

The ambulance diversion phenomenon in an Emergency Department network: a Simulation-Based Optimization study

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Abstract Most of the studies dealing with the increasing and well-known problem of Emergency Department (ED) overcrowding usually focus on modeling the patient flow within a single ED, without considering the possibilities offered by the cooperation among EDs. In this work, we analyze the overcrowding phenomenon considering an ED network rather than a single ED, focusing on the so called ambulance diversion problem and considering distinct diversion policies. A Discrete Event Simulation (DES) model is used to represent the ED network and the Simulation-Based Optimization (SBO) approach is adopted to study a first-aid network under different conditions. The aim is to optimize the performances of the entire network, in order to provide the best service to patients without carrying unsustainable resource costs. An experimentation on a real case study consisting of six big EDs in the Lazio region of Italy has been performed. The achieved results show which are the best diversion policies both in terms of patient waiting time and costs for the service providers. Our implementation of the SBO procedure is based on a novel approach adopted for the communication between the DES model and a Derivative-Free optimization algorithm without the need of external software.

Keywords: Simulation-based optimization, Healthcare management, Discrete-event simulation, Ambulance Diversion.

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