

Resistance sans frontières: containing antimicrobial resistance nationally and globally

Coordinated action on several fronts is required

Antimicrobial resistance is everywhere, and everywhere invisible. Bacteria, which comprise the bulk of microscopic life, have lived on planet Earth for 3.4 billion years, giving them a huge amount of time to diversify, to establish themselves in almost all terrestrial and aquatic niches, and to develop advanced survival skills. Antimicrobial resistance is one of these skills. The agility with which bacteria acquire resistance to antimicrobial drugs is a perfect demonstration of those skills and of Darwin's "survival of the fittest".

Antimicrobials developed for therapeutic use are a very recent addition to the range of toxins in the bacterial environment. The introduction of sulfonamides in the 1930s was followed in the early 1940s by the development of penicillin, the first "miracle drug", capable of killing bacteria causing infection in host tissues while causing no harm to the host.¹ Resistance to both drug types emerged quite rapidly after their introduction into medical practice.² Resistance has since developed, sooner or later, to all other classes of antimicrobials that have made their way into human and veterinary medicine, and into other fields of human activity.

"Control of antimicrobial use ... by itself is insufficient to control the spread of antimicrobial resistance"

Wherever antimicrobials are used, bacteria will be exposed and ultimately acquire resistance, by mutation or, more commonly, by acquiring resistance genes from other bacteria or the environment. The same is true for antiseptic agents, which are, in reality, antimicrobials that can only be safely administered topically. Although we are familiar with their use in humans, antimicrobials are currently used in a variety of other settings for the treatment and control of bacterial infections: in food-producing animals, companion animals, performance animals; in aquaculture, apiculture, and agriculture. We are extending the reach of antimicrobials by including antiseptics in home cleaning and personal hygiene products.

The alarm bells about resistance have been ringing for some time, but it has taken more than 20 years and several false starts before minds have responded collectively and focused on controlling resistance nationally and



internationally. Antimicrobial resistance is now a major item on the agendas of the World Health Assembly³ and the World Organisation for Animal Health (OIE),⁴ and has been revived as a major work focus for both the World Health Organization and the OIE. Many developed and some developing countries have generated strategies and action plans in recent years; Australia did so in 2015, when it released *Australia's First National Antimicrobial Resistance Strategy*.⁵ Although not the first attempt in this country to address the problem of resistance,^{6,7} it was the first to fully embrace the idea that resistance has no borders, ensuring that all aspects of antimicrobial use and resistance were considered. Both the Department of Health, and the Department of Agriculture and Water Resources drove the development of the Strategy.

What does the Strategy hope to achieve? It incorporates seven objectives, each with a strong motivation to cut through and achieve the changes needed to make a difference.

Increase awareness and understanding: There is ample evidence that most in our community have a poor understanding of what antibiotics can and cannot do, and what resistance is. At least half believe that antibiotics will help with the common cold, and many also believe that antimicrobial resistance means that they personally become resistant to antibiotics. NPS MedicineWise has been running advertising and other programs in response to this problem,⁸ but the impact has yet to be fully felt. Awareness and understanding are also sometimes lacking among prescribers. Although almost all doctors and veterinarians prescribe antimicrobials as part of

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their daily practice, few are aware of rational prescribing principles and their benefits. Doctors and vets need to improve their own awareness and understanding, as well as that of their clients, of the negative effects of using antimicrobials inappropriately.

Implement effective antimicrobial stewardship: Antimicrobial stewardship is the coordination of activities to ensure and promote rational prescribing in a defined context; for example, in hospitals, in the community, or in veterinary practice. Having a stewardship program is now part of hospital accreditation requirements, thanks to the efforts over many years of the Australian Commission on Safety and Quality in Health Care (ACSQHC).⁹ There is an obvious need to extend stewardship into residential aged care, general practice, small animal and equine practice, and food animal practice. The establishment last year of a Centre for Research Excellence, the National Centre for Antimicrobial Stewardship, will lay the groundwork for the development of stewardship programs in all these areas.

Develop national surveillance: Without surveillance data it is impossible to know which control strategies are effective, or how effective they are. Although Australia has for some decades had several antimicrobial use and resistance surveillance programs in human medicine, their work has lacked coordination and correlation. The ACSQHC has received funding for the development of a national coordinated use and resistance surveillance system for human health, due for completion by June 2016. This project will coordinate all existing programs, enhance them as needed, and fill important gaps, including through regular and timely reporting and trend analysis of antimicrobial dispensing data from the Pharmaceutical Benefits Scheme, and linking data on antimicrobial resistance from laboratory information systems around the country. On the veterinary and agriculture side, there have been a number of small pilot programs. Funding was recently found for a project in pig production, and there is interest in extending this initiative to the poultry sector. However, more needs to be done to establish a national surveillance program in the non-human sector that is integrated with surveillance in the human community.

Improve infection prevention and control: Control of antimicrobial use is essential, but by itself is insufficient to control the spread of antimicrobial resistance. Controlling the spread of bacterial diseases (eg, with vaccines) is a very effective way of reducing the need for antimicrobials. Infection prevention and control systems are essential components of resistance containment. Australia has national infection control guidelines for human health,¹⁰ and infection control systems are a mandatory requirement of hospital accreditation. In the non-human sectors, infection control is a key part of animal husbandry in intensive food animal industries. In veterinary practice, guidelines on infection prevention and control are available, including information on personal protection for vets and staff;¹¹

however, more could be done to prevent the spread of infection between animals.

Agree on a national research agenda: Containing antimicrobial resistance is not currently an explicit research priority in Australia. The National Health and Medical Research Council, the Australian Research Council and other funding bodies support research in antimicrobial resistance, but only on a competitive funding basis (ie, in competition with all other types of research). While some excellent studies have been supported by these organisations, there is no strategic or targeted approach which ensures that the most important research questions are prioritised, such as new drug discovery and development, rapid diagnostics, and the identification of optimal education, community and professional strategies.

Strengthen international collaboration: Australia may be an island, but we are certainly not protected from exposure to new resistances. We have a long history of effective control of the introduction of exotic infectious diseases, but have not yet recognised that the same objective should apply to exotic resistances. The recent introduction in Victoria of an exotic resistance to last-line antibiotics (carbapenem resistance), with subsequent spread in the human population, highlights the fact that this aspect of resistance crossing borders cannot be neglected.¹² Developing partnerships with countries across the world will assist Australia to learn from international best practice, avoid duplication of effort, contribute to public health outcomes in our region, and provide early warning of emerging threats.

Establish and support clear governance: None of these objectives can work without a clear, forward-looking and stable governance structure. As a federation, our national strategy requires the cooperation and coordination of the activities of nine governments and, more importantly, of numerous ministries and agencies. This is where the national Antimicrobial Resistance Prevention and Containment (AMRPC) Steering Group, reporting to the federal ministers for Health and Agriculture, supported by the Australian Strategic and Technical Advisory Group, and working in collaboration with the Australian Health Protection Principal Committee, is forging the way forward. A coordinated approach is essential. The efforts of these groups will align with international efforts and contribute to the global control of antimicrobial resistance.

All prescribers and users of antimicrobials have a responsibility to preserve their long term effectiveness and to protect the health of their nation's citizens, animals and ecosystems. With the ever increasing global movements of people, animals and goods, all nations must work together to protect each other. Resistant bugs don't respect borders.

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