Development of an Adjusted Outpatient Surgery Index (AOSI) using machine learning methods

HSD101

*Costa P[1], Rebollo P[1], Martin V[1], González L[1], Sánchez A[1], Perulero N[2], **Callejo D**[1], Priego F[1]*

[1]IQVIA, Madrid, Spain. [2]IQVIA, Barcelona, Spain.

Background

- Surgical procedures of low to medium complexity significantly benefit in quality, effectiveness, and efficiency of hospital resources from the implementation of outpatient surgery.
- Hospitals monitor their numbers of outpatient surgeries at different levels, but the comparison between hospitals is not straightforward.
- Outpatient surgery rates depend on a wide diversity of factors, such as hospital characteristics or inter-patient variation (including sociodemographic factors, pre-existing medical conditions, etc.).
- To generate an adjusted outpatient surgery index will allow:
  - To describe the volume of surgery without admission observed in the center and study its adaptation to what could be expected to occur after adjusting it.
  - To quantify the deviations between the observed vs expected surgery without admission.
  - To measure the contribution of specific groups of patients to the global index of the hospital.

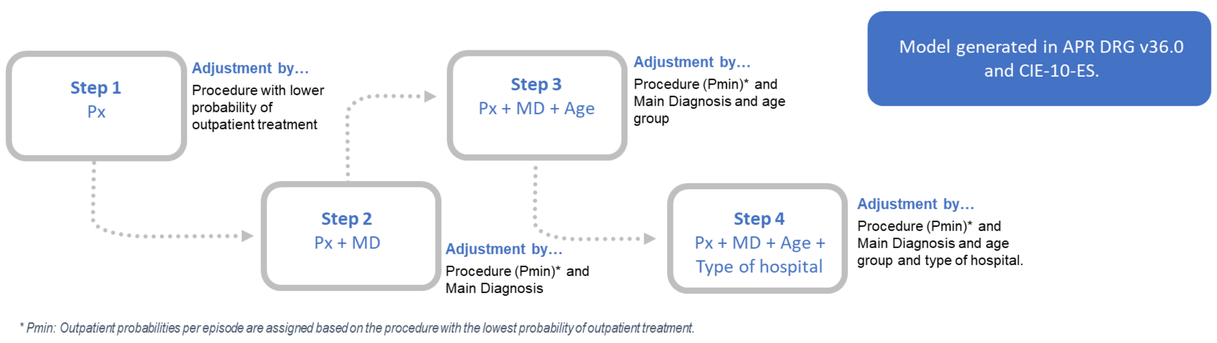
Objectives

- This study aims to develop a between hospital Adjusted Outpatient Surgery Index (AOSI) using machine learning (ML) methods with hospitalization episodes from more than 150 Spanish hospitals.

Methods

- The dataset comprised 1,6 million hospitalization episodes, labelled as either outpatient or inpatient, extracted from the IQVIA's Anonymized Hospitalization Episodes Database (ICD-10 codes).
- ML techniques (gradient boosting algorithms) trained on hospital and patient variables (diagnosis, surgical procedures, comorbidities, socio-demographic information, etc.) were used to develop a model to estimate the probability of each medical episode being treated as outpatient.
- The model has been generated from a conglomerate of Machine Learning models that estimate the expected outpatient rates (denominator of the index) at the episode level based on the explanatory variables: procedure, main diagnosis, group age and type of hospital.

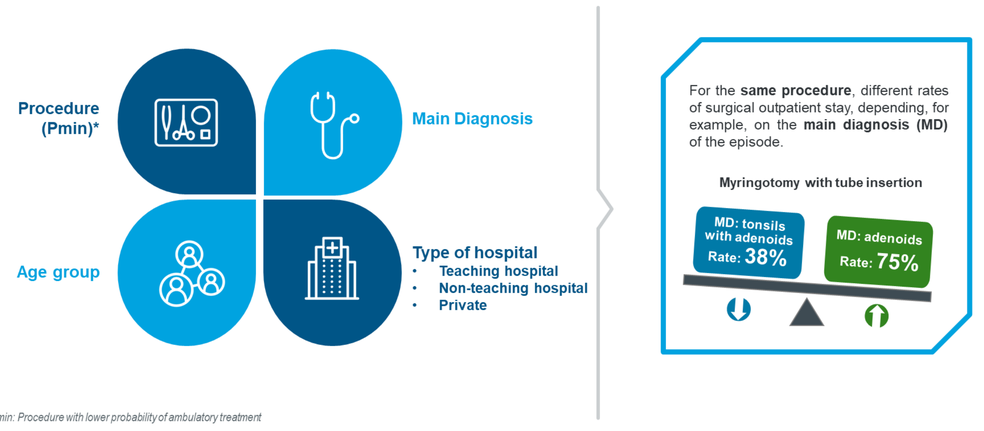
Figure 1 – Construction of the ML model



** Pmin: Outpatient probabilities per episode are assigned based on the procedure with the lowest probability of outpatient treatment.*

- The AOSI methodology presented calculates AOSI scores as the ratio between observed and expected (predicted by the model) outpatient episodes at either hospital level, procedure category level, hospital department level, etc.

Figure 2 – Variables included in the model



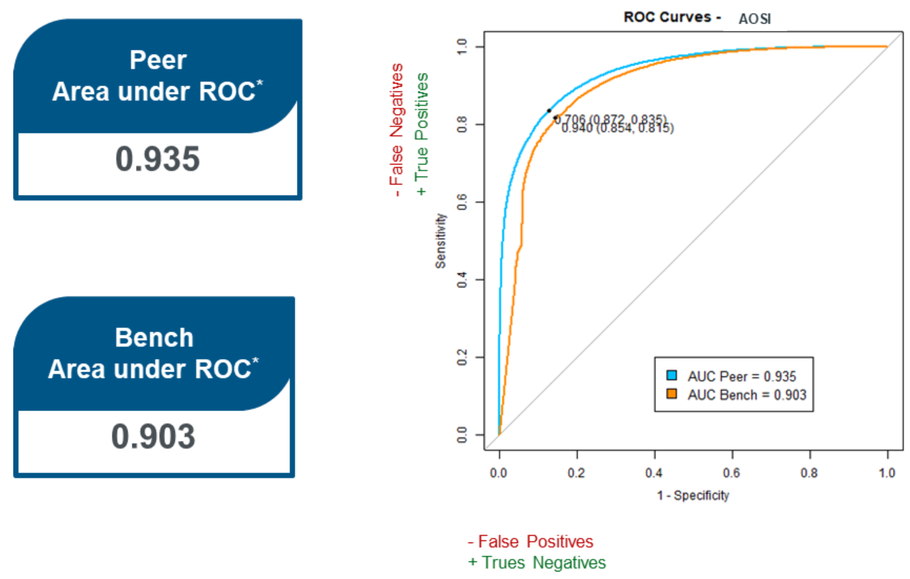
(*) Pmin: Procedure with lower probability of ambulatory treatment

- Episodes not analyzed (exclusions):
  - Episodes with main diagnosis or DRG of mental disorders, alcohol and drugs.
  - Neonates. (Age <29 days).
  - Burns. (Main Diagnosis Category 22).
  - Multiple traumas (Main Diagnosis Category 25).
  - Births and cesarean sections.
  - Palliative patients.
  - Records without the information necessary for the application of the model or incorrect.
  - DRG unlikely to be ambulatory.

Results

- The modelling analysis confirmed that the information related to surgical procedures, age, comorbidities, and hospital type are key to understand the variability behind the decisions to treat a patient as outpatient.
- The ROC score measuring the performance of the model was 0.93 (ROC values range from 0 to 1), and the AOSI developed allowed inter-hospital evaluation taking both hospital and patients heterogeneity into consideration.

Figure 3 – Model Performance



- The AOSI allows the assessment and comparison of surgery without admission, guaranteeing good quality of adjustment.

Conclusions

A new methodology supported by ML techniques was developed for the definition of the AOSI, allowing inter-hospital comparisons supported by high evaluation metrics associated to the model behind it.

Corresponding authors: Pablo Rebollo pablo.rebollo@iqvia.com and Pedro Costa pedro.costa@iqvia.com

ISPOR Congress, November 12-15, 2023. Copenhagen, Denmark. Poster HSD101 .