

Six Months post-stroke reviews: A nationwide study using the Sentinel Stroke National Audit Programme to describe trends, patients' characteristics, and use of Artificial Intelligence to investigate regional differences

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Introduction

Stroke survivors experience changes in their needs over time, particularly within one year after the acute event.

Six months post-stroke reviews provide an excellent opportunity for addressing unmet needs and preventing future complications.

Current UK guidelines strongly recommend that all stroke patients have a six-month review, but reports from the national audit suggest only few patients are being seen.

We examine trends in post-stroke six months review across the UK, compare attendants and non-attendants, and use Artificial Intelligence to gain insights to inform future improvement initiatives.

Methods

We used data from the Sentinel Stroke National Audit Programme (SSNAP) of patients admitted to stroke units in England, Northern Ireland and Wales between April 2013 and March 2018, representing data from 5 reporting periods.

We included patients with confirmed diagnosis of ischaemic and haemorrhagic stroke, that were alive within six months of their stroke admission.

We used an Ensemble Machine Learning technique (Random Forest) to identify and rank main drivers of six months review, as shown in figure 1

Based on Artificial Intelligence methodology, we developed a predictive model using Model Based Recursive Partitioning Tree modelling.

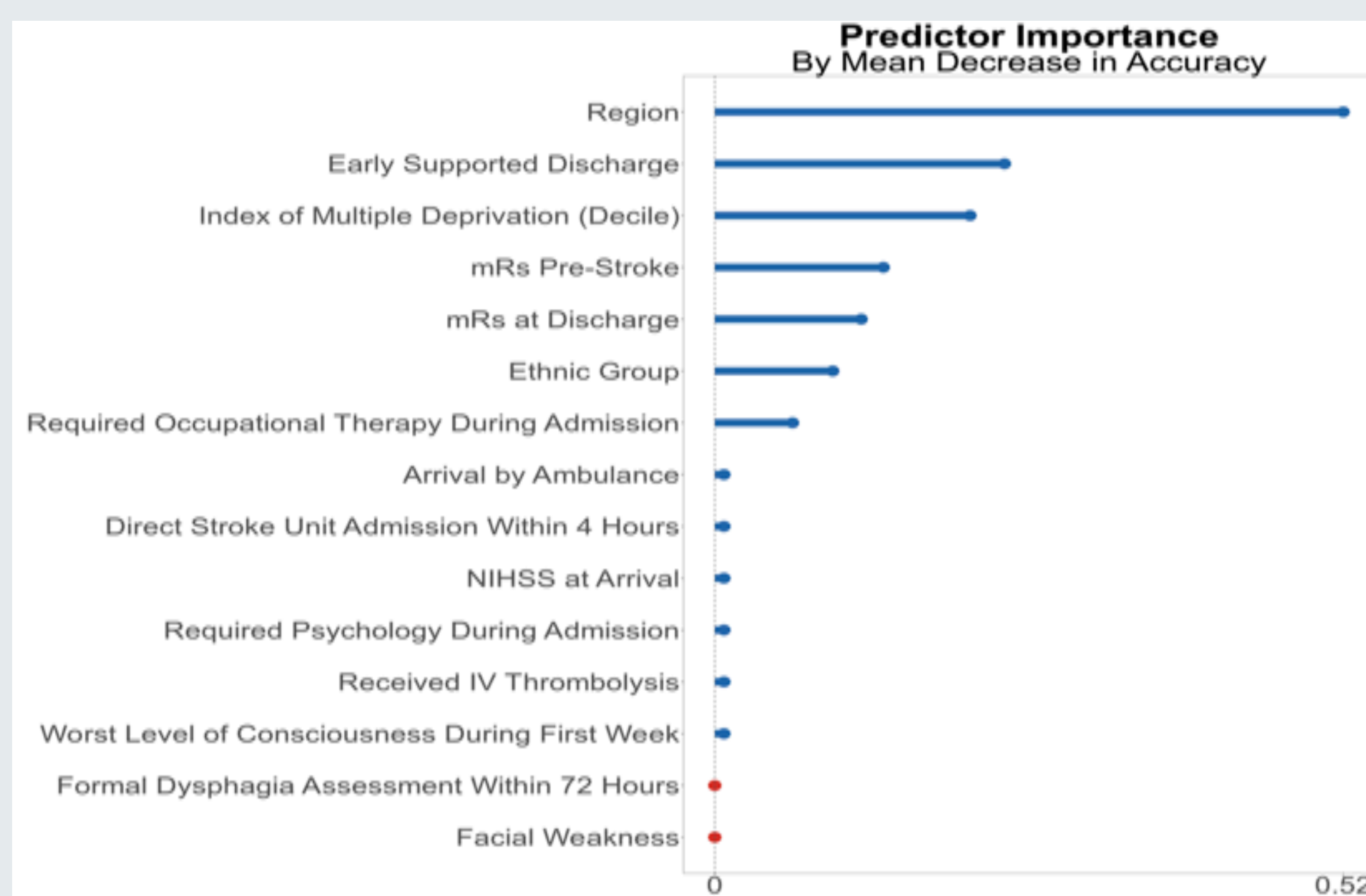


Figure 1.- Predictors ranked by importance. 'Mean Decrease in Accuracy' refers to how much the predictive power of the algorithm would decrease if the information derived from the predictor was lost. A predictor with score 0 is unimportant, while the higher the score, the more important a predictor is.

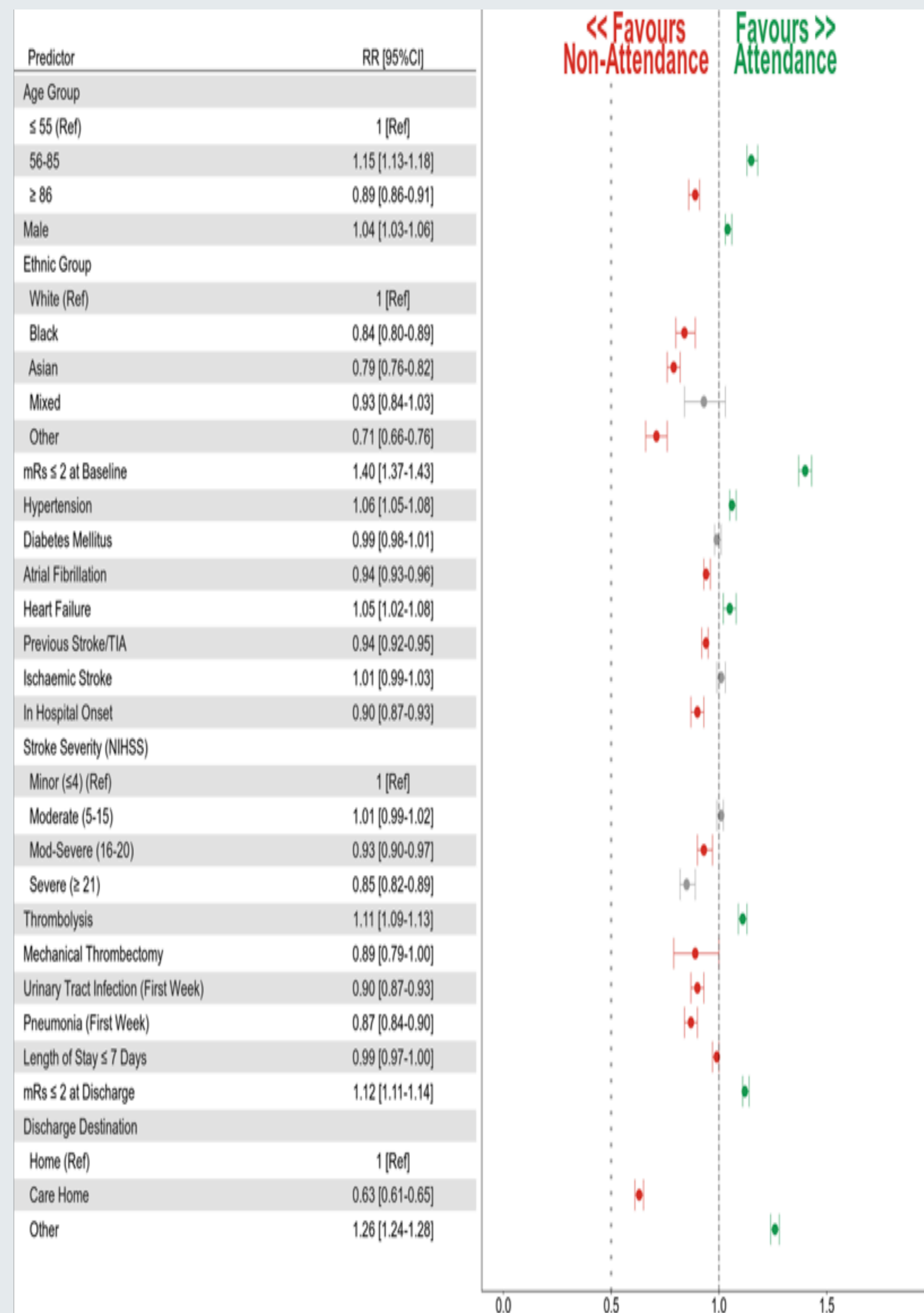


Figure 2.- Unadjusted relative risks for demographic and clinical characteristics between attendants and non-attendants to six-month assessments

Results

We included 327,156 patients into the analysis, median age was 76 years (IQR, 65 to 84); 52% were male and 91% had ischaemic strokes.

Percentage of Six Months Reviews and Trends Over Time :

The percentage of six months reviews was 24% (95%CI, 23.9% to 24.2%) across the whole study period.

A monotonic increasing trend was observed between the reporting periods of April 2013/March 2014 and April 2016/March 2017, with the percentage of six months reviews going from 18.9%(18.6% to 19.3%) to 30% (29.8% to 30.5%), (p <0.001 by Cochran-Armitage test for trend).

Identifying Important Drivers for Six Months Post-Stroke Review :

Figure 2 presents unadjusted risk ratios comparing attending and non-attending population to six-month assessments.

Predictive Model performance:

The performance of the developed model showed that is possible to identify those with less likelihood to attend six-month review

21 distinct groups based on combinations of patient characteristics including socioeconomic factors and access to services were identified.

The association between patient level characteristics and access to six months review varied greatly between these groups

The areas under the curve(AUC) demonstrated that the Model Based Recursive Partitioning Tree model achieves an accuracy of 70% (AUC 0.70, 95%CI 0.69 – 0.71)

The Model Based Recursive Partitioning outperformed a standard logistic regression model (0.62, 0.62 – 0.64) and a hierarchical logistic regression (0.68, 0.67- 68) on the test dataset.

Conclusions

- The overall rate of patients with six months reviews remains low since the beginning of SSNAP.
- Improvement of applicable patients receiving six-month reviews was observed.
- Variations exist between patients attending six months reviews explained by differences in access to services and socioeconomic factors.
- It is possible to predict the likelihood of attendance to six-month reviews using artificial intelligence methodology.
- Artificial intelligence can be used to identify variations related to qualitative improvement and therefore inform targeted initiatives

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