# The burden of antimicrobial resistance (AMR) in Oman

Executive summary

- Antimicrobial Resistance (AMR) is a major global health threat, over **200 lives** have been lost each year since 1990 in Oman due to AMR.

- In 2021, there were an estimated **170 UI (128-211)** deaths attributable to AMR and **657 UI (513-801)** 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, *Pseudomonas aeruginosa* resistant to carbapenems and *Streptococcus pneumoniae* resistant to carbapenems.

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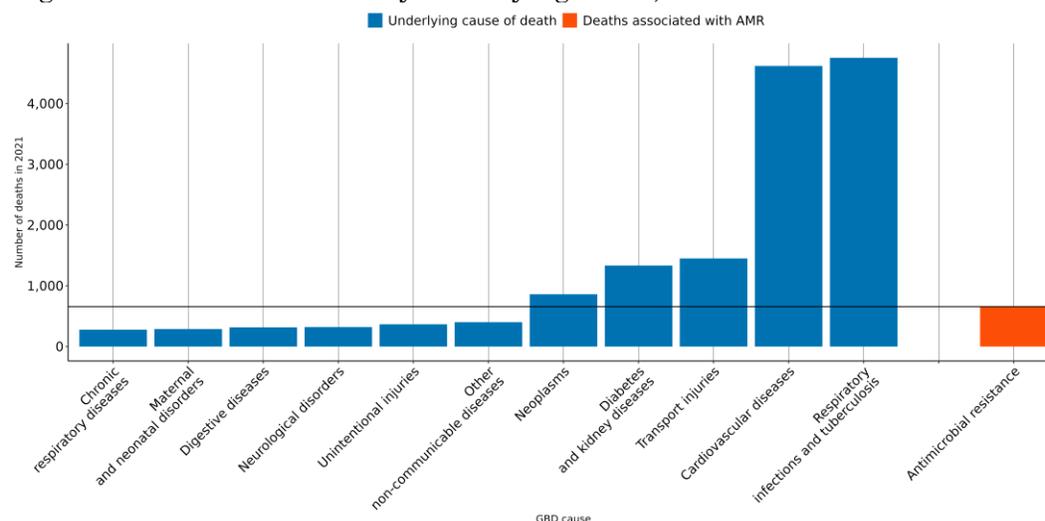

- In 2021, the number of deaths associated with AMR (orange bar in *figure 2*) were high compared to the most relevant underlying causes of death (depicted in blue) in the country. AMR associated deaths occur within multiple Global Burden of Disease (GBD) causes of death and AMR is not an underlying 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 Oman, a 10% reduction means to decrease the number of deaths associated with AMR to **653**, but currently the trend for this country could reach up to **1,050 UI [786-1,380]** AMR-associated deaths in 2030.

AMR in Oman

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 Oman between 1990 and 2019.
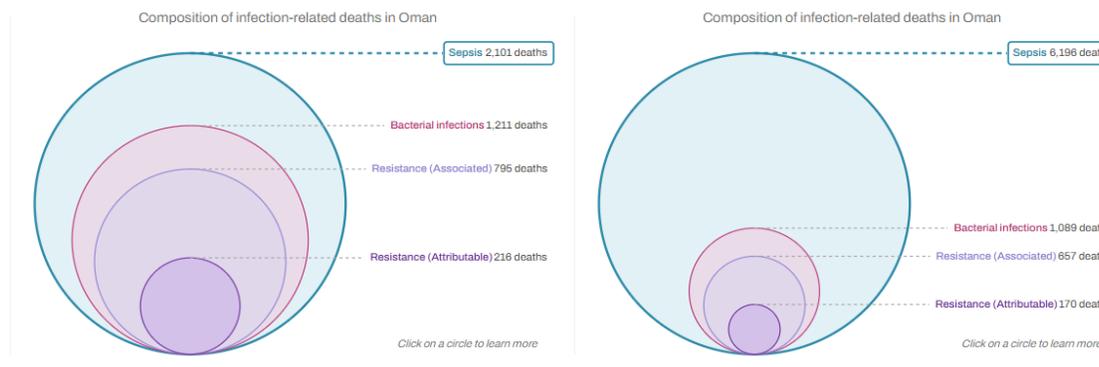
- To look at these and more visualization interactively visit [Measuring Infectious Causes and Resistance Outcomes for Burden Estimation (MICROBE)](#)

- In **Oman** in 2021, there were an estimated **170 UI (128-211)** deaths attributable to AMR and **657 UI (513-801)** 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, **Oman has the 63rd 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	
	Staphylococcus aureus 239 UI (199-279)	↑	Staphylococcus aureus 135 UI (93-177)	↑	Staphylococcus aureus 36 UI (24-50)	↑
	Escherichia coli 143 UI (119-166)	↑	Escherichia coli 116 UI (92-140)	↑	Streptococcus pneumoniae 26 UI (19-33)	↓
	Pseudomonas aeruginosa 119 UI (99-139)	↑	Streptococcus pneumoniae 84 UI (67-100)	↓	Acinetobacter baumannii 25 UI (21-30)	↓
	Streptococcus pneumoniae 109 UI (92-127)	↓	Pseudomonas aeruginosa 74 UI (58-91)	↑	Escherichia coli 24 UI (18-30)	↑
	Klebsiella pneumoniae 107 UI (89-125)	↓	Klebsiella pneumoniae 70 UI (56-84)	↓	Pseudomonas aeruginosa 20 UI (14-26)	↑
	Acinetobacter baumannii 74 UI (61-87)	↓	Acinetobacter baumannii 66 UI (54-78)	↓	Klebsiella pneumoniae 19 UI (15-23)	↓
	Group A Streptococcus 51 UI (42-59)	↑	Proteus spp. 20 UI (15-24)	↑	Enterococcus faecium 3 UI (2-4)	↑
	Enterococcus faecalis 31 UI (25-36)	↑	Enterococcus faecium 19 UI (15-23)	↑	Proteus spp. 3 UI (2-4)	↑
	Enterococcus faecium 29 UI (23-34)	↑	Group B Streptococcus 11 UI (9-14)	↑	Enterobacter spp. 3 UI (2-3)	↓
	Group B Streptococcus 28 UI (24-33)	↓	Enterococcus faecalis 11 UI (9-13)	↑	Enterococcus faecalis 2 UI (1-3)	↑

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

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

Burden Rank	Associated			Attributable		
	Staphylococcus aureus Methicillin	107 UI (60-154)	↑	Staphylococcus aureus Methicillin	27 UI (16-38)	↑
	Escherichia coli Aminopenicillin	107 UI (75-138)	↑	Streptococcus pneumoniae Carbapenems	23 UI (17-29)	↓
	Staphylococcus aureus Macrolides	86 UI (63-109)	↑	Pseudomonas aeruginosa Carbapenems	14 UI (9-19)	↑
	Streptococcus pneumoniae Carbapenems	76 UI (59-92)	↓	Acinetobacter baumannii Carbapenems	11 UI (7-14)	↑
	Escherichia coli Beta-Lactam/Lactamase Inhib.	75 UI (60-89)	↑	Escherichia coli 3GC	9 UI (6-12)	↑
	Escherichia coli 3GC	70 UI (52-87)	↑	Acinetobacter baumannii Fluoroquinolones	6 UI (5-7)	↓
	Pseudomonas aeruginosa Carbapenems	65 UI (51-79)	↑	Klebsiella pneumoniae 3GC	5 UI (3-7)	↑
	Escherichia coli TMP-SMX	63 UI (49-77)	↑	Klebsiella pneumoniae Carbapenems	5 UI (3-6)	↑
	Acinetobacter baumannii Beta-Lactam/Lactamase Inhib.	62 UI (51-73)	↓	Klebsiella pneumoniae Fluoroquinolones	4 UI (3-6)	↑
	Klebsiella pneumoniae 3GC	60 UI (49-72)	↑	Escherichia coli Fluoroquinolones	4 UI (1-6)	↑

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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 (652 UI (544-761)), lower respiratory infection (excl. COVID) (581 UI (485-676)), infections of the skin and subcutaneous systems (107 UI (85-128)), peritoneal and intra-abdominal infections (106 UI (81-130)) and upper respiratory infections (85 UI (12-159)).

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

Deaths by age group ■ 70+ ■ 50 to 69 ■ 15 to 49 ■ 5 to 14 ■ under 5

The length of each bar represents the number of deaths associated with AMR by age group
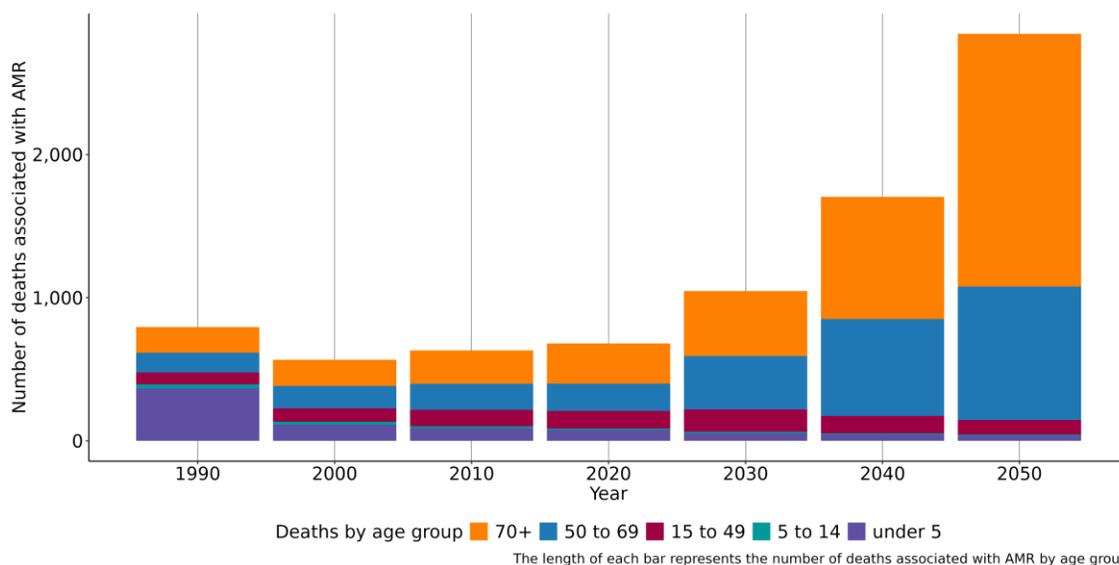
- In Oman, people aged under 5 experienced the largest number of deaths associated with AMR in 1990 but this changed by 2021 as the largest number of deaths occurred among the 70+. This indicates that prevention of infections among the under 5 has contributed to the reduction in the number of AMR associated deaths. In 2021, the number of deaths associated with AMR among the 70+ was 253 UI (200-306), whereas the mortality rate per 100,000 was 367 UI (289-444).

Data sources for Oman

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 Oman by source type

Source type	Years	Sample size	Sample size units
Microbial or laboratory data without outcome	1990-2009	9,057	Isolates
Literature studies	1990-2021	2,278	Cases/isolates/susceptibility tests
Single drug resistance profile data	2010-2021	128,478	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).

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