BED CAPACITY PLANNING TOOL

Researcher: Tian Mu Liu

Supervisor: Professor Michael Carter

Challenge

In April 2008, the Ontario government announced its top two healthcare priorities for the next four years, one of which was to reduce wait time in emergency rooms. To minimise the wait time in emergency rooms or any other departments in a hospital, this project investigated its resource planning, scheduling, and utilization.

Methodology

The project was based on the theory that the number of beds required in a hospital should be predictable by day of week and by hour of day. Most hospital surgical departments incorporate a Master Surgical Schedule with which each surgeon is given one or two days in the O.R. each week. The length of stay for each surgeon tends to be very similar from one week to the next. Each hospital also has a distinctive arrival pattern at the Emergency Department during each day of the week, and a predictable admission cycle. Using previous patient data, an Excel-based model was constructed to provide hospitals with a set of simulation and optimization tools to help identify bed requirements and help smooth and level peak demands through the week.

The Monte Carlo simulation tool was designed to estimate patient demand for beds in a hospital during a typical week of the high demand season. The model distinguishes between day, evening and night shift demand but does not simulate capacity, and it reports on the number of beds required to meet demand. The user can ask "What if?" questions around reducing length of stay, increasing demand, or improving discharge rates. The model typically identifies higher bed demand rates toward the end of the week for surgical patients. The system includes optimization tools (an integer programming mathematical model and a heuristic model) to demonstrate opportunities for smoothing and leveling the anticipated patient demand for beds by adjusting operating room schedule.

Results and Impact

The simulation model was evaluated as a decision support tool to help managers eliminate much of the guesswork in anticipating bed demand. The simulation results showed that there were more Orthopedics bed days than expected, which was believed to be the result of Orthopedics patients staying for prolonged periods of time waiting for rehab,

Day Shift for Elective Surgery

home care, long-term care home, or other placement. Patient demand for beds expected from elective surgery was smoothened across weekdays by optimising the operating room schedule, lowering the peak demand by 8% of capacity. This was achieved by modifying the operating room schedule, which reduced the maximum number of beds needed without affecting weekly patient volume.
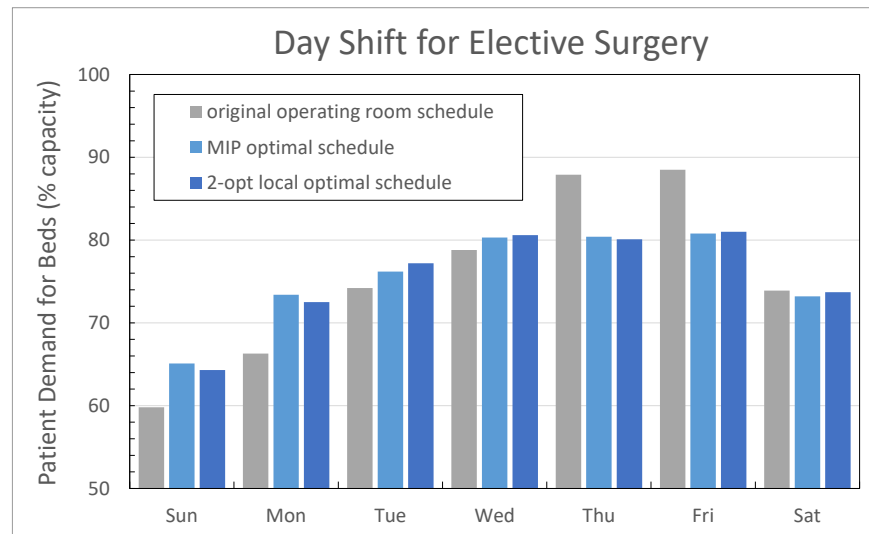
Partner Profile

William Osler Health System is Ontario's largest community hospital, serving 1.3 million people in Brampton and Etobicoke, Ontario.

Hamilton Health Sciences (HHS) consists of seven hospitals, a cancer centre, and an urgent care centre located in Hamilton, Ontario. HHS provided historical patient records that were used for validation of the model.

Regina General Hospital is one of two hospitals in Regina Qu'Appelle Health Region, and serves 260,000 residents in southern Saskatchewan.

St. Michael's Hospital is located in downtown Toronto and is one of University of Toronto's teaching hospitals. The hospital has over 480 adult inpatient beds, including around 60 intensive care beds, which together accommodate almost 25,000 patients a year.

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