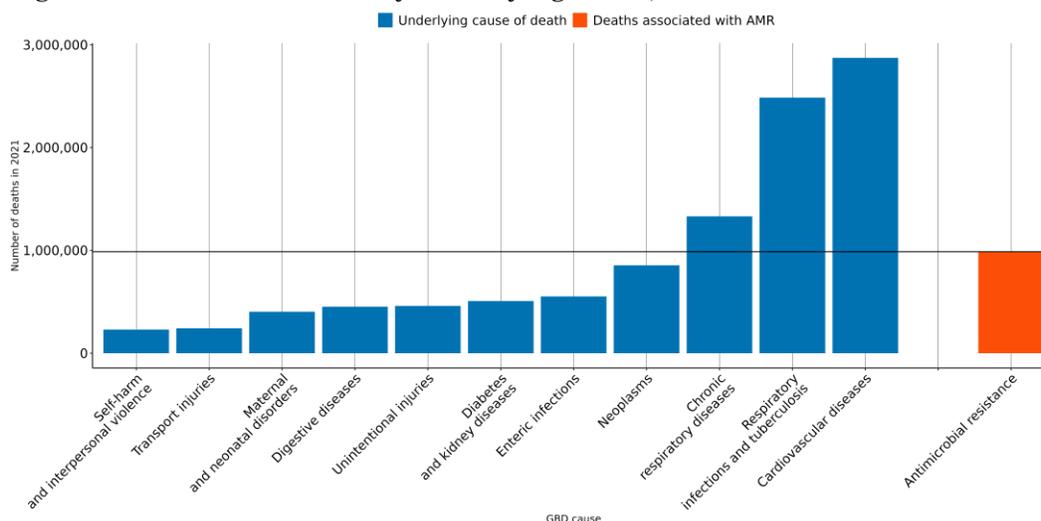


The burden of antimicrobial resistance (AMR) in India

Executive summary

- Antimicrobial Resistance (AMR) is a major global health threat, over **300,000 lives** have been lost each year since 1990 in India due to AMR.
- In 2021, there were an estimated **267,000 UI (224,000-310,000)** deaths attributable to AMR and **987,000 UI (855,000-1,120,000)** 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



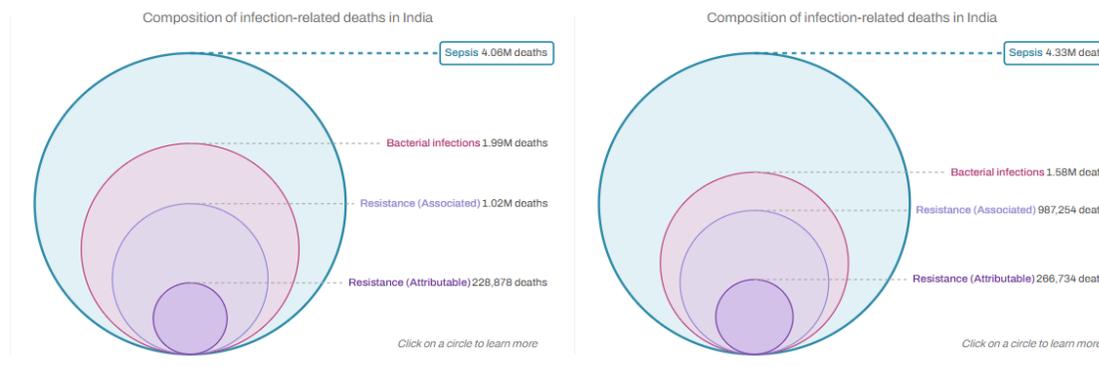
- In 2021, the number of deaths associated with AMR (orange bar in *figure 2*) were high compared to the most relevant underlying causes of death (depicted in blue) in the country. AMR associated deaths occur within multiple Global Burden of Disease (GBD) causes of death and AMR is not an underlying 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 India, a 10% reduction means to decrease the number of deaths associated with AMR to **946,000**, but currently the trend for this country could reach up to **1,200,000 UI [976,000-1,460,000]** AMR-associated deaths in 2030.

AMR in India

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 India between 1990 and 2019.



- To look at these and more visualization interactively visit [Measuring Infectious Causes and Resistance Outcomes for Burden Estimation \(MICROBE\)](#)
- In **India** in 2021, there were an estimated **267,000 UI (224,000-310,000)** deaths attributable to AMR and **987,000 UI (855,000-1,120,000)** 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, **India has the 57th 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
Burden rank	Mycobacterium tuberculosis 400,000 UI (325,000-474,000) ↓	Streptococcus pneumoniae 163,000 UI (135,000-191,000) ↓	Acinetobacter baumannii 47,600 UI (41,900-53,300) ↑
	Streptococcus pneumoniae 214,000 UI (193,000-236,000) ↓	Escherichia coli 142,000 UI (124,000-160,000) ↓	Klebsiella pneumoniae 39,700 UI (34,600-44,900) ↑
	Escherichia coli 150,000 UI (131,000-169,000) ↓	Klebsiella pneumoniae 122,000 UI (110,000-133,000) ↓	Escherichia coli 37,600 UI (32,000-43,200) ↑
	Klebsiella pneumoniae 143,000 UI (131,000-155,000) ↓	Staphylococcus aureus 121,000 UI (109,000-133,000) ↑	Streptococcus pneumoniae 35,400 UI (25,700-45,100) ↓
	Staphylococcus aureus 141,000 UI (129,000-153,000) ↑	Acinetobacter baumannii 118,000 UI (108,000-129,000) ↑	Staphylococcus aureus 32,300 UI (28,400-36,200) ↑
	Acinetobacter baumannii 122,000 UI (112,000-133,000) ↑	Pseudomonas aeruginosa 80,700 UI (70,700-90,600) ↑	Pseudomonas aeruginosa 21,600 UI (17,400-25,800) ↑
	Pseudomonas aeruginosa 113,000 UI (103,000-123,000) ↑	Mycobacterium tuberculosis 56,200 UI (48,800-63,600) ↑	Mycobacterium tuberculosis 19,600 UI (0-47,200) ↑
	Salmonella Typhi 41,600 UI (17,900-65,200) ↓	Salmonella Typhi 26,100 UI (9,770-42,400) ↓	Enterobacter spp. 6,160 UI (5,290-7,020) ↑
	Enterobacter spp. 32,000 UI (29,200-34,800) ↑	Enterobacter spp. 22,100 UI (19,000-25,100) ↑	Enterococcus faecium 3,760 UI (3,080-4,430) ↑
	Enterococcus faecalis 27,700 UI (24,900-30,400) ↑	Enterococcus faecalis 21,700 UI (19,300-24,000) ↑	Enterococcus faecalis 3,740 UI (2,720-4,760) ↑

Annualized rate of change (1990-2021): <-3% (dark blue), -1.5% to 0% (light blue), 1.5% to 3% (red), >5.0% (dark red), -3% to -1.5% (medium blue), 0% to 1.5% (pink), 3% to 5% (orange)

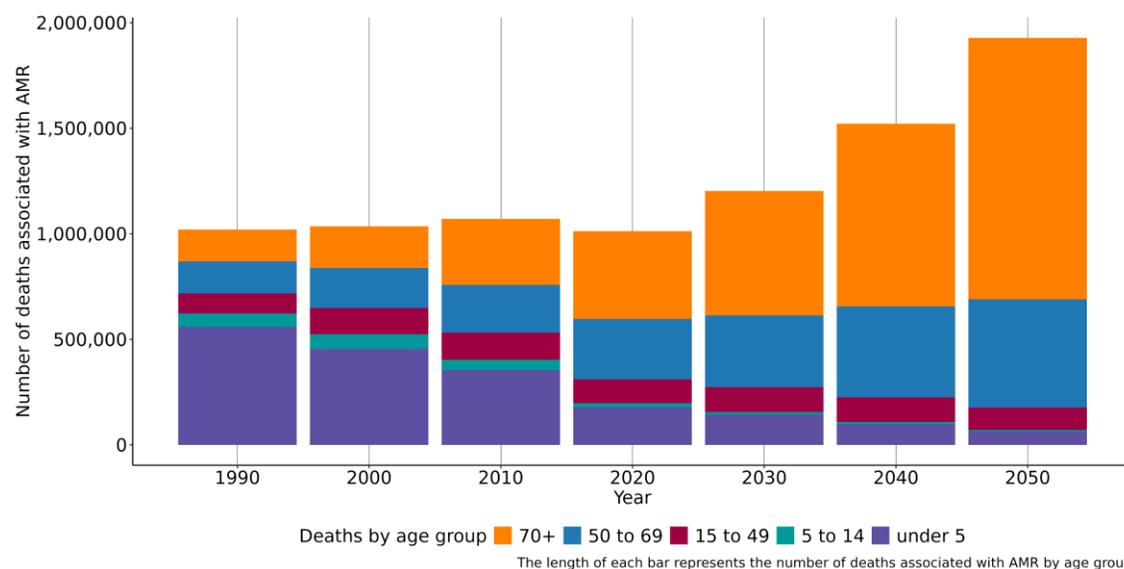
Table 2. Combinations which cause most deaths in 2021 (Number of deaths in parenthesis)

	Associated	Attributable
Burden Rank	Escherichia coli Aminopenicillin 129,000 UI (112,000-146,000) ↓	Acinetobacter baumannii Carbapenems 24,200 UI (19,300-29,100) ↑
	Escherichia coli Fluoroquinolones 119,000 UI (104,000-134,000) ↑	Staphylococcus aureus Methicillin 20,300 UI (16,500-24,200) ↑
	Streptococcus pneumoniae Macrolides 119,000 UI (98,300-139,000) ↑	Streptococcus pneumoniae Carbapenems 20,100 UI (12,100-28,000) ↓
	Acinetobacter baumannii Carbapenems 113,000 UI (103,000-123,000) ↑	Mycobacterium tuberculosis MDR excluding XDR 18,500 UI (0-45,100) ↑
	Escherichia coli 3GC 112,000 UI (96,900-127,000) ↑	Klebsiella pneumoniae Carbapenems 17,200 UI (13,400-20,900) ↑
	Acinetobacter baumannii 3GC 111,000 UI (101,000-122,000) ↑	Acinetobacter baumannii Fluoroquinolones 13,200 UI (10,800-15,700) ↑
	Staphylococcus aureus Fluoroquinolones 111,000 UI (99,300-123,000) ↑	Escherichia coli Carbapenems 12,700 UI (10,000-15,400) ↑
	Acinetobacter baumannii Anti-pseudomonal 110,000 UI (99,700-120,000) ↑	Pseudomonas aeruginosa Carbapenems 9,400 UI (6,180-12,600) ↑
	Acinetobacter baumannii 4GC 110,000 UI (99,900-120,000) ↑	Klebsiella pneumoniae Fluoroquinolones 9,330 UI (6,840-11,800) ↑
	Acinetobacter baumannii Fluoroquinolones 108,000 UI (98,000-118,000) ↑	Escherichia coli Fluoroquinolones 8,280 UI (5,960-10,600) ↑

Annualized rate of change (1990-2021): <-3% (dark blue), -1.5% to 0% (light blue), 1.5% to 3% (red), >5.0% (dark red), -3% to -1.5% (medium blue), 0% to 1.5% (pink), 3% to 5% (orange)

- 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) (659,000 UI (583,000-734,000)), bloodstream infections (543,000 UI (493,000-593,000)), diarrhea (498,000 UI (259,000-738,000)), tuberculosis (400,000 UI (325,000-474,000)) and urinary tract infections and pyelonephritis (88,900 UI (75,700-102,000)).

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



- In India, 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 416,000 UI (359,000-472,000), whereas the mortality rate per 100,000 was 698 UI (602-793).

Data sources for India

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 India by source type

Source type	Years	Sample size	Sample size units
Antibiotic use	1990-2021	15,292	Study-year datapoints
Microbial or laboratory data without outcome	1990-2021	351,650	Isolates
Microbial or laboratory data with outcome	2010-2021	950	Isolates
Literature studies	1990-2021	141,684	Cases/isolates/susceptibility tests
Single drug resistance profile data	1990-2021	695,537	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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