# The burden of antimicrobial resistance (AMR) in Saudi Arabia

Executive summary

- Antimicrobial Resistance (AMR) is a major global health threat, over **2,000 lives** have been lost each year since 1990 in Saudi Arabia due to AMR.

- In 2021, there were an estimated **2,260 UI (1,750-2,770)** deaths attributable to AMR and **8,620 UI (6,780-10,500)** deaths associated with AMR in this location.

- The largest number of deaths associated with AMR in 2021 occurred among those aged **50 to 69** in the country.

- Among the most deadly pathogen-drug combinations in 2021 were *Staphylococcus aureus* resistant to methicillin, *Acinetobacter baumannii* resistant to carbapenems and *Streptococcus pneumoniae* resistant to carbapenems.

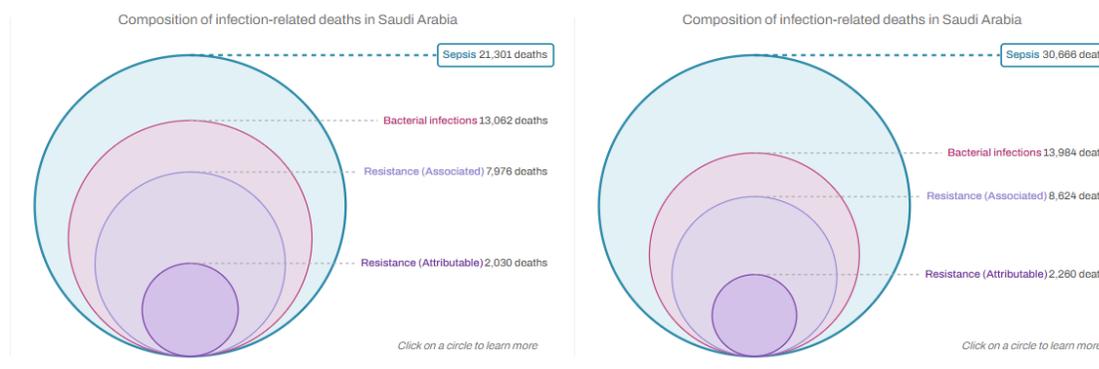Figure 1 Number of deaths by underlying cause, and those associated with AMR in 2021
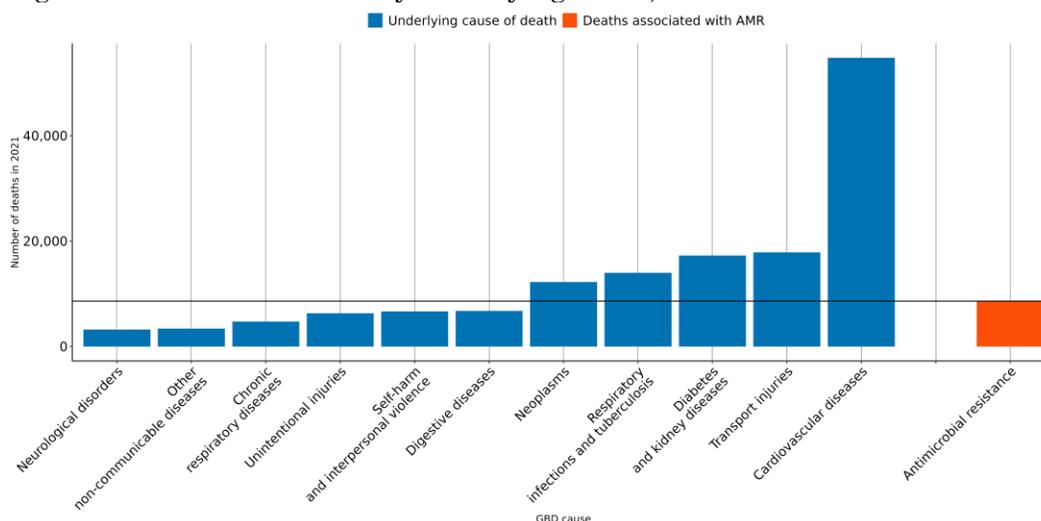
- In 2021, the number of deaths associated with AMR (orange bar in *figure 2*) were high compared to the most relevant underlying causes of death (depicted in blue) in the country. AMR associated deaths occur within multiple Global Burden of Disease (GBD) causes of death and AMR is not an underlying 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 Saudi Arabia, a 10% reduction means to decrease the number of deaths associated with AMR to **7,800**, but currently the trend for this country could reach up to **14,800 UI [11,100-19,000]** AMR-associated deaths in 2030.

AMR in Saudi Arabia

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 Saudi Arabia between 1990 and 2019.

Composition of infection-related deaths in Saudi Arabia

Sepsis 21,301 deaths
Bacterial infections 13,062 deaths
Resistance (Associated) 7,976 deaths
Resistance (Attributable) 2,030 deaths
Click on a circle to learn more

Composition of infection-related deaths in Saudi Arabia

Sepsis 30,666 deaths
Bacterial infections 13,984 deaths
Resistance (Associated) 8,624 deaths
Resistance (Attributable) 2,260 deaths
Click on a circle to learn more

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

- In **Saudi Arabia** in 2021, there were an estimated **2,260 UI (1,750-2,770)** deaths attributable to AMR and **8,620 UI (6,780-10,500)** 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, **Saudi Arabia has the 94th 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)

Overall susceptible and resistant		Associated		Attributable	
Staphylococcus aureus 2,720 UI (2,180-3,260)	↑	Staphylococcus aureus 1,730 UI (1,360-2,100)	↑	Staphylococcus aureus 484 UI (369-599)	↑
Escherichia coli 1,780 UI (1,450-2,120)	↑	Escherichia coli 1,500 UI (1,210-1,790)	↑	Acinetobacter baumannii 397 UI (320-475)	↓
Pseudomonas aeruginosa 1,430 UI (1,140-1,720)	↑	Acinetobacter baumannii 987 UI (784-1,190)	↓	Escherichia coli 320 UI (249-391)	↑
Klebsiella pneumoniae 1,340 UI (1,070-1,610)	↓	Klebsiella pneumoniae 983 UI (769-1,200)	↓	Klebsiella pneumoniae 281 UI (218-344)	↑
Streptococcus pneumoniae 1,290 UI (1,000-1,570)	↓	Streptococcus pneumoniae 930 UI (691-1,170)	↓	Streptococcus pneumoniae 228 UI (147-310)	↓
Mycobacterium tuberculosis 1,100 UI (711-1,490)	↓	Pseudomonas aeruginosa 845 UI (635-1,050)	↑	Pseudomonas aeruginosa 228 UI (154-302)	↑
Acinetobacter baumannii 1,010 UI (805-1,220)	↓	Enterococcus faecium 351 UI (275-428)	↑	Enterococcus faecium 82 UI (60-103)	↑
Group A Streptococcus 519 UI (421-618)	↑	Proteus spp. 270 UI (219-321)	↑	Proteus spp. 45 UI (35-55)	↑
Enterococcus faecalis 405 UI (328-482)	↑	Enterococcus faecalis 146 UI (112-180)	↑	Enterobacter spp. 38 UI (29-47)	↓
Enterococcus faecium 384 UI (301-467)	↑	Enterobacter spp. 140 UI (106-174)	↓	Serratia spp. 30 UI (21-39)	↓

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)

Associated			Attributable		
Staphylococcus aureus Methicillin	1,410 UI (1,010-1,810)	↑	Staphylococcus aureus Methicillin	353 UI (253-453)	↑
Escherichia coli Aminopenicillin	1,380 UI (1,090-1,660)	↑	Acinetobacter baumannii Carbapenems	207 UI (151-263)	↑
Acinetobacter baumannii Carbapenems	938 UI (744-1,130)	↑	Streptococcus pneumoniae Carbapenems	180 UI (107-252)	↓
Acinetobacter baumannii 3GC	932 UI (742-1,120)	↓	Pseudomonas aeruginosa Carbapenems	128 UI (76-179)	↑
Staphylococcus aureus Macrolides	929 UI (666-1,190)	↑	Acinetobacter baumannii Fluoroquinolones	110 UI (86-133)	↑
Escherichia coli Fluoroquinolones	928 UI (711-1,150)	↑	Klebsiella pneumoniae Carbapenems	96 UI (68-125)	↑
Acinetobacter baumannii Beta-Lactam/Lactamase Inhib.	926 UI (735-1,120)	↑	Escherichia coli 3GC	94 UI (57-130)	↑
Escherichia coli TMP-SMX	923 UI (739-1,110)	↑	Klebsiella pneumoniae Fluoroquinolones	66 UI (44-88)	↑
Acinetobacter baumannii 4GC	922 UI (730-1,110)	↓	Escherichia coli Fluoroquinolones	63 UI (36-90)	↑
Acinetobacter baumannii Fluoroquinolones	895 UI (712-1,080)	↑	Acinetobacter baumannii Aminoglycosides	59 UI (42-76)	↓

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%

 - 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 (7,700 UI (6,180-9,220)), lower respiratory infection (excl. COVID) (6,420 UI (4,980-7,850)), peritoneal and intra-abdominal infections (1,880 UI (1,440-2,310)), infections of the skin and subcutaneous systems (1,170 UI (942-1,400)) and tuberculosis (1,100 UI (711-1,490)).

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
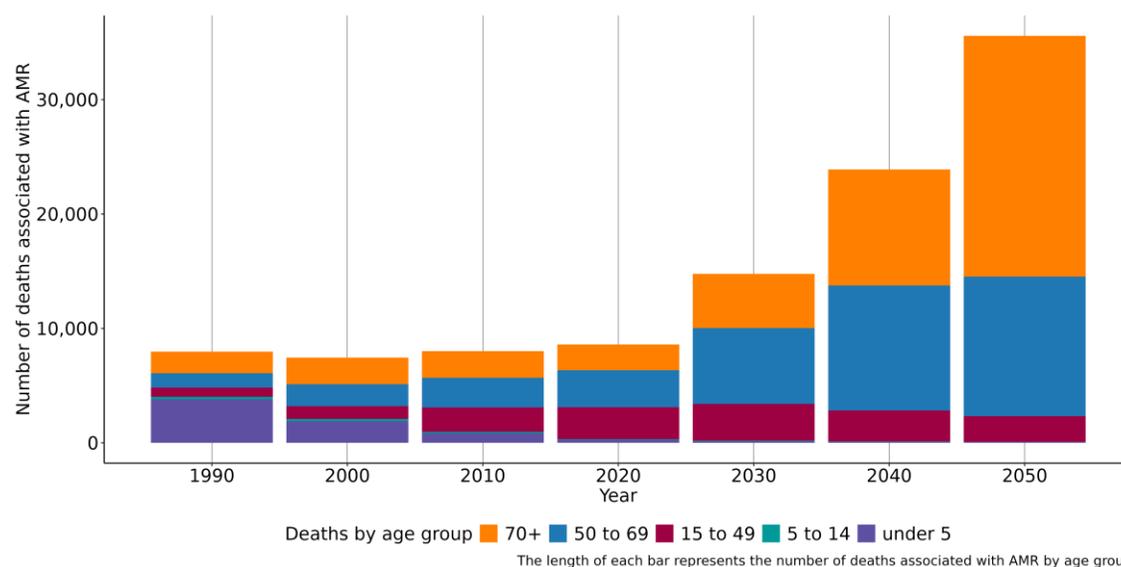
- In Saudi Arabia, people aged under 5 experienced the largest number of deaths associated with AMR in 1990 but this changed by 2021 as the largest number of deaths occurred among the 50 to 69. This indicates that prevention of infections among the under 5 has contributed to the reduction in the number of AMR associated deaths. In 2021, the number of deaths associated with AMR among the 50 to 69 was 3,360 UI (2,690-4,030), whereas the mortality rate per 100,000 was 423 UI (361-485).

Data sources for Saudi Arabia

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 Saudi Arabia by source type

Source type	Years	Sample size	Sample size units
Microbial or laboratory data without outcome	1990-2021	89,409	Isolates
Microbial or laboratory data with outcome	2010-2021	53,872	Isolates
Literature studies	1990-2021	51,002	Cases/isolates/susceptibility tests
Single drug resistance profile data	2010-2021	240,448	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:

- For inquiries about the analysis and questions from government officials, health departments, or research institutions: engage@healthdata.org

- For media-related inquiries: media@healthdata.org

- **Bluesky**: @ihmeuw.bsky.social

- **Twitter**: @IHME_UW

- **Facebook**: https://www.facebook.com/IHMEUW

- **LinkedIn**: https://www.linkedin.com/company/institute-for-health-metrics-and-evaluation