

## AMR Resources

What is Antimicrobial Resistance?

[Antibiotic resistance](#) – World Health Organisation (2018). A fact sheet summarising many of the key aspects of AMR. Contains links to useful information on other activities the WHO conducts and oversees as part of their wide-reaching work against AMR.

[Antibiotic resistance](#) – Royal Society Te Apārangi (2017). A series of useful resources compiled by the Royal Society Te Apārangi outlining the state of AMR, with a specific focus on current evidence for the prevalence of resistance in New Zealand.

[Antibiotic Resistance – The End of Modern Medicine](#) – Siouxsie Wiles (2017). An easily accessible and informative book on antibiotic resistance by a prominent New Zealand author and microbiologist.

[Antibiotic Resistance Questions and Answers](#) – US Centre for Disease Control and Prevention (2017). A Q and A explaining some basic facts about AMR and help communicate ways to prevent the development and spread of resistance.

[Antibiotic resistance: a rundown of a global crisis](#) – Aslam et al. Infection and Drug Resistance (2018). A comprehensive overview of the current global situation regarding AMR covering the threat posed, what is needed and the promise of potential solutions.

[WHO: Handle Antibiotics with Care](#) – World Health Organisation (2017). A short animated video giving a brief introduction to antibiotic resistance and containing important messages for the appropriate use of antibiotics.

## Future Impacts

[No to wait: securing the future from drug-resistant infections – Report to the Secretary General of the United Nations](#) – Interagency Coordination Group on Antimicrobial Resistance (2019). A far-reaching report outlining the prospects of AMR and the global impacts it will have. It includes major recommendations for what actions is required internationally.

[Review on antimicrobial resistance](#) – Wellcome Trust UK (2014). A landmark report commissioned by the UK Department of Health and led by economist Jim O'Neill laying out the causes and implications of AMR in the UK and worldwide.

[Peer into the post-apocalyptic future of antimicrobial resistance](#) – Wired (2017). A article on AMR that succinctly outlines the current perspective on the future implications posed by AMR.

[The global threat of antibiotic resistance](#) – ReAct. A compendium of information on AMR, including several perspectives on future implications and some useful video and infographics, produced by ReAct, an international NGO working in the this area.

## Financial Burden

[Drug-resistant infections: a threat to our economic future](#) – the World Bank (2017). A report by the World Bank on the projected financial impacts of AMR, which suggests that by 2050 those impacts will rival those of the 2008 global financial crisis.

[Why should I care: economic losses](#) – ReAct. A brief summary of the potential financial losses that will be experienced internationally if AMR is not addressed, including a number of useful resources.

[Estimating the economic costs of antimicrobial resistance](#) – Rand Corporation (2014). A summary of the report into the economic costs of AMR commissioned as part of the [UK AMR review](#). Includes a link to the full report.

[The global economic impact of anti-microbial resistance](#) – KPMG (2014). A report produced by consultancy company KPMG, commissioned as part of the [UK AMR review](#), to assess the economic impacts of AMR.

[The economic burden of antimicrobial resistance: why it is more serious than current studies suggest](#) – Smith and Coast. London School of Hygiene and Tropical Medicine (2012). A thorough review published on the full economic burden and risk posed by AMR. It details the challenges to fully estimating the cost of AMR beyond personal burden, as well as the need to effectively communicate the threat to society.

[Comprehensive cost of treating one patient with MDR/pre-XDR-TB in Wellington, New Zealand](#) – McNaughton et al. European Respiratory Journal (2016). A study investigating the cost per patient of treating resistant tuberculosis infections in New Zealand.

## Causes of Antimicrobial Resistance

[Causes of antimicrobial \(drug\) resistance](#) – US National Institute of Health (2011). A useful explanation of the biological processes that lead to drug resistance in microbes and how the use of antimicrobials contributes to these processes.

[Antimicrobial resistance: implications for New Zealanders](#) – Royal Society Te Apārangi (2017). An update on the evidence behind AMR, with a specific focus on the causes of the development and spread of resistance in New Zealand and what impact this is likely to have on public health.

[How antibiotic resistance happens](#) – US Centre for Disease Control and Prevention (2019). An overview of how microbes develop resistance to antibiotics. Includes fact sheets with useful infographics on related topics.

[The antimicrobial resistance crisis: causes, consequences, and management](#) – Michael et al. Frontiers in Public Health (2014). A review article published covering the various causes of AMR, including microbial, behavioural, clinical, agricultural and commercial influences.

## Human Health

[Antimicrobial resistance](#) – Ministry of Health (2019). This website contains information on how AMR impacts health in NZ, as well as how the clinical use of antimicrobials contributes to AMR and key messages for consumers and healthcare providers on how to help address issue.

[Let's keep antibiotics working](#) – PHARMAC. The website for PHARMAC's "Keep antibiotics working" campaign aims to encourage appropriate clinical use of antibiotics to limit their overuse, which leads to the development of AMR in the population.

[Choosing Wisely](#). Useful information for patients and health professionals on when it is appropriate to take antibiotics and what alternative treatments are available for certain conditions.

[Antibiotic resistance](#) – Health Navigator (2017). A New Zealand resource explaining the causes of AMR, how it affects community health and what can be done to help prevent its development and spread.

[Antibiotic resistance and stewardship](#) – Best Practice Advisory Centre New Zealand. A series of articles and resources to assist healthcare professionals make informed decisions about the proper prescribing of antibiotics. This part of the BPAC website includes [Antibiotics: choices for common infections](#) guideline. It provides useful information for prescribers about the most appropriate treatment options for a range of infections, to help facilitate appropriate prescribing and use of antibiotics.

[Antimicrobial resistance and primary healthcare](#) – World Health Organisation (2018). A brief summary of how AMR can be a barrier to the access of effective primary care, and how effective primary care is essential to addressing AMR and the different roles primary care providers can play, such as engagement and empowerment.

[What causes AMR?](#) – Australian Government (2017). Information about the causes of AMR relating to use of antimicrobials in human health, with links to useful information for consumers and healthcare providers working in specific areas.

## Animal Health

[Antimicrobial resistance](#) – Food and Agriculture Organisation of the United Nations. A summary page that includes information about how agriculture and food production contribute to AMR, how agriculture is affected and how this impacts human health.

[Antibiotics and resistance](#) – Ministry for Primary Industries. Information on how AMR relates to food safety and antimicrobial use in agriculture in New Zealand. This page also contains several links to other sources of information from New Zealand organisations.

[Antimicrobials in agriculture and the environment: reducing unnecessary use and waste](#) – UK Wellcome Trust (2015). A report produced as part of the [UK AMR review](#) that deals with the use of antimicrobials in agriculture and their presence in the environment. It covers the effects on human health, the contributions made to AMR and potential solutions.

[Antimicrobial resistance in the food chain](#) – World Health Organisation (2017). Information on how the use of antibiotics in food animals contributes to AMR in humans, what is currently being done and the limitations of study and action.

[WHO list of critically important antimicrobials](#) – World Health Organisation (2019). A list of critically important antimicrobials to help inform the development of risk mitigation strategies for the effective and appropriate use of antimicrobials in food production animals.

[Agriculture and food animals as a source of antimicrobial-resistant bacteria](#) – Economou and Gousia. Infection and Drug Resistance (2015). A review article giving an overview of AMR in animal agriculture, how this can be caused by the inappropriate use of antibiotics in animals, such as for growth promotion, and how this impacts human health.

## The Environment

[Antibiotic resistance in the environment](#) – Elsevier. A selection of scholarly articles related to antibiotic resistance in the environment, including a brief introduction on AMR in the context of environmental health.

[Antimicrobial resistance in the environment: summary report of an FAO meeting of experts](#) – Food and Agriculture Organisation of the United Nations (2018). A report produced by the FAO Antimicrobial Resistance Working Group on what actions are needed to minimise AMR in the environment. It also describes the need for innovation to ensure environmental protection and to determine the contribution to public health costs from environmental antimicrobial residues.

[Antimicrobial resistance in the environment: considerations for current and future risk assessment of veterinary medicinal products](#) – European Medicines Agency (2018). A reflection paper considering the effects of antimicrobial residues from the use of veterinary medicines on ecosystems and animal and human health.

[Review of antimicrobial resistance in the environment and its relevance to environmental regulators](#) – Singer et al. Frontiers in Microbiology (2016). A review that concludes that, at the time of writing, many AMR action plans do not adequately address AMR in the environment and this is in part due to knowledge deficiencies in this area.

[Antimicrobial resistance and the environment: assessment of advances, gaps and recommendations for agriculture, aquaculture and pharmaceutical manufacturing](#) – Topp et al. FEMS Microbiology Ecology (2018). An overarching assessment of the role of different industries in the development of AMR in the environment, focusing on key areas that require concerted efforts to address. These include the development of technologies and practices to help reduce antibiotic use and the need for evidence-based standards for antimicrobial residues in effluents.

[Anthropogenic environmental drivers of antimicrobial resistance in wildlife](#) – Swift et al. Science of the Total Environment (2019). A study suggesting that AMR in wildlife is not simply caused by the development of resistance in nearby human communities, but also occurs independently within these animal populations.

[Initiatives for addressing antimicrobial resistance in the environment: current situation and challenges](#) (2018). A white paper produced jointly by the US CDC, UK Wellcome Trust and the UK Science and Innovation Network that collates evidence and identifies knowledge gaps around AMR in the environment.

## One Health

[One Health](#) – World Health Organisation Europe. A summary of what One Health means in terms of AMR from the WHO's perspective, with links to websites for some of the various organisations who work with or are linked to the WHO in their AMR initiatives.

[One Health Aotearoa](#). The website for One Health Aotearoa, an organisation that aims to apply an intersectional approach to addressing health hazards in New Zealand, including AMR.

[The mandate for a global “one health” approach to antimicrobial resistance surveillance](#) – Thakur and Gray. American Journal of Tropical Medicine and Hygiene (2019). A recent editorial giving a succinct explanation of the One Health approach to AMR and why it is necessary for effective global action.

## Antimicrobial Resistance in New Zealand

[Antimicrobial resistance](#) – Environmental Science and Research. The website for ESR's public health surveillance programme for AMR, where surveillance data reports for different microbes are published.

[Antibiotic resistance is a growing problem in New Zealand](#) – Thomas et al. New Zealand Medical Journal (2014). An article that charts the increase in antibiotic resistance in New Zealand and makes the case for significantly reducing the use of antibiotics in New Zealand through effective strategies, programmes and education.

[InfectedNZ: the state of the nation](#) – Te Pūnaha Matatimi. A web page containing comments from a variety of sources on AMR in New Zealand and the threat it poses, including an editorial by Dr Siouxsie Wiles.

[The changing landscape of antimicrobial resistance in New Zealand](#) – Williamson and Heffernan. New Zealand Medical Journal (2014). A review article that gives a snapshot of AMR in New Zealand, including the prevalence of specific medically significant bacteria.

[Antimicrobial resistance: implications for New Zealanders](#) – Royal Society Te Apārangi (2017). An update on the evidence behind AMR and the impacts it will likely have on the public health of New Zealand. Includes a examples and cases studies of AMR present in New Zealand.

## Antimicrobial Use

[Trends, demographics and disparities in outpatient antibiotic consumption in New Zealand: a national study](#) – Williamson et al. Journal of Antimicrobial Chemotherapy (2016). A study of the antibiotic consumption of New Zealand outpatients focusing on differences between various demographics, concluding that future work should identify the appropriateness of antibiotic prescribing, particularly for penicillins in Pacific Island populations and children.

[Antibiotic consumption report](#) – Environmental Science and Research (2014). A report on antibiotic consumption in New Zealand between 2006 and 2014 based on ESR surveillance data showing relatively high rates of consumption compared to similar developed countries.

[Antibiotic consumption by New Zealand children: exposure is near universal by the age of 5 years](#) – Hobbs et al. Journal of Antimicrobial Chemotherapy (2017). A study of the antibiotic consumption by children in their first 5 years of life to determine how dispensing varied between population subgroups. It found that antibiotic exposure was near universal by age 5 years and the results suggest that much of the antibiotic use was likely unnecessary.

[A snapshot of antimicrobial use in New Zealand hospitals – a comparison to Australian and English data](#) – Duffy et al. New Zealand Medical Journal (2014). A comparison of antimicrobial usage data from New Zealand hospitals and figures from hospitals in Australia and the UK, showing similar usage between DHBs and variation in the type of antimicrobial agents used.

## What's Being Done

[New Zealand Antimicrobial Resistance Action Plan](#) – Ministry of Health and Ministry for Primary Industries (2017). A joint plan governed by MoH and MPI that lays out 18 priority action areas to be implemented over a 5-year period. These areas fall under 5 objectives: awareness and understanding, surveillance and research, infection prevention and control, antimicrobial stewardship, and governance, collaboration and investment.

[UN Interagency Coordination Group \(IACG\) on Antimicrobial Resistance](#) – World Health Organisation (2019). A page on the WHO website with reports produced by the IACG on the topic of AMR and links to other action plans initiated by the WHO and associated organisations.

[Combating antibiotic resistance](#) – US Food and Drug Administration (2019). A summary of the actions taken by the FDA to address the issue of AMR as an example of the role regulatory authorities can play.

[Current accounts of antimicrobial resistance: stabilisation, individualisation and antibiotics as infrastructure](#) – Chandler. Nature (2019). An article that assesses the state of global AMR initiatives and seeks to reframe AMR as an issue of systems and their interconnectedness, as opposed one of individual responsibility, in order to develop more effective strategies to address it.

## Initiatives

[World Antibiotic Awareness Week](#) – World Health Organisation (2019). A global campaign spearheaded by the WHO that is held in November and aims to spread awareness of the importance taking action to reduce the development and spread of antibiotic resistance.

[Antibiotic Amnesty 2019](#) – Pharmaceutical Society of New Zealand (2019). A New Zealand initiative, launched as part of World Antibiotic Awareness Week 2019, to encourage people to return unused antibiotics to their pharmacy for proper disposal to avoid the inappropriate use of recycled antibiotics.

## Research and Development

[Combatting Antibiotic-Resistant Bacteria \(CARB-X\)](#) and [Global Antibiotic Research and Development Partnership \(GARDP\)](#). International non-profit organisations that help to fund the development of new antibiotics and other medicines to reduce the burden of AMR.

[Drug-resistance infections: the science is on track, but the economics need fixing.](#) A feature on the Wellcome Trust UK website describing the economic barriers to the development of new medicines needed to fight AMR, including potential solutions to these problems.

[Global priority list of antibiotic-resistant bacteria to guide research, discovery, and development of new antibiotics](#) – World Health Organisation (2017). A list produced by the WHO prioritising known antibiotic-resistant bacteria that aims to guide research and development in the areas of the greatest clinical need in terms of addressing the issue of AMR.

[Progress on antibiotic resistance](#) – Nature (2018). An editorial remarking on ways in which the development and use of new diagnostic technologies could help facilitate more appropriate prescribing of antimicrobials.

## Infographics and Materials

[World Antibiotic Awareness Week](#) – World Health Organisation (2019). There are a number of useful posters, videos, animations and infographics on antibiotic resistance that are available from previous WHO World Antibiotic Awareness Week campaigns.

[Resources for antibiotic awareness](#) – Ministry of Health (2019). The MoH website contains several posters, images and other resources to help with communication and awareness of AMR.

[Antibiotic resistance](#) – Royal Society Te Apārangi (2017). The Royal Society's website contains a number of videos on AMR and there are some useful infographics contained with their Evidence Update and Fact Sheet.

[E-Bug](#) is an interactive education tool that helps students of various ages learn about microbes, antimicrobials and resistance, and includes a number of resources to help teachers educate their students in this area.

## Antimicrobial Stewardship

[What is antimicrobial stewardship?](#) – Dyar et al. Clinical Microbiology and Infection (2017). A review article that summarises the concept antimicrobial stewardship to help define it as a strategy and to provide examples of what actions can be taken within effective antimicrobial stewardship programmes.

[Antimicrobial stewardship in New Zealand](#) – Health Quality and Safety Commission (2013). A report from HQSC about antimicrobial stewardship in New Zealand that recommends a broad and collaborative approach to the rationalisation of antimicrobial use.

[Antibiotic prescribing and use](#) – US Centres for Disease Control and Prevention (2019). A section of the CDC website with resources to inform best practice antibiotic prescribing by health professionals and appropriate use by patients.

[Antimicrobial stewardship: Systems and processes for effective antimicrobial medicine use within human health and healthcare in New Zealand](#) – Best Practice Advisory Centre New Zealand (2017). BPAC guidance adopted from the National Institute for Health and Care Excellence UK, with the purpose of providing best practice recommendations on systems and processes for the effective use of antimicrobials.

[Survey of antimicrobial stewardship practices in public hospitals in New Zealand district health boards](#) – Gardiner et al. New Zealand Medical Journal (2017). A study that found a wide variation in antimicrobial stewardship programmes in place across New Zealand DHBs and provides survey results to be used to help develop an effective national stewardship plan.