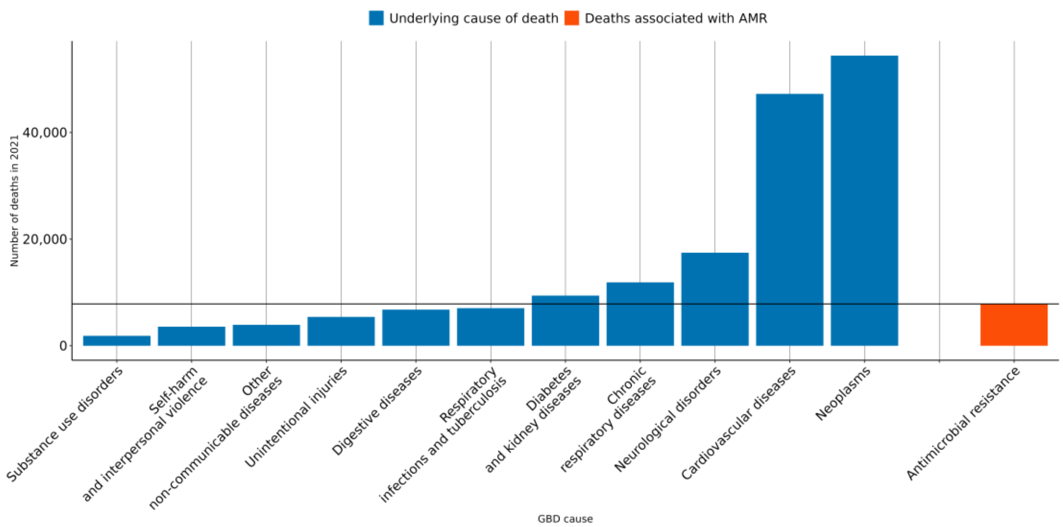
The burden of antimicrobial resistance (AMR) in Australia

Executive summary

- Antimicrobial Resistance (AMR) is a major global health threat, over **1,000 lives** have been lost each year since 1990 in Australia due to AMR.
- In 2021, there were an estimated **1,700 UI (1,420-1,970)** deaths attributable to AMR and **7,840 UI (6,850-8,840)** deaths associated with AMR in this location.
- The largest number of deaths associated with AMR in 2021 occurred among those aged **70+** in the country.
- Among the most deadly pathogen-drug combinations in 2021 were *Staphylococcus aureus* resistant to methicillin, *Escherichia coli* resistant to aminopenicillin and *Escherichia coli* resistant to third-generation cephalosporins.

Figure 1 Number of deaths by underlying cause, and those associated with AMR in 2021



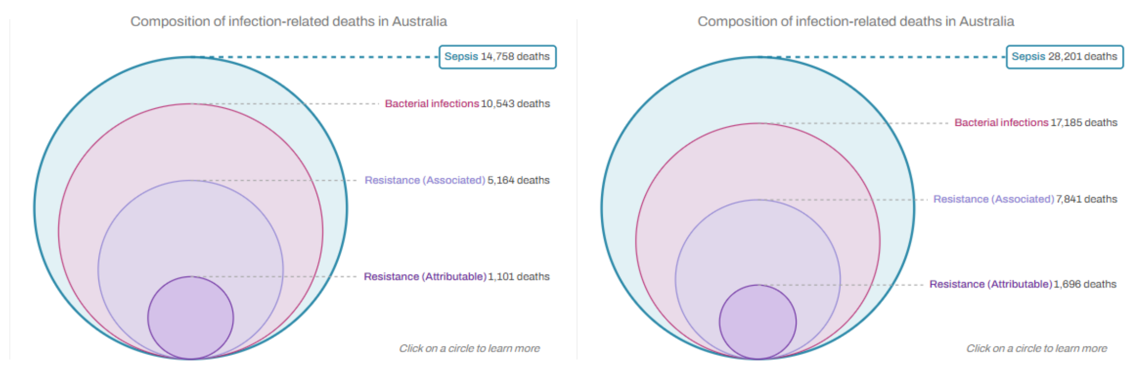
- In 2021, the number of deaths associated with AMR (orange bar in *figure 2*) were high compared to the most relevant underlying causes of death (depicted in blue) in the country. AMR associated deaths occur within multiple Global Burden of Disease (GBD) causes of death and AMR is not an underlying cause of death by itself.
- At the [2024 United Nations General Assembly high level meeting on antimicrobial resistance](), country members agreed to aim for a **10% reduction** compared to 2019 baseline **(from 4.95 to 4.45 million)** in the global number of deaths associated with AMR by 2030. But [our forecast]() indicates that in absence of concerted action, deaths associated with AMR could reach **5.5 million** (UI 4.8 - 6.2) if current trends continue. For Australia, a 10% reduction means to decrease the number of deaths associated with AMR to **6,880**, but currently the trend for this country could reach up to **10,500 UI [8,440-12,400]** AMR-associated deaths in 2030.

AMR in Australia

Key takeaways

- Antimicrobial Resistance (AMR) is a major global health threat, over *a million lives* have been lost each year since 1990.
- Globally, 4.71 (95% Uncertainty Interval (UI) 4.2-5.2) million deaths were associated with bacterial drug-resistant infections in 2021.
- And 1.14 (UI 1 - 1.3) million deaths were attributable to bacterial drug-resistant infection in the same year.
- *39 (UI 33 - 46) million deaths* directly attributable to bacterial AMR are projected to occur between 2025-2050 unless concerted action is taken. This equates to three deaths every minute.

Figure 2 Comparing 30 years of infection related deaths, and those associated with and attributable to AMR in Australia between 1990 and 2019.



- To look at these and more visualization interactively visit [Measuring Infectious Causes and Resistance Outcomes for Burden Estimation (MICROBE)]
- In **Australia** in 2021, there were an estimated **1,700 UI (1,420-1,970)** deaths attributable to AMR and **7,840 UI (6,850-8,840)** deaths associated with AMR. Here *"attributable deaths"* are considered to be those that would have been prevented had the drug-resistant bacteria causing the infections not been drug-resistant. *"Associated deaths"* are considered to be those that would not have occurred had the infections been prevented entirely.
- Across 204 countries, **Australia has the 10th lowest** age-standardized mortality rate associated with AMR in 2021.
- *Table 1* shows the bacteria which caused most deaths in 2021 (↑ indicates an increasing estimated annual rate between 1990-2021, ↓ indicates a decreasing annual trend), and *table 2* shows the pathogen-drug combinations which caused most deaths in 2021.

Table 1. Bacteria which cause most deaths in 2021 (Number of deaths in parenthesis)

Burden rank	Overall susceptible and resistant		Associated		Attributable	
1	Staphylococcus aureus 4,910 UI (4,360-5,470)	↑	Staphylococcus aureus 2,390 UI (2,100-2,670)	↑	Staphylococcus aureus 586 UI (492-681)	↑
2	Escherichia coli 3,420 UI (3,020-3,820)	↑	Escherichia coli 2,320 UI (2,040-2,600)	↑	Escherichia coli 419 UI (343-495)	↑
3	Pseudomonas aeruginosa 1,620 UI (1,440-1,800)	↑	Pseudomonas aeruginosa 594 UI (499-689)	↑	Pseudomonas aeruginosa 150 UI (117-183)	↑
4	Klebsiella pneumoniae 1,170 UI (1,030-1,300)	↑	Streptococcus pneumoniae 508 UI (444-572)	↓	Enterococcus faecium 107 UI (85-130)	↑
5	Streptococcus pneumoniae 1,140 UI (1,010-1,270)	↓	Enterococcus faecium 488 UI (429-548)	↑	Klebsiella pneumoniae 94 UI (75-114)	↑
6	Group A Streptococcus 794 UI (689-898)	↑	Klebsiella pneumoniae 417 UI (341-492)	↑	Streptococcus pneumoniae 89 UI (65-113)	↓
7	Enterococcus faecalis 596 UI (530-662)	↑	Enterobacter spp. 203 UI (179-228)	↓	Acinetobacter baumannii 74 UI (55-94)	↓
8	Enterococcus faecium 543 UI (480-606)	↑	Acinetobacter baumannii 195 UI (135-255)	↓	Enterobacter spp. 52 UI (44-59)	↓
9	Acinetobacter baumannii 533 UI (477-588)	↓	Proteus spp. 172 UI (110-234)	↑	Proteus spp. 26 UI (14-38)	↑
10	Proteus spp. 518 UI (452-584)	↑	Enterococcus faecalis 106 UI (83-129)	↓	Citrobacter spp. 22 UI (16-29)	↑

Annualized rate of change (1990-2021): <-3% · -3% to -1.5% · -1.5% to 0% · 0% to 1.5% · 1.5% to 3% · 3% to 5% · >5.0%

Table 2. Combinations which cause most deaths in 2021 (Number of deaths in parenthesis)

Burden Rank	Associated			Attributable		
1	Escherichia coli Aminopenicillin	2,200 UI (1,920-2,490)	↑	Staphylococcus aureus Methicillin	412 UI (325-499)	↑
2	Staphylococcus aureus Macrolides	1,670 UI (1,440-1,910)	↑	Escherichia coli Aminopenicillin	113 UI (87-140)	↑
3	Staphylococcus aureus Methicillin	1,630 UI (1,280-1,980)	↑	Escherichia coli 3GC	81 UI (54-108)	↑
4	Escherichia coli TMP-SMX	1,130 UI (955-1,300)	↑	Staphylococcus aureus Macrolides	76 UI (48-104)	↑
5	Escherichia coli Fluoroquinolones	969 UI (817-1,120)	↑	Pseudomonas aeruginosa Carbapenems	71 UI (48-95)	↑
6	Escherichia coli Beta-Lactam/Lactamase Inhib.	902 UI (743-1,060)	↑	Escherichia coli Fluoroquinolones	66 UI (38-94)	↑
7	Staphylococcus aureus Fluoroquinolones	721 UI (543-900)	↑	Enterococcus faecium Vancomycin	62 UI (48-76)	↑
8	Escherichia coli 3GC	673 UI (562-784)	↑	Escherichia coli TMP-SMX	61 UI (35-87)	↑
9	Enterococcus faecium Fluoroquinolones	471 UI (413-529)	↑	Escherichia coli Beta-Lactam/Lactamase Inhib.	61 UI (18-104)	↑
10	Klebsiella pneumoniae Aminoglycosides	378 UI (283-474)	↑	Streptococcus pneumoniae Carbapenems	54 UI (34-74)	↓

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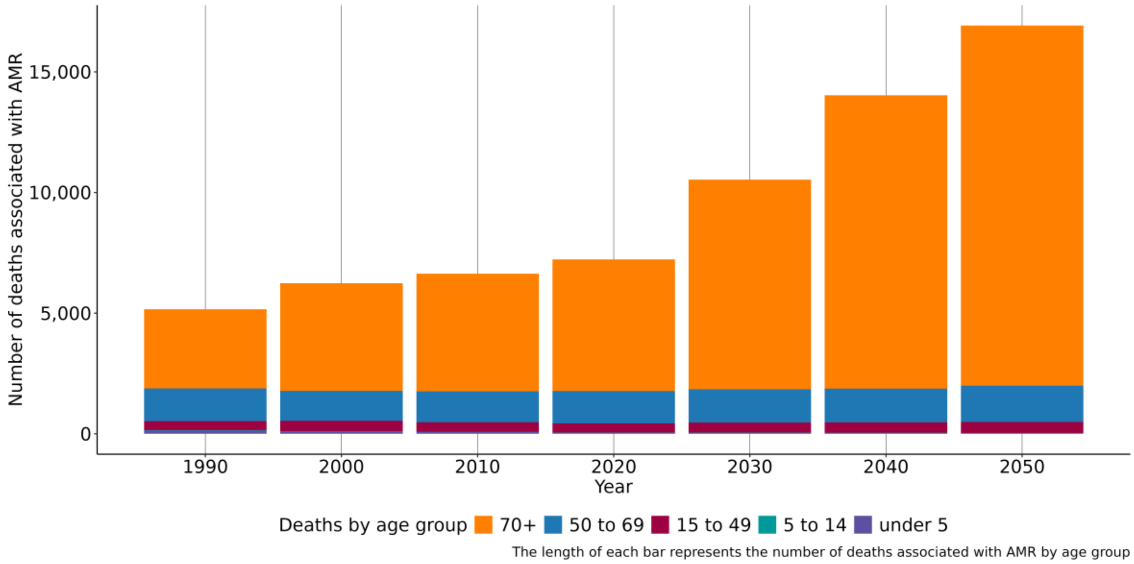
- Independently of antimicrobial resistance, the infectious syndromes accounting for the most deaths in 2021 were as follows (estimated thousands of deaths in parenthesis) bloodstream infections (9,350 UI (8,360-10,400)), lower respiratory infection (excl. COVID) (6,890 UI (5,950-7,840)), peritoneal and intra-abdominal infections (3,160 UI (2,770-3,540)), urinary tract infections and pyelonephritis (1,920 UI (1,600-2,230)) and infections of the skin and subcutaneous systems (1,370 UI (1,180-1,570)).

Figure 3. Number of deaths associated with AMR by age group between 1990-2020 and 2050 projection



- In Australia, people aged 70+ saw the largest number of deaths associated with AMR both in 1990 and 2021, which indicates that 70+ continues to be particularly vulnerable to infections which are resistant to antibiotics. In 2021, the number of deaths associated with AMR among the 70+ was 5,990 UI (5,090-6,880), whereas the mortality rate per 100,000 was 194 UI (165-223).

Data sources for Australia

In total, 520 million individual records or isolates covering 19,513 study-location-years were used as input data to our estimation process. The subset of input data for this country is shown below.

Table 3. Data inputs for Australia by source type

Source type	Years	Sample size	Sample size units
Microbial or laboratory data without outcome	1990-2021	608,197	Isolates
Microbial or laboratory data with outcome	2010-2021	1,232	Isolates
Literature studies	1990-2021	67,884	Cases/isolates/susceptibility tests
Single drug resistance profile data	1990-2021	1,782,834	Antibiotic susceptibility test

More information

About GRAM:

The purpose of the Global Research on AntiMicrobial resistance (GRAM) project is to **generate accurate and timely estimates of the magnitude and trends in antimicrobial resistance (AMR) burden** across the world, which can be used to inform treatment guidelines and agendas for decision-making and research, detect emerging problems and monitor trends to inform global strategies, as well as facilitate the assessment of interventions over time.

GRAM is the flagship project of the University of Oxford–IHME Strategic Partnership. GRAM was launched with support from the United Kingdom Department of Health and Social Care's Fleming Fund, and the Wellcome Trust.

All resources:

For all resources on AMR analysis at IHME, visit https://www.healthdata.org/antimicrobial-resistance.

To look at these and more visualization interactively visit Measuring Infectious Causes and Resistance Outcomes for Burden Estimation (MICROBE).

Data sources:

To download the list of data input sources by country, and AMR results by region, visit the Global Health Data Exchange (GHDx).

Contact us:

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