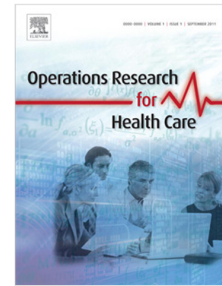


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# How can decision makers be supported in the improvement of an emergency department? A simulation, optimization and data mining approach

Ainhoa Goienetxea Uriarte<sup>a1\*</sup>, Enrique Ruiz Zúñiga<sup>a</sup>, Matías Urenda Moris<sup>a2</sup>, Amos H.C. Ng<sup>a</sup>

<sup>a)</sup> *Production and Automation Engineering Division, School of Engineering Science, University of Skövde, 54128 Skövde, Sweden*  
[ainhoa.goienetxea@his.se](mailto:ainhoa.goienetxea@his.se); [enrique.ruiz.zuniga@his.se](mailto:enrique.ruiz.zuniga@his.se); [matias.urenda.moris@his.se](mailto:matias.urenda.moris@his.se); [amos.ng@his.se](mailto:amos.ng@his.se)

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## ABSTRACT

The improvement of emergency department processes involves the need to take into consideration multiple variables and objectives in a highly dynamic and unpredictable environment, which makes the decision-making task extremely challenging. The use of different methodologies and tools to support the decision-making process is therefore a key issue. This article presents a novel approach in healthcare in which Discrete Event Simulation, Simulation-Based Multi-Objective Optimization and Data Mining techniques are used in combination. This methodology has been applied for a system improvement analysis in a Swedish emergency department. As a result of the project, the decision makers were provided with a range of nearly optimal solutions and design rules which reduce considerably the length of stay and waiting times for emergency department patients. These solutions include the optimal number of resources and the required level of improvement in key processes. The article presents and discusses the benefits achieved by applying this methodology, which has proven to be remarkably valuable for decision-making support, with regard to complex healthcare system design and improvement.

*Keywords:* Discrete Event Simulation, Simulation-Based Multi-Objective Optimization, Data mining, Decision support, Decision-making, Operational Research in Healthcare.

Abbreviations<sup>3</sup>

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<sup>1</sup> Corresponding author: Ainhoa Goienetxea Uriarte; E-mail address: [ainhoa.goienetxea@his.se](mailto:ainhoa.goienetxea@his.se); Tel.: +46 500 448 582.

<sup>2</sup> Present address: Division of Industrial Engineering and Management, Department of Engineering Science, Uppsala University, 75121 Uppsala, Sweden.

<sup>3</sup> Abbreviations: Emergency Department (ED); Operational Research (OR); Discrete Event Simulation (DES); Simulation-based Multi-Objective Optimization (SMO); Skaraborg Hospital Skövde (SkaS); National Board of Health and Welfare (SoS); System Dynamics (SD); Registered Nurses (RN); Percentile 90 (P90); Time To Triage (TTT); Time to first Meeting with the Doctor (TMD); Length Of Stay (LOS); Coefficient of Variation (CV); with respect to (w.r.t); Parallel Coordinate Plot (PCP); Flexible Pattern Mining (FPM).

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