

## Hybrid Systems Simulation Models for Transmission of Healthcare Associated Infections

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Transmission of healthcare-associated infections (HAIs) in long-term care facilities (LTCFs) possesses many distinct characteristics that are not well understood. While HAIs are primarily disseminated via contacts between healthcare workers and patients in hospitals, patient-patient and patient-visitor contacts play an important role in spreading HAIs in LTCFs. The increased risk of transmission through these routes results from frequent aggregation of residents in common areas and family visitation. Additionally, the elderly population living in LTCFs who are frequently readmitted to a hospital might acquire colonization or infection of resistant organisms while being hospitalised and transmit these organisms to other residents when returning to the LTCF and vice versa. Systems simulation modelling methods including system dynamics (SD), discrete-event simulation and agent-based models (ABM) have long been used to study the problems of HAIs in hospitals. However, the existing models do not capture the impacts of patient-patient and patient-visitor contacts and frequent hospital readmission of residents upon transmission of HAIs in LTCFs. Therefore, we develop a hybrid simulation model that combines the methodological strengths of SD and ABM to address this gap. ABM is used to model the transmission of HAIs in LTCFs taking into account heterogeneous contacts between individuals. The spread of HAIs in a hospital whose patients are transferred to and from the LTCF is modelled using SD. Information exchange between the SD and ABM components includes data on the number of patients transferred from one setting to the other, and their status of infection.