Table 1A-1. Enterobacterales (excluding *Salmonella* and *Shigella* spp.)[a]

Tier 1: Antimicrobial agents that are appropriate for routine, primary testing and reporting	Tier 2: Antimicrobial agents that are appropriate for routine, primary testing but may be reported following cascade reporting rules established at each institution	Tier 3: Antimicrobial agents that are appropriate for routine, primary testing in institutions that serve patients at high risk for MDROs but should only be reported following cascade reporting rules established at each institution	Tier 4: Antimicrobial agents that may warrant testing and reporting by clinician request if antimicrobial agents in other tiers are not optimal because of various factors
Ampicillin			
Cefazolin	Cefuroxime		
Cefotaxime or ceftriaxone[b]	Cefepime[c]		
	Ertapenem Imipenem Meropenem	Cefiderocol	
		Ceftazidime-avibactam	
		Imipenem-relebactam	
		Meropenem-vaborbactam	
Amoxicillin-clavulanate Ampicillin-sulbactam			
Piperacillin-tazobactam			
Gentamicin	Tobramycin	Plazomicin	
	Amikacin		
Ciprofloxacin Levofloxacin			
Trimethoprim-sulfamethoxazole			
	Cefotetan Cefoxitin		
	Tetracycline		
			Aztreonam[d]
			Ceftaroline[b]
			Ceftazidime[b]
			Ceftolozane-tazobactam
Urine Only			
Cefazolin (surrogate for uncomplicated UTI)[e]			
Nitrofurantoin			
		Fosfomycin[f] (*Escherichia coli*)	

Abbreviations: MDRO, multidrug-resistant organism; UTI, urinary tract infection.

Table 1A-1. Enterobacterales (Continued)

Footnotes

a. See Appendix B for species-specific intrinsic resistance profiles. If an antimicrobial agent–organism combination that is defined as intrinsically resistant is tested, the result should be reported as resistant. Consideration may be given to adding comments regarding intrinsic resistance of agents not tested.

b. *Citrobacter freundii* complex, *Enterobacter cloacae* complex, *Hafnia alvei, Klebsiella* (formerly *Enterobacter*) *aerogenes, Morganella morganii, Providencia* spp., *Serratia marcescens*, and *Yersinia enterocolitica* may test susceptible to ceftriaxone, cefotaxime, ceftazidime, and ceftaroline, but these agents may be ineffective against these genera within a few days after initiation of therapy due to derepression of inducible AmpC β-lactamase. The risk of AmpC derepression during therapy is moderate to high with *C. freundii* complex, *E. cloacae* complex, and *K. aerogenes* and appears to be less frequent with *M. morganii, Providencia* spp., and *S. marcescens*.[1] Therefore, isolates that are initially susceptible may become resistant. Testing subsequent isolates may be warranted if clinically indicated.

c. Cefepime should be considered a Tier 1 agent for testing and/or reporting of *C. freundii* complex, *E. cloacae* complex, *H. alvei, K. aerogenes, M. morganii, Providencia* spp., *S. marcescens*, and *Y. enterocolitica* (see footnote b).[1]

d. In institutions that serve patients at high risk for metallo-β-lactamase–producing Enterobacterales, aztreonam may be considered a Tier 3 agent following cascade reporting rules established at the institution.

e. See cefazolin comments in Table 2A-1 for using cefazolin as a surrogate test for oral cephalosporins and for reporting cefazolin when used for therapy in uncomplicated UTIs.

f. Report only on *E. coli* isolated from the urinary tract.

Reference for Table 1A-1

[1] Tamma PD, Aitken SL, Bonomo RA, Mathers AJ, van Duin D, Clancy CJ. IDSA 2024 guidance on the treatment of antimicrobial resistant gram-negative infections. Accessed 23 January 2024. https://www.idsociety.org/practice-guideline/amr-guidance/

NOTE: Information in boldface type is new or modified since the previous edition.

Table 2A-1. Zone Diameter and MIC Breakpoints for Enterobacterales (excluding *Salmonella* and *Shigella* spp.)

Testing Conditions

Medium:	Disk diffusion: MHA Broth dilution: CAMHB; iron-depleted CAMHB for cefiderocol (see Appendix H, **section H1**)[1] Agar dilution: MHA
Inoculum:	Broth culture method or colony suspension, equivalent to a 0.5 McFarland standard; positive blood culture broth for select antimicrobial agents with disk diffusion (see general comment [4])
Incubation:	35°C ± 2°C; ambient air Disk diffusion: 16–18 hours Dilution methods: 16–20 hours

QC Recommendations

Refer to the following:

- **Tables 4A-1, 4A-2, 5A-1, and 5A-2 that list acceptable QC ranges applicable for each method**
- **Appendix I to develop a QC plan**

When a commercial test system is used for antimicrobial susceptibility testing, refer to the manufacturer's instructions for QC **strains** and QC ranges.

Refer to Tables 3A, 3B, 3C, 3D, 3E, 3F-1, and 3F-2 for additional testing, reporting, and QC for Enterobacterales.

General Comments

(1) Refer to Table 1A-1 for antimicrobial agents that should be considered for testing and reporting by microbiology laboratories.

(2) For disk diffusion, test a maximum of 12 disks on a 150-mm plate and no more than 6 disks on a 100-mm plate; disks should be placed no less than 24 mm apart, center to center (see CLSI M02[2]). Each zone diameter should be clearly measurable; overlapping zones prevent accurate measurement. Measure the diameter of the zones of complete inhibition (as judged by the unaided eye), including the diameter of the disk (see CLSI M02QG[3]). Hold the Petri plate a few inches above a black background illuminated with reflected light. The zone margin should be considered the area showing no obvious, visible growth that can be detected with the unaided eye. Ignore faint growth of tiny colonies that can be detected only with a magnifying lens at the edge of the zone of inhibited growth. Strains of *Proteus* spp. may swarm into areas of inhibited growth around certain antimicrobial agents. With *Proteus* spp., ignore the thin veil of swarming growth in an otherwise obvious zone of growth inhibition. With trimethoprim and the sulfonamides, antagonists in the medium may allow some slight growth; therefore, disregard slight growth (20% or less of the lawn of growth) and measure the more obvious margin to determine the zone diameter.

(3) An intermediate (I) with a ^ in Tables 2 indicates agents that have the potential to concentrate in the urine. The I^ is for informational use only. The decision to report I^ is best made by each laboratory based on institution-specific guidelines and in consultation with appropriate medical personnel.

Table 2A-1. Enterobacterales (excluding *Salmonella* and *Shigella* spp.) (Continued)

(4) Positive blood culture broth can be used as the inoculum for direct disk diffusion testing of select antimicrobial agents against Enterobacterales (using methods described in Table 3F-1 and applying breakpoints in Table 3F-2). For antimicrobial agents not listed in Table 3F-2 for Enterobacterales, CLSI has not yet evaluated this direct disk diffusion method.

NOTE: Information in boldface type is new or modified since the previous edition.

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm				Interpretive Categories and MIC Breakpoints, µg/mL				Comments
		S	SDD	I	R	S	SDD	I	R	
PENICILLINS										
Ampicillin	10 µg	≥ 17	–	14–16^	≤ 13	≤ 8	–	16^	≥ 32	**(5)** Results of ampicillin testing can be used to predict results for amoxicillin. **(6)** Breakpoints when oral ampicillin is used are only for therapy of uncomplicated UTIs due to *Escherichia coli* and *Proteus mirabilis*.
Piperacillin*		–	–	–	–	≤ 8	16	–	≥ 32	**(7)** Disk diffusion breakpoints have been removed because no disk correlate data are available for the revised piperacillin MIC breakpoints. Disk diffusion breakpoints will be reassessed if data become available.
Mecillinam* (U)[a]	10 µg	≥ 15	–	12–14^	≤ 11	≤ 8	–	16^	≥ 32	**(8)** Report only on *E. coli*.
β-LACTAM COMBINATION AGENTS										
(9) Organisms that test susceptible to the β-lactam agent alone are also considered susceptible to the β-lactam combination agent. However, organisms that test susceptible to the β-lactam combination agent cannot be assumed to be susceptible to the β-lactam agent alone. Similarly, organisms that test SDD, intermediate, or resistant to the β-lactam agent alone may be susceptible to the β-lactam combination agent.										
Amoxicillin-clavulanate	20/10 µg	≥ 18	–	14–17^	≤ 13	≤ 8/4	–	16/8^	≥ 32/16	**(10)** Breakpoints when oral amoxicillin-clavulanate is used are only for therapy of uncomplicated UTIs or for completion of therapy for systemic infection.
Ampicillin-sulbactam	10/10 µg	≥ 15	–	12–14^	≤ 11	≤ 8/4	–	16/8^	≥ 32/16	
Ceftolozane-tazobactam	30/10 µg	≥ 22	–	19–21^	≤ 18	≤ 2/4	–	4/4^	≥ 8/4	

Table 2A-1. Enterobacterales (excluding *Salmonella* and *Shigella* spp.) (Continued)

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm				Interpretive Categories and MIC Breakpoints, µg/mL				Comments
		S	SDD	I	R	S	SDD	I	R	
β-LACTAM COMBINATION AGENTS (Continued)										
Ceftazidime-avibactam	30/20 µg	≥ 21	–	–	≤ 20	≤ 8/4	–	–	≥ 16/4	**(11)** Confirmatory MIC testing is indicated for isolates with zones of 20–22 mm to avoid reporting false-susceptible or false-resistant results.
Imipenem-relebactam	10/25 µg	≥ 25	–	21–24^	≤ 20	≤ 1/4	–	2/4^	≥ 4/4	**(12)** Breakpoints do not apply to the family Morganellaceae, which includes but is not limited to the genera *Morganella, Proteus,* and *Providencia*.
Meropenem-vaborbactam	20/10 µg	≥ 18	–	15–17^	≤ 14	≤ 4/8	–	8/8^	≥ 16/8	**(13)** Enterobacterales that harbor OXA-48–like enzymes may test susceptible to meropenem-vaborbactam but may not respond to meropenem-vaborbactam *in vivo*. If an OXA-48–like gene or enzyme is detected, suppress meropenem-vaborbactam or report as resistant.
Piperacillin-tazobactam	100/10 µg	≥ 25	21–24	–	≤ 20	≤ 8/4	16/4	–	≥ 32/4	
Ticarcillin-clavulanate*	75/10 µg	≥ 20	–	15–19^	≤ 14	≤ 16/2	–	32/2–64/2^	≥ 128/2	

Table 2A-1. Enterobacterales (excluding *Salmonella* and *Shigella* spp.) (Continued)

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm				Interpretive Categories and MIC Breakpoints, µg/mL				Comments
		S	SDD	I	R	S	SDD	I	R	
CEPHEMS (PARENTERAL) (Including cephalosporins I, II, III, and IV. Please refer to Glossary I.)										
(14) Following evaluation of PK/PD properties, limited clinical data, and MIC distributions, revised breakpoints for cephalosporins (cefazolin, cefotaxime, ceftazidime, ceftizoxime, and ceftriaxone) and aztreonam were first published in January 2010 (CLSI M100-S20) and are listed in this table. Cefuroxime (parenteral) was also evaluated; however, no change in breakpoints was necessary for the dosage listed in Table 2 Dosages. When using current breakpoints, routine ESBL testing is not necessary before reporting results. However, in consultation with the antimicrobial stewardship team and other relevant institutional stakeholders, laboratories may decide to perform phenotypic or genotypic testing for ESBLs, and the results may be used to guide therapeutic management or for epidemiological or infection prevention purposes. Limitations of phenotypic and genotypic methods must be considered (see Table 3A introductory text).[4] Breakpoints for drugs with limited availability in many countries (eg, moxalactam, cefonicid, cefamandole, and cefoperazone) were not evaluated. If considering use of these drugs for *E. coli, Klebsiella pneumoniae* and *Klebsiella oxytoca*, or *Proteus* spp., ESBL testing should be performed (see Table 3A). If isolates test ESBL positive, the results for moxalactam, cefonicid, cefamandole, and cefoperazone should be reported as resistant. **(15)** Some Enterobacterales may develop resistance during therapy with third-generation cephalosporins as a result of derepression of AmpC β-lactamase. This derepression is most commonly seen with *Citrobacter freundii* complex, *Enterobacter cloacae* complex, and *Klebsiella* (formerly *Enterobacter*) *aerogenes*. Isolates that are initially susceptible may become resistant within a few days after initiation of therapy. Testing subsequent isolates may be warranted if clinically indicated. The approach to reporting AST results for these organisms should be determined in consultation with the antimicrobial stewardship team and other relevant institutional stakeholders. See Table 1A-1, footnotes b and c.[4]										
Cefazolin	30 µg	≥ 23	–	20–22	≤ 19	≤ 2	–	4	≥ 8	**(16)** Breakpoints when cefazolin is used for therapy of infections other than uncomplicated UTIs due to *E. coli, K. pneumoniae,* and *P. mirabilis*. See comment (14).
Cefazolin (U)[a]	30 µg	≥ 15	–	–	≤ 14	≤ 16	–	–	≥ 32	**(17)** Breakpoints when cefazolin is used for therapy of uncomplicated UTIs due to *E. coli, K. pneumoniae,* and *P. mirabilis*. See additional information in CEPHEMS (ORAL).
Ceftaroline	30 µg	≥ 23	–	20–22^	≤ 19	≤ 0.5	–	1^	≥ 2	

Table 2A-1. Enterobacterales (excluding *Salmonella* and *Shigella* spp.) (Continued)

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm				Interpretive Categories and MIC Breakpoints, µg/mL				Comments
		S	SDD	I	R	S	SDD	I	R	
CEPHEMS (PARENTERAL) (Including cephalosporins I, II, III, and IV. Please refer to Glossary I.) (Continued)										
Cefepime	30 µg	≥ 25	19–24	–	≤ 18	≤ 2	4–8	–	≥ 16	**(18)** Cefepime S/SDD results should be suppressed or edited and reported as resistant for isolates that demonstrate carbapenemase production (see Appendix G, Table G3).
Cefotaxime or ceftriaxone	30 µg 30 µg	≥ 26 ≥ 23	– –	23–25^ 20–22^	≤ 22 ≤ 19	≤ 1 ≤ 1	– –	2^ 2^	≥ 4 ≥ 4	See comment (14).
Cefotetan	30 µg	≥ 16	–	13–15^	≤ 12	≤ 16	–	32^	≥ 64	
Cefoxitin	30 µg	≥ 18	–	15–17^	≤ 14	≤ 8	–	16^	≥ 32	
Cefuroxime (parenteral)	30 µg	≥ 18	–	15–17^	≤ 14	≤ 8	–	16^	≥ 32	See comment (14).
Ceftazidime	30 µg	≥ 21	–	18–20^	≤ 17	≤ 4	–	8^	≥ 16	See comment (14).
Cefamandole*	30 µg	≥ 18	–	15–17^	≤ 14	≤ 8	–	16^	≥ 32	See comment (14).
Cefmetazole*	30 µg	≥ 16	–	13–15^	≤ 12	≤ 16	–	32^	≥ 64	**(19)** Insufficient new data exist to reevaluate breakpoints listed here.
Cefonicid*	30 µg	≥ 18	–	15–17^	≤ 14	≤ 8	–	16^	≥ 32	See comment (14).
Cefoperazone*	75 µg	≥ 21	–	16–20	≤ 15	≤ 16	–	32	≥ 64	See comment (14).
Ceftizoxime*	30 µg	≥ 25	–	22–24^	≤ 21	≤ 1	–	2^	≥ 4	See comment (14).
Moxalactam*	30 µg	≥ 23	–	15–22^	≤ 14	≤ 8	–	16–32^	≥ 64	See comment (14).
Cefiderocol	30 µg	≥ 16	–	9–15^	≤ 8	≤ 4	–	8^	≥ 16	**(20)** The accuracy and reproducibility of cefiderocol testing results by disk diffusion and broth microdilution are markedly affected by iron concentration and inoculum preparation and may vary by disk and media manufacturer. Depending on the type of variance observed, false-resistant or false-susceptible results may occur. Testing subsequent isolates is encouraged. Discussion with prescribers and antimicrobial stewardship members regarding the potential for inaccuracies is recommended.

Table 2A-1. Enterobacterales (excluding *Salmonella* and *Shigella* spp.) (Continued)

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm				Interpretive Categories and MIC Breakpoints, µg/mL				Comments
		S	SDD	I	R	S	SDD	I	R	
CARBAPENEMS										
(25) Following evaluation of PK/PD properties, limited clinical data, and MIC distributions that include recently described carbapenemase-producing strains, revised breakpoints for carbapenems were first published in June 2010 (CLSI M100-S20-U) and are listed below. Because of limited treatment options for infections caused by organisms with carbapenem MICs or zone diameters in the intermediate range, clinicians may wish to design carbapenem dosage regimens that use maximum recommended doses and possibly prolonged IV infusion regimens, as has been reported in the literature.[5-8] Consultation with an infectious diseases specialist is recommended for isolates for which the carbapenem MICs or zone diameter results from disk diffusion testing are in the intermediate or resistant ranges. **Isolates resistant to any carbapenem tested (eg, ertapenem, imipenem, meropenem) should be tested for a carbapenemase using phenotypic and/or molecular assays. An exception to this recommendation is *Proteus, Providencia,* and *Morganella* spp. that are only resistant to imipenem. These assays should identify and ideally differentiate the presence of specific carbapenemase types (eg, KPC, NDM, OXA-48, VIM, IMP).** **Decisions related to carbapenemase testing and reporting are best made by each laboratory in consultation with the antimicrobial stewardship team and other relevant institutional stakeholders.** **These results do not replace antimicrobial susceptibility testing, but are important for treatment decisions, and to inform infection control and prevention interventions and/or epidemiologic investigations.** **Depending on local epidemiology and available resources, carbapenemase testing for *E. cloacae* complex and *K. aerogenes* isolates that are only resistant to ertapenem might not be necessary. Ertapenem resistance in these species is often due to mechanisms other than carbapenemase production and carbapenemases are currently uncommon in such isolates.** See Appendix G, Table G3 regarding suggestions for reporting when mechanism of resistance-based testing (molecular and phenotypic methods) is discordant with phenotypic AST. The following information is provided as background on carbapenemases in Enterobacterales that are largely responsible for MICs and zone diameters in the intermediate and resistant ranges, and thus the rationale for setting revised carbapenem breakpoints: • The clinical effectiveness of carbapenem treatment of infections produced by isolates for which the carbapenem MIC or disk diffusion test results are within the intermediate range is uncertain due to lack of controlled clinical studies. Imipenem MICs for *Proteus* spp., *Providencia* spp., and *Morganella morganii* tend to be higher (eg, MICs in the intermediate or resistant range) than meropenem or doripenem MICs. These isolates may have elevated imipenem MICs by mechanisms other than production of carbapenemases.										
Doripenem*	10 µg	≥ 23	–	20–22^	≤ 19	≤ 1	–	2^	≥ 4	
Ertapenem	10 µg	≥ 22	–	19–21^	≤ 18	≤ 0.5	–	1^	≥ 2	
Imipenem	10 µg	≥ 23	–	20–22^	≤ 19	≤ 1	–	2^	≥ 4	
Meropenem	10 µg	≥ 23	–	20–22^	≤ 19	≤ 1	–	2^	≥ 4	

Table 2A-1. Enterobacterales (excluding *Salmonella* and *Shigella* spp.) (Continued)

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm				Interpretive Categories and MIC Breakpoints, µg/mL				Comments
		S	SDD	I	R	S	SDD	I	R	
CEPHEMS (ORAL)										
Cefazolin (U)[a] (surrogate test for oral cephalosporins and uncomplicated UTIs)	30 µg	≥ 15	–	–	≤ 14	≤ 16	–	–	≥ 32	**(21)** Breakpoints are for cefazolin when used as a surrogate test to predict results for the oral agents cefaclor, cefdinir, cefpodoxime, cefprozil, cefuroxime, cephalexin, and loracarbef when used for therapy of uncomplicated UTIs due to *E. coli, K. pneumoniae,* and *P. mirabilis*. Cefazolin tested as a surrogate may overcall resistance to cefdinir, cefpodoxime, and cefuroxime. If cefazolin tests resistant, test these drugs individually if needed for therapy.
Cefuroxime (oral)	30 µg	≥ 23	–	15–22^	≤ 14	≤ 4	–	8–16^	≥ 32	See comment (21).
Loracarbef*	30 µg	≥ 18	–	15–17^	≤ 14	≤ 8	–	16^	≥ 32	**(22)** Do not test *Citrobacter, Providencia,* or *Enterobacter* spp. with cefdinir or loracarbef by disk diffusion because false-susceptible results have been reported. See comment (21).
Cefaclor*	30 µg	≥ 18	–	15–17^	≤ 14	≤ 8	–	16^	≥ 32	See comment (21).
Cefdinir*	5 µg	≥ 20	–	17–19^	≤ 16	≤ 1	–	2^	≥ 4	See comments (21) and (22).
Cefixime*	5 µg	≥ 19	–	16–18^	≤ 15	≤ 1	–	2^	≥ 4	**(23)** Do not test *Morganella* spp. with cefixime, cefpodoxime, or cefetamet by disk diffusion.
Cefpodoxime*	10 µg	≥ 21	–	18–20^	≤ 17	≤ 2	–	4^	≥ 8	See comments (21) and (23).
Cefprozil*	30 µg	≥ 18	–	15–17^	≤ 14	≤ 8	–	16^	≥ 32	**(24)** Do not test *Providencia* spp. with cefprozil by disk diffusion because false-susceptible results have been reported. See comment (21).
Cefetamet (Inv.)	10 µg	≥ 18	–	15–17^	≤ 14	≤ 4	–	8^	≥ 16	See comment (23).
Ceftibuten (U, Inv.)[a]	30 µg	≥ 21	–	18–20^	≤ 17	≤ 8	–	16^	≥ 32	
MONOBACTAMS										
Aztreonam	30 µg	≥ 21	–	18–20^	≤ 17	≤ 4	–	8^	≥ 16	See comment (14).

Table 2A-1. Enterobacterales (excluding *Salmonella* and *Shigella* spp.) (Continued)

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm				Interpretive Categories and MIC Breakpoints, µg/mL				Comments
		S	SDD	I	R	S	SDD	I	R	
LIPOPEPTIDES										
(26) WARNING: Clinical and PK/PD data demonstrate colistin and polymyxin B have limited clinical efficacy, even if an intermediate result is obtained. Alternative agents are strongly preferred. Colistin and polymyxin B should be used in combination with one or more active antimicrobial agents. Consultation with an infectious diseases specialist is recommended. **(27)** Several species are intrinsically resistant to the lipopeptides (colistin and polymyxin B). Refer to Appendix B.										
Colistin or polymyxin B*	– –	– –	– –	– –	– –	– –	– –	≤ 2 ≤ 2	≥ 4 ≥ 4	**(28)** Colistin (methanesulfonate) should be given with a loading dose and maximum renally adjusted doses (see international consensus guidelines[9]). **(29)** Polymyxin B should be given with a loading dose and maximum recommended doses (see international consensus guidelines[9]). **(30)** When colistin or polymyxin B is given systemically, neither is likely to be effective for pneumonia. **(31)** For colistin, broth microdilution, CBDE, and CAT MIC methods are acceptable. For polymyxin B, broth microdilution is the only approved method. Disk diffusion and gradient diffusion methods should not be performed (see Table 3E).
AMINOGLYCOSIDES										
(32) Breakpoints for gentamicin, tobramycin, and amikacin are based on population distributions of various species, PK/PD target attainment analyses with an end point of net bacterial stasis and limited clinical data. Clinical outcomes data for aminoglycosides as monotherapy for systemic infections are limited and have resulted in worse treatment outcomes (for infections outside of the urinary tract) compared with other therapies. Combination therapy for most indications other than UTIs should be considered. Consultation with an infectious diseases specialist is recommended.										
Gentamicin	10 µg	≥ 18	–	15–17^	≤ 14	≤ 2	–	4^	≥ 8	
Tobramycin	10 µg	≥ 17	–	13–16^	≤ 12	≤ 2	–	4^	≥ 8	
Amikacin	30 µg	≥ 20	–	17–19^	≤ 16	≤ 4	–	8^	≥ 16	

Table 2A-1. Enterobacterales (excluding *Salmonella* and *Shigella* spp.) (Continued)

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm				Interpretive Categories and MIC Breakpoints, µg/mL				Comments
		S	SDD	I	R	S	SDD	I	R	
AMINOGLYCOSIDES (Continued)										
Plazomicin	30 µg	≥ 18	–	15–17^	≤ 14	≤ 2	–	4^	≥ 8	See comment (12).
Kanamycin*	30 µg	≥ 18	–	14–17^	≤ 13	≤ 16	–	32^	≥ 64	
Netilmicin*	30 µg	≥ 15	–	13–14^	≤ 12	≤ 8	–	16^	≥ 32	
Streptomycin*	10 µg	≥ 15	–	12–14^	≤ 11	–	–	–	–	
TETRACYCLINES										
(33) Isolates that **test** susceptible to tetracycline are considered susceptible to doxycycline and minocycline. **Isolates** that **test** intermediate or resistant to tetracycline **should be tested against doxycycline or minocycline if those results are needed for treatment.**										
Tetracycline	30 µg	≥ 15	–	12–14	≤ 11	≤ 4	–	8	≥ 16	
Doxycycline*	30 µg	≥ 14	–	11–13	≤ 10	≤ 4	–	8	≥ 16	
Minocycline*	30 µg	≥ 16	–	13–15	≤ 12	≤ 4	–	8	≥ 16	
QUINOLONES AND FLUOROQUINOLONES (Please refer to Glossary I.)										
Ciprofloxacin Levofloxacin	5 µg 5 µg	≥ 26 ≥ 21	– –	22–25^ 17–20^	≤ 21 ≤ 16	≤ 0.25 ≤ 0.5	– –	0.5^ 1^	≥ 1 ≥ 2	
Cinoxacin* (U)[a]	100 µg	≥ 19	–	15–18^	≤ 14	≤ 16	–	32^	≥ 64	
Enoxacin* (U)[a]	10 µg	≥ 18	–	15–17^	≤ 14	≤ 2	–	4^	≥ 8	
Gatifloxacin*	5 µg	≥ 18	–	15–17^	≤ 14	≤ 2	–	4^	≥ 8	
Gemifloxacin*	5 µg	≥ 20	–	16–19	≤ 15	≤ 0.25	–	0.5	≥ 1	**(34)** Report only on *K. pneumoniae*.
Grepafloxacin*	5 µg	≥ 18	–	15–17	≤ 14	≤ 1	–	2	≥ 4	
Lomefloxacin*	10 µg	≥ 22	–	19–21^	≤ 18	≤ 2	–	4^	≥ 8	
Nalidixic acid* (U)[a]	30 µg	≥ 19	–	14–18	≤ 13	≤ 16	–	–	≥ 32	
Norfloxacin* (U)[a]	10 µg	≥ 17	–	13–16	≤ 12	≤ 4	–	8	≥ 16	
Ofloxacin*	5 µg	≥ 16	–	13–15^	≤ 12	≤ 2	–	4^	≥ 8	
Fleroxacin (Inv.)	5 µg	≥ 19	–	16–18^	≤ 15	≤ 2	–	4^	≥ 8	

Table 2A-1. Enterobacterales (excluding *Salmonella* and *Shigella* spp.) (Continued)

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm				Interpretive Categories and MIC Breakpoints, µg/mL				Comments
		S	SDD	I	R	S	SDD	I	R	
FOLATE PATHWAY ANTAGONISTS										
Trimethoprim-sulfamethoxazole	1.25/23.75 µg	≥ 16	–	11–15	≤ 10	≤ 2/38	–	–	≥ 4/76	
Sulfonamides* (U)[a]	250 or 300 µg	≥ 17	–	13–16	≤ 12	≤ 256	–	–	≥ 512	
Trimethoprim* (U)[a]	5 µg	≥ 16	–	11–15	≤ 10	≤ 8	–	–	≥ 16	
PHENICOLS										
Chloramphenicol*	30 µg	≥ 18	–	13–17	≤ 12	≤ 8	–	16	≥ 32	**(35)** Not routinely reported on isolates from the urinary tract.
FOSFOMYCINS										
Fosfomycin (U)[a]	200 µg	≥ 16	–	13–15	≤ 12	≤ 64	–	128	≥ 256	**(36)** Disk diffusion and MIC breakpoints apply only to *E. coli* urinary tract isolates and should not be extrapolated to other species of Enterobacterales. **(37)** The 200-µg fosfomycin disk contains 50 µg glucose-6-phosphate. **(38)** The only approved MIC method for testing is agar dilution using agar media supplemented with 25 µg/mL of glucose-6-phosphate. Broth dilution MIC testing should not be performed.
NITROFURANS										
Nitrofurantoin (U)[a]	300 µg	≥ 17	–	15–16	≤ 14	≤ 32	–	64	≥ 128	

Abbreviations: AST, antimicrobial susceptibility testing; CAMHB, cation-adjusted Mueller-Hinton broth; CAT, colistin agar test; CBDE, colistin broth disk elution; ESBL, extended-spectrum β-lactamase; I, intermediate; Inv., investigational agent; IV, intravenous; MHA, Mueller-Hinton agar; MIC, minimal inhibitory concentration; PK/PD, pharmacokinetic/pharmacodynamic; QC, quality control; R, resistant; S, susceptible; SDD, susceptible-dose dependent; U, urine; UTI, urinary tract infection.
Symbols: ^, designation for agents that have the potential to concentrate in the urine; *, designation for "Other" agents that are not included in Tables 1 but have established clinical breakpoints.

Table 2A-1. Enterobacterales (excluding *Salmonella* and *Shigella* spp.) (Continued)

Footnote

a. Report only on organisms isolated from the urinary tract.

References for Table 2A-1

1 Hackel MA, Tsuji M, Yamano Y, Echols R, Karlowsky JA, Sahm DF. Reproducibility of broth microdilution MICs for the novel siderophore cephalosporin, cefiderocol, determined using iron-depleted cation-adjusted Mueller-Hinton broth. *Diagn Microbiol Infect Dis.* 2019;94(4):321-325. doi:10.1016/j.diagmicrobio.2019.03.003

2 CLSI. *Performance Standards for Antimicrobial Disk Susceptibility Tests.* 14th ed. CLSI standard M02. Clinical and Laboratory Standards Institute; 2024.

3 CLSI. *M02 Disk Diffusion Reading Guide.* 2nd ed. CLSI quick guide M02-Ed14-QG. Clinical and Laboratory Standards Institute; 2024.

4 Tamma PD, Aitken SL, Bonomo RA, Mathers AJ, van Duin D, Clancy CJ. IDSA 2024 guidance on the treatment of antimicrobial resistant gram-negative infections. Accessed 15 October 2024. https://www.idsociety.org/practice-guideline/amr-guidance/

5 Perrott J, Mabasa VH, Ensom MHH. Comparing outcomes of meropenem administration strategies based on pharmacokinetic and pharmacodynamic principles: a qualitative systematic review. *Ann Pharmacother.* 2010;44(3):557-564. doi:10.1345/aph.1M339

6 Cirillo I, Vaccaro N, Turner K, Solanki B, Natarajan J, Redman R. Pharmacokinetics, safety, and tolerability of doripenem after 0.5-, 1-, and 4-hour infusions in healthy volunteers. *J Clin Pharmacol.* 2009;49(7):798-806. doi:10.1177/0091270009337012

7 Sakka SG, Glauner AK, Bulitta JB, et al. Population pharmacokinetics and pharmacodynamics of continuous versus short-term infusion of imipenem-cilastatin in critically ill patients in a randomized, controlled trial. *Antimicrob Agents Chemother.* 2007;51(9):3304-3310. doi:10.1128/AAC.01318-06

8 Peleg AY, Hooper DC. Hospital-acquired infections due to gram-negative bacteria. *N Engl J Med.* 2010;362(19):1804-1813. doi:10.1056/NEJMra0904124

9 Tsuji BT, Pogue JM, Zavascki AP, et al. International consensus guidelines for the optimal use of the polymyxins: endorsed by the American College of Clinical Pharmacy (ACCP), European Society of Clinical Microbiology and Infectious Diseases (ESCMID), Infectious Diseases Society of America (IDSA), International Society for Anti-Infective Pharmacology (ISAP), Society of Critical Care Medicine (SCCM), and Society of Infectious Diseases Pharmacists (SIDP). *Pharmacotherapy.* 2019;39(1):10-39. doi:10.1002/phar.2209