Austria

Participating institutions:
Federal Ministry of Social Affairs, Health, Care and Consumer Protection, www.sozialministerium.at
Ordensklinikum Linz, Elisabethinen, www.ordensklinikum.at

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Austria, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	ND	ND	ND	90	90
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	ND	ND	ND	ND	ND

ND: no data available.
For data reported in 2019 – 2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Austria, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	95	NA	100	97	95

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Austria, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	38	6 305	8	37	5 394	8	37	5 579	7	35	5 122	9	35	5 659	9
K. pneumoniae	38	1 333	14	36	1 133	17	36	1 326	15	34	1 256	13	35	1 401	14
P. aeruginosa	38	808	13	36	727	18	36	788	16	34	726	15	34	753	13
Acinetobacter spp.	23	82	13	22	69	12	25	80	16	21	101	7	21	100	13
S. aureus	38	3 419	12	36	2 934	14	36	3 444	14	36	3 124	12	35	3 325	12
S. pneumoniae	37	550	18	34	301	10	33	347	16	34	476	14	34	647	14
E. faecalis	37	792	16	35	840	21	36	898	23	35	918	15	34	897	15
E. faecium	34	537	33	32	509	30	31	701	36	30	668	31	28	590	25

Labs: laboratories.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICUs is presented only if there are ≥20 isolates, of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019–2023, as well as the percentage change 2019–2023, by bacterial species and antimicrobial group/agent, Austria

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	35.07	27.55^	26.95^	26.54	27.68^	↓	-21.1
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	7.14	6.35	5.71	5.25	6.60	-	-7.6
	Carbapenem (imipenem/meropenem) resistance	0.00	0.06	0.01	0.07	0.09	↑	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	13.96	11.63	10.39	8.25	9.92	↓	-28.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	5.32	4.07	3.81	3.16	3.08^	↓	-42.1
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2.03	1.83	1.13	1.09^	1.21^	↓	-40.4
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1.72	1.10	1.59	1.46	2.37	-	+37.8
	Carbapenem (imipenem/meropenem) resistance	0.20	0.12	0.15	0.14	0.29	-	+45.0
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	2.61	1.69	1.95	1.46	2.21	-	-15.3
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.90	0.50	0.52	0.42	0.59^	-	-34.4
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	0.50	0.37	0.34	0.21^	0.38^	-	-24.0
P. aeruginosa	Piperacillin-tazobactam resistance	0.79^	0.70^	0.81^	0.85^	0.82^	-	+3.8
	Ceftazidime resistance	0.83	0.81	1.19	0.94	0.96	-	+15.7
	Carbapenem (imipenem/meropenem) resistance	1.32	1.29	1.46	1.37	1.23	-	-6.8
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1.08	1.21	1.49	1.29	0.68^	-	-37.0
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.38	0.14^	0.22^	0.20^	0.12^	NA	-68.4
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.40^	0.17^	0.15^	0.28^	0.15^	NA	-62.5
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.08	0.06	0.09^	0.04	0.09	-	+12.5
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.10	0.09	0.14	0.01	0.06^	-	-40.0
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.08	0.06	0.10	0.00^	0.07^	-	-12.5
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.06	0.05	0.09^	0.00^	0.04^	-	-33.3
S. aureus	MRSA[f]	2.17	1.56	1.22	1.51	1.81	-	-16.6
S. pneumoniae	Penicillin non-wild-type[g]	0.39^	0.12^	0.21	0.27	0.49	-	+25.6
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.85	0.42	0.60	0.63	0.82	-	-3.5
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.20^	0.07^	0.10	0.11	0.23	-	+15.0
E. faecalis	High-level gentamicin resistance	0.82^	0.46^	0.46^	0.35^	0.49^	↓	-40.2
E. faecium	Vancomycin resistance	0.21	0.22	0.17	0.22	0.22	-	+4.8

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Austria, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	6 042	46.3	4 798	46.0	4 805	45.1	4 669	45.9	4 885	46.4	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	6 106	9.3	5 376	9.5	5 537	8.3	5 096	8.3	5 491	9.9	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	5 935	0.0	5 141	0.1	5 206	0.0	4 973	0.1	5 351	0.1	0.3 (0.0-1.8)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	6 111	18.2	5 373	17.3	5 539	15.1	4 788	13.9	5 409	15.0	24.0 (10.1-42.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	6 102	6.9	5 219	6.2	5 320	5.8	4 653	5.5	4 705	5.4	10.9 (4.5-28.4)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	6 072	2.7	5 192	2.8	5 286	1.7	4 307	2.0	4 489	2.2	5.9 (1.3-17.6)	↓*
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1 326	10.3	1 124	7.8	1 305	9.8	1 233	9.6	1 384	14.0	34.8 (5.7-81.5)	↑*
	Carbapenem (imipenem/meropenem) resistance	1 296	1.2	1 055	0.9	1 229	1.0	1 247	0.9	1 335	1.8	13.3 (0.0-69.7)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	1 327	15.7	1 129	12.0	1 303	12.0	1 183	10.0	1 303	13.9	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1 319	5.5	1 085	3.7	1 235	3.4	1 157	2.9	1 208	4.0	23.6 (2.6-73.3)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1 312	3.0	1 076	2.8	1 227	2.2	1 066	1.6	1 115	2.8	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	665	9.5	624	9.0	643	10.1	607	11.4	598	11.2	18.5 (3.7-54.4)	-
	Ceftazidime resistance	781	8.5	688	9.4	741	13.0	664	11.4	717	11.0	15.7 (2.8-52.7)	↑
	Carbapenem (imipenem/meropenem) resistance	786	13.4	683	15.1	737	15.9	677	16.4	711	14.2	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	805	10.7	676	14.3	722	16.6	659	15.8	653	8.6	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	784	3.8	426	2.6	438	4.1	436	3.7	444	2.3	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	633	5.1	355	3.9	279	4.3	255	9.0	287	4.2	13.1 (1.6-49.5)	NA
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	81	7.4	69	7.2	70	10.0	94	3.2	97	7.2	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	82	9.8	69	10.1	80	13.8	94	1.1	87	5.7	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	82	7.3	66	7.6	75	10.7	74	0.0	71	8.5	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	81	6.2	66	6.1	70	10.0	67	0.0	58	5.2	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	3 323	5.2	2 843	4.4	3 159	3.1	3 108	3.9	3 297	4.5	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	458	6.8	258	3.9	324	5.2	460	4.8	618	6.5	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	547	12.4	295	11.5	335	14.3	468	10.9	630	10.6	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	455	3.5	252	2.4	315	2.5	452	2.0	606	3.1	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	285	22.8	258	14.3	255	14.5	299	9.4	334	12.0	24.3 (4.3-99.0)	↓*
E. faecium	Vancomycin resistance	537	3.2	507	3.6	697	2.0	666	2.7	589	3.1	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Belgium

Participating institutions:
Sciensano, www.sciensano.be

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Belgium, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)					
Laboratories collecting *S. pneumoniae*	87	91	91	91	91
Laboratories collecting other species	26	36	43	42	42
Geographical representativeness					
Laboratories collecting *S. pneumoniae*	High	High	High	High	High
Laboratories collecting other species	Medium	High	High	High	High
Hospital representativeness	High	High	High	Medium	Medium
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	87.5[a]	129.6[a]	100.8[a]	115.8[a]	115.7[a]

[a] Not including *S. pneumoniae* network

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Belgium, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	91	NA	94	94	88

NA: not applicable. In 2020 there was no EARS-Net EQA.

[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Belgium, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	27	3 940	NA	28	4 320	NA	31	4 722	NA	31	4 540	NA	31	4 961	NA
K. pneumoniae	26	759	NA	27	912	NA	30	926	NA	29	888	NA	30	979	NA
P. aeruginosa	27	441	NA	28	504	NA	30	479	NA	29	456	NA	30	467	NA
Acinetobacter spp.	23	94	NA	23	161	NA	28	169	NA	27	170	NA	27	197	NA
S. aureus	27	1 169	NA	28	1 455	NA	30	1 615	NA	30	1 501	NA	31	1 717	NA
S. pneumoniae	89	1 548	NA	89	858	27	82	843	24	80	1 457	24	85	1 712	22
E. faecalis	26	496	NA	29	669	NA	31	712	NA	31	642	NA	30	702	NA
E. faecium	25	343	NA	26	494	NA	29	502	NA	29	424	NA	29	455	28

Labs: laboratories.

NA: not applicable.

[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.

[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Belgium

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	68.26#	54.60	48.72	48.70#	52.45#	↓	-23.2
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	13.19#	10.29	7.84	8.07#	10.14#	-	-23.1
	Carbapenem (imipenem/meropenem) resistance	0.07#	0.02	0.04	0.06#	0.08#	-	+14.3
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	25.11#	18.83	17.59	16.29#	18.33#	↓	-27.0
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	9.10#	7.76	5.21	4.89^#	6.20^#	↓	-31.9
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3.93#	2.99	1.43	1.56^#	2.17^#	↓	-44.8
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	4.97#	4.34	3.52	3.30#	3.95#	↓	-20.5
	Carbapenem (imipenem/meropenem) resistance	0.27#	0.24	0.26	0.25#	0.47#	-	+74.1
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	5.04#	5.01	3.54	3.66#	4.34#	-	-13.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	2.89#	2.87	1.67	1.58^#	1.85^#	↓	-36.0
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2.22#	2.27	1.37	1.25^#	1.46^#	↓	-34.2
P. aeruginosa	Piperacillin-tazobactam resistance	1.78#	1.35	0.97	1.06#	1.16#	↓	-34.8
	Ceftazidime resistance	1.18#	1.06	0.74	0.82#	0.83#	-	-29.7
	Carbapenem (imipenem/meropenem) resistance	1.58#	1.42	1.03	1.37#	1.09#	-	-31.0
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	2.12#	1.78	1.35	1.37#	1.48#	↓	-30.2
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	1.04#	0.46^	0.36^	0.27^#	0.30^#	NA	-71.2
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.87#	0.55^	0.40^	0.45^#	0.34^#	NA	-60.9
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.00#	0.05	0.04	0.08#	0.16#	↑	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.27#	0.53^	0.36^	0.27#	0.34#	-	+25.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.10#	0.10	0.16	0.04^#	0.14^#	-	+40.0
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.00^#	0.02^	0.04^	0.00^#	0.04^#	-	NA
S. aureus	MRSA[f]	2.62#	2.43	1.33	1.27#	2.07#	-	-21.0
S. pneumoniae	Penicillin non-wild-type[g]	1.51	1.18	1.44	1.94#	2.11#	↑	+39.7
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	2.44	1.56	1.32	2.00#	2.38#	-	-2.5
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.88	0.72	0.79	1.11#	1.22#	↑	+38.6
E. faecalis	High-level gentamicin resistance	2.05^#	0.94^	0.60^	0.45^#	0.67^#	↓	-67.3
E. faecium	Vancomycin resistance	0.07#	0.34	0.28	0.12#	0.34#	-	+385.7

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Belgium, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	3 601	56.5	4 009	56.5	4 389	55.2	4 205	56.6	4 648	55.7	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	3 937	10	4 320	9.9	4 721	8.3	4 500	8.8	4 956	10.1	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	3 926	0.1	4 126	0	4 722	0	4 296	0.1	4 958	0.1	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	3 925	19.1	4 320	18.1	4 721	18.5	4 536	17.5	4 957	18.2	24.0 (10.1-42.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3 922	6.9	4 312	7.5	4 267	6.1	3 733	6.4	4 039	7.6	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3 920	3	4 312	2.9	4 265	1.7	3 694	2.1	4 033	2.7	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	759	19.5	912	19.7	926	18.9	879	18.3	979	19.9	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	757	1.1	881	1.1	926	1.4	835	1.4	979	2.3	13.3 (0.0-69.7)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	757	19.8	911	22.8	926	19	887	20.2	978	21.9	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	755	11.4	910	13.1	858	9.7	726	10.6	794	11.5	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	755	8.7	909	10.3	858	7.9	716	8.5	793	9.1	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	439	12.1	503	11.1	478	10	438	11.9	462	12.3	18.5 (3.7-54.4)	-
	Ceftazidime resistance	427	8.2	489	9	464	8	421	9.5	451	9.1	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	440	10.7	474	12.4	479	10.6	452	14.8	465	11.6	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	440	14.3	503	14.7	479	14	456	14.7	466	15.7	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	438	7.1	304	6.3	257	7	190	6.8	209	7.2	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	423	6.1	289	8	243	8.2	166	13.3	199	8.5	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	94	0	160	1.3	167	1.2	168	2.4	194	4.1	40.1 (0.0-95.8)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	93	8.6	141	15.6	146	12.3	156	8.3	196	8.7	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	85	3.5	148	2.7	153	5.2	143	1.4	149	4.7	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	84	0	127	0.8	130	1.5	129	0	145	1.4	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	1 168	6.7	1 455	6.9	1 614	4.1	1 492	4.2	1 700	6	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	1 548	9.7	858	14.5	843	18	1 457	14.1	1 712	13.1	15.1 (3.7-39.1)	↑*
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1 548	15.7	858	19.1	843	16.5	1 457	14.6	1 712	14.8	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	1 548	5.7	858	8.7	843	9.8	1 457	8	1 712	7.6	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	363	16.8	296	13.2	351	8.5	325	6.8	363	9.1	24.3 (4.3-99.0)	↓*
E. faecium	Vancomycin resistance	343	0.6	491	2.9	502	2.8	423	1.4	454	3.7	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Bulgaria

Participating institutions:
National Center of Infectious and Parasitic Diseases,
https://ncipd.org/index.php?option=com_content&view=featured&Itemid=730&lang=en

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Bulgaria, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	45	45	45	45	45
Geographical representativeness	Medium	Medium	Medium	Medium	Medium
Hospital representativeness	Medium	Medium	Medium	Medium	Medium
Isolate representativeness	Medium	Medium	Medium	Medium	Medium
Blood culture sets per 1 000 patient-days	8.6	10.4	11.4	11.3	12.8

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Bulgaria, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	100	NA	96	100	100

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Bulgaria, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	23	352	23	23	261	19	22	263	15	18	239	21	20	306	25
K. pneumoniae	20	267	53	19	249	48	19	242	47	20	260	43	19	405	53
P. aeruginosa	16	107	40	17	70	51	15	83	45	14	76	54	17	84	54
Acinetobacter spp.	15	132	60	14	129	60	18	217	70	15	160	66	16	183	74
S. aureus	23	324	23	23	220	22	19	211	15	20	233	22	22	290	27
S. pneumoniae	14	46	35	9	28	21[c]	6	11	NA	10	27	30[c]	10	31	45
E. faecalis	20	150	35	19	165	41	21	190	37	20	145	30	19	168	40
E. faecium	17	99	31	16	77	57	13	148	62	15	145	54	19	128	53

Labs: laboratories.
NA: not applicable.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).
[c] A small number of isolates were tested (n<30), and the percentage of isolates from ICUs should be interpreted with caution.

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Bulgaria

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	6.64#	5.21#	4.85#	5.00#	6.62#	-	-0.3
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	4.05#	3.24#	2.95#	2.92#	3.68#	-	-9.1
	Carbapenem (imipenem/meropenem) resistance	0.00#	0.06#	0.03#	0.00#	0.03#	-	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	4.05#	3.36#	2.65#	2.95#	3.94#	-	-2.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	2.56#	2.25^#	2.14#	1.77#	2.81#	-	+9.8
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1.99#	1.23^#	1.17#	1.04#	1.74#	-	-12.6
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	6.27#	6.16#	6.19#	6.48#	11.13#	↑	+77.5
	Carbapenem (imipenem/meropenem) resistance	2.24#	2.19#	3.52#	3.91#	7.75#	↑	+246.0
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	5.03#	5.22#	5.41#	5.40#	10.01#	↑	+99.0
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	4.75#	4.82#	5.25#	5.12#	10.01#	↑	+110.7
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3.73#	4.13#	4.56#	4.39#	8.87#	↑	+137.8
P. aeruginosa	Piperacillin-tazobactam resistance	1.16#	1.54#	1.24#	1.29#	1.18#	-	+1.7
	Ceftazidime resistance	1.12#	1.30#	1.31#	1.50#	1.22#	-	+8.9
	Carbapenem (imipenem/meropenem) resistance	0.92#	1.03#	0.93#	1.08#	1.03#	-	+12.0
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1.09#	1.27#	0.90#	1.04#	0.96#	-	-11.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	1.16#	0.55^#	0.72#	0.70^#	0.59#	NA	-49.1
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	1.12#	0.86^#	0.90#	0.87^#	0.96#	NA	-14.3
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	3.31#	3.75#	5.96#	4.53#	5.98#	↑	+80.7
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	3.41#	3.75#	6.14#	4.60#	6.28#	↑	+84.2
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3.59#	3.44#	6.24#	4.64#	5.98#	↑	+66.6
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	3.21#	3.30#	5.50#	4.28#	5.56#	↑	+73.2
S. aureus	MRSA[f]	1.43#	0.78#	0.96#	0.85#	1.49#	-	+4.2
S. pneumoniae	Penicillin non-wild-type[g]	0.15#	0.08#	0.04#	0.23#	0.29#	-	+93.3
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.53#	0.11#	0.08#	0.23#	0.45#	-	-15.1
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.15#	0.04#	0.00#	0.12#	0.16#	-	+6.7
E. faecalis	High-level gentamicin resistance	1.82#	2.58#	3.02#	2.16#	2.29#	-	+25.8
E. faecium	Vancomycin resistance	0.42#	0.21#	0.53#	0.32#	0.26#	-	-38.1

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Bulgaria, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	352	63.4	261	66.7	263	61.2	239	68.6	306	67	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	352	38.6	261	41.4	263	37.3	239	40.2	306	37.3	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	352	0	261	0.8	263	0.4	239	0	306	0.3	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	352	38.6	261	42.9	263	33.5	239	40.6	306	39.9	24.0 (10.1-42.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	352	24.4	219	34.2	263	27	239	24.3	306	28.4	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	352	19	219	18.7	263	14.8	239	14.2	306	17.6	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	267	75.7	249	79.1	242	81.4	260	78.5	405	81.5	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	267	27	249	28.1	242	46.3	260	47.3	405	56.8	13.3 (0.0-69.7)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	267	60.7	249	67.1	242	71.1	260	65.4	405	73.3	33.7 (7.1-76.9)	↑*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	267	57.3	230	67	242	69	260	61.9	405	73.3	23.6 (2.6-73.3)	↑*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	267	44.9	230	57.4	242	59.9	260	53.1	405	64.9	21.0 (0.0-64.9)	↑*
P. aeruginosa	Piperacillin-tazobactam resistance	107	31.8	70	64.3	83	43.4	76	48.7	84	38.1	18.5 (3.7-54.4)	-
	Ceftazidime resistance	107	30.8	70	54.3	83	45.8	76	56.6	84	39.3	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	107	25.2	70	42.9	83	32.5	76	40.8	84	33.3	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	107	29.9	70	52.9	83	31.3	76	39.5	84	31	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	107	31.8	50	32	83	25.3	55	36.4	84	19	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	107	30.8	50	50	83	31.3	55	45.5	84	31	13.1 (1.6-49.5)	NA
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	132	72	129	82.9	217	77.9	160	79.4	183	86.3	40.1 (0.0-95.8)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	132	74.2	129	82.9	217	80.2	160	80.6	183	90.7	42.4 (0.0-96.6)	↑*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	132	78	129	76	217	81.6	160	81.3	183	86.3	36.7 (0.0-92.4)	↑*
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	132	69.7	129	72.9	217	71.9	160	75	183	80.3	35.2 (0.0-91.5)	↑*
S. aureus	MRSA[f]	324	14.8	220	11.8	211	15.2	233	12	290	15.9	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	46	8.7	28	7.1[h]	11	NA	27	22.2[h]	31	22.6	15.1 (3.7-39.1)	NA
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	46	30.4	28	10.7[h]	11	NA	27	22.2[h]	31	35.5	17.8 (4.0-53.8)	NA
	Combined penicillin non-wild-type and resistance to macrolides[g]	46	8.7	28	3.6[h]	11	NA	27	11.1[h]	31	12.9	9.2 (0.0-26.9)	NA
E. faecalis	High-level gentamicin resistance	150	37.3	165	47.9	190	48.4	145	44.8	168	38.7	24.3 (4.3-99.0)	-
E. faecium	Vancomycin resistance	99	12.1	77	7.8	148	10.1	145	6.2	128	5.5	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

[h] A small number of isolates were tested (n<30), and the percentage resistance should be interpreted with caution.

Croatia

Participating institutions:
Reference Center for Antimicrobial Resistance Surveillance University Hospital for Infectious Diseases (Dr Fran Mihaljević), Zagreb, https://bfm.hr/referentni-centar-za-pracenje-rezistencijebakterija-na-antibotike/

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Croatia, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	ND	80	100	90	90
Geographical representativeness	ND	High	High	High	High
Hospital representativeness	ND	High	High	High	High
Isolate representativeness	ND	High	High	High	High
Blood culture sets per 1 000 patient-days	ND	109.0	38.3	34.0	29.0

ND: no data available.
For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Croatia, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	100	NA	87	97	97

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Croatia, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	19	1 123	8	19	828	7	19	729	12	23	989	13	24	1 311	14
K. pneumoniae	17	328	14	16	270	20	18	361	32	22	369	30	22	569	27
P. aeruginosa	15	185	15	18	165	32	15	214	45	20	263	37	21	367	37
Acinetobacter spp.	16	143	31	14	225	73	18	408	75	21	291	60	20	266	53
S. aureus	15	360	11	19	424	16	18	600	30	21	618	21	24	736	20
S. pneumoniae	16	156	20	12	55	17	14	80	23	20	83	18	19	131	20
E. faecalis	14	127	16	16	162	23	17	199	38	20	215	25	24	224	24
E. faecium	11	74	19	16	88	28	14	113	50	18	133	37	22	150	33

Labs: laboratories.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Croatia

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	19.41#	14.69	10.06	15.67	21.21	-	+9.3
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	5.31#	4.22	3.34	4.93	7.56	-	+42.4
	Carbapenem (imipenem/meropenem) resistance	0.06#	0.00	0.00	0.03	0.06	-	0.0
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	9.26#	7.55	5.18	8.45	11.11	-	+20.0
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	5.06#	3.79	2.11	4.53	6.67	-	+31.8
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3.01#	2.22	1.29	2.12	4.13	-	+37.2
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	5.15#	4.34	5.55	5.73	9.03	↑	+75.3
	Carbapenem (imipenem/meropenem) resistance	1.20#	1.57	2.87	2.52	4.53	↑	+277.5
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	5.64#	4.47	5.70	5.59	9.23	↑	+63.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	4.26#	3.17	4.11	4.35	6.06	↑	+42.3
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3.65#	2.96	3.82	3.95	5.51	↑	+51.0
P. aeruginosa	Piperacillin-tazobactam resistance	0.80#	0.52	0.55	0.95	1.07	-	+33.8
	Ceftazidime resistance	1.07#	0.95	0.92	1.66	2.05	↑	+91.6
	Carbapenem (imipenem/meropenem) resistance	1.47#	1.54	1.66	2.64	3.03	↑	+106.1
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1.66#	1.17	1.04	2.01	3.29	↑	+98.2
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	1.13#	ND	ND	ND	ND	NA	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.98^#	ND	ND	ND	ND	NA	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	4.05#	6.68	10.03	8.22	7.33	-	+81.0
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	4.08#	6.78	10.01	8.16	7.30	-	+78.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3.96#	6.68	9.91	7.93	6.98	-	+76.3
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	3.89#	6.56	9.81	7.88	6.84	-	+75.8
S. aureus	MRSA[f]	2.73#	3.82	5.18	5.44	6.35	↑	+132.6
S. pneumoniae	Penicillin non-wild-type[g]	0.95#	0.40	0.32^	0.46	0.46	-	-51.6
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1.41#	0.68	0.45	0.63	0.63	↓	-55.3
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.64#	0.28	0.27^	0.43	0.29	-	-54.7
E. faecalis	High-level gentamicin resistance	0.92#	1.88	1.91	2.32	1.90	↑	+106.5
E. faecium	Vancomycin resistance	0.58#	0.89	1.11	1.37	1.01	↑	+74.1

ND: no data available.

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Croatia, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	1 108	57.1	827	57.7	728	55.8	981	55.8	1 285	57.2	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1 085	15.9	827	16.6	726	18.6	987	17.4	1 310	20	16.2 (5.6-37.3)	↑
	Carbapenem (imipenem/meropenem) resistance	1 090	0.2	820	0	686	0	980	0.1	1 302	0.2	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	1 108	27.3	826	29.7	721	29	975	30.3	1 299	29.6	24.0 (10.1-42.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1 112	14.8	828	14.9	725	11.7	985	16	1 301	17.8	10.9 (4.5-28.4)	↑
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1 064	9.2	825	8.7	714	7.3	973	7.6	1 290	11.1	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	317	53	270	52.2	361	62	369	54.2	566	55.3	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	325	12	267	19.1	353	32.9	367	24	568	27.6	13.3 (0.0-69.7)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	318	57.9	268	54.1	360	63.9	363	53.7	566	56.5	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	325	42.8	270	38.1	356	46.6	366	41.5	562	37.4	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	312	38.1	268	35.8	355	43.4	362	38.1	558	34.2	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	182	14.3	164	10.4	209	10.5	260	12.7	364	10.2	18.5 (3.7-54.4)	-
	Ceftazidime resistance	173	20.2	164	18.9	212	17.5	258	22.5	364	19.5	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	183	26.2	165	30.3	214	31.3	263	35	366	28.7	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	181	29.8	165	23	213	19.7	261	26.8	366	31.1	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	183	20.2	ND	ND	ND	ND	ND	ND	ND	ND	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	166	19.3	ND	ND	ND	ND	ND	ND	ND	ND	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	143	92.3	225	96.4	407	99.5	291	98.6	265	95.8	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	142	93.7	224	98.2	405	99.8	289	98.6	262	96.6	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	140	92.1	225	96.4	405	98.8	288	96.2	262	92.4	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	139	91.4	224	95.1	402	98.5	286	96.2	259	91.5	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	358	24.9	424	29.2	600	34.8	611	31.1	733	30	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	154	20.1	55	23.6	71	18.3	83	19.3	127	12.6	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	154	29.9	55	40	79	22.8	83	26.5	130	16.9	17.8 (4.0-53.8)	↓*
	Combined penicillin non-wild-type and resistance to macrolides[g]	152	13.8	55	16.4	70	15.7	83	18.1	126	7.9	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	125	24	161	37.9	195	39.5	212	38.2	217	30.4	24.3 (4.3-99.0)	-
E. faecium	Vancomycin resistance	74	25.7	88	33	113	39.8	131	36.6	149	23.5	19.8 (0.0-60.9)	-

ND: no data available.

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Cyprus

Participating institutions:
Microbiology Department, Nicosia General Hospital, https://shso.org.cy/clinic/mikroviologiko/

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Cyprus, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	35	75	75	75	82
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	56.9	60.9	73.8	84.4	69.4

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Cyprus, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	100	NA	100	100	100

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Cyprus, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	1	92	NA	4	114	9	4	192	13	5	225	14	8	331	NA
K. pneumoniae	1	60	NA	4	86	29	4	141	35	5	199	36	9	220	33
P. aeruginosa	1	33	25	4	64	37	4	103	42	5	98	36	8	105	29
Acinetobacter spp.	1	32	69	4	58	60	3	216	80	5	203	64	9	136	60
S. aureus	1	63	23	4	106	11	4	177	39	5	197	21	8	229	13
S. pneumoniae	1	8	NA	3	5	NA	4	11	NA	5	14	NA	6	31	27
E. faecalis	1	37	20	4	75	41	4	139	57	5	126	39	9	149	31
E. faecium	1	32	38	3	43	32	4	84	46	5	109	39	9	127	38

Labs: laboratories.
NA: not applicable.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Cyprus

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	21.53	11.56	19.94	20.78	29.93	-	+39.0
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	6.20	5.11	9.37	10.76	15.23	↑	+145.6
	Carbapenem (imipenem/meropenem) resistance	0.00	0.00	0.30	0.29	0.40	-	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	13.05	8.26	14.73	15.03	18.81	↑	+44.1
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3.26	3.60	5.65	5.01	8.08	↑	+147.9
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1.96	2.25	3.12	3.83	5.56	↑	+183.7
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	9.46	7.06	11.46	18.72	17.62	↑	+86.3
	Carbapenem (imipenem/meropenem) resistance	2.61	2.55	5.51	9.87	9.80	↑	+275.5
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	6.20	6.46	10.42	15.18	16.03	↑	+158.5
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	4.57	2.85	7.44	10.91	9.67	↑	+111.6
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3.91	2.25	7.14	9.28	8.61	↑	+120.2
P. aeruginosa	Piperacillin-tazobactam resistance	2.28	2.10	2.23	4.42	3.97	↑	+74.1
	Ceftazidime resistance	1.96	1.65	1.93	3.98	2.52	-	+28.6
	Carbapenem (imipenem/meropenem) resistance	2.28	1.95	3.72	4.72	3.44	-	+50.9
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1.30	1.95	2.68	4.27	2.52	-	+93.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.33	0.45^	0.15^	0.88^	0.66^	NA	+100.0
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	1.30	0.90^	1.19^	2.95^	1.72^	NA	+32.3
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	9.13	7.06	29.61	28.15	15.36	-	+68.2
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	9.46	7.21	29.46	28.44	15.50	-	+63.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	8.81	6.76	28.57	24.46	14.97	-	+69.9
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	8.48	6.61	28.27	24.32	14.57	-	+71.8
S. aureus	MRSA[f]	6.85	7.81	11.31	14.59	15.50	↑	+126.3
S. pneumoniae	Penicillin non-wild-type[g]	0.65^	0.30	0.74	0.74	0.93	-	+43.1
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.98	0.30	0.60	0.88	1.06	-	+8.2
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.65^	0.15	0.60	0.59	0.53	-	-18.5
E. faecalis	High-level gentamicin resistance	0.00	0.45	1.64	1.47	1.99^	↑	NA
E. faecium	Vancomycin resistance	5.22	2.85	6.40	8.99	9.01	↑	+72.6

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Cyprus, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	92	71.7	114	67.5	191	70.2	223	63.2	328	68.9	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	92	20.7	114	29.8	192	32.8	225	32.4	331	34.7	16.2 (5.6-37.3)	↑*
	Carbapenem (imipenem/meropenem) resistance	92	0.0	114	0.0	192	1.0	212	0.9	331	0.9	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	92	43.5	114	48.2	192	51.6	220	46.4	331	42.9	24.0 (10.1-42.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	92	10.9	114	21.1	192	19.8	224	15.2	330	18.5	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	92	6.5	114	13.2	192	10.9	219	11.9	330	12.7	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	60	48.3	86	54.7	141	54.6	199	63.8	220	60.5	34.8 (5.7-81.5)	↑
	Carbapenem (imipenem/meropenem) resistance	60	13.3	86	19.8	141	26.2	184	36.4	220	33.6	13.3 (0.0-69.7)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	60	31.7	86	50.0	141	49.6	191	53.9	220	55.0	33.7 (7.1-76.9)	↑*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	58	24.1	85	22.4	136	36.8	197	37.6	215	34.0	23.6 (2.6-73.3)	↑
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	58	20.7	85	17.6	136	35.3	189	33.3	215	30.2	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	33	21.2	63	22.2	102	14.7	96	31.3	105	28.6	18.5 (3.7-54.4)	-
	Ceftazidime resistance	33	18.2	63	17.5	102	12.7	97	27.8	105	18.1	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	33	21.2	63	20.6	102	24.5	97	33.0	105	24.8	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	33	12.1	63	20.6	103	17.5	92	31.5	105	18.1	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	33	3.0	49	6.1	69	1.4	64	9.4	80	6.3	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	33	12.1	49	12.2	69	11.6	63	31.7	80	16.3	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	32	87.5	58	81.0	216	92.1	202	94.6	134	86.6	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	32	90.6	58	82.8	216	91.7	202	95.5	135	86.7	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	32	84.4	58	77.6	214	89.7	202	82.2	135	83.7	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	32	81.3	58	75.9	214	88.8	202	81.7	133	82.7	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	58	36.2	106	49.1	177	42.9	195	50.8	229	51.1	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	2	NA	5	NA	11	NA	14	NA	31	22.6	15.1 (3.7-39.1)	NA
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	8	NA	5	NA	11	NA	13	NA	31	25.8	17.8 (4.0-53.8)	NA
	Combined penicillin non-wild-type and resistance to macrolides[g]	2	NA	5	NA	11	NA	13	NA	31	12.9	9.2 (0.0-26.9)	NA
E. faecalis	High-level gentamicin resistance	37	0.0	75	4.0	138	8.0	124	8.1	126	11.9	24.3 (4.3-99.0)	↑
E. faecium	Vancomycin resistance	32	50.0	43	44.2	84	51.2	109	56.0	127	53.5	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Czechia

Participating institutions:
National Institute of Public Health, www.szu.cz
National Reference Laboratory for Antibiotics, https://szu.cz/odborna-centra-a-pracoviste/centrum-epidemiologie-amikrobiologie/oddeleni-bakterialni-rezistence-na-antibiotika-a-sbirka-kultur/nrl-pro-antibiotika

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Czechia, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	81	80	80	80	70
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	16.8	19.7	21.3	21.7	18.2

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Czechia, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	100	NA	88	92	100

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Czechia, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	47	3 565	16	48	3 005	14	40	2 939	16	40	3 579	14	40	3 897	14
K. pneumoniae	48	1 563	27	48	1 476	30	43	1 618	33	44	1 638	23	46	1 669	22
P. aeruginosa	47	595	32	48	559	37	43	596	37	43	645	31	42	611	31
Acinetobacter spp.	20	95	48	20	82	44	21	122	52	18	85	50	21	91	48
S. aureus	49	2 108	23	48	2 090	24	44	2 279	26	45	2 417	21	44	2 308	20
S. pneumoniae	49	387	27	43	204	32	46	228	23	47	394	30	48	479	24
E. faecalis	43	528	30	44	584	35	40	764	37	40	640	25	39	708	30
E. faecium	39	350	38	44	413	36	40	581	46	40	381	33	38	402	36

Labs: laboratories.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Czechia

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	22.51	18.45	17.63	21.87	26.48	-	+17.6
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	6.56	4.65	4.94	6.25	8.15	-	+24.2
	Carbapenem (imipenem/meropenem) resistance	0.00^	0.02^	0.00^	0.04^	0.00^	-	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	9.49	7.07	6.75	7.73	8.81	-	-7.2
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	4.71	3.57	3.29	3.99	5.01	-	+6.4
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2.70	1.88	1.93	2.06	2.49	-	-7.8
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	9.18	7.90	9.39	9.65	10.19	↑	+11.0
	Carbapenem (imipenem/meropenem) resistance	0.09^	0.07^	0.16^	0.24^	0.26^	↑	+188.9
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	8.82	7.62	8.08	8.40	8.34	-	-5.4
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	8.64	7.33	7.86	7.76	8.06	-	-6.7
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	7.12	5.96	6.40	6.36	6.23	-	-12.5
P. aeruginosa	Piperacillin-tazobactam resistance	1.60	1.31	1.48	1.91	1.89	↑	+18.1
	Ceftazidime resistance	1.56	1.24	1.34	1.75	1.65	-	+5.8
	Carbapenem (imipenem/meropenem) resistance	1.00	1.03	1.13	1.58	1.62	↑	+62.0
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	2.32	1.86	1.86	2.13	1.83	-	-21.1
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	1.50	0.86	0.88	1.27	1.07	NA	-28.7
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	1.29	0.99	1.06	1.34	1.23	NA	-4.7
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.34	0.32	0.76	0.39	0.45	-	+32.4
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.36	0.34	0.76	0.42	0.46	-	+27.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.37	0.33	0.72	0.38	0.42	-	+13.5
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.32	0.29	0.72	0.37	0.41	-	+28.1
S. aureus	MRSA[f]	3.06	2.28	2.51	2.15	2.92	-	-4.6
S. pneumoniae	Penicillin non-wild-type[g]	0.22	0.11	0.15	0.30	0.26	-	+18.2
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.46	0.16	0.28	0.48	0.65	-	+41.3
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.10	0.05	0.09	0.12	0.08	-	-20.0
E. faecalis	High-level gentamicin resistance	1.92	2.06	3.42	2.33	2.47	-	+28.6
E. faecium	Vancomycin resistance	0.80	0.79	0.85	0.89	1.10	↑	+37.5

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Czechia, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	3 556	54.6	2 997	52.7	2 934	51.4	3 564	51.6	3 892	51.6	54.7 (32.5-68.9)	↓*
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	3 557	15.9	2 997	13.3	2 934	14.4	3 566	14.8	3 892	15.9	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	1 689	0	1 500	0.1	1 342	0	1 685	0.2	1 846	0	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	3 554	23	2 997	20.2	2 934	19.7	3 564	18.2	3 889	17.2	24.0 (10.1-42.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3 559	11.4	2 999	10.2	2 935	9.6	3 567	9.4	3 892	9.8	10.9 (4.5-28.4)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3 554	6.6	2 995	5.4	2 934	5.6	3 564	4.9	3 889	4.9	5.9 (1.3-17.6)	↓*
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1 563	50.7	1 474	45.9	1 618	49.7	1 638	49.6	1 669	46.3	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	1 314	0.6	1 232	0.5	1 348	1	1 326	1.5	1 372	1.5	13.3 (0.0-69.7)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	1 562	48.7	1 474	44.2	1 618	42.8	1 638	43.2	1 669	37.9	33.7 (7.1-76.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1 563	47.7	1 474	42.5	1 618	41.6	1 638	39.9	1 669	36.6	23.6 (2.6-73.3)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1 562	39.3	1 473	34.6	1 618	33.9	1 638	32.7	1 669	28.3	21.0 (0.0-64.9)	↓*
P. aeruginosa	Piperacillin-tazobactam resistance	584	23.6	550	20.4	590	21.5	640	25.2	610	23.4	18.5 (3.7-54.4)	-
	Ceftazidime resistance	594	22.7	559	19	596	19.3	645	22.8	611	20.5	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	595	14.5	559	15.7	595	16.3	645	20.6	610	20.2	18.6 (3.3-53.4)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	594	33.7	559	28.4	596	26.7	645	27.8	611	22.7	17.9 (5.9-52.0)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	594	21.7	559	13.2	596	12.6	645	16.6	611	13.3	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	584	19	550	15.5	589	15.4	640	17.7	609	15.3	13.1 (1.6-49.5)	NA
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	95	30.5	82	32.9	122	53.3	85	38.8	91	37.4	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	95	32.6	82	35.4	122	53.3	85	41.2	91	38.5	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	95	33.7	82	34.1	122	50.8	85	37.6	91	35.2	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	95	29.5	82	30.5	122	50.8	85	36.5	91	34.1	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	2 108	12.5	2 089	9.3	2 279	9.4	2 417	7.5	2 304	9.6	15.8 (1.5-51.1)	↓*
S. pneumoniae	Penicillin non-wild-type[g]	387	4.9	204	4.4	228	5.7	394	6.3	479	4.2	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	387	10.3	204	6.9	228	10.5	394	10.2	479	10.2	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	387	2.3	204	2	228	3.5	394	2.5	479	1.3	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	527	31.5	583	30.2	762	38.5	639	30.7	707	26.4	24.3 (4.3-99.0)	-
E. faecium	Vancomycin resistance	349	19.8	410	16.6	578	12.6	379	19.8	401	20.7	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Denmark

Participating institutions:
Statens Serum Institut, https://www.ssi.dk/
Danish Study Group for Antimicrobial Resistance Surveillance (DANRES), www.danmap.org

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Denmark, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	100	100	100	100	100
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	191.7	236.4	251.0	261.2	261.7

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Denmark, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	100	NA	100	91	80

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Denmark, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	10	5 613	2	10	5 878	3	10	6 025	3	10	5 940	5	10	5 873	5
K. pneumoniae	10	1 361	3	10	1 415	5	10	1 346	4	10	1 360	5	10	1 410	7
P. aeruginosa	10	493	5	10	505	4	10	517	5	10	498	4	10	462	6
Acinetobacter spp.	9	72	6	9	66	6	10	103	11	10	99	4	10	90	8
S. aureus	10	2 172	NA	10	2 390	5	10	2 545	5	10	2 502	6	10	2 473	8
S. pneumoniae	10	601	2	10	351	NA	10	334	NA	10	543	7	10	607	6
E. faecalis	10	632	5	10	651	7	10	686	6	10	660	7	10	643	10
E. faecium	10	737	23	10	795	20	10	802	28	10	638	22	10	614	25

Labs: laboratories.
NA: not applicable.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Denmark

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	44.61	44.38	42.65	42.24	39.54	↓	-11.4
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	6.61	6.08^	5.72^	6.01^	5.61^	↓	-15.1
	Carbapenem (imipenem/meropenem) resistance	0.07	0.15	0.10	0.02	0.03	-	-57.1
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	11.07	11.32	10.79	10.74	10.28	-	-7.1
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	5.27	5.58	4.49	4.78	4.42	↓	-16.1
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1.64	1.46^	1.13^	1.33^	1.18^	↓	-28.0
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1.43	1.31^	1.08	1.11	1.21^	-	-15.4
	Carbapenem (imipenem/meropenem) resistance	0.07	0.19	0.10	0.10	0.08	-	+14.3
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	2.24	1.84	1.64	1.74	1.67	↓	-25.4
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.81	0.79	0.48	0.61	0.62	-	-23.5
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	0.50	0.38^	0.24	0.29	0.35^	-	-30.0
P. aeruginosa	Piperacillin-tazobactam resistance	0.34	0.38	0.45	0.37	0.35	-	+2.9
	Ceftazidime resistance	0.33	0.26	0.19	0.22	0.22	-	-33.3
	Carbapenem (imipenem/meropenem) resistance	0.28	0.38	0.31	0.20	0.25	-	-10.7
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.47	0.27	0.29	0.24	0.46	-	-2.1
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.22	0.00^	0.00^	0.00^	0.03^	NA	-86.4
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.14	0.03^	0.05^	0.12^	0.08^	NA	-42.9
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.00	0.05	0.10	0.09	0.03	-	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.09	0.15	0.27	0.27	0.13	-	+44.4
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.03	0.05	0.12	0.09	0.03	-	0.0
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.00	0.05	0.10	0.05	0.03	-	NA
S. aureus	MRSA[f]	0.83	0.70	0.79	0.61^	0.47^	↓	-43.4
S. pneumoniae	Penicillin non-wild-type[g]	0.52	0.41	0.55	0.27	0.37	-	-28.8
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.36	0.22	0.29	0.29	0.37	-	+2.8
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.14	0.14	0.17	0.07	0.19	-	+35.7
E. faecalis	High-level gentamicin resistance	0.07^	0.38^	ND	0.07^	0.02^	NA	-71.4
E. faecium	Vancomycin resistance	1.24	1.31	1.46	1.29	1.11	-	-10.5

ND: no data available.

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Denmark, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	5 593	46.3	5 864	44.1	6 001	41.5	5 883	42.2	5 799	40.5	54.7 (32.5-68.9)	↓*
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	5 091	7.5	5 286	6.7	5 416	6.2	5 326	6.6	5 272	6.3	16.2 (5.6-37.3)	↓*
	Carbapenem (imipenem/meropenem) resistance	5 577	0.1	5 840	0.2	5 845	0.1	5 580	0	5 430	0	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	5 605	11.5	5 870	11.2	6 016	10.5	5 892	10.7	5 828	10.5	24.0 (10.1-42.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	5 599	5.5	5 870	5.5	6 017	4.4	5 909	4.8	5 839	4.5	10.9 (4.5-28.4)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	5 084	1.9	5 277	1.6	5 409	1.2	5 299	1.5	5 237	1.3	5.9 (1.3-17.6)	↓*
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1 248	6.7	1 264	6	1 228	5.1	1 244	5.2	1 261	5.7	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	1 356	0.3	1 413	0.8	1 324	0.5	1 312	0.5	1 326	0.4	13.3 (0.0-69.7)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	1 361	9.6	1 414	7.6	1 346	7.1	1 345	7.6	1 396	7.1	33.7 (7.1-76.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1 358	3.5	1 412	3.3	1 344	2.1	1 348	2.7	1 401	2.6	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1 245	2.3	1 261	1.7	1 228	1.1	1 232	1.4	1 251	1.7	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	493	4.1	505	4.4	517	5	495	4.4	461	4.6	18.5 (3.7-54.4)	-
	Ceftazidime resistance	471	4	471	3.2	482	2.3	473	2.7	429	3	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	491	3.3	503	4.4	514	3.5	494	2.4	457	3.3	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	493	5.5	505	3.2	517	3.3	495	2.8	461	5.9	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	490	2.7	61	0	226	0	267	0	265	0.8	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	469	1.7	61	3.3	225	1.3	265	2.6	263	1.9	13.1 (1.6-49.5)	NA
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	72	0	64	4.7	102	5.9	96	5.2	90	2.2	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	72	6.9	65	13.8	103	15.5	96	16.7	89	9	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	72	2.8	65	4.6	100	7	97	5.2	89	2.2	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	72	0	63	4.8	99	6.1	93	3.2	88	2.3	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	2 172	2.2	2 390	1.7	2 545	1.8	1 945	1.9	1 870	1.5	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	601	5	351	6.8	334	9.6	539	3	596	3.7	15.1 (3.7-39.1)	↓*
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	601	3.5	351	3.7	334	5.1	503	3.4	553	4	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	601	1.3	351	2.3	334	3	503	0.8	551	2	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	47	8.5	187	11.8	ND	ND	5	NA	3	NA	24.3 (4.3-99.0)	NA
E. faecium	Vancomycin resistance	734	9.8	793	9.6	800	10.6	632	12	609	10.8	19.8 (0.0-60.9)	-

ND: no data available.

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Estonia

Participating institutions:
Estonian Health Board, https://www.terviseamet.ee/et
East-Tallinn Central Hospital, https://itk.ee/
Tartu University Hospital, https://www.kliinikum.ee/partnerile/uhendlabor/

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Estonia, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	100	100	100	100	100
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	33.4	35.8	39.2	39.9	40.2

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Estonia, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	100	NA	91	100	100

NA: not applicable. In 2020 there was no EARS-Net EQA.

[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Estonia, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	9	910	8	9	979	7	9	930	6	9	1 003	8	9	1 103	NA
K. pneumoniae	9	179	18	9	199	13	9	235	14	9	235	13	9	303	NA
P. aeruginosa	8	70	13	9	79	20	9	87	23	9	86	16	8	79	23
Acinetobacter spp.	5	16	NA	4	12	NA	3	5	NA	3	3	NA	7	14	NA
S. aureus	9	366	11	9	367	11	9	398	8	9	407	8	9	448	NA
S. pneumoniae	9	161	8	9	80	8	9	110	7	9	152	5	9	191	NA
E. faecalis	9	93	18	9	108	19	7	85	9	9	96	14	9	128	22
E. faecium	7	74	43	8	61	16	6	83	35	9	85	28	8	78	33

Labs: laboratories.

NA: not applicable.

[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.

[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Estonia

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	15.85^	14.52^	10.45^	8.94^	14.50^	-	-8.5
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	7.93	6.09	5.64	8.86	9.08	-	+14.5
	Carbapenem (imipenem/meropenem) resistance	0.00^	0.00^	0.00^	0.08^	0.00^	-	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	11.55	10.16	9.32	12.09	10.25	-	-11.3
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3.62	3.99	3.83	4.20	3.88	-	+7.2
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1.43	1.13	1.43	2.10	1.46	-	+2.1
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1.43	1.73	2.26	2.63	2.86	↑	+100.0
	Carbapenem (imipenem/meropenem) resistance	0.00^	0.00^	0.15	0.23^	0.44^	↑	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	2.19	2.56	2.93	2.85	3.66	↑	+67.1
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.83	1.20	1.35	1.43	1.68	-	+102.4
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	0.75	1.05	0.98	1.13	1.17	-	+56.0
P. aeruginosa	Piperacillin-tazobactam resistance	0.38	0.53	0.45	0.68	0.29	-	-23.7
	Ceftazidime resistance	0.23	0.38	0.23	0.53	0.22	-	-4.3
	Carbapenem (imipenem/meropenem) resistance	0.30	0.75	0.98	0.98	0.73	-	+143.3
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.30	0.60	1.05	0.90	0.73	-	+143.3
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.15	0.00^	0.00^	0.00^	0.07^	NA	-53.3
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.15^	ND	0.00^	0.00^	0.00^	NA	-100.0
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.60	0.15	0.08	0.08	0.22	-	-63.3
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.60^	0.00^	0.08^	0.08^	0.22^	-	-63.3
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.60^	0.00^	0.08^	0.00^	0.22^	-	-63.3
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.60^	0.00^	0.08^	0.00^	0.15^	-	-75.0
S. aureus	MRSA[f]	0.83	0.83	0.45	0.68	0.66	-	-20.5
S. pneumoniae	Penicillin non-wild-type[g]	0.53	0.30	0.38	0.53	0.44^	-	-17.0
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.83	0.53	0.45^	1.20^	1.83	↑	+120.5
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.30	0.15	0.30^	0.38^	0.29^	-	-3.3
E. faecalis	High-level gentamicin resistance	0.91	1.20	0.60^	0.38^	0.51	↓	-44.0
E. faecium	Vancomycin resistance	0.23	0.15	0.45	0.68	0.66	↑	+187.0

ND: no data available.

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Estonia, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	499	42.1	422	45.7	338	41.1	274	43.4	520	38.1	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	910	11.5	979	8.3	929	8.1	1 003	11.8	1 084	11.4	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	800	0	861	0	826	0	854	0.1	894	0	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	897	17.1	959	14.1	922	13.4	987	16.3	1 054	13.3	24.0 (10.1-42.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	907	5.3	968	5.5	926	5.5	1 001	5.6	1 074	4.9	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	894	2.1	948	1.6	917	2.1	985	2.8	1 040	1.9	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	179	10.6	199	11.6	235	12.8	235	14.9	301	13	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	152	0	173	0	218	0.9	204	1.5	263	2.3	13.3 (0.0-69.7)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	179	16.2	197	17.3	235	16.6	235	16.2	297	16.8	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	179	6.1	197	8.1	235	7.7	235	8.1	300	7.7	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	179	5.6	196	7.1	235	5.5	235	6.4	296	5.4	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	70	7.1	77	9.1	87	6.9	84	10.7	79	5.1	18.5 (3.7-54.4)	-
	Ceftazidime resistance	66	4.5	77	6.5	83	3.6	82	8.5	78	3.8	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	69	5.8	79	12.7	87	14.9	85	15.3	73	13.7	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	68	5.9	76	10.5	84	16.7	84	14.3	77	13	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	67	3	1	NA	9	NA	6	NA	13	NA	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	62	3.2	ND	ND	5	NA	3	NA	13	NA	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	16	NA	11	NA	5	NA	3	NA	14	NA	40.1 (0.0-95.8)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	10	NA	7	NA	2	NA	2	NA	11	NA	42.4 (0.0-96.6)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	8	NA	5	NA	2	NA	1	NA	10	NA	36.7 (0.0-92.4)	NA
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	8	NA	5	NA	2	NA	1	NA	10	NA	35.2 (0.0-91.5)	NA
S. aureus	MRSA[f]	366	3	367	3	398	1.5	407	2.2	436	2.1	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	161	4.3	79	5.1	109	4.6	152	4.6	127	4.7	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	158	7	76	9.2	98	6.1	132	12.1	186	13.4	17.8 (4.0-53.8)	↑*
	Combined penicillin non-wild-type and resistance to macrolides[g]	158	2.5	75	2.7	97	4.1	132	3.8	122	3.3	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	93	12.9	107	15	73	11	75	6.7	125	5.6	24.3 (4.3-99.0)	↓*
E. faecium	Vancomycin resistance	74	4.1	61	3.3	83	7.2	85	10.6	77	11.7	19.8 (0.0-60.9)	↑*

ND: no data available.

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Finland

Participating institutions:
Finnish Institute for Health and Welfare, Department of Health Security, www.thl.fi
Finnish Study Group for Antimicrobial Resistance (FiRe), www.finres.fi
Finnish Hospital Infection Program (SIRO), https://thl.fi/en/web/infectious-diseases-and-vaccinations/diseases-and-disease-control/healthcare-associated-infections

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Finland, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	96	96	96	87	84
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	160.4	175.1	143.9	188.6	195.8

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Finland, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	89	NA	88	92	100

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Finland, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	19	5 418	NA	18	5 375	NA	19	5 802	NA	15	4 575	NA	15	4 269	NA
K. pneumoniae	18	869	NA	17	901	NA	19	971	NA	14	794	NA	15	727	NA
P. aeruginosa	19	470	NA	17	433	NA	19	451	NA	14	422	NA	15	367	NA
Acinetobacter spp.	16	43	NA	12	37	NA	14	47	NA	10	28	NA	10	33	NA
S. aureus	19	2 473	NA	18	2 188	NA	19	2 423	NA	15	2 418	NA	15	2 103	NA
S. pneumoniae	18	678	NA	18	293	NA	17	303	NA	15	470	NA	14	513	NA
E. faecalis	19	592	NA	18	566	NA	19	654	NA	14	490	NA	15	460	NA
E. faecium	19	291	NA	18	259	NA	18	262	NA	14	238	NA	13	196	NA

Labs: laboratories.
NA: not applicable.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Finland

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	20.10^	18.83^	18.97^	17.61^	17.76^	↓	-11.6
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	8.02	7.26	7.21	5.78	6.46	↓	-19.5
	Carbapenem (imipenem/meropenem) resistance	0.02	0.02	0.00	0.00	0.02	-	0.0
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	11.69	10.63	10.45	9.38	9.39	↓	-19.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	4.66	5.79	4.52	4.02	4.39	-	-5.8
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2.25	1.96	1.92	1.72	1.93	-	-14.2
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1.04	1.23	1.02	0.79	1.35	-	+29.8
	Carbapenem (imipenem/meropenem) resistance	0.06	0.02	0.00	0.00	0.02	-	-66.7
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	1.19	1.24	1.00	0.93	1.39	-	+16.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.66	0.98	0.77	0.39	0.81	-	+22.7
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	0.49	0.58	0.40	0.29	0.51	-	+4.1
P. aeruginosa	Piperacillin-tazobactam resistance	0.57	0.45	0.40	0.33	0.34	↓	-40.4
	Ceftazidime resistance	0.40	0.43	0.41	0.31	0.28	-	-30.0
	Carbapenem (imipenem/meropenem) resistance	0.55	0.30	0.36	0.44	0.53	-	-3.6
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.76	0.83	0.83	0.64	0.58	-	-23.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.06	0.11	0.08	0.04	0.09	NA	+50.0
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.21	0.28	0.13	0.12	0.15	NA	-28.6
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.00	0.04	0.02	0.02	0.00	-	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.00	0.06	0.02	0.02	0.00	-	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.00	0.02	0.02	0.02	0.02	-	NA
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.00	0.02	0.02	0.02	0.00	-	NA
S. aureus	MRSA[f]	1.06	1.07	1.19	1.14	1.28	-	+20.8
S. pneumoniae	Penicillin non-wild-type[g]	1.34^	0.55^	0.68^	0.58^	0.73^	-	-45.5
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1.30	0.64	0.75	1.08	1.20	-	-7.7
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.68^	0.34^	0.40^	0.31^	0.45^	-	-33.8
E. faecalis	High-level gentamicin resistance	ND	ND	ND	ND	ND	NA	NA
E. faecium	Vancomycin resistance	0.00	0.02	0.02	0.04	0.02	-	NA

ND: no data available.

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Finland, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	3 000	35.5	2 928	34.1	3 177	31.7	2 615	32.5	2 550	32.5	54.7 (32.5-68.9)	↓*
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	5 413	7.9	5 367	7.2	5 799	6.6	4 568	6.1	4 262	7.1	16.2 (5.6-37.3)	↓*
	Carbapenem (imipenem/meropenem) resistance	5 331	0	5 375	0	5 801	0	4 575	0	4 268	0	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	5 410	11.4	5 354	10.5	5 802	9.6	4 572	9.9	4 261	10.3	24.0 (10.1-42.9)	↓
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	5 159	4.8	5 373	5.7	5 802	4.1	4 367	4.4	4 241	4.8	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	5 151	2.3	5 346	1.9	5 799	1.8	4 357	1.9	4 227	2.1	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	868	6.3	901	7.2	971	5.6	794	4.8	727	8.7	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	850	0.4	901	0.1	971	0	793	0	727	0.1	13.3 (0.0-69.7)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	865	7.3	893	7.4	971	5.5	794	5.7	727	8.9	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	831	4.2	901	5.8	971	4.2	764	2.5	726	5.2	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	827	3.1	893	3.5	971	2.2	764	1.8	726	3.3	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	457	6.6	433	5.5	450	4.7	421	3.8	364	4.4	18.5 (3.7-54.4)	-
	Ceftazidime resistance	463	4.5	433	5.3	451	4.9	422	3.6	367	3.5	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	462	6.3	433	3.7	451	4.2	422	5	367	6.8	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	468	8.5	431	10.2	451	9.8	422	7.3	365	7.4	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	458	0.7	433	1.4	451	0.9	422	0.5	367	1.1	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	455	2.4	431	3.5	450	1.6	421	1.4	362	1.9	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	43	0	37	5.4	47	2.1	28	3.6[h]	33	0	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	43	0	36	8.3	47	2.1	28	3.6[h]	33	0	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	42	0	37	2.7	47	2.1	28	3.6[h]	33	3	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	42	0	36	2.8	47	2.1	28	3.6[h]	33	0	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	2 473	2.3	2 188	2.6	2 423	2.6	2 418	2.3	2 103	2.9	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	594	12	252	11.5	247	14.6	339	8.3	419	8.1	15.1 (3.7-39.1)	↓*
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	655	10.5	288	11.8	301	13.3	470	11.1	499	11.2	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	571	6.3	247	7.3	245	8.6	339	4.4	405	5.2	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	24.3 (4.3-99.0)	NA
E. faecium	Vancomycin resistance	291	0	259	0.4	261	0.4	238	0.8	196	0.5	19.8 (0.0-60.9)	-

ND: no data available.

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

[h] A small number of isolates were tested (n<30), and the percentage resistance should be interpreted with caution.

France

Participating institutions:
Santé Publique France, www.santepubliquefrance.fr
Since 2020: Surveillance and Prevention of Antimicrobial RESistance in hospital settings (SPARES), https://www.preventioninfection.fr/
National Reference Centre for Pneumococci, www.cnr-pneumo.com
Up to 2019: French National Observatory for the Epidemiology of Bacterial Resistance to Antimicrobials (ONERBA) through three participating networks: Azay-Résistance, Île-de-France, Réussir networks, www.onerba.org

Population and hospitals contributing data: coverage, representativeness and blood culture rate, France, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)[a]					
Laboratories collecting *S. pneumoniae* (CNRP)	56.0	38.0	56.0	55.0	57.0
Laboratories collecting other species (SPARES network since 2020[b])	20.0	48.0	55.0	55.0	0.0
Geographical representativeness					
Laboratories collecting *S. pneumoniae* (CNRP)	High	High	High	High	High
Laboratories collecting other species (SPARES network since 2020[b])	High	High	High	High	Low
Hospital representativeness					
Laboratories collecting *S. pneumoniae* (CNRP)	High	High	High	High	High
Laboratories collecting other species (SPARES network since 2020[b])	High	High	High	High	Low
Isolate representativeness					
Laboratories collecting *S. pneumoniae* (CNRP)	High	High	High	High	High
Laboratories collecting other species (SPARES network since 2020[b])	High	High	High	High	Low
Blood culture sets per 1 000 patient-days	112.2	54.5	54.6	58.5	ND

ND: no data available.
[a] Calculation based on proportion of hospital days in participating hospitals out of total hospital days in the country.
[b] ONERBA laboratories up to 2019.
For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, France, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	86	NA	ND	75	72

ND: no data available.
NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, France, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	46	13 536	8	779	18 939	8	743	18 796	8	720	17 744	8	ND	ND	ND
K. pneumoniae	46	3 170	15	558	5 078	16	545	4 985	17	527	5 105	14	ND	ND	ND
P. aeruginosa	45	2 200	21	490	3 656	26	489	3 918	26	468	3 574	20	ND	ND	ND
Acinetobacter spp.	45	515	17	241	710	10	219	737	11	238	870	13	ND	ND	ND
S. aureus	46	6 723	14	672	10 967	12	661	11 809	13	625	10 731	12	ND	ND	ND
S. pneumoniae	193	1 264	NA	127	668	NA	194	1 339	NA	162	928	NA	188	1 181	NA
E. faecalis	46	2 526	19	508	4 456	21	511	4 736	22	494	4 135	16	ND	ND	ND
E. faecium	46	1 080	24	295	1 428	28	311	1 567	27	291	1 504	24	ND	ND	ND

Labs: laboratories.
ND: no data available.
NA: not applicable.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, France

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	54.52	29.48	24.87	24.33	ND	NA	NA
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	8.60	5.52	4.20	4.01	ND	NA	NA
	Carbapenem (imipenem/meropenem) resistance	0.04	0.02	0.02	0.05	ND	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	16.00	9.15	7.32	6.90	ND	NA	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	6.87	3.67	2.76	2.62^	ND	NA	NA
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2.80	1.59	1.20	1.07^	ND	NA	NA
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	6.92	4.35	3.40	3.42	ND	NA	NA
	Carbapenem (imipenem/meropenem) resistance	0.22	0.08	0.10	0.13	ND	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	7.24	4.34	3.29	3.32	ND	NA	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	5.42	2.78	2.20	2.12	ND	NA	NA
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	4.45	2.38	1.84	1.74	ND	NA	NA
P. aeruginosa	Piperacillin-tazobactam resistance	2.34^	1.81	1.63	1.42^	ND	NA	NA
	Ceftazidime resistance	1.72	1.41	1.27	1.07	ND	NA	NA
	Carbapenem (imipenem/meropenem) resistance	1.97	1.40	1.25	1.06	ND	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	2.13	1.64	1.44	1.23	ND	NA	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	1.22	0.53^	0.44^	0.45^	ND	NA	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	1.13^	0.80^	0.67^	0.54^	ND	NA	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.33	0.07	0.06	0.08	ND	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.48	0.18	0.13	0.14	ND	NA	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.51	0.17	0.11	0.14^	ND	NA	NA
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.29^	0.04^	0.04^	0.05^	ND	NA	NA
S. aureus	MRSA[f]	5.61	4.02	3.41	2.97	ND	NA	NA
S. pneumoniae	Penicillin non-wild-type[g]	0.85	0.84	1.13	0.84	0.93	-	+9.4
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.65	0.56	0.81	0.62	0.73	-	+12.3
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.54	0.48	0.72	0.53	0.62	-	+14.8
E. faecalis	High-level gentamicin resistance	1.21^	ND	ND	ND	ND	NA	NA
E. faecium	Vancomycin resistance	0.05	0.02	0.02	0.03	ND	NA	NA

ND: no data available.

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, France, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	13 415	54.5	17 674	53.9	17 706	52.3	17 191	52.8	ND	ND	54.7 (32.5-68.9)	NA
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	13 019	8.8	18 857	9.5	18 735	8.3	17 722	8.4	ND	ND	16.2 (5.6-37.3)	NA
	Carbapenem (imipenem/meropenem) resistance	12 636	0	17 838	0	17 546	0.1	16 989	0.1	ND	ND	0.3 (0.0-1.8)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	13 431	16	18 569	15.9	18 446	14.8	17 517	14.7	ND	ND	24.0 (10.1-42.9)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	13 133	7	17 786	6.7	17 653	5.8	15 900	6.2	ND	ND	10.9 (4.5-28.4)	NA
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	12 639	3	17 433	2.9	17 301	2.6	15 681	2.6	ND	ND	5.9 (1.3-17.6)	NA
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	3 075	30.2	5 045	27.8	4 973	25.4	5 097	25	ND	ND	34.8 (5.7-81.5)	NA
	Carbapenem (imipenem/meropenem) resistance	3 003	1	4 796	0.5	4 727	0.8	4 965	1	ND	ND	13.3 (0.0-69.7)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	3 143	30.9	5 001	28.1	4 889	25	5 040	24.6	ND	ND	33.7 (7.1-76.9)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3 103	23.4	4 767	18.8	4 706	17.4	4 703	16.8	ND	ND	23.6 (2.6-73.3)	NA
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3 004	19.8	4 692	16.4	4 617	14.9	4 644	14	ND	ND	21.0 (0.0-64.9)	NA
P. aeruginosa	Piperacillin-tazobactam resistance	1 879	16.7	3 417	17.1	3 580	17	3 136	16.8	ND	ND	18.5 (3.7-54.4)	NA
	Ceftazidime resistance	1 999	11.5	3 574	12.8	3 754	12.5	3 375	11.9	ND	ND	15.7 (2.8-52.7)	NA
	Carbapenem (imipenem/meropenem) resistance	2 076	12.7	3 583	12.6	3 850	12.1	3 498	11.3	ND	ND	18.6 (3.3-53.4)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	2 074	13.7	3 585	14.8	3 785	14.1	3 359	13.7	ND	ND	17.9 (5.9-52.0)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	2 086	7.8	3 059	5.6	3 297	4.9	3 033	5.6	ND	ND	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	1 759	8.6	2 896	8.9	3 044	8.2	2 804	7.2	ND	ND	13.1 (1.6-49.5)	NA
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	487	9	692	3.3	720	3.1	857	3.5	ND	ND	40.1 (0.0-95.8)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	481	13.3	653	9	672	7.1	791	6.4	ND	ND	42.4 (0.0-96.6)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	473	14.6	661	8.3	673	6.1	757	7	ND	ND	36.7 (0.0-92.4)	NA
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	458	8.5	628	1.9	626	2.4	700	2.6	ND	ND	35.2 (0.0-91.5)	NA
S. aureus	MRSA[f]	6 467	11.6	10 763	12.1	11 536	11	10 628	10.4	ND	ND	15.8 (1.5-51.1)	NA
S. pneumoniae	Penicillin non-wild-type[g]	1 264	25.3	668	32.3	1 339	32	928	33.7	1 181	30.7	15.1 (3.7-39.1)	NA
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1 264	19.4	668	21.6	1 339	23	928	24.8	1 181	23.9	17.8 (4.0-53.8)	NA
	Combined penicillin non-wild-type and resistance to macrolides[g]	1 264	16.1	668	18.4	1 339	20.3	928	21.3	1 181	20.3	9.2 (0.0-26.9)	NA
E. faecalis	High-level gentamicin resistance	1 346	12	ND	ND	ND	ND	ND	ND	ND	ND	24.3 (4.3-99.0)	NA
E. faecium	Vancomycin resistance	1 062	0.7	1 385	0.6	1 517	0.5	1 470	0.7	ND	ND	19.8 (0.0-60.9)	NA

ND: no data available.

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Germany

Participating institutions:
Robert Koch Institute, www.rki.de

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Germany, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	27	33	35	40	40
Geographical representativeness	High	High	High	High	High
Hospital representativeness	Medium	Medium	Medium	Medium	Medium
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	37.9	ND	ND	ND	ND

ND: no data available.

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Germany, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	95	NA	97	97	91

NA: not applicable. In 2020 there was no EARS-Net EQA.

[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Germany, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	47	23 415	15	52	28 462	15	56	29 024	15	71	33 790	15	63	35 629	15
K. pneumoniae	47	4 721	24	52	5 994	24	56	6 539	25	71	7 372	24	63	7 915	23
P. aeruginosa	46	2 108	27	52	2 662	25	55	2 866	29	71	3 166	28	63	3 465	26
Acinetobacter spp.	46	467	15	50	609	21	53	606	19	69	749	20	62	824	18
S. aureus	47	11 958	23	52	14 431	23	56	15 804	23	71	18 773	22	63	18 571	21
S. pneumoniae	46	2 035	24	52	1 357	27	54	1 249	27	71	2 558	24	63	3 519	23
E. faecalis	47	3 770	25	52	4 630	24	56	4 938	25	71	5 720	23	63	5 686	22
E. faecium	47	2 801	48	52	3 918	47	55	4 732	49	71	4 951	46	63	4 947	43

Labs: laboratories.

[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.

[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Germany

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	50.64#	48.94#	44.66#	45.75#	47.05#	↓	-7.1
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	12.02#	10.74#	9.07#	9.58#	10.23#	-	-14.9
	Carbapenem (imipenem/meropenem) resistance	0.01#	0.02#	0.04#	0.04#	0.05#	↑	+400.0
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	18.28#	17.14#	14.61#	15.40#	17.47#	-	-4.4
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	8.53#	7.41#	5.28#	4.95#	5.33#	↓	-37.5
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3.20#	2.71#	2.11#	1.80#	2.03#	↓	-36.6
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	2.57#	2.38#	2.33#	2.32#	2.32#	-	-9.7
	Carbapenem (imipenem/meropenem) resistance	0.20#	0.11#	0.18#	0.23#	0.25#	-	+25.0
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	2.76#	2.54#	2.41#	2.61#	2.69#	-	-2.5
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1.52#	1.17#	0.93#	0.90#	0.86#	↓	-43.4
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	0.99#	0.77#	0.57#	0.65#	0.63#	↓	-36.4
P. aeruginosa	Piperacillin-tazobactam resistance	1.08#	1.12#	1.30#	1.31#	1.33#	↑	+23.1
	Ceftazidime resistance	0.94#	0.96#	1.04#	0.96#	0.98#	-	+4.3
	Carbapenem (imipenem/meropenem) resistance	1.21#	1.35#	1.46#	1.25#	1.27#	-	+5.0
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1.26#	1.03#	0.98#	0.93#	0.92#	↓	-27.0
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.38#	0.17^#	0.17#	0.20#	0.16#	NA	-57.9
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.58#	0.59^#	0.60^#	0.60#	0.60#	NA	+3.4
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.04#	0.07#	0.09#	0.08#	0.08#	-	+100.0
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.10#	0.11#	0.12#	0.11#	0.11#	-	+10.0
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.08#	0.09#	0.08#	0.09^#	0.06#	-	-25.0
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.03#	0.04^#	0.05#	0.05^#	0.04#	-	+33.3
S. aureus	MRSA[f]	3.56#	2.91#	2.64#	2.24#	2.44#	↓	-31.5
S. pneumoniae	Penicillin non-wild-type[g]	0.50#	0.29#	0.32#	0.44#	0.63#	-	+26.0
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.67#	0.35#	0.27#	0.47#	0.65#	-	-3.0
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.25#	0.10#	0.09#	0.20#	0.27#	-	+8.0
E. faecalis	High-level gentamicin resistance	1.25^#	1.38^#	1.33^#	1.37^#	1.40^#	-	+12.0
E. faecium	Vancomycin resistance	3.28#	3.18#	3.51#	2.71#	1.86#	↓	-43.3

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Germany, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	23 324	48.7	28 227	47.6	28 500	45.6	33 180	45.9	34 267	46.3	54.7 (32.5-68.9)	↓*
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	23 413	11.5	28 461	10.4	29 021	9.1	33 786	9.4	35 619	9.7	16.2 (5.6-37.3)	↓*
	Carbapenem (imipenem/meropenem) resistance	23 391	0	28 458	0	29 015	0	33 782	0	35 623	0	0.3 (0.0-1.8)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	23 374	17.5	28 446	16.5	28 997	14.7	33 757	15.2	35 535	16.6	24.0 (10.1-42.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	22 990	8.3	27 124	7.5	27 447	5.6	32 063	5.1	33 668	5.3	10.9 (4.5-28.4)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	22 971	3.1	27 110	2.7	27 427	2.2	32 040	1.9	33 601	2	5.9 (1.3-17.6)	↓*
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	4 719	12.2	5 988	10.9	6 538	10.4	7 371	10.5	7 914	9.9	34.8 (5.7-81.5)	↓*
	Carbapenem (imipenem/meropenem) resistance	4 718	0.9	5 991	0.5	6 538	0.8	7 371	1	7 915	1.1	13.3 (0.0-69.7)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	4 715	13.1	5 991	11.7	6 422	10.9	7 369	11.8	7 900	11.5	33.7 (7.1-76.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	4 654	7.3	5 746	5.6	6 217	4.3	7 058	4.2	7 553	3.8	23.6 (2.6-73.3)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	4 649	4.8	5 740	3.7	6 099	2.7	7 056	3.1	7 540	2.8	21.0 (0.0-64.9)	↓*
P. aeruginosa	Piperacillin-tazobactam resistance	2 077	11.7	2 641	11.7	2 842	13.3	3 154	13.8	3 453	13	18.5 (3.7-54.4)	↑*
	Ceftazidime resistance	2 104	10	2 660	9.9	2 861	10.6	3 161	10.1	3 456	9.5	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	2 108	12.9	2 662	13.9	2 864	14.8	3 161	13.1	3 463	12.4	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	2 108	13.4	2 662	10.6	2 865	10	3 161	9.8	3 461	8.9	17.9 (5.9-52.0)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	2 107	4.1	2 374	2	2 600	1.9	2 945	2.2	3 237	1.7	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	2 072	6.3	2 351	6.9	2 573	6.8	2 927	6.8	3 222	6.2	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	462	2.2	607	3.1	605	4.3	748	3.3	824	3.2	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	443	5	598	4.8	603	5.6	743	4.8	823	4.6	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	430	4.2	549	4.7	549	4.2	673	4.5	757	2.8	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	425	1.4	548	2.2	546	2.9	671	2.5	756	2	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	11 950	6.7	14 427	5.5	15 796	4.9	18 764	4	18 559	4.4	15.8 (1.5-51.1)	↓*
S. pneumoniae	Penicillin non-wild-type[g]	1 962	5.7	1 315	6	1 196	7.8	2 476	5.9	3 457	6.2	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1 970	7.7	1 324	7.2	1 188	6.6	2 464	6.3	3 379	6.5	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	1 903	3	1 282	2.1	1 136	2.2	2 382	2.8	3 318	2.8	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	1 561	18	2 352	16.2	2 670	14.5	4 034	11.3	4 267	11.1	24.3 (4.3-99.0)	↓*
E. faecium	Vancomycin resistance	2 797	26.3	3 906	22.3	4 721	21.6	4 945	18.2	4 936	12.7	19.8 (0.0-60.9)	↓*

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Greece

Participating institutions:
National Public Health Organization, Central Public Health Laboratory, https://eody.gov.gr/en/
University of West Attica, Department of Public Health Policy, School of Public Health, https://php.uniwa.gr/en/homepage/

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Greece, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	13	30	42	68	68
Geographical representativeness	Medium	High	High	High	High
Hospital representativeness	Medium	High	High	High	High
Isolate representativeness	Medium	Medium	Medium	High	High
Blood culture sets per 1 000 patient-days	ND	ND	ND	ND	ND

ND: no data available.
For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Greece, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	95	NA	85	90	90

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Greece, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	6	204	6	13	567	6	19	729	6	31	1 241	6	34	1 872	6
K. pneumoniae	6	312	37	12	728	38	19	1 418	49	30	1 814	37	35	2 207	30
P. aeruginosa	6	141	45	12	390	35	19	576	38	31	896	36	34	1 301	33
Acinetobacter spp.	5	196	45	12	742	47	19	1 378	60	31	1 565	44	35	1 637	41
S. aureus	5	171	8	13	449	14	19	584	13	31	922	11	36	1 174	10
S. pneumoniae	ND	ND	ND	ND	ND	ND	ND	ND	ND	17	46	11	22	77	9
E. faecalis	6	141	26	11	376	28	19	687	38	31	971	27	34	1 046	27
E. faecium	5	117	32	12	460	39	18	964	47	29	1 181	34	33	1 284	24

Labs: laboratories.
ND: no data available.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Greece*

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	6.31^#	7.81^#	7.42^#	7.63^	12.89^	↑	+104.3
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	2.58#	3.86#	3.52#	3.99	5.61	↑	+117.4
	Carbapenem (imipenem/meropenem) resistance	0.14#	0.09#	0.18#	0.26	0.41	↑	+192.9
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	4.30#	5.75#	5.51#	6.49	9.93	↑	+130.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1.86#	3.27#	2.99#	3.27	5.32	↑	+186.0
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1.15#	1.83#	1.90#	1.72	2.89	↑	+151.3
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	14.78#	16.82#	25.37#	19.55	22.18	↑	+50.1
	Carbapenem (imipenem/meropenem) resistance	13.05#	14.96#	23.30#	18.02	21.44	↑	+64.3
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	14.92#	16.79#	25.28#	19.67	23.53	↑	+57.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	12.27#	13.62#	21.56#	16.99	19.53	↑	+59.2
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	11.69#	12.94#	20.98#	16.49	18.17	↑	+55.4
P. aeruginosa	Piperacillin-tazobactam resistance	2.73^#	2.99^#	4.17^#	5.94	9.31	↑	+241.0
	Ceftazidime resistance	3.87#	3.23^#	3.70#	5.28	9.15	↑	+136.4
	Carbapenem (imipenem/meropenem) resistance	4.95#	4.20#	4.28#	5.99	9.76	↑	+97.2
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	4.73#	4.45^#	4.59#	6.03	9.46	↑	+100.0
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	4.30#	2.67^#	2.74^#	3.43^	5.99^	NA	+39.3
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	2.44^#	1.80^#	2.68^#	3.47^	5.83^	NA	+138.9
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	12.98#	21.77#	29.77#	20.36	21.18	-	+63.2
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	12.98#	21.71#	29.70#	20.43	21.03	-	+62.0
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	12.34#	20.43#	25.86#	18.88	19.39	-	+57.1
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	12.27#	20.18#	25.71#	18.71	19.15	-	+56.1
S. aureus	MRSA[f]	4.59#	5.60#	5.44#	4.96	6.51	-	+41.8
S. pneumoniae	Penicillin non-wild-type[g]	ND	ND	ND	0.19^	0.35^	NA	NA
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	ND	ND	ND	0.21	0.27	NA	NA
	Combined penicillin non-wild-type and resistance to macrolides[g]	ND	ND	ND	0.06^	0.14^	NA	NA
E. faecalis	High-level gentamicin resistance	0.72#	0.90^#	1.09^#	1.28^	1.13^	-	+56.9
E. faecium	Vancomycin resistance	3.94#	5.78#	8.70#	7.95	10.48	↑	+166.0

ND: no data available.

NA: not applicable.

* The representativeness has varied over the time period and the estimated national population coverage has been low for some of the years. Therefore the estimated incidences should be interpreted with caution.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Greece, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	154	57.1	452	55.5	557	59.8	964	57.1	1 579	57.8	54.7 (32.5-68.9)	NA
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	190	18.9	567	21.9	727	21.7	1 235	23.3	1 739	22.8	16.2 (5.6-37.3)	NA
	Carbapenem (imipenem/meropenem) resistance	203	1	566	0.5	728	1.1	1 240	1.5	1 867	1.6	0.3 (0.0-1.8)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	203	29.6	565	32.7	728	33.9	1 239	37.8	1 861	37.8	24.0 (10.1-42.9)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	201	12.9	562	18.7	719	18.6	1 239	19	1 828	20.6	10.9 (4.5-28.4)	NA
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	186	8.6	561	10.5	717	11.9	1 231	10.1	1 703	12	5.9 (1.3-17.6)	NA
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	310	66.5	726	74.5	1 416	80.4	1 802	78.2	2 078	75.6	34.8 (5.7-81.5)	NA
	Carbapenem (imipenem/meropenem) resistance	312	58.3	726	66.3	1 418	73.7	1 803	72	2 179	69.7	13.3 (0.0-69.7)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	311	66.9	726	74.4	1 418	80	1 802	78.7	2 166	76.9	33.7 (7.1-76.9)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	310	55.2	718	61	1 399	69.1	1 803	67.9	2 136	64.7	23.6 (2.6-73.3)	NA
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	307	53.1	714	58.3	1 397	67.4	1 796	66.2	2 038	63.2	21.0 (0.0-64.9)	NA
P. aeruginosa	Piperacillin-tazobactam resistance	109	34.9	270	35.6	513	36.5	847	50.5	1 212	54.4	18.5 (3.7-54.4)	NA
	Ceftazidime resistance	136	39.7	344	30.2	529	31.4	851	44.8	1 229	52.7	15.7 (2.8-52.7)	NA
	Carbapenem (imipenem/meropenem) resistance	141	48.9	378	35.7	576	33.3	887	48.7	1 294	53.4	18.6 (3.3-53.4)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	141	46.8	333	42.9	576	35.8	884	49.2	1 289	52	17.9 (5.9-52.0)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	141	42.6	301	28.6	432	28.5	601	41.1	920	46.1	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	107	31.8	171	33.9	378	31.7	549	45.5	851	48.5	13.1 (1.6-49.5)	NA
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	196	92.3	740	94.6	1 377	96.9	1 531	95.9	1 574	95.3	40.1 (0.0-95.8)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	189	95.8	729	95.7	1 371	97.2	1 527	96.5	1 566	95.1	42.4 (0.0-96.6)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	194	88.7	727	90.4	1 269	91.4	1 527	89.1	1 558	88.1	36.7 (0.0-92.4)	NA
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	187	91.4	715	90.8	1 262	91.4	1 522	88.6	1 551	87.4	35.2 (0.0-91.5)	NA
S. aureus	MRSA[f]	170	37.6	448	40.2	583	41.9	918	39	1 118	41.2	15.8 (1.5-51.1)	NA
S. pneumoniae	Penicillin non-wild-type[g]	ND	ND	ND	ND	ND	ND	30	46.7	64	39.1	15.1 (3.7-39.1)	NA
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	ND	ND	ND	ND	ND	ND	44	34.1	73	26	17.8 (4.0-53.8)	NA
	Combined penicillin non-wild-type and resistance to macrolides[g]	ND	ND	ND	ND	ND	ND	29	13.8[h]	60	16.7	9.2 (0.0-26.9)	NA
E. faecalis	High-level gentamicin resistance	128	7.8	298	9.7	517	9.5	755	12.2	762	10.5	24.3 (4.3-99.0)	NA
E. faecium	Vancomycin resistance	117	47	445	41.8	950	41.1	1 168	49.1	1 266	58.6	19.8 (0.0-60.9)	NA

ND: no data available.

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period. For Greece the change comprises the decrease in the number of laboratories reporting data, starting with 2019 data as EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

[h] A small number of isolates were tested (n<30), and the percentage resistance should be interpreted with caution.

Hungary

Participating institutions:
National Public Health Center, www.oek.hu

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Hungary, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	90	90	90	90	90
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	12.3	17.2	22.0	18.4	19.5

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Hungary, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	97	NA	100	93	96

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Hungary, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	30	2 413	12	29	1 963	15	30	2 474	16	27	2 567	13	23	2 761	10
K. pneumoniae	29	912	26	26	730	32	30	1 110	33	26	973	28	22	1 149	28
P. aeruginosa	30	884	42	26	779	44	30	1 226	57	25	1 016	45	23	950	37
Acinetobacter spp.	27	420	56	24	534	NA	29	1 447	74	25	551	64	21	430	46
S. aureus	28	1 884	16	28	1 513	23	29	2 359	22	24	2 072	17	22	2 028	16
S. pneumoniae	27	222	19	21	124	25	27	186	27	25	293	17	22	284	16
E. faecalis	30	816	37	28	962	49	31	1 562	55	25	1 020	38	24	946	30
E. faecium	27	304	42	27	471	NA	30	710	NA	24	531	40	22	449	38

Labs: laboratories.
NA: not applicable.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Hungary

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	15.93	12.02	15.12	15.64	16.72	-	+5.0
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	5.65	4.49	5.75	6.64	6.81	↑	+20.5
	Carbapenem (imipenem/meropenem) resistance	0.00	0.00	0.00	0.06	0.07	↑	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	8.27	6.76	7.88	8.50	8.22	-	-0.6
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	4.31	3.71	4.93	4.79	4.71	-	+9.3
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2.84	1.94	2.79	3.06	2.94	-	+3.5
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	3.80	3.34	4.90	4.54	5.59	↑	+47.1
	Carbapenem (imipenem/meropenem) resistance	0.09	0.06	0.11	0.57	0.76	↑	+744.4
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	3.80	3.38	4.73	4.32	5.01	↑	+31.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3.19	2.89	4.02	3.64	4.18	↑	+31.0
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2.73	2.62	3.64	3.14	3.51	↑	+28.6
P. aeruginosa	Piperacillin-tazobactam resistance	1.92	1.79	2.66	2.17	2.03	-	+5.7
	Ceftazidime resistance	1.84	1.81	2.76	2.08	1.96	-	+6.5
	Carbapenem (imipenem/meropenem) resistance	3.33	2.99	4.81	3.64	3.40	-	+2.1
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	2.02	1.94	3.09	2.12	1.72	-	-14.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	1.69	0.99	1.37	1.04	0.86	NA	-49.1
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	1.72	1.33	2.16	1.43	1.37	NA	-20.3
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	2.42	4.44	13.69	3.65	2.29	-	-5.4
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	2.97	4.64	14.08	4.03	2.43	-	-18.2
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	2.41	4.38	13.39	2.96	1.96	-	-18.7
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	2.13	4.17	13.06	2.76	1.83	-	-14.1
S. aureus	MRSA[f]	4.15	3.61	5.20	4.97	4.85	-	+16.9
S. pneumoniae	Penicillin non-wild-type[g]	0.16	0.13	0.26	0.21	0.23	-	+43.8
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.30	0.23	0.30	0.36	0.46	↑	+53.3
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.13	0.11	0.13	0.15	0.20	-	+53.8
E. faecalis	High-level gentamicin resistance	3.13	4.66	7.19	4.21	3.66	-	+16.9
E. faecium	Vancomycin resistance	1.24	1.87	3.30	2.18	1.98	-	+59.7

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Hungary, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	2 363	59.3	1 804	58.6	2 263	58.5	2 335	58.4	2 519	57.4	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	2 413	20.6	1 962	20.1	2 470	20.4	2 565	22.6	2 756	21.3	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	2 326	0	1 917	0	2 391	0	2 515	0.2	2 688	0.2	0.3 (0.0-1.8)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	2 398	30.3	1 958	30.3	2 460	28	2 531	29.3	2 732	26	24.0 (10.1-42.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	2 411	15.7	1 954	16.7	2 469	17.5	2 561	16.3	2 754	14.8	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2 397	10.4	1 950	8.8	2 452	10	2 526	10.6	2 726	9.3	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	911	36.7	728	40.4	1 110	38.6	972	40.7	1 149	42	34.8 (5.7-81.5)	↑*
	Carbapenem (imipenem/meropenem) resistance	890	0.9	721	0.7	1 092	0.9	948	5.3	1 136	5.8	13.3 (0.0-69.7)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	909	36.7	728	40.8	1 096	37.8	953	39.6	1 139	38	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	912	30.8	727	34.9	1 107	31.8	973	32.6	1 149	31.4	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	908	26.4	723	31.8	1 093	29.2	952	28.8	1 139	26.6	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	860	19.7	774	20.3	1 195	19.5	1 008	18.8	942	18.6	18.5 (3.7-54.4)	-
	Ceftazidime resistance	882	18.4	772	20.6	1 221	19.8	1 014	17.9	947	17.8	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	883	33.2	779	33.8	1 226	34.3	1 016	31.2	950	30.9	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	879	20.3	777	22	1 221	22.2	1 014	18.2	948	15.7	17.9 (5.9-52.0)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	883	16.9	761	11.4	1 207	9.9	990	9.2	938	7.9	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	854	17.7	751	15.6	1 170	16.2	983	12.7	926	12.7	13.1 (1.6-49.5)	NA
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	418	51	534	73	1 445	83	549	57.9	429	46.2	40.1 (0.0-95.8)	↓*
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	412	63.3	530	77	1 441	85.6	550	63.8	429	49	42.4 (0.0-96.6)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	419	50.6	532	72.4	1 434	81.8	547	47.2	426	39.7	36.7 (0.0-92.4)	↓*
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	410	45.6	529	69.4	1 429	80.1	544	44.3	424	37.3	35.2 (0.0-91.5)	↓*
S. aureus	MRSA[f]	1 884	19.4	1 513	21	2 359	19.3	2 072	20.9	2 028	20.7	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	222	6.3	124	8.9	185	12.4	293	6.1	284	7	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	215	12.1	115	17.4	175	14.9	288	10.8	279	14.3	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	215	5.1	115	8.7	174	6.3	288	4.5	279	6.1	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	816	33.7	962	42.6	1 561	40.4	1 020	36	946	33.4	24.3 (4.3-99.0)	-
E. faecium	Vancomycin resistance	304	35.9	471	34.8	710	40.7	531	35.8	448	38.2	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

b Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Iceland

Participating institutions:
National University Hospital of Iceland, https://www.landspitali.is
Centre for Health Security and Infectious Disease Control, https://www.landlaeknir.is
Akureyri hospital, www.sak.is

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Iceland, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	100	100	100	100	100
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	61.6	61.3	64.4	69.8	72.0

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Iceland, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	100	NA	100	50	50

NA: not applicable. In 2020 there was no EARS-Net EQA.

[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Iceland, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	2	257	2	2	245	2	2	278	1	2	235	2	2	258	3
K. pneumoniae	2	23	0[c]	2	32	3	2	29	4[c]	2	32	0	2	44	5
P. aeruginosa	2	22	14[c]	2	25	19[c]	2	32	7	2	35	6	2	27	8[c]
Acinetobacter spp.	1	3	NA	1	3	NA	1	8	NA	1	2	NA	1	1	NA
S. aureus	2	121	4	2	116	6	2	96	4	2	144	7	2	129	4
S. pneumoniae	2	44	0	2	20	0[c]	2	16	NA	2	35	3	2	38	0
E. faecalis	2	35	9	2	30	7	2	37	6	2	29	7[c]	2	33	7
E. faecium	2	13	NA	2	19	NA	2	18	NA	2	33	6	2	39	11

Labs: laboratories.
NA: not applicable.

[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.

[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

[c] A small number of isolates were tested (n<30), and the percentage of isolates from ICUs should be interpreted with caution.

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Iceland

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	37.82	37.07	34.98	29.24	35.07	-	-7.3
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	5.04	7.41	7.86	6.11	7.99	-	+58.5
	Carbapenem (imipenem/meropenem) resistance	0.00^	0.00	0.00	0.00	0.00	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	9.24	7.96	10.85	6.38	8.51	-	-7.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3.36	5.22	7.05	4.78	3.61	-	+7.4
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	0.28	2.20	2.17	2.39	2.06	-	+635.7
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	0.28	0.00	0.27	0.27	0.77	-	+175.0
	Carbapenem (imipenem/meropenem) resistance	ND	0.00	0.00	0.00	0.00	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	0.28	0.00	0.00	0.80	1.29	↑	+360.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.56	0.00	0.00	0.00	0.52	-	-7.1
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	0.00	0.00	0.00	0.00	0.00	NA	NA
P. aeruginosa	Piperacillin-tazobactam resistance	0.56^	ND	1.63	0.80	0.26	NA	-53.6
	Ceftazidime resistance	0.84	0.55	0.81	0.53	0.52	-	-38.1
	Carbapenem (imipenem/meropenem) resistance	0.00	0.82	0.81	1.06	0.26	-	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.28	0.27	0.54	1.06	0.52	-	+85.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.28	0.00	0.00	0.00	0.00	NA	-100.0
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.28^	ND	0.27	0.27	0.26	NA	-7.1
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.00	0.00	0.00	0.00	0.00	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.00	0.00	0.00	0.00	0.00	NA	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.00	0.00	0.00	0.00	0.00	NA	NA
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.00	0.00	0.00	0.00	0.00	NA	NA
S. aureus	MRSA[f]	1.96	1.65	0.27	1.06	2.06	-	+5.1
S. pneumoniae	Penicillin non-wild-type[g]	1.96	1.65	1.36	2.66	1.29	-	-34.2
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1.96	1.65	1.08	2.92	1.29	-	-34.2
	Combined penicillin non-wild-type and resistance to macrolides[g]	1.40	1.65	1.08	2.66	0.77	-	-45.0
E. faecalis	High-level gentamicin resistance	1.12	0.55	0.81	1.59	1.55	-	+38.4
E. faecium	Vancomycin resistance	0.00	0.00	0.00	0.00	0.00	NA	NA

ND: no data available.

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Iceland, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	257	52.5	245	55.1	277	46.6	235	46.8	258	52.7	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	257	7	245	11	278	10.4	235	9.8	258	12	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	2	NA	245	0	276	0	235	0	258	0	0.3 (0.0-1.8)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	252	13.1	245	11.8	277	14.4	235	10.2	258	12.8	24.0 (10.1-42.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	256	4.7	245	7.8	278	9.4	235	7.7	258	5.4	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	251	0.4	245	3.3	277	2.9	235	3.8	258	3.1	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	23	4.3[h]	32	0	29	3.4[h]	32	3.1	44	6.8	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	ND	ND	32	0	29	0.0[h]	32	0	44	0	13.3 (0.0-69.7)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	23	4.3[h]	32	0	29	0.0[h]	32	9.4	44	11.4	33.7 (7.1-76.9)	↑*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	23	8.7[h]	32	0	29	0.0[h]	32	0	44	4.5	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	23	0.0[h]	32	0	29	0.0[h]	32	0	44	0	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	2	NA	ND	ND	31	19.4	35	8.6	27	3.7[h]	18.5 (3.7-54.4)	NA
	Ceftazidime resistance	22	13.6[h]	25	8.0[h]	32	9.4	35	5.7	27	7.4[h]	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	22	0.0[h]	25	12.0[h]	32	9.4	35	11.4	27	3.7[h]	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	22	4.5[h]	25	4.0[h]	32	6.3	35	11.4	27	7.4[h]	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	22	4.5[h]	25	0.0[h]	32	0	35	0	27	0.0[h]	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	2	NA	ND	ND	31	3.2	35	2.9	27	3.7[h]	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	3	NA	3	NA	8	NA	2	NA	1	NA	40.1 (0.0-95.8)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	3	NA	3	NA	8	NA	2	NA	1	NA	42.4 (0.0-96.6)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3	NA	3	NA	8	NA	2	NA	1	NA	36.7 (0.0-92.4)	NA
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	3	NA	3	NA	8	NA	2	NA	1	NA	35.2 (0.0-91.5)	NA
S. aureus	MRSA[f]	121	5.8	116	5.2	95	1.1	144	2.8	129	6.2	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	44	15.9	20	30.0[h]	16	NA	35	28.6	38	13.2	15.1 (3.7-39.1)	NA
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	44	15.9	20	30.0[h]	16	NA	35	31.4	38	13.2	17.8 (4.0-53.8)	NA
	Combined penicillin non-wild-type and resistance to macrolides[g]	44	11.4	20	30.0[h]	16	NA	35	28.6	38	7.9	9.2 (0.0-26.9)	NA
E. faecalis	High-level gentamicin resistance	35	11.4	30	6.7	37	8.1	29	20.7[h]	33	18.2	24.3 (4.3-99.0)	-
E. faecium	Vancomycin resistance	13	NA	19	NA	18	NA	33	0	39	0	19.8 (0.0-60.9)	NA

ND: no data available.

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

[h] A small number of isolates were tested (n<30), and the percentage resistance should be interpreted with caution.

Ireland

Participating institutions:
Health Protection Surveillance Centre, www.hpsc.ie

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Ireland, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	96	96	96	93	92
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	58.9	56.5	56.5	55.8	56.5

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Ireland, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	84	NA	ND	85	90

ND: no data available.
NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Ireland, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	34	3 233	NA	33	2 851	NA	32	2 906	NA	32	3 008	NA	30	3 120	NA
K. pneumoniae	30	527	NA	33	487	NA	31	502	NA	30	469	NA	28	571	NA
P. aeruginosa	27	276	NA	26	264	NA	26	280	NA	27	303	NA	27	287	NA
Acinetobacter spp.	21	66	NA	17	54	NA	17	68	NA	17	78	NA	16	65	6
S. aureus	32	1 146	NA	31	1 024	NA	32	1 213	NA	31	1 178	NA	29	1 242	NA
S. pneumoniae	27	348	NA	27	177	NA	24	168	NA	25	286	NA	24	341	NA
E. faecalis	30	301	NA	31	312	NA	31	349	NA	30	357	NA	26	363	NA
E. faecium	27	443	NA	26	472	NA	25	603	NA	25	610	NA	27	614	NA

Labs: laboratories.
NA: not applicable.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Ireland

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	45.92	38.75	37.99	39.42	40.46	-	-11.9
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	8.28	7.07	6.01	6.18	6.70	↓	-19.1
	Carbapenem (imipenem/meropenem) resistance	0.00	0.04	0.00	0.00	0.04	-	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	13.93	11.27	9.63	9.95	10.08	↓	-27.6
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	8.07	6.36	5.78	5.53	5.61	↓	-30.5
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3.82	2.79	2.39	2.25	2.04	↓	-46.6
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1.98	1.91	1.62	1.25	1.88	-	-5.1
	Carbapenem (imipenem/meropenem) resistance	0.11	0.04	0.06	0.06	0.04	-	-63.6
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	1.93	1.74	1.69	0.98	1.79	-	-7.3
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1.23	1.18	1.10	0.79	1.03	-	-16.3
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	0.59	0.80	0.79	0.34	0.64	-	+8.5
P. aeruginosa	Piperacillin-tazobactam resistance	0.64	0.65	0.83	0.51^	0.64	-	0.0
	Ceftazidime resistance	0.53	0.52	0.65	0.57	0.39	-	-26.4
	Carbapenem (imipenem/meropenem) resistance	0.38	0.40	0.48	0.55	0.39	-	+2.6
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.55	0.76	0.50	0.49	0.43	-	-21.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.38	0.06^	0.17^	0.11^	0.04^	NA	-89.5
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.30	0.04^	0.29^	0.23^	0.21^	NA	-30.0
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.02	0.00	0.02	0.04	0.00	-	-100.0
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.11	0.06^	0.04^	0.02^	0.02	↓	-81.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.02^	0.02^	0.04	0.02^	0.00^	-	-100.0
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.00^	0.00^	0.00^	0.00^	0.00^	NA	NA
S. aureus	MRSA[f]	3.06	2.50	2.68	2.61	2.47	-	-19.3
S. pneumoniae	Penicillin non-wild-type[g]	1.06	0.59	0.69	1.49	1.18	-	+11.3
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.91	0.46	0.42	0.91	1.03	-	+13.2
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.59	0.36	0.25	0.70	0.62	-	+5.1
E. faecalis	High-level gentamicin resistance	1.19^	0.59^	0.94^	0.85^	0.95^	-	-20.2
E. faecium	Vancomycin resistance	3.61	3.53	3.45	3.68	2.66	↓	-26.3

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Ireland, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	3 201	67.5	2 841	65	2 898	63	3 003	61.8	3 115	63	54.7 (32.5-68.9)	↓*
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	3 231	12.1	2 850	11.8	2 903	10	3 007	9.7	3 118	10.4	16.2 (5.6-37.3)	↓*
	Carbapenem (imipenem/meropenem) resistance	3 229	0	2 820	0.1	2 891	0	2 996	0	3 069	0.1	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	3 223	20.4	2 844	18.9	2 898	16	3 000	15.6	3 062	16	24.0 (10.1-42.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3 232	11.8	2 849	10.6	2 904	9.6	3 004	8.7	3 111	8.7	10.9 (4.5-28.4)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3 222	5.6	2 841	4.7	2 895	4	2 995	3.5	3 052	3.2	5.9 (1.3-17.6)	↓*
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	527	17.6	487	18.7	502	15.5	469	12.6	570	16	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	527	0.9	477	0.4	497	0.6	468	0.6	563	0.4	13.3 (0.0-69.7)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	526	17.3	486	17.1	500	16.2	466	9.9	561	15.5	33.7 (7.1-76.9)	↓
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	526	11	485	11.5	502	10.6	469	7.9	571	8.8	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	525	5.3	484	7.9	500	7.6	466	3.4	560	5.5	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	276	10.9	241	12.9	262	15.3	237	10.1	278	11.2	18.5 (3.7-54.4)	-
	Ceftazidime resistance	272	9.2	240	10.4	277	11.2	281	9.6	279	6.8	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	275	6.5	261	7.3	280	8.2	302	8.6	287	6.6	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	276	9.4	262	13.7	277	8.7	299	7.7	277	7.6	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	276	6.5	161	1.9	244	3.3	267	1.9	240	0.8	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	272	5.1	138	1.4	225	6.2	199	5.5	230	4.3	13.1 (1.6-49.5)	NA
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	63	1.6	52	0	66	1.5	78	2.6	64	0	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	64	7.8	41	7.3	60	3.3	65	1.5	62	1.6	42.4 (0.0-96.6)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	57	1.8	48	2.1	64	3.1	67	1.5	58	0	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	53	0	35	0	56	0	56	0	56	0	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	1 146	12.6	1 024	11.6	1 213	10.6	1 178	10.4	1 242	9.7	15.8 (1.5-51.1)	↓*
S. pneumoniae	Penicillin non-wild-type[g]	348	14.4	177	15.8	168	19.6	286	24.5	341	16.7	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	340	12.6	170	12.9	159	12.6	270	15.9	333	15	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	340	8.2	170	10	159	7.5	270	12.2	333	9	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	243	23	175	16	260	17.3	259	15.4	299	15.4	24.3 (4.3-99.0)	↓*
E. faecium	Vancomycin resistance	443	38.4	471	35.7	602	27.6	609	28.4	613	21	19.8 (0.0-60.9)	↓*

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Italy

Participating institutions:
National Institute of Health, www.iss.it

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Italy, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	41	47	61	61	66
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	ND	57.0	66.6	60.1	61.2

ND: no data available.
For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Italy, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	95	NA	98	85	91

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Italy, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	128	18 866	6	151	19 086	6	156	22 038	7	172	25 850	7	192	28 756	7
K. pneumoniae	123	7 782	22	147	8 597	24	154	9 724	24	172	11 762	19	196	13 968	18
P. aeruginosa	124	3 895	23	145	4 678	27	154	5 085	26	170	6 032	23	192	6 695	21
Acinetobacter spp.	100	1 651	38	123	2 577	48	129	3 342	53	150	2 895	39	173	3 114	30
S. aureus	125	9 943	11	149	11 164	14	154	12 680	14	170	14 863	12	194	15 425	11
S. pneumoniae	100	1 351	10	109	685	10	107	672	14	136	1 201	11	160	1 796	11
E. faecalis	122	4 705	18	149	6 354	28	150	7 686	27	166	8 261	20	191	8 174	18
E. faecium	118	2 878	19	138	4 243	26	150	5 358	26	164	6 070	20	183	6 109	17

Labs: laboratories.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Italy

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	12.27^	9.70^	9.66^	12.99^	14.53^	-	+18.4
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	22.96	17.67	14.77	17.29	19.56	-	-14.8
	Carbapenem (imipenem/meropenem) resistance	0.26	0.30	0.24	0.18	0.31	-	+19.2
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	30.24	25.26	19.98	22.26	24.55	-	-18.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	11.82	9.59	7.98	10.04	11.76	-	-0.5
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	8.38	6.16	5.00	6.28	7.32	-	-12.6
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	17.92	16.28	14.27	17.24	19.58	-	+9.3
	Carbapenem (imipenem/meropenem) resistance	8.43	8.73	6.99	7.77	9.29	-	+10.2
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	17.00	15.87	13.32	15.59	17.42	-	+2.5
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	10.11	9.11	7.96	10.17	11.56	-	+14.3
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	9.24	8.26	7.20	9.24	10.26	-	+11.0
P. aeruginosa	Piperacillin-tazobactam resistance	3.67	3.92	3.27	3.95	3.68	-	+0.3
	Ceftazidime resistance	2.92	3.09	2.73	3.11	2.98	-	+2.1
	Carbapenem (imipenem/meropenem) resistance	2.11	2.63	2.40	2.72	2.72	↑	+28.9
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	3.40	3.22	2.66	3.07	2.74	↓	-19.4
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	1.78	ND	ND	0.62^	0.77^	NA	-56.7
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	1.88	ND	ND	1.08^	1.26^	NA	-33.0
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	5.09	7.36	8.03	6.75	6.04	-	+18.7
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	5.45	7.51	8.12	6.97	6.01	-	+10.3
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	5.21	7.15	7.78	6.68	5.78	-	+10.9
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	4.86	6.88	7.62	6.19	5.55	-	+14.2
S. aureus	MRSA[f]	13.42	13.07	10.28	11.70	10.18	↓	-24.1
S. pneumoniae	Penicillin non-wild-type[g]	0.49^	0.25^	0.14^	0.28^	0.41^	-	-16.3
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1.17	0.55	0.43	0.79	1.15	-	-1.7
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.27^	0.14^	0.09^	0.15^	0.21^	-	-22.2
E. faecalis	High-level gentamicin resistance	3.38^	4.03^	3.23^	3.36^	3.07^	-	-9.2
E. faecium	Vancomycin resistance	2.44	3.51	3.87	5.04	5.03	↑	+106.1

ND: no data available.

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Italy, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	4 457	68.1	4 214	64.5	5 850	59.6	7 590	61.6	8 951	63.2	54.7 (32.5-68.9)	↓*
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	18 409	30.9	18 750	26.4	21 897	24.4	25 656	24.2	28 557	26.7	16.2 (5.6-37.3)	↓*
	Carbapenem (imipenem/meropenem) resistance	17 086	0.4	18 001	0.5	20 645	0.4	24 042	0.3	27 623	0.4	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	18 417	40.6	18 840	37.6	21 642	33.4	25 320	31.6	27 993	34.1	24.0 (10.1-42.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	18 382	15.9	17 994	14.9	21 358	13.5	25 448	14.2	28 594	16	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	17 961	11.6	17 593	9.8	21 045	8.6	24 996	9	27 876	10.2	5.9 (1.3-17.6)	↓*
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	7 699	57.6	8 400	54.3	9 616	53.6	11 637	53.3	13 818	55.2	34.8 (5.7-81.5)	↓*
	Carbapenem (imipenem/meropenem) resistance	7 325	28.5	8 293	29.5	9 281	27.2	11 226	24.9	13 654	26.5	13.3 (0.0-69.7)	↓*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	7 692	54.7	8 486	52.4	9 487	50.7	11 513	48.7	13 547	50.1	33.7 (7.1-76.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	7 682	32.6	8 084	31.6	9 343	30.8	11 516	31.8	13 782	32.7	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	7 560	30.3	7 842	29.5	9 171	28.4	11 299	29.4	13 397	29.8	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	3 768	24.1	4 537	24.2	4 853	24.4	5 894	24.1	6 497	22.1	18.5 (3.7-54.4)	↓
	Ceftazidime resistance	3 798	19	4 473	19.3	4 886	20.2	5 894	19	6 525	17.8	15.7 (2.8-52.7)	↓
	Carbapenem (imipenem/meropenem) resistance	3 794	13.7	4 615	15.9	5 034	17.2	5 963	16.4	6 636	16	18.6 (3.3-53.4)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	3 875	21.7	4 599	19.6	4 989	19.3	5 962	18.5	6 660	16	17.9 (5.9-52.0)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	3 859	11.4	ND	ND	ND	ND	3 248	6.9	4 318	7	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	3 581	13	ND	ND	ND	ND	3 128	12.5	4 090	12	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	1 588	79.3	2 552	80.8	3 291	88.1	2 742	88.5	3 098	75.9	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1 636	82.5	2 522	83.4	3 286	89.3	2 811	89.1	3 043	76.9	42.4 (0.0-96.6)	↓
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1 637	78.8	2 496	80.2	3 253	86.4	2 827	85	3 061	73.6	36.7 (0.0-92.4)	↓*
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	1 569	76.6	2 451	78.7	3 205	86	2 648	84.1	2 998	72.1	35.2 (0.0-91.5)	↓
S. aureus	MRSA[f]	9 681	34.3	10 923	33.5	12 158	30.5	14 053	29.9	14 909	26.6	15.8 (1.5-51.1)	↓*
S. pneumoniae	Penicillin non-wild-type[g]	1 017	11.9	516	13.4	492	10	805	12.4	1 239	12.9	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1 298	22.3	639	24.1	641	24.5	1 143	25	1 712	26.2	17.8 (4.0-53.8)	↑
	Combined penicillin non-wild-type and resistance to macrolides[g]	989	6.7	491	7.7	474	6.5	773	7	1 175	6.8	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	2 395	34.9	3 028	37.4	3 217	36.3	3 574	33.8	3 469	34.5	24.3 (4.3-99.0)	-
E. faecium	Vancomycin resistance	2 839	21.3	4 166	23.6	5 200	26.9	5 905	30.7	6 017	32.5	19.8 (0.0-60.9)	↑*

ND: no data available.

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Latvia

Participating institutions:
Disease Prevention and Control Center of Latvia, www.spkc.gov.lv

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Latvia, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	90	90	90	90	90
Geographical representativeness	High	High	High	High	High
Hospital representativeness	Medium	Medium	Medium	Medium	High
Isolate representativeness	Medium	Medium	Medium	Medium	Medium
Blood culture sets per 1 000 patient-days	9.5	13.8	17.0	16.8	24.8

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Latvia, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	100	NA	ND	93	86

ND: no data available.
NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Latvia, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	10	442	20	10	379	21	11	394	20	11	484	19	13	464	8
K. pneumoniae	9	198	32	9	189	29	10	253	38	11	288	23	15	235	17
P. aeruginosa	6	49	44	9	43	31	9	78	51	9	72	35	11	44	12
Acinetobacter spp.	8	46	61	7	52	54	8	82	67	8	73	41	9	77	44
S. aureus	11	422	20	10	355	21	11	457	15	13	521	15	15	465	6
S. pneumoniae	6	79	33	5	42	38	7	56	22	8	106	25	11	70	6
E. faecalis	10	100	25	9	98	28	10	161	39	10	162	24	10	115	22
E. faecium	8	58	43	9	62	48	8	113	60	10	97	32	10	61	28

Labs: laboratories.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Latvia

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	14.64#	11.82#	9.98^#	13.27^#	6.14^#	↓	-58.1
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	5.03#	5.30#	4.23#	5.75#	6.90#	↑	+37.2
	Carbapenem (imipenem/meropenem) resistance	0.00#	0.00#	0.00#	0.00#	0.00#	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	6.37#	6.06#	4.75#	6.22#	7.61#	-	+19.5
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	2.95#	2.50#	2.52#	3.38#	4.01#	↑	+35.9
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2.37#	2.33#	1.94#	2.72#	3.42#	↑	+44.3
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	4.22#	5.30#	5.34#	6.58#	5.72#	↑	+35.5
	Carbapenem (imipenem/meropenem) resistance	0.00#	0.12#	0.23#	0.47#	0.89#	↑	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	4.22#	4.54#	4.58#	5.63#	4.96#	-	+17.5
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3.24#	2.27#	3.29#	4.21#	3.48#	-	+7.4
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2.89#	2.10#	2.99#	3.67#	3.07#	-	+6.2
P. aeruginosa	Piperacillin-tazobactam resistance	0.93#	0.23^#	1.23#	1.13#	0.53#	-	-43.0
	Ceftazidime resistance	0.93#	0.58#	1.17#	0.95^#	0.77#	-	-17.2
	Carbapenem (imipenem/meropenem) resistance	0.93#	0.64#	1.35#	0.89#	0.59#	-	-36.6
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.81#	0.70#	1.47#	1.42#	0.65#	-	-19.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.64#	0.00^#	0.23^#	0.77^#	0.06^#	NA	-90.6
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.52#	0.06^#	0.18^#	0.53^#	0.12^#	NA	-76.9
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	2.26#	2.50#	3.81#	3.08#	3.19#	-	+41.2
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1.16^#	2.50#	3.05^#	2.78^#	2.42^#	-	+108.6
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1.74#	1.92#	3.29#	2.49#	2.30#	-	+32.2
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.64^#	1.86#	2.46^#	2.25^#	1.95^#	-	+204.7
S. aureus	MRSA[f]	1.91#	1.92#	1.41#	2.19#	1.48#	-	-22.5
S. pneumoniae	Penicillin non-wild-type[g]	0.46#	0.41#	0.12#	0.18#	0.47#	-	+2.2
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.23#	0.17^#	0.00^#	0.30#	0.24#	-	+4.3
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.17#	0.06^#	0.00^#	0.06#	0.24#	-	+41.2
E. faecalis	High-level gentamicin resistance	2.37#	1.98#	4.17#	9.42#	5.78^#	↑	+143.9
E. faecium	Vancomycin resistance	1.33#	1.05#	2.00#	1.54#	0.83#	-	-37.6

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Latvia, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	438	57.8	374	54.3	344	49.4	432	51.9	208	50	54.7 (32.5-68.9)	↓*
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	442	19.7	378	24.1	393	18.3	484	20	461	25.4	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	439	0	378	0	393	0	481	0	455	0	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	442	24.9	378	27.5	392	20.7	481	21.8	455	28.4	24.0 (10.1-42.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	440	11.6	377	11.4	394	10.9	483	11.8	457	14.9	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	440	9.3	376	10.6	391	8.4	481	9.6	448	12.9	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	198	36.9	188	48.4	253	36	287	38.7	235	41.3	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	198	0	189	1.1	253	1.6	288	2.8	234	6.4	13.3 (0.0-69.7)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	198	36.9	188	41.5	252	31	287	33.1	232	36.2	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	198	28.3	186	21	252	22.2	288	24.7	234	25.2	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	198	25.3	185	19.5	251	20.3	286	21.7	231	22.5	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	45	35.6	14	NA	76	27.6	72	26.4	44	20.5	18.5 (3.7-54.4)	NA
	Ceftazidime resistance	49	32.7	42	23.8	77	26	52	30.8	41	31.7	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	49	32.7	43	25.6	78	29.5	72	20.8	44	22.7	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	49	28.6	39	30.8	78	32.1	72	33.3	44	25	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	49	22.4	7	NA	23	17.4[h]	42	31	7	NA	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	45	20	5	NA	23	13.0[h]	24	37.5[h]	7	NA	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	46	84.8	52	82.7	82	79.3	73	71.2	77	70.1	40.1 (0.0-95.8)	↓*
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	24	83.3[h]	50	86	60	86.7	60	78.3	49	83.7	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	44	68.2	52	63.5	82	68.3	73	57.5	77	50.6	36.7 (0.0-92.4)	↓*
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	22	50.0[h]	50	64	60	70	60	63.3	49	67.3	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	421	7.8	353	9.3	457	5.3	513	7.2	464	5.4	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	79	10.1	41	17.1	56	3.6	106	2.8	68	11.8	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	76	5.3	27	11.1[h]	34	0	103	4.9	67	6	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	76	3.9	27	3.7[h]	34	0	103	1	65	6.2	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	93	44.1	89	38.2	153	46.4	159	100	99	99	24.3 (4.3-99.0)	↑*
E. faecium	Vancomycin resistance	58	39.7	62	29	113	30.1	96	27.1	61	23	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

[h] A small number of isolates were tested (n<30), and the percentage resistance should be interpreted with caution.

Liechtenstein

Participating institutions:
Liechtensteinisches Landesspital, https://www.landesspital.li/
Laboratory Dr Risch[a], https://www.risch.ch/de
The Swiss Center for Antibiotic Resistance (ANRESIS)[b], https://www.anresis.ch/

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

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Liechtenstein, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	ND	ND	ND	40	40
Geographical representativeness	ND	ND	ND	Medium	Medium
Hospital representativeness	ND	ND	ND	Medium	Medium
Isolate representativeness	ND	ND	ND	Medium	Medium
Blood culture sets per 1 000 patient-days	ND	ND	ND	2.7	2.1

ND: no data available.
For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Liechtenstein, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	ND	NA	ND	100	100

ND: no data available.
NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Liechtenstein, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	13	NA	1	8	NA
K. pneumoniae	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	2	NA
P. aeruginosa	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	2	NA
Acinetobacter spp.	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
S. aureus	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	5	NA	1	2	NA
S. pneumoniae	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	3	NA	1	1	NA
E. faecalis	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	2	NA
E. faecium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Labs: laboratories.
ND: no data available.
NA: not applicable.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Liechtenstein

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	ND	ND	ND	19.08#	18.90#	NA	NA
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	ND	ND	ND	6.36#	0.00#	NA	NA
	Carbapenem (imipenem/meropenem) resistance	ND	ND	ND	0.00#	0.00#	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	ND	ND	ND	12.72#	12.60#	NA	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	ND	ND	ND	0.00#	0.00#	NA	NA
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	ND	ND	ND	0.00#	0.00#	NA	NA
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	ND	ND	ND	ND	0.00#	NA	NA
	Carbapenem (imipenem/meropenem) resistance	ND	ND	ND	ND	0.00#	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	ND	ND	ND	ND	0.00#	NA	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	ND	ND	ND	ND	0.00#	NA	NA
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	ND	ND	ND	ND	0.00#	NA	NA
P. aeruginosa	Piperacillin-tazobactam resistance	ND	ND	ND	ND	0.00#	NA	NA
	Ceftazidime resistance	ND	ND	ND	ND	0.00#	NA	NA
	Carbapenem (imipenem/meropenem) resistance	ND	ND	ND	ND	0.00#	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	ND	ND	ND	ND	0.00#	NA	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	ND	ND	ND	ND	0.00^#	NA	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	ND	ND	ND	ND	0.00^#	NA	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	ND	ND	ND	ND	ND	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	ND	ND	ND	ND	ND	NA	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	ND	ND	ND	ND	ND	NA	NA
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	ND	ND	ND	ND	ND	NA	NA
S. aureus	MRSA[f]	ND	ND	ND	6.36#	0.00#	NA	NA
S. pneumoniae	Penicillin non-wild-type[g]	ND	ND	ND	0.00^#	0.00#	NA	NA
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	ND	ND	ND	0.00#	0.00#	NA	NA
	Combined penicillin non-wild-type and resistance to macrolides[g]	ND	ND	ND	0.00^#	0.00#	NA	NA
E. faecalis	High-level gentamicin resistance	ND	ND	ND	ND	0.00#	NA	NA
E. faecium	Vancomycin resistance	ND	ND	ND	ND	ND	NA	NA

ND: no data available.

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Liechtenstein, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	ND	ND	ND	ND	ND	ND	13	NA	8	NA	54.7 (32.5-68.9)	NA
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	ND	ND	ND	ND	ND	ND	13	NA	8	NA	16.2 (5.6-37.3)	NA
	Carbapenem (imipenem/meropenem) resistance	ND	ND	ND	ND	ND	ND	13	NA	8	NA	0.3 (0.0-1.8)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	ND	ND	ND	ND	ND	ND	13	NA	8	NA	24.0 (10.1-42.9)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	ND	ND	ND	ND	ND	ND	13	NA	8	NA	10.9 (4.5-28.4)	NA
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	ND	ND	ND	ND	ND	ND	13	NA	8	NA	5.9 (1.3-17.6)	NA
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	ND	ND	ND	ND	ND	ND	ND	ND	2	NA	34.8 (5.7-81.5)	NA
	Carbapenem (imipenem/meropenem) resistance	ND	ND	ND	ND	ND	ND	ND	ND	2	NA	13.3 (0.0-69.7)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	ND	ND	ND	ND	ND	ND	ND	ND	2	NA	33.7 (7.1-76.9)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	ND	ND	ND	ND	ND	ND	ND	ND	2	NA	23.6 (2.6-73.3)	NA
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	ND	ND	ND	ND	ND	ND	ND	ND	2	NA	21.0 (0.0-64.9)	NA
P. aeruginosa	Piperacillin-tazobactam resistance	ND	ND	ND	ND	ND	ND	ND	ND	2	NA	18.5 (3.7-54.4)	NA
	Ceftazidime resistance	ND	ND	ND	ND	ND	ND	ND	ND	2	NA	15.7 (2.8-52.7)	NA
	Carbapenem (imipenem/meropenem) resistance	ND	ND	ND	ND	ND	ND	ND	ND	2	NA	18.6 (3.3-53.4)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	ND	ND	ND	ND	ND	ND	ND	ND	2	NA	17.9 (5.9-52.0)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	ND	ND	ND	ND	ND	ND	ND	ND	1	NA	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	ND	ND	ND	ND	ND	ND	ND	ND	1	NA	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	40.1 (0.0-95.8)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	42.4 (0.0-96.6)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.7 (0.0-92.4)	NA
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.2 (0.0-91.5)	NA
S. aureus	MRSA[f]	ND	ND	ND	ND	ND	ND	5	NA	2	NA	15.8 (1.5-51.1)	NA
S. pneumoniae	Penicillin non-wild-type[g]	ND	ND	ND	ND	ND	ND	2	NA	1	NA	15.1 (3.7-39.1)	NA
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	ND	ND	ND	ND	ND	ND	3	NA	1	NA	17.8 (4.0-53.8)	NA
	Combined penicillin non-wild-type and resistance to macrolides[g]	ND	ND	ND	ND	ND	ND	2	NA	1	NA	9.2 (0.0-26.9)	NA
E. faecalis	High-level gentamicin resistance	ND	ND	ND	ND	ND	ND	ND	ND	2	NA	24.3 (4.3-99.0)	NA
E. faecium	Vancomycin resistance	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	19.8 (0.0-60.9)	NA

ND: no data available.

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Lithuania

Participating institutions:
National Public Health Surveillance Laboratory, www.nvspl.lt
Institute of Hygiene, www.hi.lt

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Lithuania, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	100	100	100	100	100
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	6.1	8.1	9.8	7.9	8.8

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Lithuania, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	89	NA	100	93	93

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Lithuania, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	18	1 132	20	17	1 142	18	17	1 154	16	16	1 309	15	15	1 481	15
K. pneumoniae	17	440	28	16	413	25	14	512	29	14	517	29	15	541	28
P. aeruginosa	17	104	32	15	121	26	12	162	35	13	170	29	11	142	31
Acinetobacter spp.	13	108	57	12	157	71	13	361	78	12	141	62	12	122	45
S. aureus	18	656	21	17	704	22	16	746	21	15	828	18	15	813	19
S. pneumoniae	16	120	38	14	96	22	15	109	25	15	172	16	14	178	21
E. faecalis	15	143	30	14	140	28	14	183	41	13	167	29	14	162	17
E. faecium	14	128	38	15	145	43	13	211	44	13	164	42	11	156	31

Labs: laboratories.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Lithuania

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	23.87	23.19	23.43	27.33	31.71	↑	+32.8
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	5.62	6.51	5.62	7.20	8.78	↑	+56.2
	Carbapenem (imipenem/meropenem) resistance	0.07	0.00	0.11	0.11	0.03	-	-57.1
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	7.27	7.62	7.19	8.77	10.46	↑	+43.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3.08	4.19	3.40	3.88	5.84	↑	+89.6
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1.83	2.61	2.00	2.57	3.46	↑	+89.1
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	8.66	6.30	7.87	7.34	8.22	-	-5.1
	Carbapenem (imipenem/meropenem) resistance	0.54	0.43	0.18	0.11	0.73	-	+35.2
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	8.16	6.69	6.98	7.31	7.84	-	-3.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	6.19	4.97	5.29	4.99	5.53	-	-10.7
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	5.48	4.19	4.54	3.96	4.55	-	-17.0
P. aeruginosa	Piperacillin-tazobactam resistance	0.86	1.00	0.82	1.10	0.63	-	-26.7
	Ceftazidime resistance	0.57	0.72	0.75	0.93	0.49	-	-14.0
	Carbapenem (imipenem/meropenem) resistance	0.61	1.11	1.47	1.46	0.70	-	+14.8
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.64	0.79	0.93	1.07	0.49	-	-23.4
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.47	ND	ND	ND	ND	NA	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.47	ND	ND	ND	ND	NA	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	3.29	5.12	12.38	4.45	3.95	-	+20.1
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	3.54	5.12	12.48	4.42	3.85	-	+8.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3.19	4.72	11.73	3.99	3.46	-	+8.5
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	3.01	4.65	11.63	3.88	3.43	-	+14.0
S. aureus	MRSA[f]	2.18	2.47	2.40	2.78	2.45	-	+12.4
S. pneumoniae	Penicillin non-wild-type[g]	0.47	0.47	0.32	0.39	0.59	-	+25.5
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.43	0.50	0.72	0.89	1.12	↑	+160.5
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.32	0.32	0.18	0.18	0.38	-	+18.8
E. faecalis	High-level gentamicin resistance	1.15^	0.32^	0.61^	0.82^	1.01^	-	-12.2
E. faecium	Vancomycin resistance	1.83	2.93	5.01	3.96	3.32	-	+81.4

ND: no data available.

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Lithuania, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	1 129	59.1	1 138	56.9	1 147	57.1	1 303	58.9	1 477	61.3	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1 132	13.9	1 142	15.9	1 153	13.6	1 309	15.4	1 480	17	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	1 122	0.2	1 142	0	1 149	0.3	1 309	0.2	1 478	0.1	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	1 129	18	1 136	18.8	1 139	17.6	1 293	19	1 455	20.5	24.0 (10.1-42.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1 129	7.6	1 141	10.3	1 141	8.3	1 308	8.3	1 473	11.3	10.9 (4.5-28.4)	↑*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1 126	4.5	1 135	6.4	1 126	5	1 293	5.6	1 446	6.8	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	440	55	413	42.6	512	43	517	39.8	541	43.4	34.8 (5.7-81.5)	↓*
	Carbapenem (imipenem/meropenem) resistance	438	3.4	413	2.9	511	1	517	0.6	541	3.9	13.3 (0.0-69.7)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	438	52.1	413	45.3	510	38.2	514	39.9	532	42.1	33.7 (7.1-76.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	435	39.8	410	33.9	511	29	516	27.1	540	29.3	23.6 (2.6-73.3)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	433	35.3	410	28.5	509	25	514	21.6	531	24.5	21.0 (0.0-64.9)	↓*
P. aeruginosa	Piperacillin-tazobactam resistance	102	23.5	121	23.1	162	14.2	170	18.2	142	12.7	18.5 (3.7-54.4)	↓*
	Ceftazidime resistance	103	15.5	119	16.8	160	13.1	170	15.3	142	9.9	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	104	16.3	121	25.6	161	25.5	169	24.3	142	14.1	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	104	17.3	120	18.3	158	16.5	170	17.6	140	10	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	103	12.6	ND	ND	ND	ND	ND	ND	ND	ND	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	101	12.9	ND	ND	ND	ND	ND	ND	ND	ND	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	108	85.2	157	91.1	360	96.1	141	88.7	122	92.6	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	108	91.7	154	92.9	361	96.7	139	89.2	119	92.4	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	107	83.2	153	86.3	351	93.4	133	84.2	120	82.5	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	107	78.5	150	86.7	350	92.9	131	83.2	118	83.1	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	656	9.3	704	9.8	746	9	828	9.4	813	8.6	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	120	10.8	96	13.5	109	8.3	172	6.4	178	9.6	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	119	10.1	96	14.6	109	18.3	172	14.5	176	18.2	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	119	7.6	96	9.4	109	4.6	172	2.9	176	6.3	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	78	41	68	13.2	94	18.1	101	22.8	99	29.3	24.3 (4.3-99.0)	-
E. faecium	Vancomycin resistance	128	39.8	145	56.6	211	66.4	164	67.7	156	60.9	19.8 (0.0-60.9)	↑*

ND: no data available.

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Luxembourg

Participating institutions:
National Health Laboratory, https://lns.lu/
Microbiology Laboratory, Centre Hospitalier de Luxembourg, https://www.chl.lu/fr/service/laboratoire-de-bacteriologiemicrobiologie

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Luxembourg, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	ND	99	100	99	100
Geographical representativeness	ND	High	High	High	High
Hospital representativeness	ND	High	High	High	High
Isolate representativeness	ND	High	High	High	High
Blood culture sets per 1 000 patient-days	ND	38.9	42.1	43.9	42.5

ND: no data available.
For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Luxembourg, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	100	NA	100	80	100

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Luxembourg, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	4	492	8	4	428	8	4	354	10	4	469	4	4	461	7
K. pneumoniae	4	103	18	4	87	23	4	101	20	4	117	17	4	85	18
P. aeruginosa	4	56	18	3	51	14	3	37	27	4	47	30	4	47	17
Acinetobacter spp.	3	10	NA	2	7	NA	2	8	NA	2	13	NA	2	7	NA
S. aureus	4	209	15	4	195	18	4	199	20	4	235	13	4	190	14
S. pneumoniae	4	38	11	3	24	13[c]	4	21	5[c]	4	44	14	4	63	13
E. faecalis	4	82	24	4	95	37	4	84	37	4	86	19	4	81	14
E. faecium	4	37	32	3	42	20	4	58	38	4	69	37	4	74	24

Labs: laboratories.
NA: not applicable.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).
[c] A small number of isolates were tested (n<30), and the percentage of isolates from ICUs should be interpreted with caution.

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Luxembourg

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	46.56#	36.14	29.62	36.47	36.02	-	-22.6
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	10.20#	7.91	6.30	7.67	8.17	-	-19.9
	Carbapenem (imipenem/meropenem) resistance	0.49#	0.00	0.00	0.00	0.15	-	-69.4
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	16.62#	15.00	11.66	12.36	10.90	↓	-34.4
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	8.23#	6.13	4.88	5.32	6.96	-	-15.4
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3.13#	2.74	2.36	1.88	2.42	-	-22.7
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	4.28#	3.71	4.10	3.44	2.72	-	-36.4
	Carbapenem (imipenem/meropenem) resistance	0.16#	0.16	0.16	0.31	0.30	-	+87.5
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	4.61#	4.36	3.78	3.91	2.42	↓	-47.5
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	2.96#	2.90	2.36	1.72	1.36	↓	-54.1
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2.30#	2.90	2.05	0.94	1.06	↓	-53.9
P. aeruginosa	Piperacillin-tazobactam resistance	0.16^#	0.48	0.00	0.47	1.36	↑	+750.0
	Ceftazidime resistance	0.33#	0.32	0.47	0.47	1.21	↑	+266.7
	Carbapenem (imipenem/meropenem) resistance	0.49^#	0.65	0.47	0.47	0.91	-	+85.7
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.82#	1.77	1.42	0.94	0.61	-	-25.6
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.16#	0.16^	0.16	0.00^	0.15	NA	-6.3
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.00^#	0.32^	0.00	0.00^	0.76	NA	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.00^#	0.00	0.00	0.16	0.00^	-	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.16#	0.00	0.16	0.00	0.15	-	-6.3
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.00#	0.00	0.00	0.00	0.15	NA	NA
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.00^#	0.00	0.00	0.00	0.00^	NA	NA
S. aureus	MRSA[f]	2.14#	0.97	1.73	1.72	1.66	-	-22.4
S. pneumoniae	Penicillin non-wild-type[g]	1.32#	0.65	0.47	0.94	1.21	-	-8.3
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.49#	0.48	0.95	1.10	1.06	-	+116.3
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.16#	0.00	0.32	0.78	0.61	↑	+281.3
E. faecalis	High-level gentamicin resistance	0.66#	1.61	1.58	1.41	1.36^	-	+106.1
E. faecium	Vancomycin resistance	0.16#	0.81	0.00	0.63	0.76	-	+375.0

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Luxembourg, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	492	57.5	427	52.5	352	53.4	469	49.7	461	51.6	54.7 (32.5-68.9)	↓*
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	492	12.6	428	11.4	354	11.3	469	10.4	461	11.7	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	492	0.6	428	0	354	0	469	0	461	0.2	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	492	20.5	428	21.7	354	20.9	469	16.8	461	15.6	24.0 (10.1-42.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	492	10.2	428	8.9	354	8.8	469	7.2	461	10	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	492	3.9	428	4	354	4.2	469	2.6	461	3.5	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	103	25.2	87	26.4	101	25.7	117	18.8	85	21.2	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	103	1	87	1.1	101	1	117	1.7	84	2.4	13.3 (0.0-69.7)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	103	27.2	87	31	101	23.8	117	21.4	85	18.8	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	103	17.5	87	20.7	101	14.9	117	9.4	85	10.6	23.6 (2.6-73.3)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	103	13.6	87	20.7	101	12.9	117	5.1	85	8.2	21.0 (0.0-64.9)	↓*
P. aeruginosa	Piperacillin-tazobactam resistance	44	2.3	51	5.9	35	0	47	6.4	47	19.1	18.5 (3.7-54.4)	↑*
	Ceftazidime resistance	56	3.6	50	4	37	8.1	47	6.4	47	17	15.7 (2.8-52.7)	↑*
	Carbapenem (imipenem/meropenem) resistance	31	9.7	47	8.5	37	8.1	45	6.7	47	12.8	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	56	8.9	50	22	37	24.3	47	12.8	47	8.5	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	56	1.8	40	2.5	37	2.7	31	0	45	2.2	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	19	NA	40	5	35	0	29	0.0[h]	45	11.1	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	8	NA	7	NA	8	NA	13	NA	5	NA	40.1 (0.0-95.8)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	10	NA	7	NA	8	NA	13	NA	7	NA	42.4 (0.0-96.6)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	10	NA	7	NA	8	NA	13	NA	7	NA	36.7 (0.0-92.4)	NA
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	8	NA	7	NA	8	NA	13	NA	5	NA	35.2 (0.0-91.5)	NA
S. aureus	MRSA[f]	209	6.2	195	3.1	199	5.5	235	4.7	190	5.8	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	38	21.1	24	16.7[h]	21	14.3[h]	44	13.6	63	12.7	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	38	7.9	24	12.5[h]	21	28.6[h]	44	15.9	63	11.1	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	38	2.6	24	0.0[h]	21	9.5[h]	44	11.4	63	6.3	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	82	4.9	95	10.5	84	11.9	86	10.5	65	13.8	24.3 (4.3-99.0)	-
E. faecium	Vancomycin resistance	37	2.7	42	11.9	58	0	69	5.8	74	6.8	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

[h] A small number of isolates were tested (n<30), and the percentage resistance should be interpreted with caution.

Malta

Participating institutions:
Malta Mater Dei Hospital, Msida, https://healthservices.gov.mt/en/MDH/Pages/Home.aspx

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Malta, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	95	95	95	95	95
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	28.5	35.2	37.7	34.9	32.8

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Malta, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	100	NA	100	100	100

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Malta, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	1	332	1	1	277	2	1	299	4	1	326	3	1	416	4
K. pneumoniae	1	129	10	1	132	6	1	135	14	1	120	14	1	147	9
P. aeruginosa	1	39	23	1	49	13	1	35	29	1	47	13	1	40	8
Acinetobacter spp.	1	15	NA	1	7	NA	1	16	NA	1	14	NA	1	21	21[c]
S. aureus	1	75	7	1	92	6	1	103	8	1	116	8	1	110	5
S. pneumoniae	1	27	0[c]	1	16	NA	1	6	NA	1	14	NA	1	26	4[c]
E. faecalis	1	30	3	1	28	20[c]	1	39	16	1	33	16	1	30	7
E. faecium	1	13	NA	1	23	24[c]	1	38	42	1	32	20	1	25	21[c]

Labs: laboratories.
NA: not applicable.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).
[c] A small number of isolates were tested (n<30), and the percentage of isolates from ICUs should be interpreted with caution.

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Malta

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	45.85	33.14	39.36	41.42	50.49	-	+10.1
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	12.37	6.96	8.36	7.48	9.13	-	-26.2
	Carbapenem (imipenem/meropenem) resistance	0	0	0	0	0	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	28.37	20.05	18.76	17.38	22.53	-	-20.6
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	7.04	7.16	7.75	7.88	8.35	-	+18.6
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3.63	4.71	4.9	3.03	4.47	-	+23.1
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	10.24	10.43	7.95	6.67	7.19	↓	-29.8
	Carbapenem (imipenem/meropenem) resistance	2.13	2.05	1.84	1.21	0.97	-	-54.5
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	12.16	10.02	9.59	7.68	8.35	↓	-31.3
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	7.25	6.34	5.51	1.41	3.11	↓	-57.1
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	6.18	5.11	4.49	1.21	2.33	↓	-62.3
P. aeruginosa	Piperacillin-tazobactam resistance	1.28	1.84	2.04	0.81	0.97	-	-24.2
	Ceftazidime resistance	1.28	1.23	1.02	0.2	0.78	-	-39.1
	Carbapenem (imipenem/meropenem) resistance	0.64	0.82	0.82	1.01	0.39	-	-39.1
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1.07	1.64	0.61	0.4	0.58	-	-45.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.43	0.2	0.2	0	0.19	NA	-55.8
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.64	1.02	0.61	0.4	0.39	NA	-39.1
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0	0.2	0	0.4	0	-	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.21	0.2	0	0.4	0.19	-	-9.5
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0	0.2	0	0.2	0	-	NA
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0	0.2	0	0.2	0	-	NA
S. aureus	MRSA[f]	3.84	3.68	4.28	4.45	3.11	-	-19.0
S. pneumoniae	Penicillin non-wild-type[g]	1.92	1.84	0.61	0.61	1.36	-	-29.2
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1.49	1.43	0.61	1.01	2.72	-	+82.6
	Combined penicillin non-wild-type and resistance to macrolides[g]	1.07	1.23	0.41	0.4	1.36	-	+27.1
E. faecalis	High-level gentamicin resistance	1.71	1.43	1.22	1.41	0.39	-	-77.2
E. faecium	Vancomycin resistance	0	1.02	4.28	2.42	1.75	-	NA

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Malta, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	332	64.8	277	58.5	299	64.5	326	62.9	416	62.5	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	332	17.5	277	12.3	299	13.7	326	11.3	416	11.3	16.2 (5.6-37.3)	↓*
	Carbapenem (imipenem/meropenem) resistance	332	0	277	0	299	0	326	0	416	0	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	332	40.1	277	35.4	299	30.8	326	26.4	416	27.9	24.0 (10.1-42.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	332	9.9	277	12.6	299	12.7	326	12	416	10.3	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	332	5.1	277	8.3	299	8	326	4.6	416	5.5	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	129	37.2	132	38.6	135	28.9	120	27.5	147	25.2	34.8 (5.7-81.5)	↓*
	Carbapenem (imipenem/meropenem) resistance	129	7.8	132	7.6	135	6.7	120	5	147	3.4	13.3 (0.0-69.7)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	129	44.2	132	37.1	135	34.8	120	31.7	147	29.3	33.7 (7.1-76.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	129	26.4	132	23.5	135	20	120	5.8	147	10.9	23.6 (2.6-73.3)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	129	22.5	132	18.9	135	16.3	120	5	147	8.2	21.0 (0.0-64.9)	↓*
P. aeruginosa	Piperacillin-tazobactam resistance	39	15.4	49	18.4	35	28.6	47	8.5	40	12.5	18.5 (3.7-54.4)	-
	Ceftazidime resistance	39	15.4	49	12.2	35	14.3	47	2.1	40	10	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	39	7.7	49	8.2	35	11.4	47	10.6	40	5	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	39	12.8	49	16.3	35	8.6	47	4.3	40	7.5	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	39	5.1	49	2	35	2.9	47	0	40	2.5	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	39	7.7	49	10.2	35	8.6	47	4.3	40	5	13.1 (1.6-49.5)	NA
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	15	NA	7	NA	16	NA	14	NA	21	0.0[h]	40.1 (0.0-95.8)	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	15	NA	7	NA	16	NA	14	NA	21	4.8[h]	42.4 (0.0-96.6)	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	14	NA	7	NA	16	NA	14	NA	21	0.0[h]	36.7 (0.0-92.4)	NA
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	14	NA	7	NA	16	NA	14	NA	21	0.0[h]	35.2 (0.0-91.5)	NA
S. aureus	MRSA[f]	75	24	92	19.6	103	20.4	116	19	110	14.5	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	27	33.3[h]	16	NA	6	NA	14	NA	26	26.9[h]	15.1 (3.7-39.1)	NA
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	25	28.0[h]	16	NA	6	NA	14	NA	26	53.8[h]	17.8 (4.0-53.8)	NA
	Combined penicillin non-wild-type and resistance to macrolides[g]	25	20.0[h]	16	NA	6	NA	14	NA	26	26.9[h]	9.2 (0.0-26.9)	NA
E. faecalis	High-level gentamicin resistance	30	26.7	28	25.0[h]	38	15.8	33	21.2	29	6.9[h]	24.3 (4.3-99.0)	-
E. faecium	Vancomycin resistance	13	NA	23	21.7[h]	38	55.3	32	37.5	25	36.0[h]	19.8 (0.0-60.9)	NA

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

[h] A small number of isolates were tested (n<30), and the percentage resistance should be interpreted with caution.

Netherlands

Participating institutions:
National Institute for Public Health and the Environment, www.rivm.nl

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Netherlands, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	70	72	72	74	76
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	ND	ND	ND	ND	ND

ND: no data available.
For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Netherlands, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	89	NA	100	79	91

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Netherlands, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	35	7 302	5	38	7 498	4	35	6 576	3	36	7 217	3	38	7 843	3
K. pneumoniae	35	1 434	7	38	1 397	6	35	1 270	5	36	1 385	5	38	1 504	4
P. aeruginosa	35	683	12	37	749	11	35	730	13	36	756	9	38	775	10
Acinetobacter spp.	31	127	13	34	153	11	33	192	13	35	201	8	36	214	9
S. aureus	35	3 221	9	38	3 294	8	35	3 235	9	36	3 609	7	38	3 740	6
S. pneumoniae	35	1 552	7	38	997	6	35	839	6	36	1 538	4	38	1 695	4
E. faecalis	35	984	14	38	1 211	24	35	1 302	29	36	1 172	14	38	1 221	11
E. faecium	35	789	37	37	1 312	53	35	1 272	54	36	1 081	38	37	990	35

Labs: laboratories.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Netherlands

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	27.39	25.52	21.63	22.67	23.72	↓	-13.4
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	4.54	3.97	3.47	4.29	4.62	-	+1.8
	Carbapenem (imipenem/meropenem) resistance	0	0.02	0.02	0.02	0.05	↑	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	8.79	7.97	6.96	7.28	7.5	↓	-14.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	4.22	3.84	3.13	3.42	3.01	↓	-28.7
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1.56	1.12	1.05	1.14	1.24	-	-20.5
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1.14	1.24	1.02	1.04	1.13	-	-0.9
	Carbapenem (imipenem/meropenem) resistance	0.02	0.01	0.02	0.05	0.04	-	+100.0
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	1.31	1.46	1.03	1.34	1.26	-	-3.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.71	0.81	0.56	0.67	0.69	-	-2.8
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	0.41	0.48	0.43	0.44	0.5	-	+22.0
P. aeruginosa	Piperacillin-tazobactam resistance	0.3	0.34	0.3	0.52	0.33	-	+10.0
	Ceftazidime resistance	0.19	0.18	0.16	0.28	0.16	-	-15.8
	Carbapenem (imipenem/meropenem) resistance	0.29	0.22	0.3	0.35	0.38	↑	+31.0
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.59	0.54	0.46	0.42	0.51	-	-13.6
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.09	0.06	0.02	0.02	0.04	NA	-55.6
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.08^	0.1	0.05	0.13	0.1	NA	+25.0
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.01	0.01	0.01	0.02	0.02	-	+100.0
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.08	0.05	0.06	0.05	0.08	-	0.0
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.03	0.02	0.06	0.03	0.07	-	+133.3
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.01	0	0	0.01	0.02	-	+100.0
S. aureus	MRSA[f]	0.4	0.39	0.39	0.52	0.49	-	+22.5
S. pneumoniae	Penicillin non-wild-type[g]	0.45^	0.30^	0.32^	0.57^	0.66^	↑	+46.7
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.55	0.26	0.2	0.37	0.54	-	-1.8
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.13^	0.05^	0.04^	0.12^	0.11^	-	-15.4
E. faecalis	High-level gentamicin resistance	1.00^	1.28^	1.88^	0.83^	0.61^	-	-39.0
E. faecium	Vancomycin resistance	0.06	0.05	0.03	0.07	0.04	-	-33.3

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Netherlands, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	7 301	45.4	7 494	42.7	6 571	41.4	7 210	40.9	7 834	41	54.7 (32.5-68.9)	↓*
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	7 300	7.5	7 494	6.6	6 575	6.6	7 215	7.7	7 840	8	16.2 (5.6-37.3)	↑
	Carbapenem (imipenem/meropenem) resistance	7 299	0	7 487	0	6 569	0	7 210	0	7 780	0.1	0.3 (0.0-1.8)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	7 298	14.6	7 490	13.3	6 575	13.3	7 213	13.1	7 840	12.9	24.0 (10.1-42.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	7 301	7	7 495	6.4	6 576	6	7 216	6.2	7 841	5.2	10.9 (4.5-28.4)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	7 296	2.6	7 486	1.9	6 574	2	7 210	2.1	7 836	2.1	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1 434	9.6	1 397	11.2	1 270	10.1	1 385	9.8	1 504	10.2	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	1 433	0.2	1 396	0.1	1 270	0.2	1 384	0.4	1 483	0.4	13.3 (0.0-69.7)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	1 432	11.1	1 395	13.1	1 270	10.2	1 385	12.6	1 504	11.3	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1 434	6	1 397	7.3	1 270	5.6	1 385	6.3	1 504	6.3	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1 432	3.5	1 395	4.3	1 270	4.3	1 385	4.1	1 504	4.5	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	621	5.8	701	6.1	699	5.4	720	9.4	738	6.1	18.5 (3.7-54.4)	-
	Ceftazidime resistance	662	3.5	748	2.9	728	2.7	756	4.8	773	2.8	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	682	5.1	746	3.6	730	5.2	756	6	773	6.6	18.6 (3.3-53.4)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	682	10.4	749	9.1	730	7.9	756	7.3	775	8.9	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	683	1.6	748	1.1	728	0.4	756	0.4	775	0.6	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	598	1.7	697	1.9	696	0.9	720	2.4	735	1.8	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	124	0.8	148	0.7	185	0.5	198	1	210	1.4	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	127	7.9	147	4.1	186	3.8	198	3	211	5.2	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	124	3.2	149	1.3	191	4.2	199	2	212	4.7	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	122	0.8	139	0	179	0	195	0.5	206	1.5	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	3 221	1.5	3 293	1.5	3 231	1.5	3 609	1.9	3 739	1.8	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	1 360	4	799	4.8	648	6.2	1 157	6.4	1 156	7.8	15.1 (3.7-39.1)	↑*
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1 406	4.8	919	3.5	766	3.3	1 419	3.4	1 578	4.6	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	1 215	1.3	722	0.8	575	0.9	1 039	1.4	1 039	1.4	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	604	20	544	29.6	641	36.8	559	19.3	576	14.4	24.3 (4.3-99.0)	↓*
E. faecium	Vancomycin resistance	786	0.9	1 310	0.5	1 272	0.3	1 081	0.8	987	0.5	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Norway

Participating institutions:
University Hospital of North Norway, https://www.unn.no/fag-og-forskning/norm-norsk-overvakingssystem-for-antibiotikaresistens-hos-mikrober
Norwegian Institute of Public Health, https://www.fhi.no/
St. Olav University Hospital, Trondheim, https://www.stolav.no/

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Norway, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	94	94	94	94	94
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	86.8	91.9	87.4	97.3	80.9

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Norway, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	89	NA	93	100	94

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Norway, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	18	4 075	3	18	3 764	4	18	3 840	3	18	3 835	3	18	3 984	3
K. pneumoniae	18	832	5	18	703	5	18	787	3	17	783	3	18	787	3
P. aeruginosa	18	296	4	18	283	5	18	309	3	18	362	6	18	294	4
Acinetobacter spp.	12	23	5[c]	10	31	0	14	42	5	15	35	3	14	41	0
S. aureus	18	1 723	6	18	1 605	6	18	1 728	6	18	1 864	6	18	1 829	5
S. pneumoniae	18	507	5	18	243	3	18	263	3	18	454	4	18	493	3
E. faecalis	18	551	6	18	546	6	18	608	6	18	655	4	18	608	6
E. faecium	18	197	7	17	183	6	18	218	11	18	244	9	18	254	13

Labs: laboratories.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).
[c] A small number of isolates were tested (n<30), and the percentage of isolates from ICUs should be interpreted with caution.

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Norway

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	33.3	29.63	26.80	27.69	28.45	↓	-14.6
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	5.03	4.32	4.16	4.27	4.34	-	-13.7
	Carbapenem (imipenem/meropenem) resistance	0.04	0.02	0.00	0.02	0.04	-	0.0
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	9.14	7.37	7.46	7.69	7.79	-	-14.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	4.55	4.22	4.08	4.06	4.26	-	-6.4
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1.42	1.15	1.20	1.14	1.03	-	-27.5
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1.28	1.41	1.14	1.00	0.89	↓	-30.5
	Carbapenem (imipenem/meropenem) resistance	0.04	0.02	0.04	0.04	0.08	-	+100.0
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	1.46	1.55	1.82	1.51	1.78	-	+21.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1.02	1.01	0.79	0.61	0.64	↓	-37.3
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	0.64	0.65	0.45	0.45	0.41	↓	-35.9
P. aeruginosa	Piperacillin-tazobactam resistance	0.22	0.30^	0.32^	0.61^	0.43^	↑	+95.5
	Ceftazidime resistance	0.22	0.30	0.37	0.51	0.37	-	+68.2
	Carbapenem (imipenem/meropenem) resistance	0.44	0.36	0.41	0.43	0.41	-	-6.8
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.34	0.48	0.26	0.53	0.47	-	+38.2
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.02	0.02	0.00	0.04	0.02	NA	0.0
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.10^	0.14^	0.14^	0.20^	0.08^	NA	-20.0
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.00	0.00	0.00	0.02	0.00	-	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.00	0.00	0.04	0.00	0.00	-	NA
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.02	0.00	0.02	0.02	0.02	-	0.0
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.00	0.00	0.00	0.00	0.00	NA	NA
S. aureus	MRSA[f]	0.34	0.50	0.30	0.39	0.64	-	+88.2
S. pneumoniae	Penicillin non-wild-type[g]	0.64	0.36	0.32	0.65	0.68	-	+6.3
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.52	0.22^	0.26	0.31	0.64	-	+23.1
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.32	0.12^	0.16	0.18	0.37	-	+15.6
E. faecalis	High-level gentamicin resistance	0.44^	0.40^	0.30^	0.25^	0.12^	↓	-72.7
E. faecium	Vancomycin resistance	0.04	0.02	0.02	0.06	0.04	-	0.0

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Norway, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	4 072	41	3 758	39.8	3 837	35.4	3 737	37.8	3 983	36.9	54.7 (32.5-68.9)	↓*
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	4 075	6.2	3 762	5.8	3 839	5.5	3 739	5.8	3 984	5.6	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	4 040	0	3 646	0	3 820	0	3 738	0	3 984	0.1	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	4 068	11.3	3 735	10	3 827	9.9	3 726	10.5	3 971	10.1	24.0 (10.1-42.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	4 074	5.6	3 763	5.7	3 839	5.4	3 831	5.4	3 983	5.5	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	4 068	1.7	3 734	1.6	3 826	1.6	3 726	1.6	3 970	1.3	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	832	7.7	702	10.1	787	7.4	769	6.6	787	5.8	34.8 (5.7-81.5)	↓*
	Carbapenem (imipenem/meropenem) resistance	826	0.2	687	0.1	783	0.3	769	0.3	787	0.5	13.3 (0.0-69.7)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	832	8.8	696	11.2	782	11.8	765	10.1	783	11.7	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	831	6.1	702	7.3	786	5.1	782	4	787	4.2	23.6 (2.6-73.3)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	831	3.9	696	4.7	782	2.9	764	3	783	2.7	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	270	4.1	254	5.9	278	5.8	316	9.8	261	8.4	18.5 (3.7-54.4)	↑*
	Ceftazidime resistance	282	3.9	277	5.4	295	6.4	354	7.3	285	6.7	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	296	7.4	282	6.4	309	6.8	362	6.1	294	7.1	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	296	5.7	282	8.5	309	4.2	361	7.5	293	8.2	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	292	0.3	281	0.4	308	0	362	0.6	294	0.3	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	252	2	246	2.8	263	2.7	307	3.3	251	1.6	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	23	0.0[h]	31	0	42	0	34	2.9	41	0	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	23	0.0[h]	31	0	42	4.8	34	0	41	0	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	23	4.3[h]	30	0	42	2.4	35	2.9	40	2.5	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	23	0.0[h]	30	0	42	0	34	0	40	0	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	1 644	1	1 552	1.6	1 638	0.9	1 796	1.1	1 714	1.9	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	504	6.3	242	7.4	262	6.1	453	7.3	491	7.1	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	459	5.7	215	5.1	242	5.4	418	3.8	487	6.8	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	457	3.5	214	2.8	241	3.3	417	2.2	485	3.9	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	182	12.1	161	12.4	159	9.4	155	8.4	138	4.3	24.3 (4.3-99.0)	↓*
E. faecium	Vancomycin resistance	196	1	180	0.6	216	0.5	243	1.2	253	0.8	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

[h] A small number of isolates were tested (n<30), and the percentage resistance should be interpreted with caution.

Poland

Participating institutions:
National Medicines Institute, Department of Epidemiology and Clinical Microbiology, https://www.nil.gov.pl
National Reference Centre for Susceptibility Testing, https://korld.nil.gov.pl

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Poland, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	17	16	20	18	21
Geographical representativeness	Medium	Medium	Medium	Medium	Medium
Hospital representativeness	Medium	Medium	Medium	Medium	Medium
Isolate representativeness	Medium	Medium	High	High	High
Blood culture sets per 1 000 patient-days	39.8	45.6	54.7	51.2	55.1

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Poland, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	98	NA	98	88	97

NA: not applicable. In 2020 there was no EARS-Net EQA.

[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Poland, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	54	2 809	31	49	2 179	25	52	2 376	28	52	2 538	25	52	3 072	24
K. pneumoniae	55	1 172	45	49	1 091	35	52	1 447	47	52	1 357	39	52	1 583	38
P. aeruginosa	54	421	40	48	317	38	49	445	49	52	476	39	49	480	39
Acinetobacter spp.	46	319	64	44	373	55	50	832	69	49	469	51	48	454	56
S. aureus	55	1 843	34	50	1 676	29	52	1 975	32	52	2 073	27	52	2 145	29
S. pneumoniae	49	364	29	40	165	33	47	260	35	49	456	33	50	518	27
E. faecalis	53	773	48	49	790	36	51	1 252	50	51	972	41	52	1 005	43
E. faecium	53	443	43	48	529	38	52	908	52	51	681	40	51	731	41

Labs: laboratories.

[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.

[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Poland

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	7.98^#	4.64^#	6.47^#	7.23^#	8.12^#	-	+1.8
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	7.44#	6.24#	5.87#	6.98#	7.77#	-	+4.4
	Carbapenem (imipenem/meropenem) resistance	0.00#	0.02#	0.04#	0.03#	0.08#	↑	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	14.08#	11.67#	9.92#	10.87#	12.68#	-	-9.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	5.11#	4.86#	3.96#	4.18#	5.09#	-	-0.4
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3.70#	3.08#	2.80^#	2.55^#	3.29^#	-	-11.1
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	10.53#	11.28#	13.24#	12.29#	13.11#	↑	+24.5
	Carbapenem (imipenem/meropenem) resistance	1.38#	1.45#	3.69#	3.30#	3.69#	↑	+167.4
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	11.00#	11.64#	13.28#	11.98#	12.93#	↑	+17.5
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	8.30#	8.38#	9.92#	8.69#	9.32#	-	+12.3
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	7.75#	7.90#	9.42#	7.98^#	8.75^#	-	+12.9
P. aeruginosa	Piperacillin-tazobactam resistance	1.67#	1.42^#	1.59#	1.59#	1.63#	-	-2.4
	Ceftazidime resistance	1.30#	1.12#	1.19#	1.18#	1.32#	-	+1.5
	Carbapenem (imipenem/meropenem) resistance	1.55#	1.48#	1.63#	1.70#	1.58#	-	+1.9
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	2.20#	1.45^#	1.89#	1.65#	1.54#	-	-30.0
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	1.22#	0.77^#	0.52^#	0.65^#	0.74^#	NA	-39.3
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	1.39#	0.91^#	0.98^#	0.94^#	0.93^#	NA	-33.1
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	3.95#	4.79#	9.02#	5.25#	4.65#	-	+17.7
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	4.56#	5.32#	9.99#	5.62#	4.90#	-	+7.5
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3.92#	4.23#	7.95#	4.07#	3.82#	-	-2.6
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	3.32#	3.75#	7.00#	3.63#	3.60#	-	+8.4
S. aureus	MRSA[f]	4.26#	3.08^#	3.74^#	3.91#	3.52#	-	-17.4
S. pneumoniae	Penicillin non-wild-type[g]	0.79^#	0.28#	0.63#	0.78#	0.65#	-	-17.7
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1.28^#	0.46^#	0.82^#	1.28^#	1.27^#	-	-0.8
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.59^#	0.18^#	0.41^#	0.46^#	0.44^#	-	-25.4
E. faecalis	High-level gentamicin resistance	4.40#	5.98^#	8.42#	6.15#	5.58#	-	+26.8
E. faecium	Vancomycin resistance	2.94#	3.34#	4.08#	4.07#	3.90#	↑	+32.7

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Poland, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	836	61.6	502	56.2	809	60.6	857	57.2	956	65.6	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	2 803	17.1	2 172	17.4	2 371	18.7	2 531	18.7	3 067	19.6	16.2 (5.6-37.3)	↑*
	Carbapenem (imipenem/meropenem) resistance	2 683	0	2 080	0	2 290	0.1	2 451	0.1	2 966	0.2	0.3 (0.0-1.8)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	2 753	33	2 149	33	2 268	33.1	2 392	30.8	3 040	32.2	24.0 (10.1-42.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	2 614	12.6	2 033	14.5	2 186	13.7	2 296	12.3	2 780	14.1	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2 564	9.3	1 998	9.4	2 077	10.2	2 149	8.1	2 748	9.2	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1 166	58.3	1 088	63	1 432	70	1 345	61.9	1 573	64.3	34.8 (5.7-81.5)	↑
	Carbapenem (imipenem/meropenem) resistance	1 155	7.7	1 074	8.2	1 429	19.5	1 332	16.8	1 572	18.1	13.3 (0.0-69.7)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	1 159	61.3	1 085	65.2	1 428	70.4	1 341	60.6	1 568	63.6	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1 128	47.5	1 019	50	1 364	55.1	1 242	47.4	1 442	49.9	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1 112	45	1 012	47.4	1 333	53.5	1 221	44.3	1 424	47.4	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	409	26.4	266	32.3	440	27.3	463	23.3	467	27	18.5 (3.7-54.4)	-
	Ceftazidime resistance	418	20.1	312	21.8	442	20.4	471	17	478	21.3	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	409	24.4	316	28.5	440	28	468	24.6	476	25.6	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	417	34.1	270	32.6	443	32.3	459	24.4	477	24.9	17.9 (5.9-52.0)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	402	19.7	239	19.7	323	12.1	334	13.2	322	17.7	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	379	23.7	178	30.9	318	23.3	323	19.8	312	23.1	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	317	71	372	78.2	826	82.7	466	76.4	450	79.8	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	304	85.5	366	88.3	816	92.6	452	84.3	441	85.7	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	315	70.8	363	70.8	812	74.1	450	61.3	433	68.1	36.7 (0.0-92.4)	↓*
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	299	63.2	355	64.2	791	67	432	56.9	421	66	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	1 841	14.9	1 351	13.8	1 718	16.5	2 000	13.3	1 953	13.9	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	310	15.5	158	10.8	255	18.8	445	11.9	504	9.9	15.1 (3.7-39.1)	↓
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	312	25	123	22.8	213	29.1	352	24.7	392	25	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	268	13.4	116	9.5	208	14.9	342	9.1	381	8.9	9.2 (0.0-26.9)	↓
E. faecalis	High-level gentamicin resistance	706	40.2	703	51.6	1 153	55.2	878	47.5	914	47.2	24.3 (4.3-99.0)	-
E. faecium	Vancomycin resistance	432	44	527	38.5	900	34.3	680	40.6	728	41.3	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Portugal

Participating institutions:
National Institute of Health Doutor Ricardo Jorge, https://www.insa.min-saude.pt/
Directorate-General of Health, https://www.dgs.pt/

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Portugal, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	97	97	97	97	98
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	244.2	244.2	256.0	363.7	323.6

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Portugal, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	93	NA	81	91	83

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Portugal, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	58	6 433	4	63	5 858	4	57	5 633	4	63	5 558	4	69	6 414	4
K. pneumoniae	55	2 709	9	60	2 790	9	56	2 602	14	58	3 035	10	62	3 424	10
P. aeruginosa	54	1 061	11	57	1 061	9	53	1 016	14	56	1 131	10	58	1 187	11
Acinetobacter spp.	30	99	14	31	104	9	26	67	17	33	125	17	33	156	22
S. aureus	59	3 308	6	65	3 319	6	59	2 948	10	65	3 602	8	66	3 291	7
S. pneumoniae	53	983	NA	48	588	NA	41	427	NA	50	706	2	57	957	3
E. faecalis	54	945	9	58	990	10	52	999	13	55	1 123	10	59	1 045	9
E. faecium	43	411	15	43	406	12	43	416	17	44	520	19	53	524	14

Labs: laboratories.
NA: not applicable.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Portugal

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	34.84	31.83	27.26	28.51	31.39	-	-9.9
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	10.32	8.38	7.36	7.76	10.73	-	+4.0
	Carbapenem (imipenem/meropenem) resistance	0.04	0.09	0.18	0.17	0.32	↑	+700.0
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	17.07	14.01	12.65	11.81	15.18	-	-11.1
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	7.77	6.77	5.96	6.46	8.23	-	+5.9
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	4.04	3.48	2.84	3.28	3.96	-	-2.0
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	12.89	13.16	11.63	13.56	16.82	↑	+30.5
	Carbapenem (imipenem/meropenem) resistance	2.93	3.22	2.92	3.01	4.19	↑	+43.0
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	12.42	11.88	10.81	12.28	14.71	-	+18.4
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	8.76	7.80	6.48	6.98	7.92	-	-9.6
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	7.15	6.53	5.31	5.90	6.84	-	-4.3
P. aeruginosa	Piperacillin-tazobactam resistance	2.15	1.86	1.62	1.69	1.76	↓	-18.1
	Ceftazidime resistance	1.87	1.41	1.54	1.45	1.55	-	-17.1
	Carbapenem (imipenem/meropenem) resistance	1.88	1.42	1.43	1.32	1.17	↓	-37.8
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	2.29	1.96	1.83	1.59	1.73	↓	-24.5
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	1.05	0.47^	0.55^	0.40^	0.38^	NA	-63.8
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	1.48	0.78^	1.11^	0.77^	0.78^	NA	-47.3
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.28	0.16	0.07	0.38	0.65	-	+132.1
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.23^	0.18	0.11	0.40	0.70	↑	+204.3
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.23	0.13	0.08	0.25	0.42	-	+82.6
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.17^	0.09	0.05^	0.22	0.41	-	+141.2
S. aureus	MRSA[f]	11.39	9.80	7.23	8.81	7.39	↓	-35.1
S. pneumoniae	Penicillin non-wild-type[g]	1.23	0.71^	0.53^	0.52^	0.90^	-	-26.8
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1.22	0.88	0.77	1.02	1.36	-	+11.5
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.65^	0.42^	0.34^	0.32^	0.45^	-	-30.8
E. faecalis	High-level gentamicin resistance	1.97	1.71^	1.46^	1.71^	1.48^	↓	-24.9
E. faecium	Vancomycin resistance	0.37	0.31	0.35	0.57	0.53	↑	+43.2

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Portugal, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	5 933	58.5	5 849	54.4	5 164	52.7	5 486	52.2	5 923	54.4	54.7 (32.5-68.9)	↓*
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	6 390	16.1	5 793	14.4	5 615	13.1	5 526	14.1	6 403	17.2	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	6 372	0.1	5 833	0.2	5 466	0.3	5 362	0.3	6 183	0.5	0.3 (0.0-1.8)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	6 431	26.5	5 845	23.9	5 618	22.5	5 530	21.4	6 399	24.3	24.0 (10.1-42.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	6 428	12.1	5 788	11.7	5 605	10.6	5 544	11.7	6 407	13.2	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	6 384	6.3	5 716	6.1	5 591	5.1	5 496	6	6 385	6.4	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	2 697	47.6	2 762	47.6	2 581	45	3 013	45.2	3 403	50.7	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	2 690	10.9	2 780	11.6	2 520	11.6	2 935	10.3	3 280	13.1	13.3 (0.0-69.7)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	2 704	45.8	2 779	42.7	2 596	41.6	3 030	40.7	3 415	44.2	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	2 708	32.2	2 759	28.2	2 592	25	3 031	23.1	3 418	23.8	23.6 (2.6-73.3)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2 692	26.5	2 734	23.8	2 571	20.6	3 005	19.7	3 394	20.7	21.0 (0.0-64.9)	↓*
P. aeruginosa	Piperacillin-tazobactam resistance	1 054	20.3	1 060	17.5	985	16.4	1 125	15.1	1 172	15.4	18.5 (3.7-54.4)	↓*
	Ceftazidime resistance	1 054	17.6	977	14.4	1 013	15.2	1 120	13	1 181	13.5	15.7 (2.8-52.7)	↓*
	Carbapenem (imipenem/meropenem) resistance	1 052	17.8	1 057	13.4	1 015	14.1	1 129	11.8	1 181	10.2	18.6 (3.3-53.4)	↓*
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1 057	21.6	1 059	18.5	1 012	18.1	1 120	14.3	1 186	14.9	17.9 (5.9-52.0)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	1 060	9.9	877	5.4	875	6.3	991	4	1 047	3.7	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	1 043	14.2	794	9.8	872	12.7	980	7.9	1 034	7.7	13.1 (1.6-49.5)	NA
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	90	31.1	104	15.4	67	10.4	122	31.1	155	43.2	40.1 (0.0-95.8)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	88	26.1	101	17.8	62	17.7	123	32.5	156	46.2	42.4 (0.0-96.6)	↑*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	93	24.7	104	12.5	64	12.5	118	21.2	152	28.3	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	83	20.5	101	8.9	59	8.5	114	19.3	151	27.8	35.2 (0.0-91.5)	↑*
S. aureus	MRSA[f]	3 265	34.8	3 299	29.7	2 873	25.1	3 544	25	3 284	23.1	15.8 (1.5-51.1)	↓*
S. pneumoniae	Penicillin non-wild-type[g]	887	13.9	513	13.8	369	14.4	583	8.9	818	11.2	15.1 (3.7-39.1)	↓*
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	952	12.8	565	15.6	404	19.1	684	14.9	928	15	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	865	7.5	492	8.5	348	9.8	566	5.7	795	5.8	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	881	22.2	862	19.8	802	18.2	873	19.7	826	18.4	24.3 (4.3-99.0)	-
E. faecium	Vancomycin resistance	410	9	399	7.8	409	8.6	513	11.1	522	10.3	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Romania

Participating institutions:
National Institute of Public Health, www.insp.gov.ro

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Romania, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	11	11	11	13	13
Geographical representativeness	Low	Low	Low	Low	Low
Hospital representativeness	Low	Low	Low	Low	Low
Isolate representativeness	Low	Low	Low	Low	Low
Blood culture sets per 1 000 patient-days	20.5	26.4	26.4	32.5	39.7

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Romania, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	100	NA	100	94	100

NA: not applicable. In 2020 there was no EARS-Net EQA.

[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Romania, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	15	671	12	15	455	17	16	499	18	17	702	15	18	993	12
K. pneumoniae	15	488	43	16	478	54	16	538	52	17	628	48	19	944	39
P. aeruginosa	14	192	44	15	148	53	16	208	51	16	230	50	19	264	46
Acinetobacter spp.	15	268	75	15	298	72	16	386	73	15	319	69	18	337	62
S. aureus	14	634	23	16	418	30	16	469	27	17	597	22	18	782	22
S. pneumoniae	11	107	15	11	42	20	10	28	23[c]	11	43	7	14	81	17
E. faecalis	14	166	35	15	167	58	16	227	47	17	246	36	19	314	39
E. faecium	14	144	48	16	122	53	14	194	53	16	185	45	17	179	39

Labs: laboratories.

[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.

[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

[c] A small number of isolates were tested (n<30), and the percentage of isolates from ICUs should be interpreted with caution.

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Romania

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	15.87^#	9.31^#	10.70^#	13.66^#	18.93^#	-	+19.3
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	6.32#	4.19#	4.40#	4.97#	7.63#	-	+20.7
	Carbapenem (imipenem/meropenem) resistance	0.19#	0.14#	0.09#	0.16#	0.73#	↑	+284.2
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	8.66#	5.50#	5.82#	6.63#	10.05#	-	+16.1
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	3.23^#	1.88^#	2.04^#	2.91^#	4.44^#	-	+37.5
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1.97^#	0.99^#	0.95^#	1.45^#	2.06^#	-	+4.6
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	14.38#	15.24#	17.90#	15.76#	26.24#	↑	+82.5
	Carbapenem (imipenem/meropenem) resistance	7.12#	10.77#	13.87#	12.12#	20.02#	↑	+181.2
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	13.67#	14.77#	17.04#	15.07#	24.14#	↑	+76.6
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	10.21^#	9.31^#	10.75^#	10.83^#	18.45^#	↑	+80.7
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	9.79^#	8.94^#	9.94^#	10.06^#	17.32^#	↑	+76.9
P. aeruginosa	Piperacillin-tazobactam resistance	4.40#	2.40^#	4.36#	4.24#	5.01#	-	+13.9
	Ceftazidime resistance	4.40#	2.77#	4.40#	4.20#	5.01#	-	+13.9
	Carbapenem (imipenem/meropenem) resistance	4.78#	3.06#	4.50#	5.01#	5.57#	-	+16.5
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	4.50#	3.06#	4.36#	4.53#	5.17#	-	+14.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	4.03#	2.16^#	3.31^#	3.07^#	3.51^#	NA	-12.9
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	3.89^#	1.88^#	3.17^#	3.39^#	3.79^#	NA	-2.6
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	10.91#	13.03#	17.09#	11.47#	11.79#	-	+8.1
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	11.19#	13.31#	17.23#	11.60#	11.83#	-	+5.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	9.46^#	10.72^#	14.49^#	9.58^#	9.49^#	-	+0.3
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	9.22^#	10.49^#	14.25^#	9.33^#	9.29^#	-	+0.8
S. aureus	MRSA[f]	13.72#	9.03#	8.95#	9.37#	11.99#	-	-12.6
S. pneumoniae	Penicillin non-wild-type[g]	0.80^#	0.71#	0.47#	0.61#	1.01#	-	+26.3
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.75^#	0.47^#	0.43^#	0.53^#	0.97#	-	+29.3
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.33^#	0.38^#	0.33^#	0.48^#	0.81#	↑	+145.5
E. faecalis	High-level gentamicin resistance	2.95#	3.01^#	3.74#	3.80^#	5.29^#	↑	+79.3
E. faecium	Vancomycin resistance	2.34#	2.07#	4.02#	2.75#	2.95#	-	+26.1

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Romania, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	538	63	316	62.7	352	64.2	542	62.4	760	61.7	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	664	20.3	452	19.7	495	18.8	690	17.8	990	19.1	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	666	0.6	454	0.7	498	0.4	697	0.6	985	1.8	0.3 (0.0-1.8)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	654	28.3	450	26	498	24.7	690	23.8	980	25.4	24.0 (10.1-42.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	594	11.6	367	10.9	406	10.6	602	12	865	12.7	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	576	7.3	360	5.8	401	5	582	6.2	849	6	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	479	64.1	477	67.9	534	70.8	614	63.5	936	69.4	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	470	32.3	474	48.3	538	54.5	627	47.8	940	52.8	13.3 (0.0-69.7)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	471	62	474	66.2	536	67.2	618	60.4	935	64	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	411	53	399	49.6	440	51.6	508	52.8	801	57.1	23.6 (2.6-73.3)	↑
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	402	52	397	47.9	434	48.4	487	51.1	789	54.4	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	178	52.8	121	42.1	195	47.2	216	48.6	248	50	18.5 (3.7-54.4)	-
	Ceftazidime resistance	180	52.2	144	41	202	46	218	47.7	255	48.6	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	184	55.4	148	43.9	207	45.9	230	53.9	262	52.7	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	184	52.2	140	46.4	204	45.1	229	48.9	260	49.2	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	176	48.9	124	37.1	168	41.7	180	42.2	197	44.2	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	159	52.2	96	41.7	159	42.1	176	47.7	190	49.5	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	264	88.3	297	93.3	386	93.5	318	89.3	336	86.9	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	262	91.2	297	95.3	385	94.5	315	91.1	334	87.7	42.4 (0.0-96.6)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	241	83.8	253	90.1	336	91.1	267	88.8	285	82.5	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	236	83.5	251	88.8	335	89.9	264	87.5	282	81.6	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	625	46.9	406	47.3	461	41	596	38.9	754	39.4	15.8 (1.5-51.1)	↓*
S. pneumoniae	Penicillin non-wild-type[g]	86	19.8	39	38.5	28	35.7[h]	42	35.7	77	32.5	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	92	17.4	37	27	25	36.0[h]	36	36.1	80	30	17.8 (4.0-53.8)	↑*
	Combined penicillin non-wild-type and resistance to macrolides[g]	74	9.5	34	23.5	25	28.0[h]	36	33.3	76	26.3	9.2 (0.0-26.9)	↑*
E. faecalis	High-level gentamicin resistance	155	40.6	148	43.2	212	37.3	218	43.1	280	46.8	24.3 (4.3-99.0)	-
E. faecium	Vancomycin resistance	140	35.7	112	39.3	191	44.5	184	37	177	41.2	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

[h] A small number of isolates were tested (n<30), and the percentage resistance should be interpreted with caution.

Slovakia

Participating institutions:
National Reference Centre for Antimicrobial Resistance, https://www.uvzsr.sk
Public Health Authority of the Slovak Republic, https://www.uvzsr.sk
Regional Public Health Authority Banska Bystrica, https://www.uvzsr.sk

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Slovakia, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	56	56	56	56	54
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	36.1	27.0	32.1	29.5	30.6

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Slovakia, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	100	NA	100	100	100

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Slovakia, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	10	851	14	11	732	17	13	663	16	13	784	17	11	697	9
K. pneumoniae	10	370	26	11	405	35	13	551	41	13	409	30	11	310	18
P. aeruginosa	10	201	30	11	246	35	13	275	42	13	238	30	11	228	27
Acinetobacter spp.	8	97	44	11	95	37	12	148	57	12	155	42	8	76	28
S. aureus	10	567	18	11	540	22	13	583	20	13	578	21	11	416	12
S. pneumoniae	6	40	20	5	15	NA	6	22	18[c]	10	34	26	8	34	15
E. faecalis	10	212	32	11	199	30	12	335	42	12	275	31	11	214	19
E. faecium	10	139	32	10	121	31	12	224	52	13	155	36	10	142	17

Labs: laboratories.
NA: not applicable.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).
[c] A small number of isolates were tested (n<30), and the percentage of isolates from ICUs should be interpreted with caution.

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Slovakia

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	16.09	13.61	11.77	13.67	13.64	-	-15.2
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	6.39	6.45	4.91	5.98	5.12	-	-19.9
	Carbapenem (imipenem/meropenem) resistance	0.03	0.03	0	0	0.03	-	0.0
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	9.47	8.15	6.44	8.31	7.37	-	-22.2
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	4.62	4.42	3.07	3.55	3.27	↓	-29.2
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3.51	3.53	2.19	2.73	2.46	↓	-29.9
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	6.91	7.1	12.2	7.36	5.56	-	-19.5
	Carbapenem (imipenem/meropenem) resistance	0.52	1.05	1.96	1.87	1.33	-	+155.8
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	6.85	7.1	11.68	6.44	4.81	-	-29.8
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	5.96	6.48	10.76	5.85	4.26	-	-28.5
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	5.41	5.79	9.22	4.9	3.75	-	-30.7
P. aeruginosa	Piperacillin-tazobactam resistance	1.61^	2.32^	2.62	1.74^	2.15	-	+33.5
	Ceftazidime resistance	1.83^	2.29^	2.68	1.77^	2.39	-	+30.6
	Carbapenem (imipenem/meropenem) resistance	2.52	3.7	3.73	2.2	3.38	-	+34.1
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	3.05	3.99	4.28	3.38	3.17	-	+3.9
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	2.16	2.62	2.91	2.07	2.49	NA	+15.3
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	1.83^	2.45^	2.71^	1.91^	2.29	NA	+25.1
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	1.74	0.92	2.68	3.02	1.23	-	-29.3
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1.9	1.21	3.3	3.32	1.26	-	-33.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1.47	0.88	2.98	3.25	1.23	-	-16.3
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	1.28	0.72	2.35	2.92	1.13	-	-11.7
S. aureus	MRSA[f]	5.01	4.38	4.25	3.42	2.05	↓	-59.1
S. pneumoniae	Penicillin non-wild-type[g]	0.07	0.07	0.07	0.1	0.1	-	+42.9
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.13	0.1	0.1	0.23	0.17^	-	+30.8
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.03	0.03	0.03	0.03	0.00^	-	-100.0
E. faecalis	High-level gentamicin resistance	2.16	2.29	5.59	3.02	0.99	-	-54.2
E. faecium	Vancomycin resistance	1.31	1.57	2.49	2.1	1.09	-	-16.8

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Slovakia, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	849	57.8	728	57.1	660	54.5	767	54.2	684	58.5	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	846	23	727	27.1	649	23.1	768	23.7	696	21.6	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	785	0.1	705	0.1	625	0	738	0	696	0.1	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	850	34	729	34.2	662	29.8	782	32.4	693	31.2	24.0 (10.1-42.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	847	16.6	731	18.5	663	14.2	783	13.8	695	13.8	10.9 (4.5-28.4)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	842	12.7	724	14.9	648	10.3	767	10.8	692	10.4	5.9 (1.3-17.6)	↓
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	367	57.5	399	54.4	545	68.4	399	56.1	310	52.6	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	351	4.6	392	8.2	515	11.7	379	15	310	12.6	13.3 (0.0-69.7)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	367	56.9	403	53.8	550	64.9	409	47.9	310	45.5	33.7 (7.1-76.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	369	49.3	405	48.9	551	59.7	408	43.6	310	40.3	23.6 (2.6-73.3)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	366	45.1	399	44.4	544	51.8	399	37.3	310	35.5	21.0 (0.0-64.9)	↓*
P. aeruginosa	Piperacillin-tazobactam resistance	175	28	213	33.3	254	31.5	213	24.9	226	27.9	18.5 (3.7-54.4)	-
	Ceftazidime resistance	178	31.5	214	32.7	253	32.4	213	25.4	228	30.7	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	197	39.1	231	48.9	258	44.2	218	30.7	228	43.4	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	201	46.3	246	49.6	273	48	237	43.5	228	40.8	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	199	33.2	242	33.1	265	33.6	236	26.7	216	33.8	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	175	32	210	35.7	244	34	213	27.2	215	31.2	13.1 (1.6-49.5)	NA
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	96	55.2	91	30.8	134	61.2	150	61.3	76	47.4	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	94	61.7	95	38.9	148	68.2	155	65.2	76	48.7	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	97	46.4	95	28.4	147	61.9	154	64.3	76	47.4	36.7 (0.0-92.4)	↑
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	93	41.9	91	24.2	134	53.7	149	59.7	76	43.4	35.2 (0.0-91.5)	↑
S. aureus	MRSA[f]	563	27.2	540	24.8	582	22.3	578	18	416	14.4	15.8 (1.5-51.1)	↓*
S. pneumoniae	Penicillin non-wild-type[g]	40	5	14	NA	22	9.1[h]	33	9.1	32	9.4	15.1 (3.7-39.1)	NA
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	36	11.1	15	NA	21	14.3[h]	32	21.9	28	17.9[h]	17.8 (4.0-53.8)	NA
	Combined penicillin non-wild-type and resistance to macrolides[g]	36	2.8	14	NA	21	4.8[h]	31	3.2	26	0.0[h]	9.2 (0.0-26.9)	NA
E. faecalis	High-level gentamicin resistance	201	32.8	195	35.9	325	52.6	265	34.7	208	13.9	24.3 (4.3-99.0)	↓*
E. faecium	Vancomycin resistance	137	29.2	120	40	219	34.7	153	41.8	141	22.7	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

[h] A small number of isolates were tested (n<30), and the percentage resistance should be interpreted with caution.

Slovenia

Participating institutions:
National Institute of Public Health, www.nijz.si
Medical faculty, University of Ljubljana, https://imi.si/
National Laboratory of Health, Environment and Food, https://www.nlzoh.si/

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Slovenia, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	99	99	99	99	99
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	40.4	47.1	56.1	56.4	44.7

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Slovenia, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	91	NA	100	100	100

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Slovenia, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	10	1 610	6	10	1 617	6	10	1 681	5	10	1 660	5	10	1 639	5
K. pneumoniae	10	303	14	10	291	17	10	351	14	10	372	10	10	339	11
P. aeruginosa	10	175	26	10	186	35	9	257	20	9	220	24	10	234	21
Acinetobacter spp.	8	40	38	7	36	39	9	124	56	8	60	37	7	52	15
S. aureus	10	656	10	10	711	14	10	768	12	10	644	8	10	673	8
S. pneumoniae	10	283	10	10	172	9	10	187	8	10	225	5	10	232	8
E. faecalis	9	141	24	9	182	15	9	205	20	10	194	11	9	177	11
E. faecium	10	137	32	9	177	32	10	219	34	8	158	30	9	171	25

Labs: laboratories.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Slovenia

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	40.39	39.95	40.9	38.97	38.31	-	-5.1
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	7.67	8.24	7.47	7.43	6.78	-	-11.6
	Carbapenem (imipenem/meropenem) resistance	0	0	0	0	0.05	NA	NA
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	14.85	14.12	13.41	13.18	12.45	↓	-16.2
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	6.12	5.3	5.32	6.33	5.44	-	-11.1
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3.11	2.8	2.25	2.92	2.34	-	-24.8
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	2.43	2.22	3.64	3.69	3.72	↑	+53.1
	Carbapenem (imipenem/meropenem) resistance	0.05	0	0.14	0.34	0.62	↑	+1,140
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	2.86	3.47	4.07	3.93	4.39	↑	+53.5
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1.21	1.4	2.3	2.21	2.77	↑	+128.9
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1.12	1.06	2.06	1.97	2.24	↑	+100.0
P. aeruginosa	Piperacillin-tazobactam resistance	1.26	1.3	1.82	1.39	1.19	-	-5.6
	Ceftazidime resistance	1.36	1.2	1.77	1.39	1.24	-	-8.8
	Carbapenem (imipenem/meropenem) resistance	1.7	1.2	1.63	1.53	1.34	-	-21.2
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1.6	1.4	2.06	1.1	1.05	-	-34.4
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.34	0.10^	0.29^	0.24	0.19	NA	-44.1
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	1.02	0.19^	0.86^	0.81	0.72	NA	-29.4
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.44	0.34	3.98	1.25	0.57	-	+29.5
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.53	0.48	4.36	1.34	0.62	-	+17.0
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.49	0.43	4.07	1.25	0.62	-	+26.5
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.39	0.29	3.98	1.2	0.57	-	+46.2
S. aureus	MRSA[f]	2.38	3.37	2.87	2.68	3.24	-	+36.1
S. pneumoniae	Penicillin non-wild-type[g]	1.5	1.11	0.57	0.77	1.29	-	-14.0
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1.36	1.2	0.62	0.86	0.67	↓	-50.7
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.68	0.63	0.19	0.29	0.43	-	-36.8
E. faecalis	High-level gentamicin resistance	1.5	1.59	1.82	1.63	0.91	-	-39.3
E. faecium	Vancomycin resistance	0.19	0.1	0.38	0.1	0.38	-	+100.0

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Slovenia, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	1 610	51.7	1 617	51.3	1 681	50.8	1 659	49	1 639	49	54.7 (32.5-68.9)	-
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1 610	9.8	1 617	10.6	1 681	9.3	1 660	9.3	1 639	8.7	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	1 610	0	1 617	0	1 681	0	1 660	0	1 639	0.1	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	1 610	19	1 617	18.1	1 681	16.7	1 660	16.6	1 639	15.9	24.0 (10.1-42.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1 610	7.8	1 616	6.8	1 681	6.6	1 660	8	1 639	7	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1 610	4	1 616	3.6	1 681	2.8	1 660	3.7	1 639	3	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	303	16.5	291	15.8	351	21.7	372	20.7	339	23	34.8 (5.7-81.5)	↑*
	Carbapenem (imipenem/meropenem) resistance	303	0.3	291	0	351	0.9	372	1.9	339	3.8	13.3 (0.0-69.7)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	303	19.5	291	24.7	351	24.2	372	22	339	27.1	33.7 (7.1-76.9)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	303	8.3	290	10	351	13.7	372	12.4	339	17.1	23.6 (2.6-73.3)	↑*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	303	7.6	290	7.6	351	12.3	372	11	339	13.9	21.0 (0.0-64.9)	↑*
P. aeruginosa	Piperacillin-tazobactam resistance	175	14.9	186	14.5	257	14.8	220	13.2	234	10.7	18.5 (3.7-54.4)	-
	Ceftazidime resistance	175	16	186	13.4	257	14.4	220	13.2	234	11.1	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	175	20	186	13.4	257	13.2	220	14.5	234	12	18.6 (3.3-53.4)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	175	18.9	186	15.6	257	16.7	220	10.5	234	9.4	17.9 (5.9-52.0)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	175	4	56	3.6	174	3.4	204	2.5	230	1.7	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	175	12	56	7.1	174	10.3	204	8.3	230	6.5	13.1 (1.6-49.5)	NA
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	40	22.5	36	19.4	124	66.9	60	43.3	52	23.1	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	40	27.5	36	27.8	124	73.4	60	46.7	52	25	42.4 (0.0-96.6)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	40	25	36	25	124	68.5	60	43.3	52	25	36.7 (0.0-92.4)	-
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	40	20	36	16.7	124	66.9	60	41.7	52	23.1	35.2 (0.0-91.5)	-
S. aureus	MRSA[f]	656	7.5	711	9.8	768	7.8	644	8.7	673	10.1	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	283	11	172	13.4	187	6.4	225	7.1	232	11.6	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	283	9.9	172	14.5	187	7	225	8	232	6	17.8 (4.0-53.8)	↓*
	Combined penicillin non-wild-type and resistance to macrolides[g]	283	4.9	172	7.6	187	2.1	225	2.7	232	3.9	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	138	22.5	179	18.4	196	19.4	190	17.9	174	10.9	24.3 (4.3-99.0)	↓*
E. faecium	Vancomycin resistance	137	2.9	177	1.1	219	3.7	158	1.3	171	4.7	19.8 (0.0-60.9)	-

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Spain

Participating institutions:
Health Institute Carlos lll, www.isciii.es
National Centre for Microbiology
CIBERinfect

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Spain, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	32	36	31	30	28
Geographical representativeness	Medium	Medium	Medium	Medium	Medium
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	67.6	109.5	165.4	705.3	606.6

For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Spain, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	91	NA	91	91	88

NA: not applicable. In 2020 there was no EARS-Net EQA.

[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Spain, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	39	8 353	NA	43	7 939	NA	39	7 583	NA	41	9 717	NA	40	9 635	NA
K. pneumoniae	39	2 403	NA	42	2 244	NA	39	2 174	NA	41	2 973	NA	40	3 138	NA
P. aeruginosa	39	1 108	NA	41	1 228	NA	39	1 185	NA	41	1 403	NA	40	1 430	NA
Acinetobacter spp.	21	83	NA	21	92	NA	24	95	NA	24	92	NA	26	79	NA
S. aureus	41	2 719	NA	42	2 542	NA	40	2 594	NA	41	3 108	NA	40	2 973	NA
S. pneumoniae	37	1 038	NA	41	614	NA	37	391	NA	41	842	NA	40	1 203	NA
E. faecalis	38	1 301	NA	41	1 531	NA	40	1 542	NA	39	1 594	NA	40	1 567	NA
E. faecium	37	848	NA	42	1 104	NA	39	997	NA	39	1 095	NA	39	1 103	NA

Labs: laboratories.

NA: not applicable.

[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.

[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Spain

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	31.91#	24.40#	27.07#	34.39^#	37.50#	-	+17.5
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	7.84#	6.40#	6.65#	10.02#	11.16#	↑	+42.3
	Carbapenem (imipenem/meropenem) resistance	1.08#	0.17#	0.06^#	0.38#	0.04#	↓	-96.3
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	16.11#	13.09#	13.71#	18.78#	19.68#	↑	+22.2
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	7.50#	6.26#	6.38#	8.22#	8.78#	-	+17.1
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	3.40#	2.77#	2.71#	3.96#	4.18#	-	+22.9
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	4.03#	3.42#	3.99#	5.51#	5.69#	↑	+41.2
	Carbapenem (imipenem/meropenem) resistance	0.76#	0.60#	0.72^#	1.08#	0.96#	↑	+26.3
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	3.79#	3.35#	4.09#	5.71#	6.03#	↑	+59.1
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	2.87#	2.63#	3.04#	3.91#	3.90#	↑	+35.9
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2.41#	2.07#	2.59#	3.18#	3.13#	↑	+29.9
P. aeruginosa	Piperacillin-tazobactam resistance	1.02#	0.77#	1.06#	1.50#	0.97#	-	-4.9
	Ceftazidime resistance	0.81#	0.66#	0.83^#	1.48#	0.76#	-	-6.2
	Carbapenem (imipenem/meropenem) resistance	1.60#	1.21#	1.36#	2.21#	1.54#	-	-3.8
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1.38#	1.30#	1.60#	2.22#	2.01#	↑	+45.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	1.08#	0.62#	0.85#	0.67#	0.66#	NA	-38.9
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.93#	0.63#	0.74^#	1.19^#	0.70^#	NA	-24.7
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.31#	0.33#	0.36#	0.23#	0.21^#	↓	-32.3
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.30#	0.33#	0.37#	0.25#	0.25#	-	-16.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.26#	0.29#	0.37#	0.21#	0.19#	-	-26.9
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.26#	0.28#	0.33#	0.19#	0.16^#	-	-38.5
S. aureus	MRSA[f]	4.21#	3.13#	3.53^#	4.54^#	4.29^#	-	+1.9
S. pneumoniae	Penicillin non-wild-type[g]	1.26#	0.66^#	0.48^#	1.08^#	1.31^#	-	+4.0
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1.36#	0.76#	0.69#	1.15#	1.69^#	-	+24.3
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.66^#	0.36^#	0.27^#	0.56^#	0.79^#	-	+19.7
E. faecalis	High-level gentamicin resistance	2.57^#	2.66^#	2.91^#	2.45^#	2.24^#	-	-12.8
E. faecium	Vancomycin resistance	0.07#	0.08#	0.07#	0.22#	0.33#	↑	+371.4

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Spain, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	7 831	61.2	7 214	57.6	7 075	56.2	8 550	57.2	8 793	57.4	54.7 (32.5-68.9)	↓*
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	8 345	14.1	7 744	14.1	7 425	13.2	9 585	14.9	9 269	16.2	16.2 (5.6-37.3)	↑*
	Carbapenem (imipenem/meropenem) resistance	8 346	1.9	7 848	0.4	6 227	0.1	9 549	0.6	9 173	0.1	0.3 (0.0-1.8)	↓*
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	8 192	29.5	7 799	28.6	7 571	26.6	9 343	28.6	9 617	27.6	24.0 (10.1-42.9)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	8 304	13.6	7 829	13.6	7 567	12.4	9 367	12.5	9 609	12.3	10.9 (4.5-28.4)	↓*
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	8 138	6.3	7 512	6.3	7 408	5.4	8 863	6.4	9 232	6.1	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	2 396	25.3	2 185	26.6	2 127	27.6	2 938	26.7	3 033	25.3	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	2 398	4.8	2 228	4.6	1 847	5.7	2 917	5.2	3 003	4.3	13.3 (0.0-69.7)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	2 375	24	2 222	25.7	2 168	27.7	2 816	28.8	3 133	25.9	33.7 (7.1-76.9)	↑*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	2 370	18.2	2 229	20.1	2 169	20.6	2 899	19.2	3 126	16.8	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2 339	15.5	2 149	16.4	2 121	18	2 709	16.7	3 019	13.9	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	1 077	14.2	1 173	11.3	1 124	13.9	1 306	16.3	1 303	10.1	18.5 (3.7-54.4)	-
	Ceftazidime resistance	1 098	11.1	1 167	9.7	1 036	11.8	1 373	15.3	1 378	7.4	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	1 107	21.8	1 226	16.8	1 175	17	1 392	22.6	1 371	15.1	18.6 (3.3-53.4)	↓
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	1 105	18.7	1 211	18.2	1 157	20.3	1 353	23.4	1 430	19	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	1 083	15	1 197	8.8	1 143	10.9	1 327	7.2	1 313	6.8	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	1 040	13.5	1 119	9.6	980	11.1	1 218	13.9	1 199	7.8	13.1 (1.6-49.5)	NA
***Acinetobacter* species**	Carbapenem (imipenem/meropenem) resistance	83	56.6	92	60.9	93	57	92	35.9	71	39.4	40.1 (0.0-95.8)	↓
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	82	54.9	92	62	93	58.1	92	39.1	79	43	42.4 (0.0-96.6)	↓
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	83	47	92	53.3	93	58.1	91	33	76	32.9	36.7 (0.0-92.4)	↓
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	82	47.6	92	51.1	92	53.3	91	29.7	69	30.4	35.2 (0.0-91.5)	↓
S. aureus	MRSA[f]	2 711	23.3	2 313	23.1	1 896	27.4	2 513	25.7	2 233	25.9	15.8 (1.5-51.1)	↑
S. pneumoniae	Penicillin non-wild-type[g]	958	19.8	543	20.8	329	21.3	703	21.8	947	18.7	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	975	21	589	22.1	373	27.1	788	20.8	1 074	21.1	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	905	10.9	527	11.8	318	12.6	663	11.9	898	11.9	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	1 051	36.7	1 329	34.1	1 362	31.4	1 400	24.9	1 215	24.8	24.3 (4.3-99.0)	↓*
E. faecium	Vancomycin resistance	846	1.2	1 079	1.2	996	1	1 080	2.9	1 092	4	19.8 (0.0-60.9)	↑*

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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

Sweden

Participating institutions:
The Public Health Agency of Sweden, www.folkhalsomyndigheten.se

Population and hospitals contributing data: coverage, representativeness and blood culture rate, Sweden, 2019–2023

Parameter	2019	2020	2021	2022	2023
Estimated national population coverage (%)	78	86	89	89	89
Geographical representativeness	High	High	High	High	High
Hospital representativeness	High	High	High	High	High
Isolate representativeness	High	High	High	High	High
Blood culture sets per 1 000 patient-days	105.6	105.6	ND	ND	112.4

ND: no data available.
For data reported in 2019-2020, 'Isolate representativeness' corresponds to 'Patient and isolate representativeness' as defined in the report 'Antimicrobial resistance surveillance in Europe 2022 – 2020 data'.

Laboratories contributing data: use of clinical breakpoint guidelines and participation in EARS-Net EQA, Sweden, 2019–2023

Parameter	2019	2020	2021	2022	2023
Percentage of laboratories using EUCAST or EUCAST-harmonised guidelines[a]	100	100	100	100	100
Percentage of laboratories participating in EARS-Net EQA	95	NA	100	100	94

NA: not applicable. In 2020 there was no EARS-Net EQA.
[a] Starting with 2019 data, EARS-Net was restricted to laboratories using EUCAST or EUCAST-harmonised methodology and breakpoints.

Annual number of reporting laboratories[a], number of reported isolates and percentage[b] of isolates reported from patients in ICUs, Sweden, 2019–2023

Bacterial species	2019			2020			2021			2022			2023		
	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)	Labs (n)	Isolates (n)	Isolates from ICU (%)
E. coli	19	9 424	NA	20	9 852	NA	21	10 634	NA	21	10 563	NA	21	10 726	NA
K. pneumoniae	19	1 795	NA	20	1 843	NA	21	2 001	NA	21	2 164	NA	21	2 165	NA
P. aeruginosa	19	707	NA	20	735	NA	21	803	NA	21	853	NA	21	858	NA
Acinetobacter spp.	1	113	NA	1	126	NA	1	138	NA	1	149	NA	1	156	NA
S. aureus	20	6 173	NA	20	6 891	NA	21	7 736	NA	21	7 940	NA	21	7 916	NA
S. pneumoniae	19	1 071	NA	20	551	NA	21	672	NA	21	1 102	NA	21	1 324	NA
E. faecalis	19	1 297	NA	20	1 443	NA	21	1 635	NA	21	1 581	NA	21	1 614	NA
E. faecium	19	703	NA	20	789	NA	21	1 006	NA	21	1 022	NA	21	1 002	NA

Labs: laboratories.
NA: not applicable.
[a] Number of laboratories reporting at least one isolate during the specific year. The total number of participating laboratories might be higher.
[b] Isolates with missing information on hospital department are excluded from the calculation, and the percentage of isolates from ICU is presented only if there are ≥20 isolates of which ≥70% have data on hospital department. If not, the percentage is presented as not applicable (NA).

Estimated total incidence of bloodstream infections with resistance phenotype (n per 100 000 population) and trend, 2019-2023, as well as the percentage change 2019-2023, by bacterial species and antimicrobial group/agent, Sweden

Bacterial species	Antimicrobial group/agent	Estimated incidence[a] of isolates from bloodstream infections with resistance phenotype (n per 100 000 population)						
		2019	2020	2021	2022	2023	Trend 2019-2023[b]	Change 2019-2023 (%)[c]
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	ND	ND	ND	ND	ND	NA	NA
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	9.24	8.73	8.19	8.52	9.08	-	-1.7
	Carbapenem (imipenem/meropenem) resistance	0.03	0.01	0.06	0.04	0.04	-	+33.3
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	18.70	15.54	15.63	15.62	16.81	-	-10.1
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	7.09	6.52	6.67	6.42	7.05	-	-0.6
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	2.64	2.35	2.07	2.39	2.47	-	-6.4
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1.87	1.68	1.50	1.82	2.30	-	+23.0
	Carbapenem (imipenem/meropenem) resistance	0.03	0.06	0.03	0.04	0.12	↑	+300.0
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	2.36	2.09	2.38	2.85	2.92	↑	+23.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.94	0.74	0.82	0.78	1.04	-	+10.6
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	0.71	0.50	0.48	0.46	0.69	-	-2.8
P. aeruginosa	Piperacillin-tazobactam resistance	0.60	0.45	0.76	0.64	0.69	-	+15.0
	Ceftazidime resistance	0.45	0.42	0.57	0.47	0.49	-	+8.9
	Carbapenem (imipenem/meropenem) resistance	0.86	0.35	1.03	1.01	0.89	-	+3.5
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.81	0.61	0.93	0.84	0.84	-	+3.7
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	0.20	0.03^	0.04^	0.01^	0.01^	NA	-95.0
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	0.31	0.10^	0.21^	0.24^	0.21^	NA	-32.3
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	0.05	0.10	0.01	0.04	0.03	-	-40.0
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	0.11	0.10	0.02	0.03	0.04	↓	-63.6
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	0.08	0.11	0.08	0.02	0.02	↓	-75.0
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	0.04	0.10	0.00	0.02	0.02	-	-50.0
S. aureus	MRSA[f]	1.34	1.80	1.65	1.58	1.79	-	+33.6
S. pneumoniae	Penicillin non-wild-type[g]	0.88	0.52	0.54	1.04	0.97	-	+10.2
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	0.88	0.41	0.35	0.64	0.76	-	-13.6
	Combined penicillin non-wild-type and resistance to macrolides[g]	0.50	0.17	0.18	0.34	0.40	-	-20.0
E. faecalis	High-level gentamicin resistance	1.53	1.41^	0.78^	0.88^	0.65^	↓	-57.5
E. faecium	Vancomycin resistance	0.09	0.01^	0.03	0.03	0.07	-	-22.2

ND: no data available.

NA: not applicable.

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

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

[c] The 'Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach' (2023/C 220/01) includes 2030 EU targets, with 2019 as the baseline year: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2023_220_R_0001

[d] The aminoglycoside group includes only gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group includes only tobramycin from 2020 onwards.

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

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

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

Total number of invasive isolates tested (n) and percentage of isolates with resistance phenotype (%)[a], by bacterial species and antimicrobial group/agent, 2023 EU/EEA range, population-weighted mean and trend, Sweden, 2019–2023

Bacterial species	Antimicrobial group/agent	2019		2020		2021		2022		2023		2023 EU/EEA range and population-weighted mean[b]	Trend 2019-2023[c]
		n	%	n	%	n	%	n	%	n	%		
E. coli	Aminopenicillin (amoxicillin/ampicillin) resistance	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	54.7 (32.5-68.9)	NA
	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	9 419	7.8	9 852	7.9	10 633	7.1	10 563	7.5	10 725	7.9	16.2 (5.6-37.3)	-
	Carbapenem (imipenem/meropenem) resistance	9 413	0	9 846	0	10 626	0.1	10 558	0	10 714	0	0.3 (0.0-1.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	9 412	15.9	9 798	14.1	10 570	13.7	10 513	13.8	10 674	14.7	24.0 (10.1-42.9)	↓
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	9 410	6	9 840	5.9	10 299	6	10 549	5.7	10 714	6.2	10.9 (4.5-28.4)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	9 405	2.2	9 792	2.1	10 247	1.9	10 502	2.1	10 665	2.2	5.9 (1.3-17.6)	-
K. pneumoniae	Third-generation cephalosporin (cefotaxime/ceftriaxone/ceftazidime) resistance	1 795	8.3	1 842	8.1	2 000	7	2 161	7.8	2 165	9.9	34.8 (5.7-81.5)	-
	Carbapenem (imipenem/meropenem) resistance	1 793	0.1	1 843	0.3	1 997	0.2	2 162	0.2	2 164	0.5	13.3 (0.0-69.7)	↑
	Fluoroquinolone (ciprofloxacin/levofloxacin/ofloxacin) resistance	1 789	10.5	1 830	10.2	1 989	11.1	2 147	12.3	2 155	12.7	33.7 (7.1-76.9)	↑*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	1 794	4.2	1 839	3.6	1 939	3.9	2 160	3.4	2 164	4.5	23.6 (2.6-73.3)	-
	Combined resistance to third-generation cephalosporins, fluoroquinolones, and aminoglycosides[d]	1 789	3.2	1 827	2.4	1 927	2.3	2 142	2	2 155	3	21.0 (0.0-64.9)	-
P. aeruginosa	Piperacillin-tazobactam resistance	706	6.8	735	5.4	803	8.7	851	7.1	857	7.6	18.5 (3.7-54.4)	-
	Ceftazidime resistance	706	5.1	735	5	803	6.6	851	5.2	857	5.4	15.7 (2.8-52.7)	-
	Carbapenem (imipenem/meropenem) resistance	706	9.8	733	4.2	803	11.8	853	11	857	9.7	18.6 (3.3-53.4)	↑*
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	706	9.2	733	7.4	803	10.7	851	9.2	857	9.2	17.9 (5.9-52.0)	-
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[e]	707	2.3	464	0.6	562	0.7	603	0.2	590	0.2	9.5 (0.0-46.1)	NA
	Combined resistance to ≥3 antimicrobial groups (among piperacillin-tazobactam, ceftazidime, carbapenems, fluoroquinolones and aminoglycosides)[e]	706	3.5	464	1.9	562	3.4	598	3.7	590	3.4	13.1 (1.6-49.5)	NA
Acinetobacter species	Carbapenem (imipenem/meropenem) resistance	112	3.6	126	7.1	138	0.7	149	2.7	156	1.9	40.1 (0.0-95.8)	-
	Fluoroquinolone (ciprofloxacin/levofloxacin) resistance	113	8	126	7.1	137	1.5	149	2	156	2.6	42.4 (0.0-96.6)	↓*
	Aminoglycoside (gentamicin/netilmicin/tobramycin) resistance[d]	113	5.3	125	8	138	5.1	147	1.4	153	1.3	36.7 (0.0-92.4)	↓*
	Combined resistance to carbapenems, fluoroquinolones and aminoglycosides[d]	112	2.7	125	7.2	137	0	147	1.4	153	1.3	35.2 (0.0-91.5)	↓*
S. aureus	MRSA[f]	5 948	1.8	6 871	2.3	7 733	2	7 936	1.9	7 915	2.1	15.8 (1.5-51.1)	-
S. pneumoniae	Penicillin non-wild-type[g]	1 070	6.5	544	8.5	668	7.5	1 096	8.9	1 323	6.9	15.1 (3.7-39.1)	-
	Macrolide (azithromycin/clarithromycin/erythromycin) resistance	1 069	6.5	549	6.6	669	4.8	1 100	5.5	1 321	5.4	17.8 (4.0-53.8)	-
	Combined penicillin non-wild-type and resistance to macrolides[g]	1 068	3.7	542	2.8	665	2.6	1 095	2.9	1 320	2.8	9.2 (0.0-26.9)	-
E. faecalis	High-level gentamicin resistance	1 225	10	1 238	10.1	1 078	6.7	999	8.2	914	6.7	24.3 (4.3-99.0)	↓*
E. faecium	Vancomycin resistance	693	1	600	0.2	984	0.3	1 021	0.3	1 000	0.7	19.8 (0.0-60.9)	-

ND: no data available.

NA: not applicable.

[a] Percentages of isolates with resistance phenotype are presented only if data are available for ≥20 isolates. If not, the percentage is presented as not applicable (NA).

[b] Lowest and highest national resistance percentage among reporting EU/EEA countries (n=29, excluding France except for *S. pneumoniae*).

[c] ↑ and ↓ indicate statistically significantly increasing and decreasing trends, respectively, in the overall data; * indicates confirmation by a significant trend in the data that only includes laboratories reporting continuously for all five years; – indicates no statistically significant trend. NA: not applicable indicates that data were not reported for all years, a significant change in data source occurred during the period, or the number of isolates was <20 in any year during the period.

[d] The aminoglycoside group only includes gentamicin and tobramycin from 2020 onwards.

[e] The aminoglycoside group only includes tobramycin from 2020 onwards.

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

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