OBJECTIVE

Employ a predictive hospital capacity model to facilitate operational planning and response to the unprecedented demand for beds brought on by the COVID-19 pandemic. Specifically, to:
• facilitate proactive bed capacity management to ensure patients can continue to be cared for in the right place at the right time
• plan for a responsible return to pre-pandemic surgical scheduling volumes
• enable operations at record peak capacity rates reaching above 95 percent

IMPLEMENTATION

A COVID-19 model, which included national and community spread information, was produced to assist in a ramp up plan to bring elective surgeries and procedures back up while also accommodating the prediction of COVID-19 cases through end of year. The COVID-19 predictions subsequently led to a hospital – wide bed census model which utilized the COVID-19 outputs along with other hospital inputs (Emergency Department arrivals and admits, surgical and procedural schedules, appointment conversion and hospital to hospital transfer rates) to assist in predicting capacity needs.

A multicollaborative teamwork approach, the two models were developed in partnership between highly technical teams and the operational consumers of the models. The technical teams managed the model build and evolution under an Agile framework. Technical team members included a data scientist, data engineers, and business intelligence experts to visualize the outputs of the model.

Implementation of the model into daily huddles and its use in hospital bed capacity decision making was managed by operational leaders through an iterative process. Short PDSA cycles were utilized to evaluate success, provide awareness and ensure safe patient care during higher occupancy rates. These two models initially assisted in managing 1,053 beds during higher occupancy rates.

RESULTS

The model served as a call to action, highlighting the need to intervene and avoid the predicted bed capacity constraints. Proactive decisions were made for bed capacity management utilizing prospective data allowing for appropriate capacity to be made available (right type of bed at the right time). This included both the volatility of COVID-19 cases as well as the planned increase in elective surgical scheduling. As a result, hospital leaders were able to effectively manage the re-establishment of elective surgical practices to a level near pre-pandemic case volumes while facilitating care for the fluctuating COVID-19 population. COVID-19 census varied between 0.11% and 14.09% in 2020 and between 0.27% and 10.37% in 2021.

The model was most utilized for decision making in second large COVID-19 surge. The model’s framework is being evaluated for use in the following three domains:
• A longer – term planning version of the model is built that incorporates parameterized levers where users can make planning decisions in real time to see their expected effects on future capacity
• A shorter – term planning version of the model is being built that incorporates parameterized levers where users can make planning decisions in real time to see their expected effects on future capacity
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LESSONS LEARNED

Multiple iterations of model enhancement to refine model inputs, improve workflows to drive consistency of inputs, and expand outputs to better identify action items.

FUTURE DEVELOPMENT

Further development of the model is actively under way in the following three domains:
• The model’s framework is being evaluated for use in automating the calculation of hospital diversion criteria
• A short – term planning version of the model is being built that incorporates parameterized levers where users can make planning decisions in real time to see their expected effects on future capacity
• A longer – term planning version of the model is being built that incorporates parameterized levers where users can make planning decisions in real time to see their expected effects on future capacity