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Using machine learning to classify pediatric intensive care unit episodes in hospital admissions data

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Introduction

Paediatric critical care (PIC) episodes, unlike adult critical care, are not routinely recorded in administrative hospital records in England (Hospital Episode Statistics; HES). Previous studies have developed indicators for high dependency care and intensive care using critical care activities, but have under ascertained PIC episodes compared to national audit data (PICANet). We used linked PICANet to HES to develop and validate indicators of PIC episodes in HES Admitted Patient Care (APC).

Methods

We used data from HES APC between April 2010 and March 2011 for children aged ≤ 16 , excluding providers with no PIC units. PIC status was generated through linkage to PICANet. We matched each PIC episode with four age-provider-matched non-PIC episodes. Predictors included (but were not limited to) treatment specialty, diagnoses, operations, healthcare resource group, and admission method. Decision trees were used to identify PIC episodes in HES APC. We evaluated sensitivity, specificity, and the area under the receiver operating characteristic curve (AUC) with an 80:20 train-test hold-out validation.

Results

We matched 94,337 PIC episodes with 377,348 non-PICU episodes. The decision tree's main predictors were healthcare resource group and treatment specialty (SUSHRG, SUSCOREGHRG and TREATSPEF variables). Using this algorithm, we were able to identify 76% of PIC episodes (sensitivity). Specificity was 0.78, and the AUC was 0.85.

Conclusions

We demonstrate a proof-of-concept machine learning model to discriminate between PIC and non-PIC hospital episodes. This algorithm could be used by researchers to further understand the trajectories of children in PIC, when linkage to external data is not possible.

