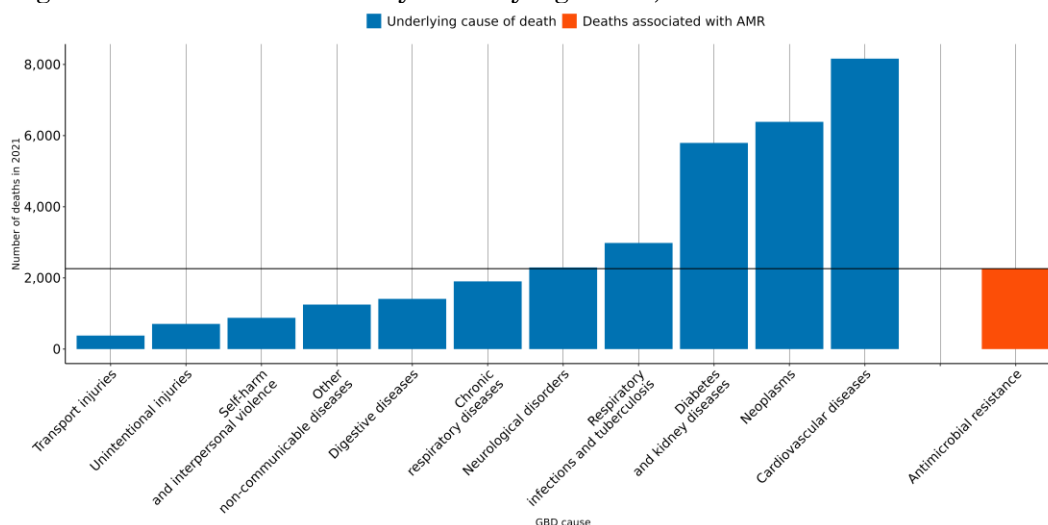


The burden of antimicrobial resistance (AMR) in Puerto Rico

Executive summary

- Antimicrobial Resistance (AMR) is a major global health threat, over **600 lives** have been lost each year since 1990 in Puerto Rico due to AMR.
- In 2021, there were an estimated **525 UI (373-676)** deaths attributable to AMR and **2,260 UI (1,690-2,830)** 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



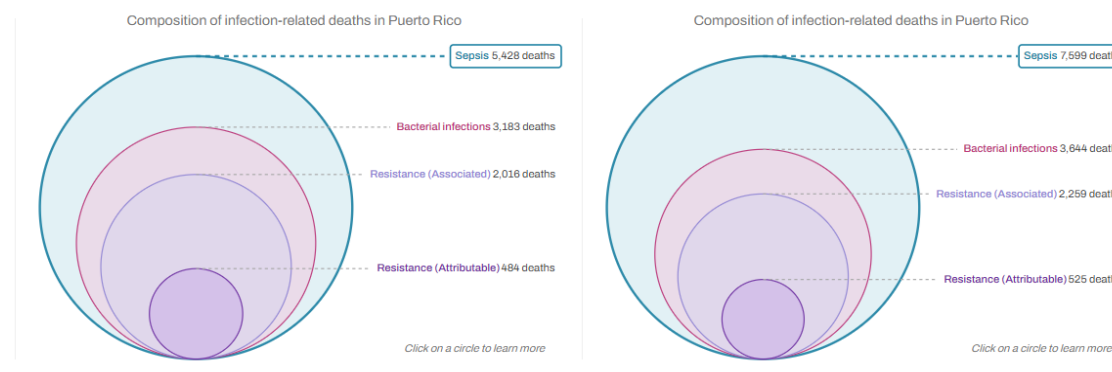
- In 2021, the number of deaths associated with AMR (orange bar in *figure 2*) were high compared to the most relevant underlying causes of death (depicted in blue) in the country. AMR associated deaths occur within multiple Global Burden of Disease (GBD) causes of death and AMR is not an underlying 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 Puerto Rico, a 10% reduction means to decrease the number of deaths associated with AMR to **2,070**, but currently the trend for this country could reach up to **2,660 UI [1,980-3,510]** AMR-associated deaths in 2030.

AMR in Puerto Rico

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 Puerto Rico between 1990 and 2019.



- To look at these and more visualization interactively visit [Measuring Infectious Causes and Resistance Outcomes for Burden Estimation \(MICROBE\)](#)
- In **Puerto Rico** in 2021, there were an estimated **525 UI (373-676)** deaths attributable to AMR and **2,260 UI (1,690-2,830)** 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, **Puerto Rico has the 43rd 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	
	Staphylococcus aureus 834 UI (687-982)	↑	Staphylococcus aureus 542 UI (384-700)	↑	Staphylococcus aureus 128 UI (69-186)	↑
	Escherichia coli 582 UI (477-686)	↑	Escherichia coli 443 UI (320-565)	↑	Escherichia coli 83 UI (59-108)	↑
	Pseudomonas aeruginosa 391 UI (321-461)	↑	Klebsiella pneumoniae 252 UI (200-304)	↑	Klebsiella pneumoniae 73 UI (58-88)	↑
	Klebsiella pneumoniae 342 UI (281-404)	↑	Pseudomonas aeruginosa 214 UI (166-262)	↑	Acinetobacter baumannii 71 UI (59-83)	↓
	Streptococcus pneumoniae 320 UI (264-376)	↓	Streptococcus pneumoniae 185 UI (124-245)	↓	Pseudomonas aeruginosa 55 UI (39-71)	↑
	Group A Streptococcus 206 UI (166-246)	↑	Acinetobacter baumannii 180 UI (147-214)	↓	Streptococcus pneumoniae 34 UI (19-48)	↓
	Acinetobacter baumannii 198 UI (163-233)	↓	Proteus spp. 82 UI (56-107)	↑	Enterobacter spp. 18 UI (14-21)	↑
	Enterococcus faecalis 120 UI (98-142)	↑	Enterococcus faecium 74 UI (58-89)	↑	Enterococcus faecium 17 UI (12-22)	↑
	Proteus spp. 119 UI (98-141)	↑	Enterobacter spp. 60 UI (48-73)	↓	Proteus spp. 11 UI (7-16)	↑
	Enterococcus faecium 100 UI (82-118)	↑	Enterococcus faecalis 51 UI (40-63)	↑	Serratia spp. 9 UI (6-11)	↓

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% (brown)

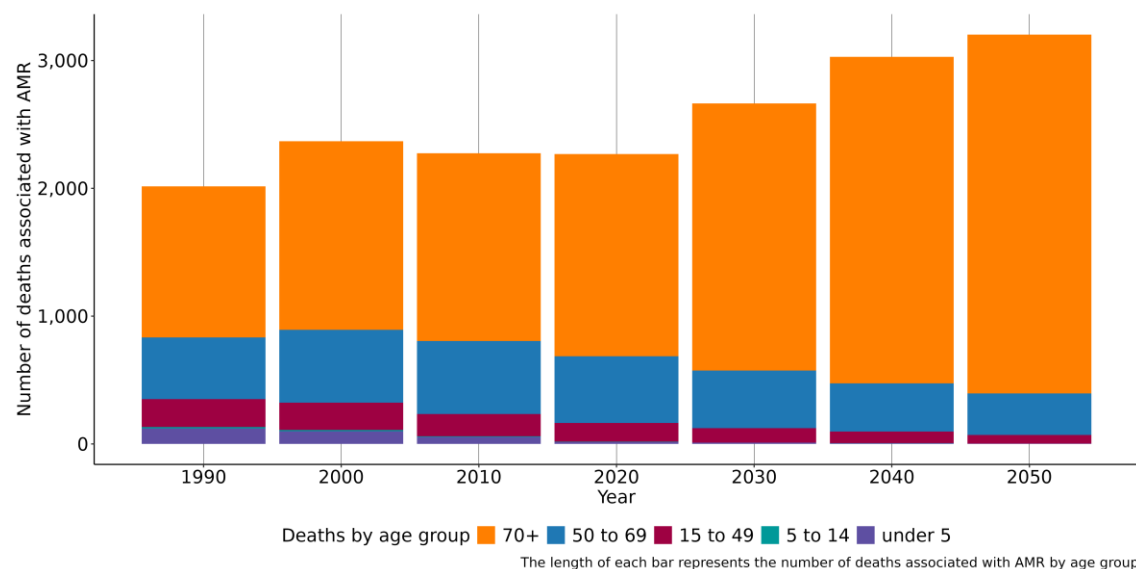
Table 2. Combinations which cause most deaths in 2021 (Number of deaths in parenthesis)

Burden Rank	Associated			Attributable		
	Staphylococcus aureus Macrolides	450 UI (338-562)	↑	Staphylococcus aureus Methicillin	86 UI (35-136)	↑
	Staphylococcus aureus Methicillin	358 UI (132-585)	↑	Acinetobacter baumannii Carbapenems	35 UI (26-44)	↓
	Escherichia coli Aminopenicillin	351 UI (131-572)	↑	Pseudomonas aeruginosa Carbapenems	28 UI (17-39)	↑
	Escherichia coli Fluoroquinolones	314 UI (233-395)	↑	Klebsiella pneumoniae Carbapenems	25 UI (18-32)	↑
	Staphylococcus aureus Fluoroquinolones	270 UI (187-353)	↑	Escherichia coli Fluoroquinolones	24 UI (13-35)	↑
	Escherichia coli TMP-SMX	266 UI (174-357)	↑	Streptococcus pneumoniae Carbapenems	22 UI (11-34)	↓
	Klebsiella pneumoniae Aminoglycosides	225 UI (176-274)	↑	Klebsiella pneumoniae Aminoglycosides	20 UI (14-25)	↑
	Klebsiella pneumoniae Fluoroquinolones	203 UI (156-249)	↑	Staphylococcus aureus Macrolides	19 UI (12-26)	↑
	Escherichia coli Beta-Lactam/Lactamase Inhib.	179 UI (134-224)	↑	Klebsiella pneumoniae Fluoroquinolones	18 UI (12-24)	↑
	Escherichia coli 3GC	157 UI (107-207)	↑	Acinetobacter baumannii Fluoroquinolones	17 UI (13-20)	↓

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% (brown)

- 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) (1,770 UI (1,450-2,100)), bloodstream infections (1,720 UI (1,420-2,020)), urinary tract infections and pyelonephritis (636 UI (513-759)), infections of the skin and subcutaneous systems (484 UI (387-581)) and peritoneal and intra-abdominal infections (396 UI (321-472)).

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



- In Puerto Rico, people aged 70+ saw the largest number of deaths associated with AMR both in 1990 and 2021, which indicates that 70+ continues to be particularly vulnerable to infections which are resistant to antibiotics. In 2021, the number of deaths associated with AMR among the 70+ was 1,610 UI (1,190-2,020), whereas the mortality rate per 100,000 was 305 UI (227-384).

Data sources for Puerto Rico

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 Puerto Rico by source type

Source type	Years	Sample size	Sample size units
Microbial or laboratory data without outcome	1990-2021	6,544	Isolates
Single drug resistance profile data	1990-2021	66,702	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 \(GHDx\)](#).

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- **LinkedIn:** <https://www.linkedin.com/company/institute-for-health-metrics-and-evaluation>