

Antimicrobial Susceptibility Testing of Bacteria That Cause Gastroenteritis



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KEYWORDS

- Susceptibility testing • *Campylobacter* • *Salmonella* • *Shigella* • *Vibrio* • *Aeromonas* • *Clostridium difficile*

KEY POINTS

- Infections due to most gastrointestinal pathogens are self-limiting in immunocompetent patients, and isolates from these patients generally do not require antimicrobial susceptibility testing (AST).
- The National Antimicrobial Resistance Monitoring System (NARMS) monitors antimicrobial resistance trends in enteric bacteria across the United States.
- New fluoroquinolone breakpoints should be used for all *Salmonella* spp.
- The Clinical and Laboratory Standards Institute (CLSI) has provided new azithromycin breakpoints for *Salmonella* Typhi.
- Although official breakpoints do not exist for azithromycin and *Campylobacter* or *Shigella*, epidemiologic cutoff values (ECOFFs) can be used for surveillance purposes.
- Antimicrobial resistance of various enteric pathogens isolated from animals and water is of concern due to transfer of resistance to humans.

Bacterial gastroenteritis is a self-limiting disease for which antimicrobial therapy is generally not indicated. In some cases, antimicrobial therapy can in fact be detrimental to the host. Such is the case when quinolones are used for the treatment of shiga-toxigenic *Escherichia coli* infection, resulting in a burst of toxin production by the organism that puts the patient at increased risk for hemolytic uremic syndrome (HUS).^{1,2}

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Similarly, the use of antimicrobials for the treatment of uncomplicated, nontyphoidal *Salmonella* gastroenteritis has been shown to increase the rate of clinical relapse and prolong carriage of the organism by the host.³ As a result, susceptibility testing of bacterial pathogens isolated from stool cultures should not be routinely performed by the laboratory for isolates from patients without underlying medical problems.^{4,5} There are, however, some clinical circumstances in which antimicrobial therapy is indicated for bacterial gastroenteritis, including patients with severe or prolonged diarrhea (characterized by ≥ 6 unformed stools per day, temperature $\geq 101^\circ\text{F}$, tenesmus, or the presence of blood in stool or fecal leukocytes), the immunocompromised host, the elderly, and infants younger than 6 months.⁶ In these cases, communication between the laboratory and the treating physician aids in determining the need for susceptibility testing and the antimicrobial agents to be tested. In addition, if the laboratory identifies *Salmonella enterica* ser. Typhi or *S enterica* ser. Paratyphi from stool, consideration should be given to susceptibility testing. Finally, isolation of any of the organisms described herein from an extraintestinal source (eg, blood, urine) warrants susceptibility testing.

In the United States, the NARMS monitors antimicrobial resistance in enteric bacteria isolated from humans, food-producing animals, and retail meat sources on an annual basis. This program, performed in collaboration between the Centers for Disease Control and Prevention (CDC), the US Food and Drug Administration (FDA), and the US Department of Agriculture, includes annual data on antimicrobial resistance in human isolates of *Salmonella*, *Shigella*, *Campylobacter*, *E coli* O157, and *Vibrio* species other than *Vibrio cholerae*. These data are publicly available on the CDC Web site and are an excellent reference for laboratories and physicians.

This article summarizes the current state of AST for the bacterial gastrointestinal pathogens.

CAMPYLOBACTER

Campylobacter is one of the most common causes of bacterial food-borne illness in the United States, and 80% to 90% of reported infections are caused by *Campylobacter jejuni*.⁷ Most cases of campylobacteriosis are characterized by acute, self-limiting diarrhea, for which antimicrobial therapy provides the limited benefit of 1.3 days of symptom relief and is therefore generally not indicated.⁸ In contrast, severe, prolonged, or relapsing campylobacteriosis, which occurs predominantly in the very young, the elderly, and the immunocompromised, is treated. The macrolide azithromycin is now the preferred agent for treating campylobacteriosis because of recent concerns of the slight risk of cardiac arrest associated with erythromycin, in particular when given with medications that inhibit CYP3A4.⁹ Resistance to both azithromycin and erythromycin remains low in the United States, with less than 2% of *C jejuni* and 9% of *Campylobacter coli* isolates reported as resistant to these agents in 2012 surveillance performed by CDC NARMS.¹⁰ In contrast, *Campylobacter* resistance to the fluoroquinolones, which are second-line agents for campylobacteriosis, has been reported with increasing frequency in the United States. In 2012, 25% of *C jejuni* isolates and 34% of *C coli* were resistant to ciprofloxacin.¹⁰ Worldwide, fluoroquinolone resistance in *Campylobacter* is increasing, with rates well more than 60% in Southeast Asia and some regions of Latin America, Africa, and India.¹¹ Doxycycline and tetracycline are alternative agents for antimicrobial therapy, but approximately half of *C jejuni* and *C coli* isolates in the United States are resistant to tetracycline.¹⁰ Macrolide resistance in *Campylobacter* is usually due to ribosomal target mutations, whereas fluoroquinolone resistance is conferred by mutation of the DNA gyrase gene *gyrA*, typically by the point mutation C257 T.^{12,13} The *tet(O)* gene, located on plasmids or chromosomes, confers high-level tetracycline resistance in *C jejuni* and *C coli*.

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