2024 Updates to CLSI M100

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The presenter states no conflict of interest and has no financial relationship to disclose relevant to the content of this presentation.

OUTLINE

I. Quick discussion(s) relative to major revisions

II. Objectives of webinar

Describe significant changes relevant to pre-existing antimicrobial susceptibility breakpoints…

Describe significant changes relevant to antimicrobial susceptibility testing methodology…

Identify (new) organism/antimicrobial combinations for which susceptibility breakpoints now exist…

as outlined in the CLSI M100-Ed34 document.

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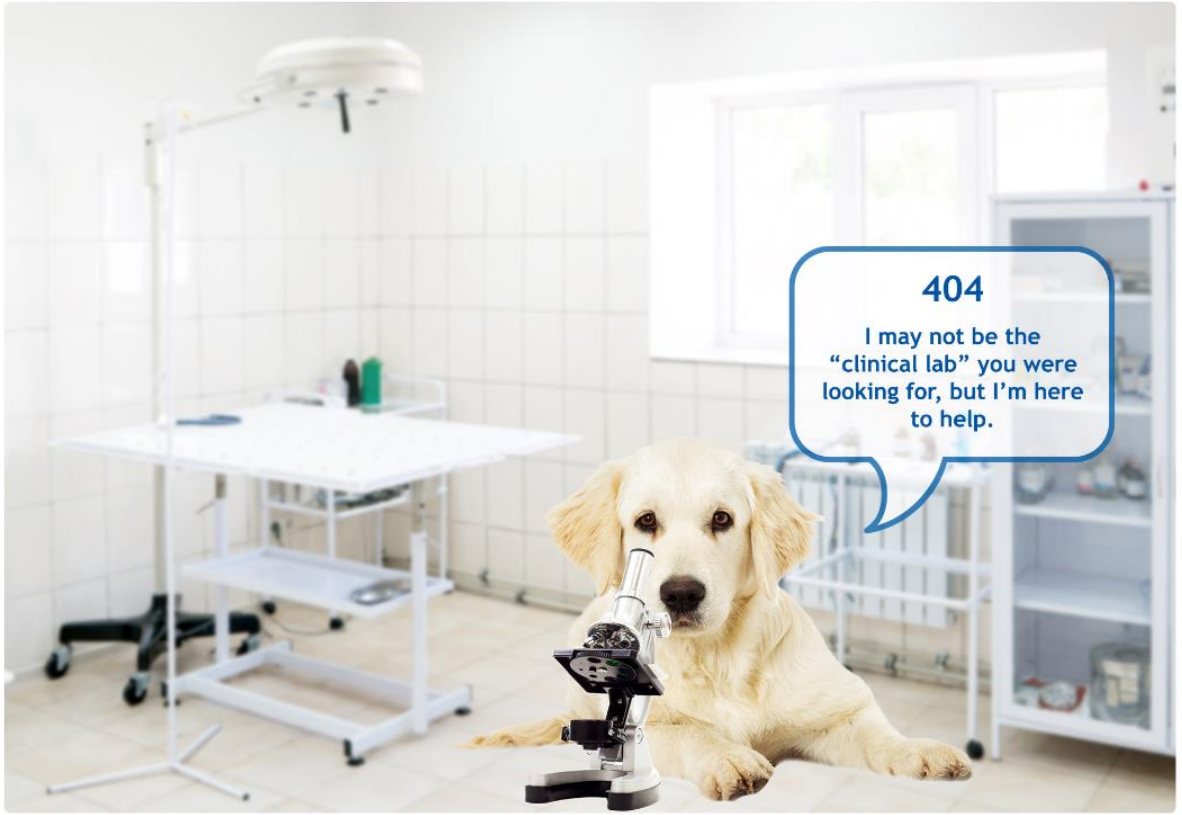

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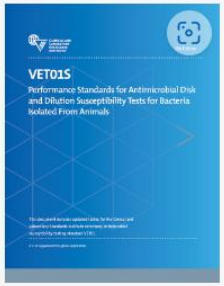

CLSI VET01S

Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated From Animals

Quickly reference the most trusted AST veterinary breakpoint tables as a convenient, complimentary supplement to the AST VET01 document.

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CLSI Using M100-Ed32

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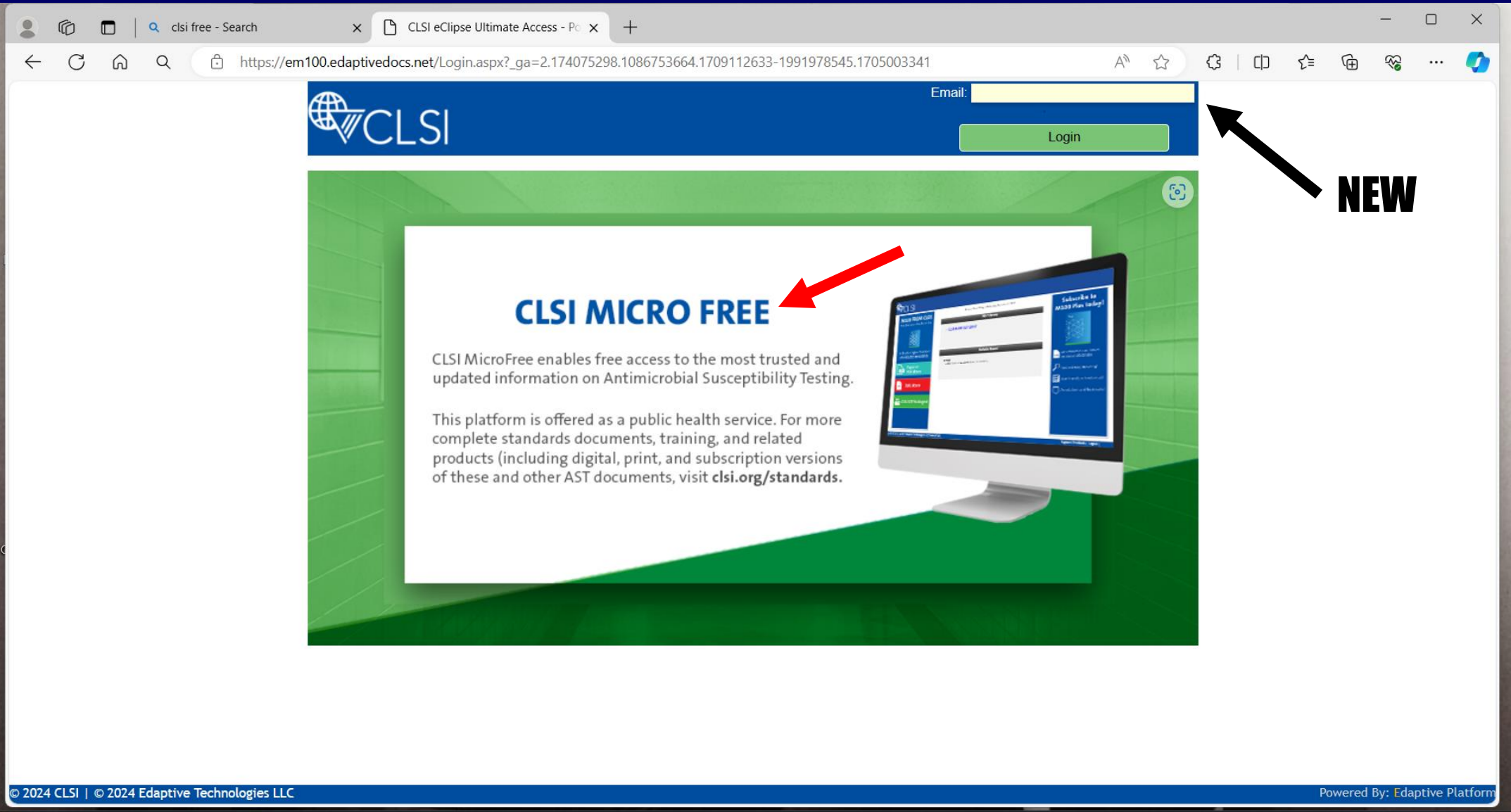

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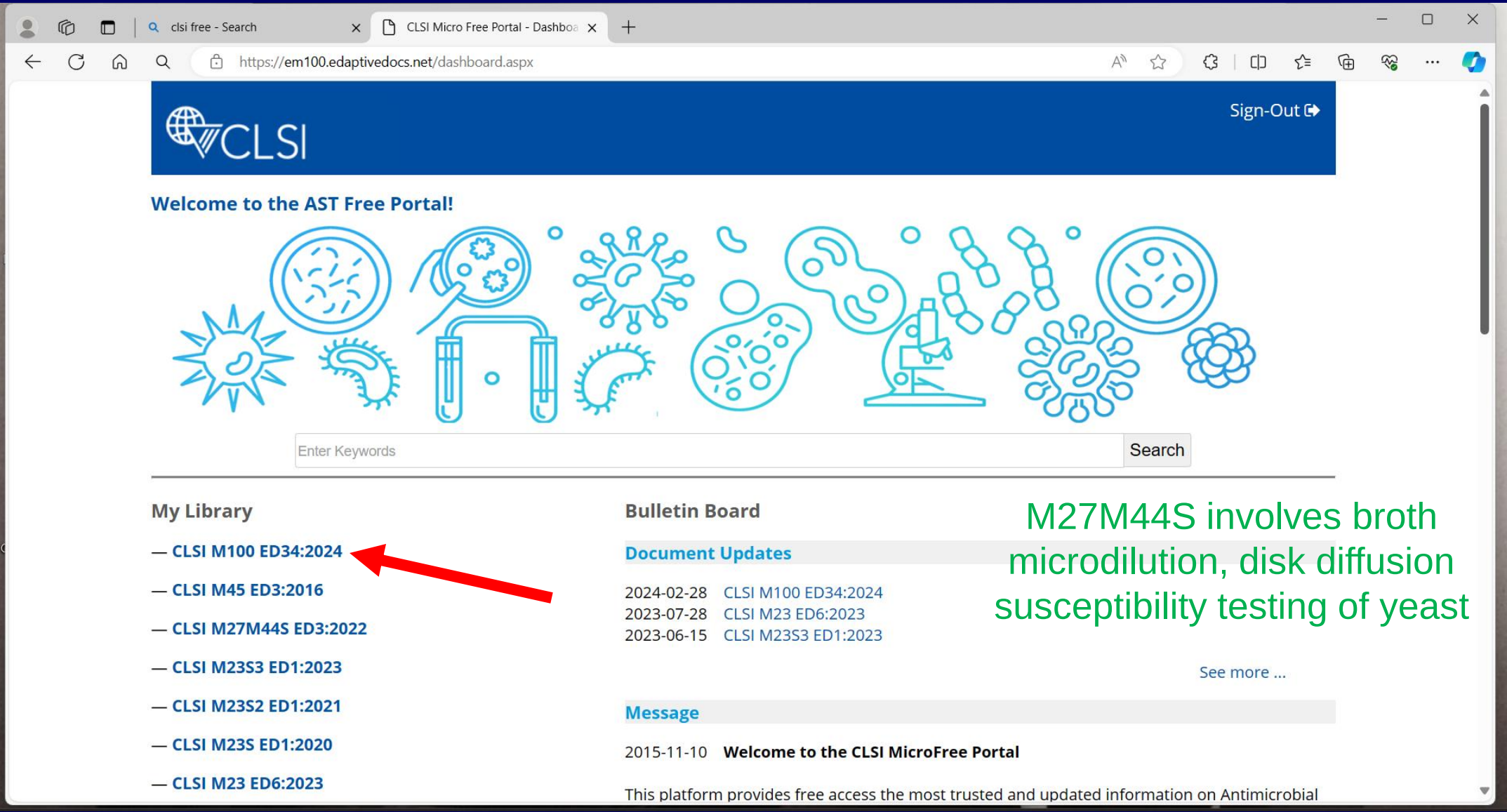

M27M44S involves broth microdilution, disk diffusion susceptibility testing of yeast

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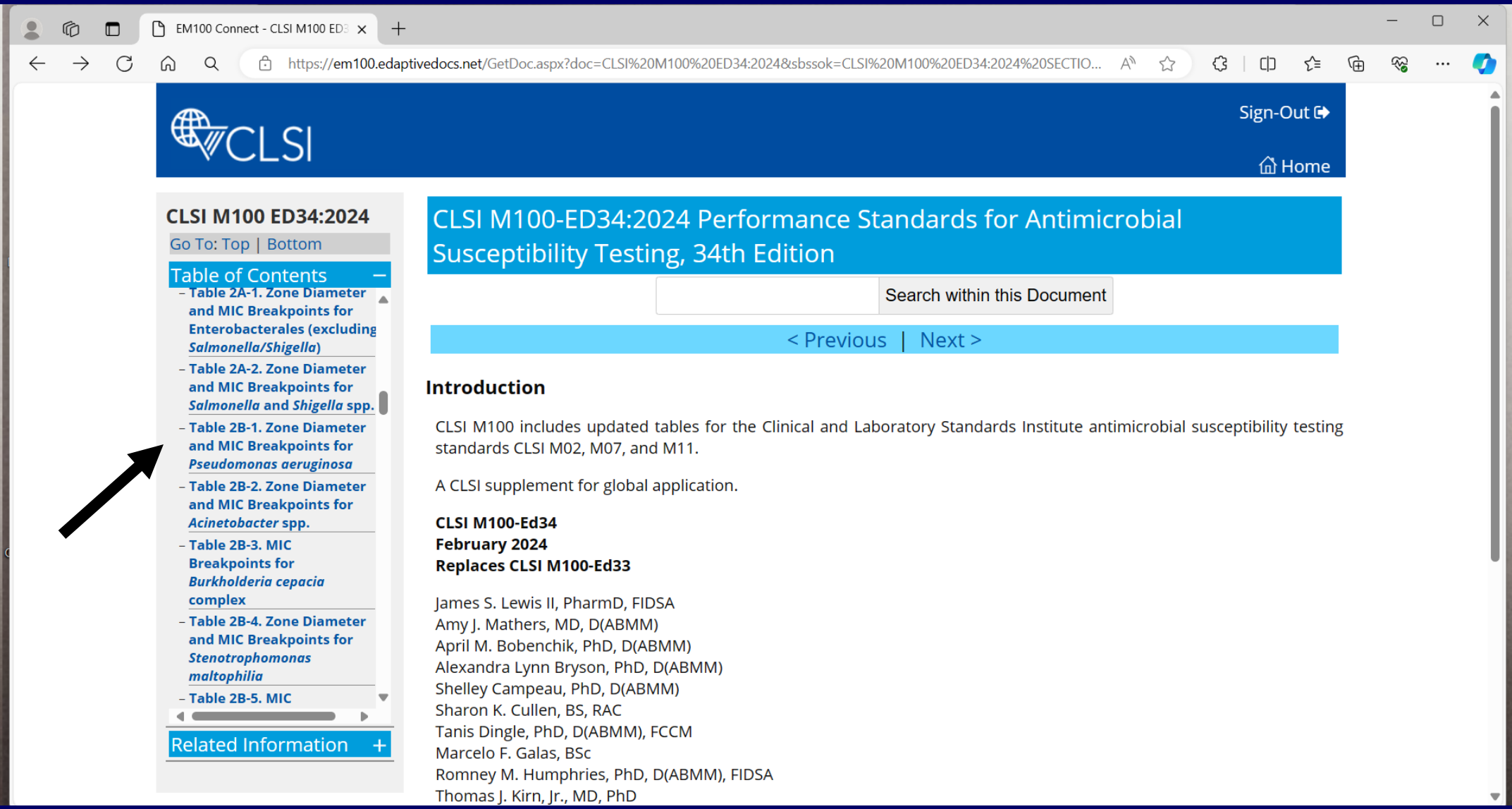
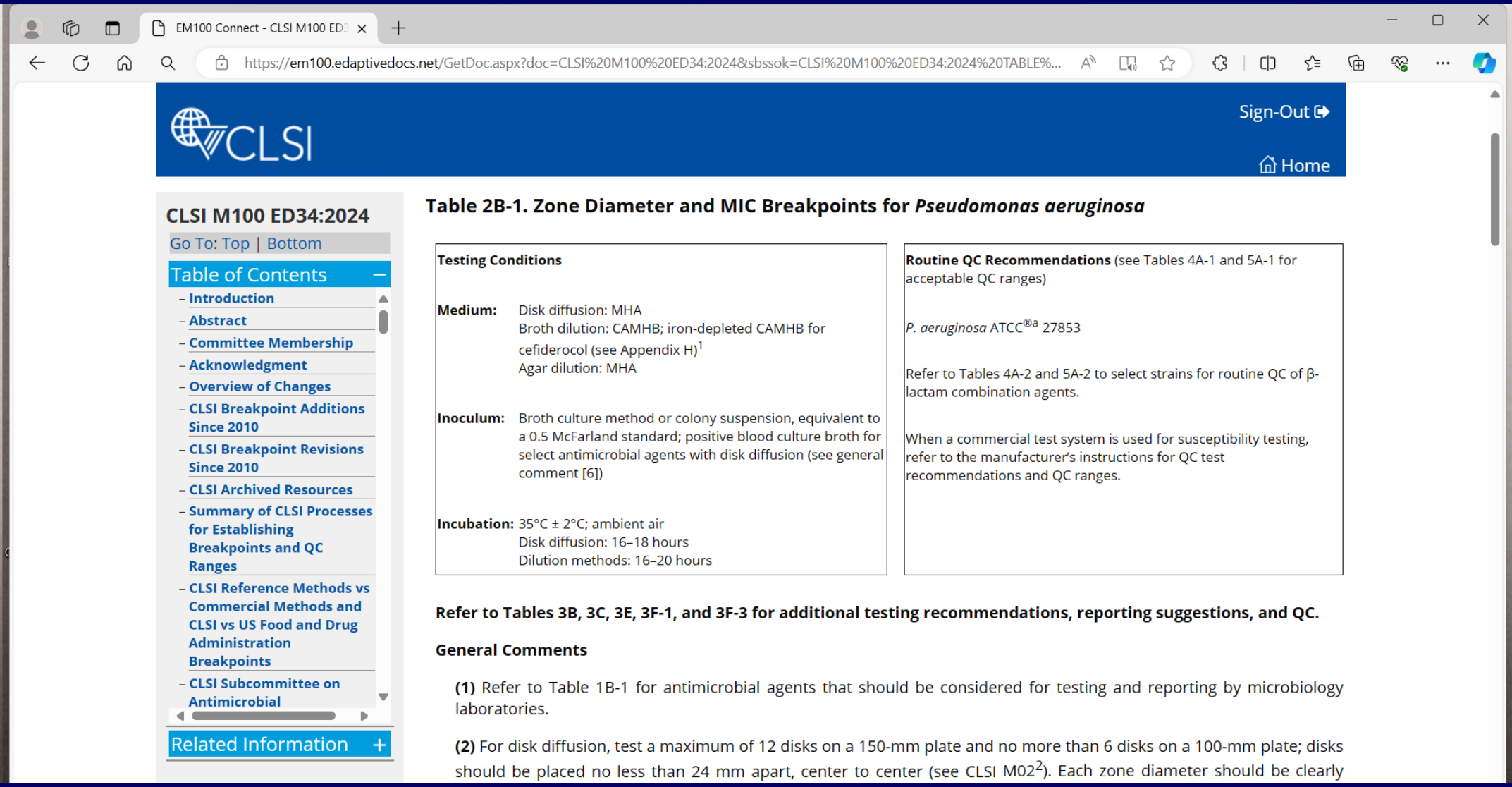
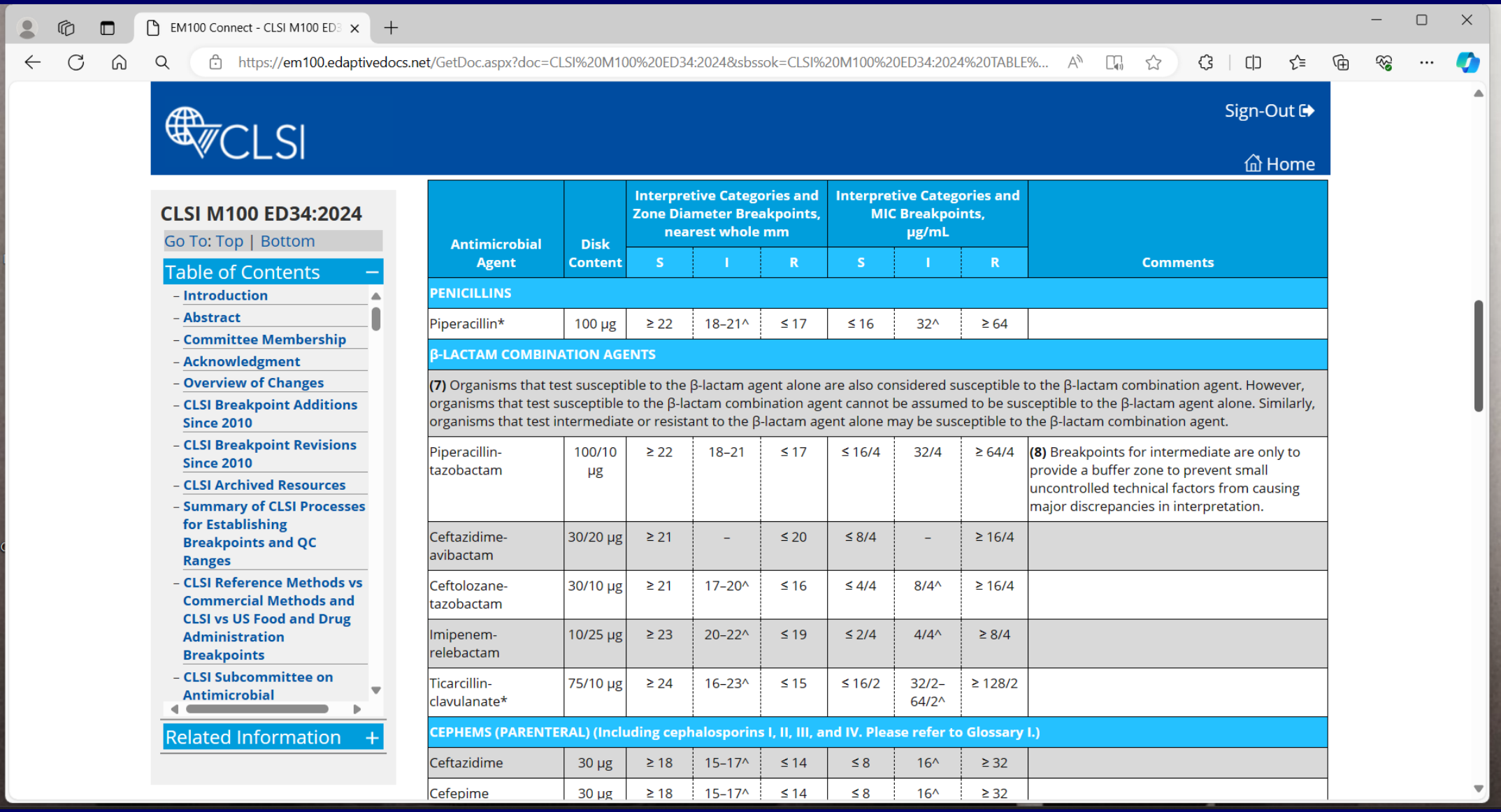


Pseudomonas aeruginosa



Pseudomonas aeruginosa



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- CLSI Subcommittee on Antimicrobial

Related Information

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm			Interpretive Categories and MIC Breakpoints, µg/mL			Comments
		S	I	R	S	I	R	
PENICILLINS								
Piperacillin*	100 µg	≥ 22	18–21^	≤ 17	≤ 16	32^	≥ 64	
β-LACTAM COMBINATION AGENTS								
(7) 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 intermediate or resistant to the β-lactam agent alone may be susceptible to the β-lactam combination agent.								
Piperacillin-tazobactam	100/10 µg	≥ 22	18–21	≤ 17	≤ 16/4	32/4	≥ 64/4	**(8)** Breakpoints for intermediate are only to provide a buffer zone to prevent small uncontrolled technical factors from causing major discrepancies in interpretation.
Ceftazidime-avibactam	30/20 µg	≥ 21	–	≤ 20	≤ 8/4	–	≥ 16/4	
Ceftolozane-tazobactam	30/10 µg	≥ 21	17–20^	≤ 16	≤ 4/4	8/4^	≥ 16/4	
Imipenem-relebactam	10/25 µg	≥ 23	20–22^	≤ 19	≤ 2/4	4/4^	≥ 8/4	
Ticarcillin-clavulanate*	75/10 µg	≥ 24	16–23^	≤ 15	≤ 16/2	32/2–64/2^	≥ 128/2	
CEPHEMS (PARENTERAL) (Including cephalosporins I, II, III, and IV. Please refer to Glossary I.)								
Ceftazidime	30 µg	≥ 18	15–17^	≤ 14	≤ 8	16^	≥ 32	
Cefepime	30 µg	≥ 18	15–17^	≤ 14	≤ 8	16^	≥ 32	

RELATED INFORMATION

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Related Information –

Document Status:

Active

References:

- CLSI M02
- CLSI M07
- CLSI M11
- CLSI M23
- CLSI M39
- CLSI M45
- CLSI M52
- IDSA 2023
- ISO 20776-1

Referenced by:

- CLSI M23S ED1:2020

CLSI M100-ED34:2024 Performance Standards for Antimicrobial Susceptibility Testing, 34th Edition

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Introduction

CLSI M100 includes updated tables for the Clinical and Laboratory Standards Institute antimicrobial susceptibility testing standards CLSI M02, M07, and M11.

A CLSI supplement for global application.

CLSI M100-Ed34
February 2024
Replaces CLSI M100-Ed33

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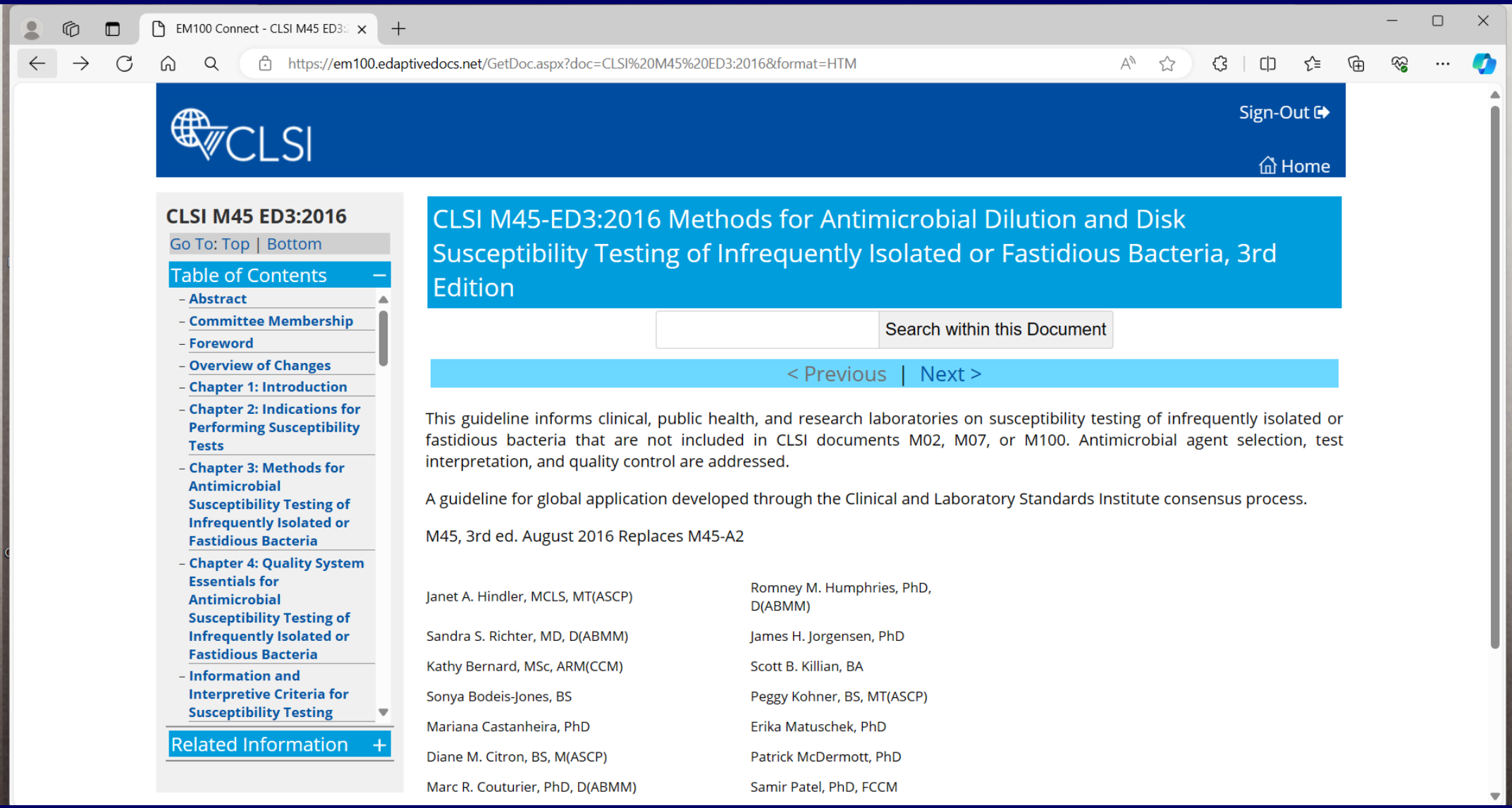
M02	Disk diffusion
M07	Broth microdilution
M11	Anaerobes
M23	Quality control
M39	Antibiogram
M45	Infrequent bacteria
M52	Commercial verification

FOR EXAMPLE, DIRECT LINK TO M45



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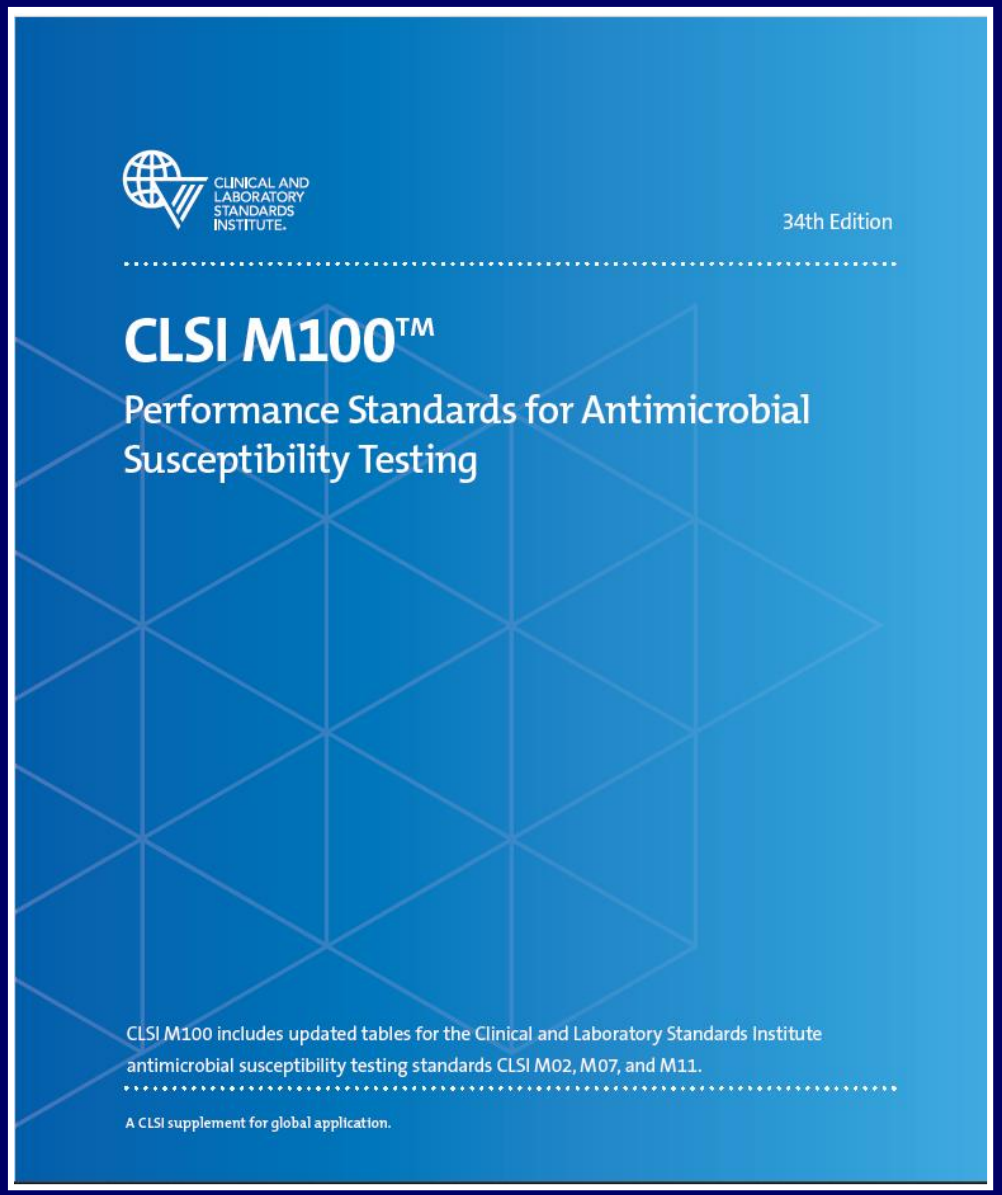

382 pages
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Three General Comments

(NON-)FASTIDIOUS GROUPINGS

- Group A Primary test and report
- Group B Optional primary test, report selectively
- Group C Supplemental report selectively
- Group U Supplemental for urine only

CLSI M100 29th ed., 2019

TABLES 1

Table 1A
Suggested Nonfastidious Groupings
M02 and M07

Table 1A. Suggested Groupings of Antimicrobial Agents Approved by the US Food and Drug Administration for Clinical Use That Should Be Considered for Testing and Reporting on Nonfastidious Organisms by Microbiology Laboratories in the United States

	Enterobacteriaceae	*Pseudomonas aeruginosa*	*Staphylococcus* spp.	*Enterococcus* spp.[m]

Table 1B
Suggested Fastidious Groupings
M02 and M07

Table 1B. Suggested Groupings of Antimicrobial Agents Approved by the US Food and Drug Administration for Clinical Use That Should Be Considered for Testing and Reporting on Fastidious Organisms by Microbiology Laboratories in the United States

	Haemophilus influenzae[d] and *Haemophilus parainfluenzae*	*Neisseria gonorrhoeae*[l]	*Streptococcus pneumoniae*[j]	*Streptococcus* spp. β-Hemolytic Group[p]	*Streptococcus* spp. Viridans Group[p]

Table 1C
Suggested Anaerobe Groupings
M11

Table 1C. Suggested Groupings of Antimicrobial Agents Approved by the US Food and Drug Administration for Clinical Use That Should Be Considered for Testing and Reporting on Anaerobic Organisms by Microbiology Laboratories in the United States

	Gram-Negative Anaerobes	Gram-Positive Anaerobes[a]

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CRITERIA FOR INCLUSION

Agents of proven efficacy
Acceptable *in vitro* test performance

CRITERIA FOR ASSIGNMENT

Clinical efficacy
Prevalence of resistance
Minimizing emergence of resistance
FDA clinical indications for use
Current consensus recommendations for first-choice or alternative drugs
Co$t

CLSI M100-Ed33, 2023

TABLE 1 GROUPINGS

- 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

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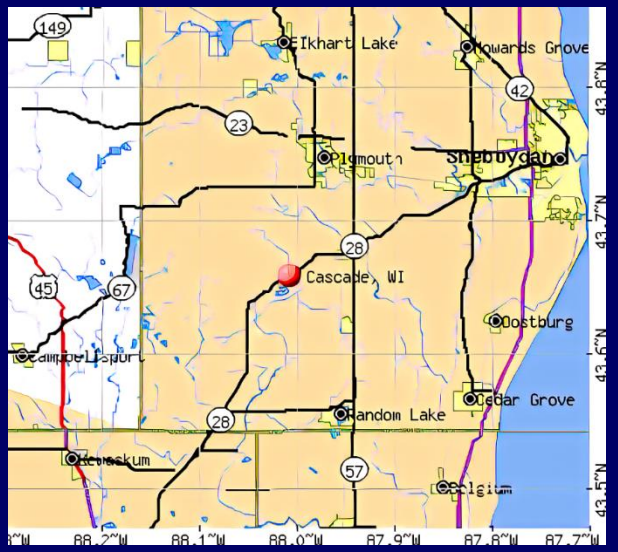
TABLE 1 GROUPINGS

- 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

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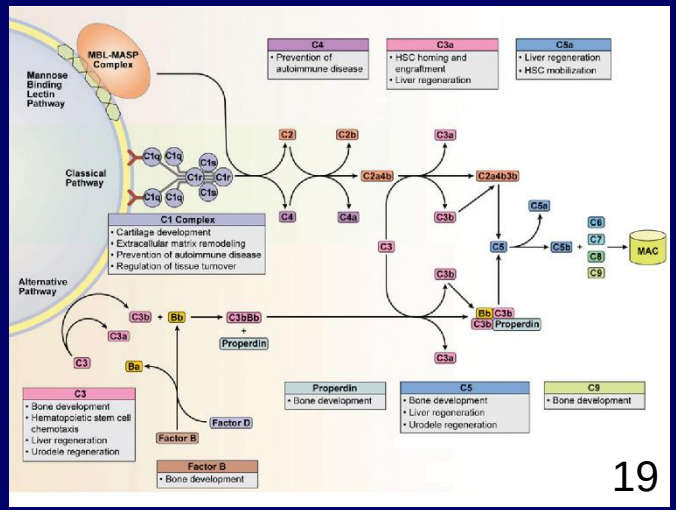
REPORTING

- **Selective** Based on defined criteria unrelated to susceptibility testing data

  Organism ID — Clinical setting
  Site of infection — Patient demographics

- **Cascade** Based on overall antimicrobial susceptibility profile of isolate



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THEY NOW PERFECTLY MATCH UP

Table 1B-2
Acinetobacter spp.
CLSI M02 and CLSI M07

Table 1B-2. *Acinetobacter* spp.

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

Table 2B-2
Acinetobacter spp.
CLSI M02 and CLSI M07

Table 2B-2. Zone Diameter and MIC Breakpoints for *Acinetobacter* spp.

Testing Conditions

Medium: Disk diffusion: MHA
Broth dilution: CAMHB; iron-depleted CAMHB for cefiderocol (see Appendix H)[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 [3])**

Incubation: 35°C ± 2°C; ambient air; 20–24 hours, all methods

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

Escherichia coli ATCC®[a] 25922 (for tetracyclines and trimethoprim-sulfamethoxazole)
Pseudomonas aeruginosa ATCC® 27853

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.

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TABLE 2B-2

Table 2B-2. *Acinetobacter* spp. (Continued)

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm			Interpretive Categories and MIC Breakpoints, µg/mL			Comments
		S	I	R	S	I	R	
PENICILLINS								
Piperacillin*	100 µg	≥ 21	18–20	≤ 17	≤ 16	32–64	≥ 128	
β-LACTAM COMBINATION AGENTS								
(4) 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 intermediate or resistant to the β-lactam agent alone may be susceptible to the β-lactam combination agent.								
Ampicillin-sulbactam	10/10 µg	≥ 15	12–14	≤ 11	≤ 8/4	16/8	≥ 32/16	
Piperacillin-tazobactam	100/10 µg	≥ 21	18–20	≤ 17	≤ 16/4	32/4–64/4	≥ 128/4	
Sulbactam-durlobactam	**10/10 µg**	**≥ 17**	**14–16**	**≤ 13**	**≤ 4/4**	**8/4**	**≥ 16/4**	
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.)								
Ceftazidime	30 µg	≥ 18	15–17	≤ 14	≤ 8	16	≥ 32	
Cefepime	30 µg	≥ 18	15–17	≤ 14	≤ 8	16	≥ 32	
Cefotaxime	30 µg	≥ 23	15–22	≤ 14	≤ 8	16–32	≥ 64	
Ceftriaxone	30 µg	≥ 21	14–20	≤ 13	≤ 8	16–32	≥ 64	

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1,2 A-1	Enterobacterales (excluding *Salmonella*/*Shigella*)
1,2 A-2	*Salmonella* and *Shigella* spp.
1,2 B-1	*Pseudomonas aeruginosa*
1,2 B-2	*Acinetobacter* spp.
1,2 B-3	*Burkholderia cepacia* complex
1,2 B-4	*Stenotrophomonas maltophilia*
1,2 B-5	Other Non-Enterobacterales
1,2 C	*Staphylococcus* spp.
1,2 D	*Enterococcus* spp.
1,2 E	*Haemophilus influenzae* and *Haemophilus parainfluenzae*
1,2 F	*Neisseria gonorrhoeae*
1,2 G	*Streptococcus pneumoniae*
1,2 H-1	*Streptococcus* spp. β-Hemolytic Group
1,2 H-2	*Streptococcus* spp. Viridans Group
1,2 I	*Neisseria meningitidis* (now has Table 1I)
1,2 J	Anaerobes (combined Gram-positive and Gram-negative)

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CLARIFICATIONS…or maybe not

- Daptomycin not routinely reported on organisms isolated from lower respiratory tract
- *Streptococcus agalactiae* intrapartum guidelines
- Susceptible isolates that may develop resistance after initiation of therapy

  Formerly “within 3 to 4 days”
  Now “within a few days”

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BEFORE

Table 2D. *Enterococcus* spp. (Continued)

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm			Interpretive Categories and MIC Breakpoints, µg/mL				Comments
		S	I	R	S	SDD	I	R	
PENICILLINS									
Penicillin	10 units	≥15	-	≤14	≤8	-	-	≥16	(7) 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*. (8) Enterococci susceptible to penicillin are predictably susceptible to ampicillin, amoxicillin, ampicillin-sulbactam, amoxicillin-clavulanate, and piperacillin-tazobactam for non-β-lactamase-producing enterococci. However, enterococci susceptible to ampicillin cannot be assumed to be susceptible to penicillin. If penicillin results are needed, testing of penicillin is required. (9) *Rx:* Combination therapy with high-dosage parenteral ampicillin, amoxicillin, penicillin, or vancomycin (for susceptible strains only), plus an aminoglycoside, is usually indicated for serious enterococcal infections, such as endocarditis, unless high-level resistance to both gentamicin and streptomycin is documented; such combinations are predicted to result in synergistic killing of enterococci. (10) 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. (11) Breakpoints when oral ampicillin is used for therapy of uncomplicated UTIs only are based on an ampicillin dosage regimen of 500 mg orally administered every 6 h or amoxicillin dosage regimen of 250 mg orally administered every 8 h or 500 mg every 12 h.
Ampicillin	10 µg	≥17	-	≤16	≤8	-	-	≥16	

Table 2D
***Enterococcus* spp.**
M02 and M07

CLSI M100-Ed33, 2023

AFTER

Table 2D
Enterococcus spp.
CLSI M02 and CLSI M07

Table 2D. *Enterococcus* spp. (Continued)

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm			Interpretive Categories and MIC Breakpoints, µg/mL				Comments
		S	I	R	S	SDD	I	R	
PENICILLINS (Continued)									
Penicillin	10 units	≥ 15	–	≤ 14	≤ 8	–	–	≥ 16	**(10)** Penicillin or ampicillin resistance among enterococci due to β-lactamase production has been reported very rarely. Penicillin or ampicillin resistance due to β-lactamase production is not reliably detected with routine disk or dilution methods but is detected using a direct, nitrocefin-based β-lactamase test. Because of the rarity of β-lactamase–positive enterococci, this test does not need to be performed routinely but can be used in selected cases. A positive β-lactamase test predicts resistance to penicillin as well as amino- and ureidopenicillins (see Glossary I).
Ampicillin	10 µg	≥ 17	–	≤ 16	≤ 8	–	–	≥ 16	

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BEFORE

Table 3E-2. Enterobacterales (Continued)

Antimicrobial Agent	Disk Content	Read Times, hours	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm				Comments
			S	SDD	I	R	
PENICILLINS							
Ampicillin	10 µg	8-10	**≥16**	-	**12-15**	**≤ 11**	(4) Results of ampicillin testing can be used to predict results for amoxicillin.
		16-18	≥ 17	-	14-16	≤ 13	(5) 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.
CEPHEMS (PARENTERAL) (Including cephalosporins I, II, III, and IV. Please refer to Glossary I.)							
Ceftriaxone	30 µg	8-10	≥ 23	-	20-22	≤ 19	(6) Breakpoints are based on a dosage regimen of 1 g administered every 24 h.
		16-18	≥ 23	-	20-22	≤ 19	
Ceftazidime	30 µg	8-10	≥ 21	-	18-20	≤ 17	(7) Breakpoints are based on a dosage regimen of 1 g administered every 8 h.
		16-18	≥ 21	-	18-20		
MONOBACTAMS							
Aztreonam	30 µg	8-10	≥ 21	-	18-20	≤ 17	(8) Breakpoints are based on a dosage regimen of 1 g administered every 8 h.
		16-18	≥ 21	-	18-20		

Table 3E-2
Zone Diameter Disk Diffusion Breakpoints for Enterobacterales Direct From Blood Culture

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AFTER

Table 3F-2
Zone Diameter Disk Diffusion Breakpoints for Enterobacterales Direct From Blood Culture

Table 3F-2. Zone Diameter Disk Diffusion Breakpoints for Enterobacterales Direct From Blood Culture

General Comments

(1) Organism identification must be known before interpreting and reporting results. Fluoroquinolone breakpoints do not apply to *Salmonella* spp. **Aztreonam, ceftazidime, and tobramycin breakpoints do not apply to *Salmonella* or *Shigella* spp.**

(2) For additional testing and reporting recommendations, refer to Table**s** 2A-1 **and 2A-2**.

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

Antimicrobial Agent	Disk Content	Read Times, hours	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm			Comments
			S	I	R	
PENICILLINS						
Ampicillin	10 µg	8–10 16–18	≥ 16 ≥ 17	12–15 14–16	≤ 11 ≤ 13	**(3)** Results of ampicillin testing can be used to predict results for amoxicillin.
CEPHEMS (PARENTERAL) (Including cephalosporins I, II, III, and IV. Please refer to Glossary I.)						
Ceftriaxone	30 µg	8–10 16–18	≥ 23 ≥ 23	20–22 20–22	≤ 19 ≤ 19	
Ceftazidime	30 µg	8–10 16–18	≥ 21 ≥ 21	18–20 18–20	≤ 17 ≤ 17	
MONOBACTAMS						
Aztreonam	30 µg	8–10 16–18	≥ 21 ≥ 21	18–20 18–20	≤ 17 ≤ 17	

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WHERE DID THEY GO?

Introduction to Table 2 Dosages. Antimicrobial Agent Dosage Regimens Used to Establish Susceptible or Susceptible-Dose Dependent Breakpoints

The evolving science of pharmacokinetics/pharmacodynamics has become increasingly important in recent years in determining MIC breakpoints. **CLSI** susceptible or susceptible-dose dependent breakpoints **added or revised since 2010** have been based on a specific dosage regimen(s); these dosage regimens are listed in the table below. Proper application of the breakpoints necessitates drug exposure at the site of infection that corresponds to or exceeds the expected systemic drug exposure at the dose listed in adult patients with normal renal function. This information should be shared with pharmacists, infectious diseases staff, and others making dosing recommendations for the institution.

CLSI guidance for establishing or revising breakpoints is available in CLSI M23.[1] Rationale documents that provide the scientific reasoning behind the subcommittee's decisions for some breakpoints, along with documentation of the standardized data and methods used to determine breakpoints, can be found on the CLSI website.[2]

NOTE 1: If both a susceptible and a susceptible-dose dependent dosage regimen were used, they are designated by "S" or "SDD" preceding the dosage regimen. Otherwise, it should be assumed that the dosage regimen applies to the susceptible breakpoint.

NOTE 2: Unless otherwise noted, refer to the approved prescribing information for the infusion duration used to set breakpoints for IV antibiotics (eg, 0.5 hours for most β-lactams, 1–1.5 hours for fluoroquinolones).

NOTE 3: Dosage regimens also include the frequency of administration designated by the abbreviation "q." For example, the amikacin susceptible breakpoint for Enterobacterales was based on a dosage regimen of 15 mg/kg IV q 24 h, which corresponds to 15 mg/kg IV administered every 24 hours.

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SUSCEPTIBLE AND -DOSE DEPENDENT

Table 2A-1
Enterobacterales (excluding *Salmonella/Shigella*)
CLSI M02 and CLSI M07

Table 2A-1. Enterobacterales (excluding *Salmonella/Shigella*) (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).

Table 2 Dosages. Dosage Regimens Used to Establish Susceptible or Susceptible-Dose Dependent Breakpoints
CLSI M02 and CLSI M07

Table 2 Dosages. Antimicrobial Agent Dosage Regimens Used to Establish Susceptible or Susceptible-Dose Dependent Breakpoints

Antimicrobial Agent	Dosage Regimen Used to Establish S or SDD Breakpoint
Table 2A-1. Enterobacterales (excluding *Salmonella/Shigella*)	
Amikacin	15 mg/kg IV q 24 h
Ampicillin (ampicillin test results predict results for amoxicillin)	Ampicillin: 2 g IV q 4–6 h or Amoxicillin: 1–2 g IV q 6 h
Ampicillin (ampicillin test results predict results for amoxicillin; *Escherichia coli* and *Proteus mirabilis* for uncomplicated UTIs only)	Ampicillin: 500 mg PO q 6 h or Amoxicillin: 250 mg PO q 8 h or 500 mg PO q 12 h
Amoxicillin-clavulanate (oral amoxicillin-clavulanate for uncomplicated UTIs or when completing therapy for systemic infection only)	1.2 g (1 g amoxicillin + 0.2 g clavulanate) IV q 6 h 500/125 mg PO q 8 h or 875/125 mg PO q 12 h
Ampicillin-sulbactam	3 g IV (2 g ampicillin + 1 g sulbactam) q 6 h
Aztreonam	1 g IV q 8 h
Cefazolin (*E. coli*, *Klebsiella pneumoniae*, and *P. mirabilis* for infections other than uncomplicated UTIs only)	2 g IV q 8 h
Cefazolin (*E. coli*, *K. pneumoniae*, and *P. mirabilis* for uncomplicated UTIs only)	1 g IV q 12 h
Ceftaroline	600 mg IV q 12 h
Cefepime	S: 1 g IV q 8 h or 2 g IV q 12 h SDD: 2 g IV q 8 h over 3 h

CLSI M100-Ed34, 2024

HERE'S OUR *Enterococcus*

Table 2D. *Enterococcus* spp.	
Ampicillin (ampicillin test results predict results for amoxicillin**; oral ampicillin or amoxicillin used for uncomplicated UTIs only)**	Ampicillin: 2 g IV q 4–6 h or 500 mg PO q 6 h Amoxicillin: 1–2 g IV q 6 h or 250 mg PO q 8 h or 500 mg PO q 12 h
Dalbavancin (vancomycin-susceptible *E. faecalis* only)	1500 mg IV once or 1000 mg IV once followed one week later by 500 mg IV once
Daptomycin (*E. faecium* only)	SDD: 8–12 mg/kg IV q 24 h
Daptomycin (*Enterococcus* spp. other than *E. faecium*)	6 mg/kg IV q 24 h
Oritavancin **(vancomycin-susceptible *E. faecalis* only)**	1200 mg IV once
Tedizolid **(*E. faecalis* only)**	200 mg IV/PO q 24 h
Telavancin **(vancomycin-susceptible *E. faecalis* only)**	10 mg/kg IV q 24 h
Table 2E. *Haemophilus influenzae* and *Haemophilus parainfluenzae*	
Amoxicillin-clavulanate	500/125 mg PO q 8 h or 875/125 mg PO q 12 h
Ampicillin (meningitis)	2 g IV q 4 h
Ampicillin-sulbactam	3 g (2 g ampicillin + 1 g sulbactam) IV q 6 h
Ceftaroline (*H. influenzae* only)	600 mg IV q 12 h
Ceftolozane-tazobactam (*H. influenzae* only)	3 g (2 g ceftolozane + 1 g tazobactam) IV q 8 h

Table 2 Dosages. Dosage Regimens Used to Establish Susceptible or Susceptible-Dose Dependent Breakpoints CLSI M02 and CLSI M07

CLSI M100-Ed34, 2024

Old Business

Table 3G-1
Test for Detecting Methicillin (Oxacillin) Resistance in *Staphylococcus aureus* and *Staphylococcus lugdunensis*

Table 3G-1. Test for Detecting Methicillin (Oxacillin) Resistance in *Staphylococcus aureus*[a] and *Staphylococcus lugdunensis*

Test	Detecting *mecA*-Mediated Resistance Using Cefoxitin[b]		Detecting *mecA*-Mediated Resistance Using Oxacillin	Detecting *mecA*-mediated Resistance Using Oxacillin Salt Agar for *S. aureus* Only
Test method	Disk diffusion	Broth microdilution	Broth microdilution and agar dilution	Agar dilution for *S. aureus*
Medium	MHA	CAMHB	CAMHB with 2% NaCl (broth microdilution) MHA with 2% NaCl (agar dilution)	MHA with 4% NaCl
Antimicrobial concentration	30-µg cefoxitin disk	4 µg/mL cefoxitin	2 µg/mL oxacillin	6 µg/mL oxacillin
Inoculum	Standard disk diffusion procedure	Standard broth microdilution procedure	Standard broth microdilution procedure or standard agar dilution procedure	Colony suspension to obtain 0.5 McFarland turbidity Using a 1-µL loop that was dipped in the suspension, spot an area 10-15 mm in diameter. Alternatively, using a swab dipped

Table 3H
Oxacillin Salt Agar Test for Methicillin (Oxacillin) Resistance in *Staphylococcus aureus*

Table 3H. Oxacillin Salt Agar Test for Detecting Methicillin (Oxacillin) Resistance in *Staphylococcus aureus*[a]

Test	Oxacillin Salt Agar
Test method	Agar dilution
Medium	MHA with 4% NaCl
Antimicrobial concentration	6 µg/mL oxacillin
Inoculum	Colony suspension to obtain 0.5 McFarland turbidity Using a 1-µL loop that was dipped in the suspension, spot an area 10–15 mm in diameter. Alternatively, using a swab dipped in the suspension and the excess liquid expressed, spot a similar area or streak an entire quadrant.

CLSI M100-Ed33, 2023; CLSI M100-Ed34, 2024

THE STREAK COMES TO AN END

Table 2C
Staphylococcus spp.
CLSI M02 and CLSI M07

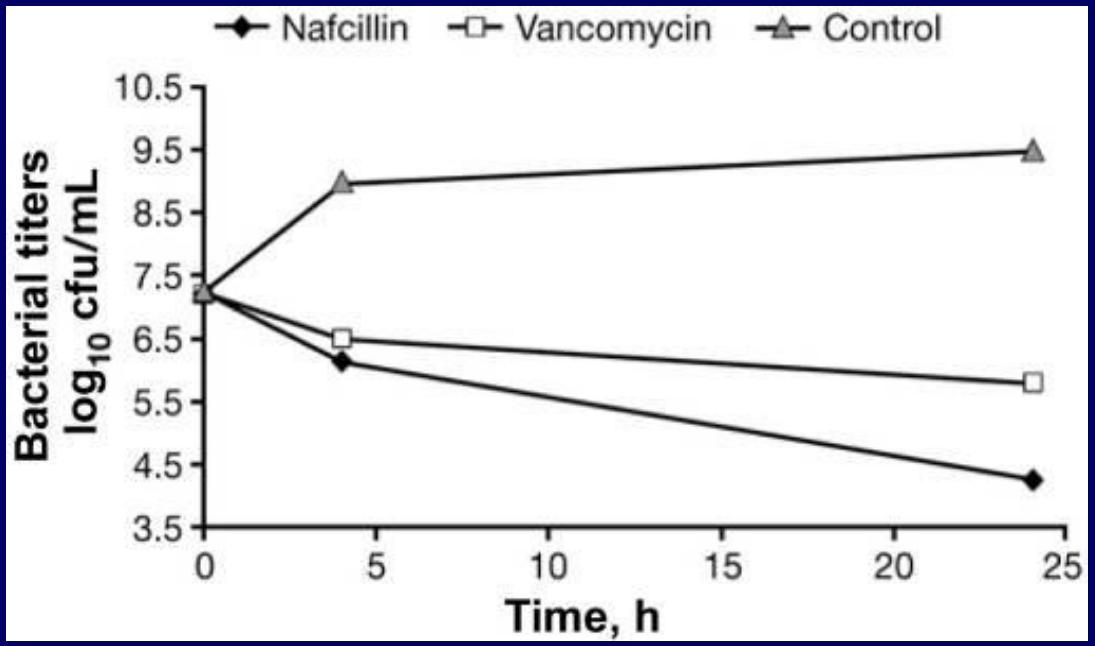
Table 2C. *Staphylococcus* spp. (Continued)

Methods or Targets for Detection of Methicillin (Oxacillin)-Resistant *Staphylococcus* spp.							
Organism	Disk Diffusion		MIC		*mecA*	PBP2a	Oxacillin Salt Agar
	Cefoxitin	Oxacillin	Cefoxitin	Oxacillin			
S. aureus	Yes (16–18 h)	No	Yes (16–20 h)	Yes (24 h)	Yes	Yes	Yes (24 h)
S. lugdunensis	Yes (16–18 h)	No	Yes (16–20 h)	Yes (24 h)	Yes	Yes	No
S. epidermidis	Yes (24 h)	Yes (16–18 h)	No	Yes (24 h)	Yes	Yes	No
S. pseudintermedius	No	Yes (16–18 h)	No	Yes (24 h)	Yes	Yes	No
S. schleiferi	No	Yes (16–18 h)	No	Yes (24 h)	Yes	Yes	No
Staphylococcus spp. (not listed above or not identified to the species level)	Yes, with exceptions[a] (24 h)	No	No	Yes (24 h)	Yes	Yes	No

Abbreviations: h, hour(s); MIC, minimal inhibitory concentration; PBP2a, penicillin-binding protein 2a.
[a] The cefoxitin disk diffusion test may not perform reliably for all species (eg, *S. haemolyticus*) that fall into the category of "*Staphylococcus* spp. (not listed above or not identified to the species level)."[6]

- Grouped by method, rather than test (data are the same)
- Added *mecA* and PBP2a determinations

CLSI M100-Ed34, 2024



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COMMENTARY

Use of Rapid Diagnostics To Manage Pediatric Bloodstream Infections? You Bet Your ASP!

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POSITIVE BLOOD CULTURE BOTTLE

JOURNAL OF CLINICAL MICROBIOLOGY, Mar. 1979, p. 347–350
0095-1137/79/03-0347/04$02.00/0

Vol. 9, No. 3

Standardization of Direct Susceptibility Test for Blood Cultures

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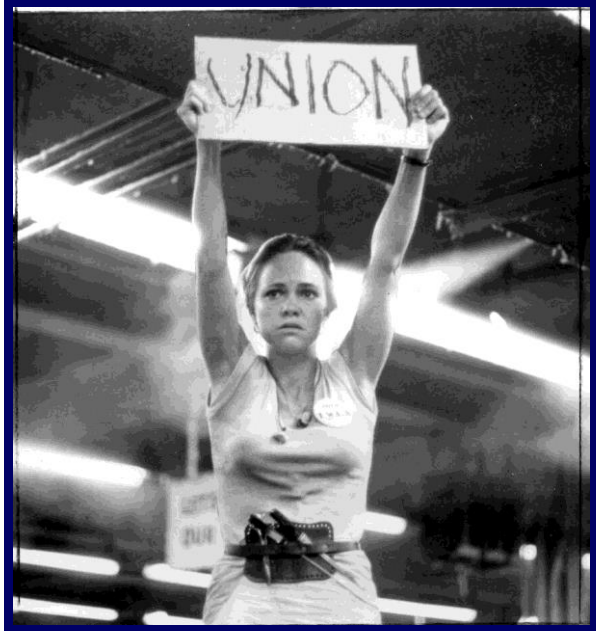
Received for publication 17 December 1978

Insufficient data are available to establish the reliability of direct disk diffusion susceptibility tests performed utilizing positive blood culture broth as inoculum. When *Staphylococcus aureus* ATCC 25923, *Escherichia coli* ATCC 25922, and *Pseudomonas aeruginosa* ATCC 27853 were used, 0.03 ml of turbid overnight blood culture broth was found to produce zone diameters closely approximating the size of diameters obtained by a standardized method. Results of direct (0.03 ml of inoculum) and standardized susceptibility tests were then compared for 116 positive blood cultures (1,069 individual disk comparisons). There were 1,011 test agreements (94.6%). There were also 48 (4.5%) minor discrepancies (change between sensitive and intermediate or between intermediate and resistant) and 10 (0.9%) major discrepancies (change between sensitive and resistant). The major discrepancies were randomly distributed among several organisms and antibiotics. Discrepancies occurred most frequently in the more clinically acceptable direction; i.e., in 79.3% the direct test indicted greater resistance than the standardized test. These data establish that 0.03 ml of turbid overnight blood culture broth produces results which compare closely to those obtained with standard methods, and in practice yield direct susceptibility results with a clinically acceptable level of reliability.



J Clin Microbiol. 9:347-350; 1979

TWO DROPS

TABLE 2. *Organisms included in the clinical comparison of the direct and standardized susceptibility tests*

Organism	No. of strains tested	Discrepancies		Agreements
		Major	Minor	
E. coli	46	2	22	390
Klebsiella	16	2	12	130
Proteus mirabilis	8	2	3	67
Providencia stuartii	1	0	1	8
Citrobacter diversus	1	0	0	9
Citrobacter freundii	1	0	1	8
Enterobacter aerogenes	3	0	1	26
Enterobacter cloacae	3	2	1	24
Enterobacter agglomerans	1	0	0	9
Serratia marcescens	3	0	0	27
P. aeruginosa	4	0	0	36
Pseudomonas species	2	0	2	16
Bordetella parapertussis	1	0	0	9
Acinetobacter calcoaceticus	1	0	0	9
S. aureus	12	0	0	120
Staphylococcus epidermidis	8	2	4	74
Enterococcus	3	0	1	29
Group D *Streptococcus* (not Enterococcus)	1	0	0	10
Viridans *Streptococcus*	1	0	0	10

TABLE 3. *Distribution of discrepancies between direct and standardized susceptibility tests by antibiotic*

Antibiotic	No. of comparisons	Discrepancies		
		Total	Major	Minor
Ampicillin	116	4 (3.8)[a]	1	3
Carbenicillin	91	4 (4.3)	0	4
Cephalothin	116	16 (13.8)	2	14
Chloramphenicol	116	6 (5.2)	3	3
Clindamycin	25	0	0	0
Colistin	91	6 (6.6)	2	4
Erythromycin	25	0	0	0
Gentamicin	116	0	0	0
Kanamycin	116	1 (0.8)	0	1
Methicillin	25	1 (4.0)	0	1
Penicillin	25	3 (12.0)	1	2
Streptomycin	91	9 (9.9)	0	9
Tetracycline	116	8 (6.9)	1	7

Major (0.9%): shift between sensitive and resistant

Minor (4.5%): shift between sensitive and intermediate
shift between intermediate and resistant

J Clin Microbiol. 9:347-350; 1979

FUTHER ENHANCEMENT

JOURNAL OF CLINICAL MICROBIOLOGY, Sept. 1984, p. 473–477
0095-1137/84/090473-05$02.00/0

Vol. 20, No. 3

Rapid Antimicrobial Susceptibility Testing of Isolates from Blood Cultures by Direct Inoculation and Early Reading of Disk Diffusion Tests

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Received 13 January 1984/Accepted 24 May 1984

Disk diffusion tests, inoculated directly from positive blood cultures, were evaluated for accuracy of reading zone diameters after 4- and 6-h and overnight incubation. In comparisons with results from standard disk diffusion tests, the 4-h results were in agreement for 83% of tests with gram-positive organisms and 64% of tests with gram-negative organisms. When minor discrepancies were ignored, the 4-h readings were in agreement for 98% of the tests with gram-positive organisms and 95% of the tests with gram-negative organisms. After 6 h of incubation, 91% of the tests with gram-positive organisms and 86% of the tests with gram-negative organisms agreed with standard results. The agreement was 99% for tests with both gram-positive and gram-negative organisms when minor discrepancies were excluded. Very major discrepancies occurred in two tests (0.1%) with gram-positive organisms and were not observed in tests with gram-negative organisms. The frequencies of major discrepancies were 3.5% after 4 h, 0.6% after 6 h, and 0.7% after overnight incubation. Ampicillin and cephalothin tests with *Escherichia coli* and *Klebsiella* spp. accounted for 81% of the major discrepancies in tests with gram-negative organisms. Oxacillin tests accounted for more than half of the major discrepancies in tests with staphylococci. The results of this study, which did not include the newer antibiotics, indicate that direct susceptibility tests from blood cultures read after 6 h of incubation are more reliable than 4-h results and produce less than 1% major errors in comparisons with standard susceptibility tests.

J Clin Microbiol. 20:473-477; 1984

READING 'EM EARLY

TABLE 1. Percentage of isolates with direct tests read after 4 or 6 h

Blood culture isolate	No. of isolates	% Read after: 4 h	% Read after: 6 h[a]
Gram positive			
S. aureus	60	22	63
Coagulase-negative staphylococci	87	3	21
Beta-hemolytic streptococci	30	37	87
Enterococci	21	19	52
Pneumococci	21	10	38
Viridans streptococci	14	0	0
Total for gram positive	233	14	44
Gram negative			
E. coli	84	52	85
Klebsiella spp.	38	40	76
Enterobacter spp.	12	42	92
P. aeruginosa	11	0	64
Others[b]	25	36	60
Total for gram negative	170	43	78

TABLE 2. Discrepancies from direct tests compared with standardized tests

Isolate type, time incubated	No. of tests	No. of discrepancies: Very major (%)	Major (%)	Minor (%)	Overall agreement (%)
Gram positive					
4 h	216	1 (0.5)	3 (1.4)	32 (14.8)	83.3
6 h	494	0	3 (0.6)	39 (7.9)	91.4
Overnight	1,307	1 (0.07)	8 (0.6)	65 (5.0)	94.3
Gram negative					
4 h	361	0	17 (4.7)	114 (31.6)	63.7
6 h	438	0	3 (0.7)	59 (13.5)	85.8
Overnight	762	0	6 (0.8)	73 (9.6)	89.6

four

J Clin Microbiol. 20:473-477; 1984

- Resistance in GNR can be multi-factorial; full phenotypic approach may be desirable
- Little standardization; very few laboratories report
- 1 carbapenem-resistant *Acinetobacter baumannii*

J Clin Microbiol. 56:e01678-17; 2018

RESULTS

TABLE 3 Resolved performance of direct-from-blood-culture disk diffusion method at 18 h, by antibiotic

Drug	No. of isolates		% CA	No. (%) of:		
	S	R		VME	ME	mE
Amikacin	45	13	96.7	0 (0)	0 (0)	2 (3.3)
Amoxicillin-clavulanate	9	17	88.9	0 (0)	1 (11.1)	2 (7.4)
Ampicillin	6	9	93.3	0 (0)	0 (0)	1 (6.7)
Aztreonam	21	28	94.3	0 (0)	0 (0)	3 (5.7)
Cefazolin	5	18	73.1	0 (0)	2 (40.0)	5 (19.2)
Cefepime	41	17	91.7	0 (0)	0 (0)	5 (8.3)
Cefoxitin	10	15	85.2	0 (0)	1 (10.0)	3 (11.1)
Ceftazidime	25	31	89.8	0 (0)	0 (0)	6 (10.2)
Ceftriaxone	16	29	87.5	0 (0)	2 (12.5)	4 (8.3)
Ciprofloxacin	26	27	96.6	0 (0)	0 (0)	1 (1.7)
Ertapenem	22	12	83.3	0 (0)	0 (0)	7 (16.7)
Gentamicin	39	18	95.0	0 (0)	1 (2.6)	2 (3.3)
Imipenem	34	21	68.3	0 (0)	3 (8.8)	15 (25.0)
Levofloxacin	33	25	91.7	0 (0)	1 (3.0)	3 (5.0)
Meropenem	37	19	84.7	0 (0)	1 (2.7)	8 (13.6)
Minocycline	29	11	80.0	0 (0)	0 (0)	9 (20.0)
Piperacillin-tazobactam	23	30	83.3	0 (0)	0 (0)	10 (16.7)
Tigecycline	35	3	87.2	0 (0)	0 (0)	5 (12.8)
Tobramycin	39	17	93.2	0 (0)	0 (0)	4 (6.8)
Trimethoprim-sulfamethoxazole	17	30	95.8	0 (0)	0 (0)	2 (4.2)

J Clin Microbiol. 56:e01678-17; 2018

RESULTS

TABLE 3 Resolved performancod-culture disk diffusion met
18 h, by antibiotic

Drug	% CA	No. (%) of: VME	ME
Amikacin	96.7	0 (0)	0 (0)
Amoxicillin-clavulanate	88.9	0 (0)	1 (11.1)
Ampicillin	93.3	0 (0)	0 (0)
Aztreonam	94.3	0 (0)	0 (0)
Cefazolin	73.1	0 (0)	2 (40.0)
Cefepime	91.7	0 (0)	0 (0)
Cefoxitin	85.2	0 (0)	1 (10.0)
Ceftazidime	89.8	0 (0)	0 (0)
Ceftriaxone	87.5	0 (0)	2 (12.5)
Ciprofloxacin	96.6	0 (0)	0 (0)
Ertapenem	83.3	0 (0)	0 (0)
Gentamicin	95.0	0 (0)	1 (2.6)
Imipenem	68.3	0 (0)	3 (8.8)
Levofloxacin	91.7	0 (0)	1 (3.0)
Meropenem	84.7	0 (0)	1 (2.7)
Minocycline	80.0	0 (0)	0 (0)
Piperacillin-tazobactam	83.3	0 (0)	0 (0)
Tigecycline	87.2	0 (0)	0 (0)
Tobramycin	93.2	0 (0)	0 (0)
Trimethoprim-sulfamethoxazole	95.8	0 (0)	0 (0)

TABLE 5 Resolved performance of direct-from-blood-culture disk diffusion method at 6 h, by antibiotic

Drug	No. of isolates S	R	% CA	No. (%) of: VME	ME	mE
Amikacin	45	13	62.2	3 (23.1)	2 (4.4)	12 (26.7)
Amoxicillin-clavulanate	9	17	60.0	0 (0)	1 (11.1)	9 (36.0)
Ampicillin	6	9	69.2	0 (0)	1 (16.7)	3 (23.1)
Aztreonam	21	28	84.2	0 (0)	1 (4.8)	5 (13.2)
Cefazolin	5	18	66.7	1 (5.6)	2 (40.0)	6 (25.0)
Cefepime	41	17	75.6	0 (0)	4 (9.8)	6 (13.3)
Cefoxitin	10	15	68.0	0 (0)	1 (10.0)	7 (28.0)
Ceftazidime	25	31	65.9	0 (0)	4 (16.0)	11 (25.0)
Ceftriaxone	16	29	77.3	0 (0)	3 (18.8)	7 (15.9)
Ciprofloxacin	24	27	57.1	0 (0)	1 (4.2)	16 (39.0)
Ertapenem	22	12	73.7	0 (0)	2 (9.1)	8 (21.1)
Gentamicin	39	18	95.6	0 (0)	0	2 (4.4)
Imipenem	34	21	46.7	0 (0)	6 (17.6)	18 (40.0)
Levofloxacin	33	25	75.6	0 (0)	1 (3.0)	10 (22.2)
Meropenem	36	19	52.3	0 (0)	9 (25.0)	11 (25.6)
Minocycline	29	11	65.9	0 (0)	0	12 (29.3)
Piperacillin-tazobactam	22	30	64.4	2 (6.7)	4 (18.2)	11 (25.0)
Tigecycline	35	3	45.7	0 (0)	3 (8.6)	16 (45.7)
Tobramycin	39	17	95.6	0 (0)	0	2 (4.4)
Trimethoprim-sulfamethoxazole	17	30	86.4	1 (3.3)	2 (11.8)	3 (6.8)

J Clin Microbiol. 56:e01678-17; 2018

Evaluation of the Performance of Direct Susceptibility Test by VITEK-2 from Positively Flagged Blood Culture Broth for Gram-Negative Bacilli

Kavipriya D[1] Suman Susan Prakash[1] Sarumathi Dhandapani[1] Deepashree Rajshekar[1] Apurba Sankar Sastry[1]

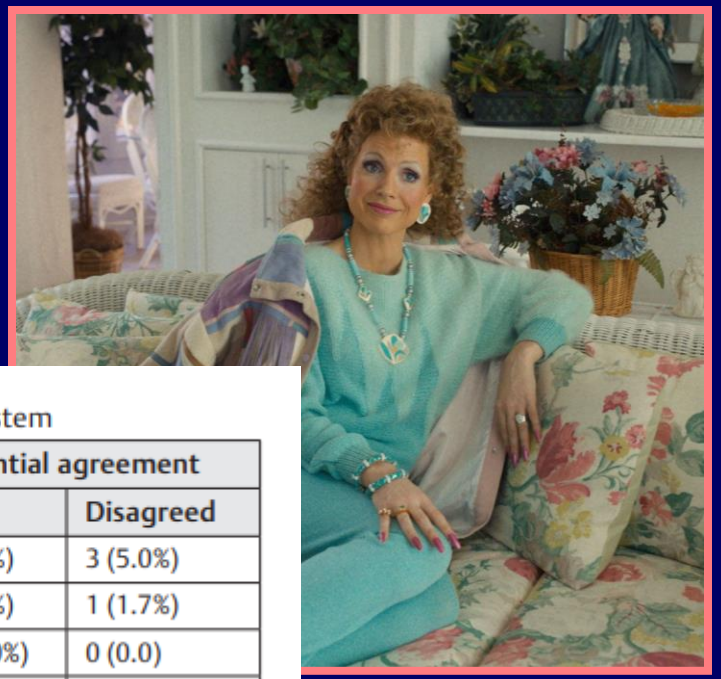


Table 3 Performance of direct test compared with reference (colony) test for nonfermenters by VITEK-2 system

Nonfermenter (60)	Categorical agreement (%)	Categorical disagreement (%)				Essential agreement	
		Minor	Major	Very major	Total	Agreed	Disagreed
Ticarcillin/clavulanic acid	57 (95.0%)	3 (5.0%)	0 (0.0)	0 (0.0)	3 (5.0%)	57 (95.0%)	3 (5.0%)
Piperacillin/tazobactam	59 (98.3%)	0 (0.0)	1 (1.7%)	0 (0.0)	1 (1.7%)	59 (98.3%)	1 (1.7%)
Ceftazidime	60 (100.0%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	60 (100.0%)	0 (0.0)
Cefoperazone/sulbactam	59 (98.3%)	1 (1.7%)	0 (0.0)	0 (0.0)	1 (1.7%)	59 (98.3%)	1 (1.7%)
Cefepime	60 (100.0%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	60 (100.0%)	0 (0.0)
Doripenem	60 (100.0%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	60 (100.0%)	0 (0.0)
Imipenem	60 (100.0%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	60 (100.0%)	0 (0.0)
Meropenem	60 (100.0%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	60 (100.0%)	0 (0.0)
Amikacin	59 (98.3%)	0 (0.0)	0 (0.0)	1 (1.7%)	1 (1.7%)	59 (98.3%)	1 (1.7%)
Gentamicin	59 (98.3%)	1 (1.7%)	0 (0.0)	0 (0.0)	1 (1.7%)	59 (98.3%)	1 (1.7%)
Ciprofloxacin	59 (98.3%)	1 (1.7%)	0 (0.0)	0 (0.0)	1 (1.7%)	59 (98.3%)	1 (1.7%)
Levofloxacin	55 (91.7%)	5 (8.3%)	0 (0.0)	0 (0.0)	5 (8.3%)	55 (91.7%)	5 (8.3%)
Minocycline	54 (90.0%)	6 (10.0%)	0 (0.0)	0 (0.0)	6 (10.0%)	54 (90.0%)	6 (10.0%)
Tigecycline	57 (95.0%)	2 (3.3%)	1 (1.6%)	0 (0.0)	3 (5.0%)	57 (95.0%)	3 (5.0%)
Colistin	60 (100.0%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	60 (100.0%)	0 (0.0)

[up to 15% categorical disagreement (mode 1.7%) for *Enterobacterales*]

J Lab Physicians. 13:374-379; 2021

Table 3F-1
Test for Performing Disk Diffusion Directly From Positive Blood Culture Broth

was Table 3E

Table 3F-1. Test for Performing Disk Diffusion Directly From Positive Blood Culture Broth

Test	Direct Disk Diffusion
Test method	Disk diffusion using positive blood culture broth
Organism group	Enterobacterales, *Pseudomonas aeruginosa*, **and *Acinetobacter* spp.**
Medium	MHA
Antimicrobial concentration	Standard disk contents for the antimicrobial agents are detailed in Table 3F-2 (Enterobacterales), Table 3F-3 (*P. aeruginosa*), **and Table 3F-4 (*Acinetobacter* spp.).**
Inoculum	Positive blood culture broth with gram-negative bacilli, used within 8 hours of flagging positive by the blood culture system
Test procedure	1. Invert blood culture bottle 5–10 times to thoroughly mix. 2. Sterilize the top of the bottle with an alcohol wipe (allow to dry) and insert 20-gauge venting needle into the blood culture bottle. 3. Dispense 4 drops of blood culture broth onto an MHA plate. As a purity check, use an inoculated blood agar plate streaked for isolation. 4. Spread blood culture broth across the entire surface of the MHA plate using a sterile cotton swab. 5. Repeat this procedure by streaking twice more, rotating the plate approximately 60 degrees each time to ensure an even distribution of inoculum. 6. Leave the lid ajar for 3–5 minutes (ideally) but no more than 15 minutes. 7. Dispense antimicrobial disks onto the surface of the inoculated MHA plate. 8. Press each disk down to ensure complete contact with the agar surface. 9. Invert the plate and place in the incubator within 15 minutes of disks being applied.
Incubation conditions	35°C ± 2°C; ambient air
Incubation length	8–10 hours or 16–18 hours (refer to Tables 3F-2, 3F-3, **and 3F-4** for antimicrobial agent–specific incubation lengths)
Results	1. Examine the blood agar purity plate to ensure pure growth. 2. Examine the test plate to ensure confluent lawn of growth appropriate to read disk zone tests per CLSI M02.[1] 3. Measure the zone diameters according to routine disk diffusion recommendations in CLSI M02.[1] 4. **Interpret results using the** zone diameter breakpoints in Tables 3F-2, 3F-3, **and 3F-4** if the gram-negative bacillus tested is confirmed to be an Enterobacterales, *P. aeruginosa*, **or *Acinetobacter* spp.**, respectively. If species is identified as another organism, do not interpret or report results. **5. Report only the interpretive category and not the measured zone size.**

4

35 ± 2

8-10 or
16-18

Daily or weekly QC; *E. coli* ATCC 25922, *P. aeruginosa* ATCC 27853, *E. coli* ATCC 35218 (NEW), others if necessary (NEW)

CLSI M100-Ed34, 2024

Acinetobacter spp. (TABLE 3F-4)

Agent	Concentration	Incubation time (hours)	Zone Diameters (mm)		
			S	I	R
ampicillin-sulbactam	10/10 μg	16-18	≥ 15	12-14	≤ 11
ceftazidime	30 μg	16-18	≥ 17	15-16	≤ 14
cefepime	30 μg	8-10	≥ 18	15-17	≤ 14
		16-18	≥ 18	15-17	≤ 14
ceftriaxone	30 μg	8-10	≥ 21	14-20	≤ 13
		16-18	≥ 20	13-19	≤ 12
meropenem	10 μg	8-10	≥ 18	15-17	≤ 14
		16-18	≥ 18	15-17	≤ 14
tobramycin	10 μg	8-10	≥ 15	13-14	≤ 12
		16-18	≥ 15	13-14	≤ 12
ciprofloxacin	5 μg	8-10	≥ 21	16-20	≤ 15
		16-18	≥ 21	16-20	≤ 15
trimethoprim-sulfamethoxazole	1.25/23.75 μg	8-10	≥ 16	11-15	≤ 10
		16-18	≥ 16	11-15	≤ 10

TABLE 3F-2 REVISIONS

Agent	Concentration	Incubation time (hours)	Zone Diameters (mm)		
			S	I	R
tobramycin	10 μg	8-10	≥ 17	13-16	≤ 12
		16-18	≥ 17	13-16	≤ 12

Intermediate increased

* direct aztreonam, ceftazidime, tobramycin not for *Salmonella* or *Shigella* spp.
* direct ciprofloxacin not for *Salmonella* spp.

Glucose fermenters
Reduce nitrates to nitrites
Non-spore-forming GNR
Grows on routine media
Facultative
Oxidase-negative (except *Plesiomonas*)

CLSI M100-Ed34, 2024

TABLE 3F-3 NEWBIES

Agent	Concentration	Incubation time (hours)	Zone Diameters (mm)		
			S	I	R
cefepime	30 μg	16-18	≥ 18	15-17	≤ 14
tobramycin	10 μg	8-10	≥ 19	13-18	≤ 12
		16-18	≥ 19	13-18	≤ 12

* confirmatory cefepime MIC testing for zone diameters 15-17 mm

CLSI M100-Ed34, 2024

GETTING BUSIER EVERY YEAR

Table 3F-1
Test for Performing Disk Diffusion Directly From Positive Blood Culture Broth

Table 3F-1. (Continued)

	Antimicrobial Agent	Date of Addition (M100 Edition)	8–10 h	16–18 h
Breakpoint Additions Since 2021 (Continued)	*Pseudomonas aeruginosa*			
	Cefepime	February 2024 (M100-Ed34)		X
	Ceftazidime	February 2022 (M100-Ed32)		X
	Ciprofloxacin	February 2022 (M100-Ed32)	X	X
	Meropenem	February 2022 (M100-Ed32)		X
		March 2023 (M100-Ed33)	X	
	Tobramycin	February 2022 (M100-Ed32)	X	X
	Acinetobacter spp.			
	Ampicillin-sulbactam	February 2024 (M100-Ed34)		X
	Cefepime	February 2024 (M100-Ed34)	X	X
	Ceftazidime	February 2024 (M100-Ed34)		X
	Ceftriaxone	February 2024 (M100-Ed34)	X	X
	Ciprofloxacin	February 2024 (M100-Ed34)	X	X
	Meropenem	February 2024 (M100-Ed34)	X	X
	Tobramycin	February 2024 (M100-Ed34)	X	X
	Trimethoprim-sulfamethoxazole	February 2024 (M100-Ed34)	X	X
Breakpoint Revisions Since 2021	Enterobacterales			
	Tobramycin	February 2024 (M100-Ed34)	X	X
	Pseudomonas aeruginosa			
	Tobramycin	February 2024 (M100-Ed34)	X	X

Abbreviations: ATCC®, American Type Culture Collection; MHA, Mueller-Hinton agar; QC, quality control.

CLSI M100-Ed34, 2024

Three Big Ones

A SPECIFIC *Salmonella Shigella* TABLE

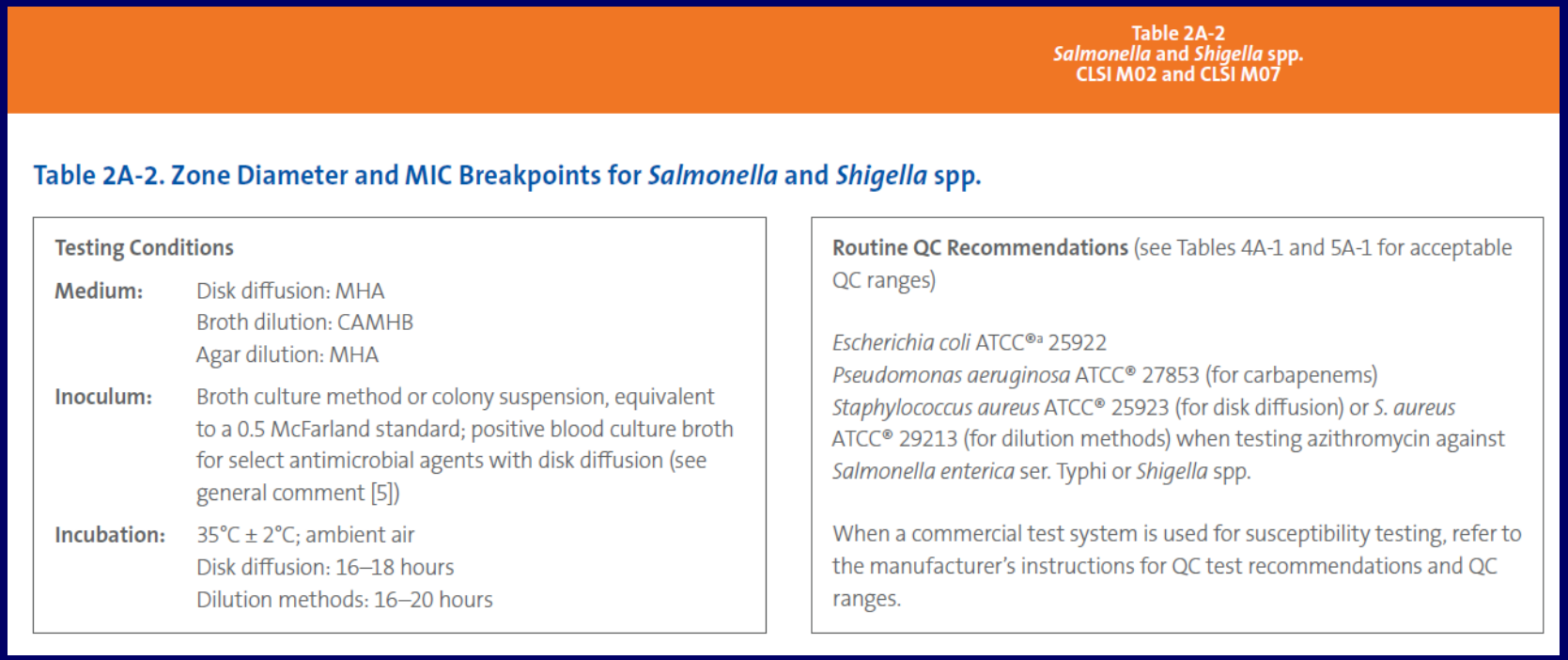


Table 2A-2
Salmonella and *Shigella* spp.
CLSI M02 and CLSI M07

Table 2A-2. Zone Diameter and MIC Breakpoints for *Salmonella* and *Shigella* spp.

Testing Conditions

Medium: Disk diffusion: MHA
Broth dilution: CAMHB
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 [5])

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.

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

- Ampicillin, fluoroquinolone, T/S for fecal; add 3° cephem for extra-intestinal isolates
- Testing is indicated for all *Shigella* spp. isolates

CLSI M100-Ed34, 2024

TABLE 2A-2

- Testable agents same as *Enterobacterales*

  ampicillin
  cefotaxime, ceftriaxone
  ertapenem, imipenem, meropenem
  tetracycline, doxycycline, minocycline
  trimethoprim-sulfamethoxazole
  chloramphenicol

- Azithromycin (different than *Enterobacterales*)

  Only for *Shigella* spp., *Salmonella* serotype Typhi

CLSI M100-Ed34, 2024

TABLE 2A-2

Ciprofloxacin

Isolate	Broth Microdilution			Disk Diffusion		
	S	I	R	S	I	R
Enterobacterales	≤ 0.25	0.5	≥ 1	≥ 26	22-25	≤ 21
Shigella spp.	≤ 0.25	0.5	≥ 1	≥ 26	22-25	≤ 21
Salmonella spp.	≤ 0.06	0.12-0.5	≥ 1	≥ 31	21-30	≤ 20

Levofloxacin

Isolate	Broth Microdilution			Disk Diffusion		
	S	I	R	S	I	R
Enterobacterales	≤ 0.5	1	≥ 2	≥ 21	17-20	≤ 16
Shigella spp.	≤ 0.5	1	≥ 2	≥ 21	17-20	≤ 16
Salmonella spp.	≤ 0.12	0.25-1	≥ 2			

Ofloxacin/*Shigella* mirror *Enterobacterales*; no disk diffusion for *Salmonella*

CLSI M100-Ed34, 2024

BUH-BYE *Burkholderia cepacia* complex

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm			Interpretive Categories and MIC Breakpoints, µg/mL			Comments
		S	I	R	S	I	R	
β-LACTAM COMBINATION AGENTS								
Ticarcillin-clavulanate*	–	–	–	–	≤ 16/2	32/2–64/2	≥ 128/2	
CEPHEMS (PARENTERAL) (Including cephalosporins I, II, III, and IV. Please refer to Glossary I.)								
Ceftazidime					≤ 8	16	≥ 32	
CARBAPENEMS								
Meropenem					≤ 4	8	≥ 16	
TETRACYCLINES								
Minocycline					≤ 4	8	≥ 16	
FLUOROQUINOLONES								
Levofloxacin	–	–	–	–	≤ 2	4	≥ 8	
FOLATE PATHWAY ANTAGONISTS								
Trimethoprim-sulfamethoxazole					≤ 2/38	–	≥ 4/76	
PHENICOLS								
Chloramphenicol*	–	–	–	–	≤ 8	16	≥ 32	**(4)** Not routinely reported on organisms isolated from the urinary tract.

CLSI M100-Ed34, 2024

CARBAPENEMS

- Resistance via:

  Carbapenemases (direct hydrolysis of agent)
  ESBL or AmpC + cell wall permeability defect

- New Delhi metallo-β-lactamase (NDM)

  Hydrolyzes almost all traditional β-lactams

  Not inhibited by ceftazidime-avibactam
  imipenem-relebactam
  meropenem-vaborbactam

  Inhibited by aztreonam

J Clin Microbiol. 61:e0164722; 2023

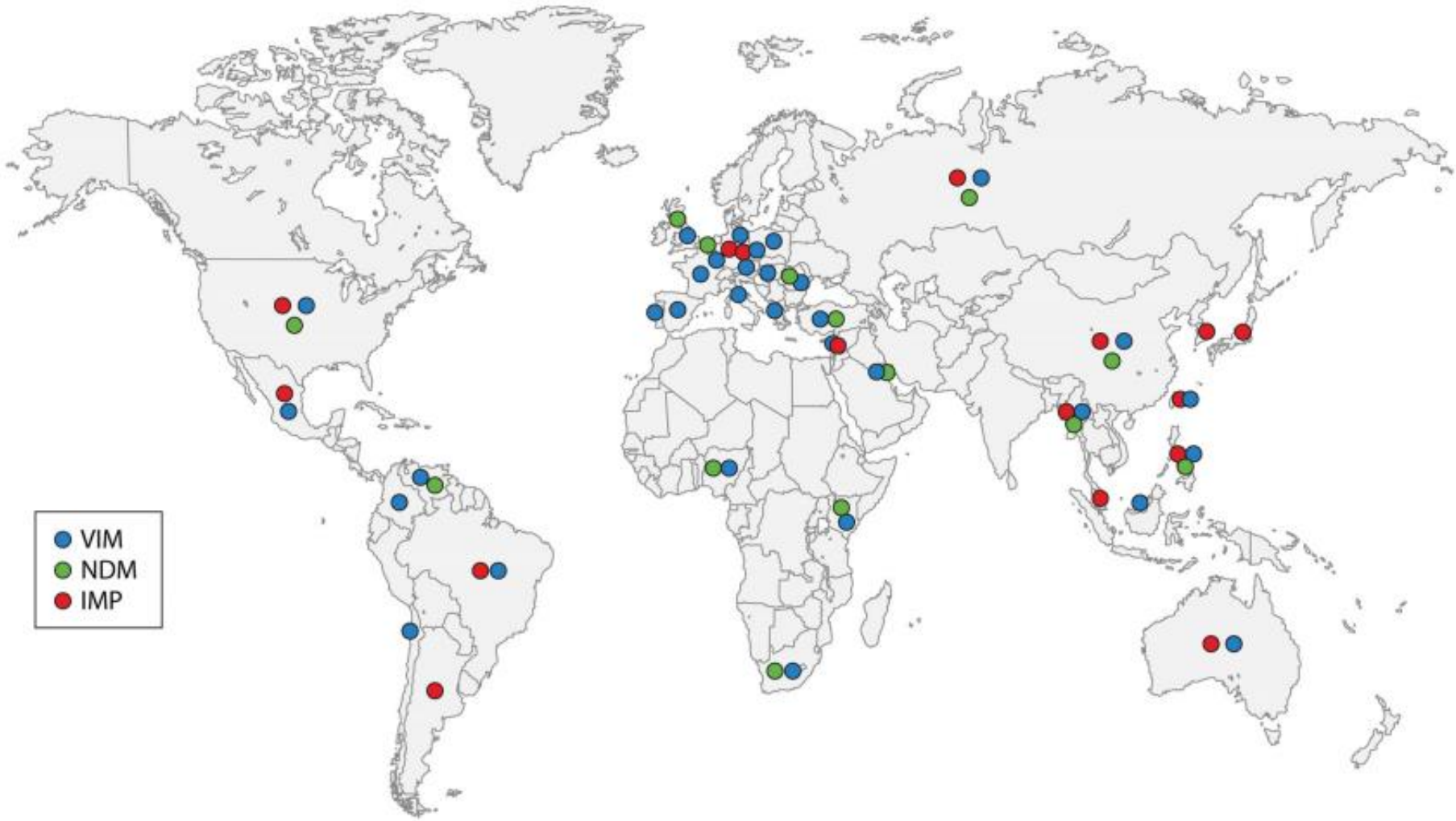


FIG 5 Global distribution of metallo-β-lactamase-positive *Enterobacteriaceae* and *P. aeruginosa*, including NDM-type enzymes collected from 2012 to 2014 from surveillance. (Republished from reference 287).

Clin Microbiol Rev. 33:e00047-19; 2020

THIS GETS COMPLICATED

- NDM isolates frequently harbor other β-lactamases

  Able to hydrolyze aztreonam
  Inhibited by avibactam

- Aztreonam and ceftazidime-avibactam (ATM-CZA)

  Enhanced *in vitro* activity (next two slides)
  Clinical efficacy against multi-drug- and

  resistant to three or more classes

  extensively drug-resistant

  resistant to all but one or two classes

  Enterobacterales (following two slides)

J Clin Microbiol. 61:e0164722; 2023

IN VITRO ASSESSMENTS

All Enterobacterales[a] (N = 18 713)

Antimicrobials	MIC (mg/L)			%S CLSI	%S EUCAST[b]
	MIC_{50}	MIC_{90}	MIC range		
Aztreonam/avibactam[c]	0.03	0.25	0.015–128	99.9	
Amikacin	2	8	0.25–128	95.2	92.8
Aztreonam	0.12	128	0.015–256	69.8	69.8
Cefepime	0.12	64	0.12–64	71.8	74.3
Ceftazidime	0.25	128	0.015–256	70.7	70.7
Colistin[d,e]	0.5	16	0.06–16	NA	97.1
Gentamicin	0.5	32	0.12–32	80.8	79.8
Imipenem	0.25	2	0.06–16	86.7	93.6
Levofloxacin	0.25	16	0.25–16	66.8	71.9
Meropenem	0.06	0.25	0.06–32	92.6	94.5
Piperacillin/tazobactam	4	128	0.12–128	81.3	75.5
Tigecycline	0.25	1	0.015–16	98.4[f]	97.8[g]

provisional MIC of ≤ 8 μg/mL used for susceptibility, based on pharmacokinetic/ pharmacodynamic modeling

	Breakpoint (μg/mL) for:				
	Aztreonam			Ceftazidime-avibactam	
Organism	S	I	R	S	R
Enterobacterales	≤4	8	≥16	≤8/4	≥16/4
Pseudomonas aeruginosa	≤8	16	≥32	≤8/4	≥16/4
Stenotrophomonas maltophilia					

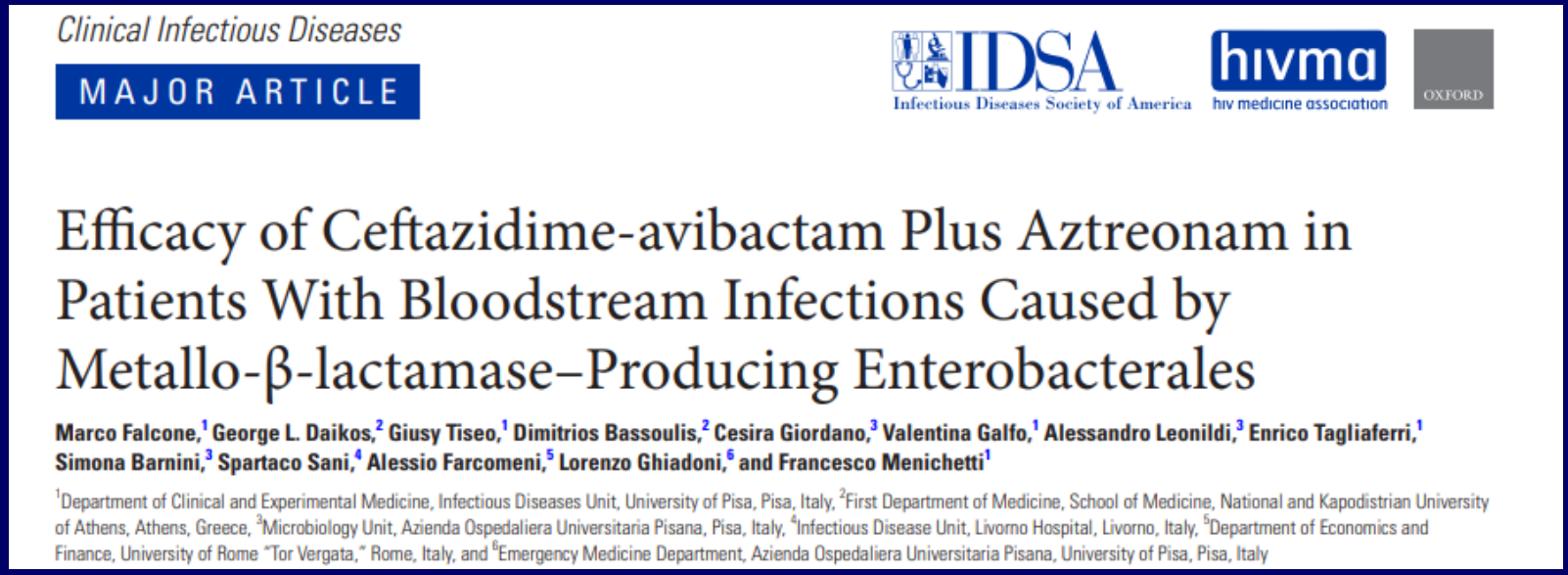
J Glob Antimicrob Resist. 30:214-221; 2022

IN VITRO ASSESSMENTS

Table 5
Activity of aztreonam and aztreonam/avibactam (MIC in mg/L) against different enzyme variants and combinations for all Enterobacterales, 2019.

All Enterobacterales[a] (N = 18 713)	Drug	n	MIC (mg/L)			%S CLSI	%S EUCAST[b]
			MIC Range	MIC_{50}	MIC_{90}		
MBL positive[c]	Aztreonam	462	0.015–256	128	256	14.7	12.6
	Aztreonam/avibactam[d]		0.015–16	0.12	0.5	99.6	
IMP[e]	Aztreonam	6	0.25–128	64	128	33.3	33.3
	Aztreonam/avibactam[d]		0.03–2	0.25	2	100.0	
VIM[f]	Aztreonam	49	0.06–256	64	128	18.4	18.4
	Aztreonam/avibactam[d]		0.015–2	0.12	0.5	100.0	
NDM[g]	Aztreonam	408	0.015–256	128	256	14.2	14.2
	Aztreonam/avibactam[d]		0.015–16	0.12	0.5	99.5	
NDM-1	Aztreonam	270	0.015–256	128	256	14.4	14.4
	Aztreonam/avibactam[d]		0.015–4	0.12	0.5	100.0	
NDM-5	Aztreonam	113	0.015–256	128	256	13.3	13.3
	Aztreonam/avibactam[d]		0.015–16	0.25	4	98.2	
NDM-7	Aztreonam	17	0.03–256	128	256	23.5	23.5
	Aztreonam/avibactam[d]		0.03–0.5	0.12	0.5	100.0	
IMP+VIM	Aztreonam	55	0.06–256	64	128	20	20
	Aztreonam/avibactam[d]		0.015–2	0.12	0.5	100.0	
IMP+NDM	Aztreonam	414	0.015–256	128	256	14.5	14.5
	Aztreonam/avibactam[d]		0.015–16	0.12	0.5	99.5	
NDM+VIM	Aztreonam	456	0.015–256	128	256	14.5	14.5
	Aztreonam/avibactam[d]		0.015–16	0.12	0.5	99.6	
KPC positive[h]	Aztreonam	368	2–256	256	256	2.5	2.5
	Aztreonam/avibactam[d]		0.015–4	0.25	0.5	100.0	
OXA positive[i]	Aztreonam	461	0.06–256	128	256	9.3	9.3
	Aztreonam/avibactam[d]		0.015–16	0.25	0.5	99.8	
KPC+MBL positive	Aztreonam	820	0.015–256	128	256	9.4	9.4
	Aztreonam/avibactam[d]		0.015–16	0.25	0.5	99.8	
OXA+MBL positive	Aztreonam	843	0.015–256	128	256	12.3	12.3
	Aztreonam/avibactam[d]		0.015–16	0.25	0.5	99.6	
KPC+OXA+MBL positive	Aztreonam	1197	0.015–256	128	256	9.4	9.4
	Aztreonam/avibactam[d]		0.015–16	0.25	0.5	99.8	

J Glob Antimicrob Resist. 30:214-221; 2022



Clinical Infectious Diseases

MAJOR ARTICLE

IDSA Infectious Diseases Society of America | hivma hiv medicine association | OXFORD

Efficacy of Ceftazidime-avibactam Plus Aztreonam in Patients With Bloodstream Infections Caused by Metallo-β-lactamase–Producing Enterobacterales

Marco Falcone,[1] George L. Daikos,[2] Giusy Tiseo,[1] Dimitrios Bassoulis,[2] Cesira Giordano,[3] Valentina Galfo,[1] Alessandro Leonildi,[3] Enrico Tagliaferri,[1] Simona Barnini,[3] Spartaco Sani,[4] Alessio Farcomeni,[5] Lorenzo Ghiadoni,[6] and Francesco Menichetti[1]

[1]Department of Clinical and Experimental Medicine, Infectious Diseases Unit, University of Pisa, Pisa, Italy, [2]First Department of Medicine, School of Medicine, National and Kapodistrian University of Athens, Athens, Greece, [3]Microbiology Unit, Azienda Ospedaliera Universitaria Pisana, Pisa, Italy, [4]Infectious Disease Unit, Livorno Hospital, Livorno, Italy, [5]Department of Economics and Finance, University of Rome "Tor Vergata," Rome, Italy, and [6]Emergency Medicine Department, Azienda Ospedaliera Universitaria Pisana, University of Pisa, Pisa, Italy

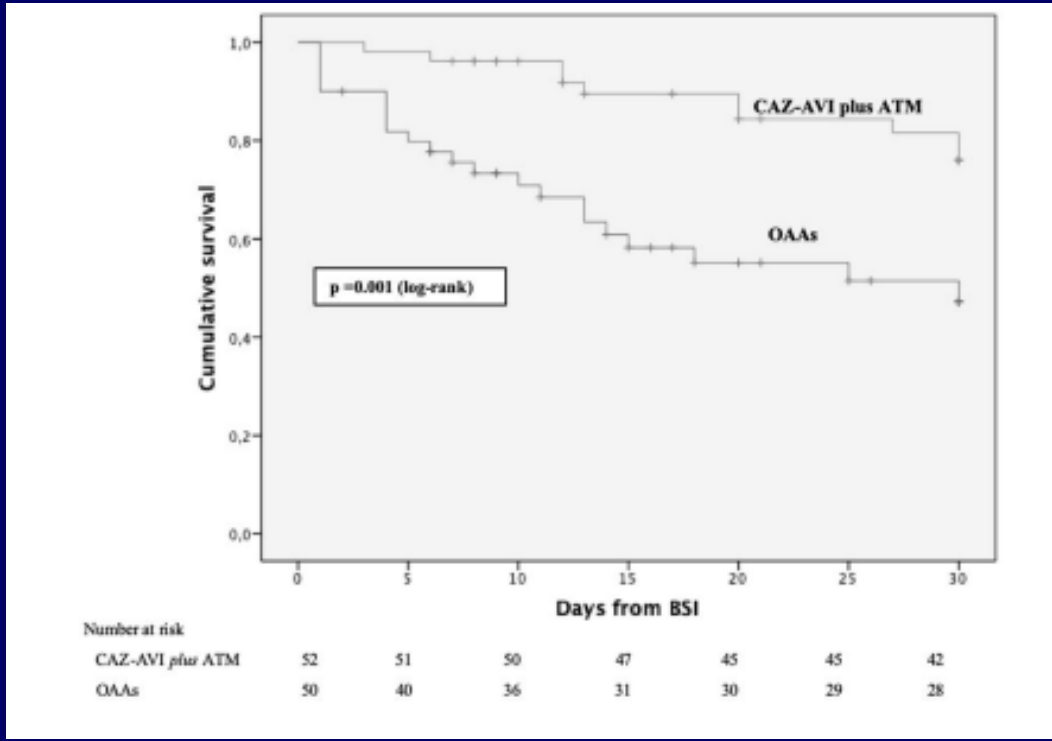
- 102 bloodstream infections
  - 82 NDM; 20 VIM (carbapenemase)
  - 93 *Klebsiella pneumoniae*, 5 *Enterobacter* spp.
- 52 received ATM-CZA
  50 received other active antibiotics (OAA)
  - 27 with colistin

Clin Infect Dis. 72:1871-1878; 2021

CLINICAL EFFICACY

Table 2. Targeted Antibiotic Regimens Administered in 102 Bloodstream Infections Due to Metallo-β-Lactamase–Producing Enterobacterales

Antibiotic Regimen	No. (%) (N = 102)	Mortality, No. (%)
CAZ-AVI + ATM[a]	52 (51)	10/52 (19.2)
OAAs		
Colistin-containing regimens	27 (26.5)	16/27 (59.3)
Colistin + fosfomycin + tigecycline	7	6/7
Colistin + fosfomycin	7	5/7
Colistin + meropenem	5	3/5
Colistin + ATM ± piperacillin-tazobactam	4	1/4
Colistin + gentamicin	1	0/1
Colistin + cotrimoxazole	1	0/1
Colistin alone	2	1/2
Regimens not containing colistin	23 (22.5)	6/23 (26.1)
Tigecycline + aminoglycosides	8	2/8
Fosfomycin + aminoglycosides	5	0/5
Tigecycline + fosfomycin	2	2/2
Tigecycline + meropenem	1	0/1
ATM + aminoglycosides	4	1/4
ATM + fosfomycin	1	0/1
ATM alone	2	1/2

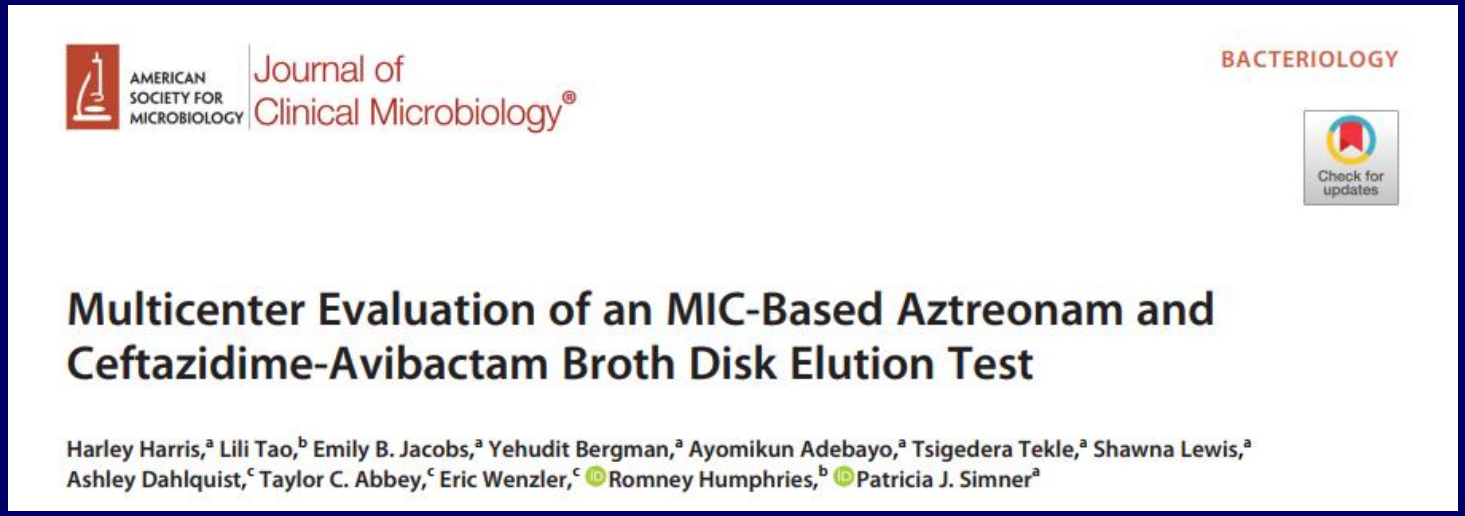


↓ 30d mortality rate $P = 0.007$

↓ d14 clinical failure $P = 0.002$

shorter length of stay $P = 0.007$

Clin Infect Dis. 72:1871-1878; 2021



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BACTERIOLOGY

Check for updates

Multicenter Evaluation of an MIC-Based Aztreonam and Ceftazidime-Avibactam Broth Disk Elution Test

Harley Harris,[a] Lili Tao,[b] Emily B. Jacobs,[a] Yehudit Bergman,[a] Ayomikun Adebayo,[a] Tsigedera Tekle,[a] Shawna Lewis,[a] Ashley Dahlquist,[c] Taylor C. Abbey,[c] Eric Wenzler,[c] Romney Humphries,[b] Patricia J. Simner[a]

- Broth disk elution method
  - 30 μg ATM
  - 30/20 μg CZA in 5 mL MH broth
  - 6/6/4 μg/mL ATM-CZA (growth/no growth)
- ~150 clinical isolates
  - metallo-β-lactamase *Enterobacterales*
  - carbapenem-resistant *P. aeruginosa*
  - *Stenotrophomonas maltophilia*
- 97.9% categorical agreement vs. BMD; 2.4% ME

J Clin Microbiol. 61:e0164722; 2023

Table 3D. Aztreonam Plus Ceftazidime-Avibactam Broth Disk Elution Method[1]

Due to limited therapeutic options, there may be a clinical need to assess the *in vitro* activity of the combination of aztreonam and ceftazidime-avibactam to guide therapeutic management of multidrug-resistant gram-negative bacterial infections, especially those caused by MBL producers.

The aztreonam plus ceftazidime-avibactam broth disk elution method was established with limited disk and/or media manufacturers and is considered provisional until additional data are evaluated by CLSI and shown to meet CLSI M23[2] guidance.

NOTE 1: Manufacturer-related issues were observed with different combinations of antimicrobial disks and CAMHB when the aztreonam plus ceftazidime-avibactam broth disk elution method was performed. QC of the method must be performed with every new lot or shipment of reagents to ensure the accuracy of results.

NOTE 2: Information in boldface type is new or modified since the previous edition.

Test	Aztreonam Plus Ceftazidime-Avibactam Broth Disk Elution
Organism group	Enterobacterales and *Stenotrophomonas maltophilia*
When to perform this test	Testing multidrug-resistant isolates, especially MBL producers
Test method	Tube dilution using aztreonam and ceftazidime-avibactam disks as the antimicrobial source
Medium	CAMHB (5-mL tubes)
Antimicrobial concentration	30-µg aztreonam disks 30/20-µg ceftazidime-avibactam disks Final concentration: 6 µg/mL aztreonam, 6 µg/mL ceftazidime, 4 µg/mL avibactam
Inoculum	1. Using a loop or swab, pick 3–5 colonies from a fresh (18–24 hours) nonselective agar plate and transfer to sterile saline (4–5 mL). 2. Adjust turbidity to equivalent of a 0.5 McFarland turbidity standard.

TABLE 3D

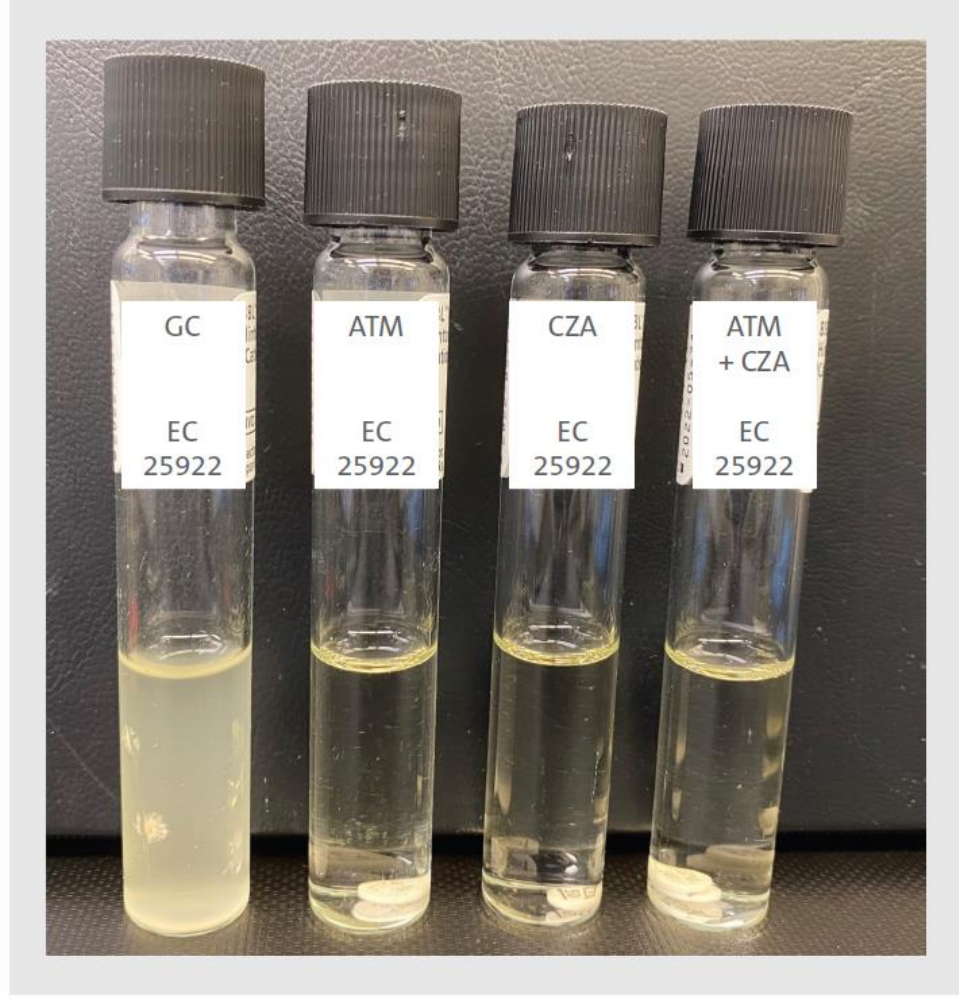
- Four 5-mL Mueller Hinton broth tubes; add disks

Mock	Ceftazidime-avibactam (1)
Aztreonam (1)	Aztreonam (1) + ceftazidime-avibactam (1)

- Vortex; allow 30-60 minutes for elution
- 25 μL of 0.5 McFarland turbidity equivalent to all tubes
- Vortex at slow speed; ensure disks at bottom
- Incubate 16-20 hours in 33-35°C ambient air

CLSI M100-Ed34, 2024

TABLE 3D

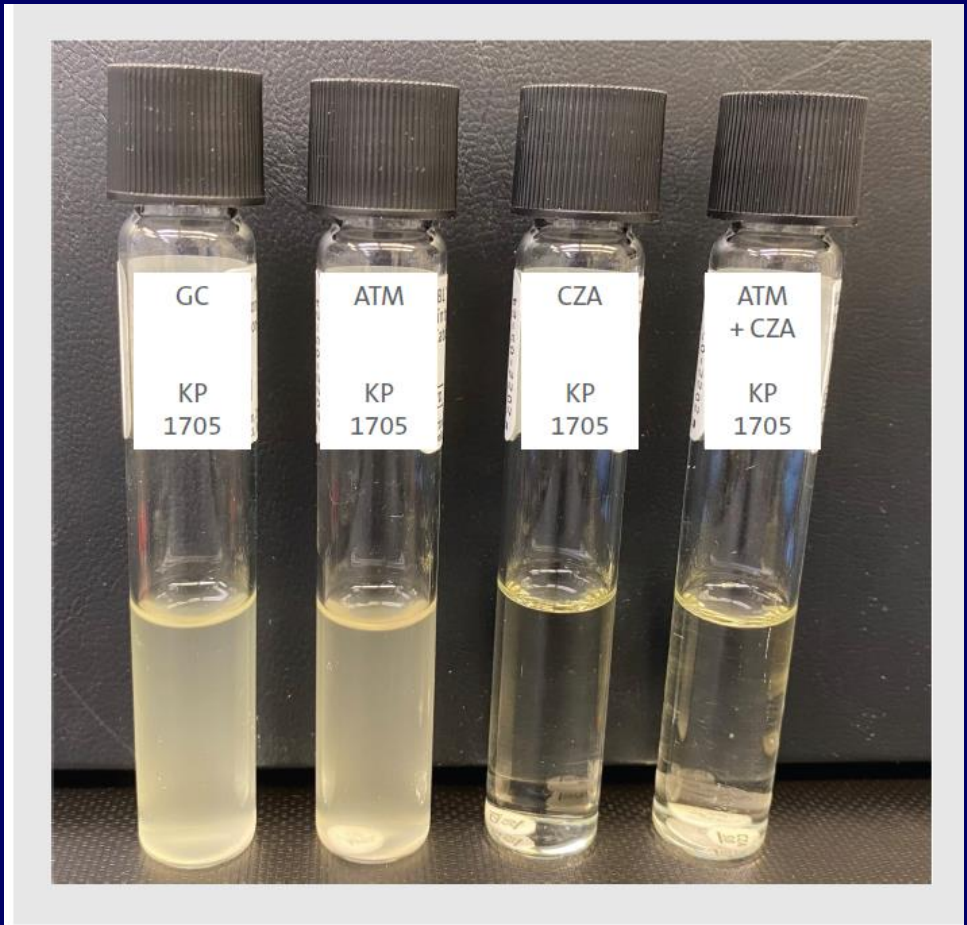


susceptible to all antimicrobial agents evaluated

Escherichia coli ATCC 25922

CLSI M100-Ed34, 2024

TABLE 3D



not susceptible to ATM; susceptible to CZA and ATM-CZA

Klebsiella pneumoniae ATCC BAA-1705

CLSI M100-Ed34, 2024

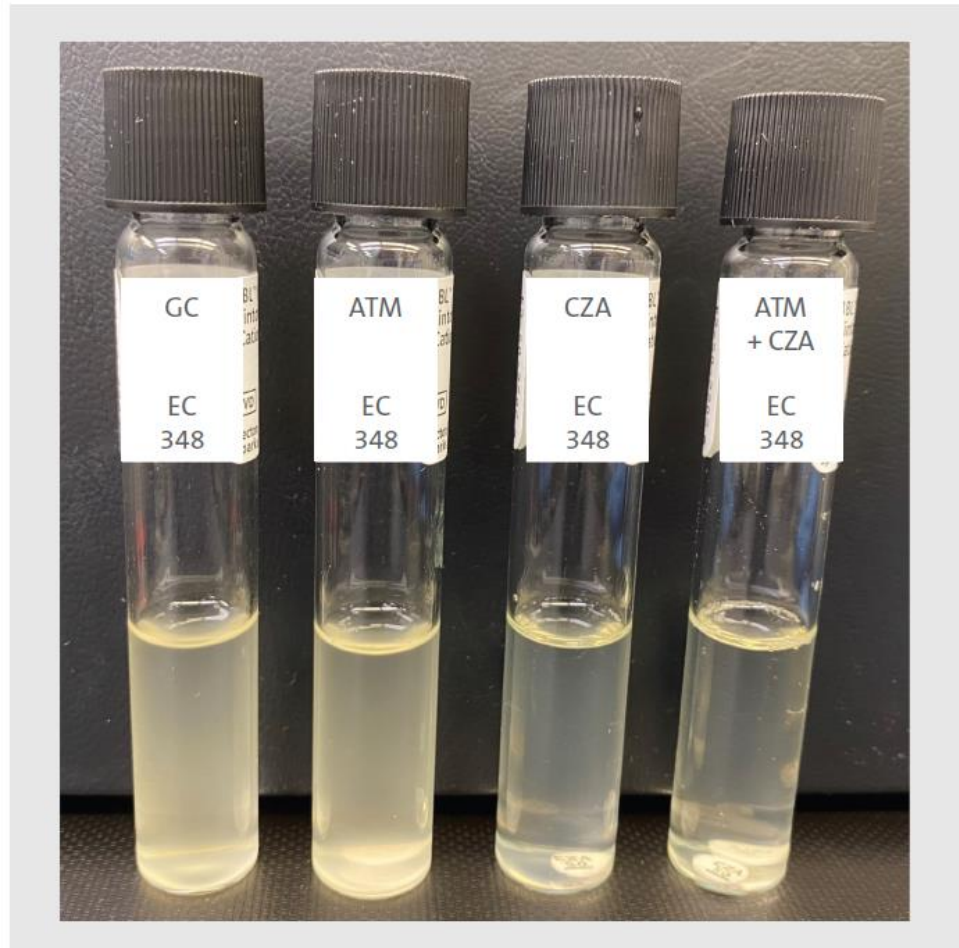
TABLE 3D

not susceptible to ATM or CZA; susceptible to ATM-CZA

Klebsiella pneumoniae ATCC BAA-2146

CLSI M100-Ed34, 2024

TABLE 3D



Escherichia coli AR Bank #0348

not susceptible to any antimicrobial agents evaluated

this control is necessary due to manufacturer differences in disks and Mueller Hinton broth

CLSI M100-Ed34, 2024


GET WILD UNO
UNO
NOW WITH CUSTOMIZABLE WILD CARDS!
2
3
4
WILD
2–10
7+

Table 1


one
BEE GEES

TABLE 1 IMPORTANT Δs

- Additions

  Sulbactam-durlobactam *Acinetobacter* spp. (1B-2; tier 3)
  New *Neisseria meningitidis* Table 1I
  Penicillin/ampicillin Table 1J: Tier 1 Gram-positives
  Tier 4 Gram-negatives

- Revisions

  Wordsmithed comment about *Enterococcus*/penicillin

- Deletions

  Stenotrophomonas maltophilia/ceftazidime (1B-4);
  only cefiderocol remains

CLSI M100-Ed34, 2024

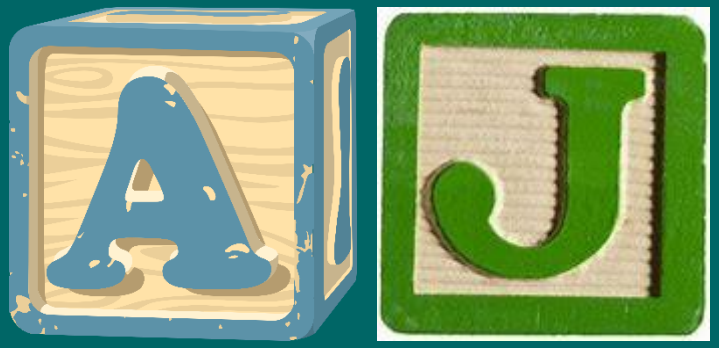

A
J

Table 2

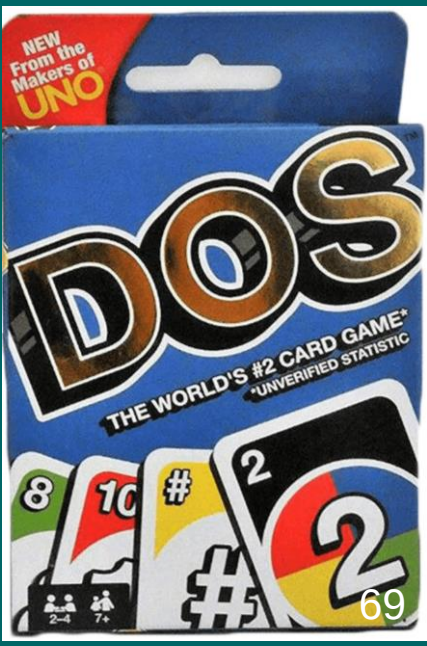

NEW From the Makers of UNO
DOS
THE WORLD'S #2 CARD GAME*
*UNVERIFIED STATISTIC
8
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TABLE 2A-1 IMPORTANT ADDITIONS

- Carbapenemase

  Enterobacterales harboring OXA-48-like enzymes may test susceptible to meropenem-vaborbactam but have less clinical response; if OXA-48-like determinant or enzyme detected, suppress meropenem-vaborbactam result or report resistant

- More carbapenemase

  Change cefepime S or SDD interpretations to resistant in isolates demonstrating carbapenemase

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THE NON-FERMENTER TABLE 2

- Additions

Sulbactam-durlobactam MIC and disk diffusion breakpoints for *Acinetobacter* spp. (2B-2)

Trimethoprim-sulfamethoxazole should not be used for *Stenotrophomonas maltophilia* monotherapy

Organism	Method	Minocycline Previous			Minocycline New		
		S	I	R	S	I	R
S. maltophilia	BMD	≤ 4	8	≥ 16	≤ 1	2	≥ 4
	DD	≥ 19	15-18	≤ 14	≥ 26	21-25	≤ 20

- Deletions

All *Burkholderia cepacia* disk diffusion (2B-3)

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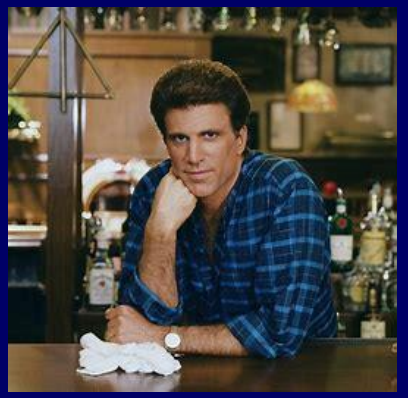
GRAM-POSITIVE Δs



- Tedizolid additions
  - Disk diffusion for *S. aureus* (Table 2C)
  - Disk diffusion for *S. pyogenes* and *S. agalactiae* only (Table 2H-1)
  - Disk diffusion for *S. anginosus* group only (Table 2H-2)
- Linezolid
  - MIC confirmation no longer needed for *S. aureus* resistant via disk diffusion

Organism	Method	Linezolid Previous			Linezolid New		
		S	I	R	S	I	R
S. aureus	BMD	≤ 4		≥ 8	≤ 4		≥ 8
	DD	≥ 21		≤ 20	≥ 26	23-25	≤ 22

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Table 3

AS A REMINDER…

Table 3A
Tests for ESBLs

Table 3B
CarbaNP Test for Suspected Carbapenemase Production

★ Table 3C
Modified Carbapenem Inactivation Methods

Table 3D
Aztreonam Plus Ceftazidime-Avibactam Broth Disk Elution Method

now Table 3E — Table 3D
Tests for Colistin Resistance for
Enterobacterales and *Pseudomonas aeruginosa*

now Table 3F-1,2,3,4 — Table 3E
Test for Performing Disk Diffusion Directly From
Positive Blood Culture Broth

now Table 3G — Table 3F
Test for β-Lactamase Production
in *Staphylococcus* spp.

Table 3H
Oxacillin Salt Agar Test for Methicillin (Oxacillin) Resistance in *Staphylococcus aureus*

now Table 3I — Table 3H
Vancomycin Agar Screen for *Staphylococcus aureus*
and *Enterococcus* spp.

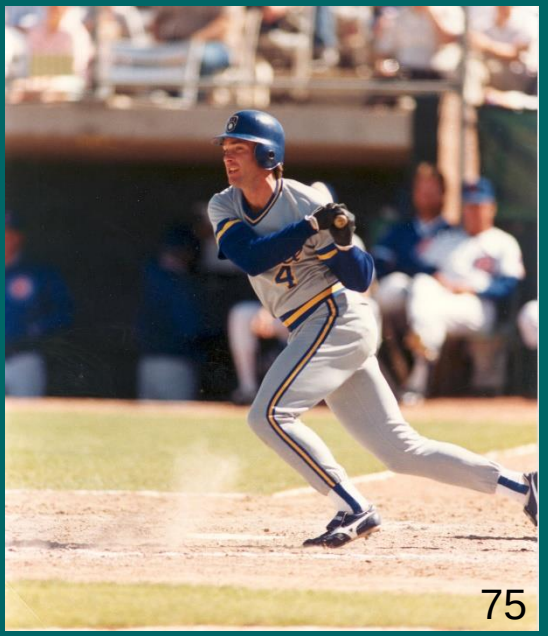
now Table 3J — Table 3I
Test for Inducible Clindamycin Resistance in *Staphylococcus* spp.,
Streptococcus pneumoniae, and *Streptococcus* spp. β-Hemolytic Group

now Table 3K — Table 3J
Test for High-Level Mupirocin Resistance in
Staphylococcus aureus

now Table 3L — Table 3K
Test for High-Level Aminoglycoside Resistance in
Enterococcus spp.

★ Test interpretation change from: positive, negative, indeterminate
to: positive, negative, inconclusive

Table 4



DISK DIFFUSION QC REVISIONS

Staphylococcus aureus ATCC 25923	tedizolid linezolid
Staphylococcus aureus ATCC 43300[a]	cefoxitin

[a] Listed as a supplemental strain (acceptable cefoxitin zone ≤ 21 mm); *S. aureus* ATCC 25923 also listed as QC strain (acceptable zone 23-29 mm)

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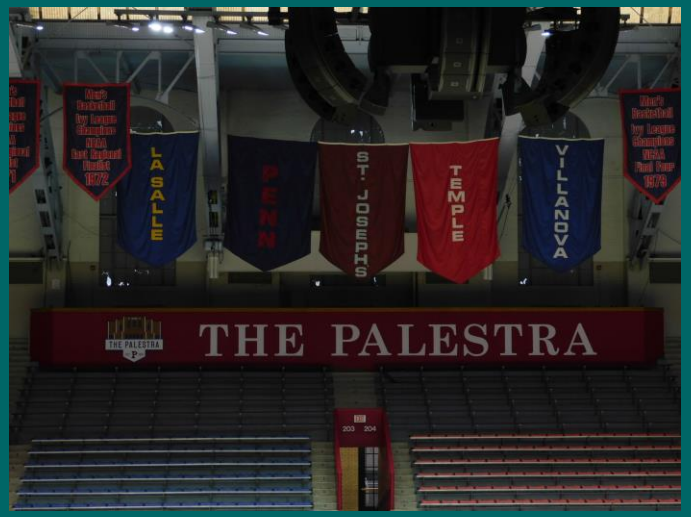

Table 5

SOME MIC QC ADDITIONS/REVISIONS

E. coli ATCC 25922	upleganan aztreonam imipenem-funobactam
E. coli NCTC 13846	colistin QC alternative[a] polymyxin B QC alternative
E. coli ATCC BAA-3170	colistin QC alternative[a]
K. pneumoniae ATCC BAA-1705	imipenem-funobactam
K. pneumoniae ATCC 700603	aztreonam imipenem-funobactam
P. aeruginosa ATCC 27853	upleganan, colistin, imipenem-funobactam
S. aureus ATCC 43300	cefoxitin (≥ 8 μg/mL) oxacillin (≥ 4 μg/mL)
S. aureus ATCC 29213	exebacase

[a] Colistin QC range has been deleted for *E. coli* ATCC 25922

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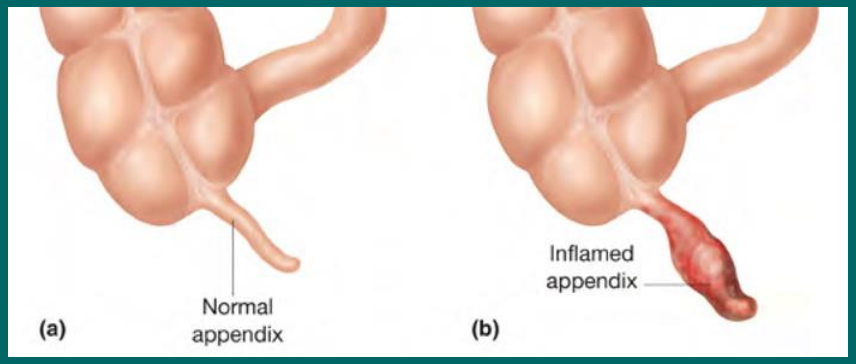
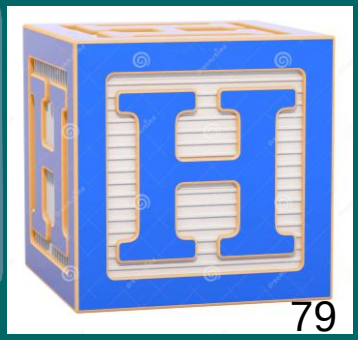


Appendices



REVISIONS OF NOTE

- Appendix B (intrinsic resistance)

B1. Enterobacterales (Continued)

Organism ↓ / Antimicrobial Agent →	Ampicillin	Amoxicillin-clavulanate	Ampicillin-sulbactam	Ticarcillin	Cephalosporins I: Cefazolin, Cephalothin	Cephamycins: Cefoxitin, Cefotetan	Cephalosporins II: Cefuroxime	Imipenem	Tetracyclines	Tigecycline	Nitrofurantoin	Polymyxin B Colistin	Aminoglycosides
Proteus vulgaris	R				R		R	[d]	R	R	R	R	
Providencia rettgeri	R	R			R			[d]	R	R	R	R	
Providencia stuartii	R	R			R			[d]	R	R	R	R	[e]
Raoultella spp.[f]	R			R									
Salmonella and *Shigella* spp.	There is no intrinsic resistance to β-lactams in these organisms; refer to **WARNING** below for reporting.												
Serratia marcescens	R	R	R		R	R	R				R	R	
Yersinia enterocolitica	R	R		R	R								

Serratia marcescens/tobramycin removed

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REVISIONS OF NOTE

- Appendix H (cefiderocol)

Figure H2-B

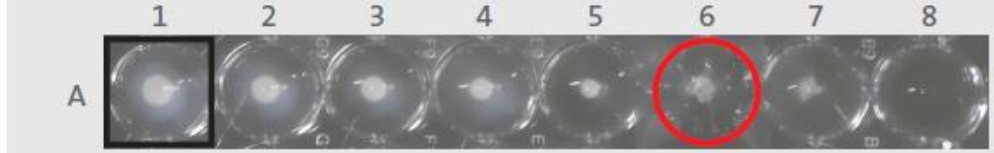

Figure H2-C

Aides in MIC determination; no trailing, no haze;
First well with button ≤ 1 mm is MIC

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Thank you for your attention.
Have a better 2024.