

# Estimated incidence of bloodstream infections with three key pathogens in the EU/EEA in 2019

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## Scope of this document

This document presents the estimated incidence of bloodstream infections (BSI) with three key antibiotic-resistant bacteria, at country level in EU/EEA countries, using public data sources.

## Background

Each year, the ECDC-coordinated European Antimicrobial Resistance Surveillance Network (EARS-Net) collects surveillance data from EU/EEA countries on antimicrobial resistance (AMR) for eight pathogens, in invasive infections. The data are from local clinical laboratories, produced during antimicrobial susceptibility testing (AST) of isolates from blood and cerebrospinal fluid (CSF) samples, thereby providing information on AMR for these pathogens in the EU/EEA [1].

EARS-Net is primarily designed to enable epidemiological surveillance of national-level trends in the percentage of isolates that are resistant to selected antimicrobial agents. Each year, EU/EEA countries report to ECDC their estimation of the geographical coverage of their EARS-Net data, and also their estimation of the representativeness of the reported isolates to all isolates from invasive infections, nationally. Even though geographical coverage varies between countries, national representativeness is generally high, and the reported AMR percentages are considered reliable [1].

While EARS-Net was not designed to monitor trends in overall notifications of cases (number of infections), or in the incidence of such cases expressed as the number of infections per 100 000 population, ECDC and nationally designated co-authors in 30 EU/EEA countries, recommended in 2021 that, 'For EARS-Net, it would therefore be important to supplement the routine outputs, that currently only provide AMR percentages, with additional information on the number of infections caused by antimicrobial-resistant and -susceptible pathogens and possibly include an estimated incidence of infections.' [2].

## ECDC calculation of the health burden of infections with antibiotic-resistant bacteria

In November 2022, ECDC published a technical report, 'Assessing the health burden of infections with antibiotic-resistant bacteria in the EU/EEA, 2016–2020', using an established methodological approach [3, 4]. The approach, which includes, as an intermediate step, an estimation of the incidence of these infections, was used to produce the estimates for this report. Countries reviewed, and where necessary corrected, the data that were used for that report, and also critically reviewed the draft report and validated the final data.

As presented in that report (Annex 1, Table S1-1), ECDC estimates that in the EU/EEA in 2019 (i.e. the year immediately prior to the COVID-19 pandemic-associated changes to healthcare and society), the two antibiotic-resistant bacteria responsible for the largest number of infections in the EU/EEA were: third-generation cephalosporin-resistant *Escherichia coli* and methicillin-resistant *Staphylococcus aureus* (MRSA). Carbapenem-resistant *Klebsiella pneumoniae*, although responsible for a smaller number of infections in the EU/EEA overall, shows large variations in the number of infections depending on the country, and is considered an emerging threat of public health importance.

The table below presents the estimated incidence for these three antibiotic-resistant bacteria at country level in 2019, using the same methodology as in previous reports [3, 4] with the difference that it does not take into account the national data corrections, rather only incorporating published EARS-Net and Eurostat data. This difference, and the inherent inaccuracies in the surveillance system, mean that the presented incidences of bloodstream infections with antibiotic-resistant bacteria can only be considered as estimates. The methodology and data sources for this report are presented in the Annex.

**Table 1. Estimated incidence of bloodstream infections<sup>a</sup> with three selected antibiotic-resistant bacteria, EU/EEA countries, 2019**

Country	Estimated incidence <sup>a</sup> of bloodstream infections <sup>a</sup> in 2019 (number per 100 000 population <sup>b</sup> )		
	Methicillin-resistant <i>Staphylococcus aureus</i>	Third-generation cephalosporin-resistant <i>Escherichia coli</i>	Carbapenem-resistant <i>Klebsiella pneumoniae</i>
Austria	2.2	7.1	0.20
Belgium	2.6	13.2	0.27
Bulgaria	1.5	4.3	2.29
Croatia	2.7	5.3	1.20
Cyprus	6.9	6.2	2.61
Czechia	3.1	6.6	0.09
Denmark	0.8	6.6	0.07
Estonia	0.8	7.9	0.00
Finland	1.1	8.0	0.06
France	5.6	8.6	0.22
Germany	3.6	12.0	0.20
Greece	4.6	2.6	13.05
Hungary	4.2	5.7	0.09
Ireland	3.1	8.3	0.11
Italy	13.6	23.2	8.51
Latvia	1.9	5.0	0.00
Lithuania	2.2	5.6	0.54
Luxembourg	2.1	10.1	0.16
Malta	3.8	12.4	2.13
Netherlands	0.4	4.5	0.02
Poland	4.3	7.4	1.38
Portugal	11.4	10.3	2.93
Romania	13.7	6.3	7.12
Slovakia	5.0	6.4	0.52
Slovenia	2.4	7.7	0.05
Spain	4.2	7.8	0.76

Country	Estimated incidence <sup>a</sup> of bloodstream infections <sup>a</sup> in 2019 (number per 100 000 population <sup>b</sup> )		
	Meticillin-resistant <i>Staphylococcus aureus</i>	Third-generation cephalosporin-resistant <i>Escherichia coli</i>	Carbapenem-resistant <i>Klebsiella pneumoniae</i>
Sweden <sup>c</sup>	1.3	9.2	0.03
<b>EU crude incidence<sup>a,b,c,d</sup></b>	<b>5.6</b>	<b>10.4</b>	<b>2.18</b>
<b>EU population-weighted mean incidence<sup>a,b,c,e</sup></b>	<b>5.6</b>	<b>10.4</b>	<b>2.18</b>
Iceland	2.0	5.0	0.00
Liechtenstein	N.D.	N.D.	N.D.
Norway	0.3	5.0	0.04
<b>EU/EEA crude incidence<sup>a,b,c,d</sup></b>	<b>5.6</b>	<b>10.4</b>	<b>2.15</b>
<b>EU/EEA population-weighted mean incidence<sup>a,b,c,e</sup></b>	<b>5.6</b>	<b>10.4</b>	<b>2.15</b>

*a: Incidence was estimated using the EARS-Net data reported to The European Surveillance System (TESSy). Each de-duplicated isolate from a blood sample (>99% data) or cerebrospinal fluid sample (<1% data) was considered a proxy for a bloodstream infection [1]. The estimates were adjusted according to the national coverage reported by each country using the methodology described in the ECDC report, 'Assessing the health burden of infections with antibiotic-resistant bacteria in the EU/EEA, 2016–2020' [3].*

*b: All denominators are Eurostat mid-year population estimates for 2019 (21 March 2023 release).*

*c: Data reported to EARS-Net by Sweden cannot be checked for all possible duplicate isolates reported from the same patient.*

*d: Crude incidence corresponds to the sum of the estimated number of bloodstream infections in all countries divided by the total population in the EU and EU/EEA, respectively.*

*e: The population-weighted mean is a weighted national average, with the contribution of each national result being relative to its population size. It was calculated by multiplying the incidence for each country with the corresponding national population fraction based on the total EU (or EU/EEA) population, and then summing up the results.*

*N.D.: No data. Liechtenstein did not report data to EARS-Net in 2019.*

## References

1. European Centre for Disease Prevention and Control (ECDC). Antimicrobial resistance in the EU/EEA (EARS-Net) - Annual Epidemiological Report 2021. Stockholm: ECDC; 2022. Available at: <https://www.ecdc.europa.eu/en/publications-data/surveillance-antimicrobial-resistance-europe-2021>
2. Gagliotti C, Högberg LD, Billström H, Eckmanns T, Giske CG, Heuer OE, et al. *Staphylococcus aureus* bloodstream infections: diverging trends of meticillin-resistant and meticillin-susceptible isolates, EU/EEA, 2005 to 2018. Euro Surveill. 2021 Nov;26(46):pii=2002094. Available at: <https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2021.26.46.2002094>
3. European Centre for Disease Prevention and Control (ECDC). Assessing the health burden of infections with antibiotic-resistant bacteria in the EU/EEA, 2016–2020. Stockholm: ECDC; 2022. Available at: <https://www.ecdc.europa.eu/en/publications-data/health-burden-infections-antibiotic-resistant-bacteria-2016-2020>
4. Cassini A, Högberg LD, Plachouras D, Quattrocchi A, Hoxha A, Simonsen GS, et al. Attributable deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in the EU and the European Economic Area in 2015: a population-level modelling analysis. Lancet Infect Dis. 2019 Jan;19(1):56-66. Available at: <https://www.sciencedirect.com/science/article/pii/S1473309918306054?via%3Dihub>

# Annex: Methodology to estimate the incidence of bloodstream infections from public data sources

## Calculation of estimated incidence

For the purposes of this document, each isolate from a blood sample (>99% data) or cerebrospinal fluid sample (<1% data) was considered a proxy for a bloodstream infection (BSI). One case of BSI corresponds to an isolate reported by an EU/EEA country to ECDC TESSy, with potential duplicate isolates removed from the dataset prior to analysis, according to the EARS-Net surveillance protocol (<https://www.ecdc.europa.eu/en/publications-data/surveillance-antimicrobial-resistance-europe-2021>).

The estimated national BSI incidence was calculated as:

$$\frac{(\text{number of de-duplicated isolates reported to ECDC TESSy}) / (\% \text{ population coverage reported to ECDC TESSy} / 100) \times 100\,000}{(\text{mid-year population reported to Eurostat})}$$

If the national coverage data were not reported for a specific year, the calculation used the most recently reported coverage data.

## Data sources

**Table A1: Data sources for the estimation of the incidence of bloodstream infections**

Variable	Data source
Number of de-duplicated isolates reported to ECDC TESSy	EARS-Net Annual Epidemiological Report for Antimicrobial Resistance (EARS-Net) in the EU/EEA (Available at: <a href="https://www.ecdc.europa.eu/en/publications-data/monitoring/all-annual-epidemiological-reports">https://www.ecdc.europa.eu/en/publications-data/monitoring/all-annual-epidemiological-reports</a> ). Data are also presented in an interactive database, the Surveillance Atlas of Infectious Diseases (Available at: <a href="https://atlas.ecdc.europa.eu/public/index.aspx">https://atlas.ecdc.europa.eu/public/index.aspx</a> ).
% population coverage reported to ECDC TESSy	EARS-Net Annual Epidemiological Report for Antimicrobial Resistance (EARS-Net) in the EU/EEA (Available at: <a href="https://www.ecdc.europa.eu/en/publications-data/monitoring/all-annual-epidemiological-reports">https://www.ecdc.europa.eu/en/publications-data/monitoring/all-annual-epidemiological-reports</a> ).
Mid-year population reported to Eurostat	Eurostat. Population and demography - overview. Brussels: European Commission; 2022 (Available at: <a href="https://ec.europa.eu/eurostat/web/population-demography">https://ec.europa.eu/eurostat/web/population-demography</a> )

## Population-weighted mean incidence

The population-weighted mean for the EU or the EU/EEA was calculated by multiplying the incidence for each country with the corresponding national population fraction based on the total EU (or EU/EEA) population, and then summing up the results. Mid-year population data were retrieved from the Eurostat online database (Available at: <https://ec.europa.eu/eurostat/web/population-demography>). In the table, the crude incidence and population-weighted mean incidence appear to be the same, because the differences are not visible with the number of decimal places presented in the table.