AUSTRALIA'S DATA-ENABLED RESEARCH FUTURE:

HEALTH AND MEDICAL SCIENCES

APPENDICES C-E

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Appendix C: A scenario on dementia

The current landscape of dementia and future projections

Dementia is one of the largest health and social challenges facing Australia and the world. In 2018, dementia was the second leading cause of death in Australia and the leading cause of death in females. [1] The most recent reporting from the Australian Institute of Health and Wellbeing (AIHW), estimates that between 400,000 and 459,000 Australians have dementia, but the exact number of cases is still unknown.[1]

Australia's population is ageing, with the number of Australians aged 65-69 expected to increase by around one third and those aged 85 and over predicted to more than double.[1] Although dementia can affect younger people, it is more common with advancing age, leaving the growing population of older Australians vulnerable to significant levels of disability and dependency and placing an ever increasing burden on the rest of society in needs for health and social care.[1] The number of people with dementia is expected to reach between 550,000 and 590,000 by 2030.[1] One study predicts that by 2058, without a major medical breakthrough, over 1 million people will have dementia in Australia.[2]

AIHW estimates that dementia contributes 3.8% to the total burden of disease in Australia. In 2018, dementia cost the Australian economy approximately $15 billion. This cost is predicted to rise to more than $36.8 billion by 2056.[3]

Dementia, although a highly used term by the general public, is an umbrella term which captures many disorders that have problems with cognitive function as either the key symptom, such as Alzheimer's disease, or as a potential symptom, such as Huntington's disease. The causes of dementia vary depending on the type of dementia and are influenced by a range of factors acting in combination – some factors are increasingly well understood, and others are largely unknown. Research into the genetics of dementia has provided some useful insights, but for diseases like Alzheimer's, there is still a lot to learn. Importantly, diagnosis remains difficult, especially in the early stages when therapies are likely to have much greater impact. Additionally, there are no therapeutics for Alzheimer's disease that can reverse symptoms.[4] The same goes for the biological causes of Alzheimer's with more work needed to strengthen existing analysis and address knowledge gaps. Links have also been found between risk factors for cardiovascular disease and certain types of dementia, such as high blood pressure, diabetes, and high cholesterol. Important findings like this may have implications for

[1] Australian Government. Royal Commission into Aged Care Quality and Safety. Aged Care Reform: Projecting Future Impacts. 2020. Available at: https://agedcare.royalcommission.gov.au/sites/default/files/2020-09/research-paper-11-aged-care-reform-projecting-future-impacts.pdf

[2] Dementia Australia. Dementia prevalence data. Available at: https://www.dementia.org.au/information/statistics/prevalence-data

[3] Dementia Australia. Economic cost of dementia in Australia: 2016-2056. 2017. Available at: https://www.dementia.org.au/sites/default/files/NATIONAL/documents/The-economic-cost-of-dementia-in-Australia-2016-to-2056.pdf

[4] Dementia Australia. Causes of dementia. Available at: https://www.dementia.org.au/about-dementia/dementia-research/causes-of-dementia

preventive strategies in the future however, at present there is no definitive way to prevent dementia.[4]

Research has identified several non-genetic risk factors that can be managed through lifestyle changes or existing medical intervention including, physical activity, diet, education, social engagement, and mental health.[1] It is also worth noting that since risk factors for dementia are common, people with Alzheimer's or other primary forms of dementia will also have a cardiovascular component. Moreover, most people with dementia will have multiple comorbidities.

Delays in dementia diagnosis are still common in Australia, particularly in primary care settings. Researchers continue to investigate and develop better tools for accurate and early diagnosis. Work is also ongoing to improve current treatments and work towards a cure.

The signs, symptoms and impacts of dementia vary significantly across different stages of the condition. Dementia has profound personal and social costs for the individual suffering from the condition, their family, and their community. People with dementia often rely on informal carers, alongside health and aged care services – their care needs progressively worsening through the moderate and advanced stages of the condition. In 2021, it is estimated that almost 1.6 million people in Australia are involved in the care of someone living with dementia.[5] Aged care services are both economically and structurally under pressure from the continued rise in dementia cases and workforce capacity is already being tested.[6]

The health gap between vulnerable populations including rural and remote communities, Aboriginal and Torres Strait Islander people and those living in disadvantaged communities, is projected to increase and gender inequities could be exacerbated. At present there is a lack of national data on how common dementia is among Aboriginal and Torres Strait Islander peoples. Early analyses of existing data suggest that dementia is more common in Aboriginal and Torres Strait Islander peoples than in the general population.[7]

At present, Australia lacks large-scale national datasets that integrate key data such as natural history, clinical, imaging and multi 'omic' data that can be used by many to reliably map the issues.[8] The lack of easy accessibility to such data is preventing research from occurring since collection of such data is especially difficult in dementia. In addition, without a cure or increasingly effective prevention or treatment options, the health, social and economic impact of dementia will continue to rise. We also lack clear evidence on management of dementia and ways to integrate dementia care across the clinical trajectory with other health and aged care, including opportunities for healthy ageing, prevention and reablement.

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[5] Dementia Australia. Dementia statistics. Available at: https://www.dementia.org.au/statistics

[6] Australian Government. Royal Commission into Aged Care Quality and Safety. Aged Care Reform: Projecting Future Impacts. 2020. Available at: https://agedcare.royalcommission.gov.au/sites/default/files/2020-09/research-paper-11-aged-care-reform-projecting-future-impacts.pdf

[7] Australian Institute of Health and Welfare 2014 Australia's health 2014. Australia's health series no. 14. Cat. no. AUS 178. Canberra: AIHW.

[8] AIHW. Dementia data gaps and opportunities. 2020. Available at: https://www.aihw.gov.au/reports/dementia/dementia-data-gaps-and-opportunities/contents/summary

Reducing the impact of dementia: A future scenario

The future scenario described below will be used as a framework to discuss the roundtable objectives. It has been drafted to stimulate discussion on the current and future **research data needs and requirements** necessary to bring about this positive future. *We acknowledge that other factors will influence some of the aspects presented in the scenario.*

Scenario

This scenario examines a positive future where the number of people with dementia has continued to decrease (when adjusted by age), due to a reduction in risk factors and the predicted impacts on the individual, society and the economy have been reduced.

Imagine if the onset of dementia was delayed, cognitive decline was detected early and slowed, people were assisted to adapt to their changing cognitive capacities and to optimise their wellbeing, and people were supported to have good quality of life despite having dementia (or caring for someone with dementia).

In this scenario, in the second half of this century, there continues to be an increasing number of people with dementia in Australia as the population ages. However, at each stage of the condition individuals now have an improved quality of life, enabled by several underpinning mechanisms.

Advances in our understanding of risks and protective factors for dementia have led to significant progress in preventive approaches to the condition. A greater number of Australians are engaging in physical activity, eat a healthier diet, have reduced rates of smoking and alcohol consumption, have higher levels of education and cognitive activity, are more socially engaged, and have improved mental health. Consequently, rates of other chronic diseases impacting Australians, such as cardiovascular disease and diabetes have declined, both of which have been linked to Alzheimer's – creating a positive feedback loop.

Healthcare professionals now have access to better, more sophisticated screening tools and assessment tests, which have enabled higher rates of early diagnosis and which cater for the full diversity of the populations at risk. These changes have also led to greater accuracy and consistency of reporting and monitoring. Improved communication strategies have strengthened public understanding of dementia contributing to the increasing rates of early diagnosis and a reduction in the stigmatisation of the condition.

Discovery and development of novel treatments have provided a crucial step towards an improved quality of life for people with dementia at all stages. Breakthroughs in medical technologies and pharmaceutical developments accompanied by improved data infrastructure have enabled cross sector and interdisciplinary collaboration. This has resulted in treatments that delay the progress of dementia, ameliorate symptoms, and maintain independence for a longer period, but only if caught early enough in the disease course. In addition, developments in our understanding of the factors that lead to the progression of symptoms from early to moderate to advanced, have contribution to overarching advances.

Hospital admissions for symptoms related to dementia have declined and hospital diagnosis and recording procedures have been standardised, facilitating consistent and accurate reporting. People with dementia are spending less time in hospital and mortality rates have declined. The healthcare workforce is adequately prepared, equipped, and empowered to deal with the growing rates of dementia in Australia. Similar changes have been seen in the aged care workforce, with facilities able to manage the growing demand for dementia-specific aged

care services. Carers are also well supported through policies and programs that prioritise the needs of families and have been developed in conjunction with the people who use them. Importantly, there is better integration of the health and aged care systems, and these systems now interact more effectively with carers.

Considerations to achieve the future scenario

To enable the outcomes outlined in the future scenario above, it will be necessary to consider a number of key influencing factors, the dynamics of how they interact and on what timeline. It will also be important to go beyond the status quo approach to dementia and develop novel, impactful solutions, particularly those that enable collaboration across domains.

Researchers will need to ask a wide range of research questions that tackle these significant challenges – with associated broad ranging data requirements. This includes developing an understanding of what is currently not working, and how cross-disciplinary input can be leveraged. Considerations should be Specific, Measurable, Achievable, Relevant and Time-bound (SMART).

A selected list of possible primary considerations is below.

In addition, actions to prevent or delay progress of dementia, and to improve quality of life for those suffering from the condition, can lead to several broader secondary implications for society, the economy, and the environment

A selected list of potential secondary implications is below.

Disease stage	Examples of primary considerations to help achieve the future scenario	Data needs and requirements
Prevention	Risk factors Protective factors Social determinants of health Risk prediction Personalised prevention Vulnerable populations	Throughout the roundtable discussion we will explore the data infrastructure, assets, policies, and skills that will underpin these primary considerations.
Early stage	Diagnostic and prognostic investigations Health professional training Reporting systems Targeted public communication and preparation strategies Access to health care settings Monitoring of disease progression Genomic and epidemiological examinations	
Moderate stage	Education and training for all relevant sectors Optimisation and integration of health care and aged care services Carer support Appropriate, well-funded, sustainable care settings including community, home based, residential, hospice and acute care Cost to individuals and society Drug discovery, development, manufacturing, supply chains Ongoing testing	

	Targeted therapies Condition progression monitoring practices Advanced care planning Maintenance of independence	
Advanced stage	End of life planning Specialised palliative care settings Access to personalised care Education and training for all relevant sectors Optimisation and integration of health care and aged care services Collaboration between care settings Public and private systems Workforce capacity Funding Cost to individual and society Carer support Mental health support for family, friends, and communities New treatments	

Table 1: Dementia - Primary considerations

Area for consideration	Secondary implications
Human Health	• Reducing the prevalence of risk factors and increasing protective behaviours could result in fewer cases of other chronic conditions in Australia and lead to longer life expectancy with implications for population health dynamics. • Strategies to ameliorate dementia symptoms could lead to improved physical and mental health for those who suffer from dementia, carers, and families
Society	• Healthier and more well educated adults may be more productive and likely to contribute to national economic development through employment and reduced burden on healthcare services with whole of society benefits. • Improving quality of life for those with dementia is likely to impact family and community relationships positively, reducing burden on carers and society.
Health and aged care systems	• Reduced numbers of dementia admissions and length of stay in hospitals could free up resources that benefit the delivery of other healthcare • A more integrated health and aged care system could save money, reduce pressure on the workforce and lead to improved patient outcomes • Health and aged care spending dynamics will change, influencing other services
Natural environment	• Strategies to promote a more active population, who live in greener cities with better transport links and access to walking and cycling paths would have less need for fossil fuel intensive resources. • A population that consumes less meat as part of a healthier diet resulting from protective behaviours, could influence sustainable agricultural practices. • The sustainable development of healthy liveable cities that promote protective behaviours will help reduce carbon emissions. • A more informed, productive adult population could advance issues of climate change and promote sustainability. • Conversely, an increase life expectancy could lead to a larger population which could in turn compound issues related to human-induced climate change.

Governments and the economy	• Budget considerations will need to be adapted to reduce the impacts of dementia with potential implications for other public spending. • A population with greater quality of life and longer independence will form a growing proportion of the voting population. Political implications may exist which influence all age groups.

Table 2: Dementia - Secondary considerations

Appendix D: A scenario on obesity

The current landscape of overweight and obesity and future projections

The prevalence of overweight and obesity has been increasing worldwide and is recognised as a major public health concern. Australia had the 6th highest proportion of people with overweight or obesity aged over 15 among 22 OECD member countries in 2019.[9] The most recent report from the Australian Institute of Health and Wellbeing (AIHW) shows that in 2017-18, an estimated two in three (12.5 million) adults in Australia aged 18 years and over were affected by overweight or obesity.[9] Of great concern, one in four (1.2 million) children and adolescents aged 2-17 were categorised with overweight or obesity, increasing their risk of poor physical health, illness and mortality in adulthood.[10]

Obesity is influenced by a range of factors including food and nutrition, social norms, physical activity, and other biological and environmental factors that have their impact across an entire lifetime. Younger generations are gaining weight faster than older generations. Children and adolescents with obesity are more likely to have obesity in adulthood and evidence suggests that the likelihood of adults with obesity attaining healthy body weight is low.[10,11]

Obesity is a risk factor for many of Australia's most prevalent diseases from coronary heart disease to diabetes, some cancers and more.[12] In 2015, obesity contributed 8.4% to the total burden of disease in Australia and was one of five key risk factors that caused the most burden.[13] In addition, people with obesity, on average, require more healthcare than other people. They also experience social inequalities; for instance, people with obesity have lower rates of employment and rely more on social security benefits.[14] One study estimated that in 2019, the *per capita* economic impact of overweight and obesity in Australia came to $24 billion USD (approximately $32 billion AUD). The same study predicted that by 2060, this cost could rise to $103 billion USD (approximately $140 billion AUD).[15]

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[9] AIHW. Overweight and obesity: an interactive insight. 2020. Available at: https://www.aihw.gov.au/reports/overweight-obesity/overweight-and-obesity-an-interactive-insight/contents/prevalence#aboriginal

[10] AIHW. Australia's children. 2020. Available at: https://www.aihw.gov.au/reports/children-youth/australias-children/contents/health/overweight-and-obesity

[11] Fildes A, Charlton J, Rudisill C, Littlejohns P, Prevost AT, Gulliford MC. Probability of an Obese Person Attaining Normal Body Weight: Cohort Study Using Electronic Health Records. *Am J Public Health*. 2015;105(9):e54-e59. doi:10.2105/AJPH.2015.302773

[12] Obesity Evidence Hub. Impacts. Available at: https://www.obesityevidencehub.org.au/collections/impacts

[13] AIHW. Burden of disease. 2020. Available at: https://www.aihw.gov.au/reports/australias-health/burden-of-disease

[14] Duckett S, Swerissen H, Wiltshire T. A Sugary Drinks Tax: Recovering the Community Costs of Obesity. Melbourne, Australia: Grattan Institute; 2016.

[15] Okunogbe A, Nugent R, Spencer G, *et al*. Economic impacts of overweight and obesity: current and future estimates for eight countries. *BMJ Global Health* 2021;**6:**e006351.

Overweight and obesity rates disproportionately impact lower socioeconomic, remote, and Aboriginal and Torres Strait Islander communities.[9] High body mass was the second leading risk factor contributing to the health gap between Indigenous Australians and non-Indigenous Australians in 2011, accounting for 14% of the gap.[16]

Reducing the impact of dementia: A future scenario

The future scenario described below will be used as a framework to discuss the roundtable objectives. It has been drafted to stimulate discussion on the current and future **research data needs and requirements** necessary to bring about this positive future. *We acknowledge that other factors will influence some of the aspects presented in the scenario.*

Scenario

In the second half of this century, significantly fewer Australians are living with overweight or obesity with rates steadily declining across all stages of life. Obesity remains a significant risk factor associated with a range of conditions including diabetes, cardiovascular disease, some cancers, musculoskeletal disease, infertility, sleep apnoea, disability, mental health concerns, and dementia.[17] However, the declining incidence and prevalence of obesity has led to a reduction in the rates of these diseases and in turn, increased Australia's life expectancy. Australians are more active, have improved nutrition and overall live healthier lifestyles, all of which have contributed to the prevention of chronic diseases and mental illness – consequently improving quality of life.

In 2021, vulnerable groups suffered greater overweight and obesity rates when compared to the overall population. From 2050, this gap is contracting – as have a range of other health gaps reported in these communities, including cardiovascular disease and life expectancy. Aboriginal and Torres Strait Islander people, those living in rural and remote setting and people from the lowest socioeconomic areas live heathier lives that are more aligned with the broader population.

The projected social and economic impacts of high overweight and obesity rates have not eventuated. More Australians are employed, not reliant on government benefits, and actively involved in stimulating economic growth. Communities have greater access to green spaces, public transport, and affordable healthy food options. In addition, healthier Australians have maintained closer connections to their support groups including families and communities. Health and aged care spending have reduced, allowing savings to be redistributed towards overarching benefits to the Australian public. Cross-sector, interdisciplinary collaboration has facilitated many of these positive changes, with services integrated to achieve holistic and widespread impact.

Considerations to achieve the future scenario

[16] AIHW. Australian Burden of Disease Study. Impact and causes of illness and death in Aboriginal and Torres Strait Islander people. 2011. Available at: https://www.aihw.gov.au/reports/burden-of-disease/illness-death-indigenous-australians/summary

[17] Peeters A, Backholer K. Is the health burden associated with obesity changing? Am J Epidemiol. 2012 Nov 15;176(10):840-5. doi: 10.1093/aje/kws328. Epub 2012 Oct 25. PMID: 23100248.

To enable the outcomes outlined in the future scenario above, it will be necessary to consider a number of key influencing factors, the dynamics of how they interact and on what timeline. It will also be important to go beyond the status quo approach to overweight and obesity and develop novel, impactful solutions, particularly those that enable collaboration across domains.

Researchers will need to ask a wide range of research questions that tackle these significant challenges – with associated broad ranging data requirements. This includes developing an understanding of what is currently not working, and how cross-disciplinary input can be leveraged.

A selected list of possible primary considerations is below.

In addition, actions to reduce the number of people with overweight or obesity across all ages, and the resulting decrease in the prevalence of several chronic diseases, can lead to several broader secondary implications for society, the economy, and the environment.

A selected list of potential secondary implications is below.

Area for consideration	Examples of primary considerations to help achieve the future scenario	Data needs and requirements
Downstream determinants	Poor nutrition Physical inactivity Sedentary behaviours Poor sleep Genetic and other biological factors	Throughout the roundtable discussion we will explore the data infrastructure, assets, policies, and skills that will underpin these primary considerations.
Social, economic, and cultural determinants	Priority populations including Aboriginal and Torres Strait Islander peoples, rural and remote communities, children, and adolescents Socioeconomic status Level of education Employment status Accessibility and affordability of healthy food Housing Media/social media Food, sugary drinks and alcohol advertising and marketing Social and cultural norms around food, alcohol consumption, body shape and weight, promotion of inactivity	
Built environments	School settings Workplace settings	

	Home and neighbourhood settings Urban planning and design of cities/towns Access to green spaces Building design Recreational facilities Transportation systems	
Policies, programs, and funding	Government policy affecting food standards and availability, health, civil society, education, economic, housing, employment Dietary guidelines Government and private funding that influence food consumption and physical activity Private programs and policies that influence food consumption and physical activity	

Table 3: Obesity - Primary considerations

Area for consideration	Secondary implications
Natural environment	• A more active population, living in greener cities with better transport links and access to walking and cycling paths would have less need for fossil fuel intensive resources. • A population that consumes less meat and more fruit and vegetables as part of a healthier diet, could influence sustainable agricultural practices. • The sustainable development of healthy liveable cities will help reduce carbon emissions. • A more informed population could advance issues of climate change and promote sustainability. • Conversely, an increase life expectancy could lead to a larger population which could in turn compound issues related to human-induced climate change.
Built environment	• Developing the appropriate built infrastructure required to reduce rates of obesity, will require workforce and government resources that may impact fiscal expenditure and influence economic growth. • Built infrastructure such as hospitals and aged care facilities could be impacted by a healthier population.
Society	• Healthier adults may be more likely to contribute to national economic development through employment and reduced burden on healthcare services with whole of society benefits. • Heathier people of all ages are more likely to have positive and productive family and community relationships reducing burden on carers. • Healthier adults are less often absent from work and have greater productivity levels • Healthier children and adolescents are less often absent from school
Industries	• Addressing the root causes of obesity will include the promotion of healthy foods, drinks, and other habits, and social norms. This has the potential to impact a range of groups that rely on the proliferation of unhealthy practices. These groups include, but are not limited to, those who profit from fast/junk food, highly processed foods, sugary drinks, alcohol, cigarettes, video games and social media. • Prevention of diseases will have implications for the pharmaceutical industry as healthier populations may have less need for medications.
Governments	• Budget considerations will be different with a healthier population with potential benefits for society.

Table 4: Obesity - Secondary considerations

Appendix E: A scenario on antimicrobial resistance

The current landscape of antimicrobial resistance and future projections

Antimicrobial Resistance (AMR) is currently one of the biggest threats to both human and animal health in Australia and globally. If left unchecked, it has the potential to undermine major medical advances with devastating impacts. At the current trajectory, AMR will significantly limit the effectiveness of lifesaving treatments used to fight infections such as pneumonia, salmonellosis, gonorrhoea, infections resulting from chemotherapy and surgeries such as organ transplants, caesarean sections, and care of pre-term babies. [18,19]

It is estimated that on average 290 people die each year in Australia due to infections from eight resistant bacteria.[20] By 2050, this is predicted to rise to an estimated 10,430 deaths. One model suggests that by 2050, AMR could cost the Australian economy between $142 billion and $238 billion annually.[21] Today, global deaths related to drug-resistant infections total approximately 700,000 every year and this is projected to rise to 10 million a year, costing 100 trillion USD.[22]

In Australia, AMR predominantly arises from overuse or misuse of antimicrobials in humans and animals, poor hygiene practices and global travel.[23] Because of this, worsening AMR poses a significant international challenge, with low- and middle-income countries suffering the greatest public health burden. As international travel becomes even more accessible, Australians moving around the globe are at risk of contracting infections that are resistant to treatments, compounding the issue within the country.

The impact of AMR on human health is only one piece of the puzzle. The importance of the environment in the spread of antimicrobial resistance is becoming increasingly clear. Anthropogenically derived AMR enters the environment through myriad pathways with the potential to have a significant impact on the health of animals and the wider ecosystem.[24]

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[18] WHO. Antibiotic resistance. 2020. Available at: https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance

[19] Australian Commission on Safety and Quality in Health Care. AURA 2019. Third Australian report on antimicrobial use and resistance in human health. Available at: https://www.safetyandquality.gov.au/sites/default/files/2019-06/AURA-2019-Report.pdf

[20] OECD. Stemming the Superbug Tide: Just a Few Dollars More. Available at: oe.cd/amr-2018

[21] UTS. OUTBREAK. A One Health antimicrobial resistance economic perspective. 2020. Available at: https://outbreakproject.com.au/wp-content/uploads/2020/12/OUTBREAK_REPORT_2020_economics_ERRATUM.pdf

[22] UK Government. Tackling Drug-Resistant Infections Globally: Final report and recommendations. The review on Antimicrobial Resistance chaired by Jim O'Neill. 2016. Available at: https://amr-review.org/sites/default/files/160518_Final%20paper_with%20cover.pdf

[23] Australian Government. Antimicrobial Resistance. Available at: https://www.amr.gov.au/about-amr/what-causes-amr

[24] Food and Agriculture Organisation of the United Nations. Antimicrobial resistance in the Environment. 2018. Available at: http://www.fao.org/3/BU656en/bu656en.pdf

Resistant bacteria are found in surface waters, soils, animal and human waste and foods of plant origin. In addition, resistant microbes are being found increasingly in animals kept as pets, animals used for agriculture and wildlife, particularly those that live near humans.

Further research to strengthen existing analysis and address gaps related to the consequences of AMR in the environment and the risk this poses to human health is still ongoing.[24] However cross-sector, interdisciplinary and international collaboration will be necessary to tackle this major challenge for the health of humans, animals, and the environment.

Reducing the impact of antimicrobial resistance: A future scenario

The future scenario described below will be used as a framework to discuss the roundtable objectives. It has been drafted to stimulate discussion on the current and future **research data needs and requirements** necessary to bring about this positive future. *We acknowledge that other factors will influence some of the aspects presented in the scenario. This scenario examines a positive future in which the rates of emergence and spread of AMR has declined.*

Scenario

By 2050 and beyond, most existing antimicrobial medicines remain effective against infections both globally and in Australia. Additionally, development of new antimicrobials is occurring at a rate sufficient to curb the spread of AMR. Lifesaving treatments for a range of diseases including, but not limited to, pneumonia, HIV, malaria, and infections resulting from surgery and chemotherapy are no longer at risk of becoming ineffective. Consequently, deaths related to AMR have not increased and have not overwhelmed health systems.

Antimicrobial overuse and misuse in humans, animals and plants has declined and safer usage practices have been implemented. One Health, cross-sector and interdisciplinary policies and strategies have been implemented – these target the core issues and interact dynamically in both humans and animals. Communication strategies for improving prescriber and public awareness on appropriate antimicrobial use have been successful, enabling widespread recognition and fomenting a deeper understanding of the issues across society. The gap between the broader public and groups previously vulnerable to the impacts of AMR has diminished. This includes socioeconomically disadvantaged communities, older Australians, mothers and infants, prison populations, the homeless or those living in overcrowded housing, sex workers and those with limited access to healthcare. In addition, management and monitoring of existing spread continues to improve, with the necessary infrastructure in place to support timely and robust analysis.

The projected economic burden caused by AMR has not eventuated. Healthcare and aged care systems are not overrun by cases of resistant infections with emerging cases treatable through the development of new medicines where necessary. Surveillance and monitoring practices have evolved, contributing significantly to the reduction in spread and digital health systems have enabled more efficient, dynamic, and personalised public health responses. Importantly, because prevention of the spread of resistant infections has occurred through improved hygiene, overarching benefits for human health have resulted and in turn, relieved a portion of the economic and societal burden.

Improvements to human usage of antimicrobials has also benefited natural eco-systems with limited spread to the environment through waste, water, and soil. Australia has become a

world leader in minimising the use of antibiotics in food producing animals.[25] Antibiotic stewardship practices in agriculture continue to improve, protecting the health of animals and humans alike.

Australia is also at the forefront of international efforts to curb the spread of AMR. Australian decision makers have taken opportunities to empower low- and middle-income countries through partnerships that have enhanced development of collaborative strategies to support their health needs and paid attention to the deficiencies in their access to the determinants of good health. This has enabled proper management of AMR globally, ultimately allowing sustainable effective management of AMR nationally.

Considerations to achieve the future scenario

Australia's National Antimicrobial Resistance Strategy: 2020 & Beyond, lays out seven key priority areas for action.[26] To enable the outcomes outlined in the future scenario above, it will be necessary to consider a number of key influencing factors, the dynamics of how they interact and on what timeline. It will also be important to go beyond the status quo approach to AMR and develop novel, impactful solutions, particularly those centred around One Health.

Researchers will need to ask a wide range of research questions that tackle these significant challenges – with associated broad ranging data requirements. This includes developing an understanding of what is currently not working, and how cross-disciplinary input can be leveraged.

A selected list of possible primary considerations is below.[26]

In addition, actions to reduce the long-term impacts of AMR can lead to several broader secondary implications for society, the economy, and the environment. A selected list of potential secondary implications is below.

[25] Australian Government. AMR in animal health in Australia. Available at: https://www.amr.gov.au/about-amr/amr-australia/amr-and-animal-health-australia

[26] Australian Government. Australia's National Antimicrobial Resistance Strategy 2020 & Beyond. 2020. Available at: https://www.amr.gov.au/resources/australias-national-antimicrobial-resistance-strategy-2020-and-beyond

Area for consideration	Examples of primary considerations to help achieve the future scenario	Data needs and requirements
Governance for AMR initiatives	Sustainable funding for combating AMR One Health approach to national and local policies and programs Sector-specific action plans Linkages and opportunities between stakeholders and across sectors Sustained political will Regulation and legislation Incentives Shifting social norms	Throughout the roundtable discussion we will explore the data infrastructure, assets, policies, and skills that will underpin these primary considerations.
Prevention and control of infection and the spread of resistance	Overuse and misuse within the health and agriculture systems Disease prevention practices Standards for prevention and control Biosecurity Compliance Interdisciplinary monitoring and management practices National and international information sharing on emerging AMR trends Digital health	
Engagement in the combat against resistance	Targeting and strategic communication to support whole-of-society awareness and behavioural change One Health communication Public and political awareness Education and training for all relevant sectors	

	Access to information Vulnerable populations	
Usage and stewardship practices	Prescribing guidelines and best practice support Agricultural antimicrobial stewardship Monitoring of compliance Antimicrobial stewardship policy Targeted approaches for a variety of healthcare settings including primary care, aged care etc	
Surveillance and response to resistance and usage	One Health surveillance and information sharing systems Alignment of testing and reporting practices Drug discovery, development, manufacturing, diagnostics, supply chains Genomic and epidemiological examination	
A collaborative research agenda across sectors	One Health based research Coordination and information sharing Research types e.g. implementation, health services, basic science, political science, economics Co-design Funding Public and private systems	
Global collaboration and partnerships	International surveillance and monitoring Advancing global knowledge and promoting action against AMR Provision of regional support	

	Collaborative biosecurity measures Capacity building Public and private systems	

Table 5: AMR - Primary considerations

Area for consideration	Secondary implications
Human health	• Treatments such as care of pre-term babies, caesarean sections and chemotherapy remain safe have potential impacts on population dynamics • Reduced family and community burden, improved physical and mental health • Practices employed to reduce AMR spread including better waste management systems lead to overarching benefits to human health • Public education practices to reduce AMR spread also reduce spread of other diseases leading to reduction in other transmissible infections
Environmental health	• Safer, healthier ecosystems with greater opportunities to thrive and diversify • Safer, more ethical use of antimicrobials in agriculture and animal care, improving animal quality of life • Practices employed to reduce AMR spread resulting in better, ethical care of animals
Built environment	• Updated infrastructure and urban planning practices including development of waste management systems, housing construction, building locations, green spaces • One Health urban and rural planning strategies and practices • Improved construction of agricultural facilities
Healthcare systems	• Reduced risk of AMR spread among healthcare workforce • Less pressure on healthcare system • Greater resources allocated for management of other diseases/conditions including emerging diseases
Local and global social and political dynamics	• Local and international travel unaffected • Evolving regional and global political partnerships facilitated by collaboration on AMR
The economy	• Healthcare savings help stimulate economic growth • Reliable international travel minimises economic fluctuations • Redistribution of cost for other public spending such as research, education, infrastructure

Table 6: AMR - Secondary considerations