership and support in all jurisdictions.	The Australian Government to appoint representatives from each State/Territory; these may be drawn from: <ul style="list-style-type: none"> • interested infectious disease physicians, clinical microbiologists and pharmacists; • state special interest groups, therapeutic advisory groups or appropriate professional bodies.
2.	Implement IT solutions for deficiencies identified in the pilot program undertaken by the South Australian Government.	Develop suitable functionality to extract antimicrobial usage data from hospital pharmacies; <ul style="list-style-type: none"> • In the first year employ a programmer to refine the tool developed at St George Hospital; • By the end of the second year, negotiate a solution with iSOFT Australia Pty Ltd to improve functionality.
3.	Develop a standardised national system of drug descriptors.	Coordinate this process through an AHMAC Working Group.
4.	Enhancements to current reporting	<ul style="list-style-type: none"> • total antimicrobial consumption over time both at hospital and national level; • periodic reporting of some agents used to treat multi-resistant infections; • expand the range of agents to facilitate comprehensive monitoring of use, including high-cost antifungals; • stratify hospital use data into clinical groups based on hospital size; • include surveillance for specialised units (e.g. ICU, burns, cystic fibrosis, haematology/oncology) where feasible; • develop automated quarterly and annual reporting using an agreed format for data presentation.
5.	Recruit additional hospitals to this program once the infrastructure for data collection and reporting is established.	<ul style="list-style-type: none"> • Include by the end of the second year, all AIHW principal referral hospitals; • Stratify the larger hospitals by size to enable more appropriate benchmarking between individual hospitals and their pooled peer group rates.

Budget

Item	FTE	\$ On-going
Salary plus on-costs Senior Project Pharmacist	1.0	\$82,000
Administration officer	1.0	\$46,000
Total salary		\$128,000
Goods and Services		\$32,000
Total expenditure		\$160,000

References

1. Pilot National Antimicrobial Utilisation Surveillance Program. Report to the Australian Government Department of Health and Ageing. Communicable Disease Control Branch, Department of Health, Government of South Australia. October 2005.
2. Strategy for Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group. August 2003.
3. Action Plan for National Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group. August 2003.

Project 2: A national surveillance system for the use of antibiotics in the community.**Objectives**

1. Develop and implement a nationally representative program for the surveillance of antimicrobial utilisation in the Australian community.
2. Establish a system of regular reporting to stakeholders to enable them to examine their own antimicrobial usage rates over time and identify areas of high usage as targets for local/national intervention programs.
3. Provide an Australian antimicrobial use dataset that will enable comparison within Australia and with international data.

Rationale

The increasing incidence of antimicrobial resistance (AMR) and the association with high antimicrobial usage rates in the community is a cause for concern worldwide. Published data suggest that concomitant surveillance of both AMR and antimicrobial usage is helpful in interpreting AMR surveillance data. It can provide objective and quantitative data to evaluate usage patterns and can assist in the ability to respond to problems of AMR in a precise and targeted way.

Background

It is estimated that there are 25 million prescriptions for antimicrobials issued in Australia per year from the country's 5,000 pharmacies. There is no single dataset readily available to regulators and health professionals in Australia that provides a comprehensive estimate of antimicrobial use in the community.

There is more than one source of existing data or combinations thereof that could be considered in order to redress this deficiency.

a.) Antimicrobial import statistics

The JETACAR Report summarised the volume of antimicrobial imports into Australia for the period 1992 to 1997 using data obtained from the Therapeutic Goods Administration. Importers are required to identify the 'end-use' of imported antimicrobials into one of three broad categories - 'human', 'stockfeed' or 'veterinary'. These data provide bulk volumes on intended use that have no direct link to actual use over a period of time or to specific correlates (e.g. population, disease or organism). However, these data can be correlated with other data sources to identify increasing or decreasing trends in imports of individual or classes of antimicrobial(s). These data have continued to be summarised on an annual basis by EAGAR but have not been published for the period 1998 to date. The Office of Chemical Safety in the Australian Government Department of Health and Ageing now has the responsibility for compiling this information and is in discussion with EAGAR as to the best way to present their annual report.

b.) The DUSC datasets

The use of antimicrobials in the community is monitored by the Australian Government's Department of Health and Ageing's Pharmaceutical Benefits Advisory Committee (PBAC). Specifically, the PBAC's Drug Utilisation Sub Committee (DUSC) collates and reports on usage data. These data are reported annually in the publication *Australian Statistics on Medicines*. The most recent publication is for the year 2003, however, more up to date data sets are generally available from DUSC upon request. These data represent estimates of the aggregate community use of prescription medicines in Australia. The DUSC dataset draws on two sources:

- i.) Medicare Australia collects data for drugs dispensed through community pharmacies. This represents actual count information on prescriptions subsidised through the Pharmaceutical Benefits Scheme (PBS). The data:
 - Are estimated to capture 56% of antimicrobials dispensed through pharmacies and have a bias towards concession card holders;
 - Include antimicrobials prescribed for patients discharged from hospitals and by Emergency Departments in those States that have PBS in hospitals;
 - Miss antimicrobials that fall below the level of co-payment needed to attract a subsidy; and
 - Can be sub-grouped by type of practitioner (e.g. GP, specialist) and by geographical areas.

- ii.) Survey data from 150 (of an estimated 5,000 pharmacies in Australia is collected on behalf of DUSC by the Pharmacy Guild of Australia to provide an estimate of non-subsidised prescriptions.
 - Data are collected monthly for drugs in the non-subsidised categories (i.e. private prescriptions and PBS prescriptions priced under the general patient co-payment).
 - The survey is designed as a stratified random sample using the Pharmacy Guild membership (which represents approximately 80% of pharmacies in Australia) as the population base.
 - Negotiations are underway between the Australian Government and Pharmacy Guild to obtain the complete data set, rather than only a sample.

The DUSC data set is a useful surveillance tool for antimicrobial usage in Australia. It will allow the identification of trends and changes of trends in antimicrobial usage over time. The PBS component can be analysed by geographical area, type of practitioner and patient category. However the data are not summarised in a manner that allows detailed analysis in relation to AMR, as there is a lack of demographic descriptors in relation to the supply and indication for use of antimicrobials.

c.) International Medical Statistics (IMS) Data

This dataset captures all supply of antimicrobials to private and public hospitals and pharmacies and is analysable to the level of the individual hospital/pharmacy. However, some data are extrapolated as some Companies only supply the data on the condition that it is aggregated and not identifiable to the company or specific product.

- While the data are not a direct record of antimicrobial use, there is little wastage at the hospital and pharmacy level and as most ordering is 'just in time', the data reflects recent supply and indirectly, recent use;

- Data are identified by product and therefore an estimate of Defined Daily Dose (DDD) could be readily calculated; and
- These data are provided by Companies and use by regulatory agencies requires the consent of contributing Companies before data can be provided. There are considerable costs associated with the purchase of IMS data. The Department of Health and Ageing has recently been unsuccessful in negotiations to obtain these data.

d.) Other data sets

Three other data sets link prescription to indication and can provide valuable information on the use of antimicrobials in general practice. All can be purchased.

- i.) The IMS Australian Medical Index™ (AMI) measures the disease incidence and patient treatment as seen in general practice in Australia. The data is sourced from a stratified panel of 420 General Practitioners (GPs) who provide details of their diagnoses and treatments on personalised prescription pads or electronically. Each GP is recruited for four quarters, and reports for 1 week (seven consecutive days) each quarter. The panel is statistically stratified by region and years since graduation. The AMI is available quarterly in PDF, hardcopy format and through IMS+, and monthly through IMS online databases.
- ii.) The Bettering the Evaluation and Care of Health (BEACH) data set (University of Sydney) is derived from a rolling random sample of approximately 1000 GPs who record details of 100 consecutive patient encounters. This provides cross-sectional data that allows an estimation of antimicrobial use for various conditions;
- iii.) The General Practice Research Network (GPRN) is owned by Health Communications Network (the largest provider of prescribing software [Medical Director] to GPs) and includes longitudinal data for a changing cohort of 250-300 GPs since about 2000.

Outcomes and Deliverables

The program will:

1. Enable examination of trends in community antimicrobial use at state and national levels that can be correlated with AMR data, and form the basis for larger scale interventions to rationalise community antimicrobial prescribing.
2. Evaluate the impact of interventions in the community setting at local, state and national level.
3. Measure the impact of infections involving resistant organisms and hence the patient morbidity, mortality and healthcare costs associated with treatment failure;
4. Provide data that will facilitate risk analysis for new registration applications, extensions of use application, Pharmaceutical Benefits listing and reviews of antimicrobial registration by regulatory authorities.
5. Produce longitudinal antimicrobial usage data that may be used to demonstrate a link between antimicrobial use and resistance in the future, both at local community and national level.

Work Program

Goal	Process	Tasks
1.	Establish a committee or working group to provide a more formal structure for implementation of the project and to provide on-going leadership and support in all jurisdictions. Ideally this should be the same group that implements Project 1 – surveillance of antimicrobial use in hospitals.	The Australian Government to appoint representatives from each State/Territory; these may be drawn from: <ul style="list-style-type: none"> interested infectious disease physicians, clinical microbiologists and pharmacists; state special interest groups, therapeutic advisory groups or appropriate professional bodies.
2.	Establish a minimum requirement for the type of data to be collected, the analyses to be undertaken and the format of the reports and information produced, irrespective of the source.	The information and reports generated from the data need, as a minimum to be : <ul style="list-style-type: none"> comprehensive and sufficient to enable determination of trends in use; produced on a regular basis (quarterly summaries with annual consolidated data) and in a timely manner; analysed and reported to provide information for action by regulators and health professionals; some reports to be in a form that can be published for the information of the general public.
3.	Refine reporting of antimicrobial import data.	Negotiate with the Office of Chemical Safety to produce annual reports in a format that can be integrated with other antimicrobial use data for interpreting AMR surveillance data.
4.	Review the DUSC dataset with a view to providing a data set that is more amenable to monitoring trends in use and associations with AMR.	<ul style="list-style-type: none"> DUSC to negotiate with Pharmacy Guild to include the full data set of non-subsidised prescriptions; DUSC data to be presented with the frequency and in the format as agreed in Goal 2 above.
5.	Review the options for purchase of commercially available datasets that are more comprehensive and link prescription to indication.	Negotiate access to and costs for supply of antimicrobial use data from: <ul style="list-style-type: none"> IMS; University of Sydney (BEACH data set); Health Communications Network (GPRN data);

Budget

Modifications to collection, collation and reporting of DUSC antimicrobial utilisation data and antimicrobial import statistics will be undertaken within the current budget of the respective units of the Australian Government Department of Health and Ageing.

Approximate costs for the purchase of the antimicrobial usage components of the commercial datasets are listed below. These are annual costs based on provision of a quarterly report for all products classified as “J01 – systemic antibiotics”.

	Retail data	Hospital data	Total
IMS	\$66,000	\$47,000	\$113,000
BEACH	\$16,000		
HCN - GPRN	\$110,000		

References

1. Strategy for Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group. August 2003.
2. Action Plan for National Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group. August 2003.
3. Australian Statistics in Medicine. Accessed on 05.06.2006 at <http://www.health.gov.au/internet/wcms/publishing.nsf/Content/health-pbs-general-pubs-asm.htm>
4. IMS Health http://www.imshealth.com.au/web/home/0,3153,71618411_63872702,00.html
5. General Practice Research Network (GPRN) Health Communication Network (HCN) <http://www.hcn.net.au/doctors/gprn.asp>
6. Bettering the Evaluation and Care of Health (BEACH) Project. <http://www.fmrc.org.au/beach.htm>

Project 3: Monitoring the quantities of antimicrobials used in animal husbandry.

Objectives

1. Further develop and implement a national program for the surveillance of the amount of antimicrobial products used in veterinary medicine and animal production in Australia.
2. Establish a system of regular reporting to stakeholders to enable them to identify areas of high usage as targets for local intervention programs.
3. Provide an Australian antimicrobial use dataset that will enable comparison with international data.

Rationale

Monitoring the quantities of antimicrobials used in animals can provide objective and quantitative data to evaluate usage patterns by animal species and antimicrobial class that will enable the assessment of antimicrobial exposure of the animal population. These data are essential for risk analysis, can be helpful in interpreting antimicrobial resistance (AMR) surveillance data and can assist in the ability to respond to problems of AMR in a precise and targeted way.

Background

The JETACAR Report summarised the volume of antimicrobial imports into Australia for the period 1992 to 1997 using data obtained from the Therapeutic Goods Administration (TGA). Importers are required to identify the 'end-use' of imported antimicrobials into one of three broad categories - 'human', 'stockfeed' or 'veterinary'. These data provide bulk volumes on intended use that have no direct link to actual use or to specific correlates (e.g. population, disease or organism). As a result, the data lack the detail necessary for analysis and correlation with AMR. These data have continued to be summarised on an annual basis by EAGAR but have not been published for the period 1998 to date.

In 2003, in response to the JETACAR Report, the Australian Pesticides and Veterinary Medicines Authority (APVMA) announced its intention to collect animal antimicrobial sales data from registrants as a means of estimating the amount of antimicrobial products used in veterinary medicine and animal production. This information was voluntarily supplied by registrants for the period 1999 to 2002 and was summarised and published by the APVMA. Data from 2003/2004 is currently being summarised by APVMA. While these data are a significant improvement on the TGA import data, the detail necessary for critical analysis in relating AMR to antimicrobial use is still lacking and supply of the data depends on the goodwill of the registrant.

Until 2003, New Zealand used a similar approach with registrants voluntarily supplying sales statistics to the regulatory authority. However, since 2003, the registration of all antimicrobials in New Zealand now includes a statutory requirement to provide annual sales data.

Differences in the regulatory environment in Australia and New Zealand currently prevent mandating that similar data be made available in Australia for surveillance of antimicrobial use. There is provision in the current Australian legislation to require registrants to provide annual sales statistics to the APVMA for the purposes of calculating the levy to be paid by the registrants. However the legislation stipulates that this information cannot be used for any other

purpose. The legislation would have to be changed to mandate the reporting of antimicrobial sales data for surveillance purposes.

However, the New Zealand approach, and that currently taken by APVMA in Australia, gathers sales/supply data and is only an indirect indicator of antimicrobial use. A useful adjunct to the collection of sales data would be to undertake a detailed review of antimicrobial prescribing practices in the various animal species and husbandry practices - e.g. for cattle this could include: dairy calves, dairy cows, beef range cattle, beef feedlot cattle. A different species could be reviewed each year. This valuable information would allow veterinary special interest groups to review and better target antimicrobial therapy and prophylaxis.

Outcomes and Deliverables

The program will:

1. Improve existing collection of antimicrobial end-usage data, for national surveillance reporting. The data collected will:
 - Assist with risk analysis for applications for registration of new antimicrobial products or for extensions of use;
 - Be used in formal reviews of the registration of antimicrobials by regulatory authorities;
 - Enable trends in antimicrobial usage to be studied;
 - Allow changes in use to be related to development (if any) of AMR in animals or the transfer of resistance from food animals to humans;
 - Compare medical, agricultural and other antimicrobial use as part of an integrated national approach to optimise antimicrobial use; and
 - Enable international reporting and comparisons.

2. Facilitate the development of prescribing and regulatory interventions that would improve the prudent use of antimicrobials by:
 - Identifying where reviews of prescribing practice may be required to be modified;
 - Enabling the evaluation of the effectiveness of prudent use efforts and mitigation strategies.

Work Program

Goal	Process	Tasks
1.	Registrants to report annual antimicrobial sales data in a format that will allow regulators, the animal industries and the public to make an informed assessment of antimicrobial use patterns in livestock.	<ul style="list-style-type: none"> • Consult with stakeholders regarding the scope, content and format of reports produced to date; • Identify gaps in the data collected; • Benchmark against methods used in other countries; • Modify data collection and reporting as required.
2.	If reporting by registrants is inconsistent, or there are significant data gaps identified, amend legislation to make the reporting by registrants of antimicrobial use data a statutory requirement.	<ul style="list-style-type: none"> • Consult with registrants, the animal industries and other stakeholders; • Obtain policy approval from the Australian Government; • Draft and implement the required legislation.
3.	Implement annual reporting of antimicrobials sold for veterinary or animal husbandry.	<ul style="list-style-type: none"> • Use format agreed with stakeholders.
4.	Review of common prescribing practices in	<ul style="list-style-type: none"> • Consult with Australian Veterinary Association

Goal	Process	Tasks
	the various livestock species/husbandry practices, including aquaculture.	Therapeutic Advisory Committee and Special Interest Groups; <ul style="list-style-type: none"> • Decide on species and husbandry practices to review; • Decide on timetable; • Decide format of data collection, collation and reporting.

Budget

Annual APVMA cost to collect, collate and report annual sales data: \$10,000¹

NOTE:

¹ No additional budgetary requirement in addition to the operational costs already incurred by registrants and APVMA in supplying, collating and analysing this data.

Any consultations leading up to the drafting of legislation will be undertaken as part of the statutory requirements of the APVMA and the Australian Government Department of Agriculture, Fisheries and Forestry.

References

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2. Anon: (2004). Regulatory control of antibiotics to manage antibiotic resistance. Annual report: 2004. Agricultural Compounds and Veterinary Medicines Group, New Zealand Food Safety Authority.
3. Anon: (2003). Strategy for Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group. August 2003.
4. Anon: (2003). Action Plan for National Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group. August 2003.
5. T. Nicholls, J. Acar, F. Anthony, A. Franklin, R. Gupta, Y. Tamura, S. Thompson, E.J. Threlfall, D. Vose, M. van Vuuren, D.G. White, H.C. Wegener & M.L. Costarrica. (002) Antimicrobial resistance: monitoring the quantities of antimicrobials used in animal husbandry. Rev. sci. tech. Off. int. Epiz., 20 (3), 841-847

Project 4: Implementation of a national system for active surveillance of antimicrobial resistance in pathogens of importance in human health

Objectives

1. Conduct annual active (targeted) surveillance programs to determine the prevalence of antimicrobial resistance (AMR) in pathogens causing serious health problems in hospital-acquired infections.
2. Conduct annual active (targeted) surveillance programs to determine the prevalence of AMR in pathogens causing serious health problems in community-acquired infections.
3. Collate data and develop electronic capture of data from laboratories to a central database.
4. Summarise and report on AMR prevalence in hospital and community acquired infections in peer-reviewed journals, scientific meetings and conferences and in annual reports to government.

Rationale

Passive surveillance systems for AMR have the potential to document, retrospectively, the emergence and increasing or decreasing trends of resistance to particular antimicrobials in individual or a range of organisms. Active surveillance involves proactive, targeted surveillance that allows closer scrutiny and detailed analysis of those trends, testing for a broader range of antimicrobials in specific pathogens, and can give an early indication of the effectiveness of specific interventions to reduce the prevalence of AMR in a particular situation.

Background

The Australian Group for Antimicrobial Resistance (AGAR) has conducted targeted surveillance of AMR in Australian teaching hospitals since 1986. AGAR has broad laboratory membership representing the major teaching hospitals in all Australian capital cities, the major private laboratories, and several regional public hospitals. All states/territories are represented.

The use of an active surveillance strategy with standard methodology for prospective collection and examination of clinically significant isolates has produced data that accurately reflects the changing prevalence of AMR in major hospitals and the community. AGAR has played an important role in documenting the spread of methicillin-resistant *Staphylococcus aureus* (MRSA) in the 1980's and 1990's and the emergence of vancomycin-resistant enterococci (VRE) as an important nosocomial pathogen in the 1990's. In addition AGAR has conducted national surveys of AMR in *Streptococcus pneumoniae*, community isolates of *S. aureus*, *Haemophilus influenzae* and in the *Enterobacteriaceae* (*Klebsiella pneumoniae* and *Escherichia coli*).

The core surveys conducted each year are for *S. aureus* and *Enterobacteriaceae*. In addition, each year other organisms are targeted for study where it is decided that AMR in the targeted pathogen has significance for human health. Results of surveys are submitted to the federal government, published in peer-reviewed journals and presented at national and international conferences.

While the primary focus to date has been on isolates from health care-associated infections in major teaching hospitals in capital cities, the relatively recent inclusion of major private pathology laboratories and regional public hospitals as members of AGAR gives the opportunity to conduct valid surveys of community-acquired infections. AGAR has the necessary

infrastructure and expertise to conduct AMR surveys on organisms other than bacteria that may cause serious health problems (e.g. fungi).

Since 2003, the Australian Government Department of Health and Ageing (DoHA) has funded AGAR. Continued operation, further development and broadening of the scope of this critically important program depend on securing stable, recurrent funding.

Outcomes and Deliverables

The surveillance program will:

1. Develop a national data set on the prevalence of AMR in pathogens causing serious health problems in hospital- and community-acquired infections. These data can be used:
 - to detect the emergence of particular strains of AMR;
 - to detect trends in AMR to identify the need for particular interventions and to assess the impact of interventions;
 - to inform the development or modification of therapeutic guidelines;
 - in risk analysis to determine the risk to human health;
 - to provide a basis for policy recommendations for public health; and
 - to inform decisions about the on-going and future needs for AMR surveillance.
2. Provide tools for regular reporting of data on targeted hospital and community-acquired AMR infections in humans. Reports can be customised to provide data by health care facility, region, state or nationally.

Work Program

Goal	Process	Tasks
1.	AGAR has agreed on projects to be undertaken for 2006/2007.	<ul style="list-style-type: none"> • Community <i>Staphylococcus aureus</i> Surveillance Program (32 laboratories) (Commences July 2006) • Hospital and Community Gram Negative Surveillance Program (32 laboratories) (Commences July 2006) • Hospital and Community Enterococcus Surveillance Program (32 laboratories) (Commences January 2007)
2.	Submit budget proposal to Australian Government Department of Health and Ageing (DoHA) for approval.	DoHA consideration
3.	Implement agreed projects for 2006/2007 for AMR in hospital- and community-acquired pathogens	32 AGAR member laboratories to participate.
4.	Conduct AGAR Committee Meetings	<ul style="list-style-type: none"> • November 2006 (44 delegates); • May 2007 (65 delegates)
5.	Submit reports to DoHA <ul style="list-style-type: none"> • Hospital <i>S. aureus</i> program • Hospital & Community G-ve program • Hospital and Community enterococcus program 	<ul style="list-style-type: none"> • Preliminary reports June 2007 • Final reports September 2007
6.	Investigate options for electronic capture and	Examine options for integration into the proposed national database to be developed from the

Goal	Process	Tasks
	reporting of data.	Queensland Health Antibigram project (see Project 6)

Budget

Surveillance Projects for 2006/2007

1. Community *Staphylococcus aureus* Surveillance Program (32 laboratories)
2. Hospital and Community Gram Negative Surveillance Program (32 laboratories)
3. Hospital and Community Enterococcus Surveillance Program (32 laboratories)

		2006/2007	2005/2006
Project support	Coordinator – 1.0 FTE Scientific Officer	81,590	75,000
Reagents	Surveillance Programs		
	<ul style="list-style-type: none"> • <i>Staphylococcus aureus</i> • Gram Negative Bacteria • Enterococcus • <i>Haemophilus influenzae</i> 	32,000 32,000 32,000 N/A	32,000 N/A N/A 16,000
	Epidemiological typing		
	<ul style="list-style-type: none"> • <i>Staphylococcus aureus</i> 	25,000	25,000
	Detection of Pantone-Valentine leukocidin	2,200	N/A
	<ul style="list-style-type: none"> • <i>Staphylococcus aureus</i> 		
	Molecular characterisation of ESBL		
	<ul style="list-style-type: none"> • Gram Negative Bacteria (2004) • Gram Negative Bacteria (2006) 	10,000 10,000	N/A N/A
Meetings	Committee Meetings		
	<ul style="list-style-type: none"> • November • May 	18,000 36,000	18,000 32,000
TOTAL		\$278,790	\$198,000

References

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2. Strategy for Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group. August 2003.
3. Action Plan for National Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group. August 2003.

Project 5: A national system of surveillance of multi-resistant organisms (MROs)

Objectives

1. To develop a system of national surveillance for multi-resistant organisms (MROs)³ by:
 - forging links with key MRO data collections from all states and territories;
 - evaluating data quality in these data collections and identifying deficiencies;
 - developing functionality to upload data from laboratory information systems nation wide;
 - refining existing reporting tools to estimate the prevalence of MROs in human pathogens and detect the emergence of new MRO patterns at a local, regional, and national level.
2. Within 24 months to report national data on the prevalence of MROs.

Rationale

Infections with MROs pose a therapeutic dilemma for physicians and can result in significant pain, prolonged illness and even, in rare cases, death. The cost of MRO infections to society, the hospital system, patients and their carers is substantial. Most States/Territories have health care associated infection surveillance programs that operate at hospital and state level. Despite widespread activity in most jurisdictions, there is considerable variation in resourcing and scope of surveillance undertaken. There is no national program that draws together data on incidence and prevalence of MROs in the hospital and community setting.

Background

MROs are a problem Australia-wide and cause morbidity in Australian health care facilities and in the community. MROs include, but are not limited to:

- Methicillin-resistant *Staphylococcus aureus* (MRSA);
- *Staphylococcus aureus* with reduced vancomycin susceptibility (hVISA);
- Vancomycin resistant *Enterococcus* spp. (VRE);
- Extended-spectrum β -lactamase (ESBL) producing *Klebsiella pneumoniae*; and
- Multiple antimicrobial resistant *Acinetobacter*.

Most of these resistant bacteria are readily identified in microbiology laboratories and results are stored in laboratory information management systems. All States/Territories have local hospital-based and/or statewide surveillance programs for hospital-acquired infections, many of which are caused by MROs.

Nationally consistent measurement of the dynamics of the spread of these MROs within healthcare facilities and in the community (and spread between the two), can provide important information about focal outbreaks, levels of endemicity and the on-going effectiveness of infection control interventions. While these data are collated at a local and state level, there is no national system that allows aggregation to alert the various jurisdictions to new or emerging MROs or to track trends and assess interventions on an Australia-wide scale.

The Australian Commission on Safety and Quality in Health Care commenced operation in January 2006 and succeeded the former Australian Council for Safety and Quality in Health

³ bacteria with resistance to two or more antimicrobials from different classes.

Care. The Commission is in the process of appointing members and setting up the necessary governance arrangements. Functions of the Commission include:

- To lead and coordinate improvements in safety and quality in health care in Australia by identifying issues and policy directions, recommending priorities for action, disseminating knowledge, and advocating for safety and quality;
- To report publicly on the state of safety and quality including performance against national standards;
- To recommend national data sets for safety and quality, working within current multilateral governmental arrangements for data development, standards, collection and reporting.

Outcomes and Deliverables

The program will improve treatment outcomes for patients through:

1. Developing a standardised national data set on the prevalence of MROs in community- and hospital-acquired infections. These data can be used:
 - to detect the emergence of particular strains of MRO;
 - to detect trends in MROs to identify the need for particular interventions and to assess the impact of interventions;
 - as key infection control indicators;
 - in risk analysis to determine the risk to human health; and
 - to provide a basis for policy recommendations for public health.
2. Providing tools for regular reporting of data on MRO infections in community- and hospital-acquired infections. Reports can be customised to provide data by
 - district, region, state or nationally.
 - health care facility, ward, testing laboratory,
 - specimen type, organism, or antimicrobial.

Work Program

Goal	Process	Tasks
1.	Liaise with the Australian Commission on Safety and Quality in Health Care.	<ul style="list-style-type: none"> • Establish the role of this project in meeting some of the Commission's objectives;
2.	Establish a committee or working group to provide a more formal structure for implementation of the project and to provide on-going leadership and support in all jurisdictions.	<p>The Australian Government to appoint representatives from each State/Territory; these may be drawn from:</p> <ul style="list-style-type: none"> • interested infectious disease physicians, infection control practitioners and clinical microbiologists; • state special interest groups, therapeutic advisory groups or appropriate professional bodies;
3.	Develop nationally consistent approach to surveillance of MROs.	<ul style="list-style-type: none"> • agree on definitions of MROs and for MRO surveillance
4.	Once the 'Antibiogram' program (see Project 6) is implemented nationally, develop enhancements to capture and identify MRO data.	<p>Develop suitable functionality to extract MRO data from the national Antibiogram program;</p> <ul style="list-style-type: none"> • MROs by type for community and hospital infections at hospital, regional and national level; • include surveillance for specialised units (e.g. ICU, burns, cystic fibrosis, haematology/oncology) where feasible;

Goal	Process	Tasks
		<ul style="list-style-type: none"> develop automated quarterly and annual reporting using an agreed format for data presentation.
5.	Recruit additional hospitals to this program once the infrastructure for data collection and reporting is established.	<ul style="list-style-type: none"> Include by the end of the second year, all AIHW principal referral hospitals;

Budget

No specific budget is sought for this project. Surveillance activities are already undertaken in all jurisdictions according to identified risks and priorities. Once Project 6 [Development and deployment of a national information system for passive surveillance of AMR in bacteria of importance in human health] is rolled out nationally, the data collation, extraction and reporting to fulfil the objectives of this project can be implemented.

References

1. Multi-resistant organism (MRO) surveillance indicator definitions. Australian Council for Safety and Quality in Health Care. September 2004.
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Project 6: Development and deployment of a national information system for passive surveillance of antimicrobial resistance in bacteria of importance in human health.

Objectives

This project will develop and implement a national passive surveillance system for AMR:

1. Within the first 12 months, further develop and refine the existing Queensland Health Scientific Services (QHPSS) passive surveillance system for antimicrobial resistance (AMR) to create a national system by:
 - forging links with key AMR data collections from all over Australia for human pathogens;
 - evaluating data quality in these data collections and identify deficiencies;
 - develop functionality to upload data from laboratory information systems nation wide;
 - refine existing reporting tools to estimate the prevalence of AMR in human pathogens and detect the emergence of new AMR patterns at a local, regional, supra-regional and national level.
2. Within 18 months, upload one year's data from all participating Australian laboratories
3. Within 24 months report national data on the prevalence of AMR in human health.

Rationale

Passive surveillance systems for AMR have the potential to document, in a timely manner, trends of increasing or decreasing resistance to particular antimicrobials in individual or a range of organisms and also are an essential tool in monitoring the effectiveness of interventions to reduce the prevalence of AMR.

Background

While many private and hospital laboratories are able to produce local cumulative susceptibility summaries and a wealth of data is stored in local and regional databases, to date, it has not been possible to draw this data together into a national system of passive surveillance of AMR in Australia. Establishment of an Australian arm of The Surveillance Network™ (TSN®) in the late 1990s promised to provide the timely passive surveillance recommended in the JETACAR Report. This commercial venture was not viable in Australia and no longer operates here. However, the TSN data from 1997-2004 were purchased by the Australian Society for Antimicrobials and is currently stored electronically (with backup).

Clinical demand for local susceptibility data and a commitment to monitoring regional and supra-regional trends in AMR led Queensland Health Pathology and Scientific Services (QHPSS) to develop a state-wide system of passive surveillance using a robust industry standard relational database. Data from 1994 to 2004 has been uploaded from 33 QHPSS laboratories throughout the state. Ad hoc inquiries to assess trends can be made specifying a number of parameters such as time period, specimen type, organism, antimicrobial, region, health care facility etc. The relational database gives the Queensland system the capacity for enlargement to handle data input from other laboratory information systems nationally. This has been demonstrated by recently uploading one year's data from a private laboratory in Queensland with funding provided by the Australian Government Department of Health and Ageing (DoHA) in 2005. The web application allows remote inquiry access with appropriate levels of security and confidentiality.

This project will use the Queensland Antibigram program as the basis to develop a national passive surveillance system that has the potential to fulfil the recommendation for national passive surveillance of AMR contained in the JETACAR Report.

Outcomes and Deliverables

The program will:

1. Develop a standardised national data set on the prevalence of AMR in specimens submitted to private and hospital laboratories during routine human health investigations:
 - An early outcome will be the incorporation of the TSN[®] data into the national database. This will provide historical data from 94 hospital and 9 private laboratories over the period 1997 to 2004 (an estimated 15 million test results, from over 2 million strains and 1.5 million patients).
 - Upload all available historic data from participating laboratories;
 - On an on-going basis, each year upload the previous year's historic data from all participating laboratories;
2. Provide tools for regular reporting of data on AMR infections in humans. Reports can be customised to provide data by
 - district, region, state or nationally.
 - health care facility, ward, testing laboratory,
 - specimen type, organism, or antimicrobial.
3. Enable clinicians, laboratories, health managers and other interested stakeholders to estimate the prevalence and detect trends of AMR.
4. Develop 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 strains 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.

Work Program

Goal	Process	Tasks
1.	Communication, scope and design	<ul style="list-style-type: none"> • Establish project governance and appoint project management team; • Communication phase with Australian pathology laboratories; • Gap analysis current vs. required functionality and determine estimated development time; • Assess system requirements (data volumes, user numbers etc)
2.	Development and pilot	<ul style="list-style-type: none"> • Approved software enhancement will be coded; • Appropriate infrastructure (server etc) and support (facilities management, back ups etc) arrangements will be finalized; • The TSN® data purchased and held by the Australian Society of Antimicrobials will be uploaded into the national database. • Data from each State will be incorporated into the system; • EAGAR will sign-off on program status before next phase;
3.	National implementation	One year's data from each participating Australian laboratory will be uploaded to the antibiogram system and be made available via the internet
4.	Ongoing maintenance.	<ul style="list-style-type: none"> • On a yearly basis each laboratory will provide another year's data for incorporation into the system; • Ongoing system improvements as approved by EAGAR.

Budget

Guaranteed funding is sought for the first two years in order to establish the project and implement all laboratories. For years 3 and beyond, users of the system may need to make a commitment to share the ongoing support costs based on an agreed cost-apportionment method.

1. Purchase of TSN data

\$80,000

2. Antibigram Passive Surveillance Program:	IMPLEMENTATION PHASE		MAINTENANCE PHASE		
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Project Support					
Antibigram System Project Manager (AO8) Full time 2 year	\$104,000	\$108,160			
Antibigram System Coordinator (AO6) Full time ongoing. - Technical implementation client data sets. - Ongoing system administration	\$86,858	\$90,333	\$93,946	\$97,704	\$101,612
System Support Officer (AO5) 1.0 FTE - Project and ongoing - Role during project - project and client support. Assist with data testing and processing. - Post project - routine data management and client support.	\$75,919	\$78,955	\$82,114	\$85,398	\$88,814
Contract programming – - data base enhancements & verification scripts, - custom reports - upload TSN data	\$25,000				
QH PC Support Charge PC * 3 Year 2 - 2 ongoing	\$6,600	\$6,600	\$4,400	\$4,400	\$4,400
Telephone handsets (3 initial) and call costs	\$1,500	\$1,000	\$1,000	\$1,000	\$1,000
QH secure internet and remote access accounts - project staff	\$1,000	\$1,000	\$750	\$750	\$750
Staff administrative charge (\$6,800 per FTE p.a.)	\$20,400	\$20,400	\$13,600	\$13,600	\$13,600
Travel/ accommodation costs. Including supporting national steering committee	\$25,000	\$25,000	\$10,000	\$10,000	\$10,000
Infrastructure costs					
Staging server - Based at QHSS Coopers Plains. Replace every 4 years.	\$25,000			\$25,000	
Data centre charges - maintenance, back ups, offsite storage etc.	\$9,000	\$9,270	\$9,548	\$9,835	\$10,130
Production web servers (Dual servers and licenses inc. MS Operating System, MS SQL Server etc) replace every 4 years	\$65,000			\$65,000	
Data centre and maintenance charges (back ups, offsite storage etc.) CITEC (Qld Gov't Cdata Centre and QH Information Division)	\$55,000	\$56,650	\$58,350	\$60,100	\$61,903
Communications / traffic costs	\$1,000	\$2,000	\$2,000	\$2,000	\$2,000
Data base management - (QH Information Division)	\$20,000	\$20,600	\$21,218	\$21,855	\$22,510
Contingency		\$80,000			
TOTAL per Year	\$521,277	\$498,928	\$296,925	\$396,641	\$316,719
TOTAL per Phase	\$1,020,205		\$1,010,285		
TOTAL Overall	\$2,030,490				

Note: salary costs and recurrent charges assume 4% and 3% annual escalation respectively. EB labour and CPI increases.

References

1. Strategy for Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group. August 2003.
2. Action Plan for National Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group. August 2003.
3. Nimmo GR, Fong J. (2004) Passive surveillance of antimicrobial resistance in Queensland public hospitals: the basis for a national system? *Commun Dis Intell*;28:230-235.
4. Turnidge J, McCarthy LR, Master RN, Kepner DE, Weslock J. (2003) TSN Database Australia, a new tool to monitor antimicrobial resistance in Australia. *Commun Dis Intell*;27 Suppl:S67-S69.

Project 7: Surveillance for Antimicrobial Resistance in Bacteria of Food Animal Origin.

Objectives

1. Implement an annual targeted active surveillance program to determine the prevalence of antimicrobial resistance (AMR) of animal and public health significance in key indicator and zoonotic bacteria found in the digestive tract of livestock and in aquaculture.
2. Collate data and develop electronic capture of data from laboratories to a central database.
3. Summarise and report on AMR prevalence in livestock and aquaculture.

Rationale

Modern intensive food animal production is still dependent on the use of antimicrobials for the prevention, treatment and control of diseases. In addition, antimicrobials are also used as growth promotants to improve growth rate and feed efficiency. These practices inevitably provide favourable conditions for selection, spread and persistence of antimicrobial-resistant bacteria.

There is general agreement in the international literature with the JETACAR Report finding that there is qualitative evidence that the feeding of antimicrobials to animals leads to resistant bacteria and that these bacteria or their resistance genes can be passed to humans, principally via the food chain. An active surveillance program can provide estimates for the prevalence of resistance to antimicrobials in key indicator and zoonotic organisms of public health importance.

Background

As a response to Recommendation 10 of the JETACAR Report, the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) developed and conducted a pilot surveillance program for AMR in bacteria of food animal origin in 2003/2004. Since there was no formal surveillance system for AMR in animals at the national level, the program was referred to as a 'pilot'. The project served two purposes.

- i.) to provide preliminary estimates for the prevalence of resistance to antimicrobials of public health importance in key indicator organisms found in the caecum of cattle, pigs and chickens; and
- ii.) to establish the most efficient operational requirements for the implementation of a wider and on-going surveillance program.

Data from the pilot program has been provided to the relevant livestock industry organisations and to EAGAR for consideration. Operational requirements for an on-going surveillance program have been tested with respect to effective sourcing of samples; standardisation of sample collection and transport; standardisation of laboratory identification of bacterial isolates and AMR susceptibility testing; establishment of a cost-effective quality assurance program; and efficient systems to collate, store and report the data.

DAFF is currently considering the development of a pilot program for surveillance of AMR in aquaculture species.

Outcomes and Deliverables

1. The surveillance program will:
 - determine the prevalence of resistance to antimicrobials of animal and public health importance in key indicator and zoonotic bacteria found in the digestive tract of livestock and in aquaculture;
 - detect the emergence of AMR in these indicator and zoonotic bacteria;
 - investigate any association or trends there might be between emergence of resistance and the pattern of use of antimicrobials in animals;
 - estimate the burden of antimicrobial resistance in animals that can be related to resistance patterns and trends in humans;
2. The data generated will be used:
 - to encourage responsible use of antimicrobials by veterinarians and prolong the efficacy and use of these products;
 - in the assessment of risks to public health of the transfer of AMR through the food chain and to form the basis of risk management policy;
 - to provide the basis for specific interventions and to monitor the effect of those interventions; and
 - to provide a basis for policy recommendations for public and animal health; and
 - to inform decisions about the on-going and future needs for AMR surveillance in animals;
3. An annual report on the prevalence and nature of AMR of public health significance in livestock and aquaculture.

Work Program

Goal	Process	Tasks
1.	Review of Pilot program operation and findings	<ul style="list-style-type: none"> • Identify modifications that need to be made; • Assess new developments in methodology; • Consider other species for inclusion in sampling program; and • Make recommendations for an on-going program.
2.	Establish the outline of an on-going targeted national surveillance program for AMR in bacteria isolated from livestock.	<ul style="list-style-type: none"> • Program management and coordination; • Funding; • Sampling framework; • Sample collection and testing; • Data collation and reporting.
3.	Develop a pilot program for AMR surveillance in aquaculture	<ul style="list-style-type: none"> • Sampling framework and sample collection; • Analytical methods; • Data collation and reporting;
4.	Annual review of the role of AMR surveillance in bacteria from livestock and aquaculture within the context of the National AMR Surveillance Strategy.	<ul style="list-style-type: none"> • Undertaken by the Australian Government with input from EAGAR, AHMAC¹ and PISC².

NOTE: ¹ Australian Health Ministers Advisory Council

² Primary Industries Standing Committee

Budget**1. AMR Surveillance in Livestock**

Scope	No.	Cost	Total
Primary isolation @ \$30			\$51,000
E.coli	500	15,000	
Enterococci	600	18,000	
Campylobacter	600	18,000	
ID isolates for MIC @ \$30			\$36,000
E.coli	450	13,500	
Enterococci	450	13,500	
Campylobacter	300	9,000	
MIC @ \$100			\$120,000
E.coli	450	45,000	
Enterococci	450	45,000	
Campylobacter	300	30,000	
Sample collection and transport etc			\$40,000
Sample collection		32,000	
Freight and packaging		8,000	
Program management and reporting, indirect costs			\$50,000
TOTAL			\$297,000

NOTE:

1. The number of samples to be tested per animal species/bacterium combination per annum based on an expected prevalence of resistant organisms of <10% is 138 samples per animal species/bacterium combination (95% confidence limit and 5% precision).
2. Costing is based on obtaining 450 isolates each of E.coli and Enterococcus and 300 isolates of Campylobacter from cattle, pigs and poultry per annum.
3. Precise sampling details will need to be refined after review of the recently completed pilot program.

2. Pilot Program for AMR Surveillance in Aquaculture (Preliminary)

Scope	No.	Cost	Total
Primary isolation @ \$30			\$12,000
Bacteria 'a'	200	6,000	
Bacteria 'b'	200	6,000	
ID isolates for MIC @ \$30			\$12,000
Bacteria 'a'	200	6,000	
Bacteria 'b'	200	6,000	
MIC @ \$100			\$30,000
Bacteria 'a'	150	15,000	
Bacteria 'b'	150	15,000	
Sample collection and transport etc			\$12,000
Sample collection		10,000	
Freight and packaging		2,000	
Program management and reporting, indirect costs			\$10,000
TOTAL			\$86,000

NOTE:

Final costing for a pilot program for AMR surveillance in aquaculture will be developed once the scope of the program in terms of sample numbers, bacteria and antimicrobials is determined.

References

1. DAFF. (2006). Pilot Surveillance Program for Antimicrobial Resistance in Bacteria of Food Animal Origin: November 2003 to July 2004. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.
2. Anon. (2003). Strategy for Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group.
3. Anon: (2003). Action Plan for National Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group.
4. A. Franklin, J. Acar, F. Anthony, R. Gupta, T. Nicholls, Y. Tamura, S. Thompson, E.J. Threlfall, D. Vose, M. van Vuuren, D.G. White, H.C. Wegener & M.L. Costarrica. (2001). Antimicrobial resistance: harmonisation of national antimicrobial resistance monitoring and surveillance programmes in animals and in animal-derived food. *Rev. sci. tech. Off. int. Epiz.* 20 (3): 859-970 available at: http://www.oie.int/eng/publicat/RT/2003/A_R20318.htm.
5. Anon. (1999). The Use Of Antibiotics In Food-Producing Animals: Antibiotic-Resistant Bacteria In Animals And Humans. Joint Expert Technical Advisory Committee on Antibiotic Resistance (JETACAR). Commonwealth Department of Health and Aged Care, Commonwealth Department of Agriculture, Fisheries and Forestry - Australia. <http://www.health.gov.au/pubhlth/strateg/jetacar/index.htm>

Project 8: Surveillance for antimicrobial resistance in bacteria isolated from food and food products.

Objectives

1. Develop and implement a pilot program of active and passive surveillance for antimicrobial resistance (AMR) in bacteria derived from food that has a public health focus.
2. Collate data and develop electronic capture of data from laboratories to a central database.
3. Summarise and report on AMR prevalence in food.
4. Review the pilot program with a view to establishing the requirements for an ongoing national surveillance program for AMR in food that is a component of the broader Australian Surveillance Strategy for AMR.

Rationale

There is growing concern internationally over the role foodborne bacteria may play in the emergence of AMR in human disease. Sufficient qualitative evidence now exists to suggest that the use of antimicrobials in food animals leads to resistant bacteria. The principal mechanism for transfer of these resistant bacteria or their resistance genes from animals to humans, when it occurs, is via the food chain.

Background

In Australia, there has been no systematic active surveillance of antimicrobial resistance in bacteria isolated from food, including animal derived foods. Three recent initiatives to redress this are:

1. Members of OzFoodNet conducted a period prevalence survey of the susceptibility of *Campylobacter jejuni* isolates to 10 antimicrobial agents from September 2001 to August 2002. The very low level of ciprofloxacin resistance reflects the success of Australia's policy of restricting the use of fluoroquinolone antimicrobials in food-producing animals.
2. A recently completed project undertaken by the Microbiological Diagnostic Unit (MDU) at Melbourne University has reported on passive surveillance data for AMR in *Salmonella* isolates from MDU and IMVS in Adelaide. This has provided a template that can be fine-tuned and used for the collection, collation and reporting of this data in the future.
3. In 2005, the Food Regulation Standing Committee (FRSC) and EAGAR approved the design and funding for a survey that would provide essential baseline data on the prevalence of AMR in Australian food. The proposed survey will allow identification of the relative importance of the food supply as a vehicle for transfer of AMR and establish the most efficient mechanisms for implementation of an ongoing wider active surveillance program. This project will commence later in 2006 after finalisation of tenders to undertake the work.
4. A joint project between NSW Health, SA Health, DoHA and FSANZ will undertake a baseline survey of the microbiological quality of retail chicken meat, including typing and AMR testing of *Salmonella* and *Campylobacter* isolates from humans and retail chicken meat samples taken in the same time period.

Outcomes and Deliverables

The program will:

1. Establish the most efficient mechanisms for the implementation of a full active surveillance program, including:
 - effective sourcing of samples for active surveillance and data for passive surveillance;
 - methods of sample collection and transport;
 - standardisation of laboratory identification of bacterial isolates and AMR susceptibility testing; and
 - efficient systems to collate, store and report the data.
2. Collate passive surveillance data for *Salmonella* and *Campylobacter*.
3. Provide a snapshot of AMR and resistance patterns of bacteria (*Salmonella*, *E.coli*, and *Campylobacter*) in food.
4. Establish guidelines for the analysis, interpretation and reporting of AMR data that is of public health concern.
5. Provide national data on the prevalence of AMR in food. These data can be used to inform risk assessment, to assist in development of risk management measures for AMR in food and establish the future need for on-going AMR surveillance in foods.

Work Program

Goal	Process	Tasks
1.	Implement the FRSC and EAGAR endorsed pilot program of active surveillance for antimicrobial resistance in food that has a public health focus	<ul style="list-style-type: none"> • mechanisms to fund the project have been agreed by AHMAC; • the project has been endorsed by EAGAR, AHMC, and ANZFRMC; • appoint a coordinator to manage the program; • agree to standard operating procedures for <ul style="list-style-type: none"> - isolation and identification of bacteria; - antimicrobial susceptibility testing; - refine and validate sample collection and monitoring between the labs and existing networks; - call for tenders to undertake the project; • implement the project
2.	Collate passive surveillance data for <i>Salmonella</i> .	<ul style="list-style-type: none"> • review the recent study undertaken by MDU on trends in AMR of <i>Salmonella</i> isolated from humans, animals and food over the past decade; <ul style="list-style-type: none"> - identify gaps and differences in existing surveillance mechanisms and propose and institute any changes that are required; • establish mechanisms for an ongoing coordinated national approach to the collection, evaluation and reporting of passive AMR surveillance data for <i>Salmonella</i>; <ul style="list-style-type: none"> - establish on-going funding mechanism.
3.	Establish an ongoing coordinated national project for AMR surveillance in	<ul style="list-style-type: none"> • investigate and implement mechanisms for the collection, evaluation and reporting of AMR in <i>Campylobacter</i> isolates from foodborne disease

Goal	Process	Tasks
	<i>Campylobacter</i>	<p>outbreaks.</p> <ul style="list-style-type: none"> agree on funding mechanism for this project.
4.	Collate data and develop electronic capture of data from laboratories to a central database (This is a component of the Proposed Project 6).	<ul style="list-style-type: none"> data from both active and passive surveillance; data should be compatible with the human and animal data collection; develop reporting tools from the national database
5.	Summarise AMR prevalence in food as determined by active surveillance and existing data.	<ul style="list-style-type: none"> With cooperation from stakeholders develop reporting mechanisms that will: <ul style="list-style-type: none"> identify any trends in AMR prevalence; identify associations, if any, between AMR and use patterns of antimicrobials; identify any associations between AMR in food, animal and human bacterial isolates. produce a report on findings and trends in AMR resistance in bacteria of food origin
6.	Review the operation of the pilot program with a view to making amendments for incorporation into the development of an ongoing program.	<p>ANZFRMC and EAGAR to consider:</p> <ul style="list-style-type: none"> outcomes of the pilot program; any new developments in sampling and testing methods; any other food and bacteria for inclusion in the program
7.	Review the role of AMR surveillance in food within the context of the National AMR Surveillance Strategy.	<p>The Australian Government, with advice from EAGAR, AHMC and ANZFRMC to:</p> <ul style="list-style-type: none"> establish the role and outline of ongoing national AMR surveillance in food; secure ongoing funding

Budget

Funding from State/Territory and Commonwealth Governments to date for surveillance of AMR in food is as follows:

a.) OzFoodNet survey of <i>Campylobacter</i> (Funded by DoHA)	\$52,525
b.) <i>Salmonella</i> passive surveillance (MDU & IMVS) (Funded by DoHA and DAFF)	\$77,000
c.) Pilot AMR Surveillance program (Funded by DoHA, DAFF and the States/Territories)	\$340,000
• Sample collection	52,000
• Bacterial isolation	112,000
• Freight, materials & packaging	2,000
• AMR testing (Vitek & <i>Campylobacter</i>)	110,000
• <i>Salmonella</i> serotyping	4,000
• Project management	60,000

References

1. Scope and design of a pilot survey for the assessment of antimicrobial resistance (AMR) in bacteria in Australian Food. A report prepared by Food Science Australia for Australian Department of Agriculture, Fisheries and Forestry and Department of Primary Industries Victoria. 2005.
2. Unicomb L, Ferguson J, Stafford R et al (2006). Low-level fluoroquinolone resistance among *Campylobacter jejuni* isolates in Australia. *CID* 42: 1368-1374.
3. Strategy for Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group. August 2003.
4. Action Plan for National Antimicrobial Resistance (AMR) Surveillance in Australia. Report prepared by the Commonwealth Interdepartmental JETACAR Implementation Group. August 2003.
5. Salmonella passive surveillance report that is in preparation. Report prepared by the Microbiological Diagnostic Unit, Melbourne University. 2006.

Project 9: Surveillance for antimicrobial resistance in animal pathogens with implications for public health.

Objectives

1. To identify antimicrobial resistance (AMR) in animal pathogens that has the potential to become a public health concern; and
2. To recommend surveillance activities for inclusion in the National Antimicrobial Resistance Surveillance Program.

Rationale

Antimicrobial use in animals will select for and amplify resistant bacteria in animals. These bacteria or their resistance genes can spread from animals to humans and cause disease.

Background

While it is generally agreed that the principal mechanism for transfer of resistant bacteria or their resistance genes from animals to humans occurs via the food chain (see Project 7), there are other potential sources of resistance transfer from animals to humans that need consideration.

Animal pathogens can develop resistance to antimicrobials that have close analogues used in human medicine e.g. third generation cephalosporins. Resistant zoonotic/pathogenic bacteria can be passed directly from animals to humans (e.g. *Salmonella*) or their resistance genes can be passed to commensals that can in turn transfer the resistance genes to other species or strains of bacteria in humans.

Increasing levels of pet ownership and attention to pet welfare has resulted in the frequent use in small animal veterinary practice of antimicrobial preparations used in human medicine such as aminopenicillins, cephalosporins and fluoroquinolones. Studies indicate the emergence in pet animal isolates of resistance of zoonotic potential and clinical interest such as methicillin-resistant *Staphylococcus aureus* (MRSA) and extended-spectrum β -lactamase (ESBL)-producing gram-negative bacteria. Investigations suggest that the source of these resistant organisms in some instances, can be the human cohorts of these pets. The pets can then in turn act as a reservoir of these organisms within the human and animal populations.

In the overall context of the burden of AMR in the human population, these sources are inconsequential and would warrant a low priority. They are however included in this national program for the sake of completeness.

Outcomes and Deliverables

The program will:

1. Identify data collections of AMR in animal pathogens that are of public health interest and facilitate collation of this data on a national basis.
2. Initiate targeted AMR surveillance programs in food and companion animals where it is identified that there is the potential for resistance in pathogens/commensals to human antimicrobial analogues.

Work Program

Goal	Process	Tasks
1.	Negotiate with animal industries for access to existing AMR survey data from research projects.	<ul style="list-style-type: none"> • Identify industry-sponsored surveys of AMR. e.g. pork, beef and poultry industry; • Establish mechanisms to collate and report the relevant data in a format agreeable to all stakeholders.
2.	Initiate targeted surveys where gaps in AMR surveillance are identified.	<ul style="list-style-type: none"> • Identify organisms/antimicrobials/animal species for surveillance; <ul style="list-style-type: none"> - Pathogens/commensals in food animals with resistance to human antimicrobial analogues; - Pathogens/commensals in companion animals with resistance to human antimicrobial analogues • Establish a cost-effective surveillance program based on a rolling 3-year timetable.

Budget

No budget has been considered for this project as, at this stage, it is a low priority and unlikely to warrant initiation in the next three years.

References

1. Guardabassi L, Schwarz S and Lloyd D (2004). Pet animals as reservoirs of antimicrobial resistant bacteria. *J Antimicrob Ther* 54: 321-332.
2. Malik S, Peng H and Barton M (2005). Antibiotic resistance in staphylococci associated with cats and dogs - Review. *J Appl Microbiol*, 99: 1283-1293.
3. Sidjabat HE, Townsend KM, Hanson ND, Bell JM, Stokes HW, Gobius KS, Moss SM, Trott DJ. (2006). Identification of bla(CMY-7) and associated plasmid-mediated resistance genes in multidrug-resistant *Escherichia coli* isolated from dogs at a veterinary teaching hospital in Australia. *J Antimicrob Chemother*;57(5):840-848.
4. Malik S, Coombs GW, O'Brien FG, Peng H, Barton MD (2006). Molecular typing of methicillin-resistant staphylococci isolated from cats and dogs. *J Antimicrob Chemother*. 58(2):428-31.

APPENDIX 1: Comparison of international antimicrobial resistance management & surveillance systems

This comparison is confined to those countries that have developed national integrated antimicrobial resistance (AMR) management and surveillance programs. Links to additional programs follow the table.

	Canada	Denmark	Sweden	Norway	USA
Program	<ul style="list-style-type: none"> • CNISP – Canadian Nosocomial Infection Surveillance Program • CIPARS – Canadian Integrated Program for Antimicrobial Resistance Surveillance 	<ul style="list-style-type: none"> • DANMAP – Danish Integrated Antimicrobial Resistance Monitoring and Research Program 	<ul style="list-style-type: none"> • SWEDRES – Swedish Antibiotic Utilisation and Resistance in Human Medicine • SVARM – Swedish Veterinary Antimicrobial Resistance Monitoring 	<ul style="list-style-type: none"> • NORM – Norwegian Program for Monitoring Antimicrobial Resistance - Humans • NORMVET - Norwegian Program for Monitoring Antimicrobial Resistance – Veterinary and Food Production Sectors 	<ul style="list-style-type: none"> • NARMS – National Antimicrobial Resistance Monitoring System • NNIS - National Nosocomial Infections Surveillance System
Commenced	CCAR – 1998 CNISP – 1995 CIPARS - 2003	1995	SWEDRES -2000 SVARM - 2000	NORM - 1999 NORMVET 2000	NARMS- 1996 NNIS –1970
Established under	<ul style="list-style-type: none"> • CIPARS was developed in response to recommendations of the 2002 Health Canada Advisory Committee on Animal Uses of Antimicrobials and Impact on Resistance and Human Health; • National Action Plan developed by CCAR (2004). • CNISP –Laboratory Centre For Disease Control 	As an initiative of Danish Ministry of Health & Danish Ministry of Food, Agriculture & Fisheries	Plan of action against antibiotic resistance – proposal from the National Board of Health and Welfare, June 2000.	National action plan against AMR issued by Ministry of Health & Social Affairs (2000)	<ul style="list-style-type: none"> • NARMS - FDA held a joint Veterinary Medicine and an Anti-Infective Drugs Advisory Committee to address the specific issue of approval of fluoroquinolones for use in poultry. From this NARMS developed as collaboration between US FDA's CVM and USDA and CDC. • NNIS – Routine collection of data for aggregation in national database started in 1970
Coordinating unit and location	<ul style="list-style-type: none"> • National Steering Committee for Antimicrobial Resistance Surveillance in Enterics; 	<ul style="list-style-type: none"> • Danish Institute for Food and Veterinary Research • Danish Veterinary and Food 	<ul style="list-style-type: none"> • SWEDRES – Swedish Institute for Infectious Disease Control, Solna • SVARM – National 	<ul style="list-style-type: none"> • Reference Centre for Detection of Antimicrobial Resistance at University of Tromso and 24 decentralised 	<ul style="list-style-type: none"> • NARMS - Centre for Veterinary Medicine (CVM) in the Food and Drug Administration.

	Canada	Denmark	Sweden	Norway	USA
	<ul style="list-style-type: none"> National Steering Committee for Monitoring Antimicrobial Use in Agriculture and Veterinary Medicine. Members of the Canadian Hospital Epidemiology Committee (CHEC), a subcommittee of the Canadian Infectious Diseases Society, and the Laboratory Centre for Disease Control (LCDC), Health Canada 	<p>Administration</p> <ul style="list-style-type: none"> Danish Medicines Agency Statens Serum Institut 	<p>Veterinary Institute, Uppsala</p>	<p>localities (NORM)</p> <ul style="list-style-type: none"> Norwegian Zoonoses Centre, Oslo (NORMVET) 	<ul style="list-style-type: none"> NNIS - CDC
Oversight	<p>Canadian Committee on Antibiotic Resistance (CCAR).</p> <ul style="list-style-type: none"> Incorporated organisation with a volunteer Board of Directors of individual experts elected by member organisations; 3 working groups – on infection prevention and control, surveillance and international benchmarking. Contract with and funded by Canada’s Public Health Agency; Specific deliverables in communications, outreach and policy development for the Federal Government with respect to AMR. CCAR partners with members and other organisations on deliverables. 	<p>DANMAP Board with representatives from</p> <ul style="list-style-type: none"> Danish Institute for Food & Veterinary Research Danish Veterinary & Food Administration Statens Serum Institut Danish Medicines Agency 	<p>STRAMA – Swedish Strategic Program for the Rational Use of Antimicrobial Agents and Surveillance of Resistance.</p> <ul style="list-style-type: none"> Management Board meets twice yearly to decide on projects, set priorities and distribute funds. 	<ul style="list-style-type: none"> NORM reference group – hospital clinical microbiologists and the Institute of Public Health NORMVET reference group – representatives from government veterinary/agricultural institutes 	<ul style="list-style-type: none"> NARMS - CVM with periodic Expert Reviews
Funded by	<ul style="list-style-type: none"> Canadian Public Health Agency 	<p>Ministry of Health & Ministry of Family and Consumer Affairs</p>	<p>Swedish Government</p>	<p>Ministry of Health & Social Affairs</p>	<p>FDA via interagency agreements with both USDA and CDC, and also interagency</p>

	Canada	Denmark	Sweden	Norway	USA
	<ul style="list-style-type: none"> Health Canada Canadian Food Inspection Agency 				agreements with APHIS and FSIS
Most recent report	<ul style="list-style-type: none"> CCAR – 2004/2005 CIPARS - 2003 	2004	2005	2003	NARMS - 2003/2004 NNIS - 2004
Scope	<p>CIPARS</p> <ul style="list-style-type: none"> AMR in enteric pathogens in humans; AMR in enteric pathogens and commensals from agri-food sector; Antimicrobial use in humans and animals. <p>CNISP</p> <ul style="list-style-type: none"> national nosocomial infection rates, 2) to determine the impact of infection due to multiresistant organisms 	Coordinated national surveillance & research program for antimicrobial consumption and AMR in bacteria from humans, animals and food.	<ul style="list-style-type: none"> Human & animal AMR surveillance; Human and animal antimicrobial consumption 	<ul style="list-style-type: none"> Human & animal AMR surveillance; Human and animal antimicrobial consumption. 	<p>NARMS</p> <ul style="list-style-type: none"> Enteric organisms in humans, animals and retail meats. <p>NNIS</p> <ul style="list-style-type: none"> Pathogens isolated from patients in high risk departments of hospitals from blood stream infections, pneumonia, UTI and SSI
AMR surveillance – Humans	<p>CIPARS</p> <ul style="list-style-type: none"> Passive surveillance of Salmonella isolates sent for typing; 	<ul style="list-style-type: none"> Proportion of Salmonella and Campylobacter isolates sent for typing; Enterococcus and E.coli – targeted sampling of the healthy population; Staph aureus and Streptococci isolated from blood sent for typing; Other clinical isolates from participating laboratories; 	<ul style="list-style-type: none"> Notifiable diseases – resistant Strep pneumoniae, MRSA, VRE, TB. RSQC surveys –all 30 labs collect quantitative data for defined antibiotics in 100 consecutive clinical isolates of a number of bacterial species – core and targeted. National database (ResNet); Sentinel surveillance of Salmonella, Shigella, Campylobacter and Helicobacter not done routinely – special investigations and research 	<ul style="list-style-type: none"> Periodic sampling from patients with defined clinical conditions; 24 labs – local testing using identical criteria for sampling; 7 different bacteria monitored; 	<p>NARMS</p> <ul style="list-style-type: none"> Isolates submitted by state and local public health labs to CDC for testing; <i>Salmonella</i>, <i>E.coli</i>, <i>Enterococci</i>, <i>Campylobacter</i>, <i>Listeria</i>, <i>Shigella</i>
Usage – humans	IMS Health provides community antimicrobial use data to the Public Health	Data collated by Danish Medicines Authority;	Apoteket AB (National Corporation of Swedish Pharmacies) produces	Monitored by Institute of Public Health	Usage data is collected and analysed as part of NNIS.

	Canada	Denmark	Sweden	Norway	USA
	<p>Agency – two datasets are used:</p> <ul style="list-style-type: none"> Canadian CompuScript (CCS) tracks the number and size of prescriptions dispensed by retail pharmacies; data are stratified by store size, type and province to arrive at an estimate of antimicrobial use through pharmacies; Canadian Disease and Therapeutic Index (CDTI) provides data on patterns and treatment of disease by office-based physicians. Reported as DDD¹. 	<ul style="list-style-type: none"> monthly reporting of consumption from all pharmacies (including hospital pharmacies) to DMA; includes data on patient, supplier but not indication for prescription. Reported as DDD¹. 	<p>national and county sales statistics;</p> <ul style="list-style-type: none"> All pharmacy prescriptions; Hospitals – sales statistics national, county, hospital and hospital department. Reported as DDD¹. 	<ul style="list-style-type: none"> Mandatory reports from wholesalers of sales to pharmacies and hospitals Hospital sales represent 8% of total sales Reported as DDD¹ 	
AMR surveillance – animals	<p>CIPARS</p> <ul style="list-style-type: none"> Active abattoir surveillance of <i>E.coli</i> and <i>Salmonella</i> from cattle, pigs and poultry; Active surveillance of food at retail; <i>Campylobacter</i>; <i>Enterococcus</i>, <i>E.coli</i> and <i>Salmonella</i> from poultry, pork and beef. Passive surveillance of <i>Salmonella</i> isolates sent for typing. Sentinel on-farm surveillance for commensal and zoonotic bacteria – program in development. 	<ul style="list-style-type: none"> Clinical isolates from diagnostic submissions – cattle, pigs, poultry; Indicator bacteria from animals at slaughter; <i>Salmonella</i> from clinical cases, feed stuffs and food; Food - at wholesale and retail outlets; local and imported foods sampled. 	<p>Zoonotic bacteria –</p> <ul style="list-style-type: none"> <i>Salmonella</i> is a notifiable disease; <i>Campylobacter</i> sampled from healthy pigs at abattoirs; <p>Indicator bacteria</p> <ul style="list-style-type: none"> <i>E.coli</i> and <i>Enterococcus</i> from healthy pigs at abattoirs; <p>Animal pathogens</p> <ul style="list-style-type: none"> From clinical cases and autopsy – targeted bacterial species from pigs, cattle, horses, dogs and cats. 	<ul style="list-style-type: none"> Clinical isolates from diagnostic submissions – dogs, pigs, poultry; Indicator bacteria sampled at abattoirs – pigs, poultry, cattle, sheep; Zoonotic bacteria – <i>Salmonella</i>, <i>Campylobacter</i>, <i>Yersinia</i> & <i>Shigella</i> - from live animals, meat, feed and necropsy specimens and human clinical isolates 	<p>NARMS</p> <ul style="list-style-type: none"> Samples from healthy animals at abattoirs and on-farm; from veterinary diagnostic labs; testing at Athens Georgia; <i>Salmonella</i>, <i>E.coli</i> <i>Enterococci</i>, <i>Campylobacter</i> Retail meats and animal feeds tested for <i>Salmonella</i>, <i>E.coli</i>, <i>Enterococci</i>, <i>Campylobacter</i> at CVM in Laurel MD.
AMR usage - animals	<ul style="list-style-type: none"> National system for monitoring use in animals is under development; Annual Sales data – project is underway for Canadian Animal Health Institute to 	<p>Data obtained from VetStat</p> <ul style="list-style-type: none"> the data is USE, not sales of antimicrobials; contains detailed information on all prescriptions including 	<p>Sales statistics supplied by Apoteket AB</p> <ul style="list-style-type: none"> all antimicrobials available only on veterinary prescription; all are dispensed through 	<p>Monitored by Institute of Public Health</p> <ul style="list-style-type: none"> Mandatory reports from wholesalers of sales Feed additives – approval from Norwegian 	<p>United States lacks a mechanism for collecting antimicrobial usage data. Options are under consideration and the subject was extensively canvassed in <i>Prev Vet Med</i> 73 (2&3) Feb</p>

	Canada	Denmark	Sweden	Norway	USA
	<p>provide annual sales data to CIPARS;</p> <ul style="list-style-type: none"> • Sentinel farm project – monitoring antimicrobial use and resistance on sentinel farms – broiler chickens, grower/finisher pigs and feedlot beef. 	<p>species, age of animal and farm;</p> <ul style="list-style-type: none"> • Vets required by law to report to VetStat the use of all prescription medicines in food animals; • All therapeutic drugs are prescription only and 99% are supplied through pharmacies • Pre-mixes used in medicated feeds sold through feed mills which report all sales to VetStat • reported in Defined Animal Daily Doses (ADD) 	<p>pharmacies supplied by two wholesalers;</p> <ul style="list-style-type: none"> • data generated from electronic pharmacy records of sales; • Vets not permitted by law to make a profit from dispensing medicines; • Reported as kg of active substance 	<p>Agricultural Inspection Service</p> <ul style="list-style-type: none"> • Therapeutic use – prescription only dispensed through pharmacies supplied by wholesalers. • Medicated feeds- veterinary prescription. • Reported as amount of active in kg. 	2006.

NOTE:

- ¹ **DDD: Defined daily dose** – the assumed average maintenance dose per day for a drug used for its main indication in adults; Expressed as a number of DDD per 1,000 population per day (primary health care) or DDD per 1,000 occupied beds per day (hospitals).

APPENDIX 2: WEB Links to antimicrobial resistance surveillance

Canadian Committee on Antimicrobial Resistance (CCAR)

<http://www.ccar-ccra.com/english/ccar-e.shtml>

Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

<http://www.phac-aspc.gc.ca/cipars-picra/>

Danish Integrated Antimicrobial Resistance Monitoring and Research Programme (DANMAP)

<http://www.dfvf.dk/Default.asp?ID=9604>

European Antimicrobial Resistance Surveillance System (EARSS)

<http://www.rivm.nl/earss/>

European Surveillance of Antimicrobial Consumption (ESAC)

http://www.esac.ua.ac.be/main.aspx?c=*ESAC2

Intensive Care Antimicrobial Resistance Epidemiology (ICARE)

<http://www.sph.emory.edu/ICARE/index.php>

National Antimicrobial Resistance Monitoring System (NARMS) for Enteric Bacteria

http://www.fda.gov/cvm/narms_pg.html

National Nosocomial Infections Surveillance (NNIS) System

http://www.cdc.gov/ncidod/dhqp/nnis_pubs.html

Norway: Antimicrobial resistance in bacteria from animals, feed, and food

<http://www.zoonose.no/Zoonosis-centre.htm> and

http://www.vetinst.no/inet_eng/index.asp?strUrl=1001239i&topExpand=&subExpand=

Swedish Veterinary Antimicrobial Resistance Monitoring (SVARM)

<http://www.sva.se/dokument/stdmall.html?id=790&searchstring=SVARM&visaarkiv=1>

WHONET

<http://www.who.int/drugresistance/whonetsoftware/en/>