The influence of backlog on emergency department crowding: a comparative case study analysis

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Abstract

Emergency department (ED) crowding has been a prolonged challenge of the healthcare sector in many countries. Whilst ED crowding is often attributed to a more system-wide mismatch between rising demand and constrained financial and material resources, improving the internal ED process remains critical due to its immediate impact on the quality of the care service. This study conducts a comparative analysis between an English ED suffering severer crowding and a Dutch ED which is hardly affected by the problem to gain an in-depth understanding on how severe crowding problems can be explained by the internal operational processes of an ED.

Keywords: backlog, emergency department crowding, healthcare operations

Introduction

Emergency department (ED) crowding has been a prolonged challenge of the healthcare sector in many countries. Crowding results in long waiting times, excessive length of stay (LOS), and poor quality of care. The National Health Service (NHS) in England introduced a 'four-hour target' in 2004, which intended to prevent ED crowding by instituting a maximum LOS aimed for at least 98% of ED patients (Pine et al. 2011). However, the percentage was relaxed to 95% in 2010, followed by a recent announcement of adjusting the target to "urgent health problems" in the future as more and more EDs struggled to meet the target (Campbell and Mason, 2017). Failing the 'four-hour target' implies the severity of ED crowding in England; the NHS has recognised it as a crisis to be addressed urgently.

Whilst ED crowding is often attributed to a more system-wide mismatch between rising demand (e.g., changing demographics) and constrained financial and material resources, improving the internal ED process remains critical due to its immediate impact on the quality of the care service. Additionally, an intra-organisational strategy is perhaps the most realistic solution to the crisis in short term before any system-wide improvements are achieved in long term. The latter is a persistent challenge itself due to

political and economic uncertainty, especially after the UK Brexit. The Netherlands is one of the very few countries that have reported no significant issues on ED crowding (Pine et al. 2011). As such, this study tries to get in-depth insights by comparing an uncrowded ED in the Netherlands with a 'fire-fighting' ED in England, investigating the research question – *How can severe crowding problems be explained from the internal operational processes in an ED?*

Design/methodology/approach

Given the focus of the internal ED process, the comparison in the study looks into the 'throughput' component of a universally embraced 'input-throughput-output' conceptual ED crowding model by Asplin et al. (2003). The 'throughput' component stresses factors (e.g., ED capacity, ED workload, and ED efficiency) associated with patient LOS within the ED. A fluid model approach, which is graphically reflected in throughput diagrams (Wiendahl, 1988), is employed to determine the main measure (i.e. LOS) of the 'throughput' component. It allows to provide a fully dynamic perspective of the system performance during the day, without being blurred by 'input' factors such as individual patient circumstances and seasonal factors that are not directly subject to the internal ED process. Patient arrival and departure times are collected retrospectively from the information system in each of the EDs over a 12-month period.

Findings

The comparison between the EDs reveals the importance of system recovery for addressing or preventing ED crowding, where patient inflow and outflow, LOS, and number of patients held in the departments are analysed over the 24-hour time window during a full year. Detailed findings and implications include:

- The Dutch ED catches up the backlog during the night when the inflow cools down; this enables a nearly empty start in the morning so that the department keeps up with much higher inflow rates during the daytime. Adversely, the English ED holds a rather high volume of patients who stay even longer in the department at night than in the daytime despite much lower inflow rates. As a result, the two EDs deal with similar inflow levels during the daytime but the English ED suffers severer crowding; the system never sufficiently recovers before new peaks arrive.
- Inadequate staffing is a typical "throughput" factor that causes crowding. The number of fully qualified emergency physicians in the English ED reduces in the evening while patient inflow rates reach the highest peak of the day. The mismatch between demand and supply quickly builds up a backlog that knocks into the night when resources are even more constrained, thus is impossible to catch up.
- ED beds without adequate staffing are a 'hidden' contributor to excessive LOS, but are often misunderstood as a quick solution to crowding. The number of beds in the Dutch ED and the English ED are disproportional to their volume of patients (e.g., annual visits); the higher bed-to-patient ratio in the English ED does not seem to help but potentially intensifies the crowding situation.

ED crowding is defined as a periodic problem in the literature. However, the power of an empty start observed in the comparison between the Dutch ED and the English ED argues a continuing backlog influence. A capacity shortage not only increases patient LOS at the time but also builds up a backlog that depletes resources in the future.

Relevance/contribution

The practical contribution of this study is clear in providing new insights into the crowding problems of EDs, which at the end may be a matter of life and death. Besides

the study contributes to the literature on health care operations in multiple ways: (1) it addresses the commonly identified problem of crowding in emergency care in a novel way by comparing an English ED suffering severe crowding with a Dutch ED without any crowding issues, despite having similar peak inflow rates and comparable capacity levels; (2) it shows how crowding problems can be attributed to a phenomenon of system recovery that has not been addressed in literature before; (3) methodologically, the study is the first to use a fluid model approach to reveal differences in ED performance.

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