

Clinical Science

Dedicated operating room for emergency surgery generates more utilization, less overtime, and less cancellations



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Abstract

BACKGROUND: Two approaches prevail for reserving operating room (OR) capacity for emergency surgery: (1) dedicated emergency ORs and (2) evenly allocating capacity to all elective ORs, thereby creating a virtual emergency team. Previous studies contradict which approach leads to the best performance in OR utilization.

METHODS: Quasi-experimental controlled time-series design with empirical data from 3 university medical centers. Four different time periods were compared with analysis of variance with contrasts.

RESULTS: Performance was measured based on 467,522 surgical cases. After closing the dedicated emergency OR, utilization slightly increased; overtime also increased. This was in contrast to earlier simulated results. The 2 control centers, maintaining a dedicated emergency OR, showed a higher increase in utilization and a decrease in overtime, along with a smaller ratio of case cancellations because of emergency surgery.

CONCLUSION: This study shows that in daily practice a dedicated emergency OR is the preferred approach in performance terms regarding utilization, overtime, and case cancellations.

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Operating rooms (ORs) are of paramount importance to a hospital, given the fact that more than 60% of admitted

patients are treated in the OR.¹ Efficient use of OR capacity is pivotal as it is considered a high-cost environment and a limited hospital resource.² Because of the aging population and developments in surgery, demands for OR facilities are likely to increase. Moreover, because of shortages of qualified OR staff, utilization of ORs is an ever-increasing challenge.¹ For this reason, optimal scheduling of ORs to ensure effective and efficient use of OR capacity is crucial. However, variability in processes, dependence on limited capacity in other parts of the hospital such as intensive

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care units, large numbers of surgical departments competing for limited OR facilities, and particularly the unpredictable arrival and duration of emergency surgeries render scheduling complex.^{1,3} Emergency procedures hamper the elective OR schedule, resulting in delays, case cancellations, or overtime.³

Previous studies have described different approaches to deal with emergency procedures and the disturbances they create in elective OR schedules.^{3–12} Overall, these different approaches can be divided into 2 basic methods for reserving OR capacity for emergency surgery: (1) concentrating all reserved OR capacity in dedicated emergency ORs and (2) evenly allocating capacity for emergency surgery to all elective ORs, thereby creating a virtual emergency team. Several studies have suggested to favor approach (1),^{3,4,7–10,13} while other studies promote approach (2).^{5,6,11,12} Conclusions of these previous studies contradict with regard to the allocation method leading to the best performance in OR utilization. Many hospitals debate on this subject and in practice “closing the dedicated emergency OR” is becoming the preferred approach.

In 2007, Wullink et al¹² compared the 2 basic approaches for reserving OR capacity for emergency patients by using a discrete event simulation model simulating the actual situation. Results that were based on a large database indicated that the policy of reserving capacity for emergency surgery in all elective ORs could lead to an improvement in waiting times for emergency surgery from 74 (± 4.4) minutes to 8 (± 5) minutes, while working in overtime was reduced by 20% and overall OR utilization increased by 3%. The results of this simulation study led to the closing of the emergency OR at Erasmus University Medical Center Rotterdam (Erasmus MC) and to planning emergency procedures during the day in the reserved slack time of all elective ORs.

A systematic review conducted by Fone et al¹⁴ concluded simulation modeling to be a powerful method to inform policy makers in the provision of health care. Although the number of modeling papers has grown substantially over recent years, few report on the outcomes of implementation of models, therefore the true value of modeling cannot be assessed. It is likely that many modeling studies that are published before implementation of the relevant intervention(s) has been carried out and evaluated. OR scheduling is one of the popular topics for computer simulation modeling in health care. The potential of mathematical modeling to inform evidence-based policy development in health care is clear; however, information on the outcomes of model implementation and hence the value of modeling requires further research.¹⁴

The purpose of this study was to evaluate the policy outcomes of reserving capacity for emergency surgery in all elective ORs, in terms of OR utilization. This policy was assessed using a controlled time-series design and empirical OR data of 3 University Medical Centers (UMCs) in the Netherlands.

Methods

The definition of emergency surgery was based on the unplanned nature of identification of the need for surgery and the relative urgency for surgical intervention, without which the patient’s health may deteriorate and risk poor clinical outcomes.¹⁵ This included all nonelective (unplanned) surgical cases, both urgent and semiurgent. The timeframe for indication of urgency included all nonelective cases requiring surgery immediately, within 2 hours, within 6 hours, or within 24 hours.

To measure the influence of the emergency scheduling approach, a quasi-experimental controlled time-series design was applied. Data were retrieved directly from the Hospital Information Systems of 3 UMCs. The analysis concerned data for the period of 8 consecutive years from January 1, 2000 to December 31, 2007. In addition, more recent data from 2008 to 2011 were included in the results; however, these recent years were not part of the actual study period. In this study, data from 3 university hospitals were included: the Erasmus MC which applied a new method for emergency planning, and 2 control UMCs. These control UMCs were selected, based on comparability with the Erasmus MC in size and patient mix.

Three performance indicators were relevant for the evaluation of the emergency planning approach:

- Raw utilization was defined as the total amount of case durations (elective and emergency cases) during block time, divided by the total amount of allocated block time for the complete OR department $\times 100\%$. This definition excluded turnover time and overtime. Block time or “opening hours” are generally from 8:00 am to 16:00 pm. The common scheduled start and finish times were corrected in case of an intentional alternation, for example, because of regular team meetings, extended block time.
- The number of ORs running after scheduled room exit time (generally 16:00 hours), divided by the total number of available staffed ORs $\times 100\%$.
- Cumulative “overtime” from all ORs running late, divided by the total amount of allocated block time $\times 100\%$. Overtime was quantified by the difference in minutes between the scheduled and actual room exit time of the last patient of the day. The common finish time was corrected in case of a scheduled extended block time (more than the standard of 8 hours).

These parameters were measured daily and prospectively for the OR departments of 3 UMCs. We divided the available data into 4 time periods of 2 years each. With 2 measurement periods before the implementation (2000/2001 and 2002/2003) and 2 measurement periods after the implementation (2004/2005 and 2006/2007), we created an interrupted time-series design that allowed to control for changes in the parameters not caused by the intervention.¹⁶ Data analysis was performed with SPSS Statistics 20 (IBM

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