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Gonorrhea Ain't Gone: Dissemination of Resistance via Core Groups

Gonorrhea (Gr) is a common sexually transmitted infection associated with pelvic inflammatory disease, increased susceptibility to HIV infection, and vertical transmission to neonates. The brief duration of untreated Gr, combined with low average rates of sex partner acquisition in the population, make Gr dependent on relatively small numbers of individuals with high rates of sex partner acquisition (so-called "core groups") in order to avoid extinction. Dependence on core groups represents an important vulnerability for Gr, and targeted antimicrobial treatment of these groups has proven an extremely effective means of reducing Gr incidence to very low levels throughout the population. However, rapid emergence of resistance to several antibiotic classes in recent years has been associated with a contemporaneous resurgence in Gr rates. I will use a simple, behavior-structured transmission model to show that treatment of core groups represents a highly effective strategy in the absence of resistance, but in the presence of antibiotic resistance treatment of core groups enhances dissemination of resistant strains, and undermines control efforts. In models that include two different treatment classes, a more durable reduction in Gr incidence is seen with random allocation of treatment than with sequential use of drug classes, but the preferred strategy involves use of rapid tests and targeted therapy based on microbial drug susceptibility. This model provides insights into the rapid of emergence of resistant Gr, and highlights the importance of developing point-of-care tests for antimicrobial resistance in order to maintain the advances in Gr control achieved over the past 40 years.