

Quality Improvement Through Better Estimation and Appropriateness of Resources to Intensive Care Units: The Ontario Algorithm

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BACKGROUND

To provide critically ill patients timely and quality care, it is important for intensive care units (ICUs) to have adequate bed capacity. Evidence suggest that critical care system works most efficiently when ICU bed occupancy rate ranges between 80% and 85%. In the recent years Ontario’s critical care services is experiencing ongoing occupancy pressures in many hospitals, and with projected increase in the aging population demand for critical care beds are projected to increase. Previous studies have shown when bed occupancy rates exceeds 85%, bed shortages and long ED waiting times, poor patient outcomes are observed.

To monitor and address capacity issues, the Ontario Algorithm/Model for management of adult critical care unit capacity investment was developed by Critical Care Services Ontario (CCSO). This algorithm takes into consideration several factors such as bed occupancy rate, ventilator occupancy rate, and the specialty of services, to calculate capacity score to determine investment needs. To further support the algorithm, additional analyses is done to examine trends over time of unavailable bed days and awaiting transfer to alternative care patient bed days. These two variables are well documented to impact bed occupancy. The main goal of the algorithm is to assist system leaders in making evidence-based decisions when appropriating resources to ICUs, and thereby mitigate the pressures in capacity.

AIMS & ACTION TAKEN

Aim:

1. To better plan and maintain Ontario’s provincial critical care capacity in order to efficiently manage the increasing occupancy pressures as well as the demographic shift that is projected to significantly increase in the number of seniors living in Ontario.
2. To effectively address the projected increase in demand for services and manage the risk of its impact (e.g. long wait times, worse patient outcomes).
- 3.To better prepare for surge capacity planning.

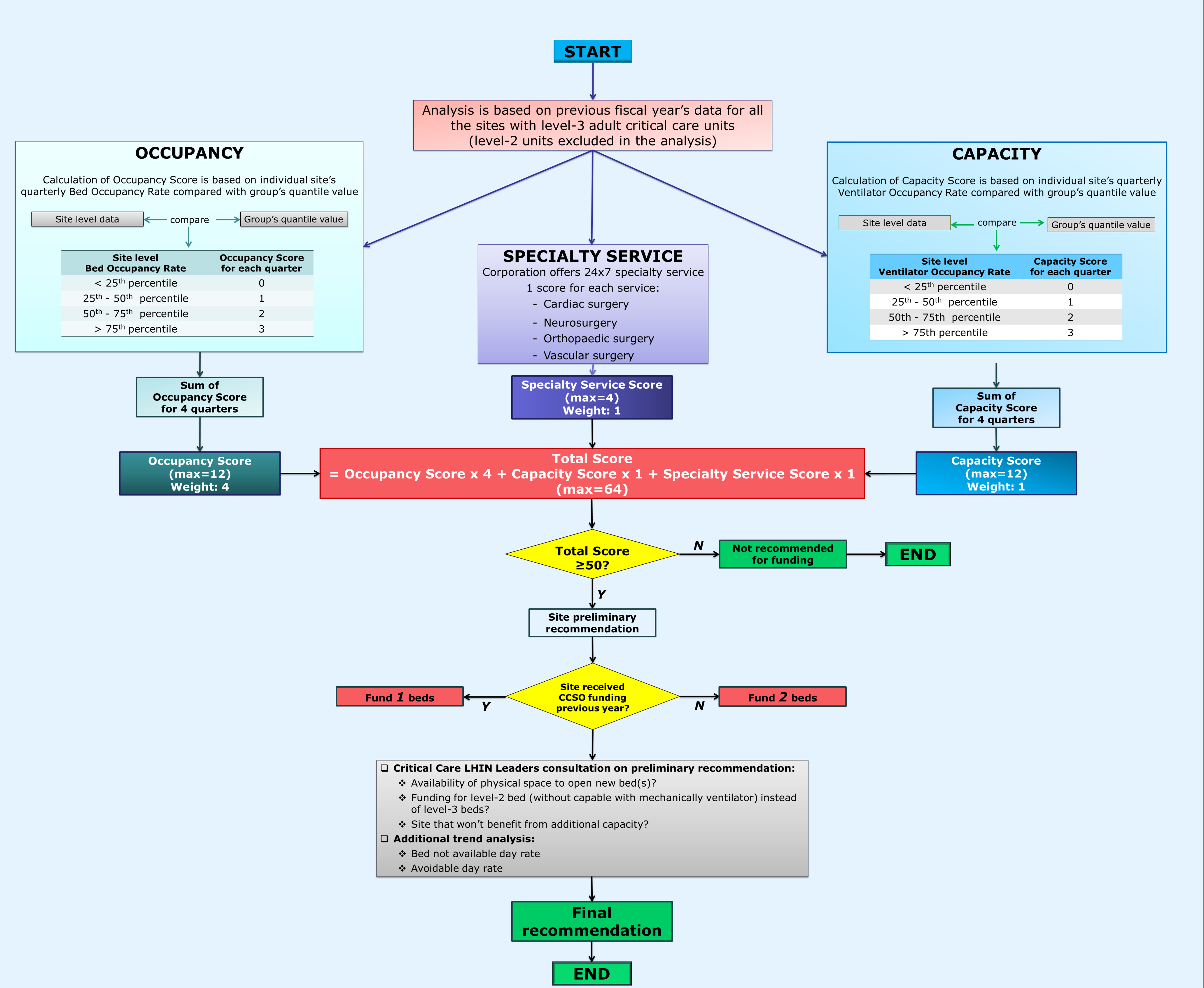
4. Action Taken:

CCSO has developed an adult level-3 Critical Care Unit Capacity Investment Recommendation Algorithm (Figure 1) to manage occupancy issues in Ontario. Based on the results obtained from this algorithm, recommendations for funding additional critical care beds are recommended to the MOHLTC, on a yearly basis.

RESULTS

- Informed by the results of the Algorithm, MOHLTC in the last six years has funded 90 additional adult critical care beds equipped with mechanical ventilators i.e. about 15 beds/year. This investment has improved the services
- Adult ICU admissions in level-3 critical care units increased by 5.5%, from 80M in FY2009/10 to 85M in FY2015/16 (Table 1)
 - Level-3 adult critical care yearly bed occupancy rate in the province stabilized at around 85% (Table 1).
 - The average length of stay (LOS) in level-3 adult ICUs remained constant over time about 4.7 days (Table 1)
 - *Bed not available day rate* decreased over time from 4.4% in FY2009/10 to 1.5% in FY2015/16
 - *Avoidable bed day rate* has slightly increased over the last seven years (Table 1), implying that patient flow is not optimum and patients are not moving out of ICU beds in a timely manner.

Figure 1. Level 3 Adult Critical Care Unit Capacity Investment Recommendation Algorithm



SALIENT FEATURES OF THE ALGORITHM

- ✓ Takes into consideration three indicators i.e. bed occupancy, specialty of care, and ventilator occupancy
- ✓ Compares site level data with group quartile values
- ✓ Allocates weight to each of the three indicators (the weights are arbitrarily allocated with consensus of experts)
- ✓ Supported by additional analyses of variables known to impact occupancy rates.

Table 1. Description of ICU Capacity Indicators (level-3 units)

	Occupancy Rate (%)	Number of Admission	Average LOS (Days)	Bed Not Available Day Rate (%)	Avoidable Day Rate (%)
FY2009/10	83.7	80,722	4.6	4.4	6.9
FY2010/11	85.0	80,717	4.7	3.7	7.3
FY2011/12	85.4	81,060	4.9	3.0	7.6
FY2012/13	85.1	83,079	4.7	2.6	7.2
FY2013/14	85.4	83,181	4.8	2.2	7.2
FY2014/15	85.5	84,001	4.8	1.8	7.7
FY2015/16	84.7	85,137	4.6	1.5	7.7

CONCLUSIONS/NEXT STEPS

- Although the algorithm has not been widely tested in other provinces, our experiences of using the Algorithm for estimating and forecasting ICU occupancy in Ontario is very positive. The estimates from the algorithm is used by the MOHLTC for funding allocations.
- The algorithm is data dependent. Routinely collected critical care information is needed to populate the model. The accuracy of estimates and forecast are dependent on the quality of data.
- Other indicators are being considered to be included in the model/algorithm to improve its predictability.

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