

Antimicrobial resistance of clinical isolates of bacteria in 2025

The antimicrobial susceptibility of major bacteria isolated from various clinical specimens sent to the Seoul Clinical Laboratories (SCL) in January-December 2025 were analyzed by hospital type. Request for bacteria cultures were received from general hospitals (GH) with more than 100 beds, small and medium-sized hospitals (SMH) with fewer than 100 beds, and long-term care hospitals (LTCH). Bacterial identification was performed using MALDI TOF MS Biotyper (Bruker Daltonics GmbH, Bremen, Germany). Antimicrobial susceptibility was tested using a VITEK 2 (bioMerieux, Marcy-l'Étoile, France) instrument according to the criteria of the Clinical and Laboratory Standards Institute (CLSI). All susceptibility data for infection control and duplicated data from the same patient were excluded. In 2025, *Escherichia coli* was the most commonly isolated bacteria, followed by *Pseudomonas aeruginosa*, coagulase-negative *Staphylococcus*, and *Klebsiella pneumoniae*. Among the Gram-negative rods, *K. pneumoniae*, *Proteus mirabilis* and *Acinetobacter baumannii* were commonly isolated in addition to *E. coli*, *P. aeruginosa*. The antimicrobial susceptibilities of *Enterobacterales* are shown in Table 1; glucose-nonfermenting Gram-negative bacilli are shown in Table 2; and staphylococci and enterococci are shown in Table 3.

Table 1. Antimicrobial susceptibility (%) of frequently isolated *Enterobacterales* by hospital type at a referral medical laboratory in 2025

Antimicrobial agents	<i>Escherichia coli</i>			<i>Klebsiella pneumoniae</i>			<i>K. (Enterobacter) aerogenes</i>			<i>Klebsiella oxytoca</i>		
	SMH (31757)	GH (12131)	LTCH (2697)	SMH (3848)	GH (2640)	LTCH (1358)	SMH (944)	GH (278)	LTCH (35)	SMH (380)	GH (180)	LTCH (45)
	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R
Ampicillin	31 68	27 72	10 89	0 100	0 100	0 100	0 100	0 100	0 100	0 100	0 100	0 100
Amox-clavulanate	73 15	70 15	45 28	66 19	60 27	20 63	0 100	0 100	0 100	87 8	91 6	82 16
Pip-tazobactam	93 6	91 7	70 25	67 27	60 35	19 74	86 11	78 19	54 40	90 6	93 5	84 16
Cefazolin	63 37	54 46	23 77	58 42	53 47	13 87	0 100	0 100	0 100	49 51	50 50	40 60
Cefotaxime	70 29	61 39	26 74	58 41	54 46	14 86	86 13	79 20	57 40	89 10	94 5	82 18
Ceftazidime	75 12	69 17	36 48	63 33	57 40	16 80	88 12	79 20	60 40	93 6	98 2	82 13
Cefepime	80 14	72 21	35 54	66 32	59 40	19 79	97 2	98 1	83 11	96 4	99 1	91 7
Ertapenem	99 1	99 1	92 7	91 8	80 19	51 48	99 1	98 1	97 3	98 2	99 1	91 9
Imipenem	99 1	99 1	93 6	90 8	80 18	50 43	99 1	98 1	97 3	98 1	98 1	91 9
Meropenem	99 1	99 1	94 6	92 8	81 18	53 46	99 1	99 1	97 3	98 2	99 1	91 9
Ciprofloxacin	32 48	27 55	9 83	52 42	48 47	9 86	95 3	94 2	71 17	84 11	83 14	71 18
Amikacin	97 2	96 3	82 13	96 3	93 7	69 30	99 1	100 0	89 11	99 1	100 0	93 7
Gentamicin	78 22	76 24	64 36	80 20	79 21	48 52	99 1	100 0	97 3	96 4	96 4	96 4
Tobramycin	76 19	73 22	50 45	71 25	67 30	28 68	98 1	99 0	86 14	93 4	95 3	89 11
Cotrimoxazole	65 35	65 35	54 46	69 31	68 32	36 64	98 2	99 1	86 14	91 9	93 7	87 13
Nitrofurantoin ^a	96 1	95 1	92 3	18 35	17 45	8 68	14 21	14 21	5 37	82 1	84 1	86 0

Antimicrobial agents	<i>Enterobacter cloacae</i>			<i>Citrobacter freundii</i>			<i>Citrobacter koseri</i>			<i>Serratia marcescens</i>		
	SMH (813)	GH (458)	LTCH (112)	SMH (590)	GH (249)	LTCH (126)	SMH (432)	GH (140)	LTCH (231)	SMH (484)	GH (246)	LTCH (128)
	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R
Ampicillin	1 99	0 100	0 100	2 98	1 99	4 96	0 100	0 100	0 100	0 100	0 100	0 100
Amox-clavulanate	1 99	0 100	0 100	2 98	1 99	4 96	88 9	88 11	17 70	0 100	0 100	0 100
Pip-tazobactam	75 20	76 21	54 41	82 14	73 23	82 15	87 8	89 9	16 75	94 5	94 5	53 40
Cefazolin	1 100	0 100	0 100	1 99	0 100	2 98	85 15	84 16	15 85	0 100	0 100	0 100
Cefotaxime	69 30	68 31	38 62	77 21	67 32	70 30	85 15	84 16	15 84	83 15	87 10	46 51
Ceftazidime	71 28	71 28	41 54	80 19	69 30	73 22	88 11	86 13	28 68	92 8	96 2	66 29
Cefepime	82 13	80 16	54 35	96 2	93 5	91 6	88 12	88 11	28 67	92 7	96 1	68 10
Ertapenem	93 3	90 3	75 14	97 3	96 3	90 7	96 3	94 5	58 40	98 1	97 2	68 29
Imipenem	97 2	96 2	86 14	97 3	97 3	92 7	97 2	94 5	59 38	99 1	98 2	68 30
Meropenem	98 2	97 2	86 14	97 3	97 2	93 6	98 2	94 4	61 36	99 1	98 2	70 26
Ciprofloxacin	72 21	69 23	34 51	61 29	61 31	42 40	84 11	85 13	13 70	80 13	86 11	47 38
Amikacin	97 3	99 1	91 7	98 2	97 3	95 5	99 1	95 5	63 37	98 1	99 0	93 3
Gentamicin	91 9	94 6	76 24	93 6	91 9	91 9	91 9	91 9	34 66	98 1	100 0	95 5
Tobramycin	86 12	92 6	68 31	87 8	85 11	86 10	91 8	88 9	29 68	84 2	81 1	88 7
Cotrimoxazole	87 13	88 12	64 36	85 15	87 13	79 21	96 4	93 7	61 39	100 0	100 0	98 2
Nitrofurantoin ^a	33 15	36 14	41 13	94 2	94 5	94 1	81 2	77 3	48 23	0 100	0 100	0 100

Antimicrobial agents	<i>Morganella morganii</i>			<i>Proteus mirabilis</i>			<i>Providencia rettgeri</i>			<i>Providencia stuartii</i>		
	SMH (603)	GH (204)	LTCH (181)	SMH (2097)	GH (825)	LTCH (1128)	SMH (125)	GH (60)	LTCH (68)	SMH (110)	GH (35)	LTCH (141)
	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R
Ampicillin	0 100	0 100	1 99	45 55	37 63	4 96	1 98	0 100	0 98	0 98	0 100	0 100
Amox-clavulanate	0 100	0 100	1 99	61 16	61 18	39 26	0 99	0 100	0 100	0 100	0 100	0 100
Pip-tazobactam	97 3	95 5	84 16	96 3	95 4	93 6	68 32	92 8	48 52	94 6	100 0	95 5
Cefazolin	0 100	1 99	0 100	61 39	50 50	12 88	0 100	2 98	0 100	0 100	0 100	0 100
Cefotaxime	65 27	57 30	37 57	64 35	53 47	17 83	50 44	58 41	21 76	47 51	49 49	34 63
Ceftazidime	86 8	80 13	63 32	86 12	84 15	50 48	59 41	68 29	29 68	94 6	100 0	84 14
Cefepime	97 0	92 4	79 13	74 9	67 12	34 19	61 24	78 10	32 44	94 4	86 6	76 15
Ertapenem	99 0	98 0	92 4	100 0	100 0	99 0	98 1	95 3	73 16	94 3	100 0	90 6
Imipenem	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Meropenem	100 0	100 0	95 5	100 0	100 0	100 0	99 1	93 5	98 0	97 2	100 0	98 1
Ciprofloxacin	74 24	67 30	30 68	52 48	42 57	6 94	46 50	45 53	38 59	15 85	23 77	14 86
Amikacin	97 2	98 2	79 21	80 20	78 22	41 59	64 35	62 38	22 76	64 36	69 31	81 19
Gentamicin	90 10	87 12	56 43	58 42	50 50	12 88	61 38	78 20	22 78	0 100	0 100	3 97
Tobramycin	92 7	91 9	60 34	61 35	57 38	17 77	62 36	55 17	27 73	0 100	0 100	2 97
Cotrimoxazole	82 18	71 29	49 51	58 42	51 49	24 76	86 14	67 33	51 49	44 56	63 37	48 52
Nitrofurantoin ^a	0 99	0 99	0 100	0 100	0 99	0 100	5 95	0 100	14 86	0 100	0 100	0 100

Abbreviation: SMH, small and medium-sized hospital; GH, general hospital; LTCH, long-term care hospital; (), No. tested; S, susceptible; R, resistant; Amox, amoxicillin; Pip, piperacillin; -, Not tested. Intrinsic resistances are blue shaded.

^a Only on organisms isolated from the urinary tract.

The cefotaxime resistance rates of *E. coli* were 29%, 39%, and 74% in SMH, GH, and LTCH, respectively, similar to those of first-generation cephalosporins and carbapenem resistance rate was less than 7% (Table 1). The fluoroquinolone resistance rate was about 50% in SMH and GH, but 83% in LTCH. The cotrimoxazole resistance rate was 46% in LTCH, which was slightly higher than that in SMH and GH. The carbapenem resistance rates of *K. pneumoniae* were high at 8% and 18-19% in SMH and GH, respectively, and at 43-48% in LTCH, which were increased by 15-17% compared with 2024. Among isolates from LTCH, carbapenem resistance rates were 36-40% for *Citrobacter koseri* and 26-30% for *Serratia marcescens*, increased by 12% and 17-21%, respectively, but 4-5% for *Morganella morganii*, decreased by 14-15% compared with 2024. The cefotaxime resistance rate of *S. marcescens* from LTCH increased by 12%, whereas those of *M. morganii*, *Providencia rettgeri* and *P. stuartii* decreased by 12-16% compared with 2024.

Table 2. Antimicrobial susceptibility (%) of frequently isolated glucose-nonfermenting Gram-negative bacilli by hospital type at a referral medical laboratory in 2025

Antimicrobial agents	<i>Acinetobacter baumannii</i>			<i>Acinetobacter spp.</i>			<i>Pseudomonas aeruginosa</i>			<i>Stenotrophomonas maltophilia</i>		
	SMH (983)	GH (1095)	LTCH (1530)	SMH (979)	GH (703)	LTCH (722)	SMH (4446)	GH (2658)	LTCH (4720)	SMH (796)	GH (767)	LTCH (909)
	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R
Amp-sulbactam	34 47	21 62	13 62	83 11	81 11	77 16	- -	- -	- -	- -	- -	- -
Pip-tazobactam	29 70	16 84	7 92	57 38	54 41	37 58	55 39	60 34	32 61	- -	- -	- -
Ceftazidime	30 69	16 83	9 90	74 14	64 16	66 26	69 27	74 23	53 42	- -	- -	- -
Cefepime	- -	- -	- -	- -	- -	- -	64 22	69 19	47 35	- -	- -	- -
Imipenem	28 71	16 84	7 93	72 26	62 37	50 47	49 46	56 39	31 66	- -	- -	- -
Meropenem	30 70	16 83	8 92	77 20	67 31	53 42	55 38	63 30	34 58	- -	- -	- -
Amikacin	41 57	29 70	18 80	87 10	87 9	69 19	- -	- -	- -	- -	- -	- -
Gentamicin	37 61	22 74	14 82	80 14	68 23	57 31	- -	- -	- -	- -	- -	- -
Tobramycin	39 61	24 76	18 82	83 16	74 24	66 33	73 27	76 24	49 51	- -	- -	- -
Ciprofloxacin	26 73	14 86	6 94	63 36	52 47	32 65	50 46	56 39	24 74	- -	- -	- -
Levofloxacin	27 69	14 83	6 89	67 19	59 26	37 35	- -	- -	- -	83 12	82 13	73 22
Cotrimoxazole	35 65	23 77	16 84	81 19	81 19	64 36	- -	- -	- -	92 8	91 9	83 17
Minocycline	86 11	87 7	76 15	94 5	93 4	89 9	- -	- -	- -	86 11	85 12	83 14

Abbreviation: Amp, ampicillin; Pip, piperacillin.

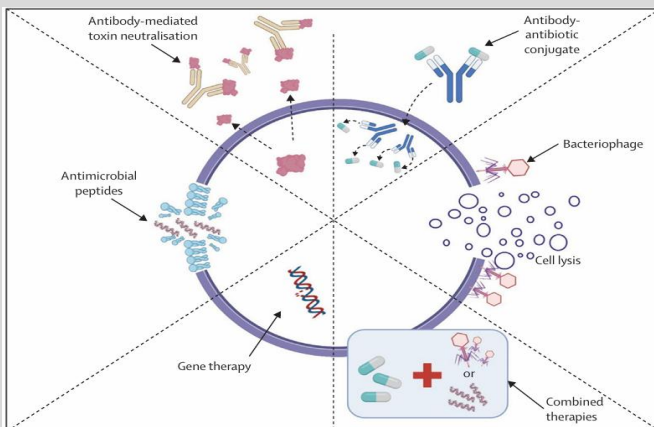
The resistance rates of *A. baumannii* were 47-62% for ampicillin-sulbactam, 70-93% for carbapenem, 69-94% for fluoroquinolone, which were decreased by 7-9%, and 57-80% for amikacin, increased by 1-7% compared with 2024. By contrast, the resistance rates of non-*baumannii* *Acinetobacter* spp. were 11-16% for ampicillin-sulbactam, 20-47% for carbapenem, 19-65% for fluoroquinolone, and 9-19% for amikacin, and carbapenem resistance rates among isolates from LTCH increased by 6-7% compared with 2024 (Table 2). The resistance rates of *P. aeruginosa* were 23-42% for ceftazidime, 34-61% for piperacillin-tazobactam, 30-66% for carbapenem, and 39-74% for ciprofloxacin, with resistance among LTCH isolates increasing by 4-7% compared with 2024. Both *Acinetobacter* spp. and *P. aeruginosa* showed higher resistance rates in isolates from LTCH. The resistance rates of *Stenotrophomonas maltophilia* were 12-22% for levofloxacin and 8-17% for cotrimoxazole, and 11-14% for minocycline. Minocycline resistance among isolates GH and LTCH increased by 5% and 6%, respectively, compared with 2024.

Table 3. Antimicrobial susceptibility (%) of *Staphylococcus* and *Enterococcus* by hospital type at a referral medical laboratory in 2025

Antimicrobial agents	<i>Staphylococcus aureus</i>			Coagulase-neg. <i>Staphylococcus</i>			<i>Enterococcus faecalis</i>			<i>Enterococcus faecium</i>		
	SMH (4302)	GH (2264)	LTCH (807)	SMH (4508)	GH (3418)	LTCH (1439)	SMH (4157)	GH (1315)	LTCH (399)	SMH (969)	GH (1159)	LTCH (795)
	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R	S R
Ampicillin	- -	- -	- -	- -	- -	- -	99 1	98 2	95 5	7 93	6 94	2 98
Penicillin G	13 87	11 89	3 97	11 89	8 92	1 99	95 5	84 16	75 25	7 93	6 94	2 98
Oxacillin	50 50	47 53	14 86	43 57	30 70	7 93	- -	- -	- -	- -	- -	- -
Clindamycin	66 34	62 38	42 58	72 27	66 32	40 57	- -	- -	- -	- -	- -	- -
Erythromycin	63 37	59 41	39 61	51 48	45 53	32 68	- -	- -	- -	- -	- -	- -
Tetracycline ^a	85 15	83 17	86 14	83 17	82 18	84 16	13 87	13 87	10 89	74 26	83 17	73 27
Tigecycline	100 0	100 0	100 0	100 0	100 0	100 0	100 0	100 0	100 0	100 0	100 0	100 0
Cotrimoxazole	97 3	97 3	93 7	91 9	90 10	78 22	- -	- -	- -	- -	- -	- -
Ciprofloxacin ^a	68 31	66 33	19 81	67 29	55 41	14 83	81 19	63 36	23 77	4 94	2 97	1 99
Levofloxacin	69 31	67 33	19 81	68 31	56 43	14 85	- -	- -	- -	- -	- -	- -
Teicoplanin	100 0	100 0	100 0	100 0	100 0	99 0	100 0	100 0	99 1	68 32	69 31	53 47
Vancomycin	100 0	100 0	100 0	100 0	100 0	100 0	100 0	100 0	99 1	68 32	69 32	52 48
Gentamicin	70 23	70 24	37 50	64 18	57 25	36 42	- -	- -	- -	- -	- -	- -
Linezolid	100 0	100 0	100 0	100 0	100 0	100 0	100 0	100 0	100 0	100 0	100 0	100 0
Rifampin	99 1	99 1	97 3	94 5	90 9	80 19	- -	- -	- -	- -	- -	- -
Nitrofurantoin ^a	- -	- -	- -	- -	- -	- -	99 0	99 1	97 2	7 75	5 83	5 87

^a Only on *Enterococcus* spp. isolated from the urinary tract.

The oxacillin resistance rate of *Staphylococcus aureus* (MRSA) was 50% and 53% in SMH and GH, respectively, and 86% in LTCH. The resistance rates were 34-58% for clindamycin, 3-7% for cotrimoxazole, and 0% for vancomycin, teicoplanin, tigecycline, and linezolid (Table 3). The antimicrobial resistance of coagulase-negative *Staphylococcus* were similar to those of *S. aureus*, however, oxacillin and cotrimoxazole resistance rates were high at 57-93% and 9-22%, respectively. The ampicillin resistance rate of *Enterococcus faecalis* was less than 5%, whereas that of *E. faecium* was 93-98%. Vancomycin and teicoplanin resistance rates were less than 1% for *E. faecalis*, but 31-48% for *E. faecium*. Nitrofurantoin resistance rate was less than 2% for *E. faecalis*, but 75-87% for *E. faecium*. The resistance rates of Gram-positive cocci were mostly similar to 2024, however, vancomycin and teicoplanin resistance among *E. faecium* isolates from LTCH increased by 6% and 5%, respectively.



Emerging therapies for tackling Antimicrobial resistance

Source: Lancet Microbe 2025;6:100947