

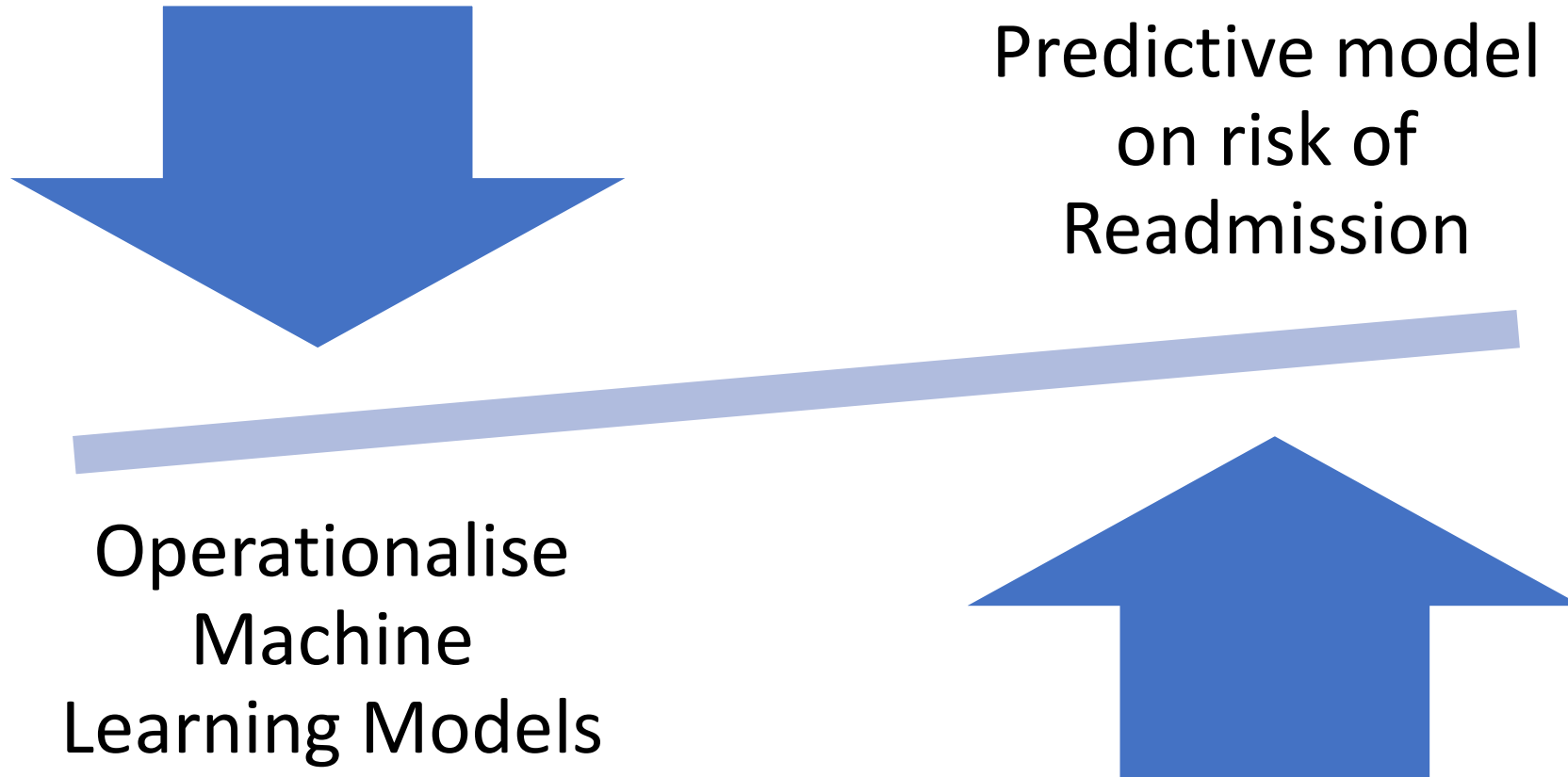
Predicting Patients at Risk of 30-day Unplanned Hospital Readmission

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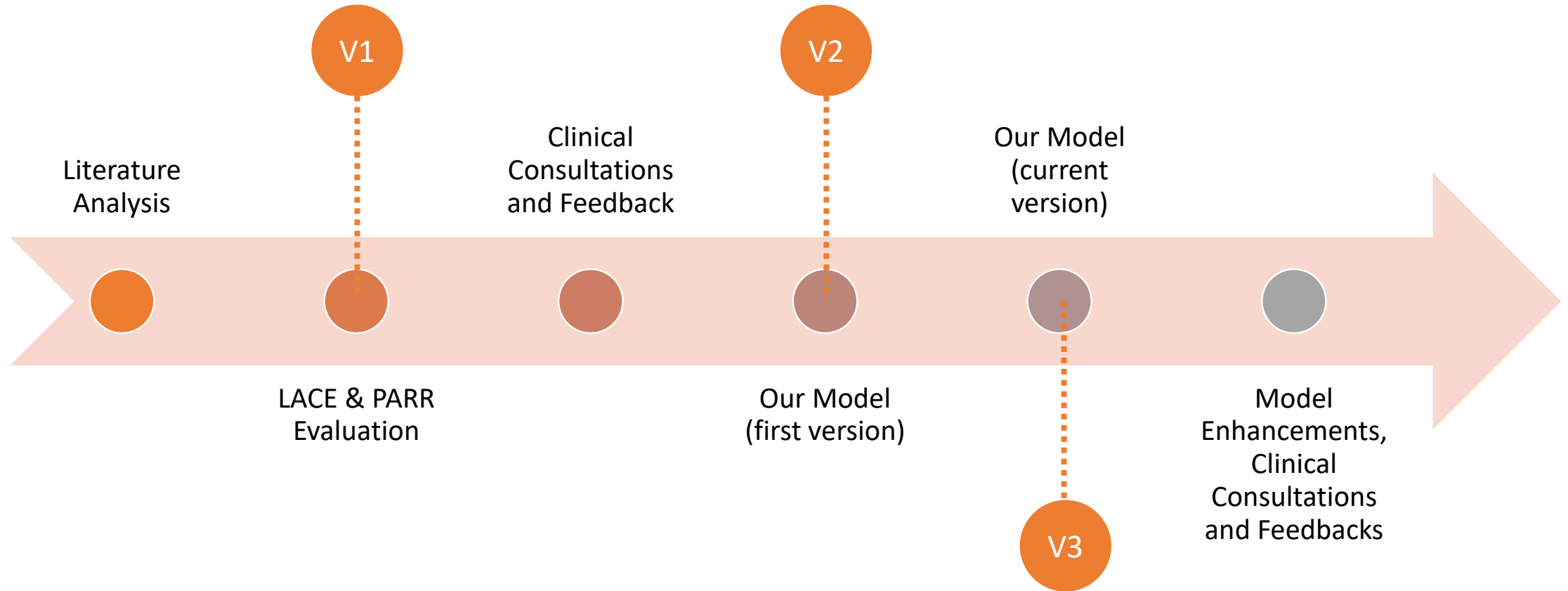
HIC, MELBOURNE - AUG 2019



Our Focus



Project Overview





**LACE AND PARR (NZ)
EVALUATION – Version 1**

LACE: LACE Index for Readmission

- Length of stay (days)
- Acute (emergent) admission
- Charlson Comorbidity Index
- Number of Emergency Department visits within 6 months

PARR (NZ): Patient At-Risk of Hospital Readmission (NZ)

- Gender
- Age
- Race (Maori, Pacific, Asian, others)
- Cost weight of last admission
- Code for last submission
- Diagnoses for last admission
- Number of acute admissions in previous 90, 180 days, 2 years



LACE SCORE

0.658

AUROC

PARR (NZ) SCORE

0.628

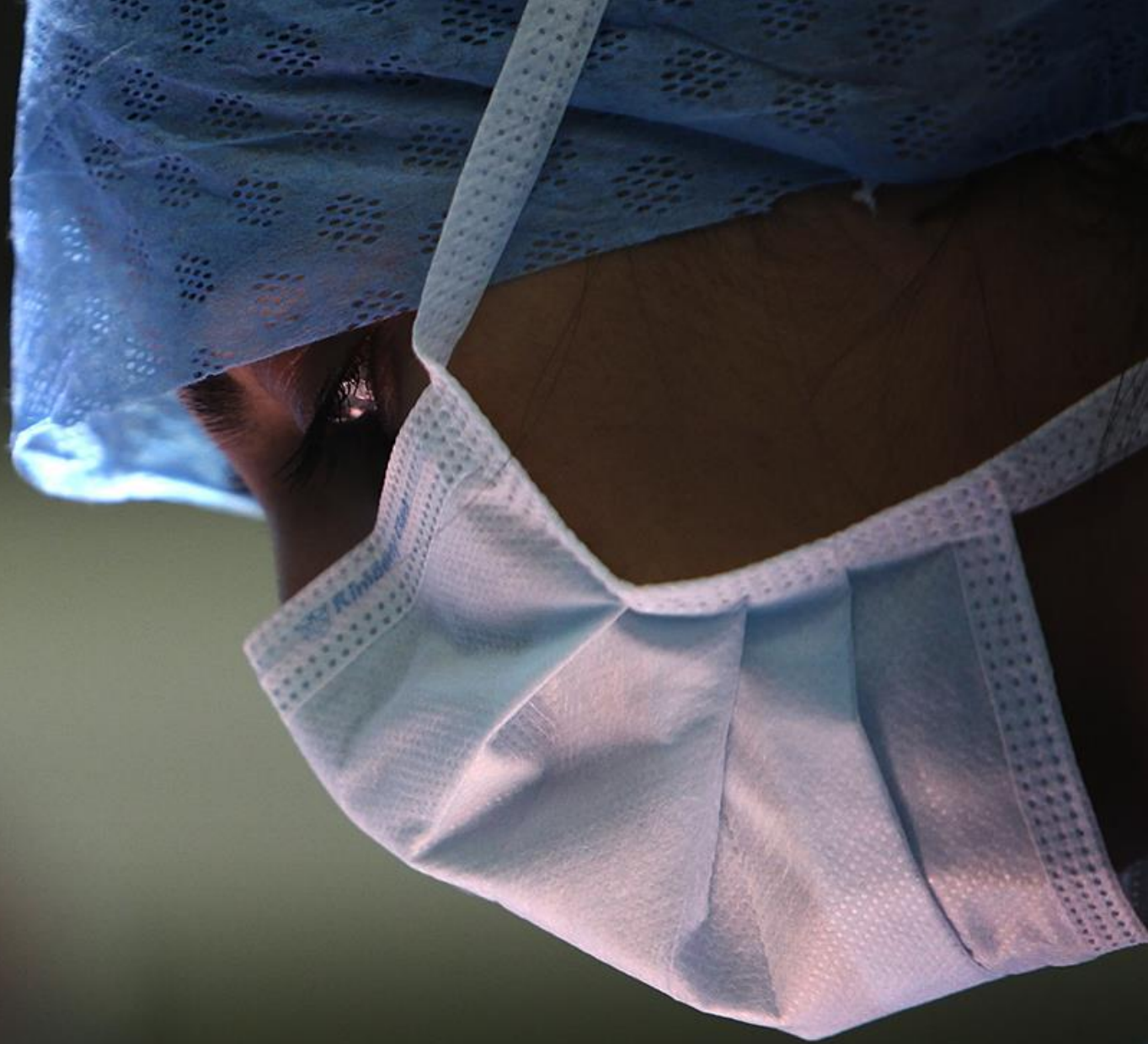
AUROC

180,118 admissions with 22,565 (12.5%) positive readmissions within 30 days following the discharge.

Performance Measure

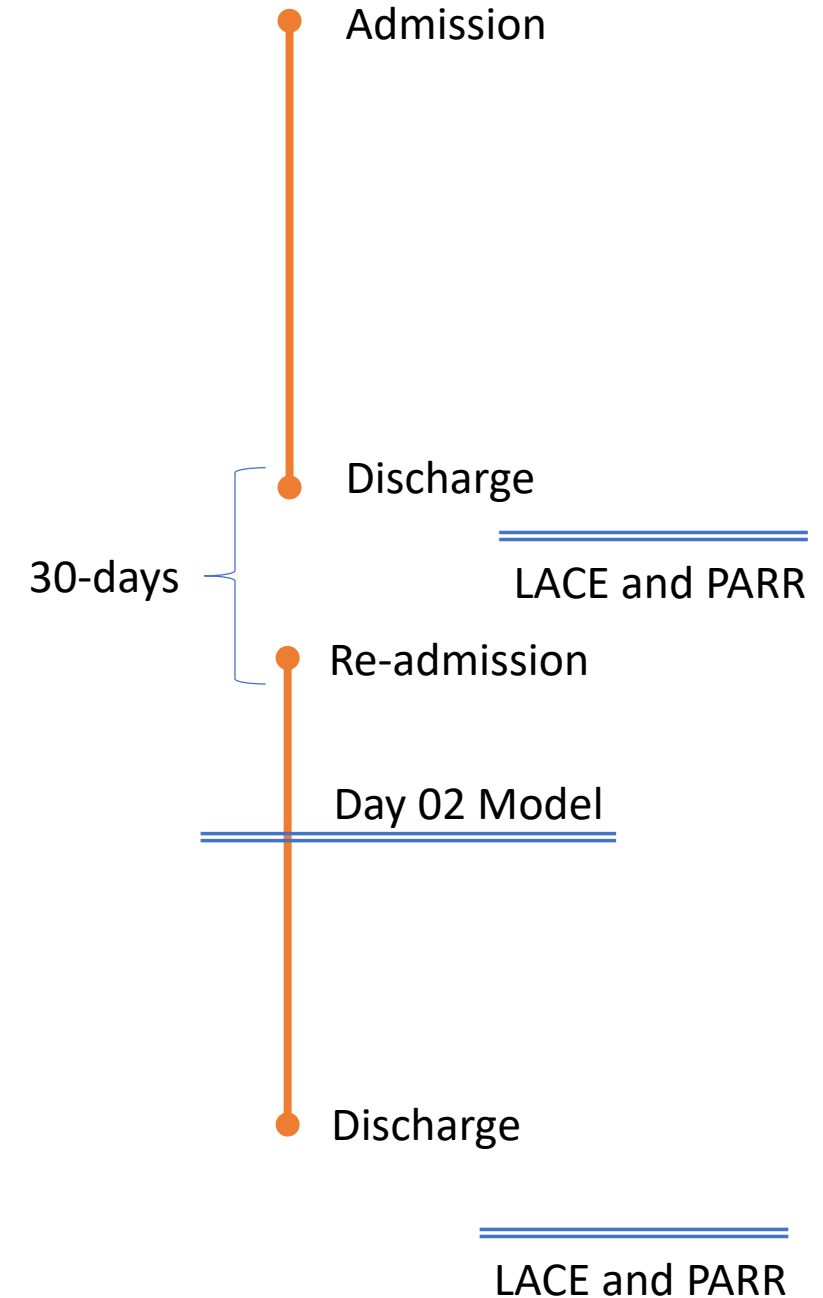
- With 5-fold stratified cross-validation, every model was trained and evaluated five times and the mean performance was measured using **F1-score, ROCAUC, accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV)**
- Due to the imbalanced dataset, we used **F1-score** to select the best performing models
- Other metrics were also recorded and compared

DAY 02 RISK OF READMISSION MODEL

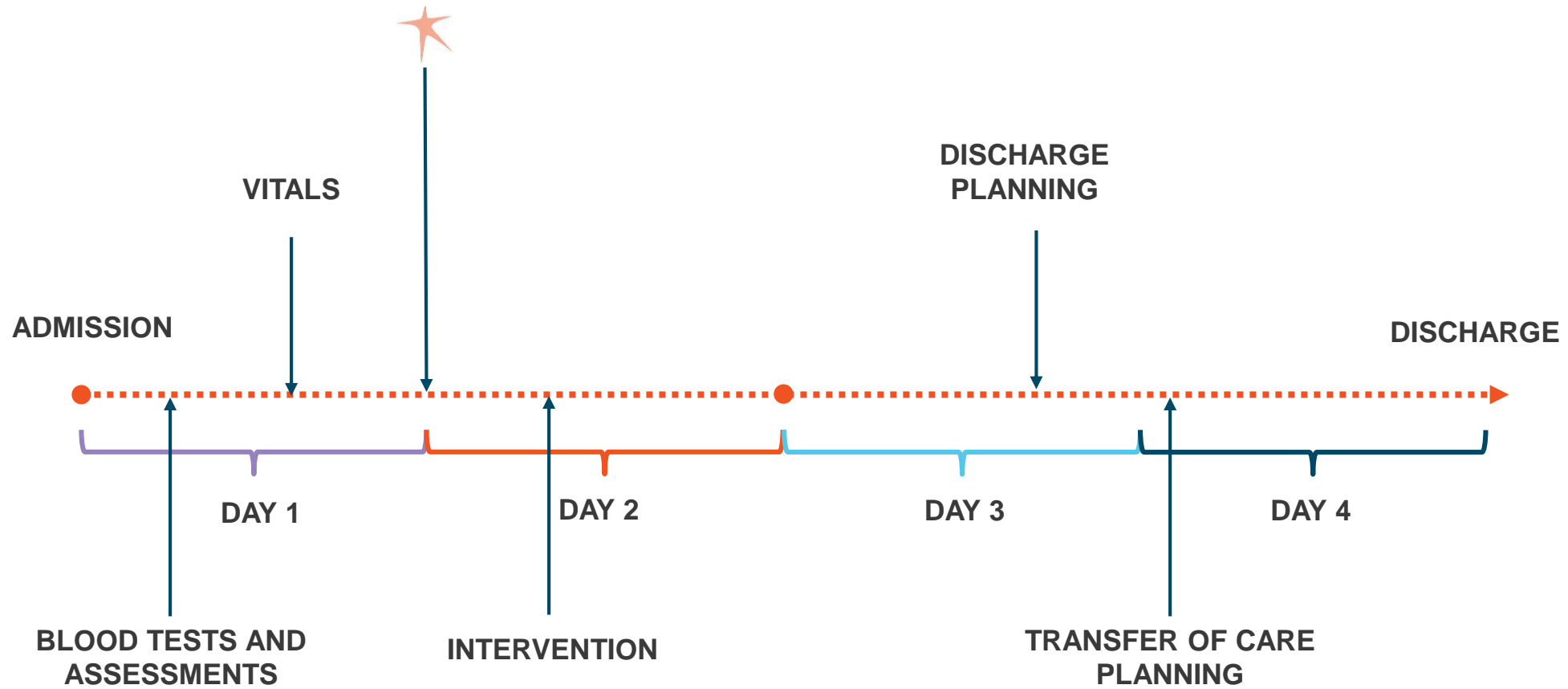


DAY 02 MODEL

- Day 01 is the day of admission (excludes day stays and outpatients)
- Need to get the data availability balance correct – current vs. historic information
- Day 02 is where we can get just enough information related to the current admission as well as historic information
- Clinicians will be notified of the risk while patient is in hospital (unlike LACE and PARR – risk calculated after the discharge)



PATIENT JOURNEY TIMELINE



Data and Features Overview

	# CASES	% POSITIVE CASES
Entire Dataset	205832	11.9% (24461)
Medicine	122117	13.7% (122117)
Surgery	58870	10.2% (58870)

50+ Features

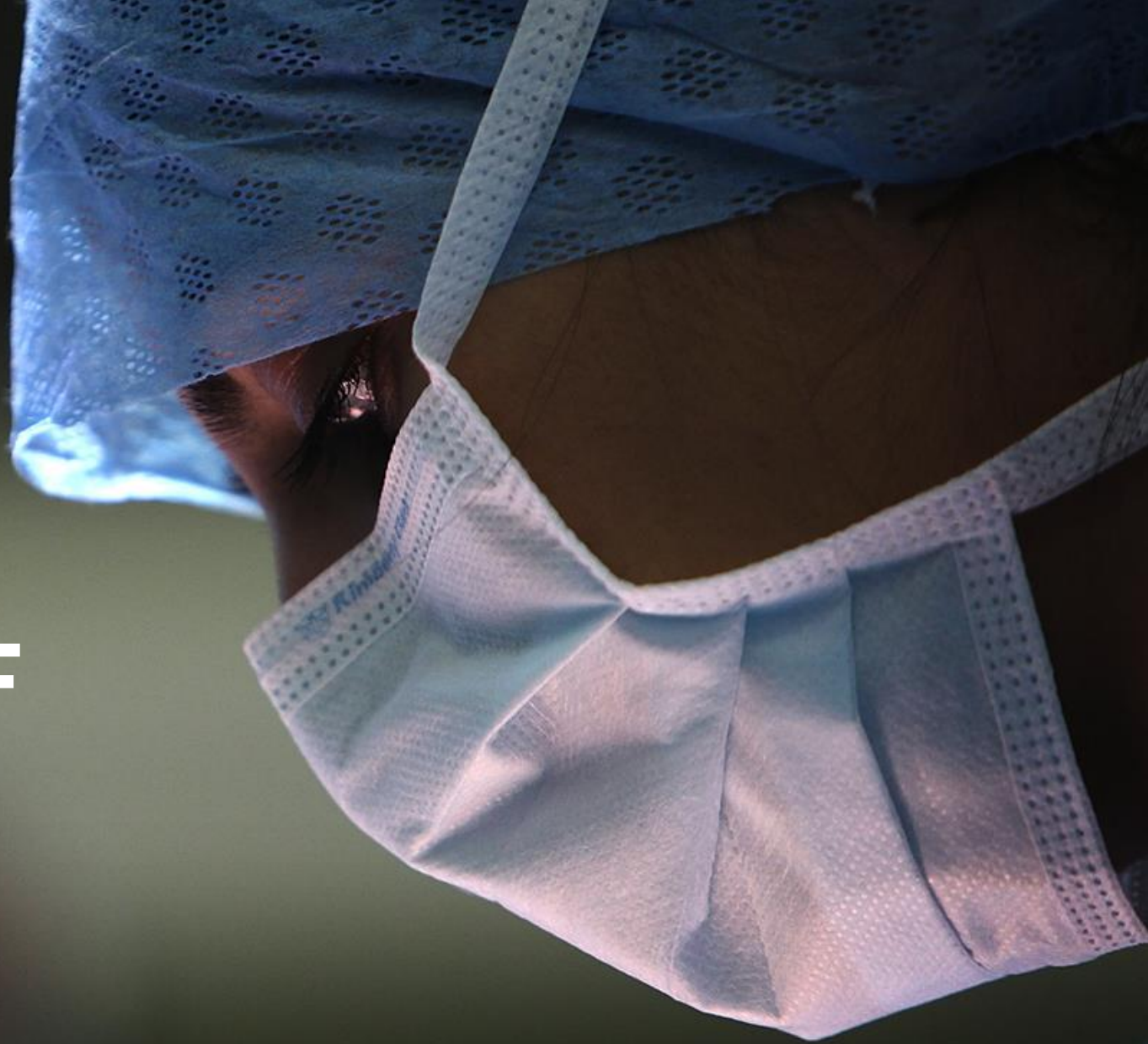
Demographic
Pathological (lab)
Chronic Conditions
Vital Signs
Historic Information

Models - Generic, Medicine and Surgery

	GENERIC	MEDICINE	SURGERY
F1 SCORE	0.339±0.004	0.360±0.003	0.309±0.005
ROC_AUC	0.727±0.003	0.717±0.005	0.732±0.005
ACCURACY	0.791±0.002	0.747±0.002	0.804±0.002



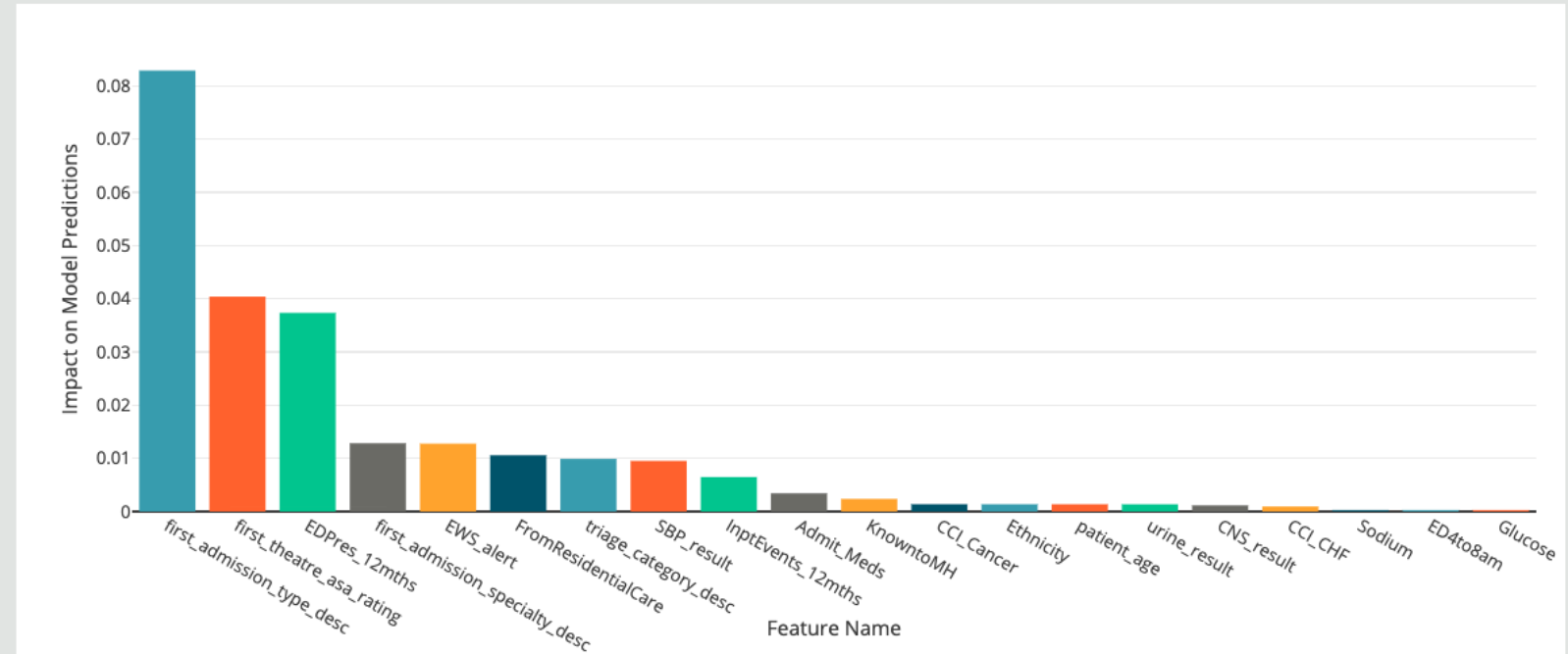
INTERPRETATION OF DAY 02 RISK OF READMISSION MODEL



Feature Description

feature	description
first_admission_type_desc	Admission type of the first inpatient admission during the hospital journey.
first_theatre_asa_rating	1 - a normal healthy patient; 5 - A moribund patient who is not expected to survive. 0 - abnormal value.
EDPres_12mths	Number of Emergency Department presentation in the past 12 months.
first_admission_specialty_desc	Specialty of the first inpatient admission during the hospital journey.
EWS_alert	Whether alerted based on the early warning score.
FromResidentialCare	Whether patient is from residential care or not.
triage_category_desc	Tirage category.
SBP_result	Systolic blood pressure.
InptEvents_12mths	Number of acute inpatient events in the past 12 months.
Admit_Meds	Number of medicines prescribed at the day of admission.
KnowntoMH	Whether known to mental health.
CCI_Cancer	Whether had cancer in the past 5 years.

Feature Importance



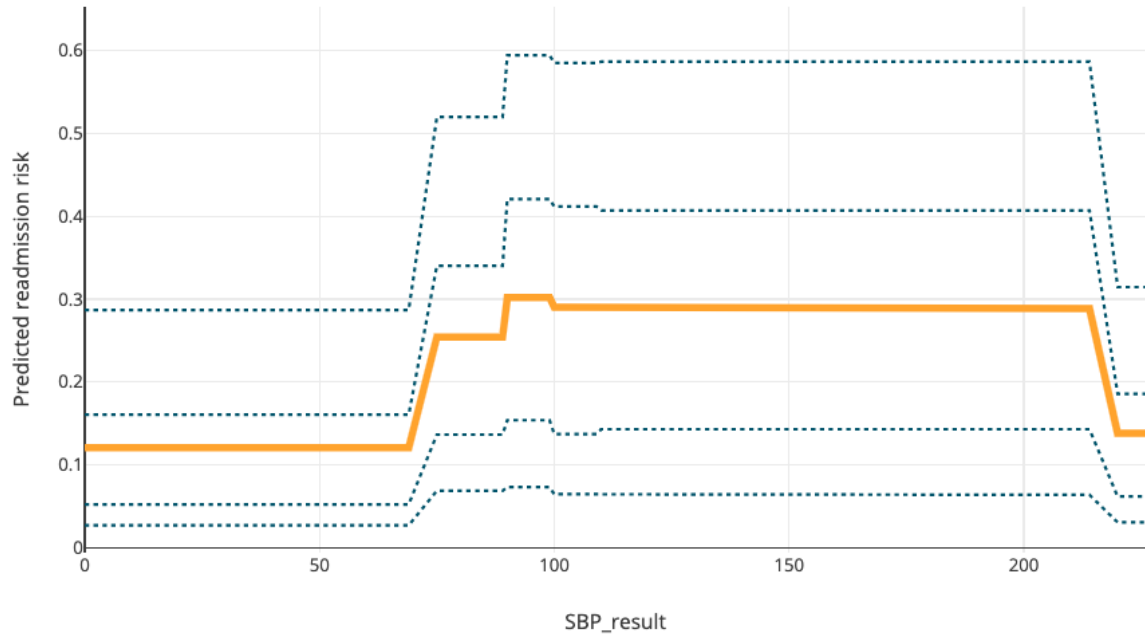
Impact on Risk: Single Feature

Curve

SBP_result

SELECT ONE CASE

Predicted readmission risk against SBP_result

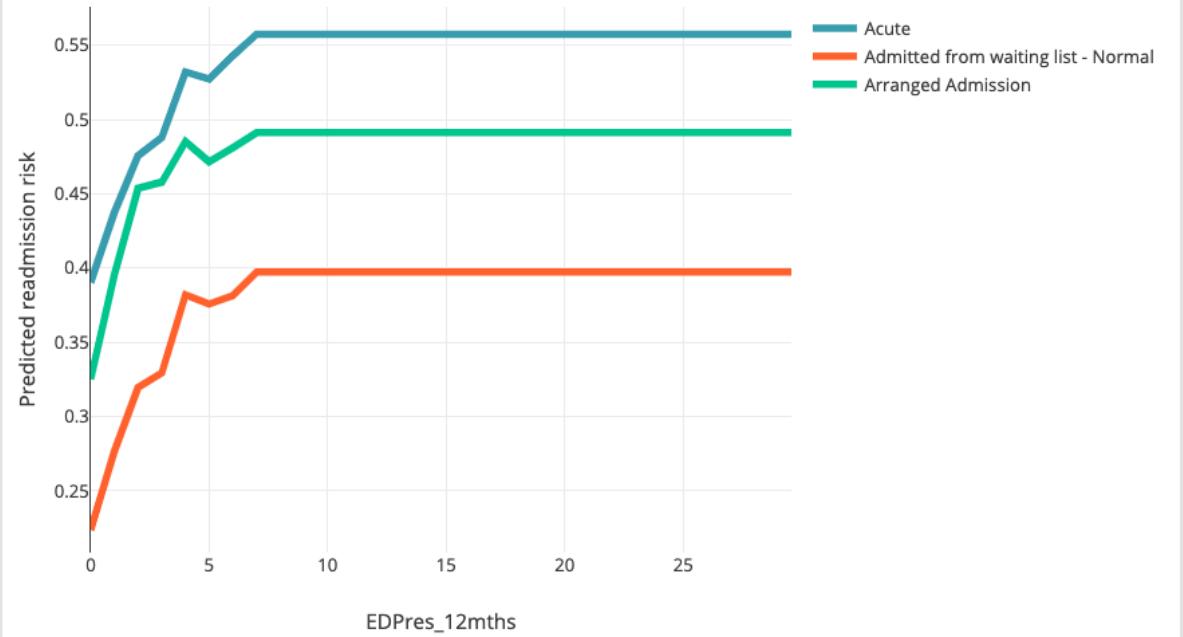


Impact on Risk: Double Features

MultiCurve

adt_ed

Predicted readmission risk against EDPres_12mths and first_admission_type_desc

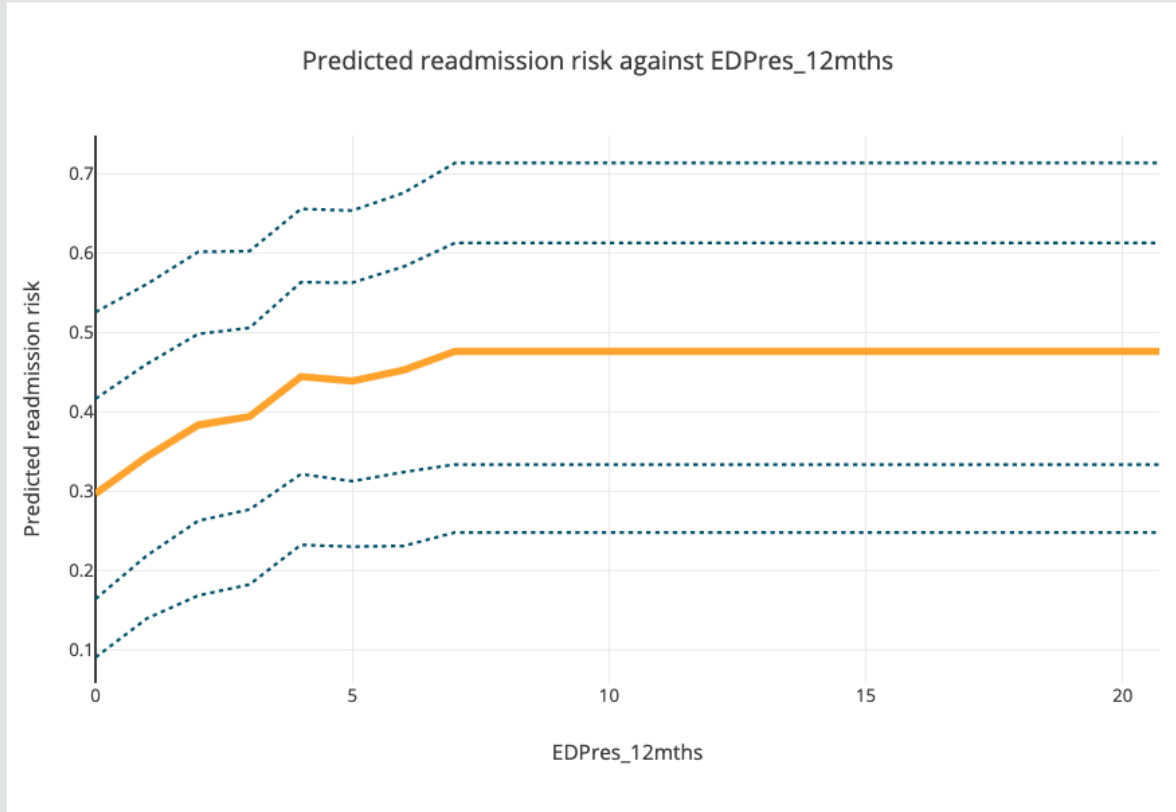


Impact on Risk: Single Feature

Curve ▾

EDPres_12mths ▾

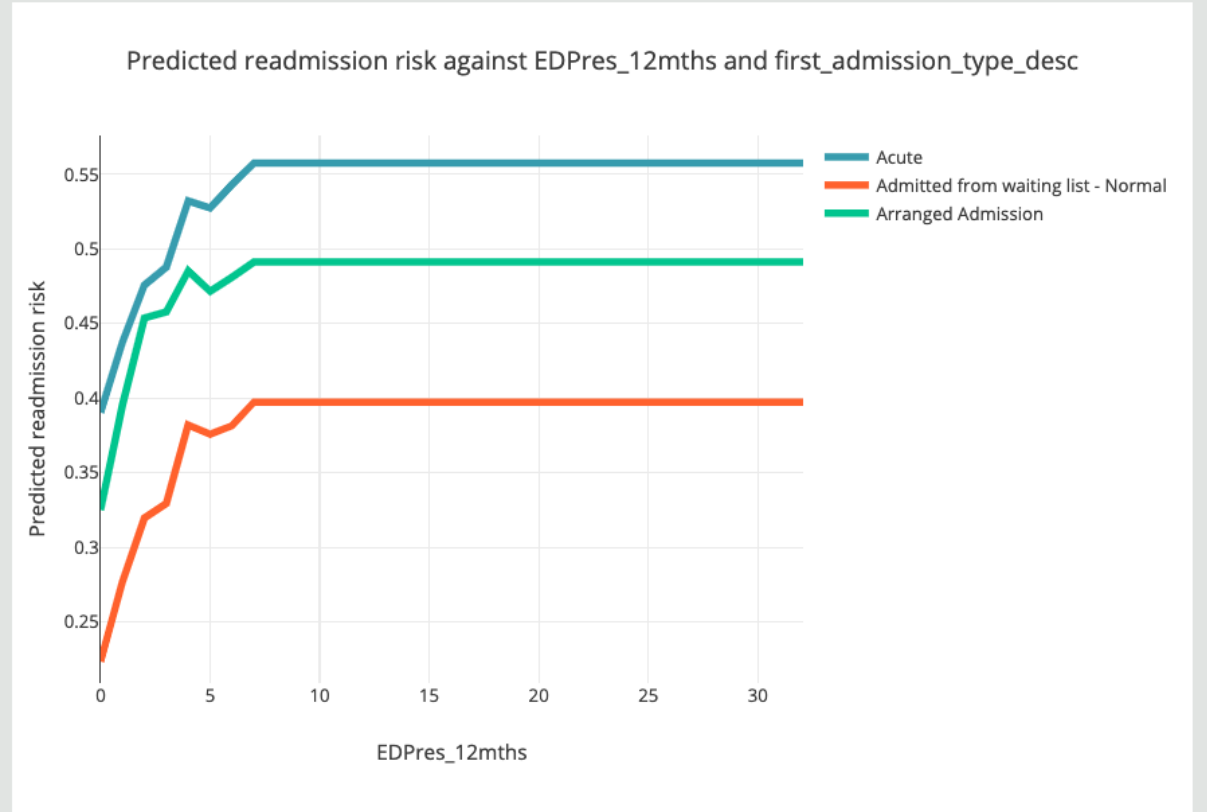
SELECT ONE CASE



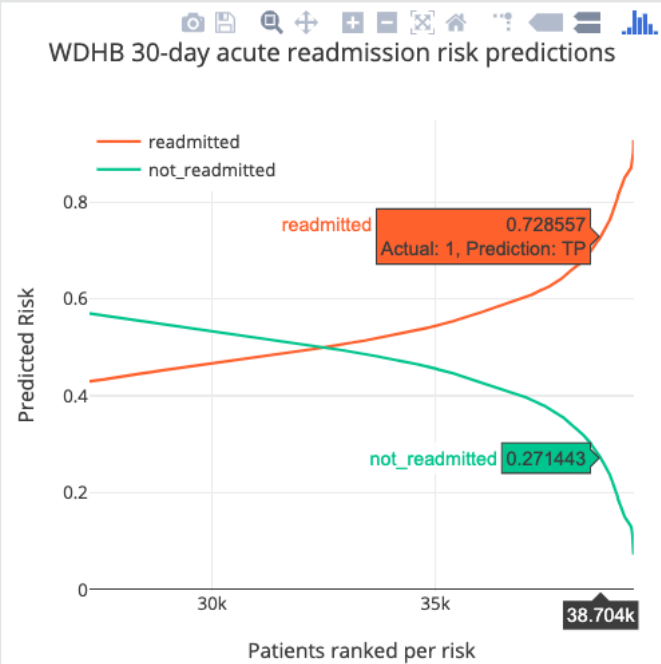
Impact on Risk: Double Features

MultiCurve ▾

adt_ed ▾



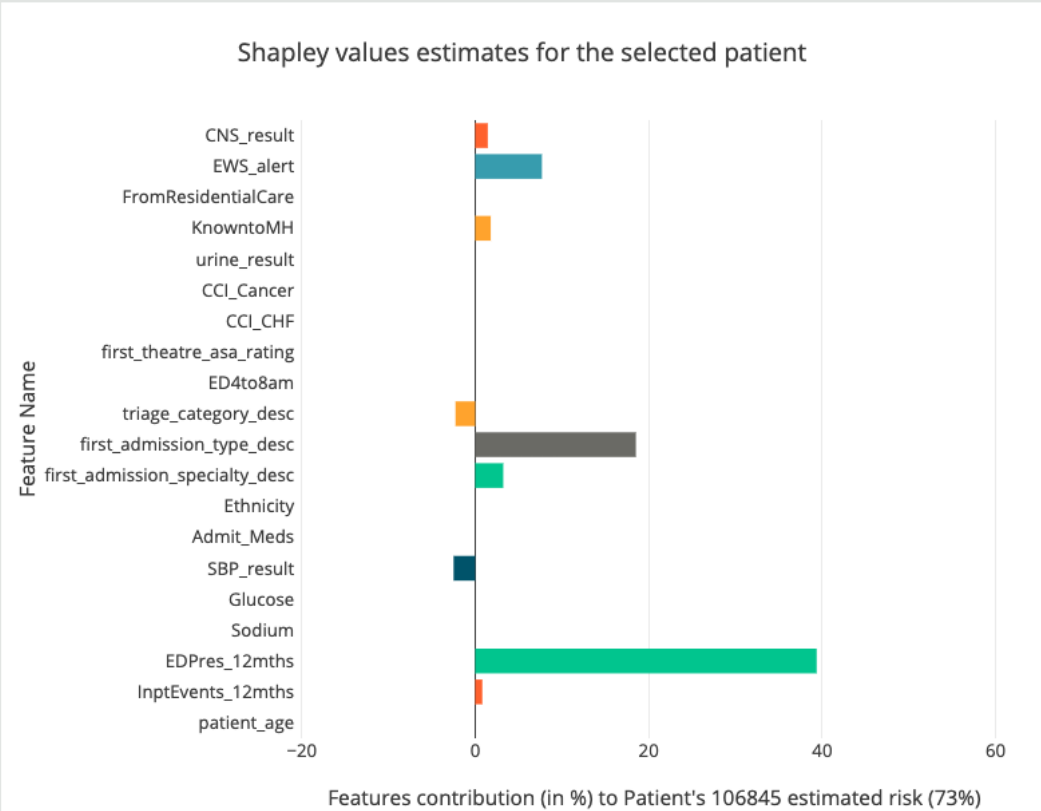
Readmission Risk Predictions



Case Profile

EWS_alert	0	
FromResidentialCare	0	
KnownToMH	1	
urine_result	Not catheterized	
CCI_Cancer	0	
CCI_CHF	0	
first_theatre_asa_rating	Unknown	
ED4to8am	0	
triage_category_desc	Emergency	
first_admission_type_desc	Acute	
first_admission_specialty_desc	Gynaecology	
Ethnicity	European	
Admit_Meds	0	
SBP_result	118	mmHg
Glucose		mmol/L
Sodium		mmol/L
EDPres_12mths	4	
InptEvents_12mths	4	
patient_age	24	yr

Case-based Feature Importance



Next Steps

- Finetune and enhancements to the current model
- Review of features and key factors
- Clinical consultations and feedback
- Continue working on the Interpretation of the model

Questions?

Precision Driven Health research partnership: Safely
accessing data to build tools that improve health
Dr Kevin Ross, Orion Health
Wednesday 14 August, 11.00am
Industry | New models: Precision and personal
healthcare