Race and Comorbidities Predict ICU Length of Stay After Stroke Thrombectomy

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Abstract

Introduction: Predicting intensive care unit length of stay (ICU-LOS) enhances care quality at hospitals, but no study has developed accurate predictive models of ICU-LOS for stroke thrombectomy patients. Our aim was to develop predictive models for ICU-LOS of stroke patients treated with mechanical thrombectomy using data from the national Medicare Provider Analysis and Review (MEDPAR) database.

Methods: We used MEDPAR data from 28,931 patients between 2017-2018. Initial predictor variables were patient demographics (age, sex, and race), type of admission, Medicare original reason for entitlement code (OREC, e.g., Aged), and diagnoses quantified as Charlson Comorbidity Index overall (CCI), or Present on Admission (CCI-POA). CCI and CCI-POA were both investigated throughout the study. Statistical analysis was completed to investigate inter-feature relationships and facilitate feature selection. Hyperparameter optimization and model evaluation (minimum mean absolute error) were completed using nested cross-validation for six different machine learning regression methods.

Results: Significant associations among population subsets were identified (e.g., variable ICU-LOS for different races). High accuracy was observed for ICU-LOS prediction using all predictors with CCI (MAE≈0.000004 days) and all predictors with CCI-POA (MAE≈0.426 days). Feature importance analysis identified Race and CCI/CCI-POA as the most significant predictors. Models re-evaluated using Race and CCI/CCI-POA only achieved equal or better accuracy (MAE-RF≈0.000004 days using CCI and ≈0.445 days using CCI-POA).

Conclusion: Data available at hospitals, including pre-treatment patient data available on admission, can predict ICU-LOS with high accuracy. Together, CCI/CCI-POA and Race can forecast a patient's ICU-LOS with an error of less than a half day.