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DESIGN AND DEVELOPMENT OF A LEAN-BASED MODEL FOR THE EMERGENCY DEPARTMENT GREEN ZONE OF A PUBLIC UNIVERSITY HOSPITAL IN MALAYSIA

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Abstract

Emergency Departments (EDs) operate under sustained pressure from increasing patient demand, overcrowding, and workflow inefficiencies. Although Lean principles have been widely adopted in healthcare to address these challenges, there remains limited documentation of systematic processes for designing and developing Lean-based intervention models in complex clinical environments. This study aimed to systematically design and develop a Lean-based model for the green zone of a public university hospital Emergency Department using a Design and Development Research (DDR) framework. This study comprised three phases: (i) needs analysis, (ii) model design and development, and (iii) model validation. A multidisciplinary Lean team conducted Value Stream Mapping (VSM) and Gemba to identify workflow inefficiencies and non-value-added activities. Improvement opportunities were prioritised using an effort–impact matrix to ensure feasibility within existing resource constraints. The prioritised components were integrated into a future-state workflow, constituting the Lean-based model, which was subsequently implemented at a pilot level within the department. Future-state VSM analysis projected a reduction in overall process length time from 6.7 hours to 4.5 hours,

corresponding to an estimated 29% improvement in patient waiting time. Expert validation demonstrated strong agreement regarding the clarity, feasibility, and operational alignment of model components. This study provides a structured and reproducible pathway for the development and preliminary implementation of Lean-based interventions in Emergency Department setting, contributing methodological guidance for systematic healthcare process redesign in resource-constrained environments. © 2026 Malaysian Public Health Physicians Association. All rights reserved.

Author keywords

Emergency Department; Green Zone; Healthcare Quality Improvement; Lean Model; Patient Waiting Time; Workflow Improvement

Indexed keywords

EMTREE medical terms

article; cohort analysis; crowding (area); drug development; emergency ward; German Democratic Republic; health care quality; Malaysia; pilot study; total quality management; university hospital; value stream mapping; workflow

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