

Modelling pathogen spread in a hospital network including indirect patient movements

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Abstract

Recently, multidrug-resistant Enterobacteriaceae (MDR-E) have become a major public health threat. While traditional infection control strategies primarily target the containment of intra-hospital transmission of such pathogens, there is growing evidence that the patient traffic between hospitals is an important route of MDR-E spread. The movements of patients between hospitals and its impact on spread of pathogen were often studied using network models, but most models only included official direct patient transfers between hospitals. However, patients are mainly discharged from the hospital and after some time readmitted to the same or a different unit (indirect transfers) and if they still carry the pathogen, they contribute to its spread. We propose a network model, combined with ODEs, focusing on assessing the importance of indirect transfers for the spread of MDR-E. In particular, we introduce communities of recently discharged patients, waiting for re-admission/admission to a different facility, based on an anonymized patients' data set provided by the insurance company AOK Lower Saxony (Germany). Although a history of epidemic spread for hospital-acquired infection is not available, we compare a scenario with disease transmission limited to direct transfers between hospitals to the scenario with indirect transfers including the community. We show that the latter effect has significant impact on the prevalence of the system under consideration.

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