Short-Term Inpatient Bed Demand & Supply Prediction

Srinath Sridharan[1], Oh Hong Choon[1], Venkataraman Narayan[2], Stephanie Ng[3]

[1] *Health Services Research, Changi General Hospital*
[2] *Data Management and Informatics, Changi General Hospital*
[3] *Accident and Emergency Operations, Changi General Hospital*

Background
We developed a short-term Functional Bed Occupancy Rate (FBOR) prediction tool, which allows the Bed Management Unit (BMU) at Changi General Hospital (CGH) to anticipate short-term functional bed demand.

Methodology
Based on retrospective daily FBOR records during the period April 2016 to September 2018, we employed Auto Regressive Integrated Moving Average (ARIMA) to predict the FBOR for next 1, 3 and 7 days. We explored different training time horizons (past 90, 180 and 365 days) and different FBOR forecasting time horizons (next 1, 3 and 7 days). For operational needs, we converted the FBOR predictions into two-class classification problem, i.e. >FBOR threshold and <FBOR threshold. The FBOR thresholds we explored are 110% 112% and 115%, as per our BMU suggestion. The models were assessed on positive predictive value (PPV), negative predictive value (NPV) and accuracy.

Results
The model performance increased as the (a) forecasting horizon decreased, (b) training horizon increased and (c) FBOR threshold decreased. The best model performance with an accuracy of 84%, PPV of 71%, NPV of 89% was achieved when the training horizon was the past 365 days and forecast horizon of 1-day.

Conclusions
We developed a model to predict FBOR with an accuracy of 84% and this tool is currently under a pilot testing to validate its performance with real time data. We are also evaluating the impact of predictive model where the BMU staff will be taking proactive actions like cohorting patients to free up beds which match the demands of the patients waiting.