Table 1A-2. *Salmonella* and *Shigella* spp.[a,b]

Tier 1: Antimicrobial agents that are appropriate for routine, primary testing and reporting	Tier 2: Antimicrobial agents that are appropriate for routine, primary testing but may be reported following cascade reporting rules established at each institution	Tier 3: Antimicrobial agents that are appropriate for routine, primary testing in institutions that serve patients at high risk for MDROs but should only be reported following cascade reporting rules established at each institution	Tier 4: Antimicrobial agents that may warrant testing and reporting by clinician request if antimicrobial agents in other tiers are not optimal because of various factors
Ampicillin			
Ciprofloxacin Levofloxacin			
Trimethoprim-sulfamethoxazole			
Cefotaxime or ceftriaxone			Ertapenem[c] Imipenem[c] Meropenem[c]
	Azithromycin[d]		
			Tetracycline

Abbreviations: AST, antimicrobial susceptibility testing; MDRO, multidrug-resistant organism.

Footnotes

a. Table 2A-2 should be used for interpreting AST results for *Salmonella* and *Shigella* spp.

b. **WARNING:** For *Salmonella* and *Shigella* spp., aminoglycosides, first- and second-generation cephalosporins, and cephamycins may appear active *in vitro* but are not effective clinically and should not be reported as susceptible. Routine susceptibility testing is not indicated for nontyphoidal *Salmonella* spp. isolated from intestinal sources. However, susceptibility testing is indicated for all *Shigella* isolates. When fecal isolates of *Salmonella* and *Shigella* spp. are tested, only ampicillin, a fluoroquinolone, and trimethoprim-sulfamethoxazole should be reported routinely. In addition, for extraintestinal isolates of *Salmonella* spp., a third-generation cephalosporin should be tested and reported. Azithromycin may be tested and reported per institutional guidelines.

c. Ertapenem, imipenem, and/or meropenem might be considered for testing and/or reporting for isolates resistant to all agents in Tiers 1 and 2, although there are limited clinical data suggesting their effectiveness for treating salmonellosis or shigellosis.[1]

d. Report only on *Salmonella enterica* ser. Typhi and *Shigella* spp.

Reference for Table 1A-2

1 CDC Health Alert Network. Extensively drug-resistant *Salmonella* Typhi infections among U.S. residents without international travel. Accessed 15 October 2024. https://emergency.cdc.gov/han/pdf/CDC-HAN-439-XDR-Salmonella-Typhi-Infections-in-U.S.-Without-Intl-Travel-02.12.2021.pdf

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

QC Recommendations

Refer to the following:

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

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

General Comments

(1) Refer to Table 1A-2 for antimicrobial agents that should be considered for testing and reporting by microbiology laboratories.

(2) For disk diffusion, test a maximum of 12 disks on a 150-mm plate and no more than 6 disks on a 100-mm plate; disks should be placed no less than 24 mm apart, center to center (see CLSI M02)[1]. Each zone diameter should be clearly measurable; overlapping zones prevent accurate measurement. Measure the diameter of the zones of complete inhibition (as judged by the unaided eye), including the diameter of the disk (see CLSI M02QG[2]). Hold the Petri plate a few inches above a black background illuminated with reflected light. The zone margin should be considered the area showing no obvious, visible growth that can be detected with the unaided eye. Ignore faint growth of tiny colonies that can be detected only with a magnifying lens at the edge of the zone of inhibited growth. With trimethoprim-sulfamethoxazole, antagonists in the medium may allow some slight growth; therefore, disregard slight growth (20% or less of the lawn of growth) and measure the more obvious margin to determine the zone diameter.

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

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

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

(5) Positive blood culture broth can be used as the inoculum for direct disk diffusion testing of select antimicrobial agents against Enterobacterales (using methods described in Table 3F-1 and applying breakpoints in Table 3F-2). Only drugs appropriate for *Salmonella* or *Shigella* spp. should be reported. For antimicrobial agents not listed in Table 3F-2 for Enterobacterales, CLSI has not yet evaluated this direct disk diffusion method.

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

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm				Interpretive Categories and MIC Breakpoints, µg/mL				Comments
		S	SDD	I	R	S	SDD	I	R	
PENICILLINS										
Ampicillin	10 µg	≥ 17	–	14–16^	≤ 13	≤ 8	–	16^	≥ 32	**(6)** Results of ampicillin testing can be used to predict results for amoxicillin. **(7)** Breakpoints when oral ampicillin is used for therapy of salmonellosis or shigellosis. See general comment (3).
CEPHEMS (PARENTERAL) (Including cephalosporins I, II, III, and IV. Please refer to Glossary I.)										
(8) WARNING: First- and second-generation cephalosporins and cephamycins may appear active *in vitro* but are not effective clinically and should not be reported as susceptible.										
Cefotaxime or	30 µg	≥ 26	–	23–25^	≤ 22	≤ 1	–	2^	≥ 4	
ceftriaxone	30 µg	≥ 23		20–22^	≤ 19	≤ 1		2^	≥ 4	
CARBAPENEMS										
(9) Ertapenem, imipenem, and/or meropenem might be considered for testing for isolates resistant to all other agents listed in Table 1A-2, although there are limited clinical data suggesting their effectiveness for treating salmonellosis or shigellosis.[3]										
Ertapenem	10 µg	≥ 22	–	19–21^	≤ 18	≤ 0.5	–	1^	≥ 2	
Imipenem	10 µg	≥ 23	–	20–22^	≤ 19	≤ 1	–	2^	≥ 4	
Meropenem	10 µg	≥ 23	–	20–22^	≤ 19	≤ 1	–	2^	≥ 4	

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

Antimicrobial Agent	Disk Content	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm				Interpretive Categories and MIC Breakpoints, µg/mL				Comments
		S	SDD	I	R	S	SDD	I	R	
MACROLIDES										
Azithromycin	15 µg	≥ 13	–	–	≤ 12	≤ 16	–	–	≥ 32	**(10)** *S. enterica* ser. Typhi only: breakpoints are based on MIC distribution data and limited clinical data.
		≥ 16	–	11–15	≤ 10	≤ 8	–	16	≥ 32	**(11)** *Shigella* spp. only: azithromycin disk diffusion zones can be hazy and difficult to measure, especially *Shigella 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.
TETRACYCLINES										
(12) Isolates that **test** susceptible to tetracycline are considered susceptible to doxycycline and minocycline. **Isolates** that **test** intermediate or resistant to tetracycline **should be tested against doxycycline or minocycline if those results are needed for treatment.**										
Tetracycline	30 µg	≥ 15	–	12–14	≤ 11	≤ 4	–	8	≥ 16	
Doxycycline*	30 µg	≥ 14	–	11–13	≤ 10	≤ 4	–	8	≥ 16	
Minocycline*	30 µg	≥ 16	–	13–15	≤ 12	≤ 4	–	8	≥ 16	
FLUOROQUINOLONES for *Salmonella* spp.										
(13) For testing and reporting of *Salmonella* spp. (including *S. enterica* ser. Typhi and *S. enterica* ser. Paratyphi A-C). Routine susceptibility testing is not indicated for nontyphoidal *Salmonella* spp. isolated from intestinal sources. **(14)** The preferred test for assessing fluoroquinolone susceptibility or resistance in *Salmonella* spp. is a ciprofloxacin MIC test. A levofloxacin or ofloxacin MIC test can be performed if either agent, respectively, is the fluoroquinolone of choice in a specific facility. If a ciprofloxacin, levofloxacin, or ofloxacin MIC or ciprofloxacin disk diffusion test cannot be done, pefloxacin disk diffusion may be used as a surrogate test to predict ciprofloxacin susceptibility. **(15)** No single test detects resistance resulting from all possible fluoroquinolone resistance mechanisms that have been identified in *Salmonella* spp.										
Ciprofloxacin Levofloxacin	5 µg –	≥ 31 –	– –	21–30^ –	≤ 20 –	≤ 0.06 ≤ 0.12	– –	0.12–0.5^ 0.25–1^	≥ 1 ≥ 2	**(16)** Isolates of *Salmonella* spp. that test not susceptible to ciprofloxacin, levofloxacin, ofloxacin, or pefloxacin may be associated with clinical failure or delayed response in fluoroquinolone-treated patients with salmonellosis.
Ofloxacin*	–	–	–	–	–	≤ 0.12	–	0.25–1^	≥ 2	