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SIMULATION OF PATIENT FLOW AND PATHOGEN TRANSMISSION IN A SYSTEM OF HEALTHCARE FACILITIES

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ABSTRACT

Recently multidrug-resistant Enterobacteriaceae (MDR-E) is an important public healthcare problem in many European countries. While traditional infection control strategies primarily target the containment of intra-hospital transmission, there is a growing evidence that the inter-hospital patient traffic is an important factor for the spread of MDR-E within healthcare systems.

We propose network-based models, which reflect a patient traffic between the healthcare facilities and thus provide the framework to systematic study of transmission dynamics of MDR-E together with the effectiveness of infection control strategies to contain their spread. Although model dynamics is based on the network structure, the spread of bacteria within the healthcare system is modelled separately by different submodels, e.g. systems of ordinary differential equations.

In our study we would like to compare two different approaches. Within the first approach we treat the patients in the proposed mathematical model as a bulk and we use a deterministic model to mimic the patient flow within the network and predict the disease spread rate. Second possibility is to focus on the individual patients and to introduce some probabilistic factors into the model, like for example probability of patient transfer to another facility or probability of transfer already infected patients. Thus the results are no longer deterministic, but also the simulation may be much more costly. However, it can capture more details. We would like to discuss pros and cons of both approaches, and also explore their various properties. Examples of results of simulations with both model types will be presented and discussed.

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