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Note: Contact information for the Alaska Section of Epidemiology can be found at the end of this message.

Infections with *Shigella* are reportable in Alaska; call the Section of Epidemiology at 907-269-8000. More details about reporting are available at the Conditions Reportable webpage, see: <http://dhss.alaska.gov/dph/Epi/Pages/pubs/conditions/default.aspx>

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CDC Recommendations for Diagnosing and Managing *Shigella* Strains with Possible Reduced Susceptibility to Ciprofloxacin

Summary

This Health Advisory describes the identification of emerging *Shigella* strains with elevated minimum inhibitory concentration values for ciprofloxacin and outlines new recommendations for clinical diagnosis, management, and reporting, as well as new recommendations for laboratories and public health officials. Current interpretive criteria provided by the Clinical and Laboratory Standards Institute (CLSI) categorize these strains as susceptible to ciprofloxacin, which is a fluoroquinolone antibiotic and a key agent in the management of *Shigella* infections.

However, recent data from the Centers for Disease Control and Prevention (CDC) and state and local public health partners show that these strains often have a quinolone resistance gene that may lead to clinically significant reduced susceptibility to fluoroquinolone antibiotics. Clinicians treating patients with multidrug-resistant shigellosis for whom antibiotic treatment is indicated should avoid prescribing fluoroquinolones if the ciprofloxacin MIC is 0.12 µg/mL or higher even if the laboratory report identifies the isolate as susceptible, and should work closely with their clinical microbiology laboratory and infectious disease specialists to determine appropriate antimicrobial therapy.

Shigellosis is a nationally notifiable condition, and all cases of shigellosis should be reported to local health departments.

Background

CDC has identified an increase in *Shigella* isolates in the United States with minimum inhibitory concentration (MIC) values of 0.12–1 µg/mL for the fluoroquinolone antibiotic ciprofloxacin. Preliminary data suggest that all *Shigella* isolates with ciprofloxacin MICs in this range for which results are available harbor at least one quinolone resistance gene known to confer reduced susceptibility in enteric bacteria. *Shigella* isolates without a quinolone resistance gene typically have a ciprofloxacin MIC of ≤0.015 µg/mL. Current CLSI criteria categorize *Shigella* isolates with a ciprofloxacin MIC of ≤1 µg/mL as susceptible to ciprofloxacin (1).

CDC does not yet know whether fluoroquinolone treatment of a *Shigella* infection with a ciprofloxacin MIC of 0.12–1 µg/mL is associated with a worse clinical outcome for the patient or if such treatment increases the risk of transmission to other individuals. In *Salmonella* isolates, ciprofloxacin MICs of 0.12–1 µg/mL have been associated with reduced susceptibility, prolonged clinical illness, and treatment failures and are now categorized by CLSI as intermediate or resistant to ciprofloxacin in *Salmonella* species.

Fluoroquinolone resistance is of particular concern given that data from the National Antimicrobial Resistance Monitoring System indicate that many *Shigella* isolates with a quinolone resistance gene also are resistant to many other commonly used treatment agents, such as azithromycin, trimethoprim-sulfamethoxazole, amoxicillin-clavulanic acid, and ampicillin. This susceptibility profile may encourage clinicians to prescribe fluoroquinolone antibiotics to patients who require treatment.

Rising fluoroquinolone MIC values among *Shigella* isolates may be related to the emergence of plasmid-mediated quinolone resistance (PMQR) genes in *Shigella* species in the United States. *Shigella* strains harboring PMQR genes were identified earlier this year following whole genome sequencing of isolates from a multistate outbreak of multidrug-resistant *Shigella flexneri* infections predominantly affecting adult men, many of whom identify as men who have sex with men, according to epidemiologic data collected by CDC's *Shigella* program as part of outbreak response. PMQR genes have also been identified in sporadic cases of *Shigella sonnei*. Plasmid-mediated resistance genes are of particular concern because of their ability to spread between bacteria and their ability to promote chromosomal mutations conferring quinolone resistance, potentially resulting in rapid spread of fluoroquinolone resistance within or between populations of bacteria. The prevalence of PMQR genes among all U.S. *Shigella* isolates is currently unknown.

Any patient with a *Shigella* infection could carry a strain harboring a quinolone resistance gene with a ciprofloxacin MIC of 0.12–1 µg/mL.

The emergence of *Shigella* species with ciprofloxacin MICs of 0.12–1 µg/mL and their association with quinolone resistance genes raises the following concerns:

- Fluoroquinolone treatment of *Shigella* infection with a strain harboring a quinolone resistance gene may be less effective and may increase the risk of a more severe clinical course for the individual (e.g., increased duration or severity of symptoms, increased need for hospitalization or admission to an intensive care unit, increased length of hospitalization, or increased risk of death).
- Fluoroquinolone treatment of *Shigella* infection with a strain harboring a quinolone resistance gene also may increase the risk of secondary cases, if the treatment prolongs the duration or increases the quantity of organisms shed in the stool, given the very low infectious dose required for transmission of *Shigella* bacteria.

RECOMMENDATIONS FOR CLINICIANS

Diagnosis

- **Order stool culture for patients suspected of having a *Shigella* infection to obtain isolates for antimicrobial susceptibility testing.**
 - Culture-independent diagnostic testing does not provide an isolate and therefore cannot be used to assess susceptibility.
- **Order antimicrobial susceptibility testing when ordering stool culture for *Shigella*.**
 - When antimicrobial susceptibility testing is performed by broth microdilution, request ciprofloxacin testing that includes dilutions of 0.12 µg/mL or lower.
 - Even when treatment is not indicated, identifying patients with drug-resistant infections (i.e., ordering susceptibility testing) will help to inform public health management, such as when to return to work, school, and group settings.

Management

- **Do not routinely prescribe antibiotic therapy for *Shigella* infection. Instead, reserve antibiotic therapy for patients for whom it is clinically indicated or when public health officials advise treatment in an outbreak setting.**
 - Shigellosis is generally a self-limited infection lasting 5-7 days.
 - Unnecessary treatment with antibiotics promotes resistance.
 - Treatment can shorten the duration of some illnesses, though typically only by 1-2 days.
 - Empiric treatment with an antibiotic to which the organism is resistant may worsen symptoms or prolong the duration of shedding of the organism.
 - If empiric treatment is clinically indicated before antimicrobial susceptibility results are available, refer to recent hospital, clinical laboratory, or public health agency antibiograms.
 - Antibiotic treatment is recommended for patients who are immunocompromised or who develop severe illness (e.g., patients requiring hospitalization, those with invasive disease, or those with complications).
 - Local or state health officials may advise antibiotic treatment to mitigate or prevent outbreaks in certain settings (e.g., childcare, food handling).
- **When antibiotic treatment is indicated, tailor antibiotic choice to antimicrobial susceptibility results as soon as possible with special attention given to the MIC for fluoroquinolone antibiotics.**
 - Avoid prescribing fluoroquinolones if the ciprofloxacin MIC is 0.12 µg/mL or higher even if the laboratory report identifies the isolate as susceptible.
 - Know the potential risks of fluoroquinolone treatment of *Shigella* infections with ciprofloxacin MICs in this range, including possible treatment failure and increased risk of secondary transmission.
 - The interpretation of MIC values varies for the different fluoroquinolone antibiotics; if susceptibility results are reported for a fluoroquinolone other than ciprofloxacin, contact the microbiology laboratory for assistance with interpretation.
 - If MIC values are not reported to the clinician with susceptibility results, consider contacting the microbiology laboratory where the susceptibility testing was performed to determine the ciprofloxacin MIC value before treating a patient with a fluoroquinolone agent. Some susceptibility testing methods do not produce a MIC value; the impact of a quinolone resistance gene on test results by other methods (e.g., disk diffusion) is not yet known.
 - Consult an infectious disease specialist for cases where the *Shigella* isolate is resistant to multiple antibiotics and appropriate treatment is unclear.
- **Obtain follow-up stool cultures in shigellosis patients who have continued or worsening symptoms despite antibiotic therapy.**
- **Consult your local or state health department for guidance on when patients may return to childcare, school, or work.**
- **Counsel patients with active diarrhea on how they can prevent spreading the infection to others, regardless of whether antibiotic treatment is prescribed.**
 - Wash hands with soap and water for at least 20 seconds, especially after using the toilet, after handling a soiled diaper, and before eating.
 - Avoid preparing food for others, when possible.
 - Children with active diarrhea should not attend childcare, school, or group activities while they are ill.
 - Wait to have sex (vaginal, anal, and oral) for two weeks after you no longer have diarrhea. Use safe sex practices for several weeks after resuming sex, because *Shigella* bacteria may still be in stool for several weeks.

Reporting

- Shigellosis is a nationally notifiable condition. Report all cases of shigellosis to your local health department.
- Clinicians who identify a patient with shigellosis and a ciprofloxacin MIC of 0.12–1 µg/mL should include this finding along with other information regarding the case to their local health department to facilitate further testing of the isolate.

RECOMMENDATIONS FOR LABORATORIES

- Know that a *Shigella* isolate with a ciprofloxacin MIC of 0.12–1 µg/mL may be associated with the presence of a quinolone resistance gene.
- Test *Shigella* isolates using susceptibility panels that include 0.12, 0.25, and 0.5 µg/mL dilutions for ciprofloxacin, when using a commercially available automated system (such as BD Phoenix, MicroScan, Vitek 2, or similar system) for susceptibility testing.
- Include MIC values for fluoroquinolone agents in the susceptibility testing report for *Shigella* isolates.
- Report all findings of strains of *Shigella* with a ciprofloxacin MIC of 0.12–1 µg/mL to the state public health laboratory, and submit isolates to it to facilitate further phenotypic and genetic testing.

RECOMMENDATIONS FOR PUBLIC HEALTH OFFICIALS

- Know that a *Shigella* isolate with a ciprofloxacin MIC of 0.12–1 µg/mL may be associated with the presence of a quinolone resistance gene.
- Contact CDC at EntericBacteria@cdc.gov if you receive reports of patients with *Shigella* infection and possible fluoroquinolone treatment failure.
- Submit *Shigella* isolates with a ciprofloxacin MIC of 0.12–1 µg/mL to the state public health laboratory for whole genome sequencing, if possible. If the state laboratory does not have capacity to sequence the isolate, please notify CDC at EntericBacteria@cdc.gov.

What CDC is Doing

CDC is working with state and local public health departments and clinical partners to investigate if clinical outcomes are worse for patients infected with *Shigella* strains harboring a quinolone resistance gene who receive ciprofloxacin treatment.

- CDC has notified representatives at the U.S. Food and Drug Administration and CLSI, who will review CDC's findings to determine whether a change to the susceptible range of MIC values for ciprofloxacin in *Shigella* is warranted.
- CDC will continue to monitor trends in antimicrobial susceptibility of *Shigella* isolates and will perform genetic testing on select strains with ciprofloxacin MICs of 0.12–1 µg/mL or higher to confirm the presence and type of quinolone resistance genes.

For More Information

- For general information about *Shigella* or shigellosis, visit <https://www.cdc.gov/shigella/>.
- For technical information about *Shigella* or shigellosis, including information about national surveillance and other educational resources for medical and public health professionals, visit <https://www.cdc.gov/shigella/resources.html>.
- For information about prevention and control of shigellosis, including recommendations for men who have sex with men, visit <https://www.cdc.gov/shigella/prevention-control.html>.
- For more information about the serious public health threat posed by antimicrobial resistant *Shigella*, refer to “Antibiotic Resistance Threats in the United States, 2013”

available at <https://www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf>.

- For more information about ciprofloxacin and azithromycin-nonsusceptible shigellosis in the United States, refer to previous Health Alert Network Advisory 379 at <https://emergency.cdc.gov/han/han00379.asp>.
- For specific inquiries related to this Health Advisory, email EntericBacteria@cdc.gov.

Reference

1. Clinical and Laboratory Standards Institute. *Performance Standards for Antimicrobial Susceptibility Testing*. 27th ed. CLSI supplement M100. Wayne, PA: Clinical and Laboratory Standards Institute; 2017.

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