

Brief Research Report

Emergency medicine as a driver of hospital efficiency

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Dan Med J 2026;73(1):A09250713. doi: 10.61409/A09250713

ABSTRACT

INTRODUCTION. Emergency Medicine was introduced as a speciality in Denmark in 2018 to ensure efficient, evidence-based management of acute patients. At North Zealand Hospital, an independent emergency department (ED) was fully implemented in 2021, followed by a consolidation phase. This study aimed to assess how the design of an ED influences the rest of the hospital by examining bed-day consumption during a time with increasing patient volume.

METHODS. Activity and bed-day utilisation were compared across two 12-month periods: before (1-JUL-2018 to 30-JUN-2019) and after implementation of an independent ED (1-JUN-2023 to 30-JUL-2024). Included were all patients admitted to somatic departments (excluding gynaecology, paediatrics and a casualty unit). For each contact, the responsible speciality at discharge from the ED was registered.

RESULTS. Patient contacts increased by 20% (from 40,061 to 48,193). The proportion of patients managed entirely by emergency medicine rose by 139%, whereas the share handled by the other specialities decreased by 23%. Despite the higher intake, total bed-days decreased by 21%.

CONCLUSIONS. Establishment of an independent ED contributed to reduced hospital bed utilisation despite increasing patient load. Emergency medicine qualifies the selection of patients in need of hospitalisation, improves the operational efficiency of the hospital and minimises unnecessary admissions.

FUNDING. None.

TRIAL REGISTRATION. Data were drawn fully anonymised for statistical purposes only and therefore did not require formal registration.

Since a policy reform in 2007, the Danish emergency departments (ED) have been undergoing substantial redesign. More than 40 acute hospitals were reduced to 21, with the ED becoming the sole point of emergency access to each hospital. The reform granted each acute hospital a large degree of freedom to organise its individual ED. Thus, 21 different organisational models were established. These 21 models can be grouped into three generic types. The “independent” ED, which is staffed by dedicated ED doctors and nurses who work only in the ED. The “virtual” ED, which is staffed by other medical specialities from the hospital, who take shifts in the ED as before the reform. The “hybrid” ED, which is a middle ground between these two outliers. In this model, some patients are seen by ED doctors and some by the other specialities [1].

Data regarding the advantages and disadvantages of these three models are scarce. The Danish Centre for Social Science Research VIVE published a comprehensive report on the challenges faced by Danish EDs. This report is based on stakeholder interviews; however, it does not include quantitative data, probably because none was available [2].

Developing an independent ED has previously been shown to reduce hospital admissions [3]. To our knowledge,

the previous study of 3,930 patients remains the only investigation to assess how ED design influences activity in the wider hospital. Since that study, Emergency Medicine became a recognised speciality in Denmark in 2018 [4], which has enabled EDs to be staffed by emergency medicine specialists and strengthened the professional basis for rapid assessment and treatment in the acute care pathway. Patients requiring hospital admission are referred to inpatient wards, whereas others are treated and discharged directly from the ED, thus reducing crowding [5].

At North Zealand Hospital, an independent ED with its own staff and bed capacity was established in 2021. The hospital has 565 beds and a population base of approximately 320,000 citizens. In-hospital departments include surgery, orthopaedic surgery, neurology, cardiology, endocrinology, nephrology, lung medicine, infectious medicine, paediatrics and gynaecology. The ED employs 41 physicians. Near the ED is a short-stay unit staffed by the in-hospital specialities.

Aside from gynaecology and orthopaedic surgery, all adult acute patients are evaluated by the ED, which can either treat and discharge or refer the patient to the short-stay unit or an in-hospital ward. This design ensures synergy by aligning the hospital's internal interfaces with Emergency Medicine workflows.

This is a retrospective quality study investigating how patient flow through the ED affects hospital bed-day demand. We explored this topic by comparing patient flow and bed-day demand during two time periods, before and after the implementation of an independent ED.

Methods

We compared two identical 12-month periods:

Period 1 (1-JUL-2018 to 30-JUN-2019) occurred before the implementation of an independent ED and was free of COVID-19 restrictions.

Period 2 (1-JUN-2023 to 30-JUL-2024) was located as late as possible, after the implementation of an independent ED in 2021, to allow measurement of changes after the ED's consolidation. The method of recording bed days is the same in both periods, but would have differed if an earlier period had been chosen.

Data sources and definitions

- Patient contacts to North Zealand Hospital (excluding gynaecology, paediatrics and the casualty unit).
- Responsible speciality at discharge from the ED.
- Bed days generated by acute hospital admissions within the medical, surgical and neurological departments. These departments were selected because they account for the patients admitted through the ED. One bed day was defined as one in-hospital bed occupied for 24 hours. Hospital stays in the ED or the short-stay unit do not count as bed days. A bed occupancy of a fraction of 24 hours would contribute with that fraction, which is why bed-days in the two periods deviate by -1.
- Data were retrieved from the electronic health record through Epic's data warehouse using the SAP Web Intelligence tool. This was done by a statistical employee at the hospital's data unit. Accuracy was verified by comparing the study data with other patient flow data collected over several years. Data handling and statistical analyses were performed by the authors using Microsoft Excel.
- For period 2, readmissions ≤ 72 hours were obtained from the Capital Region's Clinical Quality Database. These data are not available for period 1.

Trial registration: Data were drawn fully anonymised for statistical purposes only and therefore did not require formal registration.

Results

There was a 20% increase in acute patient contacts to the hospital, from 40,061 to 48,196. Patient contacts handled by internal medicine, surgery and neurology decreased by 23% from 28,845 to 22,076 contacts. Emergency medicine experienced a 139% increase in patient contacts from 10,688 to 25,878 contacts (**Table 1**).

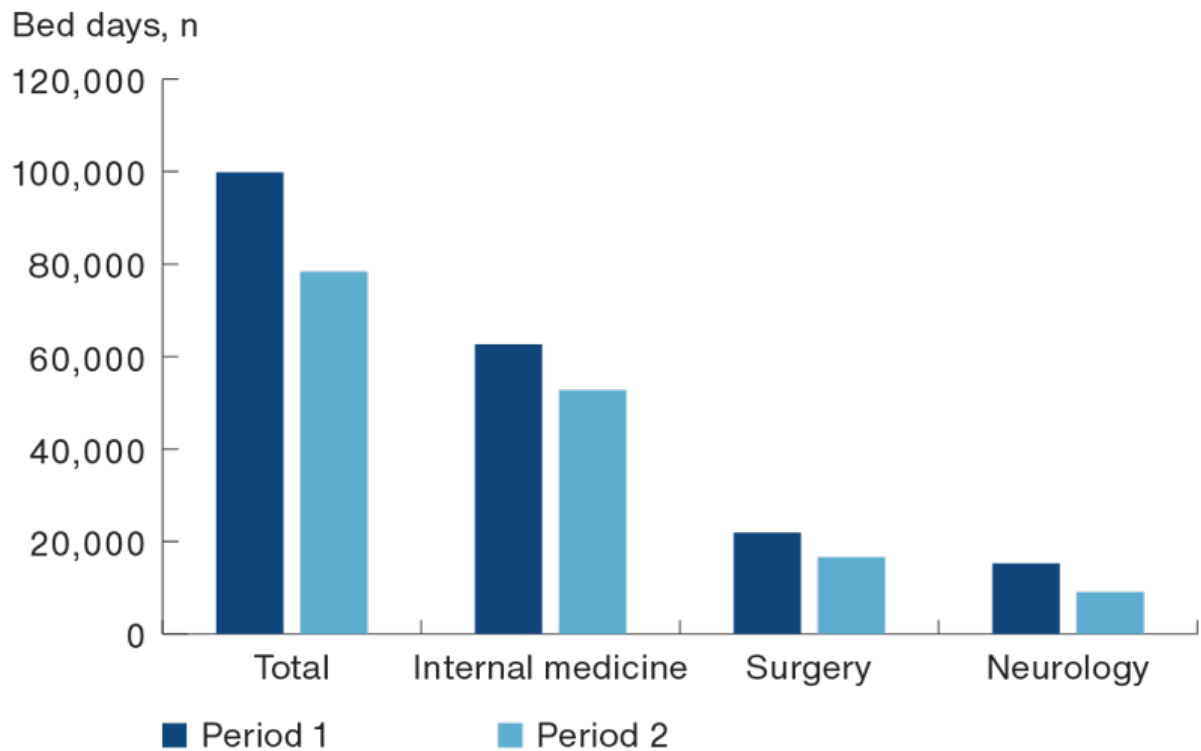
TABLE 1 Development in patient contacts generated by acute patients, and bed-day utilisation.

	Period 1, n	Period 2, n	Change, %
Patient contacts	40,061	48,196	+20
Emergency medicine patients	10,688	25,575	+139
Internal medicine, surgery & neurology	28,845	22,076	-23
Other ^a	528	545	+3
<i>Bed days</i>			
Total	99,834	78,379	-21
Medicine	62,664	52,734	-16
Surgery	21,906	16,572	-24
Neurology	15,265	9,074	-41

a) Includes patients who were allocated to specialities that were unavailable at the North Zealand Hospital, such allocation is rooted in an inconvenient coding practice.

The bed-day demand generated by acute patients for the hospital is presented in Table 1 and **Figure 1**.

FIGURE 1 Bed-day utilisation before and after implementation of an independent emergency department.



During period 2, the readmission rate within 72 hours for acute hospital stays shorter than 24 hours at North Zealand hospital was 6.2%. This is the lowest rate recorded across the five acute hospitals in the Capital Region, with readmission rates for patients admitted through an emergency department as follows: Amager-Hvidovre 6.8%, Bispebjerg 6.9%, Herlev 6.8% and Bornholm 7.3%.

Discussion

Our findings show that establishing an independent ED significantly influences admission patterns to other hospital specialities. By acting as a filter, Emergency medicine ensures targeted admissions and prevents unnecessary inpatient stays. Instead of automatic admissions, patients undergo early evaluation, enabling rapid discharge or precise referral as needed. Precise referral of patients with conditions that are best treated by a specific medical speciality enables optimal and rapid treatment, minimising the length of hospital stay. This approach reduces in-hospital crowding.

The marked increase in patients managed by emergency medicine without a proportional rise in bed-day consumption indicates effective, speciality-based evaluation and treatment. Importantly, the higher discharge rate from the ED did not lead to excess readmissions compared with other hospitals. It would have been interesting to examine the readmission rate between periods 1 and 2, but the necessary data were unavailable.

A strength of the study is that it was conducted at the same hospital and within the same geographic and demographic population base. However, the single-centre design is also a weakness. It would be interesting to

investigate if our results may be replicated at other hospitals.

No other significant organisational changes occurred between period 1 and period 2, and there has been no substantial increase in population. Therefore, the reason for the 20% increase in ED patient contacts remains uncertain. It may originate from an inadequate filter function in the out-of-hours medical helpline (1813), but with the current suboptimal registration, this can only be assumed.

Conclusions

Implementation of an independent ED at North Zealand Hospital has enabled efficient management of acute patient pathways. Despite increasing patient volumes, overall bed-day utilisation declined. Emergency medicine should be considered a key driver of efficient modern hospital operation.

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Accepted 17 November 2025

Published 10 December 2025

Conflicts of interest none. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. These are available together with the article at ugeskriftet.dk/dmj

References can be found with the article at ugeskriftet.dk/dmj

Cite this as *Dan Med J* 2026;73(1):A09250713

doi [10.61409/A09250713](https://doi.org/10.61409/A09250713)

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