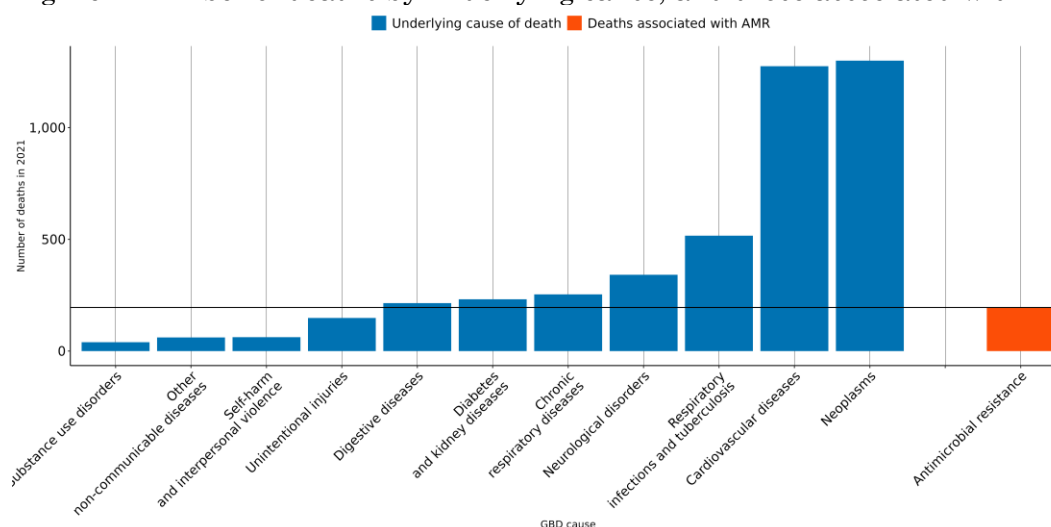


The burden of antimicrobial resistance (AMR) in Luxembourg

Executive summary

- Antimicrobial Resistance (AMR) is a major global health threat, over **40 lives** have been lost each year since 1990 in Luxembourg due to AMR.
- In 2021, there were an estimated **38 UI (31-46)** deaths attributable to AMR and **195 UI (157-233)** 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



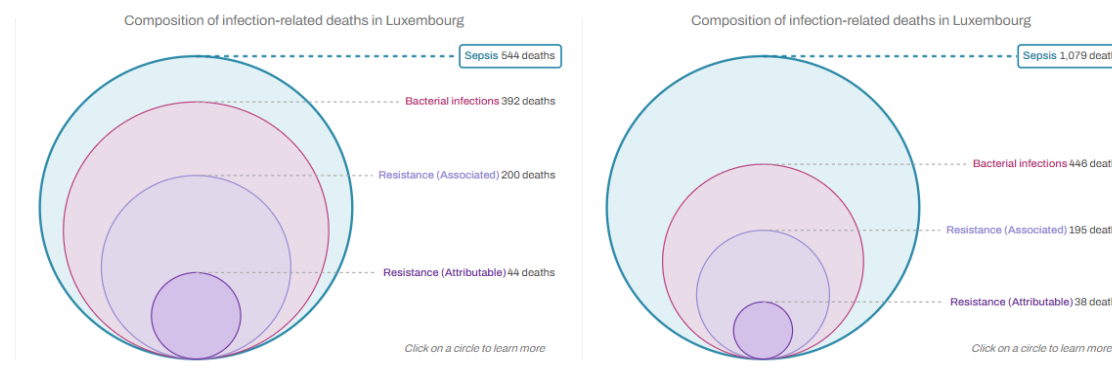
- In 2021, the number of deaths associated with AMR (orange bar in *figure 2*) were high compared to the most relevant underlying causes of death (depicted in blue) in the country. AMR associated deaths occur within multiple Global Burden of Disease (GBD) causes of death and AMR is not an underlying 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 Luxembourg, a 10% reduction means to decrease the number of deaths associated with AMR to **190**, but currently the trend for this country could reach up to **255 UI [198-315]** AMR-associated deaths in 2030.

AMR in Luxembourg

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 Luxembourg between 1990 and 2019.



- To look at these and more visualization interactively visit [Measuring Infectious Causes and Resistance Outcomes for Burden Estimation \(MICROBE\)](#)
- In **Luxembourg** in 2021, there were an estimated **38 UI (31-46)** deaths attributable to AMR and **195 UI (157-233)** 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, **Luxembourg has the 11th 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	
	Bacteria	UI (range)	Bacteria	UI (range)	Bacteria	UI (range)
	Staphylococcus aureus	141 UI (124-158)	Escherichia coli	51 UI (43-58)	Escherichia coli	9 UI (7-11)
	Escherichia coli	77 UI (68-86)	Staphylococcus aureus	48 UI (38-59)	Staphylococcus aureus	9 UI (7-10)
	Pseudomonas aeruginosa	44 UI (39-49)	Pseudomonas aeruginosa	16 UI (12-20)	Pseudomonas aeruginosa	4 UI (3-5)
	Streptococcus pneumoniae	33 UI (29-37)	Klebsiella pneumoniae	13 UI (10-17)	Klebsiella pneumoniae	3 UI (2-4)
	Klebsiella pneumoniae	31 UI (27-35)	Streptococcus pneumoniae	12 UI (8-17)	Acinetobacter baumannii	3 UI (2-4)
	Group A Streptococcus	16 UI (14-19)	Enterococcus faecium	11 UI (9-13)	Streptococcus pneumoniae	2 UI (1-3)
	Enterococcus faecalis	14 UI (13-16)	Acinetobacter baumannii	8 UI (6-10)	Enterococcus faecium	2 UI (1-2)
	Enterococcus faecium	14 UI (12-16)	Enterococcus faecalis	8 UI (7-9)	Enterobacter spp.	1 UI (1-2)
	Proteus spp.	12 UI (11-14)	Proteus spp.	8 UI (5-10)	Enterococcus faecalis	1 UI (1-2)
	Enterobacter spp.	12 UI (11-13)	Enterobacter spp.	7 UI (5-8)	Proteus spp.	1 UI (1-2)

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

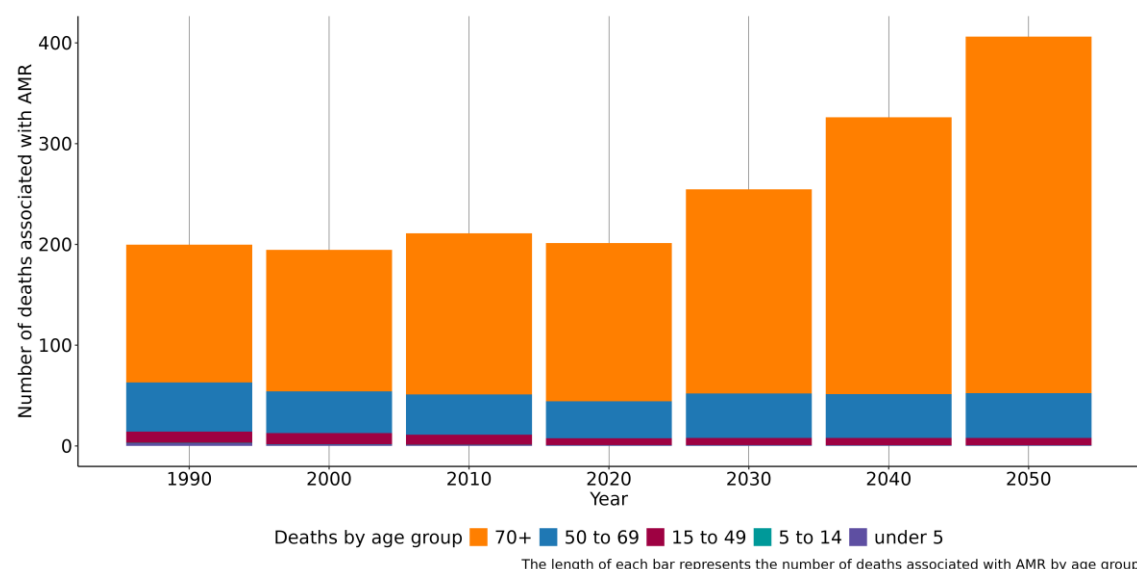
Table 2. Combinations which cause most deaths in 2021 (Number of deaths in parenthesis)

Burden Rank	Associated		Attributable	
	Bacteria	UI (range)	Bacteria	UI (range)
	Escherichia coli Aminopenicillin	47 UI (38-56)	Staphylococcus aureus Methicillin	4 UI (3-6)
	Staphylococcus aureus Macrolides	37 UI (26-48)	Escherichia coli Beta-Lactam/Lactamase Inhib.	2 UI (1-4)
	Escherichia coli Beta-Lactam/Lactamase Inhib.	27 UI (22-32)	Escherichia coli Aminopenicillin	2 UI (1-3)
	Escherichia coli TMP-SMX	24 UI (15-33)	Staphylococcus aureus Macrolides	2 UI (1-2)
	Escherichia coli Fluoroquinolones	21 UI (16-27)	Escherichia coli Fluoroquinolones	2 UI (1-2)
	Staphylococcus aureus Fluoroquinolones	21 UI (16-26)	Pseudomonas aeruginosa Carbapenems	1 UI (1-2)
	Staphylococcus aureus Methicillin	18 UI (10-26)	Staphylococcus aureus Fluoroquinolones	1 UI (0-3)
	Enterococcus faecium Fluoroquinolones	13 UI (11-15)	Streptococcus pneumoniae Carbapenems	1 UI (1-2)
	Escherichia coli 3GC	11 UI (8-14)	Escherichia coli TMP-SMX	1 UI (1-2)
	Pseudomonas aeruginosa Fluoroquinolones	10 UI (8-13)	Escherichia coli 3GC	1 UI (1-2)

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

- 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 (235 UI (208-262)), lower respiratory infection (excl. COVID) (184 UI (161-207)), peritoneal and intra-abdominal infections (92 UI (80-103)), endocarditis (38 UI (32-43)) and urinary tract infections and pyelonephritis (31 UI (26-35)).

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



- In Luxembourg, 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 149 UI (118-179), whereas the mortality rate per 100,000 was 224 UI (178-270).

Data sources for Luxembourg

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 Luxembourg by source type

Source type	Years	Sample size	Sample size units
Microbial or laboratory data without outcome	1990-2021	91,873	Isolates
Microbial or laboratory data with outcome	1990-2021	993	Isolates
Single drug resistance profile data	2010-2021	7,409	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>