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Title	Australia's response to the global threat of antimicrobial resistance: past, present and future
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Australia's response to the global threat of antimicrobial resistance: past, present and future

Antimicrobial resistance is a global problem that needs long term solutions and major resource investments

The importance and scope of the problem of antimicrobial resistance (AMR) and its impact on human health have been increasingly recognised in the past decade, including by the World Health Organization¹ and major national bodies such as the Centers for Disease Control and Prevention in the United States² and the Department of Health in the United Kingdom.³ A 2016 report estimated that AMR would be responsible for 10 million excess deaths globally, and a cumulative cost of US\$100 trillion by 2050 if current evolution and spread of the problem is not abated.⁴ Australia is not immune to these threats and some of the most pressing ones are highlighted in a review in this issue of the Journal.⁵ A recent study estimated that Australian hospitals spend an additional \$11.3 million annually treating just two of our many AMR threats, such as ceftriaxone-resistant *Escherichia coli* bloodstream infections and methicillin-resistant *Staphylococcus aureus* (MRSA) infections.⁶ MRSA and vancomycin-resistant enterococcus have been established in Australian hospitals for decades, and while some progress has been made in reducing MRSA infections, Australia has one of the highest rates of vancomycin-resistant enterococcus infection in the world. We are increasingly faced with simple urinary tract infections that are untreatable with oral antibiotics, and cases of gonorrhoea that are essentially untreatable have also been reported. Australia is in the top 10% for per-capita antibiotic consumption in the world,⁷ and almost one in two Australians is prescribed at least one course of antibiotics on the Pharmaceutical Benefits Scheme each year.⁸

Australia once led the world in actions to limit AMR. In 1978, a group of infectious diseases physicians and clinical pharmacologists developed therapeutic guidelines in part as a response to the first cases of MRSA infection seen in Australia. Surveillance programs for AMR, such as the Australian Group on Antimicrobial Resistance and the National Antimicrobial Utilisation Surveillance Program, were initiated in the 1980s. The Joint Expert Technical Advisory Committee on Antibiotic Resistance, established in 1998, made recommendations to reduce AMR in humans and animals. This was followed by the Expert Advisory Group on Antimicrobial Resistance (EAGAR), which nominated importance ratings for antibiotics in human health to inform regulation. Coordinated public policy preserved important antibiotics such as quinolones⁹ and linked public hospital accreditation to antimicrobial stewardship programs. The National Prescribing Service (now NPS MedicineWise) led a successful program to reduce the use of antibiotics in primary care in the 1990s.

However, momentum was largely lost in the 2000s with the disbanding of EAGAR, until the first national Antimicrobial Resistance Summit in 2011, held by the Australasian Society for Infectious Diseases (ASID) and the Australian Society for Antimicrobials (ASA). This summit called for a system to respond to AMR that included comprehensive surveillance of AMR and usage across all animal and human sectors to inform interventions and response, underpinned by research. Australia's first national AMR strategy (2015–2019) has begun to address these concerns, aiming for a “One Health” approach and with significant progress on surveillance, antimicrobial stewardship, and research. As a part of this strategy, the Australian Commission on Safety and Quality in Health Care established in 2016 a national AMR and antimicrobial usage surveillance system for human health: the Antibiotic Use and Resistance

in Australia (AURA) system. In 2018, The WHO Joint External Evaluation on AMR recognised these achievements, and Australia now contributes to the global surveillance of AMR through the WHO global AMR surveillance system (GLASS), which may ultimately allow benchmarking of resistance rates against those of other countries.

In June 2017, ASID and the ASA held the second national Australian Antimicrobial Resistance Summit. Key representatives and stakeholders from state and federal governments, research, human health care, veterinary and agricultural sectors discussed the way forward to improve the response to AMR in Australia, resulting in several key recommendations (Box). Many of the speakers noted that while Australia currently has many existing entities that are important for controlling AMR, they are poorly coordinated by the current structure and approach, and current investment has not been sufficient to deal with critical areas, including primary and aged care, domestic animals and the environment. The key overarching recommendation was that Australia should, as a priority, develop a central cross-jurisdictional mechanism to coordinate and manage national AMR control activities. This could be achieved by the establishment of a new Australian National Coordinating Centre on Antimicrobial Resistance that is responsible for effective coordination of current and future AMR efforts in human and animal health and agriculture. Notably, this is a key recommendation of the WHO to countries to facilitate implementation of their national AMR action plans. Since some of the components for effective action are already present, the national coordinating centre could be structured as a central umbrella agency with a small physical footprint and key focus on facilitating interventions, communication and support across all jurisdictions. Australia's system to identify and respond to foodborne outbreaks (OzFoodNet) is a potential "hub and spoke" model of national coordination. Although a national coordinating centre has not yet been established, the Australian Government has undertaken a number of activities in response to their strategic plan, including a review of existing regulations to help identify areas where changes can be made to limit emergence of resistance,¹⁰ and increased activities to improve antimicrobial stewardship in general practice, aged care facilities and veterinary practices.

Where to from here? The key elements are mostly present: medical professionals, infection control practitioners and pharmacists are engaged; a nascent national surveillance system continues to be developed; and most jurisdictions have strong laboratory capacity, although focused on public health rather than AMR. However, these need to be expanded, adequately resourced and coordinated, with serious investment from state and territory governments in addition to the Commonwealth. AURA focuses on surveillance and lacks some fundamental elements of a proposed national coordinating centre. First, it only applies to human health and does not collect data on antibiotic use or AMR in animals and agriculture. Second, it is not strongly linked to response mechanisms that respond to outbreaks of multiresistant organisms, deal with antibiotic shortages or improve prescribing practices, nor is it able to drive a research agenda that directs research towards key questions that will improve Australia's capacity to understand and respond to AMR.

As a model of what Australia's next plan could look like, the recently released 5-year national action plan on AMR, in the United Kingdom, is visionary and ambitious.³ This plan includes concrete targets, including: halving health care-associated gram-negative bloodstream infections, reducing the number of specific drug-resistant infections in people by 10% by 2025, reducing antimicrobial use in humans by 15% by 2024, and reducing antibiotic use in food-producing animals by 25% between 2016 and 2020. It takes a global perspective, considering the impact of AMR on people in lower and middle-income countries, is fully integrated across animal and human health, and includes plans to increase vaccination (to prevent infections) and to incentivise research and development of novel antimicrobials.

Despite increasing government investment in the AMR strategy in recent years, further investment is needed if we are to effectively address the urgent threat of AMR. Such an increase in investment may be difficult for politicians to sell to the voting public currently because the community is not aware of AMR and does not perceive it as a potential threat to them as individuals, let alone to all areas of human and animal health. Therefore, as medical professionals, our next step should be to raise public awareness of the human impact of AMR as we see it. This may require us to change the way we communicate the problem of AMR just as is being done for climate change. Climate change is controversial but increasingly visible to the Australian and global communities. AMR, on the other hand, is not controversial (it is

clearly anthropogenic), but is also not visible to most people, partly because of the complexity of the problem and the fact that it is not one pathogen or one disease. We need to think of AMR in a similar way to climate change: a global problem that needs long term solutions and major resource investments. It is critical that Australia ensures a nationally and regionally coordinated approach to addressing this threat based on comprehensive surveillance to inform targets and a sound understanding of effective strategies to respond.

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[Insert Box]

Recommendations arising from the second national Australian Antimicrobial Resistance Summit

Strategic pillar 1: improve infection prevention and control

- 1.1 Facilitate national adoption of the WHO core components of infection prevention and control (IPC) to enhance and focus national IPC initiatives as a key AMR control strategy
- 1.2 Establish a national coordinated hospital-acquired infection (HAI) surveillance program that allows Australia to accurately report on the epidemiology of HAI infection and associated AMR for direct action
- 1.3 Enhance and refocus national IPC initiatives for both human and animal health so that they become a key AMR control strategy

Strategic pillar 2: practical antimicrobial stewardship

- 2.1 Reduce antimicrobial usage in the human community to OECD average
 - Immediate action: revoke repeat prescribing option for all antimicrobial prescriptions on PBS
- 2.2 National human and animal prescribing guidelines freely available in all GP and veterinary clinics and linked to accreditation
- 2.3 Quality-based audit and feedback of appropriateness of antimicrobial use in human and animal health

Strategic pillar 3: improving AMR surveillance and outbreak response

- 3.1 Human and animal AMR surveillance should be integrated under a single surveillance authority and linked to an effective implementation arm
- 3.2 All Australian laboratories should move to a single antimicrobial susceptibility testing system
- 3.3 Strengthen processes for managing outbreaks of multiresistant organisms

Strategic pillar 4: research and development

- 4.1 Nominate AMR research as a high national priority for human and animal health
- 4.2 Align research and development priorities to the four strategic pillars
- 4.3 Emphasise transparency in cross-sector and cross-jurisdictional collaboration and coordination for research and development

AMR = antimicrobial resistance; OECD = Organisation for Economic Cooperation and Development; PBS = Pharmaceutical Benefits Scheme; WHO = World Health Organization.

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