An Applicable Method To Estimate The Broader Value Of Antibiotics: Dynamic Transmission Model

EE409

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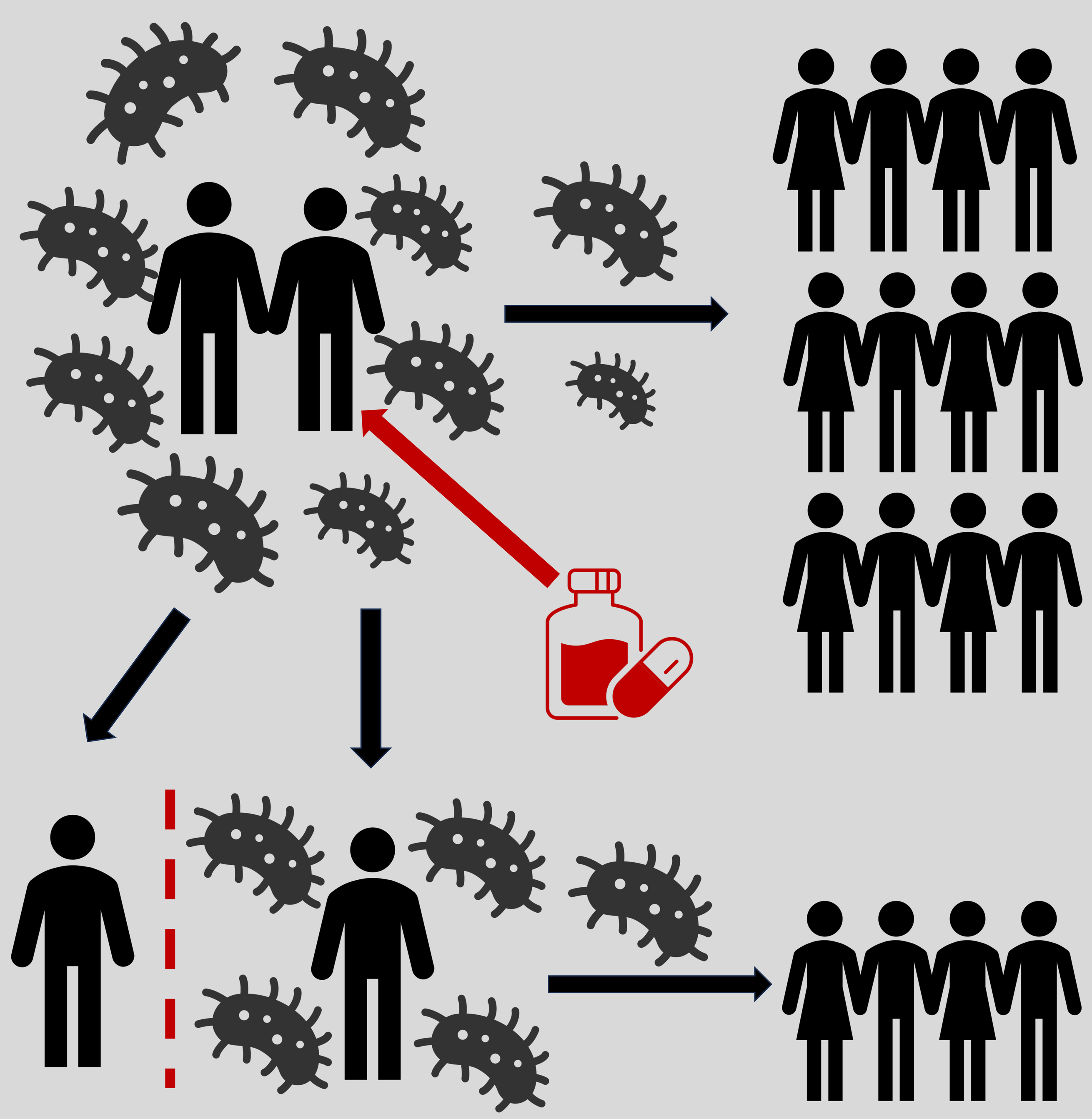
OBJECTIVES: The default framework in economic evaluation follows a noncommunicable disease (NCD) paradigm, focusing on benefits accrued to an individual patient, which overlooks the broader value of antibiotics. This research on methods aims to explore an applicable method to estimate the broader value, which is **dynamic transmission model**.



METHODS: One of the most widely applied dynamic transmission models is **compartmental model**, which is characterized by its dynamic nature. It primarily categorizes the population into different compartments based on their disease states, such as susceptible, infected, and immune individuals. By establishing a set of differential equations between these different compartments of the population, the model investigates the dynamic process of disease transmission.

$$\frac{dS}{dt} = -\beta SI \qquad \frac{dI}{dt} = \beta SI - \gamma I \qquad \frac{dR}{dt} = \gamma I$$

RESULTS: Apply the model to simulate the transmission of a certain bacterium and the dynamic changes in bacterial infections among hospitalized patients following the administration of either new or traditional antibiotics, thereby allowing for an economic evaluation of these two treatment strategies. Patients in the hospital environment are divided into three compartments based on their bacterial infection status: S (susceptible), I (infected), and R (recovered). The conversion rate from I to R is the efficacy of antibiotic use, which varies between new and traditional antibiotics. The use of new antibiotics increases the number of patients transitioning from I to R per unit of time. As the proportion of infected individuals decreases, the likelihood of effective contact between susceptible and infected patients also decreases, thus preventing some patients from transitioning from S to I. The broader value accruing from avoiding these infections, which is known as the transmission value, thus can be determined in this way.

CONCLUSION: The dynamic transmission model holds the potential to measure the broader value of antibiotics, which facilitates a more comprehensive assessment of antibiotics' overall value and refines the economic evaluation framework for antibiotics.

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