

Comparing Intervention Strategies for Reducing *Clostridioides difficile* Transmission in Acute Healthcare Settings: An Agent-Based Modeling Study

CURRENT STATUS: UNDER REVIEW

BMC Infectious Diseases  BMC Series

Brittany Stephenson
Lewis University

✉ bsteph13@vols.utk.edu *Corresponding Author*
ORCID: <https://orcid.org/0000-0001-5478-4072>

Cristina Lanzas
North Carolina State University

Suzanne Lenhart
University of Tennessee Knoxville College of Arts and Sciences

Eduardo Ponce
University of Tennessee Knoxville Department of Electrical Engineering and Computer Science

Jason Bintz
Johnson University Tennessee

Erik R. Dubberke
Washington University in Saint Louis School of Medicine

Judy Day
University of Tennessee Knoxville

DOI:

10.21203/rs.2.21003/v1

SUBJECT AREAS

Infectious Diseases

KEYWORDS

Clostridioides difficile, environmental transmission, agent-based model, stochastic model, healthcare

Abstract

Background

Clostridioides difficile infection (CDI) is one of the most common healthcare infections. Common strategies aiming at controlling CDI include antibiotic stewardship, environmental decontamination, and improved hand hygiene and contact precautions. Mathematical models provide a framework to evaluate control strategies. Our objective is to evaluate the effectiveness of control strategies in decreasing *C. difficile* colonization and infection using an agent-based model in an acute healthcare setting.

Methods

We developed an agent-based model that simulates the transmission of *C. difficile* in medical wards. This model explicitly incorporates healthcare workers (HCWs) as vectors of transmission, tracks individual patient antibiotic histories, incorporates varying risk levels of antibiotics with respect to CDI susceptibility, and tracks contamination levels of ward rooms by *C. difficile*. Interventions include two forms of antimicrobial stewardship, increased environmental decontamination through room cleaning, improved HCW compliance, and a preliminary assessment of vaccination.

Results

Increased HCW contact precaution compliance with CDI patients was ranked as the most effective intervention in decreasing colonizations, with reductions up to 56%. Antibiotic stewardship practices were highly ranked after contact precaution compliance. Vaccination and reduction of high-risk antibiotics were the most effective intervention in decreasing CDI. Vaccination reduced CDI cases to up to 90%, and the reduction of high-risk antibiotics decreased CDI cases up to 23%.

Conclusions

Overall, interventions that decrease patient susceptibility were the most effective interventions in reducing both colonizations and CDI cases.

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed.

However, the manuscript can be downloaded and accessed as a PDF.

Figures

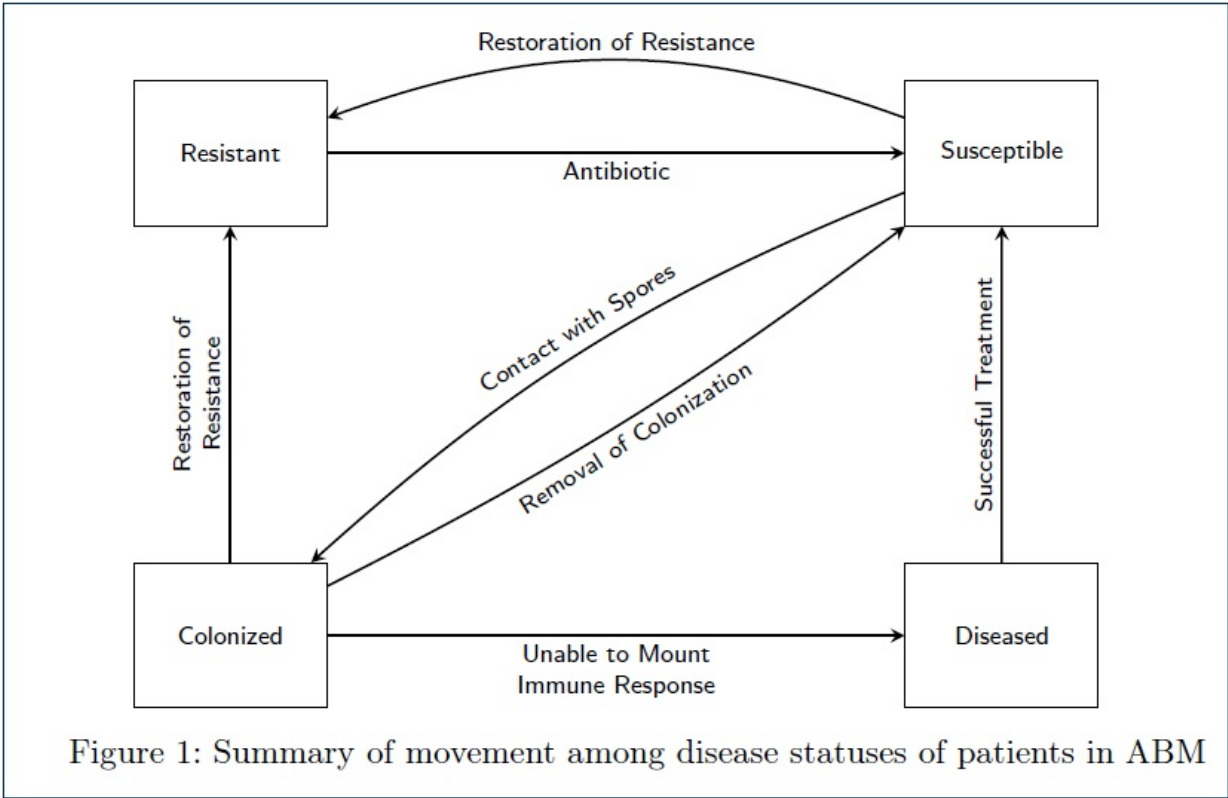


Figure 1

Summary of movement among disease statuses of patients in ABM

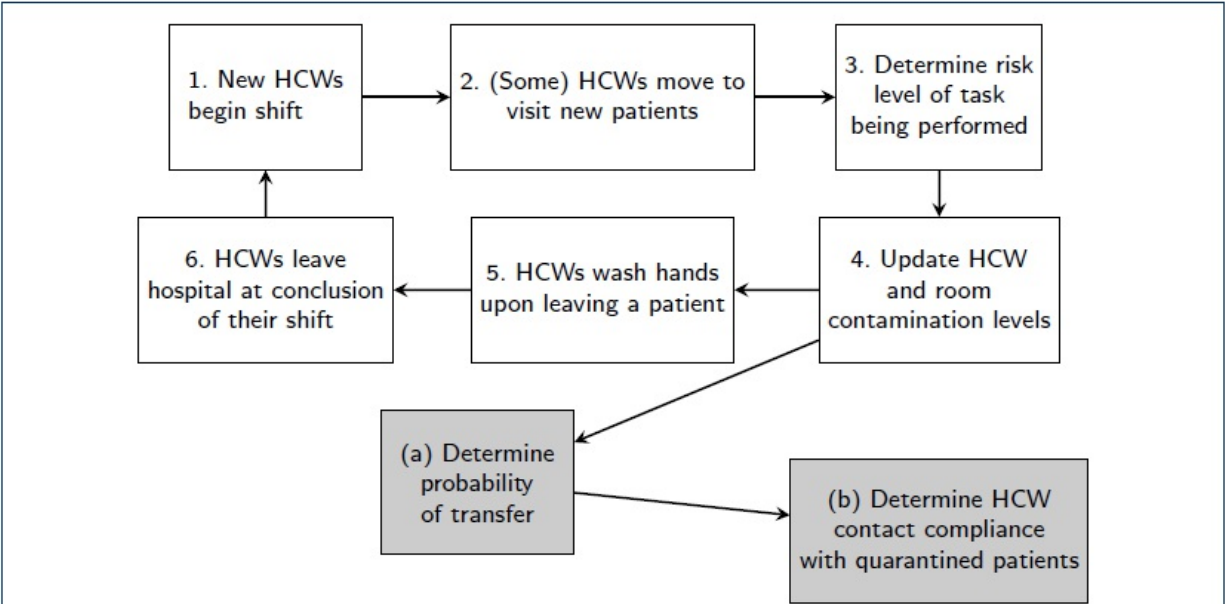


Figure 2: Summary of ABM processes that are run at each 15-minute time step

Figure 2

Summary of ABM processes that are run at each 15-minute time step

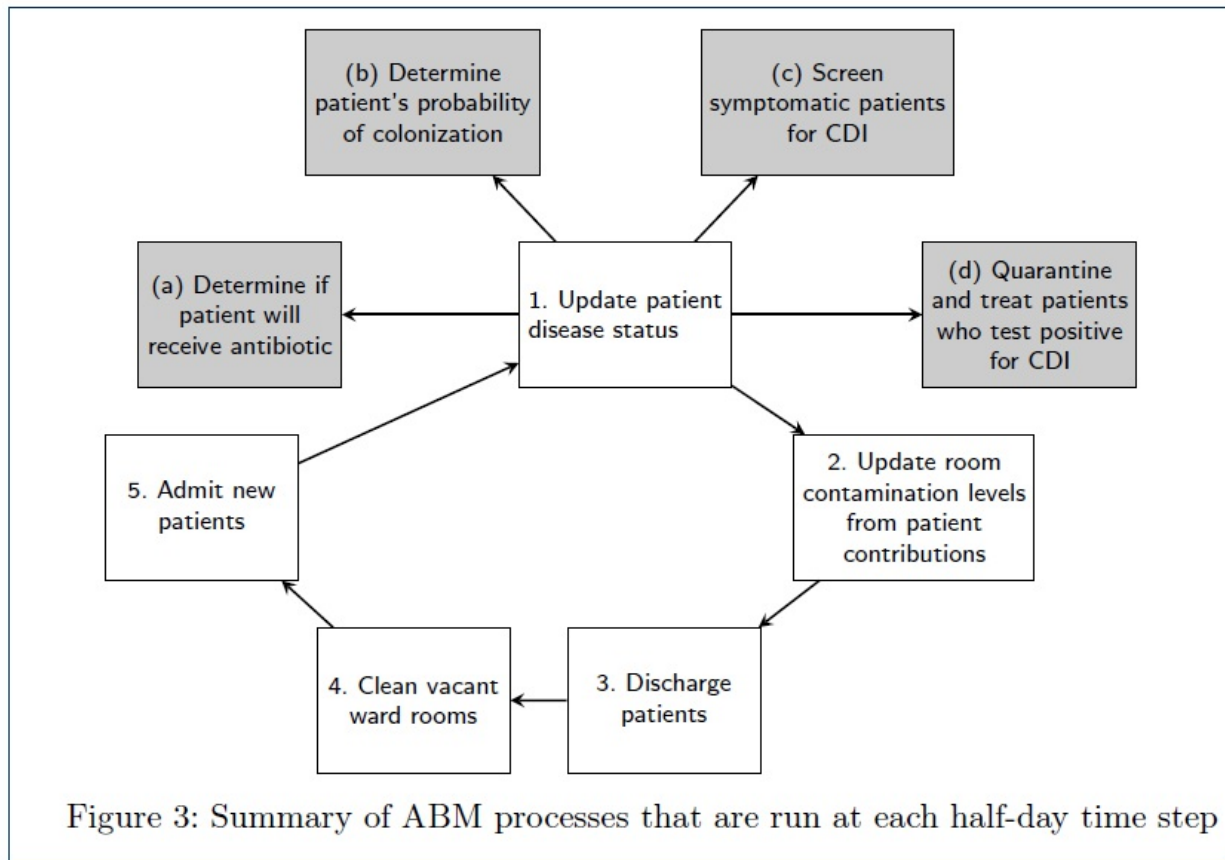


Figure 3

Summary of ABM processes that are run at each half-day time step

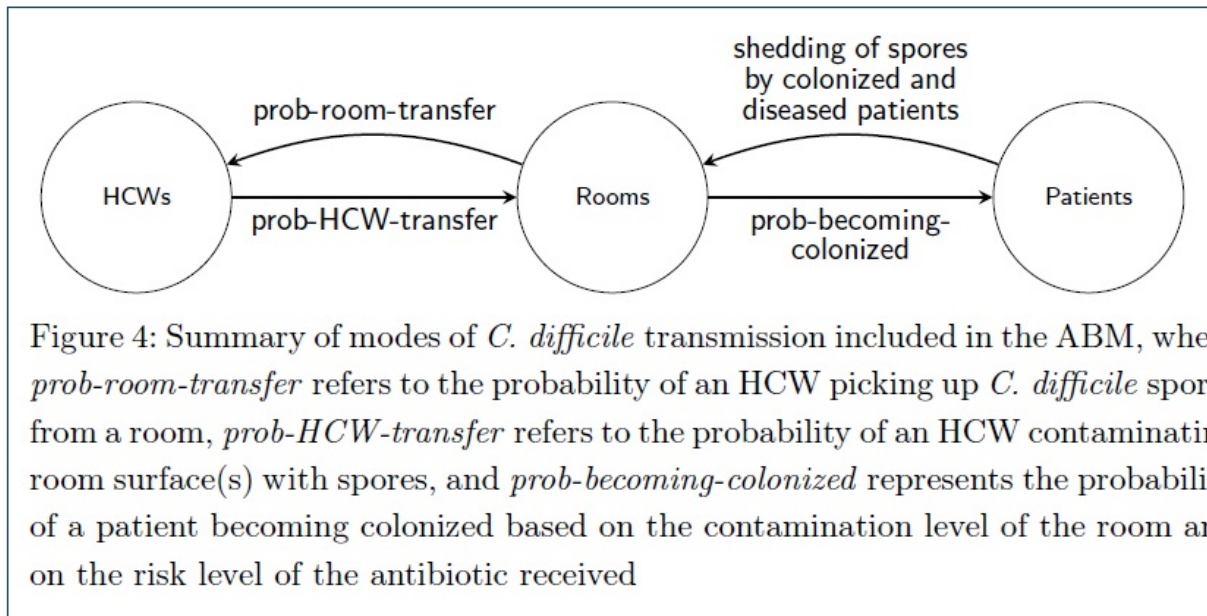


Figure 4

Summary of modes of *C. difficile* transmission included in the ABM, where *prob-room-transfer* refers to the probability of an HCW picking up *C. difficile* spores from a room, *prob-HCW-transfer* refers to the probability of an HCW contaminating room surface(s) with spores, and *prob-becoming-colonized* represents the probability of a patient becoming colonized based on the contamination level of the room and on the risk level of the antibiotic received

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

[AdditionalFile1.pdf](#)