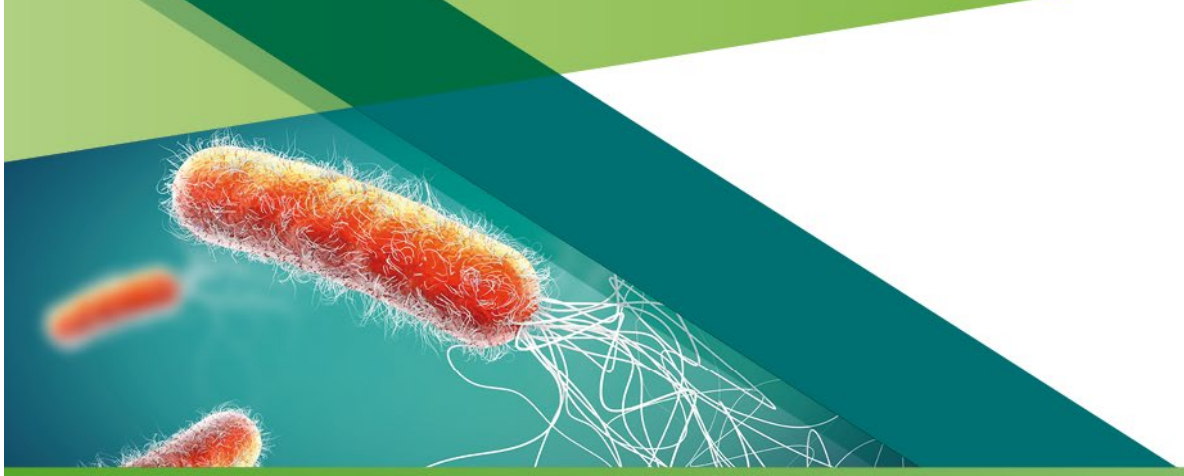

SURVEILLANCE REPORT

Antimicrobial resistance in the EU/EEA (EARS-Net)

Annual Epidemiological Report for 2024

Key facts

- In 2025, all European Union/European Economic Area (EU/EEA) countries reported data for 2024 to the European Antimicrobial Resistance Surveillance Network (EARS-Net).
- Antimicrobial resistance (AMR) can be expressed as the estimated total incidence of bloodstream infections with antimicrobial-resistant bacteria (infections per 100 000 population).

EU targets on antimicrobial resistance

- In 2024, the estimated total EU incidence of meticillin-resistant *Staphylococcus aureus* (MRSA) bloodstream infections was 4.48 per 100 000 population (EU country range 0.55–13.63). This was 20.4% lower than in 2019 (baseline year) and 0.31 per 100 000 population lower than the 2030 target of 4.79 per 100 000 population. For the EU overall, a statistically significant decreasing trend was detected between 2019 (baseline year) and 2024.
- The estimated total EU incidence of third-generation cephalosporin-resistant *Escherichia coli* bloodstream infections was 11.03 per 100 000 population (EU country range 3.75–22.79) in 2024. This was 5.9% higher than in 2019 (baseline year) and 1.65 per 100 000 population higher than the 2030 target of 9.38 per 100 000 population. For the EU overall, there was no statistically significant trend detected between 2019 (baseline year) and 2024.
- The estimated total EU incidence of carbapenem-resistant *Klebsiella pneumoniae* bloodstream infections was 3.51 per 100 000 population (EU country range 0.02–20.31) in 2024. This was 61.0% higher than in 2019 (baseline year) and 1.44 per 100 000 population higher than the 2030 target of 2.07 per 100 000 population. For the EU overall, a statistically significant increasing trend was detected between 2019 (baseline year) and 2024.
- In summary, while the EU target for the incidence of MRSA bloodstream infections had already been reached by 2024, the results for the other two EU targets were not on track. The estimated EU incidence of third-generation cephalosporin-resistant *E. coli* bloodstream infections with a 10% reduction target increased by more than 5% compared to 2019 (baseline year). Moreover, the estimated EU incidence of carbapenem-resistant *K. pneumoniae* bloodstream infections increased by over 60% compared to 2019, which differs substantially from the target of a 5% reduction by 2030.

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Overall antimicrobial resistance situation in the EU/EEA

- Data from EARS-Net show that, as in previous years, AMR levels remained high in the EU/EEA in 2024.
- Increases in the estimated EU/EEA incidences of bloodstream infections with resistant bacteria were observed not only for two of the above-mentioned AMR-pathogen combinations with an EU target, but also for many other bacteria and antimicrobial groups under surveillance during the period 2020–2024, such as carbapenem-resistant *E. coli*, all resistance incidences for *Streptococcus pneumoniae*, and vancomycin-resistant *Enterococcus faecium*.
- The AMR situation reported by EU/EEA countries varied widely, depending on the bacterial species, antimicrobial group and geographical region. Higher AMR was generally reported by countries in southern, central and eastern Europe.
- For each bacterial species, country-specific information on the estimated incidence of antimicrobial-resistant bloodstream infections (including the recommended EU targets on AMR), the percentage of invasive isolates with AMR, data availability and the percentage of intensive-care-unit patients is available in the country summaries. Results by age group and sex are available in the ECDC Surveillance Atlas of Infectious Diseases (https://atlas.ecdc.europa.eu/).

Public health conclusions

- Estimates based on EARS-Net data from 2020 indicate that each year more than 35 000 people die in the EU/EEA as a direct consequence of antimicrobial-resistant infections.
- The poor progress towards the EU targets on AMR overall and the many increases in the estimated EU/EEA incidences of bloodstream infections with resistant bacteria in the EU/EEA highlight the urgent need for intensified public health action against AMR.
- The Council Recommendation on stepping up EU actions to combat AMR in a One Health approach (2023/C 220/01) encourages Member States to develop and implement national action plans against AMR, and highlights the need for Member States to allocate appropriate human and financial resources for the effective implementation of these plans.
- In the absence of stronger, swifter public health action, it is unlikely that the EU will reach all its AMR targets by 2030. Moreover, AMR will continue to jeopardise EU preparedness, leading to an increased number of infections with antimicrobial-resistant bacteria that will be more difficult to treat, greater challenges for patient safety and a rise in AMR-related deaths.

Methods

The results presented in this report are based on antimicrobial resistance (AMR) data from invasive isolates (retrieved from blood or cerebrospinal fluid samples) reported to the European Antimicrobial Resistance Surveillance Network (EARS-Net) by all (n=30) European Union (EU) and European Economic Area (EEA) countries in 2025 (data referring to 2024). Until the end of 2019, EARS-Net collected data from the United Kingdom (UK), however this stopped as of 2020 when the UK withdrew from the European Union. Data from the UK are excluded from the results in this report. Results for the UK from before 2020 can be found in previous Annual Epidemiological Reports. France did not report isolate-level 2023 data for some of the bacterial species-antimicrobial group combinations and therefore 2023 data for France have been imputed for the EU and EU/EEA results in this report. The latest country-specific data, based on the isolate level data reported to ECDC, can be retrieved from the ECDC Surveillance Atlas of Infectious Diseases [1].

EARS-Net

EARS-Net is coordinated by ECDC with the aim of collecting, analysing and reporting data on AMR through a network of national surveillance systems across EU/EEA countries and, as defined in the EARS-Net reporting protocol [2], facilitating action to address AMR.

EARS-Net is based on a network of representatives nominated by EU/EEA countries (i.e. national focal points for AMR, and operational contact points for epidemiology, microbiology and The European Surveillance System (TESSy) and EpiPulse Cases for diseases caused by antimicrobial-resistant microorganisms). These representatives collect routine clinical antimicrobial susceptibility testing (AST) data through national AMR surveillance networks. Participating institutions are listed in Annex 1. Scientific guidance and support are provided by the EARS-Net Disease Network Coordination Committee which is composed of experts elected from the nominated national focal points and operational contact points, complemented by observers from organisations involved in AMR surveillance. EARS-Net activities are coordinated in close collaboration with three other ECDC surveillance networks: the European Antimicrobial Resistance Genes Surveillance Network (EURGen-Net), the European Surveillance of Antimicrobial Consumption Network (ESAC-Net) and the Healthcare-Associated Infections Surveillance Network (HAI-Net). EARS-Net also collaborates with the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) and with the European Committee on Antimicrobial Susceptibility Testing (EUCAST), which is supported by ECDC and ESCMID. Data from EARS-Net are also provided to the World Health Organization (WHO) Regional Office for Europe and made available via the WHO Regional Office for Europe AMR dashboard, together with AMR data from the WHO European Region [3]. A summary for the WHO European Region is published jointly with WHO Regional Office for Europe [4]. ECDC also provides EARS-Net data via WHO's Regional Office for Europe to the WHO Global Antimicrobial Resistance and Use Surveillance System (GLASS) [5].

In 2024, all EU Member States and three EEA countries participated in EARS-Net. Since the initiation of the network, there has been a large increase in the number of participating laboratories, which suggests that national AMR surveillance systems in the EU/EEA are being strengthened. The laboratories that participate in the annual EARS-Net external quality assessment (EQA) exercise contribute to improved data quality and an increasing ability of EU/EEA countries to report comparable AMR data [6]. However, not all the laboratories providing EARS-Net data for 2024 participated in the 2024 EARS-Net EQA exercise. Moreover, not all the laboratories invited to the EARS-Net EQA exercise actually participated. This fact is reflected in the country summaries. The results from the EARS-Net EQA exercise for 2024, including details of the participation rate by country, are published in a separate report [6].

It is possible for reporting countries to correct and re-upload historical data. The latest published report therefore supersedes previous reports and reflects the most recent available data. This report is based on data reported to EARS-Net for the period 2019–2024 and retrieved from EpiPulse Cases on 19 August 2025.

Antimicrobial susceptibility data

Each year, countries report routine AST results, collected from one or more clinical microbiology laboratories, to ECDC. When it is not possible to include data from all the relevant laboratories, countries can report data from sentinel laboratories. Either way, the data reflect the laboratory AST data that are collected in the surveillance system of each country. The AMR surveillance focuses on invasive (blood and cerebrospinal fluid) isolates of eight key bacterial species (*Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Acinetobacter* species, *Streptococcus pneumoniae*, *Staphylococcus aureus, Enterococcus faecalis* and *Enterococcus faecium*). Other notifiable diseases caused by microorganisms with AMR, such as *Campylobacter* spp., *Mycobacterium tuberculosis, Neisseria gonorrhoeae*, and *Salmonella* spp., are also monitored by ECDC [7] but are not included in EARS-Net.

EARS-Net collects AMR data from EU/EEA countries through EpiPulse, a web-based platform for data submission and storage hosted by ECDC [8]. Previously the data were collected through TESSy until TESSy was integrated into the larger platform EpiPulse on 2 July 2023. Since 28 April 2025, the EARS-Net AMR data are collected through EpiPulse Cases on the EpiPulse platform. For detailed information on data collection, refer to the EARS-Net reporting protocol [2].

Only data from invasive (blood and cerebrospinal fluid) isolates are included in EARS-Net. This restriction aims to reduce the impact of different sampling frames between laboratories and countries, which would hamper data interpretation. Any bacterial isolate of the species under surveillance found in a sample taken from a normally sterile body fluid may be considered a pathogen. However, the inclusion of routine, non-invasive isolates may produce results that cannot be compared for surveillance purposes. This is because healthcare-seeking behaviour may differ between countries and, in addition, the processing of such samples is heavily influenced by clinical interpretation and diagnostic and treatment guidelines, which vary between countries.

Historically, EARS-Net accepted data on isolates from both blood and cerebrospinal fluid samples for *E. coli*, *K. pneumoniae*, *P. aeruginosa*, *Acinetobacter* spp. and *S. pneumoniae*, but only isolates from blood samples for *S. aureus*, *E. faecalis* and *E. faecium*. Starting with 2019 data, in order to harmonise data collection between the Central Asian and European Surveillance of Antimicrobial Resistance (CAESAR) network and EARS-Net, EARS-Net includes data from both blood and cerebrospinal fluid samples for all bacterial species under surveillance.

Starting with the data collected for 2019, EARS-Net only accepts data generated using EUCAST clinical breakpoints [9]. Before this, the use of EUCAST breakpoints was encouraged, but results based on other interpretive criteria used by reporting countries were also accepted for analysis.

From 2020 onwards, EUCAST clinical breakpoints for aminoglycosides indicate that in systemic infections caused by *E. coli*, *K. pneumoniae*, *P. aeruginosa* and *Acinetobacter* spp., aminoglycosides should be used in combination with other active therapies.

Coverage and representativeness of population, hospitals and patients included in EARS-Net

Data sources

Since 2018, data on population coverage, number of blood culture sets, and country representativeness have been collected via TESSy/EpiPulse [8]. Data for previous years combined TESSy data with data collected through questionnaires distributed to the national focal points for AMR.

Indicators of coverage and representativeness

Population coverage

Population coverage is expressed as the estimated percentage of the population in an entire country under surveillance by the laboratories reporting data to EARS-Net. This value should be considered as an indication of the crude population coverage, since the exact percentage of the population under surveillance is often difficult to assess, due to overlapping hospital catchment areas and patients seeking care in areas other than their area of residence. The population coverage is calculated as the mean of the coverage for the following bacterial species: *E. coli*, *K. pneumoniae*, *P. aeruginosa*, *S. aureus*, *E. faecalis* and *E. faecium*. Due to outliers in some countries, *S. pneumoniae* and *Acinetobacter* spp. are not included in the calculation.

Geographical representativeness

Geographical representativeness is a qualitative indicator referring to geographical coverage. The categories for 2023 are listed and described in Table 1. The definition was adjusted as of the data collection in 2022 [2]. For data reported for 2019–2020, the definition of geographical representativeness can be found in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data' [10].

Hospital representativeness

Hospital representativeness is a qualitative indicator referring to representativeness of hospitals served by the EARS-Net-participating laboratories, compared to the country distribution of the various types of hospitals. The categories are listed and described in Table 1.

Isolate representativeness

Isolate representativeness is a qualitative indicator referring to representativeness of data reported by EARS-Net laboratories in relation to the microorganisms causing invasive infections in the included hospitals. The categories are listed and described in Table 1. The collection of data related to isolate representativeness was adjusted as of the data collection in 2022 [2]. With data reported for 2019–2020, isolate representativeness refers to patient and isolate representativeness, defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data' [10].

Blood culture rate

The blood culture rate refers to the number of blood culture sets taken per 1 000 patient-days in hospitals served by EARS-Net laboratories and sent to these laboratories. The definition of a 'blood culture set' and a 'patient-day' may differ between and within countries, and this may influence the estimate. Blood culture rates were calculated as the mean of the number of blood culture sets divided by the mean total number of patient-days for hospitals served by laboratories that provided the number of blood culture sets performed, as reported for the following bacterial species: *E. coli*, *K. pneumoniae*, *P. aeruginosa*, *S. aureus*, *E. faecalis* and *E. faecium* and multiplied by 1 000. Due to outliers in some countries, data reported for *S. pneumoniae* and *Acinetobacter* spp. are not included in the calculation of the mean blood culture rate.

Isolates from intensive care units

The percentage of isolates reported from intensive care units (ICUs) are calculated for each bacterial species. Isolates with missing information on hospital department are excluded from the calculation, and the results are only presented if there are ≥ 20 isolates, with 70% having data on hospital department.

Data analysis

Before being analysed, data are de-duplicated to include only the first isolate per patient, year, and bacterial species. Moreover, EU and EU/EEA analyses do not include countries that have reported data for less than three years to EARS-Net during the relevant time period.

Estimated EU/EEA incidence of invasive isolates

Invasive isolates refer to isolates from blood or cerebrospinal fluid samples. EARS-Net only includes isolates from these types of samples. For each bacterial species, the total number of invasive isolates was estimated by dividing the number of isolates for the bacterial species reported by a country to EARS-Net by the reported population coverage of the country, and then adding the resulting numbers. This sum was then divided by the EU/EEA population to arrive at the estimated EU/EEA incidence of invasive isolates for the specific pathogen. The most recently reported coverage for the respective year is used, as reported to TESSy/EpiPulse Cases for 2018–2024. If possible, the coverage reported for the year (Y) is used. If the coverage for year Y is not available, the coverage in the preceding year (Y-1) is used. If neither are available, the coverage for the following year (Y+1) is used. If the coverage is still missing, the process is repeated in the same order, but a year further from the intended year (Y). This process is repeated for as long as possible within the reported data, covering the years 2018–2024.

Susceptibility test categories

For the analysis, the qualitative susceptibility categories – 'susceptible, standard dosing regimen' (S), 'susceptible, increased exposure' (I) and 'resistant' (R) – are used, as reported by the laboratory, since quantitative susceptibility information is missing for a large part of the data. An isolate is considered resistant to an antimicrobial agent when tested and interpreted as R, in accordance with the clinical breakpoint criteria used by the local laboratory.

For *P. aeruginosa*, *E. coli*, *K. pneumoniae*, and *Acinetobacter* spp. and some antimicrobial agent combinations presented in this report, EUCAST breakpoints are available, as of 2021, for isolates from meningitis versus other isolates ('non-meningitis'). When possible, and starting with 2021 data, it is recommended that EU/EEA countries that generate the susceptibility categorisation of isolates at national level use 'non-meningitis' breakpoints for all interpretations, although EARS-Net does accept data as they are. As clinical patient data are not collected in EARS-Net, information is not available on which breakpoint was used to categorise susceptibility. However, it is assumed that only a very small number of infections reported to EARS-Net are meningitis cases and the large majority are bloodstream infections. Moreover, as even in the case of cerebrospinal fluid samples, it is recommended that countries report the susceptibility categories according to 'non-meningitis' breakpoints, the impact on the overall results is expected to be minor.

The term 'penicillin non-wild-type' is used in this report for *S. pneumoniae*, referring to *S. pneumoniae* isolates reported by local laboratories as I or R to penicillin, assuming minimum inhibitory concentrations (MICs) to benzylpenicillin above those of wild-type isolates (> 0.06 mg/L).

Estimated incidence and estimated number of cases of bloodstream infections with resistant bacteria

The estimated incidence of invasive isolates is considered to reflect the incidence of bloodstream infections with the respective resistant bacteria since, in the de-duplicated EARS-Net data, the number of isolates from blood samples far outweighs that from cerebrospinal fluid samples. As an example, during the period 2019–2024, each year the de-duplicated dataset consisted of more than 99% isolates from blood samples and less than 1% isolates from cerebrospinal fluid samples.

The bacterial species–antimicrobial agent combinations presented in this report for 2024 are shown in Table 2. When combining results for antimicrobial agents representing an antimicrobial group, the outcome is based on the most resistant result. For example, if the AST result of a bacterial species for imipenem is I and the AST result for meropenem is R, then the AST result for the group carbapenems, which comprises imipenem and meropenem, is set as R. The definition of combined AMR is determined as R to at least one antimicrobial agent in each of the antimicrobial groups (except for *S. pneumoniae*, for which combined AMR is calculated as combined penicillin non-wild-type and R to macrolides). Isolates with missing data for one or more of the required antimicrobial groups are excluded from the analysis of combined AMR.

For each bacterial species–antimicrobial agent/group combination (or for *S. pneumoniae* and penicillin, non-wild-type), the national estimated incidence of bloodstream infections with resistant bacteria was calculated by dividing the number of cases reported as R by the national population, as reported to Eurostat [11], multiplied by the

estimated population coverage, as reported to EARS-Net. The estimated national number of cases was calculated by dividing the number of resistant cases reported by the estimated population coverage. The national results are included in the respective country summary.

For the EU and the EU/EEA respectively, first the number of cases in each country was divided by the respective national coverage. Next, the results for all countries were totalled, resulting in the estimated number of cases in the EU or EU/EEA, which was then divided by the respective total EU or EU/EEA population to arrive at the estimated EU or EU/EEA incidence of bloodstream infections with resistant bacteria.

The most recently reported coverage for the respective year is used, as reported to TESSy/EpiPulse Cases for 2018–2024. If possible, the coverage reported for the year (Y) is used. If the coverage for year Y is not available, the coverage for the preceding year (Y-1) is used. If neither are available, the coverage for the following year (Y+1) is used. If the coverage is still missing, the process is repeated, in the same order, but a year further from the intended year (Y). The process is repeated for as long as possible within the reported data, covering the years 2018–2024.

It should be noted that the reported incidence rates per population are estimates which are based on the estimated national population coverage of the AMR data, as reported by each country. The estimated incidence of bloodstream infections with resistant bacteria may therefore need to be interpreted with caution if the national population coverage is estimated as less than 100%. In addition, when national representativeness is considered by a country to be less than 'High', further caution must be exercised when interpreting the results. In tables with results for one country or where countries are specified, the estimated incidences of bloodstream infections with resistant bacteria are marked with a footnote if one or more of the three representativeness indicators (geographical, hospital and/or isolate representativeness) were not reported as 'High', or when the antimicrobial group/agent was tested for <90% of isolates.

For the EU, EU/EEA and each individual country, the statistical significance of temporal trends in the estimated incidence for 2019–2024 and the last five years (2020–2024) was assessed by negative binomial regression, and a p-value of <0.05 was considered significant.

National percentages

AMR (or for *S. pneumoniae* and penicillin, non-wild-type) percentages are presented for a single antimicrobial agent and/or group of antimicrobial agents. The bacterial species–antimicrobial agent combinations presented in this report for 2024 are shown in Table 2. When combining results for antimicrobial agents representing an antimicrobial group, the outcome is based on the most resistant result. For example, if the AST result of a bacterial species for imipenem is I and the AST result for meropenem is R, then the AST result for the group carbapenems, which comprises imipenem and meropenem, is set as R. The definition of combined AMR is determined as R to at least one antimicrobial agent in each of the antimicrobial groups (except for *S. pneumoniae*, for which combined AMR is calculated as combined penicillin non-wild-type and R to macrolides). Isolates with missing data for one or more of the required antimicrobial groups are excluded from the analysis of combined AMR. If fewer than 20 isolates are reported for a specific bacterial species–antimicrobial group combination in a country, percentages are not displayed in this report, except for the novel antimicrobials generally. AST results for novel antimicrobials with activity versus gram-negative bacilli are reported only for carbapenem-resistant isolates. In addition, we report the number of carbapenem-resistant isolates for which AST results for the novel antimicrobials are missing. The proportion of isolates with missing AST results for novel antimicrobials should be considered when interpreting the results, as a high number of missing data indicates that the testing or reporting is highly selective and therefore likely to generate an inflated resistance percentage.

The statistical significance of temporal trends in AMR percentages by country is calculated based on data for the last five years (2020–2024). EU/EEA countries that did not report data for all years within the period under consideration, or that reported fewer than 20 isolates for the specific bacterial species–antimicrobial agent/group combination in any year within the period are not included in the analysis. The statistical significance of trends is assessed by a chi-square test for trend, and a p-value of <0.05 is considered significant. An additional sensitivity analysis is performed when assessing the significance of the trends, by including only laboratories that continuously reported data for the full five-year period. This minimises bias due to changes in reporting laboratories over time (due to expansion of the surveillance network, for instance). In some cases, this restriction results in a considerably lower number of isolates when compared with the analysis that includes all laboratories. This analysis relies on countries consistently using the same code for the respective reporting laboratory.

Population-weighted EU/EEA mean percentage

A population-weighted EU/EEA mean percentage is calculated for each bacterial species–antimicrobial agent/group combination, based on data reported by EU/EEA countries. Country weightings are used to adjust for imbalances in reporting propensity and population coverage, as in most cases the total number of reported isolates by country does not reflect the population size.

The population-weighted EU/EEA mean percentage is determined by multiplying the AMR percentage for each country with the population weight (i.e. the proportion of the total EU/EEA population represented by each country) and summing the results. Weights are rescaled if AMR percentages are not available for one or more countries. Annual population data are retrieved from the Eurostat online database [11].

The statistical significance of temporal trends in AMR percentages for the population-weighted EU/EEA mean is calculated based on data for the last five years (2020–2024). EU/EEA countries that did not report data for all years within the period under consideration, or for which synthetic case-based data were not available for one year of missing data, or that reported fewer than 20 isolates for the specific bacterial species–antimicrobial agent/group combination in any year within the period are not included in the analysis. The statistical significance of trends is assessed by a chi-square test for trend, and a p-value of <0.05 is considered significant. An additional sensitivity analysis is performed when assessing the significance of the trends by including only laboratories that continuously reported data for the full five-year period. This minimises bias due to changes in reporting laboratories over time (due to expansion of the surveillance network, for instance). In some cases, this restriction results in a considerably lower number of isolates when compared with the analysis that includes all laboratories. This analysis relies on countries consistently using the same code for the respective reporting laboratory.

Combined resistance

The analysis of combined resistance excludes isolates with incomplete AST information for the antimicrobial groups covered. This analysis can also highlight bacterial species for which AMR results in EARS-Net may be biased, due to selective testing or reporting. For example, a high proportion of isolates with missing AST information on the antimicrobials included for one of the species under EARS-Net surveillance may indicate selective testing.

Definitions of geographical areas

Definitions of geographical areas are based on the definitions by the Publications Office of the EU [12]. The definitions are adjusted to only include EU/EEA countries and avoid countries being included in more than one geographical area.

- **Central and Eastern Europe:** Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia.
- **Northern Europe:** Denmark, Finland, Iceland, Norway, Sweden.
- **Southern Europe:** Cyprus, Greece, Italy, Malta, Portugal, Spain.
- **Western Europe:** France, Germany, Ireland, Liechtenstein, Luxembourg, Netherlands, Austria, Belgium.

Imputed national data applied for EU and EU/EEA estimates

Before pooling the respective EU and EU/EEA isolate data, for countries with one year of missing data but with data available for the years before and after that year (France 2023 data, except for *S. pneumoniae*), a dataset was created by linear interpolation, with the number of reported resistant and susceptible isolates for the relevant bacterial species-antimicrobial group/agent combination, using the observed data from the preceding and following year. These counts were expanded into a synthetic case-based dataset for the relevant year and country so that the marginal distribution of each binary variable matched the interpolated counts. These data were added to the reported national data for all EU and EU/EEA estimates, but not to the respective national estimates.

Before using national coverage data for EU and EU/EEA estimations, the coverage for countries with one year of missing data, but with data for the years before and after that year (France 2023 data, except for *S. pneumoniae*) was estimated as the mean coverage, based on the data reported for the preceding and following year.

Novel antimicrobials

In 2024, EARS-Net pilot-tested the collection of AST data on novel antimicrobials that have potential use for treatment of infections with carbapenem-resistant gram-negative bacteria. These novel antimicrobials were selected based on their inclusion in the 'Reserve' group of the 2023 WHO Access Watch Reserve (AWaRe) classification [13]. In 2024, countries could report available AST data for cefiderocol, ceftazidime-avibactam, ceftolozane-tazobactam, imipenem-relebactam, and meropenem-vaborbactam for *E. coli, K. pneumoniae, P. aeruginosa* and *Acinetobacter* spp. Starting in 2025, EARS-Net updated this list, with countries asked to report AST data for aztreonam-avibactam, cefiderocol, ceftazidime-avibactam, imipenem-relebactam, and meropenem-vaborbactam for *E. coli* and *K. pneumoniae*, and cefiderocol, ceftazidime-avibactam, ceftolozane-tazobactam, imipenem-relebactam, and meropenem-vaborbactam for *P. aeruginosa,* and cefiderocol for *Acinetobacter* spp..

The national 2024 results on novel antimicrobials are presented in the respective country summaries.

EASTR25

In 2025, DTU National Food Institute (Denmark) coordinated the 'ECDC survey regarding AST of six Reserve antimicrobials' ('EASTR25') at local/regional and national clinical laboratories in the EU/EEA that participated in the 2024 EARS-Net EQA. The objective of the survey was to collect information regarding their AST profiles for blood samples (as a minimum) involving the 'Reserve' group of the WHO AWaRe classification of antibiotics, used to treat infections with the four carbapenem-resistant gram-negative bacteria species included in the EARS-Net surveillance.

Between 27 March and 26 April 2025, 269 laboratories from all the EU/EEA countries except Iceland submitted survey data. Of these, 10 identified themselves as national reference laboratories, 36 as regional reference laboratories and 222 as local laboratories, while one laboratory did not report its laboratory type. Almost all described themselves as either a public laboratory (193 laboratories; 72%) or a 'public and private laboratory' (65 laboratories; 24%). In 2024, only 22 laboratories reported that they had not performed any, or an unknown number of AST on the novel antimicrobials for the EARS-Net pathogens included. These were located in 13 countries, 12 of which had at least one laboratory in the EASTR25 survey that reported having performed such a test that year.

Most laboratories (225/269 (84%) from 26 countries) reported that their criteria for selecting isolates for AST of the novel antimicrobials included either testing of all isolates/all blood isolates, isolates that had exhibited phenotypic carbapenem resistance in previous AST, or isolates with ESBL, carbapenemases or *AmpC* overproduction detected through molecular methods (for example PCR or whole-genome sequencing) (Table 3).

Overall, according to the survey, 20 or more EU/EEA countries had laboratories that tested for cefiderocol (all four pathogens), ceftazidime-avibactam (*E. coli, K. pneumoniae, P. aeruginosa)*, meropenem-vaborbactam (*E. coli, K. pneumoniae)* and ceftolozane-tazobactam (*P. aeruginosa*) (Table 4) in 2024.

The selection criteria for AST of the novel antimicrobials in the EU/EEA and the data on carbapenem resistance reported via EARS-Net, indicate that EARS-Net is missing data on novel antimicrobials for some EU/EEA countries (Table 3). Reasons for this could include these novel antimicrobials not yet being under national surveillance in the countries or the data not yet having been reported to EARS-Net. In addition, the survey results indicate that for several of the bacterial species-novel antimicrobial combinations there is potential data for at least two thirds of the EU/EEA countries, but the number of reporting countries in EARS-Net is uniformly lower (Table 4).

In summary, the survey results indicate that the selection criteria applied in most laboratories in the EU/EEA permit analysis of the antimicrobial results for the novel antimicrobials for carbapenem-resistant gram-negative bacteria at EU/EEA level. However, given the number of countries with missing data on the novel antimicrobials in the data collected by EARS-Net in 2025, EU/EEA-level analysis is not included in this report for 2024, and the national-level results are presented in each respective country summary.

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Table 1. Population and hospitals contributing data: coverage, representativeness and blood culture rate, EU/EEA, 2024

Country	Estimated population coverage[a] (%)	Geographical representativeness[b]	Hospital representativeness[c]	Isolate representativeness[d]	Blood culture rate (blood culture sets/ 1 000 patient-days)[e]
Austria	90	High	High	High	ND
Belgium	40[f]	Medium	Medium	High	145.0[f]
Bulgaria	45	Medium	Medium	Medium	12.2
Croatia	90	High	High	High	39.1
Cyprus	82	High	High	High	70.6
Czechia	70	High	High	High	23.4
Denmark	100	High	High	High	265.8
Estonia	100	High	High	High	38.4
Finland	82	High	High	High	188.7
France	57	High	High	High	61.5
Germany	50	High	High	High	ND
Greece	68	High	High	High	ND
Hungary	90	High	High	High	21.9
Iceland	100	High	High	High	72.0
Ireland	85	High	High	High	59.5
Italy	67	High	High	High	65.7
Latvia	90	High	High	Medium	20.1
Liechtenstein	40	Medium	Medium	Medium	1.5
Lithuania	100	High	High	High	14.6
Luxembourg	99	High	High	High	44.1
Malta	95	High	High	High	35.0
Netherlands	78	High	High	High	ND
Norway	94	High	High	High	91.7
Poland	20	Medium	Medium	High	57.7
Portugal	98	High	High	High	205.1
Romania	15	Low	Low	Low	32.9
Slovakia	53	High	High	High	31.6
Slovenia	99	High	High	High	66.8
Spain	29	Medium	High	High	588.1
Sweden	89	High	High	High	112.4

ND: no data available.

[a] *As estimated by the national focal points for AMR and/or operational contact points for AMR. Estimated national population coverage: mean population coverage (%) of laboratories reporting* Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Staphylococcus aureus, Enterococcus faecalis *and* Enterococcus faecium *to EARS-Net. Due to outliers in some countries,* Streptococcus pneumoniae *and* Acinetobacter *spp. are not included in the calculation.*

[b] *Geographical representativeness. High: all main geographical regions of the country are covered. Medium: most geographical regions of the country are covered. Low: only a few geographical areas of the country are covered.*

[c] *Hospital representativeness. High: the hospital selection is representative of the acute care hospital distribution in the country. Medium: the hospital selection is partly representative of the acute care hospital distribution in the country. Low: the hospital selection is insufficiently representative of the acute care hospital distribution in the country.*

[d] *Isolate representativeness. High: the isolate selection is representative of microorganisms causing invasive infections in the included hospitals. Medium: the isolate selection is partly representative of microorganisms causing invasive infections in the included hospitals. Low: the isolate selection is insufficiently representative of microorganisms causing invasive infections in the included hospitals.*

[e] *Blood culture rate (blood culture sets/1 000 patient-days): refers to the mean number of blood culture sets divided by the mean total of patient-days of hospitals served by laboratories that provided the blood culture sets performed, as reported for the following bacterial species:* Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Staphylococcus aureus, Enterococcus faecalis *and* Enterococcus faecium*, and multiplied by 1 000. The definition of a 'blood culture set' and a 'patient-day' might differ between countries and influence the estimate.*

[f] *Not including the country's* S. pneumoniae *network.*

Table 2. Bacterial species-antimicrobial group/agent combinations presented in this report for 2024

Bacterial species	Assessed antimicrobial group/agent resistance or specific resistance mechanism	Indicative antimicrobial agent(s)
Escherichia coli	Aminopenicillins	Ampicillin or amoxicillin
	Third-generation cephalosporins	Cefotaxime, ceftriaxone or ceftazidime
	Carbapenems	Imipenem or meropenem
	Fluoroquinolones	Ciprofloxacin, levofloxacin or ofloxacin
	Aminoglycosides	Gentamicin or tobramycin
	(Novel antibiotics and combinations)[a]	Aztreonam-avibactam, cefiderocol, ceftazidime-avibactam, imipenem-relebactam, or meropenem-vaborbactam
Klebsiella pneumoniae	Third-generation cephalosporins	Cefotaxime, ceftriaxone or ceftazidime
	Carbapenems	Imipenem or meropenem
	Fluoroquinolones	Ciprofloxacin, levofloxacin or ofloxacin
	Aminoglycosides	Gentamicin or tobramycin
	(Novel antibiotics and combinations) [a]	Aztreonam-avibactam, cefiderocol, ceftazidime-avibactam, imipenem-relebactam, or meropenem-vaborbactam
Pseudomonas aeruginosa	Piperacillin-tazobactam	Piperacillin-tazobactam
	Ceftazidime	Ceftazidime
	Carbapenems	Imipenem or meropenem
	Fluoroquinolones	Ciprofloxacin or levofloxacin
	Aminoglycosides	Tobramycin
	(Novel antibiotics and combinations) [a]	Cefiderocol, ceftazidime-avibactam, ceftolozane-tazobactam, imipenem-relebactam, or meropenem-vaborbactam
Acinetobacter species	Carbapenems	Imipenem or meropenem
	Fluoroquinolones	Ciprofloxacin or levofloxacin
	Aminoglycosides	Gentamicin or tobramycin
	(Novel antibiotics and combinations) [a]	Cefiderocol
Staphylococcus aureus	MRSA	Cefoxitin or oxacillin[b]
	Fluoroquinolones	Ciprofloxacin, levofloxacin or norfloxacin[c]
	Rifampicin	Rifampin
Streptococcus pneumoniae	Penicillins	Penicillin or oxacillin[d]
	Third-generation cephalosporins	Cefotaxime or ceftriaxone
	Fluoroquinolones	Levofloxacin, norfloxacin or moxifloxacin[e]
	Macrolides	Azithromycin, clarithromycin or erythromycin
Enterococcus faecalis	High-level aminoglycoside resistance	Gentamicin
Enterococcus faecium	Aminopenicillins	Ampicillin or amoxicillin
	High-level aminoglycoside resistance	Gentamicin
	Vancomycin	Vancomycin

MRSA: meticillin-resistant Staphylococcus aureus.

[a] *Analysed for carbapenem-resistant gram-negative bacteria.*
[b] *MRSA is based on AST results for cefoxitin or, if unavailable, oxacillin. AST results reported for cloxacillin, dicloxacillin, flucloxacillin or meticillin are accepted as a marker for oxacillin resistance if oxacillin is not reported. If no phenotypic results are available, data from molecular confirmation tests (detection of* mecA *gene by PCR or a positive PBP2A-agglutination test) are accepted as a marker for MRSA.*
[c] *AST results for norfloxacin are accepted if neither ciprofloxacin nor levofloxacin results are available.*
[d] *Penicillin results are based on penicillin or, if not available, oxacillin.*
[e] *AST results for norfloxacin are accepted if neither levofloxacin nor moxifloxacin results are available.*

Table 3. Criteria used to select isolates for antimicrobial susceptibility testing of reserve antimicrobials[a] among gram-negative bacteria[b], reported by clinical laboratories that responded to the EASTR25 survey (269 laboratories in 29 EU/EEA countries) and number of EU/EEA countries reporting 2024 data on AST results for the novel antimicrobials in gram-negative carbapenem-resistant bacteria

EASTR25 survey				EARS-Net surveillance			
				AST results for novel antimicrobials in gram-negative carbapenem-resistant bacteria[c]		Gram-negative carbapenem-resistant bacteria[d]	
Reported criteria	Number of laboratories	Number of countries	Countries[e]	Number of countries	Countries	Number of countries	Countries
All isolates are tested, from all samples/all isolates recovered from blood are tested	82	11	CZ, DE[f], EL, ES, FR, HR, IT, LT, PL, PT, RO	19	AT, BE, CY, CZ, DE, EE, EL, FR, HU, IE, IS, IT, LU, LV, NO, PL, PT, RO, SI	29	AT, BE, BG, CY, CZ, DE, DK, EE, EL, ES, FI, FR, HR, HU, IE, IS, IT, LT, LU, LV, MT, NL, NO, PL, PT, RO, SE, SI, SK
Isolates are tested if phenotypic carbapenem resistance was detected in previous AST	134	26	AT, BE, BG, CY, CZ, DE, DK, EE, EL, ES, FI, FR, HR, IE, IT, LT, LU, LV, NL, NO, PL, PT, RO, SE, SI, SK,				
Isolates are tested if ESBL, carbapenemases or *AmpC* overproduction were detected through molecular methods (for example PCR or whole-genome sequencing)	9	7	EE, EL, FI, HR, IE, IT, NL				
Isolates are tested if previous AST revealed phenotypic resistance towards other antimicrobials (e.g. colistin)	8	6	DE, FR, IT, MT, SI, SK				
Not applicable, AST is not performed for these antimicrobials	9	8	BE, EE, FI, IE, IT, LT, NL, NO				
Other criteria	27	17	AT, BE, CZ, EL, ES, FR, HU, IE, IT, LI, LV, NL, NO, PT, SE, SK				

[a] *Cefiderocol, ceftazidime-avibactam, ceftolozane-tazobactam, imipenem-relebactam, meropenem-vaborbactam and aztreonam-avibactam.*
[b] Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa *and* Acinetobacter *spp. included in EARS-Net surveillance; EASTR25 – the ECDC survey regarding AST of six Reserve antimicrobials.*
[c] *Not reporting data could be due to no gram-negative carbapenem-resistant bacteria being detected under EARS-Net surveillance.*
[d] *If data are available for ≥ 20 isolates.*
[e] *n=29 countries, as all EU/EEA countries except Iceland responded to the EASTR25 survey. The reported criteria can differ between laboratories in a country.*
[f] *Only one regional reference laboratory, for the other countries this included local laboratories.*

Table 4. Number of countries and laboratories performing antimicrobial susceptibility testing for novel antimicrobials for the four gram-negative bacteria under EARS-Net surveillance in the EU/EEA in 2024 according to the EASTR25 survey (269 laboratories in 29 EU/EEA countries) and the total number of EU/EEA countries reporting the respective EARS-Net data for 2024

Pathogen	Novel antimicrobial	EASTR25 survey		EARS-Net surveillance	
		Number of countries	Number of laboratories	Number of countries	Countries
Escherichia coli	aztreonam-avibactam	15	41		
	cefiderocol	23	104	4	DE, FR, IS, RO
	ceftazidime-avibactam	27	210	11	BE, CY, DE, EL, FR, HU, IS, IT, PL, PT, RO
	imipenem-relebactam	16	116	4	DE, EL, FR, IT
	meropenem-vaborbactam	20	141	6	DE, EL, FR, IS, IT, PL
Klebsiella pneumoniae	aztreonam-avibactam	16	45	2	CZ, HU
	cefiderocol	24	131	10	AT, BE, CZ, DE, EE, FR, HU, IT, PL, RO
	ceftazidime-avibactam	28	233	18	AT, BE, CY, CZ, DE, EE, EL, FR, HU, IE, IT, LU, LV, NO, PL, PT, RO, SI
	imipenem-relebactam	17	142	9	AT, CZ, DE, EL, FR, HU, IT, PL, RO
	meropenem-vaborbactam	20	162	11	AT, BE, CY, CZ, DE, EL, FR, IT, PL, PT, RO
Pseudomonas aeruginosa	cefiderocol	25	134	10	AT, BE, CZ, DE, EE, FR, HU, IS, PL, RO
	ceftazidime-avibactam	27	224	19	AT, BE, CY, CZ, DE, EE, EL, FR, HU, IE, IS, IT, LU, LV, NO, PL, PT, RO, SI
	ceftolozane-tazobactam	26	218	14	AT, BE, CZ, DE, EE, EL, FR, HU, IT, LV, NO, PL, PT, RO
	imipenem-relebactam	18	145	9	AT, CZ, DE, EL, FR, HU, IT, PL, RO
	meropenem-vaborbactam	19	139	8	AT, BE, CZ, DE, EL, FR, PL, RO
Acinetobacter spp.	cefiderocol	24	123	8	CZ, DE, EE, FR, HU, IT, PL, RO

Overview

EU/EEA country participation in EARS-Net

In 2025, all EU Member States and EEA countries reported data for 2024 to EARS-Net. Twenty (66.7%) of these 30 countries reported that their participating laboratories had a population coverage of over two-thirds of the national population, including 13 countries that reported having a coverage of 90.0% or more. However, six countries reported data with a coverage of less than half of the population (Table 1).

Twenty-three (76.7%) of the 30 participating countries indicated that their reported data had a high national representativeness based on three metrics: geographical areas covered, acute care hospitals included, and microorganisms that caused invasive infections in these hospitals. A further two countries reported that the representativeness was 'high' for two of the three metrics, and one country reported representativeness as 'low' for all three metrics (Table 1).

The blood culture rate in hospitals served by the laboratories that reported data to EARS-Net for 2024 was reported by 26 countries. The blood culture rates, measured as blood culture sets per 1 000 patient-days, varied widely among the countries. However, these estimates should be interpreted with caution since the definitions of a 'blood culture set' and a 'patient-day' may differ between and within countries.

In 2024, all but one country reported isolate data for all eight bacterial species under surveillance by EARS-Net (*E. coli*, *K. pneumoniae*, *P. aeruginosa*, *Acinetobacter* spp., *S. pneumoniae*, *S. aureus*, *E. faecalis* and *E. faecium*). Liechtenstein reported isolate data for *E. coli*, *K. pneumoniae*, *S. pneumoniae*, *S. aureus, E. faecalis* and *E. faecium*.

Based on the laboratory identifiers provided by the countries, the number of laboratories participating in EARS-Net has increased since 2020, indicating that national AMR surveillance systems are being strengthened in the EU/EEA. For 2024, data were reported from 1 993 laboratories. Moreover, 791 laboratories were identified as having reported data for each year during the period 2020–2024.

As part of the reporting of AST data for novel antimicrobials, 19 (65.5%) of the 29 countries that reported carbapenem-resistant gram-negative bacteria for 2024 reported data on susceptibility to at least one novel antimicrobial (Table 3). Due to the amount of missing data (Table 4), these data were analysed at country level, but not at EU/EEA level.

Epidemiology of bacterial species under surveillance in EARS-Net in the EU/EEA

Progress towards the EU targets on antimicrobial resistance

Since 2023, there have been recommended EU targets on AMR to reduce the total EU incidence of meticillin-resistant *S. aureus* (MRSA), third-generation cephalosporin-resistant *E. coli* and carbapenem-resistant *K. pneumoniae* bloodstream infections by 15%, 10% and 5% by 2030 against the baseline year 2019, respectively [1].

In the data for 2024, the estimated total EU incidence of MRSA bloodstream infections was 4.48 per 100 000 population (EU country range 0.55–13.63) (Table 6). This was 20.4% lower than in 2019 (baseline year) and 0.31 per 100 000 population lower than the 2030 target of 4.79 per 100 000 population. For the EU overall, a statistically significant decreasing trend was detected between 2019 (baseline year) and 2024. At country level, 12 countries (Bulgaria, Czechia, Denmark, France, Germany, Ireland, Italy, Luxembourg, Malta, Poland, Portugal and Slovakia)[1] had already reached their respective target. However, six EU countries had seen a statistically significant increasing trend in the estimated incidence since 2019.

The estimated total EU incidence of third-generation cephalosporin-resistant *E. coli* bloodstream infections was 11.03 per 100 000 population (EU country range 3.75–22.79) in 2024 (Table 5). This was 5.9% higher than in 2019 (baseline year) and 1.65 per 100 000 population higher than the 2030 target of 9.38 per 100 000 population. For the EU overall, no statistically significant trend was detected between 2019 (baseline year) and 2024. At country level, four countries (Bulgaria, Denmark, Finland and France)[2] had already reached their respective targets. Meanwhile, eight EU countries had seen a statistically significant increasing trend in the estimated incidence since 2019.

The estimated total EU incidence of carbapenem-resistant *K. pneumoniae* bloodstream infections was 3.51 per 100 000 population (EU country range 0.02–20.31) in 2024 (Table 7). This was 61.0% higher than in 2019 (baseline year) and 1.44 per 100 000 population higher than the 2030 target of 2.07 per 100 000 population. For the EU overall, a statistically significant increasing trend was detected between 2019 (baseline year) and 2024. At country level, five countries had reached their respective target (Finland, France, Ireland, Luxembourg and Malta). However, since 2019 a statistically significant increasing trend in the estimated incidence has been noted in 18 EU countries.

[1] The results for Bulgaria, Denmark, Germany and Poland should be interpreted with caution.
[2] The results for Bulgaria and Denmark should be interpreted with caution.

Epidemiological summary

When interpreting the results in this report, which mainly focusses on the five-year period 2020–2024, it is important to take into consideration the COVID-19 interventions and pandemic-associated pressures on healthcare in 2020 and 2021. Moreover, EU and EU/EEA analyses do not include countries that reported data to EARS-Net for less than three years during this time period. For France, which lacked 2023 isolate-level data for bacteria other than *S. pneumoniae*, data could be imputed from 2022 and 2024 and these data were included in EU and EU/EEA analyses – unlike the previous annual epidemiological report where 2023 data for France were not included other than for *S. pneumoniae*.

Compared to 2020, the total number of reported invasive isolates for the EU/EEA increased from 339 189 to 474 364 in 2024. For bacteria, the highest estimated EU/EEA incidence of invasive isolates from all reporting laboratories in 2024 was *E. coli* (73.9 per 100 000 population), followed by *S. aureus* (37.9 per 100 000 population), *K. pneumoniae* (25.3 per 100 000 population), *E. faecalis* (14.6 per 100 000 population), *P. aeruginosa* (11.1 per 100 000 population), *E. faecium* (10.6 per 100 000 population), *S. pneumoniae* (8.0 per 100 000 population) and *Acinetobacter* spp. (4.5 per 100 000 population) (Table 8). This ranking did not differ from the ranking for 2023 (Table 8). Compared to 2020, all the estimated incidences of invasive isolates under EARS-Net surveillance in the EU/EEA had increased (Table 8). The largest increase in estimated incidence occurred for *S. pneumoniae* (+116.2%; from 3.7 to 8.0) followed by *K. pneumoniae* (+31.8%; from 19.2 to 25.3). Since 2021, *S. pneumoniae* has increased on an annual basis. There have also been annual increases for *E. coli, K. pneumoniae* and *P. aeruginosa* since 2021 (Table 8).

For AMR, the situation reported by EU/EEA countries to EARS-Net for 2024 varied widely, depending on the bacterial species, antimicrobial group and geographical region, as demonstrated by varying AMR percentages, and also often the estimated incidence of bloodstream infections with AMR (Table 9a, Table 9b, Figures 1–10 and 'Country summaries').

Overall, in 2024 more than 80% of the estimated EU/EEA incidences of bloodstream infections with AMR under EARS-Net surveillance exceeded one per 100 000 population. Moreover, the results showed increases from 2020 to 2024 for more than two thirds (70.4%) of the combinations, ranging from +5.3% to +129.2% (Table 9a). In particular, there was a statistically significant increasing trend in all AMR combinations for *K. pneumoniae* and *S. pneumoniae,* and for aminopenicillin resistance, third-generation cephalosporin resistance, carbapenem resistance, fluoroquinolone resistance and combined third-generation cephalosporin, fluoroquinolone, and aminoglycoside resistance in *E. coli* and for piperacillin-tazobactam resistance and ceftazidime resistance in *P. aeruginosa*.

Overall, in 2024, the population-weighted EU/EEA mean AMR percentages exceeded 10% in 85.2% of the combinations under regular surveillance. However, for some of the pathogens the pattern of change in the population-weighted EU/EEA mean AMR percentages differed from the estimated EU/EEA incidence of bloodstream infections with AMR. From 2020 to 2024, the results showed increases for just over a quarter (25.9%) of the combinations, ranging from +0.1% to +2.2% (Table 9b). The AMR percentage for most of the species–antimicrobial combinations showed either a significantly decreasing or no significant trend. The exceptions were aminopenicillin resistance, third-generation cephalosporin resistance and carbapenem resistance in *E.* coli, carbapenem resistance in *K. pneumoniae*, and penicillin non-wild-type and macrolide resistance, including the combination of these two types of resistance, in *S. pneumoniae* (Table 9b).

The estimated AMR incidence and AMR percentage may move in different directions, as the AMR percentage also depends on the incidence of infections by susceptible bacteria.

In 2024, the bacterial species with the highest estimated EU/EEA incidence of invasive infections (Table 8) and the highest estimated EU/EEA incidences of bloodstream infections with AMR was *E. coli* (Table 9a). Although resistance to carbapenems was rare (Table 9a), all the estimated EU/EEA incidences of *E. coli* bloodstream infections with AMR under EARS-Net surveillance (aminopenicillins, fluoroquinolones, third-generation cephalosporins, aminoglycosides and carbapenems) increased compared to 2020, and there was a significantly increasing trend for aminopenicillin resistance, fluoroquinolone resistance, third-generation cephalosporin resistance, and carbapenem resistance (Table 9a). The trend pattern was similar for the respective EU/EEA population-weighted mean percentages, with one exception: a significant decreasing trend in the EU/EEA population-weighted mean percentage for fluoroquinolone resistance (Table 9b). Resistance to multiple antimicrobial groups was common. During the period 2020–2024, the estimated EU/EEA incidence of bloodstream infections with combined AMR showed a statistically significant increasing trend, however the equivalent EU/EEA population-weighted mean showed no statistically significant trend during the same period (Table 9b). With the exception of carbapenem resistance, which remained low in all countries, large inter-country variations were noted for all the antimicrobial groups under surveillance (Table 9a and 9b).

During the period 2020–2024, all the estimated EU/EEA incidences of *K. pneumoniae* bloodstream infections with AMR under EARS-Net surveillance (fluoroquinolones, third-generation cephalosporins, aminoglycosides and carbapenems) increased and showed significantly increasing trends (Table 9a). With the EU/EEA population-weighted mean percentage, this trend was only seen for carbapenem resistance (Table 9b). For the other antimicrobial groups, the EU/EEA population-weighted mean percentage showed statistically significant decreasing trends. The estimated EU/EEA incidence of combined resistance to fluoroquinolones, third-generation cephalosporins and aminoglycosides in *K. pneumoniae* bloodstream infections showed a statistically significant increasing trend during the period 2020–2024, whereas the equivalent EU/EEA population-weighted mean showed a statistically significant decreasing trend during the same period (Table 9b). Large inter-country variations were noted for all the antimicrobial groups under surveillance (Table 9a and 9b).

Between 2020 and 2024, the estimated EU/EEA incidence of *P. aeruginosa* bloodstream infections with resistance to piperacillin-tazobactam and ceftazidime increased and showed a significantly increasing trend (Table 9a). However,

compared to 2023, all the estimated EU/EEA incidences of bloodstream infections with *P. aeruginosa* with AMR under EARS-Net surveillance (piperacillin-tazobactam, ceftazidime, fluoroquinolones, aminoglycosides and carbapenems) decreased (Table 9a). For aminoglycosides and combined resistance, these results should be interpreted with caution due to limited AST in many of the EU/EEA countries (see 'Country summaries'). For 2020–2024, the EU/EEA population-weighted mean AMR percentage trends decreased significantly for all the percentages (Table 9b). At country level for 2024, 20 countries reported >10% carbapenem resistance, nine of which reported >20% carbapenem resistance ('Country summaries'). Resistance to two or more antimicrobial groups was frequent (Table 12). During the period 2020–2024, the estimated EU/EEA incidence of combined resistance, defined as resistance to at least three of the antimicrobial groups under surveillance, showed no statistically significant trend in *P. aeruginosa* bloodstream infections, whereas the equivalent EU/EEA population-weighted mean percentage, showed a statistically significant decreasing trend (Table 9b). Large inter-country variations were noted in all antimicrobial groups for the AMR percentages (Table 9b), but less so for the estimated incidences of AMR bloodstream infections (Table 9a).

Between 2020 and 2024, only the estimated EU/EEA incidence of *Acinetobacter* spp. bloodstream infections with resistance to aminoglycosides showed a statistically significant decreasing trend (Table 9a). However, all the estimated EU/EEA resistance incidences had decreased compared to the high incidences seen in 2021 (particularly high) and 2023. The EU/EEA population-weighted mean AMR percentage showed statistically significant decreasing trends for all the antimicrobial groups under surveillance in the EU/EEA between 2020 and 2024 (Table 9b). The estimated EU/EEA incidence of combined resistance to carbapenems, fluoroquinolones and aminoglycosides in bloodstream infections increased between 2020 and 2021, and then decreased until 2024. There was no statistically significant trend for the period 2020−2024. The EU/EEA population-weighted mean percentage of combined resistance showed a similar pattern, but with a statistically significant decreasing trend. Large inter-country variations were noted for all antimicrobial groups (Table 9a and 9b).

The estimated EU/EEA incidence of MRSA bloodstream infections showed no statistically significant trend for the period 2020–2024 (Table 9a), whereas the EU/EEA population-weighted mean MRSA percentage exhibited a significantly decreasing trend (Table 9b). Moreover, the MRSA percentage either showed a statistically significant decreasing trend or no statistically significant trend (i.e. neither decreasing nor increasing) in most EU/EEA countries. With MRSA, combined resistance to another antimicrobial group was quite common. Large inter-country variations were noted for MRSA (Table 9a and 9b).

Compared to 2020, the 2024 estimated EU/EEA incidences of bloodstream infections with resistant *S. pneumoniae* more than doubled and there was a statistically significant increasing trend for the EU/EEA for all incidences between 2020 and 2024 (Table 9a). These trends were also seen in the equivalent EU/EEA population-weighted mean percentages (Table 9b). The estimated EU/EEA incidence of combined AMR (i.e. macrolide resistance and penicillin non-wild-type) in *S. pneumoniae* bloodstream infections had also more than doubled compared to 2020, and showed a statistically significant increasing trend during the period 2020–2024. The EU/EEA population-weighted mean percentage for combined resistance also showed a significantly increasing trend (Table 9b). At country level, 18 EU/EEA countries showed this trend in the incidence of penicillin non-wild-type *S. pneumoniae* bloodstream infections for 2020–2024, and 20 EU/EEA countries showed an equivalent trend in the incidence of macrolide-resistant *S. pneumoniae* bloodstream infections for 2020–2024 ('Country summaries'). Large inter-country variations in AMR percentages were noted for all antimicrobial groups (Table 9b), although there was less inter-country variation in the estimated incidences.

During the period 2020−2024, the estimated EU/EEA incidence of high-level gentamicin-resistant *E. faecalis* bloodstream infections increased from 2020 to 2021, before decreasing until 2024 with a statistically significant decreasing trend (Table 9a). However, it should be noted that for each year more than one third of the countries reported that susceptibility to gentamicin was tested for <90% of isolates ('Country summaries'). The EU/EEA population-weighted mean percentage has been decreasing since 2020 (Table 9b) and showed a significantly decreasing trend for the period 2020–2024. However, at country level seven countries reported an estimated incidence of high-level gentamicin resistance above three per 100 000 population ('Country summaries'). Large inter-country variations in AMR percentages were noted (Table 9b) although there was less variation in the estimated incidence.

Between 2020 and 2024, although the estimated EU/EEA incidence of vancomycin-resistant *E. faecium* bloodstream infections did increase compared to 2020, it did not show a significantly increasing trend (Table 9a). While at country level seven countries showed a statistically significant increasing trend, the incidence decreased compared to 2021 and 2022. The EU/EEA population-weighted mean percentage of vancomycin-resistant *E. faecium* was lower than that for 2020, but the trend was not significant (Table 9b). AMR to two or more antimicrobial groups was common (Table 16). For the estimated incidence of vancomycin-resistant *E. faecium* bloodstream infections, 14 countries reported an incidence below 0.50 per 100 000 population ('Country summaries') and three countries reported an incidence above 5.00 per 100 000 population. Twelve countries reported vancomycin-resistant *E. faecium* percentages below 5% (Figure 10) and ten countries reported percentages above 25%.

In general, higher AMR percentages and estimated incidences of bloodstream infections with AMR were reported by countries in southern, central and eastern Europe.

For each bacterial species, country-specific information on the estimated incidence of antimicrobial-resistant bloodstream infections (including the recommended EU targets on AMR); the percentage of invasive isolates with AMR; data availability, and the percentage of ICU patients is available in the country summaries. Results by age group and sex are available in ECDC's Surveillance Atlas of Infectious Diseases [2]. As of 2024, the country summaries also include information on susceptibility to novel antimicrobials among gram-negative carbapenem-resistant isolates.

Discussion

In 2025, all EU/EEA countries reported data for 2024 to EARS-Net. Representativeness, as reported by the countries, was high at 77%. This indicates that, although all EU/EEA countries are included in EARS-Net, in some countries work is still needed to improve surveillance representativeness.

The EARS-Net data indicated that there had been a general increase in the EU/EEA estimated incidences of invasive infections between 2020 and 2024. This could potentially reflect changes in the EU/EEA population, such as an increase in the number of people vulnerable to developing these severe infections over time, due to factors such as aging, invasive medical treatments and immunosuppression.

This report showed that while the EU target for the incidence of MRSA bloodstream infections had already been reached by 2024, the results for the other two EU targets were not on track. The estimated EU incidence of third-generation cephalosporin-resistant *E. coli* bloodstream infections with a 10% reduction target increased by more than 5% compared to 2019 (baseline year). Meanwhile, the estimated EU incidence of carbapenem-resistant *K. pneumoniae* bloodstream infections increased by over 60% compared to 2019 (baseline year), which differs substantially from the target of a 5% reduction by 2030. This indicates the need to rapidly strengthen prevention and control actions in the EU, as highlighted in the Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach [1].

Overall, AMR levels remained high in the EU/EEA in 2024, as in previous years. Nevertheless, the AMR situation reported by EU/EEA countries varied widely, depending on the bacterial species, antimicrobial group and geographical region. In general, higher AMR percentages and estimated incidences of bloodstream infections with AMR were reported by countries in southern, central and eastern Europe.

Increases in the estimated EU/EEA incidences of bloodstream infections with resistant bacteria were observed not only for two of the above-mentioned AMR-pathogen combinations with an EU target, but also for many other bacteria and antimicrobial groups under surveillance. Even though the COVID-19 pandemic-associated interventions and pressures on healthcare during 2020–2021 could have influenced the estimated incidence pattern for invasive isolates and their resistance during the period 2020–2024, the increases in the estimated incidences are a cause for concern.

Among the most worrying developments are:

- the increasing carbapenem resistance in *K. pneumoniae* together with the recent ECDC assessment that the probability of further spread in the EU/EEA can be considered high [3], especially in combination with the presence of genetic markers of hypervirulence [4];
- the increasing estimated AMR incidences (including for carbapenems) for *E. coli* – a bacterium that is one of the most common causes of bloodstream infections in Europe, indicating that the EU/EEA is not progressing in the right direction for *E. coli*;
- the doubling of the estimated AMR incidences for *S. pneumoniae* since 2020, with increasing trends in a majority of the EU/EEA countries. This increase could possibly reflect the lifting of non-pharmaceutical interventions (NPIs) for SARS-CoV-2, however this should not detract from the increasing AMR incidences and the trend noted at EU/EEA level and in a majority of EU/EEA countries;
- the increase in the estimated EU/EEA incidence of vancomycin-resistant *E. faecium* bloodstream infections compared to 2020, with statistically significant increasing trends observed for several countries.

On the other hand, there are also encouraging developments at EU/EEA level. For example, the population-weighted mean MRSA percentage and the estimated incidence of MRSA bloodstream infections have decreased overall during the last five years. In addition, the high levels of AMR among *Acinetobacter* spp. noted in 2021 decreased in subsequent years, suggesting that efforts to improve the situation may have had an effect. Another example is AMR in *P. aeruginosa.* All the estimated EU/EEA incidences of *P. aeruginosa* bloodstream infections with AMR have decreased since 2023, and the EU/EEA AMR percentages for 2020–2024 showed statistically significant decreasing trends. However, these results should be interpreted with caution for aminoglycosides and combined resistance due to limited AST in many of the EU/EEA countries.

Nevertheless, although there are signs that the AMR situation is improving at EU/EEA level for some of the EARS-Net pathogens, the situation at country level is still a cause for concern. For *S. aureus,* MRSA continues to show an increasing trend in some countries. For *P. aeruginosa*, high AMR percentages were observed in several countries and carbapenem resistance was common among the tested invasive isolates. As *P. aeruginosa* is intrinsically resistant to many antimicrobial agents, additional acquired resistance is further complicating the treatment of *P. aeruginosa* infections. Moreover, *P. aeruginosa* is one of the major causes of healthcare-associated infection in Europe [5-6]. In addition, *Acinetobacter* spp. continue to display high EU/EEA population-weighted mean AMR percentages and the estimated incidence of combined resistance in some countries is high. Since *Acinetobacter* spp. are also intrinsically resistant to many antimicrobial agents, additional acquired AMR is further complicating treatment of *Acinetobacter* spp. infections. For *E. faecalis*, a high estimated incidence of high-level gentamicin-resistant *E. faecalis* bloodstream infections was reported in over one fifth of the EU/EEA countries in 2024. Even though the results should be interpreted with caution due to limited AST in many of the EU/EEA countries, this indicates that antimicrobial-resistant enterococci remain a major challenge for infection prevention and control (IPC) in Europe.

By providing an overview of the wide variability in the estimated incidences of bloodstream infections with AMR and AMR percentages across EU/EEA countries in 2024 (see 'Country summaries'), the report suggests that there are further opportunities for significant AMR reduction through interventions to improve IPC and antimicrobial stewardship practices. For example, for carbapenem-resistant *K. pneumoniae* and other carbapenem-resistant Enterobacterales (CRE), the recently updated ECDC rapid risk assessment on CRE noted that the spread could be reduced by consistently applied IPC and antimicrobial stewardship, and the impact mitigated by measures such as timely laboratory detection and infection management [3].

The concerns raised regarding CRE, specifically carbapenem-resistant *K. pneumoniae* and carbapenem-resistant *E. coli,* led to the adoption of a Health Security Committee (HSC) opinion on this topic in May 2025 [7]. The HSC opinion noted that the deteriorating situation may have been influenced by the COVID-19 pandemic, as well as war casualties and patients transferred from Ukraine since 2022 [8]. The HSC opinion also stated that CRE pose a threat to EU preparedness in future pandemics or significant mass casualty events, and emphasised the importance of reducing the spread. To counteract the deteriorating situation for CRE, the HSC opinion proposed measures for the EU/EEA, including support that can be provided by the recently established European Reference Laboratory on AMR (EURL-PH-AMR), the EU guidelines on IPC in human health developed by the European Commission in collaboration with ECDC, to be published in 2026, and the European Commission support of research and access to antimicrobials. Measures at EU/EEA country level include CRE national management teams and management plans.

When interpreting the EARS-Net data, it is important to be mindful of the structure of the surveillance system, including variations in national blood culture rates, as well as changes in the national surveillance systems and in EARS-Net over time. An example of a resulting limitation to EARS-Net is that, although ECDC published the report 'Operational public health considerations for the prevention and control of infectious diseases in the context of Russia's aggression towards Ukraine' [9] which specifically raises the issue of multi-drug resistant organisms, data reported to EARS-Net cannot assess the magnitude of the impact of Russia's war of aggression on Ukraine in terms of AMR occurrence in the EU/EEA. Another limitation is that EARS-Net currently only covers eight pathogens. However, other relevant pathogens may be covered at country level and several of the pathogens are covered by other disease networks coordinated by ECDC. For example, EURGen-Net recently published an investigation into carbapenemase-producing *Providencia stuartii* [10]. This investigation concluded that systematic surveillance of carbapenem-resistant *P. stuartii* was needed in EU/EEA and adjacent countries. One previous limitation of EARS-Net was the lack of AST data on novel antimicrobials for treatment of carbapenem-resistant gram-negative bacteria. However, as of 2025 these data are now being collected and presented at country level (see 'Country summaries').

The European Health Union was created in 2020 to better protect the health of EU citizens [11]. This included strengthened mandates for ECDC and the European Medicines Agency (EMA), the creation of the European Health Emergency preparedness and Response Authority (HERA) and a new Regulation on serious cross-border threats to health, adopted by the Council on 24 October 2022 [12]. Moreover, a large budget is available under the EU4Health programme (EUR 5.3 billion for the period 2021–2027), which is one of the main instruments for the European Health Union, dedicated to wider policy areas and including action on AMR.

At the global level, the Political Declaration of the High-Level Meeting on AMR at the United Nations (UN) General Assembly (September 2024) also highlighted the importance of AMR as a health threat [13]. The Declaration called for the establishment of an independent panel to collect evidence for action against AMR and the European Commission has declared that it will be providing funds for the establishment of such a panel [14].

Public health implications

Estimates based on EARS-Net data from 2020 indicate that each year more than 35 000 people die in the EU/EEA as a direct consequence of antimicrobial-resistant infections [15]. The overall poor progress towards the EU targets on AMR and the many increases in the estimated EU/EEA incidences of bloodstream infections with resistant bacteria highlight the urgent need for intensified public health action against AMR.

The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01), adopted in 2023, encourages Member States to develop and implement national action plans against AMR, and highlights the need for them to allocate appropriate human and financial resources for the effective implementation of these plans [1].

Public health interventions to tackle AMR can have a significant positive impact on population health and future healthcare expenditure in the EU/EEA. A mixed intervention package has been estimated to potentially prevent nearly 613 000 resistant infections and avoid more than 10 000 deaths per year in the EU/EEA. The combined health expenditure reduction and productivity gains from such a package would be about three times higher than the average cost of implementing the package [16].

In the absence of stronger, and swifter public health action, it is unlikely that the EU will reach all its AMR targets by 2030. Moreover, AMR will continue to jeopardise EU preparedness, leading to an increased number of infections with antimicrobial-resistant bacteria that will be more difficult to treat, greater challenges for patient safety and a rise in AMR-related deaths.

Table 5. Third-generation cephalosporin-resistant *Escherichia coli* bloodstream infections, EU/EEA countries, 2019 and 2024: estimated incidence, trend, change in proportion, estimated incidence and estimated total number of cases, and target as percentage reduction and estimated incidence in 2030

Country[a]	Estimated incidence[b] (n per 100 000 population)							Progress towards target			Target[c]	
	2019	2020	2021	2022	2023	2024	Trend 2019–2024[d]	Change in estimated incidence (%) 2019–2024	Change in estimated incidence (n per 100 000 population) 2019–2024	Changes in estimated number of cases 2019–2024*	Recommended change (%) 2019–2030	Target 2030 (n per 100 000 population)
Liechtenstein	ND	ND	ND	6.36#	0.00#	**0.00#**	NA	NA	NA	NA	NA	NA
Bulgaria	4.05#	3.24#	2.95#	2.92#	3.68#	**3.75#**	-	-7.4	-0.30	-42	0	4.05
Norway	5.03	4.32	4.16	4.27	4.34	**5.18**	-	+3.0	+0.15	+19	NA	NA
Greece	2.58#	3.86#	3.52#	3.99	5.61	**5.4**	NA	+109.3	+2.82	+285	0	2.58
France	8.6	5.52	4.2	4.01	ND	**5.74**	NA	-33.3	-2.86	-1 830	-10	7.74
Netherlands	4.54	3.97	3.47	4.29	4.62	**5.84**	-	+28.6	+1.30	+263	0	4.54
Croatia	5.31	4.22	3.34	4.93	7.56	**5.9**	-	+11.1	+0.59	+12	0	5.31
Denmark	6.61	6.08^	5.72^	6.01^	5.61^	**6.09^**	-	-7.9	-0.52	-21	-5	6.28
Slovakia	6.39	6.45	4.91	5.98	5.12	**6.64**	-	+3.9	+0.25	+12	-5	6.07
Finland	8.02	7.26	7.21	5.78	6.46	**6.7**	↓	-16.5	-1.32	-67	-10	7.22
Hungary	5.65	4.49	5.75	6.64	6.81	**7.37**	↑	+30.4	+1.72	+154	0	5.65
Slovenia	7.67	8.24	7.47	7.43	6.78	**7.37**	-	-3.9	-0.30	-3	-10	6.90
Ireland	8.28	7.07	6.01	6.18	6.7	**7.54**	-	-8.9	-0.74	-3	-10	7.45
Austria	7.14	6.35	5.71	5.25	6.6	**7.9**	-	+10.6	+0.76	+91	-10	6.43
Estonia	7.93	6.09	5.64	8.86	9.08	**8.07**	-	+1.8	+0.14	+6	-10	7.14
Czechia	6.56	4.65	4.94	6.25	8.15	**8.83**	↑	+34.6	+2.27	+264	-5	6.23
Poland	7.44#	6.24#	5.87#	6.98#	7.77#	**9.43#**	↑	+26.7	+1.99	+631	-10	6.70
Lithuania	5.62	6.51	5.62	7.2	8.78	**9.53**	↑	+69.6	+3.91	+118	0	5.62
Romania	6.32#	4.19#	4.40#	4.97#	7.63#	**9.68#**	↑	+53.2	+3.36	+619	-5	6.00
Luxembourg	10.2	7.91	6.3	7.67	8.17	**10.22**	-	+0.2	+0.02	+6	-12	8.98
Sweden	9.24	8.73	8.19	8.52	9.08	**10.55**	-	+14.2	+1.31	+169	-10	8.32
Iceland	5.04	7.41	7.86	6.11	7.99	**10.69**	↑	+112.1	+5.65	+23	NA	NA

Country[a]	Estimated incidence[b] (n per 100 000 population)							Progress towards target			Target[c]	
	2019	2020	2021	2022	2023	2024	Trend 2019–2024[d]	Change in estimated incidence (%) 2019–2024	Change in estimated incidence (n per 100 000 population) 2019–2024	Changes in estimated number of cases 2019–2024*	Recommended change (%) 2019–2030	Target 2030 (n per 100 000 population)
Latvia	5.03#	5.30#	4.23#	5.75#	6.96#	**10.98#**	↑	+118.3	+5.95	+109	0	5.03
Germany	12.02#	10.74#	9.07#	9.15#	9.75#	**11.98**	-	-0.3	-0.04	+22	-12	10.58
Spain	7.84#	6.40#	6.65#	10.02#	11.16#	**12.45#**	↑	+58.8	+4.61	+2 370	-10	7.06
Portugal	10.32	8.38	7.36	7.76	10.73	**13.08**	-	+26.7	+2.76	+331	-12	9.08
Belgium	13.19#	10.29	7.84	8.07#	10.14#	**13.39#**	-	+1.5	+0.20	+71	-12	11.61
Cyprus	6.2	5.11	9.37	10.76	15.23	**19.56**	↑	+215.5	+13.36	+135	-5	5.89
Italy	22.96	17.67	14.77	17.29	19.56	**22.19**	-	-3.4	-0.77	-770	-12	20.20
Malta	12.37	6.96	8.36	7.48	9.13	**22.79**	-	+84.2	+10.42	+67	-12	10.89
EU	**10.42**	**8.38**	**7.32**	**8.26**	**9.43**	**11.03**	**-**	**+5.9**	**+0.61**	**+3 000**	**-10**	**9.38**
EU/EEA	**10.35**	**8.33**	**7.28**	**8.21**	**9.37**	**10.96**	**-**	**+5.9**	**+0.61**	**+3 043**	**NA**	**NA**

ND, no data available; NA, not applicable.

^ The antimicrobial group/agent was tested for < 90% of isolates. The results should be interpreted with caution.

 # One or more of the three representativeness indicators (geographical, hospital and/or isolate representativeness) were not reported as 'High'. The results should be interpreted with caution.

[a] Countries are ranked by increasing estimated incidence in 2024.

[b] Total number of cases and incidence were estimated for each country and the EU separately. Each de-duplicated isolate from a blood sample (>99% data) or cerebrospinal fluid sample (<1% data) was considered a proxy for bloodstream infection (for more information, see https://www.ecdc.europa.eu/en/publications-data/reporting-protocol-antimicrobial-resistance-amr)

[c] The 'Council recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health Approach' (2023/C220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=oj:JOC_2023_220_R_0001

[d] ↑ indicates a statistically significant increasing trend; ↓ indicates a statistically significant decreasing trend; - indicates absence of a statistically significant trend.

** Country level calculations differ from the EU and EU/EEA level calculation and are calculated as described in the EARS-Net reporting protocol.*

National reduction target reached (see Council recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach 2023/C 220/01. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=oj:JOC_2023_220_R_0001)

Table 6. **Meticillin-resistant *Staphylococcus aureus* (MRSA)[a] bloodstream infections, EU/EEA countries, 2019 and 2024: estimated incidence, trend, change in proportion, estimated incidence and estimated total number of cases, and target as percentage reduction and estimated incidence in 2030**

Country[b]	Estimated incidence[c] (n per 100 000 population)							Progress towards target			Target[d]	
	2019	2020	2021	2022	2023	2024	Trend 2019–2024[e]	Change in estimated incidence (%) 2019–2024	Change in estimated incidence (n per 100 000 population) 2019–2024	Changes in estimated number of cases 2019–2024*	Recommended change (%) 2019–2030	Target 2030 (n per 100 000 population)
Denmark	0.83	0.70	0.79	0.61^	0.47^	**0.55^**	↓	-33.7	-0.28	-15	-3	0.81
Netherlands	0.40	0.39	0.39	0.52	0.49	**0.59**	↑	+47.5	+0.19	+37	-3	0.39
Norway	0.34	0.50	0.30	0.39	0.64	**0.69**	↑	+102.9	+0.35	+20	NA	NA
Estonia	0.83	0.83	0.45	0.68	0.66	**1.09**	-	+31.3	+0.26	+4	-3	0.81
Bulgaria	1.43#	0.78#	0.96#	0.85#	1.49#	**1.13#**	-	-21.0	-0.30	-27	-3	1.39
Luxembourg	2.14	0.97	1.73	1.72	1.66	**1.50**	-	-29.9	-0.64	-3	-6	2.01
Finland	1.06	1.07	1.19	1.12	1.28	**1.83**	↑	+72.6	+0.77	+44	-3	1.03
Latvia	1.91#	1.92#	1.41#	2.19#	1.48#	**1.96^#**	-	+2.6	+0.05	0	-6	1.80
Sweden	1.34	1.80	1.65	1.58	1.79	**2.07**	↑	+54.5	+0.73	+81	-3	1.30
Iceland	1.96	1.65	0.27	1.06	2.06	**2.09**	-	+6.6	+0.13	+1	NA	NA
Austria	2.17	1.56	1.22	1.51	1.81	**2.21**	-	+1.8	+0.04	+10	-6	2.04
Germany	3.56#	2.91#	2.64#	2.15#	2.32#	**2.43**	↓	-31.7	-1.13	-933	-10	3.20
Ireland	3.06	2.50	2.68	2.61	2.47	**2.57**	-	-16.0	-0.49	-12	-6	2.88
Czechia	3.06	2.28	2.51	2.15	2.92	**2.79**	-	-8.8	-0.27	-22	-6	2.88
Slovenia	2.38	3.37	2.87	2.68	3.24	**2.81**	-	+18.1	+0.43	+10	-6	2.24
Belgium	2.62#	2.43	1.33	1.27#	2.07#	**2.96#**	-	+13.0	+0.34	+50	-6	2.46
Malta	3.84	3.68	4.28	4.45	3.11	**2.99**	-	-22.1	-0.85	-2	-10	3.46
France	5.61	4.02	3.41	2.97	ND	**3.06**	NA	-45.5	-2.55	-1 664	-18	4.60
Lithuania	2.18	2.47	2.40	2.78	2.45	**3.22**	↑	+47.7	+1.04	+32	-6	2.05
Slovakia	5.01	4.38	4.25	3.42	2.05	**3.27**	↓	-34.7	-1.74	-96	-10	4.51
Poland	4.26#	3.08^#	3.74^#	3.91#	3.52#	**3.43#**	-	-19.5	-0.83	-363	-10	3.83
Spain	4.21#	3.13#	3.53^#	4.54^#	4.29^#	**3.90^#**	-	-7.4	-0.31	-78	-10	3.79

Country[b]	Estimated incidence[c] (n per 100 000 population)							Progress towards target			Target[d]	
	2019	2020	2021	2022	2023	2024	Trend 2019–2024[e]	Change in estimated incidence (%) 2019–2024	Change in estimated incidence (n per 100 000 population) 2019–2024	Changes in estimated number of cases 2019–2024*	Recommended change (%) 2019–2030	Target 2030 (n per 100 000 population)
Hungary	4.15	3.61	5.20	4.97	4.85	**4.42**	-	+6.5	+0.27	+18	-10	3.73
Croatia	2.73	3.82	5.18	5.44	6.35	**5.03**	↑	+84.2	+2.30	+83	-6	2.57
Greece	4.59#	5.60#	5.44#	4.96	6.51	**5.54**	NA	+20.7	+0.95	+84	-10	4.13
Liechtenstein	ND	ND	ND	6.36#	0.00#	**6.25#**	NA	NA	NA	NA	NA	NA
Portugal	11.39	9.80	7.23	8.81	7.39	**8.22**	↓	-27.8	-3.17	-296	-18	9.34
Italy	13.42	13.07	10.28	11.70	10.18	**10.54**	↓	-21.5	-2.88	-1 889	-18	11.00
Romania	13.72#	9.03#	8.95#	9.37#	11.99#	**13.15#**	-	-4.2	-0.57	-157	-18	11.25
Cyprus	6.85	7.81	11.31	14.59	15.50	**13.63**	↑	+99.0	+6.78	+72	-18	5.62
EU	**5.63**	**4.73**	**4.26**	**4.44**	**4.37**	**4.48**	↓	**-20.4**	**-1.15**	**-5 032**	**-15**	**4.79**
EU/EEA	**5.57**	**4.68**	**4.21**	**4.39**	**4.32**	**4.43**	↓	**-20.5**	**-1.14**	**-5 008**	**NA**	**NA**

ND, no data available; NA, not applicable.

^ The antimicrobial group/agent was tested for < 90% of isolates. The results should be interpreted with caution.

 # One or more of the three representativeness indicators (geographical, hospital and/or isolate representativeness) were not reported as 'High'. The results should be interpreted with caution.

[a] MRSA is based on AST results for cefoxitin or, if unavailable, oxacillin. AST results reported for cloxacillin, dicloxacillin, flucloxacillin or meticillin are accepted as a marker for oxacillin resistance if oxacillin is not reported. If no phenotypic results are available, data from molecular confirmation tests (detection of mecA gene PCR or a positive PBP2A-agglutination test) are accepted as a marker for MRSA.

[b] Countries are ranked by increasing estimated incidence in 2024.

[c] Total number of cases and incidence were estimated for each country and the EU separately. Each de-duplicated isolate from a blood sample (>99% data) or cerebrospinal fluid sample (<1% data) was considered a proxy for bloodstream infection (for more information, see https://www.ecdc.europa.eu/en/publications-data/reporting-protocol-antimicrobial-resistance-amr)

[d] The 'Council recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health Approach' (2023/C220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=oj:JOC_2023_220_R_0001

[e] ↑ indicates a statistically significant increasing trend; ↓ indicates a statistically significant decreasing trend; - indicates absence of a statistically significant trend.

** Country level calculations differ from the EU and EU/EEA level calculation and are calculated as described in the EARS-Net reporting protocol.*

National reduction target reached (see Council recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach 2023/C 220/01. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=oj:JOC_2023_220_R_0001)

Table 7. Carbapenem-resistant *Klebsiella pneumoniae* bloodstream infections, EU/EEA countries, 2019 and 2024: estimated incidence, trend, change in proportion, estimated incidence and estimated total number of cases, and the target as percentage reduction and estimated incidence in 2030

Country[a]	Estimated incidence[b] (n per 100 000 population)							Progress towards target			Target[c]	
	2019	2020	2021	2022	2023	2024	Trend 2019–2024[d]	Change in estimated incidence (%) 2019–2024	Change in estimated incidence (n per 100 000 population) 2019–2024	Changes in estimated number of cases 2019–2024*	Recommended change (%) 2019–2030	Target 2030 (n per 100 000 population)
Iceland	ND	0.00	0.00	0.00	0.00	**0.00**	NA	NA	NA	NA	NA	NA
Liechtenstein	ND	ND	ND	ND	0.00#	**0.00#**	NA	NA	NA	NA	NA	NA
Ireland	0.11	0.04	0.06	0.06	0.04	**0.02**	-	-81.8	-0.09	-4	-2	0.11
Finland	0.06	0.02	0.00	0.00	0.02	**0.04**	-	-33.3	-0.02	-1	-2	0.06
Netherlands	0.02	0.01	0.02	0.05	0.04	**0.09**	↑	+350.0	+0.07	+12	0	0.02
Denmark	0.07	0.19	0.10	0.10	0.08	**0.10**	-	+42.9	+0.03	+2	-2	0.07
Norway	0.04	0.02	0.04	0.04	0.08	**0.13**	↑	+225.0	+0.09	+5	NA	NA
Sweden	0.03	0.06	0.03	0.04	0.12	**0.14**	↑	+366.7	+0.11	+12	0	0.03
Luxembourg	0.16	0.16	0.16	0.31	0.30	**0.15**	-	-6.3	-0.01	0	-2	0.16
France	0.22	0.08	0.10	0.13	ND	**0.19**	NA	-13.6	-0.03	-22	-2	0.22
Austria	0.20	0.12	0.15	0.14	0.29	**0.29**	↑	+45.0	+0.09	+9	-2	0.20
Estonia	0.00^	0.00^	0.15	0.23^	0.44^	**0.29^**	↑	NA	+0.29	+4	0	0.00
Germany	0.20#	0.11#	0.18#	0.23#	0.24#	**0.33**	↑	+65.0	+0.13	+109	-2	0.20
Czechia	0.09^	0.07^	0.16^	0.24^	0.26^	**0.41^**	↑	+355.6	+0.32	+34	-2	0.09
Belgium	0.27#	0.24	0.26	0.25#	0.47#	**0.44#**	↑	+63.0	+0.17	+22	-2	0.26
Slovenia	0.05	0.00	0.14	0.34	0.62	**0.62**	↑	+1 140.0	+0.57	+12	-2	0.05
Malta	2.13	2.05	1.84	1.21	0.97	**0.93**	↓	-56.3	-1.20	-5	-4	2.04
Hungary	0.09	0.06	0.11	0.57	0.76	**0.97**	↑	+977.8	+0.88	+84	-2	0.09
Spain	0.76#	0.60#	0.72^#	1.08#	0.96#	**1.20#**	↑	+57.9	+0.44	+227	-4	0.73
Slovakia	0.52	1.05	1.96	1.87	1.33	**1.74**	↑	+234.6	+1.22	+66	-4	0.50
Latvia	0.00#	0.12#	0.23#	0.47#	0.89#	**2.08#**	↑	NA	+2.08	+39	0	0.00
Lithuania	0.54	0.43	0.18	0.11	0.73	**2.39**	-	+342.6	+1.85	+54	-4	0.52

Country[a]	Estimated incidence[b] (n per 100 000 population)							Progress towards target			Target[c]	
	2019	2020	2021	2022	2023	2024	Trend 2019–2024[d]	Change in estimated incidence (%) 2019–2024	Change in estimated incidence (n per 100 000 population) 2019–2024	Changes in estimated number of cases 2019–2024*	Recommended change (%) 2019–2030	Target 2030 (n per 100 000 population)
Portugal	2.93	3.22	2.92	3.01	4.19	**4.22**	↑	+44.0	+1.29	+148	-5	2.78
Croatia	1.20	1.57	2.87	2.52	4.53	**4.49**	↑	+274.2	+3.29	+125	-4	1.15
Poland	1.38#	1.45#	3.69#	3.30#	3.69#	**5.15#**	↑	+273.2	+3.77	+1 361	-4	1.32
Italy	8.43	8.73	6.99	7.77	9.29	**9.29**	-	+10.2	+0.86	+391	-5	8.01
Bulgaria	2.24#	2.19#	3.52#	3.91#	7.75#	**10.62#**	↑	+374.1	+8.38	+528	-4	2.15
Greece	13.05#	14.96#	23.30#	18.02	21.44	**14.89**	NA	+14.1	+1.84	+149	-5	12.40
Cyprus	2.61	2.55	5.51	9.87	9.80	**19.81**	↑	+659.0	+17.20	+169	-5	2.48
Romania	7.12#	10.77#	13.87#	12.12#	20.02#	**20.31#**	↑	+185.3	+13.19	+2 492	-5	6.76
EU	**2.18**	**2.37**	**2.72**	**2.66**	**3.39**	**3.51**	**↑**	**+61.0**	**+1.33**	**+6 017**	**-5**	**2.07**
EU/EEA	**2.15**	**2.34**	**2.69**	**2.62**	**3.35**	**3.46**	**↑**	**+60.9**	**+1.31**	**+6 022**	**NA**	**NA**

ND, no data available; NA, not applicable.

^ The antimicrobial group/agent was tested for < 90% of isolates. The results should be interpreted with caution.

 # One or more of the three representativeness indicators (geographical, hospital and/or isolate representativeness) were not reported as 'High'. The results should be interpreted with caution.

[a] Countries are ranked by increasing estimated incidence in 2024.

[b] Total number of cases and incidence were estimated for each country and the EU separately. Each de-duplicated isolate from a blood sample (>99% data) or cerebrospinal fluid sample (<1% data) was considered a proxy for bloodstream infection (for more information, see https://www.ecdc.europa.eu/en/publications-data/reporting-protocol-antimicrobial-resistance-amr

[c] The 'Council recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health Approach' (2023/C220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=oj:JOC_2023_220_R_0001

[d] ↑ indicates a statistically significant increasing trend; ↓ indicates a statistically significant decreasing trend; - indicates absence of a statistically significant trend.

** Country level calculations differ from the EU and EU/EEA level calculation and are calculated as described in the EARS-Net reporting protocol.*

National reduction target reached (see Council recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach 2023/C 220/01. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=oj:JOC_2023_220_R_0001)

Table 8. Estimated incidence of invasive isolates (per 100 000 population) by bacterial species, EU/EEA 2020–2024

Bacterial species	Estimated incidence (per 100 000 population)					
	2020	2021	2022	2023	2024	Change 2020–2024 (%)
Escherichia coli	63.2	60.4	63.6	67.4	73.9	+16.9
Klebsiella pneumoniae	19.2	19.3	20.5	22.6	25.3	+31.8
Pseudomonas aeruginosa	9.6	9.6	9.9	10.3	11.1	+15.6
Acinetobacter spp.	4.3	5.5	4.3	4.3	4.5	+4.7
Staphylococcus aureus	33.7	34.0	35.5	35.3	37.9	+12.5
Streptococcus pneumoniae	3.7	3.6	5.6	7.1	8.0	+116.2
Enterococcus faecalis	13.6	14.3	13.7	13.6	14.6	+7.4
Enterococcus faecium	9.2	10.5	9.9	9.7	10.6	+15.2

Table 9a. Estimated total incidence of bloodstream infections with resistance phenotype (number per 100 000 population) and trend, 2024 EU/EEA country range in estimated incidence, 2020–2024, by bacterial species and antimicrobial group/agent, EU/EEA

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (number per 100 000 population)						
		2020	2021	2022	2023	2024	Trend 2020–2024[b]	EU/EEA country range 2024
Escherichia coli	Aminopenicillin (amoxicillin/ampicillin) resistance	25.58	24.09	25.62	27.67	31.68	↑	6.43–64.29
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	8.33	7.28	8.21	9.37	10.96	↑	0.00–22.79
	Carbapenem (imipenem/meropenem) resistance	0.08	0.07	0.11	0.13	0.15	↑	0.00–1.26
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	13.48	11.78	12.73	14.17	15.71	↑	3.07–39.61
	Aminoglycoside (gentamicin/tobramycin) resistance	5.76	4.80	5.23	5.99	6.68	-	0.00–27.28
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides	2.78	2.33	2.58	2.99	3.31	↑	0.00–19.99
Klebsiella pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	6.75	6.95	7.16	8.32	9.03	↑	0.00–28.02
	Carbapenem (imipenem/meropenem) resistance	2.34	2.69	2.62	3.35	3.46	↑	0.00–20.31
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	6.74	6.77	6.90	7.93	8.53	↑	0.00–28.77
	Aminoglycoside (gentamicin/tobramycin) resistance	4.36	4.53	4.60	5.33	5.58	↑	0.00–18.81
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides	3.83	4.03	4.05	4.67	4.84	↑	0.00–17.52
Pseudomonas aeruginosa	Piperacillin-tazobactam resistance	1.65	1.74	1.88	1.89	1.81	↑	0.26–7.45
	Ceftazidime resistance	1.40	1.49	1.58	1.61	1.52	↑	0.22–7.61
	Carbapenem (imipenem/meropenem) resistance	1.60	1.72	1.82	1.84	1.74	-	0.12–8.34
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1.71	1.75	1.81	1.81	1.65	-	0.36–8.05
	Aminoglycoside (tobramycin) resistance	0.60	0.66	0.64	0.72	0.58	-	0.00–5.06
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)	0.75	0.87	0.94	0.96	0.79	-	0.00–4.91
Acinetobacter **species**	Carbapenem (imipenem/meropenem) resistance	2.80	3.99	2.71	2.50	2.49	-	0.00–14.59
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	2.92	4.14	2.81	2.55	2.50	-	0.00–14.27
	Aminoglycoside (gentamicin/tobramycin) resistance	2.60	3.68	2.46	2.25	2.13	↓	0.00–12.50
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides	2.46	3.50	2.31	2.15	2.03	-	0.00–12.29

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (number per 100 000 population)						
		2020	2021	2022	2023	2024	Trend 2020–2024[b]	EU/EEA country range 2024
Staphylococcus aureus	MRSA[c]	4.68	4.21	4.39	4.32	4.43	-	0.55–13.63
Streptococcus pneumoniae	Penicillin non-wild-type[d]	0.47	0.51	0.63	0.76	0.99	↑	0.00–2.85
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.51	0.53	0.73	0.95	1.12	↑	0.12–6.25
	Combined penicillin non-wild-type and resistance to macrolides[d]	0.24	0.28	0.34	0.43	0.55	↑	0.00–1.76
Enterococcus faecalis	High-level gentamicin resistance	2.55	2.94	2.45	2.31	2.20	↓	0.02–6.29
Enterococcus faecium	Vancomycin resistance	1.76	2.15	2.06	1.93	1.96	-	0.00–9.97

[a] *Incidence was estimated using the EARS-Net data reported to EpiPulse. Each de-duplicated isolate from a blood sample (>99% data) or cerebrospinal fluid sample (<1% data) was considered a proxy for a bloodstream infection.*

[b] *↑ and ↓ indicate statistically significant increasing and decreasing trends, respectively.*

[c] *MRSA is based on AST results for cefoxitin or, if unavailable, oxacillin. AST results reported for cloxacillin, dicloxacillin, flucloxacillin or meticillin are accepted as a marker for oxacillin resistance if oxacillin is not reported. If no phenotypic results are available, data from molecular confirmation tests (detection of* mecA *gene PCR or a positive PBP2A-agglutination test) are accepted as a marker for MRSA.*

[d] *Penicillin results are based on penicillin or, if unavailable, oxacillin. For* S. pneumoniae*, the term 'penicillin non-wild-type' is used in this report, referring to* S. pneumoniae *isolates reported by local laboratories as susceptible, increased exposure (I) or resistant (R) to penicillin, assuming MIC to benzylpenicillin above those of wild-type isolates (> 0.06 mg/L). The qualitative susceptibility categories (S/I/R) as reported by the laboratory are used, since quantitative susceptibility information is missing for a large part of the data.*

Table 9b. Total number of invasive isolates tested (n) and percentages of isolates with AMR phenotype, by bacterial species and antimicrobial group/agent, population-weighted EU/EEA mean and trend and 2024 EU/EEA country range, 2020–2024

Bacterial species	Antimicrobial group/agent	2020		2021		2022		2023		2024		Trend 2020–2024[a]	2024 EU/EEA country range[b]
		n	%	N	%	n	%	n	%	n	%		
Escherichia coli	Aminopenicillin (amoxicillin/ampicillin) resistance	107 371	54.6	109 168	53.2	118 681	53.4	127 625	54.5	149 417	54.7	↑ *	34.4–71.1
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	139 057	14.9	144 030	13.9	154 773	14.3	166 640	15.2	188 111	16.0	↑ *	6.8–38.7
	Carbapenem (imipenem/meropenem) resistance	135 624	0.2	138 372	0.2	149 933	0.2	162 146	0.3	183 242	0.3	↑ *	0.0–2.5
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	139 372	23.8	144 012	22.0	153 982	22.0	166 523	22.5	187 427	22.5	↓ *	9.9–49.3
	Aminoglycoside (gentamicin/tobramycin) resistance	136 101	10.9	140 285	9.7	149 754	9.6	161 632	10.3	179 152	10.4	-	4.5–29.6
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides	134 115	5.7	138 516	5.1	147 057	5.1	158 908	5.5	175 789	5.5	-	1.2–21.7
Klebsiella pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	39 848	33.9	43 839	34.3	48 342	32.8	54 070	33.5	62 017	32.9	↓ *	4.9–84.3
	Carbapenem (imipenem/meropenem) resistance	39 279	10.0	42 584	11.7	47 334	10.9	53 291	11.5	60 785	11.3	↑ *	0.0–67.6
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	40 066	33.9	43 651	33.6	48 066	32.1	53 935	32.2	61 702	31.4	↓ *	0.0–80.3
	Aminoglycoside (gentamicin/tobramycin) resistance	38 977	23.7	42 759	23.8	47 147	22.5	52 903	22.5	59 476	21.5	↓ *	0.0–73.8
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides	38 331	21.0	42 105	21.3	46 302	20.0	51 866	19.9	58 262	18.8	↓ *	0.0–71.5
Pseudomonas aeruginosa	Piperacillin-tazobactam resistance	19 799	18.8	21 778	18.8	23 242	19.4	24 826	18.2	27 356	16.4	↓ *	3.9–53.7
	Ceftazidime resistance	20 122	15.5	22 112	15.9	23 689	16.2	25 295	15.2	27 705	13.8	↓ *	2.8–51.5
	Carbapenem (imipenem/meropenem) resistance	20 517	17.9	22 629	18.2	24 082	18.7	25 664	17.5	28 167	15.9	↓ *	1.5–53.4
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	20 425	19.6	22 489	18.8	23 874	18.6	25 553	17.2	27 935	15.3	↓ *	4.9–51.9
	Aminoglycoside (tobramycin) resistance	12 880	9.4	14 573	8.9	18 359	8.9	20 211	8.7	21 733	7.0	↓ *	0.0–44.6

Bacterial species	Antimicrobial group/agent	2020		2021		2022		2023		2024		Trend 2020–2024[a]	2024 EU/EEA country range[b]
		n	%	N	%	n	%	n	%	n	%		
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)	12 041	13.6	13 720	12.6	17 377	13.4	19 179	12.2	20 565	10.0	↓ *	0.0–47.5
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	7 507	37.9	11 289	40.0	9 442	36.3	9 907	34.6	10 308	31.6	↓ *	0.0–94.1
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	7 372	41.7	11 183	43.2	9 384	38.8	9 757	36.9	10 064	33.2	↓ *	0.0–95.2
	Aminoglycoside (gentamicin/tobramycin) resistance	7 275	37.0	10 955	39.8	9 212	34.2	9 565	31.9	9 635	29.0	↓ *	1.8–89.9
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides	7 111	34.0	10 728	36.9	8 878	31.8	9 352	30.2	9 392	27.0	↓ *	0.0–89.5
Staphylococcus aureus	MRSA[c]	72 976	16.7	79 551	16.2	85 625	15.2	87 046	14.9	95 166	14.2	↓ *	1.9–46.0
Streptococcus pneumoniae	Penicillin non-wild-type[d]	8 076	15.5	8 490	16.2	13 370	16.3	16 703	15.2	19 520	17.3	↑	0.0–36.6
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	8 407	16.8	8 784	18.4	14 086	17.9	17 742	17.8	20 372	19.0	↑ *	4.0–44.2
	Combined penicillin non-wild-type and resistance to macrolides[d]	7 782	8.9	8 166	9.8	12 832	9.7	16 073	9.3	18 814	11.1	↑ *	0.0–25.6
Enterococcus faecalis	High-level gentamicin resistance	14 316	29.0	16 523	28.9	17 406	25.2	17 409	24.3	18 260	22.6	↓ *	4.8–49.2
Enterococcus faecium	Vancomycin resistance	18 349	16.8	22 792	17.0	23 079	17.6	23 452	16.9	25 678	16.5	-	0.0–61.7

NA: not applicable.

*[a] ↑ and ↓ indicate statistically significant increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that a significant change in data sources occurred during the period.*

[b] Lowest and highest national AMR percentage among reporting EU/EEA countries (n=30).

[c] MRSA is based on AST results for cefoxitin or, if unavailable, oxacillin. AST results reported for cloxacillin, dicloxacillin, flucloxacillin or meticillin are accepted as a marker for oxacillin resistance if oxacillin is not reported. If no phenotypic results are available, data from molecular confirmation tests (detection of mecA *gene by PCR or a positive PBP2A-agglutination test) are accepted as a marker for MRSA.*

[d] Penicillin results are based on penicillin or, if unavailable, oxacillin. For S. pneumoniae*, the term penicillin non-wild-type is used in this report, referring to* S. pneumoniae *isolates reported by local laboratories as susceptible, increased exposure (I) or resistant (R) to penicillin, assuming MIC to benzylpenicillin above those of wild-type isolates (> 0.06 mg/L). The qualitative susceptibility categories (S/I/R) as reported by the laboratory are used, since quantitative susceptibility information is missing for a large part of the data.*

References – Section 2

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Bacterial species-specific results

Escherichia coli

Epidemiology

For 2024, 30 EU/EEA countries reported 190 172 invasive isolates of *E. coli*. When comparing 2020 to 2024, there was an increase in the number of reported invasive *E. coli* isolates (+35.5%; 140 387 and 190 172, respectively). The estimated EU/EEA incidence of invasive *E. coli* isolates increased from 63.2 per 100 000 population in 2020 to 73.9 per 100 000 population in 2024 (Table 8).

Of all reported invasive isolates in 2024, 188 111 (98.9%) had AST results for third-generation cephalosporins, 187 427 (98.6%) for fluoroquinolones, 183 242 (96.4%) for carbapenems, 179 152 (94.2%) for aminoglycosides, and 149 417 (78.6%) for aminopenicillins (Table 9b).

In 2024, the highest estimated EU/EEA incidence of *E. coli* bloodstream infections by AMR phenotype was reported for aminopenicillins (31.68 per 100 000 population), followed by fluoroquinolones (15.71 per 100 000 population), third-generation cephalosporins (10.96 per 100 000 population), and aminoglycosides (6.68 per 100 000 population). Resistance to carbapenems was rare (0.15 per 100 000 population) (Table 9a). Compared to 2020, all the 2024 estimated EU/EEA incidences of *E. coli* bloodstream infections with resistance had increased, and showed a significantly increasing trend for aminopenicillin resistance, fluoroquinolone resistance, third-generation cephalosporin resistance, and carbapenem resistance for 2020−2024 (Table 9a). Moreover, since 2021, the estimated EU/EEA incidences of bloodstream infections with AMR have been increasing.

For the EU AMR target (i.e. the estimated incidence of third-generation cephalosporin-resistant *E. coli* bloodstream infections) there was a 5.9% increase against the baseline year 2019, resulting in an estimated incidence of 11.03 per 100 000 population (Table 5). This is 1.65 per 100 000 population higher than the 2030 target of 9.38 per 100 000 population. For the target the EU country range was 3.75−22.79 per 100 000 population in 2024. For the EU overall, no statistically significant trend was detected between 2019 (baseline year) and 2024. At country level, four countries (Bulgaria, Denmark, Finland and France)[3] had already reached their respective target. Meanwhile eight EU countries had a statistically significant increasing trend in the estimated incidence since 2019 (Table 5).

At EU/EEA level, more than half (55.0%) of the invasive *E. coli* isolates reported to EARS-Net for 2024 were resistant to at least one of the antimicrobial groups under surveillance (aminopenicillins, fluoroquinolones, third-generation cephalosporins, aminoglycosides and carbapenems) (Table 10). In 2024, the highest EU/EEA population-weighted mean AMR percentage was reported for aminopenicillins (54.7%), followed by fluoroquinolones (22.5%), third-generation cephalosporins (16.0%), and aminoglycosides (10.4%). Resistance to carbapenems remained rare (0.3%) (Table 9b). Between 2020 and 2024, there was a significant increasing trend in the EU/EEA population-weighted mean percentage for aminopenicillin resistance, third-generation cephalosporin resistance and carbapenem resistance, as well as a significant decreasing trend in in the EU/EEA population-weighted mean percentage for fluoroquinolone resistance. When restricting the analysis to include only laboratories that continuously reported data for all five years, all trends remained significant (Table 9b).

Resistance to multiple antimicrobial groups was common. Among the AMR phenotypes, resistance to aminopenicillins, both as single resistance and in combination with other antimicrobial groups, was the most common at EU/EEA level (Table 10). In 2024, the percentage of combined resistance, measured as resistance to third-generation cephalosporins, fluoroquinolones and aminoglycosides, was 5.5% (EU/EEA population-weighted mean) with no statistically significant trend during the period 2020–2024 (Table 9b). The estimated EU/EEA incidence of bloodstream infections with combined resistance, measured as resistance to third-generation cephalosporins, fluoroquinolones and aminoglycosides, was 3.31 per 100 000 population and this showed a statistically significant increasing trend during the period 2020–2024.

With the exception of carbapenem resistance, which remained low in all countries, large inter-country variations were noted for all the antimicrobial groups under surveillance (Table 9a and 9b), with higher AMR percentages generally reported from countries in southern, central and eastern Europe than from countries in northern and western Europe (Figures 1 and 3 and 'Country summaries'), although such a pattern was not always evident (Figure 2). For the estimated incidences of AMR bloodstream infections, the pattern was less clear, although it did indicate that, apart from resistance to aminopenicillins, the highest estimated incidences were generally reported from countries in southern Europe (see 'Country summaries').

[3] The results for Bulgaria and Denmark should be interpreted with caution.

Table 10. ***Escherichia coli.*** **Total number of invasive isolates tested (n =134 499)[a] and AMR percentage (%) per phenotype, EU/EEA, 2024**

AMR pattern[b]	Number of isolates	Percentage of total[c]
Susceptible to all included antimicrobial groups[d]	**60 514**	**45.0**
Single resistance (to indicated antimicrobial group)		
Total (any single resistance)	**42 801**	**31.8**
Aminopenicillins	39 233	29.2
Fluoroquinolones	3 080	2.3
Other antimicrobial groups	488	0.4
Resistance to two antimicrobial groups		
Total (any two-group combinations)	**14 254**	**10.6**
Aminopenicillins + fluoroquinolones	7 318	5.4
Aminopenicillins + third-generation cephalosporins	4 180	3.1
Aminopenicillins + aminoglycosides	2 591	1.9
Other antimicrobial group combinations	165	0.1
Resistance to three antimicrobial groups		
Total (any three-group combinations)	**10 755**	**8.0**
Aminopenicillins + third-generation cephalosporins + fluoroquinolones	7 762	5.8
Aminopenicillins + fluoroquinolones + aminoglycosides	2 134	1.6
Other antimicrobial group combinations	859	0.6
Resistance to four antimicrobial groups		
Total (any four-group combinations)	**6 069**	**4.5**
Aminopenicillins + third-generation cephalosporins + fluoroquinolones + aminoglycosides	5 994	4.5
Other antimicrobial group combinations	75	0.1
Resistance to five antimicrobial groups		
Aminopenicillins + third-generation cephalosporins + fluoroquinolones + aminoglycosides + carbapenems	**106**	**0.1**

[a] Only isolates with complete susceptibility information for aminopenicillins (amoxicillin or ampicillin), third-generation cephalosporins (cefotaxime, ceftriaxone or ceftazidime), carbapenems (imipenem or meropenem), fluoroquinolones (ciprofloxacin, levofloxacin or ofloxacin) and aminoglycosides (gentamicin or tobramycin) were included in the analysis. This represented 71% (134 499 /190 172) of all reported E. coli *isolates. If the antimicrobial susceptibility testing (AST) result for third-generation cephalosporins is reported as resistant (R) then resistance to aminopenicillins is assumed even if the AST result is reported as S or I.*
[b] Only AMR combinations >1% of the total are specified.
[c] Not adjusted for population differences in the reporting countries.
[d] Aminopenicillins (amoxicillin or ampicillin), third-generation cephalosporins (cefotaxime, ceftriaxone or ceftazidime), carbapenems (imipenem or meropenem), fluoroquinolones (ciprofloxacin, levofloxacin or ofloxacin) and aminoglycosides (gentamicin or tobramycin).

Figure 1. ***Escherichia coli.*** **Percentage of invasive isolates resistant to fluoroquinolones (ciprofloxacin/levofloxacin/ofloxacin), by country, EU/EEA, 2024**

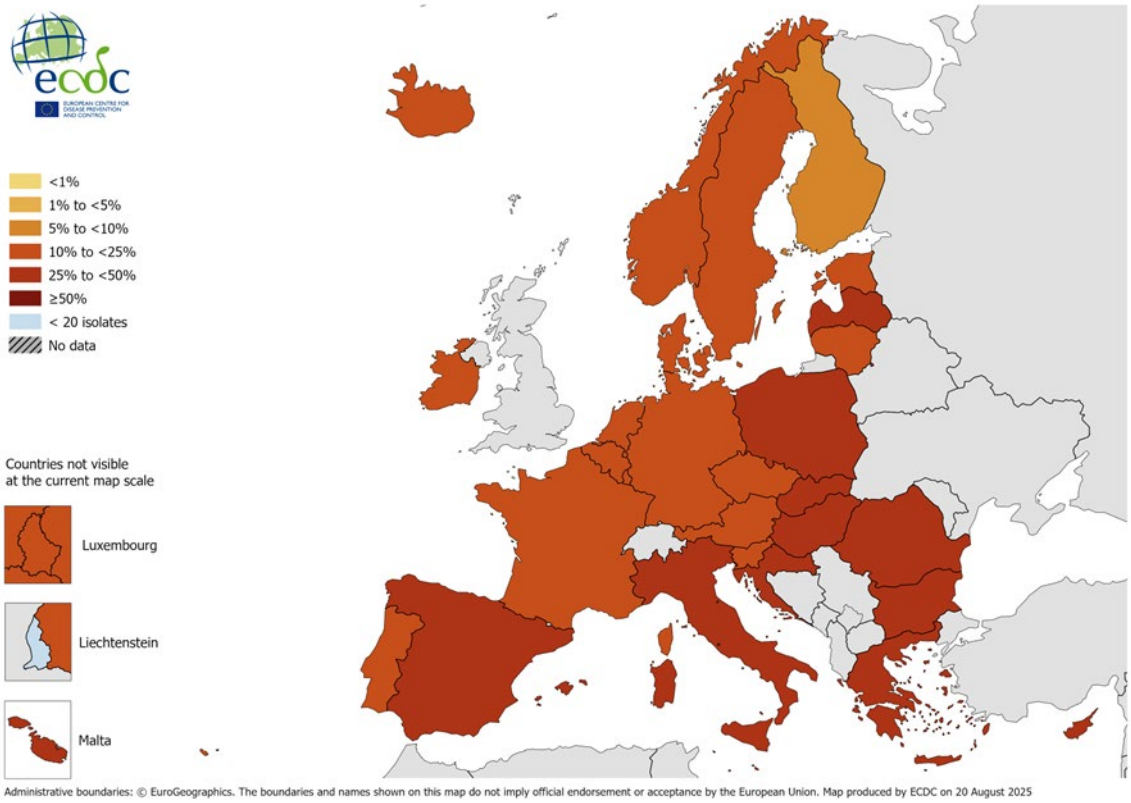


Figure 2. ***Escherichia coli*****. Percentage of invasive isolates resistant to third-generation cephalosporins (cefotaxime/ceftriaxone/ceftazidime), by country, EU/EEA, 2024**

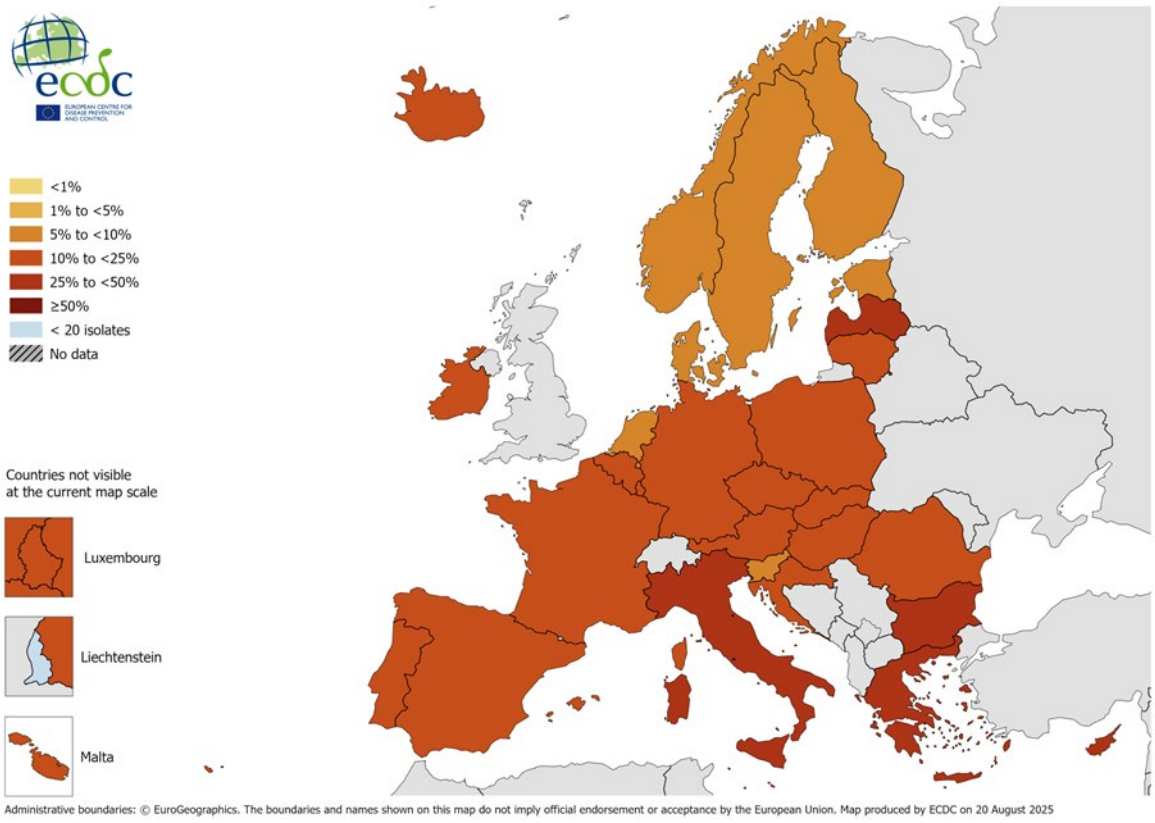
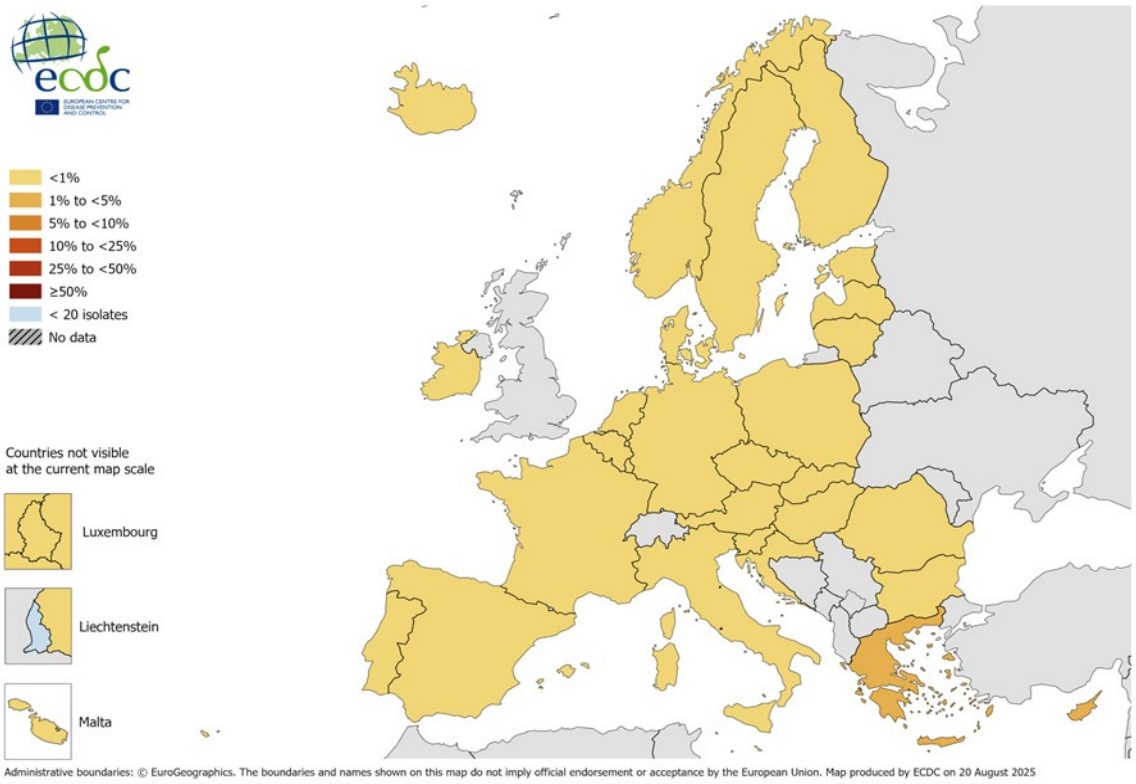


Figure 3. *Escherichia coli*. Percentage of invasive isolates resistant to carbapenems (imipenem/meropenem), by country, EU/EEA, 2024



Discussion

E. coli is one of the most common causes of bloodstream infections in Europe, and prompt access to effective antimicrobial treatment is essential to reduce the health-related and economic burden caused by *E. coli* infection. In ECDC's study of the EU/EEA health burden of AMR for the period 2016–2020, the largest burden of disease was caused by infections with third-generation cephalosporin-resistant *E. coli*, both in terms of the number of cases and the number of attributable deaths [1]. As antimicrobial-resistant *E. coli* infections commonly occur in the community, interventions to reduce the burden of infection should not be restricted to hospital settings but should also target primary and community care.

With an increase of 5.9% compared to 2019 (baseline year), the estimated EU incidence of third-generation cephalosporin-resistant *E. coli* bloodstream infections for 2024 indicates that the EU is not on track to reach the agreed target of a 10% reduction in incidence by 2030 [2]. Since the decrease seen in 2020 and 2021 when the target appeared to have been reached, there have been annual increases resulting in the EU no longer being on track to reach its target. Moreover, there was an increase in all the estimated EU/EEA resistance incidences compared to 2020, and the presence of increasing trends for all but one indicates that the EU/EEA is not moving in the right direction. This underlines the need for further efforts to improve antimicrobial stewardship and IPC.

Increasing resistance was also indicated in this report by a significantly increasing trend (2020−2024) in resistance percentages (EU/EEA population-weighted mean) for aminopenicillin resistance, third-generation cephalosporin resistance and carbapenem resistance in *E. coli*.

It is worth noting that the 2021 EARS-Net EQA indicated that there was under-reporting of carbapenem resistance [3]. Moreover, in the 2022, 2023 and 2024 EARS-Net EQA there was over-reporting of resistance to ceftazidime [4-6]. This should be kept in mind when interpreting the results presented. Nevertheless, most of the EU/EEA AMR percentages and estimated incidences reported for 2024 remain high, and the estimated incidences have increased compared to 2023.

Use of broad-spectrum antimicrobials is a known risk factor for the colonisation and spread of antimicrobial-resistant Enterobacterales, including *E. coli*. Associations between national AMR percentages in *E. coli* and national antimicrobial consumption rates have been reported [7]. Although data from ESAC-Net showed a considerable decrease in antimicrobial consumption in 2020 and 2021 compared to previous years and an increase for 2022−2024 [8-9], that pattern is not as clearly reflected for the EU/EEA population-weighted mean AMR percentages for *E. coli* and *K. pneumoniae*. However, for *E. coli* and *K. pneumoniae* the estimated EU/EEA incidences of bloodstream infections with

AMR have generally shown increases since 2021 and 2020 respectively, indicating some similarity to the pattern reported by ESAC-Net.

High levels of AMR have been reported in *E. coli* isolates in food-producing animals in Europe [10]. In addition, a low, but increasing occurrence of carbapenemase producing *E. coli* isolates has also been dectected [10]. It is therefore essential to ensure cross-sectoral collaboration between the human, veterinary and food-production sectors, adopting a 'One Health' approach which addresses AMR in both humans and food-producing animals. ECDC is working closely with the European Food Safety Authority (EFSA) and the European Medicines Agency (EMA) to better understand the interrelationships between antimicrobial use and AMR in humans and animals across Europe. To this end, in 2024, the three agencies produced the fourth joint inter-agency report on integrated analysis of antimicrobial agent consumption and occurrence of AMR in bacteria from humans and food-producing animals in the EU/EEA [7].

Carbapenem-resistant isolates remained rare among the invasive *E. coli* isolates included in EARS-Net. However, the increasing EU/EEA estimated incidence and population-weighted mean resistance percentage are of concern. An increase in serious infections caused by carbapenem-resistant *E. coli* would have severe consequences on the burden of AMR in the EU/EEA. Carbapenem-resistant Enterobacterales (CRE) infections are associated with high mortality, primarily due to delays in the administration of effective treatment and the limited availability of treatment options. The 2025 update of ECDC's rapid risk assessment on CRE highlights the need for high standards in IPC combined with antimicrobial stewardship, to prevent further spread [11].

Carbapenem resistance is most often mediated by a range of carbapenemases and there are carbapenemase-producing isolates that test susceptible to meropenem and/or imipenem, based on clinical breakpoints. These will only be detected by using the screening cut-offs recommended by EUCAST. One example is OXA-244-producing *E. coli* which, in routine clinical microbiology laboratories may only be classified as extended-spectrum beta-lactamase-producing rather than carbapenemase-producing *E. coli*, unless specifically tested for OXA-48-like carbapenemases.

An ECDC risk assessment on OXA-244-producing *E. coli* [12] indicated a pan-European problem, with a high risk of OXA-244-producing *E. coli* spreading further in the EU/EEA, given the rapid and simultaneous increase in multiple countries between 2016 and 2019. Another study based on *E. coli* data from the EU/EEA in 2012−2020 collected by ECDC with a focus on another carbapenemase, New Delhi metallo-β-lactamase (NDM)-5, concluded that *E. coli* carrying the related gene $bla_{\text{NDM-5}}$ are spreading rapidly and could contribute to further carbapenem resistance in the coming years [13]. In addition, a recent study in the EU/EEA indicated an increase in the detection of carbapenemase genes in *E. coli* ST131 [14]. The authors raised the concern that, as *E. coli* ST131 has previously been implicated in the global spread of another form of resistance gene, this could indicate a similar scenario for carbapenemase genes. There is a risk that spread of carbapenemase-producing *E. coli* in the community may further contribute to the loss of carbapenems as options for treatment of multidrug-resistant *E. coli* infections. This highlights the need to further investigate the sources and routes of transmission for carbapenemase-producing *E. coli*.

To address the need for further investigation of the sources and routes of transmission for carbapenemase-producing *E. coli* and to complement the phenotypic-based surveillance data available from EARS-Net, the periodic carbapenem- and/or colistin-resistant Enterobacterales (CCRE) surveys have been incorporated into a network – the European Antimicrobial Resistance Genes Surveillance Network (EURGen-Net) [15]. The latest survey results will provide information on the prevalence and distribution of carbapenemases and contribute to a better understanding of the epidemiology of CRE in Europe and risk factors associated with CRE infection and colonisation. ECDC is also able, to a limited extent, to provide Member States with access to whole-genome sequencing services, primarily for investigating potential multi-country outbreaks. By way of example, these services were provided for a combined clonal and plasmid-mediated outbreak of carbapenemase-producing Enterobacterales (CPE) in Lithuania during the period 2019−2020 [16].

Resistance to newly released antimicrobials has proved to be a challenge for the optimal treatment of infections with CRE that are resistant to these new antimicrobials [17]. WHO sees a critical need for research and development of new antibiotics targeting both third-generation cephalosporin resistant and carbapenem-resistant Enterobacterales [18], to which both *E. coli* and *K. pneumoniae* belong. This highlights the need to also monitor for resistance to new antimicrobials. EARS-Net took steps in this direction by piloting the inclusion of novel antimicrobials in the data collection for 2024 and including it as an integrated part of EARS-Net surveillance as of 2025. The country summaries contain the results on novel antimicrobials for 2024.

Klebsiella pneumoniae

Epidemiology

For 2024, 30 EU/EEA countries reported 62 774 invasive isolates of *K. pneumoniae*. When comparing 2020 to 2024, there was an increase in the number of reported invasive *K. pneumoniae* isolates (+55.6%; 40 350 and 62 7749, respectively). Since 2020, it has increased (+31.8%) from 19.2 per 100 000 population to 25.3 per 100 000 population in 2024, with an 11.9% increase in 2024 compared to 2023 (22.6 per 100 000 population) (Table 8).

Of all reported invasive isolates in 2024, 62 017 (98.8%) had AST results for third-generation cephalosporins, 61 702 (98.3%) for fluoroquinolones, 60 785 (96.8%) for carbapenems, and 59 476 (94.7%) for aminoglycosides (Table 9b).

In 2024, the highest estimated EU/EEA incidence of bloodstream *K. pneumoniae* infections by resistance phenotype was reported for third-generation cephalosporins (9.03 per 100 000 population), followed by fluoroquinolones (8.53 per 100 000 population), aminoglycosides (5.58 per 100 000 population), and carbapenems (3.46 per 100 000 population) (Table 9a). During the period 2020−2024, all the estimated EU/EEA incidences of *K. pneumoniae* bloodstream infections with AMR increased and showed significantly increasing trends (Table 9a). The estimated EU/EEA incidences of *K. pneumoniae* bloodstream infections with AMR have shown annual increases since 2020, with the exception of carbapenem resistance. For carbapenem resistance annual increases have been seen since 2022. The result for the EU AMR target (i.e. the estimated incidence of carbapenem-resistant *K. pneumoniae* bloodstream infections) was a 61.0% increase in the estimated incidence against the baseline year 2019, and 1.44 per 100 000 population higher than the 2030 target of 2.07 per 100 000 population. For the EU overall, a statistically significant increasing trend was detected between 2019 and 2024. The EU country range for the target was 0.02−20.31 per 100 000 population in 2024. At country level, five countries had reached their respective target (Finland, France, Ireland, Luxembourg and Malta). However, since 2019 a statistically significant increasing trend in the estimated incidence has been noted in 18 EU countries.

At EU/EEA level, more than a third (39.1%) of the invasive *K. pneumoniae* isolates reported to EARS-Net for 2024 were resistant to at least one of the antimicrobial groups under surveillance (fluoroquinolones, third-generation cephalosporins, aminoglycosides, and carbapenems) (Table 11). In 2024, the highest EU/EEA population-weighted mean AMR percentage was reported for third-generation cephalosporins (32.9%), followed by fluoroquinolones (31.4%), aminoglycosides (21.5%) and carbapenems (11.3%) (Table 9b). Between 2020 and 2024, there was a significantly increasing trend in the EU/EEA population-weighted mean percentage for carbapenem resistance. At the same time, the EU/EEA trend for third-generation cephalosporin, fluoroquinolone and aminoglycoside resistance decreased significantly. When the trend analysis was restricted to include only laboratories that continuously reported data, all the EU/EEA trends remained statistically significant (Table 9b).

AMR to a single antimicrobial group was less commonly reported than AMR to two, three or four antimicrobial groups, with the most common AMR phenotype being combined resistance to third-generation cephalosporins, fluoroquinolones and aminoglycosides (Table 11). The EU/EEA population-weighted mean for combined resistance to fluoroquinolones, third-generation cephalosporins and aminoglycosides was 18.8% in 2024 and showed a statistically significant decreasing trend during the period 2020−2024 (Table 9b). When the analysis was restricted to laboratories that continuously reported data, this trend remained. However, the estimated EU/EEA incidence of the same combined resistance in *K. pneumoniae* bloodstream infections was 4.84 per 100 000 population and showed a statistically significant increasing trend during the period 2020–2024.

Large inter-country variations were noted for all antimicrobial groups under surveillance (Table 9a and 9b), with higher AMR percentages and estimated incidences of AMR bloodstream infections generally reported from countries in southern, central and eastern Europe than from countries in northern and western Europe (Figures 4 and 5 and 'Country summaries'). Nine countries reported carbapenem resistance percentages above 10.0% for *K. pneumoniae*. The countries reporting the highest percentages of carbapenem resistance in *K. pneumoniae* were also generally among those reporting the highest AMR percentages for the other antimicrobial groups. For the estimated incidences of bloodstream infections with AMR, the pattern was quite similar (see 'Country summaries').

Table 11. ***Klebsiella pneumoniae.*** **Total number of invasive isolates tested (n = 56 808)[a] and AMR percentage (%) per phenotype, EU/EEA, 2024**

AMR pattern[b]	Number of isolates	Percentage of total[c]
Susceptible to all included antimicrobial groups [d]	**34 615**	**60.9**
Single resistance (to indicated antimicrobial group)		
Total (any single resistance)	**4 971**	**8.8**
Third-generation cephalosporins	2 759	4.9
Fluoroquinolones	1 979	3.5
Other antimicrobial groups	233	0.4
Resistance to two antimicrobial groups		
Total (any two-group combinations)	**5 142**	**9.1**
Third-generation cephalosporins + fluoroquinolones	3 737	6.6
Third-generation cephalosporins + aminoglycosides	686	1.2
Other antimicrobial group combinations	719	1.3
Resistance to three antimicrobial groups		
Total (any three-group combinations)	**6 969**	**12.3**
Third-generation cephalosporins + fluoroquinolones + aminoglycosides	5 427	9.6
Third-generation cephalosporins + fluoroquinolones + carbapenems	1 419	2.5
Other antimicrobial group combinations	123	0.2
Resistance to four antimicrobial groups		
Third-generation cephalosporins + fluoroquinolones + aminoglycosides + carbapenems	**5 111**	**9.0**

[a] Only isolates with complete susceptibility information for third-generation cephalosporins (cefotaxime, ceftriaxone or ceftazidime), carbapenems (imipenem or meropenem), fluoroquinolones (ciprofloxacin, levofloxacin or ofloxacin) and aminoglycosides (gentamicin or tobramycin) were included in the analysis. This represented 90% (56 808/62 774) of all reported K. pneumoniae *isolates.*
[b] Only AMR combinations >1% of the total are specified.
[c] Not adjusted for population differences in the reporting countries.
[d] Third-generation cephalosporins (cefotaxime, ceftriaxone or ceftazidime), carbapenems (imipenem or meropenem), fluoroquinolones (ciprofloxacin, levofloxacin or ofloxacin) and aminoglycosides (gentamicin or tobramycin).

Figure 4. ***Klebsiella pneumoniae*****. Percentage of invasive isolates resistant to third-generation cephalosporins (cefotaxime/ceftriaxone/ceftazidime), by country, EU/EEA, 2024**

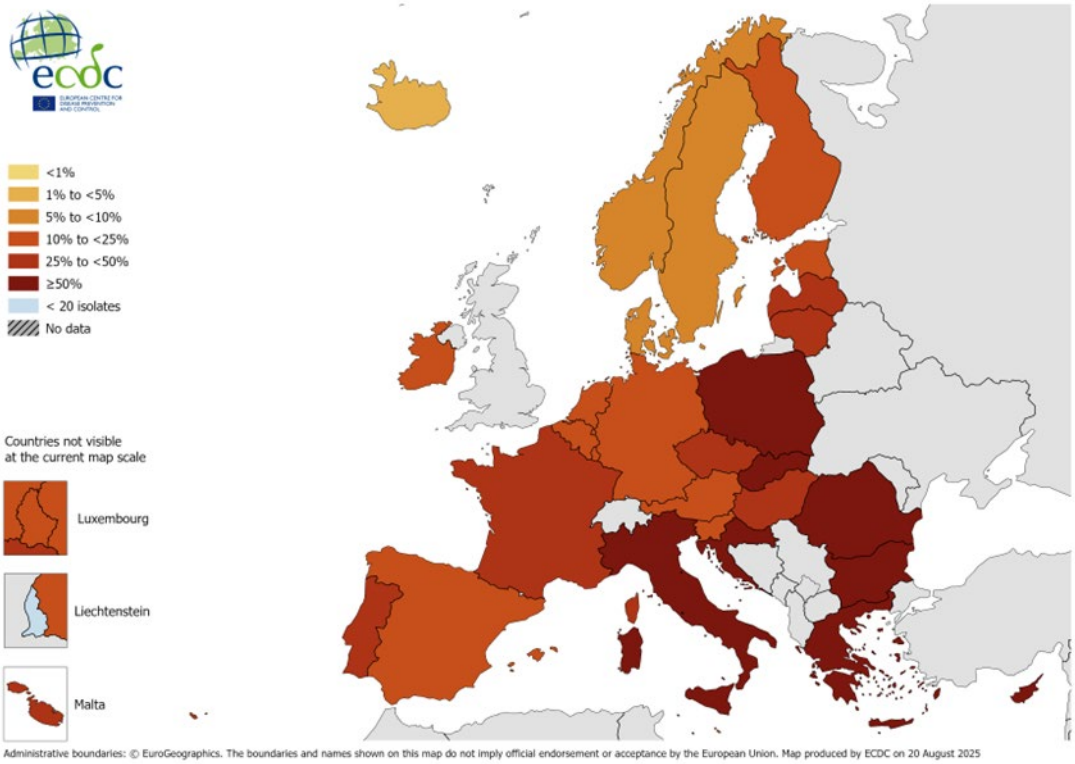
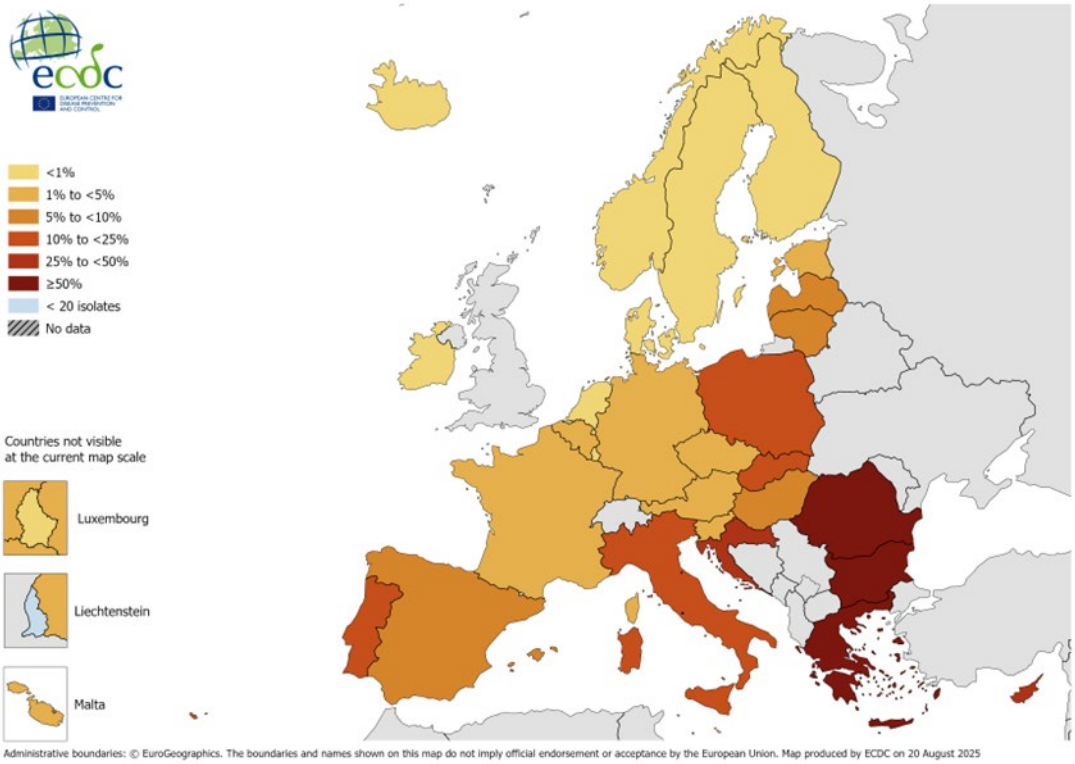


Figure 5. ***Klebsiella pneumoniae*****. Percentage of invasive isolates resistant to carbapenems (imipenem/meropenem), by country, EU/EEA, 2024**



Discussion

The AMR situation for *K. pneumoniae* in the EU/EEA remains problematic. ECDC's study of the EU/EEA health burden of AMR for the period 2016–2020 showed that the largest burden of disease was caused by infections with third-generation cephalosporin-resistant *E. coli*, followed by MRSA and third-generation cephalosporin-resistant *K. pneumoniae*. Infections with these three antibiotic-resistant bacteria resulted in the largest health impact, generating 58.2% of the total burden, measured in disability-adjusted life years (DALYs) [1].

Moreover, all the estimated EU/EEA incidences of resistant *K. pneumoniae* bloodstream infections increased compared to 2020. This includes carbapenem-resistant *K. pneumoniae*, which increased by more than 45% compared to 2020. For the EU the estimated incidence for carbapenem-resistant *K. pneumoniae* increased by more than 60% compared to 2019, which is the baseline year for the EU target. Moreover, there was a statistically significant increasing trend for the EU, as well as 18 EU countries. This is an indication that overall, the EU is not on track to reach the agreed target of a 5% reduction in incidence by 2030, compared to the baseline year 2019 [2]. Moreover, it highlights the urgent need for intensified public health action against carbapenem-resistant *K. pneumoniae*.

The 2021 EARS-Net EQA indicated that decreased carbapenem susceptibility in *K. pneumoniae* was probably over-reported in 2021 [3], and the EARS-Net 2023 and 2024 EQA similarly indicated that carbapenem resistance may be over-reported [5-6]. This calls for some caution when interpreting the results in this report for the EU and the EU/EEA.

Nevertheless, the results show a significantly increasing trend in both the estimated EU/EEA incidences of carbapenem-resistant *K. pneumoniae* bloodstream infections, as well as the EU/EEA population-weighted mean percentage for carbapenem resistance during the period 2020−2024. Carbapenem resistance was often combined with AMR to several other key antimicrobial groups, leading to a severely limited range of treatment options for serious infections caused by this type of bacteria. ECDC's studies of the AMR health burden found that even though the level of carbapenem-resistant *K. pneumoniae* was relatively low, the impact of AMR on the EU/EEA health burden is heavy because of the high level of attributable mortality caused by these infections [1,19]. In 2020, the number of deaths attributable to carbapenem-resistant *K. pneumoniae* in 2020 was estimated to be 4 076 [1].

The highest percentages and estimated incidences of carbapenem-resistant *K. pneumoniae* were observed in countries in southern, central and eastern Europe, with some similarities to the distribution of CPE reflected in a survey conducted by EURGen-Net [20]. Results from EURGen-Net also show that in several EU/EEA countries the situation regarding the spread of CPE deteriorated between 2010 and 2018 [21]. Numerous reports on outbreaks with varying potential for, or recorded cross-border spread of CPE demonstrate the transmission potential in the healthcare systems of EU/EEA countries [21–23]. Outbreaks and clusters in EU/EEA countries also highlight the importance of detecting CPE early in settings with low incidence, due to high transmissibility [21–25].

CRE can be resistant to carbapenems resulting from a variety of mechanisms, but most frequently through production of carbapenemase enzymes. It is not possible to assess the overall presence and spread of CPE from the data available through EARS-Net, as some carbapenemases do not confer a fully carbapenem-resistant phenotype. One example is the OXA-48-like carbapenemase enzymes, which present a particular problem for laboratory detection because of their weak capacity to hydrolyse carbapenems [21].

In addition, the emergence and spread of *K. pneumoniae* with genetic markers of hypervirulence and resistance to carbapenems is a further cause of concern. An ECDC rapid risk assessment noted that since 2019 in the EU/EEA there has been an increase in reports of *K. pneumoniae* isolates belonging to the hypervirulent ST23-K1 lineage that also exhibit carbapenemase genes [26]. This is worrying since this lineage has been linked with invasive infections and dissemination to various body sites, for example causing hepatic abscesses that can occur in healthy individuals. A recent investigation in the EU/EEA also showed that a plasmid with both resistance and hypervirulence genes carried by *K. pneumoniae* had been detected in 10 EU countries [27]. There were also indications that the plasmid could possibly spread across Enterobacterales species. Early detection of hypervirulent *K. pneumoniae*, as well as close cooperation between clinicians and public health services, and increased laboratory capacity for the detection of these isolates is needed to prevent spread among the patient population in the EU/EEA.

There is also a need for increased capacity in the EU/EEA to support outbreak investigations and surveillance with real-time whole genome sequencing in order to identify high-risk clones and implement enhanced control measures to avoid further spread [24, 25]. One initiative to address this need is the CCRE surveys (part of EURGen-Net) that will provide updated and more detailed information on the distribution of carbapenemase-producing *K. pneumoniae* in Europe [15]. It has been shown that it is possible to implement a modified version of the survey at national level to allow collection of near real-time data that is useful for IPC work [28].

The recent update of ECDC's rapid risk assessment on CRE concluded that the probability of further spread of CRE in the EU/EEA can be considered as high [11]. It highlighted that the spread could be reduced by consistently applied IPC and antimicrobial stewardship. Moreover, the impact could be mitigated by measures such as timely laboratory detection and infection management. As a result, in May 2025, the Health Security Committee (HSC) adopted an opinion that proposes countermeasures to be applied in the EU/EEA [29]. These measures include actions at

EU/EEA level, such as support that can be provided by the recently established European Reference Laboratory on AMR in bacteria (EURL-PH-AMR), the EU guidelines on IPC in human health developed by the European Commission in coordination with ECDC and expected to be published in 2026 and the European Commission support of research and access to antimicrobials [30]. The measures also include action at EU/EEA country level, such as CRE national management teams and management plans [30].

Many EU/EEA countries have developed and implemented recommendations and guidance documents on multidrug-resistant Enterobacterales and/or CRE [31], indicating a trend towards nationally coordinated responses to this public health threat. Moreover, in 2017, to support countries, ECDC published a guidance document on how to prevent the entry and spread of CRE into healthcare settings. The guidance outlines evidence-based best practices for the prevention of CRE, including measures for intervention that can be adopted or adapted to local needs, depending on the availability of financial and structural resources [32].

It should be noted that the data reported on *K. pneumoniae* may have been affected by changes over time in the identification and nomenclature of *K. pneumoniae*. Species previously but no longer identified as *K. pneumoniae* sensu strictu are less often found to be resistant. As a result, the reported percentage of resistant *K. pneumoniae* in the EU/EEA may have increased over time. However, in many cases, laboratories will have difficulties in distinguishing species belonging to the *K. pneumoniae* complex. The size of the impact, in terms of changes in identification and nomenclature, is unknown.

Resistance to newly released antimicrobials has turned out to be a challenge for the optimal treatment of infections with CRE that are resistant to these new antimicrobials [17]. WHO sees a critical need for research and development of new antibiotics targeting both third-generation cephalosporin resistant and carbapenem-resistant Enterobacterales [18], to which both *E. coli* and *K. pneumoniae* belong. This highlights the need to also monitor for resistance to novel antimicrobials. EARS-Net took steps in this direction by piloting the inclusion of novel antimicrobials in the data collection for 2024 and including the collection of data as an integrated part of EARS-Net surveillance as of 2025. The country summaries contain the results on novel antimicrobials for 2024.

Pseudomonas aeruginosa

Epidemiology

For 2024, 29 EU/EEA countries reported 28 639 invasive isolates of *P. aeruginosa*. Liechtenstein reported no *P. aeruginosa* isolates. When comparing 2020 to 2024, there was an increase in the number of reported *P. aeruginosa* isolates (+37.8%; 20 777 and 28 639, respectively). The estimated incidence of invasive *P. aeruginosa* isolates increased (+7.8%) from 9.6 per 100 000 population in 2020 to 11.1 per 100 000 population in 2024 (Table 8).

Of all reported invasive isolates in 2024, 28 167 (98.4%) had AST results for carbapenems, 27 935 (97.5%) for fluoroquinolones, 27 705 (96.7%) for ceftazidime, 27 356 (95.5%) for piperacillin-tazobactam, and 21 733 (75.9%) for aminoglycosides (Table 9b).

In 2024, the highest estimated EU/EEA incidence of bloodstream *P. aeruginosa* infections by resistance phenotype was reported for piperacillin-tazobactam (1.81 per 100 000 population), followed by carbapenems (1.74 per 100 000 population), fluoroquinolones (1.65 per 100 000 population), ceftazidime (1.52 per 100 000 population), and aminoglycosides (0.58 per 100 000 population) (Table 9a). During the period 2020–2024, the estimated EU/EEA incidence of *P. aeruginosa* bloodstream infections with resistance to piperacillin-tazobactam and ceftazidime increased and showed significantly increasing trends (Table 9a). However, compared to 2023, all the estimated EU/EEA incidences of bloodstream infections with *P. aeruginosa* infections with AMR decreased (Table 9a). It should be noted that for the aminoglycosides, for each year more than one third of the countries reported that the antimicrobial group was tested for <90% of isolates (see 'Country summaries').

In the EU/EEA, 29.4% of the invasive *P. aeruginosa* isolates reported to EARS-Net for 2024 were resistant to at least one of the antimicrobial groups under surveillance (piperacillin-tazobactam, fluoroquinolones, ceftazidime, aminoglycosides and carbapenems) (Table 12). The highest EU/EEA population-weighted mean AMR percentage in 2024 was reported for piperacillin-tazobactam (16.4%), followed by carbapenems (15.9%), fluoroquinolones (15.3%), ceftazidime (13.8%) and aminoglycosides (8.7%) (Table 9b). Between 2020 and 2024, the EU/EEA population-weighted mean AMR percentage trend decreased significantly for all the EU/EEA population-weighted mean AMR percentages. When the analysis was restricted to include only laboratories that continuously reported data for all five years, the trend remained statistically significant (Table 9b). Moreover, compared to 2023, all the 2024 EU/EEA population-weighted mean AMR percentages showed decreases. At country level for 2024, 20 countries reported >10% carbapenem resistance, nine of which reported >20% carbapenem resistance (see 'Country summaries').

Resistance to two or more antimicrobial groups was frequent: found in 16.9% of all tested invasive isolates (Table 12). The EU/EEA population-weighted mean for combined resistance, defined as resistance to at least three of the antimicrobial groups under surveillance, was 10.0% in 2024 and showed a statistically significant decreasing trend during the period 2020−2024 (Table 9b). When the analysis was restricted to laboratories that continuously reported data, this trend remained. The estimated EU/EEA incidence of combined resistance in *P. aeruginosa* bloodstream infections, measured as resistance to at least three of the antimicrobial groups under surveillance, was 0.79 per 100 000 population − an increase compared to 2020 (0.75 per 100 000 population), but a decrease compared to 2023 (0.96 per 100 000 population). There was no statistically significant trend during the period 2020–2024. However, it should be noted that for each year more than one third of the countries reported that <90% of isolates were tested for the combined antimicrobials (see 'Country summaries').

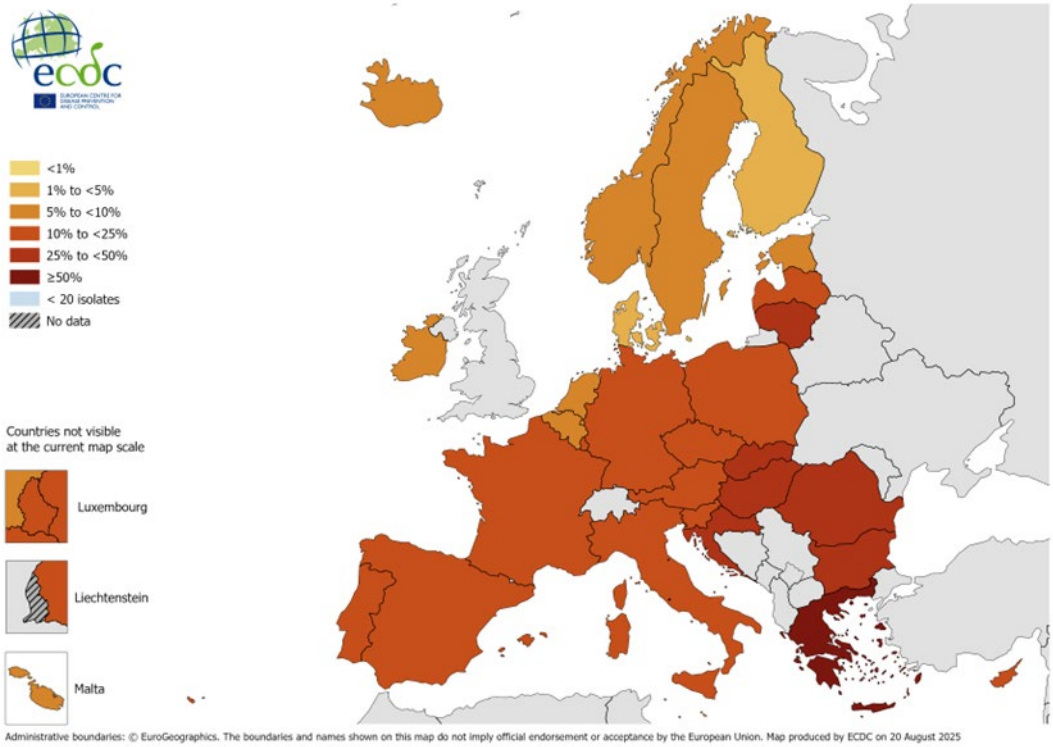
Large inter-country variations were noted for all antimicrobial groups for the AMR percentages (Table 9b) but less so for the estimated incidences of AMR bloodstream infections (Table 9a). Higher AMR percentages were generally reported from countries in southern, central and eastern Europe than from countries in northern and western Europe (Figure 6 and 'Country summaries'). For the estimated incidences of bloodstream infections with AMR, the pattern was fairly similar ('Country summaries').

Table 12. ***Pseudomonas aeruginosa.*** **Total number of invasive isolates tested (n =20 565)[a] and AMR percentage (%) per phenotype, EU/EEA, 2024**

AMR pattern[b]	Number of isolates	Percentage of total[c]
Susceptible to all included antimicrobial groups[d]	**14 515**	**70.6**
Single resistance (to indicated antimicrobial group)		
Total (any single resistance)	**2 565**	**12.5**
Carbapenems	1 059	5.1
Fluoroquinolones	844	4.1
Piperacillin-tazobactam	439	2.1
Other antimicrobial groups	223	1.1
Resistance to two antimicrobial groups		
Total (any two group combinations)	**1 588**	**7.7**
Piperacillin-tazobactam + ceftazidime	892	4.3
Fluoroquinolones + carbapenems	276	1.3
Other antimicrobial group combinations	420	2.0
Resistance to three antimicrobial groups		
Total (any three group combinations)	**741**	**3.6**
Piperacillin-tazobactam + ceftazidime + carbapenems	324	1.6
Other antimicrobial group combinations	417	2.0
Resistance to four antimicrobial groups		
Total (any four group combinations)	**446**	**2.2**
Piperacillin-tazobactam + fluoroquinolones + ceftazidime + carbapenems	262	1.3
Other antimicrobial group combinations	184	0.9
Resistance to five antimicrobial groups		
Piperacillin-tazobactam + fluoroquinolones + ceftazidime + aminoglycosides + carbapenems	**710**	**3.5**

[a] Only isolates with complete susceptibility information for piperacillin-tazobactam, ceftazidime, carbapenems (imipenem or meropenem), fluoroquinolones (ciprofloxacin or levofloxacin) and aminoglycosides (tobramycin) were included in the analysis. This represented 72% (20 565 / 28 639) of all reported P. aeruginosa *isolates.*
[b] Only AMR combinations >1% of the total are specified.
[c] Not adjusted for population differences in the reporting countries.
[d] Piperacillin-tazobactam, ceftazidime, carbapenems (imipenem or meropenem), fluoroquinolones (ciprofloxacin or levofloxacin) and aminoglycosides (tobramycin).

Figure 6. ***Pseudomonas aeruginosa.*** **Percentage of invasive isolates with resistance to carbapenems (imipenem/meropenem), by country, EU/EEA, 2024**



Discussion

EARS-Net data showed increasing trends in estimated EU/EEA incidences of *P. aeruginosa* bloodstream infections with piperacillin-tazobactam resistance, as well as ceftazidime resistance during the period 2020–2024, but all combinations have decreased since 2023. However, these results should be interpreted with caution for aminoglycosides and combined resistance due to limited AST in many of the EU/EEA countries. The trends were not reflected in the AMR percentages at EU/EEA level during the same period. Moreover, there were statistically significant decreasing trends noted for all the EU/EEA AMR percentages (2020−2024). Nevertheless, high AMR percentages were observed in several countries, especially in countries in southern, central and eastern Europe, and carbapenem resistance was common among the tested invasive isolates. As *P. aeruginosa* is intrinsically resistant to many antimicrobial agents, additional acquired resistance is further complicating the treatment of *P. aeruginosa* infections.

The 2024 EARS-Net EQA exercise showed an under-reporting of ceftazidime resistance in the EU/EEA and an over-reporting of carbapenem resistance and piperacillin-tazobactam resistance [6]. The 2022 EARS-Net EQA exercise showed an over-reporting of resistance towards levofloxacin in *P. aeruginosa* [4]. Whether the AMR overestimation remains for fluoroquinolones is uncertain, since the 2023 EARS-Net EQA exercise did not include a *P. aeruginosa* isolate [5] and the 2024 EARS-Net EQA contained a levofloxacin resistant *P. aeruginosa* isolate. Some caution is therefore advised when interpreting the results for *P. aeruginosa*.

The public health implications of AMR in *P. aeruginosa* should not be ignored. Although the estimated EU/EEA incidences for *P. aeruginosa* bloodstream infections with AMR are the lowest among the gram-negative bacteria under EARS-Net surveillance, *P. aeruginosa* remains one of the major causes of healthcare-associated infection in Europe [33-34]. In addition, an ECDC report based on EARS-Net data estimated that in 2020 there were 67 638 infections with carbapenem-resistant *P. aeruginosa,* and 3 210 deaths attributable to the same bacterial species antimicrobial group combination [1].

An analysis based on 2016 EARS-Net data highlighted that countries reporting high percentages of *P. aeruginosa* and *Acinetobacter* spp. bloodstream infections among all reported bloodstream infections were also those where the percentage of isolates with acquired AMR in gram-negative bacteria was generally highest [35]. This finding is probably attributable to shared risk factors, such as a high consumption of broad-spectrum antimicrobials and varying IPC practices in healthcare [36]. Addressing these factors and implementing high standards of IPC in healthcare within these countries would probably have a positive impact, both on the burden of infections caused by bacteria with high levels of intrinsic AMR, such as *P. aeruginosa* and *Acinetobacter* spp., and on bacteria with acquired AMR.

At the global level, WHO has listed carbapenem-resistant *P. aeruginosa* as a pathogen of high priority that requires research and the development of new antibiotics [18].

Acinetobacter species

Epidemiology

For 2024, 29 EU/EEA countries reported 10 512 invasive isolates of *Acinetobacter* spp.. Five EU/EEA countries each reported fewer than 30 isolates, and Liechtenstein did not report any isolates to EpiPulse Cases.

When comparing 2020 to 2024, there was an increase in the number of reported invasive *Acinetobacter* spp. isolates (+38.3%; 7 599 and 10 512, respectively). However, compared to the highest number reported during 2020–2024 (2021 n=11 444) there was a decrease in 2024, even though there has been an increase (n=10 037) compared to 2023. The estimated EU/EEA incidence of invasive *Acinetobacter* spp. isolates increased (+4.7%) from 4.3 per 100 000 population in 2020 to 4.7 per 100 000 population in 2024. However, it did not reach the high incidence noted for 2021 (5.5 per 100 000 population) (Table 8).

Of all reported invasive isolates reported for 2024, 10 308 (98.1%) had AST results for carbapenems, 10 064 (95.7%) for fluoroquinolones, and 9 635 (91.7%) for aminoglycosides (Table 9b).

In 2024, the highest estimated EU/EEA incidence of *Acinetobacter* spp. bloodstream infections by resistance phenotype was reported for fluoroquinolones (2.5 per 100 000 population), followed by carbapenems (2.49 per 100 000 population), and aminoglycosides (2.13 per 100 000 population) (Table 9a). During the period 2020–2024, the estimated EU/EEA incidence of *Acinetobacter* spp. bloodstream infections with resistance to aminoglycosides showed a statistically significant decreasing trend (Table 9a). However, all the estimated EU/EEA resistance incidences had decreased compared to the high incidences seen in 2021 (particularly high) and 2023. At country level, it was noted that for each of the 2024 estimated resistance incidences for fluoroquinolones, carbapenems, and aminoglycosides, 6–7 countries reported >5.0 per 100 000 population, depending on the antimicrobial group.

More than half (55.6%) of the invasive *Acinetobacter* spp. isolates reported by EU/EEA countries to EARS-Net for 2024 were resistant to at least one of the antimicrobial groups under surveillance (fluoroquinolones, aminoglycosides and carbapenems) (Table 13). The highest EU/EEA population-weighted mean AMR percentage in 2024 was reported for fluoroquinolones (33.2%), followed by carbapenems (31.6%) and aminoglycosides (29.0%) (Table 9b). Between 2020 and 2024, statistically significant decreasing trends in AMR were detected for all the antimicrobial groups under surveillance in the EU/EEA (Table 9b). The trends remained statistically significant when restricting the analysis to continuously reporting laboratories. Compared to the high numbers noted for 2021 there had been a decrease for all the antimicrobial groups in the last three years. However, for the same AMR proportions 5–7 countries reported >80% resistance, depending on the antimicrobial group.

Resistance to one or two antimicrobial groups was considerably less common than combined resistance to all three groups under surveillance (Table 13). Between 2020 and 2024, the EU/EEA population-weighted mean percentage for combined resistance to carbapenems, fluoroquinolones and aminoglycosides increased (from 34.0% to 36.9% between 2020 and 2021) and then decreased to reach 27.0% in 2024. This generated a statistically significant decreasing trend (2020–2024). The estimated EU/EEA incidence of combined resistance in bloodstream infections, measured as resistance to carbapenems, fluoroquinolones and aminoglycosides, showed a similar pattern, reaching 2.03 per 100 000 population in 2024. However, there was no statistically significant trend during the period 2020–2024. Moreover, six countries reported an estimated incidence of combined resistance above 5.00 per 100 000 population in 2024 (see 'Country summaries').

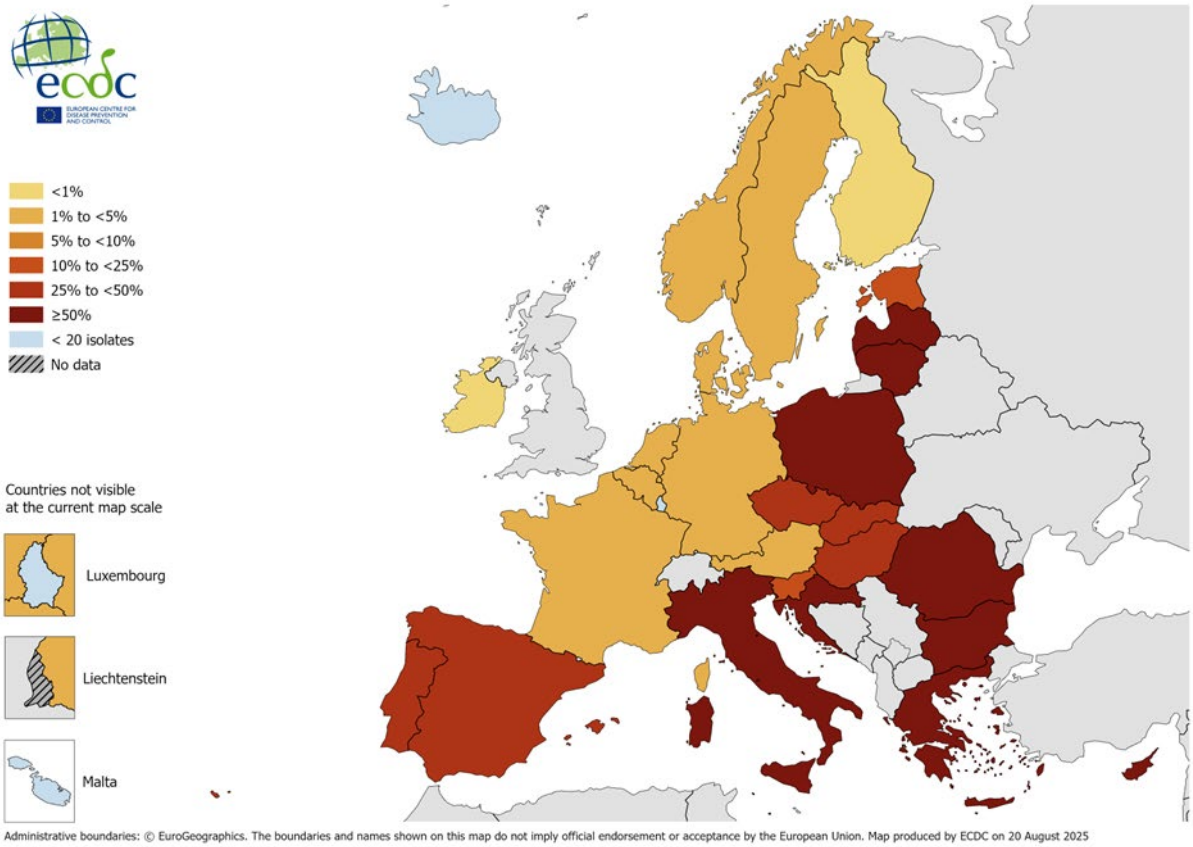
Large inter-country variations were noted for all antimicrobial groups (Table 9a and 9b), with higher AMR percentages and estimated incidences of AMR bloodstream infections generally reported from countries in southern, central and eastern Europe than from countries in northern and western Europe ('Country summaries' and Figure 7).

Table 13. ***Acinetobacter*** **species. Total number of invasive isolates tested (n =9 435)[a] and AMR percentage (%) per phenotype, EU/EEA, 2024**

AMR pattern[b]	Number of isolates	Percentage of total[c]
Susceptible to all included antimicrobial groups[d]	**4 185**	**44.4**
Single resistance (to indicated antimicrobial group)		
Total (any single resistance)	**268**	**2.8**
Fluoroquinolones	129	1.4
Other antimicrobial groups	139	1.5
Resistance to two antimicrobial groups		
Total (any two-group combinations)	**493**	**5.2**
Fluoroquinolones + carbapenems	409	4.3
Other antimicrobial group combinations	84	0.9
Resistance to three antimicrobial groups		
Fluoroquinolones + aminoglycosides + carbapenems	**4 489**	**47.6**

[a] Only isolates with complete susceptibility information for carbapenems (imipenem or meropenem), fluoroquinolones (ciprofloxacin or levofloxacin) and aminoglycosides (gentamicin or tobramycin) were included in the analysis. This represented 90% (9 435 / 10 512) of all reported Acinetobacter *spp. isolates.*
[b] Only AMR combinations >1% of the total are specified.
[c] Not adjusted for population differences in the reporting countries.
[d] Carbapenems (imipenem or meropenem), fluoroquinolones (ciprofloxacin or levofloxacin) and aminoglycosides (gentamicin or tobramycin).

Figure 7. ***Acinetobacter*** **species. Percentage of invasive isolates with resistance to carbapenems (imipenem/meropenem), by country, EU/EEA, 2024**



Discussion

Of all the bacterial species under surveillance by EARS-Net, *Acinetobacter* spp. was the least commonly reported for 2024. A publication based on 2017−2021 EARS-Net data from laboratories that continuously reported over these five years showed an increase in reported isolates in 2020−2021. In the countries with carbapenem resistance percentages in *Acinetobacter* spp. exceeding 50% in 2018–2019, a major part of these isolates consisted of carbapenem-resistant infections in ICU patients [37]. This development implied that the situation with *Acinetobacter* spp. in the EU/EEA had deteriorated and indicated the need for reinforced *Acinetobacter* spp. preparedness, and IPC in EU/EEA healthcare facilities. This need for action was further emphasised by ECDC's estimate that in 2020 3 656 deaths were attributable to carbapenem-resistant *Acinetobacter* spp. [1]. Overall, the results for 2022–2024, for both the EU/EEA population-weighted mean AMR percentages and the estimated EU/EEA incidences of bloodstream infections with AMR, suggest that the efforts to improve the situation may have had an effect.

Acinetobacter spp., and multidrug-resistant strains in particular, are notoriously difficult to eradicate from the hospital environment once established, surviving on dry surfaces, readily contaminating healthcare providers' hands, and being spread by asymptomatic carriers [38]. Therefore, although the data reported to EARS-Net indicate that at EU/EEA level, the previous deterioration in the *Acinetobacter* spp. situation may be improving, the fact that *Acinetobacter* spp. continue to display high EU/EEA population-weighted mean AMR percentages is of concern. In addition, the 2022 and 2024 EARS-Net EQA both indicated that in EARS-Net resistance to aminoglycosides is under-reported, and this result should therefore be interpreted with some caution [4,6].

The inter-country range in AMR percentages remains one of the widest ranges among all pathogens included in EARS-Net. In 2024, the percentage of invasive isolates resistant to at least one of the antimicrobial groups under surveillance (fluoroquinolones, aminoglycosides or carbapenems) ranged between 0.0% and 95.2%, depending on the reporting country. Moreover, for carbapenem resistance one country reached 94.1%. In general, the highest AMR percentages and estimated incidences of bloodstream infections with AMR were generally reported from countries in southern, central and eastern Europe. The high levels of AMR in these countries are a serious concern since the most frequently reported AMR phenotype was combined resistance to all three antimicrobial groups under surveillance, severely limiting options for patient treatment. *Acinetobacter* spp. are intrinsically resistant to many antimicrobial agents, and therefore additional acquired AMR is further complicating treatment of *Acinetobacter* spp. infections.

ECDC's risk assessment on carbapenem-resistant *Acinetobacter baumannii* in healthcare settings highlights the need for increased efforts to face this significant threat to patients and healthcare systems in all EU/EEA countries. The document outlines options for reducing risks through clinical management; prevention of transmission in hospitals and other healthcare settings; prevention of cross-border transmission and improvement in the preparedness of EU/EEA countries. Options for response presented in the risk assessment include timely laboratory reporting, screening and pre-emptive isolation of high-risk patients, good IPC practices, rigorous environmental cleaning and disinfection, and antimicrobial stewardship programmes [39].

To further assist EU/EEA countries as well as Western Balkan countries and Türkiye in enhancing their capacities for detection and control of infections caused by carbapenem-resistant *A. baumannii* (CRAb), ECDC has expanded EURGen-Net to include the conducting of a genomic survey of CRAb in 2024–2025 [40].

WHO has listed carbapenem-resistant *A. baumannii* as a pathogen of critical priority in its global priority list of antibiotic-resistant bacteria, requiring research and the development of new antibiotics [18].

Staphylococcus aureus

Epidemiology

For 2024, 30 EU/EEA countries reported 98 335 invasive isolates of *S. aureus*. When comparing 2020 to 2024, there was an increase in the number of reported *S. aureus* invasive isolates (+32.6%; 74 180 and 98 335, respectively). The estimated EU/EEA incidence of *S. aureus* invasive isolates during the same period showed a smaller increase (+12.5%), from 33.7 per 100 000 population to 37.9 per 100 000 population (Table 8).

Of all reported invasive isolates in 2024, 95 166 (96.8%) had AST results or molecular confirmation test results available to determine MRSA status (Table 9b).

In 2024, the estimated EU/EEA incidence of MRSA bloodstream infections was 4.43 per 100 000 population (Table 9a) and showed no statistically significant trend for 2020–2024, however there was an increase compared to 2023 (4.32 per 100 000 population). For the EU, the estimated total EU incidence of MRSA bloodstream infections was 4.48 per 100 000 population in 2024 and during the period 2019–2024, the estimated EU incidence of MRSA bloodstream infections showed a statistically significant decreasing trend (Table 6). The result for the AMR target, the estimated EU incidence of MRSA bloodstream infections, was a 20.4% decrease in the estimated incidence between 2019 (baseline year) and 2024, from 5.63 to 4.48 cases per 100 000 population. This was 0.31 per 100 000 population lower than the 2030 target. The EU country range for the incidence of MRSA bloodstream infections was 0.55−13.63 per 100 000 population in 2024 (Table 6). At country level, 12 countries (Bulgaria, Czechia, Denmark, France, Germany, Ireland, Italy, Luxembourg, Malta, Poland, Portugal and Slovakia)[4] had already reached their respective target in 2024. However, six EU countries had a statistically significant increasing trend in the estimated incidence since 2019 and had not reached their respective targets.

A little more than one sixth (16.9%) of the invasive *S. aureus* isolates reported by EU/EEA countries to EARS-Net for 2024 were resistant to at least one of the antimicrobial groups under surveillance (meticillin/MRSA, fluoroquinolones and rifampicin) (Table 14).

The EU/EEA population-weighted mean MRSA percentage was 14.2% in 2024. This denotes a significantly decreasing trend for the period 2020−2024, from 16.7% to 14.2%, a trend that remained statistically significant when the analysis was restricted to include only laboratories that continuously reported data for all five years (Table 9b). Moreover, the MRSA percentage either showed a statistically significant decreasing trend or no statistically significant trend (i.e. neither decreasing nor increasing) in most EU/EEA countries.

With MRSA, combined resistance to another antimicrobial group was quite common. The most common AMR combination was MRSA and resistance to fluoroquinolones (Table 14).

Large inter-country variations were noted for MRSA (Table 9b), with higher AMR percentages generally reported from countries in southern, central and eastern Europe than from northern Europe (Figure 8 and 'Country summaries'). For the estimated incidences of bloodstream infections with AMR, the pattern was fairly similar ('Country summaries').

[4] The results for Bulgaria, Denmark, Germany and Poland should be interpreted with caution.

Table 14. ***Staphylococcus aureus.*** **Total number of invasive isolates tested (n =71 579)[a] and AMR percentage (%) per phenotype, EU/EEA, 2024**

AMR pattern[b]	Number of isolates	Percentage of total[c]
Susceptible to all included antimicrobial groups[d]	**59 508**	**83.1**
Single resistance (to indicated antimicrobial group)		
Total (any single resistance)	**6 320**	**8.8**
Fluoroquinolones	3 076	4.3
Meticillin/MRSA	2 652	3.7
Other antimicrobial groups	592	0.8
Resistance to two antimicrobial groups		
Total (any two-group combinations)	**5 397**	**7.5**
Meticillin/MRSA + fluoroquinolones	5 207	7.3
Other resistance combinations	190	0.3
Resistance to three antimicrobial groups		
Meticillin/MRSA + fluoroquinolones + rifampicin	**354**	**0.5**

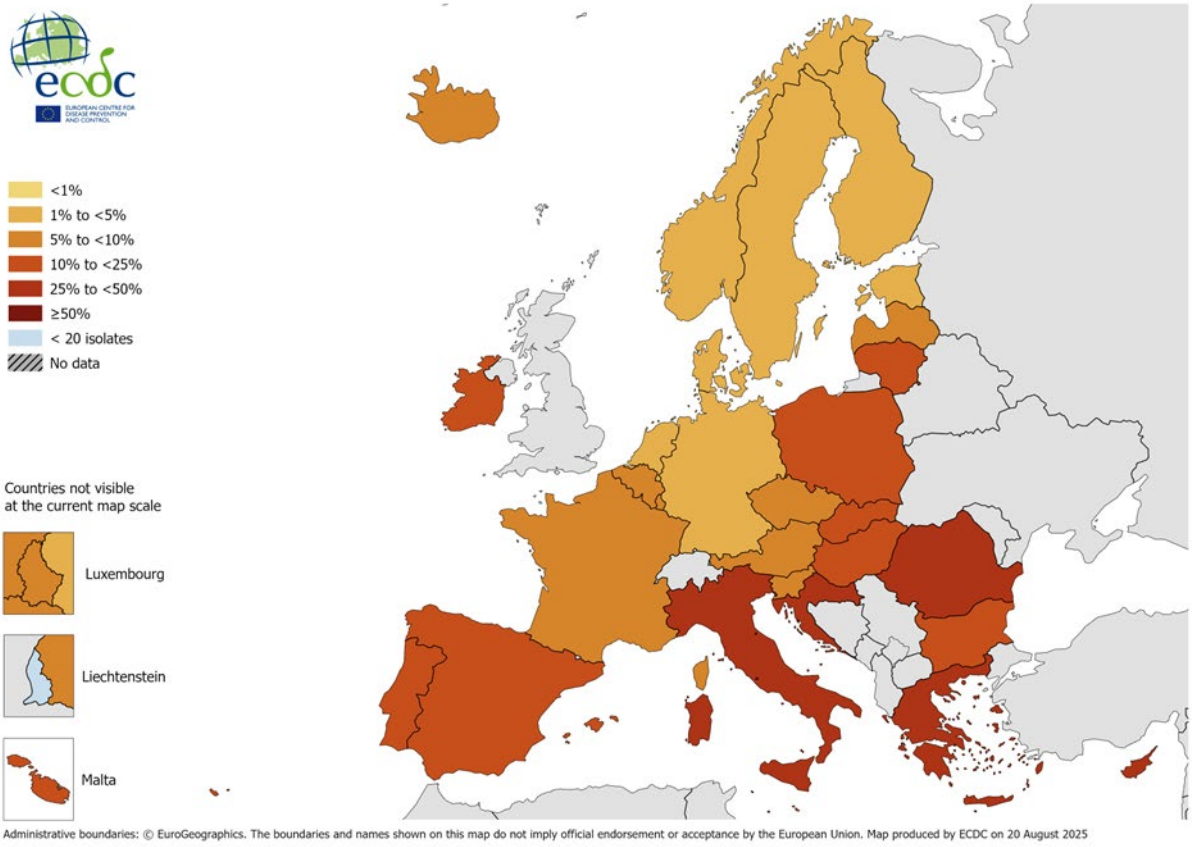
[a] *Only isolates with complete susceptibility information for MRSA, fluoroquinolones and rifampicin were included in the analysis. This represented 73% (71 579 / 98 335) of all reported* S. aureus *isolates. MRSA is based on AST results for cefoxitin, or if unavailable, oxacillin. AST results reported for cloxacillin, dicloxacillin, flucloxacillin or meticillin are accepted as a marker for oxacillin resistance if oxacillin is not reported. If no phenotypic results are available, data from molecular confirmation tests (detection of* mecA *gene by PCR or a positive PBP2A-agglutination test) are accepted as a marker for MRSA. For fluoroquinolones (ciprofloxacin or levofloxacin) AST results for norfloxacin are also accepted if neither ciprofloxacin nor levofloxacin results are available.*

[b] *Only AMR combinations >1% of the total are specified.*

[c] *Not adjusted for population differences in the reporting countries.*

[d] *MRSA, fluoroquinolones and rifampicin. MRSA is based on AST results for cefoxitin, or if unavailable, oxacillin. AST results reported for cloxacillin, dicloxacillin, flucloxacillin or meticillin are accepted as a marker for oxacillin resistance if oxacillin is not reported. If no phenotypic results are available, data from molecular confirmation tests (detection of* mecA *gene by PCR or a positive PBP2A-agglutination test) are accepted as a marker for MRSA. For fluoroquinolones (ciprofloxacin or levofloxacin) AST results for norfloxacin are also accepted if neither ciprofloxacin nor levofloxacin results are available.*

Figure 8. ***Staphylococcus aureus.*** **Percentage of invasive isolates resistant to meticillin (MRSA)[a], by country, EU/EEA, 2024**



[a] *For EARS-Net, MRSA is based on AST results for cefoxitin or, if unavailable, oxacillin. AST results reported for cloxacillin, dicloxacillin, flucloxacillin or meticillin are accepted as a marker for oxacillin resistance if oxacillin is not reported. If no phenotypic results are available, data from molecular confirmation tests (detection of* mecA *gene by PCR or a positive PBP2A-agglutination test) are accepted as a marker for MRSA.*

Discussion

For the EU/EEA, the population-weighted mean MRSA percentage and the estimated incidence of MRSA bloodstream infections indicated an improvement over the last five years. This was also reflected in the EU target for MRSA as EARS-Net data currently indicate that by 2024 the EU had already reached the agreed target of a 15% reduction in incidence by 2030 against 2019 (baseline year) [2].

Several countries have developed and implemented national recommendations and guidance documents on preventing the spread of MRSA, focusing on improved IPC and prudent antimicrobial use [31]. In 2024, the estimated incidence of MRSA bloodstream infections and the MRSA percentage also showed either no trend or a decreasing trend in most EU/EEA countries. However, it is also worth noting that some countries had an increasing trend in the estimated incidence of MRSA bloodstream infections and the MRSA percentage.

The 2024 EARS-Net EQA exercise indicated that in EARS-Net MRSA is over-reported, and the results should therefore be interpreted with some caution [6]. Despite this and the overall positive developments seen for MRSA in the EU/EEA, MRSA remains an important pathogen in Europe, with combined resistance to another antimicrobial group being quite common and high MRSA percentages still being observed in several countries. *S. aureus* is one of the most common causes of bloodstream infections, with a high burden in terms of morbidity and mortality [1,19]. In addition, although not covered by EARS-Net which focusses on isolates from blood and cerebrospinal fluid, ECDC has seen recent reports from EU/EEA countries on outbreaks of fusidic-acid-resistant MRSA, mainly manifesting as impetigo [41].

Although the EU/EEA population-weighted MRSA percentage, as reported by EARS-Net, has been decreasing for many years, ECDC's study of the health burden of AMR reported an increase in estimated incidence of MRSA infections between 2007 and 2015. Further analysis of the age-group-specific incidence of MRSA infections found that this mainly related to infants and those aged 55 years or above [19]. A separate study based on EARS-Net data for the period 2005–2018 highlighted that the decrease in the percentage of MRSA among *S. aureus* bloodstream infections was mainly due to the increasing number of meticillin-susceptible *S. aureus* bloodstream infections. The

seemingly conflicting results highlighted the need to improve surveillance of AMR by reporting not only AMR percentages, but also the incidence of infections with antimicrobial-resistant bacteria such as MRSA [42]. The estimation of the incidence of bloodstream infections with antimicrobial-resistant bacteria has therefore been added to the annual epidemiological report for EARS-Net for all bacterial species-antimicrobial group combinations under EARS-Net surveillance.

MRSA surveillance is also carried out in the animal and food safety sector. At present, monitoring of MRSA in animals and food is voluntary and only performed in a few countries. Nevertheless, this monitoring did detect MRSA, mainly livestock-associated MRSA (LA-MRSA), in food and food-producing animals in 2022–2023 [10]. LA-MRSA poses a zoonotic risk, particularly for those in close contact with livestock. Although data collected through EARS-Net do not allow the identification of LA-MRSA isolates, an ECDC survey documented increasing numbers of detections and geographical dispersion of LA-MRSA in humans in the EU/EEA during the period 2007–2013, highlighting the veterinary and public health significance of LA-MRSA as a One-Health issue [43].

WHO has listed MRSA as a pathogen of high priority in its global priority list of antibiotic-resistant bacteria, emphasising the significant treatment difficulties that can be critical in some populations [18].

Streptococcus pneumoniae

Epidemiology

For 2024, 30 EU/EEA countries reported 21 211 invasive isolates of *S. pneumoniae*. When comparing 2020 to 2024, there was an increase in the number of reported *S. pneumoniae* invasive isolates (+141.8%; 8 771 and 21 211, respectively). Since the increase between 2021 (9 178) and 2022 (14 709) the annual increases have become less marked. Nevertheless, the number has still been increasing annually since 2020. The estimated incidence of *S. pneumoniae* invasive isolates has increased from 3.7 per 100 000 population in 2020 to 8.0 per 100 000 population in 2024 (Table 8). This means that the incidence has more than doubled since 2020.

Of the invasive isolates reported in 2024, 20 372 (96.0%) had AST results for macrolides and 19 520 (92.0%) had AST results for penicillins (Table 9b).

For this report, the term 'penicillin non-wild-type' refers to *S. pneumoniae* isolates reported by local laboratories as 'susceptible, increased exposure' (I) or resistant (R) to penicillin, assuming an MIC for benzylpenicillin above that for the wild-type isolates (> 0.06 mg/L). The analysis was based on the qualitative susceptibility categories S/I/R, since quantitative susceptibility information was missing for a large part of the reported data.

In 2024, the highest estimated EU/EEA incidence of *S. pneumoniae* bloodstream infections by resistance phenotype was reported for macrolides (1.12 per 100 000 population), followed by 'penicillin non-wild-type' (0.99 per 100 000 population) (Table 9a). During the period 2020–2024, the estimated EU/EEA incidences of bloodstream infections with resistant *S. pneumoniae* showed an increase. This resulted in the 2024 incidences being more than double those reported for 2020. There was a statistically significant increasing trend for the EU/EEA for all incidences (Table 9a). At country level, 18 EU/EEA countries showed a statistically significant trend in incidence of 'penicillin non-wild-type' *S. pneumoniae* bloodstream infections for 2020–2024 and 20 EU/EEA countries showed a statistically significant trend in incidence of macrolide resistant *S. pneumoniae* bloodstream infections for 2020–2024 ('Country summaries').

More than one fifth (21.1%) of the invasive *S. pneumoniae* isolates reported by EU/EEA countries to EARS-Net for 2024 were resistant to at least one of the antimicrobial groups under surveillance ('penicillin non-wild-type', third-generation cephalosporins, fluoroquinolones and macrolides) (Table 15). In 2024, the EU/EEA population-weighted mean percentage was 19.0% for macrolide resistance and 17.3% for 'penicillin non-wild-type' (Table 9b). Between 2020 and 2024, the trend in the EU/EEA population-weighted mean percentage of macrolide resistance and 'penicillin non-wild-type' resistance increased significantly, with percentages increasing from 16.8% to 19.0% and from 15.5% to 17.3%, respectively (Table 9b). These trends remained significant when the analysis was restricted to include only laboratories that continuously reported data for all five years.

The EU/EEA population-weighted mean percentage for combined 'penicillin non-wild-type' and resistance to macrolides was 11.1% in 2024, with a significantly increasing trend during the period 2020−2024 (Table 9b). Moreover, the trend remained statistically significant for macrolide resistance when the analysis was restricted to include only laboratories that continuously reported data for all five years. Resistance to antimicrobial groups other than 'penicillin non-wild-type' and macrolides was less common (Table 15). The estimated EU/EEA incidence of combined AMR (i.e. macrolide resistance and 'penicillin non-wild-type') in *S. pneumoniae* bloodstream infections, was 0.55 per 100 000 population in 2024. This had more than doubled compared to 2020 (0.24 per 100 000 population) and showed a statistically significant increasing trend during the period 2020–2024.

Large inter-country variations in AMR percentage were noted for all antimicrobial groups (Table 9b, Figure 9), with higher macrolide resistance and 'penicillin non-wild-type' percentages generally reported from countries in southern Europe than countries in northern Europe. For the estimated incidences of bloodstream infections with resistant *S. pneumoniae*, this pattern was not evident and there was less inter-country variation.

Table 15. ***Streptococcus pneumoniae.*** **Total number of invasive isolates tested (n = 13 703)[a] and percentage non-wild-type/AMR (%) per phenotype, EU/EEA, 2024**

AMR pattern[b]	Number of isolates	Percentage of total[c]
Susceptible to all included antimicrobial groups[d]	**10 809**	**78.9**
Single non-wild-type/resistance (to indicated antimicrobial groups)		
Total (any single resistance)	**1 756**	**12.8**
Macrolides	969	7.1
Penicillin non-wild-type[e]	746	5.4
Other antimicrobial groups	41	0.3
Non-wild-type/resistance to two antimicrobial groups		
Total (any two-group combinations)	**1 041**	**7.6**
Penicillin non-wild-type + macrolides	1 001	7.3
Other antimicrobial group combinations	40	0.3
Non-wild-type/resistance to three antimicrobial groups		
Total (any three-group combinations)	**75**	**0.5**
Other antimicrobial group combinations	75	0.5
Non-wild-type/resistance to four antimicrobial groups		
Penicillin non-wild-type + third-generation cephalosporins + fluoroquinolones + macrolides	**22**	**0.2**

[a] *Only isolates with complete susceptibility information for penicillins (based on penicillin or, if unavailable, oxacillin), third-generation cephalosporins (cefotaxime or ceftriaxone) and fluoroquinolones (levofloxacin or moxifloxacin - AST results for norfloxacin are also accepted if neither levofloxacin nor moxifloxacin results are available) and macrolides (azithromycin, clarithromycin or erythromycin) were included in the analysis. This represented 65% (13 703 / 21 211) of all reported* S. pneumoniae *isolates.*

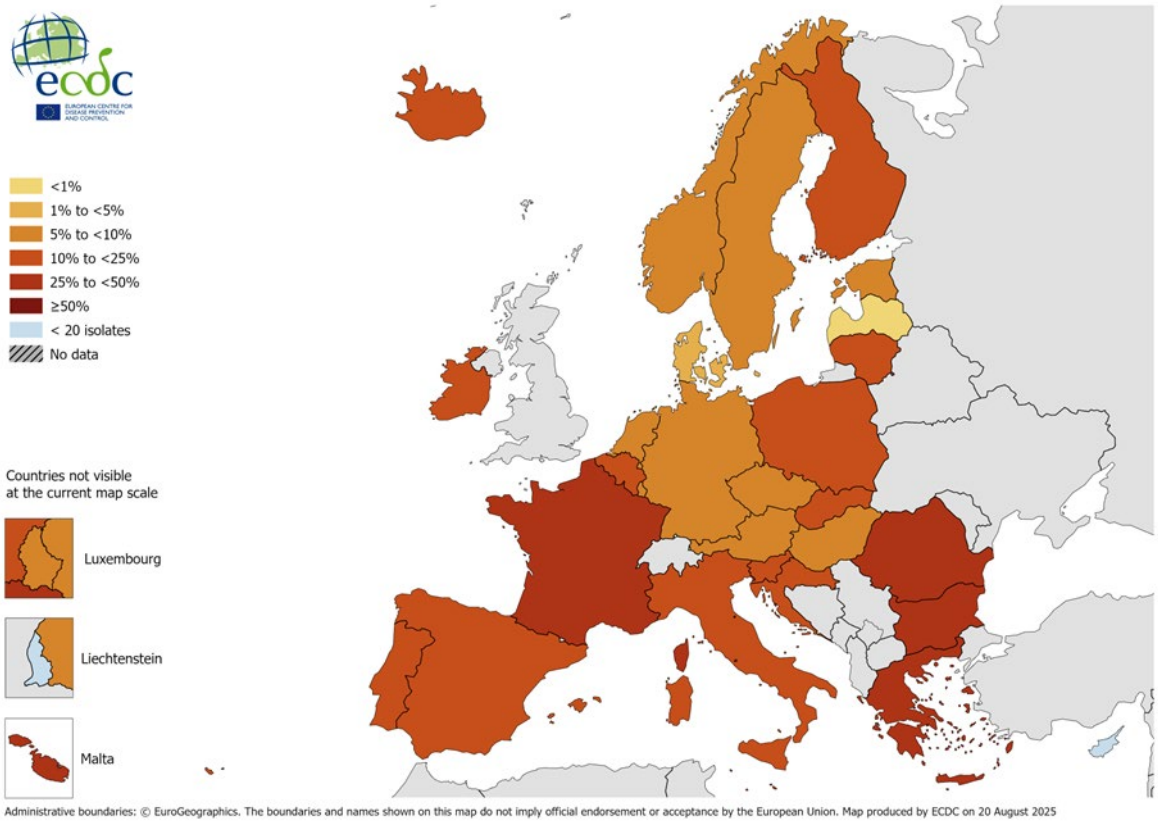
[b] *Only AMR combinations >1% of the total are specified.*

[c] *Not adjusted for population differences in the reporting countries.*

[d] *Penicillins (based on penicillin or, if unavailable, oxacillin), third-generation cephalosporins (cefotaxime or ceftriaxone) and fluoroquinolones (levofloxacin or moxifloxacin - AST results for norfloxacin are also accepted if neither levofloxacin nor moxifloxacin results are available) and macrolides (azithromycin, clarithromycin or erythromycin) were included in the analysis.*

[e] *For* S. pneumoniae*, the term 'penicillin non-wild-type' is used in this report, referring to* S. pneumoniae *isolates reported by local laboratories as 'susceptible, increased exposure' (I) or resistant (R) to penicillin, assuming MIC for benzylpenicillin above that for wild-type isolates (> 0.06 mg/L). The qualitative susceptibility categories (S/I/R) as reported by the laboratory are used, since quantitative susceptibility information is missing for a large part of the data.*

Figure 9. *Streptococcus pneumoniae*. Percentage of penicillin[a] non-wild type[b] invasive isolates, by country, EU/EEA, 2024



[a] *Penicillin results are based on penicillin or, if unavailable, oxacillin.*

[b] *For* S. pneumoniae*, the term 'penicillin non-wild-type' is used in this report, referring to* S. pneumoniae *isolates reported by local laboratories as 'susceptible, increased exposure' (I) or resistant (R) to penicillin, assuming MIC for benzylpenicillin above that for wild-type isolates (> 0.06 mg/L). The qualitative susceptibility categories (S/I/R) as reported by the laboratory are used, since quantitative susceptibility information is missing for a large part of the data.*

Discussion

Non-pharmaceutical interventions introduced to reduce severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmission [44] may have contributed to the decrease in respiratory tract infections, including *S. pneumoniae* infections in 2020–2021. The subsequent lifting of the non-pharmaceutical interventions [44] may have contributed to the observed doubling of the number of invasive *S. pneumoniae* isolates and the estimated EU/EEA incidence of invasive isolates in 2024 compared to 2020.

In EARS-Net a doubling of the EU/EEA resistance incidences was noted with statistically significant increasing trends. Moreover, there were also increasing trends in the population-weighted EU/EEA mean percentages for 'penicillin non-wild-type' and macrolide resistance between 2020 and 2024. At country level, increasing trends in the estimated resistance incidences were noted for a majority of the countries and there was limited inter-country variation in the estimated resistance incidences. However, there were large inter-country variations in AMR percentages in 2024.

When considering the increasing estimated EU/EEA incidence of 'penicillin non-wild-type' *S. pneumoniae* bloodstream infections and the increased EU/EEA population-weighted mean percentage for 'penicillin non-wild-type' *S. pneumoniae*, it should be noted that the 2022 EARS-Net EQA indicated that reduced susceptibility to benzylpenicillin was under-reported in EARS-Net [4]. Neither the 2023 nor the 2024 EARS-Net EQA exercise included a *S. pneumoniae* isolate [5-6] and it is therefore unknown if this is still the case.

In parallel with EARS-Net, surveillance of invasive pneumococcal disease in the EU/EEA is covered by another surveillance network, the European Invasive Bacterial Disease Surveillance Network (EU-IBD), also coordinated by ECDC. This network collects additional data on invasive pneumococcal disease cases throughout the EU/EEA – for example data on outcome [45]. A recent report from this surveillance shows that the percentage of resistance to penicillin was 12.8%, based on data reported by 12 countries, and 19% for erythromycin, based on data reported by eleven countries for 2022 [45]. It is, however, difficult to compare data from the two surveillance systems due to differences – for example in the number of reporting countries.

Most EU/EEA countries have implemented routine immunisation for children with multivalent pneumococcal conjugated vaccines (PCVs). In some countries, high-risk adult groups, such as elderly people and immunocompromised individuals, are also targeted with the polysaccharide vaccine or with PCVs [46]. Changes in immunisation and serotype coverage of the PCVs available will probably have an impact on the epidemiology of *S. pneumoniae* in the EU/EEA, both in terms of changes in the age-specific incidence and potential serotype replacement. It is also conceivable that the COVID-19 pandemic and related public health interventions and changes in antibiotic consumption [47] may further affect *S. pneumoniae* epidemiology in the EU/EEA.

WHO has listed macrolide-resistant *S. pneumoniae* as a pathogen of medium priority in its global priority list of antibiotic-resistant bacteria, indicating moderate treatment difficulties that can be critical in some populations [18].

Enterococcus faecalis

Epidemiology

For 2024, 30 EU/EEA countries reported 36 610 invasive isolates of *E. faecalis*. The estimated EU/EEA incidence of invasive *E. faecalis* isolates increased (+7.4%) from 13.6 per 100 000 population in 2020 to 14.6 per 100 000 population in 2024 (Table 8).

Of the invasive isolates reported, 18 260 (49.9%) had AST results for high-level gentamicin (Table 9b).

In 2024, the estimated EU/EEA incidence of *E. faecalis* bloodstream infections with high-level gentamicin resistance was 2.2 per 100 000 population) (Table 9a). During the period 2020−2024, the estimated EU/EEA incidence of high-level gentamicin-resistant *E. faecalis* bloodstream infections increased from 2020 (2.55 per 100 000 population) to 2021 (2.94 per 100 000 population) and then decreased until 2024. The results showed a statistically significant decreasing trend in the EU/EEA (Table 9a). At country level, seven countries reported an estimated incidence of high-level gentamicin resistance above 3 per 100 000 population (see 'Country summaries'). However, it should be noted that for each year more than one third of the countries reported that susceptibility to gentamicin was tested for <90% of isolates ('Country summaries').

In 2024, the EU/EEA population-weighted mean percentage of high-level gentamicin resistance in *E. faecalis* was 22.6%. This represents a decrease since 2020, when the percentage was 29.0% (Table 9b). A significantly decreasing trend was noted for high-level gentamicin resistance during the period 2020–2024. The trend remained significant when the analysis was restricted to include only laboratories that continuously reported data for all five years.

Large inter-country variations in AMR percentage were noted for high-level gentamicin resistance in *E. faecalis* (Table 9b). Although there were generally higher AMR percentages reported from countries in southern, central and eastern Europe than from countries in northern and western Europe, there were exceptions ('Country summaries'). More information is provided in ECDC's Surveillance Atlas of Infectious Diseases [48]. For the estimated incidence of high-level gentamicin-resistant *E. faecalis* infections, this pattern was quite similar but there was less inter-country variation.

Discussion

Although both the EU/EEA population-weighted mean percentage and the estimated EU/EEA incidence of high-level gentamicin resistance in *E. faecalis* have decreased significantly, the estimated incidence of high-level gentamicin-resistant *E. faecalis* bloodstream infections reported was high in more than a fifth of the EU/EEA countries in 2024. Although the results should be interpreted with caution due to limited AST in many of the EU/EEA countries, they indicate that antimicrobial-resistant enterococci remain a major IPC challenge and an important cause of healthcare-associated infections in Europe. In addition to the fact that infections caused by resistant strains are difficult to treat, enterococci are also easily disseminated in healthcare settings.

Enterococcus faecium

Epidemiology

For 2024, 30 EU/EEA countries reported 26 111 invasive isolates of *E. faecium.*

Over the last five years, the number of reported invasive isolates of *E. faecium* at EU/EEA level increased by +39.1% from 18 765 in 2020 to 26 111 in 2024. The estimated EU/EEA incidence of invasive *E. faecium* isolates increased (+15.2%) from 9.2 per 100 000 population in 2020 to 10.6 per 100 000 population in 2024 (Table 8).

Of the invasive isolates reported in 2024, 25 678 (98.3%) had AST results for vancomycin (Table 9b).

In 2024, the estimated EU/EEA incidence of vancomycin-resistant *E. faecium* bloodstream infections was 1.96 per 100 000 population which was an increase compared to 2020 (1.76 per 100 000 population) (Table 9a). During the period 2020–2024, the estimated EU/EEA incidence of vancomycin-resistant *E. faecium* bloodstream infections increased, although it did not show a significantly increasing trend (Table 9a). However, compared to 2021 (2.15 per 100 000 population) and 2022 (2.06 per 100 000 population), the incidence decreased.

The EU/EEA population-weighted mean percentage of vancomycin resistance in *E. faecium* was 16.5% in 2024, representing a decrease compared to 2020 when the percentage was 16.8%. There was no significant trend (Table 9b).

More than nine-tenths (91.3%) of the invasive *E. faecium* isolates reported by all EU/EEA countries to EARS-Net for 2024 were resistant to at least one of the antimicrobial groups under surveillance (aminopenicillins, gentamicin (high-level resistance) and vancomycin) (Table 16).

AMR to two or more antimicrobial groups was common - seen in 58.2% of all tested invasive isolates (Table 16).

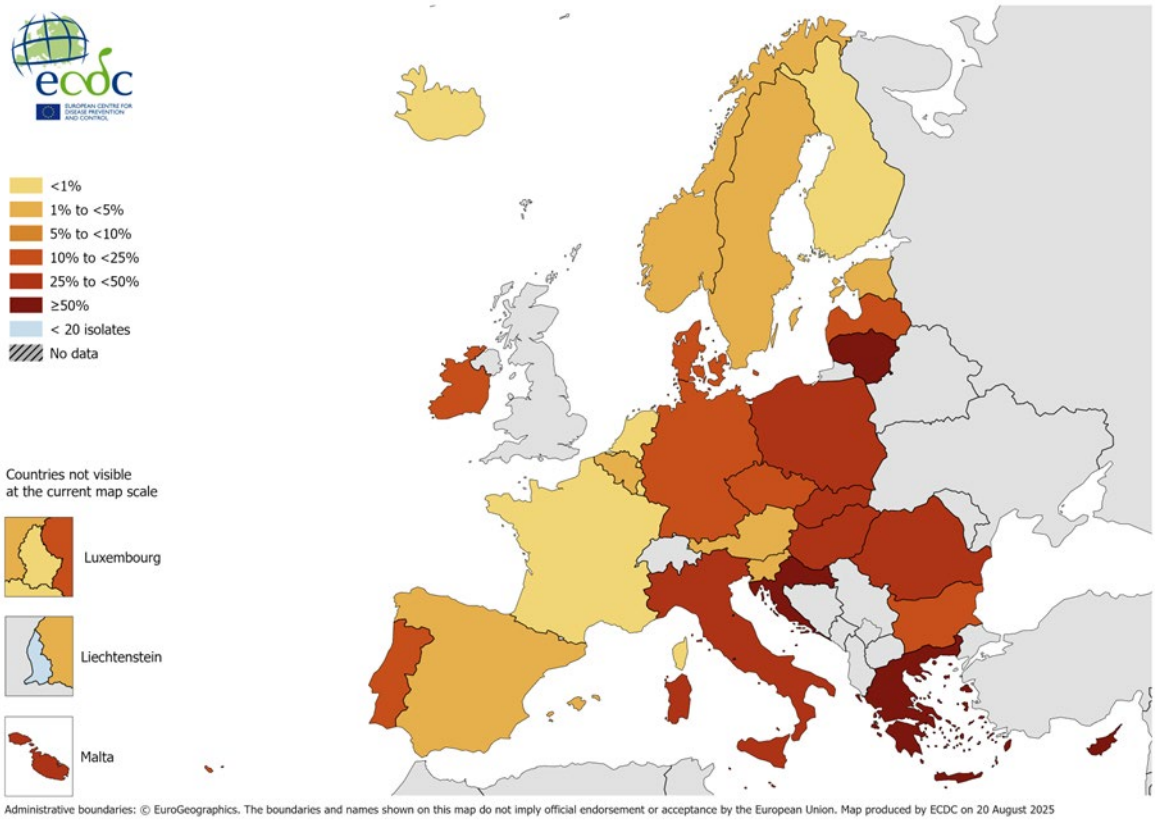
National percentages of vancomycin resistance ranged from 0.0% to 61.7% (Table 9b), with 12 countries reporting percentages below 5% (Figure 10) and ten countries reporting percentages above 25%. In total, seven countries noted a statistically significant increasing trend. The estimated incidence of vancomycin-resistant *E. faecium* bloodstream infections ranged from 0.00 to 9.97 per 100 000 population, with 14 countries reporting an estimated incidence below 0.50 per 100 000 population ('Country summaries') and three countries reporting an incidence above 5.00 per 100 000 population. Moreover, seven countries showed an increasing trend that was statistically significant. High vancomycin-resistant *E. faecium* percentages were reported from countries in central and eastern and southern Europe, as well as Ireland. For the estimated incidence of vancomycin-resistant *E. faecium* bloodstream infections, the pattern was similar.

Table 16. *Enterococcus faecium.* Total number of invasive isolates tested (n = 12 995)[a] and AMR percentage (%) per phenotype, EU/EEA, 2024

AMR pattern[b]	Number of isolates	Percentage of total[c]
Susceptible to all included antimicrobial groups[d]	**1 130**	**8.7**
Single resistance (to indicated antimicrobial group)		
Total (any single resistance)	**4 297**	**33.1**
Aminopenicillins	4 218	32.5
Other antimicrobial groups	79	0.6
Resistance to two antimicrobial groups		
Total (any two-group combinations)	**6 133**	**47.2**
Aminopenicillins + gentamicin (high level resistance)	5 016	38.6
Aminopenicillins + vancomycin	1 103	8.5
Other resistance combinations	14	0.1
Resistance to three antimicrobial groups		
Aminopenicillins + gentamicin (high level resistance) + vancomycin	**1 435**	**11.0**

[a] *Only isolates with complete susceptibility information for aminopenicillins (ampicillin or amoxicillin), gentamicin (high-level resistance) and vancomycin were included in the analysis. This represented 50% (12 995 / 26 111) of all reported* E. faecium *isolates.*
[b] *Only AMR combinations >1% of the total are specified.*
[c] *Not adjusted for population differences in the reporting countries.*
[d] *Aminopenicillins (ampicillin or amoxicillin), gentamicin (high-level resistance) and vancomycin.*

Figure 10. ***Enterococcus faecium*****. Percentage of invasive isolates resistant to vancomycin, by country, EU/EEA, 2024**



Discussion

The increase in the estimated EU/EEA incidence of invasive *E. faecium* isolates and the estimated incidence of vancomycin-resistant *E. faecium* bloodstream infections in the EU/EEA compared to 2020, with statistically significant increasing trends observed for several countries, is a cause for concern.

An ECDC study of the health burden of AMR in the EU/EEA estimated that the median number of infections and deaths attributable to vancomycin-resistant enterococci almost doubled between 2007 and 2015 [19]. A more recent ECDC study estimated that the number of these infections increased from 47 124 in 2016 to 117 866 in the EU/EEA in 2020, with a concomitant increase in the number of attributable deaths from 1 335 to 3 414 [1]. The rise in the estimated EU/EEA incidence of vancomycin-resistant *E. faecium* bloodstream infections in 2024 compared to 2020 contributes to a further increase in the health burden of vancomycin-resistant enterococci infections.

The significantly increasing trend in the estimated incidence of vancomycin-resistant *E. faecium* bloodstream infections observed for several individual countries highlights the urgent need for closer monitoring to better understand the epidemiology, clonal diversity and risk factors associated with vancomycin-resistant *E. faecium* infection.

In addition to the fact that infections caused by vancomycin-resistant strains are difficult to treat, enterococci are also easily disseminated in healthcare settings. A report published by ECDC confirmed that *Enterococcus* spp. continued to be a frequently observed healthcare-associated infection in European acute care hospitals in 2022–2023 [34]. The same report showed high levels of vancomycin resistance in healthcare-associated infections with *E. faecium*. These results attest to the fact that high levels of antimicrobial-resistant enterococci remain a major infection control challenge in Europe.

Enterococci have intrinsic resistance to several antimicrobial classes, and any additional acquired AMR severely limits the number of treatment options. WHO has listed vancomycin-resistant *E. faecium* as a pathogen of high priority in the global bacterial pathogen priority list, indicating that research and the development of new antibiotics is required [18].

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Annex 1. Participating institutions

Country	Participating institutions	Web link
Austria	Federal Ministry of Social Affairs, Health, Care and Consumer Protection	www.sozialministerium.at
	Ordensklinikum Linz, Elisabethinen	www.ordensklinikum.at
Belgium	Sciensano	www.sciensano.be
Bulgaria	National Center of Infectious and Parasitic Diseases	https://ncipd.org/index.php?option=com_content&view=featured&Itemid=730&lang=en
Croatia	Reference Center for Antimicrobial Resistance Surveillance University Hospital for Infectious Diseases (Dr Fran Mihaljević), Zagreb	https://bfm.hr/referentni-centar-za-pracenje-rezistencijebakterija-na-antibotike/
Cyprus	Microbiology Department, Nicosia General Hospital	https://shso.org.cy/clinic/mikroviologiko/
Czechia	National Institute of Public Health	www.szu.cz
	National Reference Laboratory for Antibiotics	https://szu.cz/odborna-centra-a-pracoviste/centrum-epidemiologie-a-mikrobiologie/oddeleni-bakterialni-rezistence-na-antibiotika-a-sbirka-kultur/nrl-pro-antibiotika
Denmark	Statens Serum Institut	https://www.ssi.dk/
	Danish Study Group for Antimicrobial Resistance Surveillance (DANRES)	www.danmap.org
Estonia	Estonian Health Board	https://www.terviseamet.ee/et
	East-Tallinn Central Hospital	https://itk.ee/
	Tartu University Hospital	https://www.kliinikum.ee/partnerile/uhendlabor/
Finland	Finnish Institute for Health and Welfare, Department of Health Security	www.thl.fi
	Finnish Study Group for Antimicrobial Resistance (FiRe)	www.finres.fi
	Finnish Hospital Infection Program (SIRO)	https://thl.fi/en/web/infectious-diseases-and-vaccinations/diseases-and-disease-control/healthcare-associated-infections
France	Santé Publique France	www.santepubliquefrance.fr
	Since 2020:	
	Surveillance and Prevention of Antimicrobial RESistance in hospital settings (SPARES)	https://www.preventioninfection.fr/
	National Reference Centre for Pneumococci	www.cnr-pneumo.com
	Up to 2019:	
	French National Observatory for the Epidemiology of Bacterial Resistance to Antimicrobials (ONERBA) through three participating networks:	www.onerba.org
	Azay-Résistance	
	Île-de-France	
	Réussir	
Germany	Robert Koch Institute	www.rki.de
Greece	National Public Health Organization, Central Public Health Laboratory	https://eody.gov.gr/en/
Hungary	National Public Health Center	www.oek.hu
Iceland	National University Hospital of Iceland	https://www.landspitali.is
	Centre for Health Security and Infectious Disease Control	https://www.landlaeknir.is
	Akureyri hospital	www.sak.is
Ireland	Health Protection Surveillance Centre	www.hpsc.ie
Italy	National Institute of Health	www.iss.it
Latvia	Disease Prevention and Control Center of Latvia	www.spkc.gov.lv
Liechtenstein	Liechtensteinisches Landesspital	https://www.landesspital.li/
	Laboratory Dr Risch[a]	https://www.risch.ch/de
	The Swiss Center for Antibiotic Resistance (ANRESIS)[b]	https://www.anresis.ch/

Country	Participating institutions	Web link
Lithuania	National Public Health Surveillance Laboratory	www.nvspl.lt
	Institute of Hygiene	www.hi.lt
Luxembourg	National Health Laboratory	https://lns.lu/
	Microbiology Laboratory, Centre Hospitalier de Luxembourg	https://www.chl.lu/fr/service/laboratoire-de-bacteriologie-microbiologie
Malta	Malta Mater Dei Hospital, Msida	https://healthservices.gov.mt/en/MDH/Pages/Home.aspx
Netherlands	National Institute for Public Health and the Environment	www.rivm.nl
Norway	University Hospital of North Norway	https://www.unn.no/fag-og-forskning/norm-norsk-overvakingssystem-for-antibiotikaresistens-hos-mikrober
	Norwegian Institute of Public Health	https://www.fhi.no/
	St Olav University Hospital, Trondheim	https://www.stolav.no/
Poland	National Medicines Institute, Department of Epidemiology and Clinical Microbiology	https://www.nil.gov.pl
	National Reference Centre for Susceptibility Testing	https://korld.nil.gov.pl
Portugal	National Institute of Health Doutor Ricardo Jorge	https://www.insa.min-saude.pt/
	Directorate-General of Health	https://www.dgs.pt/
Romania	National Institute of Public Health	www.insp.gov.ro
Slovakia	National Reference Centre for Antimicrobial Resistance	https://www.uvzsr.sk
	Public Health Authority of the Slovak Republic	https://www.uvzsr.sk
	Regional Public Health Authority Banska Bystrica	https://www.uvzsr.sk
Slovenia	National Institute of Public Health	www.nijz.si
	Medical Faculty, University of Ljubljana	https://imi.si/
	National Laboratory of Health, Environment and Food	https://www.nlzoh.si/
Spain	Health Institute Carlos lll	www.isciii.es
	National Centre for Microbiology	
	CIBERinfect	
Sweden	The Public Health Agency of Sweden	www.folkhalsomyndigheten.se

[a] *Liechtenstein uses Laboratory Dr Risch as a participating institution at national level.*
[b] *Liechtenstein uses the Swiss Center for Antibiotic Resistance as a participating institution at national level.*