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**SURVEILLANCE** REPORT

# Surveillance of antimicrobial resistance in Europe

2017

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Annual report of the European Antimicrobial Resistance Surveillance Network (EARS-Net)

2017

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# Summary

The results presented in this report are based on antimicrobial resistance data from invasive isolates reported to the European Antimicrobial Resistance Surveillance Network (EARS-Net) by 30 European Union (EU) and European Economic Area (EEA) countries in 2018 (data referring to 2017), and on trend analyses of data reported by the participating countries for the period 2014 to 2017.

Despite the political prioritisation of antimicrobial resistance as a threat to public health and the availability of evidence-based guidance for antimicrobial stewardship and infection prevention and control, high levels of resistance remain in the EU/EEA for several bacterial species–antimicrobial group combinations. Intercountry variations also indicate that that there is scope for significant reductions in antimicrobial resistance in many countries through strengthening of current best practice.

The antimicrobial resistance situation in Europe displays wide variations depending on the bacterial species, antimicrobial group and geographical region. For several bacterial species–antimicrobial group combinations, a north-to-south and west-to-east gradient is evident. In general, lower resistance percentages were reported by countries in the north while higher percentages were reported in the south and east of Europe.

For *Escherichia coli* and *Klebsiella pneumoniae*, combined resistance to several antimicrobial groups was frequent, and extended-spectrum beta-lactamase (ESBL) production was common. Resistance percentages were generally higher in *K. pneumoniae* than in *E. coli*. For *E. coli*, there was a small but significant increase in the trend of the EU/EEA population-weighted mean percentage for third-generation cephalosporin resistance from 14.2% in 2014 to 14.9% in 2017, a trend that remained significant when only laboratories reporting consistently during all four years were included. By contrast, no significant trends were noted for the *K. pneumoniae* EU/EEA population-weighted mean resistance percentages when restricting analyses to the laboratories that consistently reported data during the four-year period.

While carbapenem resistance remained rare in *E. coli*, several countries reported carbapenem resistance percentages above 10% for *K. pneumoniae*. Carbapenem resistance was also common in *Pseudomonas aeruginosa* and *Acinetobacter* species, and at higher percentages compared with *K. pneumoniae*. For all four gram-negative bacteria, the countries reporting the highest carbapenem resistance percentages were also among the countries reporting the highest resistance percentages for other antimicrobial groups.

For *Streptococcus pneumoniae*, the resistance situation appeared stable between 2014 and 2017, but with large inter-country variations. Macrolide non-susceptibility was, for most countries, more frequent than penicillin non-susceptibility.

For *Staphylococcus aureus*, the decline in the percentage of meticillin-resistant, i.e. MRSA, isolates reported in previous years continued in 2017. The EU/EEA population-weighted mean MRSA percentage decreased significantly from 19.6% in 2014 to 16.9% in 2017, with similar decreasing trends reported from more than one fourth of the countries. Nevertheless, MRSA remains an important pathogen in the EU/EEA, as the levels of MRSA were still high in several countries, and combined resistance to other antimicrobial groups was common.

Among enterococci, the increasing trend of *Enterococcus faecium* resistant to vancomycin is a cause of concern. The EU/EEA population-weighted mean percentage increased significantly from 10.4% in 2014 to 14.9% in 2017, and corresponding increasing trends were noted in around one third of the countries.

EARS-Net data for 2017 show that antimicrobial resistance remains a serious threat in Europe. For invasive bacterial infections, prompt treatment with effective antimicrobial agents is especially important and is one of the single most effective interventions to reduce the risk of fatal outcome. The high percentages of resistance to key antimicrobial groups reported from many countries are therefore of great concern and represent a serious threat to patient safety in Europe. Prudent antimicrobial use and comprehensive infection prevention and control strategies targeting all healthcare sectors are the cornerstones of effective interventions aiming to prevent selection and transmission of bacteria resistant to antimicrobial agents.

# 1 Introduction

## Antimicrobial resistance

Antimicrobial resistance (AMR) is the ability of a microorganism to resist the action of one or more antimicrobial agents. The consequences can be severe, as prompt treatment with effective antimicrobials is the most important intervention to reduce the risk of poor outcome of serious infections.

Development of AMR is a natural phenomenon caused by mutations in bacterial genes, or acquisition of exogenous resistance genes carried by mobile genetic elements that can spread horizontally between bacteria. Bacteria can acquire multiple resistance mechanisms and hence become resistant to several antimicrobial agents, which is particularly problematic as it may severely limit the available treatment alternatives for the infection.

The major drivers behind the occurrence and spread of AMR are the use of antimicrobial agents and the transmission of antimicrobial-resistant microorganisms between humans; between animals; and between humans, animals and the environment. While antimicrobial use exerts ecological pressure on bacteria and contributes to the emergence and selection of AMR, poor infection prevention and control practices favour the further spread of these bacteria.

The problem of AMR calls for concerted efforts at the country level as well as close international cooperation. AMR is listed as a special health issue in the Commission Implementing Decision (EU) 2018/945 of 22 June 2018 on the communicable diseases and related special health issues to be covered by epidemiological surveillance [1].

## EARS-Net

The European Antimicrobial Resistance Surveillance Network (EARS-Net) is the main EU surveillance system for AMR in bacteria that cause serious infections. Data reported from the network serve as important indicators on the occurrence and spread of AMR in Europe. All 28 EU Member States and two EEA countries (Iceland and Norway) participate in EARS-Net. The vast majority of the countries regularly report data for all bacteria and antimicrobial groups under surveillance. The number of participating laboratories continuously increased since the initiation of the network, indicating a strengthening of national AMR surveillance systems in the EU/EEA. The widespread and continuing implementation of European Committee on Antimicrobial Susceptibility Testing (EUCAST) guidelines for antibacterial susceptibility testing in Europe, and the high proportion of 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.

EARS-Net is the continuation of the European Antimicrobial Resistance Surveillance System (EARSS), which was coordinated by the Dutch National Institute for Public Health and the Environment (RIVM). Established in 1998, EARSS successfully created an international network for AMR surveillance and demonstrated how international AMR data could inform decisions and raise awareness among stakeholders and policymakers. On 1 January 2010, the administration of EARSS was transferred from RIVM to ECDC and the network was renamed EARS-Net.

EARS-Net is based on a network of representatives (National Focal Points for AMR; Operational Contact Points for Epidemiology, for Microbiology and for TESSy interaction) from the EU/EEA countries that collect routine clinical antimicrobial susceptibility data from national AMR surveillance initiatives. Scientific guidance and support is provided by the EARS-Net Disease Network Coordination Committee, which is composed of individual experts elected from the appointed National Focal Points and Operational Contact Points, and completed by observers from other organisations involved in AMR surveillance. EARS-Net activities are coordinated in close collaboration with two other major ECDC surveillance networks: 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), in particular with EUCAST, which receives support from ECDC and ESCMID.

Through close collaboration and by using compatible methodology, the Central Asian and Eastern European Surveillance of Antimicrobial Resistance (CAESAR) Network, coordinated by the World Health Organization Regional Office for Europe, complements EARS-Net in non-EU/EEA countries to obtain a pan-European overview of the AMR situation [2].

The objectives of EARS-Net are to:

- collect comparable, representative and accurate AMR data
- analyse temporal and spatial trends of AMR in Europe
- provide timely AMR data for policy decisions
- encourage the implementation, maintenance and improvement of national AMR surveillance programmes; and
- support national systems in their efforts to improve diagnostic accuracy by offering an annual external quality assessment.

# 2 EARS-Net data collection and analysis

A total of 30 countries, including all EU Member States and two EEA countries (Iceland and Norway) reported AMR data for 2017 to EARS-Net before the end of August 2018. Only data from invasive (blood and cerebrospinal fluid) isolates are included in EARS-Net. The panels of species-antimicrobial agent combinations under surveillance are defined in the EARS-Net reporting protocol [3]. In addition, the EUCAST guidelines for detection of resistance mechanisms and specific types of resistance of clinical and/or epidemiological importance describe the mechanisms of resistance and recommend methods of detection for key EARS-Net species-antimicrobial group combinations [4].

Routine antimicrobial susceptibility testing (AST) results are collected from clinical laboratories by the national network representatives in each participating country. National data are uploaded directly to The European Surveillance System (TESSy) at ECDC on a yearly basis. Data presented by EARS-Net might diverge slightly from the data presented by the countries themselves as analysis algorithms and population coverage might differ.

## Data analysis

In terms of analysis, an isolate is considered resistant to an antimicrobial agent when tested and interpreted as resistant (R) in accordance with the clinical breakpoint criteria used by the local laboratory. An isolate is considered non-susceptible to an antimicrobial agent when tested and interpreted as either resistant (R) or intermediately susceptible (I) with the same local clinical breakpoint criteria. EARS-Net encourages the use of EUCAST breakpoints, but results based on other interpretive criteria used by the reporting countries were accepted for the analysis.

The use of EUCAST breakpoints has increased over the years. In 2017, approximately 89% of the participating laboratories used EUCAST, or EUCAST-harmonised, clinical breakpoints, which is an improvement compared with previous years and increases comparability of the reported data [5].

### National percentages

As a general rule, results were reported as a resistance percentage, i.e. the percentage of R isolates out of all isolates with AST information for that specific species–antimicrobial group. For some bacteria, results were reported as the percentage of non-susceptible (I+R) isolates out of all isolates with the relevant information. For selected analyses, a 95% confidence interval was determined.

If fewer than 10 isolates were reported for a specific species–antimicrobial group combination in a country, the resistance percentage was not calculated and the results were not displayed on the maps presented in this report.

### EU/EEA population-weighted mean percentage

A population-weighted EU/EEA mean percentage was determined by multiplying the percentage resistance for each country with the corresponding national population weight and summing up the results; weights were rescaled if resistance percentages were not available for one or more countries. Annual population data were retrieved from the Eurostat online database [6].

Country weightings were used to adjust for imbalances in reporting propensity and population coverage, as the total number of reported isolates by country does not, in most cases, reflect the population size. As an improvement compared to previous reports, the methodology for calculating the EU/EEA population-weighted mean percentage has been adjusted to better control for increasing differences in the national number of reported isolates. This sometimes resulted in differences compared with the EU/EEA population-weighted means in previous reports.

### Trend analyses

The statistical significance of temporal trends of resistance percentages by country and for the EU/EEA population-weighted mean was calculated based on data from the last four years, i.e. 2014 to 2017. Countries reporting fewer than 20 isolates per year, or not providing data for all years within the considered period, were not included in the analysis. The statistical significance of trends was assessed by the Cochran–Armitage test, and a p-value of $\leq 0.05$ was considered significant. An additional sensitivity analysis was performed by repeating the Cochran–Armitage test, including only laboratories that consistently reported data for the full four-year period, thus minimising selection bias when assessing the significance of the trends. This restriction might, in some cases, have resulted in a considerably lower number of isolates compared with the analysis that included all participating laboratories.

## Data validity

The results, both for inter-country comparisons and in some cases national trends, should be interpreted with caution. Several factors might influence the results and result in over- as well as underestimation of resistance percentages.

Key indicators of the population coverage and data representativeness are presented in the country summary sheets, available in the Annex. Some of the most

important potential sources of bias in EARS-Net are explained below.

## Population coverage

Population coverage varied among reporting countries. Some countries report data from large national surveillance systems with a high national coverage, whereas other countries report data from a smaller subset of local laboratories and hospitals. For an overview of the population coverage and the number of reporting laboratories, see Annex. For countries reporting data from only a small number of hospitals and laboratories located in one specific geographical area, the sample may not be representative of the whole country. Likewise, national trends may not be representative of regional situations because pooled data could mask variations at the local level.

## Sampling

EARS-Net data are exclusively based on invasive isolates from blood or cerebrospinal fluid. The clinical relevance of indicator bacteria isolated from these body sites is undisputable. This restriction prevents some of the inconsistencies that arise from differences in clinical case definitions, different sampling frames or heterogeneous healthcare utilisation that would otherwise confound the data analysis if isolates from all anatomical sites were accepted. However, invasive isolates may not be representative of isolates of the same bacterial species from other type of infections, e.g. urinary tract infections, pneumonia and wound infections.

Case ascertainment of patients with bloodstream infections is strongly linked to diagnostic practices and the frequency with which blood cultures are taken. Therefore, variations in blood culture frequency (non-differential sampling) result in an increasing uncertainty when comparing resistance percentages between hospitals and countries.

Differential sampling can occur if blood cultures are typically only performed after empirical treatment does not show an adequate therapeutic response. Predictably, this will lead to an overestimation of the resistance percentage by not including susceptible bloodstream infection isolates in the denominator.

## Laboratory routines and capacity

The use of guidelines for clinical breakpoints varies among countries in Europe, and in some instances even between laboratories in the same country. As a result, the interpretation of AST results may vary, at least for resistance mechanisms resulting in minimum inhibitory concentrations (MICs) close to the breakpoints. In addition, clinical breakpoints may change over time, as breakpoints may be revised. As quantitative data (i.e. disk diffusion zone diameters or MIC values) were not always provided by participating laboratories, only the reported local interpretations as S, I or R were considered for the analyses.

All laboratories providing data to EARS-Net are offered participation in an annual EQA exercise to assess the reliability of their laboratory test results. The level of performance for EQA specimens is generally high [5].

# 3 Antimicrobial resistance in Europe 2014 to 2017

## 3.1 *Escherichia coli*

*Escherichia coli* is part of the normal intestinal microbiota in humans, but is also a common cause of severe infections. It is the most frequent cause of bloodstream infections and urinary tract infections in the EU/EEA and involved in infections of both community and healthcare origin. In addition, it is associated with intra-abdominal infections and causes neonatal meningitis.

Resistance in *E. coli* readily develops either through mutations, as often seen for fluoroquinolone resistance, or by acquisition of mobile genetic elements encoding resistance mechanisms, such as the production of extended spectrum beta-lactamases (ESBLs) and carbapenemases. ESBLs are enzymes that confer resistance to most beta-lactam antibiotics, including third-generation cephalosporins, and are often seen in combination with other resistance mechanisms, causing multidrug-resistance. Carbapenems usually resist the effect of ESBLs and might remain as one of the few treatment options for severe infections. A recently emerging threat is carbapenem resistance mediated by a range of carbapenemases, which may confer resistance to virtually all available beta-lactam antibiotics. Carbapenamase genes are often located on plasmids that can be exchanged between Enterobacteriaceae, such as *E. coli*, and other gram-negative bacteria.

### Antimicrobial resistance

At the EU/EEA level, more than half (58.2%) of the *E. coli* isolates reported to EARS-Net for 2017 were resistant to at least one of the antimicrobial groups under regular surveillance, i.e. aminopenicillins, fluoroquinolones, third-generation cephalosporins, aminoglycosides and carbapenems (Table 3.1). In 2017, the highest EU/EEA population-weighted mean resistance percentage was reported for aminopenicillins (58.7%), followed by fluoroquinolones (25.7%), third-generation cephalosporins (14.9%) and aminoglycosides (11.4%) (Tables 3.2–3.5). In 2017, resistance to carbapenems remained rare in *E. coli* (Table 3.6).

There were small but significant increasing trends in the EU/EEA population-weighted mean percentages of fluoroquinolone resistance and third-generation cephalosporin resistance between 2014 and 2017 (Tables 3.3–3.4). For carbapenem resistance, there was a very small but significantly decreasing trend at the EU/EEA level (Table 3.6). When restricting the analysis to only include the laboratories that consistently reported data during all four years, only the trend for third-generation cephalosporin resistance remained statistically significant.

Resistance to multiple antimicrobial groups was common. Among the resistant phenotypes, resistance to aminopenicillins, both as single resistance or in combination with other antimicrobial groups, was the most common at the EU/EEA level (Table 3.1). In 2017, combined resistance, measured as resistance to fluoroquinolones, third-generation cephalosporins and aminoglycosides was 6.3% (EU/EEA population-weighted mean) and did not significantly change during the period 2014–2017 (Table 3.7).

As in previous years, a majority (87.4%) of the third-generation cephalosporin-resistant isolates from 2017 were extended-spectrum beta-lactamase (ESBL)-positive. Only data from laboratories reporting ESBL results for all isolates identified as resistant to third-generation cephalosporins (64.9% of the laboratories reporting AST data for third-generation cephalosporins in *E. coli*), and only data from countries reporting at least 10 such isolates were included in the analysis (24 countries).

Except for carbapenem resistance, large inter-country variations were noted for all antimicrobial groups under regular surveillance, with generally higher resistance percentages reported from the southern and eastern parts of Europe than from northern Europe (Figures 3.2–3.6). Inter-country differences between the proportions of isolates that were fully susceptible to the included antimicrobial groups were also present (Figure 3.1).

### Discussion

As *E. coli* is the most common cause of bloodstream infection in Europe, prompt access to effective antimicrobial treatment is essential to reduce the health-related and economic burden associated with this type of infection. The high levels of ESBLs and the increasing frequency of resistance to key antimicrobial groups is a serious concern and reflects a continuous loss of effectiveness in treatment of patients with serious infections.

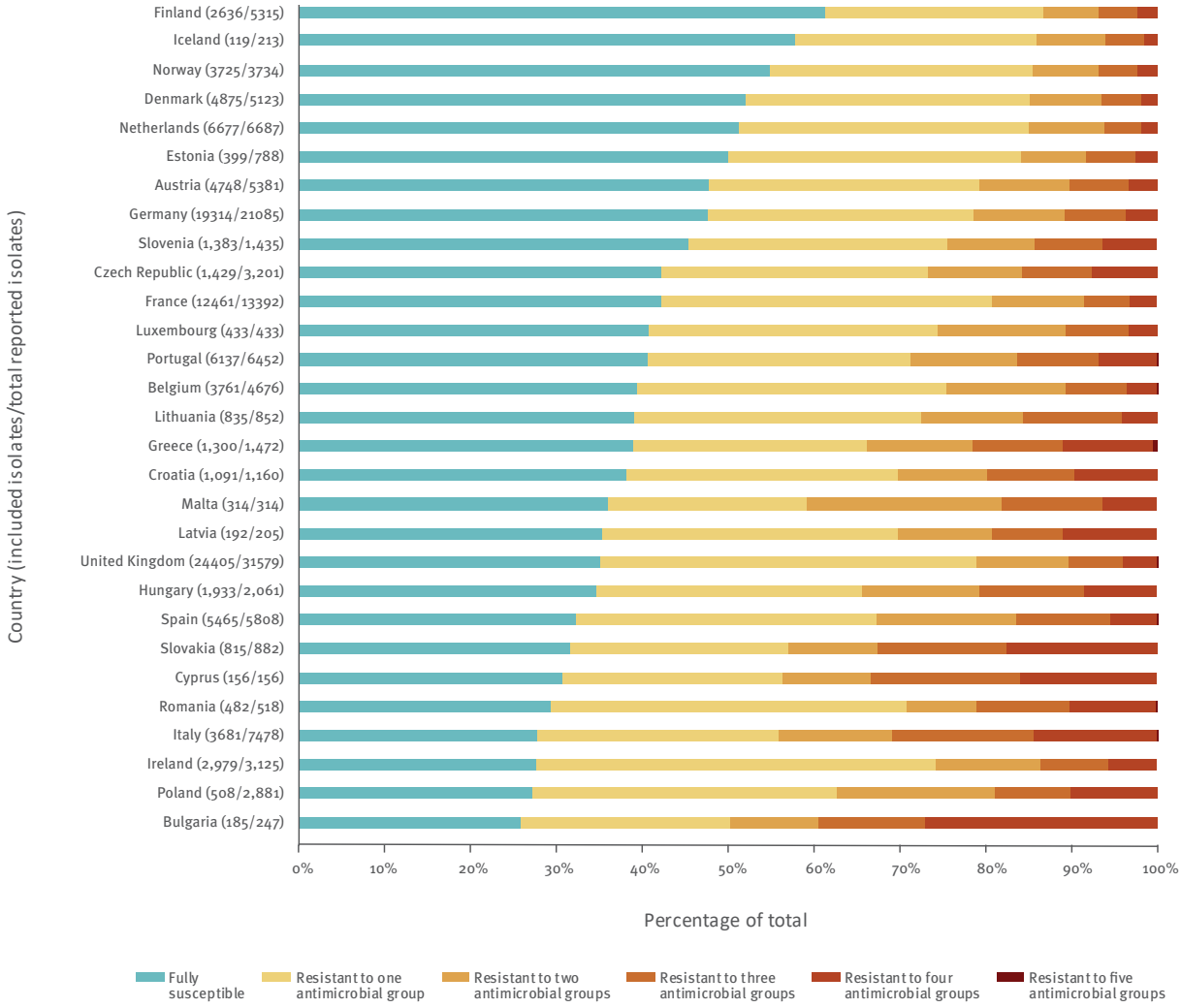
Use of broad-spectrum antimicrobials is a known risk factor for colonisation and spread of resistant Enterobacteriaceae, including *E. coli*. Associations between EARS-Net national *E. coli* resistance levels and national antimicrobial consumption in both the hospital and community sector have been found [7], underlining the importance of comprehensive antimicrobial stewardship programmes targeting both the community and healthcare settings [8].

The high levels of ESBLs and increasing resistance to key antimicrobial groups might also lead to an increased consumption of carbapenems, which in turn can increase the selection pressure and facilitated the spread of carbapenem-resistant Enterobacteriaceae (CRE). CRE infections are associated with high mortality, primarily

due to delays in effective treatment and the limited availability of treatment options. In 2017, the percentage of carbapenem resistance in the invasive *E. coli* isolates reported to EARS-Net remained low. However, continued and close monitoring remains essential as carbapenem-resistant *E. coli* are adapted to spread in healthcare settings and in the community. A recently updated ECDC rapid risk assessment on CRE highlights the need for high standards in infection prevention and control, combined with adequate microbiological capacity to detected and prevent further spread [9].

CRE can be resistant to carbapenems as a result of various mechanisms, including – with increasing frequency – production of carbapenemase enzymes. The overall presence and spread of carbapenemase-producing Enterobacteriaceae is not possible to assess by the data available from EARS-Net as some carbapenemases do not confer a fully carbapenem-resistant phenotype. One example is the OXA-48-like carbapenemase enzymes that present a particular problem for laboratory detection because of their weak hydrolysing capacity of carbapenems [10]. To address the need for enhanced CRE surveillance and to complement the phenotypic-based surveillance data available from EARS-Net, the European Antimicrobial Resistance Genes Surveillance Network (EURGen-Net), a new ECDC network for genomic-based surveillance of multidrug-resistant bacteria, was established. As part of this network, a carbapenem- and/or colistin-resistant Enterobacteriaceae (CCRE) project was initiated, covering a total of 37 EU/EEA countries and EU enlargement countries. The project's duration is from 2018 to 2020 [11]. The results of this project will provide information on the prevalence and distribution of carbapenemases and contribute to a better understanding of the dissemination of CRE in Europe and the risk factors associated with CRE infections.

**Figure 3.1.** ***Escherichia coli.*** **Distribution of isolates: fully susceptible and resistant to one, two, three, four and five antimicrobial groups (among isolates tested against aminopenicillins, fluoroquinolones, third-generation cephalosporins, aminoglycosides and carbapenems), EU/EEA countries, 2017**




Only data from isolates tested against all included antimicrobial groups included in analysis.

Trends in fluoroquinolone resistance might be influenced by the fact that, in 2016, EUCAST lowered its clinical breakpoints for several fluoroquinolones in Enterobacteriaceae. As EARS-Net bases its results on SIR interpretations, it is not possible to assess when or to what degree this change has been implemented by the participating laboratories and how this change has influenced the results. As a consequence, trend analyses for fluoroquinolone resistance should be interpreted with caution.

As high *E. coli* resistance levels have been reported from food-producing animals in Europe, including isolates with carbapenemase production [12], the need to ensure cross-sectoral collaboration between the veterinary and food production sectors is essential. This work is underpinned by the European Commission's 'One Health' approach, which addresses resistance in both humans and animals. ECDC is working closely with the European Food Safety Authority and the European Medicines Agency to better understand the interrelationship between antimicrobial use and antimicrobial resistance in humans and animals across Europe.

**Table 3.1. *Escherichia coli*. Total number of tested isolates* and resistance combinations among invasive isolates tested against aminopenicillins, fluoroquinolones, third-generation cephalosporins, aminoglycosides and carbapenems (n=112 327), EU/EEA countries, 2017**

| Resistance pattern | Number of isolates | Percentage (%) of total** |
|---|---|---|
| **Fully susceptible** | **46 913** | **41.8** |
| Single resistance (to indicated antimicrobial group) | | |
| **Total (all single resistance)** | **39 649** | **35.3** |
| Aminopenicillins | 36 570 | 32.6 |
| Fluoroquinolones | 2 868 | 2.6 |
| Other antimicrobial groups | 211 | 0.2 |
| Resistance to two antimicrobial groups | | |
| **Total (all two-group combinations)** | **12 340** | **11.0** |
| Aminopenicillins + fluoroquinolones | 7 730 | 6.9 |
| Aminopenicillins + third-generation cephalosporins | 2 501 | 2.2 |
| Aminopenicillins + aminoglycosides | 1 933 | 1.7 |
| Other antimicrobial group combinations | 176 | 0.2 |
| Resistance to three antimicrobial groups | | |
| **Total (all three-group combinations)** | **8 205** | **7.3** |
| Aminopenicillins + third-generation cephalosporins + fluoroquinolones | 5 040 | 4.5 |
| Aminopenicillins + fluoroquinolones + aminoglycosides | 2 668 | 2.4 |
| Other antimicrobial group combinations | 497 | 0.4 |
| Resistance to four antimicrobial groups | | |
| **Total (all four-group combinations)** | **5 196** | **4.6** |
| Aminopenicillins + third-generation cephalosporins + fluoroquinolones + aminoglycosides | 5 174 | 4.6 |
| Other antimicrobial group combinations | 22 | ‹0.1 |
| Resistance to five antimicrobial groups | | |
| Aminopenicillins + third-generation cephalosporins + fluoroquinolones + aminoglycosides + carbapenems | 24 | ‹0.1 |

Only resistance combinations ›1% of the total are specified.

* Only data from isolates tested against all five antimicrobial groups were included in the analysis.

** Not adjusted for population differences in the reporting countries.

**Figure 3.2.** ***Escherichia coli*****. Percentage (%) of invasive isolates with resistance to fluoroquinolones, by country, EU/EEA countries, 2017**

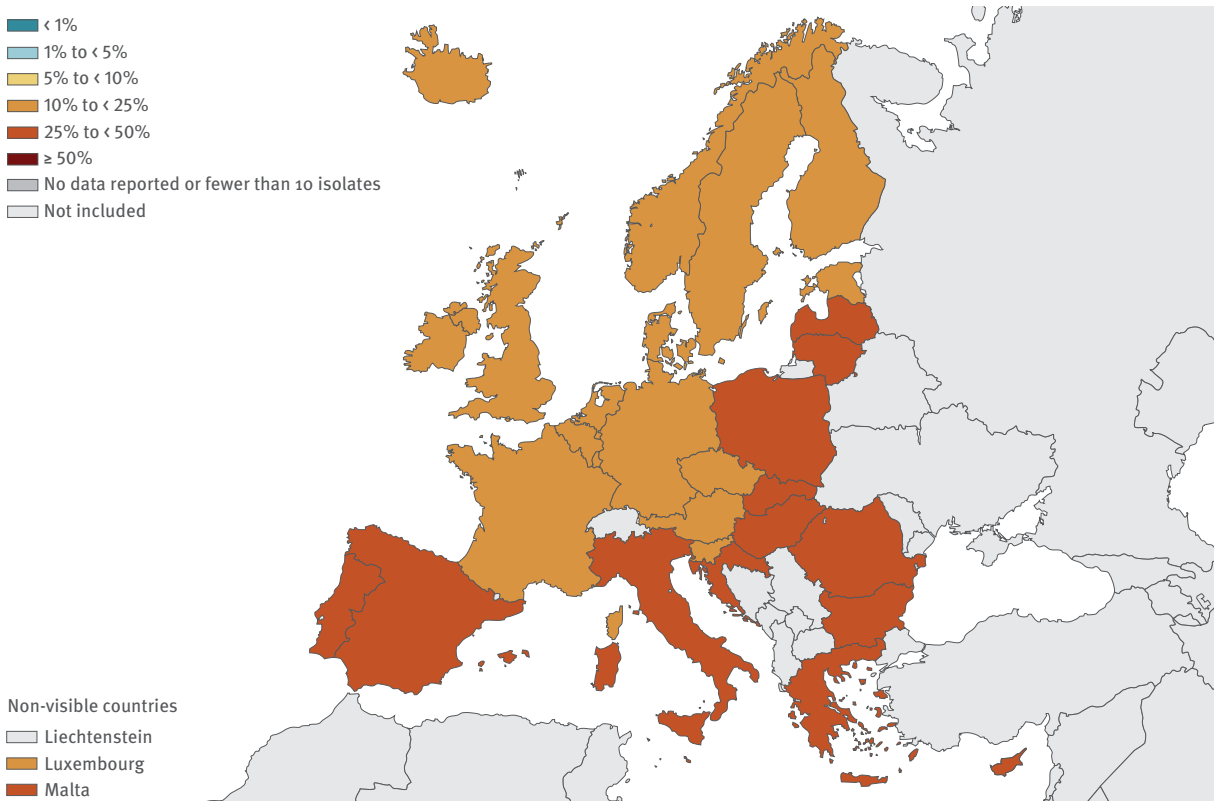



**Figure 3.3.** ***Escherichia coli*****. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, by country, EU/EEA countries, 2017**

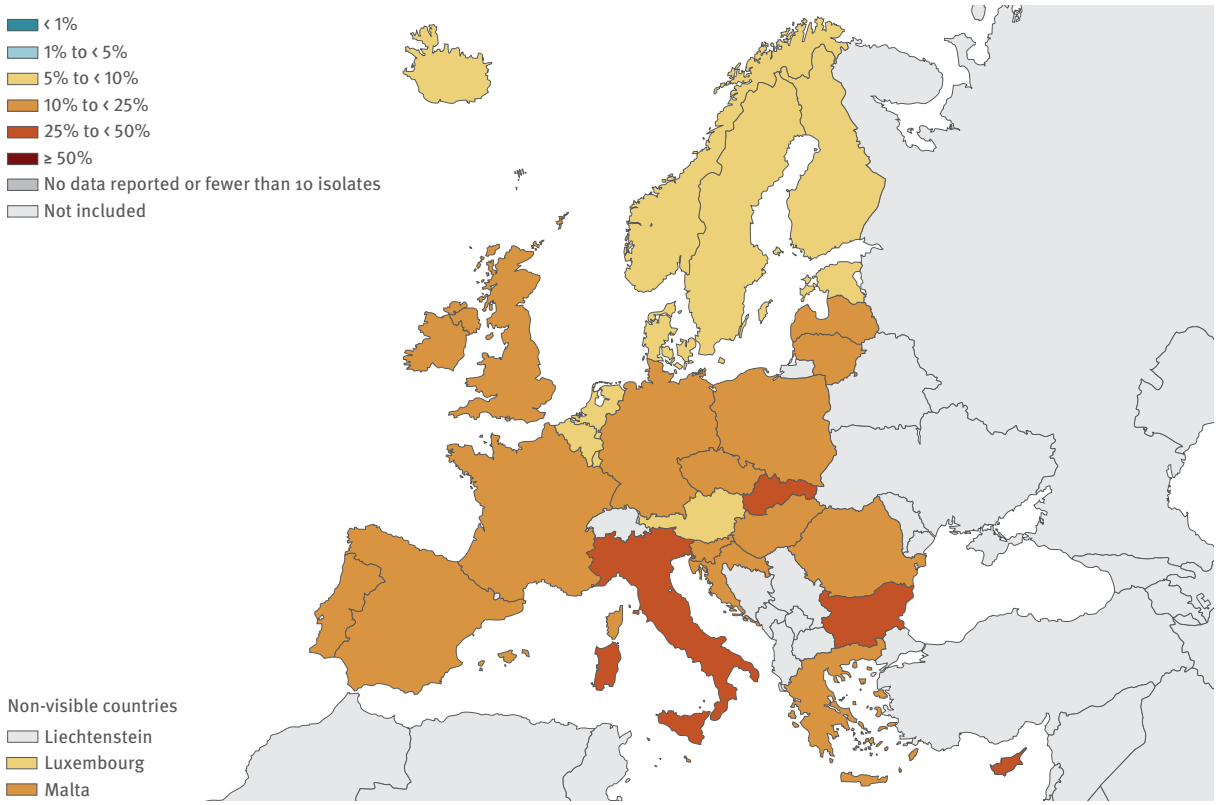


**Figure 3.4.** ***Escherichia coli*****. Percentage (%) of invasive isolates with resistance to aminoglycosides, by country, EU/EEA countries, 2017**

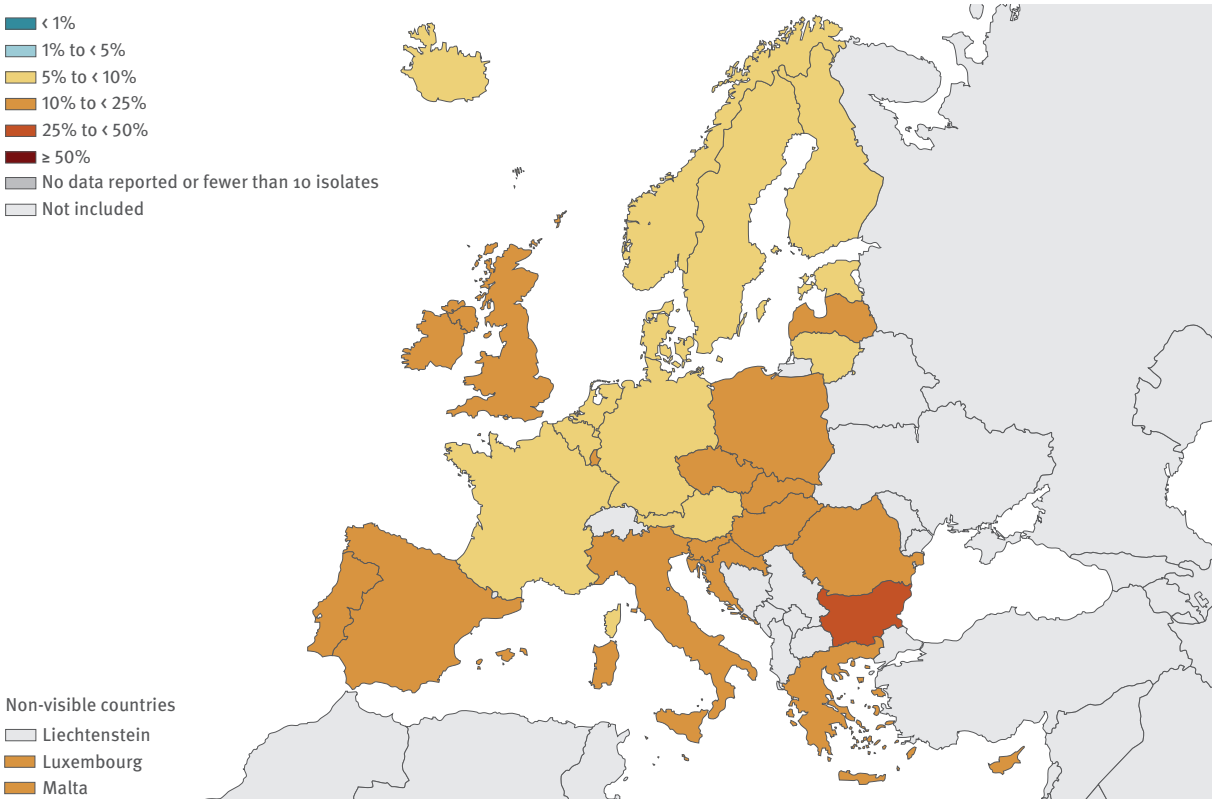



**Figure 3.5.** ***Escherichia coli*****. Percentage (%) of invasive isolates with resistance to carbapenems, by country, EU/EEA countries, 2017**

**Figure 3.6.** ***Escherichia coli.*** **Percentage (%) of invasive isolates with combined resistance to third-generation cephalosporins, fluoroquinolones and aminoglycosides, by country, EU/EEA countries, 2017**

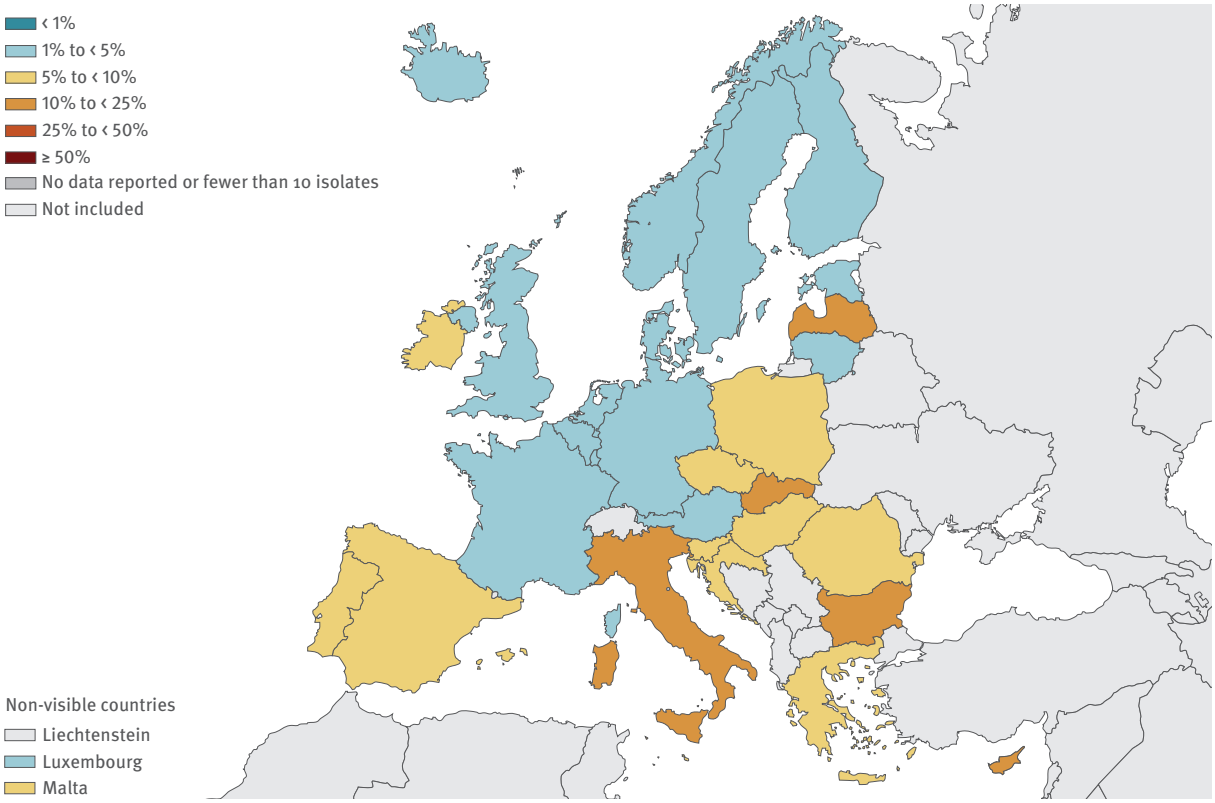


**Table 3.2.** ***Escherichia coli*. Total number of invasive isolates tested (N) and percentage with resistance to aminopenicillins (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Finland | 2365 | 34.7 | (33-37) | 2472 | 36.0 | (34-38) | 2690 | 35.8 | (34-38) | 2874 | 35.2 | (33-37) | |
| Iceland | 151 | 43.0 | (35-51) | 173 | 44.5 | (37-52) | 192 | 43.8 | (37-51) | 213 | 41.3 | (35-48) | |
| Norway | 3404 | 41.8 | (40-43) | 3299 | 45.8 | (44-48) | 3615 | 42.9 | (41-45) | 3731 | 42.2 | (41-44) | |
| Denmark | 4490 | 44.9 | (43-46) | 4594 | 45.3 | (44-47) | 4698 | 45.0 | (44-46) | 4885 | 45.6 | (44-47) | |
| Netherlands | 6458 | 46.0 | (45-47) | 5376 | 47.2 | (46-49) | 6394 | 45.9 | (45-47) | 6684 | 45.9 | (45-47) | |
| Estonia | 261 | 47.1 | (41-53) | 196 | 47.4 | (40-55) | 471 | 46.7 | (42-51) | 439 | 47.8 | (43-53) | |
| Germany | 5543 | 51.7 | (50-53) | 8358 | 49.4 | (48-50) | 15957 | 49.0 | (48-50) | 19786 | 49.1 | (48-50) | ↓ # |
| Austria | 4742 | 50.4 | (49-52) | 4880 | 49.9 | (48-51) | 5094 | 50.5 | (49-52) | 5188 | 49.5 | (48-51) | |
| Slovenia | 1216 | 52.6 | (50-55) | 1326 | 54.8 | (52-58) | 1420 | 57.1 | (54-60) | 1435 | 51.6 | (49-54) | |
| Czech Republic | 2978 | 54.4 | (53-56) | 3172 | 54.3 | (53-56) | 3055 | 55.1 | (53-57) | 3198 | 53.0 | (51-55) | |
| France | 10325 | 55.9 | (55-57) | 10946 | 57.0 | (56-58) | 11248 | 57.2 | (56-58) | 13293 | 55.6 | (55-56) | |
| Luxembourg | 371 | 59.6 | (54-65) | 347 | 60.2 | (55-65) | 419 | 53.2 | (48-58) | 433 | 55.9 | (51-61) | |
| Portugal | 4899 | 58.9 | (57-60) | 5177 | 57.8 | (56-59) | 5772 | 59.2 | (58-61) | 6245 | 56.2 | (55-57) | ↓ |
| Belgium | 2876 | 58.9 | (57-61) | 2674 | 58.0 | (56-60) | 3736 | 58.0 | (56-60) | 4669 | 57.5 | (56-59) | |
| Greece | 1057 | 55.7 | (53-59) | 1079 | 56.1 | (53-59) | 1170 | 56.9 | (54-60) | 1306 | 57.5 | (55-60) | |
| Lithuania | 590 | 57.8 | (54-62) | 582 | 59.6 | (56-64) | 794 | 59.2 | (56-63) | 845 | 57.8 | (54-61) | |
| **EU/EEA (population-weighted mean)** | **73881** | **58.5** | **(58-59)** | **77813** | **58.9** | **(59-59)** | **107383** | **59.0** | **(59-59)** | **122955** | **58.7** | **(58-59)** | |
| Croatia | 1077 | 54.0 | (51-57) | 1042 | 55.3 | (52-58) | 1043 | 57.3 | (54-60) | 1135 | 58.8 | (56-62) | ↑ |
| Malta | 268 | 53.0 | (47-59) | 238 | 55.5 | (49-62) | 328 | 60.1 | (55-65) | 314 | 59.6 | (54-65) | |
| Hungary | 1603 | 59.1 | (57-61) | 1970 | 60.6 | (58-63) | 1969 | 57.4 | (55-60) | 2021 | 60.3 | (58-62) | |
| Latvia | 182 | 48.4 | (41-56) | 192 | 53.6 | (46-61) | 247 | 55.1 | (49-61) | 202 | 60.4 | (53-67) | ↑ |
| United Kingdom | 6637 | 62.7 | (62-64) | 5117 | 65.8 | (64-67) | 21614 | 62.7 | (62-63) | 28647 | 62.5 | (62-63) | ↓ # |
| Spain | 5817 | 64.9 | (64-66) | 6427 | 63.9 | (63-65) | 6791 | 64.1 | (63-65) | 5724 | 62.6 | (61-64) | ↓ |
| Slovakia | 866 | 64.5 | (61-68) | 878 | 62.8 | (59-66) | 817 | 62.3 | (59-66) | 853 | 64.9 | (62-68) | |
| Cyprus | 153 | 71.2 | (63-78) | 123 | 68.3 | (59-76) | 149 | 69.1 | (61-76) | 156 | 65.4 | (57-73) | |
| Italy | 2178 | 65.4 | (63-67) | 3385 | 67.4 | (66-69) | 3114 | 66.9 | (65-69) | 4078 | 67.1 | (66-69) | |
| Romania | 253 | 68.0 | (62-74) | 259 | 73.0 | (67-78) | 376 | 72.3 | (68-77) | 494 | 68.2 | (64-72) | |
| Poland | 268 | 59.7 | (54-66) | 346 | 64.7 | (59-70) | 1034 | 64.5 | (62-67) | 913 | 69.4 | (66-72) | ↑ # |
| Ireland | 2694 | 68.7 | (67-70) | 2646 | 66.2 | (64-68) | 2990 | 68.1 | (66-70) | 2991 | 69.8 | (68-71) | |
| Bulgaria | 159 | 73.0 | (65-80) | 143 | 66.4 | (58-74) | 186 | 78.0 | (71-84) | 203 | 73.9 | (67-80) | |
| Sweden | - | - | - | 396 | 34.1 | (29-39) | - | - | - | - | - | - | N/A |

–: No data

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

**Table 3.3** ***Escherichia coli*. Total number of invasive isolates tested (N) and percentage with resistance to fluoroquinolones (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Iceland | 141 | 7.8 | (4-14) | 162 | 6.8 | (3-12) | 178 | 9.6 | (6-15) | 199 | 11.6 | (7-17) | |
| Finland | 3987 | 11.0 | (10-12) | 4404 | 11.2 | (10-12) | 4808 | 11.5 | (11-12) | 5305 | 12.0 | (11-13) | |
| Denmark | 4489 | 12.3 | (11-13) | 4570 | 11.9 | (11-13) | 4827 | 11.0 | (10-12) | 5123 | 12.8 | (12-14) | |
| Norway | 3415 | 11.0 | (10-12) | 3298 | 10.2 | (9-11) | 3611 | 10.9 | (10-12) | 3731 | 13.6 | (12-15) | ↑ |
| Netherlands | 6444 | 13.3 | (12-14) | 5379 | 13.2 | (12-14) | 6398 | 12.8 | (12-14) | 6685 | 14.2 | (13-15) | |
| France | 10307 | 17.6 | (17-18) | 10998 | 17.7 | (17-18) | 11251 | 16.7 | (16-17) | 13328 | 15.0 | (14-16) | ↓ |
| Sweden | 5142 | 11.3 | (10-12) | 5525 | 12.6 | (12-14) | 6947 | 13.7 | (13-14) | 5762 | 15.8 | (15-17) | N/A |
| Estonia | 407 | 12.3 | (9-16) | 256 | 15.2 | (11-20) | 699 | 13.9 | (11-17) | 781 | 17.4 | (15-20) | ↑ |
| United Kingdom | 6921 | 16.8 | (16-18) | 5812 | 15.6 | (15-17) | 22883 | 16.3 | (16-17) | 30185 | 17.5 | (17-18) | ↑ # |
| Austria | 4642 | 19.8 | (19-21) | 4808 | 20.0 | (19-21) | 5278 | 19.8 | (19-21) | 5367 | 20.5 | (19-22) | |
| Germany | 6163 | 20.6 | (20-22) | 9019 | 19.4 | (19-20) | 17196 | 19.4 | (19-20) | 21080 | 20.9 | (20-21) | |
| Luxembourg | 368 | 24.7 | (20-29) | 347 | 24.2 | (20-29) | 418 | 28.9 | (25-34) | 433 | 22.9 | (19-27) | |
| Ireland | 2703 | 24.5 | (23-26) | 2631 | 23.1 | (21-25) | 2990 | 22.9 | (21-24) | 3119 | 23.6 | (22-25) | |
| Belgium | 2599 | 26.7 | (25-28) | 2565 | 26.6 | (25-28) | 3854 | 24.5 | (23-26) | 4382 | 23.8 | (23-25) | ↓ # |
| Czech Republic | 2976 | 21.6 | (20-23) | 3165 | 22.6 | (21-24) | 3061 | 27.6 | (26-29) | 3199 | 24.5 | (23-26) | ↑ |
| Slovenia | 1216 | 23.3 | (21-26) | 1325 | 24.6 | (22-27) | 1420 | 25.6 | (23-28) | 1383 | 24.9 | (23-27) | |
| Lithuania | 592 | 12.8 | (10-16) | 583 | 20.6 | (17-24) | 790 | 19.7 | (17-23) | 849 | 25.2 | (22-28) | ↑ |
| **EU/EEA (population-weighted mean)** | **83863** | **25.4** | **(25-26)** | **90137** | **24.8** | **(24-25)** | **124306** | **25.2** | **(25-25)** | **138652** | **25.7** | **(25-26)** | ↑ # |
| Romania | 307 | 31.3 | (26-37) | 371 | 30.7 | (26-36) | 418 | 30.6 | (26-35) | 518 | 26.4 | (23-30) | |
| Portugal | 5027 | 32.4 | (31-34) | 5371 | 29.7 | (28-31) | 5783 | 28.9 | (28-30) | 6424 | 27.3 | (26-28) | ↓ |
| Croatia | 1072 | 20.1 | (18-23) | 1038 | 24.0 | (21-27) | 1041 | 27.9 | (25-31) | 1150 | 28.2 | (26-31) | ↑ |
| Latvia | 181 | 17.7 | (12-24) | 194 | 27.8 | (22-35) | 245 | 27.8 | (22-34) | 201 | 30.3 | (24-37) | ↑ |
| Hungary | 1614 | 28.4 | (26-31) | 2021 | 29.0 | (27-31) | 1986 | 26.8 | (25-29) | 2051 | 30.6 | (29-33) | |
| Spain | 5818 | 34.0 | (33-35) | 6484 | 31.6 | (30-33) | 6793 | 32.8 | (32-34) | 5557 | 32.5 | (31-34) | |
| Greece | 1105 | 32.8 | (30-36) | 1191 | 30.6 | (28-33) | 1304 | 32.1 | (30-35) | 1464 | 32.9 | (31-35) | |
| Poland | 1057 | 29.2 | (27-32) | 1571 | 27.9 | (26-30) | 2637 | 33.1 | (31-35) | 1832 | 35.9 | (34-38) | ↑ # |
| Bulgaria | 215 | 38.6 | (32-45) | 204 | 35.3 | (29-42) | 237 | 42.2 | (36-49) | 247 | 42.1 | (36-49) | |
| Cyprus | 153 | 46.4 | (38-55) | 123 | 45.5 | (37-55) | 149 | 47.0 | (39-55) | 156 | 42.9 | (35-51) | |
| Slovakia | 887 | 43.0 | (40-46) | 894 | 44.2 | (41-48) | 826 | 40.4 | (37-44) | 882 | 43.2 | (40-47) | |
| Malta | 268 | 28.7 | (23-35) | 238 | 37.4 | (31-44) | 328 | 41.5 | (36-47) | 314 | 43.3 | (38-49) | ↑ |
| Italy | 3647 | 43.9 | (42-46) | 5590 | 44.4 | (43-46) | 5950 | 43.3 | (42-45) | 6945 | 44.9 | (44-46) | |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

**Table 3.4.** ***Escherichia coli*. Total number of invasive isolates tested (N) and percentage with resistance to third-generation cephalosporins (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Norway | 3421 | 5.8 | (5-7) | 3301 | 6.0 | (5-7) | 3617 | 5.6 | (5-6) | 3734 | 5.9 | (5-7) | |
| Iceland | 152 | 3.3 | (1-8) | 173 | 1.7 | (0-5) | 192 | 4.2 | (2-8) | 213 | 6.1 | (3-10) | |
| Netherlands | 6497 | 5.7 | (5-6) | 5378 | 5.7 | (5-6) | 6397 | 6.4 | (6-7) | 6684 | 6.2 | (6-7) | |
| Denmark | 4410 | 7.0 | (6-8) | 4561 | 7.5 | (7-8) | 4659 | 6.6 | (6-7) | 4883 | 6.9 | (6-8) | |
| Finland | 4009 | 5.4 | (5-6) | 4342 | 6.1 | (5-7) | 4742 | 6.9 | (6-8) | 5223 | 6.9 | (6-8) | ↑ |
| Sweden | 6546 | 5.6 | (5-6) | 5995 | 6.2 | (6-7) | 6958 | 8.3 | (8-9) | 5790 | 7.4 | (7-8) | N/A |
| Estonia | 410 | 9.3 | (7-12) | 246 | 11.4 | (8-16) | 701 | 9.0 | (7-11) | 788 | 8.8 | (7-11) | |
| Austria | 4739 | 9.4 | (9-10) | 4900 | 9.7 | (9-11) | 5267 | 10.0 | (9-11) | 5129 | 9.6 | (9-10) | |
| Belgium | 2802 | 9.7 | (9-11) | 2593 | 9.7 | (9-11) | 3737 | 10.5 | (10-12) | 4672 | 9.7 | (9-11) | |
| Luxembourg | 368 | 12.0 | (9-16) | 347 | 12.7 | (9-17) | 418 | 13.6 | (10-17) | 433 | 9.7 | (7-13) | |
| France | 10349 | 9.9 | (9-11) | 11051 | 11.0 | (10-12) | 11313 | 11.2 | (11-12) | 13352 | 10.2 | (10-11) | |
| United Kingdom | 6221 | 10.3 | (10-11) | 5169 | 11.3 | (10-12) | 21846 | 9.2 | (9-10) | 27925 | 10.3 | (10-11) | |
| Ireland | 2691 | 10.7 | (10-12) | 2638 | 11.4 | (10-13) | 2985 | 11.4 | (10-13) | 3121 | 12.0 | (11-13) | |
| Germany | 6246 | 10.5 | (10-11) | 9031 | 10.3 | (10-11) | 17190 | 11.1 | (11-12) | 21070 | 12.3 | (12-13) | ↑ |
| Slovenia | 1216 | 12.7 | (11-15) | 1326 | 13.7 | (12-16) | 1420 | 12.5 | (11-14) | 1435 | 12.5 | (11-14) | |
| Spain | 5821 | 12.3 | (12-13) | 6428 | 11.6 | (11-12) | 6796 | 15.0 | (14-16) | 5804 | 12.8 | (12-14) | ↑ # |
| Czech Republic | 2978 | 14.0 | (13-15) | 3172 | 14.5 | (13-16) | 3061 | 15.1 | (14-16) | 3199 | 14.2 | (13-15) | |
| **EU/EEA (population-weighted mean)** | **85092** | **14.2** | **(14-14)** | **90126** | **14.6** | **(14-15)** | **123087** | **14.9** | **(15-15)** | **137677** | **14.9** | **(15-15)** | ↑ |
| Malta | 268 | 10.8 | (7-15) | 238 | 11.8 | (8-17) | 328 | 14.6 | (11-19) | 314 | 15.6 | (12-20) | |
| Portugal | 5024 | 16.4 | (15-17) | 5376 | 16.1 | (15-17) | 5784 | 16.1 | (15-17) | 6441 | 15.6 | (15-16) | |
| Croatia | 1079 | 10.8 | (9-13) | 1046 | 12.5 | (11-15) | 1045 | 14.7 | (13-17) | 1148 | 16.5 | (14-19) | ↑ |
| Poland | 1085 | 10.5 | (9-12) | 1610 | 11.9 | (10-14) | 2719 | 13.7 | (12-15) | 2866 | 16.7 | (15-18) | ↑ |
| Lithuania | 594 | 8.1 | (6-11) | 581 | 16.0 | (13-19) | 795 | 14.7 | (12-17) | 852 | 16.8 | (14-19) | ↑ |
| Greece | 1122 | 21.0 | (19-24) | 1215 | 19.8 | (18-22) | 1304 | 17.6 | (16-20) | 1470 | 18.3 | (16-20) | ↓ # |
| Romania | 306 | 29.4 | (24-35) | 369 | 26.8 | (22-32) | 418 | 23.4 | (19-28) | 518 | 18.7 | (15-22) | ↓ |
| Hungary | 1619 | 16.4 | (15-18) | 2026 | 16.7 | (15-18) | 1993 | 16.7 | (15-18) | 2058 | 20.1 | (18-22) | ↑ |
| Latvia | 165 | 10.9 | (7-17) | 201 | 17.9 | (13-24) | 253 | 24.1 | (19-30) | 205 | 22.0 | (16-28) | ↑ |
| Italy | 3694 | 28.7 | (27-30) | 5592 | 30.1 | (29-31) | 5938 | 29.8 | (29-31) | 7077 | 29.5 | (28-31) | |
| Cyprus | 153 | 28.8 | (22-37) | 123 | 28.5 | (21-37) | 149 | 30.2 | (23-38) | 156 | 30.8 | (24-39) | |
| Slovakia | 889 | 31.8 | (29-35) | 893 | 30.0 | (27-33) | 824 | 29.7 | (27-33) | 870 | 30.9 | (28-34) | |
| Bulgaria | 218 | 40.4 | (34-47) | 205 | 38.5 | (32-46) | 238 | 41.6 | (35-48) | 247 | 41.3 | (35-48) | |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

**Table 3.5.** ***Escherichia coli.*** **Total number of invasive isolates tested (N) and percentage with resistance to aminoglycosides (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Finland | 3817 | 4.6 | (4-5) | 4135 | 5.4 | (5-6) | 4519 | 4.9 | (4-6) | 4982 | 5.0 | (4-6) | |
| Iceland | 152 | 5.3 | (2-10) | 173 | 2.9 | (1-7) | 192 | 3.6 | (1-7) | 213 | 5.6 | (3-10) | |
| Netherlands | 6485 | 6.3 | (6-7) | 5378 | 6.0 | (5-7) | 6397 | 6.2 | (6-7) | 6686 | 5.6 | (5-6) | |
| Estonia | 411 | 6.8 | (5-10) | 257 | 9.3 | (6-14) | 702 | 7.4 | (6-10) | 786 | 5.7 | (4-8) | |
| Denmark | 4493 | 7.3 | (7-8) | 4591 | 6.8 | (6-8) | 4846 | 6.1 | (5-7) | 5122 | 6.0 | (5-7) | ↓ |
| Sweden | 5606 | 6.1 | (5-7) | 5761 | 6.4 | (6-7) | 6949 | 7.2 | (7-8) | 5758 | 6.5 | (6-7) | N/A |
| Germany | 6244 | 6.9 | (6-8) | 9029 | 7.1 | (7-8) | 17023 | 7.0 | (7-7) | 20623 | 6.9 | (7-7) | |
| France | 10341 | 7.7 | (7-8) | 11055 | 8.2 | (8-9) | 11135 | 7.9 | (7-8) | 13103 | 7.0 | (7-7) | ↓ |
| Norway | 3419 | 5.9 | (5-7) | 3301 | 6.0 | (5-7) | 3614 | 5.5 | (5-6) | 3732 | 7.2 | (6-8) | |
| Austria | 4726 | 7.1 | (6-8) | 4884 | 7.0 | (6-8) | 5248 | 7.8 | (7-9) | 5318 | 7.7 | (7-8) | |
| Belgium | 2045 | 8.9 | (8-10) | 2286 | 8.4 | (7-10) | 3499 | 8.4 | (8-9) | 3769 | 8.1 | (7-9) | |
| Lithuania | 584 | 10.6 | (8-13) | 583 | 10.1 | (8-13) | 791 | 8.0 | (6-10) | 848 | 8.3 | (6-10) | |
| United Kingdom | 7274 | 8.9 | (8-10) | 6052 | 9.9 | (9-11) | 23166 | 9.9 | (9-10) | 30739 | 10.0 | (10-10) | ↑ |
| Luxembourg | 367 | 7.9 | (5-11) | 347 | 8.9 | (6-12) | 418 | 9.1 | (7-12) | 433 | 10.4 | (8-14) | |
| Czech Republic | 2979 | 10.7 | (10-12) | 3172 | 11.3 | (10-13) | 3061 | 12.2 | (11-13) | 3199 | 10.7 | (10-12) | |
| Malta | 268 | 9.7 | (6-14) | 238 | 12.2 | (8-17) | 328 | 10.4 | (7-14) | 314 | 10.8 | (8-15) | |
| **EU/EEA (population-weighted mean)** | **84015** | **11.3** | **(11-11)** | **90050** | **11.6** | **(11-12)** | **123625** | **11.6** | **(11-12)** | **138883** | **11.4** | **(11-12)** | |
| Slovenia | 1216 | 11.3 | (10-13) | 1326 | 12.9 | (11-15) | 1420 | 10.6 | (9-12) | 1435 | 11.4 | (10-13) | |
| Ireland | 2705 | 12.1 | (11-13) | 2646 | 11.8 | (11-13) | 2991 | 11.2 | (10-12) | 3123 | 11.9 | (11-13) | |
| Portugal | 4991 | 15.1 | (14-16) | 5372 | 13.8 | (13-15) | 5765 | 13.1 | (12-14) | 6387 | 11.9 | (11-13) | ↓ |
| Latvia | 181 | 8.3 | (5-13) | 191 | 14.1 | (10-20) | 244 | 12.7 | (9-18) | 201 | 13.4 | (9-19) | |
| Spain | 5820 | 15.1 | (14-16) | 6489 | 14.7 | (14-16) | 6796 | 14.5 | (14-15) | 5805 | 13.8 | (13-15) | |
| Poland | 1068 | 9.8 | (8-12) | 1581 | 11.2 | (10-13) | 2521 | 13.3 | (12-15) | 2719 | 14.0 | (13-15) | ↑ # |
| Hungary | 1610 | 14.7 | (13-17) | 2020 | 13.6 | (12-15) | 1992 | 13.3 | (12-15) | 2060 | 15.1 | (14-17) | |
| Romania | 303 | 17.2 | (13-22) | 366 | 18.3 | (14-23) | 414 | 15.0 | (12-19) | 513 | 15.2 | (12-19) | |
| Croatia | 1077 | 10.9 | (9-13) | 1008 | 12.7 | (11-15) | 1027 | 15.7 | (14-18) | 1154 | 16.6 | (15-19) | ↑ |
| Greece | 1110 | 15.6 | (14-18) | 1200 | 16.1 | (14-18) | 1301 | 16.8 | (15-19) | 1467 | 17.0 | (15-19) | |
| Italy | 3493 | 19.4 | (18-21) | 5408 | 20.2 | (19-21) | 6079 | 19.0 | (18-20) | 7134 | 18.4 | (18-19) | |
| Cyprus | 153 | 17.6 | (12-25) | 123 | 13.8 | (8-21) | 149 | 16.1 | (11-23) | 156 | 21.8 | (16-29) | |
| Slovakia | 888 | 22.7 | (20-26) | 896 | 24.2 | (21-27) | 828 | 20.2 | (17-23) | 875 | 22.5 | (20-25) | |
| Bulgaria | 189 | 29.1 | (23-36) | 182 | 19.8 | (14-26) | 210 | 34.8 | (28-42) | 229 | 36.2 | (30-43) | ↑ |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

**Table 3.6.** ***Escherichia coli.*** **Total number of invasive isolates tested (N) and percentage with resistance to carbapenems (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Bulgaria | 197 | 0.5 | (0-3) | 182 | 0.0 | (0-2) | 224 | 0.9 | (0-3) | 247 | 0.0 | (0-1) | |
| Croatia | 1079 | 0.0 | (0-0) | 1046 | 0.0 | (0-0) | 1045 | 0.0 | (0-0) | 1132 | 0.0 | (0-0) | |
| Czech Republic | 1702 | 0.0 | (0-0) | 1471 | 0.0 | (0-0) | 1483 | 0.0 | (0-0) | 1431 | 0.0 | (0-0) | |
| Estonia | 254 | 0.0 | (0-1) | 219 | 0.0 | (0-2) | 602 | 0.0 | (0-1) | 687 | 0.0 | (0-1) | |
| Finland | 4013 | 0.0 | (0-0) | 4425 | 0.0 | (0-0) | 4832 | <0.1 | (0-0) | 5315 | 0.0 | (0-0) | |
| Iceland | 140 | 0.0 | (0-3) | 162 | 0.0 | (0-0) | 192 | 0.0 | (0-0) | 198 | 0.0 | (0-0) | |
| Lithuania | 593 | 0.0 | (0-1) | 579 | 0.0 | (0-1) | 793 | 0.0 | (0-0) | 849 | 0.0 | (0-0) | |
| Luxembourg | 368 | 0.3 | (0-2) | 347 | 0.0 | (0-1) | 418 | 0.0 | (0-1) | 433 | 0.0 | (0-1) | |
| Latvia | 182 | 0.0 | (0-2) | 192 | 0.0 | (0-2) | 246 | 0.0 | (0-1) | 203 | 0.0 | (0-2) | |
| Malta | 268 | 0.0 | (0-1) | 238 | 0.0 | (0-2) | 328 | 0.0 | (0-1) | 314 | 0.0 | (0-1) | |
| Slovenia | 1216 | 0.0 | (0-0) | 1326 | 0.0 | (0-0) | 1420 | 0.0 | (0-0) | 1435 | 0.0 | (0-0) | |
| Slovakia | 820 | 0.0 | (0-0) | 830 | 0.0 | (0-0) | 751 | 0.0 | (0-0) | 844 | 0.0 | (0-0) | |
| Germany | 6247 | 0.1 | (0-0) | 9032 | <0.1 | (0-0) | 17196 | <0.1 | (0-0) | 21080 | <0.1 | (0-0) | ↓ |
| Denmark | 3946 | <0.1 | (0-0) | 4046 | <0.1 | (0-0) | 4671 | 0.0 | (0-0) | 5117 | <0.1 | (0-0) | |
| Austria | 4600 | <0.1 | (0-0) | 4760 | <0.1 | (0-0) | 5134 | <0.1 | (0-0) | 5227 | <0.1 | (0-0) | |
| Belgium | 2614 | <0.1 | (0-0) | 2588 | 0.0 | (0-0) | 3845 | 0.1 | (0-0) | 4672 | <0.1 | (0-0) | |
| Spain | 5817 | 0.1 | (0-0) | 6399 | <0.1 | (0-0) | 6790 | 0.1 | (0-0) | 5802 | <0.1 | (0-0) | |
| France | 9693 | <0.1 | (0-0) | 10481 | <0.1 | (0-0) | 10929 | <0.1 | (0-0) | 12843 | <0.1 | (0-0) | |
| Sweden | 6298 | 0.0 | (0-0) | 5307 | 0.1 | (0-0) | 6927 | 0.1 | (0-0) | 5769 | <0.1 | (0-0) | N/A |
| United Kingdom | 6367 | 0.1 | (0-0) | 5497 | 0.3 | (0-0) | 22762 | <0.1 | (0-0) | 30074 | <0.1 | (0-0) | ↓ |
| Ireland | 2697 | <0.1 | (0-0) | 2615 | <0.1 | (0-0) | 2989 | <0.1 | (0-0) | 3116 | <0.1 | (0-0) | |
| Netherlands | 6475 | 0.0 | (0-0) | 5375 | <0.1 | (0-0) | 6394 | 0.0 | (0-0) | 6682 | <0.1 | (0-0) | |
| Poland | 979 | 0.2 | (0-1) | 1499 | 0.1 | (0-0) | 2553 | <0.1 | (0-0) | 2741 | <0.1 | (0-0) | |
| Hungary | 1517 | 0.0 | (0-0) | 1922 | 0.0 | (0-0) | 1905 | 0.0 | (0-0) | 1987 | 0.1 | (0-0) | |
| Norway | 3420 | 0.0 | (0-0) | 3297 | <0.1 | (0-0) | 3616 | 0.1 | (0-0) | 3733 | 0.1 | (0-0) | |
| **EU/EEA (population-weighted mean)** | **81776** | **0.1** | **(0-0)** | **86487** | **0.2** | **(0-0)** | **121774** | **0.1** | **(0-0)** | **137728** | **0.1** | **(0-0)** | **↓ #** |
| Italy | 3696 | 0.2 | (0-0) | 5592 | 0.2 | (0-0) | 6106 | 0.3 | (0-0) | 7280 | 0.3 | (0-0) | |
| Portugal | 4998 | <0.1 | (0-0) | 5354 | 0.1 | (0-0) | 5760 | <0.1 | (0-0) | 6384 | 0.3 | (0-1) | ↑ |
| Romania | 305 | 0.7 | (0-2) | 368 | 1.9 | (1-4) | 411 | 1.0 | (0-2) | 510 | 0.4 | (0-1) | |
| Cyprus | 153 | 0.0 | (0-2) | 123 | 0.0 | (0-3) | 149 | 0.0 | (0-2) | 156 | 1.3 | (0-5) | |
| Greece | 1122 | 1.2 | (1-2) | 1215 | 1.2 | (1-2) | 1303 | 0.9 | (0-2) | 1467 | 1.6 | (1-2) | |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

**Table 3.7.** ***Escherichia coli*. Total number of isolates tested (N) and percentage with combined resistance to fluoroquinolones, third-generation cephalosporins and aminoglycosides (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Iceland | 141 | 1.4 | (0-5) | 162 | 0.0 | (0-2) | 178 | 1.1 | (0-4) | 199 | 1.5 | (0-4) | |
| Denmark | 4406 | 1.9 | (1-2) | 4531 | 2.5 | (2-3) | 4640 | 1.8 | (1-2) | 4883 | 1.8 | (1-2) | |
| Netherlands | 6425 | 2.1 | (2-3) | 5377 | 2.0 | (2-2) | 6396 | 2.3 | (2-3) | 6681 | 1.9 | (2-2) | |
| Sweden | 4203 | 2.0 | (2-2) | 5257 | 2.5 | (2-3) | 6939 | 3.1 | (3-4) | 5746 | 2.0 | (2-2) | N/A |
| Finland | 3787 | 2.2 | (2-3) | 4103 | 2.6 | (2-3) | 4492 | 2.4 | (2-3) | 4971 | 2.4 | (2-3) | |
| Norway | 3413 | 2.0 | (2-2) | 3298 | 1.9 | (1-2) | 3609 | 1.9 | (2-2) | 3729 | 2.4 | (2-3) | |
| France | 10299 | 3.5 | (3-4) | 10988 | 3.9 | (4-4) | 11082 | 3.8 | (3-4) | 13038 | 3.0 | (3-3) | ↓ |
| Austria | 4609 | 2.6 | (2-3) | 4785 | 2.9 | (2-3) | 5235 | 3.5 | (3-4) | 5071 | 3.3 | (3-4) | ↑ |
| Belgium | 2045 | 3.9 | (3-5) | 2285 | 3.5 | (3-4) | 3496 | 3.8 | (3-4) | 3765 | 3.5 | (3-4) | |
| Luxembourg | 367 | 3.8 | (2-6) | 347 | 5.2 | (3-8) | 418 | 3.8 | (2-6) | 433 | 3.5 | (2-6) | |
| Germany | 6158 | 3.0 | (3-3) | 9013 | 3.0 | (3-3) | 17013 | 3.4 | (3-4) | 20610 | 3.7 | (3-4) | ↑ |
| Estonia | 404 | 3.5 | (2-6) | 233 | 5.2 | (3-9) | 698 | 4.0 | (3-6) | 780 | 3.7 | (3-5) | |
| United Kingdom | 6191 | 4.4 | (4-5) | 5119 | 4.5 | (4-5) | 21101 | 4.0 | (4-4) | 26808 | 4.1 | (4-4) | |
| Lithuania | 582 | 2.6 | (1-4) | 581 | 4.3 | (3-6) | 783 | 2.6 | (2-4) | 845 | 4.4 | (3-6) | |
| Spain | 5814 | 5.3 | (5-6) | 6416 | 5.5 | (5-6) | 6787 | 6.2 | (6-7) | 5551 | 5.5 | (5-6) | |
| Ireland | 2689 | 4.7 | (4-6) | 2621 | 5.4 | (5-6) | 2984 | 5.3 | (5-6) | 3116 | 5.7 | (5-7) | |
| Czech Republic | 2976 | 6.4 | (6-7) | 3165 | 6.9 | (6-8) | 3061 | 7.9 | (7-9) | 3199 | 6.3 | (5-7) | |
| Slovenia | 1216 | 7.1 | (6-9) | 1325 | 8.1 | (7-10) | 1420 | 6.9 | (6-8) | 1383 | 6.3 | (5-8) | |
| **EU/EEA (population-weighted mean)** | **80896** | **6.2** | **(6-6)** | **88084** | **6.3** | **(6-6)** | **120727** | **6.4** | **(6-7)** | **132208** | **6.3** | **(6-6)** | |
| Malta | 268 | 6.7 | (4-10) | 238 | 7.1 | (4-11) | 328 | 5.5 | (3-9) | 314 | 6.4 | (4-10) | |
| Portugal | 4989 | 8.2 | (7-9) | 5366 | 7.6 | (7-8) | 5762 | 7.7 | (7-8) | 6365 | 6.6 | (6-7) | ↓ |
| Hungary | 1599 | 8.2 | (7-10) | 2015 | 6.7 | (6-8) | 1981 | 6.4 | (5-8) | 2047 | 8.2 | (7-9) | |
| Poland | 1026 | 5.6 | (4-7) | 1532 | 6.1 | (5-7) | 2411 | 8.5 | (7-10) | 1666 | 8.2 | (7-10) | ↑ |
| Croatia | 1070 | 6.0 | (5-8) | 1000 | 6.9 | (5-9) | 1023 | 9.4 | (8-11) | 1133 | 9.4 | (8-11) | ↑ |
| Romania | 298 | 14.4 | (11-19) | 364 | 13.5 | (10-17) | 410 | 11.7 | (9-15) | 513 | 9.7 | (7-13) | ↓ |
| Greece | 1102 | 10.7 | (9-13) | 1187 | 10.7 | (9-13) | 1300 | 10.4 | (9-12) | 1463 | 9.8 | (8-11) | |
| Latvia | 163 | 2.5 | (1-6) | 191 | 10.5 | (7-16) | 242 | 10.3 | (7-15) | 197 | 11.2 | (7-16) | ↑ |
| Italy | 3428 | 13.7 | (13-15) | 5389 | 14.6 | (14-16) | 5763 | 12.9 | (12-14) | 6454 | 13.7 | (13-15) | |
| Cyprus | 153 | 13.1 | (8-19) | 123 | 9.8 | (5-16) | 149 | 11.4 | (7-18) | 156 | 15.4 | (10-22) | |
| Slovakia | 887 | 17.0 | (15-20) | 891 | 17.1 | (15-20) | 822 | 14.8 | (12-17) | 863 | 17.7 | (15-20) | |
| Bulgaria | 188 | 20.2 | (15-27) | 182 | 12.6 | (8-18) | 204 | 22.1 | (17-28) | 229 | 24.9 | (19-31) | |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

## 3.2 *Klebsiella pneumoniae*

*Klebsiella pneumoniae* predominantly colonises hospitalised individuals, where it is mainly found in the gastrointestinal tract, skin and the respiratory tract. The majority of infections caused by *K. pneumoniae* are healthcare-associated and can spread rapidly between patients and via the hands of hospital personnel, leading to nosocomial outbreaks. Infections include urinary tract infections, lower respiratory tract infections, intra-abdominal infections and bloodstream infections.

Similar to *E. coli*, *K. pneumoniae* can be resistant to multiple antimicrobial agents, and resistance traits are frequently acquired through plasmids. In contrast to *E. coli*, *K. pneumoniae* has a chromosomally encoded class A beta-lactamase and is thus intrinsically resistant to aminopenicillins. Many novel ESBL variants were initially identified in *K. pneumoniae* and were only subsequently found in *E. coli*. Carbapenems frequently resist the effect of ESBLs and might remain as one of the few treatment options for severe *K. pneumoniae* infections. A recently emerging threat is carbapenem resistance mediated by a range of carbapenemases, which may confer resistance to virtually all available beta-lactam antibacterial drugs. Carbapenamase genes are often located on plasmids that can be exchanged between Enterobacteriaceae, including *K. pneumoniae*, and other gram-negative bacteria.

### Antimicrobial resistance

At the EU/EEA level, more than a third (34.1%) of the *K. pneumoniae* isolates reported to EARS-Net for 2017 were resistant to at least one of the antimicrobial groups under regular surveillance, i.e. fluoroquinolones, third-generation cephalosporins, aminoglycosides and carbapenems (Table 3.8). In 2017, the highest EU/EEA population-weighted mean resistance percentage was reported for fluoroquinolones (31.5%), followed by third-generation cephalosporins (31.2%), aminoglycosides (24.1%) and carbapenems (7.2%) (Tables 3.9–3.12). There was a small but significant increase in the EU/EEA population-weighted mean percentage for fluoroquinolone resistance, however the trend did not remain significant when the analysis was limited to the laboratories that consistently reported data during the period. No significant trend was noted for any of the other antimicrobial groups, including combined resistance to fluoroquinolones, third-generation cephalosporins and aminoglycosides (Tables 3.9–3.13).

Single resistance was less commonly reported than resistance to two or more antimicrobial groups, with the most common resistance phenotype being combined resistance to fluoroquinolones, third-generation cephalosporins and aminoglycosides (Table 3.8).

A majority of the third-generation cephalosporin-resistant isolates were ESBL positive. Only data from laboratories reporting ESBL results for all isolates identified as resistant to third-generation cephalosporins (76% of the laboratories reporting AST data for third-generation cephalosporins in *K. pneumoniae*), and only data from countries reporting at least 10 such isolates were included (23 countries). Among the *K. pneumoniae* isolates meeting the inclusion criteria, 87.8% were ascertained as ESBL-positive by the participating laboratories in 2017.

Large inter-country variations could be noted for all antimicrobial groups under regular surveillance, with generally higher resistance percentages reported from the southern and eastern parts of Europe than from northern Europe (Figures 3.8–3.12). The countries reporting the highest percentages of carbapenem resistance were also among the countries reporting the highest resistance percentages for the other antimicrobial groups. Similar distinct variations could be seen in the country-specific distributions between fully susceptible isolates and isolates with resistance to one, two, three or four antimicrobial groups (Figure 3.7).

### Discussion

Despite the stabilising EU/EEA resistance levels in *K. pneumoniae* reported during the last four years, the *K. pneumoniae* resistance situation remains problematic in the EU/EEA. The high levels of carbapenem resistance reported in several countries in the southern and south-eastern parts of Europe, almost always combined with resistance to several other key antimicrobial groups, have serious public health implications and represent an increasing threat to European healthcare delivery and patient safety. Multidrug-resistance and carbapenem resistance have been associated with higher healthcare costs, prolonged hospital stays, treatment failures and mortality. Remaining treatment alternatives for these infections are very limited. The World Health Organization (WHO) sees a critical need for research and the development of new antibiotics which target third-generation cephalosporin and carbapenem resistance in Enterobacteriaceae, including *K. pneumoniae* and *E. coli* [13].

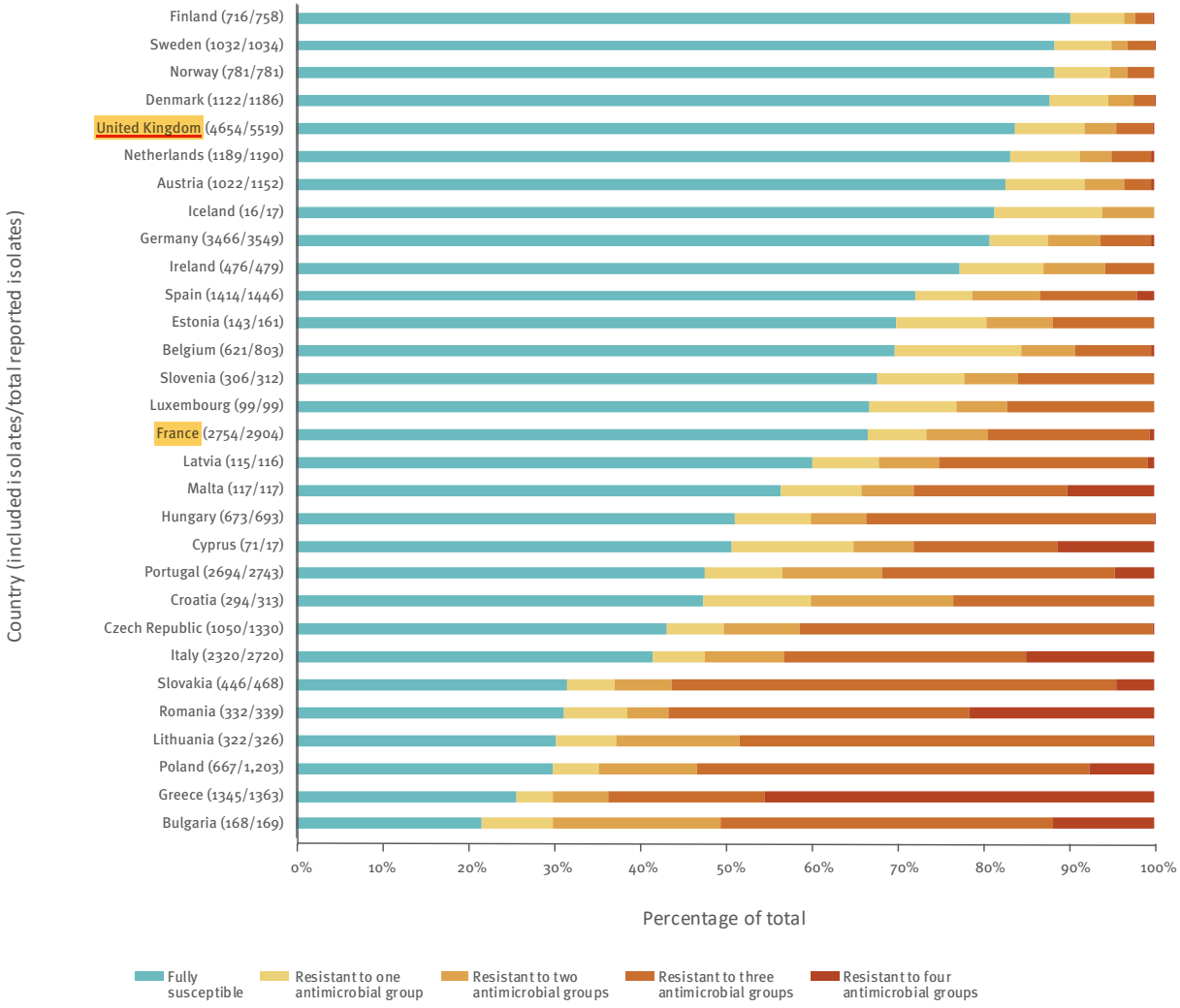
As highlighted in the recent updated ECDC rapid risk assessment on CRE, options for action include timely and appropriate diagnosis, high standards of infection prevention and control and antimicrobial stewardship [9]. In recent years, many EU/EEA countries have also developed and implemented recommendations and guidance documents on multidrug-resistant Enterobacteriaceae and/or CRE [14], indicating a trend towards nationally coordinated responses to this public health threat. 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 [15].

As for *E. coli*, the frequency of carbapenem-resistant isolates determined by phenotypic methods might underestimate the distribution and spread of carbapenemase-producing *K. pneumoniae*, especially in countries where carbapenemases such as OXA-48 are common.

This is partly reflected by the substantially higher percentages of carbapenem non-susceptible *K. pneumoniae* compared to carbapenem-resistant *K. pneumoniae* in some countries [16]. The recently launched carbapenem- and/or colistin-resistant Enterobacteriaceae (CCRE) project as part of the European Antimicrobial Resistance Genes Surveillance Network (EURGen-Net) will provide updated and more detailed information on the distribution of carbapenemase-producing *K. pneumoniae* in Europe [11].

Colistin is frequently being used to treat CRE infections, but colistin resistance may develop in patients treated with colistin. The recent discovery of transferable plasmid-mediated colistin resistance genes that can transmit colistin resistance more easily between bacteria further increased the risk for spread of colistin resistance [17]. Colistin resistance poses a substantial public health risk to the EU/EEA because it further limits treatment options in patients with infections caused by multidrug-resistant gram-negative bacteria, including CRE. The distribution of colistin resistance is difficult to assess through EARS-Net, as colistin susceptibility testing is generally not part of the initial routine AST panel for Enterobacteriaceae, but rather performed at national level after referral of multidrug-resistant isolates to a reference laboratory. In addition, colistin susceptibility testing is methodologically challenging, substantially reducing the quality of results from agar dilution, disk diffusion and gradient diffusion. A joint EUCAST and CLSI subcommittee has issued recommendations confirming that broth microdilution is so far the only valid method for colistin susceptibility testing [18]. A survey among EARS-Net participating laboratories in 2017 showed that a majority of the responding local laboratories did not test for colistin susceptibility locally or used

**Figure 3.7. *Klebsiella pneumoniae*. Distribution of isolates: fully susceptible and resistant to one, two, three and four antimicrobial groups (among isolates tested against fluoroquinolones, third-generation cephalosporins, aminoglycosides and carbapenems), EU/EEA countries, 2017**




Only data from isolates tested against all included antimicrobial groups included in analysis.

methods that are not recommended by EUCAST (unpublished data, ECDC/UK NEQAS), leading to the conclusion that data sources other than EARS-Net are needed for colistin susceptibility surveillance until local laboratory capacity has improved. To better understand the capacity for colistin susceptibility testing and the distribution of colistin-resistant Enterobacteriaceae in Europe, ECDC included colistin in the surveillance panel of the CCRE project. This project includes a capacity building component fro reference laboratories, which hopefully will also improve diagnostic capacity at the local level.

Similar to *E. coli*, the trends in fluoroquinolone resistance may be influenced by the fact that in 2016, EUCAST lowered its clinical breakpoints for several fluoroquinolones in Enterobacteriaceae. As EARS-Net bases its results on SIR interpretations, it is not possible to assess when or to what degree this change has been implemented by participating laboratories and how these changes have influenced the results. As a consequence, trend analyses for fluoroquinolone resistance should be interpreted with caution.

**Table 3.8. *Klebsiella pneumoniae*. Total number of invasive isolates tested* and resistance combinations among isolates tested against fluoroquinolones, third-generation cephalosporins, aminoglycosides and carbapenems (n=30 409). EU/EEA countries, 2017**

| Resistance pattern | Number of isolates | Percentage (%) of total** |
|---|---|---|
| Fully susceptible | **20 045** | **65.9** |
| Single resistance (to indicated antimicrobial group) | | |
| **Total (all single resistance)** | **2 287** | **7.5** |
| Third-generation cephalosporins | 1 215 | 4.0 |
| Fluoroquinolones | 842 | 2.8 |
| Other antimicrobial groups | 230 | 0.8 |
| Resistance to two antimicrobial groups | | |
| **Total (all two-group combinations)** | **1 993** | **6.6** |
| Third-generation cephalosporins + fluoroquinolones | 1 127 | 3.7 |
| Third-generation cephalosporins + aminoglycosides | 468 | 1.5 |
| Fluoroquinolones + aminoglycosides | 333 | 1.1 |
| Other antimicrobial group combinations | 65 | 0.2 |
| Resistance to three antimicrobial groups | | |
| **Total (all three-group combinations)** | **4 719** | **15.5** |
| Third-generation cephalosporins + fluoroquinolones + aminoglycosides | 4 114 | 13.5 |
| Third-generation cephalosporins + fluoroquinolones + carbapenems | 524 | 1.7 |
| Other antimicrobial group combinations | 81 | 0.3 |
| Resistance to four antimicrobial groups | | |
| Third-generation cephalosporins + fluoroquinolones + aminoglycosides + carbapenems | **1 365** | **4.5** |

Only resistance combinations >1% of the total are specified.

* Only data from isolates tested against all four antimicrobials groups were included in the analysis.

** Not adjusted for population differences in the reporting countries.

**Figure 3.8.** ***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to fluoroquinolones, by country, EU/EEA countries, 2017**

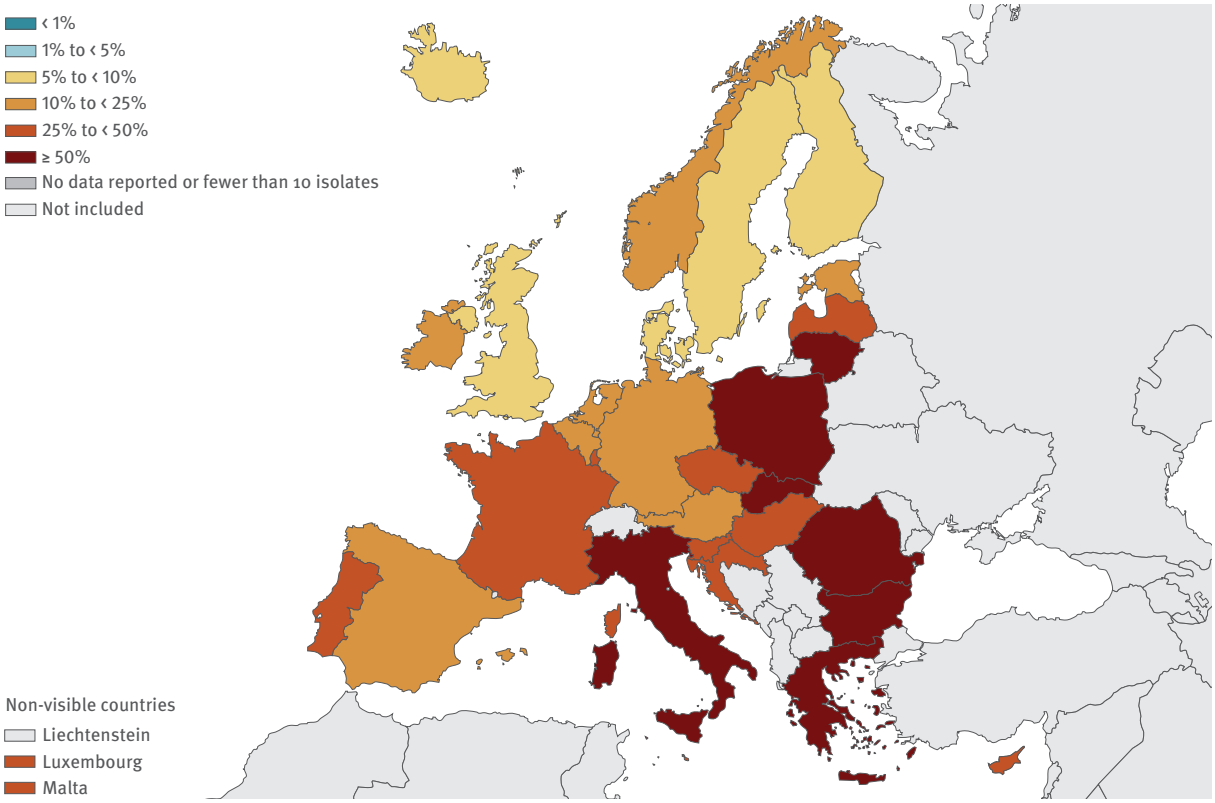



**Figure 3.9.** ***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, by country, EU/EEA countries, 2017**

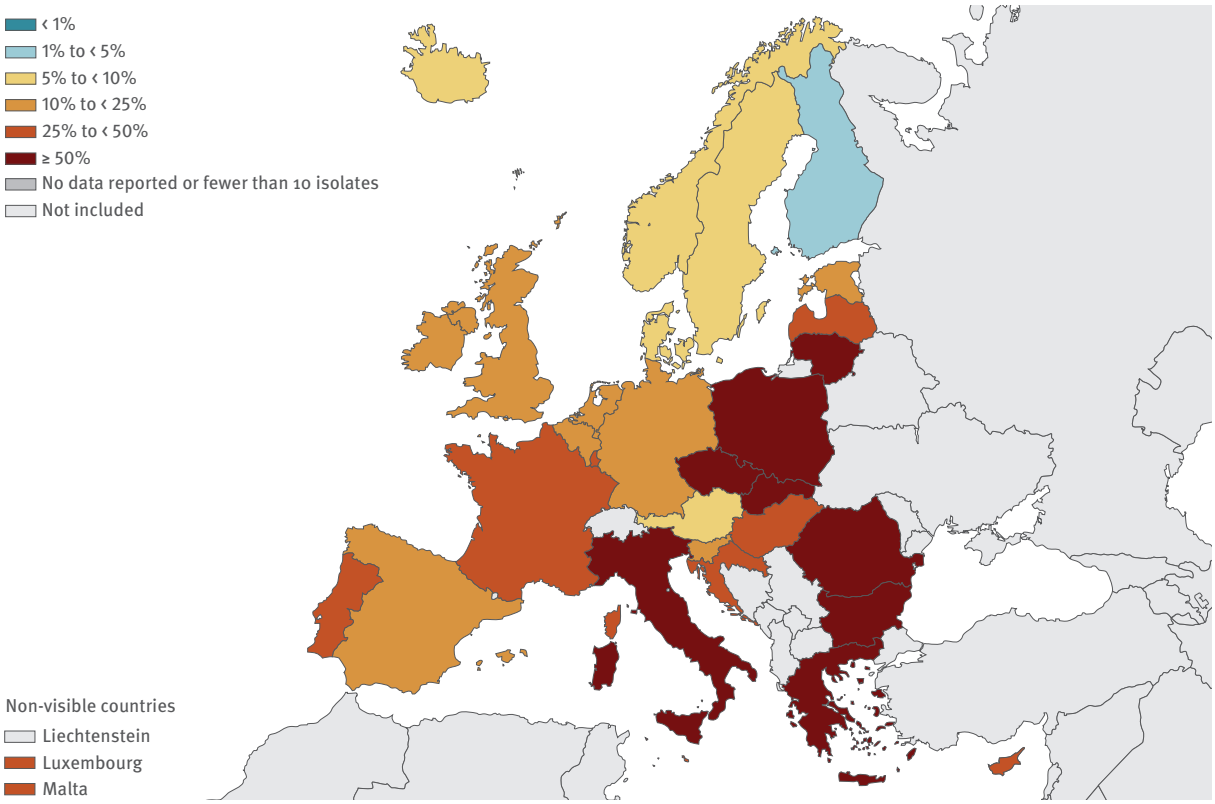


**Figure 3.10.** ***Klebsiella pneumoniae*****. Percentage (%) of invasive isolates with resistance to aminoglycosides, by country, EU/EEA countries, 2017**

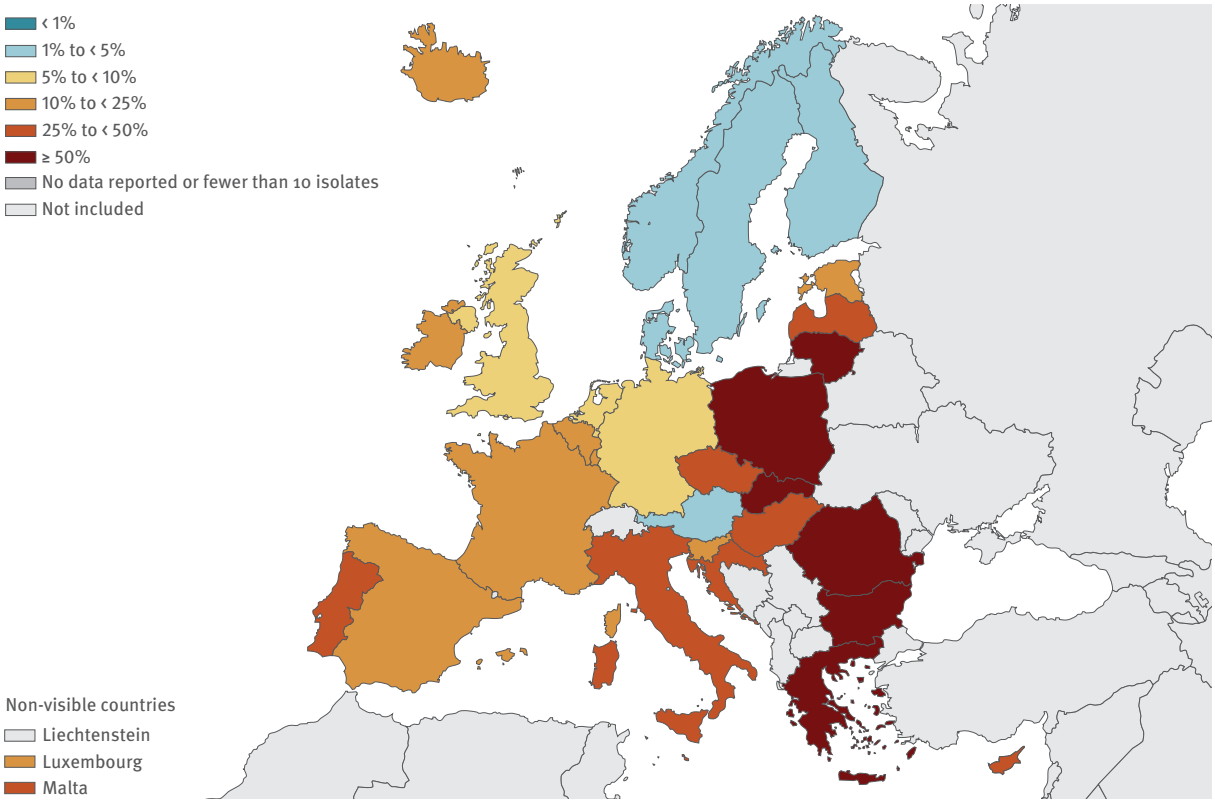



**Figure 3.11.** ***Klebsiella pneumoniae*****. Percentage (%) of invasive isolates with resistance to carbapenems, by country, EU/EEA countries, 2017**

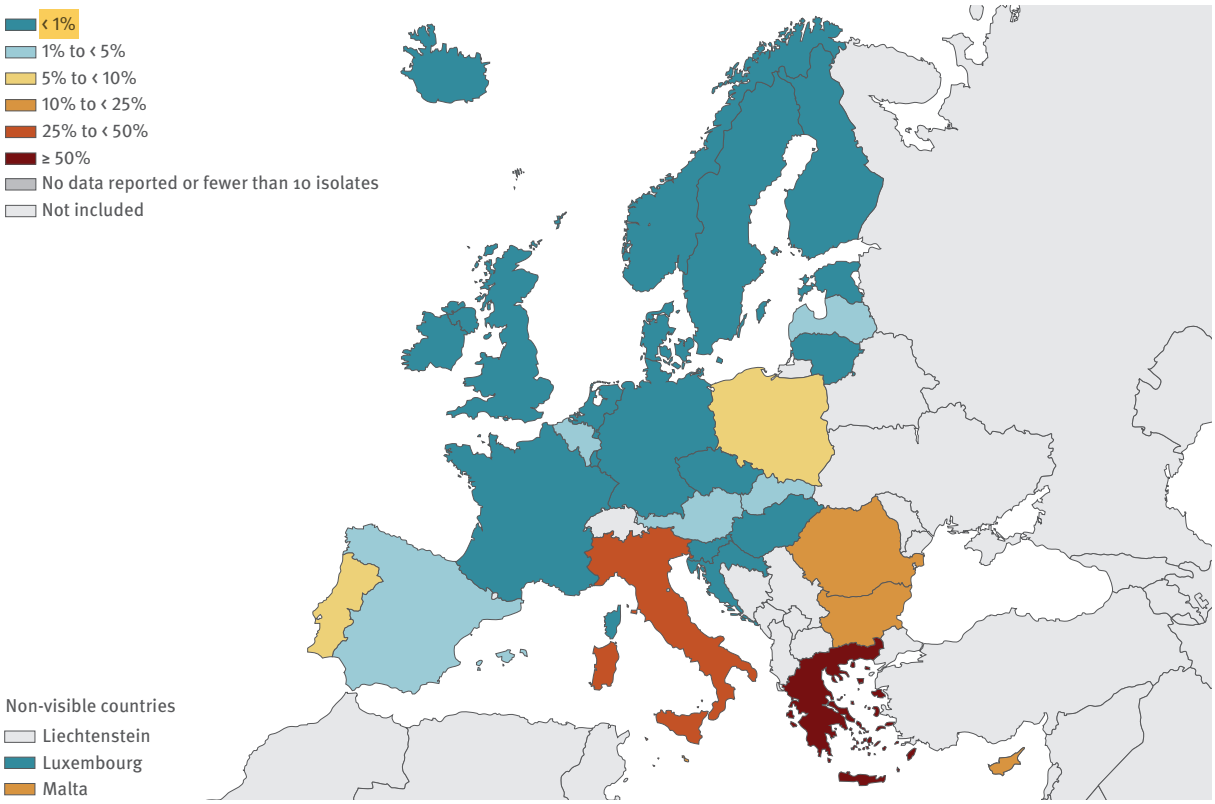


**Figure 3.12.** ***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with combined resistance to fluoroquinolones, third-generation cephalosporins and aminoglycosides, by country, EU/EEA countries, 2017**

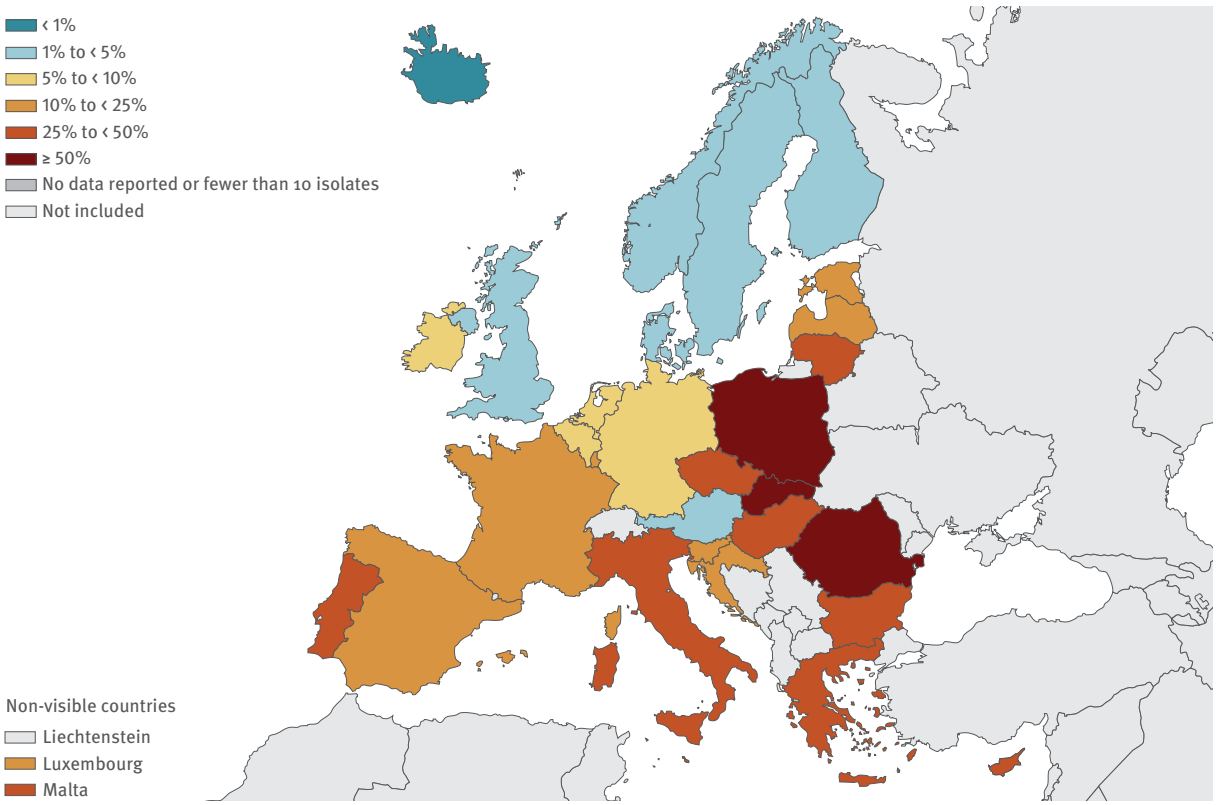


**Table 3.9. *Klebsiella pneumoniae*. Total number of invasive isolates tested (N) and percentage with resistance to fluoroquinolones (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Iceland | 28 | 3.6 | (0-18) | 35 | 2.9 | (0-15) | 21 | 0.0 | (0-16) | 16 | 6.3 | (0-30) | N/A |
| Finland | 581 | 4.6 | (3-7) | 658 | 3.3 | (2-5) | 769 | 2.7 | (2-4) | 756 | 7.9 | (6-10) | ↑ |
| Denmark | 943 | 6.9 | (5-9) | 935 | 5.3 | (4-7) | 1152 | 5.3 | (4-7) | 1183 | 9.1 | (8-11) | ↑ # |
| United Kingdom | 1130 | 7.7 | (6-9) | 1011 | 13.3 | (11-16) | 4065 | 7.5 | (7-8) | 5293 | 9.3 | (9-10) | |
| Sweden | 763 | 4.1 | (3-6) | 907 | 4.5 | (3-6) | 1533 | 5.4 | (4-7) | 1034 | 9.8 | (8-12) | N/A |
| Norway | 746 | 6.2 | (5-8) | 700 | 5.0 | (4-7) | 808 | 4.3 | (3-6) | 781 | 10.2 | (8-13) | ↑ |
| Netherlands | 886 | 4.7 | (3-6) | 908 | 6.8 | (5-9) | 1134 | 6.9 | (5-9) | 1190 | 11.9 | (10-14) | ↑ |
| Austria | 971 | 10.4 | (9-12) | 1029 | 11.7 | (10-14) | 1246 | 9.8 | (8-12) | 1147 | 14.2 | (12-16) | ↑ |
| Ireland | 355 | 13.5 | (10-18) | 388 | 17.0 | (13-21) | 453 | 11.3 | (8-15) | 478 | 14.9 | (12-18) | |
| Germany | 980 | 12.7 | (11-15) | 1580 | 9.6 | (8-11) | 3068 | 12.6 | (11-14) | 3549 | 15.6 | (14-17) | ↑ |
| Spain | 1266 | 18.6 | (17-21) | 1508 | 21.6 | (20-24) | 1676 | 22.7 | (21-25) | 1419 | 22.6 | (20-25) | ↑ |
| Belgium | 506 | 18.2 | (15-22) | 379 | 22.7 | (19-27) | 669 | 23.6 | (20-27) | 803 | 23.7 | (21-27) | ↑ # |
| Estonia | 133 | 21.8 | (15-30) | 62 | 33.9 | (22-47) | 183 | 29.5 | (23-37) | 161 | 24.8 | (18-32) | |
| France | 2175 | 31.0 | (29-33) | 2332 | 30.7 | (29-33) | 2589 | 27.7 | (26-29) | 2886 | 26.8 | (25-28) | ↓ |
| Luxembourg | 66 | 31.8 | (21-44) | 60 | 20.0 | (11-32) | 78 | 35.9 | (25-48) | 99 | 28.3 | (20-38) | |
| Slovenia | 233 | 32.6 | (27-39) | 237 | 24.5 | (19-30) | 267 | 29.6 | (24-35) | 306 | 30.4 | (25-36) | |
| **EU/EEA (population-weighted mean)** | **19990** | **30.4** | **(30-31)** | **22417** | **30.1** | **(30-31)** | **30583** | **30.3** | **(30-31)** | **32409** | **31.5** | **(31-32)** | ↑ # |
| Latvia | 116 | 44.8 | (36-54) | 112 | 42.0 | (33-52) | 91 | 41.8 | (32-53) | 116 | 32.8 | (24-42) | |
| Cyprus | 80 | 26.3 | (17-37) | 62 | 37.1 | (25-50) | 75 | 32.0 | (22-44) | 71 | 35.2 | (24-47) | |
| Malta | 99 | 32.3 | (23-42) | 88 | 26.1 | (17-37) | 102 | 33.3 | (24-43) | 117 | 39.3 | (30-49) | |
| Croatia | 330 | 44.8 | (39-50) | 380 | 48.7 | (44-54) | 318 | 43.4 | (38-49) | 309 | 40.8 | (35-46) | |
| Hungary | 641 | 34.9 | (31-39) | 700 | 36.7 | (33-40) | 713 | 35.2 | (32-39) | 685 | 41.5 | (38-45) | ↑ |
| Portugal | 1712 | 36.5 | (34-39) | 2094 | 38.6 | (36-41) | 2350 | 41.7 | (40-44) | 2736 | 45.7 | (44-48) | ↑ |
| Czech Republic | 1382 | 48.0 | (45-51) | 1416 | 48.9 | (46-52) | 1384 | 50.5 | (48-53) | 1329 | 49.2 | (46-52) | |
| Italy | 1295 | 55.7 | (53-58) | 2000 | 53.7 | (51-56) | 2248 | 56.0 | (54-58) | 2562 | 55.7 | (54-58) | |
| Bulgaria | 151 | 50.3 | (42-59) | 96 | 37.5 | (28-48) | 160 | 55.6 | (48-63) | 169 | 59.8 | (52-67) | ↑ |
| Romania | 257 | 66.5 | (60-72) | 267 | 61.4 | (55-67) | 342 | 60.8 | (55-66) | 337 | 64.1 | (59-69) | |
| Lithuania | 154 | 45.5 | (37-54) | 179 | 45.8 | (38-53) | 324 | 54.6 | (49-60) | 326 | 64.7 | (59-70) | ↑ |
| Poland | 455 | 67.9 | (63-72) | 659 | 63.9 | (60-68) | 1119 | 66.8 | (64-70) | 739 | 66.3 | (63-70) | |
| Slovakia | 493 | 70.8 | (67-75) | 474 | 70.0 | (66-74) | 466 | 66.3 | (62-71) | 466 | 66.7 | (62-71) | |
| Greece | 1063 | 67.6 | (65-70) | 1161 | 66.4 | (64-69) | 1180 | 68.6 | (66-71) | 1346 | 66.9 | (64-69) | |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

**Table 3.10.** ***Klebsiella pneumoniae*. Total number of invasive isolates tested (N) and percentage with resistance to third-generation cephalosporins (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Finland | 582 | 2.4 | (1-4) | 644 | 3.0 | (2-5) | 760 | 4.1 | (3-6) | 744 | 4.6 | (3-6) | ↑ |
| Sweden | 1000 | 4.5 | (3-6) | 1001 | 3.3 | (2-5) | 1537 | 4.9 | (4-6) | 1034 | 5.6 | (4-7) | N/A |
| Norway | 746 | 5.9 | (4-8) | 701 | 5.0 | (4-7) | 811 | 5.8 | (4-8) | 781 | 5.8 | (4-8) | |
| Iceland | 28 | 0.0 | (0-12) | 36 | 0.0 | (0-10) | 25 | 0.0 | (0-14) | 17 | 5.9 | (0-29) | N/A |
| Denmark | 925 | 7.6 | (6-9) | 929 | 7.8 | (6-10) | 1118 | 7.5 | (6-9) | 1125 | 7.3 | (6-9) | |
| Austria | 996 | 8.2 | (7-10) | 1050 | 8.4 | (7-10) | 1245 | 9.6 | (8-11) | 1072 | 8.6 | (7-10) | |
| Netherlands | 911 | 5.5 | (4-7) | 908 | 8.6 | (7-11) | 1134 | 10.3 | (9-12) | 1189 | 10.9 | (9-13) | ↑ |
| United Kingdom | 978 | 9.3 | (8-11) | 916 | 10.5 | (9-13) | 3914 | 8.9 | (8-10) | 4973 | 11.4 | (10-12) | ↑ # |
| Ireland | 354 | 11.6 | (8-15) | 387 | 14.7 | (11-19) | 452 | 13.5 | (10-17) | 478 | 14.6 | (12-18) | |
| Germany | 1006 | 12.7 | (11-15) | 1581 | 10.2 | (9-12) | 3068 | 13.6 | (12-15) | 3546 | 14.7 | (14-16) | ↑ |
| Belgium | 485 | 16.3 | (13-20) | 406 | 19.7 | (16-24) | 669 | 22.9 | (20-26) | 803 | 19.3 | (17-22) | |
| Estonia | 135 | 20.7 | (14-29) | 93 | 23.7 | (15-34) | 183 | 32.8 | (26-40) | 161 | 21.1 | (15-28) | |
| Spain | 1265 | 18.0 | (16-20) | 1491 | 20.3 | (18-22) | 1677 | 22.4 | (20-24) | 1445 | 21.4 | (19-24) | ↑ |
| Slovenia | 233 | 26.6 | (21-33) | 237 | 22.8 | (18-29) | 267 | 22.8 | (18-28) | 312 | 23.7 | (19-29) | |
| Luxembourg | 66 | 34.8 | (24-48) | 60 | 28.3 | (17-41) | 78 | 35.9 | (25-48) | 99 | 27.3 | (19-37) | |
| France | 2192 | 29.6 | (28-32) | 2338 | 30.5 | (29-32) | 2597 | 28.9 | (27-31) | 2892 | 28.8 | (27-31) | |
| **EU/EEA (population-weighted mean)** | **20188** | **31.4** | **(31-32)** | **22511** | **31.0** | **(31-32)** | **30447** | **31.4** | **(31-32)** | **32453** | **31.2** | **(31-32)** | |
| Latvia | 104 | 52.9 | (43-63) | 115 | 47.0 | (38-56) | 95 | 47.4 | (37-58) | 116 | 33.6 | (25-43) | ↓ |
| Malta | 99 | 28.3 | (20-38) | 88 | 15.9 | (9-25) | 102 | 21.6 | (14-31) | 117 | 35.0 | (26-44) | |
| Hungary | 644 | 35.6 | (32-39) | 704 | 37.2 | (34-41) | 722 | 37.5 | (34-41) | 693 | 41.1 | (37-45) | ↑ |
| Croatia | 334 | 47.9 | (42-53) | 380 | 46.8 | (42-52) | 321 | 48.6 | (43-54) | 309 | 41.7 | (36-47) | |
| Portugal | 1712 | 40.9 | (39-43) | 2094 | 40.4 | (38-43) | 2349 | 46.7 | (45-49) | 2743 | 44.9 | (43-47) | ↑ |
| Cyprus | 80 | 32.5 | (22-44) | 62 | 43.5 | (31-57) | 75 | 30.7 | (21-42) | 71 | 46.5 | (35-59) | |
| Czech Republic | 1383 | 52.9 | (50-56) | 1417 | 54.1 | (51-57) | 1384 | 51.8 | (49-54) | 1329 | 53.2 | (50-56) | |
| Italy | 1319 | 56.5 | (54-59) | 1999 | 55.9 | (54-58) | 2246 | 55.8 | (54-58) | 2546 | 54.6 | (53-57) | |
| Romania | 256 | 73.8 | (68-79) | 270 | 70.7 | (65-76) | 344 | 68.0 | (63-73) | 339 | 62.5 | (57-68) | ↓ |
| Poland | 465 | 68.2 | (64-72) | 676 | 64.2 | (60-68) | 1142 | 64.4 | (62-67) | 1203 | 63.0 | (60-66) | |
| Lithuania | 154 | 52.6 | (44-61) | 178 | 51.7 | (44-59) | 326 | 56.7 | (51-62) | 326 | 63.2 | (58-68) | ↑ |
| Slovakia | 493 | 69.4 | (65-73) | 469 | 67.2 | (63-71) | 465 | 61.3 | (57-66) | 459 | 63.2 | (59-68) | ↓ |
| Greece | 1092 | 72.5 | (70-75) | 1185 | 69.5 | (67-72) | 1181 | 72.5 | (70-75) | 1362 | 69.2 | (67-72) | |
| Bulgaria | 151 | 74.8 | (67-82) | 96 | 75.0 | (65-83) | 160 | 72.5 | (65-79) | 169 | 76.3 | (69-83) | |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

**Table 3.11. *Klebsiella pneumoniae*. Total number of invasive isolates tested (N) and percentage with resistance to aminoglycosides (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Finland | 559 | 2.3 | (1-4) | 625 | 1.9 | (1-3) | 727 | 2.3 | (1-4) | 721 | 2.9 | (2-4) | |
| Denmark | 943 | 4.9 | (4-6) | 938 | 2.6 | (2-4) | 1154 | 3.2 | (2-4) | 1186 | 3.2 | (2-4) | |
| Norway | 744 | 4.8 | (3-7) | 700 | 3.6 | (2-5) | 809 | 3.3 | (2-5) | 781 | 4.2 | (3-6) | |
| Sweden | 860 | 3.3 | (2-5) | 943 | 3.2 | (2-5) | 1141 | 3.4 | (2-5) | 1033 | 4.7 | (4-6) | N/A |
| Austria | 925 | 5.5 | (4-7) | 959 | 4.8 | (4-6) | 1157 | 4.8 | (4-6) | 1141 | 4.8 | (4-6) | |
| Netherlands | 898 | 3.9 | (3-5) | 908 | 5.7 | (4-7) | 1134 | 6.1 | (5-8) | 1190 | 7.6 | (6-9) | ↑ # |
| United Kingdom | 1174 | 5.5 | (4-7) | 1070 | 9.3 | (8-11) | 4135 | 6.7 | (6-7) | 5363 | 7.9 | (7-9) | ↑ # |
| Germany | 1006 | 7.1 | (6-9) | 1582 | 5.6 | (5-7) | 3042 | 7.7 | (7-9) | 3468 | 8.0 | (7-9) | ↑ |
| Iceland | 28 | 3.6 | (0-18) | 36 | 0.0 | (0-10) | 25 | 0.0 | (0-14) | 17 | 11.8 | (1-36) | N/A |
| Ireland | 354 | 12.1 | (9-16) | 389 | 15.9 | (12-20) | 453 | 11.5 | (9-15) | 479 | 11.9 | (9-15) | |
| Estonia | 135 | 18.5 | (12-26) | 61 | 21.3 | (12-34) | 183 | 21.3 | (16-28) | 161 | 12.4 | (8-19) | |
| Belgium | 341 | 10.9 | (8-15) | 354 | 11.6 | (8-15) | 637 | 13.8 | (11-17) | 633 | 12.5 | (10-15) | |
| Slovenia | 233 | 20.2 | (15-26) | 237 | 19.0 | (14-25) | 267 | 16.5 | (12-21) | 312 | 16.0 | (12-21) | |
| Spain | 1264 | 13.8 | (12-16) | 1509 | 16.0 | (14-18) | 1678 | 15.5 | (14-17) | 1445 | 17.6 | (16-20) | ↑ |
| Luxembourg | 66 | 19.7 | (11-31) | 60 | 15.0 | (7-27) | 78 | 26.9 | (18-38) | 99 | 18.2 | (11-27) | |
| France | 2188 | 27.7 | (26-30) | 2337 | 26.3 | (25-28) | 2569 | 26.2 | (25-28) | 2857 | 23.8 | (22-25) | ↓ |
| **EU/EEA (population-weighted mean)** | **19828** | **25.0** | **(24-26)** | **22360** | **24.2** | **(24-25)** | **30023** | **24.4** | **(24-25)** | **32620** | **24.1** | **(24-25)** | |
| Cyprus | 80 | 28.7 | (19-40) | 62 | 37.1 | (25-50) | 75 | 22.7 | (14-34) | 71 | 26.8 | (17-39) | |
| Latvia | 118 | 43.2 | (34-53) | 113 | 43.4 | (34-53) | 91 | 38.5 | (28-49) | 115 | 29.6 | (21-39) | ↓ |
| Croatia | 334 | 48.8 | (43-54) | 380 | 43.2 | (38-48) | 316 | 36.1 | (31-42) | 311 | 30.9 | (26-36) | ↓ |
| Malta | 99 | 28.3 | (20-38) | 88 | 22.7 | (14-33) | 102 | 22.5 | (15-32) | 117 | 31.6 | (23-41) | |
| Portugal | 1706 | 30.5 | (28-33) | 2090 | 32.6 | (31-35) | 2337 | 35.0 | (33-37) | 2717 | 33.5 | (32-35) | ↑ |
| Italy | 1190 | 36.2 | (33-39) | 1956 | 34.0 | (32-36) | 2300 | 36.1 | (34-38) | 2571 | 34.5 | (33-36) | |
| Hungary | 639 | 31.8 | (28-36) | 706 | 34.6 | (31-38) | 720 | 34.7 | (31-38) | 693 | 37.8 | (34-42) | ↑ |
| Czech Republic | 1383 | 50.7 | (48-53) | 1417 | 51.9 | (49-55) | 1385 | 47.1 | (44-50) | 1330 | 49.6 | (47-52) | |
| Greece | 1067 | 59.3 | (56-62) | 1170 | 50.7 | (48-54) | 1171 | 52.9 | (50-56) | 1348 | 53.2 | (50-56) | ↓ |
| Lithuania | 152 | 49.3 | (41-58) | 179 | 46.4 | (39-54) | 325 | 49.2 | (44-55) | 322 | 53.7 | (48-59) | |
| Poland | 455 | 59.1 | (54-64) | 666 | 58.6 | (55-62) | 1075 | 56.7 | (54-60) | 1165 | 55.5 | (53-58) | |
| Romania | 250 | 67.6 | (61-73) | 266 | 54.1 | (48-60) | 336 | 61.9 | (56-67) | 338 | 58.6 | (53-64) | |
| Slovakia | 494 | 68.2 | (64-72) | 475 | 66.5 | (62-71) | 466 | 62.4 | (58-67) | 468 | 61.1 | (57-66) | ↓ |
| Bulgaria | 143 | 65.7 | (57-73) | 84 | 59.5 | (48-70) | 135 | 64.4 | (56-72) | 168 | 63.1 | (55-70) | |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

**Table 3.12. *Klebsiella pneumoniae*. Total number of invasive isolates tested (N) and percentage with resistance to carbapenems (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Estonia | 92 | 0.0 | (0-4) | 56 | 0.0 | (0-6) | 168 | 0.0 | (0-2) | 143 | 0.0 | (0-3) | |
| Croatia | 334 | 0.9 | (0-3) | 380 | 2.4 | (1-4) | 323 | 0.0 | (0-1) | 302 | 0.0 | (0-1) | ↓ |
| Iceland | 28 | 0.0 | (0-12) | 35 | 0.0 | (0-12) | 21 | 0.0 | (0-12) | 16 | 0.0 | (0-13) | N/A |
| Luxembourg | 66 | 1.5 | (0-8) | 60 | 0.0 | (0-6) | 78 | 0.0 | (0-5) | 99 | 0.0 | (0-4) | |
| Norway | 746 | 0.0 | (0-0) | 700 | 0.1 | (0-1) | 810 | 0.0 | (0-0) | 781 | 0.0 | (0-0) | |
| Slovenia | 233 | 0.9 | (0-3) | 237 | 1.3 | (0-4) | 267 | 0.0 | (0-1) | 312 | 0.0 | (0-1) | ↓ |
| Hungary | 621 | 1.1 | (0-2) | 687 | 0.1 | (0-1) | 703 | 0.4 | (0-1) | 681 | 0.1 | (0-1) | |
| Sweden | 978 | 0.0 | (0-0) | 900 | 0.0 | (0-0) | 1531 | 0.1 | (0-0) | 1033 | 0.1 | (0-1) | N/A |
| Ireland | 353 | 0.6 | (0-2) | 389 | 0.5 | (0-2) | 453 | 0.7 | (0-2) | 478 | 0.2 | (0-1) | |
| Denmark | 830 | 0.2 | (0-1) | 846 | 0.0 | (0-0) | 1119 | 0.3 | (0-1) | 1185 | 0.3 | (0-1) | |
| Finland | 583 | 0.0 | (0-1) | 658 | 0.0 | (0-1) | 770 | 0.3 | (0-1) | 758 | 0.3 | (0-1) | |
| Czech Republic | 1148 | 0.1 | (0-0) | 1100 | 0.3 | (0-1) | 1096 | 0.0 | (0-0) | 1051 | 0.4 | (0-1) | |
| Germany | 1006 | 0.7 | (0-1) | 1583 | 0.1 | (0-0) | 3068 | 0.5 | (0-1) | 3549 | 0.5 | (0-1) | |
| Netherlands | 903 | 0.2 | (0-1) | 907 | 0.1 | (0-1) | 1131 | 0.1 | (0-0) | 1190 | 0.5 | (0-1) | |
| Lithuania | 154 | 1.3 | (0-5) | 177 | 0.0 | (0-2) | 325 | 0.0 | (0-1) | 325 | 0.6 | (0-2) | |
| United Kingdom | 1069 | 0.8 | (0-2) | 962 | 0.4 | (0-1) | 4068 | 0.3 | (0-0) | 5274 | 0.6 | (0-1) | |
| France | 2103 | 0.5 | (0-1) | 2244 | 0.5 | (0-1) | 2528 | 0.4 | (0-1) | 2807 | 0.7 | (0-1) | |
| Austria | 971 | 0.6 | (0-1) | 1022 | 0.8 | (0-2) | 1198 | 0.7 | (0-1) | 1109 | 1.0 | (0-2) | |
| Belgium | 429 | 0.5 | (0-2) | 389 | 0.5 | (0-2) | 669 | 2.4 | (1-4) | 791 | 1.1 | (1-2) | |
| Latvia | 118 | 1.7 | (0-6) | 112 | 0.0 | (0-3) | 90 | 2.2 | (0-8) | 116 | 1.7 | (0-6) | |
| Spain | 1266 | 2.3 | (2-3) | 1483 | 2.2 | (1-3) | 1677 | 2.1 | (1-3) | 1442 | 2.7 | (2-4) | |
| Slovakia | 456 | 2.6 | (1-5) | 436 | 0.9 | (0-2) | 435 | 2.5 | (1-4) | 450 | 4.4 | (3-7) | ↑ |
| Poland | 451 | 1.3 | (0-3) | 660 | 0.5 | (0-1) | 1123 | 2.1 | (1-3) | 1161 | 6.4 | (5-8) | ↑ |
| **EU/EEA (population-weighted mean)** | **19617** | **7.3** | **(7-8)** | **21808** | **6.8** | **(6-7)** | **30148** | **7.4** | **(7-8)** | **32461** | **7.2** | **(7-7)** | |
| Portugal | 1701 | 1.8 | (1-3) | 2085 | 3.4 | (3-4) | 2340 | 5.2 | (4-6) | 2720 | 8.6 | (8-10) | ↑ |
| Malta | 99 | 9.1 | (4-17) | 88 | 4.5 | (1-11) | 102 | 5.9 | (2-12) | 117 | 10.3 | (5-17) | |
| Bulgaria | 139 | 7.2 | (4-13) | 95 | 3.2 | (1-9) | 159 | 4.4 | (2-9) | 169 | 12.4 | (8-18) | |
| Cyprus | 80 | 5.0 | (1-12) | 62 | 12.9 | (6-24) | 75 | 10.7 | (5-20) | 71 | 15.5 | (8-26) | |
| Romania | 257 | 31.5 | (26-38) | 271 | 24.7 | (20-30) | 334 | 31.4 | (26-37) | 334 | 22.5 | (18-27) | |
| Italy | 1315 | 32.9 | (30-36) | 1999 | 33.5 | (31-36) | 2307 | 33.9 | (32-36) | 2634 | 29.7 | (28-31) | ↓ |
| Greece | 1088 | 62.3 | (59-65) | 1185 | 61.9 | (59-65) | 1180 | 66.9 | (64-70) | 1363 | 64.7 | (62-67) | |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

**Table 3.13.** ***Klebsiella pneumoniae*. Total number of isolates tested (N) and percentage with combined resistance to fluoroquinolones, third-generation cephalosporins and aminoglycosides (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Iceland | 28 | 0.0 | (0-12) | 35 | 0.0 | (0-10) | 21 | 0.0 | (0-16) | 16 | 0.0 | (0-21) | N/A |
| Denmark | 925 | 3.1 | (2-4) | 924 | 1.1 | (1-2) | 1112 | 1.4 | (1-2) | 1122 | 2.4 | (2-3) | |
| Finland | 556 | 1.4 | (1-3) | 623 | 1.1 | (0-2) | 726 | 1.2 | (1-2) | 716 | 2.4 | (1-4) | |
| Austria | 900 | 3.2 | (2-5) | 936 | 3.3 | (2-5) | 1156 | 3.5 | (3-5) | 1062 | 3.0 | (2-4) | |
| Norway | 744 | 3.9 | (3-6) | 699 | 2.3 | (1-4) | 807 | 2.6 | (2-4) | 781 | 3.2 | (2-5) | |
| Sweden | 623 | 1.4 | (1-3) | 860 | 1.9 | (1-3) | 1141 | 2.1 | (1-3) | 1033 | 3.3 | (2-5) | N/A |
| United Kingdom | 975 | 3.1 | (2-4) | 906 | 4.2 | (3-6) | 3764 | 3.7 | (3-4) | 4760 | 4.2 | (4-5) | |
| Netherlands | 865 | 2.0 | (1-3) | 908 | 3.0 | (2-4) | 1134 | 3.5 | (3-5) | 1189 | 5.0 | (4-6) | ↑ |
| Ireland | 353 | 7.4 | (5-11) | 387 | 7.2 | (5-10) | 452 | 5.8 | (4-8) | 477 | 5.9 | (4-8) | |
| Germany | 979 | 5.3 | (4-7) | 1578 | 3.2 | (2-4) | 3038 | 5.3 | (5-6) | 3466 | 6.3 | (5-7) | ↑ |
| Belgium | 341 | 7.9 | (5-11) | 353 | 9.3 | (7-13) | 637 | 9.3 | (7-12) | 633 | 8.5 | (6-11) | |
| Estonia | 131 | 11.5 | (7-18) | 36 | 22.2 | (10-39) | 183 | 16.9 | (12-23) | 161 | 11.8 | (7-18) | |
| Spain | 1263 | 10.1 | (8-12) | 1488 | 11.7 | (10-13) | 1674 | 12.4 | (11-14) | 1417 | 13.0 | (11-15) | ↑ |
| Slovenia | 233 | 18.9 | (14-25) | 237 | 16.9 | (12-22) | 267 | 13.1 | (9-18) | 306 | 16.0 | (12-21) | |
| Luxembourg | 66 | 16.7 | (9-28) | 60 | 13.3 | (6-25) | 78 | 24.4 | (15-35) | 99 | 17.2 | (10-26) | |
| France | 2172 | 23.7 | (22-26) | 2324 | 22.5 | (21-24) | 2556 | 21.3 | (20-23) | 2844 | 19.4 | (18-21) | ↓ |
| **EU/EEA (population-weighted mean)** | **19193** | **20.8** | **(20-21)** | **21930** | **19.7** | **(19-20)** | **29403** | **20.6** | **(20-21)** | **31098** | **20.5** | **(20-21)** | |
| Croatia | 330 | 30.6 | (26-36) | 380 | 32.4 | (28-37) | 309 | 27.5 | (23-33) | 305 | 23.0 | (18-28) | ↓ |
| Latvia | 104 | 41.3 | (32-51) | 112 | 36.6 | (28-46) | 91 | 31.9 | (22-42) | 115 | 24.3 | (17-33) | ↓ |
| Cyprus | 80 | 15.0 | (8-25) | 62 | 17.7 | (9-30) | 75 | 18.7 | (11-29) | 71 | 25.4 | (16-37) | |
| Malta | 99 | 25.3 | (17-35) | 88 | 14.8 | (8-24) | 102 | 14.7 | (8-23) | 117 | 28.2 | (20-37) | |
| Portugal | 1705 | 22.8 | (21-25) | 2084 | 25.0 | (23-27) | 2332 | 27.2 | (25-29) | 2711 | 28.4 | (27-30) | ↑ |
| Italy | 1164 | 32.0 | (29-35) | 1940 | 29.7 | (28-32) | 2174 | 32.7 | (31-35) | 2352 | 31.6 | (30-34) | |
| Hungary | 636 | 28.6 | (25-32) | 698 | 30.2 | (27-34) | 711 | 30.1 | (27-34) | 685 | 33.1 | (30-37) | |
| Czech Republic | 1382 | 38.7 | (36-41) | 1416 | 41.5 | (39-44) | 1384 | 40.8 | (38-43) | 1329 | 41.8 | (39-44) | |
| Greece | 1061 | 55.1 | (52-58) | 1160 | 46.7 | (44-50) | 1171 | 48.4 | (46-51) | 1345 | 47.9 | (45-51) | ↓ |
| Lithuania | 152 | 35.5 | (28-44) | 178 | 39.9 | (33-47) | 323 | 42.1 | (37-48) | 322 | 48.1 | (43-54) | ↑ |
| Bulgaria | 143 | 44.1 | (36-53) | 84 | 28.6 | (19-39) | 133 | 45.9 | (37-55) | 168 | 50.0 | (42-58) | |
| Poland | 443 | 54.6 | (50-59) | 645 | 54.0 | (50-58) | 1052 | 53.6 | (51-57) | 703 | 52.6 | (49-56) | |
| Romania | 247 | 56.3 | (50-63) | 261 | 49.8 | (44-56) | 335 | 55.2 | (50-61) | 336 | 55.4 | (50-61) | |
| Slovakia | 493 | 63.3 | (59-68) | 468 | 59.6 | (55-64) | 465 | 55.7 | (51-60) | 457 | 57.1 | (52-62) | ↓ |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

# 3.3 *Pseudomonas aeruginosa*

*Pseudomonas aeruginosa* is a non-fermenting gram-negative bacterium that is ubiquitous in aquatic environments in nature. It is an opportunistic pathogen and a major cause of infection in hospitalised patients with localised or systemic impairment of immune defences. It commonly causes healthcare-associated pneumonia (including ventilator-associated pneumonia), bloodstream infections and urinary tract infections.

*P. aeruginosa* is intrinsically resistant to the majority of antimicrobial agents due to its selective ability to prevent various antibiotic molecules from penetrating its outer membrane or to extrude them if they enter the cell. The antimicrobial groups that remain active include some fluoroquinolones (e.g. ciprofloxacin and levofloxacin), aminoglycosides (e.g. gentamicin, tobramycin and amikacin), some beta-lactams (e.g. piperacillin-tazobactam, ceftazidime, cefepime, ceftolozane-tazobactam, ceftazidime-avibactam, imipenem, meropenem, doripenem) and polymyxins. Resistance of *P. aeruginosa* to these agents can be acquired through one or more of several mechanisms, including modified antimicrobial targets, efflux, reduced permeability and degrading enzymes.

## Antimicrobial resistance

In the EU/EEA, 30.8% of the *P. aeruginosa* isolates reported to EARS-Net for 2017 were resistant to at least one of the antimicrobial groups under regular surveillance (piperacillin ± tazobactam, fluoroquinolones, ceftazidime, aminoglycosides and carbapenems) (Table 3.14). The highest EU/EEA population-weighted mean resistance percentage in 2017 was reported for fluoroquinolones (20.3%), followed by piperacillin ± tazobactam (18.3%), carbapenems (17.4%), ceftazidime (14.7%) and aminoglycosides (13.2%) (Tables 3.15–3.19). For all antimicrobial groups under regular surveillance, the EU/EEA population-weighted mean percentage decreased significantly between 2014 and 2017 (Tables 3.15–3.19). When only considering the laboratories that consistently reported data during all four years, only the decreasing trends for piperacillin ± tazobactam resistance, aminoglycoside resistance and carbapenem resistance remained statistically significant (Tables 3.15–3.19).

Resistance to two or more antimicrobial groups was common and seen in 18.3% of all tested isolates. (Table 3.14). The EU/EEA population-weighted mean percentage of combined resistance, defined as resistance to at least three of the antimicrobial groups under surveillance, significantly decreased between 2014 and 2017 (Table 3.20).

Large inter-country variations could be noted for all antimicrobial groups, with generally higher resistance percentages reported from southern and eastern parts of Europe than northern Europe (Figures 3.13–3.18).

## Discussion and conclusion

EARS-Net data showed that at the EU/EEA level, small but significantly decreasing trends in resistance were noted for *P. aeruginosa* for all antimicrobial groups under surveillance during the period 2014 to 2017, although these trends did not always remain statistically significant when only the laboratories that consistently reported data during the period were included. Nevertheless, high resistance percentages and combined resistance persisted in many countries, especially in the eastern and south-eastern parts of Europe. As *P. aeruginosa* is intrinsically resistant to many antimicrobial agents, additional acquired resistance is further complicating treatment of serious infections in already vulnerable patient groups.

The public health implications of resistant *P. aeruginosa* should not be neglected, as the bacterium remains one of the major causes of healthcare-associated infection in Europe [19–20]. Due to its ubiquitous nature and potential virulence, *P. aeruginosa* is a challenging pathogen to control in healthcare settings. Prudent antimicrobial use and high standards of infection prevention and control are essential to prevent the situation from further deteriorating.

**Table 3.14.** ***Pseudomonas aeruginosa.*** **Total number of tested isolates and resistance combinations among invasive isolates tested against at least three antimicrobial groups among piperacillin ± tazobactam, ceftazidime, fluoroquinolones, aminoglycosides and carbapenems (n=16 885), EU/EEA countries, 2017**

| Resistance pattern | Number of isolates | Percentage (%) of total* |
|---|---|---|
| Fully susceptible (to tested antibiotics) | **11691** | **69.2** |
| Single resistance (to indicated antimicrobial group) | | |
| **Total (all single resistance types)** | **2104** | **12.5** |
| Carbapenems | 775 | 4.6 |
| Fluoroquinolones | 696 | 4.1 |
| [Piperacillin ± tazobactam] | 339 | 2.0 |
| Aminoglycosides | 185 | 1.1 |
| Ceftazidime | 109 | 0.6 |
| Resistance to two antimicrobial groups | | |
| **Total (all two groups combinations)** | **1185** | **7.0** |
| [Piperacillin ± tazobactam] + ceftazidime | 444 | 2.6 |
| Fluoroquinolones + aminoglycosides | 173 | 1.0 |
| Fluoroquinolones + carbapenems | 232 | 1.4 |
| Other antimicrobial group combinations | 336 | 2.0 |
| Resistance to three antimicrobial groups | | |
| **Total (all three group combinations)** | **669** | **4.0** |
| Fluoroquinolones + aminoglycosides + carbapenems | 163 | 1.0 |
| Other antimicrobial group combinations | 506 | 3.0 |
| Resistance to four antimicrobial groups | | |
| **Total (all four group combinations)** | **577** | **3.4** |
| [Piperacillin ± tazobactam] + fluoroquinolones + aminoglycosides + carbapenems | 185 | 1.1 |
| Fluoroquinolones + ceftazidime + aminoglycosides + carbapenems | 174 | 1.0 |
| Other antimicrobial group combinations | 218 | 1.3 |
| Resistance to five antimicrobial groups | | |
| [Piperacillin ± tazobactam] + fluoroquinolones + ceftazidime + aminoglycosides + carbapenems | **659** | **3.9** |

Only resistance combinations >1% of the total are specified

* Not adjusted for population differences in the reporting countries

**Figure 3.13.** ***Pseudomonas aeruginosa.*** **Percentage (%) of invasive isolates with resistance to piperacillin ± tazobactam, by country, EU/EEA countries, 2017**

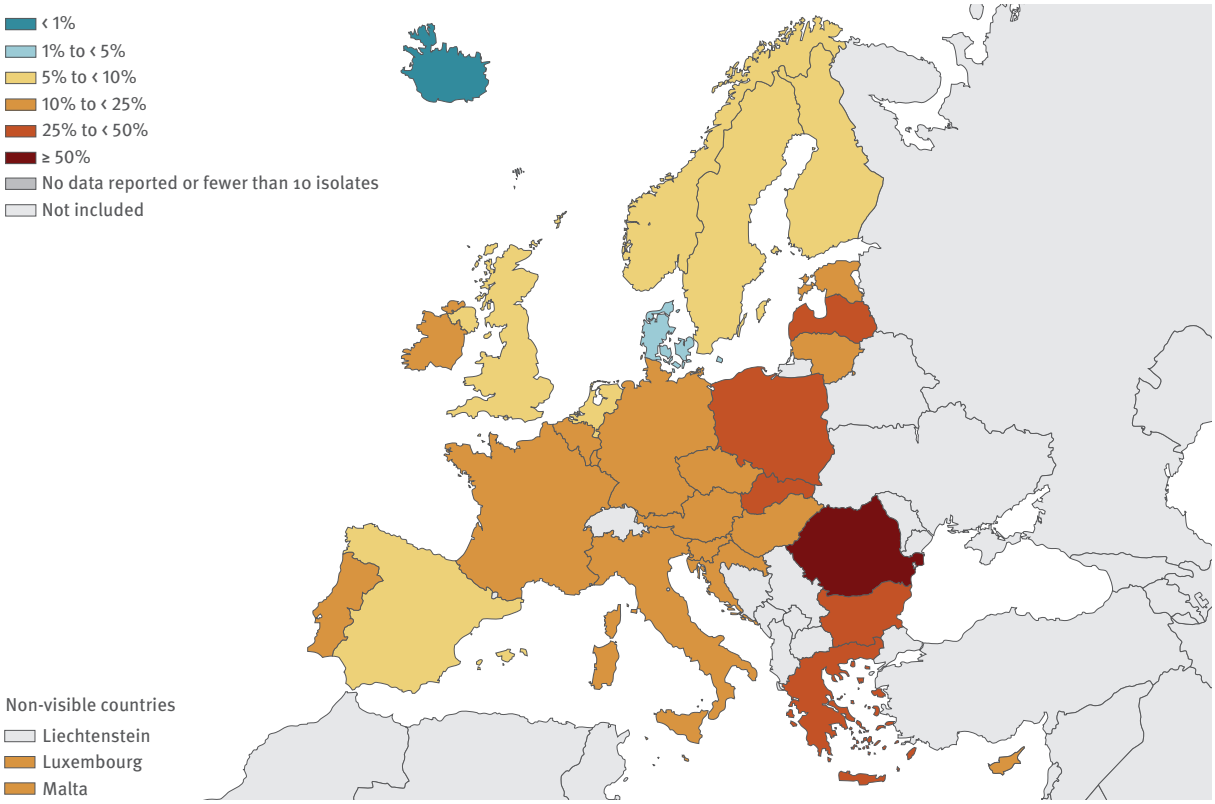


**Figure 3.14.** ***Pseudomonas aeruginosa*. Percentage (%) of invasive isolates with resistance to fluoroquinolones, by country, EU/EEA countries, 2017**

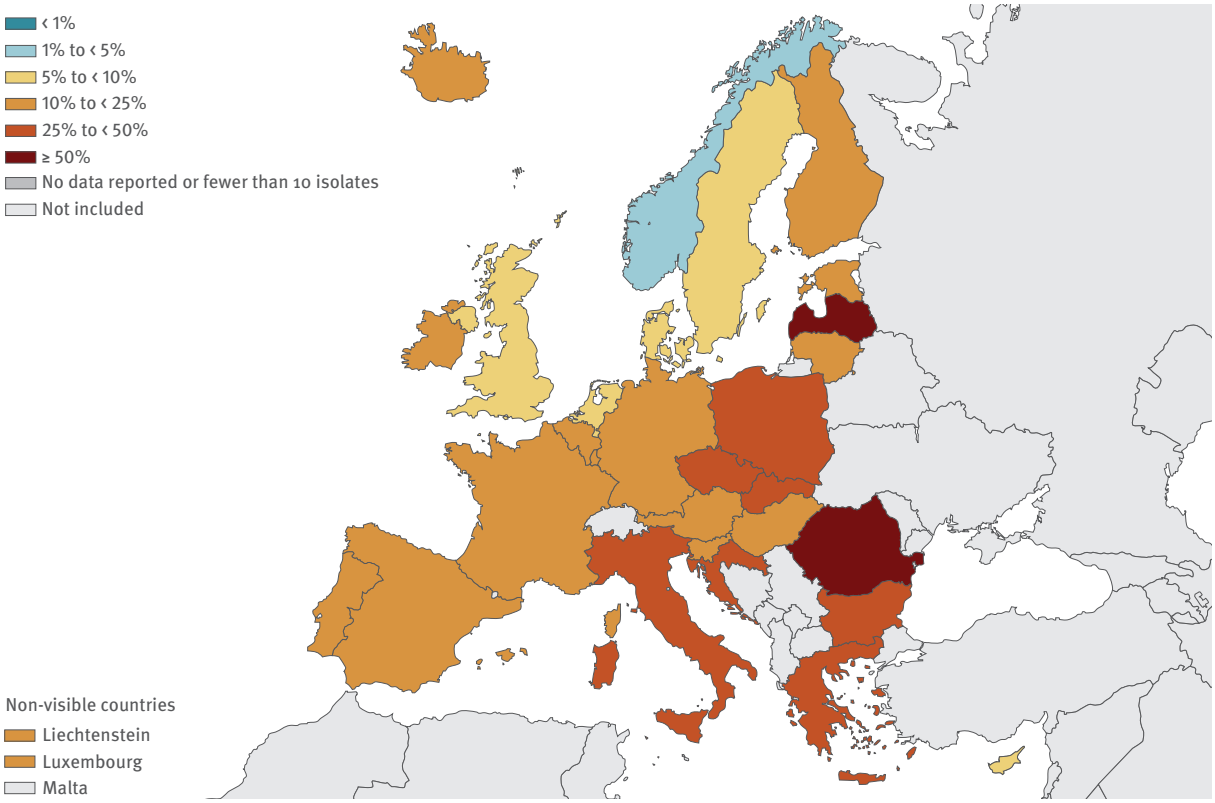



**Figure 3.15.** ***Pseudomonas aeruginosa*. Percentage (%) of invasive isolates with resistance to ceftazidime, by country, EU/EEA countries, 2017**

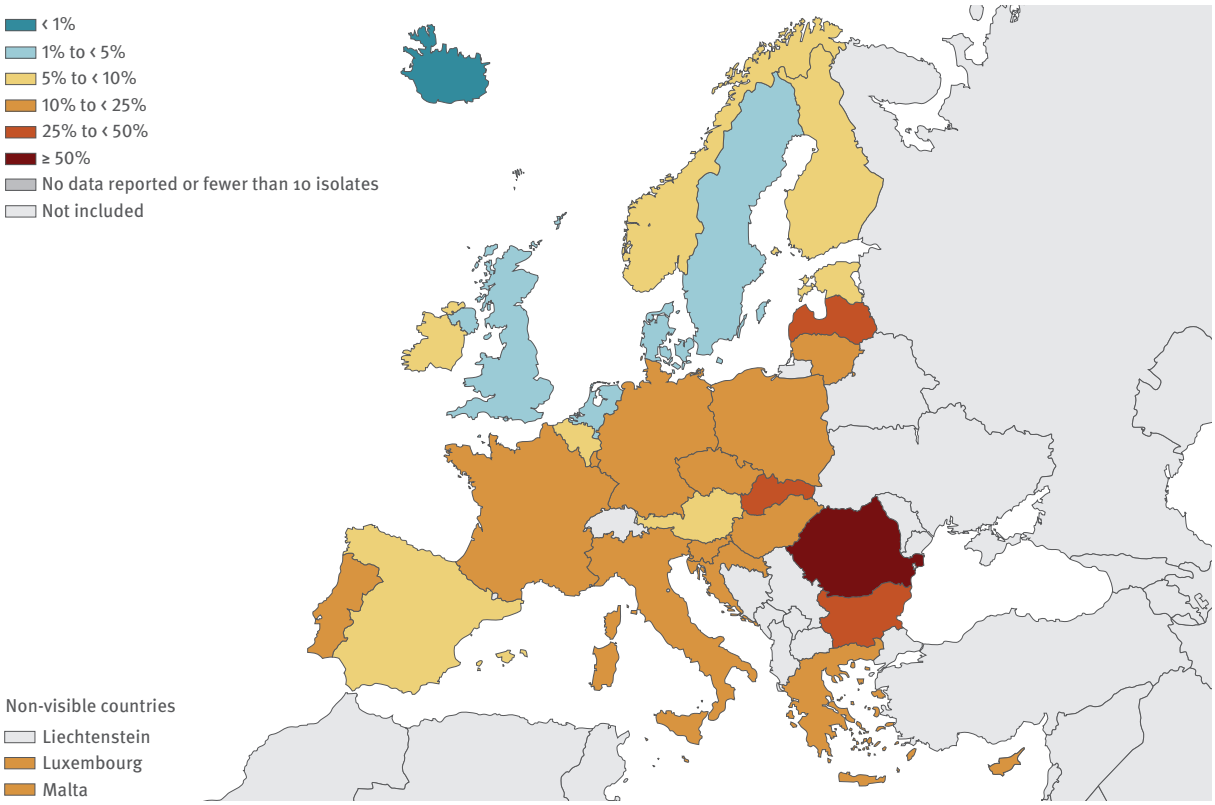


**Figure 3.16.** ***Pseudomonas aeruginosa*. Percentage (%) of invasive isolates with resistance to aminoglycosides, by country, EU/EEA countries, 2017**

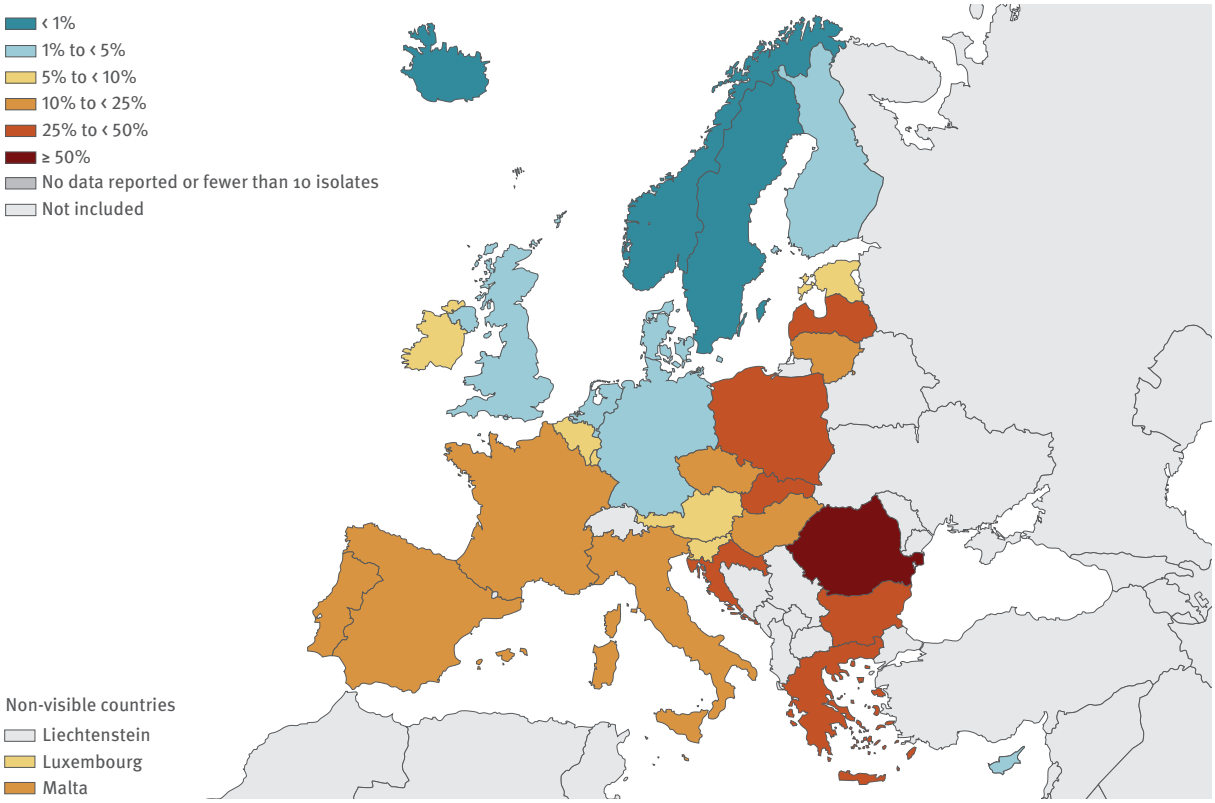



**Figure 3.17.** ***Pseudomonas aeruginosa*. Percentage (%) of invasive isolates with resistance to carbapenems, by country, EU/EEA countries, 2017**

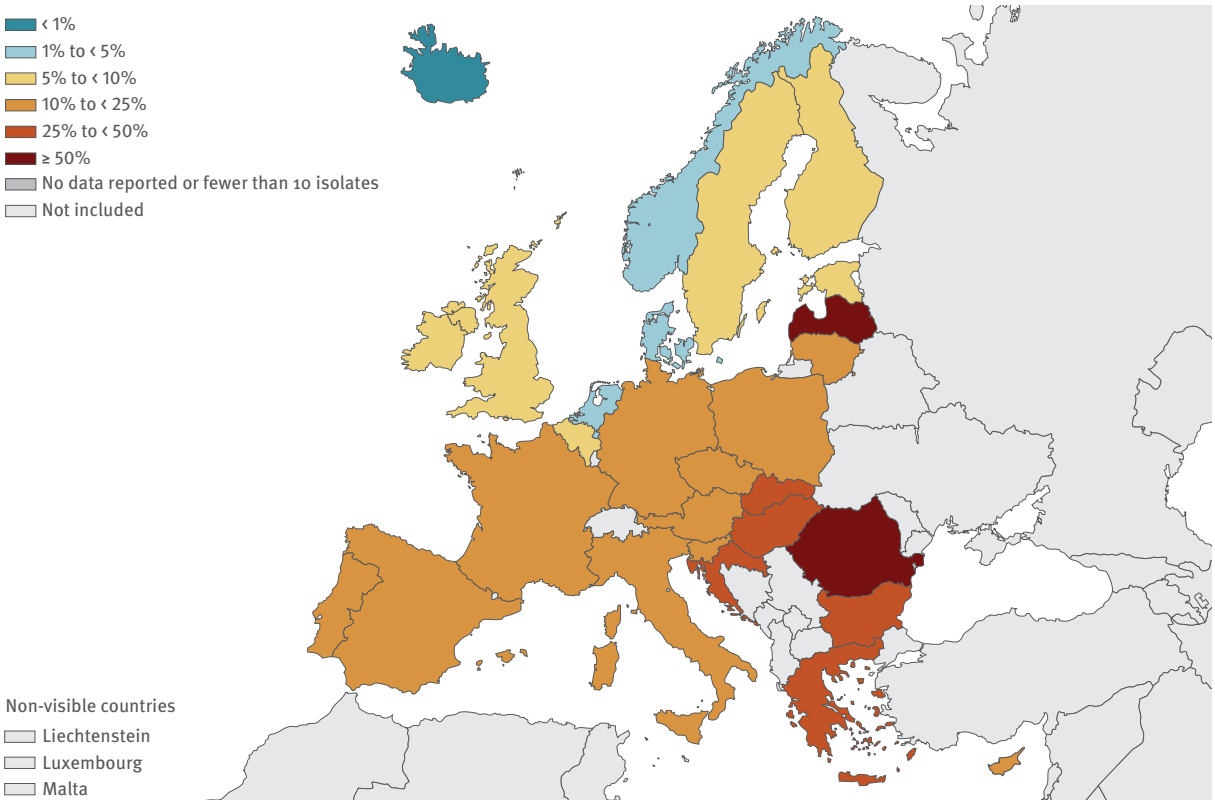


**Figure 3.18.** ***Pseudomonas aeruginosa.*** **Percentage (%) of invasive isolates with combined resistance (resistance to three or more antimicrobial groups among piperacillin ± tazobactam, ceftazidime, fluoroquinolones, aminoglycosides and carbapenems), by country, EU/EEA countries, 2017**

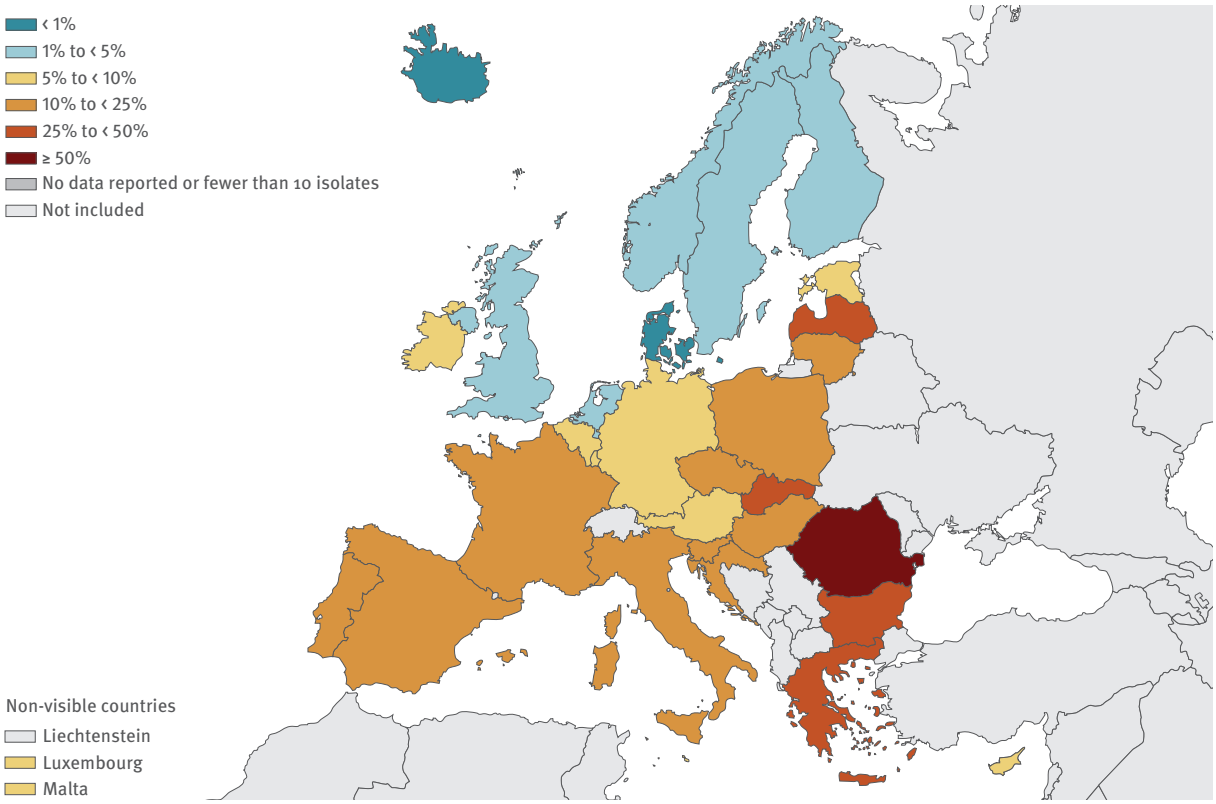


**Table 3.15. *Pseudomonas aeruginosa*. Total number of invasive isolates tested (N) and percentage with resistance to piperacillin ± tazobactam (%R), including 95 % confidence intervals (95 %CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Iceland | 11 | 9.1 | (0-41) | 11 | 0.0 | (0-28) | 17 | 0.0 | (0-20) | 17 | 0.0 | (0-20) | N/A |
| Denmark | 388 | 4.4 | (3-7) | 441 | 4.1 | (2-6) | 460 | 3.5 | (2-6) | 484 | 2.9 | (2-5) | |
| United Kingdom | 610 | 4.8 | (3-7) | 493 | 10.3 | (8-13) | 2039 | 6.0 | (5-7) | 2697 | 5.3 | (4-6) | |
| Norway | 254 | 7.9 | (5-12) | 227 | 5.7 | (3-10) | 215 | 7.4 | (4-12) | 183 | 6.0 | (3-11) | |
| Sweden | 337 | 4.7 | (3-8) | 399 | 5.8 | (4-9) | 472 | 7.4 | (5-10) | 446 | 6.3 | (4-9) | N/A |
| Finland | 306 | 6.9 | (4-10) | 333 | 7.2 | (5-11) | 351 | 9.4 | (7-13) | 377 | 6.4 | (4-9) | |
| Netherlands | 530 | 8.1 | (6-11) | 494 | 6.5 | (4-9) | 520 | 4.0 | (3-6) | 620 | 7.1 | (5-9) | |
| Spain | 870 | 7.8 | (6-10) | 871 | 9.1 | (7-11) | 817 | 9.4 | (8-12) | 788 | 8.2 | (6-10) | |
| Belgium | 294 | 9.5 | (6-13) | 251 | 8.0 | (5-12) | 318 | 9.7 | (7-14) | 439 | 10.5 | (8-14) | |
| Luxembourg | 37 | 10.8 | (3-25) | 27 | 0.0 | (0-13) | 40 | 12.5 | (4-27) | 54 | 11.1 | (4-23) | |
| Slovenia | 112 | 25.9 | (18-35) | 141 | 9.9 | (6-16) | 143 | 19.6 | (13-27) | 138 | 13.0 | (8-20) | |
| Austria | 636 | 11.8 | (9-15) | 675 | 11.9 | (10-15) | 689 | 13.8 | (11-17) | 721 | 13.5 | (11-16) | |
| Ireland | 178 | 11.2 | (7-17) | 195 | 9.2 | (6-14) | 243 | 12.8 | (9-18) | 286 | 14.0 | (10-19) | |
| Estonia | 39 | 10.3 | (3-24) | 16 | 6.3 | (0-30) | 53 | 17.0 | (8-30) | 55 | 14.5 | (6-27) | N/A |
| Germany | 642 | 17.4 | (15-21) | 972 | 17.5 | (15-20) | 1423 | 17.2 | (15-19) | 1755 | 16.2 | (14-18) | |
| Croatia | 216 | 24.5 | (19-31) | 249 | 24.5 | (19-30) | 252 | 18.7 | (14-24) | 234 | 16.2 | (12-22) | ↓ |
| Cyprus | 42 | 16.7 | (7-31) | 43 | 4.7 | (1-16) | 64 | 12.5 | (6-23) | 53 | 17.0 | (8-30) | |
| Lithuania | 31 | 32.3 | (17-51) | 41 | 29.3 | (16-46) | 74 | 13.5 | (7-23) | 89 | 18.0 | (11-28) | ↓ # |
| **EU/EEA (population-weighted mean)** | **11525** | **19.5** | **(19-20)** | **12569** | **19.9** | **(19-21)** | **15152** | **18.8** | **(18-19)** | **16414** | **18.3** | **(18-19)** | ↓ |
| France | 1783 | 17.0 | (15-19) | 1915 | 16.1 | (15-18) | 1958 | 17.4 | (16-19) | 1690 | 19.2 | (17-21) | |
| Malta | 36 | 8.3 | (2-22) | 25 | 16.0 | (5-36) | 40 | 12.5 | (4-27) | 37 | 21.6 | (10-38) | |
| Czech Republic | 429 | 23.1 | (19-27) | 463 | 25.3 | (21-29) | 458 | 25.3 | (21-30) | 409 | 23.0 | (19-27) | |
| Italy | 686 | 31.5 | (28-35) | 1074 | 29.5 | (27-32) | 1147 | 30.7 | (28-33) | 1312 | 24.2 | (22-27) | ↓ |
| Portugal | 1061 | 28.5 | (26-31) | 1176 | 24.5 | (22-27) | 1230 | 22.7 | (20-25) | 1206 | 24.2 | (22-27) | ↓ |
| Hungary | 736 | 23.5 | (20-27) | 747 | 26.9 | (24-30) | 720 | 23.6 | (21-27) | 721 | 24.3 | (21-28) | |
| Greece | 666 | 31.4 | (28-35) | 638 | 22.3 | (19-26) | 692 | 28.3 | (25-32) | 813 | 29.6 | (27-33) | |
| Poland | 185 | 32.4 | (26-40) | 249 | 37.8 | (32-44) | 393 | 30.0 | (26-35) | 389 | 32.1 | (28-37) | |
| Bulgaria | 48 | 31.3 | (19-46) | 55 | 27.3 | (16-41) | 55 | 40.0 | (27-54) | 69 | 33.3 | 22-46) | |
| Latvia | 3 | ** | (**) | 13 | 23.1 | (5-54) | 15 | 26.7 | (8-55) | 14 | 35.7 | (13-65) | N/A |
| Slovakia | 269 | 36.1 | (30-42) | 257 | 42.4 | (36-49) | 168 | 36.9 | (30-45) | 187 | 42.8 | (36-50) | |
| Romania | 90 | 62.2 | (51-72) | 78 | 59.0 | (47-70) | 86 | 48.8 | (38-60) | 131 | 53.4 | (45-62) | |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

** Less than 10 isolates reported, no percentage calculated

**Table 3.16.** ***Pseudomonas aeruginosa.*** **Total number of invasive isolates tested (N) and percentage with resistance to fluoroquinolones (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Norway | 257 | 3.1 | (1-6) | 230 | 5.2 | (3-9) | 227 | 5.7 | (3-10) | 205 | 4.9 | (2-9) | |
| Denmark | 388 | 3.6 | (2-6) | 420 | 5.0 | (3-8) | 460 | 3.7 | (2-6) | 484 | 5.0 | (3-7) | |
| Cyprus | 42 | 16.7 | (7-31) | 43 | 11.6 | (4-25) | 64 | 20.3 | (11-32) | 53 | 5.7 | (1-16) | |
| United Kingdom | 629 | 5.4 | (4-7) | 522 | 8.8 | (7-12) | 2119 | 6.9 | (6-8) | 2802 | 7.7 | (7-9) | |
| Sweden | 338 | 7.7 | (5-11) | 382 | 4.7 | (3-7) | 469 | 6.0 | (4-9) | 445 | 9.0 | (6-12) | N/A |
| Netherlands | 541 | 6.7 | (5-9) | 502 | 5.8 | (4-8) | 543 | 6.1 | (4-8) | 657 | 9.9 | (8-12) | ↑ # |
| Belgium | 309 | 12.6 | (9-17) | 261 | 11.1 | (8-16) | 366 | 14.5 | (11-19) | 430 | 10.5 | (8-14) | |
| Malta | 36 | 2.8 | (0-15) | 25 | 12.0 | (3-31) | 40 | 10.0 | (3-24) | 37 | 10.8 | (3-25) | |
| Finland | 289 | 10.0 | (7-14) | 302 | 8.9 | (6-13) | 292 | 7.9 | (5-12) | 356 | 11.2 | (8-15) | |
| Iceland | 11 | 0.0 | (0-28) | 12 | 8.3 | (0-38) | 17 | 17.6 | (4-43) | 17 | 11.8 | (1-36) | N/A |
| Austria | 599 | 10.9 | (8-14) | 659 | 10.3 | (8-13) | 694 | 7.2 | (5-9) | 721 | 12.3 | (10-15) | |
| Estonia | 39 | 10.3 | (3-24) | 18 | 0.0 | (0-19) | 56 | 3.6 | (0-12) | 56 | 12.5 | (5-24) | N/A |
| Luxembourg | 41 | 9.8 | (3-23) | 28 | 17.9 | (6-37) | 40 | 12.5 | (4-27) | 56 | 12.5 | (5-24) | |
| Ireland | 178 | 8.4 | (5-14) | 194 | 9.8 | (6-15) | 243 | 11.9 | (8-17) | 287 | 13.9 | (10-18) | ↑ |
| Germany | 623 | 13.0 | (10-16) | 970 | 14.3 | (12-17) | 1423 | 12.4 | (11-14) | 1755 | 14.2 | (13-16) | |
| France | 1779 | 20.6 | (19-23) | 1939 | 19.1 | (17-21) | 1971 | 13.6 | (12-15) | 1709 | 15.1 | (13-17) | ↓ |
| Spain | 873 | 24.6 | (22-28) | 881 | 23.0 | (20-26) | 843 | 23.0 | (20-26) | 842 | 20.1 | (17-23) | ↓ |
| **EU/EEA (population-weighted mean)** | **11629** | **20.8** | **(20-22)** | **12681** | **20.9** | **(20-22)** | **15388** | **18.8** | **(18-19)** | **16704** | **20.3** | **(20-21)** | ↓ # |
| Slovenia | 112 | 22.3 | (15-31) | 141 | 14.2 | (9-21) | 143 | 20.3 | (14-28) | 123 | 20.3 | (14-29) | |
| Lithuania | 31 | 25.8 | (12-45) | 41 | 26.8 | (14-43) | 73 | 15.1 | (8-25) | 89 | 21.3 | (13-31) | |
| Hungary | 743 | 24.6 | (22-28) | 769 | 24.7 | (22-28) | 736 | 24.3 | (21-28) | 732 | 23.4 | (20-27) | |
| Portugal | 1062 | 26.3 | (24-29) | 1185 | 22.7 | (20-25) | 1227 | 20.1 | (18-22) | 1208 | 23.7 | (21-26) | |
| Italy | 739 | 28.3 | (25-32) | 1080 | 24.6 | (22-27) | 1166 | 24.7 | (22-27) | 1390 | 25.1 | (23-27) | |
| Bulgaria | 48 | 27.1 | (15-42) | 55 | 36.4 | (24-50) | 56 | 35.7 | (23-50) | 71 | 28.2 | (18-40) | |
| Czech Republic | 447 | 32.7 | (28-37) | 464 | 30.0 | (26-34) | 464 | 34.7 | (30-39) | 411 | 30.2 | (26-35) | |
| Croatia | 230 | 30.0 | (24-36) | 256 | 35.2 | (29-41) | 259 | 37.5 | (32-44) | 237 | 32.9 | (27-39) | |
| Greece | 676 | 37.7 | (34-41) | 662 | 34.1 | (31-38) | 702 | 34.6 | (31-38) | 816 | 35.3 | (32-39) | |
| Poland | 184 | 35.3 | (28-43) | 257 | 36.2 | (30-42) | 400 | 31.0 | (26-36) | 358 | 37.2 | (32-42) | |
| Slovakia | 275 | 45.5 | (39-52) | 278 | 52.2 | (46-58) | 190 | 47.4 | (40-55) | 211 | 46.9 | (40-54) | |
| Romania | 92 | 55.4 | (45-66) | 92 | 62.0 | (51-72) | 89 | 51.7 | (41-62) | 132 | 62.1 | (53-70) | |
| Latvia | 18 | 16.7 | (4-41) | 13 | 23.1 | (5-54) | 16 | 31.3 | (11-59) | 14 | 64.3 | (35-87) | N/A |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

**Table 3.17. *Pseudomonas aeruginosa*. Total number of invasive isolates tested (N) and percentage with resistance to ceftazidime (%R), including 95% confidence intervals (95% CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Iceland | 11 | 9.1 | (0-41) | 11 | 0.0 | (0-28) | 17 | 0.0 | (0-20) | 17 | 0.0 | (0-20) | N/A |
| Denmark | 386 | 3.9 | (2-6) | 439 | 3.6 | (2-6) | 447 | 4.5 | (3-7) | 461 | 3.5 | (2-6) | |
| Netherlands | 534 | 4.9 | (3-7) | 502 | 4.4 | (3-7) | 543 | 3.3 | (2-5) | 657 | 3.5 | (2-5) | |
| Sweden | 433 | 5.5 | (4-8) | 379 | 4.5 | (3-7) | 473 | 7.4 | (5-10) | 446 | 4.5 | (3-7) | N/A |
| United Kingdom | 588 | 4.6 | (3-7) | 472 | 6.1 | (4-9) | 2021 | 4.3 | (3-5) | 2680 | 4.7 | (4-6) | |
| Norway | 251 | 5.2 | (3-9) | 216 | 5.6 | (3-10) | 224 | 7.1 | (4-11) | 197 | 5.1 | (2-9) | |
| Finland | 307 | 6.2 | (4-9) | 334 | 6.9 | (4-10) | 352 | 5.4 | (3-8) | 378 | 6.1 | (4-9) | |
| Belgium | 316 | 8.9 | (6-13) | 226 | 6.2 | (3-10) | 320 | 7.8 | (5-11) | 431 | 7.2 | (5-10) | |
| Estonia | 28 | 7.1 | (1-24) | 7 | ** | (**) | 17 | 17.6 | (4-43) | 47 | 8.5 | (2-20) | N/A |
| Austria | 631 | 8.7 | (7-11) | 577 | 9.9 | (8-13) | 628 | 11.3 | (9-14) | 620 | 8.7 | (7-11) | |
| Spain | 864 | 9.6 | (8-12) | 816 | 10.4 | (8-13) | 836 | 10.2 | (8-12) | 836 | 9.6 | (8-12) | |
| Ireland | 175 | 8.0 | (4-13) | 195 | 7.2 | (4-12) | 243 | 10.7 | (7-15) | 272 | 9.6 | (6-14) | |
| Germany | 638 | 9.9 | (8-12) | 968 | 8.9 | (7-11) | 1421 | 10.1 | (9-12) | 1744 | 10.1 | (9-12) | |
| France | 1778 | 12.0 | (11-14) | 1919 | 11.6 | (10-13) | 1956 | 11.3 | (10-13) | 1568 | 12.2 | (11-14) | |
| Luxembourg | 41 | 2.4 | (0-13) | 28 | 7.1 | (1-24) | 40 | 5.0 | (1-17) | 56 | 12.5 | (5-24) | |
| Slovenia | 112 | 20.5 | (13-29) | 141 | 9.9 | (6-16) | 143 | 17.5 | (12-25) | 138 | 13.0 | (8-20) | |
| Cyprus | 42 | 23.8 | (12-39) | 43 | 4.7 | (1-16) | 64 | 10.9 | (5-21) | 53 | 13.2 | (5-25) | |
| Czech Republic | 446 | 21.5 | (18-26) | 464 | 19.6 | (16-24) | 464 | 19.2 | (16-23) | 411 | 13.4 | (10-17) | ↓ |
| Malta | 36 | 2.8 | (0-15) | 25 | 8.0 | (1-26) | 40 | 7.5 | (2-20) | 37 | 13.5 | (5-29) | |
| **EU/EEA (population-weighted mean)** | **11588** | **15.4** | **(15-16)** | **12383** | **15.4** | **(15-16)** | **15102** | **14.4** | **(14-15)** | **16266** | **14.7** | **(14-15)** | **↓ #** |
| Lithuania | 30 | 16.7 | (6-35) | 41 | 19.5 | (9-35) | 74 | 10.8 | (5-20) | 88 | 14.8 | (8-24) | |
| Portugal | 1061 | 22.0 | (20-25) | 1185 | 19.2 | (17-22) | 1228 | 18.0 | (16-20) | 1216 | 18.6 | (16-21) | ↓ |
| Croatia | 227 | 24.2 | (19-30) | 248 | 18.5 | (14-24) | 240 | 20.8 | (16-27) | 231 | 19.5 | (15-25) | |
| Italy | 683 | 24.9 | (22-28) | 1068 | 21.7 | (19-24) | 1160 | 23.0 | (21-26) | 1332 | 20.0 | (18-22) | ↓ # |
| Hungary | 739 | 24.1 | (21-27) | 763 | 24.2 | (21-27) | 735 | 20.7 | (18-24) | 729 | 23.9 | (21-27) | |
| Poland | 183 | 21.9 | (16-29) | 259 | 27.8 | (22-34) | 401 | 19.5 | (16-24) | 415 | 24.6 | (21-29) | |
| Greece | 649 | 26.7 | (23-30) | 660 | 19.4 | (16-23) | 696 | 33.6 | (30-37) | 814 | 24.9 | (22-28) | |
| Slovakia | 261 | 29.5 | (24-35) | 247 | 34.8 | (29-41) | 164 | 31.1 | (24-39) | 180 | 35.6 | (29-43) | |
| Bulgaria | 47 | 29.8 | (17-45) | 52 | 26.9 | (16-41) | 54 | 38.9 | (26-53) | 71 | 38.0 | (27-50) | |
| Latvia | 3 | ** | (**) | 13 | 23.1 | (5-54) | 15 | 26.7 | (8-55) | 14 | 42.9 | (18-71) | N/A |
| Romania | 88 | 59.1 | (48-69) | 85 | 65.9 | (55-76) | 86 | 44.2 | (33-55) | 127 | 55.9 | (47-65) | |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

** Less than 10 isolates reported, no percentage calculated

**Table 3.18.** ***Pseudomonas aeruginosa.*** **Total number of invasive isolates tested (N) and percentage with resistance to aminoglycosides (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Iceland | 11 | 0.0 | (0-28) | 12 | 0.0 | (0-26) | 17 | 0.0 | (0-20) | 17 | 0.0 | (0-20) | N/A |
| Norway | 240 | 1.3 | (0-4) | 219 | 0.9 | (0-3) | 213 | 0.9 | (0-3) | 183 | 0.5 | (0-3) | |
| Sweden | 313 | 0.6 | (0-2) | 387 | 1.3 | (0-3) | 471 | 0.8 | (0-2) | 444 | 0.9 | (0-2) | N/A |
| Denmark | 388 | 2.3 | (1-4) | 441 | 2.3 | (1-4) | 460 | 1.7 | (1-3) | 484 | 1.0 | (0-2) | |
| Cyprus | 42 | 9.5 | (3-23) | 43 | 0.0 | (0-8) | 64 | 4.7 | (1-13) | 53 | 1.9 | (0-10) | |
| Finland | 305 | 2.3 | (1-5) | 341 | 1.8 | (1-4) | 352 | 2.3 | (1-4) | 378 | 1.9 | (1-4) | |
| United Kingdom | 641 | 1.7 | (1-3) | 539 | 5.2 | (3-7) | 2140 | 3.6 | (3-4) | 2831 | 3.9 | (3-5) | |
| Netherlands | 544 | 2.9 | (2-5) | 502 | 2.8 | (2-5) | 541 | 2.8 | (2-5) | 657 | 4.0 | (3-6) | |
| Germany | 643 | 5.9 | (4-8) | 966 | 7.1 | (6-9) | 1421 | 6.8 | (6-8) | 1729 | 4.8 | (4-6) | |
| Austria | 638 | 6.6 | (5-9) | 678 | 6.3 | (5-8) | 692 | 6.1 | (4-8) | 717 | 5.0 | (4-7) | |
| Estonia | 40 | 7.5 | (2-20) | 17 | 5.9 | (0-29) | 54 | 7.4 | (2-18) | 56 | 5.4 | (1-15) | N/A |
| Luxembourg | 39 | 7.7 | (2-21) | 28 | 3.6 | (0-18) | 40 | 15.0 | (6-30) | 56 | 5.4 | (1-15) | |
| Belgium | 258 | 8.5 | (5-13) | 218 | 6.0 | (3-10) | 327 | 11.0 | (8-15) | 377 | 7.7 | (5-11) | |
| Ireland | 178 | 5.6 | (3-10) | 195 | 4.1 | (2-8) | 243 | 10.3 | (7-15) | 288 | 8.7 | (6-13) | |
| Slovenia | 112 | 8.9 | (4-16) | 141 | 9.2 | (5-15) | 143 | 13.3 | (8-20) | 138 | 8.7 | (5-15) | |
| Malta | 36 | 11.1 | (3-26) | 25 | 16.0 | (5-36) | 40 | 7.5 | (2-20) | 37 | 10.8 | (3-25) | |
| France | 1767 | 15.7 | (14-18) | 1950 | 14.1 | (13-16) | 1976 | 10.7 | (9-12) | 1713 | 10.9 | (9-12) | ↓ |
| Portugal | 1064 | 17.6 | (15-20) | 1191 | 13.5 | (12-16) | 1230 | 11.6 | (10-14) | 1210 | 12.1 | (10-14) | |
| Spain | 873 | 16.5 | (14-19) | 883 | 16.4 | (14-19) | 843 | 15.3 | (13-18) | 838 | 12.5 | (10-15) | ↓ |
| **EU/EEA (population-weighted mean)** | **11576** | **16.1** | **(15-17)** | **12703** | **15.3** | **(15-16)** | **15408** | **14.1** | **(14-15)** | **16732** | **13.2** | **(13-14)** | ↓ |
| Lithuania | 30 | 26.7 | (12-46) | 41 | 24.4 | (12-40) | 74 | 14.9 | (8-25) | 89 | 13.5 | (7-22) | ↓ # |
| Czech Republic | 446 | 20.6 | (17-25) | 464 | 21.3 | (18-25) | 464 | 18.8 | (15-23) | 411 | 14.4 | (11-18) | ↓ |
| Hungary | 741 | 21.1 | (18-24) | 766 | 20.5 | (18-24) | 740 | 17.6 | (15-21) | 734 | 14.6 | (12-17) | ↓ |
| Italy | 704 | 23.2 | (20-26) | 1050 | 17.2 | (15-20) | 1203 | 19.1 | (17-21) | 1428 | 18.0 | (16-20) | ↓ |
| Poland | 185 | 31.9 | (25-39) | 258 | 30.6 | (25-37) | 367 | 25.6 | (21-30) | 384 | 25.5 | (21-30) | ↓ |
| Croatia | 231 | 35.1 | (29-42) | 256 | 34.0 | (28-40) | 260 | 33.5 | (28-40) | 237 | 26.6 | (21-33) | |
| Bulgaria | 44 | 31.8 | (19-48) | 47 | 27.7 | (16-43) | 39 | 48.7 | (32-65) | 71 | 28.2 | (18-40) | |
| Greece | 676 | 35.8 | (32-40) | 667 | 26.4 | (23-30) | 701 | 28.0 | (25-31) | 815 | 30.2 | (27-33) | |
| Slovakia | 276 | 37.0 | (31-43) | 277 | 41.9 | (36-48) | 191 | 33.0 | (26-40) | 211 | 36.0 | (30-43) | |
| Latvia | 18 | 5.6 | (0-27) | 11 | 9.1 | (0-41) | 15 | 20.0 | (4-48) | 14 | 42.9 | (18-71) | N/A |
| Romania | 93 | 63.4 | (53-73) | 90 | 63.3 | (53-73) | 87 | 50.6 | (40-61) | 132 | 57.6 | (49-66) | |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

**Table 3.19** ***Pseudomonas aeruginosa*. Total number of invasive isolates tested (N) and percentage with resistance to carbapenems (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Iceland | 11 | 9.1 | (0-41) | 12 | 0.0 | (0-26) | 17 | 5.9 | (0-29) | 17 | 0.0 | (0-20) | N/A |
| Denmark | 386 | 4.7 | (3-7) | 437 | 4.6 | (3-7) | 458 | 2.4 | (1-4) | 484 | 2.5 | (1-4) | ↓ |
| Norway | 256 | 5.9 | (3-9) | 228 | 5.7 | (3-10) | 225 | 6.7 | (4-11) | 205 | 3.4 | (1-7) | |
| Netherlands | 543 | 4.4 | (3-7) | 500 | 4.0 | (2-6) | 543 | 3.7 | (2-6) | 655 | 4.4 | (3-6) | |
| United Kingdom | 590 | 6.3 | (4-9) | 499 | 2.4 | (1-4) | 2108 | 5.1 | (4-6) | 2804 | 5.7 | (5-7) | |
| Finland | 307 | 7.2 | (5-11) | 341 | 4.7 | (3-8) | 352 | 6.0 | (4-9) | 377 | 6.1 | (4-9) | |
| Belgium | 344 | 10.2 | (7-14) | 256 | 3.9 | (2-7) | 365 | 9.6 | (7-13) | 474 | 8.2 | (6-11) | |
| Ireland | 177 | 8.5 | (5-14) | 195 | 9.2 | (6-14) | 243 | 6.2 | (3-10) | 288 | 9.0 | (6-13) | |
| Sweden | 408 | 7.1 | (5-10) | 398 | 6.5 | (4-9) | 472 | 11.0 | (8-14) | 446 | 9.0 | (6-12) | N/A |
| Estonia | 39 | 15.4 | (6-31) | 16 | 12.5 | (2-38) | 54 | 20.4 | (11-34) | 55 | 9.1 | (3-20) | N/A |
| Luxembourg | 42 | 4.8 | (1-16) | 24 | 8.3 | (1-27) | 31 | 6.5 | (1-21) | 56 | 10.7 | (4-22) | |
| Malta | 36 | 13.9 | (5-29) | 25 | 16.0 | (5-36) | 40 | 12.5 | (4-27) | 37 | 10.8 | (3-25) | |
| Germany | 642 | 17.0 | (14-20) | 971 | 14.7 | (13-17) | 1422 | 14.5 | (13-16) | 1753 | 12.7 | (11-14) | ↓ |
| Austria | 636 | 12.7 | (10-16) | 680 | 12.2 | (10-15) | 696 | 12.9 | (11-16) | 725 | 13.9 | (11-17) | |
| France | 1780 | 18.7 | (17-21) | 1925 | 16.4 | (15-18) | 1968 | 15.6 | (14-17) | 1710 | 13.9 | (12-16) | ↓ |
| Czech Republic | 448 | 14.1 | (11-18) | 464 | 10.6 | (8-14) | 464 | 8.8 | (6-12) | 411 | 14.8 | (12-19) | |
| Cyprus | 42 | 33.3 | (20-50) | 43 | 20.9 | (10-36) | 64 | 18.8 | (10-30) | 53 | 17.0 | (8-30) | |
| **EU/EEA (population-weighted mean)** | **11789** | **19.7** | **(19-20)** | **12719** | **19.4** | **(19-20)** | **15456** | **18.2** | **(18-19)** | **16864** | **17.4** | **(17-18)** | ↓ |
| Slovenia | 112 | 31.3 | (23-41) | 141 | 15.6 | (10-23) | 143 | 19.6 | (13-27) | 138 | 17.4 | (11-25) | ↓ |
| Portugal | 1064 | 22.5 | (20-25) | 1191 | 19.8 | (18-22) | 1227 | 19.2 | (17-21) | 1215 | 18.3 | (16-21) | ↓ |
| Spain | 872 | 18.5 | (16-21) | 872 | 22.7 | (20-26) | 842 | 21.4 | (19-24) | 835 | 18.4 | (16-21) | |
| Italy | 753 | 25.1 | (22-28) | 1082 | 23.0 | (21-26) | 1206 | 23.5 | (21-26) | 1434 | 19.9 | (18-22) | ↓ |
| Poland | 185 | 27.6 | (21-35) | 254 | 37.0 | (31-43) | 397 | 26.2 | (22-31) | 393 | 24.2 | (20-29) | ↓ # |
| Lithuania | 31 | 29.0 | (14-48) | 41 | 26.8 | (14-43) | 74 | 16.2 | (9-27) | 89 | 24.7 | (16-35) | |
| Bulgaria | 48 | 29.2 | (17-44) | 55 | 25.5 | (15-39) | 56 | 30.4 | (19-44) | 71 | 25.4 | (16-37) | |
| Croatia | 232 | 35.3 | (29-42) | 257 | 38.5 | (33-45) | 260 | 42.3 | (36-49) | 238 | 30.7 | (25-37) | |
| Hungary | 744 | 33.5 | (30-37) | 770 | 35.8 | (32-39) | 739 | 33.3 | (30-37) | 733 | 36.6 | (33-40) | |
| Greece | 699 | 42.9 | (39-47) | 675 | 40.4 | (37-44) | 699 | 42.1 | (38-46) | 821 | 39.3 | (36-43) | |
| Slovakia | 250 | 38.4 | (32-45) | 262 | 51.9 | (46-58) | 182 | 42.3 | (35-50) | 202 | 47.0 | (40-54) | |
| Latvia | 18 | 16.7 | (4-41) | 13 | 15.4 | (2-45) | 16 | 31.3 | (11-59) | 14 | 57.1 | (29-82) | N/A |
| Romania | 94 | 58.5 | (48-69) | 92 | 66.3 | (56-76) | 93 | 51.6 | (41-62) | 131 | 63.4 | (54-72) | |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

**Table 3.20.** ***Pseudomonas aeruginosa.*** **Total number of invasive isolates tested (N) with combined resistance (resistance to three or more antimicrobial groups among piperacillin ± tazobactam, ceftazidime, fluoroquinolones, aminoglycosides and carbapenems) including 95 % confidence intervals (95 % CI), by country, EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Iceland | 11 | 0.0 | (0-28) | 12 | 0.0 | (0-26) | 17 | 0.0 | (0-18) | 17 | 0.0 | (0-18) | N/A |
| Denmark | 388 | 1.5 | (1-3) | 441 | 2.3 | (1-4) | 460 | 1.3 | (1-3) | 484 | 0.4 | (0-1) | |
| Norway | 257 | 1.6 | (0-4) | 230 | 1.3 | (0-4) | 227 | 2.6 | (1-6) | 205 | 1.5 | (0-4) | |
| Netherlands | 542 | 2.8 | (2-5) | 502 | 2.8 | (2-5) | 543 | 2.6 | (2-4) | 657 | 2.1 | (1-4) | |
| United Kingdom | 627 | 1.6 | (1-3) | 501 | 3.8 | (2-6) | 2131 | 2.5 | (2-3) | 2830 | 2.4 | (2-3) | |
| Sweden | 436 | 1.6 | (1-3) | 386 | 2.6 | (1-5) | 472 | 5.3 | (4-8) | 446 | 3.1 | (2-5) | |
| Finland | 306 | 3.9 | (2-7) | 341 | 4.7 | (3-8) | 352 | 3.4 | (2-6) | 378 | 3.4 | (2-6) | |
| Luxembourg | 41 | 4.9 | (1-17) | 28 | 3.6 | (0-18) | 40 | 2.5 | (0-13) | 56 | 5.4 | (2-15) | |
| Belgium | 297 | 8.4 | (6-12) | 260 | 4.6 | (2-8) | 366 | 6.3 | (4-9) | 439 | 6.6 | (5-9) | |
| Austria | 638 | 7.1 | (5-9) | 680 | 6.8 | (5-9) | 697 | 6.7 | (5-9) | 724 | 7.0 | (5-9) | |
| Germany | 643 | 8.9 | (7-11) | 941 | 8.2 | (7-10) | 1320 | 7.9 | (7-9) | 1755 | 7.2 | (6-9) | |
| Ireland | 178 | 5.6 | (3-10) | 195 | 5.1 | (2-9) | 243 | 8.6 | (6-13) | 288 | 7.6 | (5-11) | |
| Malta | 36 | 5.6 | (2-18) | 25 | 12.0 | (3-31) | 40 | 5.0 | (1-17) | 37 | 8.1 | (3-21) | |
| Estonia | 40 | 0.0 | (0-9) | 15 | 0.0 | (0-22) | 56 | 3.6 | (1-12) | 57 | 8.8 | (4-19) | N/A |
| Cyprus | 42 | 14.3 | (5-29) | 43 | 2.3 | (0-12) | 64 | 4.7 | (2-13) | 53 | 9.4 | (4-20) | |
| France | 1784 | 13.2 | (12-15) | 1940 | 12.0 | (11-14) | 1972 | 10.7 | (9-12) | 1709 | 10.6 | (9-12) | ↓ # |
| Slovenia | 112 | 18.8 | (12-27) | 141 | 7.1 | (3-13) | 143 | 15.4 | (10-22) | 138 | 10.9 | (7-17) | |
| Spain | 873 | 12.4 | (10-15) | 874 | 14.2 | (12-17) | 843 | 14.5 | (12-17) | 837 | 10.9 | (9-13) | |
| **EU/EEA (population-weighted mean)** | **11810** | **15.4** | **(15-16)** | **12711** | **15.1** | **(14-16)** | **15410** | **13.7** | **(13-14)** | **16885** | **13.3** | **(13-14)** | ↓ |
| Portugal | 1064 | 20.6 | (18-23) | 1186 | 16.9 | (14-18) | 1230 | 14.8 | (13-17) | 1214 | 16.1 | (14-18) | ↓ |
| Lithuania | 31 | 25.8 | (12-45) | 41 | 24.4 | (12-40) | 74 | 10.8 | (6-20) | 89 | 16.9 | (10-26) | |
| Czech Republic | 446 | 20.2 | (17-24) | 464 | 19.0 | (15-23) | 464 | 19.6 | (16-23) | 411 | 17.3 | (14-21) | |
| Italy | 746 | 22.9 | (20-26) | 1082 | 20.0 | (18-22) | 1206 | 20.1 | (18-23) | 1436 | 17.5 | (16-20) | ↓ |
| Hungary | 746 | 21.7 | (19-25) | 770 | 20.9 | (18-24) | 740 | 19.1 | (16-22) | 735 | 18.1 | (15-21) | |
| Croatia | 232 | 31.5 | (26-38) | 257 | 28.0 | (23-34) | 260 | 31.9 | (27-38) | 238 | 21.4 | (17-27) | ↓ |
| Poland | 187 | 26.7 | (21-34) | 260 | 29.6 | (24-36) | 403 | 20.6 | (17-25) | 417 | 22.8 | (19-27) | |
| Bulgaria | 48 | 29.2 | (17-44) | 55 | 29.1 | (18-43) | 56 | 35.7 | (24-59) | 71 | 26.8 | (18-38) | |
| Greece | 679 | 36.1 | (32-40) | 666 | 28.4 | (25-32) | 702 | 31.6 | (28-35) | 816 | 32.4 | (29-36) | |
| Slovakia | 268 | 37.3 | (32-43) | 270 | 40.7 | (35-47) | 183 | 33.9 | (27-41) | 202 | 39.1 | (33-46) | |
| Latvia | 18 | 11.1 | (1-35) | 13 | 15.4 | (2-45) | 16 | 18.8 | (7-43) | 14 | 42.9 | (20-66) | N/A |
| Romania | 94 | 59.6 | (49-70) | 92 | 63.0 | (52-73) | 90 | 42.9 | (39-59) | 132 | 59.1 | (51-67) | |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

# 3.4 *Acinetobacter* species

The *Acinetobacter* genus consists of a large number of species which can be divided into two complexes: the *Acinetobacter baumannii* complex – the group including most of the disease-causing species (*A. baumannii*, *A. pittii* and *A. nosocomialis*) – and the generally less pathogenic *Acinetobacter* non-*baumannii* group. The correct identification of *Acinetobacter* isolates to species level is difficult, although possible with mass spectrometry and genotypic methods.

Species belonging to the *Acinetobacter baumannii* group are opportunistic pathogens primarily associated with healthcare-associated infections including ventilator-associated pneumonia, central-line-associated bloodstream infections, urinary tract infections and wound infections. Risk factors for infection include advanced age, presence of serious underlying disease, immune suppression, major trauma or burn injuries, invasive procedures, presence of indwelling catheters, mechanical ventilation, extended hospital stay and previous administration of antibiotics.

*Acinetobacter* spp., particularly those belonging to the *A. baumannii* complex, are intrinsically resistant to most antimicrobial agents due to their selective ability to prevent various molecules from penetrating their outer membrane. The antimicrobial groups that remain active include some fluoroquinolones (e.g. ciprofloxacin and levofloxacin), aminoglycosides (e.g. gentamicin, tobramycin and amikacin), carbapenems (imipenem and meropenem), polymyxins (polymyxin B and colistin) and possibly sulbactam and tigecycline. Acquired resistance results from mutational changes in the chromosome and acquisition of plasmid-mediated resistance genes.

## Antimicrobial resistance

More than half of the *Acinetobacter* spp. isolates reported by EU/EEA countries to EARS-Net for 2017 (55.0%) were resistant to at least one of the antimicrobial groups under regular surveillance, i.e. fluoroquinolones, aminoglycosides and carbapenems (Table 3.21). In 2017, the EU/EEA population-weighted mean percentage showed little variation between the antimicrobial groups and varied between 32.4% and 37.6% (Tables 3.22–3.24). Trend analyses were not performed for the EU/EEA population-weighted means as the proportion of laboratories that consistently reported data for the full four-year period remained low.

Resistance to one or two antimicrobial groups was considerably less common than combined resistance to all three groups under surveillance (Table 3.21). In 2017, the population-weighted EU/EEA mean percentage for combined resistance to fluoroquinolones, aminoglycosides and carbapenems was 28.4% (Table 3.25).

Large inter-country variations were noted for all antimicrobial groups under regular surveillance, with generally higher resistance percentages reported from southern and eastern parts of Europe than from northern Europe (Figures 3.20–3.23). Single resistance to one antimicrobial group was less common in countries reporting comparatively low proportions of fully susceptible isolates (Figure 3.19).

## Discussion and conclusion

As in previous years, antimicrobial resistance in *Acinetobacter* spp. varied largely across Europe, with generally high resistance percentages reported from the Baltic countries and from southern and south-eastern Europe. More than half of the *Acinetobacter* spp. isolates reported to EARS-Net for 2017 were resistant to at least one antimicrobial group under surveillance. Combined resistance to multiple antimicrobial groups was common. The most frequently reported resistance phenotype was resistance to all three groups under regular surveillance, i.e. fluoroquinolones, aminoglycosides and carbapenems. This is a public health concern because it not only severely limits options for patient treatment but also constitutes an infection prevention

**Table 3.21. *Acinetobacter* spp. Overall resistance and resistance combinations among invasive isolates tested to fluoroquinolones, aminoglycosides and carbapenems (n=5 853)*, EU/EEA countries, 2017**

| Resistance pattern | Number of isolates | % of total** |
|---|---|---|
| Fully susceptible | 2633 | 45.0 |
| Single resistance (to indicated antimicrobial group) | | |
| **Total (any single resistance)** | **249** | **4.3** |
| Fluoroquinolones | 158 | 2.7 |
| Aminoglycosides | 56 | 1.0 |
| Carbapenems | 35 | 0.6 |
| Resistance to two antimicrobial groups | | |
| **Total (any two-group combinations)** | **441** | **7.5** |
| Fluoroquinolones + carbapenems | 283 | 4.8 |
| Fluoroquinolones + aminoglycosides | 145 | 2.5 |
| Aminoglycosides + carbapenems | 13 | 0.2 |
| Resistance to three antimicrobial groups | | |
| Fluoroquinolones + aminoglycosides + carbapenems | 2530 | 43.2 |

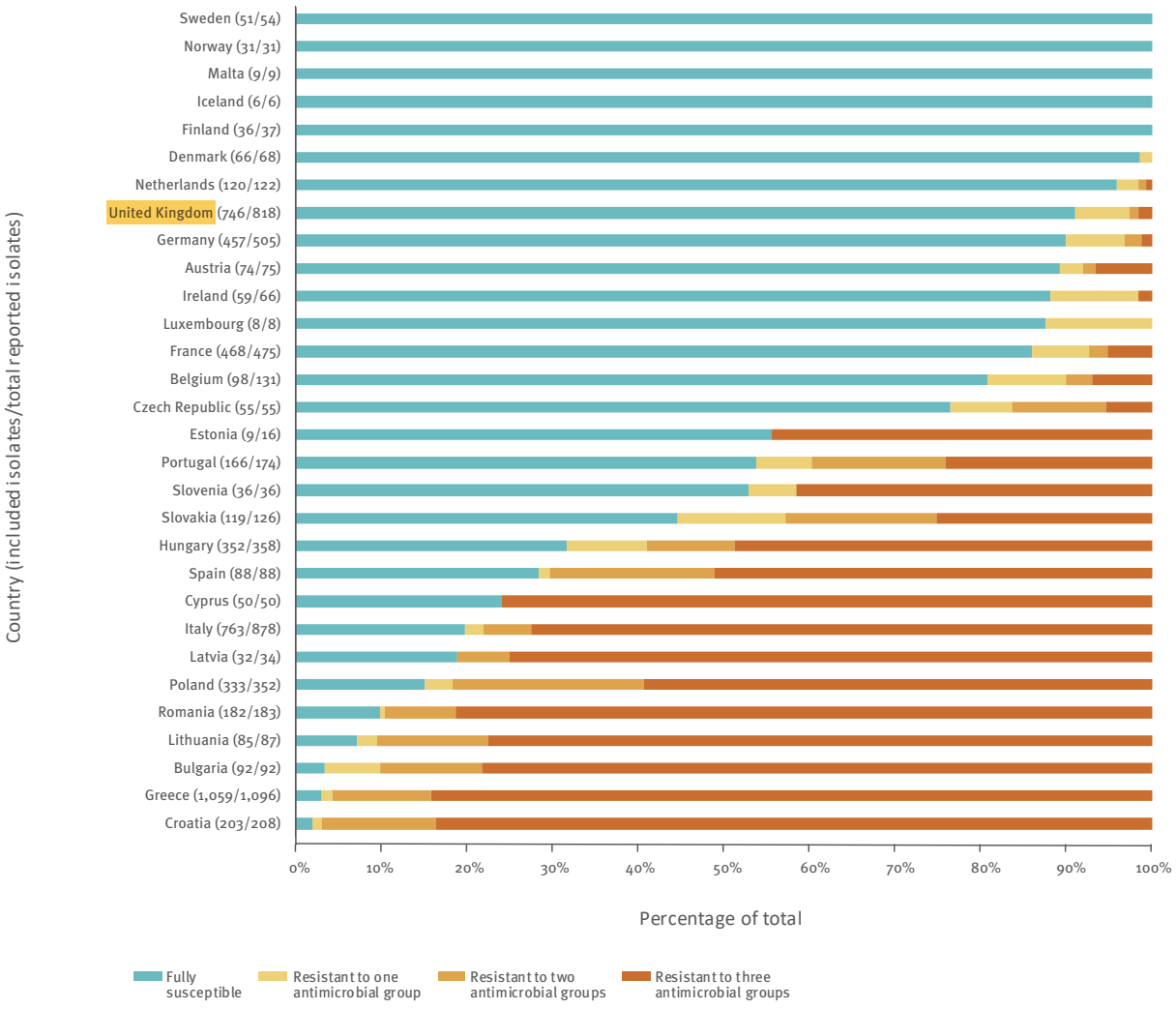
* Only data from isolates tested against all three antimicrobial groups were included in the analysis.

** Not adjusted for population differences in the reporting countries.

and control challenge. The presence of multidrug-resistant *Acinetobacter* spp. in the healthcare environment is problematic: the bacterium can persist in the environment for long periods and is notoriously difficult to eradicate once established.

ECDC's risk assessment on carbapenem-resistant *Acinetobacter baumannii* in healthcare highlights the need of increased efforts to face this significant threat to patients and healthcare systems in all EU/EEA countries. The document outlines options to reduce risks through clinical management, prevention of transmission in hospitals and other healthcare settings, prevention of cross-border transmission, and improvement of preparedness of EU/EEA countries. Options for response presented in the risk assessment included timely laboratory reporting, screening and pre-emptive isolation of high-risk patients, high-standard infection control and antimicrobial stewardship programmes [21].

**Figure 3.19. *Acinetobacter* spp. Distribution of isolates: fully susceptible and resistant to one, two and three antimicrobial groups (among isolates tested against fluoroquinolones, aminoglycosides and carbapenems), EU/EEA countries, 2017**




Only data from isolates tested against all included antimicrobial groups included in analysis.

**Figure 3.20.** ***Acinetobacter*** **spp. Percentage (%) of invasive isolates with resistance to fluoroquinolones, by country, EU/EEA countries, 2017**

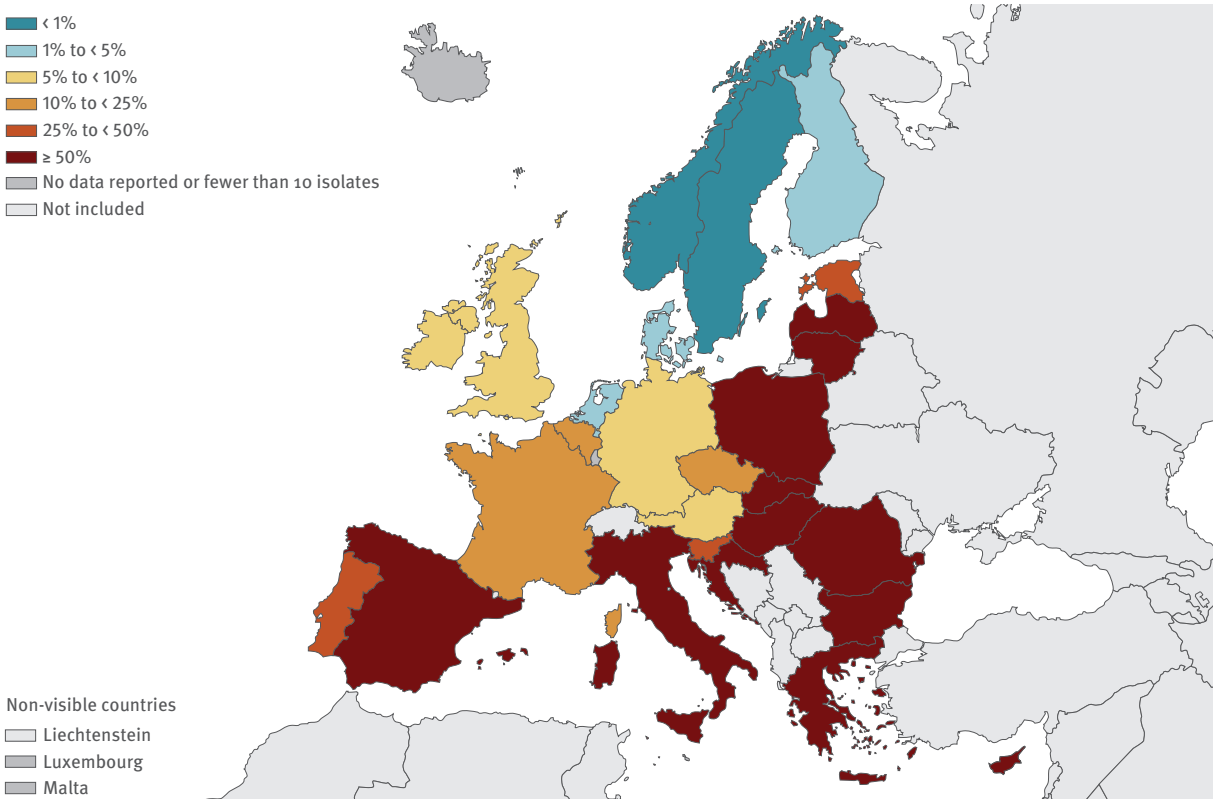



**Figure 3.21.** ***Acinetobacter*** **spp. Percentage (%) of invasive isolates with resistance to aminoglycosides, by country, EU/EEA countries, 2017**

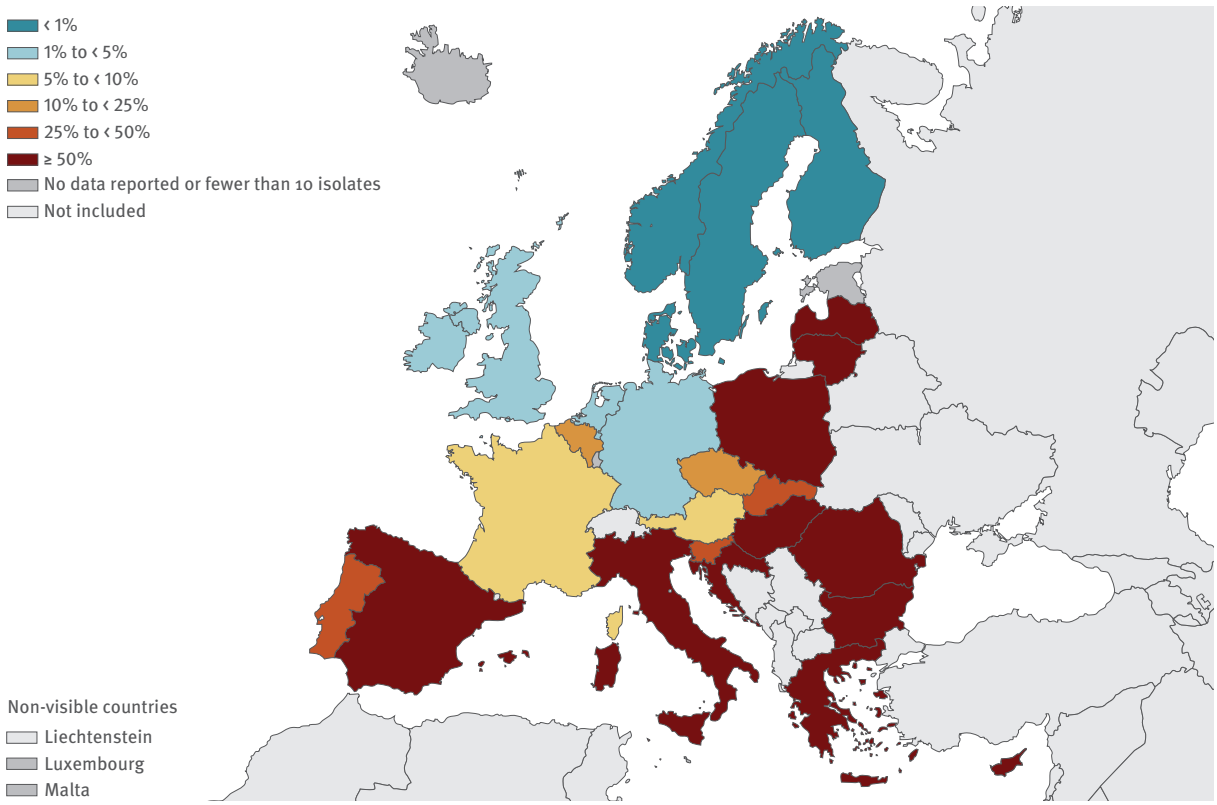


**Figure 3.22.** ***Acinetobacter*** **spp. Percentage (%) of invasive isolates with resistance to carbapenems, by country, EU/EEA countries, 2017**

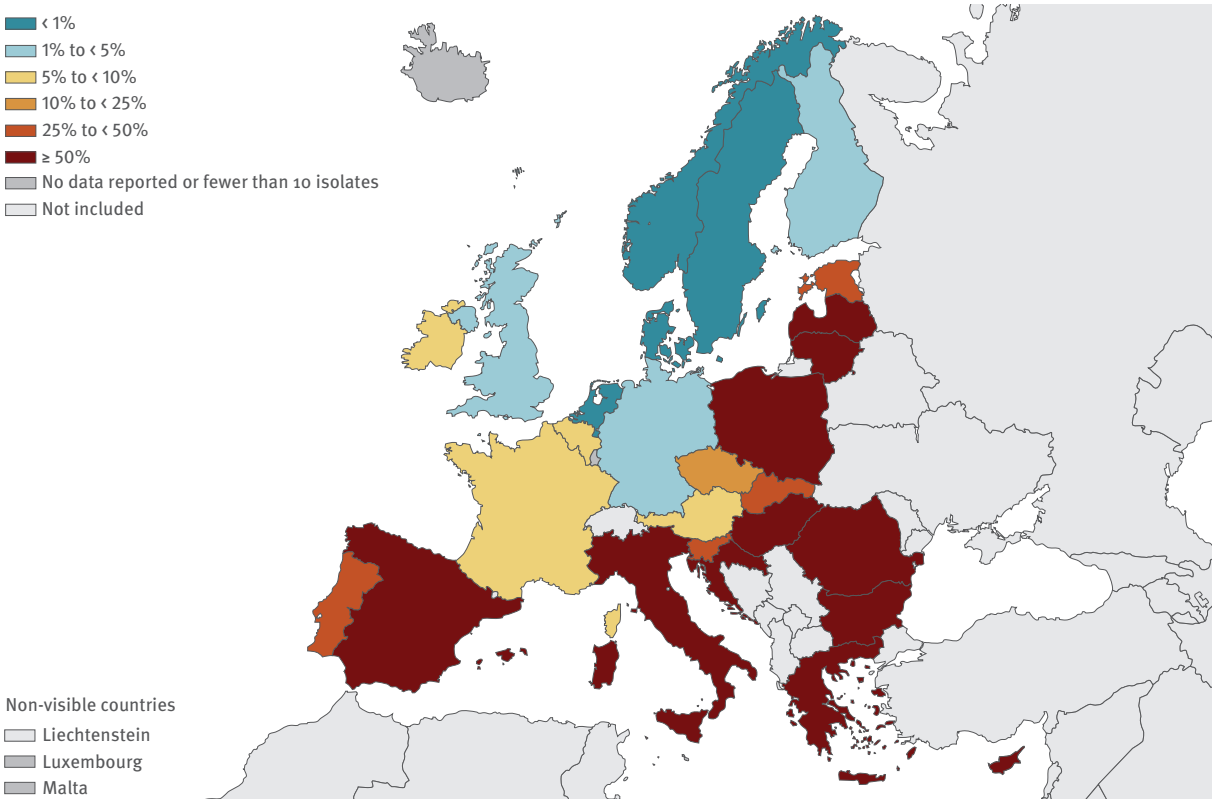



**Figure 3.23.** ***Acinetobacter*** **spp. Percentage (%) of invasive isolates with combined resistance to fluoroquinolones, aminoglycosides and carbapenems, by country, EU/EEA countries, 2017**

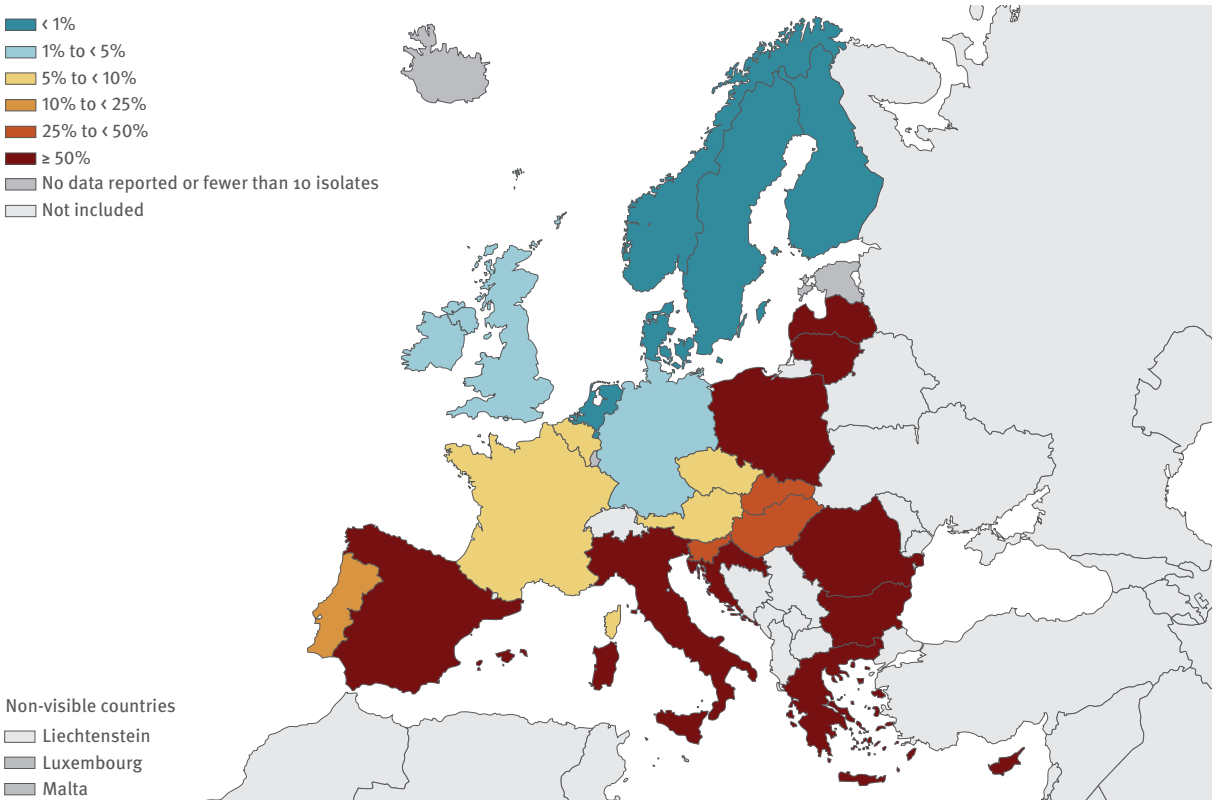


**Table 3.22.** ***Acinetobacter*** **spp. Total number of invasive isolates tested (N) and percentage with resistance to fluoroquinolones (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Norway | 34 | 5.9 | (1-20) | 32 | 9.4 | (2-25) | 33 | 3.0 | (0-16) | 31 | 0.0 | (0-11) | |
| Sweden | 52 | 11.5 | (4-23) | 26 | 3.8 | (0-20) | 86 | 4.7 | (1-11) | 54 | 0.0 | (0-7) | N/A |
| Denmark | 69 | 2.9 | (0-10) | 68 | 5.9 | (2-14) | 72 | 2.8 | (0-10) | 68 | 1.5 | (0-8) | |
| Finland | 31 | 6.5 | (1-21) | 43 | 2.3 | (0-12) | 28 | 0.0 | (0-12) | 37 | 2.7 | (0-14) | |
| Netherlands | 72 | 4.2 | (1-12) | 74 | 6.8 | (2-15) | 106 | 2.8 | (1-8) | 122 | 3.3 | (1-8) | |
| United Kingdom | 123 | 11.4 | (6-18) | 139 | 7.2 | (4-13) | 589 | 4.4 | (3-6) | 793 | 6.3 | (5-8) | |
| Germany | 199 | 6.0 | (3-10) | 339 | 8.6 | (6-12) | 460 | 5.7 | (4-8) | 498 | 6.8 | (5-9) | |
| Ireland | 86 | 4.7 | (1-11) | 83 | 4.8 | (1-12) | 68 | 1.5 | (0-8) | 66 | 7.6 | (3-17) | |
| Austria | 75 | 5.3 | (1-13) | 61 | 16.4 | (8-28) | 81 | 16.0 | (9-26) | 74 | 9.5 | (4-19) | |
| Belgium | 4 | ** | (**) | 26 | 0.0 | (0-13) | 78 | 7.7 | (3-16) | 130 | 10.8 | (6-17) | N/A |
| France | 395 | 11.9 | (9-16) | 430 | 13.5 | (10-17) | 452 | 15.0 | (12-19) | 473 | 12.3 | (9-16) | |
| Czech Republic | 59 | 15.3 | (7-27) | 60 | 18.3 | (10-30) | 57 | 17.5 | (9-30) | 55 | 20.0 | (10-33) | |
| Estonia | - | - | (-) | 4 | ** | (**) | 5 | ** | (**) | 11 | 36.4 | (11-69) | N/A |
| **EU/EEA (population-weighted mean)** | **4244** | **40.2** | **(39-42)** | **5028** | **38.6** | **(37-40)** | **5591** | **37.5** | **(36-39)** | **6069** | **37.6** | **(36-39)** | **N/A** |
| Portugal | 264 | 52.7 | (46-59) | 308 | 55.8 | (50-61) | 206 | 50.5 | (43-58) | 172 | 38.4 | (31-46) | ↓ |
| Slovenia | 34 | 41.2 | (25-59) | 31 | 58.1 | (39-75) | 60 | 55.0 | (42-68) | 36 | 47.2 | (30-65) | |
| Slovakia | 170 | 51.8 | (44-59) | 154 | 51.9 | (44-60) | 115 | 46.1 | (37-56) | 126 | 52.4 | (43-61) | |
| Hungary | 441 | 66.4 | (62-71) | 464 | 68.1 | (64-72) | 397 | 68.0 | (63-73) | 352 | 67.0 | (62-72) | |
| Spain | 79 | 67.1 | (56-77) | 95 | 64.2 | (54-74) | 106 | 68.9 | (59-78) | 88 | 70.5 | (60-80) | |
| Cyprus | 58 | 77.6 | (65-87) | 60 | 83.3 | (71-92) | 28 | 71.4 | (51-87) | 50 | 76.0 | (62-87) | |
| Italy | 469 | 92.1 | (89-94) | 664 | 81.6 | (78-85) | 697 | 79.9 | (77-83) | 804 | 79.2 | (76-82) | ↓ |
| Latvia | 52 | 88.5 | (77-96) | 60 | 78.3 | (66-88) | 68 | 85.3 | (75-93) | 33 | 81.8 | (65-93) | |
| Poland | 185 | 82.7 | (76-88) | 243 | 88.1 | (83-92) | 393 | 83.0 | (79-87) | 348 | 83.0 | (79-87) | |
| Romania | 123 | 83.7 | (76-90) | 189 | 82.5 | (76-88) | 157 | 91.1 | (85-95) | 183 | 89.1 | (84-93) | ↑ |
| Lithuania | 66 | 84.8 | (74-92) | 73 | 93.2 | (85-98) | 87 | 87.4 | (79-94) | 86 | 91.9 | (84-97) | |
| Bulgaria | 115 | 73.9 | (65-82) | 131 | 78.6 | (71-85) | 106 | 67.9 | (58-77) | 92 | 95.7 | (89-99) | ↑ |
| Greece | 806 | 95.3 | (94-97) | 946 | 94.9 | (93-96) | 862 | 94.9 | (93-96) | 1060 | 96.0 | (95-97) | |
| Croatia | 164 | 92.1 | (87-96) | 196 | 92.3 | (88-96) | 176 | 94.9 | (91-98) | 204 | 98.0 | (95-99) | ↑ |
| Iceland | 3 | ** | (**) | 6 | ** | (**) | 3 | ** | (**) | 6 | ** | (**) | N/A |
| Luxembourg | 6 | ** | (**) | 8 | ** | (**) | 8 | ** | (**) | 8 | ** | (**) | N/A |
| Malta | 10 | 30.0 | (7-65) | 15 | 13.3 | (2-40) | 7 | ** | (**) | 9 | ** | (**) | N/A |

–: No data

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

** Less than 10 isolates reported, no percentage calculated

**Table 3.23. *Acinetobacter* spp. Total number of invasive isolates tested (N) and percentage with resistance to aminoglycosides (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Denmark | 60 | 1.7 | (0-9) | 63 | 4.8 | (1-13) | 70 | 0.0 | (0-5) | 68 | 0.0 | (0-5) | |
| Finland | 31 | 3.2 | (0-17) | 42 | 2.4 | (0-13) | 28 | 3.6 | (0-18) | 36 | 0.0 | (0-10) | |
| Norway | 33 | 3.0 | (0-16) | 32 | 9.4 | (2-25) | 32 | 3.1 | (0-16) | 31 | 0.0 | (0-11) | |
| Sweden | 36 | 2.8 | (0-15) | 26 | 3.8 | (0-20) | 85 | 5.9 | (2-13) | 51 | 0.0 | (0-7) | N/A |
| Netherlands | 73 | 5.5 | (2-13) | 74 | 10.8 | (5-20) | 103 | 3.9 | (1-10) | 120 | 2.5 | (1-7) | |
| Ireland | 89 | 2.2 | (0-8) | 80 | 3.8 | (1-11) | 63 | 1.6 | (0-9) | 62 | 3.2 | (0-11) | |
| Germany | 197 | 4.1 | (2-8) | 331 | 5.4 | (3-8) | 436 | 3.0 | (2-5) | 460 | 3.5 | (2-6) | |
| United Kingdom | 129 | 10.1 | (5-17) | 153 | 2.0 | (0-6) | 598 | 3.3 | (2-5) | 790 | 4.6 | (3-6) | |
| France | 409 | 8.3 | (6-11) | 431 | 11.1 | (8-14) | 449 | 12.2 | (9-16) | 474 | 9.1 | (7-12) | |
| Austria | 79 | 8.9 | (4-17) | 63 | 6.3 | (2-15) | 81 | 16.0 | (9-26) | 75 | 9.3 | (4-18) | |
| Czech Republic | 59 | 10.2 | (4-21) | 60 | 15.0 | (7-27) | 57 | 8.8 | (3-19) | 55 | 12.7 | (5-24) | |
| Belgium | 2 | ** | (**) | 15 | 0.0 | (0-22) | 66 | 1.5 | (0-8) | 99 | 13.1 | (7-21) | N/A |
| Portugal | 265 | 42.3 | (36-48) | 310 | 46.5 | (41-52) | 206 | 39.3 | (33-46) | 168 | 28.6 | (22-36) | |
| **EU/EEA (population-weighted mean)** | **4190** | **34.5** | **(33-36)** | **4997** | **32.4** | **(31-34)** | **5557** | **32.8** | **(32-34)** | **6022** | **32.4** | **(31-34)** | **N/A** |
| Slovakia | 170 | 40.6 | (33-48) | 154 | 42.9 | (35-51) | 115 | 40.9 | (32-50) | 125 | 40.0 | (31-49) | |
| Slovenia | 34 | 32.4 | (17-51) | 31 | 41.9 | (25-61) | 60 | 43.3 | (31-57) | 36 | 41.7 | (26-59) | |
| Spain | 80 | 58.8 | (47-70) | 96 | 49.0 | (39-59) | 106 | 50.9 | (41-61) | 88 | 54.5 | (44-65) | |
| Hungary | 444 | 59.5 | (55-64) | 465 | 60.6 | (56-65) | 401 | 59.1 | (54-64) | 358 | 56.1 | (51-61) | |
| Poland | 188 | 58.5 | (51-66) | 245 | 70.2 | (64-76) | 387 | 72.6 | (68-77) | 344 | 72.7 | (68-77) | ↑ |
| Cyprus | 57 | 73.7 | (60-84) | 59 | 74.6 | (62-85) | 28 | 57.1 | (37-76) | 50 | 76.0 | (62-87) | |
| Italy | 444 | 88.3 | (85-91) | 656 | 74.7 | (71-78) | 704 | 76.4 | (73-80) | 836 | 76.1 | (73-79) | ↓ |
| Latvia | 52 | 69.2 | (55-81) | 61 | 59.0 | (46-71) | 81 | 77.8 | (67-86) | 33 | 78.8 | (61-91) | |
| Lithuania | 65 | 80.0 | (68-89) | 73 | 90.4 | (81-96) | 87 | 82.8 | (73-90) | 86 | 81.4 | (72-89) | |
| Romania | 122 | 77.0 | (69-84) | 188 | 80.9 | (74-86) | 152 | 89.5 | (83-94) | 183 | 83.6 | (77-89) | |
| Croatia | 166 | 82.5 | (76-88) | 197 | 88.3 | (83-92) | 182 | 83.0 | (77-88) | 206 | 84.0 | (78-89) | |
| Greece | 800 | 83.9 | (81-86) | 945 | 83.7 | (81-86) | 878 | 85.0 | (82-87) | 1064 | 85.6 | (83-88) | |
| Bulgaria | 87 | 60.9 | (50-71) | 116 | 74.1 | (65-82) | 79 | 81.0 | (71-89) | 92 | 89.1 | (81-95) | ↑ |
| Estonia | - | - | (-) | 2 | ** | (**) | 5 | ** | (**) | 9 | ** | (**) | N/A |
| Iceland | 3 | ** | (**) | 6 | ** | (**) | 3 | ** | (**) | 6 | ** | (**) | N/A |
| Luxembourg | 6 | ** | (**) | 8 | ** | (**) | 8 | 12.5 | (0-53) | 8 | ** | (**) | N/A |
| Malta | 10 | 30.0 | (7-65) | 15 | 13.3 | (2-40) | 7 | ** | (**) | 9 | ** | (**) | N/A |

–: No data

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

** Less than 10 isolates reported, no percentage calculated

**Table 3.24. *Acinetobacter* spp. Total number of invasive isolates tested (N) and percentage with resistance to carbapenems (%R), including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Denmark | 62 | 1.6 | (0-9) | 65 | 4.6 | (1-13) | 69 | 0.0 | (0-5) | 66 | 0.0 | (0-5) | |
| Norway | 34 | 2.9 | (0-15) | 32 | 9.4 | (2-25) | 33 | 0.0 | (0-11) | 31 | 0.0 | (0-11) | |
| Sweden | 52 | 3.8 | (0-13) | 34 | 2.9 | (0-15) | 84 | 1.2 | (0-6) | 54 | 0.0 | (0-7) | N/A |
| Netherlands | 74 | 0.0 | (0-5) | 73 | 4.1 | (1-12) | 104 | 0.0 | (0-3) | 121 | 0.8 | (0-5) | |
| Finland | 32 | 3.1 | (0-16) | 43 | 2.3 | (0-12) | 28 | 0.0 | (0-12) | 37 | 2.7 | (0-14) | |
| United Kingdom | 120 | 1.7 | (0-6) | 132 | 0.8 | (0-4) | 584 | 1.5 | (1-3) | 782 | 2.8 | (2-4) | |
| Germany | 201 | 5.5 | (3-10) | 337 | 6.5 | (4-10) | 452 | 4.9 | (3-7) | 502 | 4.4 | (3-7) | |
| France | 401 | 2.5 | (1-5) | 428 | 5.6 | (4-8) | 450 | 7.1 | (5-10) | 469 | 6.2 | (4-9) | ↑ |
| Ireland | 79 | 1.3 | (0-7) | 84 | 6.0 | (2-13) | 65 | 0.0 | (0-6) | 63 | 6.3 | (2-15) | |
| Austria | 78 | 6.4 | (2-14) | 64 | 9.4 | (4-19) | 81 | 12.3 | (6-22) | 75 | 6.7 | (2-15) | |
| Belgium | 4 | ** | (**) | 24 | 0.0 | (0-14) | 78 | 2.6 | (0-9) | 131 | 6.9 | (3-13) | N/A |
| Czech Republic | 59 | 5.1 | (1-14) | 60 | 6.7 | (2-16) | 57 | 1.8 | (0-9) | 55 | 12.7 | (5-24) | |
| Slovakia | 161 | 32.9 | (26-41) | 142 | 28.2 | (21-36) | 109 | 28.4 | (20-38) | 120 | 31.7 | (23-41) | |
| Estonia | - | - | (-) | 3 | ** | (**) | 8 | ** | (**) | 15 | 33.3 | (12-62) | N/A |
| **EU/EEA (population-weighted mean)** | **4275** | **33.2** | **(32-35)** | **5052** | **32.1** | **(31-33)** | **5588** | **32.6** | **(31-34)** | **6158** | **33.4** | **(32-35)** | **N/A** |
| Portugal | 262 | 53.1 | (47-59) | 307 | 57.7 | (52-63) | 206 | 51.9 | (45-59) | 172 | 40.7 | (33-48) | ↓ |
| Slovenia | 34 | 26.5 | (13-44) | 31 | 38.7 | (22-58) | 60 | 43.3 | (31-57) | 36 | 41.7 | (26-59) | |
| Hungary | 443 | 44.5 | (40-49) | 467 | 55.2 | (51-60) | 401 | 58.6 | (54-63) | 358 | 52.5 | (47-58) | ↑ |
| Poland | 189 | 53.4 | (46-61) | 244 | 65.6 | (59-72) | 391 | 66.0 | (61-71) | 344 | 67.4 | (62-72) | ↑ # |
| Spain | 78 | 65.4 | (54-76) | 95 | 53.7 | (43-64) | 106 | 62.3 | (52-71) | 88 | 68.2 | (57-78) | |
| Cyprus | 58 | 77.6 | (65-87) | 59 | 83.1 | (71-92) | 28 | 71.4 | (51-87) | 50 | 76.0 | (62-87) | |
| Italy | 477 | 89.9 | (87-92) | 664 | 78.3 | (75-81) | 702 | 78.5 | (75-81) | 868 | 78.7 | (76-81) | ↓ |
| Latvia | 52 | 78.8 | (65-89) | 61 | 68.9 | (56-80) | 82 | 73.2 | (62-82) | 34 | 79.4 | (62-91) | |
| Bulgaria | 110 | 59.1 | (49-68) | 130 | 73.8 | (65-81) | 103 | 74.8 | (65-83) | 92 | 80.4 | (71-88) | ↑ |
| Romania | 123 | 81.3 | (73-88) | 189 | 81.5 | (75-87) | 160 | 85.0 | (79-90) | 182 | 87.4 | (82-92) | |
| Lithuania | 66 | 69.7 | (57-80) | 73 | 80.8 | (70-89) | 87 | 81.6 | (72-89) | 87 | 88.5 | (80-94) | ↑ |
| Greece | 841 | 93.2 | (91-95) | 983 | 93.5 | (92-95) | 861 | 95.4 | (94-97) | 1095 | 94.8 | (93-96) | |
| Croatia | 166 | 87.3 | (81-92) | 200 | 89.0 | (84-93) | 181 | 94.5 | (90-97) | 208 | 96.2 | (93-98) | ↑ |
| Iceland | 3 | ** | (**) | 6 | ** | (**) | 3 | ** | (**) | 6 | ** | (**) | N/A |
| Luxembourg | 6 | ** | (**) | 7 | ** | (**) | 8 | ** | (**) | 8 | ** | (**) | N/A |
| Malta | 10 | 10.0 | (0-45) | 15 | 13.3 | (2-40) | 7 | ** | (**) | 9 | ** | (**) | N/A |

–: No data

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

** Less than 10 isolates reported, no percentage calculated

**Table 3.25.** ***Acinetobacter*** **spp. Total number of isolates tested (N) and percentage with combined resistance to fluoroquinolones, aminoglycosides and carbapenems (%R), including 95 % confidence intervals (95 % CI), by country, EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Denmark | 49 | 0.0 | (0-7) | 60 | 3.3 | (0-12) | 67 | 0.0 | (0-5) | 66 | 0.0 | (0-5) | |
| Finland | 30 | 0.0 | (0-12) | 42 | 2.4 | (0-13) | 28 | 0.0 | (0-12) | 36 | 0.0 | (0-10) | |
| Norway | 33 | 3.0 | (0-16) | 32 | 9.4 | (2-25) | 32 | 0.0 | (0-11) | 31 | 0.0 | (0-11) | |
| Sweden | 36 | 2.8 | (0-15) | 26 | 3.8 | (0-20) | 84 | 1.2 | (0-6) | 51 | 0.0 | (0-7) | N/A |
| Netherlands | 69 | 0.0 | (0-5) | 73 | 4.1 | (1-12) | 100 | 0.0 | (0-4) | 120 | 0.8 | (0-5) | |
| Germany | 188 | 2.1 | (1-5) | 328 | 3.7 | (2-6) | 435 | 2.3 | (1-4) | 457 | 1.3 | (0-3) | |
| Ireland | 79 | 1.3 | (0-7) | 75 | 1.3 | (0-7) | 61 | 0.0 | (0-6) | 59 | 1.7 | (0-9) | |
| United Kingdom | 119 | 1.7 | (0-6) | 131 | 0.0 | (0-3) | 558 | 0.9 | (0-2) | 746 | 1.7 | (1-3) | |
| France | 391 | 1.5 | (1-3) | 424 | 5.2 | (3-8) | 447 | 6.7 | (5-9) | 468 | 5.3 | (3-8) | ↑ |
| Czech Republic | 59 | 5.1 | (1-14) | 60 | 5.0 | (1-14) | 57 | 0.0 | (0-6) | 55 | 5.5 | (1-15) | |
| Austria | 74 | 2.7 | (0-9) | 61 | 4.9 | (1-14) | 81 | 8.6 | (4-17) | 74 | 6.8 | (2-15) | |
| Belgium | 2 | ** | (**) | 13 | 0.0 | (0-25) | 64 | 0.0 | (0-6) | 98 | 7.1 | (3-14) | N/A |
| Portugal | 260 | 39.2 | (33-45) | 302 | 45.0 | (39-51) | 206 | 37.9 | (31-45) | 166 | 24.1 | (18-31) | ↓ |
| Slovakia | 160 | 24.4 | (18-32) | 142 | 23.2 | (17-31) | 109 | 24.8 | (17-34) | 119 | 25.2 | (18-34) | |
| **EU/EEA (population-weighted mean)** | **4074** | **28.5** | **(27-30)** | **4901** | **27.7** | **(26-29)** | **5413** | **28.3** | **(27-30)** | **5853** | **28.4** | **(27-30)** | **N/A** |
| Slovenia | 34 | 20.6 | (9-38) | 31 | 35.5 | (19-55) | 60 | 38.3 | (26-52) | 36 | 41.7 | (26-59) | |
| Hungary | 438 | 38.4 | (34-43) | 462 | 51.7 | (47-56) | 397 | 52.4 | (47-57) | 352 | 48.9 | (44-54) | ↑ |
| Spain | 78 | 55.1 | (43-66) | 94 | 41.5 | (31-52) | 106 | 44.3 | (35-54) | 88 | 51.1 | (40-62) | |
| Poland | 184 | 38.0 | (31-45) | 240 | 54.6 | (48-61) | 383 | 59.3 | (54-64) | 333 | 59.5 | (54-65) | ↓ |
| Italy | 437 | 86.3 | (83-89) | 650 | 72.6 | (69-76) | 692 | 74.7 | (71-78) | 763 | 72.6 | (69-76) | ↓ |
| Latvia | 52 | 61.5 | (47-75) | 60 | 46.7 | (34-60) | 67 | 67.2 | (55-78) | 32 | 75.0 | (57-89) | |
| Cyprus | 57 | 73.7 | (60-84) | 59 | 72.9 | (60-84) | 28 | 57.1 | (37-76) | 50 | 76.0 | (62-87) | |
| Lithuania | 65 | 60.0 | (47-72) | 73 | 76.7 | (65-86) | 87 | 75.9 | (65-84) | 85 | 77.6 | (67-86) | ↑ |
| Bulgaria | 85 | 47.1 | (36-58) | 112 | 66.1 | (57-75) | 76 | 72.4 | (61-82) | 92 | 78.3 | (68-86) | ↑ |
| Romania | 121 | 76.9 | (68-84) | 186 | 76.9 | (70-83) | 152 | 82.9 | (76-89) | 182 | 81.3 | (75-87) | |
| Croatia | 162 | 80.9 | (74-87) | 193 | 87.0 | (81-91) | 175 | 81.1 | (75-87) | 203 | 83.7 | (78-89) | |
| Greece | 793 | 82.6 | (80-85) | 943 | 82.2 | (80-85) | 838 | 84.0 | (81-86) | 1059 | 84.3 | (82-86) | |
| Estonia | - | - | (-) | 1 | ** | (**) | 5 | ** | (**) | 9 | ** | (**) | N/A |
| Iceland | 3 | ** | (**) | 6 | ** | (**) | 3 | ** | (**) | 6 | ** | (**) | N/A |
| Luxembourg | 6 | ** | (**) | 7 | ** | (**) | 8 | ** | (**) | 8 | ** | (**) | N/A |
| Malta | 10 | 10.0 | (0-45) | 15 | 6.7 | (0-32) | 7 | ** | (**) | 9 | ** | (**) | N/A |

–: No data

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

** Less than 10 isolates reported, no percentage calculated

## 3.5 *Streptococcus pneumoniae*

*Streptococcus pneumoniae* is a common cause of disease, especially among young children, elderly people and patients with compromised immune functions. The clinical spectrum ranges from upper airway and middle ear infection to pneumonia, bloodstream infection and meningitis.

The mechanism of penicillin resistance in *S. pneumoniae* consists of alterations in penicillin-binding proteins (PBPs), which may result in reduced affinity to penicillin G and a variable spectrum of other beta-lactams. Alterations in PBPs are due to homologous DNA recombination with PBP gene sequences originating from commensal streptococci. Acquisition of mosaic PBP results in different degrees of resistance, ranging from low-level clinical resistance, conventionally termed intermediate (I), to full clinical resistance (R). In the absence of meningitis, infections with intermediate isolates are often successfully treated with high doses of benzylpenicillin or of an aminopenicillin.

Macrolide resistance is mainly due to acquisition of either an erythromycin ribosomal methylation gene or a macrolide efflux system gene.

### Antimicrobial resistance

In 2017, as in previous years, wide inter-country variations could be noted in *S. pneumoniae* susceptibility. The national percentages of isolates with penicillin non-susceptibility ranged from 0.2% to 45.5% (Table 3.26) and from 3.6% to 36.8% for macrolide non-susceptibility (Table 3.27, Figure 3.24). Macrolide non-susceptibility was, for most countries, higher than penicillin non-susceptibility. Combined non-susceptibility to both penicillins and macrolides was less common, with a majority of the countries reporting this phenotype for less than 10% of the tested isolates (Table 3.28).

Data might not be comparable across all countries and years as the clinical breakpoints used to determine penicillin susceptibility in *S. pneumoniae* differ depending on the sites of infection and the guidelines used for interpretation. Consequently, a population-weighted EU/EEA mean percentage was not calculated for *S. pneumoniae*.

### Discussion and conclusion

Based on EARS-Net data, the resistance situation in *S. pneumoniae* appears stable in the EU/EEA, with few countries reporting increasing or decreasing trends during the period 2014–2017. As in previous years, large inter-country variations could be noted for penicillin susceptibility. Differences in the clinical breakpoints used for determining penicillin susceptibility in *S. pneumoniae* with regard to guidelines used and the sites of infection introduce bias when comparing national data reported to EARS-Net. Limited information on the guidelines used for interpretation and incomplete quantitative susceptibility data hamper any assessment of inter-country differences.

In parallel to EARS-Net, the invasive pneumococcal disease (IPD) enhanced surveillance initiative, which is also coordinated by ECDC, collects additional data on IPD cases from reference laboratories throughout the EU/EEA [22]. Data from this surveillance initiative show that the prevalence of non-susceptibility increased for penicillin and erythromycin in all countries that consistently reported antimicrobial susceptibility data between 2014 and 2016. It is, however, difficult to compare data from the two surveillance systems due to differences in data sources and completeness of reporting. The two surveillance systems within ECDC are currently being harmonised to make best use of available data.

Most EU/EEA countries have implemented routine immunisation for children with multivalent pneumococcal conjugated vaccines (PCVs). In some countries, adult high-risk groups such as the elderly and immunocompromised are also targeted with the polysaccharide vaccine or with PCVs [23]. Increased immunisation and better serotype coverage of the available PCVs are likely to impact the epidemiology of non-susceptible *S. pneumoniae* in the EU/EEA, both in terms of changes in the age-specific incidence and potential serotype replacement. Continued long-term monitoring of antimicrobial non-susceptibility is crucial to detect the emergence of non-vaccine, non-susceptible serotypes.

**Figure 3.24.** ***Streptococcus pneumoniae.*** **Percentage (%) of invasive isolates non-susceptible to macrolides, by country, EU/EEA countries, 2017**

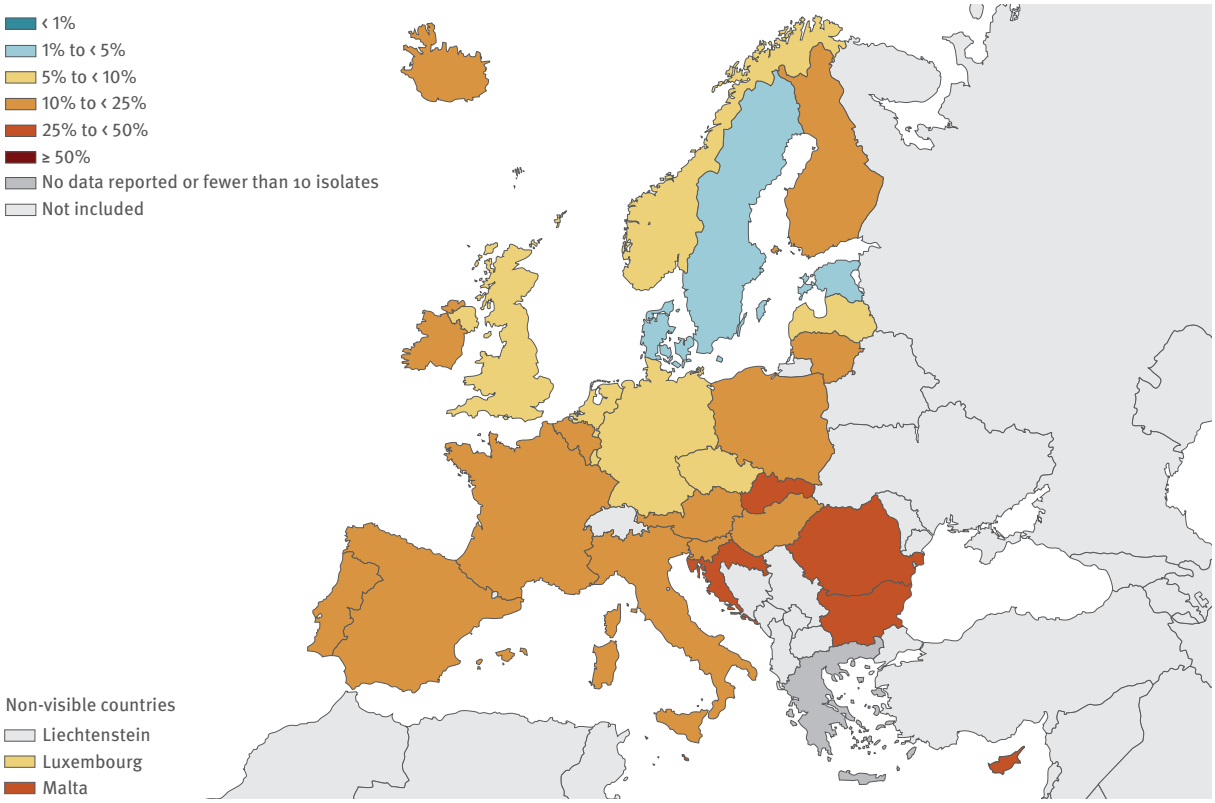


**Table 3.26.** ***Streptococcus pneumoniae*. Total number of tested isolates (N) and percentages non-susceptible to penicillin (%IR), including 95 % confidence intervals (95 % CI), by country, EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Belgium | 1110 | 1.3 | (1-2) | 1361 | 0.6 | (0-1) | 1327 | 0.4 | (0-1) | 1472 | 0.2 | (0-1) | ↓ |
| Estonia | 72 | 4.2 | (1-12) | 72 | 2.8 | (0-10) | 112 | 3.6 | (1-9) | 141 | 2.1 | (0-6) | |
| Netherlands | 1139 | 2.1 | (1-3) | 1163 | 1.8 | (1-3) | 1391 | 2.2 | (2-3) | 1401 | 3.4 | (3-5) | ↑ |
| Denmark | 709 | 5.6 | (4-8) | 747 | 4.7 | (3-6) | 707 | 6.1 | (4-8) | 727 | 3.9 | (3-6) | |
| Germany | 499 | 4.4 | (3-7) | 761 | 6.2 | (5-8) | 1359 | 4.6 | (4-6) | 1823 | 4.8 | (4-6) | |
| Norway | 534 | 5.1 | (3-7) | 429 | 5.4 | (3-8) | 500 | 4.4 | (3-7) | 480 | 4.8 | (3-7) | |
| Czech Republic | 274 | 5.8 | (3-9) | 284 | 3.2 | (1-6) | 266 | 4.5 | (2-8) | 366 | 4.9 | (3-8) | |
| United Kingdom | 1288 | 5.1 | (4-6) | 1095 | 7.8 | (6-10) | 3201 | 4.9 | (4-6) | 3963 | 5.3 | (5-6) | |
| Austria | 361 | 5.3 | (3-8) | 444 | 5.6 | (4-8) | 440 | 3.4 | (2-6) | 463 | 6.0 | (4-9) | |
| Sweden | 696 | 7.9 | (6-10) | 420 | 9.8 | (7-13) | 882 | 7.1 | (6-9) | 750 | 6.1 | (5-8) | |
| Luxembourg | 32 | 6.3 | (1-21) | 27 | 3.7 | (0-19) | 51 | 13.7 | (6-26) | 45 | 6.7 | (1-18) | |
| Hungary | 128 | 11.7 | (7-19) | 181 | 7.2 | (4-12) | 174 | 15.5 | (10-22) | 204 | 6.9 | (4-11) | |
| Slovenia | 300 | 9.7 | (7-14) | 323 | 9.0 | (6-13) | 269 | 6.7 | (4-10) | 319 | 10.0 | (7-14) | |
| Finland | 593 | 12.5 | (10-15) | 677 | 12.7 | (10-15) | 706 | 10.3 | (8-13) | 698 | 10.5 | (8-13) | |
| Italy | 183 | 15.3 | (10-21) | 389 | 12.3 | (9-16) | 399 | 6.5 | (4-9) | 522 | 10.5 | (8-13) | ↓ # |
| Portugal | 610 | 10.2 | (8-13) | 797 | 11.2 | (9-14) | 884 | 12.2 | (10-15) | 997 | 12.8 | (11-15) | |
| Lithuania | 67 | 16.4 | (8-27) | 87 | 16.1 | (9-26) | 99 | 16.2 | (10-25) | 109 | 15.6 | (9-24) | |
| Ireland | 328 | 17.7 | (14-22) | 303 | 17.5 | (13-22) | 363 | 16.5 | (13-21) | 412 | 15.8 | (12-20) | |
| Poland | 130 | 29.2 | (22-38) | 217 | 24.4 | (19-31) | 337 | 19.3 | (15-24) | 290 | 16.6 | (12-21) | ↓ |
| Latvia | 48 | 4.2 | (1-14) | 59 | 8.5 | (3-19) | 61 | 11.5 | (5-22) | 51 | 17.6 | (8-31) | ↑ |
| Iceland | 25 | 8.0 | (1-26) | 25 | 24.0 | (9-45) | 19 | 10.5 | (1-33) | 27 | 18.5 | (6-38) | N/A |
| Spain | 551 | 27.9 | (24-32) | 665 | 23.5 | (20-27) | 643 | 25.0 | (22-29) | 706 | 22.5 | (19-26) | |
| Croatia | 129 | 26.4 | (19-35) | 126 | 19.0 | (13-27) | 155 | 21.9 | (16-29) | 129 | 22.5 | (16-31) | |
| Slovakia | 29 | 20.7 | (8-40) | 27 | 22.2 | (9-42) | 13 | 7.7 | (0-36) | 39 | 25.6 | (13-42) | N/A |
| France | 656 | 22.3 | (19-26) | 1068 | 22.9 | (20-26) | 1046 | 25.3 | (23-28) | 614 | 25.9 | (22-30) | |
| Bulgaria | 32 | 25.0 | (11-43) | 35 | 22.9 | (10-40) | 33 | 27.3 | (13-46) | 29 | 27.6 | (13-47) | |
| Romania | 45 | 46.7 | (32-62) | 41 | 39.0 | (24-55) | 56 | 41.1 | (28-55) | 79 | 29.1 | (19-40) | |
| Malta | 8 | ** | (**) | 20 | 35 | (15-59) | 10 | 10 | (0-45) | 19 | 31.6 | (13-57) | N/A |
| Cyprus | 12 | 0 | (0-26) | 7 | ** | (**) | 10 | 40 | (12-74) | 11 | 45.5 | (17-77) | N/A |
| Greece | - | - | (-) | - | - | (-) | - | - | (-) | - | - | (-) | N/A |

–: No data

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

** Less than 10 isolates reported, no percentage calculated

**Table 3.27.** ***Streptococcus pneumoniae*. Total number of tested isolates (N) and percentages non-susceptible to macrolides (%IR), including 95 % confidence intervals (95 % CI), by country, EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Denmark | 709 | 6.6 | (5-9) | 747 | 5.2 | (4-7) | 707 | 4.8 | (3-7) | 727 | 3.6 | (2-5) | ↓ |
| Estonia | 54 | 5.6 | (1-15) | 54 | 7.4 | (2-18) | 100 | 8.0 | (4-15) | 127 | 3.9 | (1-9) | |
| Sweden | 788 | 6.7 | (5-9) | 850 | 6.9 | (5-9) | 899 | 5.8 | (4-8) | 750 | 4.8 | (3-7) | N/A |
| Netherlands | 1287 | 4.3 | (3-6) | 1168 | 3.9 | (3-5) | 1389 | 3.1 | (2-4) | 1406 | 5.7 | (5-7) | |
| Norway | 492 | 7.5 | (5-10) | 403 | 10.7 | (8-14) | 473 | 9.5 | (7-13) | 439 | 5.9 | (4-9) | |
| United Kingdom | 1260 | 7.1 | (6-9) | 1077 | 7.2 | (6-9) | 3423 | 6.5 | (6-7) | 4273 | 6.0 | (5-7) | |
| Germany | 494 | 7.1 | (5-10) | 758 | 8.4 | (7-11) | 1386 | 8.2 | (7-10) | 1852 | 7.1 | (6-8) | |
| Latvia | 49 | 4.1 | (0-14) | 58 | 6.9 | (2-17) | 52 | 5.8 | (1-16) | 28 | 7.1 | (1-24) | |
| Luxembourg | 35 | 14.3 | (5-30) | 29 | 0.0 | (0-12) | 51 | 15.7 | (7-29) | 49 | 8.2 | (2-20) | |
| Czech Republic | 274 | 7.7 | (5-11) | 284 | 6.7 | (4-10) | 263 | 7.2 | (4-11) | 366 | 9.3 | (7-13) | |
| Austria | 400 | 10.5 | (8-14) | 439 | 8.7 | (6-12) | 455 | 8.8 | (6-12) | 507 | 11.2 | (9-14) | |
| Hungary | 123 | 14.6 | (9-22) | 170 | 11.2 | (7-17) | 166 | 13.3 | (8-19) | 187 | 11.8 | (8-17) | |
| Ireland | 317 | 13.9 | (10-18) | 296 | 15.5 | (12-20) | 354 | 14.4 | (11-19) | 396 | 13.1 | (10-17) | |
| Finland | 636 | 14.5 | (12-17) | 765 | 14.4 | (12-17) | 791 | 12.0 | (10-14) | 808 | 15.5 | (13-18) | |
| Portugal | 658 | 16.0 | (13-19) | 822 | 17.0 | (15-20) | 912 | 15.1 | (13-18) | 1024 | 15.5 | (13-18) | |
| Belgium | 1108 | 17.9 | (16-20) | 1361 | 18.7 | (17-21) | 1327 | 15.9 | (14-18) | 1472 | 15.6 | (14-18) | ↓ # |
| Slovenia | 300 | 19.3 | (15-24) | 323 | 18.9 | (15-24) | 269 | 13.8 | (10-18) | 216 | 15.7 | (11-21) | |
| Lithuania | 62 | 22.6 | (13-35) | 72 | 12.5 | (6-22) | 94 | 18.1 | (11-27) | 107 | 15.9 | (10-24) | |
| Iceland | 24 | 12.5 | (3-32) | 25 | 12.0 | (3-31) | 19 | 0.0 | (0-18) | 27 | 18.5 | (6-38) | N/A |
| Spain | 544 | 20.0 | (17-24) | 631 | 23.5 | (20-27) | 630 | 25.9 | (22-29) | 691 | 21.6 | (19-25) | |
| France | 656 | 23.0 | (20-26) | 1068 | 24.4 | (22-27) | 1046 | 26.4 | (24-29) | 614 | 23.3 | (20-27) | |
| Italy | 252 | 28.6 | (23-35) | 428 | 24.5 | (21-29) | 464 | 23.1 | (19-27) | 599 | 23.4 | (20-27) | |
| Poland | 121 | 29.8 | (22-39) | 206 | 31.1 | (25-38) | 277 | 30.7 | (25-36) | 253 | 24.9 | (20-31) | |
| Cyprus | 11 | 0.0 | (0-28) | 7 | ** | (**) | 10 | 60.0 | (26-88) | 19 | 26.3 | (9-51) | N/A |
| Bulgaria | 30 | 26.7 | (12-46) | 33 | 21.2 | (9-39) | 32 | 21.9 | (9-40) | 29 | 27.6 | (13-47) | |
| Romania | 50 | 48.0 | (34-63) | 20 | 30.0 | (12-54) | 59 | 39.0 | (27-53) | 76 | 27.6 | (18-39) | ↓ # |
| Slovakia | 29 | 41.4 | (24-61) | 34 | 35.3 | (20-54) | 12 | 8.3 | (0-38) | 31 | 35.5 | (19-55) | N/A |
| Croatia | 116 | 21.6 | (14-30) | 126 | 19.8 | (13-28) | 154 | 35.1 | (28-43) | 127 | 36.2 | (28-45) | ↑ |
| Malta | 8 | ** | (**) | 20 | 40.0 | (19-64) | 9 | ** | (**) | 19 | 36.8 | (16-62) | N/A |
| Greece | - | - | (-) | - | - | (-) | - | - | (-) | - | - | (-) | N/A |

–: No data

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

** Less than 10 isolates reported, no percentage calculated

**Table 3.28.** ***Streptococcus pneumoniae*. Total number of tested isolates (N) and percentages non-susceptible to penicillins and macrolides (%IR), including 95 % confidence intervals (95 % CI), by country, EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Belgium | 1069 | 0.7 | (0-1) | 1361 | 0.4 | (0-1) | 1327 | 0.3 | (0-1) | 1472 | 0.1 | (0-0) | ↓ |
| Netherlands | 1025 | 1.2 | (1-2) | 1030 | 0.9 | (0-2) | 1263 | 0.4 | (0-1) | 1297 | 1.1 | (1-2) | |
| Estonia | 54 | 1.9 | (0-10) | 27 | 3.7 | (0-19) | 100 | 1.0 | (0-5) | 127 | 1.6 | (0-6) | |
| Denmark | 709 | 3.9 | (3-6) | 747 | 2.4 | (1-4) | 707 | 2.3 | (1-4) | 727 | 1.8 | (1-3) | ↓ |
| United Kingdom | 1190 | 2.9 | (2-4) | 1060 | 2.7 | (2-4) | 3136 | 2.6 | (2-3) | 3885 | 2.0 | (2-2) | ↓ # |
| Germany | 491 | 1.4 | (1-3) | 748 | 2.7 | (2-4) | 1342 | 2.2 | (1-3) | 1803 | 2.4 | (2-3) | |
| Norway | 490 | 2.2 | (1-4) | 403 | 2.5 | (1-5) | 469 | 2.8 | (1-5) | 439 | 2.5 | (1-4) | |
| Czech Republic | 274 | 3.3 | (2-6) | 284 | 1.8 | (1-4) | 263 | 1.1 | (0-3) | 366 | 3.0 | (2-5) | |
| Sweden | 693 | 4.2 | (3-6) | 409 | 5.6 | (4-8) | 877 | 4.0 | (3-6) | 745 | 3.0 | (2-4) | N/A |
| Austria | 351 | 2.8 | (1-5) | 433 | 2.5 | (1-4) | 438 | 1.4 | (1-3) | 457 | 3.3 | (2-5) | |
| Latvia | 46 | 4.3 | (1-15) | 53 | 1.9 | (0-10) | 51 | 3.9 | (0-13) | 28 | 3.6 | (0-18) | |
| Luxembourg | 32 | 6.3 | (1-21) | 27 | 0.0 | (0-13) | 51 | 7.8 | (2-19) | 45 | 4.4 | (1-15) | |
| Italy | 163 | 11.0 | (7-17) | 347 | 5.8 | (4-9) | 361 | 4.4 | (3-7) | 474 | 5.3 | (3-8) | ↓ # |
| Hungary | 123 | 7.3 | (3-13) | 170 | 1.8 | (0-5) | 166 | 7.8 | (4-13) | 187 | 6.4 | (3-11) | |
| Slovenia | 300 | 4.7 | (3-8) | 323 | 5.0 | (3-8) | 269 | 3.7 | (2-7) | 216 | 6.5 | (4-11) | |
| Finland | 570 | 6.5 | (5-9) | 654 | 7.0 | (5-9) | 687 | 6.1 | (4-8) | 671 | 6.7 | (5-9) | |
| Portugal | 601 | 5.8 | (4-8) | 776 | 6.6 | (5-9) | 868 | 6.7 | (5-9) | 978 | 7.2 | (6-9) | |
| Ireland | 317 | 11.4 | (8-15) | 296 | 10.8 | (8-15) | 354 | 9.9 | (7-13) | 396 | 9.6 | (7-13) | |
| Lithuania | 62 | 16.1 | (8-28) | 72 | 11.1 | (5-21) | 94 | 12.8 | (7-21) | 107 | 11.2 | (6-19) | |
| Spain | 526 | 12.2 | (9-15) | 624 | 12.0 | (10-15) | 612 | 14.4 | (12-17) | 676 | 12.4 | (10-15) | |
| Poland | 119 | 24.4 | (17-33) | 195 | 19.5 | (14-26) | 271 | 16.6 | (12-22) | 241 | 14.1 | (10-19) | ↓ # |
| Iceland | 24 | 8.3 | (1-27) | 25 | 8.0 | (1-26) | 19 | 0.0 | (0-18) | 27 | 14.8 | (4-34) | N/A |
| Croatia | 116 | 10.3 | (5-17) | 126 | 7.9 | (4-14) | 154 | 15.6 | (10-22) | 126 | 15.9 | (10-23) | |
| Bulgaria | 30 | 10.0 | (2-27) | 32 | 12.5 | (4-29) | 32 | 9.4 | (2-25) | 29 | 17.2 | (6-36) | |
| France | 656 | 15.9 | (13-19) | 1068 | 17.4 | (15-20) | 1046 | 18.3 | (16-21) | 614 | 17.8 | (15-21) | |
| Slovakia | 26 | 19.2 | (7-39) | 27 | 22.2 | (9-42) | 12 | 0.0 | (0-26) | 30 | 23.3 | (10-42) | N/A |
| Romania | 45 | 37.8 | (24-53) | 20 | 25.0 | (9-49) | 56 | 30.4 | (19-44) | 75 | 24.0 | (15-35) | |
| Malta | 8 | ** | (**) | 20 | 25.0 | (9-49) | 9 | ** | (**) | 19 | 26.3 | (9-51) | N/A |
| Cyprus | 11 | 0.0 | (0-28) | 7 | ** | (**) | 10 | 40.0 | (12-74) | 11 | 45.5 | (17-77) | N/A |
| Greece | - | - | (-) | - | - | (-) | - | - | (-) | - | - | (-) | N/A |

–: No data

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

** Less than 10 isolates reported, no percentage calculated

## 3.6 *Staphylococcus aureus*

*Staphylococcus aureus* is a gram-positive bacterium that frequently colonises the skin of healthy humans. However, *S. aureus* is also an opportunistic microorganism involved in infections of both community and healthcare origin. Besides being a common cause of skin, soft tissue and bone infections, it is one of the leading causes of bloodstream infections in Europe. *S. aureus* acquires resistance to meticillin and some other beta-lactam agents through expression of the exogenous *mecA*, or less frequently, the *mecC* gene. These genes code for a variant penicillin-binding protein PBP2' (PBP2a) with low affinity for beta-lactams and able to substitute for the function of the other penicillin-binding proteins, thus preventing the inhibition of cell wall synthesis by beta-lactams.

### Antimicrobial resistance

The EU/EEA population-weighted mean MRSA percentage was 16.9% in 2017. This is a result of a significantly decreasing trend between 2014 and 2017 (Table 3.30).

In 2017, large differences in national MRSA percentages could be noted, ranging from 1.0% to 44.4% (Figure 3.30). Close to a third of the countries reported significantly decreasing trends during the period 2014–2017, including countries with both low and high percentages of MRSA (Table 3.30).

Among MRSA, combined resistance to other antimicrobial groups was common. The most common resistance combination was MRSA and resistance to fluoroquinolones. Rifampicin resistance was less common (Table 3.29).

### Discussion and conclusion

MRSA percentages seem to be stabilising or still decreasing in a majority of EU/EEA countries, which is also reflected in the continuously decreasing EU/EEA population-weighted mean. Many countries have developed and implemented national recommendations and guidance documents on the prevention of spread of MRSA, focusing on both improved infection prevention and control and prudent antimicrobial use [14].

Despite this positive development, MRSA remains an important pathogen in Europe. *S. aureus* is one of the most common causes of serious bacterial infections, exhibiting high rates of morbidity and mortality. The high percentages of MRSA in some countries, often combined with resistance to other antimicrobials, are a concern and contributing to the burden of AMR. Carriage and infection with MRSA is only associated with healthcare exposure, and community-associated MRSA (CA-MRSA) are increasingly being reported from many parts of the world. The proportion of community-onset infections caused by MRSA clones that are usually associated with healthcare (HA-MRSA) has also increased, indicating transfer of HA-MRSA clones into the community [24]. In order to further slow the spread of MRSA in Europe, comprehensive MRSA strategies targeting all healthcare sectors remain essential.

The monitoring of MRSA in animals and food is currently voluntary and only performed in a limited number of countries, but shows a constantly evolving situation including detection of livestock-associated MRSA (LA-MRSA), HA-MRSA and CA-MRSA from companion animals and/or livestock [12]. Recently, LA-MRSA has gained increasing attention, as it poses a zoonotic risk, particularly for those working in close contact with livestock. An ECDC survey documents the increasing detection and geographical dispersion of LA-MRSA in humans in the EU/EEA between 2007 and 2013 and highlights the public health and veterinary importance of LA-MRSA as a One Health issue [25].

**Table 3.29. *Staphylococcus aureus*. Total number of tested isolates* and resistance combinations among invasive isolates tested against meticillin, fluoroquinolones and rifampicin (n=49 424), EU/EEA countries, 2017**

| Resistance pattern | Number of isolates | Percentage (%) of total** |
|---|---|---|
| Fully susceptible | **40 088** | **81.1** |
| Single resistance (to indicated antimicrobial group) | | |
| **Total (any single resistance)** | **3 940** | **8.0** |
| MRSA | 1 094 | 2.2 |
| Fluoroquinolones | 2 665 | 5.4 |
| Rifampicin | 181 | 0.4 |
| Resistance to two antimicrobial groups | | |
| **Total (any two-group combinations)** | **5 187** | **10.5** |
| MRSA + fluoroquinolones | 5 133 | 10.4 |
| Other resistance combinations | 54 | 0.1 |
| Resistance to three antimicrobial groups | | |
| MRSA + fluoroquinolones + rifampicin | **209** | **0.4** |

Only resistance combinations >1 % of the total are specified.

* Only data from isolates tested against all three antimicrobial groups were included in the analysis.

** Not adjusted for population differences in the reporting countries.

**Figure 3.25.** ***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), by country, EU/EEA countries, 2017**

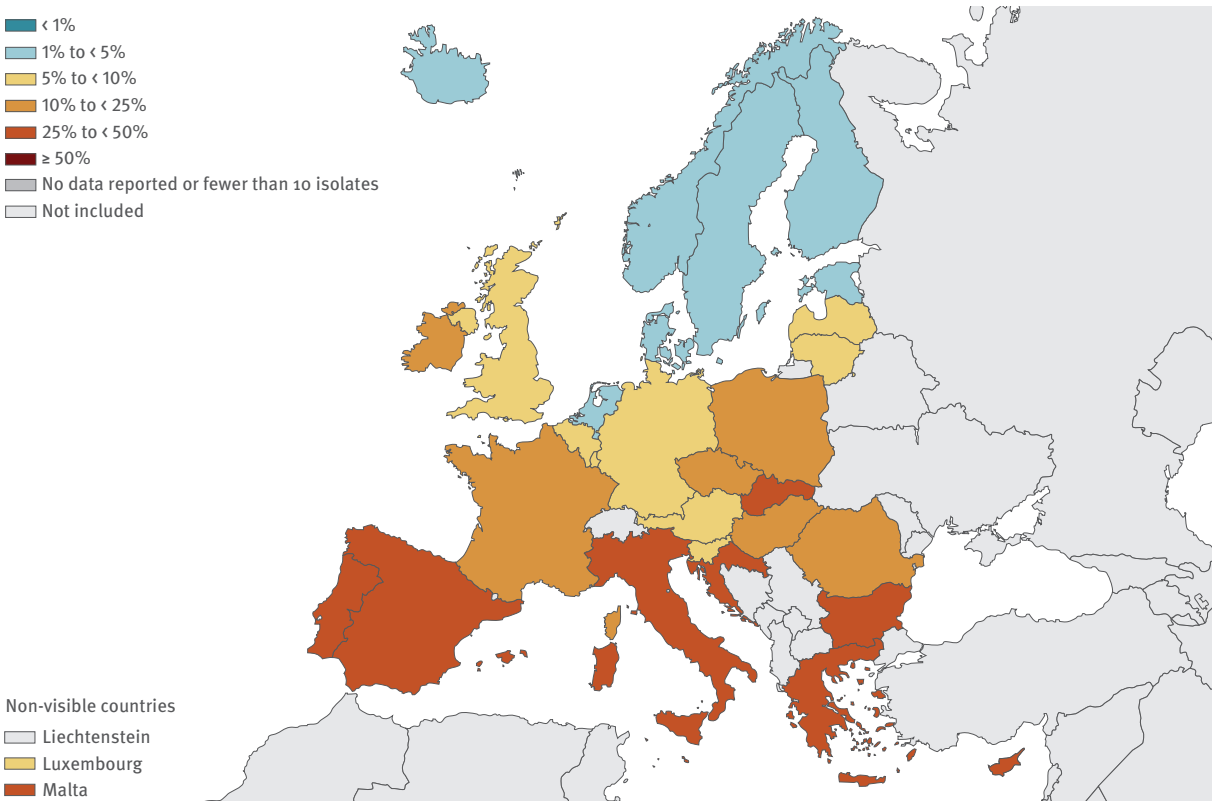


**Table 3.30.** ***Staphylococcus aureus*. Total number of invasive isolates tested (N) and percentage with resistance to meticillin (MRSA) including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Norway | 1544 | 1.0 | (1-2) | 1453 | 1.2 | (1-2) | 1448 | 1.2 | (1-2) | 1462 | 1.0 | (1-2) | |
| Sweden | 2745 | 1.0 | (1-1) | 3124 | 0.8 | (1-1) | 3450 | 2.3 | (2-3) | 3787 | 1.2 | (1-2) | N/A |
| Iceland | 61 | 3.3 | (0-11) | 88 | 0.0 | (0-4) | 76 | 1.3 | (0-7) | 69 | 1.4 | (0-8) | |
| Netherlands | 2524 | 1.0 | (1-1) | 2107 | 1.3 | (1-2) | 2699 | 1.2 | (1-2) | 2694 | 1.5 | (1-2) | |
| Finland | 1831 | 2.6 | (2-3) | 2070 | 1.9 | (1-3) | 1890 | 2.2 | (2-3) | 2439 | 2.0 | (1-3) | |
| Estonia | 223 | 3.1 | (1-6) | 151 | 4.0 | (1-8) | 314 | 3.5 | (2-6) | 290 | 2.1 | (1-4) | |
| Denmark | 1874 | 2.5 | (2-3) | 1876 | 1.6 | (1-2) | 1963 | 2.0 | (1-3) | 1996 | 2.5 | (2-3) | |
| Latvia | 220 | 8.2 | (5-13) | 251 | 5.6 | (3-9) | 284 | 4.2 | (2-7) | 210 | 5.7 | (3-10) | |
| Austria | 2651 | 7.8 | (7-9) | 2785 | 7.5 | (7-9) | 3053 | 7.1 | (6-8) | 3158 | 5.9 | (5-7) | ↓ |
| United Kingdom | 2400 | 11.3 | (10-13) | 2757 | 10.8 | (10-12) | 6717 | 6.7 | (6-7) | 8883 | 6.9 | (6-7) | ↓ |
| Belgium | 988 | 13.5 | (11-16) | 913 | 12.3 | (10-15) | 1364 | 12.2 | (10-14) | 1511 | 8.5 | (7-10) | ↓ |
| Lithuania | 383 | 7.8 | (5-11) | 376 | 8.5 | (6-12) | 503 | 11.3 | (9-14) | 514 | 8.8 | (6-12) | |
| Slovenia | 495 | 13.1 | (10-16) | 513 | 9.2 | (7-12) | 534 | 11.0 | (9-14) | 576 | 9.0 | (7-12) | |
| Germany | 3146 | 12.9 | (12-14) | 5020 | 11.3 | (10-12) | 9866 | 10.2 | (10-11) | 12021 | 9.1 | (9-10) | ↓ |
| Luxembourg | 125 | 12.0 | (7-19) | 135 | 8.9 | (5-15) | 187 | 10.2 | (6-15) | 200 | 9.5 | (6-14) | |
| France | 5484 | 17.4 | (16-18) | 5535 | 15.7 | (15-17) | 5578 | 13.8 | (13-15) | 6472 | 12.9 | (12-14) | ↓ |
| Czech Republic | 1695 | 13.0 | (11-15) | 1806 | 13.7 | (12-15) | 1887 | 13.9 | (12-16) | 1944 | 13.2 | (12-15) | |
| Bulgaria | 216 | 20.8 | (16-27) | 222 | 13.1 | (9-18) | 231 | 14.3 | (10-19) | 227 | 13.7 | (9-19) | |
| Poland | 490 | 20.6 | (17-24) | 958 | 15.8 | (14-18) | 1772 | 16.4 | (15-18) | 1805 | 15.2 | (14-17) | ↓ # |
| Ireland | 1075 | 19.4 | (17-22) | 1057 | 18.1 | (16-21) | 1143 | 14.3 | (12-17) | 1140 | 16.3 | (14-19) | ↓ |
| **EU/EEA (population-weighted mean)** | **40906** | **19.6** | **(19-20)** | **45509** | **19.0** | **(19-19)** | **57387** | **17.7** | **(17-18)** | **64769** | **16.9** | **(17-17)** | ↓ |
| Hungary | 1279 | 23.1 | (21-25) | 1517 | 24.7 | (23-27) | 1668 | 25.2 | (23-27) | 1566 | 23.6 | (22-26) | |
| Spain | 1920 | 22.1 | (20-24) | 1968 | 25.3 | (23-27) | 1944 | 25.8 | (24-28) | 1804 | 25.3 | (23-27) | ↑ |
| Croatia | 484 | 21.3 | (18-25) | 486 | 24.5 | (21-29) | 458 | 25.3 | (21-30) | 520 | 28.5 | (25-33) | ↑ |
| Slovakia | 640 | 28.0 | (25-32) | 583 | 28.1 | (25-32) | 571 | 27.1 | (24-31) | 613 | 29.2 | (26-33) | |
| Cyprus | 136 | 36.0 | (28-45) | 143 | 43.4 | (35-52) | 139 | 38.8 | (31-47) | 125 | 31.2 | (23-40) | |
| Italy | 2134 | 33.6 | (32-36) | 3000 | 34.1 | (32-36) | 2981 | 33.6 | (32-35) | 3591 | 33.9 | (32-35) | |
| Greece | 556 | 37.1 | (33-41) | 612 | 39.4 | (35-43) | 639 | 38.8 | (35-43) | 822 | 38.4 | (35-42) | |
| Portugal | 3193 | 47.4 | (46-49) | 3619 | 46.8 | (45-48) | 3454 | 43.6 | (42-45) | 3728 | 39.2 | (38-41) | ↓ |
| Malta | 78 | 43.6 | (32-55) | 87 | 49.4 | (39-60) | 97 | 37.1 | (28-48) | 95 | 42.1 | (32-53) | |
| Romania | 316 | 56.0 | (50-62) | 297 | 57.2 | (51-63) | 477 | 50.5 | (46-55) | 507 | 44.4 | (40-49) | ↓ |

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

\# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

# 3.7 Enterococci

Enterococci belong to the normal bacterial microbiota of the gastrointestinal tract of humans. They are regarded commensals but can cause invasive diseases when the commensal relationship with the host is disrupted. Enterococci can cause a variety of infections, including urinary tract infections, bloodstream infections and endocarditis, and are associated with peritonitis and intra-abdominal abscesses. The vast majority of clinical enterococcal infections in humans are caused by *Enterococcus faecalis* and *E. faecium*.

Enterococci are intrinsically resistant to a broad range of antimicrobial agents including cephalosporins, sulphonamides and low concentrations of aminoglycosides. By nature, enterococci also have low susceptibility to many beta-lactam agents as a consequence of their low-affinity penicillin-binding proteins. However, there is commonly synergy between aminoglycosides and penicillins or glycopeptides against enterococci without acquired high-level glycopeptide resistance. Some enterococci have acquired genes conferring high-level resistance to aminoglycosides, causing loss of any synergistic effect between beta-lactams and aminoglycosides.

Glycopeptide resistance of clinical relevance is mostly mediated through two phenotypes: VanA, with high-level resistance to vancomycin and a variable level of resistance to teicoplanin, and VanB, with a variable level of resistance, in most cases to vancomycin only.

## Antimicrobial resistance

### *Enterococcus faecalis*: high-level gentamicin resistance

In 2017, the EU/EEA population-weighted mean percentage for high-level gentamicin resistance in *E. faecalis* was 30.0%, with national percentages ranging from 7.1% to 45.9% (Figure 3.26). The EU/EEA trend decreased significantly between 2014 and 2017, with similar significantly decreasing national trends reported from almost one fourth of the countries (Table 3.31).

### *Enterococcus faecalis*: vancomycin resistance

Vancomycin resistance in *E. faecalis* remained low in most countries. For more information, please refer to the online ECDC *Surveillance Atlas of Infectious Diseases* [16].

### *Enterococcus faecium*: vancomycin resistance

The EU/EEA population-weighted mean percentage for vancomycin resistance in *E. faecium* was 14.9% in 2017, which represents a significant increase from 2014 when the percentage was 10.4%.

In 2017, national percentages ranged from 0.0% to 43.9%. Eleven out of the 30 reporting countries reported resistance percentages below 5% (Figure 3.27). Several of the countries reporting comparatively high percentages of resistance to vancomycin also reported significantly increasing trends for the last four years (Table 3.32). For several countries, the increase during the four-year period was considerable.

### *Enterococcus faecium*: high-level gentamicin resistance

With few exceptions, national percentages for high-level aminoglycoside resistance in *E. faecium* were higher than for *E. faecalis*. For more information, please refer to ECDC's *Surveillance Atlas of Infectious Diseases* [16].

## Discussion and conclusion

Data from EARS-Net indicate that vancomycin-resistant *E. faecium* is becoming a cause for concern in Europe. The significantly increasing trend, observed at the EU/EEA level and in many of the individual countries, highlights the need for close monitoring. Enterococci have intrinsic resistance to several antimicrobial classes, and any additional acquired resistance severely limits the number of treatment options. WHO has listed vancomycin-resistant *E. faecium* as a pathogen with high priority in its global priority list of antibiotic-resistant bacteria, emphasising the paucity of available and effective treatment options [13]. High levels of antimicrobial-resistant enterococci remain a major infection control challenge and an important cause of healthcare-associated infections in Europe. Besides the fact that infections caused by resistant strains are difficult to treat, enterococci easily disseminate in healthcare settings.

The reason behind the increase of vancomycin-resistant *E. faecium* in Europe remains unclear. Studies performed in individual EU/EEA countries show highly regional spread with multiple hospital outbreaks [26–28]. Contrary to many other bacterium–antimicrobial group combinations under surveillance by EARS-Net, no distinct geographical pattern could be seen for vancomycin-resistant *E. faecium*, as high resistance levels were reported from countries in both southern, eastern and northern Europe. Better knowledge of the epidemiology of vancomycin-resistant enterococci is needed to guide prevention and control strategies.

**Figure 3.26.** ***Enterococcus faecalis*. Percentage (%) of invasive isolates with high-level resistance to gentamicin, by country, EU/EEA countries, 2017**

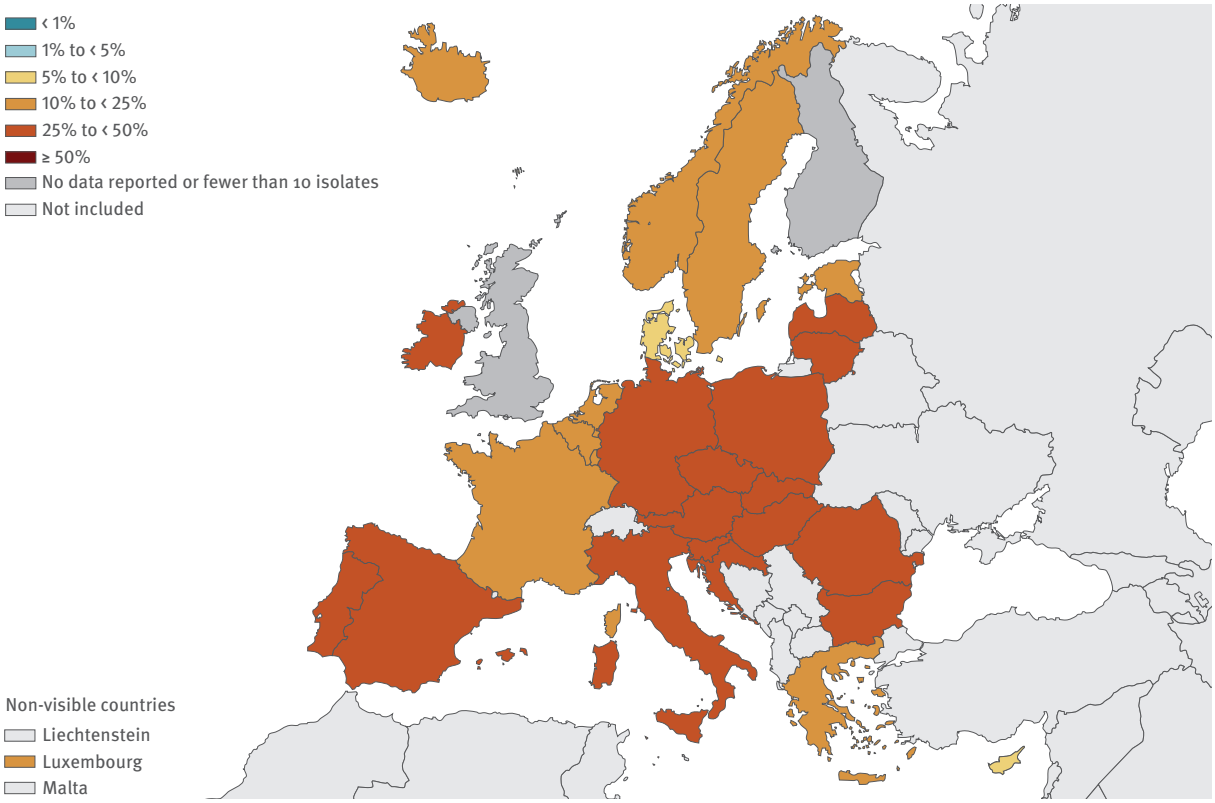



**Figure 3.27.** ***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, by country, EU/EEA countries, 2017**

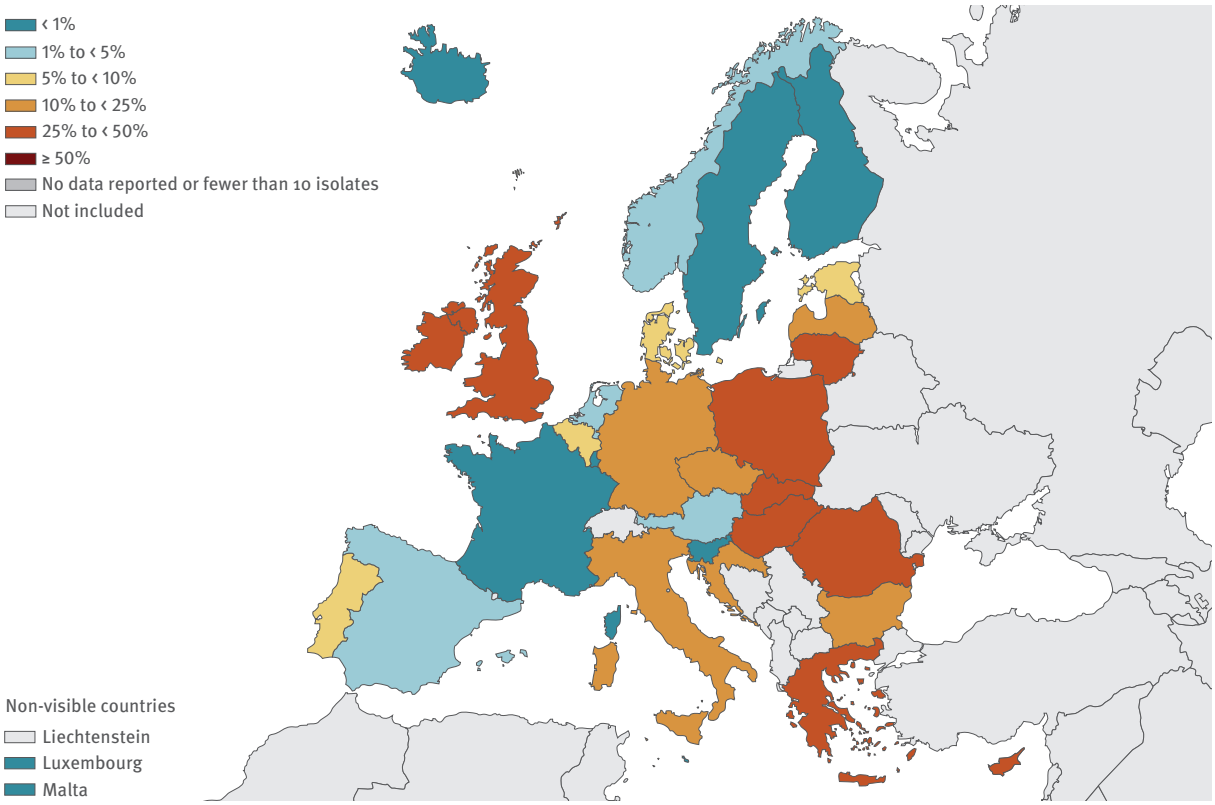


**Table 3.31.** ***Enterococcus faecalis*. Total number of invasive isolates tested (N) and percentage with high-level resistance to gentamicin including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Denmark | 60 | 30.0 | (19-43) | 63 | 25.4 | (15-38) | 56 | 19.6 | (10-32) | 56 | 7.1 | (2-17) | ↓ |
| Cyprus | 80 | 17.5 | (10-28) | 58 | 8.6 | (3-19) | 39 | 20.5 | (9-36) | 70 | 8.6 | (3-18) | |
| Greece | 407 | 20.1 | (16-24) | 460 | 13.3 | (10-17) | 540 | 15.9 | (13-19) | 621 | 12.2 | (10-15) | ↓ |
| France | 1741 | 13.7 | (12-15) | 1097 | 12.2 | (10-14) | 1057 | 15.0 | (13-17) | 795 | 12.7 | (10-15) | |
| Sweden | 723 | 15.8 | (13-19) | 579 | 12.6 | (10-16) | 722 | 13.4 | (11-16) | 945 | 13.3 | (11-16) | N/A |
| Norway | 270 | 20.7 | (16-26) | 163 | 9.8 | (6-15) | 221 | 15.8 | (11-21) | 216 | 14.4 | (10-20) | |
| Belgium | 170 | 22.9 | (17-30) | 249 | 13.3 | (9-18) | 328 | 19.8 | (16-25) | 304 | 16.4 | (12-21) | |
| Iceland | 12 | 8.3 | (0-38) | 21 | 14.3 | (3-36) | 24 | 16.7 | (5-37) | 33 | 18.2 | (7-35) | N/A |
| Estonia | 19 | 36.8 | (16-62) | 26 | 26.9 | (12-48) | 56 | 32.1 | (20-46) | 71 | 19.7 | (11-31) | N/A |
| Luxembourg | 39 | 30.8 | (17-48) | 56 | 14.3 | (6-26) | 48 | 12.5 | (5-25) | 82 | 22.0 | (14-32) | |
| Netherlands | 403 | 28.8 | (24-33) | 343 | 23.0 | (19-28) | 451 | 24.4 | (20-29) | 537 | 24.4 | (21-28) | |
| Germany | 903 | 33.6 | (30-37) | 1295 | 30.7 | (28-33) | 2341 | 25.2 | (23-27) | 2658 | 25.7 | (24-27) | ↓ |
| Portugal | 607 | 32.6 | (29-37) | 872 | 33.3 | (30-36) | 851 | 33.8 | (31-37) | 931 | 25.8 | (23-29) | ↓ |
| **EU/EEA (population-weighted mean)** | **9737** | **36.3** | **(35-37)** | **10711** | **31.9** | **(31-33)** | **12698** | **31.8** | **(31-33)** | **13459** | **30.0** | **(29-31)** | ↓ |
| Slovakia | 261 | 41.0 | (35-47) | 234 | 49.1 | (43-56) | 213 | 45.1 | (38-52) | 213 | 25.8 | (20-32) | ↓ |
| Ireland | 290 | 31.4 | (26-37) | 261 | 28.0 | (23-34) | 265 | 29.4 | (24-35) | 302 | 30.8 | (26-36) | |
| Austria | 421 | 37.1 | (32-42) | 501 | 33.7 | (30-38) | 447 | 33.3 | (29-38) | 474 | 33.1 | (29-38) | |
| Croatia | 149 | 32.9 | (25-41) | 203 | 35.5 | (29-42) | 179 | 33.0 | (26-40) | 171 | 33.3 | (26-41) | |
| Slovenia | 119 | 36.1 | (28-45) | 133 | 32.3 | (24-41) | 152 | 43.4 | (35-52) | 167 | 33.5 | (26-41) | |
| Czech Republic | 525 | 38.7 | (34-43) | 544 | 38.8 | (35-43) | 515 | 37.1 | (33-41) | 526 | 34.0 | (30-38) | |
| Malta | 28 | 25.0 | (11-45) | 29 | 27.6 | (13-47) | 33 | 39.4 | (23-58) | 29 | 34.5 | (18-54) | |
| Spain | 970 | 38.9 | (36-42) | 936 | 40.0 | (37-43) | 950 | 37.5 | (34-41) | 845 | 36.7 | (33-40) | |
| Lithuania | 65 | 29.2 | (19-42) | 63 | 44.4 | (32-58) | 45 | 35.6 | (22-51) | 60 | 36.7 | (25-50) | |
| Poland | 148 | 43.9 | (36-52) | 388 | 46.4 | (41-51) | 666 | 43.1 | (39-47) | 660 | 41.2 | (37-45) | |
| Hungary | 659 | 49.8 | (46-54) | 730 | 45.5 | (42-49) | 786 | 42.2 | (39-46) | 769 | 41.5 | (38-45) | ↓ |
| Bulgaria | 105 | 40.0 | (31-50) | 100 | 42.0 | (32-52) | 98 | 46.9 | (37-57) | 133 | 43.6 | (35-52) | |
| Romania | 34 | 76.5 | (59-89) | - | - | (-) | 87 | 56.3 | (45-67) | 89 | 44.9 | (34-56) | N/A |
| Latvia | 13 | 46.2 | (19-75) | 58 | 36.2 | (24-50) | 87 | 46.0 | (35-57) | 72 | 45.8 | (34-58) | N/A |
| Italy | 516 | 55.2 | (51-60) | 1249 | 47.8 | (45-51) | 1441 | 45.3 | (43-48) | 1630 | 45.9 | (43-48) | ↓ |
| Finland | - | - | (-) | - | - | (-) | - | - | (-) | - | - | (-) | N/A |
| United Kingdom | - | - | (-) | - | - | (-) | - | - | (-) | - | - | (-) | N/A |

–: No data

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

**Table 3.32.** ***Enterococcus faecium.*** **Total number of invasive isolates tested (N) and percentage with resistance to vancomycin, including 95 % confidence intervals (95 % CI), EU/EEA countries, 2014 to 2017**

| Country | 2014 | | | 2015 | | | 2016 | | | 2017 | | | Trend 2014-2017* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | N | %R | (95%CI) | |
| Iceland | 11 | 0.0 | (0-28) | 20 | 0.0 | (0-17) | 16 | 0.0 | (0-21) | 17 | 0.0 | (0-20) | N/A |
| Luxembourg | 31 | 3.2 | (0-17) | 23 | 0.0 | (0-15) | 31 | 0.0 | (0-11) | 34 | 0.0 | (0-10) | |
| Malta | 11 | 0.0 | (0-28) | 6 | ** | (**) | 12 | 8.3 | (0-38) | 13 | 0.0 | (0-25) | N/A |
| Sweden | 452 | 0.4 | (0-2) | 408 | 0.0 | (0-1) | 546 | 0.4 | (0-1) | 530 | 0.0 | (0-1) | N/A |
| Finland | 368 | 0.0 | (0-1) | 298 | 0.3 | (0-2) | 294 | 0.0 | (0-1) | 301 | 0.7 | (0-2) | |
| Slovenia | 115 | 1.7 | (0-6) | 124 | 4.8 | (2-10) | 111 | 0.0 | (0-3) | 149 | 0.7 | (0-4) | |
| France | 737 | 0.5 | (0-1) | 849 | 0.8 | (0-2) | 808 | 0.6 | (0-1) | 986 | 0.8 | (0-2) | |
| Netherlands | 532 | 1.1 | (0-2) | 572 | 1.4 | (1-3) | 685 | 0.9 | (0-2) | 807 | 1.4 | (1-2) | |
| Spain | 546 | 2.4 | (1-4) | 571 | 2.5 | (1-4) | 628 | 2.1 | (1-4) | 545 | 1.8 | (1-3) | |
| Austria | 480 | 4.4 | (3-7) | 483 | 3.1 | (2-5) | 533 | 4.3 | (3-6) | 570 | 3.2 | (2-5) | |
| Norway | 227 | 1.8 | (0-4) | 185 | 0.0 | (0-2) | 213 | 1.9 | (1-5) | 202 | 4.5 | (2-8) | ↑ |
| Belgium | 195 | 3.1 | (1-7) | 163 | 0.6 | (0-3) | 289 | 1.7 | (1-4) | 417 | 5.5 | (4-8) | ↑ # |
| Estonia | 48 | 0.0 | (0-7) | 27 | 0.0 | (0-13) | 64 | 0.0 | (0-6) | 52 | 5.8 | (1-16) | ↑ |
| Denmark | 715 | 4.5 | (3-6) | 690 | 3.2 | (2-5) | 679 | 7.5 | (6-10) | 785 | 7.0 | (5-9) | ↑ |
| Portugal | 363 | 20.1 | (16-25) | 459 | 20.3 | (17-24) | 411 | 7.5 | (5-11) | 461 | 7.2 | (5-10) | ↓ |
| Czech Republic | 250 | 4.4 | (2-8) | 322 | 9.6 | (7-13) | 258 | 7.8 | (5-12) | 264 | 13.3 | (9-18) | ↑ |
| Italy | 472 | 8.5 | (6-11) | 756 | 11.2 | (9-14) | 941 | 13.4 | (11-16) | 1049 | 14.6 | (13-17) | ↑ |
| **EU/EEA (population-weighted mean)** | **8324** | **10.4** | **(10-11)** | **9152** | **10.5** | **(10-11)** | **12330** | **12.3** | **(12-13)** | **13920** | **14.9** | **(14-16)** | ↑ |
| Germany | 882 | 9.1 | (7-11) | 1347 | 10.5 | (9-12) | 2043 | 11.9 | (11-13) | 2448 | 16.5 | (15-18) | ↑ |
| Bulgaria | 60 | 13.3 | (6-25) | 41 | 14.6 | (6-29) | 44 | 18.2 | (8-33) | 84 | 19.0 | (11-29) | |
| Croatia | 67 | 10.4 | (4-20) | 93 | 25.8 | (17-36) | 104 | 22.1 | (15-31) | 89 | 19.1 | (12-29) | |
| Latvia | 15 | 13.3 | (2-40) | 34 | 17.6 | (7-35) | 56 | 28.6 | (17-42) | 39 | 25.6 | (13-42) | N/A |
| United Kingdom | 423 | 21.3 | (17-25) | 218 | 17.0 | (12-23) | 1803 | 17.0 | (15-19) | 2202 | 25.8 | (24-28) | ↑ |
| Hungary | 224 | 8.5 | (5-13) | 240 | 16.7 | (12-22) | 272 | 22.4 | (18-28) | 315 | 28.3 | (23-34) | ↑ |
| Greece | 264 | 26.9 | (22-33) | 315 | 19.7 | (15-25) | 358 | 27.9 | (23-33) | 412 | 30.8 | (26-36) | ↑ # |
| Poland | 182 | 21.4 | (16-28) | 215 | 17.7 | (13-23) | 405 | 26.2 | (22-31) | 400 | 31.5 | (27-36) | ↑ # |
| Slovakia | 129 | 10.1 | (5-17) | 143 | 14.7 | (9-22) | 125 | 26.4 | (19-35) | 122 | 32.0 | (24-41) | ↑ |
| Romania | 56 | 25.0 | (14-38) | 72 | 25.0 | (16-37) | 77 | 39.0 | (28-51) | 64 | 34.4 | (23-47) | |
| Lithuania | 44 | 4.5 | (1-15) | 52 | 17.3 | (8-30) | 61 | 21.3 | (12-34) | 80 | 36.3 | (26-48) | ↑ # |
| Ireland | 390 | 45.1 | (40-50) | 404 | 45.8 | (41-51) | 422 | 44.1 | (39-49) | 442 | 38.2 | (34-43) | ↓ |
| Cyprus | 35 | 40.0 | (24-58) | 28 | 28.6 | (13-49) | 41 | 46.3 | (31-63) | 41 | 43.9 | (28-60) | |

–: No data

* ↑ and ↓ indicate significant increasing and decreasing trends, respectively.

# indicates a significant trend in the overall data; when only data from laboratories consistently reporting all four years included, no trend could be detected.

N/A: Not applicable as data were not reported for all years, a significant change in data source occurred during the period or number of isolates was below 20 in any year during the period.

** Less than 10 isolates reported, no percentage calculated

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# Annex

# National institutions/organisations participating in EARS-Net

## Austria

Federal Ministry of Labour, Social Affairs, Health and Consumer Protection
www.sozialministerium.at/site

Medical University Vienna
www.meduniwien.ac.at

Ordensklinikum Linz, Elisabethinen
www.ordensklinikum.at

## Belgium

Sciensano
www.sciensano.be

## Bulgaria

Alexander University Hospital, Sofia

National Center of Infectious and Parasitic Diseases

## Croatia

Reference Center for Antimicrobial Resistance Surveillance, Ministry of Health

Zagreb University Hospital for Infectious Diseases 'Dr. Fran Mihaljević'

## Cyprus

Microbiology Department, Nicosia General Hospital

## Czech Republic

National Institute of Public Health
www.szu.cz

National Reference Laboratory for Antibiotics

## Denmark

Statens Serum Institut, Danish Study Group for Antimicrobial Resistance Surveillance (DANRES)
www.danmap.org

## Estonia

Estonian Health Board

East-Tallinn Central Hospital

Tartu University Hospital

## Finland

National Institute for Health and Welfare
www.thl.fi

Finnish Hospital Infection Program (SIRO)
www.thl.fi/siro

Finnish Study Group for Antimicrobial Resistance (FiRe)
www.finres.fi

## France

Santé Publique France, the French National Public Health Agency
www.santepubliquefrance.fr

French National Observatory for the Epidemiology of Bacterial Resistance to Antimicrobials (ONERBA) through 3 participating networks:

Azay-Résistance, Île-de-France and Réussir networks
www.onerba.org

National Reference Centre for Pneumococci
www.cnr-pneumo.com

## Germany

Robert Koch Institute
www.rki.de

## Greece

Hellenic Pasteur Institute

National School of Public Health

National and Kapodistrian University of Athens, Medical School
www.mednet.gr/whonet

## Hungary

National Public Health Institute

## Iceland

National University Hospital of Iceland

Centre for Health Security and Infectious Disease Control

## 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

## Lithuania

National Public Health Surveillance Laboratory
www.nvspl.lt

Institute of Hygiene
www.hi.lt

## Luxembourg

National Health Laboratory

Microbiology Laboratory, Centre Hospitalier de Luxembourg

## Malta

Mater Dei Hospital, Msida

## Netherlands

National Institute for Public Health and the Environment
www.rivm.nl

## Norway

University Hospital of North Norway

Norwegian Institute of Public Health

St. Olav University Hospital, Trondheim

### Poland

National Medicines Institute, Department of Epidemiology and Clinical Microbiology

National Reference Centre for Susceptibility Testing

### Portugal

National Institute of Health Doutor Ricardo Jorge
www.insarj.pt

Ministry of Health

Directorate-General of Health

### Romania

National Institute of Public Health

### Slovakia

National Reference Centre for Antimicrobial Resistance

Public Health Authority of the Slovak Republic

Regional Public Health Authority Banska Bystrica

### Slovenia

National Institute of Public Health
www.nijz.si

Medical faculty, University of Ljubljana

National Laboratory of Health, Environment and Food

### Spain

Health Institute Carlos lll
www.isciii.es

National Centre for Microbiology

### Sweden

Public Health Agency of Sweden
www.folkhalsomyndigheten.se

### United Kingdom

Public Health England
www.gov.uk/government/organisations/public-health-england

Health Protection Scotland
www.hps.scot.nhs.uk

Public Health Agency Northern Ireland

Public Health Wales
www.publichealthwales.org

# Country summaries

The country summaries provide information on the population coverage, hospital coverage and representativeness of data provided by the laboratories that reported data to EARS-Net. The summaries include quantitative and qualitative measures related to the population under surveillance, the hospitals served by participating laboratories, laboratory practices, and the use of blood cultures. For more information on how differences in patient sampling and laboratory practices might impact data validity, please refer to Chapter 2.

In addition, national resistance percentages from 2010 to 2017 are presented together with the EU/EEA population-weighted mean percentages for selected bacterium–antimicrobial group combinations. Data for all bacterium–antimicrobial groups under regular surveillance by EARS-Net for the period 2000–2017 are available in ECDC's Surveillance Atlas of Infectious Diseases [16].

The following section describes the format and methodology underpinning the country-specific information listed in the tables and figures of this annex.

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

### Data sources

The collection of national surveillance system characteristics as part of the EARS-Net data call is currently under revision; therefore, two separate data sources were used.

In addition to the data reported to TESSy, a questionnaire covering all indicators was sent to the nominated National Focal Points for Antimicrobial Resistance in June and July 2018. For countries not responding or indicating that similar data had already been provided to TESSy, TESSy data were used as data source to the extent possible.

### Indicators

Estimated national population coverage is expressed as the estimated percentage of the national population under surveillance by the laboratories contributing data to EARS-Net. It should be considered as an indication of the national coverage because the exact proportion of the population under surveillance is often difficult to assess.

Country coverage was calculated as the mean of the population coverages of the following microorganisms: *E. coli*, *K. pneumoniae*, *S. aureus*, *E. faecalis* and *E. faecium*. Due to outliers in some countries, *S. pneumoniae* and *Acinetobacter* spp. were not included in the calculation.

Population sample representativeness is a qualitative indicator referring to the geographical representativeness of data. The categories are:

- High: All main geographical regions are covered and data are considered as representative of the national epidemiology.
- Medium: Most geographical regions are covered and data are considered of medium representativeness of the national epidemiology.
- Poor: Only a few geographical areas are covered and data are poorly representative of the national epidemiology.
- Unknown: unknown or no data provided.

Hospital sample representativeness is a qualitative indicator referring to the representativeness of hospitals served by the EARS-Net participating laboratories, compared to the national distribution of the types of hospitals (specialised, tertiary care, secondary care and primary care). The categories are:

- High: The hospital sample is representative of the acute care hospital distribution in the country.
- Medium: The hospital sample is partly representative of the acute care hospital distribution in the country.
- Poor: The hospital sample is poorly representative of the acute care hospital distribution in the country.
- Unknown: Unknown or no data provided.

Blood culture sets/1000 patient-days refers to the number of blood culture sets per 1000 inpatient occupied bed-days in hospitals served by EARS-Net laboratories. The definition of an inpatient bed day might differ between countries, and influence the estimate.

Isolate sample representativeness is a qualitative indicator referring to representativeness of blood cultures reported by EARS-Net laboratories. The categories are:

- High: The isolate sample is representative of microorganisms causing invasive infections and of patient case-mix of the included hospitals.
- Medium: The isolate sample is partly representative of microorganisms causing invasive infections and of patient case-mix of the included hospitals.
- Poor: The isolate sample is poorly representative of microorganisms causing invasive infections and of patient case-mix of the included hospitals.
- Unknown: Unknown or no data provided.

## Laboratories contributing data to EARS-Net – participation in EARS-Net EQA exercise and use of EUCAST guidelines

### Data source

Data were provided from the annual EARS-Net external quality assessment (EQA) exercise, coordinated by the ECDC contractor United Kingdom National External Quality Assessment Service (UK NEQAS). For more information on the EARS-Net EQA exercise, please refer to the separate EQA report [5].

### Indicators

'Percentage of laboratories participating in EARS-Net EQA' represents the proportion of laboratories invited to participate in the EARS-Net EQA exercise that returned reports within the agreed time.

Percentage of laboratories using EUCAST or EUCAST harmonised guidelines' refers to the proportion of laboratories reporting to use EUCAST or EUCAST-harmonised clinical guidelines among laboratories returning reports on the EARS-Net EQA exercise. Guidelines from the British Society for Antimicrobial Chemotherapy (BSAC) and the Société Française de Microbiologie (SFM) were considered as harmonised with EUCAST as both have implemented EUCAST breakpoints in their national MIC breakpoint recommendations and adjusted the interpretation of their disk diffusion methods accordingly.

## Annual number of reporting laboratories, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU)

### Data source

EARS-Net data 2014 to 2017.

### Indicators

Table 3 provides information on the number of laboratories, the number of isolates and the proportion of isolates from patients in intensive care units (ICUs), by year and by pathogen. The percentage of isolates from patients in ICUs was only calculated if information on hospital unit type was available from more than 50% of the isolates.

The actual total number of laboratories participating in EARS-Net could for some countries be higher than the number presented, as only laboratories reporting at least one isolate during each specific year are included.

## Percentage (%) of invasive isolates with resistance to selected antimicrobial groups

### Data source

EARS-Net data 2010–2017. For an explanation on the methodology used for the EU/EEA population-weighted mean, please refer to Chapter 2.

### Indicators

Percentage of invasive isolates with resistance to selected antimicrobial groups: *Staphylococcus aureus* with resistance to meticillin (MRSA), *Escherichia coli* with resistance to third-generation cephalosporins, *Klebsiella pneumoniae* with resistance to carbapenems and *Enterococcus faecium* with resistance to vancomycin.

# Austria

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Austria, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 90 | 90 | 90 | Unknown |
| Population sample representativeness | High | High | High | Unknown |
| Hospital sample representativeness | Unknown | Unknown | Unknown | Unknown |
| Blood culture sets/1000 patient-days | 16.0 | 15.7 | 16.2 | Unknown |
| Isolate sample representativeness | Unknown | Unknown | Unknown | Unknown |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Austria, 2014–2017

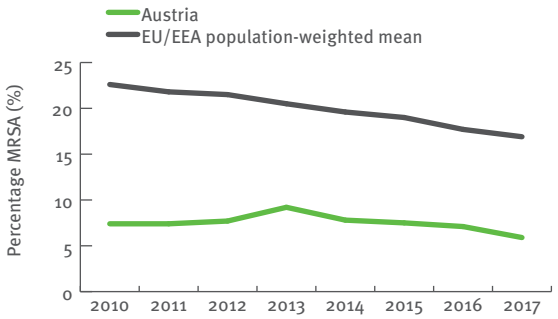
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 95 | 100 | 100 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 100 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Austria 2014–2017

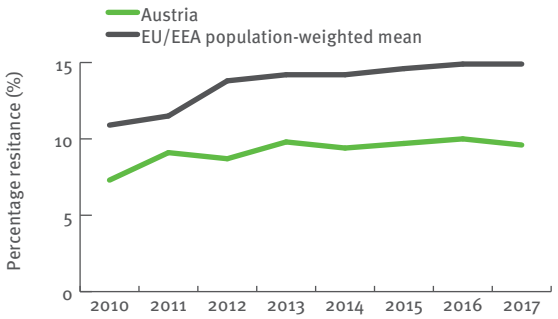
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 39 | 4757 | 9 | 39 | 4919 | 8 | 39 | 5285 | 8 | 39 | 5381 | 9 |
| *K. pneumoniae* | 39 | 996 | 13 | 39 | 1065 | 13 | 38 | 1247 | 12 | 39 | 1152 | 13 |
| *P. aeruginosa* | 39 | 638 | 14 | 39 | 680 | 17 | 39 | 697 | 17 | 39 | 725 | 16 |
| *Acinetobacter* spp. | 21 | 79 | 17 | 21 | 64 | 17 | 24 | 81 | 14 | 25 | 75 | 11 |
| *S. pneumoniae* | 39 | 410 | 14 | 38 | 450 | 20 | 39 | 457 | 21 | 39 | 513 | 18 |
| *S. aureus* | 39 | 2662 | 11 | 39 | 2815 | 13 | 39 | 3057 | 13 | 39 | 3162 | 13 |
| *E. faecalis* | 38 | 660 | 16 | 39 | 685 | 15 | 38 | 677 | 15 | 38 | 769 | 18 |
| *E. faecium* | 37 | 480 | 27 | 38 | 485 | 31 | 38 | 535 | 28 | 38 | 573 | 31 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

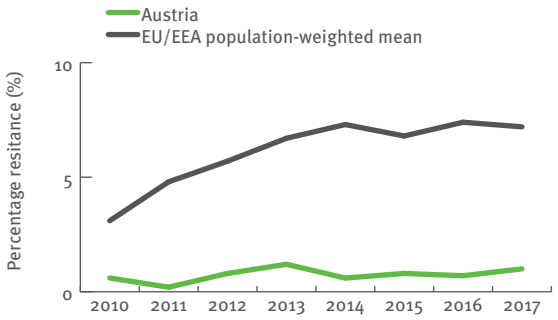
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Austria and EU/EEA population-weighted mean, 2010–2017**



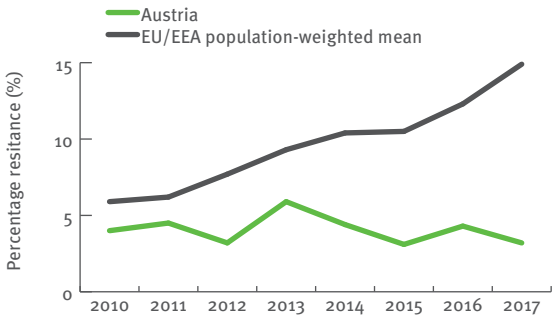

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Austria and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Austria and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Austria and EU/EEA population-weighted mean, 2010–2017**



# Belgium

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Belgium, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 25 | 24 | 29 | 30 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days | Unknown | Unknown | Unknown | Unknown |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Belgium, 2014–2017

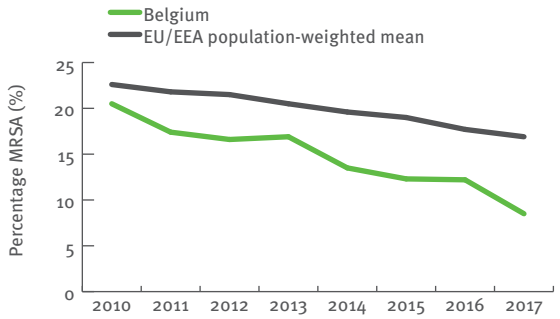
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 87 | 87 | 100 | 90 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 60 | 67 | 65 | 68 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Belgium 2014–2017

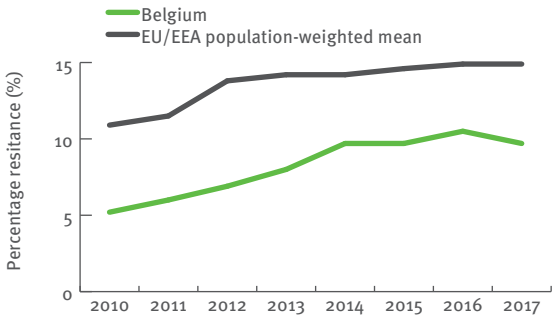
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 27 | 2895 | Unknown | 25 | 2685 | Unknown | 31 | 3856 | Unknown | 32 | 4676 | Unknown |
| *K. pneumoniae* | 26 | 506 | Unknown | 24 | 406 | Unknown | 28 | 669 | Unknown | 31 | 803 | Unknown |
| *P. aeruginosa* | 27 | 357 | Unknown | 25 | 263 | Unknown | 31 | 366 | Unknown | 31 | 474 | Unknown |
| *Acinetobacter spp.* | 3 | 4 | Unknown | 8 | 26 | Unknown | 18 | 79 | Unknown | 21 | 131 | Unknown |
| *S. pneumoniae* | 96 | 1181 | Unknown | 91 | 1361 | Unknown | 97 | 1327 | Unknown | 91 | 1472 | Unknown |
| *S. aureus* | 27 | 1034 | Unknown | 25 | 994 | Unknown | 31 | 1368 | Unknown | 31 | 1531 | Unknown |
| *E. faecalis* | 25 | 363 | Unknown | 25 | 386 | Unknown | 30 | 465 | Unknown | 31 | 551 | Unknown |
| *E. faecium* | 23 | 195 | Unknown | 23 | 164 | Unknown | 27 | 289 | Unknown | 30 | 418 | Unknown |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

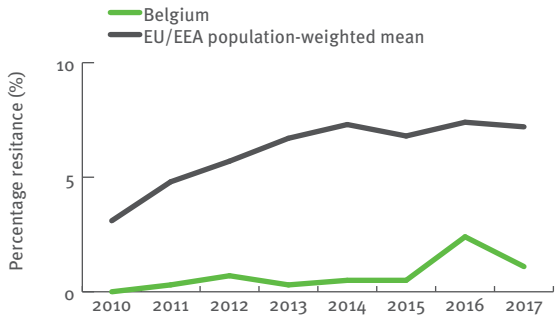
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Belgium and EU/EEA population-weighted mean, 2010–2017**



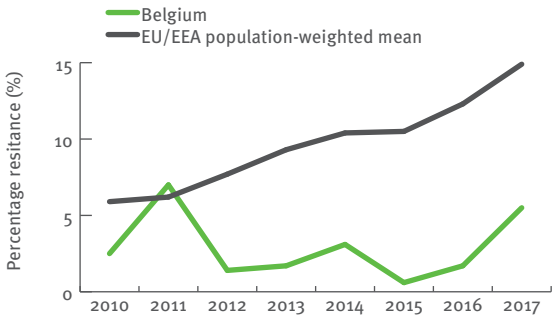

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Belgium and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Belgium and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Belgium and EU/EEA population-weighted mean, 2010–2017**



# Bulgaria

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Bulgaria, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 30 | 30 | 30 | 30 |
| Population sample representativeness | Medium | Medium | Medium | Medium |
| Hospital sample representativeness | Poor | Poor | Poor | Poor |
| Blood culture sets/1000 patient-days | Unknown | 8.2 | 7.2 | 8.3 |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Bulgaria, 2014–2017

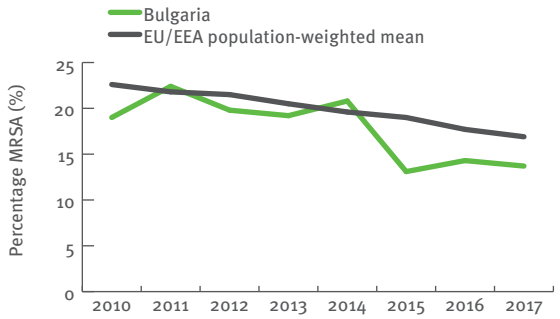
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 100 | 91 | 95 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 5 | 5 | 100 | 95 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Bulgaria 2014–2017

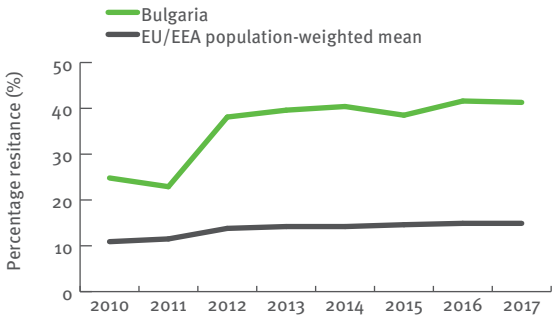
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 20 | 218 | 12 | 19 | 205 | 18 | 20 | 241 | 13 | 20 | 247 | 16 |
| *K. pneumoniae* | 17 | 151 | 28 | 16 | 96 | 19 | 17 | 161 | 29 | 18 | 169 | 33 |
| *P. aeruginosa* | 12 | 48 | 38 | 13 | 55 | 22 | 12 | 56 | 39 | 16 | 71 | 24 |
| *Acinetobacter* spp. | 15 | 115 | 57 | 18 | 133 | 59 | 15 | 106 | 48 | 15 | 92 | 62 |
| *S. pneumoniae* | 12 | 32 | 19 | 10 | 36 | 28 | 13 | 33 | 18 | 12 | 29 | 38 |
| *S. aureus* | 20 | 216 | 25 | 20 | 222 | 20 | 18 | 231 | 19 | 18 | 227 | 23 |
| *E. faecalis* | 19 | 122 | 30 | 19 | 113 | 35 | 17 | 114 | 25 | 17 | 133 | 26 |
| *E. faecium* | 13 | 60 | 37 | 13 | 43 | 42 | 12 | 45 | 53 | 17 | 84 | 39 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

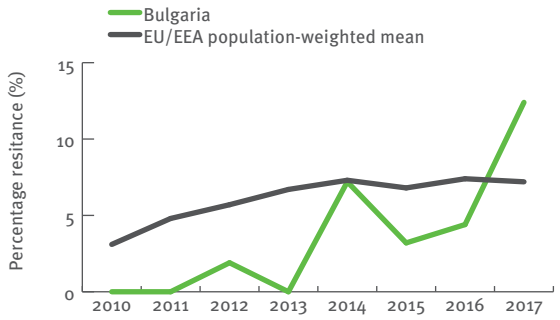
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Bulgaria and EU/EEA population-weighted mean, 2010–2017**



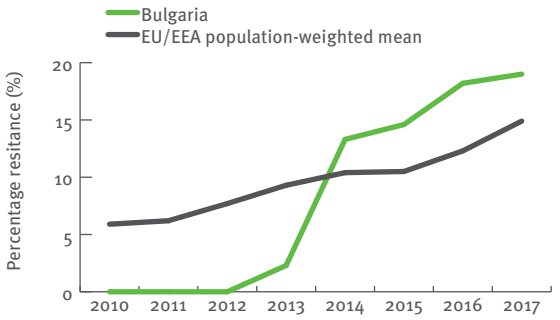

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Bulgaria and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Bulgaria and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Bulgaria and EU/EEA population-weighted mean, 2010–2017**



# Croatia

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Croatia, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 80 | 78 | 78 | 80 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | Unknown | Unknown | Unknown | Unknown |
| Blood culture sets/1000 patient-days | Unknown | Unknown | Unknown | Unknown |
| Isolate sample representativeness | Unknown | Unknown | Unknown | Unknown |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Croatia, 2014–2017

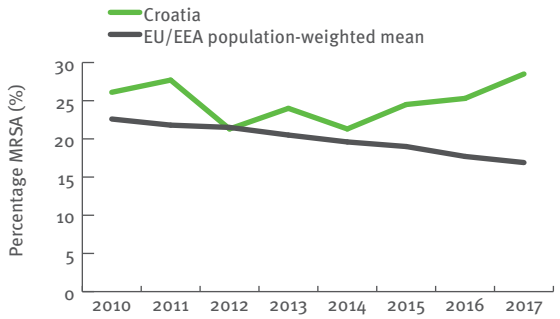
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 91 | 94 | 94 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 100 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Croatia 2014–2017

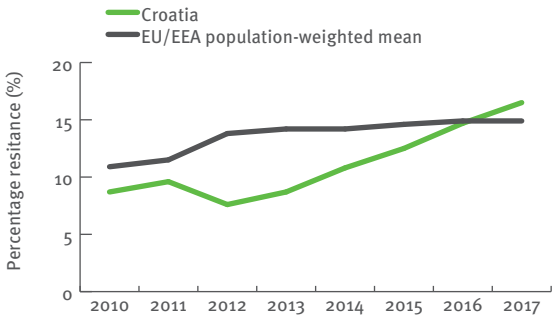
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 18 | 1080 | 4 | 18 | 1046 | 5 | 18 | 1045 | 6 | 19 | 1160 | 6 |
| *K. pneumoniae* | 16 | 334 | 12 | 17 | 380 | 17 | 17 | 323 | 19 | 19 | 313 | 18 |
| *P. aeruginosa* | 16 | 232 | 25 | 17 | 257 | 11 | 16 | 260 | 23 | 17 | 238 | 17 |
| *Acinetobacter* spp. | 15 | 167 | 37 | 17 | 200 | 27 | 14 | 182 | 41 | 17 | 208 | 42 |
| *S. pneumoniae* | 14 | 129 | 19 | 15 | 126 | 7 | 17 | 155 | 22 | 16 | 130 | 13 |
| *S. aureus* | 16 | 485 | 13 | 16 | 488 | 12 | 18 | 458 | 12 | 18 | 520 | 16 |
| *E. faecalis* | 15 | 152 | 16 | 13 | 205 | 13 | 15 | 179 | 12 | 17 | 171 | 11 |
| *E. faecium* | 13 | 68 | 12 | 14 | 93 | 18 | 15 | 104 | 17 | 12 | 89 | 12 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

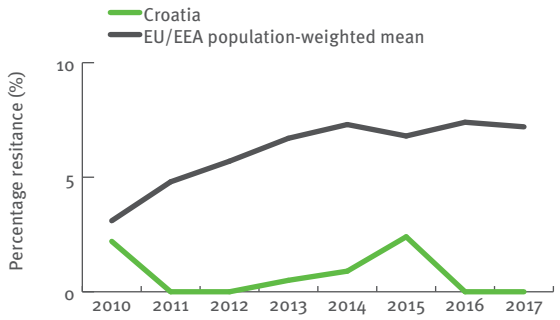
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Croatia and EU/EEA population-weighted mean, 2010–2017**



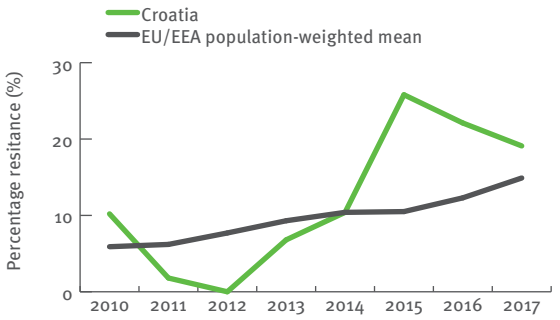

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Croatia and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Croatia and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Croatia and EU/EEA population-weighted mean, 2010–2017**



# Cyprus

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Cyprus, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 85 | 85 | 85 | 85 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days | 38.7 | 41.4 | 46.2 | 44.9 |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Cyprus, 2014–2017

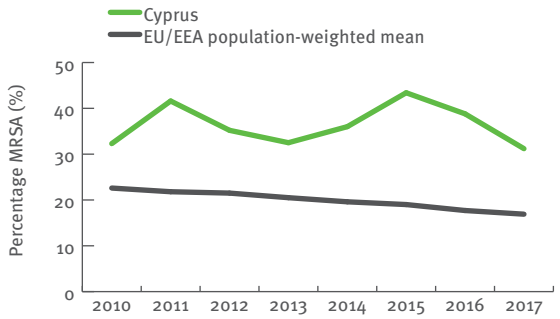
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 100 | 80 | 100 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 0 | 0 | 0 | 20 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Cyprus 2014–2017

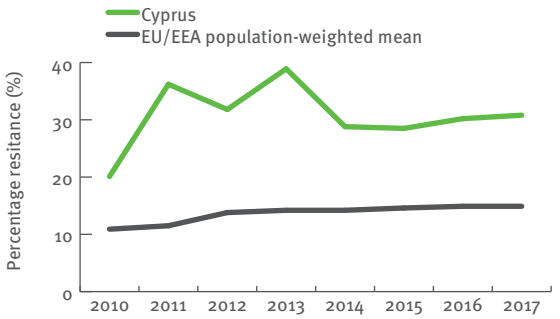
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 5 | 153 | 17 | 5 | 123 | 12 | 5 | 149 | 16 | 5 | 156 | 14 |
| *K. pneumoniae* | 5 | 80 | 41 | 5 | 62 | 43 | 5 | 75 | 30 | 5 | 71 | 33 |
| *P. aeruginosa* | 5 | 42 | 28 | 5 | 43 | 47 | 5 | 64 | 40 | 4 | 53 | 33 |
| *Acinetobacter* spp. | 5 | 58 | 68 | 5 | 61 | 66 | 5 | 29 | 69 | 5 | 50 | 46 |
| *S. pneumoniae* | 4 | 12 | 17 | 4 | 7 | 14 | 4 | 10 | 11 | 4 | 19 | 37 |
| *S. aureus* | 5 | 138 | 23 | 5 | 145 | 22 | 5 | 141 | 21 | 5 | 129 | 26 |
| *E. faecalis* | 5 | 80 | 51 | 5 | 58 | 49 | 5 | 39 | 42 | 5 | 70 | 30 |
| *E. faecium* | 5 | 35 | 50 | 5 | 28 | 50 | 4 | 41 | 28 | 5 | 41 | 26 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

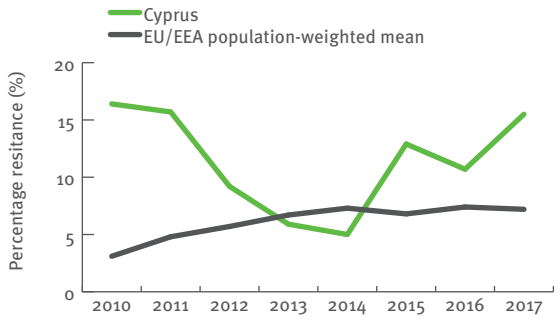
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Cyprus and EU/EEA population-weighted mean, 2010–2017**



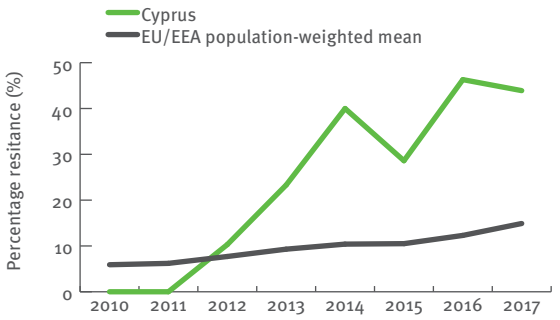

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Cyprus and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Cyprus and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Cyprus and EU/EEA population-weighted mean, 2010–2017**



# Czech Republic

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Austria, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 79 | 85 | 85 | 85 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days | 18.8 | 18.6 | 18.0 | 18.0 |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Austria, 2014–2017

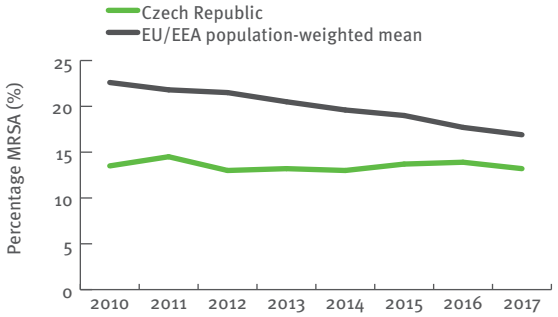
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 96 | 94 | 96 | 100 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 98 | 98 | 98 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Czech Republic 2014–2017

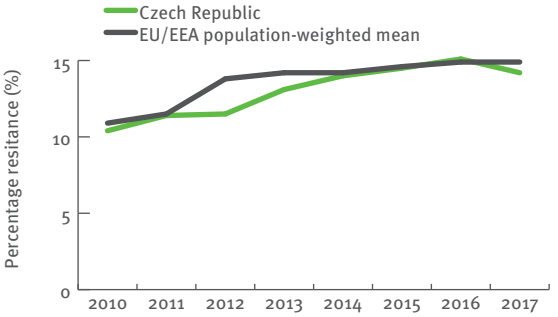
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 45 | 2981 | 17 | 45 | 3174 | 17 | 44 | 3075 | 16 | 43 | 3201 | 17 |
| *K. pneumoniae* | 44 | 1383 | 37 | 46 | 1418 | 34 | 45 | 1385 | 30 | 46 | 1330 | 27 |
| *P. aeruginosa* | 40 | 448 | 42 | 44 | 464 | 37 | 43 | 465 | 37 | 44 | 411 | 36 |
| *Acinetobacter* spp. | 18 | 59 | 53 | 15 | 60 | 33 | 15 | 57 | 22 | 17 | 55 | 31 |
| *S. pneumoniae* | 45 | 274 | 28 | 44 | 284 | 32 | 42 | 267 | 32 | 46 | 366 | 24 |
| *S. aureus* | 44 | 1695 | 25 | 46 | 1806 | 23 | 45 | 1887 | 21 | 47 | 1944 | 21 |
| *E. faecalis* | 42 | 525 | 40 | 43 | 547 | 35 | 42 | 515 | 31 | 41 | 529 | 30 |
| *E. faecium* | 34 | 250 | 32 | 36 | 322 | 40 | 38 | 259 | 39 | 39 | 264 | 36 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

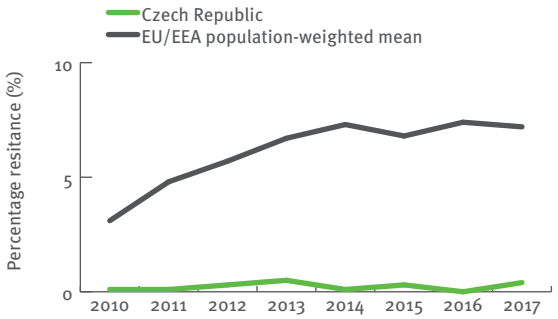
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Czech Republic and EU/EEA population-weighted mean, 2010–2017**



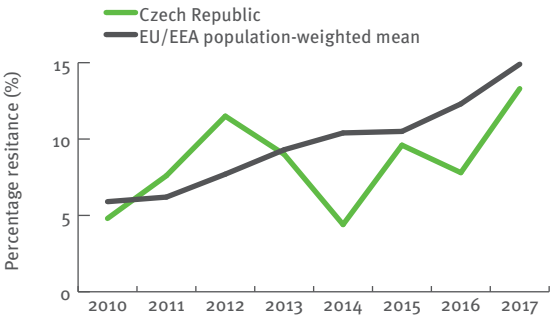

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Czech Republic and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Czech Republic and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Czech Republic and EU/EEA population-weighted mean, 2010–2017**



# Denmark

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Denmark, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 100 | 100 | 100 | 100 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days | 108.1 | 117.2 | 121.9 | 138.5 |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Denmark, 2014–2017

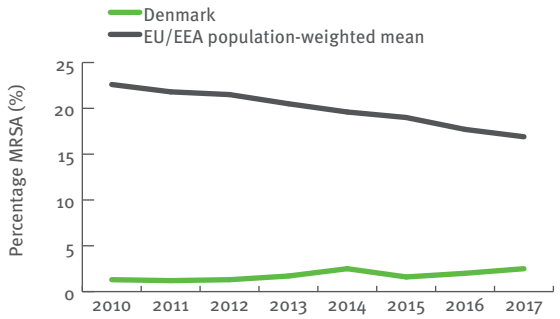
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 77 | 100 | 92 | 91 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 100 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Denmark 2014–2017

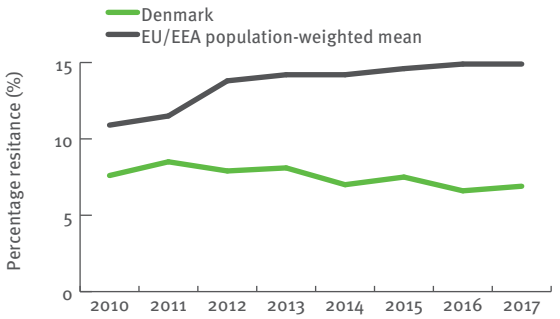
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 10 | 4496 | 4 | 11 | 4597 | 3 | 11 | 4847 | 2 | 10 | 5123 | 2 |
| *K. pneumoniae* | 10 | 943 | 5 | 11 | 939 | 5 | 11 | 1156 | 4 | 10 | 1186 | 3 |
| *P. aeruginosa* | 10 | 388 | 7 | 11 | 442 | 4 | 11 | 460 | 5 | 10 | 484 | 6 |
| *Acinetobacter* spp. | 10 | 72 | 3 | 10 | 68 | Unknown | 11 | 72 | 8 | 9 | 68 | 5 |
| *S. pneumoniae* | 11 | 709 | Unknown | 11 | 747 | Unknown | 10 | 707 | Unknown | 10 | 727 | Unknown |
| *S. aureus* | 11 | 1874 | Unknown | 11 | 1876 | Unknown | 10 | 1963 | Unknown | 10 | 1996 | Unknown |
| *E. faecalis* | 10 | 587 | 9 | 11 | 610 | 8 | 11 | 600 | 8 | 10 | 674 | 6 |
| *E. faecium* | 10 | 721 | 32 | 11 | 693 | 35 | 11 | 685 | 31 | 10 | 786 | 30 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

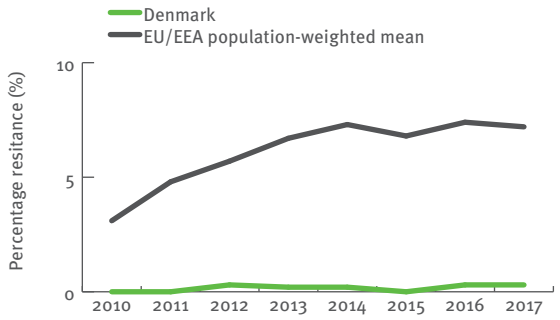
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Denmark and EU/EEA population-weighted mean, 2010–2017**



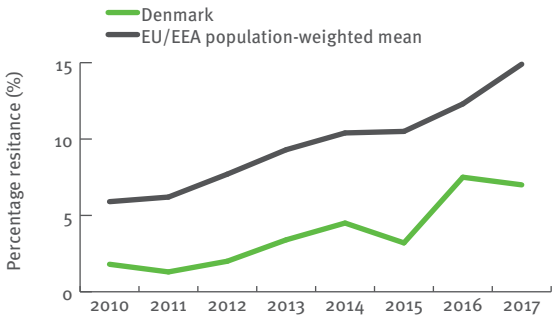

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Denmark and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Denmark and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Denmark and EU/EEA population-weighted mean, 2010–2017**



# Estonia

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Estonia, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 100 | 100 | 100 | 100 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days | 16.7 | 23.2 | 26.6 | 34.1 |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Estonia, 2014–2017

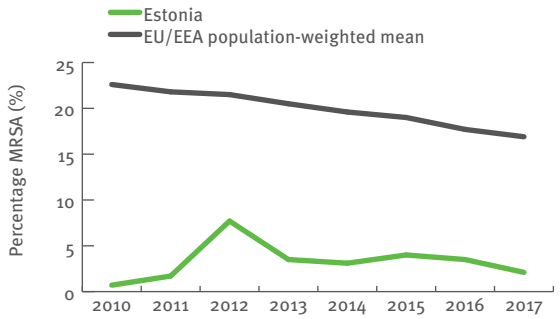
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 91 | 100 | 100 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 100 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Estonia 2014–2017

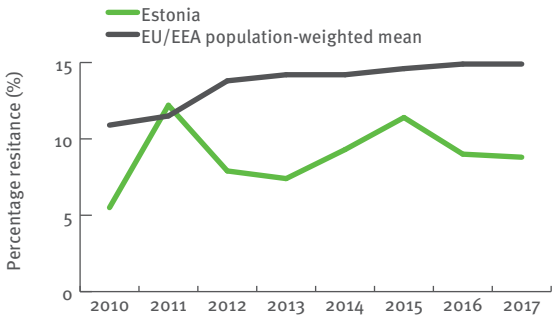
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 11 | 412 | 18 | 11 | 513 | 13 | 11 | 702 | 10 | 10 | 788 | 9 |
| *K. pneumoniae* | 10 | 136 | 31 | 9 | 133 | 28 | 10 | 183 | 20 | 10 | 161 | 20 |
| *P. aeruginosa* | 7 | 40 | 25 | 7 | 38 | 37 | 8 | 56 | 33 | 9 | 57 | 39 |
| *Acinetobacter* spp. | - | - | - | 5 | 8 | 25 | 3 | 8 | 13 | 9 | 16 | 19 |
| *S. pneumoniae* | 10 | 72 | 19 | 10 | 102 | 19 | 11 | 112 | 16 | 11 | 141 | 10 |
| *S. aureus* | 11 | 226 | 16 | 11 | 231 | 15 | 11 | 314 | 12 | 10 | 290 | 8 |
| *E. faecalis* | 8 | 31 | 32 | 10 | 59 | 34 | 9 | 56 | 25 | 10 | 71 | 23 |
| *E. faecium* | 7 | 50 | 40 | 7 | 44 | 34 | 8 | 64 | 38 | 10 | 52 | 37 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

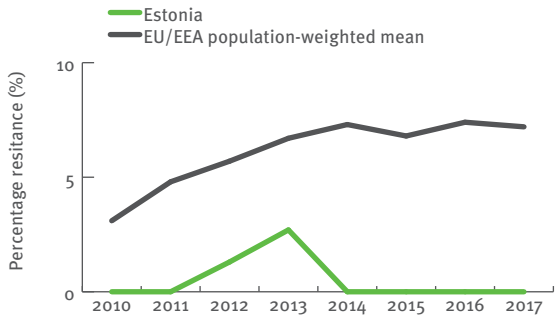
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Estonia and EU/EEA population-weighted mean, 2010–2017**



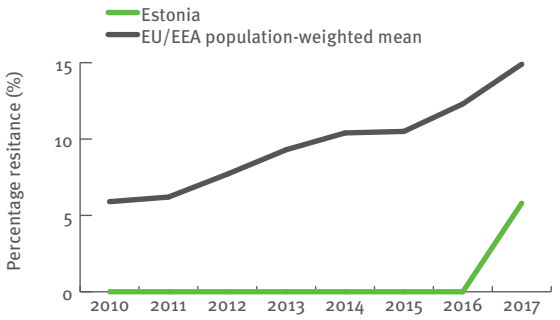

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Estonia and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Estonia and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Estonia and EU/EEA population-weighted mean, 2010–2017**



# Finland

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Finland, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 98 | 100 | 98 | 100 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | Unknown | High |
| Blood culture sets/1000 patient-days | 88.3 | 104.7 | Unknown | 154.9 |
| Isolate sample representativeness | High | High | Unknown | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Finland, 2014–2017

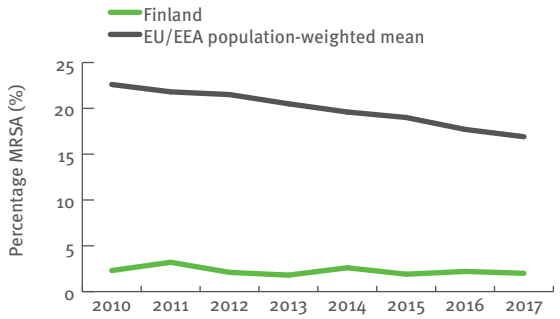
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 94 | 100 | 94 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 100 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Finland 2014–2017

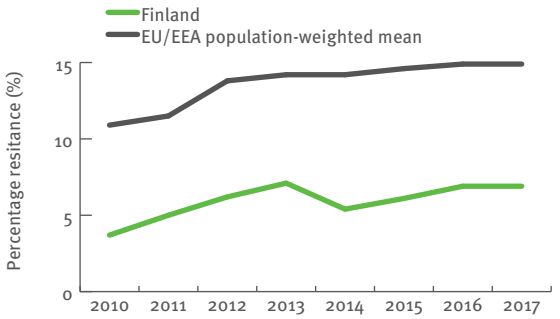
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 19 | 4013 | 1 | 20 | 4425 | 1 | 20 | 4833 | 1 | 20 | 5315 | 1 |
| *K. pneumoniae* | 19 | 583 | 2 | 20 | 658 | 3 | 20 | 770 | 3 | 20 | 758 | 2 |
| *P. aeruginosa* | 19 | 307 | 4 | 20 | 341 | 4 | 20 | 352 | 6 | 20 | 378 | 3 |
| *Acinetobacter* spp. | 14 | 32 | 0 | 16 | 43 | 4 | 12 | 28 | 0 | 11 | 37 | 0 |
| *S. pneumoniae* | 19 | 659 | 1 | 20 | 788 | 2 | 20 | 810 | 1 | 20 | 835 | 1 |
| *S. aureus* | 19 | 1831 | 3 | 20 | 2070 | 2 | 18 | 1890 | 3 | 20 | 2439 | 3 |
| *E. faecalis* | 19 | 476 | 2 | 20 | 478 | 2 | 20 | 499 | 3 | 20 | 549 | 0 |
| *E. faecium* | 19 | 368 | 13 | 20 | 299 | 7 | 20 | 295 | 10 | 20 | 301 | 6 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

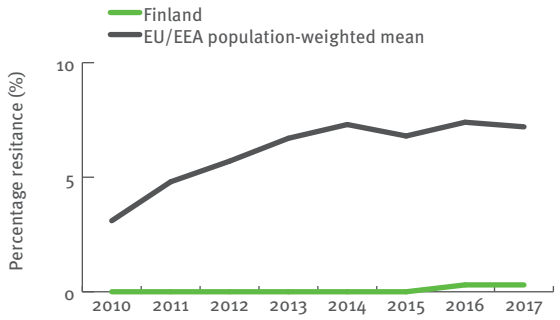
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Finland and EU/EEA population-weighted mean, 2010–2017**



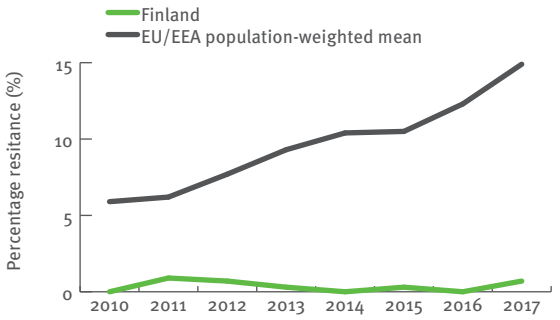

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Finland and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Finland and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Finland and EU/EEA population-weighted mean, 2010–2017**



# France

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, France, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%)* | | | | |
| Laboratories collecting *S. pneumoniae* (CNRP) | 44 | 67 | 51 | 58** |
| Laboratories collecting others species (Onerba) | 19 | 19 | 20 | 22 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days*** | 81.2 | 79.9 | 77.1 | 88.1 |
| Isolate sample representativeness | High | High | High | High |

* Calculation based on proportion hospital days in participating hospitals out of total hospital days in the country / ** Restricted to first half of the year / *** Calculated only for Onerba Network

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, France, 2014–2017

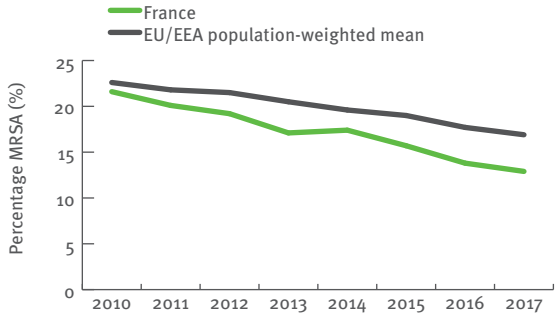
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 89 | 95 | 86 | 87 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 100 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), France 2014–2017

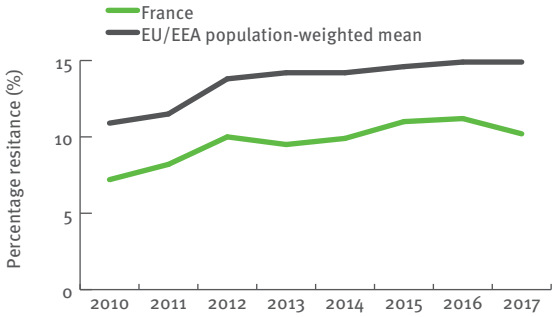
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 53 | 10350 | 8 | 54 | 11067 | 8 | 49 | 11337 | 9 | 54 | 13392 | 8 |
| *K. pneumoniae* | 53 | 2196 | 16 | 53 | 2350 | 17 | 49 | 2608 | 17 | 54 | 2904 | 16 |
| *P. aeruginosa* | 53 | 1789 | 24 | 53 | 1956 | 24 | 49 | 1988 | 23 | 36 | 1721 | 22 |
| *Acinetobacter* spp. | 49 | 409 | 13 | 48 | 434 | 14 | 48 | 454 | 18 | 52 | 475 | 16 |
| *S. pneumoniae* | 150 | 656 | Unknown | 198 | 1068 | Unknown | 175 | 1046 | Unknown | 169** | 614** | Unknown |
| *S. aureus* | 53 | 5498 | 13 | 54 | 5597 | 15 | 50 | 5699 | 14 | 54 | 6668 | 14 |
| *E. faecalis* | 53 | 1940 | 19 | 53 | 1999 | 21 | 49 | 2022 | 19 | 53 | 2259 | 19 |
| *E. faecium* | 51 | 753 | 28 | 53 | 853 | 29 | 48 | 819 | 28 | 53 | 1000 | 27 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.
** Restricted to first half of the year for 2017

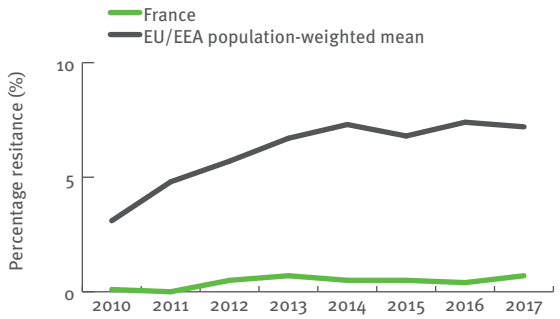
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), France and EU/EEA population-weighted mean, 2010–2017**



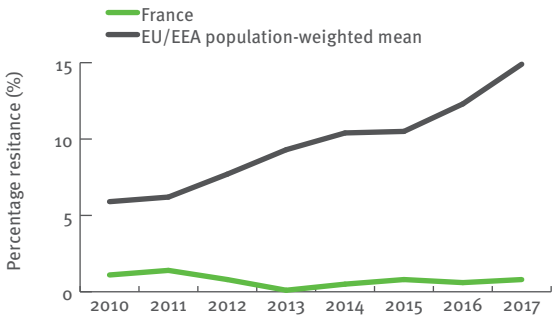

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, France and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, France and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, France and EU/EEA population-weighted mean, 2010–2017**



# Germany

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Germany, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 15 | 22 | 26 | 30 |
| Population sample representativeness | Medium | High | High | High |
| Hospital sample representativeness | Medium | Medium | Medium | Medium |
| Blood culture sets/1000 patient-days | 16.3 | 24.9 | 26.2 | 27.2 |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Germany, 2014–2017

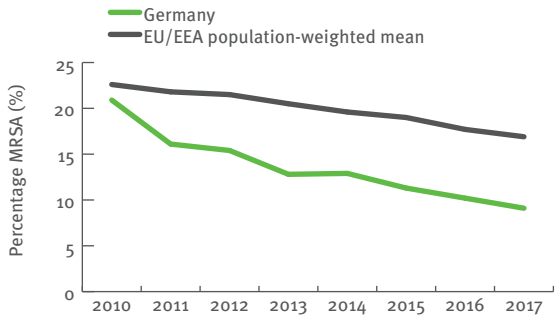
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 92 | 93 | 91 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 88 | 94 | 83 | 81 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Germany 2014–2017

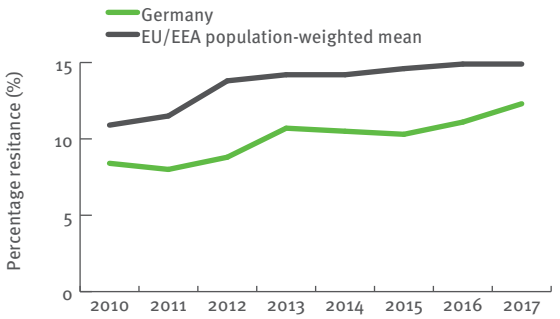
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 21 | 6251 | 16 | 30 | 9036 | 14 | 41 | 17199 | 14 | 53 | 21085 | 14 |
| *K. pneumoniae* | 20 | 1008 | 25 | 29 | 1584 | 20 | 40 | 3070 | 22 | 52 | 3549 | 22 |
| *P. aeruginosa* | 20 | 643 | 28 | 29 | 972 | 27 | 39 | 1423 | 27 | 52 | 1756 | 26 |
| *Acinetobacter* spp. | 17 | 208 | 17 | 25 | 340 | 19 | 38 | 463 | 18 | 48 | 505 | 17 |
| *S. pneumoniae* | 21 | 502 | 22 | 29 | 772 | 21 | 40 | 1403 | 23 | 51 | 1872 | 22 |
| *S. aureus* | 21 | 3417 | 23 | 30 | 5026 | 21 | 41 | 9870 | 20 | 53 | 12034 | 21 |
| *E. faecalis* | 21 | 1146 | 26 | 30 | 1725 | 23 | 41 | 2959 | 24 | 53 | 3725 | 24 |
| *E. faecium* | 21 | 889 | 40 | 29 | 1348 | 42 | 41 | 2049 | 40 | 53 | 2454 | 40 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

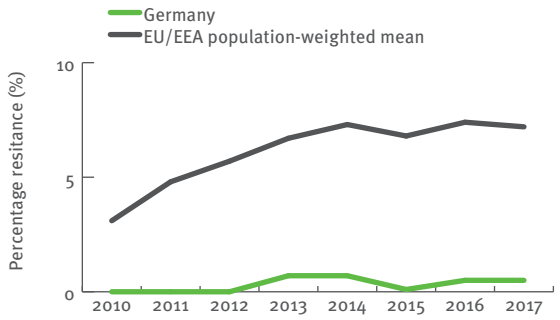
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Germany and EU/EEA population-weighted mean, 2010–2017**



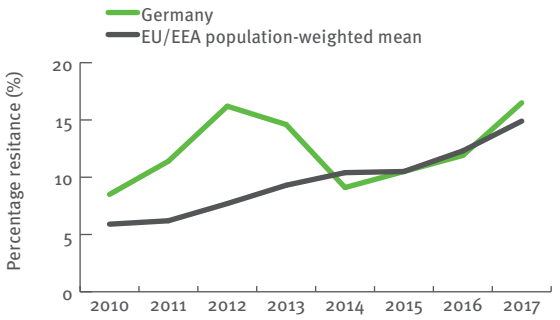

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Germany and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Germany and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Germany and EU/EEA population-weighted mean, 2010–2017**



# Greece

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Greece, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 56 | 55 | 55 | Unknown |
| Population sample representativeness | Unknown | Unknown | Unknown | Unknown |
| Hospital sample representativeness | Unknown | Unknown | Unknown | Unknown |
| Blood culture sets/1000 patient-days | Unknown | Unknown | Unknown | Unknown |
| Isolate sample representativeness | Unknown | Unknown | Unknown | Unknown |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Greece, 2014–2017

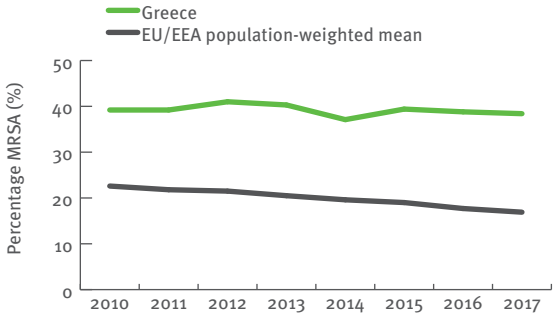
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 89 | 89 | 96 | 89 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 8 | 7 | 12 | 13 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Greece 2014–2017

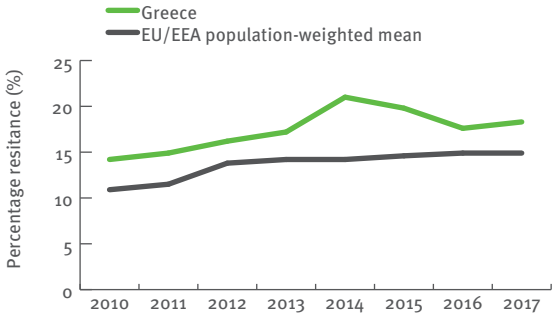
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 26 | 1123 | 4 | 29 | 1218 | 3 | 31 | 1306 | 4 | 32 | 1472 | 5 |
| *K. pneumoniae* | 27 | 1093 | 43 | 28 | 1187 | 37 | 30 | 1183 | 40 | 33 | 1363 | 37 |
| *P. aeruginosa* | 26 | 700 | 46 | 28 | 680 | 35 | 31 | 705 | 41 | 31 | 821 | 37 |
| *Acinetobacter* spp. | 26 | 844 | 62 | 29 | 1001 | 52 | 29 | 903 | 57 | 32 | 1096 | 50 |
| *S. pneumoniae* | - | - | - | - | - | - | - | - | - | - | - | - |
| *S. aureus* | 27 | 575 | 12 | 29 | 635 | 8 | 31 | 682 | 10 | 33 | 833 | 10 |
| *E. faecalis* | 26 | 449 | 31 | 28 | 506 | 27 | 28 | 576 | 34 | 33 | 638 | 24 |
| *E. faecium* | 25 | 276 | 30 | 26 | 320 | 30 | 28 | 358 | 31 | 31 | 412 | 25 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

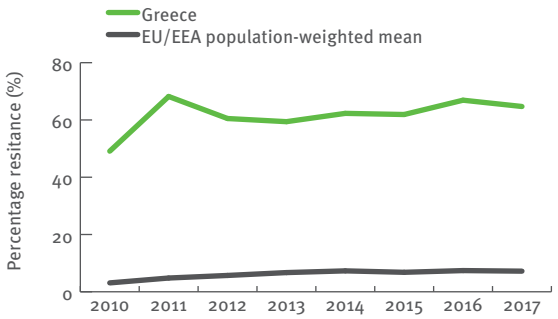
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Greece and EU/EEA population-weighted mean, 2010–2017**



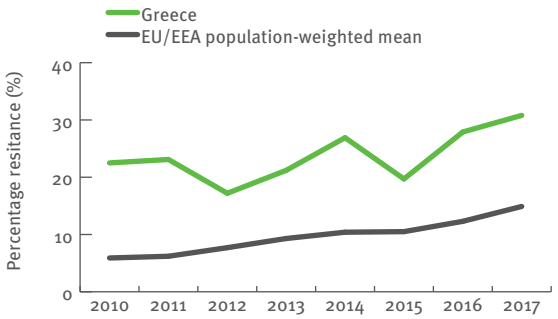

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Greece and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Greece and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Greece and EU/EEA population-weighted mean, 2010–2017**



# Hungary

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Hungary, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 90 | 90 | 90 | Unknown |
| Population sample representativeness | High | High | High | Unknown |
| Hospital sample representativeness | Unknown | Unknown | Unknown | Unknown |
| Blood culture sets/1000 patient-days | 11.7 | 10.4 | 9.8 | 11.5 |
| Isolate sample representativeness | Unknown | Unknown | Unknown | Unknown |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Hungary, 2014–2017

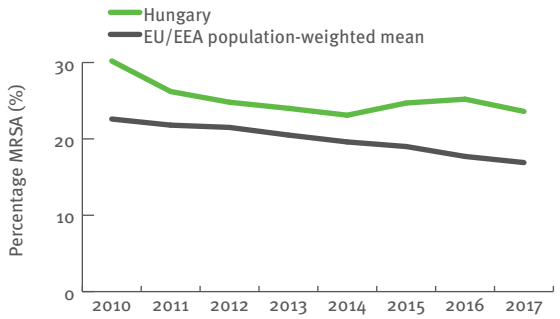
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 97 | 100 | 100 | 97 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 100 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Hungary 2014–2017

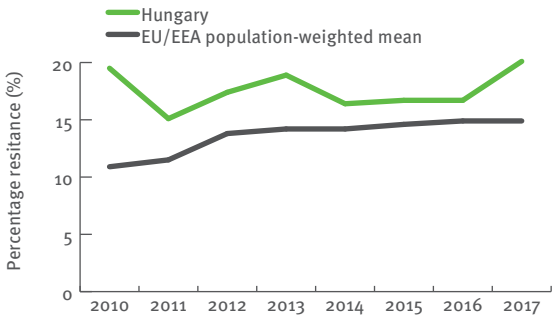
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 30 | 1622 | 14 | 30 | 2026 | 14 | 29 | 1995 | 12 | 31 | 2061 | 12 |
| *K. pneumoniae* | 28 | 644 | 26 | 27 | 706 | 31 | 29 | 723 | 27 | 29 | 693 | 24 |
| *P. aeruginosa* | 29 | 746 | 46 | 29 | 770 | 47 | 29 | 740 | 44 | 30 | 735 | 49 |
| *Acinetobacter* spp. | 27 | 446 | 59 | 25 | 467 | 53 | 26 | 401 | 56 | 31 | 358 | 50 |
| *S. pneumoniae* | 25 | 129 | 32 | 27 | 181 | 28 | 27 | 174 | 24 | 27 | 204 | 16 |
| *S. aureus* | 26 | 1279 | 22 | 27 | 1517 | 20 | 28 | 1668 | 19 | 28 | 1566 | 18 |
| *E. faecalis* | 28 | 659 | 36 | 27 | 730 | 35 | 28 | 786 | 36 | 30 | 769 | 36 |
| *E. faecium* | 21 | 224 | 46 | 23 | 240 | 44 | 25 | 272 | 46 | 27 | 315 | 44 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

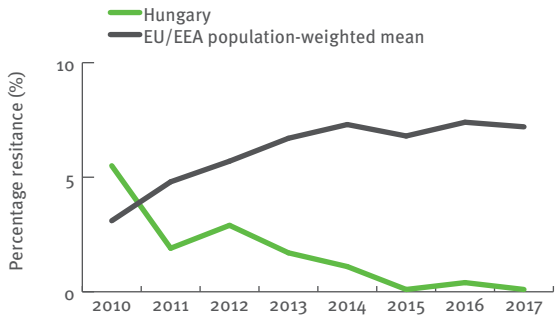
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Hungary and EU/EEA population-weighted mean, 2010–2017**



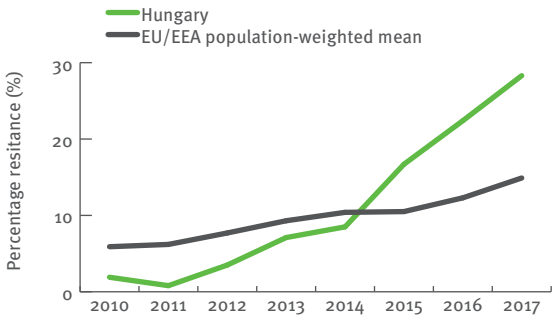

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Hungary and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Hungary and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Hungary and EU/EEA population-weighted mean, 2010–2017**



# Iceland

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Iceland, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 100 | 100 | 100 | Unknown |
| Population sample representativeness | High | High | High | Unknown |
| Hospital sample representativeness | Unknown | Unknown | Unknown | Unknown |
| Blood culture sets/1000 patient-days | Unknown | Unknown | Unknown | Unknown |
| Isolate sample representativeness | Unknown | Unknown | Unknown | Unknown |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Iceland, 2014–2017

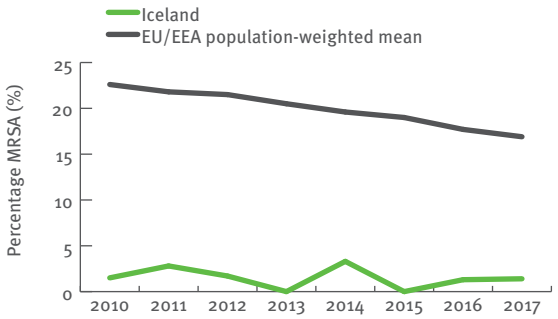
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 100 | 100 | 100 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 50 | 50 | 50 | 50 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Iceland 2014–2017

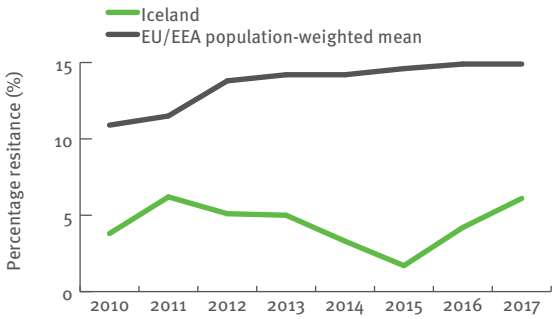
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 2 | 152 | 2 | 2 | 173 | 1 | 2 | 192 | 1 | 2 | 213 | 0 |
| *K. pneumoniae* | 1 | 28 | 4 | 2 | 36 | 0 | 2 | 25 | 4 | 2 | 17 | 0 |
| *P. aeruginosa* | 1 | 11 | 22 | 2 | 12 | 0 | 2 | 17 | 13 | 1 | 17 | 18 |
| *Acinetobacter* spp. | 1 | 3 | 50 | 1 | 6 | 17 | 1 | 3 | 0 | 1 | 6 | 0 |
| *S. pneumoniae* | 2 | 25 | 0 | 1 | 25 | 0 | 2 | 19 | 5 | 2 | 27 | 4 |
| *S. aureus* | 2 | 61 | 9 | 2 | 88 | 3 | 2 | 76 | 1 | 2 | 69 | 7 |
| *E. faecalis* | 1 | 12 | 9 | 2 | 21 | 0 | 2 | 24 | 5 | 2 | 33 | 3 |
| *E. faecium* | 1 | 11 | 20 | 1 | 20 | 16 | 1 | 16 | 13 | 1 | 17 | 12 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

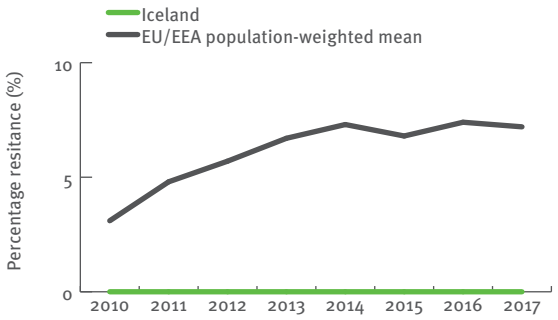
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Iceland and EU/EEA population-weighted mean, 2010–2017**



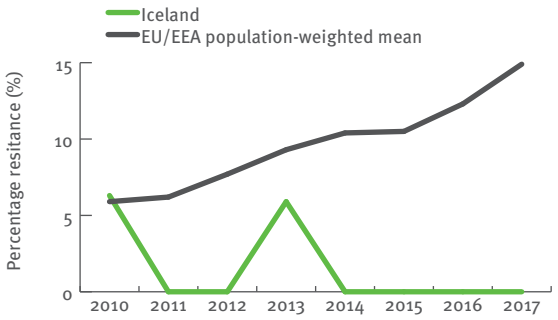

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Iceland and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Iceland and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Iceland and EU/EEA population-weighted mean, 2010–2017**



# Ireland

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Ireland, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 100 | 97 | 99 | 100 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days | 52.3 | 53.0 | 57.5 | 58.0 |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Ireland, 2014–2017

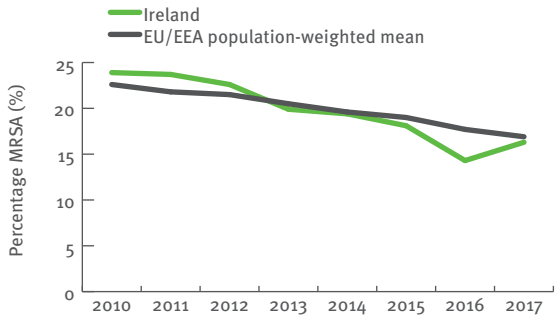
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 92 | 92 | 90 | 85 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 86 | 92 | 91 | 94 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Ireland 2014–2017

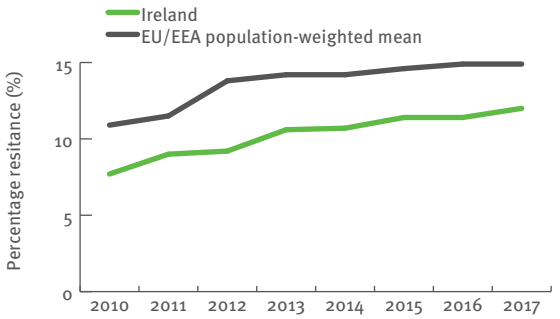
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 39 | 2705 | Unknown | 39 | 2649 | Unknown | 39 | 2991 | 5 | 39 | 3125 | Unknown |
| *K. pneumoniae* | 34 | 355 | Unknown | 30 | 389 | Unknown | 32 | 453 | 10 | 35 | 479 | Unknown |
| *P. aeruginosa* | 31 | 178 | Unknown | 29 | 195 | Unknown | 30 | 243 | 11 | 33 | 288 | Unknown |
| *Acinetobacter* spp. | 24 | 89 | Unknown | 21 | 86 | Unknown | 25 | 68 | 9 | 23 | 66 | Unknown |
| *S. pneumoniae* | 34 | 328 | Unknown | 30 | 303 | Unknown | 31 | 363 | 3 | 31 | 412 | Unknown |
| *S. aureus* | 37 | 1075 | Unknown | 37 | 1057 | Unknown | 37 | 1143 | 6 | 37 | 1144 | Unknown |
| *E. faecalis* | 32 | 308 | Unknown | 35 | 292 | Unknown | 34 | 290 | 8 | 33 | 340 | Unknown |
| *E. faecium* | 29 | 390 | Unknown | 29 | 405 | Unknown | 31 | 423 | 26 | 33 | 442 | Unknown |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

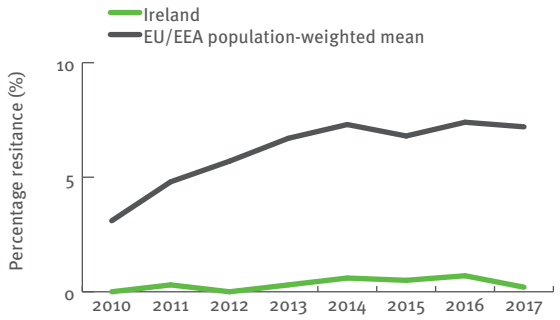
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Ireland and EU/EEA population-weighted mean, 2010–2017**



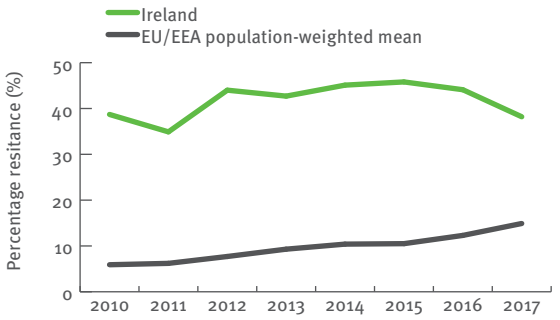

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Ireland and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Ireland and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Ireland and EU/EEA population-weighted mean, 2010–2017**



# Italy

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Italy, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 16 | 15 | 17 | 21 |
| Population sample representativeness | Unknown | Unknown | Unknown | Medium |
| Hospital sample representativeness | Unknown | Unknown | Unknown | Unknown |
| Blood culture sets/1000 patient-days | 31.6 | Unknown | Unknown | Unknown |
| Isolate sample representativeness | Unknown | Unknown | Unknown | Unknown |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Italy, 2014–2017

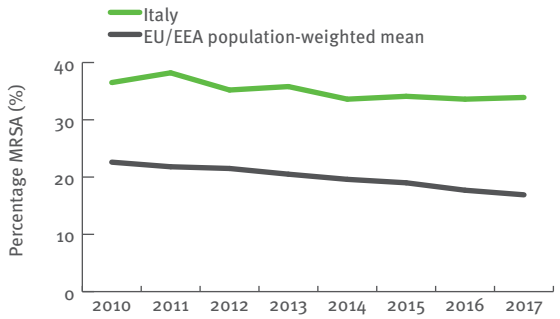
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 86 | 95 | 92 | 97 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 100 | 98 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Italy 2014–2017

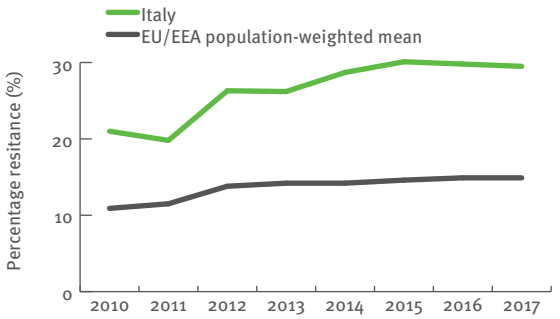
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 38 | 3802 | 7 | 45 | 5605 | 8 | 46 | 6110 | 7 | 54 | 7478 | 6 |
| *K. pneumoniae* | 45 | 1352 | 27 | 43 | 2015 | 28 | 47 | 2314 | 27 | 55 | 2720 | 25 |
| *P. aeruginosa* | 37 | 760 | 32 | 41 | 1083 | 29 | 43 | 1207 | 25 | 54 | 1455 | 24 |
| *Acinetobacter* spp. | 31 | 483 | 58 | 40 | 667 | 56 | 41 | 708 | 46 | 48 | 878 | 42 |
| *S. pneumoniae* | 42 | 284 | 12 | 39 | 479 | 10 | 43 | 515 | 11 | 52 | 673 | 9 |
| *S. aureus* | 46 | 2270 | 11 | 46 | 3300 | 15 | 46 | 3309 | 13 | 55 | 4213 | 14 |
| *E. faecalis* | 32 | 863 | 21 | 45 | 1622 | 24 | 47 | 1617 | 22 | 55 | 2004 | 23 |
| *E. faecium* | 46 | 558 | 22 | 45 | 771 | 27 | 47 | 958 | 21 | 54 | 1085 | 20 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

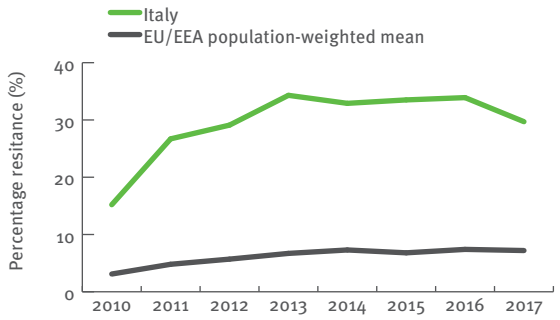
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Italy and EU/EEA population-weighted mean, 2010–2017**



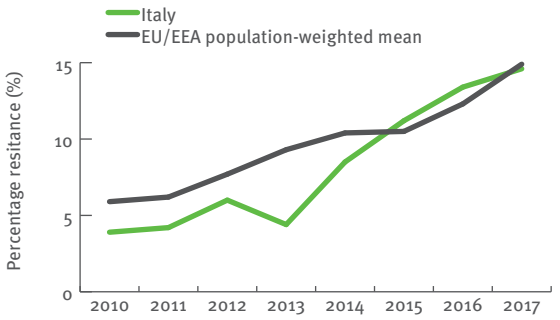

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Italy and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Italy and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Italy and EU/EEA population-weighted mean, 2010–2017**



# Latvia

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Latvia, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 90 | 90 | 90 | 90 |
| Population sample representativeness | Medium | Medium | High | High |
| Hospital sample representativeness | Medium | Medium | Medium | Medium |
| Blood culture sets/1000 patient-days | 5.7 | 6.7 | 6.6 | 6.1 |
| Isolate sample representativeness | Medium | Medium | Medium | Medium |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Latvia, 2014–2017

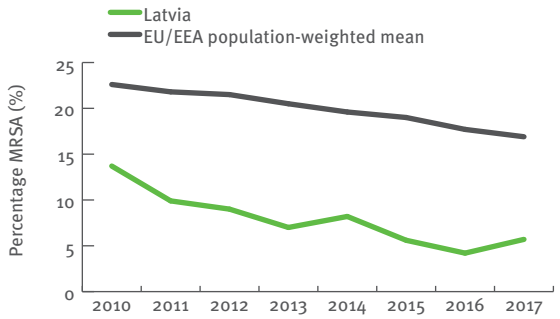
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 100 | 94 | 88 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 13 | 13 | 27 | 21 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Latvia 2014–2017

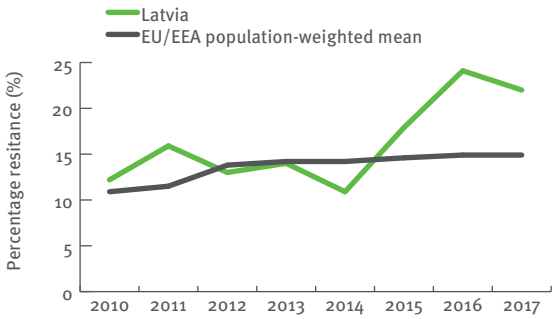
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 10 | 182 | 33 | 11 | 201 | 29 | 11 | 253 | 18 | 12 | 205 | 20 |
| *K. pneumoniae* | 12 | 118 | 47 | 11 | 115 | 51 | 8 | 95 | 33 | 7 | 116 | 41 |
| *P. aeruginosa* | 6 | 18 | 44 | 6 | 13 | 15 | 5 | 16 | 31 | 4 | 14 | 64 |
| *Acinetobacter* spp. | 6 | 52 | 60 | 6 | 61 | 56 | 7 | 82 | 56 | 7 | 34 | 62 |
| *S. pneumoniae* | 7 | 51 | 71 | 9 | 64 | 53 | 8 | 63 | 60 | 9 | 53 | 38 |
| *S. aureus* | 13 | 222 | 25 | 15 | 253 | 18 | 14 | 286 | 19 | 11 | 229 | 22 |
| *E. faecalis* | 8 | 44 | 30 | 10 | 60 | 37 | 12 | 89 | 33 | 8 | 74 | 36 |
| *E. faecium* | 6 | 35 | 37 | 10 | 34 | 47 | 6 | 56 | 46 | 5 | 39 | 54 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

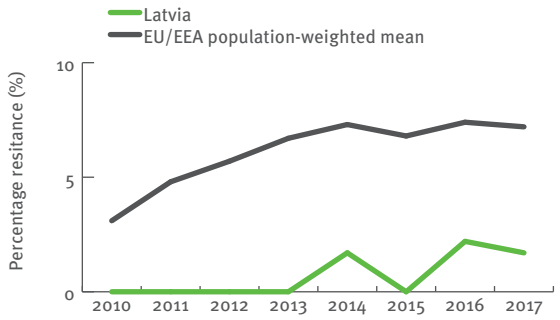
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Latvia and EU/EEA population-weighted mean, 2010–2017**



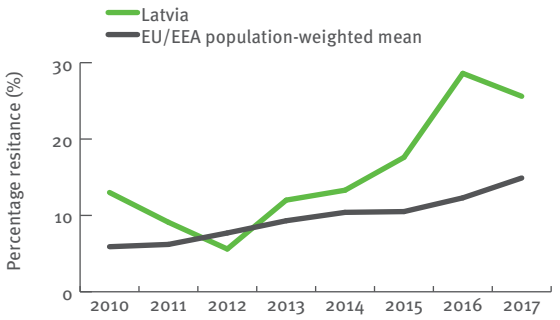

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Latvia and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Latvia and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Latvia and EU/EEA population-weighted mean, 2010–2017**



# Lithuania

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Lithuania, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | Unknown | 90 | 100 | 100 |
| Population sample representativeness | Unknown | High | High | High |
| Hospital sample representativeness | Unknown | Unknown | High | High |
| Blood culture sets/1000 patient-days | Unknown | Unknown | 7.1 | 6.3 |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Lithuania, 2014–2017

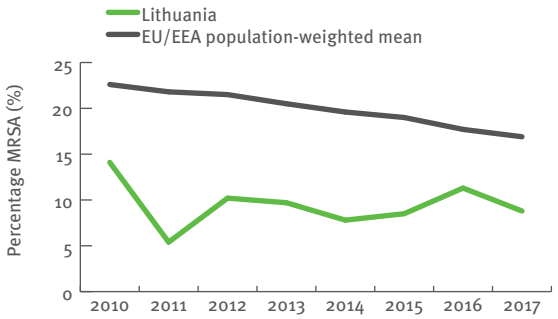
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 91 | 100 | 100 | 94 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 80 | 100 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Lithuania 2014–2017

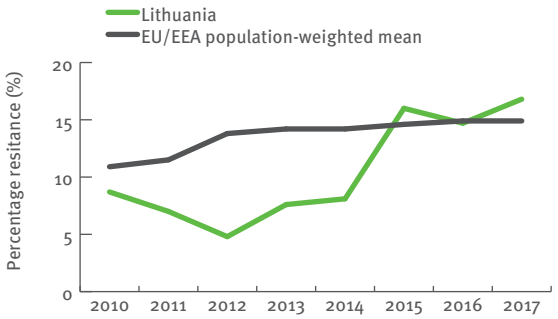
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 13 | 594 | 18 | 15 | 583 | 22 | 17 | 797 | 21 | 16 | 852 | 19 |
| *K. pneumoniae* | 12 | 154 | 38 | 12 | 179 | 39 | 16 | 326 | 31 | 15 | 326 | 30 |
| *P. aeruginosa* | 9 | 31 | 52 | 9 | 41 | 37 | 13 | 74 | 36 | 13 | 89 | 36 |
| *Acinetobacter* spp. | 11 | 66 | 52 | 11 | 73 | 62 | 11 | 87 | 64 | 12 | 87 | 56 |
| *S. pneumoniae* | 10 | 67 | 39 | 14 | 87 | 41 | 12 | 99 | 24 | 14 | 109 | 24 |
| *S. aureus* | 13 | 383 | 22 | 14 | 376 | 24 | 17 | 505 | 22 | 16 | 515 | 19 |
| *E. faecalis* | 12 | 78 | 38 | 12 | 81 | 37 | 13 | 86 | 25 | 13 | 111 | 23 |
| *E. faecium* | 10 | 44 | 23 | 8 | 52 | 40 | 13 | 61 | 38 | 13 | 80 | 31 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

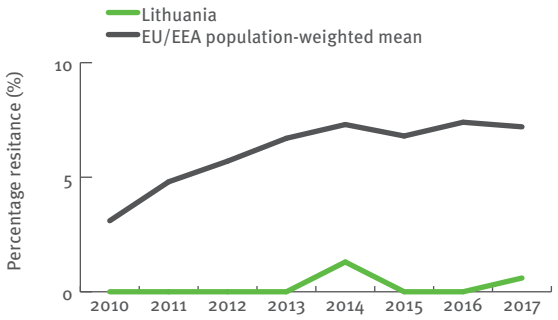
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Lithuania and EU/EEA population-weighted mean, 2010–2017**



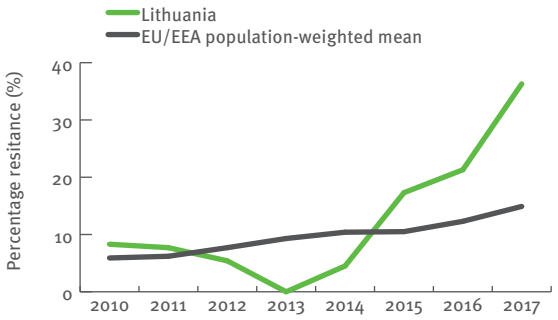

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Lithuania and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Lithuania and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Lithuania and EU/EEA population-weighted mean, 2010–2017**



# Luxembourg

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Luxembourg, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 100 | 100 | 100 | Unknown |
| Population sample representativeness | High | High | High | Unknown |
| Hospital sample representativeness | Unknown | Unknown | Unknown | Unknown |
| Blood culture sets/1000 patient-days | Unknown | Unknown | 26.0 | Unknown |
| Isolate sample representativeness | Unknown | Unknown | Unknown | Unknown |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Luxembourg, 2014–2017

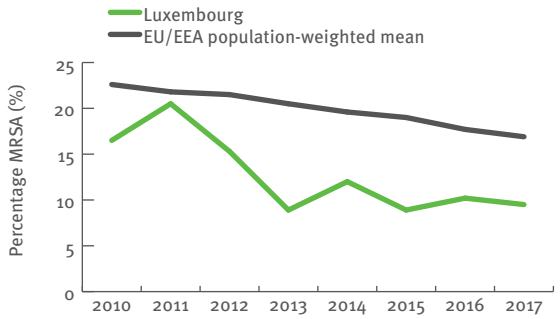
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 83 | 100 | 50 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 67 | 60 | 80 | 80 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Luxembourg 2014–2017

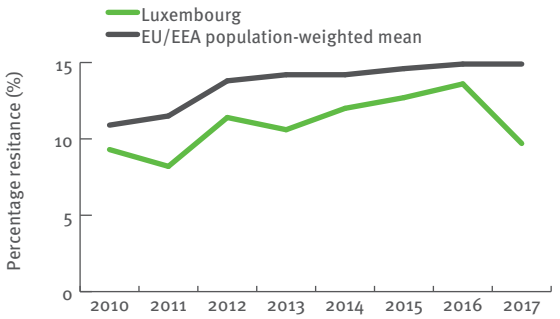
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 5 | 371 | 7 | 5 | 347 | 7 | 4 | 419 | 11 | 4 | 433 | 8 |
| *K. pneumoniae* | 4 | 66 | 10 | 4 | 60 | 19 | 4 | 78 | 25 | 4 | 99 | 21 |
| *P. aeruginosa* | 5 | 42 | 13 | 4 | 28 | 17 | 4 | 40 | 15 | 4 | 56 | 21 |
| *Acinetobacter* spp. | 3 | 6 | 20 | 2 | 8 | 0 | 2 | 8 | 38 | 2 | 8 | 0 |
| *S. pneumoniae* | 5 | 35 | 12 | 5 | 29 | 17 | 4 | 51 | 10 | 4 | 49 | 12 |
| *S. aureus* | 5 | 125 | 19 | 7 | 135 | 21 | 4 | 188 | 25 | 4 | 200 | 17 |
| *E. faecalis* | 5 | 45 | 23 | 5 | 58 | 17 | 4 | 48 | 24 | 4 | 87 | 27 |
| *E. faecium* | 4 | 32 | 41 | 4 | 23 | 55 | 4 | 31 | 20 | 4 | 34 | 32 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

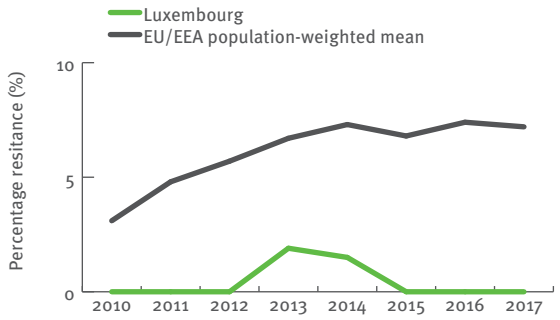
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Luxembourg and EU/EEA population-weighted mean, 2010–2017**



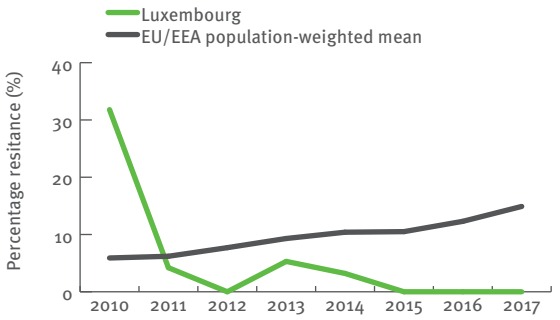

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Luxembourg and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Luxembourg and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Luxembourg and EU/EEA population-weighted mean, 2010–2017**



# Malta

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Malta, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 95 | 95 | 95 | 95 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days | 21.0 | 22.7 | 25.0 | 26.3 |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Malta, 2014–2017

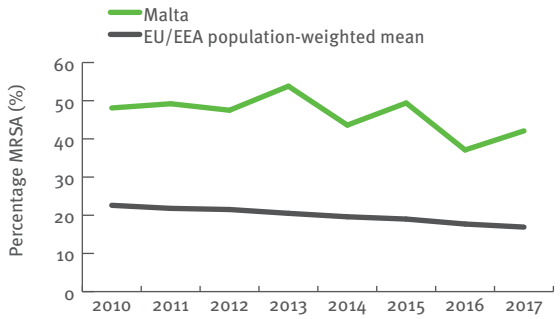
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 100 | 100 | 100 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 100 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Malta 2014–2017

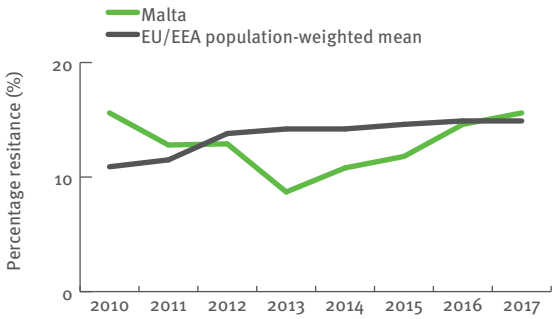
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 1 | 268 | 2 | 1 | 238 | 2 | 1 | 328 | 4 | 1 | 314 | 1 |
| *K. pneumoniae* | 1 | 99 | 11 | 1 | 88 | 10 | 1 | 102 | 9 | 1 | 117 | 10 |
| *P. aeruginosa* | 1 | 36 | 18 | 1 | 25 | 8 | 1 | 40 | 5 | 1 | 37 | 19 |
| *Acinetobacter* spp. | 1 | 10 | 20 | 1 | 15 | 0 | 1 | 7 | 14 | 1 | 9 | 0 |
| *S. pneumoniae* | 1 | 8 | 0 | 1 | 20 | 5 | 1 | 10 | 0 | 1 | 19 | 7 |
| *S. aureus* | 1 | 79 | 3 | 1 | 87 | 4 | 1 | 97 | 4 | 1 | 97 | 1 |
| *E. faecalis* | 1 | 30 | 3 | 1 | 31 | 7 | 1 | 33 | 0 | 1 | 29 | 5 |
| *E. faecium* | 1 | 11 | 0 | 1 | 6 | 0 | 1 | 12 | 25 | 1 | 13 | 10 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

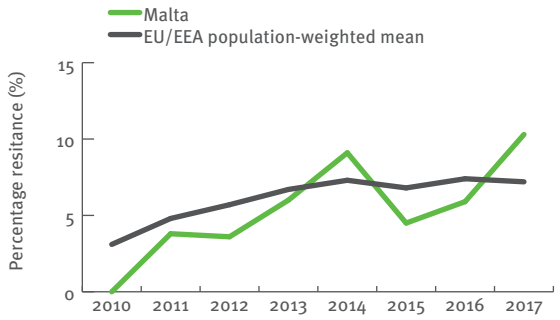
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Malta and EU/EEA population-weighted mean, 2010–2017**



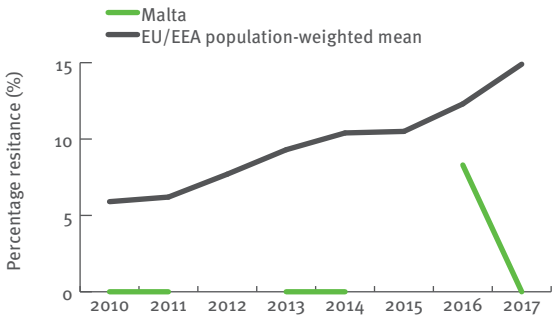

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Malta and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Malta and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Malta and EU/EEA population-weighted mean, 2010–2017**




As less than 10 isolates were reported for Malta for 2012 and 2015, no resistance percentages are displayed for these years.

# Netherlands

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Netherlands, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 65 | 65 | 65 | 65 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days | Unknown | Unknown | Unknown | Unknown |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Netherlands, 2014–2017

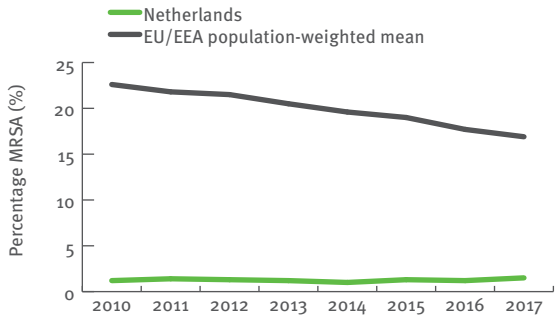
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 82 | 73 | 85 | 85 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 96 | 93 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Netherlands 2014–2017

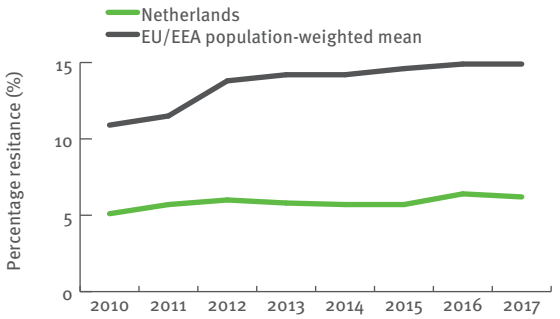
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 35 | 6514 | 10 | 27 | 5380 | 10 | 32 | 6398 | 9 | 33 | 6687 | 7 |
| *K. pneumoniae* | 35 | 926 | 14 | 27 | 908 | 13 | 32 | 1135 | 11 | 33 | 1190 | 11 |
| *P. aeruginosa* | 35 | 555 | 24 | 27 | 502 | 22 | 31 | 543 | 14 | 33 | 657 | 17 |
| *Acinetobacter* spp. | 26 | 75 | 22 | 21 | 74 | 19 | 31 | 108 | 13 | 30 | 122 | 21 |
| *S. pneumoniae* | 35 | 1406 | 16 | 27 | 1301 | 15 | 32 | 1517 | 12 | 33 | 1511 | 10 |
| *S. aureus* | 35 | 2580 | 15 | 27 | 2107 | 15 | 32 | 2702 | 11 | 33 | 2695 | 11 |
| *E. faecalis* | 35 | 721 | 23 | 27 | 648 | 22 | 32 | 783 | 21 | 33 | 895 | 19 |
| *E. faecium* | 34 | 535 | 50 | 27 | 572 | 53 | 32 | 686 | 50 | 33 | 808 | 47 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

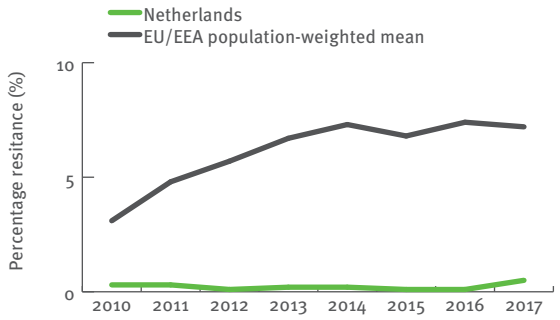
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Netherlands and EU/EEA population-weighted mean, 2010–2017**



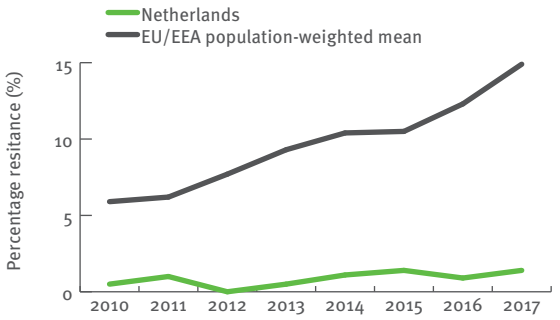

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Netherlands and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Netherlands and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Netherlands and EU/EEA population-weighted mean, 2010–2017**



# Norway

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Norway, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 100 | 100 | 100 | 100 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | Unknown | Unknown | Unknown | High |
| Blood culture sets/1000 patient-days | 55.4 | 56.9 | 63.2 | Unknown |
| Isolate sample representativeness | Unknown | Unknown | Unknown | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Norway, 2014–2017

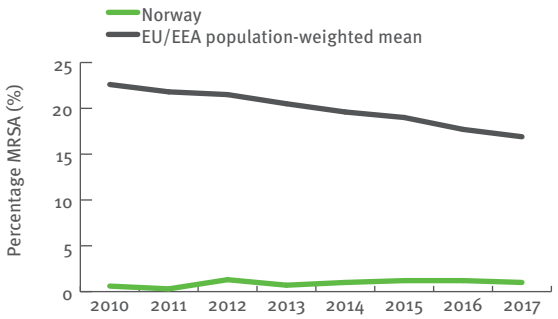
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 89 | 100 | 95 | 95 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 100 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Norway 2014–2017

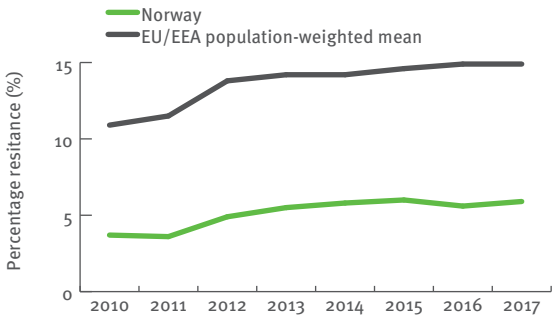
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 19 | 3422 | 4 | 18 | 3302 | 4 | 18 | 3618 | 4 | 18 | 3734 | 3 |
| *K. pneumoniae* | 18 | 746 | 5 | 18 | 701 | 6 | 18 | 811 | 5 | 18 | 781 | 4 |
| *P. aeruginosa* | 19 | 257 | 7 | 18 | 230 | 7 | 18 | 227 | 5 | 18 | 205 | 5 |
| *Acinetobacter* spp. | 13 | 34 | 3 | 11 | 32 | 13 | 12 | 33 | 6 | 12 | 31 | 10 |
| *S. pneumoniae* | 19 | 536 | 7 | 18 | 429 | 5 | 18 | 504 | 3 | 18 | 482 | 6 |
| *S. aureus* | 19 | 1546 | 6 | 18 | 1457 | 6 | 18 | 1485 | 4 | 18 | 1507 | 5 |
| *E. faecalis* | 19 | 536 | 6 | 18 | 439 | 5 | 18 | 530 | 6 | 18 | 526 | 5 |
| *E. faecium* | 18 | 228 | 11 | 18 | 186 | 11 | 18 | 215 | 15 | 18 | 209 | 10 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

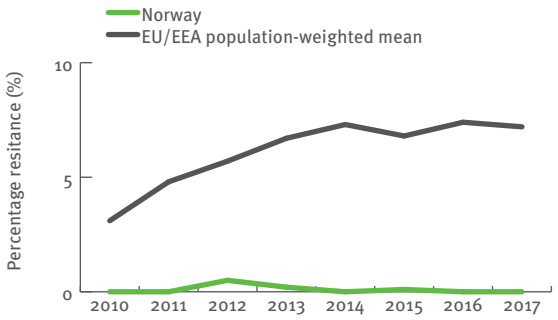
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Norway and EU/EEA population-weighted mean, 2010–2017**



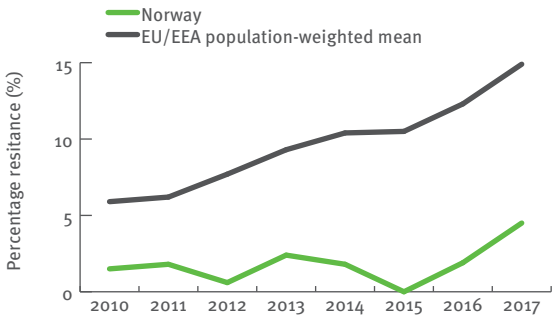

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Norway and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Norway and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Norway and EU/EEA population-weighted mean, 2010–2017**



# Poland

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Poland, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 11 | 14 | 20 | 19 |
| Population sample representativeness | Medium | Medium | Medium/ High | Medium/ High |
| Hospital sample representativeness | Medium | Medium | High | High |
| Blood culture sets/1000 patient-days | 28.3 | 31.9 | 30.3 | 38.1 |
| Isolate sample representativeness | Medium | Medium | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Poland, 2014–2017

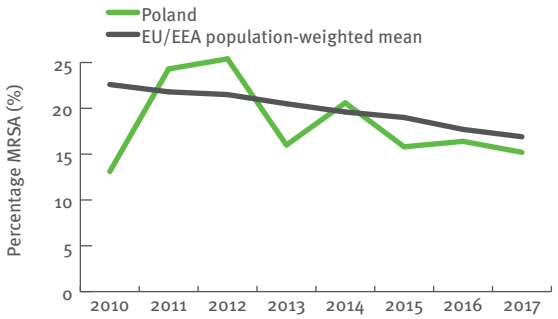
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 96 | 93 | 92 | 96 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 100 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Poland 2014–2017

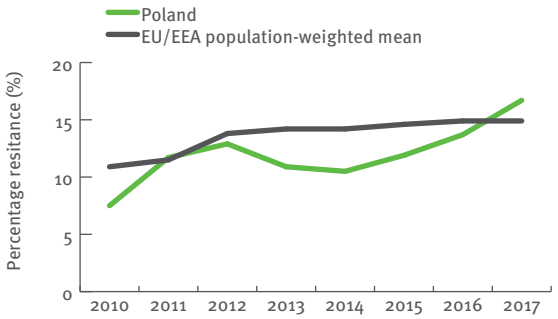
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 32 | 1096 | 11 | 48 | 1616 | 12 | 67 | 2735 | 13 | 65 | 2881 | 28 |
| *K. pneumoniae* | 32 | 466 | 33 | 47 | 679 | 36 | 66 | 1142 | 35 | 65 | 1203 | 41 |
| *P. aeruginosa* | 30 | 187 | 43 | 40 | 260 | 38 | 60 | 403 | 32 | 64 | 417 | 45 |
| *Acinetobacter* spp. | 27 | 189 | 58 | 38 | 246 | 59 | 53 | 394 | 50 | 56 | 352 | 59 |
| *S. pneumoniae* | 31 | 133 | 14 | 40 | 230 | 14 | 57 | 343 | 14 | 60 | 374 | 30 |
| *S. aureus* | 32 | 750 | 14 | 48 | 1192 | 16 | 65 | 1842 | 16 | 66 | 1848 | 32 |
| *E. faecalis* | 29 | 272 | 35 | 47 | 432 | 37 | 65 | 743 | 29 | 65 | 758 | 46 |
| *E. faecium* | 28 | 185 | 36 | 41 | 216 | 37 | 55 | 405 | 30 | 60 | 410 | 43 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

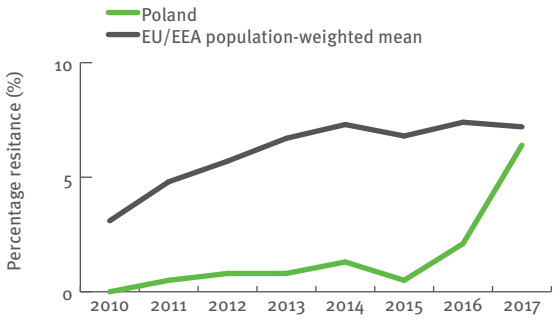
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Poland and EU/EEA population-weighted mean, 2010–2017**



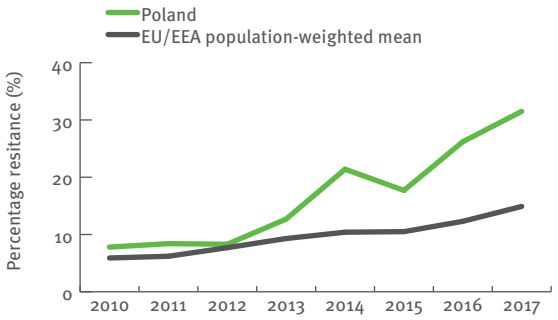

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Poland and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Poland and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Poland and EU/EEA population-weighted mean, 2010–2017**



# Portugal

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Portugal, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 95 | 96 | 97 | 97 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days | 196.8 | 195.4 | Unknown | 148.1 |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Portugal, 2014–2017

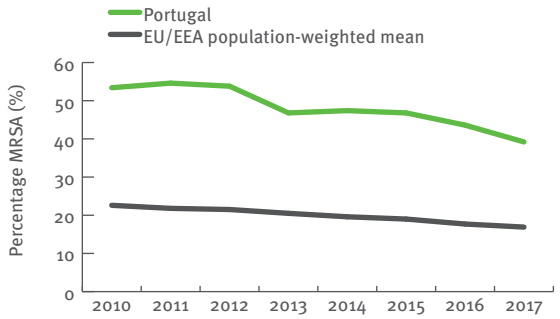
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 94 | 92 | 88 | 88 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 98 | 97 | 99 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Portugal 2014–2017

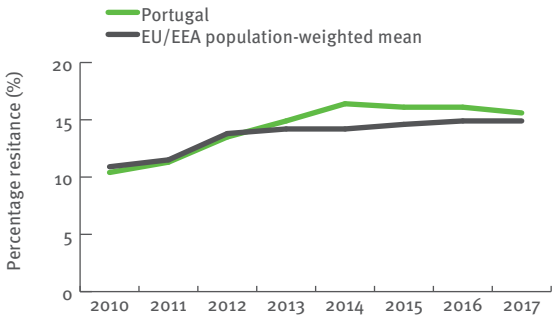
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 56 | 5027 | 4 | 58 | 5377 | 5 | 60 | 5786 | 4 | 62 | 6452 | 4 |
| *K. pneumoniae* | 53 | 1714 | 9 | 58 | 2099 | 10 | 59 | 2352 | 10 | 61 | 2743 | 9 |
| *P. aeruginosa* | 51 | 1064 | 12 | 56 | 1192 | 15 | 57 | 1230 | 13 | 57 | 1220 | 12 |
| *Acinetobacter* spp. | 40 | 266 | 24 | 43 | 312 | 17 | 39 | 207 | 21 | 36 | 174 | 16 |
| *S. pneumoniae* | 50 | 668 | 3 | 51 | 843 | 3 | 57 | 928 | 2 | 54 | 1056 | 1 |
| *S. aureus* | 53 | 3241 | 8 | 57 | 3645 | 7 | 59 | 3482 | 7 | 64 | 3789 | 5 |
| *E. faecalis* | 50 | 1324 | 16 | 53 | 981 | 10 | 56 | 972 | 1 | 58 | 1014 | 8 |
| *E. faecium* | 42 | 634 | 26 | 43 | 459 | 22 | 45 | 411 | 2 | 46 | 467 | 16 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

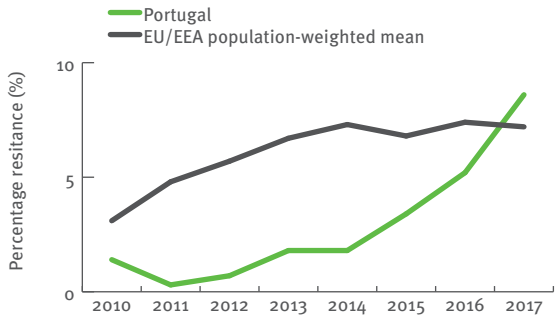
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Portugal and EU/EEA population-weighted mean, 2010–2017**



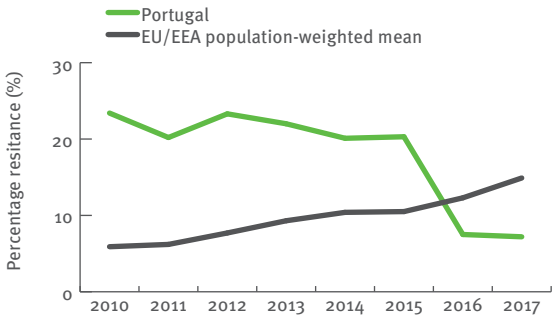

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Portugal and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Portugal and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Portugal and EU/EEA population-weighted mean, 2010–2017**



# Romania

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Romania, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | Unknown | 15 | Unknown | Unknown |
| Population sample representativeness | Unknown | Unknown | Unknown | Unknown |
| Hospital sample representativeness | Unknown | Unknown | Unknown | Unknown |
| Blood culture sets/1000 patient-days | 24.4 | Unknown | Unknown | Unknown |
| Isolate sample representativeness | Unknown | Unknown | Unknown | Unknown |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Romania, 2014–2017

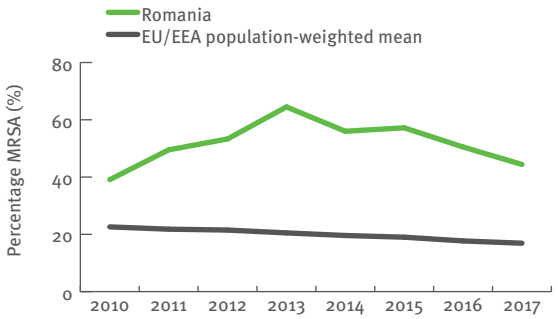
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 95 | 94 | 87 | 93 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 28 | 31 | 38 | 77 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Romania 2014–2017

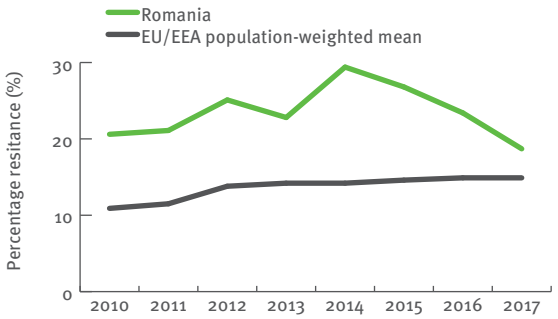
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 16 | 309 | 8 | 12 | 371 | 10 | 13 | 420 | 10 | 14 | 518 | 12 |
| *K. pneumoniae* | 16 | 258 | 39 | 13 | 271 | 39 | 13 | 344 | 38 | 14 | 339 | 40 |
| *P. aeruginosa* | 15 | 94 | 40 | 11 | 92 | 49 | 13 | 93 | 39 | 14 | 132 | 45 |
| *Acinetobacter* spp. | 16 | 124 | 67 | 13 | 190 | 56 | 13 | 160 | 54 | 12 | 183 | 70 |
| *S. pneumoniae* | 12 | 50 | 8 | 9 | 70 | 1 | 8 | 60 | 12 | 11 | 81 | 21 |
| *S. aureus* | 15 | 399 | 19 | 13 | 424 | 21 | 14 | 495 | 25 | 14 | 535 | 21 |
| *E. faecalis* | 15 | 102 | 25 | 12 | 113 | 21 | 13 | 115 | 34 | 14 | 128 | 33 |
| *E. faecium* | 12 | 56 | 45 | 10 | 72 | 35 | 13 | 78 | 46 | 13 | 64 | 44 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

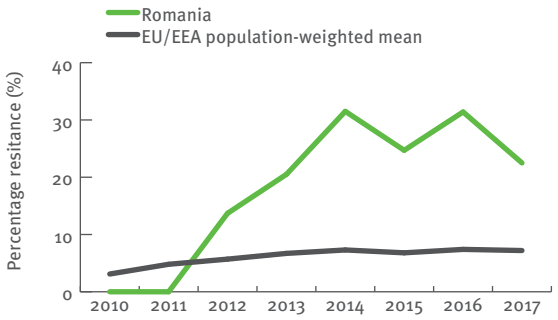
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Romania and EU/EEA population-weighted mean, 2010–2017**



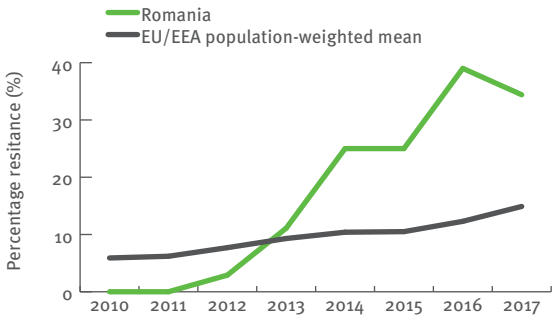

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Romania and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Romania and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Romania and EU/EEA population-weighted mean, 2010–2017**



# Slovakia

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Slovakia, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 75 | 75 | 70 | 68 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days | 19.4 | 20.1 | 20.3 | 20.8 |
| Isolate sample representativeness | Unknown | Unknown | Unknown | Unknown |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Slovakia, 2014–2017

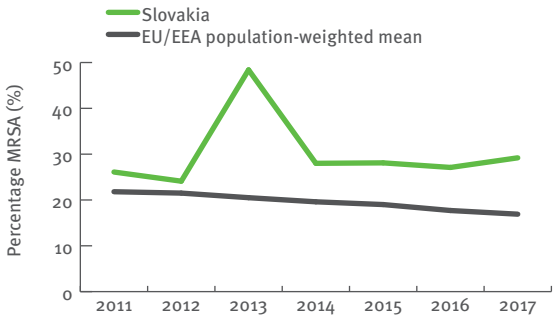
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 100 | 100 | 100 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 100 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Slovakia 2014–2017

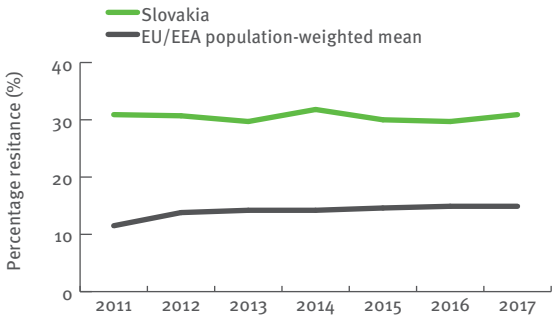
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 14 | 889 | 11 | 14 | 896 | 14 | 13 | 829 | 14 | 13 | 882 | 13 |
| *K. pneumoniae* | 14 | 494 | 30 | 14 | 475 | 31 | 13 | 466 | 26 | 13 | 468 | 28 |
| *P. aeruginosa* | 14 | 276 | 30 | 14 | 278 | 35 | 12 | 191 | 35 | 13 | 211 | 27 |
| *Acinetobacter* spp. | 14 | 171 | 37 | 14 | 154 | 33 | 13 | 115 | 32 | 13 | 126 | 35 |
| *S. pneumoniae* | 9 | 32 | 47 | 9 | 34 | 35 | 5 | 13 | 31 | 10 | 40 | 28 |
| *S. aureus* | 14 | 640 | 16 | 14 | 583 | 16 | 13 | 572 | 19 | 13 | 614 | 16 |
| *E. faecalis* | 13 | 282 | 29 | 14 | 255 | 31 | 13 | 233 | 22 | 13 | 226 | 28 |
| *E. faecium* | 13 | 129 | 25 | 14 | 146 | 36 | 12 | 126 | 27 | 11 | 122 | 32 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

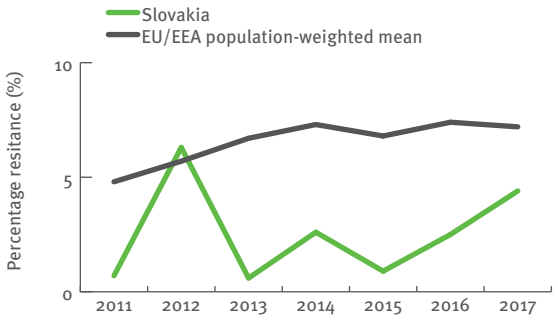
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Slovakia and EU/EEA population-weighted mean, 2011–2017**



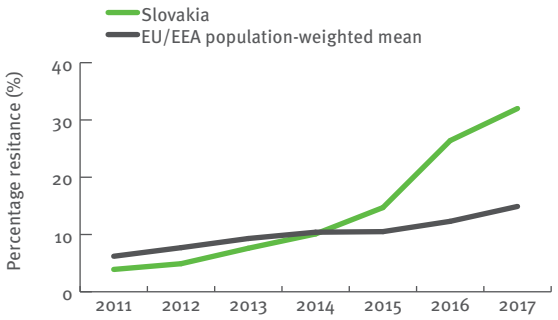

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Slovakia and EU/EEA population-weighted mean, 2011–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Slovakia and EU/EEA population-weighted mean, 2011–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Slovakia and EU/EEA population-weighted mean, 2011–2017**



# Slovenia

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Slovenia, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 99 | 99 | 99 | 99 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days | 34.8 | 35.1 | 35.0 | 41.2 |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Slovenia, 2014–2017

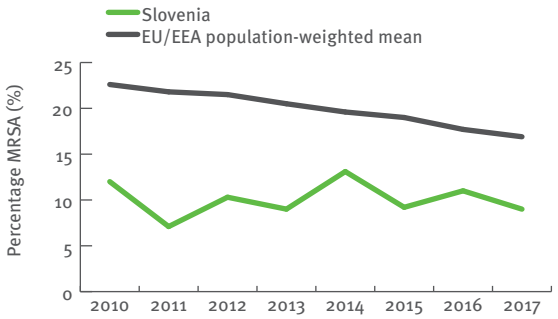
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 100 | 100 | 100 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 91 | 91 | 91 | 91 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Slovenia 2014–2017

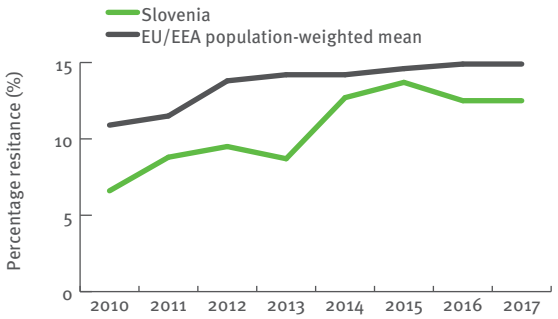
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 10 | 1216 | 8 | 10 | 1326 | 8 | 10 | 1420 | 10 | 10 | 1435 | 9 |
| *K. pneumoniae* | 10 | 233 | 18 | 10 | 237 | 17 | 10 | 267 | 19 | 10 | 312 | 18 |
| *P. aeruginosa* | 9 | 112 | 34 | 10 | 141 | 26 | 10 | 143 | 38 | 10 | 138 | 28 |
| *Acinetobacter* spp. | 8 | 34 | 35 | 7 | 31 | 29 | 7 | 60 | 35 | 4 | 36 | 50 |
| *S. pneumoniae* | 10 | 300 | 9 | 10 | 323 | 14 | 10 | 269 | 12 | 10 | 319 | 10 |
| *S. aureus* | 10 | 495 | 11 | 10 | 513 | 11 | 10 | 534 | 11 | 10 | 576 | 12 |
| *E. faecalis* | 10 | 120 | 23 | 10 | 133 | 17 | 10 | 161 | 24 | 10 | 171 | 16 |
| *E. faecium* | 10 | 115 | 38 | 9 | 124 | 34 | 9 | 111 | 42 | 9 | 149 | 41 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

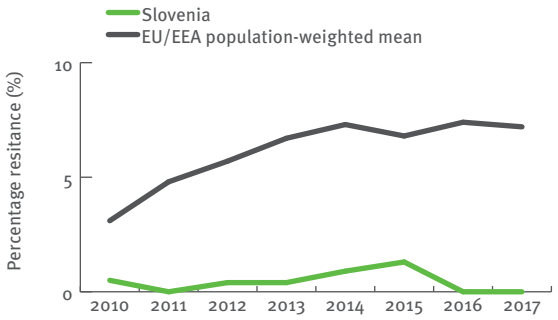
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Slovenia and EU/EEA population-weighted mean, 2010–2017**



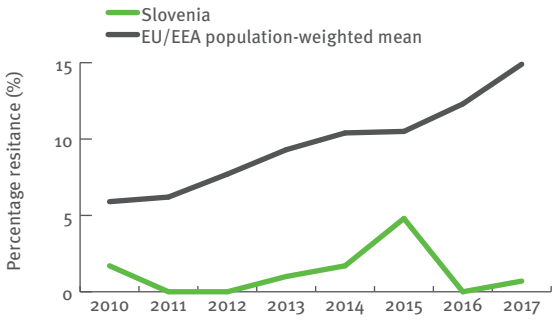

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Slovenia and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Slovenia and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Slovenia and EU/EEA population-weighted mean, 2010–2017**



# Spain

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Spain, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 39 | 40 | 38 | 37 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days | 43.7 | 46.2 | 60.4 | Unknown |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Spain, 2014–2017

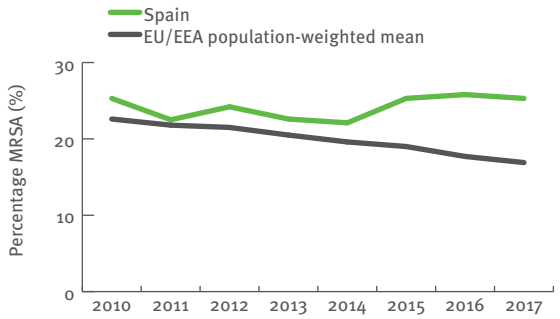
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 88 | 98 | 98 | 90 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 39 | 43 | 46 | 58 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Spain 2014–2017

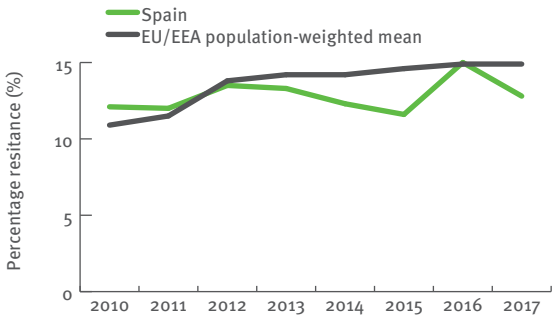
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 38 | 5824 | 5 | 40 | 6493 | 5 | 38 | 6800 | 5 | 36 | 5808 | 5 |
| *K. pneumoniae* | 39 | 1266 | 11 | 40 | 1510 | 12 | 38 | 1680 | 11 | 35 | 1446 | 11 |
| *P. aeruginosa* | 39 | 874 | 16 | 40 | 884 | 21 | 37 | 843 | 19 | 35 | 843 | 16 |
| *Acinetobacter* spp. | 23 | 83 | 24 | 26 | 96 | 41 | 24 | 106 | 37 | 21 | 88 | 47 |
| *S. pneumoniae* | 38 | 583 | 9 | 36 | 672 | 9 | 36 | 672 | 7 | 33 | 722 | 7 |
| *S. aureus* | 39 | 1943 | 10 | 39 | 2002 | 11 | 37 | 1972 | 10 | 36 | 1873 | 10 |
| *E. faecalis* | 39 | 998 | 15 | 39 | 992 | 15 | 37 | 986 | 13 | 35 | 931 | 14 |
| *E. faecium* | 37 | 554 | 17 | 38 | 580 | 15 | 35 | 630 | 18 | 34 | 574 | 15 |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

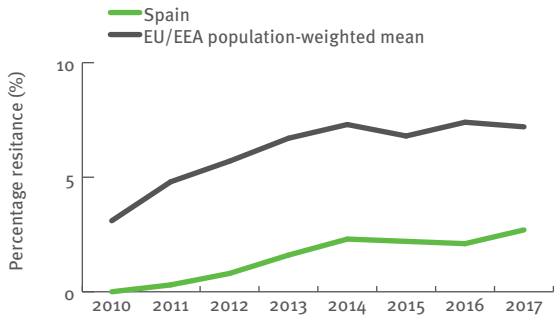
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Spain and EU/EEA population-weighted mean, 2010–2017**



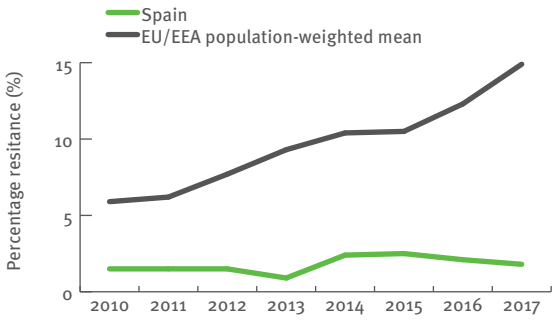

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Spain and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Spain and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Spain and EU/EEA population-weighted mean, 2010–2017**



# Sweden

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, Sweden, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | 73 | 75 | 75 | 57 |
| Population sample representativeness | High | High | High | High |
| Hospital sample representativeness | High | High | High | High |
| Blood culture sets/1000 patient-days | 118.8 | 128.2 | 139.0 | 156.7 |
| Isolate sample representativeness | High | High | High | High |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, Sweden, 2014–2017

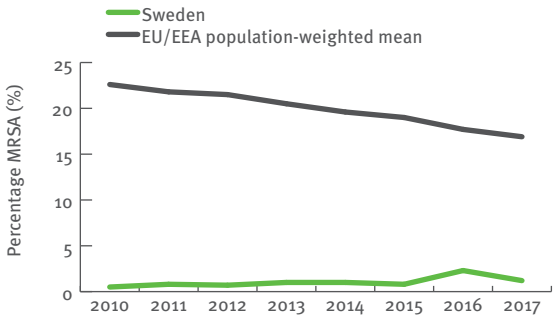
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 100 | 89 | 100 | 100 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 100 | 100 | 100 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), Sweden 2014–2017

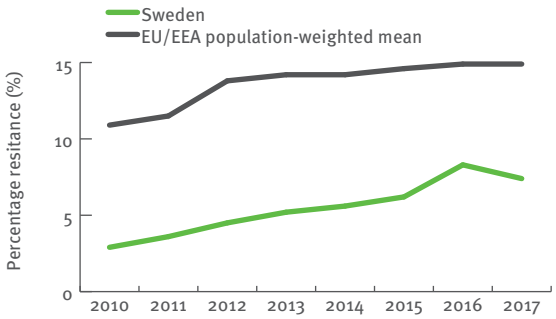
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 16 | 6549 | 1 | 17 | 6768 | Unknown | 14 | 6970 | Unknown | 10 | 5807 | Unknown |
| *K. pneumoniae* | 16 | 1000 | 3 | 17 | 1141 | Unknown | 15 | 1537 | Unknown | 10 | 1034 | Unknown |
| *P. aeruginosa* | 16 | 438 | Unknown | 17 | 435 | Unknown | 13 | 473 | Unknown | 10 | 446 | Unknown |
| *Acinetobacter* spp. | 10 | 52 | 7 | 9 | 35 | Unknown | 12 | 86 | Unknown | 1 | 54 | Unknown |
| *S. pneumoniae* | 16 | 792 | 1 | 17 | 867 | Unknown | 14 | 904 | Unknown | 11 | 755 | Unknown |
| *S. aureus* | 16 | 3501 | 3 | 17 | 3415 | Unknown | 15 | 3903 | Unknown | 11 | 3800 | Unknown |
| *E. faecalis* | 16 | 905 | 2 | 17 | 868 | Unknown | 14 | 1019 | Unknown | 11 | 1630 | Unknown |
| *E. faecium* | 16 | 453 | 9 | 17 | 412 | Unknown | 14 | 561 | Unknown | 11 | 622 | Unknown |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

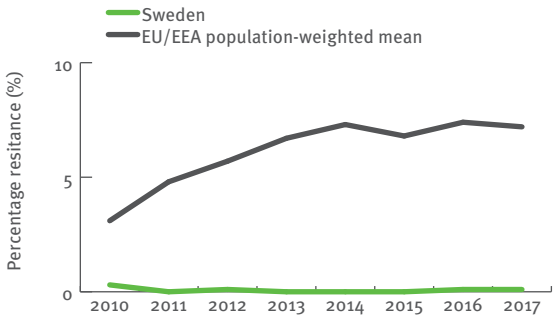
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), Sweden and EU/EEA population-weighted mean, 2010–2017**



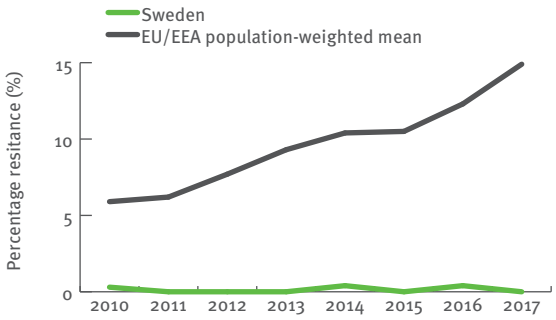

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, Sweden and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, Sweden and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, Sweden and EU/EEA population-weighted mean, 2010–2017**



# United Kingdom

### Coverage and representativeness of population, hospitals and isolates included in EARS-Net, United Kingdom, 2014–2017

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Estimated national population coverage (%) | Unknown | Unknown | Unknown | Unknown |
| Population sample representativeness | Unknown | Unknown | Unknown | Unknown |
| Hospital sample representativeness | Unknown | Unknown | Unknown | Unknown |
| Blood culture sets/1000 patient-days | 44.5 | 65.4 | 59.8 | 52.0 |
| Isolate sample representativeness | Unknown | Unknown | Unknown | Unknown |

### Laboratories contributing data to EARS-Net: participation in EARS-Net EQA and use of clinical guidelines, United Kingdom, 2014–2017

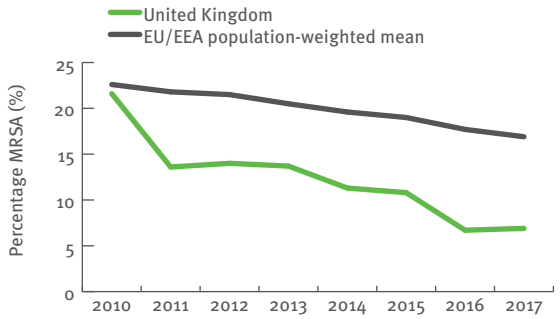
| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Percentage laboratories participating in EARS-Net EQA | 90 | 90 | 88 | 82 |
| Percentage laboratories using EUCAST or EUCAST harmonised guidelines | 100 | 98 | 98 | 96 |

### Annual number of reporting laboratories*, number of reported isolates and proportion of isolates reported from patients in intensive care units (ICU), United Kingdom 2014–2017

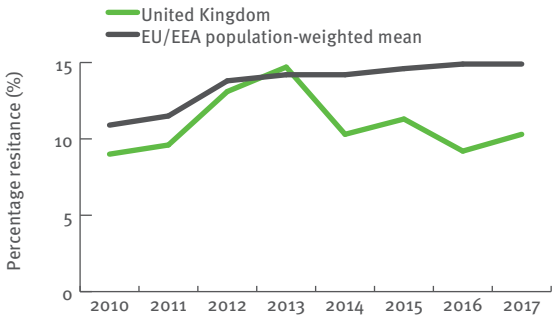
| Pathogen | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) | Laboratories (N) | Isolates (N) | Isolates from ICUs (%) |
| *E. coli* | 31 | 7369 | Unknown | 22 | 6117 | Unknown | 91 | 23714 | Unknown | 106 | 31579 | Unknown |
| *K. pneumoniae* | 29 | 1180 | Unknown | 22 | 1077 | Unknown | 89 | 4236 | Unknown | 105 | 5519 | Unknown |
| *P. aeruginosa* | 29 | 649 | Unknown | 22 | 541 | Unknown | 87 | 2187 | Unknown | 104 | 2911 | Unknown |
| *Acinetobacter* spp. | 27 | 129 | Unknown | 20 | 153 | Unknown | 77 | 615 | Unknown | 96 | 818 | Unknown |
| *S. pneumoniae* | 56 | 1418 | Unknown | 44 | 1126 | Unknown | 90 | 3522 | Unknown | 102 | 4373 | Unknown |
| *S. aureus* | 56 | 3569 | Unknown | 47 | 3125 | Unknown | 92 | 7798 | Unknown | 106 | 10031 | Unknown |
| *E. faecalis* | 29 | 512 | Unknown | 22 | 422 | Unknown | 87 | 1868 | Unknown | 103 | 2792 | Unknown |
| *E. faecium* | 28 | 433 | Unknown | 20 | 354 | Unknown | 85 | 1919 | Unknown | 101 | 2306 | Unknown |

* Number of laboratories reporting at least one isolate during the specific year. Total number of laboratories participating in EARS-Net might be higher.

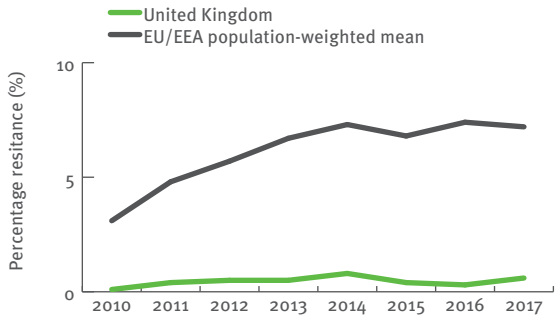
***Staphylococcus aureus*. Percentage (%) of invasive isolates with resistance to meticillin (MRSA), United Kingdom and EU/EEA population-weighted mean, 2010–2017**



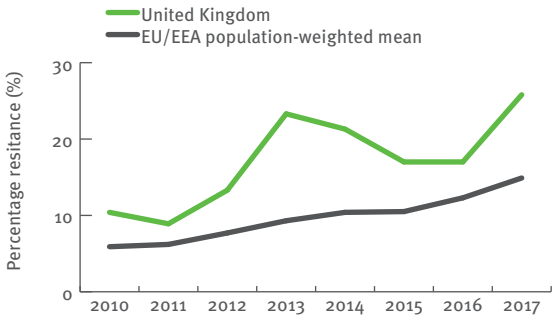

***Escherichia coli*. Percentage (%) of invasive isolates with resistance to third-generation cephalosporins, United Kingdom and EU/EEA population-weighted mean, 2010–2017**




***Klebsiella pneumoniae*. Percentage (%) of invasive isolates with resistance to carbapenems, United Kingdom and EU/EEA population-weighted mean, 2010–2017**




***Enterococcus faecium*. Percentage (%) of invasive isolates with resistance to vancomycin, United Kingdom and EU/EEA population-weighted mean, 2010–2017**



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