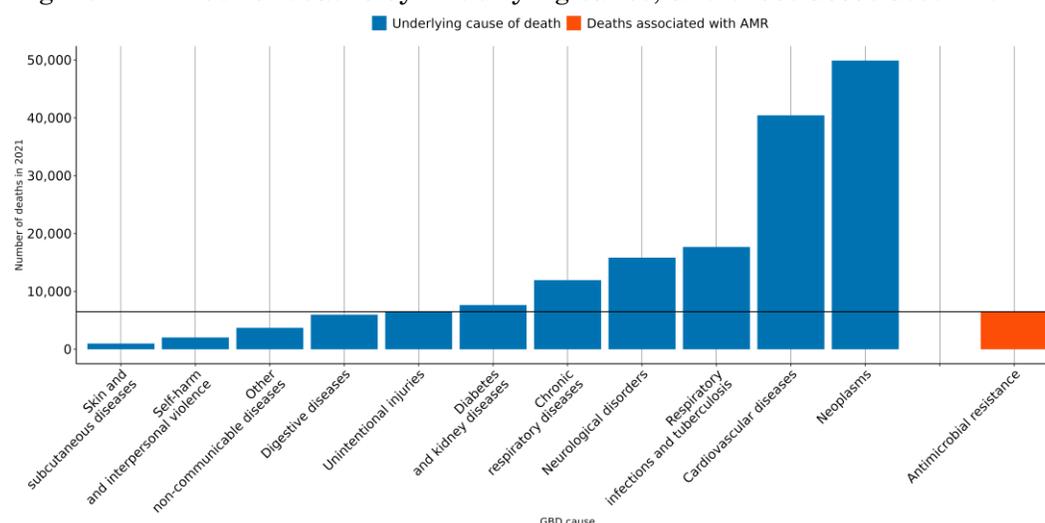


The burden of antimicrobial resistance (AMR) in the Netherlands

Executive summary

- Antimicrobial Resistance (AMR) is a major global health threat, over **1,000 lives** have been lost each year since 1990 in the Netherlands due to AMR.
- In 2021, there were an estimated **1,170 UI (984-1,350)** deaths attributable to AMR and **6,500 UI (5,480-7,520)** 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, *Escherichia coli* resistant to aminopenicillin and *Escherichia coli* resistant to beta lactam / beta-lactamase inhibitors.

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



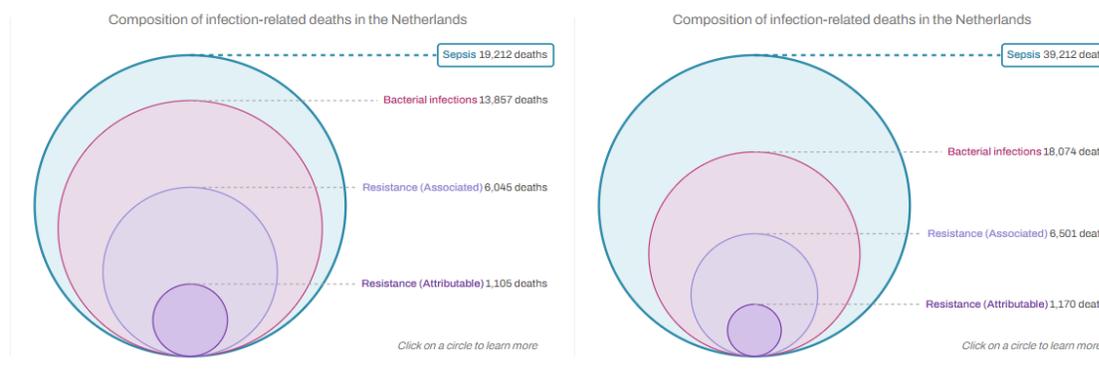
- In 2021, the number of deaths associated with AMR (orange bar in *figure 2*) were high compared to the most relevant underlying causes of death (depicted in blue) in the country. AMR associated deaths occur within multiple Global Burden of Disease (GBD) causes of death and AMR is not an underlying 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 the Netherlands, a 10% reduction means to decrease the number of deaths associated with AMR to **5,890**, but currently the trend for this country could reach up to **8,310 UI [6,320-10,200]** AMR-associated deaths in 2030.

AMR in the Netherlands

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 the Netherlands between 1990 and 2019.



- To look at these and more visualization interactively visit [Measuring Infectious Causes and Resistance Outcomes for Burden Estimation \(MICROBE\)](#)
- In **the Netherlands** in 2021, there were an estimated **1,170 UI (984-1,350)** deaths attributable to AMR and **6,500 UI (5,480-7,520)** 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, **the Netherlands has the 14th 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)

	Overall susceptible and resistant	Associated	Attributable
Burden rank	Staphylococcus aureus 5,610 UI (4,950-6,280) ↑	Escherichia coli 1,680 UI (1,460-1,900) ↑	Escherichia coli 289 UI (223-355) ↑
	Escherichia coli 3,090 UI (2,710-3,470) ↑	Staphylococcus aureus 1,660 UI (1,390-1,930) ↑	Staphylococcus aureus 281 UI (228-335) ↑
	Pseudomonas aeruginosa 1,770 UI (1,560-1,970) ↑	Enterococcus faecium 528 UI (462-593) ↑	Pseudomonas aeruginosa 126 UI (94-158) ↓
	Streptococcus pneumoniae 1,430 UI (1,260-1,590) ↓	Pseudomonas aeruginosa 502 UI (409-595) ↓	Acinetobacter baumannii 92 UI (73-111) ↓
	Klebsiella pneumoniae 1,280 UI (1,130-1,440) ↑	Streptococcus pneumoniae 424 UI (321-527) ↓	Klebsiella pneumoniae 85 UI (62-107) ↓
	Group A Streptococcus 837 UI (719-954) ↑	Klebsiella pneumoniae 407 UI (321-494) ↓	Enterococcus faecium 66 UI (41-91) ↑
	Enterococcus faecium 572 UI (502-641) ↑	Proteus spp. 308 UI (237-380) ↑	Streptococcus pneumoniae 58 UI (43-74) ↓
	Enterococcus faecalis 561 UI (495-628) ↑	Acinetobacter baumannii 263 UI (202-323) ↓	Proteus spp. 42 UI (31-54) ↑
	Proteus spp. 557 UI (484-630) ↑	Enterobacter spp. 153 UI (119-188) ↓	Enterobacter spp. 38 UI (30-45) ↓
	Enterobacter spp. 457 UI (403-511) ↑	Enterococcus faecalis 136 UI (115-156) ↓	Enterococcus faecalis 25 UI (18-31) ↓

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

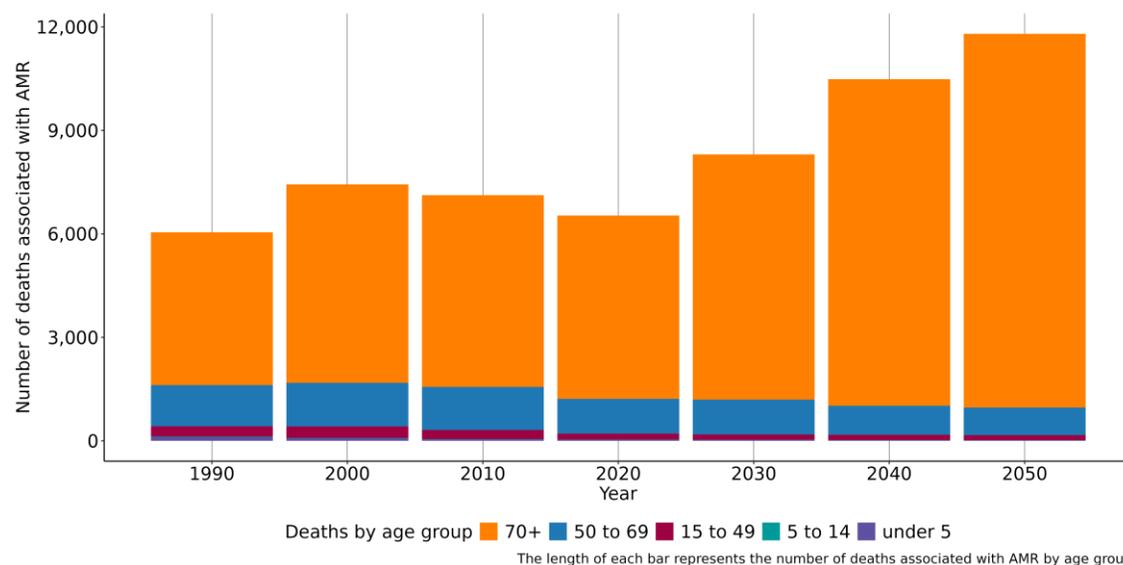
Table 2. Combinations which cause most deaths in 2021 (Number of deaths in parenthesis)

	Associated	Attributable
Burden Rank	Escherichia coli Aminopenicillin 1,490 UI (1,240-1,740) ↑	Staphylococcus aureus Methicillin 114 UI (82-146) ↑
	Staphylococcus aureus Macrolides 1,220 UI (925-1,520) ↑	Escherichia coli Beta-Lactam/Lactamase Inhib. 79 UI (26-132) ↑
	Escherichia coli Beta-Lactam/Lactamase Inhib. 865 UI (704-1,030) ↑	Escherichia coli Aminopenicillin 70 UI (43-96) ↑
	Escherichia coli TMP-SMX 769 UI (549-990) ↑	Enterococcus faecium Fluoroquinolones 61 UI (36-87) ↑
	Staphylococcus aureus Fluoroquinolones 662 UI (529-795) ↓	Pseudomonas aeruginosa Carbapenems 61 UI (40-82) ↓
	Escherichia coli Fluoroquinolones 609 UI (448-769) ↑	Staphylococcus aureus Macrolides 60 UI (38-81) ↑
	Enterococcus faecium Fluoroquinolones 506 UI (441-571) ↑	Staphylococcus aureus Fluoroquinolones 46 UI (14-78) ↓
	Staphylococcus aureus Methicillin 485 UI (326-644) ↑	Escherichia coli TMP-SMX 44 UI (23-64) ↑
	Proteus spp. Aminopenicillin 356 UI (301-412) ↑	Staphylococcus aureus Vancomycin 43 UI (26-60) ↑
	Pseudomonas aeruginosa Fluoroquinolones 322 UI (257-387) ↑	Escherichia coli Fluoroquinolones 42 UI (18-66) ↑

Annualized rate of change (1990-2021): <-3% (blue), -1.5% to 0% (light blue), 1.5% to 3% (red), >5.0% (dark red), -3% to -1.5% (light 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) (8,780 UI (7,660-9,890)), bloodstream infections (7,870 UI (6,960-8,780)), peritoneal and intra-abdominal infections (2,890 UI (2,530-3,260)), urinary tract infections and pyelonephritis (2,830 UI (2,400-3,250)) and endocarditis (1,480 UI (1,280-1,680)).

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



- In the Netherlands, 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 5,280 UI (4,380-6,190), whereas the mortality rate per 100,000 was 215 UI (178-252).

Data sources for the Netherlands

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 the Netherlands by source type

Source type	Years	Sample size	Sample size units
Microbial or laboratory data without outcome	1990-2021	1,657,223	Isolates
Microbial or laboratory data with outcome	1990-2021	41,309	Isolates
Literature studies	1990-2021	5,513	Cases/isolates/susceptibility tests
Single drug resistance profile data	2010-2021	126,170	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>