# The burden of antimicrobial resistance (AMR) in Morocco

Executive summary

- Antimicrobial Resistance (AMR) is a major global health threat, over **3,000 lives** have been lost each year since 1990 in Morocco due to AMR.

- In 2021, there were an estimated **2,960 UI (2,290-3,620)** deaths attributable to AMR and **12,700 UI (10,000-15,400)** 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 *Acinetobacter baumannii* resistant to carbapenems.

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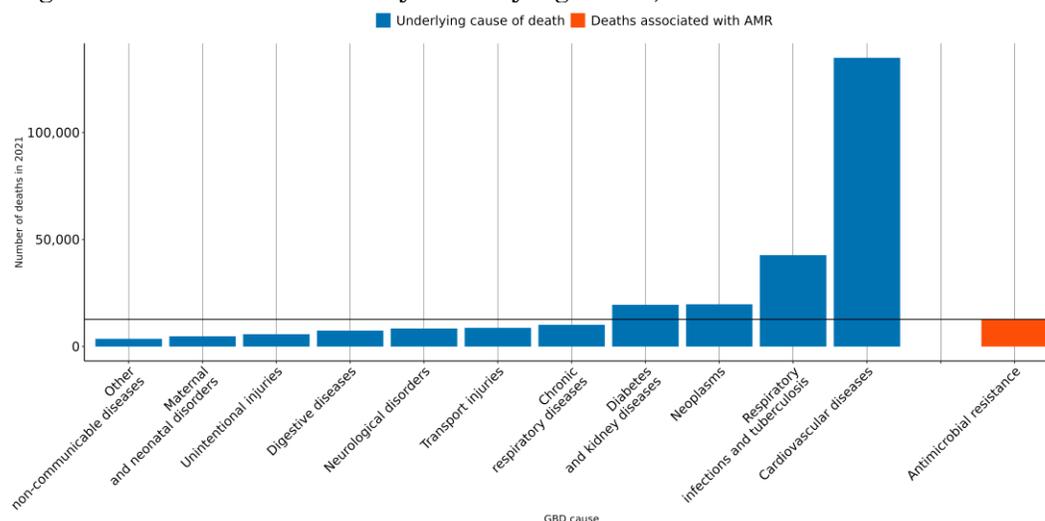

- In 2021, the number of deaths associated with AMR (orange bar in *figure 2*) were high compared to the most relevant underlying causes of death (depicted in blue) in the country. AMR associated deaths occur within multiple Global Burden of Disease (GBD) causes of death and AMR is not an underlying 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 Morocco, a 10% reduction means to decrease the number of deaths associated with AMR to **11,900**, but currently the trend for this country could reach up to **15,400 UI [11,400-19,700]** AMR-associated deaths in 2030.

AMR in Morocco

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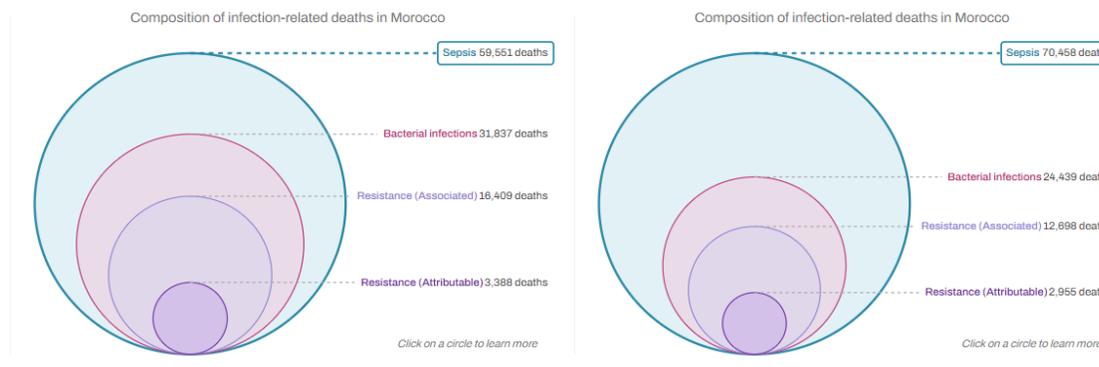
- To look at these and more visualization interactively visit [Measuring Infectious Causes and Resistance Outcomes for Burden Estimation (MICROBE)](#)

- In **Morocco** in 2021, there were an estimated **2,960 UI (2,290-3,620)** deaths attributable to AMR and **12,700 UI (10,000-15,400)** 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, **Morocco has the 68th 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)
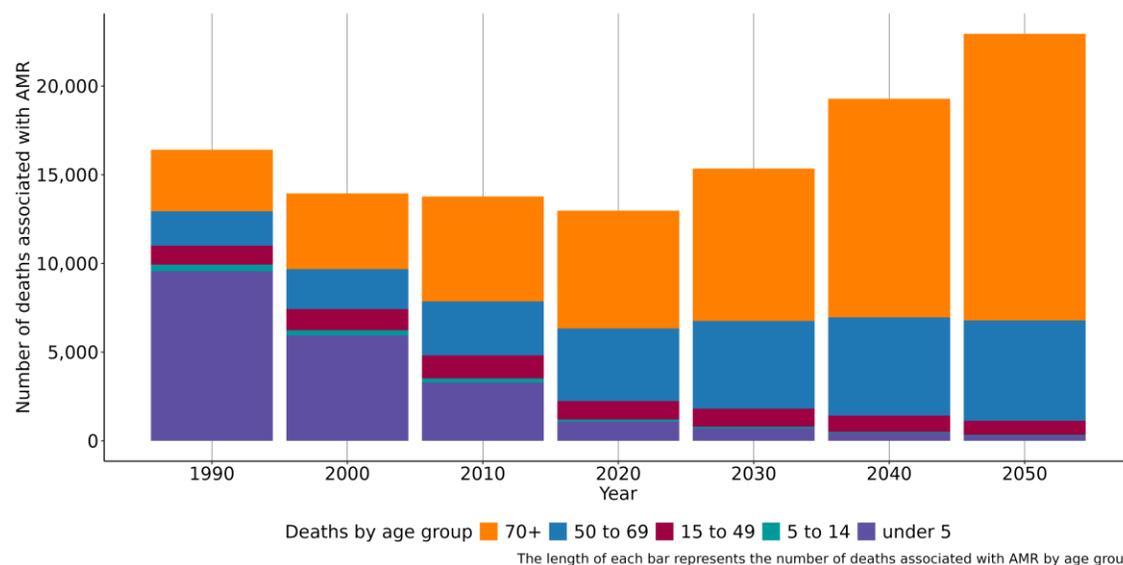
Burden rank	Overall susceptible and resistant		Associated		Attributable	
1	Staphylococcus aureus 4,040 UI (3,320-4,760)	↑	Klebsiella pneumoniae 2,270 UI (1,840-2,700)	↓	Klebsiella pneumoniae 579 UI (459-699)	↓
2	Mycobacterium tuberculosis 3,080 UI (876-5,280)	↓	Escherichia coli 2,120 UI (1,750-2,500)	↓	Acinetobacter baumannii 508 UI (425-591)	↓
3	Klebsiella pneumoniae 2,830 UI (2,330-3,320)	↓	Streptococcus pneumoniae 1,550 UI (1,090-2,020)	↓	Pseudomonas aeruginosa 400 UI (288-512)	↑
4	Streptococcus pneumoniae 2,660 UI (2,190-3,140)	↓	Pseudomonas aeruginosa 1,520 UI (1,180-1,850)	↓	Escherichia coli 400 UI (309-491)	↓
5	Pseudomonas aeruginosa 2,650 UI (2,190-3,120)	↑	Staphylococcus aureus 1,420 UI (979-1,870)	↑	Staphylococcus aureus 320 UI (207-433)	↑
6	Escherichia coli 2,650 UI (2,210-3,090)	↓	Acinetobacter baumannii 1,270 UI (1,040-1,500)	↓	Streptococcus pneumoniae 271 UI (161-381)	↓
7	Acinetobacter baumannii 1,310 UI (1,070-1,550)	↓	Enterobacter spp. 432 UI (345-520)	↓	Enterobacter spp. 106 UI (85-127)	↓
8	Enterobacter spp. 628 UI (516-740)	↑	Enterococcus faecium 391 UI (313-468)	↑	Enterococcus faecium 70 UI (48-92)	↑
9	Enterococcus faecalis 603 UI (492-714)	↑	Proteus spp. 309 UI (229-389)	↑	Serratia spp. 62 UI (46-77)	↓
10	Group A Streptococcus 568 UI (466-670)	↑	Serratia spp. 249 UI (185-314)	↓	Mycobacterium tuberculosis 46 UI (0-171)	↑

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	1,870 UI (1,330-2,410) ↓	Acinetobacter baumannii Carbapenems	255 UI (196-315) ↑
2	Klebsiella pneumoniae Beta-Lactam/Lactamase Inhib.	1,800 UI (1,380-2,220) ↓	Pseudomonas aeruginosa Carbapenems	199 UI (124-275) ↑
3	Klebsiella pneumoniae TMP-SMX	1,790 UI (1,420-2,170) ↓	Staphylococcus aureus Methicillin	180 UI (109-252) ↑
4	Klebsiella pneumoniae Fluoroquinolones	1,700 UI (1,350-2,060) ↑	Acinetobacter baumannii Fluoroquinolones	148 UI (117-180) ↓
5	Klebsiella pneumoniae Aminoglycosides	1,560 UI (1,200-1,920) ↑	Klebsiella pneumoniae Fluoroquinolones	139 UI (92-187) ↑
6	Klebsiella pneumoniae 3GC	1,510 UI (1,210-1,810) ↑	Streptococcus pneumoniae Carbapenems	120 UI (61-180) ↓
7	Escherichia coli TMP-SMX	1,370 UI (1,080-1,670) ↓	Klebsiella pneumoniae Carbapenems	119 UI (86-152) ↑
8	Escherichia coli Fluoroquinolones	1,360 UI (1,040-1,670) ↑	Klebsiella pneumoniae Aminoglycosides	109 UI (75-144) ↑
9	Acinetobacter baumannii 4GC	1,200 UI (979-1,430) ↓	Escherichia coli Fluoroquinolones	96 UI (47-145) ↑
10	Acinetobacter baumannii 3GC	1,190 UI (968-1,410) ↓	Pseudomonas aeruginosa Fluoroquinolones	83 UI (54-113) ↓

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) (12,400 UI (10,000-14,700)), bloodstream infections (11,800 UI (9,670-13,900)), tuberculosis (3,080 UI (876-5,280)), urinary tract infections and pyelonephritis (2,010 UI (1,550-2,480)) and peritoneal and intra-abdominal infections (1,980 UI (1,520-2,440)).

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 Morocco, 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 6,510 UI (5,220-7,800), whereas the mortality rate per 100,000 was 394 UI (316-472).

Data sources for Morocco

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 Morocco by source type

Source type	Years	Sample size	Sample size units
Microbial or laboratory data without outcome	1990-2021	146,828	Isolates
Microbial or laboratory data with outcome	1990-2021	377	Isolates
Literature studies	1990-2021	152,503	Cases/isolates/susceptibility tests
Single drug resistance profile data	2010-2021	75,384	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