# The burden of antimicrobial resistance (AMR) in Mali

Executive summary

- Antimicrobial Resistance (AMR) is a major global health threat, over **6,000 lives** have been lost each year since 1990 in Mali due to AMR.

- In 2021, there were an estimated **5,380 UI (3,990-6,770)** deaths attributable to AMR and **23,300 UI (17,800-28,700)** deaths associated with AMR in this location.

- The largest number of deaths associated with AMR in 2021 occurred among those aged **under 5** in the country.

- Among the most deadly pathogen-drug combinations in 2021 were *Escherichia coli* resistant to carbapenems, *Klebsiella pneumoniae* resistant to fluoroquinolones and *Klebsiella pneumoniae* resistant to third-generation cephalosporins.

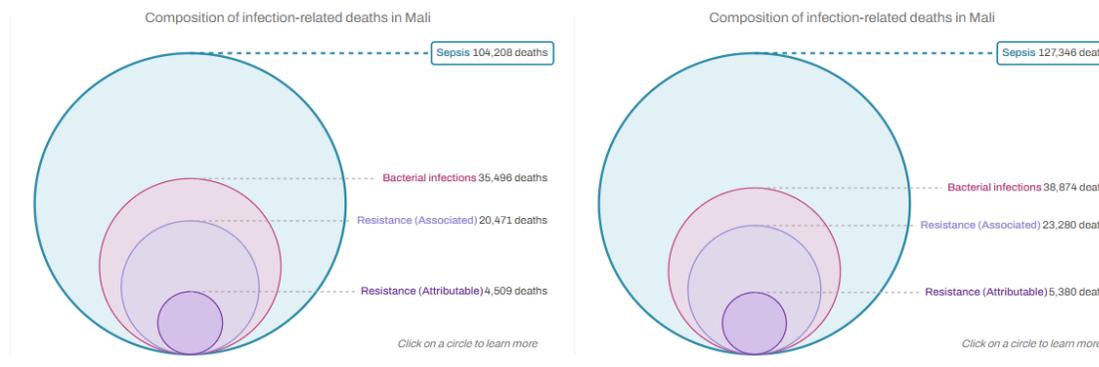Figure 1 Number of deaths by underlying cause, and those associated with AMR in 2021
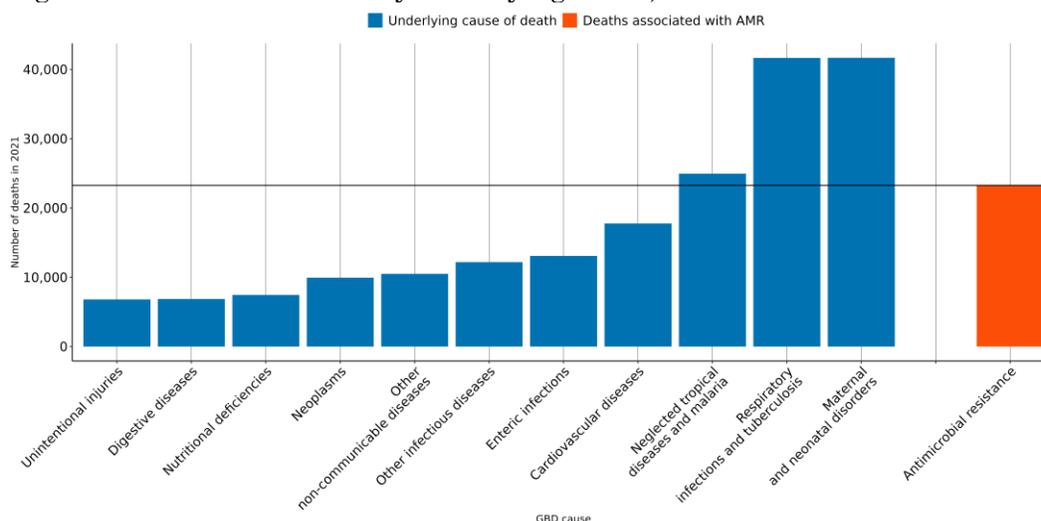
- In 2021, the number of deaths associated with AMR (orange bar in *figure 2*) were high compared to the most relevant underlying causes of death (depicted in blue) in the country. AMR associated deaths occur within multiple Global Burden of Disease (GBD) causes of death and AMR is not an underlying 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 Mali, a 10% reduction means to decrease the number of deaths associated with AMR to **22,900**, but currently the trend for this country could reach up to **25,800 UI [18,700-34,600]** AMR-associated deaths in 2030.

AMR in Mali

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 Mali between 1990 and 2019.

Composition of infection-related deaths in Mali — Sepsis 104,208 deaths; Bacterial infections 35,496 deaths; Resistance (Associated) 20,471 deaths; Resistance (Attributable) 4,509 deaths. *Click on a circle to learn more*

Composition of infection-related deaths in Mali — Sepsis 127,346 deaths; Bacterial infections 38,874 deaths; Resistance (Associated) 23,280 deaths; Resistance (Attributable) 5,380 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 **Mali** in 2021, there were an estimated **5,380 UI (3,990-6,770)** deaths attributable to AMR and **23,300 UI (17,800-28,700)** 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, **Mali has the 20th highest** 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	
Mycobacterium tuberculosis 4,910 UI (3,390-6,430)	↓	Klebsiella pneumoniae 4,450 UI (3,500-5,400)	↑	Klebsiella pneumoniae 1,070 UI (795-1,340)	↑
Klebsiella pneumoniae 4,810 UI (3,830-5,800)	↑	Streptococcus pneumoniae 4,000 UI (2,960-5,030)	↓	Acinetobacter baumannii 903 UI (719-1,090)	↑
Streptococcus pneumoniae 4,800 UI (3,800-5,790)	↓	Escherichia coli 3,310 UI (2,540-4,080)	↓	Escherichia coli 847 UI (628-1,070)	↑
Non-typhoidal Salmonella 4,120 UI (2,070-6,170)	↑	Acinetobacter baumannii 2,420 UI (1,870-2,960)	↑	Streptococcus pneumoniae 682 UI (432-933)	↓
Escherichia coli 3,390 UI (2,610-4,170)	↓	Staphylococcus aureus 2,070 UI (1,420-2,710)	↑	Pseudomonas aeruginosa 500 UI (329-672)	↑
Pseudomonas aeruginosa 3,020 UI (2,440-3,600)	↑	Pseudomonas aeruginosa 2,010 UI (1,460-2,550)	↑	Staphylococcus aureus 401 UI (235-567)	↑
Staphylococcus aureus 2,870 UI (2,310-3,430)	↑	Group B Streptococcus 763 UI (511-1,020)	↑	Enterobacter spp. 188 UI (147-230)	↑
Acinetobacter baumannii 2,650 UI (2,090-3,220)	↑	Serratia spp. 704 UI (480-928)	↑	Serratia spp. 181 UI (120-243)	↑
Group B Streptococcus 1,760 UI (1,290-2,230)	↑	Enterobacter spp. 595 UI (466-723)	↑	Group B Streptococcus 93 UI (47-138)	↑
Serratia spp. 1,040 UI (775-1,310)	↑	Non-typhoidal Salmonella 560 UI (267-853)	↑	Mycobacterium tuberculosis 88 UI (0-283)	↑

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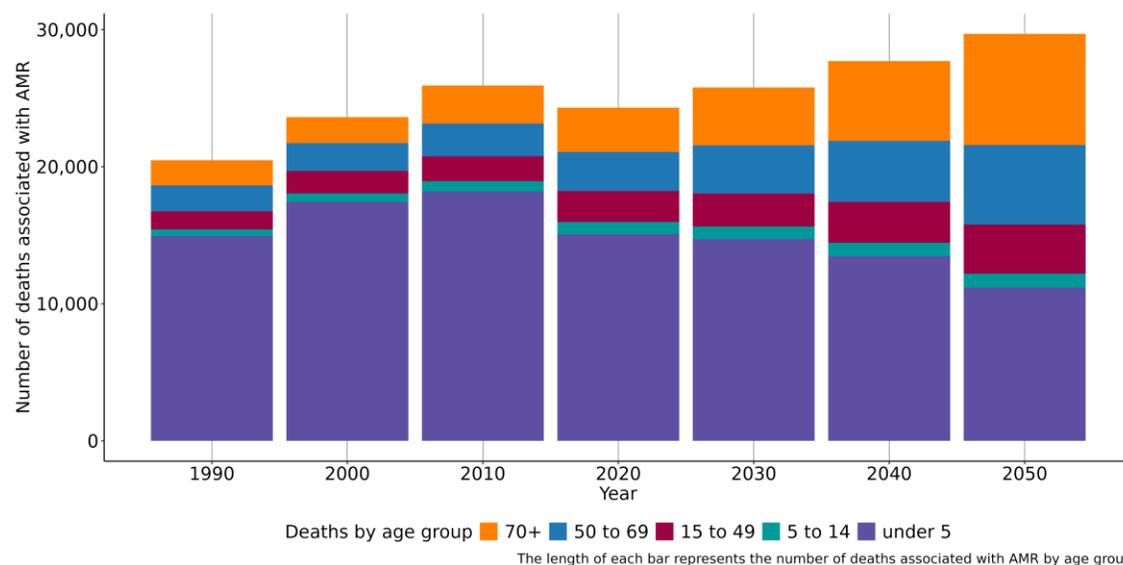
Table 2. Combinations which cause most deaths in 2021 (Number of deaths in parenthesis)

Associated			Attributable		
Klebsiella pneumoniae Beta-Lactam/Lactamase Inhib.	4,240 UI (3,300-5,190)	↑	Escherichia coli Carbapenems	293 UI (198-388)	↑
Klebsiella pneumoniae TMP-SMX	4,060 UI (3,170-4,950)	↑	Klebsiella pneumoniae Fluoroquinolones	235 UI (144-326)	↑
Klebsiella pneumoniae Fluoroquinolones	3,370 UI (2,520-4,230)	↑	Klebsiella pneumoniae 3GC	230 UI (127-333)	↑
Klebsiella pneumoniae 3GC	3,260 UI (2,510-4,010)	↑	Acinetobacter baumannii Carbapenems	225 UI (118-332)	↑
Streptococcus pneumoniae Macrolides	3,250 UI (2,360-4,140)	↑	Pseudomonas aeruginosa Carbapenems	196 UI (106-287)	↑
Escherichia coli Aminopenicillin	3,190 UI (2,370-4,010)	↓	Klebsiella pneumoniae Aminoglycosides	194 UI (128-260)	↑
Klebsiella pneumoniae Aminoglycosides	3,130 UI (2,350-3,920)	↑	Acinetobacter baumannii Fluoroquinolones	191 UI (143-239)	↑
Escherichia coli TMP-SMX	2,940 UI (2,260-3,620)	↓	Streptococcus pneumoniae Fluoroquinolones	178 UI (62-294)	↓
Escherichia coli Beta-Lactam/Lactamase Inhib.	2,830 UI (2,170-3,500)	↓	Staphylococcus aureus Methicillin	168 UI (61-275)	↑
Escherichia coli Fluoroquinolones	2,410 UI (1,650-3,170)	↑	Streptococcus pneumoniae 3GC	167 UI (107-227)	↑

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) bloodstream infections (22,300 UI (16,600-28,000)), lower respiratory infection (excl. COVID) (14,200 UI (11,300-17,200)), diarrhea (8,940 UI (5,080-12,800)), tuberculosis (4,910 UI (3,390-6,430)) and typhoid fever, paratyphoid fever, and invasive non-typhoidal salmonella (4,470 UI (2,420-6,520)).

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 Mali, people aged under 5 saw the largest number of deaths associated with AMR both in 1990 and 2021, which indicates that under 5 continues to be particularly vulnerable to infections which are resistant to antibiotics. In 2021, the number of deaths associated with AMR among the under 5 was 14,300 UI (10,100-18,500), whereas the mortality rate per 100,000 was 833 UI (653-1,010).

Data sources for Mali

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 Mali by source type

Source type	Years	Sample size	Sample size units
Mortality surveillance (Minimally invasive tissue sampling [MITS])	2010-2021	138	Deaths
Antibiotic use	1990-2021	1,851	Study-year datapoints
Microbial or laboratory data without outcome	1990-2021	507	Isolates
Literature studies	1990-2021	3,677	Cases/isolates/susceptibility tests
Single drug resistance profile data	2010-2021	2,432	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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