

CDC Antimicrobial Resistance Threats Report

Drug-resistant *Neisseria gonorrhoeae* Data Methods

Several iterations of drug-resistant gonococcal incidence and cost estimates have been developed and reported over the years, with improvements and refinements in methodology over time [1-4]. Since CDC's *COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report 2022*, the methodology has been updated to incorporate sex-of-sex-partner data as a proxy for infections in women [5]. Previous iterations assumed that the same percent of gonococcal infections in men that are resistant could be applied to women. This approach may have overestimated resistance in women, because resistance in men who have sex with men (MSM) is generally higher than among men who have sex with women only/men who have sex with men and women (MSW/MSMW) [6-7].

The number and costs of drug-resistant gonococcal infections were estimated as follows.

For each year of data from the Gonococcal Isolate Surveillance Project (GISP) during 2018-2023 [8], we:

1. Restricted to 15-39-year-olds.
2. Calculated the proportion of isolates with resistance or elevated minimum inhibitory concentrations (MICs) to any of the six antibiotics tested for in GISP (azithromycin, ceftriaxone, cefixime, ciprofloxacin, tetracycline, and penicillin) among all men; this was used to estimate resistance in male incident gonococcal infections.
3. Calculated the proportion of isolates with resistance or elevated MICs to any of the six antibiotics tested for in GISP among MSW and MSMW; this estimate was used to estimate the resistance in female incident gonococcal infections. Isolates with missing sex-of-sex-partner data were excluded.
4. Did not perform raking or reweighting of the GISP data, as Nielsen et al. [2], found that "aggregated GISP data are generally representative of men in the United States who are reported with urogenital gonorrhea."

To estimate age-sex specific (ages 15-24 and 25-39 years) gonococcal incidence, the method described in Kreisel et al. was used, which incorporated gonorrhea case report data from the National Notifiable Diseases Surveillance System and supporting estimates of gonococcal natural history and health service utilization into a mathematical model [1]. To estimate the age-sex specific number of resistant incident gonococcal infections, the sex-specific incidence estimates were then multiplied by the sex-specific resistance-percents, accounting for uncertainty in the underlying GISP data [4].

For each year, to estimate the age-sex specific costs of resistant incident gonococcal infections, the age- and sex-specific number of incident infections was multiplied by the age- and sex-specific costs (which reflects the sum of direct medical and productivity costs per incident gonococcal infection) [9]. For these calculations, we applied published estimates of the average lifetime cost per gonococcal infection in the United States, which were not stratified by resistance status.

Final estimates were characterized by point estimates and 95% credible intervals (range of values likely to include the true value). Though previous estimates have been reported for 2018-2019, the estimates reported here have been updated to use this improved methodology.

The antimicrobial susceptibility criteria used in GISP in 2018-2023 are as follows: ceftriaxone, MIC ≥ 0.5 $\mu\text{g/ml}$ (decreased susceptibility); ceftriaxone, MIC ≥ 0.125 $\mu\text{g/ml}$ (elevated MIC); cefixime, MIC ≥ 0.5 $\mu\text{g/ml}$ (decreased susceptibility); cefixime, MIC ≥ 0.25 $\mu\text{g/ml}$ (elevated MIC); azithromycin, MIC ≥ 2.0 $\mu\text{g/ml}$ (elevated MIC); ciprofloxacin, MIC = 0.125–0.5 $\mu\text{g/ml}$ (intermediate resistance); ciprofloxacin, MIC ≥ 1.0 $\mu\text{g/ml}$ (resistant); penicillin, MIC ≥ 2.0 $\mu\text{g/ml}$ or β -lactamase positive (resistant); tetracycline, MIC ≥ 2.0 $\mu\text{g/ml}$ (resistant).

Starting in 2023, GISP expanded to include rapid detection and response capabilities and was rebranded as the “Combatting Antimicrobial Resistant Gonorrhea and Other STIs” (CARGOS) program. Future data on drug-resistant gonorrhea will be reported from the CARGOS program.

References

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