

## **A 0-1 Goal Programming Approach to Optimize the Layout of Hospital Units: A Case Study in an Emergency Department in Seoul**

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**Abstract :** This paper proposes a method to optimize the layout of an emergency department (ED) based on real executions of care processes by considering several planning objectives simultaneously. Recently, demand for healthcare services has been dramatically increased. As the demand for healthcare services increases, so do the need for new healthcare buildings as well as the need for redesign and renovating existing ones. The importance of implementation of a standard set of engineering facilities planning and design techniques has been already proved in both manufacturing and service industry with many significant functional efficiencies. However, high complexity of care processes remains a major challenge to apply these methods in healthcare environments. Process mining techniques applied in this study to tackle the problem of complexity and to enhance care process analysis. Process related information such as clinical pathways extracted from the information system of an ED. A 0-1 goal programming approach is then proposed to find a single layout that simultaneously satisfies several goals. The proposed model solved by optimization software CPLEX 12. The solution reached using the proposed method has 42.2% improvement in terms of walking distance of normal patients and 47.6% improvement in walking distance of critical patients at minimum cost of relocation. It has been observed that lots of patients must unnecessarily walk long distances during their visit to the emergency department because of an inefficient design. A carefully designed layout can significantly decrease patient walking distance and related complications.

**Keywords :** healthcare operation management, goal programming, facility layout problem, process mining, clinical processes

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