# The burden of antimicrobial resistance (AMR) in the Democratic People's Republic of Korea

## Executive summary

- Antimicrobial Resistance (AMR) is a major global health threat, over **4,000 lives** have been lost each year since 1990 in the Democratic People's Republic of Korea due to AMR.

- In 2021, there were an estimated **4,370 UI (3,010-5,730)** deaths attributable to AMR and **17,500 UI (13,100-21,800)** 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 multi-drug resistant *Mycobacterium tuberculosis* (excluding extensive drug-resistance), *Staphylococcus aureus* resistant to methicillin and *Streptococcus pneumoniae* resistant to carbapenems.

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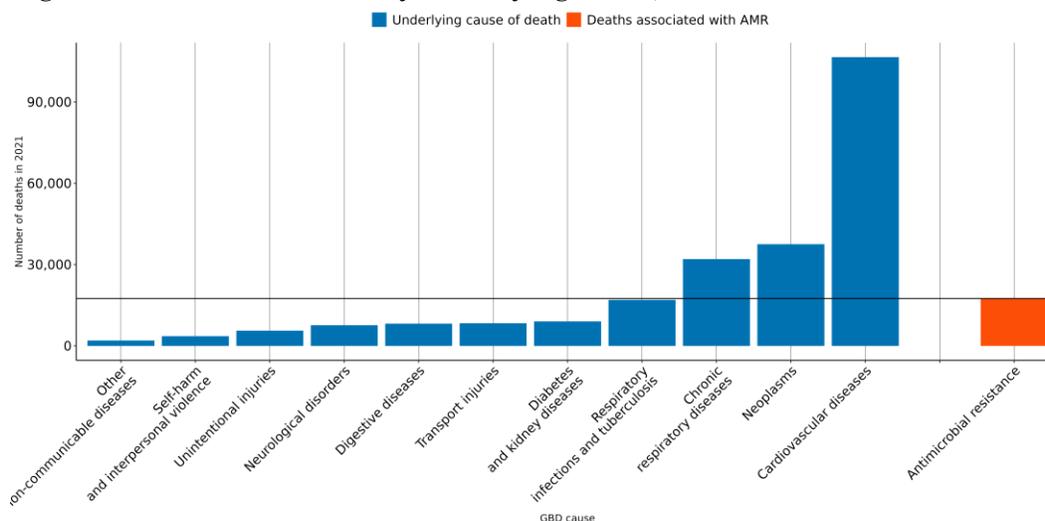


- In 2021, the number of deaths associated with AMR (orange bar in *figure 2*) were high compared to the most relevant underlying causes of death (depicted in blue) in the country. AMR associated deaths occur within multiple Global Burden of Disease (GBD) causes of death and AMR is not an underlying 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 the N Korea, a 10% reduction means to decrease the number of deaths associated with AMR to **15,900**, but currently the trend for this country could reach up to **21,500 UI [15,800-28,400]** AMR-associated deaths in 2030.

# AMR in the Democratic People's Republic of Korea

## 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 Democratic People's Republic of Korea between 1990 and 2019.
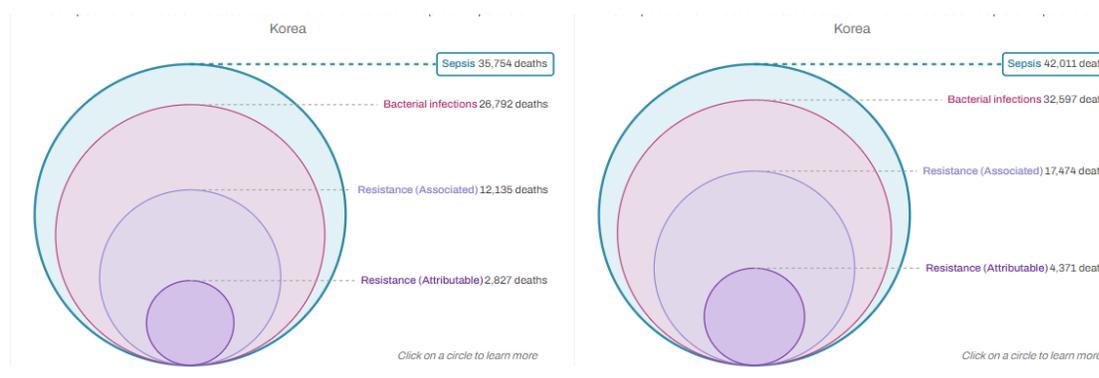


- To look at these and more visualization interactively visit [Measuring Infectious Causes and Resistance Outcomes for Burden Estimation (MICROBE)](#)

- In **the Democratic People's Republic of Korea** in 2021, there were an estimated **4,370 UI (3,010-5,730)** deaths attributable to AMR and **17,500 UI (13,100-21,800)** 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 Democratic People's Republic of Korea has the 98th 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 | |
|---|---|---|---|---|---|
| Mycobacterium tuberculosis 11,000 UI (7,430-14,600) | ↑ | Streptococcus pneumoniae 3,680 UI (2,860-4,500) | ↓ | Streptococcus pneumoniae 811 UI (539-1,080) | ↓ |
| Streptococcus pneumoniae 4,120 UI (3,280-4,960) | ↓ | Staphylococcus aureus 2,750 UI (1,830-3,660) | ↑ | Staphylococcus aureus 713 UI (398-1,030) | ↑ |
| Staphylococcus aureus 4,110 UI (3,340-4,880) | ↑ | Escherichia coli 1,920 UI (1,400-2,440) | ↑ | Acinetobacter baumannii 577 UI (456-698) | ↑ |
| Klebsiella pneumoniae 2,540 UI (2,030-3,050) | ↑ | Klebsiella pneumoniae 1,800 UI (1,320-2,280) | ↑ | Klebsiella pneumoniae 453 UI (328-578) | ↑ |
| Pseudomonas aeruginosa 2,470 UI (1,980-2,950) | ↑ | Pseudomonas aeruginosa 1,670 UI (1,230-2,110) | ↑ | Pseudomonas aeruginosa 431 UI (282-581) | ↑ |
| Escherichia coli 2,210 UI (1,770-2,650) | ↑ | Acinetobacter baumannii 1,480 UI (1,160-1,790) | ↑ | Escherichia coli 403 UI (273-534) | ↑ |
| Acinetobacter baumannii 1,590 UI (1,270-1,910) | ↑ | Mycobacterium tuberculosis 1,200 UI (341-2,720) | ↑ | Mycobacterium tuberculosis 395 UI (0-1,170) | ↑ |
| Enterobacter spp. 748 UI (604-892) | ↑ | Enterobacter spp. 622 UI (498-747) | ↑ | Enterobacter spp. 170 UI (132-208) | ↑ |
| Enterococcus faecalis 711 UI (573-848) | ↑ | Enterococcus faecalis 445 UI (354-535) | ↑ | Serratia spp. 120 UI (94-146) | ↑ |
| Serratia spp. 479 UI (386-571) | ↑ | Serratia spp. 418 UI (332-503) | ↑ | Enterococcus faecalis 72 UI (44-99) | ↑ |

Burden rank

Annualized rate of change (1990-2021)   <-3%   -1.5% to 0%   1.5% to 3%   >5.0%
-3% to -1.5%   0% to 1.5%   3% to 5%

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

| Associated | | | Attributable | | |
|---|---|---|---|---|---|
| Streptococcus pneumoniae Macrolides | 3,440 UI (2,670-4,210) | ↓ | Staphylococcus aureus Methicillin | 497 UI (230-763) | ↑ |
| Streptococcus pneumoniae TMP-SMX | 2,420 UI (1,520-3,330) | ↑ | Streptococcus pneumoniae Carbapenems | 450 UI (247-653) | ↓ |
| Staphylococcus aureus Methicillin | 2,060 UI (880-3,240) | ↑ | Mycobacterium tuberculosis MDR excluding XDR | 327 UI (0-1,000) | ↑ |
| Staphylococcus aureus Macrolides | 2,050 UI (1,500-2,610) | ↑ | Acinetobacter baumannii Carbapenems | 270 UI (180-359) | ↑ |
| Escherichia coli Aminopenicillin | 1,760 UI (986-2,530) | ↑ | Pseudomonas aeruginosa Carbapenems | 184 UI (97-270) | ↑ |
| Streptococcus pneumoniae Penicillin | 1,750 UI (943-2,560) | ↓ | Escherichia coli 3GC | 156 UI (94-217) | ↑ |
| Streptococcus pneumoniae Carbapenems | 1,680 UI (1,000-2,350) | ↓ | Acinetobacter baumannii Fluoroquinolones | 131 UI (100-161) | ↑ |
| Klebsiella pneumoniae Aminoglycosides | 1,420 UI (1,040-1,790) | ↑ | Streptococcus pneumoniae Macrolides | 128 UI (74-183) | ↓ |
| Acinetobacter baumannii 4GC | 1,400 UI (1,080-1,720) | ↑ | Klebsiella pneumoniae Aminoglycosides | 109 UI (74-145) | ↑ |
| Streptococcus pneumoniae 3GC | 1,360 UI (894-1,830) | ↑ | Klebsiella pneumoniae 3GC | 96 UI (55-137) | ↑ |

Burden Rank

Annualized rate of change (1990-2021)   <-3%   -1.5% to 0%   1.5% to 3%   >5.0%
-3% to -1.5%   0% to 1.5%   3% to 5%

- 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) (13,000 UI (10,200-15,800)), bloodstream infections (11,700 UI (9,490-13,900)), tuberculosis (11,000 UI (7,430-14,600)), peritoneal and intra-abdominal infections (1,770 UI (1,270-2,270)) and urinary tract infections and pyelonephritis (1,140 UI (785-1,490)).

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



The length of each bar represents the number of deaths associated with AMR by age group
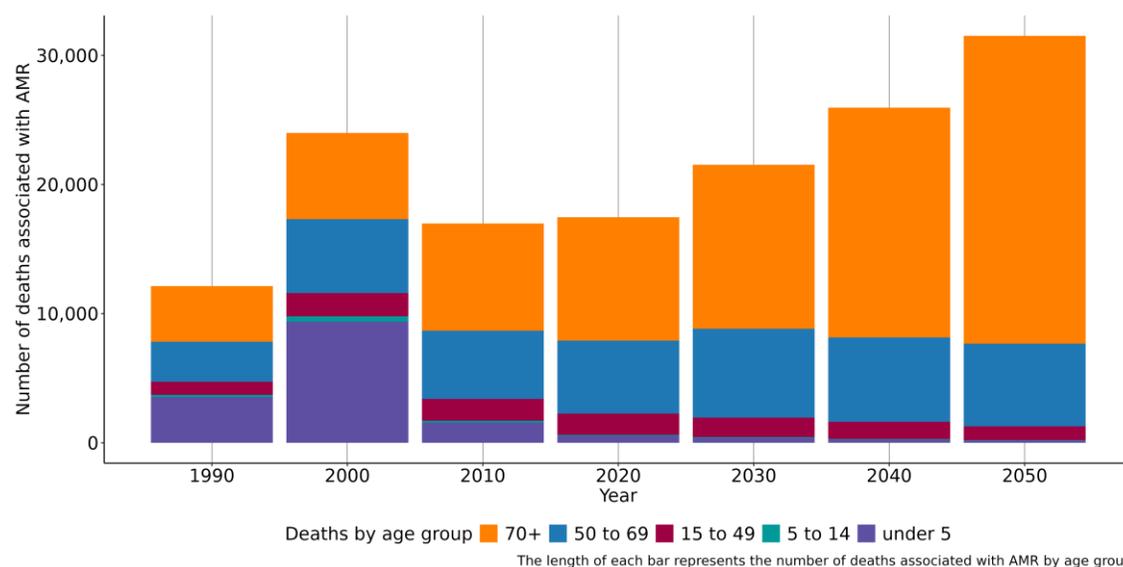
- In the Democratic People's Republic of Korea, people aged 70+ saw the largest number of deaths associated with AMR both in 1990 and 2021, which indicates that 70+ continues to be particularly vulnerable to infections which are resistant to antibiotics. In 2021, the number of deaths associated with AMR among the 70+ was 9,540 UI (7,400-11,700), whereas the mortality rate per 100,000 was 545 UI (423-667).

**Data sources for the Democratic People's Republic of Korea**

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 Democratic People's Republic of Korea by source type

| Source type | Years | Sample size | Sample size units |
|---|---|---|---|
| No other source but GBD study input | None | | GBD study input |

**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