Antimicrobial Resistance (EARS-Net) Data in Ireland

2024

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Abbreviations

Abbreviation	Explanation
3GC	Third Generation Cephalosporins
ac -	Acinetobacter species
AMR	Antimicrobial Resistance
BSI	Bloodstream Infection
CAI	Community Acquired Infection
CLSI	Clinical and Laboratory Standards Institute
CPE	Carbapenemase Producing Enterobacterales
EARS	European Antimicrobial Resistance Surveillance
ECDC	European Centre for Disease Prevention and Control
eco	Escherichia coli
EEA	European Economic Area
efa	Enterococcus faecalis
efm	Enterococcus faecium
EQA	External Quality Assessment
ESBL	Extended Spectrum Beta Lactamase
EU	European Union
EUCAST	European Committee on Antimicrobial Susceptibility Testing
HAI	Healthcare Associated Infection
HPSC	Health Protection Surveillance Centre
iGAS	Invasive Group A Streptococcus
iGBS	Invasive Group B Streptococcus
KPC	Klebsiella pneumoniae carbapenemase
kpn	Klebsiella pneumoniae
MDR	Multi Drug Resistant
MIC	Minimum Inhibitory Concentration
MRSA	Meticillin Resistant Staphylococcus aureus

Abbreviation	Explanation
MSSA	Meticillin Susceptible Staphylococcus aureus
NDM	New Delhi Metallo Beta Lactamase
NWT	Non Wild Type
OXA	Oxacillinase
pae	Pseudomonas aeruginosa
RIS	Resistance, Susceptible at Increased Exposure, Susceptible
sau	Staphylococcus aureus
spn	Streptococcus pneumoniae
VREfm	Vancomycin Resistant Enterococcus faecium
VSEfm	Vancomycin Susceptible Enterococcus faecium
WHO	World Health Organization
WT	Wild Type

Introduction

Antimicrobial Resistance Surveillance

Infectious disease surveillance is important in monitoring and evaluating emerging patterns and trends of disease. It provides information for action, thus timely data collection, validation, analysis, feedback and reporting is very important. Through surveillance we can: describe the current burden and epidemiology of a disease, monitor trends over time, investigate emergence and spread of new pathogens and variants, inform policy makers for action, and observe the effects of interventions.

Surveillance data provide a basis for taking action to control AMR and the importance of data is highlighted in the European One Health Action Plan against Antimicrobial Resistance. Surveillance of AMR is listed as a special health issue in the Regulation (EU) 2022/2371 of the European Parliament and of the Council of 23 November 2022 on serious cross-border threats to health.

In addition, surveillance data is used by WHO to prepare a list of 'priority pathogens' that have developed resistance to key antibiotics used to treat the infections they cause and for which new antibiotics are urgently required. The main international AMR surveillance system in the EU is the European Antimicrobial Resistance Surveillance Network (EARS-Net). Many of the pathogens (drug-bug combinations) that are under EARS-Net surveillance are listed among the "high" or "critical" group by WHO.

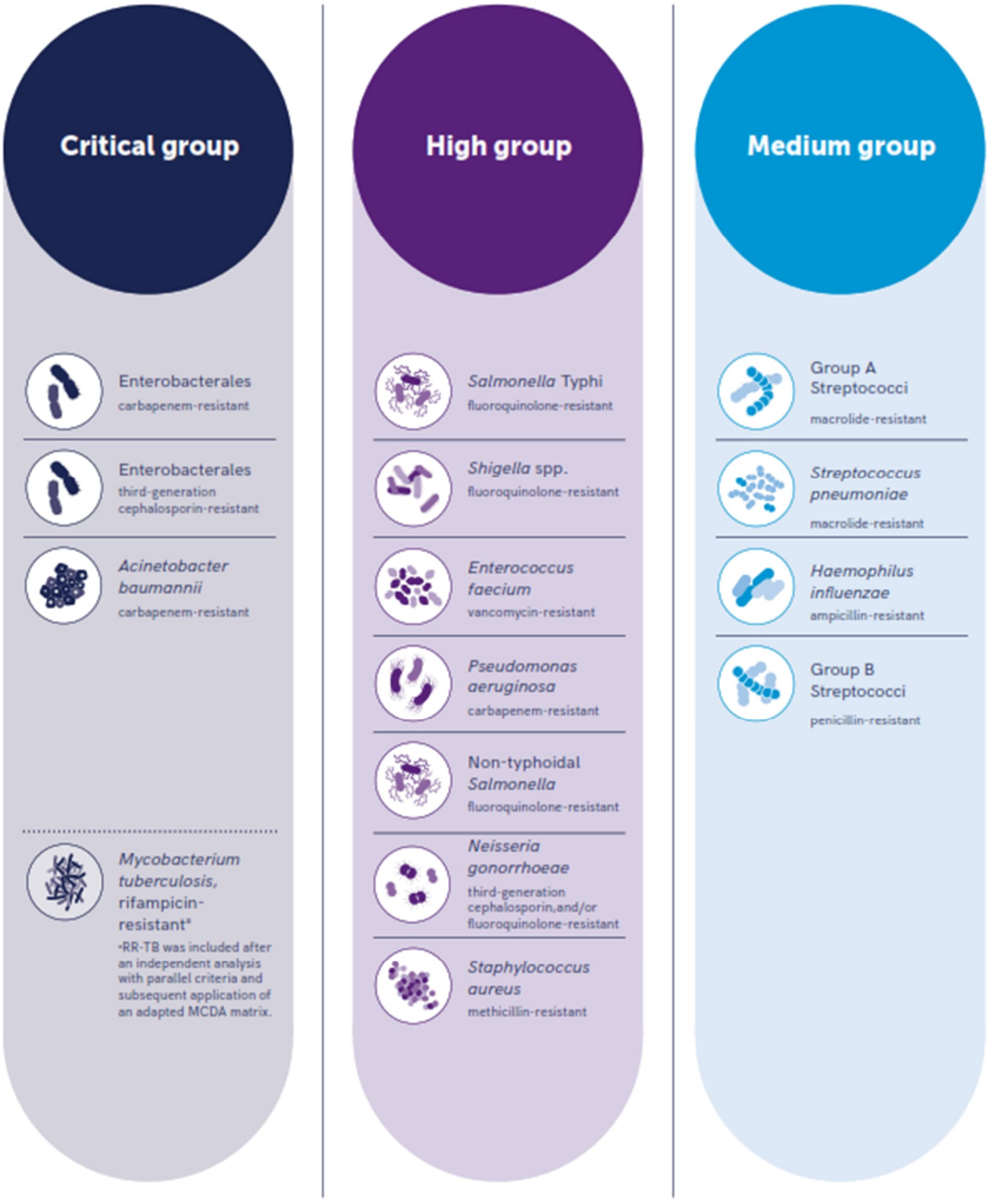


Figure 1: WHO Bacterial Priority Pathogens List, 2024

EARS-Net Background

The European Antimicrobial Resistance Surveillance System (EARSS), established in 1998, was the predecessor of EARS-Net. EARSS was initially funded by the European Commission's Directorate General for Health and Consumer Affairs and the Dutch Ministry of Health, Welfare and Sports. The network steadily grew and involved an increasing number of European countries. On 1 January 2010, the administration and coordination of EARSS was transferred to the European Centre for Disease Prevention and Control (ECDC). The network was renamed the 'European Antimicrobial Resistance Surveillance Network (EARS-Net)'. EARS-Net is the largest publicly funded system for antimicrobial resistance (AMR) surveillance in Europe.

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 annual external quality assessments (EQA).

More information on EARS-Net can be found on ECDC's website.

Methodology

EARS-Net collects antimicrobial resistance data on the first invasive isolate (from blood or cerebrospinal fluid) for each of the eight EARS-Net pathogens listed below, per patient, per year:

- *Escherichia coli*
- *Staphylococcus aureus*
- *Klebsiella pneumoniae*
- *Enterococcus faecium*
- *Streptococcus pneumoniae*
- *Enterococcus faecalis*
- *Pseudomonas aeruginosa*
- *Acinetobacter* species

Routinely-generated qualitative (RIS) and quantitative (MIC) data from laboratories on key antibiotics for eight pathogens under surveillance data is sent to HPSC. In addition, HPSC collects data on 3 non-EARS-Net pathogens. These are invasive isolates of Group A Streptococcus, Group B Streptococcus and *Candida* species.

Nationally, data are stored in WHONET format (a free software from WHO, which is versatile for collecting, storing and analysing AMR data) and in an Access Database at HPSC. Data analyses and reporting is done through RStudio which is a programming software for statistical computing and graphics.

EARS-Net at ECDC requires that countries submit data only from laboratories using EUCAST guidelines. Data from laboratories still following CLSI guidelines are included in the national data for this report but are not submitted to ECDC. Therefore, the numbers, proportions, and rates in this report will differ from those produced by ECDC later this year. ECDC will publish its 2024 Annual Epidemiological Report in November 2025, in advance of European Antibiotic Awareness Day.

EARS-Net laboratories are also required to participate in the annual EARS-Net EQA exercise.

National Results

Key Points

Participation by laboratories and population coverage

- EARS-Net 2024 data were reported by 32 laboratories, representing approx. 82% coverage of the Irish population. This is a substantial drop from the 96-100% coverage seen over the previous four years.
- Four laboratories, including two representing tertiary (HSE Model 4) hospitals, did not submit data for 2024 due to staffing issues.
- In 2024, 31 of 34 laboratories in Ireland following EUCAST guidelines participated in the mandatory EARS-Net external quality assurance (EQA) exercise.

Use of recommended EUCAST guidelines

- As of 2022, ECDC mandated that all laboratories submitting data to EARS-Net should use EUCAST breakpoints and methods for antimicrobial susceptibility testing. At the end of 2024, two Irish laboratories were still reporting using CLSI guidelines. Consequently, there are slight differences between the data reported nationally in this report with what Ireland reports to EARS-Net at ECDC. For data from 2025 onwards, it is proposed that only data from EUCAST laboratories in Ireland be accepted by HPSC.

Overall numbers of cases reported

- Data were received on 6,138 invasive isolates of the eight EARS-Net pathogens, which is lower than in 2023 when 6,980 isolates were reported (34 laboratories; 96% coverage). However, when comparing the data for the 31 labs reporting in both years, there was a 4% increase in the numbers (2023, n=5,860).
- There was an increase in the number of cases reported for four of the eight pathogens, with the biggest increase seen for *S. pneumoniae* (+19%) followed by *P. aeruginosa* (+9%), *K. pneumoniae* (+7%) and *E. coli* (+6%). Two pathogens saw decreasing numbers, *E. faecalis* (-12%) and *S. aureus* (-3%); while numbers were stable for *E. faecium* and *Acinetobacter* spp.
- Of the three additional pathogens (not part of ECDC's EARS-Net surveillance), there was an increase in the numbers of Group B streptococci (+17%) compared with a decrease for both Group A streptococci (-46%; which follows the upsurge in iGAS cases between late 2022 and summer 2023), and *Candida* spp. (-27%).

Key resistance findings

- In 2024, the proportion of meticillin-resistant *S. aureus* (%MRSA) increased to 10.7% (2023,9.6%). The MRSA incidence rate increased to 0.31 cases per 1,000 patient days (2023, 0.30). Despite the rise in MRSA, the incidence rates of MSSA and overall *S. aureus* BSI decreased over the same period.
- The proportion of vancomycin-resistant *E. faecium* (%VREfm) increased slightly to 21.8% in 2024 (2023, 21.4%); however, the five-year trend is still significantly downwards. The VREfm incidence rate decreased to 0.30 cases per 1,000 patient days (2023, 0.31). In

addition, the VSEfm and total *E. faecium* incidence rates also decreased over the same period.

- Carbapenem resistance remains at low levels among *E. coli* (0.1%), *K. pneumoniae* (1.2%), *P. aeruginosa* (5.2%) and *Acinetobacter* spp. (0%) in Ireland compared to the EU/EEA population-weighted mean AMR percentage in 2023 of 0.3%, 13.3%, 18.6% and 40.1%, respectively. Carbapenem-resistant *K. pneumoniae* and *Acinetobacter* spp. remain major threats to public health in Europe, with WHO listing both as pathogens of critical priority in its global bacterial priority pathogen list 2024.
- Among the *Candida* spp. reported, there were no *Candida auris* isolates, which are typically resistant to fluconazole.

Table 1: Number of laboratories participating over the latest 5-year period and population coverage

	2020	2021	2022	2023	2024
Total Number of Laboratories	38	37	36	36	36
Number of Participating Laboratories	38	37	35	34	32
Population Coverage (%)	100	100	97	96	82

EU/EEA targets on Antimicrobial Resistance

In 2023, following a proposal from the European Commission, the Council of the European Union set targets to reduce the total EU incidence of the following AMR organisms from bloodstream infections across the EU/EEA by 2030 compared with the baseline year of 2019*:

- Meticillin-resistant *S. aureus* (MRSA) by 15%
- 3rd-generation cephalosporin-resistant *E. coli* by 10%
- Carbapenem-resistant *K. pneumoniae* by 5%

For Ireland, the target reductions were set at 6%, 10% and 2%, respectively.

*The 'Council recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health Approach' (2023/C220/01) includes 2030 EU targets, with 2019 as the baseline year:

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=oj:JOC_2023_220_R_0001

Table 2: Estimated total incidence of bloodstream infections in Ireland (number per 100 000 population) for the 3 EU/EEA targets, including the 2019 baseline and 2030 target, as well as the 2020–2024 trend

Bacterial species	Antimicrobial group/agent	Estimated incidence of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)								
		Data for Ireland, as reported by ECDC/EARS-Net								
		2019 (baseline)	2020	2021	2022	2023	2024	Trend 2020–2024[a]	2030 Target	
Escherichia coli	Third-generation cephalosporin (cefotaxime/ceftriaxone/ ceftazidime) resistance	8.28	7.07	6.01	6.18	6.7	7.54	-	7.45	
Klebsiella pneumoniae	Carbapenem (imipenem/meropenem) resistance	0.11	0.04	0.06	0.06	0.04	0.02	-	0.11	Target already met
Staphylococcus aureus	MRSA	3.06	2.50	2.68	2.61	2.47	2.57	-	2.88	Target already met

[a] ↑ and ↓ indicate statistically significant increasing and decreasing trends, respectively; – indicates no statistically significant trend.

The 2024 data shows that Ireland has already met two of the three targets on AMR as set by the European Commission.

While MRSA has decreased across the EU/EEA in recent years, 3rd-generation cephalosporin-resistant *E. coli* and carbapenem-resistant *K. pneumoniae* have increased. The data from Ireland are encouraging but vigilance is required.

Breakdown by pathogen

E. coli was responsible for almost half of the bloodstream infections among EARS-Net pathogens in 2024 (49%), followed by *S. aureus* (18%). The proportions of *E. faecium* and *K. pneumoniae* infections were very close, at 9% and 8%, respectively. *Acinetobacter* spp. accounted for only 1% of the infections.

Between 2023 and 2024, the number of laboratories participating in EARS-Net decreased from 34 to 32, resulting in a drop in population coverage from 96% to 82%. When restricting the analysis to the 31 laboratories that submitted data in both years, an increase in reported cases was observed for four of the eight pathogens. The largest increase was seen for *S. pneumoniae* (+19%), followed by *P. aeruginosa* (+9%), *K. pneumoniae* (+7%), and *E. coli* (+6%). In contrast, two pathogens showed a decline in reported cases: *E faecalis* (-12%) and *S. aureus* (-3%). Case numbers remained stable for *E. faecium* and *Acinetobacter* spp.

Figure 1: Distribution of BSI in Ireland over the latest year by EARS-Net pathogen and week

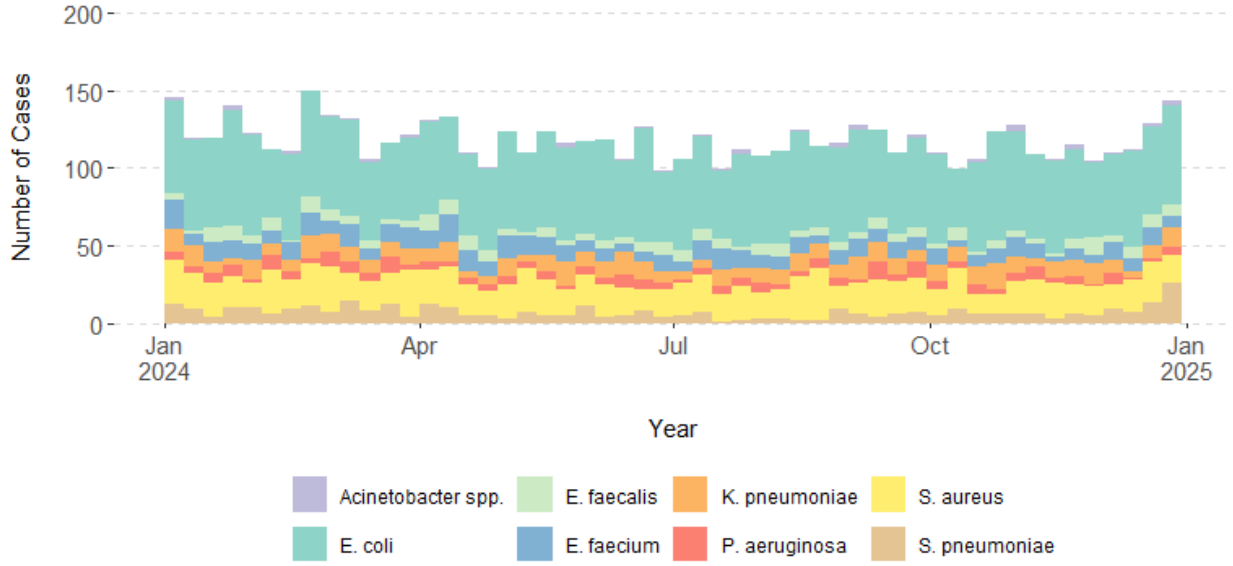
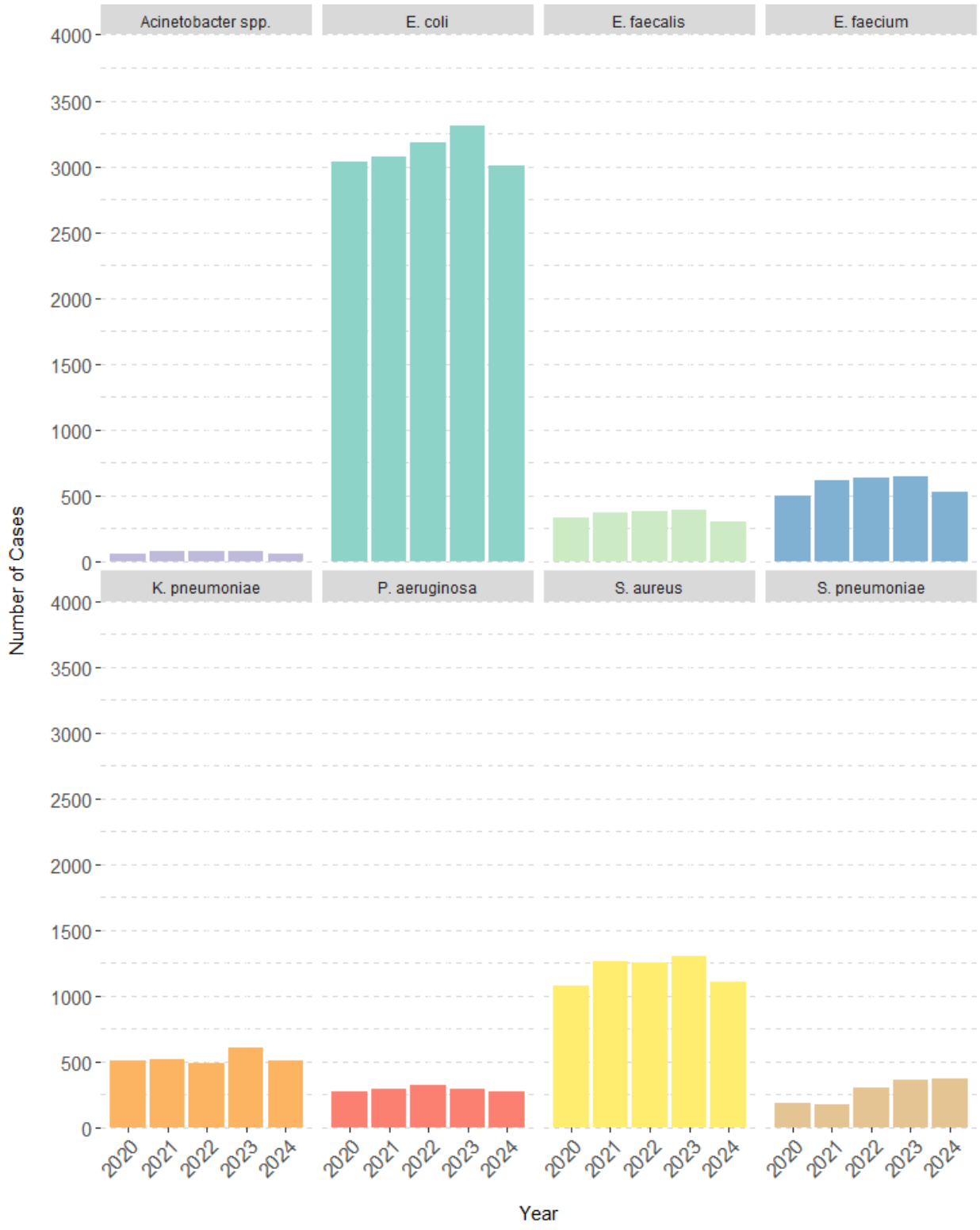


Figure 2: Number of bloodstream infections (BSIs) in Ireland in the last 5 years by EARS-Net pathogen and year

Note: The numbers for 2024 are lower than expected due to the overall lower coverage of the population (82% in 2024 compared with >95% for 2020-2023)



Demographics

Gender and age distribution

The majority of bloodstream infections occurred in male patients. The only exceptions were *E. coli* infections, where just over 50% of the infections occurred in females; and *Acinetobacter* spp., where 65% of infections were in females but the overall numbers were low.

The burden was highest among the older population (aged >65 years) for nearly all pathogens. The only exception was *Acinetobacter* spp. infections, where there was a higher proportion of infections in younger age groups.

Figure 3: Gender distribution of cases in the latest year by EARS-Net pathogen in Ireland

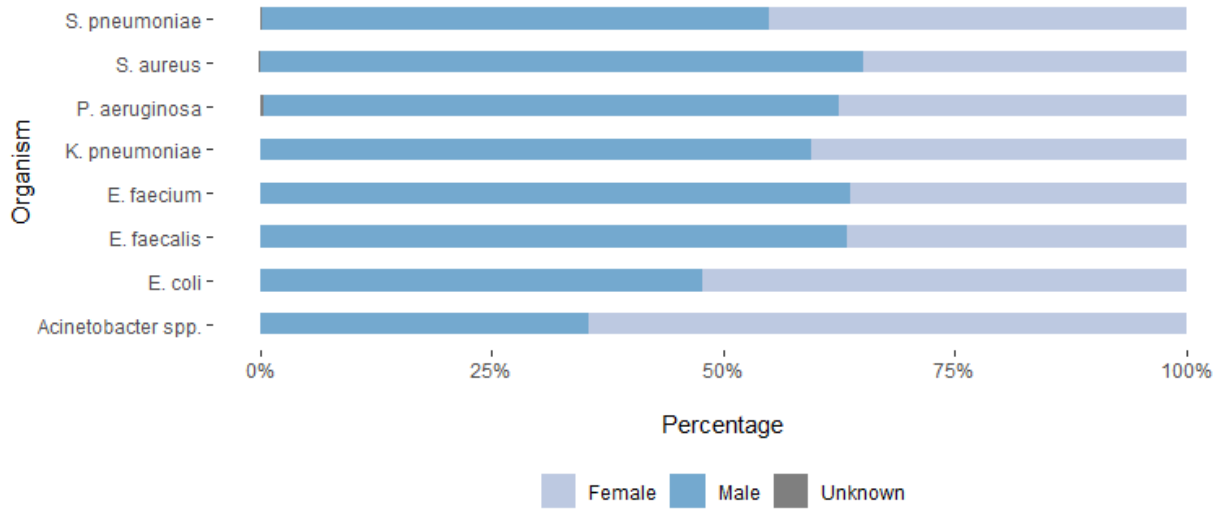
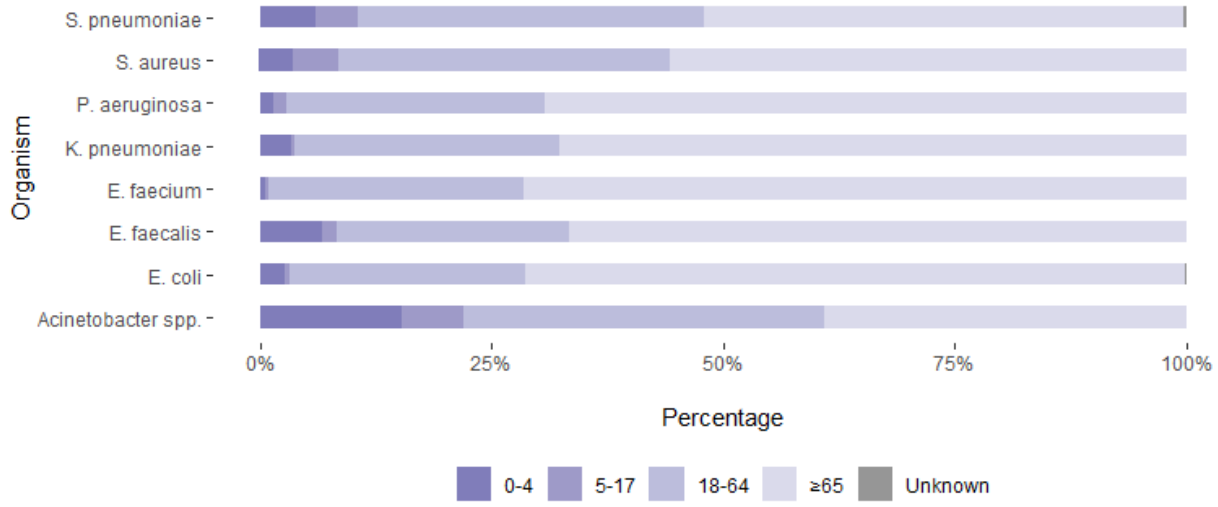
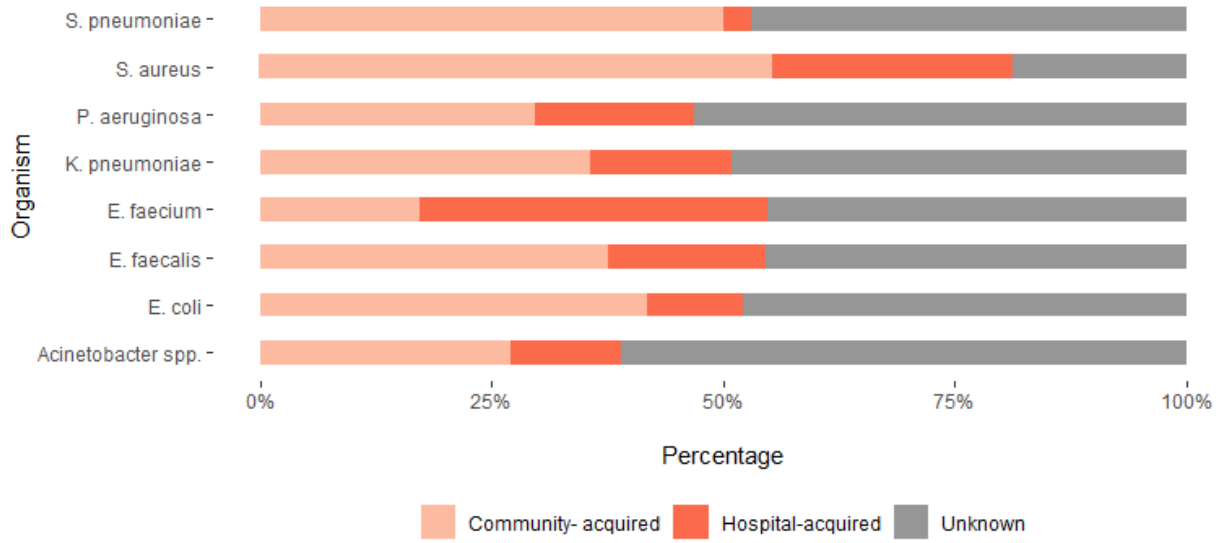


Figure 4: Age distribution of cases in the latest year by EARS-Net pathogen in Ireland



HAI status

Figure 5: HAI status of cases in the latest year by EARS-Net pathogen in Ireland



Hospital-acquired infection (HAI) was defined as an infection where the specimen date was more than two days after the admission date (i.e., more than 48 hours after admission). Community-acquired infection (CAI) was defined as an infection where the specimen date was less than or equal to two days before the admission date (i.e., within 48 hours of admission). Unfortunately, the admission date was missing for many patients (43%), preventing their categorization as either CAI or HAI.

When isolates with missing admission dates are excluded, CAIs were most common in *S. pneumoniae* and *E. coli* infections. In contrast, *E. faecium* infections had the highest proportion of HAIs.

Table 3: HAI status of cases in the latest year by EARS-Net pathogen in Ireland (excluding unknowns)

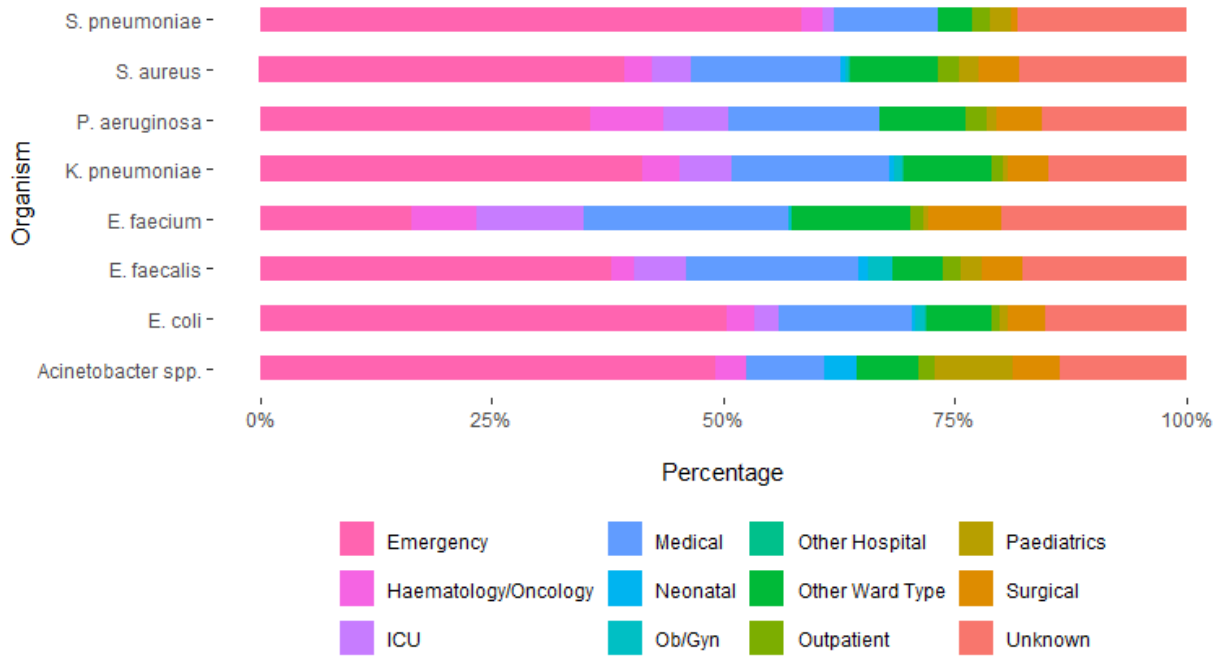
	ac-	eco	efa	efm	kpn	pae	sau	spn
CAI	69.6%	80.2%	68.9%	31.4%	70.0%	63.5%	68.2%	94.4%
HAI	30.4%	19.8%	31.1%	68.6%	30.0%	36.5%	31.8%	5.6%

Location within hospital

Almost 84% of the cases (patients with a BSI due to an EARS-Net pathogen) had information on their location (department within the hospital, or elsewhere) completed.

Of those cases for which department was provided, the majority of positive specimens were taken for patients in emergency wards (53%), followed by medical wards (19%). ICU patients accounted for almost 5% of all cases. The breakdown of department type by pathogen can be found in the figure above.

Figure 6: Ward type of cases in the latest year by EARS-Net pathogen in Ireland



Data by individual pathogen

1. Escherichia coli

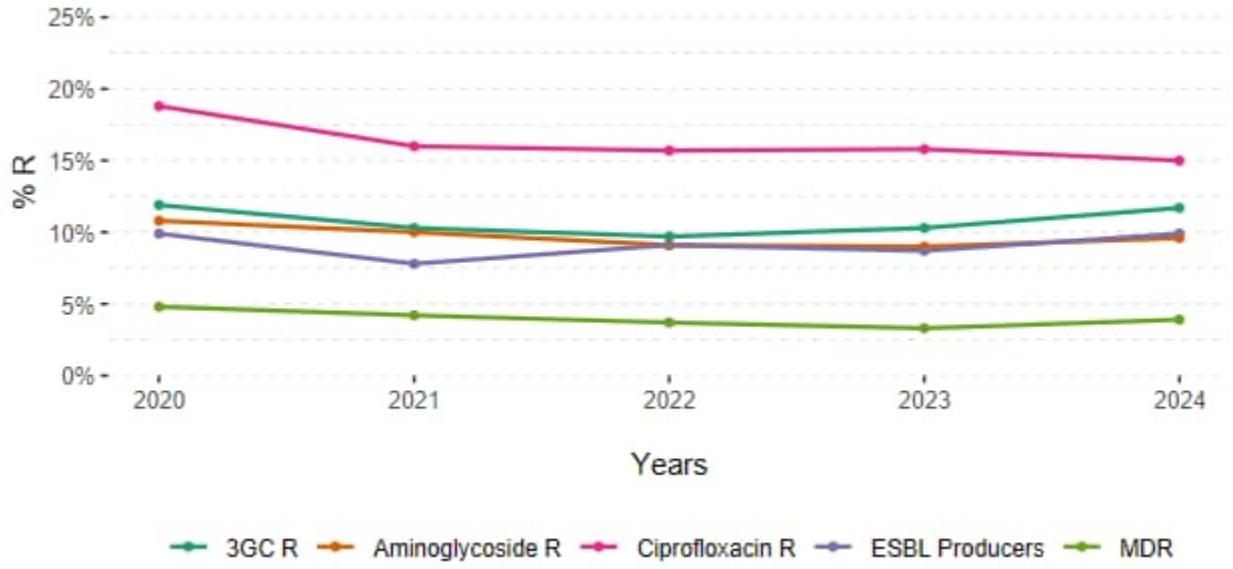
- In 2024, there were 3,004 *E. coli* bloodstream infections reported from 32 laboratories. This is lower than in 2023 when there were 3,312 reports from 35 laboratories. When restricting the data to the 31 laboratories that reported data for both years, there was an increase of 6% in the numbers.
- From 2023 to 2024, resistance proportions to most of the key antibiotics reported for *E. coli* bloodstream infections increased slightly or were relatively stable.
- Resistance to third-generation cephalosporins (3GC) increased to 12% (2023, 10%). Similarly, the proportion of extended-spectrum beta-lactamase (ESBL) producers increased to 10% (2023, 9%).
- Multi-drug resistance (MDR) in *E. coli* increased to 4% in 2024 (2023, 3%).
- The proportion of carbapenem-resistant *E. coli* remains at low levels (0.1% for both 2023 and 2024). Only five *E. coli* isolates were found to be carbapenemase-producers (CPE) in 2024: 3 OXA-48, one KPC and one NDM.
- Over the latest 5-year period, some of the indicators (ciprofloxacin, amninoglycosides and MDR) show a downward trend; however, none of these are statistically significant.
- The resistance levels observed in 2024 are similar or slightly lower compared to those in 2020.
- AMR levels among *E. coli* BSIs are moderately low compared to other EU/EEA countries.

Key Resistance Indicators

Table 4: Antimicrobial resistance in invasive *E. coli* infections in Ireland

	2020	2021	2022	2023	2024
Total Isolates	3032	3073	3181	3312	3004
Ampicillin R	65.2%	63.0%	62.1%	62.9%	63.7%
Amoxicillin/Clavulanic Acid R	49.1%	48.7%	45.1%	47.7%	47.2%
Piperacillin/Tazobactam R	13.2%	12.5%	11.6%	12.7%	12.9%
Cefoxitin R	6.5%	4.6%	4.8%	4.8%	5.8%
Cefotaxime/Ceftriaxone R	11.2%	9.1%	10.0%	9.9%	11.4%
Ceftazidime R	10.8%	10.0%	8.3%	8.8%	10.5%
3GC R	11.9%	10.3%	9.7%	10.3%	11.7%
ESBL Producers	9.9%	7.8%	9.1%	8.7%	9.9%
Ciprofloxacin R	18.8%	16.0%	15.7%	15.8%	15.0%
Gentamicin R	9.3%	8.8%	7.7%	7.7%	8.3%
Aminoglycoside R	10.8%	10.0%	9.1%	9.0%	9.6%
MDR	4.8%	4.2%	3.7%	3.3%	3.9%
Carbapenem R	0.3%	0.1%	0.3%	0.1%	0.1%
CPE (n)	3	0	4	3	5

Figure 7: Key resistance indicators in invasive *E. coli* infections in Ireland



Third-Generation Cephalosporin Resistance and Extended-Spectrum Beta-Lactamase Production

Table 5: 3rd-generation cephalosporin resistance in invasive *E. coli* infections in Ireland

Year	Total Cases	R	I	S	% R
2020	3,032	361	5	2,665	11.9%
2021	3,073	315	10	2,744	10.3%
2022	3,181	310	9	2,861	9.7%
2023	3,312	341	13	2,954	10.3%
2024	3,004	351	16	2,630	11.7%

Figure 8: 3rd-generation cephalosporin resistance in invasive *E. coli* infections in the EU/EEA in 2023

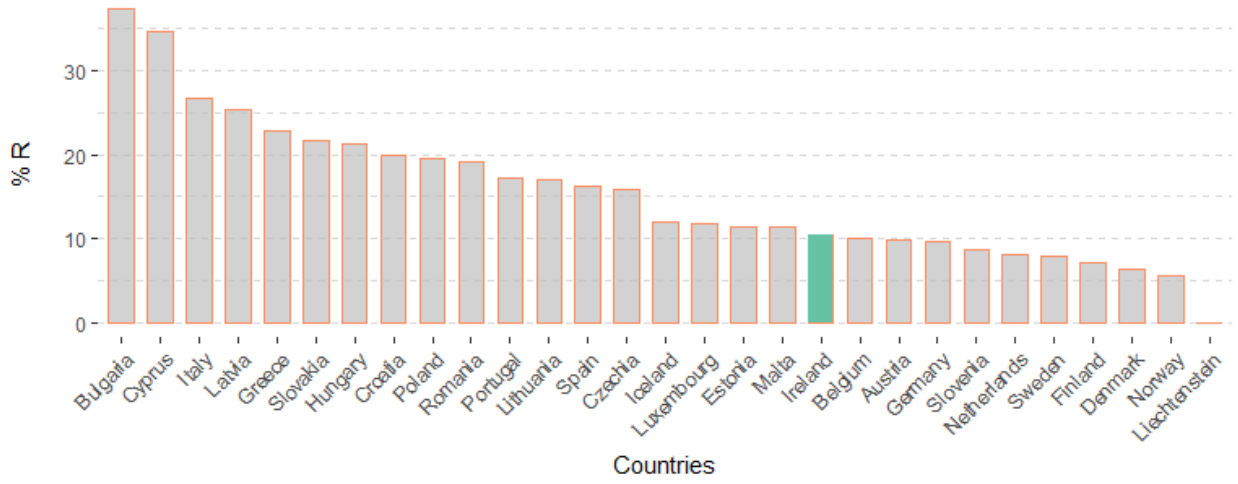


Table 6: ESBL-production in invasive *E. coli* infections in Ireland

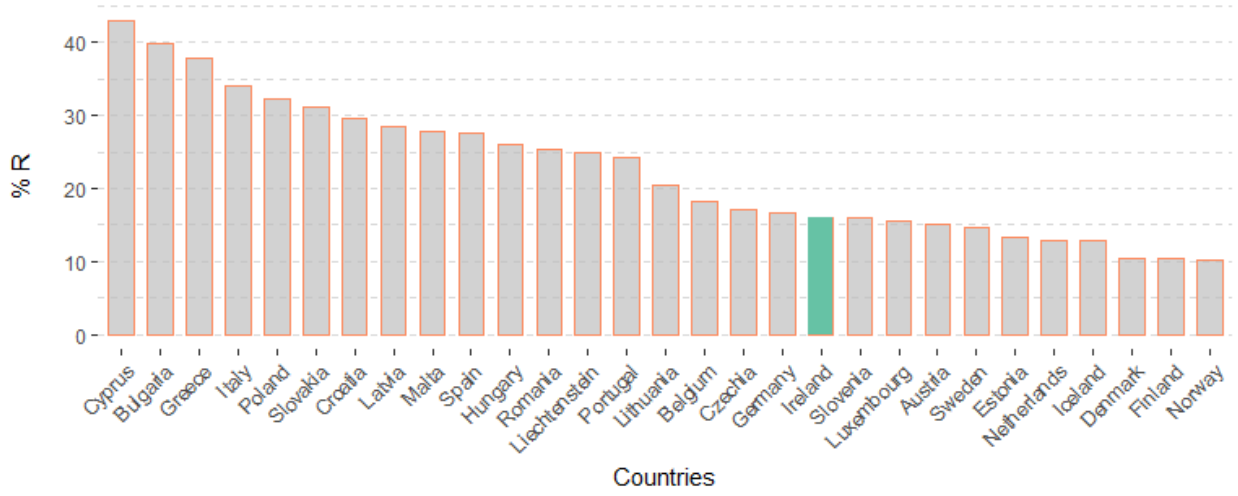
Year	Total Cases	Pos	Neg	ESBL Positivity
2020	3,032	264	2,399	9.9%
2021	3,073	226	2,656	7.8%
2022	3,181	271	2,694	9.1%
2023	3,312	285	2,996	8.7%
2024	3,004	283	2,563	9.9%

Fluoroquinolone Resistance

Table 7: Fluoroquinolone resistance in invasive *E. coli* infections in Ireland

Year	Total Cases	R	I	S	% R
2020	3,032	568	63	2,393	18.8%
2021	3,073	492	41	2,530	16.1%
2022	3,181	498	42	2,632	15.7%
2023	3,312	515	40	2,697	15.8%
2024	3,004	448	42	2,499	15.0%

Figure 9: Fluoroquinolone resistance in invasive *E. coli* infections in the EU/EEA in 2023

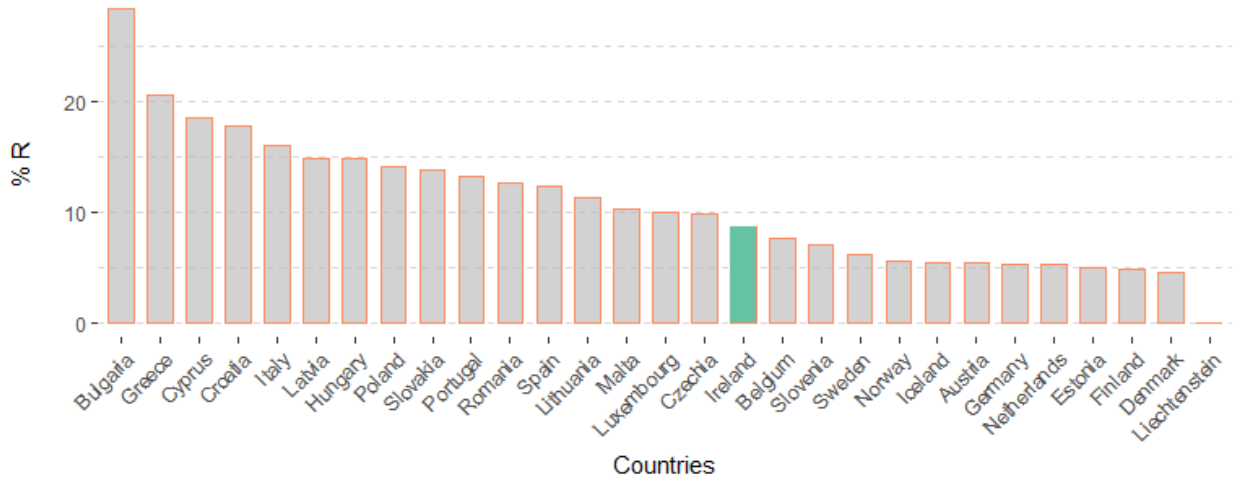


Aminoglycoside Resistance

Table 8: Aminoglycoside resistance in invasive *E. coli* infections in Ireland

Year	Total Cases	R	I	S	% R
2020	3,032	326	2	2,702	10.8%
2021	3,073	307	0	2,764	10.0%
2022	3,181	289	1	2,887	9.1%
2023	3,312	297	0	3,004	9.0%
2024	3,004	289	1	2,712	9.6%

Figure 10: Aminoglycoside resistance in invasive *E. coli* infections in the EU/EEA in 2023



Carbapenem Resistance

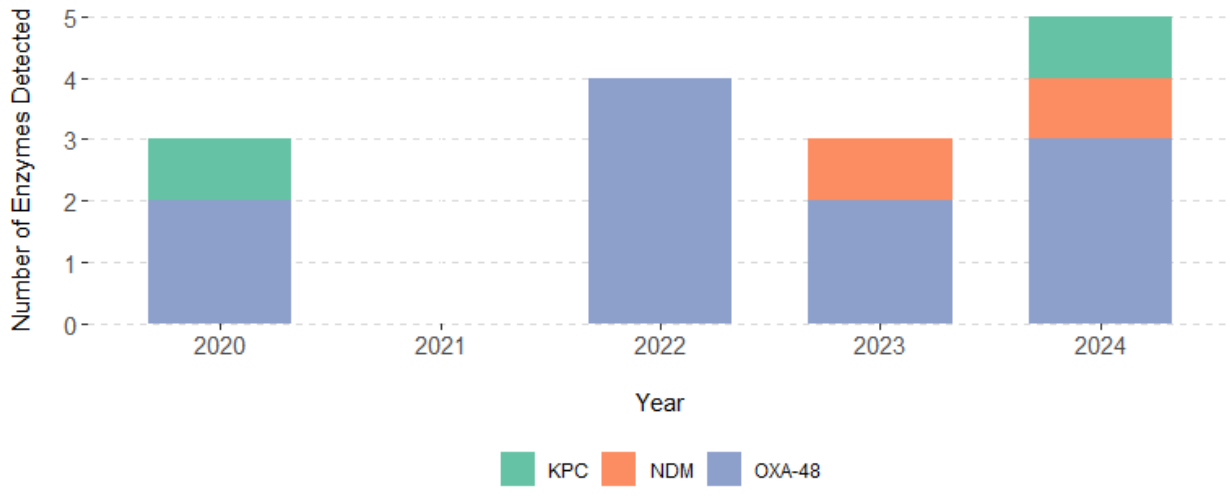
Table 9: Carbapenem resistance in invasive *E. coli* infections in Ireland

Year	Total Cases	R	I	S	% R
2020	3,032	9	0	2,992	0.3%
2021	3,073	4	0	3,054	0.1%
2022	3,181	10	0	3,168	0.3%
2023	3,312	4	1	3,302	0.1%
2024	3,004	2	0	3,000	0.1%

Table 10: Carbapenemase-producing *E. coli* infections by enzyme type in Ireland

Year	KPC	NDM	OXA-48	Total
2020	1	0	2	3
2021	0	0	0	0
2022	0	0	4	4
2023	0	1	2	3
2024	1	1	3	5

Figure 11: Carbapenemase-producing *E. coli* infections by enzyme type in Ireland

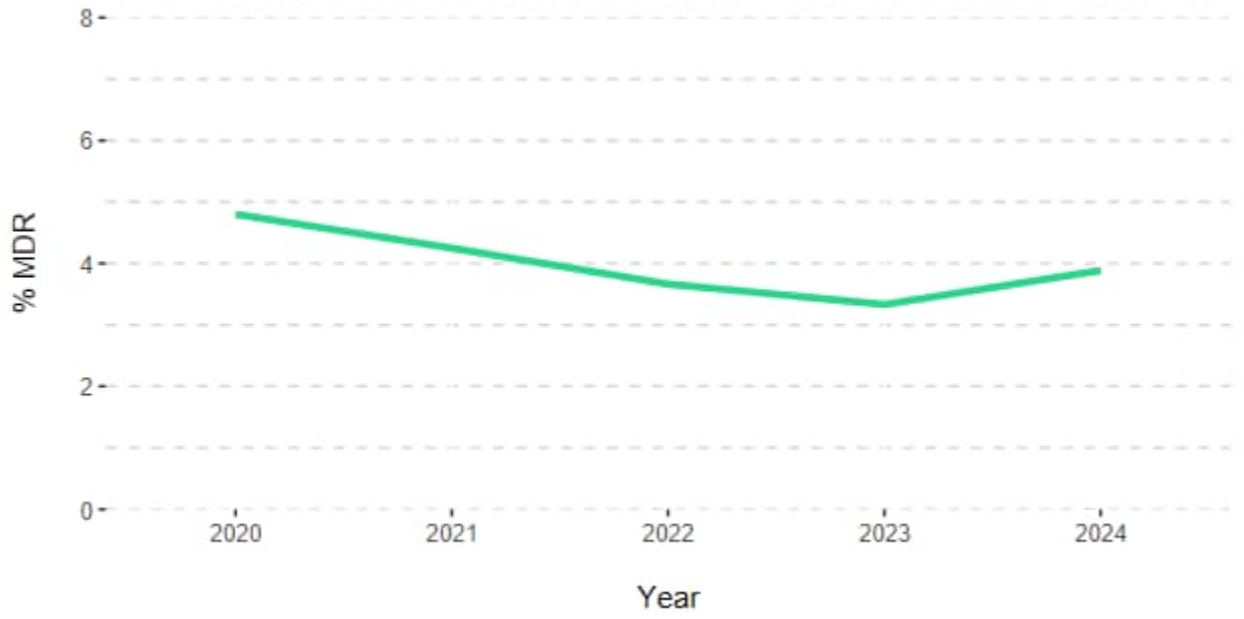


Multi-Drug Resistance

Table 11: Multi-drug resistance in invasive *E. coli* infections in Ireland

Year	Total Cases	MDR	Incomplete	Non-MDR	% MDR
2020	3,032	145	11	2,876	4.8%
2021	3,073	130	13	2,930	4.2%
2022	3,181	116	14	3,051	3.7%
2023	3,312	108	70	3,134	3.3%
2024	3,004	116	19	2,869	3.9%

Figure 12: Multi-drug resistance in invasive *E. coli* infections in Ireland



2. Staphylococcus aureus

- In 2024, there were 1,103 *S. aureus* bloodstream infections reported from 32 laboratories. This is lower than in 2023 when there were 1,307 reports from 35 laboratories. When restricting the data to the 31 laboratories that reported data for both years, there was a decrease of 3% in the numbers.
- In 2024, the proportion of meticillin-resistant *S. aureus* (%MRSA) increased to 10.7% from 9.6% in 2023, which was the lowest %MRSA reported over 26 years of EARS-Net surveillance in Ireland.
- Over the latest 5-year period, the %MRSA shows a downward trend; however, this is not statistically significant.
- The MRSA incidence rate increased to 0.031 cases per 1,000 patient days (2023, 0.029). By contrast, there was a decrease in the incidence rate of meticillin-susceptible *S. aureus* (MSSA) to 0.257 cases per 1,000 patient days (2023, 0.269).
- Overall, the *S. aureus* infection incidence rate decreased over the last year from 0.298 cases per 1,000 patient days in 2023 to 0.288 in 2024).
- MRSA levels are moderately low compared to other EU/EEA countries.

Key Resistance Indicators

Table 12: Antimicrobial resistance in invasive *S. aureus* infections in Ireland

	2020	2021	2022	2023	2024
Total Isolates	1081	1262	1250	1307	1103
MRSA	11.7%	10.9%	10.6%	9.6%	10.7%
Ciprofloxacin R	12.7%	9.8%	11.7%	9.9%	10.0%
Linezolid R	0.0%	0.0%	0.1%	0.2%	0.0%
Rifampicin R	0.5%	0.6%	1.0%	0.7%	0.3%
Vancomycin R	0.0%	0.0%	0.0%	0.0%	0.0%

Meticillin-Resistant *Staphylococcus aureus* Proportions

Table 13: Meticillin resistance proportions in invasive *S. aureus* infections in Ireland

Year	Total Cases	R	I	S	% R
2020	1,081	126	0	954	11.7%
2021	1,262	138	0	1,124	10.9%
2022	1,250	132	0	1,118	10.6%
2023	1,307	126	0	1,181	9.6%
2024	1,103	118	0	985	10.7%

Figure 13: Meticillin resistance proportions in invasive *S. aureus* infections in Ireland

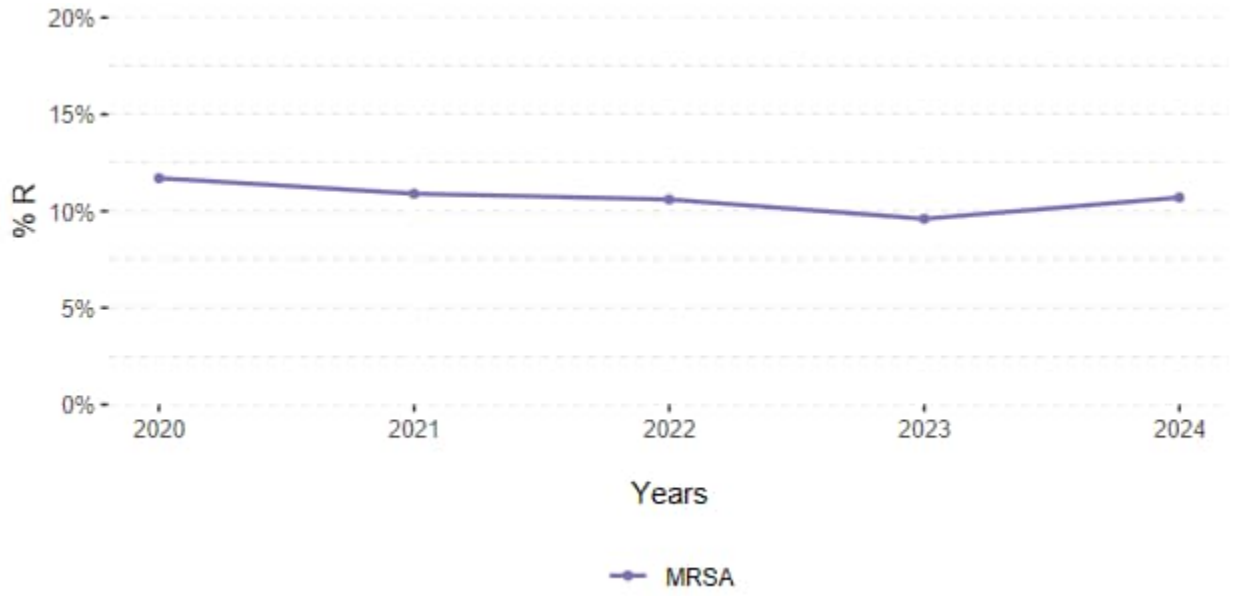
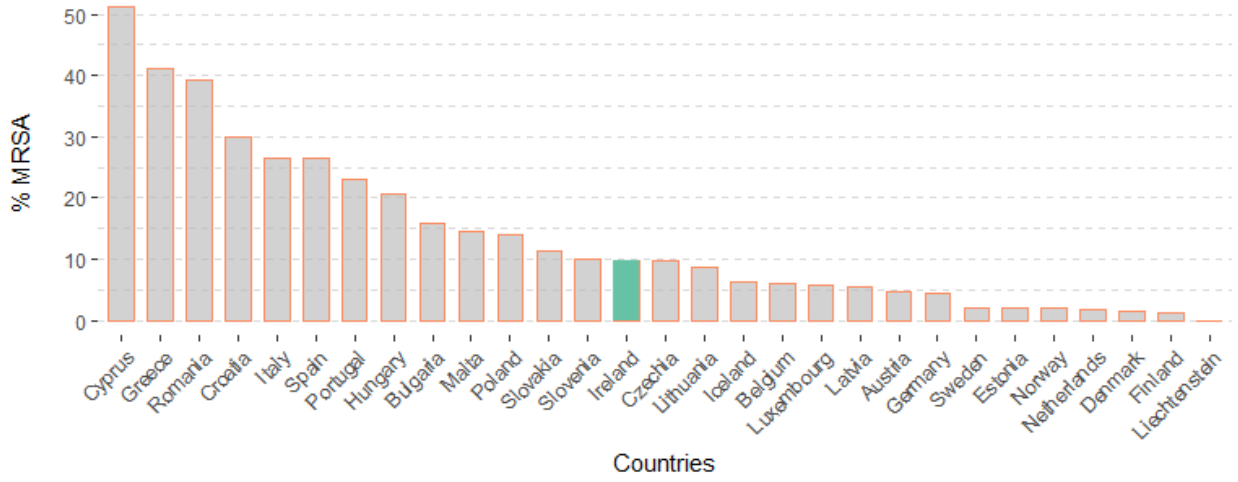


Figure 14: Meticillin resistance in invasive *S. aureus* infections in the EU/EEA in 2023



Meticillin-Resistant *Staphylococcus aureus* Incidence Rates

Table 14: Invasive *S. aureus* incidence rates in Ireland

Year	Bed Days Used	SAU Rate per 1000 Patient Days	MRSA Rate per 1000 Patient Days	MSSA Rate per 1000 Patient Days
2020	3,667,687	0.295	0.034	0.260
2021	4,038,076	0.313	0.034	0.278
2022	4,209,051	0.297	0.031	0.266
2023	4,391,891	0.298	0.029	0.269
2024	3,833,155	0.288	0.031	0.257

Figure 15: Invasive *S. aureus* incidence rates in Ireland

3. Klebsiella pneumoniae

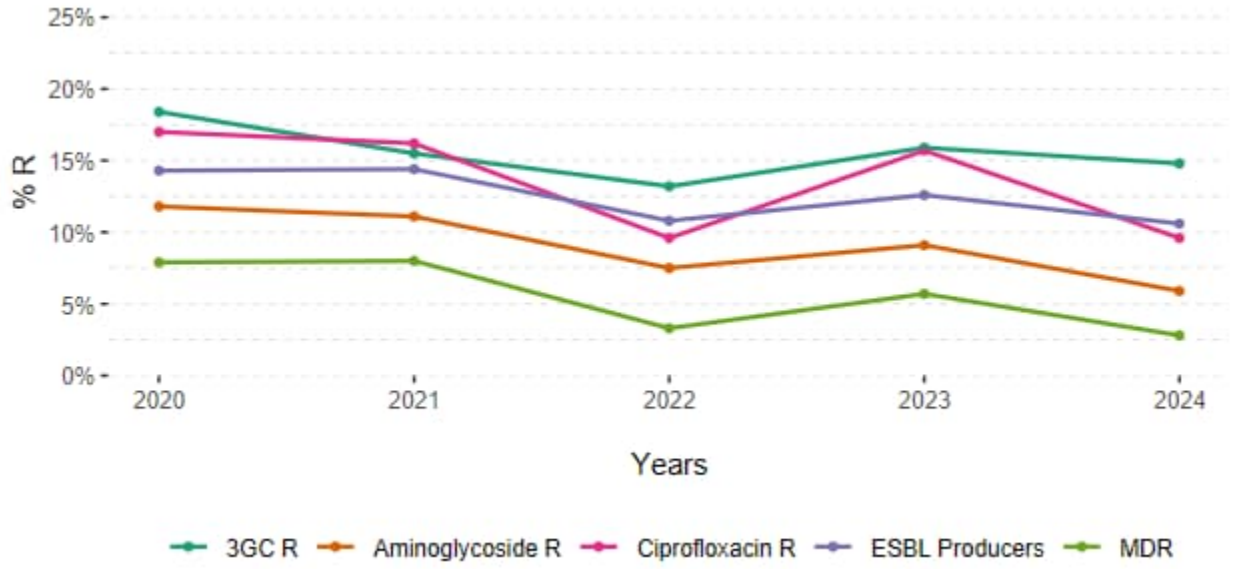
- In 2024, there were 511 *K. pneumoniae* bloodstream infections reported from 32 laboratories. This is lower than in 2023 when there were 604 reports from 35 laboratories. When restricting the data to the 31 laboratories that reported data for both years, there was an increase of 7% in the numbers.
- From 2023 to 2024, resistance proportions to most of the key antibiotics reported for *K. pneumoniae* bloodstream infections decreased.
- Resistance to third-generation cephalosporins (3GC) decreased to 15% (2023, 16%), while the proportion of extended-spectrum beta-lactamase (ESBL) producers decreased to 11% (2023, 12%).
- Multi-drug resistance (MDR) decreased to 3% in 2024 (2023, 6%).
- The proportion of carbapenem-resistant *K. pneumoniae* decreased to 1.2% (2023, 1.4%); Only six *K. pneumoniae* isolates were found to be carbapenemase-producers (CPE) in 2024: 5 OXA-48 and one KPC.
- Over the latest 5-year period, most of the indicators show a downward trend; however, apart from aminoglycosides, none of these are statistically significant.
- The resistance levels in 2024 are lower compared to those seen in 2020; however, there is a lot of variation in proportions over the years, hence most downward trends are not statistically significant.
- AMR levels among *K. pneumoniae* BSIs are low for most key antibiotics compared to most EU/EEA countries.

Key Resistance Indicators

Table 15: Antimicrobial resistance in invasive *K. pneumoniae* infections in Ireland

	2020	2021	2022	2023	2024
Total Isolates	512	515	492	604	511
Ampicillin R	99.2%	99.8%	100.0%	99.7%	98.8%
Amoxicillin/Clavulanic Acid R	32.2%	32.5%	29.3%	34.2%	29.7%
Piperacillin/Tazobactam R	20.5%	21.3%	21.9%	25.3%	21.5%
Cefoxitin R	6.5%	5.8%	5.7%	8.3%	9.1%
Cefotaxime/Ceftriaxone R	16.9%	14.9%	11.2%	14.3%	13.4%
Ceftazidime R	18.4%	16.1%	12.8%	15.2%	13.8%
3GC R	18.4%	15.5%	13.2%	15.9%	14.8%
ESBL Producers	14.3%	14.4%	10.8%	12.6%	10.6%
Ciprofloxacin R	17.0%	16.2%	9.6%	15.7%	9.6%
Gentamicin R	9.1%	9.3%	7.3%	8.6%	4.8%
Aminoglycoside R	11.8%	11.1%	7.5%	9.1%	5.9%
MDR	7.9%	8.0%	3.3%	5.7%	2.8%
Carbapenem R	1.8%	2.0%	1.2%	1.5%	1.2%
CPE (n)	5	8	5	10	6

Figure 16: Key resistance indicators in invasive *K. pneumoniae* infections in Ireland



Third-Generation Cephalosporin Resistance and Extended-Spectrum Beta-Lactamase Production

Table 16: 3rd-generation cephalosporin resistance in invasive *K. pneumoniae* infections in Ireland

Year	Total Cases	R	I	S	% R
2020	512	94	4	414	18.4%
2021	515	80	1	434	15.5%
2022	492	65	1	426	13.2%
2023	604	96	3	503	15.9%
2024	511	75	0	432	14.8%

Figure 17: 3rd-generation cephalosporin resistance in invasive *K. pneumoniae* infections in the EU/EEA in 2023

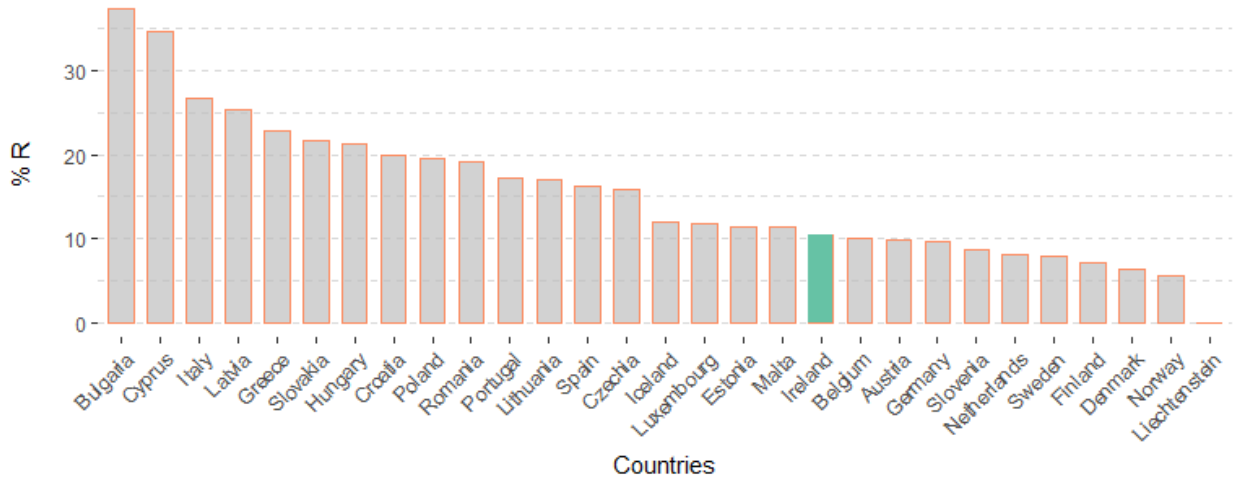


Table 17: ESBL-production in invasive *K. pneumoniae* infections in Ireland

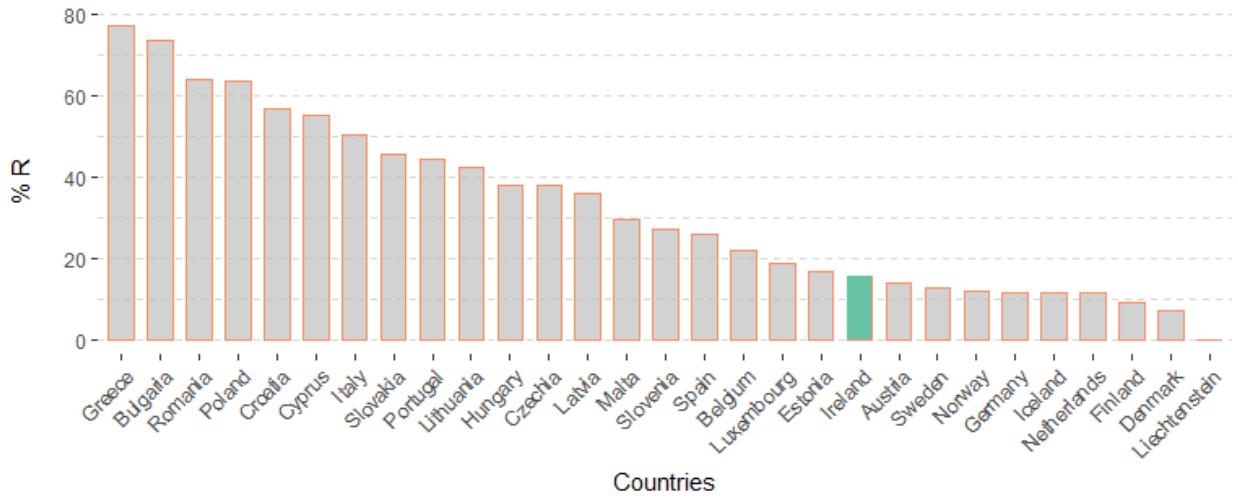
Year	Total Cases	Pos	Neg	ESBL Positivity
2020	512	65	391	14.3%
2021	515	70	415	14.4%
2022	492	47	390	10.8%
2023	604	74	515	12.6%
2024	511	51	428	10.6%

Fluoroquinolone Resistance

Table 18: Fluoroquinolone resistance in invasive *K. pneumoniae* infections in Ireland

Year	Total Cases	R	I	S	% R
2020	512	87	15	409	17.0%
2021	515	83	12	418	16.2%
2022	492	47	8	434	9.6%
2023	604	93	10	490	15.7%
2024	511	48	11	441	9.6%

Figure 18: Fluoroquinolone resistance in invasive *K. pneumoniae* infections in the EU/EEA in 2023



Aminoglycoside Resistance

Table 19: Aminoglycoside resistance in invasive *K. pneumoniae* infections in Ireland

Year	Total Cases	R	I	S	% R
2020	512	60	1	449	11.8%
2021	515	57	0	458	11.1%
2022	492	37	0	455	7.5%
2023	604	55	0	548	9.1%
2024	511	30	0	476	5.9%

Carbapenem Resistance

Table 20: Carbapenem resistance in invasive *K. pneumoniae* infections in Ireland

Year	Total Cases	R	I	S	% R
2020	512	9	1	495	1.8%
2021	515	10	0	501	2.0%
2022	492	6	0	485	1.2%
2023	604	9	1	593	1.5%
2024	511	6	0	502	1.2%

Table 21: Carbapenemase-producing *K. pneumoniae* infections in Ireland

Year	KPC	NDM	OXA-48	OXA-48/NDM	Total
2020	1	1	3	0	5
2021	3	1	4	0	8
2022	1	0	4	0	5
2023	0	0	9	1	10
2024	1	0	5	0	6

Figure 19: Carbapenemase-producing *K. pneumoniae* infections by enzyme type in Ireland

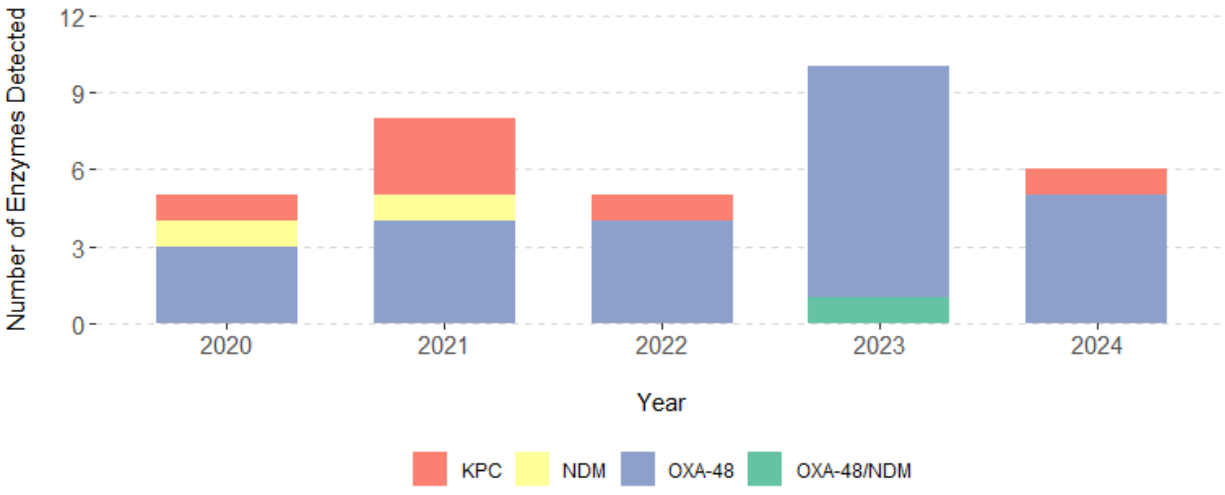
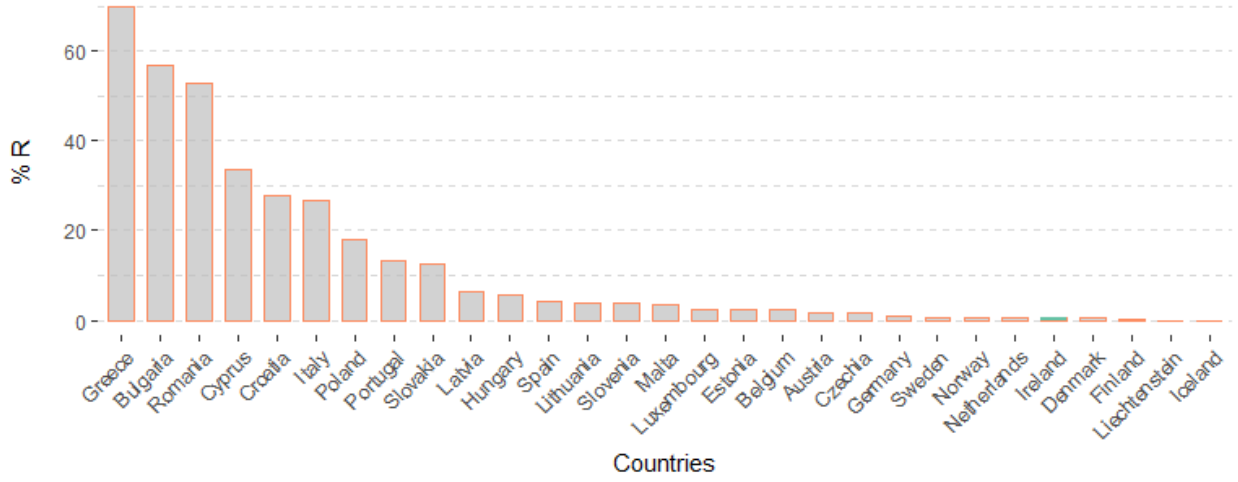


Figure 20: Carbapenem resistance in invasive *K. pneumoniae* infections in the EU/EEA in 2023



Multi-Drug Resistance

Table 22: Multi-drug resistance in invasive *K. pneumoniae* infections in Ireland

Year	Total Cases	MDR	Incomplete	Non-MDR	% MDR
2020	512	40	3	469	7.9%
2021	515	41	2	472	8.0%
2022	492	16	3	473	3.3%
2023	604	34	12	558	5.7%
2024	511	14	13	484	2.8%

Figure 21: Multi-drug resistance in invasive *K. pneumoniae* infections in Ireland

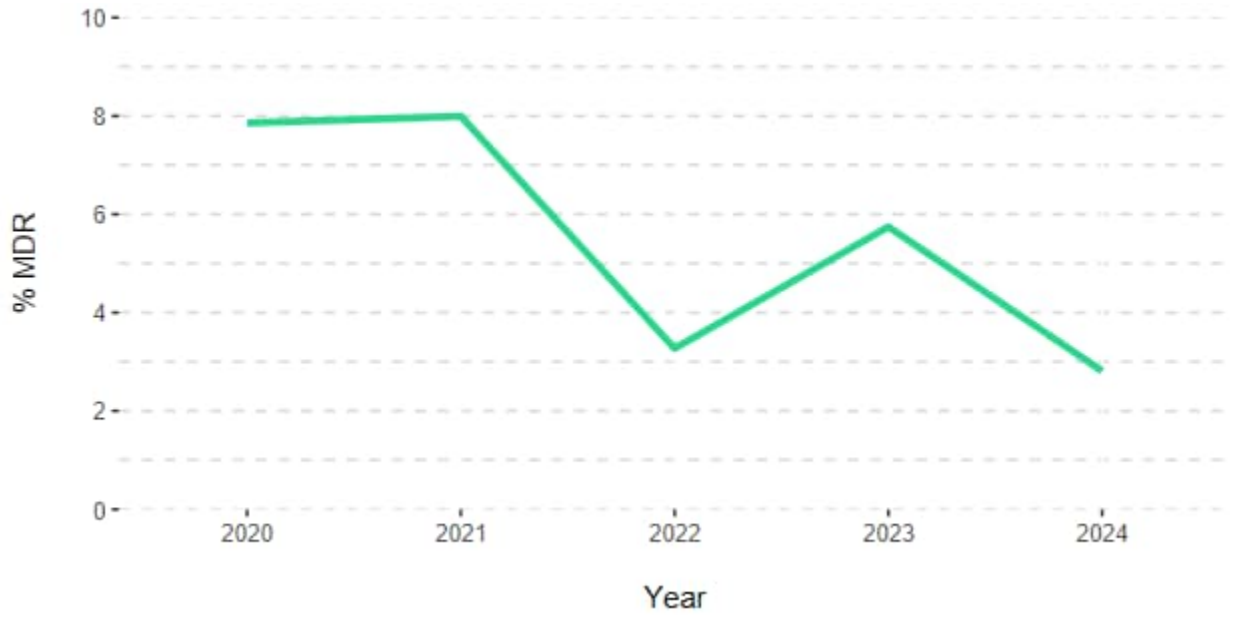
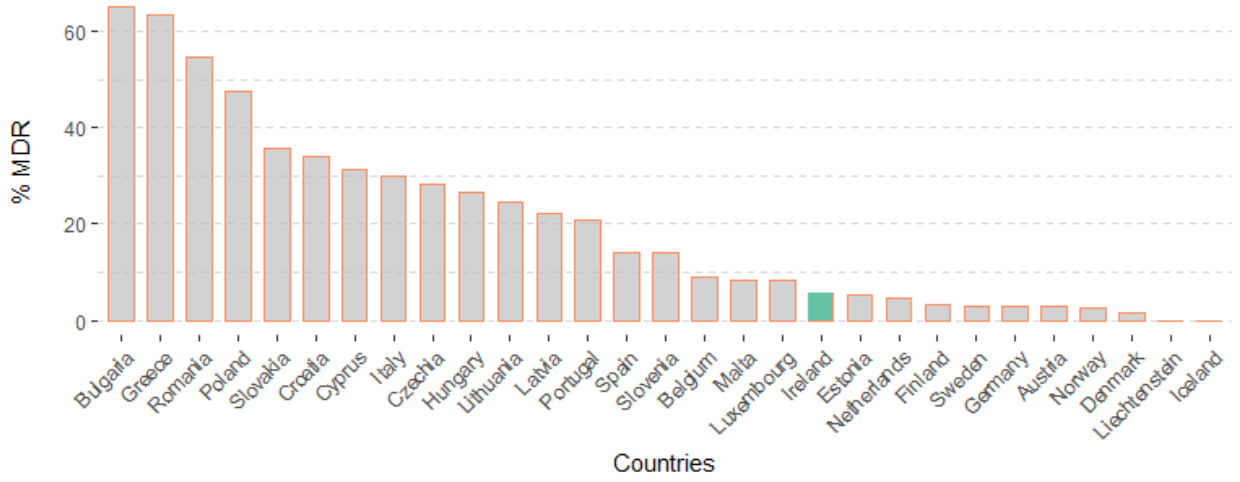


Figure 22: Multi-drug resistance in invasive *K. pneumoniae* infections in the EU/EEA in 2023



4. Enterococcus faecium

- In 2024, there were 523 invasive *E. faecium* infections reported from 32 laboratories. This is lower than in 2023 when there were 639 reports from 35 laboratories. When restricting the data to the 31 laboratories that reported data for both years, the numbers were relatively stable.
- In 2024, the proportion of vancomycin-resistant *E. faecium* (%VREfm) increased slightly to 21.8% from 21.4% in 2023, which was the lowest %VREfm reported in Ireland over the past 20 years.
- Despite the slight increase in %VREfm in 2024, there is still a significant decrease in the latest 5-year trend.
- The VREfm incidence decreased slightly to 0.030 infections per 1000 patient days in 2024 (2023, 0.031 infections per 1000 patient days), while VSEfm incidence decreased to 0.107 infections per 1000 patient days (2023, 0.114). The overall *E. faecium* incidence decreased to 0.136 infections per 1000 patient days (2023, 0.145).
- VRE, especially among *E. faecium* (or VREfm), is a growing problem throughout the EU/EEA area; Ireland is one of a few countries where there has been a decreasing trend in the % VREfm in recent years.
- Despite the decreasing trend in Ireland, VREfm remains a significant challenge to Irish healthcare.

Key Resistance Indicators

Table 23: Antimicrobial resistance in invasive *E. faecium* infections in Ireland

	2020	2021	2022	2023	2024
Total Isolates	499	619	634	639	523
Vancomycin R	35.7%	27.2%	27.8%	21.4%	21.8%
Ampicillin R	95.4%	94.8%	96.6%	96.0%	94.3%
High Level Gentamicin R	59.2%	60.2%	60.8%	62.2%	65.9%
Linezolid R	1.1%	0.3%	0.6%	0.2%	0.6%
MDR	25.3%	18.1%	17.2%	16.9%	14.2%

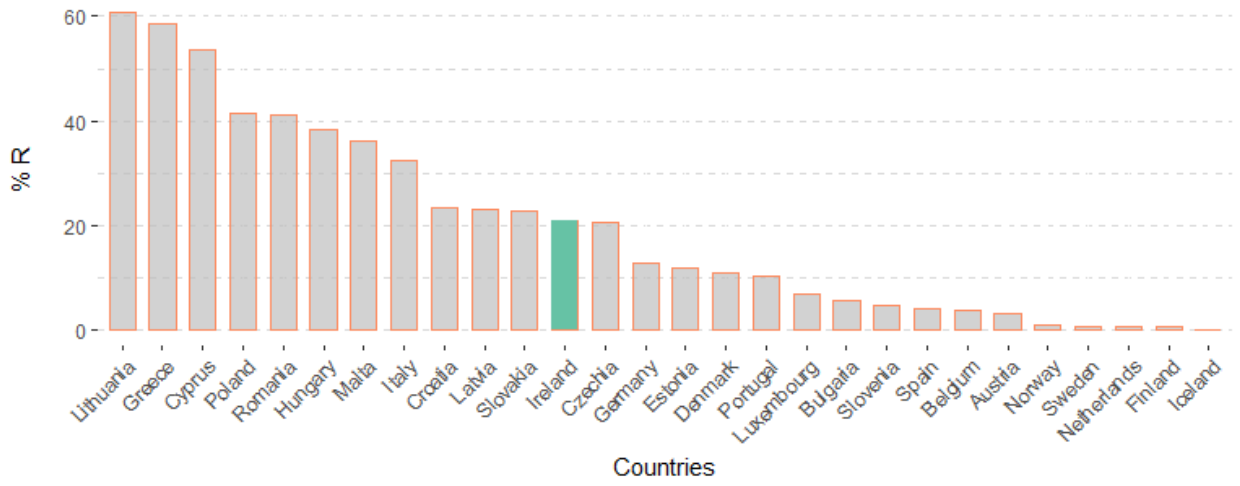
Vancomycin-Resistant *Enterococcus faecium* Proportions

Table 24: Vancomycin resistance in invasive *E. faecium* infections in Ireland

Year	Total Cases	R	I	S	% R
2020	499	178	0	320	35.7%
2021	619	168	0	450	27.2%
2022	634	176	0	456	27.8%
2023	639	136	0	500	21.4%
2024	523	114	0	409	21.8%

Figure 23: Vancomycin resistance in invasive *E. faecium* infections in Ireland

Figure 24: Vancomycin resistance in invasive *E. faecium* infections in the EU/EEA in 2023

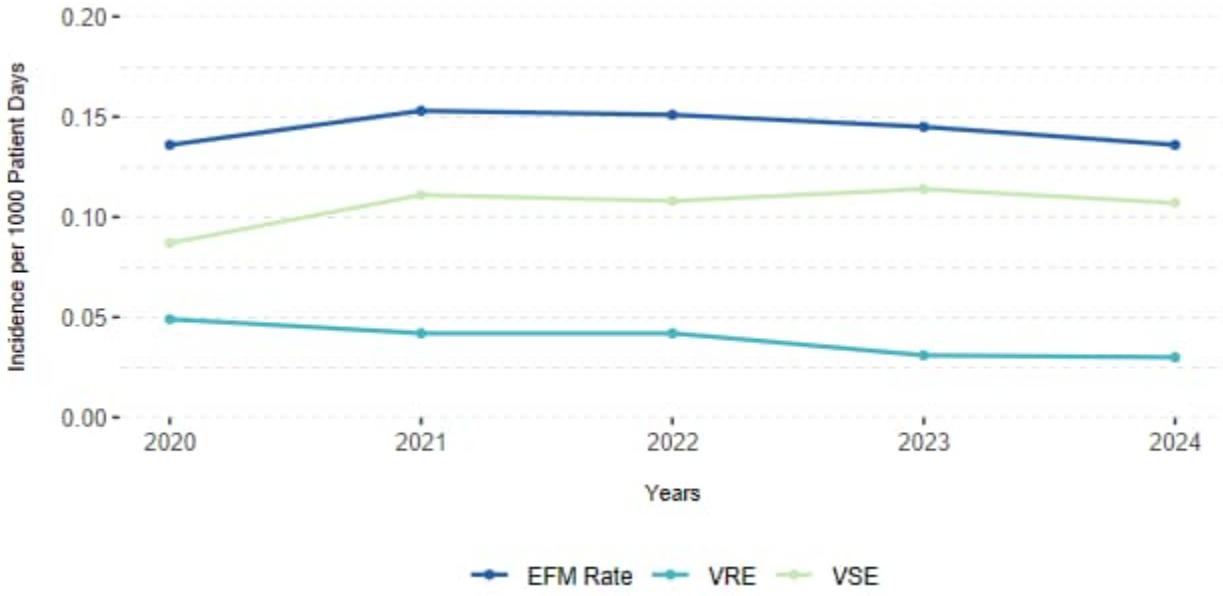


Vancomycin-Resistant *Enterococcus faecium* Incidence Rates

Table 25: Invasive *E. faecium* incidence rates in Ireland

Year	Bed Days Used	EFM Rate per 1000 Patient Days	VRE Rate per 1000 Patient Days	VSE Rate per 1000 Patient Days
2020	3,667,687	0.136	0.049	0.087
2021	4,038,076	0.153	0.042	0.111
2022	4,209,051	0.151	0.042	0.108
2023	4,391,891	0.145	0.031	0.114
2024	3,833,155	0.136	0.030	0.107

Figure 25: Invasive *E. faecium* Incidence Rates in Ireland



5. Pseudomonas aeruginosa

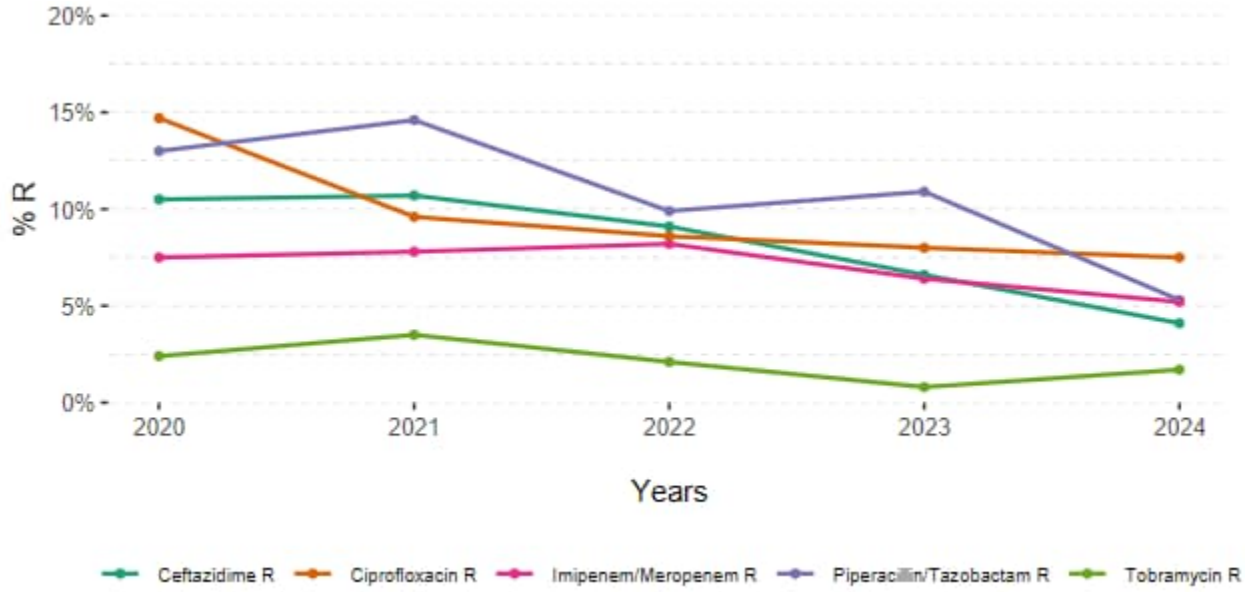
- In 2024, there were 269 invasive *P. aeruginosa* infections reported from 32 laboratories. This is lower than in 2023 when there were 297 reports from 35 laboratories. When restricting the data to the 31 laboratories that reported data for both years, there was an increase of 9% in the numbers.
- In 2024, 1.2% of isolates were MDR, representing a decrease from 3.4% in 2023.
- AMR levels among invasive *P. aeruginosa* infections are low-to-moderately low for most key antibiotics compared to most EU/EEA countries.

Key Resistance Indicators

Table 26: Antimicrobial resistance in invasive *P. aeruginosa* infections in Ireland

	2020	2021	2022	2023	2024
Total Isolates	271	294	319	297	269
Piperacillin/Tazobactam R	13.0%	14.6%	9.9%	10.9%	5.3%
Ceftazidime R	10.5%	10.7%	9.1%	6.6%	4.1%
Imipenem/Meropenem R	7.5%	7.8%	8.2%	6.4%	5.2%
Ciprofloxacin R	14.7%	9.6%	8.6%	8.0%	7.5%
Tobramycin R	2.4%	3.5%	2.1%	0.8%	1.7%
MDR	2.1%	6.0%	4.8%	4.7%	2.2%

Figure 26: Key resistance indicators in invasive *P. aeruginosa* infections in Ireland

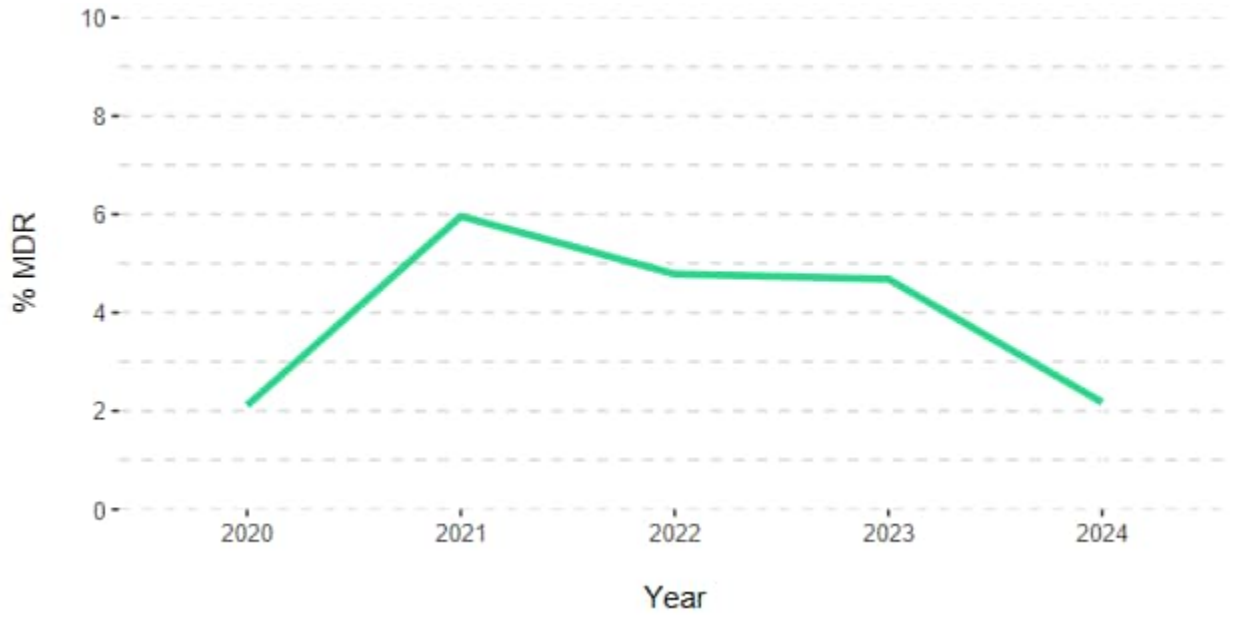


Multi-Drug Resistance

Table 27: Multi-drug resistance in invasive *P. aeruginosa* infections in Ireland

Year	Total Cases	MDR	Incomplete	Non-MDR	% MDR
2020	271	3	129	139	2.1%
2021	294	14	59	221	6.0%
2022	319	10	107	199	4.8%
2023	297	11	62	224	4.7%
2024	269	5	39	225	2.2%

Figure 27: Multi-drug resistance in invasive *P. aeruginosa* infections in Ireland



6. Enterococcus faecalis

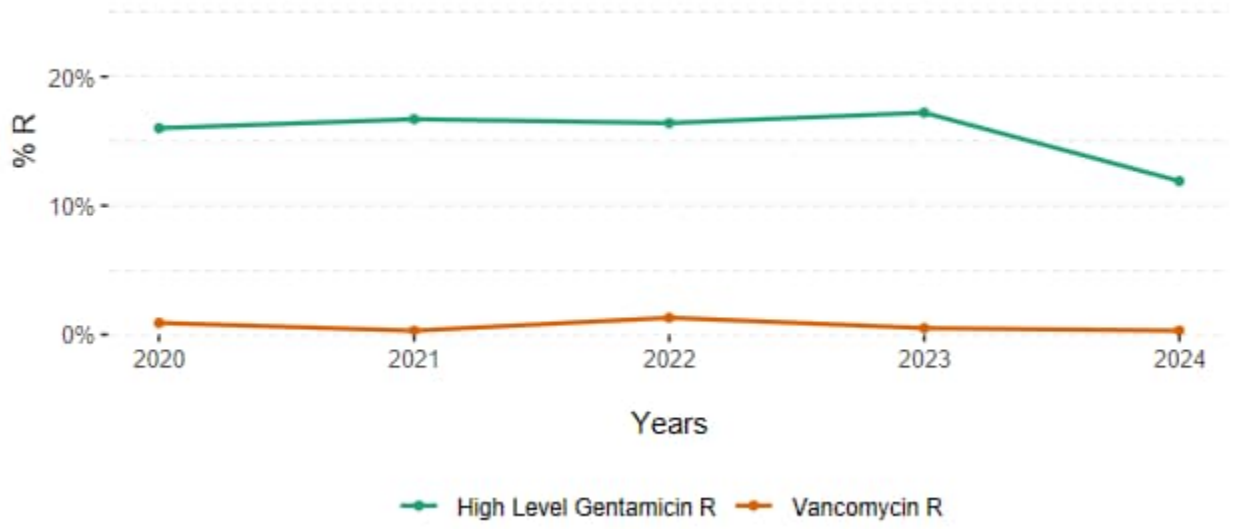
- In 2024, there were 300 *E. faecalis* bloodstream infections reported from 32 laboratories. This is lower than in 2023 when there were 389 reports from 35 laboratories. When restricting the data to the 31 laboratories that reported data for both years, there was a reduction of 12% in the numbers.
- Only one isolate was vancomycin-resistant in 2024 (0.3%).
- In 2024, high-level gentamicin resistance among invasive *E. faecalis* bloodstream infections decreased to 12% (2023, 17%).
- Only one linezolid-resistant *E. faecalis* was reported in 2024.

Key Resistance Indicators

Table 28: Antimicrobial resistance in invasive *E. faecalis* infections in Ireland

	2020	2021	2022	2023	2024
Total Isolates	330	365	375	389	300
Vancomycin R	0.9%	0.3%	1.3%	0.5%	0.3%
Ampicillin R	0.9%	0.8%	1.1%	0.5%	0.7%
High Level Gentamicin R	16.0%	16.7%	16.4%	17.2%	11.9%
Linezolid R	0.0%	0.6%	0.0%	0.3%	0.4%
MDR	0.0%	0.0%	0.7%	0.0%	0.0%

Figure 28: Key resistance indicators in invasive *E. faecalis* infections in Ireland

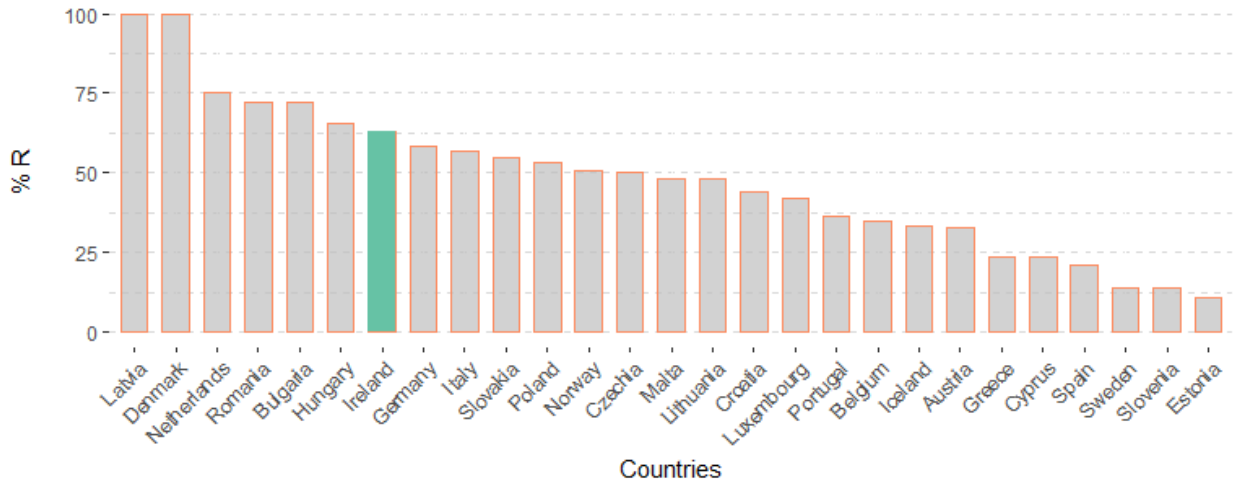


High-Level Gentamicin Resistance

Table 29: High-level gentamicin resistance in invasive *E. faecalis* infections in Ireland

Year	Total Cases	R	I	S	% R
2020	330	30	0	158	16.0%
2021	365	46	0	229	16.7%
2022	375	45	0	230	16.4%
2023	389	55	1	264	17.2%
2024	300	24	0	178	11.9%

Figure 29: High-level gentamicin resistance in invasive *E. faecalis* infections in the EU/EEA in 2023



7. Acinetobacter species

- In 2024, there were 59 invasive *Acinetobacter* spp. infections reported from 32 laboratories. This is lower than in 2023 when there were 71 reports from 35 laboratories. When restricting the data to the 31 laboratories that reported data for both years, the numbers were stable.
- Resistance to all key antibiotics, including carbapenems, remains at low levels.
- No multi-drug resistance (MDR) or carbapenem resistance among invasive *Acinetobacter* spp. infections were reported in Ireland in
- MDR and carbapenem resistant *Acinetobacter* spp. is a major problem in Southern and Eastern European countries, with six and eight countries, respectively, reporting proportions in excess of 75% in 2023 for each of these.

Key Resistance Indicators

Table 30: Antimicrobial resistance in invasive *Acinetobacter* infections in Ireland

	2020	2021	2022	2023	2024
Total Isolates	53	73	80	71	59
Fluoroquinolone R	7.3%	3.1%	1.4%	1.4%	5.6%
Gentamicin R	2.2%	3.1%	1.6%	0.0%	1.7%
Aminoglycoside R	2.2%	3.0%	1.5%	1.5%	1.7%
Imipenem/Meropenem R	0.0%	1.5%	2.5%	0.0%	0.0%
MDR	0.0%	0.0%	0.0%	0.0%	0.0%

igure 30: Key resistance indicators in invasive *Acinetobacter* infections in Ireland

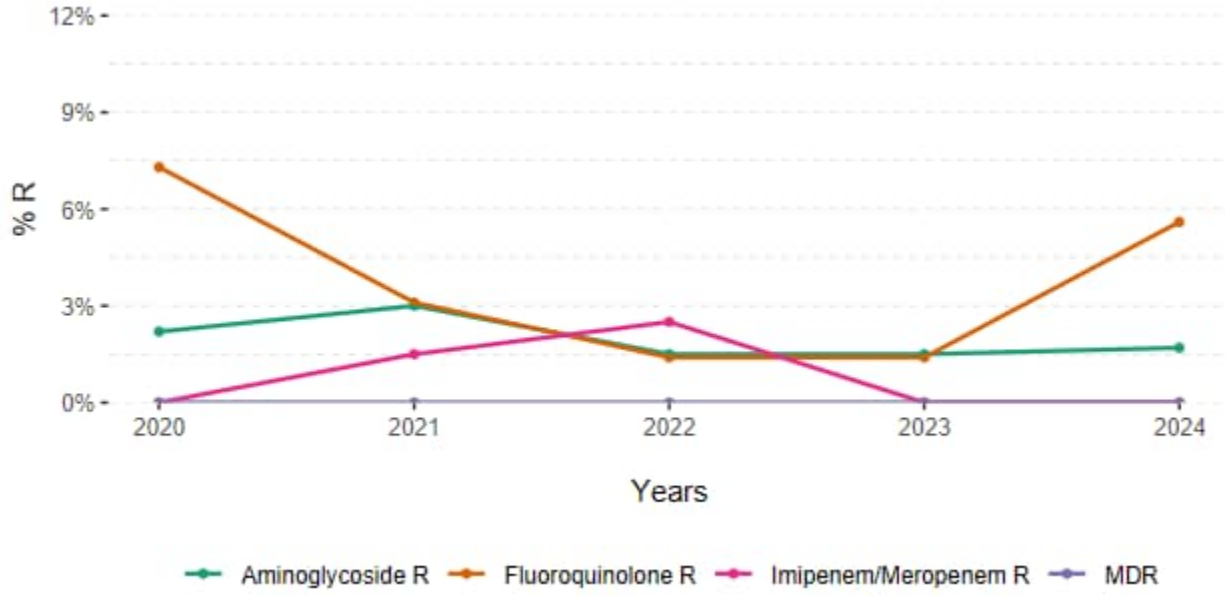
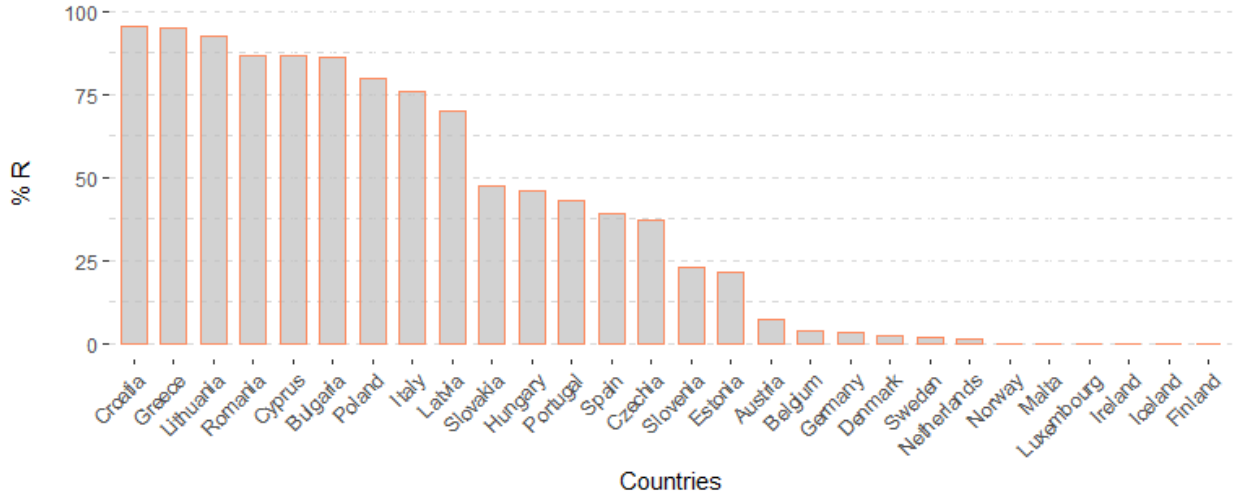


Figure 31: Carbapenem resistance in invasive *Acinetobacter* infections in the EU/EEA in 2023



8. Streptococcus pneumoniae

- In 2024, there were 369 invasive *S. pneumoniae* infections reported from 32 laboratories. This is higher than in 2023 when there were 361 reports from 35 laboratories. When restricting the data to the 31 laboratories that reported data for both years, there was an increase of 19% in the numbers.
- Penicillin non-wild type (Pen-NWT) refers to *S. pneumoniae* isolates reported as either "susceptible, increased exposure" (I) or resistant (R); with MICs above those of the wild type isolates (>0.06mg/L). Wild type (WT) organisms are those with no phenotypically detectable resistance mechanisms (acquired or by mutation) to a particular antimicrobial. Penicillin-WT strains of *S. pneumoniae* are typically susceptible to penicillin.
- In 2024, 21% of all invasive *S. pneumoniae* isolates were penicillin non-wild type (Pen-NWT) representing an increase from 17% in 2023.

Key Resistance Indicators

Table 31: Antimicrobial resistance in invasive *Streptococcus pneumoniae* infections in Ireland

	2020	2021	2022	2023	2024
Total Isolates	189	179	305	361	369
Typed Isolates (n)	170	154	276	335	330
Typed Isolates (%)	89.9%	86.0%	90.5%	92.8%	89.4%
Penicillin Non-WT (n)	32	34	72	61	76
Penicillin Non-WT (%)	16.9%	19.0%	23.6%	17.4%	20.8%
Penicillin R (Pen Non-WT)	0.0%	1.1%	2.0%	1.7%	2.7%
Penicillin I (Pen Non-WT)	16.9%	17.9%	21.6%	15.2%	17.9%
Erythromycin R (%)	13.2%	12.2%	16.5%	14.1%	12.9%

Figure 32: Key resistance indicators in invasive *Streptococcus pneumoniae* infections in Ireland

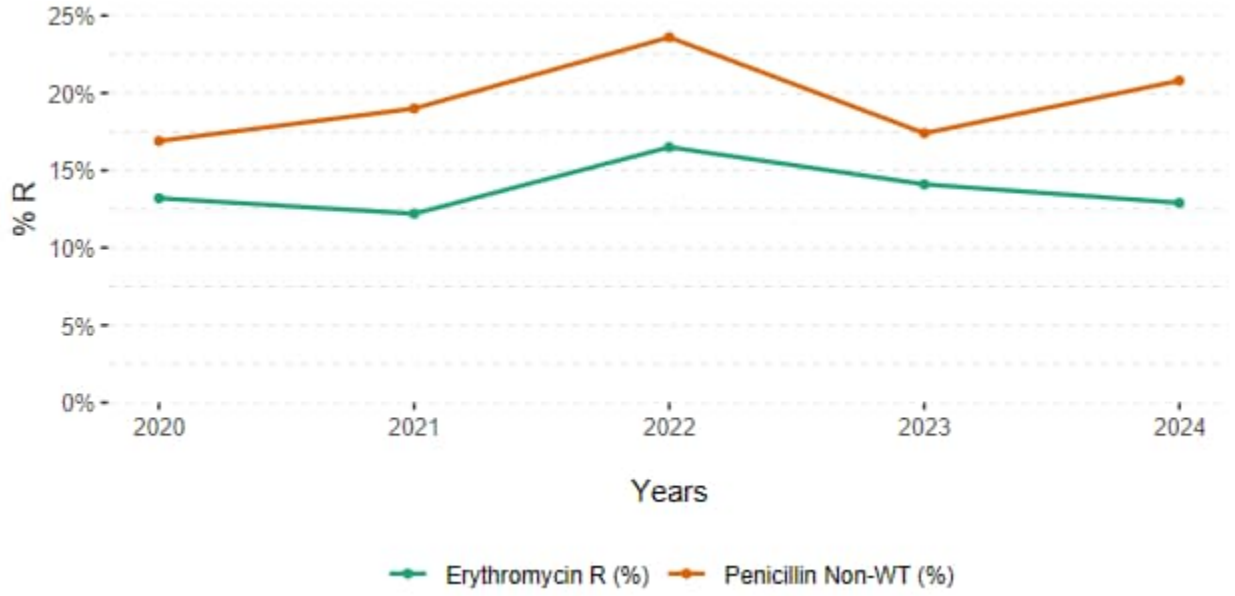
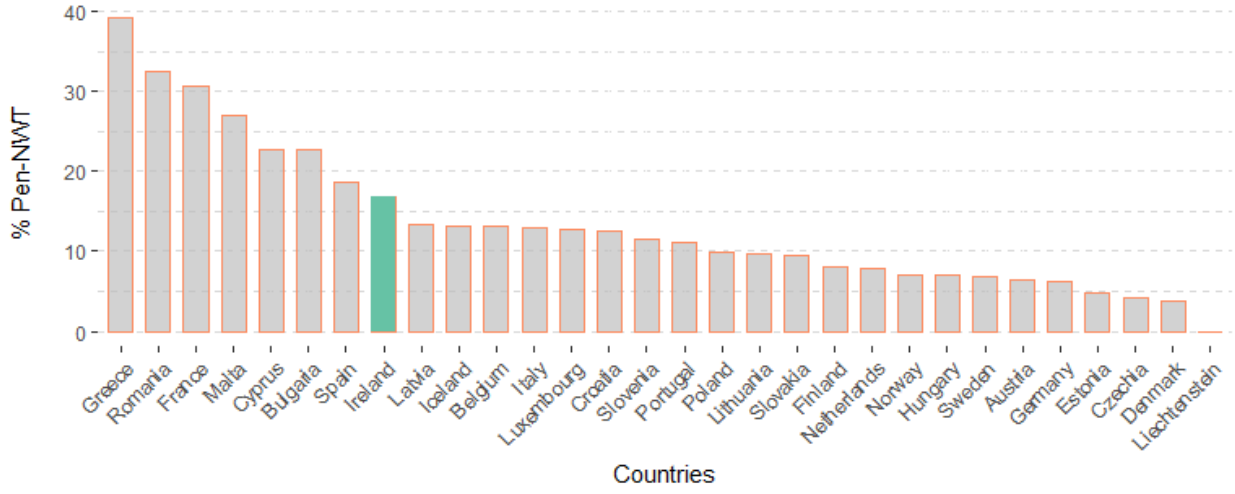


Figure 33: Penicillin non-wild type in invasive *Streptococcus pneumoniae* infections in the EU/EEA in 2023



9. Invasive Group A Streptococcus (iGAS)

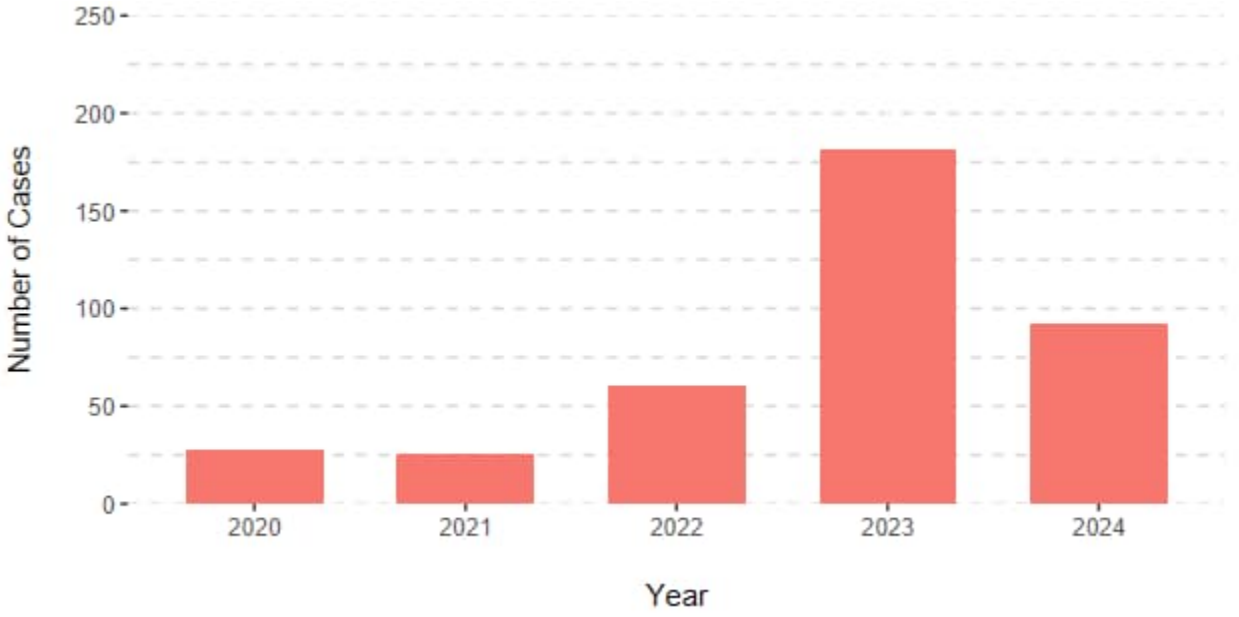
- As of 2024, the case definition of iGAS for the purpose of AMR surveillance was amended to include isolates from blood and CSF only, in line with the other EARS-Net pathogens. Data presented for earlier years in this report have been adjusted accordingly.
- In 2024, there were 92 invasive GAS infections reported from 32 laboratories. This is lower than in 2023 when there were 182 reports from 35 laboratories. When restricting the data to the 31 laboratories that reported data for both years, there was a reduction of 46% in the numbers. This fall in numbers follows the unusual iGAS upsurge experienced at the end of 2022 to summer 2023 (post-COVID-19 pandemic).
- In 2024, erythromycin resistance among invasive GAS infections increased to 9% (2023, 4%).

Key Resistance Indicators

Table 32: Antimicrobial resistance in iGAS infections in Ireland

	2020	2021	2022	2023	2024
Total Isolates	28	26	61	182	92
Typed Isolates (n)	24	22	56	172	84
Typed Isolates (%)	85.7%	84.6%	91.8%	94.5%	91.3%
Erythromycin R	14.3%	16.7%	10.2%	3.6%	9.4%

Figure 34: Number of iGAS infections (submitted to EARS-Net for the purpose of AMR surveillance) in Ireland over the last 5 years



10. Invasive Group B Streptococcus (iGBS)

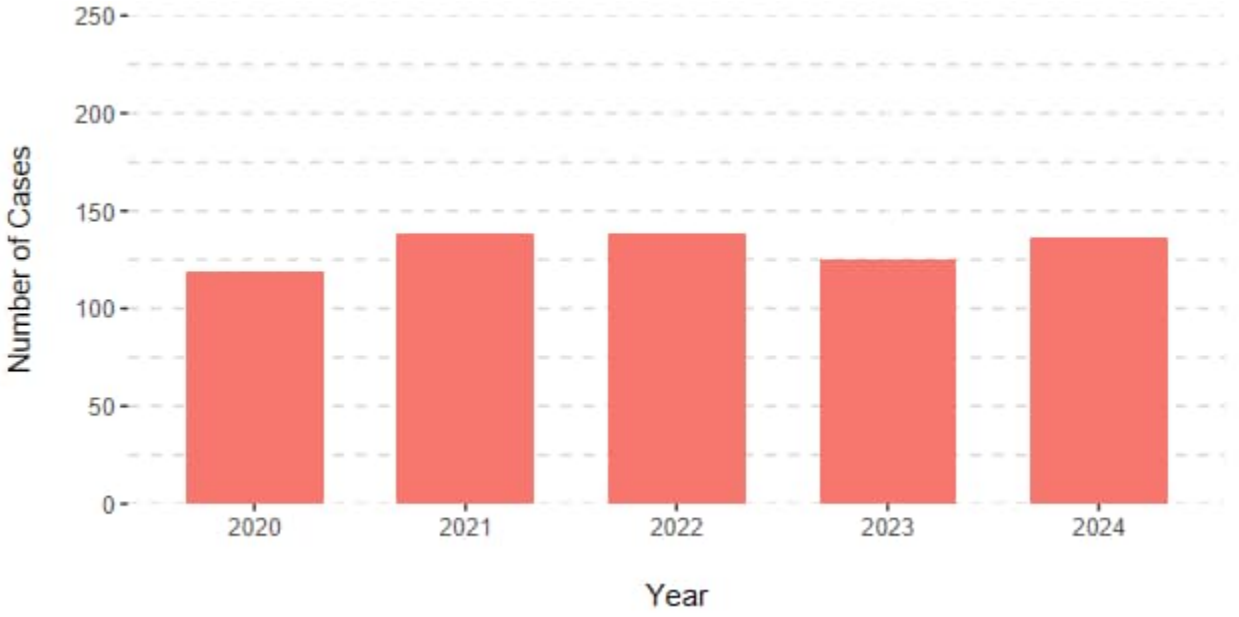
- For the purpose of AMR surveillance, we collect data on invasive Group B streptococcus (iGBS) infections from all age groups, and not just from infants <90 days which is what is currently notifiable in Ireland.
- In 2024, there were 136 iGBS infections reported from 32 laboratories. This is higher than in 2023 when there were 125 reports from 35 laboratories. When restricting the data to the 31 laboratories that reported data for both years, there was an increase of 17% in the numbers.
- In 2024, erythromycin resistance among invasive GAS infections increased to 47% (2023, 41%).

Key Resistance Indicators

Table 33: Antimicrobial resistance in iGBS infections in Ireland

	2020	2021	2022	2023	2024
Total Isolates	119	139	138	125	136
Typed Isolates (n)	49	44	20	68	26
Typed Isolates (%)	41.2%	31.7%	14.5%	54.4%	19.1%
Erythromycin R	26.7%	42.9%	40.9%	41.4%	46.5%

Figure 35: Number of iGBS infections (submitted to EARS-Net for the purpose of AMR surveillance) in Ireland over the last 5 years



11. Candida spp.

- In 2024, there were 211 invasive *Candida* spp. infections reported from 32 laboratories. This is higher than in 2023 when there were 363 reports from 35 laboratories. When restricting the data to the 31 laboratories that reported data for both years, there was a 27% decrease in the numbers.
- *C. auris* is a recently emerged pathogen causing severe hospital-acquired systemic infections. It is very important to speciate candida isolates to exclude *C. auris* from the diagnosis.
- In 2024, all but one candida isolate was speciated. Since the surveillance started in 2017, no *C. auris* from invasive infections have been reported.

Figure 36: Invasive *Candida* spp. infections by species in the latest year in Ireland

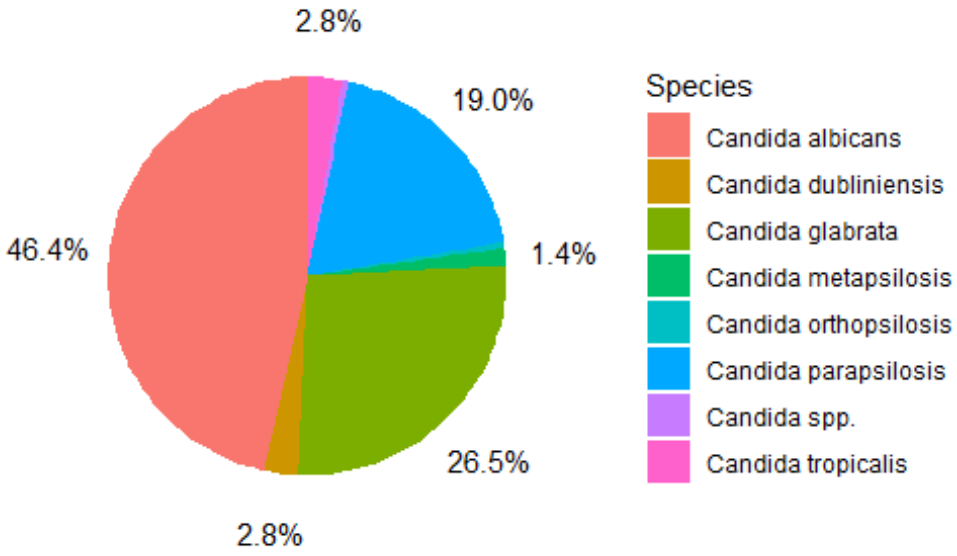


Table 34: Breakdown of invasive *Candida* spp. infections by species in Ireland

Organism	2020	2021	2022	2023	2024
Candida albicans	85	125	129	153	98
Candida glabrata	53	78	84	96	56
Candida parapsilosis	57	51	49	73	40
Candida dubliniensis	5	10	4	9	6
Candida tropicalis	4	17	9	7	6
Candida metapsilosis	0	0	1	4	3
Candida spp.	11	0	1	0	1
Candida orthopsilosis	0	1	0	2	1
Candida guilliermondii	1	1	3	1	0
Candida krusei	0	6	1	6	0
Candida lipolyticas	0	1	0	0	0
Candida lusitaniae	5	2	4	6	0
Candida pelliculosa	0	0	0	1	0
Candida duobushaemolonii	0	0	0	2	0
Candida fermentati	0	0	0	2	0
Candida auris	0	0	0	0	0
Total	**221**	**292**	**285**	**362**	**211**

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