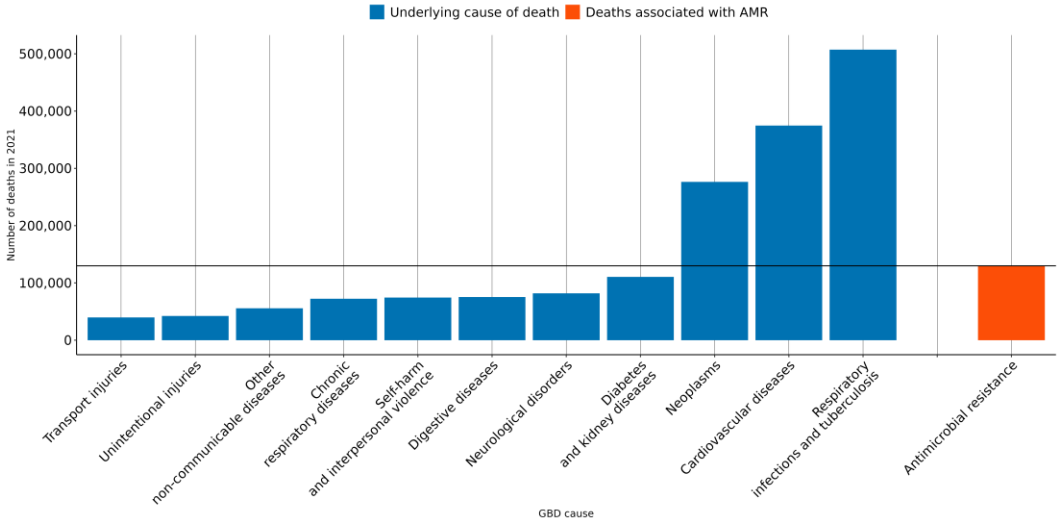
The burden of antimicrobial resistance (AMR) in Brazil

Executive summary

- Antimicrobial Resistance (AMR) is a major global health threat, over **30,000 lives** have been lost each year since 1990 in Brazil due to AMR.
- In 2021, there were an estimated **31,700 UI (27,200-36,100)** deaths attributable to AMR and **130,000 UI (115,000-145,000)** 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, *Klebsiella pneumoniae* resistant to carbapenems and *Acinetobacter baumannii* resistant to carbapenems.

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



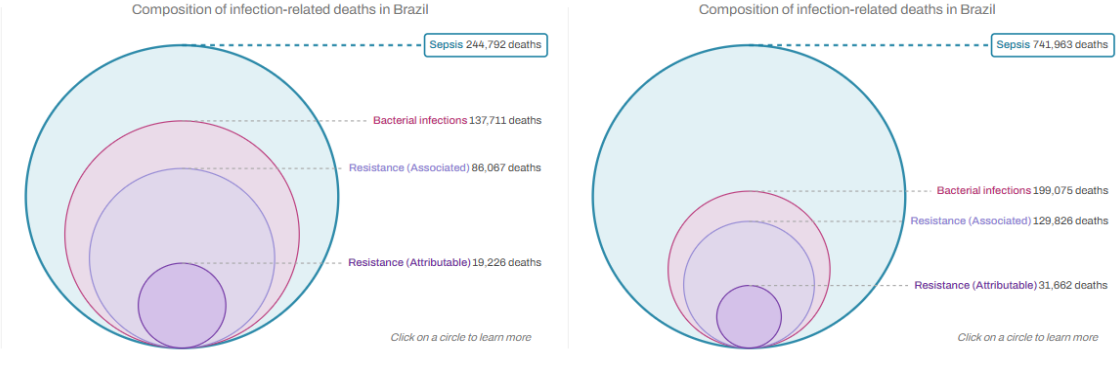
- In 2021, the number of deaths associated with AMR (orange bar in *figure 2*) were high compared to the most relevant underlying causes of death (depicted in blue) in the country. AMR associated deaths occur within multiple Global Burden of Disease (GBD) causes of death and AMR is not an underlying 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 Brazil, a 10% reduction means to decrease the number of deaths associated with AMR to **122,000**, but currently the trend for this country could reach up to **175,000 UI [139,000-214,000]** AMR-associated deaths in 2030.

AMR in Brazil

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 Brazil between 1990 and 2019.



- To look at these and more visualization interactively visit Measuring Infectious Causes and Resistance Outcomes for Burden Estimation (MICROBE)
- In **Brazil** in 2021, there were an estimated **31,700 UI (27,200-36,100)** deaths attributable to AMR and **130,000 UI (115,000-145,000)** 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, **Brazil has the 98th 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 34,600 UI (31,800-37,400) ↑	Staphylococcus aureus 23,700 UI (20,700-26,700) ↑	Klebsiella pneumoniae 5,990 UI (5,250-6,730) ↑
2	Escherichia coli 29,700 UI (26,900-32,500) ↑	Escherichia coli 21,400 UI (18,700-24,000) ↑	Staphylococcus aureus 4,940 UI (3,770-6,120) ↑
3	Klebsiella pneumoniae 24,600 UI (22,600-26,600) ↑	Klebsiella pneumoniae 19,800 UI (17,800-21,900) ↑	Acinetobacter baumannii 4,780 UI (4,320-5,250) ↑
4	Streptococcus pneumoniae 24,100 UI (22,100-26,100) ↓	Streptococcus pneumoniae 16,100 UI (13,500-18,600) ↓	Escherichia coli 3,950 UI (3,280-4,620) ↑
5	Pseudomonas aeruginosa 22,400 UI (20,700-24,200) ↑	Pseudomonas aeruginosa 14,000 UI (12,400-15,600) ↑	Pseudomonas aeruginosa 3,730 UI (3,040-4,420) ↑
6	Acinetobacter baumannii 12,400 UI (11,500-13,200) ↑	Acinetobacter baumannii 11,900 UI (11,000-12,800) ↑	Streptococcus pneumoniae 3,340 UI (2,600-4,080) ↓
7	Proteus spp. 5,980 UI (5,400-6,550) ↑	Proteus spp. 4,490 UI (3,910-5,070) ↑	Enterococcus faecium 1,110 UI (971-1,250) ↑
8	Enterococcus faecalis 5,870 UI (5,360-6,380) ↑	Enterococcus faecium 3,770 UI (3,470-4,060) ↑	Enterobacter spp. 1,000 UI (898-1,110) ↑
9	Group A Streptococcus 5,670 UI (5,130-6,220) ↑	Enterobacter spp. 3,610 UI (3,150-4,080) ↑	Proteus spp. 643 UI (524-762) ↑
10	Mycobacterium tuberculosis 5,610 UI (5,360-5,850) ↓	Enterococcus faecalis 2,540 UI (1,990-3,090) ↑	Enterococcus faecalis 575 UI (356-795) ↑

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%

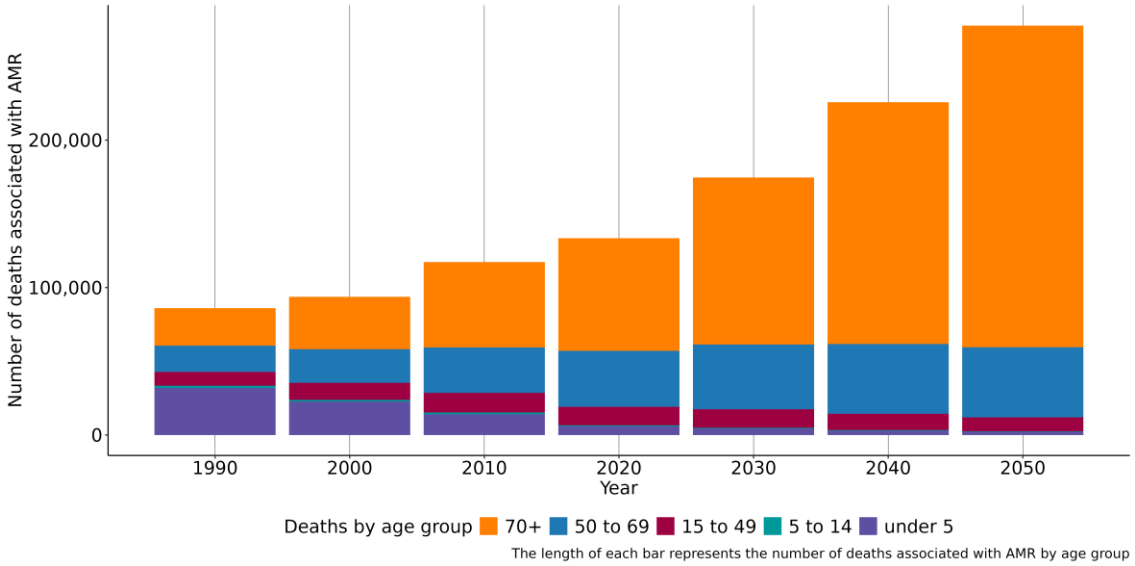
Table 2. Combinations which cause most deaths in 2021 (Number of deaths in parenthesis)

Burden Rank	Associated		Attributable	
1	Staphylococcus aureus Macrolides	21,400 UI (18,900-23,900) ↑	Staphylococcus aureus Methicillin	3,090 UI (2,100-4,090) ↑
2	Escherichia coli Aminopenicillin	17,700 UI (14,200-21,100) ↑	Acinetobacter baumannii Carbapenems	2,490 UI (2,030-2,950) ↑
3	Klebsiella pneumoniae Fluoroquinolones	16,400 UI (14,500-18,300) ↑	Klebsiella pneumoniae Carbapenems	2,330 UI (1,860-2,800) ↑
4	Klebsiella pneumoniae TMP-SMX	14,800 UI (12,600-17,100) ↑	Pseudomonas aeruginosa Carbapenems	2,200 UI (1,620-2,780) ↑
5	Klebsiella pneumoniae Aminoglycosides	14,200 UI (12,000-16,400) ↑	Streptococcus pneumoniae Carbapenems	2,090 UI (1,450-2,740) ↑
6	Klebsiella pneumoniae Beta-Lactam/Lactamase Inhib.	13,800 UI (11,200-16,300) ↑	Acinetobacter baumannii Fluoroquinolones	1,440 UI (1,190-1,700) ↑
7	Escherichia coli TMP-SMX	13,300 UI (10,900-15,700) ↑	Klebsiella pneumoniae Fluoroquinolones	1,420 UI (1,010-1,830) ↑
8	Staphylococcus aureus Methicillin	13,000 UI (8,390-17,600) ↑	Klebsiella pneumoniae Aminoglycosides	1,030 UI (761-1,300) ↑
9	Escherichia coli Fluoroquinolones	12,500 UI (10,000-14,900) ↑	Staphylococcus aureus Macrolides	973 UI (652-1,290) ↑
10	Klebsiella pneumoniae 3GC	12,300 UI (10,700-13,900) ↑	Escherichia coli Fluoroquinolones	927 UI (506-1,350) ↑

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) (120,000 UI (108,000-131,000)), bloodstream infections (79,400 UI (73,800-84,900)), urinary tract infections and pyelonephritis (36,100 UI (32,100-40,000)), peritoneal and intra-abdominal infections (22,700 UI (20,800-24,600)) and infections of the skin and subcutaneous systems (14,900 UI (13,200-16,600)).

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



- In Brazil, 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 73,300 UI (62,300-84,400), whereas the mortality rate per 100,000 was 522 UI (443-600).

Data sources for Brazil

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 Brazil by source type

Source type	Years	Sample size	Sample size units
Antibiotic use	1990-2009	74	Study-year datapoints
Microbial or laboratory data without outcome	1990-2021	686,376	Isolates
Microbial or laboratory data with outcome	2010-2021	310	Isolates
Literature studies	1990-2021	17,654	Cases/isolates/susceptibility tests
Single drug resistance profile data	1990-2021	253,965	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