

A comprehensive approach to operating theatre scheduling

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Abstract: Operating theatre scheduling is widely accepted as being an extremely important driver of hospital capacity, efficiency, and output. Each year approximately 300 million major procedures are performed worldwide (Dobson, 2020) with the total healthcare system costing \$9 trillion in 2020 (WHO, 2023).

Despite the vast amount of published theoretical work on operating room management, only a very small percentage of this work has been implemented in an operational setting. Nothing has been found that incorporates all the factors within one study such that it is scalable and generic enough to be implemented in any hospital. The aim of this research is to provide a novel comprehensive scheduling approach and to provide solution techniques which are fast and produce near if not optimal solutions. The desired outcome is to bridge the gap between research and the real world by demonstrating that the scheduling tool may be implemented in a large South-East Queensland hospital. Early results have indicated a conservative increase of 10% utilisation may be achieved compared to current practice, with associated reduced waiting lists, culminating in improved patient care outcomes.

The hospital system is so complex and involves many disciplines. Perhaps this is one of the leading reasons why implementable solutions are so hard to achieve. For this reason, we have contextualised this research within a broader research team that attempts to view this system holistically. The decision support tool emulating from this study is called The Hospital Optimisation Model and Scheduler (THOMAS). It is a discrete event simulation, optimisation model that employs hybrid and hyper meta-heuristics including simulated annealing, threshold acceptance and tabu search. It also extends upon the work by other members in the QUT research team and the FLOH application (a patient flow model for hospitals). Health practitioners can use FLOH to identify the big picture capacity issues, then they can drill down with THOMAS to discover how to practically address those issues. It is also intended that the study will identify future research opportunities to optimise staff levels, equipment, and instrument tray inventory. THOMAS is currently being trialled and evaluated by one of the partner hospitals.

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REFERENCES

- Dobson, G.P. 2020. Trauma of major surgery: A global problem that is not going away. *Int J Surg.* 2020 Sep; 81: 47–54.
- World Health Organisation. 2022. "Global spending on health: Rising to the pandemic's challenges". <https://www.who.int/publications/i/item/9789240064911>

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