

CDC Antimicrobial Resistance Threats Report

Drug-resistant *Shigella* Data Methods

Estimates of the annual number of infections, hospitalizations, and deaths from *Shigella* that were resistant to ceftriaxone, ciprofloxacin, or nonsusceptible (resistant or intermediate) to azithromycin in 2022 and 2023 were reported.

To measure resistance, a subset of *Shigella* isolates (pure samples of *Shigella*) collected from patient specimens and received at public health laboratories were sampled at a ratio of one per every 20 isolates and submitted to the CDC National Antimicrobial Resistance Monitoring System (NARMS) [1]. NARMS conducted antimicrobial susceptibility testing (AST) by broth microdilution to determine minimum inhibitory concentrations (MICs) for ceftriaxone, ciprofloxacin, azithromycin, and other antibiotics [2].

Clinical breakpoints defined by the Clinical and Laboratory Standards Institute (CLSI) were used to categorize MICs [3]. Isolates that were resistant to ampicillin, ciprofloxacin, ceftriaxone, trimethoprim-sulfamethoxazole, and nonsusceptible (MIC ≥ 16 $\mu\text{g/mL}$) to azithromycin were defined as extensively drug-resistant (XDR).

Prevalence of resistance was calculated by dividing the number of isolates with resistance (or, for azithromycin, nonsusceptibility) to specific antibiotics by the total number of isolates undergoing AST, and the Clopper-Pearson exact method was used to calculate 95% confidence intervals (range of values likely to include the true value) [4].

Annual estimates of illnesses, hospitalizations, and deaths were generated using multiplicative models consistent with methods described in Scallan et al [5]. Successive factors were applied by multiplication to obtain proportional increases or decreases in the count. Briefly, laboratory-confirmed illnesses reported to FoodNet [6–9] were scaled up to the U.S. population. The number of illnesses was estimated by applying year- and pathogen-specific underdiagnosis multipliers to the national laboratory-confirmed illnesses. The underdiagnosis multipliers accounted for ill people not seeking medical care, not submitting specimens for testing, and laboratories not reporting a pathogen.

Numbers of hospitalizations and deaths were estimated by applying incidences of hospitalization and death and year-specific underdiagnosis multipliers for hospitalizations to the national laboratory-confirmed illnesses. The underdiagnosis multipliers for hospitalizations accounted for hospitalized people not submitting specimens for testing and laboratories not reporting a pathogen. In contrast to Scallan et al. foodborne-focused analyses [5], these models estimated all infections occurring in the United States regardless of transmission route (i.e., not restricted to foodborne or domestically acquired infections).

To estimate the burden attributable to infections caused by drug-resistant *Shigella*, annual resistance proportions from NARMS were incorporated into the model. Resistance prevalence, with associated binomial uncertainty, was used to probabilistically partition total estimated illnesses, hospitalizations, and deaths into resistant components. Means and 95% credible intervals (range of values likely to include the true value) were calculated.

References

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