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Table 2A. Zone Diameter and MIC Breakpoints for Enterobacterales

Testing Conditions

Medium: Disk diffusion: MHA
Broth dilution: CAMHB; iron-depleted CAMHB for cefiderocol (see Appendix I)[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 [6]).

Incubation: 35°C ± 2°C; ambient air
Disk diffusion: 16–18 hours
Dilution methods: 16–20 hours

Routine QC Recommendations (see Tables 4A-1 and 5A-1 for acceptable QC ranges)

Escherichia coli ATCC®[a] 25922
Pseudomonas aeruginosa ATCC® 27853 (for carbapenems)
Staphylococcus aureus ATCC® 25923 (for disk diffusion) or *S. aureus* ATCC® 29213 (for dilution methods) when testing azithromycin against *Salmonella enterica* ser. Typhi *or Shigella* spp.
Refer to Tables 4A-2 and 5A-2 to select strains for routine QC of β-lactam combination agents.

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

Refer to Tables 3A, 3B, and 3C for additional testing, reporting, and QC for Enterobacterales.

General Comments

(1) Refer to Tables 1A-1B 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 M02,[2] Subchapter 3.6). 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 the *M02 Disk Diffusion Reading Guide*[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) When fecal isolates of *Salmonella* and *Shigella* spp. are tested, only ampicillin, a fluoroquinolone, and trimethoprim-sulfamethoxazole should be reported routinely. Data regarding whether amoxicillin should be used to treat shigellosis are conflicting. When reporting ampicillin results, state that treatment of shigellosis with amoxicillin might **have poorer efficacy compared with treatment with ampicillin.** In addition, for extraintestinal isolates of *Salmonella* spp., a third-generation cephalosporin should be tested and reported, and chloramphenicol may be tested and reported if requested. Susceptibility testing is indicated for typhoidal *Salmonella* (*S. enterica* ser. Typhi and *S. enterica* ser. Paratyphi A–C) isolated from extraintestinal and intestinal sources. Routine susceptibility testing is not indicated for nontyphoidal *Salmonella* spp. isolated from intestinal sources. In contrast, susceptibility testing is indicated for all *Shigella* isolates.

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Table 2A. Enterobacterales (Continued)

(4) The dosage regimens shown in the comments column below are those needed to achieve plasma drug exposures (in adults with normal renal and hepatic functions) on which breakpoints were based. When implementing new breakpoints, it is strongly recommended that laboratories share this information with the antimicrobial stewardship team **and other relevant institutional stakeholders.**

(5) 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.

(6) 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 3E-1 and applying breakpoints in Table 3E-2). For antimicrobial agents not listed in Table 3E-2 for Enterobacterales, CLSI has not yet evaluated this direct disk diffusion method.

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

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Table 2A. Enterobacterales (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	
PENICILLINS										
Ampicillin	10 µg	≥ 17	-	14-16^	≤ 13	≤ 8	-	16^	≥ 32	**(7)** Results of ampicillin testing can be used to predict results for amoxicillin. **(8)** Breakpoints are based on an ampicillin dosage regimen of 2 g parenterally administered every 4-6 h or an amoxicillin dosage regimen of 1-2 g parenterally administered every 6 h. **(9)** Breakpoints when oral ampicillin is used **only** for therapy of **salmonellosis, shigellosis, or** uncomplicated UTIs due to *E. coli* **and** *P. mirabilis* are based on an ampicillin dosage regimen of 500 mg orally administered every 6 h or an amoxicillin dosage regimen of 250 mg orally administered every 8 h or 500 mg every 12 h. See general comment (3).
Piperacillin*		-	-	-	-	≤ 8	16	-	≥ 32	**(10)** 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*	10 µg	≥ 15	-	12-14^	≤ 11	≤ 8	-	16^	≥ 32	**(11)** For testing and reporting of *E. coli* urinary tract isolates only.

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Table 2A. Enterobacterales (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										
(12) 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	**(13)** Breakpoints are based on a dosage regimen of 1.2 g IV administered every 6 h. **(14)** Breakpoints when amoxicillin-clavulanate is used for therapy of uncomplicated UTIs or for completion of therapy for systemic infection are based on a dosage regimen of either 875/125 mg administered orally every 12 h or 500/125 mg every 8 h.
Ampicillin-sulbactam	10/10 µg	≥ 15	-	12-14^	≤ 11	≤ 8/4	-	16/8^	≥ 32/16	**(15)** Breakpoints are based on a dosage regimen of 3 g administered parenterally every 6 h.
Ceftolozane-tazobactam	30/10 µg	≥ 22	-	19-21^	≤ 18	≤ 2/4	-	4/4^	≥ 8/4	**(16)** Breakpoints are based on a dosage regimen of 3 g administered every 8 h for pneumonia and 1.5 g administered every 8 h for other indications.
Ceftazidime-avibactam	30/20 µg	≥ 21	-	-	≤ 20	≤ 8/4	-	-	≥ 16/4	**(17)** Breakpoints are based on a dosage regimen of 2.5 g every 8 h administered over 2 h. **(18)** 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	**(19)** Breakpoints are based on a dosage regimen of 1.25 g administered every 6 h. **(20)** Breakpoints do not apply to the family Morganellaceae, which includes but is not limited to the genera *Morganella*, *Proteus*, and *Providencia*.

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Table 2A. Enterobacterales (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	
ß-LACTAM COMBINATION AGENTS (Continued)										
Meropenem-vaborbactam	20/10 µg	≥ 18	-	15-17^	≤ 14	≤ 4/8	-	8/8^	≥ 16/8	**(21)** Breakpoints are based on a dosage regimen of 4 g every 8 h administered over 3 h.
Piperacillin-tazobactam	100/10 µg	≥ 25	21-24		≤ 20	≤ 8/4	16/4		≥ 32/4	**(22)** Breakpoints for susceptible are based on a dosage regimen of 3.375-4.5 g administered every 6 h as a 30-minute infusion. Breakpoints for SDD are based on a dosage regimen of 4.5 g administered every 6 h as a 3-h infusion or 4.5 g administered every 8 h as a 4-h infusion.
Ticarcillin-clavulanate*	75/10 µg	≥ 20	-	15-19^	≤ 14	≤ 16/2	-	32/2-64/2^	≥ 128/2	
CEPHEMS (PARENTERAL) (Including cephalosporins I, II, III, and IV. Please refer to Glossary I.)										
(23) WARNING: For *Salmonella* spp. and *Shigella* spp., first- and second-generation cephalosporins and cephamycins may appear active *in vitro* but are not effective clinically and should not be reported as susceptible. **(24)** 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 (M100-S20) and are listed in this table. Cefuroxime (parenteral) was also evaluated; however, no change in breakpoints was necessary for the dosage indicated below. 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*, ***K. pneumoniae*** **and** ***K. 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. **(25) Some Enterobacterales may develop resistance during therapy with third-generation cephalosporins as a result of derepression of AmpC ß-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, footnotes b and c.[4]**									

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Table 2A. Enterobacterales (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)										
Cefazolin	30 µg	≥ 23	-	20-22	≤ 19	≤ 2	-	4	≥ 8	**(26)** Breakpoints when cefazolin is used for therapy of infections other than uncomplicated UTIs due to *E. coli*, *K. pneumoniae*, and *P. mirabilis*. Breakpoints are based on a dosage regimen of 2 g administered every 8 h. See comment (24).
Cefazolin **(U)**[b]	30 µg	≥ 15	-	-	≤ 14	≤ 16	-	-	≥ 32	**(27)** Breakpoints when cefazolin is used for therapy of uncomplicated UTIs due to *E. coli*, *K. pneumoniae*, and *P. mirabilis*. Breakpoints are based on a dosage regimen of 1 g administered every 12 h. See additional information in CEPHEMS (ORAL).
Ceftaroline	30 µg	≥ 23	-	20-22^	≤ 19	≤ 0.5	-	1^	≥ 2	**(28)** Breakpoints are based on a dosage regimen of 600 mg administered every 12 h.
Cefepime	30 µg	≥ 25	19-24	-	≤ 18	≤ 2	4-8	-	≥ 16	**(29)** The breakpoint for susceptible is based on a dosage regimen of 1 g administered every 12 h. The breakpoint for SDD is based on dosage regimens that result in higher cefepime exposure, either higher doses or more frequent doses or both, up to approved maximum dosage regimens. See Appendix E for more information about breakpoints and dosage regimens. Also see the definition of SDD in the Instructions for Use of Tables section.
Cefotaxime or ceftriaxone	30 µg 30 µg	≥ 26 ≥ 23	-	23-25^ 20-22^	≤ 22 ≤ 19	≤ 1 ≤ 1	-	2^ 2^	≥ 4 ≥ 4	**(30)** Breakpoints are based on a dosage regimen of 1 g administered every 24 h for ceftriaxone and 1 g administered every 8 h for cefotaxime. See comment (24).

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Table 2A. Enterobacterales (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)										
Cefotetan	30 µg	≥ 16	-	13-15^	≤ 12	≤ 16	-	32^	≥ 64	
Cefoxitin	30 µg	≥ 18	-	15-17^	≤ 14	≤ 8	-	16^	≥ 32	**(31)** Breakpoints are based on a dosage regimen of at least 8 g per day (eg, 2 g administered every 6 h).
Cefuroxime (parenteral)	30 µg	≥ 18	-	15-17^	≤ 14	≤ 8	-	16^	≥ 32	**(32)** Breakpoints are based on a dosage regimen of 1.5 g administered every 8 h. See comment (24).
Ceftazidime	30 µg	≥ 21	-	18-20^	≤ 17	≤ 4	-	8^	≥ 16	**(33)** Breakpoints are based on a dosage regimen of 1 g administered every 8 h. See comment (24).
Cefamandole*	30 µg	≥ 18	-	15-17^	≤ 14	≤ 8	-	16^	≥ 32	See comment (24).
Cefmetazole*	30 µg	≥ 16	-	13-15^	≤ 12	≤ 16	-	32^	≥ 64	**(34)** Insufficient new data exist to reevaluate breakpoints listed here.
Cefonicid*	30 µg	≥ 18	-	15-17^	≤ 14	≤ 8	-	16^	≥ 32	See comment (24).
Cefoperazone*	75 µg	≥ 21	-	16-20	≤ 15	≤ 16	-	32	≥ 64	See comment (24).
Ceftizoxime*	30 µg	≥ 25	-	22-24^	≤ 21	≤ 1	-	2^	≥ 4	**(35)** Breakpoints are based on a dosage regimen of 1 g administered every 12 h. See comment (24).
Moxalactam*	30 µg	≥ 23	-	15-22^	≤ 14	≤ 8	-	16-32^	≥ 64	See comment (24).
Cefiderocol	30 µg	≥ 16	-	9-15^	≤ 8	≤ 4	-	8^	≥ 16	**(36)** Breakpoints are based on a dosage regimen of 2 g every 8 h administered over 3 h. **(37) 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.**

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Table 2A. Enterobacterales (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)										
Cefuroxime (oral)	30 µg	≥ 23	-	15-22^	≤ 14	≤ 4		8-16^	≥ 32	See comment (38).
Cefazolin **(U)**[b] (surrogate test for oral cephalosporins and uncomplicated UTIs)	30 µg	≥ 15	-	-	≤ 14	≤ 16	-	-	≥ 32	**(38)** 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.
Loracarbef*****	30 µg	≥ 18	-	15-17^	≤ 14	≤ 8	-	16^	≥ 32	**(39)** Do not test *Citrobacter*, *Providencia*, or *Enterobacter* spp. with cefdinir or loracarbef by disk diffusion because false-susceptible results have been reported. See comment (38).
Cefaclor*****	30 µg	≥ 18	-	15-17^	≤ 14	≤ 8	-	16^	≥ 32	See comment (38).
Cefdinir*****	5 µg	≥ 20	-	17-19^	≤ 16	≤ 1	-	2^	≥ 4	See comments (38) and (39).
Cefixime*****	5 µg	≥ 19	-	16-18^	≤ 15	≤ 1	-	2^	≥ 4	**(40)** 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 (38) and (40).
Cefprozil*****	30 µg	≥ 18	-	15-17^	≤ 14	≤ 8	-	16^	≥ 32	**(41)** Do not test *Providencia* spp. with cefprozil by disk diffusion because false-susceptible results have been reported. See comment (38).
Cefetamet **(Inv.)**	10 µg	≥ 18	-	15-17^	≤ 14	≤ 4	-	8^	≥ 16	See comment (40).
Ceftibuten **(U, Inv.)**[b]	30 µg	≥ 21	-	18-20^	≤ 17	≤ 8	-	16^	≥ 32	

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Table 2A. Enterobacterales (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	
MONOBACTAMS										
Aztreonam	30 µg	≥ 21	-	18-20^	≤ 17	≤ 4	-	8^	≥ 16	**(42)** Breakpoints are based on a dosage regimen of 1 g administered every 8 h. See comment (24).
CARBAPENEMS										
(43) 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 (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 intravenous 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. **Institutional treatment guidelines, infection prevention procedures, or epidemiological investigations may necessitate identification of carbapenemase-producing Enterobacterales. Isolates with elevated carbapenem MICs (intermediate or resistant) can be tested for carbapenemase production by a phenotypic and/or a molecular assay (refer to Tables 3B and 3C for methods). See Appendix H, Table H3 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	**(44)** Breakpoints are based on a dosage regimen of 500 mg administered every 8 h.
Ertapenem	10 µg	≥ 22	-	19-21^	≤ 18	≤ 0.5	-	1^	≥ 2	**(45)** Breakpoints are based on a dosage regimen of 1 g administered every 24 h.
Imipenem	10 µg	≥ 23	-	20-22^	≤ 19	≤ 1	-	2^	≥ 4	**(46)** Breakpoints are based on a dosage regimen of 500 mg administered every 6 h or 1 g every 8 h.
Meropenem	10 µg	≥ 23	-	20-22^	≤ 19	≤ 1	-	2^	≥ 4	**(47)** Breakpoints are based on a dosage regimen of 1 g administered every 8 h.

Table 2A. Enterobacterales (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										
(48) 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. **(49)** Several species are intrinsically resistant to the lipopeptides (colistin and polymyxin B). Refer to Appendix B.										
Colistin or polymyxin B*		- -	- -	- -	- -	- -	- -	≤ 2 ≤ 2	≥ 4 ≥ 4	**(50)** Colistin (methanesulfonate) should be given with a loading dose and maximum renally adjusted doses (see International Consensus Guidelines[9]). **(51)** Polymyxin B should be given with a loading dose and maximum recommended doses (see International Consensus Guidelines[9]). **(52)** When colistin or polymyxin B is given systemically, neither is likely to be effective for pneumonia. **(53)** 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 3D).

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Table 2A. Enterobacterales (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										
(54) WARNING: For *Salmonella* spp. and *Shigella* spp., aminoglycosides may appear active *in vitro* but are not effective clinically and should not be reported as susceptible. **(55) 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**	**(56) Breakpoints are based on a dosage regimen of 7 mg/kg parenterally administered every 24 h.**
Tobramycin	10 µg	**≥ 17**	-	13-**16^**	≤ 12	**≤ 2**	-	**4^**	**≥ 8**	**(57) Breakpoints are based on a dosage regimen of 7 mg/kg parenterally administered every 24 h.**
Amikacin	30 µg	**≥ 20**	-	**17-19^**	**≤ 16**	**≤ 4**	-	**8^**	**≥ 16**	**(58) Breakpoints are based on a dosage regimen of 15 mg/kg parenterally administered every 24 h.**
Plazomicin	**30 µg**	**≥ 18**	**-**	**15-17^**	**≤ 14**	**≤ 2**	**-**	**4^**	**≥ 8**	**(59) Breakpoints are based on a dosage regimen of 15 mg/kg every 24 h over 30 minutes.** **See comment (20).**
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	-	-	-	-	
MACROLIDES										
Azithromycin	15 µg	≥ 13	-	-	≤ 12	≤ 16	-	-	≥ 32	**(60)** *S. enterica* ser. Typhi only: breakpoints are based on MIC distribution data and limited clinical data. **(61)** Breakpoints are based on a dosage regimen of 500 mg administered daily.
		≥ 16	-	11-15	≤ 10	≤ 8	-	16	≥ 32	**(62)** *Shigella* spp. only: azithromycin disk diffusion zones can be hazy and difficult to measure, especially *S. sonnei*. If an isolate has a zone of inhibition that is difficult to measure, an MIC method is recommended. Media source may affect the clarity of the end points for disk diffusion tests. See comment (61).

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Table 2A. Enterobacterales (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	
TETRACYCLINES										
(63) Organisms that are susceptible to tetracycline are also considered susceptible to doxycycline and minocycline. However, some organisms that are intermediate or resistant to tetracycline may be susceptible to doxycycline, minocycline, or both.										
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 for Enterobacterales except *Salmonella* spp. (Please refer to Glossary I.)										
Ciprofloxacin	5 µg	≥ 26	-	22-25^	≤ 21	≤ 0.25	-	0.5^	≥ 1	**(64)** Breakpoints for ciprofloxacin are based on a dosage regimen of 400 mg IV or 500 mg orally administered every 12 h.
Levofloxacin	5 µg	≥ 21		17-20^	≤ 16	≤ 0.5	-	1^	≥ 2	**(65)** Breakpoints for levofloxacin are based on a dosage regimen of 750 mg administered every 24 h.
Cinoxacin* **(U)**[b]	100 µg	≥ 19	-	15-18^	≤ 14	≤ 16	-	32^	≥ 64	
Enoxacin* **(U)**[b]	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	**(66) 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)**[b]	30 µg	≥ 19	-	14-18	≤ 13	≤ 16	-	-	≥ 32	
Norfloxacin* **(U)**[b]	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	

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Table 2A. Enterobacterales (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	
QUINOLONES AND FLUOROQUINOLONES for *Salmonella* spp. (Please refer to Glossary I.)										
(67) For testing and reporting of *Salmonella* spp. (including *S. enterica* ser. Typhi and *S. enterica* ser. Paratyphi A-C). Routine susceptibility testing is not indicated for nontyphoidal *Salmonella* spp. isolated from intestinal sources. **(68)** The preferred test for assessing fluoroquinolone susceptibility or resistance in *Salmonella* spp. is a ciprofloxacin MIC test. A levofloxacin or ofloxacin MIC test can be performed if either agent, respectively, is the fluoroquinolone of choice in a specific facility. If a ciprofloxacin, levofloxacin, or ofloxacin MIC or ciprofloxacin disk diffusion test cannot be done, pefloxacin disk diffusion may be used as surrogate test to predict ciprofloxacin susceptibility. **(69)** No single test detects resistance resulting from all possible fluoroquinolone resistance mechanisms that have been identified in *Salmonella* spp.										
Ciprofloxacin Levofloxacin	5 µg -	≥ 31 -	- -	21-30^ -	≤ 20 -	≤ 0.06 ≤ 0.12	- -	0.12-0.5 ^ 0.25-1^	≥ 1 ≥ 2	**(70)** Isolates of *Salmonella* spp. that test not susceptible to ciprofloxacin, levofloxacin, ofloxacin, or pefloxacin may be associated with clinical failure or delayed response in fluoroquinolone-treated patients with salmonellosis.
Ofloxacin	-	-	-	-	-	≤ 0.12	-	0.25-1^	≥ 2	
Pefloxacin **(Inv.)** (surrogate test for ciprofloxacin)	5 µg	≥ 24	-	-	≤ 23	-	-	-	-	**(71)** Report results as ciprofloxacin susceptible or resistant based on the pefloxacin test result. Pefloxacin will not detect resistance in *Salmonella* spp. due to *aac(6')-Ib-cr*. Pefloxacin disks are not available in the United States. See comment (69).
FOLATE PATHWAY ANTAGONISTS										
Trimethoprim-sulfamethoxazole	1.25/ 23.75 µg	≥ 16	-	11-15	≤ 10	≤ 2/38	-	-	≥ 4/76	See general comment (3).
Sulfonamides***** **(U)**[b]	250 or 300 µg	≥ 17	-	13-16	≤ 12	≤ 256	-	-	≥ 512	**(72)** Sulfisoxazole can be used to represent any of the currently available sulfonamide preparations.
Trimethoprim***** **(U)**[b]	5 µg	≥ 16	-	11-15	≤ 10	≤ 8	-	-	≥ 16	
PHENICOLS										
Chloramphenicol*****	30 µg	≥ 18	-	13-17	≤ 12	≤ 8	-	16	≥ 32	**(73)** Not routinely reported on isolates from the urinary tract.

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Table 2A. Enterobacterales (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	
FOSFOMYCINS										
Fosfomycin **(U)**[b]	200 µg	≥ 16	-	13-15	≤ 12	≤ 64	-	128	≥ 256	**(74)** Disk diffusion and MIC breakpoints apply only to *E. coli* urinary tract isolates and should not be extrapolated to other species of Enterobacterales. **(75)** The 200-µg fosfomycin disk contains 50 µg glucose-6-phosphate. **(76)** 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)**[b]	300 µg	≥ 17	-	15-16	≤ 14	≤ 32	-	64	≥ 128	

Abbreviations: **AST, antimicrobial susceptibility testing;** ATCC®, American Type Culture Collection; CAMHB, cation-adjusted Mueller-Hinton broth; CAT, colistin agar test; CBDE, colistin broth disk elution; eCIM, EDTA-modified carbapenem inactivation method; ESBL, extended-spectrum β-lactamase; I, intermediate; **Inv., investigational agent;** IV, intravenous; mCIM, modified carbapenem inactivation method; 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.**

Footnotes

a. ATCC® is a registered trademark of the American Type Culture Collection.

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

Table 2A. Enterobacterales (Continued)

References for Table 2A

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