Emergency Department Wait Time Modelling and Prediction at North York General Hospital

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Abstract

Background: With wait times for emergency care in Ontario exceeding provincial targets, both patients and healthcare providers demand real-time information to support resource allocation and capacity management. At the North York General Hospital (NYGH) Yellow Zone (YZ), emergency care providers seek accurate forecasts of waiting times to improve in-process communication and to prescribe actions to relieve patient crowding.

Method: Two years of data spanning 2013-2014 were collected from NYGH’s Wellsoft Information System to create time series of patient wait time from arrival to physician assessment (PIA time) and patient wait time from physician assessment to discharge from the YZ (PTE time). Multivariable regression with ARIMA errors was fit to the series to determine the patient-based and systematic predictors of wait times for Yellow Zone patients at the time of entry to the Emergency Department.

Results: A regression on CTAS 2 and CTAS 3 occupancy with ARIMA(1,0,0)(0,1,1)24 errors was determined to yield the lowest error in forecasting PIA time. Prediction accuracy improved when patients were grouped by CTAS level and complaint. ARIMA methods did not find correlations between PTE time and any patient grouping, and yielded low prediction accuracy for forecasting the PTE time of individual patients. 90% of patients waited up to 118 minutes more in PTE time than predicted, compared to up to 47.88 minutes for PIA time.

Conclusions: The results suggest that regression models with ARIMA errors have utility in forecasting PIA time and can achieve comparable accuracy to existing healthcare wait time reporting websites. The study provides empirical support for creating patient-grouped forecasting tools for PIA time and adds evidence that CTAS level is a significant dimension of occupancy. It is proposed that the PIA time model be used to test interventions to reduce unnecessarily long PIA wait times in the YZ. The prediction of PTE time may be improved by using quantitative clustering methods to create patient subgroups, and by incorporating the impact of post-physician assessment activities, such as diagnostic imaging, laboratory requisitions, and external consultations, into a forecasting model.