

## METAPOPULATION MODEL TO EVALUATE C.DIFFICILE POTENTIAL VACCINE INTERVENTIONS

### Abstract:

*Clostridioides difficile* (C.difficile) is one of the underlying causes of healthcare-associated infections (HAI) in the United States. This bacterium colonizes the large intestine, and it can cause colitis and diarrhea that can be fatal in some cases. This disease has a comparatively higher prevalence rate in the hospital and nursing facility population than in the general community, and potential preventive measures such as vaccination are currently available only in these facilities through clinical trials.

To assess the impact of vaccine efficacy, even if the vaccine is not available to the people in the community, we developed a deterministic model of disease flow in a metapopulation of community, hospital, and skilled nursing facilities. We analyzed the potential effect of vaccination on the prevalence of the disease in the heterogeneous population by measuring its efficacy on susceptibility, colonization, infectiousness, and clinical disease with the group of vaccinated individuals. We determined the value of the parameters using clinical and observation data and calibrated the model parameters to match the observed prevalence. We also analyzed the most sensitive parameters for the cumulative asymptomatic and symptomatic cases of C. difficile in the metapopulation, as well as the prevalence of colonized and diseased individuals in the community, skilled nursing facility, and hospital in the absence of vaccine efficacy. Similarly, we compared the simulated solution curves of the cumulative cases of asymptomatic and symptomatic individuals as well as the prevalence of the colonized and diseased individuals, not only highlighting the relative infectiousness in central but also in different percentages of vaccine efficacy, including one-year and 15-year time intervals.

Our results demonstrate that incrementing the various vaccine efficacy effects reduces the cumulated cases of C. difficile and the prevalence of the colonized and diseased individuals in the metapopulation over time, with the dominant effect coming from lowering the transmission rate into the colonized state .



***The Fall 2025 Math Seminar speaker is Dr. Archana Timsina, who will present her research talk on Friday, November 21, 2025, at 12:00 PM in ST 319***

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