Modeling mathematically the influence of plasmids on the propagation of bacterial resistance to antibiotics

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Keywords: bacteria, antibiotic resistance, plamsids, equilibria, stability.

Diversity of drugs against bacterial infections, and development of resistance to such drugs are increasing. We formulate and analyze a deterministic model for the population dynamics of sensitive and resistant bacteria to multiple bactericidal and bacteriostatic antibiotics, assuming that drug resistance is acquired through mutations and plasmid transmission. Model equilibria are determined from qualitative analysis, and numerical simulations are used to assess temporal dynamics of sensitive and drug-resistant bacteria. The model presents three possibilities: elimination of bacteria, persistence of only resistant bacteria, or coexistence of sensitive and resistant bacteria. Evolution to one of these scenarios depends on thresholds numbers involving sensitive and resistant bacteria.

References

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