مجموعه جداول انتخاب شده از
CLSI M100 **33th** ed., **2023**
برای میکروارگانیسم های اولویت دار
در برنامه کشوری مهار مقاومت میکروبی
بر اساس راهنمای سازمان جهانی بهداشت
(GLASS)

ویرایش **هفتم**

سال ۱۴۰۲

کمیته تخصصی میکروب شناسی

آزمایشگاه مرجع سلامت

وزارت بهداشت، درمان و آموزش پزشکی

بسمه تعالی

این سند با هدف استفاده آزمایشگاه‌های بیمارستان‌های **منتخب** در برنامه کشوری مهار مقاومت میکروبی تهیه شده است ولی در سایر آزمایشگاه‌های پزشکی غیر منتخب، با در نظر گرفتن راهنماهای مربوط به مرکز درمانی/ بیمارستان برای انجام آزمایش و گزارش‌دهی آزمایش تعیین حساسیت ضدمیکروبی، نیز می تواند استفاده شود.

آزمایشگاه‌های بیمارستان‌های **منتخب** برای آزمایش و گزارش‌دهی میکروارگانیسم‌های بیماریزای اولویت‌دار باید مطابق جدول زیر عمل نمایند.

GLASS target pathogens and specimen types

Target pathogens	Specimens
Acinetobacter spp.	Blood
Escherichia coli	
Streptococcus pneumoniae	
Salmonella spp.	
Staphylococcus aureus	
Klebsiella pneumoniae	
Enterococcus spp.	
Pseudomonas aeruginosa	
Escherichia coli	Urine
Klebsiella pneumoniae	
Enterococcus spp.	
Pseudomonas aeruginosa	
Salmonella spp.	Stool
Shigella spp.	

ویرایش هفتم این سند جایگزین ویرایش قبلی (ویرایش ششم - سال ۱۴۰۱) می باشد. تغییرات عمده در ویرایش هفتم این سند در جدول زیر فهرست شده است. تغییرات کوچک یا ویراستاری و توضیحات، با حروف پررنگ نوشته شده است.

Overview of Changes

Table	Changes
Escherichia coli	Added: • Levofloxacin disk diffusion breakpoints (page 6) Revised: • Gentamicin, and amikacin disk diffusion breakpoints (page 6)
Klebsiella pneumonia	Added: • Levofloxacin disk diffusion breakpoints (page 10) Revised: • Gentamicin, and amikacin disk diffusion breakpoints (page 9)
Salmonella spp.	Added: • Levofloxacin MIC breakpoints (page 12) • Imipenem, meropenem and tetracycline disk diffusion breakpoints (page 12)
Shigella spp.	Added: • Levofloxacin, imipenem, meropenem and tetracycline disk diffusion breakpoints (pages 13-14)
Tests for Extended-Spectrum β-Lactamases in *Escherichia coli, Klebsiella pneumonia, Salmonella* spp. *and Shigella* spp.	Added: • Note (page 15)
Pseudomonas aeruginosa	Revised: • Piperacillin-tazobactam and tobramycin disk diffusion breakpoints (pages 17-18) • Urine designation for amikacin (page 18) Deleted: • Gentamicin disk diffusion breakpoints
Acinetobacter spp.	Added: • Comment (d) (page 19)
Staphylococcus aureus	Added: • Levofloxacin disk diffusion breakpoints (page 23)
Enterococcus spp.	Added: • Levofloxacin disk diffusion breakpoints (page 25)

Note: Intermediate ranges denoted with a "^" for the applicable antimicrobial agents in the drug groups are based on the known ability of these agents to concentrate in the urine.

Escherichia coli					
Antimicrobial Agent	**Disk Content**	**Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm**			**Comments**
		S	**I**	**R**	
PENICILLINS					
Ampicillin	10 µg	≥ 17	14–16^	≤ 13	(a) Results of ampicillin testing can be used to predict results for amoxicillin. **(b) 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. (c) 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.**
CEPHEMS					
Cefazolin (PARENTERAL)	30 µg	≥ 23	20–22	≤ 19	Breakpoints when cefazolin is used for therapy of infections other than uncomplicated UTIs due to *E. coli*, *K. pneumoniae* & *P. mirabilis*. Breakpoints are based on a dosage regimen of 2 g administered every 8 h.
Cefazolin (PARENTERAL) (urine)	30 µg	≥ 15	-	≤ 14	**(a) Report only on organisms isolated from the urinary tract.** (b) Breakpoints when cefazolin is used for therapy of uncomplicated UTIs due to *E. coli*, *K. pneumoniae* & *P. mirabilis*. Breakpoints are based on a dosage regimen of 1 g administered every 12 h.

***Escherichia coli* (continued)**					
Cefazolin (ORAL) (surrogate test for oral cephalosporins & uncomplicated UTIs) (urine)	30 µg	≥ 15	-	≤ 14	**(a) Report only on organisms isolated from the urinary tract.** (b) Breakpoints are for cefazolin when used as a surrogate test to predict results for the oral agent 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 as a surrogate may overcall resistance to cefdinir, cefpodoxime, and cefuroxime. If cefazolin tests resistant, test these drugs individually if needed for therapy.
Cefepime	30 µg	≥ 25	19–24	≤ 18	The breakpoint for susceptible is based on a dosage regimen of 1 g administered every 12 h. The Breakpoint for SDD* is based on dosing regimens that result in higher cefepime exposure, either higher doses or more frequent doses or both, up to approved maximum dosing regimens. *SDD: Susceptible-Dose Dependent
Cefotaxime or ceftriaxone	30 µg 30 µg	≥ 26 ≥ 23	23–25^ 20–22^	≤ 22 ≤ 19	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.
Ceftazidime	30 µg	≥ 21	18–20^	≤ 17	Breakpoints are based on a dosage regimen of 1 g administered every 8 h.
CARBAPENEMS					
Imipenem	10 µg	≥ 23	20–22^	≤ 19	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	Breakpoints are based on a dosage regimen of 1 g administered every 8 h.

Escherichia coli (continued)

LIPOPEPTIDES					
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.					
Colistin or polymixin B		-	-	-	(a) Colistin (methanesulfonate) should be given with a loading dose and maximum renally adjusted dose. (b) Polymixin B should be given with a loading dose and maximum recommended dose. (c) When colistin or polymixin B is given systemically, neither is likely to be effective for pneumonia. (d) For colistin, broth microdilution, CBDE*, and CAT** MIC methods are acceptable. For polymixin B, broth microdilution is the only approved method. Disk diffusion and gradient diffusion methods should not be performed (see Table 3D, Pages **174-179**). *CBDE: Colistin Broth Disk Elution **CAT: Colistin Agar Test
					Interpretive Categories and MIC Breakpoints, µg/mL
					S | **I** | **R**
					- | ≤ 2 | ≥ 4
AMINOGLYCOSIDES					
Gentamicin	10 µg	**≥ 18**	**15-17^**	**≤ 14**	**Breakpoints are based on a dosage regimen of 7 mg/kg parenterally administered every 24 h.**
Amikacin	30 µg	**≥ 20**	**17–19^**	**≤ 16**	**Breakpoints are based on a dosage regimen of 15 mg/kg parenterally administered every 24 h.**
FLUOROQUINOLONES					
Ciprofloxacin **or** **levofloxacin**	5 µg **5 µg**	≥ 26 **≥ 21**	22-25^ **17-20^**	≤ 21 **≤ 16**	(a) Breakpoints for ciprofloxacin are based on a dosage regimen of 400 mg IV or 500 mg orally administered every 12 h. **(b) Breakpoints for levofloxacin are based on a dosage regimen of 750 mg administered every 24 h.**

Escherichia coli (continued)					
FOLATE PATHWAY INHIBITORS					
Trimethoprim- sulfamethoxazole	1.25/ 23.75 µg	≥ 16	11–15	≤ 10	
NITROFURANS					
Nitrofurantoin (urine)	300 µg	≥ 17	15–16	≤ 14	Report only on organisms isolated from the urinary tract.

Klebsiella pneumoniae					
Antimicrobial Agent	**Disk Content**	**Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm**			**Comments**
		S	**I**	**R**	
CEPHEMS					
Cefazolin (PARENTERAL)	30 µg	≥ 23	20–22	≤ 19	Breakpoints when cefazolin is used for therapy of infections other than uncomplicated UTIs due to *E. coli*, *K. pneumoniae* & *P.mirabilis*. Breakpoints are based on a dosage regimen of 2 g administered every 8 h.
Cefazolin (PARENTERAL) (urine)	30 µg	≥ 15	-	≤ 14	**(a) Report only on organisms isolated from the urinary tract.** (b) Breakpoints when cefazolin is used for therapy of uncomplicated UTIs due to *E. coli*, *K. pneumoniae* & *P. mirabilis*. Breakpoints are based on a dosage regimen of 1 g administered every 12 h.
Cefazolin (ORAL) (surrogate test for oral cephalosporins & uncomplicated UTI) (urine)	30 µg	≥ 15	-	≤ 14	**(a) Report only on organisms isolated from the urinary tract.** (b) Breakpoints are for cefazolin when cefazolin results are used 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 as a surrogate may overcall resistance to cefdinir, cefpodoxime, and cefuroxime. If cefazolin tests resistant, test these drugs individually if needed for therapy.
Cefepime	30 µg	≥ 25	19–24	≤ 18	The Breakpoint for susceptible is based on a dosage regimen of 1 g every 12 h. The Breakpoint for SDD* is based on dosing regimens that result in higher cefepime exposure, either higher doses or more frequent doses or both, up to approved maximum dosing regimens. *SDD: Susceptible-Dose Dependent
Cefotaxime or ceftriaxone	30 µg 30 µg	≥ 26 ≥ 23	23–25^ 20–22^	≤ 22 ≤ 19	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.

Klebsiella pneumonia (continued)					
Ceftazidime	30 µg	≥ 21	18–20^	≤ 17	Breakpoints are based on a dosage regimen of 1 g administered every 8 h.
CARBAPENEMS					
Imipenem	10 µg	≥ 23	20–22^	≤ 19	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	Breakpoints are based on a dosage regimen of 1 g administered every 8 h.
LIPOPEPTIDES					
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.					
Colistin or polymixin B	-	-	-	-	(a) Colistin (methanesulfonate) should be given with a loading dose and maximum renally adjusted dose. (b) Polymixin B should be given with a loading dose and maximum recommended doses. (c) When colistin or polymixin B is given systemically, neither is likely to be effective for pneumonia. (d) For colistin, broth microdilution, CBDE*, and CAT** MIC methods are acceptable. For polymixin B, broth microdilution is the only approved method. Disk diffusion and gradient diffusion methods should not be performed (see Table 3D, Pages **174-179**). *CBDE: Colistin Broth Disk Elution **CAT: Colistin Agar Test
					Interpretive Categories and MIC Breakpoints, µg/mL
					S / **I** / **R**
					- / ≤ 2 / ≥ 4
AMINOGLYCOSIDES					
Gentamicin	10 µg	**≥ 18**	**15-17^**	**≤ 14**	**Breakpoints are based on a dosage regimen of 7 mg/kg parenterally administered every 24 h.**
Amikacin	30 µg	**≥ 20**	**17–19^**	**≤ 16**	**Breakpoints are based on a dosage regimen of 15 mg/kg parenterally administered every 24 h.**

Klebsiella pneumonia (continued)					
FLUOROQUINOLONES					
Ciprofloxacin **or** **levofloxacin**	5 µg **5 µg**	≥ 26 **≥ 21**	22-25^ **17-20^**	≤ 21 **≤ 16**	(a) Breakpoints for ciprofloxacin are based on a dosage regimen of 400 mg IV or 500 mg orally administered every 12 h. **(b) Breakpoints for levofloxacin are based on a dosage regimen of 750 mg administered every 24 h.**
FOLATE PATHWAY INHIBITORS					
Trimethoprim-sulfamethoxazole	1.25/ 23.75 µg	≥ 16	11–15	≤ 10	
NITROFURANS					
Nitrofurantoin (urine)	300 µg	≥ 17	15–16	≤ 14	Report only on organisms isolated from the urinary tract.

* When fecal isolates of *Salmonella* spp. are tested, only ampicillin, a fluoroquinolone, and trimethoprim-sulfamethoxazole should be reported routinely. 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**

***Salmonella* spp.**					
Antimicrobial Agent	**Disk Content**	**Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm**			**Comments**
		S	**I**	**R**	
PENICILLINS					
Ampicillin	10 µg	≥ 17	–	≤ 13	(a) Results of ampicillin testing can be used to predict results for amoxicillin. **(b) Breakpoints are based on an ampicillin dosage regimen of 2 g parenterally administered every 4–6 h.** **(c) 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.**
CEPHEMS					
Ceftriaxone **or** ceftazidime (For extraintestinal isolates)	30 µg 30 µg	≥ 23 ≥ 21	– –	≤ 19 ≤ 17	(a) Breakpoints are based on a dosage regimen of 1 g administered every 24 h for ceftriaxone (b) Breakpoints are based on a dosage regimen of 1 g administered every 8 h.

***Salmonella* spp. (continued)**					
FLUOROQUINOLONES					
The preferred test for assessing fluroquinolone 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.					
Ciprofloxacin **or** **levofloxacin**	5 µg – –	≥ 31 – –	–	≤ 20 – –	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. **Interpretive Categories and MIC Breakpoints, µg/mL For Levofloxacin** **S** / **I** / **R** **≤ 0.12** / **–** / **≥ 2**
FOLATE PATHWAY INHIBITORS					
Trimethoprim-sulfamethoxazole	1.25/ 23.75 µg	≥ 16	11–15	≤ 10	
PHENICOLS					
Chloramphenicol	30 µg	≥ 18	13–17	≤ 12	
MACROLIDS					
Azithromycin	15 µg	≥ 13	–	≤ 12	(a) *S. enterica* ser. Typhi only: breakpoints are based on MIC distribution data and limited clinical data. (b) Breakpoints are based on a dosage regimen of 500 mg administered daily.
CARBAPENEMS					
These antimicrobial agents may warrant testing and reporting by clinical request if antimicrobial agents in other tiers are not optimal because of various factors*					
Imipenem	**10 µg**	**≥ 23**	**–**	**≤ 19**	**Breakpoints are based on a dosage regimen of 500 mg administered every 6 h or 1 g every 8 h.**
Meropenem	**10 µg**	**≥ 23**	**–**	**≤ 19**	**Breakpoints are based on a dosage regimen of 1 g administered every 8 h.**
TETRACYCLINES					
These antimicrobial agents may warrant testing and reporting by clinical request if antimicrobial agents in other tiers are not optimal because of various factors*					
Tetracycline	**30 µg**	**≥ 15**	**12–14**	**≤ 11**	**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.**

*** توجه: آزمایشگاه‌های بیمارستان‌های منتخب ملزم به انجام آزمایش و گزارش‌دهی این سه آنتی‌بیوتیک برای گونه های سالمونلا و شیگلا می باشند.**

*When fecal isolates of *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. Susceptibility testing is indicated for all *Shigella* isolates.**

***Shigella* spp.**					
Antimicrobial Agent	**Disk Content**	**Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm**			**Comments**
		S	**I**	**R**	
PENICILLINS					
Ampicillin	10 µg	≥ 17	–	≤ 13	(a) Results of ampicillin testing can be used to predict results for amoxicillin. **(b) Breakpoints are based on an ampicillin dosage regimen of 2 g parenterally administered every 4–6 h. (c) 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.**
CEPHEMS					
Ceftriaxone **or** ceftazidime (Only for ciprofloxacin resistant strain)	30 µg 30 µg	≥ 23 ≥ 21	– –	≤ 19 ≤ 17	Breakpoints are based on a dosage regimen of 1 g administered every 24 h for ceftriaxone Breakpoints are based on a dosage regimen of 1 g administered every 8 h.
FLUOROQUINOLONES					
Ciprofloxacin **or** **levofloxacin**	5 µg **5 µg**	≥ 26 **≥ 21**	– –	≤ 21 **≤ 16**	Breakpoints for ciprofloxacin are based on a dosage regimen of 400 mg IV or 500 mg orally administered every 12 h. **Breakpoints for levofloxacin are based on a dosage regimen of 750 mg administered every 24 h.**

***Shigella* spp. (continued)**					
FOLATE PATHWAY INHIBITORS					
Trimethoprim-sulfamethoxazole	1.25/ 23.75 µg	≥ 16	11–15	≤ 10	
MACROLIDES					
Azithromycin	15 µg	≥ 16	11-15	≤ 10	(a) *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. (b) Breakpoints are based on a dosage regimen of 500 mg administered daily.
CARBAPENEMS					
These antimicrobial agents may warrant testing and reporting by clinical request if antimicrobial agents in other tiers are not optimal because of various factors*					
Imipenem	**10 µg**	**≥ 23**	**–**	**≤ 19**	**Breakpoints are based on a dosage regimen of 500 mg administered every 6 h or 1 g every 8 h.**
Meropenem	**10 µg**	**≥ 23**	**–**	**≤ 19**	**Breakpoints are based on a dosage regimen of 1 g administered every 8 h.**
TETRACYCLINES					
These antimicrobial agents may warrant testing and reporting by clinical request if antimicrobial agents in other tiers are not optimal because of various factors*					
Tetracycline	**30 µg**	**≥ 15**	**12–14**	**≤ 11**	**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.**

*** توجه: آزمایشگاه‌های بیمارستان‌های منتخب ملزم به انجام آزمایش و گزارش‌دهی این سه آنتی‌بیوتیک برای گونه های سالمونلا و شیگلا می باشند.**

Tests for Extended-Spectrum β-Lactamases in *Escherichia coli, Klebsiella pneumonia, Salmonella* spp and *Shigella* spp.

NOTE: Following evaluation of PK/PD properties, limited clinical data, and MIC distributions, revised breakpoints for cefazolin, cefotaxime, ceftazidime, ceftizoxime, ceftriaxone, and aztreonam were published in January 2010 (M100-S20) and are listed in Table 2A. Cefuroxime (parenteral) was also evaluated; however, no change in breakpoints was necessary with the dosage. When using the current breakpoints, routine ESBL testing is not necessary before reporting results. If ESBL testing is performed, the results may be used to guide therapeutic management or for epidemiological or infection prevention purposes.

Some phenotypic ESBL tests have known limitations that affect sensitivity (eg, false-negative results due to the coproduction of an AmpC β-lactamase) and specificity (eg, false-positive results due to hyperproduction of non-ESBL β-lactamases combined with altered permeability). Genotypic methods are limited by the targets included in the assay (eg, most FDA-cleared ESBL assays target only blaCTX-M). Limitations of phenotypic and genotypic methods must be considered.

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, Klebsiella oxytoca,* or *Proteus mirabilis*, ESBL testing should be performed. If isolates test ESBL positive, the results for moxalactam, cefonicid, cefamandole, and cefoperazone should be reported as resistant.

Tests for Extended-Spectrum β-Lactamases in *Escherichia coli, Klebsiella pneumonia, Salmonella* spp and *Shigella* spp. (continued)		
Test	**Criteria for Performance of ESBL Test**	**ESBL Test**
Antimicrobial concentration	Cefpodoxime 10 µg or Ceftazidime 30 µg or Aztreonam 30 µg or Cefotaxime 30 µg or Ceftriaxone 30 µg (Testing more than one antimicrobial agent improves the sensitivity of ESBL detection.)	Ceftazidime 30 µg Ceftazidime-clavulanate 30/10 µg and Cefotaxime 30 µg Cefotaxime-clavulanate 30/10 µg (Testing necessitates using both cefotaxime and ceftazidime, alone and in combination with clavulanate.)
Results	Cefpodoxime zone ≤ 17 mm Ceftazidime zone ≤ 22 mm Aztreonam zone ≤ 27 mm Cefotaxime zone ≤ 27 mm Ceftriaxone zone ≤ 25 mm Zones above may indicate ESBL production.	A ≥ 5mm increase in a zone diameter for either antimicrobial agent tested in combination with clavulanate vs the zone diameter of the agent when tested alone = ESBL (eg, ceftazidime zone = 16; ceftazidime-clavulanate zone = 21).
Reporting		For all confirmed ESBL-producing strains: If laboratories do not use current cephalosporin and aztreonam breakpoints, the test interpretation should be reported as resistant for all penicillins, cephalosporins, and aztreonam. If laboratories use current cephalosporin and aztreonam breakpoints, then test interpretations for these agents do not need to be changed from susceptible to resistant.

Pseudomonas aeruginosa							
Antimicrobial Agent	**Disk Content**	**Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm**			**Comments**		
		S	**I**	**R**			
β-LACTAM/β-LACTAMASE INHIBITOR COMBINATIONS							
Piperacillin-tazobactam	100/10 µg	**≥ 22**	**18–21^**	**≤ 17**	**Breakpoints for susceptible are based on a dosage regimen of 4.5 g administered every 6 h over 30 minutes or over 3 h. Breakpoints for intermediate are only to provide a buffer zone to prevent small uncontrolled technical factors from causing major discrepancies in interpretations.**		
CEPHEMS							
Cefepime	30 µg	≥ 18	15-17^	≤ 14	Breakpoints are based on a dosage regimen of 1 g administtered every 8 h or 2 g administtered every 12 h.		
Ceftazidime	30 µg	≥ 18	15-17^	≤ 14	Breakpoints are based on a dosage regimen of 1 g administtered every 6 h or 2 g administtered every 8 h.		
LIPOPEPTID							
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.							
Colistin or polymixin B	-	-	-	-	(a) Colistin (methanesulfonate) should be given with a loading dose and maximum renally adjusted doses. (b) Polymixin B should be given with a loading dose and maximum recommended doses. (c) When colistin or polymixin B is given systemically, neither is likely to be effective for pneumonia. (d) For colistin, broth microdilution, CBDE*, and CAT** MIC methods are acceptable. For polymixin B, broth microdilution is the only approved method. Disk diffusion and gradient diffusion methods should not be performed (see Table 3D, Pages **174-179**). *CBDE: Colistin Broth Disk Elution **CAT: Colistin Agar Test		
					Interpretive Categories and MIC Breakpoints, µg/mL		
					S	**I**	**R**
					-	≤ 2	≥ 4

Pseudomonas aeruginosa (continued)					
CARBAPENEMS					
Imipenem	10 µg	≥ 19	16-18^	≤ 15	Breakpoints for imipenem are based on a dosage regimen of 1 g administered every 8 h or 500 mg administered every 6 h.
Meropenem	10 µg	≥ 19	16-18^	≤ 15	Breakpoints for meropenem are based on a dosage regimen of 1 g administered every 8 h.
AMINOGLYCOSIDES					
Tobramycin	10 µg	**≥ 19**	13-**18**^	≤ 12	**(a) Breakpoints are based on a dosage regimen of 7 mg/kg parenterally administered every 24 h.** **(b) Tobramycin does not predict susceptibility to gentamicin.**
Amikacin (**Urine)**	30 µg	≥ 17	15–16^	≤ 14	**(a) Report only on organisms isolated from the urinary tract.** **(b) Breakpoints are based on a dosage regimen of 15 mg/kg parenterally administered every 24 h.**
FLUOROQUINOLONES					
Ciprofloxacin	5 µg	≥ 25	19-24^	≤ 18	Breakpoints are based on a dosage regimen of 400 mg IV administered every 8 h.

Acinetobacter spp.					
Antimicrobial Agent	**Disk Content**	**Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm**			**Comments**
		S	**I**	**R**	
β-LACTAM/β-LACTAMASE INHIBITOR COMBINATIONS					
Ampicillin-sulbactam	10/10 µg	≥ 15	12-14	≤ 11	
Piperacillin-tazobactam	100/10 µg	≥ 21	18–20	≤ 17	
CEPHEMS					
Cefepime	30 µg	≥ 18	15-17	≤ 14	
Ceftazidime	30 µg	≥ 18	15-17	≤ 14	
CARBAPENEMS					
Imipenem	10 µg	≥ 22	19-21	≤ 18	Breakpoints are based on a dosage regimen of 500 mg administered every 6 h.
Meropenem	10 µg	≥ 18	15-17	≤ 14	Breakpoints are based on a dosage regimen of 1 g administered every 8 h or 500 mg administered every 6 h.
LIPOPEPTID					
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.					
Colistin or polymixin B	-	-	-	-	(a) Colistin (methanesulfonate) should be given with a loading dose and maximum renally adjusted doses. (b) Polymixin B should be given with a loading dose and maximum recommended doses. (c) When colistin or polymixin B is given systemically, the drug is unlikely to be effective for pneumonia. **(d) The only approved MIC methods is broth microdilution. CBDE*, CAT**, disk diffusion, and gradient diffusion should not be performed.** *CBDE: Colistin Broth Disk Elution **CAT: Colistin Agar Test
					Interpretive Categories and MIC Breakpoints, µg/mL
					S | **I** | **R**
					- | ≤ 2 | ≥ 4

Acinetobacter spp. (continued)					
AMINOGLYCOSIDES					
Gentamicin	10 µg	≥ 15	13-14	≤ 12	
Tobramycin	10 µg	≥ 15	13-14	≤ 12	
Amikacin	30 µg	≥ 17	15–16	≤ 14	
TETRACYCLINES					
Minocycline	30 µg	≥ 16	13–15	≤ 12	
FLUOROQUINOLONES					
Ciprofloxacin	5 µg	≥ 21	16–20	≤ 15	
FOLATE PATHWAY INHIBITORS					
Trimethoprim-sulfamethoxazole	1.25/ 23.75 µg	≥ 16	11–15	≤ 10	

Staphylococcus aureus					
Antimicrobial Agent	**Disk Content**	**Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm**			**Comments**
		S	**I**	**R**	
PENICILLINASE-LABILE PENICILLINS					
Penicillin	10 units	≥ 29	-	≤ 28	(a) Penicillin should be used to test the susceptibility of all staphylococci to all penicillinase-labile penicillins. Penicillin-resistant strains of staphylococci produce β-lactamase. Perform test(s) to detect β-lactamase production on staphylococci for which the penicillin MICs are ≤ 0.12 µg/mL or zone diameters ≥ 29 mm before reporting the isolate as penicillin susceptible. Rare isolates of staphylococci that contain genes for β-lactamase production may appear negative by β-lactamase tests. Consequently, for serious infections requiring penicillin therapy, laboratories should perform MIC tests and β-lactamase testing on all subsequent isolates from the same patient. PCR testing of the isolate for the *blaZ* β-lactamase gene may be considered. See Table 3F, Pages **186-187**. (b) For methicillin (oxacillin)-resistant staphylococci report penicillin as resistant or do not report.

***Staphylococcus aureus* (continued)**					
PENICILLINASE-STABLE PENICILLINS					
Oxacillin (Oxacillin disk testing is not reliable for *S. aureus* and *S. lugdunensis*.)	30 µg Cefoxitin (surrogate test for oxacillin)	≥ 22 (cefoxitin)	-	≤ 21 (cefoxitin)	(a) Cefoxitin is tested as a surrogate for oxacillin for some species of *Staphylococcus*. Isolates that test resistant by cefoxitin or oxacillin, when using the appropriate test method for the species, should be reported as methicillin (oxacillin) resistant. If testing only cefoxitin, report as methicillin (oxacillin) susceptible or resistant based on the cefoxitin result. Isolates that test either *mecA* negative or PBP2a negative or cefoxitin susceptible should be reported as methicillin (oxacillin) susceptible. (b) For isolates of *S. aureus* that do not grow well on CAMHB* or unsupplemented MHA (eg, small-colony variants), testing on other media (eg, BMHA) does not reliably detect *mecA*-mediated resistance. Testing for PBP2a using induced growth (ie, growth taken from the zone margin surrounding a cefoxitin disk on either BMHA or a blood agar plate after 24 hours incubation in 5% CO_2) or *mecA* should be done. *Cation Adgusted Mueller Hinton Agar

***Staphylococcus aureus* (continued)**					
GLYCOPEPTIDES					
Vancomycin	-	-	-	-	(a) For *S. aureus*, vancomycin-susceptible isolates may become vancomycin intermediate during the course of prolonged therapy. (b) MIC tests should be performed to determine the susceptibility of all isolates of staphylococci to vancomycin. The disk test does not differentiate vancomycin-susceptible isolates of *S. aureus* from vancomycin-intermediate isolates, nor does the test differentiate among vancomycin susceptible, -intermediate, and -resistant isolates of *Staphylococcus* spp. other than *S. aureus* all of which give similar size zones of inhibition. (c) Send any *S. aureus* for which the vancomycin is ≥ 8 µg/mL to a reference laboratory. **Interpretive Categories and MIC Breakpoints, µg/mL** **S** ≤ 2 / **I** 4-8 / **R** ≥ 16
Teicoplanin (Optional) (Investigation)	-	-	-	-	**Interpretive Categories and MIC Breakpoints, µg/mL** **S** ≤ 8 / **I** 16 / **R** ≥ 32
TETRACYCLINES					
Doxycycline	30 µg	≥ 16	13-15	≤ 12	
MACROLIDES					
Erythromycin	15 µg	≥ 23	14-22	≤ 13	Not routinely reported on organisms isolated from the urinary tract.
FLUOROQUINOLONES					
Ciprofloxacin **or** **levofloxacin**	5 µg **5 µg**	≥ 21 **≥ 19**	16–20 **16-18**	≤ 15 **≤ 15**	*Staphylococcus* spp. may develop resistance during prolonged therapy with quinolones. Therefore, isolates that are initially susceptible may become resistant within three to four days after initiation of therapy. Testing of repeat isolates may be warranted.

Staphylococcus aureus (continued)					
NITROFURANTOINS					
Nitrofurantoin	300 µg	≥ 17	15-16	≤ 14	Report only on organisms isolated from the urinary tract.
FOLATE PATHWAY INHIBITORS					
Trimethoprim-sulfamethoxazole	1.25/ 23.75 µg	≥ 16	11-15	≤ 10	
LINCOSAMIDES					
Clindamycin	2 µg	≥ 21	15-20	≤ 14	(a) Not routinely reported on organisms isolated from the urinary tract. (b) For isolates that test erythromycin resistant and clindamycin susceptible or intermediate, testing for ICR* by disk diffusion using the D-zone test or by broth microdilution is required befor reporting clindamycin (See Table 3I, Pages **196-198**). (c) D-zone test: 15-µg erythromycin and 2-µg clindamycin disks spaced 15–26 mm apart. Report isolates with ICR as "clindamycin resistant" (See Table 3I, Pages **196-198**). *ICR: Inducible clindamycin resistance
ANSAMYCINS					
Rifampin	5 µg	≥ 20	17-19	≤ 16	*Rx*: should not be used alone for antimicrobial therapy.

***Enterococcus* spp.**					
Antimicrobial Agent	**Disk Content**	**Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm**			**Comments**
		S	**I**	**R**	
PENICILLINS					
Ampicillin	10 µg	≥ 17	-	≤ 16	The results of ampicillin susceptibility tests should be used to predict the activity of amoxicillin. Ampicillin results may be used to predict susceptibility to amoxicillin-clavulanate, ampicillin-sulbactam, and piperacillin-tazobactam among non–β-lactamase producing enterococci. Ampicillin susceptibility can be used to predict imipenem susceptibility, providing the species is confirmed to be *E. faecalis.*
GLYCOPEPTIDES					
Vancomycin	30 µg	≥ 17	15-16	≤ 14	When testing vancomycin against enterococci, plates should be held a full 24 hours for accurate detection of resistance. Zones should be examined using transmitted light; the presence of a haze or any growth within the zone of inhibition indicates resistance. Organisms with intermediate zones should be tested by an MIC method as described in M07. For isolates for which the vancomycin MICs are 8 to 16 µg/mL, perform biochemical tests for identification as listed under the "Vancomycin MIC ≥ 8 µg/mL" test found in Table 3H, Pages **194-195**.
FLUOROQUINOLONES					
Ciprofloxacin (Urine) **or** **levofloxacin (Urine)**	5 µg **5 µg**	≥ 21 **≥ 21**	16–20^ **14-16^**	≤ 15 **≤ 13**	Report only on organisms isolated from the urinary tract.
NITROFURANTOINS					
Nitrofurantoin (Urine)	300 µg	≥ 17	15-16	≤ 14	Report only on organisms isolated from the urinary tract.
OXAZOLIDINONES					
Linezolid	30 µg	≥ 23	21-22	≤ 20	

Test for Gentamicin High-Level Aminoglycoside Resistance in *Enterococcus* spp.					
Antimicrobial Agent	**Disk Content**	**Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm**			**Comments**
		S	**Inconclusive**	**R**	
Gentamicin	120 µg	≥ 10	7-9	= 6	If disk diffusion result is inconclusive: perform an agar dilution or broth dilution MIC test to confirm (See Table 3K, Pages **202-204**).

∗ For disk diffusion, test a maximum of 9 disks on a 150-mm plate and 4 disks on a 100-mm plate.

Streptococcus pneumoniae					
Antimicrobial Agent	**Disk Content**	**Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm**			**Comments**
		S	**I**	**R**	
Penicillin and cefotaxime, ceftriaxone, or meropenem should be tested by a reliable MIC method (such as that described in M071) and reported routinely with *S. pneumoniae* isolated from CSF. Such isolates can also be tested against vancomycin using the MIC or disk diffusion method. With isolates from other sites, the oxacillin disk test may be used. If the oxacillin zone size is ≤ 19 mm, cefotaxime, ceftriaxone, meropenem, or penicillin MICs should be determined.					
PENICILLINS					
Penicillin (nonmeningitis)	1 µg Oxacillin	≥ 20	-	-	Isolates of pneumococci with oxacillin zone sizes of ≥20 mm are susceptible (MIC ≤ 0.06 µg/mL) to penicillin. Penicillin and cefotaxime, ceftriaxone, or meropenem MICs should be determined for those isolates with oxacillin zone diameters of ≤ 19 mm, because zones of ≤ 19 mm occur with penicillin-resistant, -intermediate, or certain -susceptible strains. For isolates with oxacillin zones ≤ 19 mm, do not report penicillin as resistant without performing a penicillin MIC test.
Penicillin parenteral (nonmeningitis) (optional)	-	-	-	-	**Interpretive Categories and MIC Breakpoints, µg/mL** **S** ≤ 2 / **I** 4 / **R** ≥ 8 (a) *Rx*: Doses of intravenous penicillin of at least 2 million units every 4 hours in adults with normal renal function (12 million units per day) can be used to treat nonmeningeal pneumococcal infections due to strains with penicillin MICs ≤ 2 µg/mL. Strains with an intermediate MIC of 4 µg/mL may require penicillin doses of 18 to 24 million units per day. **(b) For all isolates other than those from CSF, report interpretations for both meningitis and nonmeningitis.**

Streptococcus pneumoniae (continued)					
CEPHEMS					
Ceftriaxone (nonmeningitis)	-	-	-	-	**Interpretive Categories and MIC Breakpoints, µg/mL** **S** | **I** | **R** ≤ 1 | 2 | ≥ 4 **For all isolates other than those from CSF, report interpretations for both meningitis and nonmeningitis.**
TETRACYCLINES					
Doxycycline	30 µg	≥ 28	25-27	≤ 24	Organisms that are susceptible to tetracycline are also considered susceptible to doxycycline. However, resistance to doxycycline cannot be inferred from tetracycline resistance.
MACROLIDES					
Erythromycin	15 µg	≥ 21	16-20	≤ 15	(a) Susceptibility and resistance to azithromycin, clarithromycin, and dirithromycin can be predicted by testing erythromycin. (b) Not routinely reported on organisms isolated from the urinary tract.
FLUOROQUINOLONES					
Levofloxacin	5 µg	≥ 17	14-16	≤ 13	
FOLATE PATHWAY INHIBITORS					
Trimethoprim-sulfamethoxazole	1.25/ 23.75 µg	≥ 19	16-18	≤ 15	
LINCOSAMIDES					
Clindamycin	2 µg	≥ 19	16-18	≤ 15	(a) Not routinely reported on organisms isolated from the urinary tract. (b) For isolates that test erythromycin resistant and clindamycin susceptible or intermediate, testing for ICR* by disk diffusion using the D-zone test or by broth microdilution is required befor reporting clindamycin (See Table 3I, Pages **196-198**). (c) D-zone test: 15-µg erythromycin and 2-µg clindamycin disks spaced 15–26 mm apart. Report isolates with ICR as "clindamycin resistant" (See Table 3I, Pages **196-198**). *ICR: Inducible clindamycin resistance