Breaking Acute Bed Capacity Bottlenecks: Decision Support Insights from Ireland's Regional Health Area E Mid-West

Sinéad Madden

School of Engineering

University of Limerick

Hybrid Simulation Modelling Lab, Ireland

E-mail: info@hybridsimulationmodelling.com

Abstract

Introduction: University Hospital Limerick (UHL), serving Ireland's Mid-West (MW), faces chronic overcrowding. Long waits and delayed discharges reinforce each other, driving congestion. Balancing feedback loops exist but their impact is limited by capacity. The 2019 to 2023 trolley crisis, with 239 deaths (90% in critical condition), shows why congestion must be seen as dynamic rather than static.

Approach: The Midwest Integrated Demand and Capacity Analysis for Regional Emergency-care (MIDCARE) model is a dynamic simulation. It shows acute congestion emerging from capacity bottlenecks and workforce strain. Feedback loop analysis and sensitivity tests identify infrastructure limits and consultant shortages as drivers. MIDCARE supports informed redistribution, phased investment and staffing growth and delivers a decision support tool aligned with Government of Ireland Sláintecare reform.

Results: Bed capacity must expand significantly, Model 4 beds from 420 (2009) to over 1,400 by 2050, Model 2 beds to approximately 474. Consultants rise from 129 to 1040 to hold 85% occupancy. UHL Emergency Department (ED) attendances crossed the 60,000 critical mass point in 2016, Limerick's population triggered in 2024, Clare early 2030s and North Tipperary late 2040s.

Discussion: The MIDCARE model offers a new, data-driven way to better understand and tackle hospital capacity issues in Ireland's MW. To make the model as useful and accurate as possible, policy and decision-makers should participate in a Group Model Building (GMB) workshop to help fine-tune key assumptions and confirm that the model reflects real-world conditions.