# The burden of antimicrobial resistance (AMR) in the Syrian Arab Republic

Executive summary

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

- In 2021, there were an estimated **1,520 UI (1,090-1,940)** deaths attributable to AMR and **5,920 UI (4,360-7,490)** 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, *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
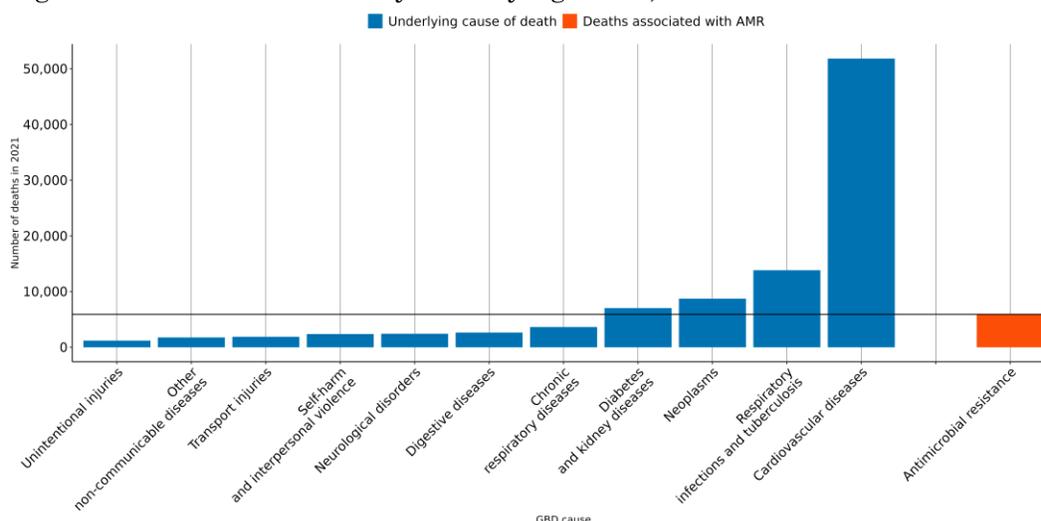

- In 2021, the number of deaths associated with AMR (orange bar in *figure 2*) were high compared to the most relevant underlying causes of death (depicted in blue) in the country. AMR associated deaths occur within multiple Global Burden of Disease (GBD) causes of death and AMR is not an underlying 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 the Syria, a 10% reduction means to decrease the number of deaths associated with AMR to **6,840**, but currently the trend for this country could reach up to **9,730 UI [5,900-15,500]** AMR-associated deaths in 2030.

AMR in the Syrian Arab Republic

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 the Syrian Arab Republic between 1990 and 2019.
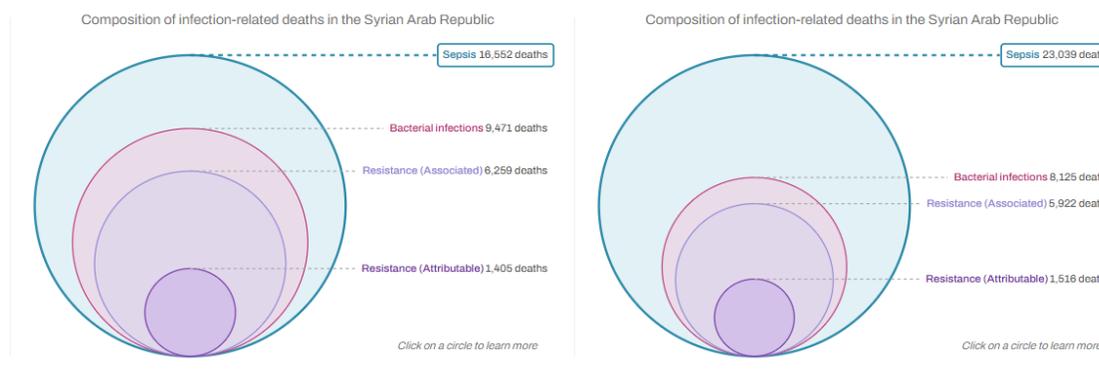
- To look at these and more visualization interactively visit [Measuring Infectious Causes and Resistance Outcomes for Burden Estimation (MICROBE)](link)

- In **the Syrian Arab Republic** in 2021, there were an estimated **1,520 UI (1,090-1,940)** deaths attributable to AMR and **5,920 UI (4,360-7,490)** 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, **the Syrian Arab Republic has the 102nd 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 1,600 UI (1,220-1,990)	↑	Streptococcus pneumoniae 1,190 UI (856-1,520)	↓	Staphylococcus aureus 322 UI (210-435)	↑
Streptococcus pneumoniae 1,500 UI (1,140-1,850)	↓	Staphylococcus aureus 1,150 UI (798-1,500)	↑	Acinetobacter baumannii 272 UI (216-328)	↑
Escherichia coli 913 UI (699-1,130)	↑	Escherichia coli 836 UI (633-1,040)	↑	Streptococcus pneumoniae 258 UI (162-353)	↓
Pseudomonas aeruginosa 829 UI (630-1,030)	↓	Acinetobacter baumannii 679 UI (511-848)	↑	Escherichia coli 183 UI (130-236)	↑
Klebsiella pneumoniae 796 UI (605-986)	↓	Klebsiella pneumoniae 601 UI (444-758)	↓	Klebsiella pneumoniae 160 UI (119-201)	↓
Acinetobacter baumannii 691 UI (518-864)	↑	Pseudomonas aeruginosa 559 UI (407-711)	↓	Pseudomonas aeruginosa 148 UI (100-197)	↓
Enterococcus faecalis 280 UI (209-350)	↑	Enterococcus faecalis 189 UI (140-239)	↑	Enterococcus faecalis 37 UI (21-52)	↑
Enterobacter spp. 248 UI (187-308)	↑	Enterobacter spp. 159 UI (117-202)	↓	Enterobacter spp. 34 UI (24-44)	↓
Enterococcus faecium 182 UI (137-228)	↑	Enterococcus faecium 130 UI (96-164)	↑	Enterococcus faecium 25 UI (16-33)	↑
Proteus spp. 164 UI (125-204)	↑	Proteus spp. 128 UI (91-165)	↑	Serratia spp. 22 UI (17-28)	↓

Burden rank

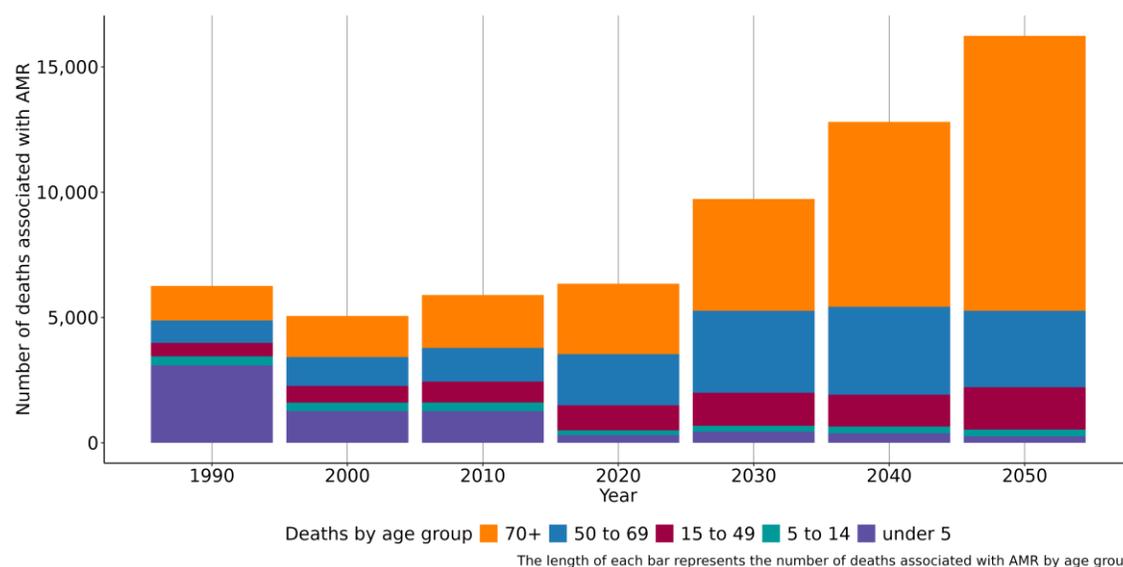Annualized rate of change (1990-2021): <-3% | -3% to -1.5% | -1.5% to 0% | 0% to 1.5% | 1.5% to 3% | 3% to 5% | >5.0%

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

Associated			Attributable		
Staphylococcus aureus Methicillin	968 UI (573-1,360)	↑	Staphylococcus aureus Methicillin	248 UI (155-340)	↑
Streptococcus pneumoniae Macrolides	885 UI (621-1,150)	↑	Streptococcus pneumoniae Carbapenems	153 UI (88-217)	↓
Staphylococcus aureus Macrolides	832 UI (596-1,070)	↑	Acinetobacter baumannii Carbapenems	131 UI (95-168)	↑
Streptococcus pneumoniae TMP-SMX	822 UI (500-1,140)	↓	Acinetobacter baumannii Fluoroquinolones	75 UI (58-93)	↑
Escherichia coli Aminopenicillin	749 UI (455-1,040)	↑	Escherichia coli 3GC	68 UI (42-94)	↑
Acinetobacter baumannii 4GC	667 UI (500-833)	↑	Pseudomonas aeruginosa Carbapenems	64 UI (36-92)	↑
Acinetobacter baumannii 3GC	666 UI (500-831)	↑	Acinetobacter baumannii Aminoglycosides	43 UI (29-56)	↓
Acinetobacter baumannii Anti-pseudomonal	646 UI (486-807)	↑	Escherichia coli Fluoroquinolones	41 UI (21-60)	↑
Acinetobacter baumannii Beta-Lactam/Lactamase Inhib.	629 UI (473-785)	↑	Klebsiella pneumoniae Fluoroquinolones	37 UI (23-50)	↑
Acinetobacter baumannii Carbapenems	612 UI (456-768)	↑	Klebsiella pneumoniae Aminoglycosides	36 UI (25-48)	↓

Burden Rank

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%

- Independently of antimicrobial resistance, the infectious syndromes accounting for the most deaths in 2021 were as follows (estimated thousands of deaths in parenthesis) lower respiratory infection (excl. COVID) (4,160 UI (3,140-5,180)), bloodstream infections (3,980 UI (3,010-4,950)), urinary tract infections and pyelonephritis (945 UI (679-1,210)), peritoneal and intra-abdominal infections (747 UI (552-941)) and infections of the skin and subcutaneous systems (327 UI (234-420)).

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 the Syrian Arab Republic, 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 2,800 UI (2,110-3,490), whereas the mortality rate per 100,000 was 475 UI (358-591).

Data sources for the Syrian Arab Republic

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 the Syrian Arab Republic by source type

Source type	Years	Sample size	Sample size units
Antibiotic use	1990-2009	861	Study-year datapoints
Microbial or laboratory data without outcome	1990-2021	55	Isolates
Literature studies	2010-2021	1,277	Cases/isolates/susceptibility tests
Single drug resistance profile data	2010-2021	515	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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