

A PREDICTIVE APPROACH TO REDUCING NON ATTENDANCE

Transforming Outpatient care
through data

Peter Andrews - Nov 2025

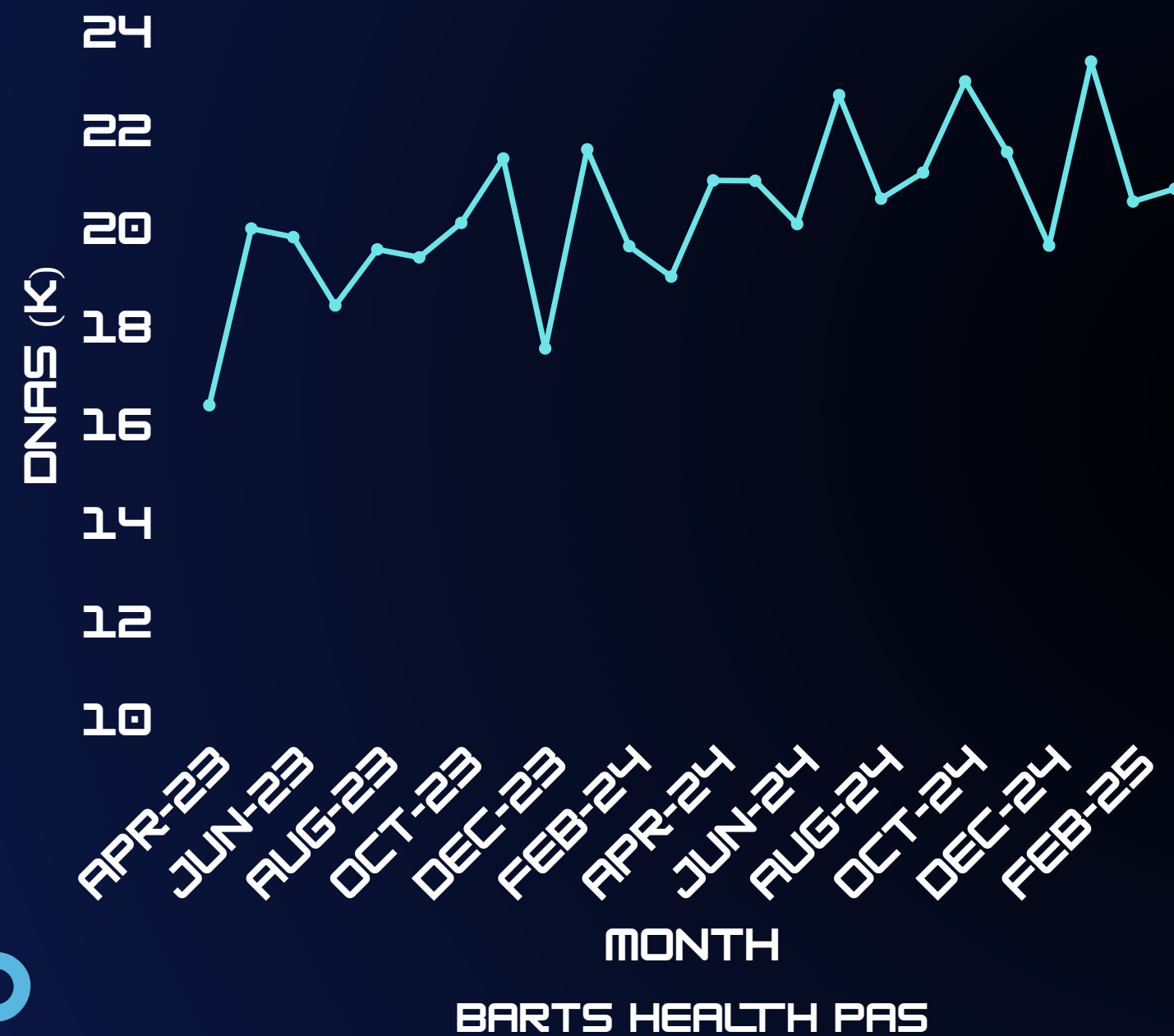
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NHS Trust



HSMA

THE SITUATION



1

18K MISSED APPOINTMENTS EACH MONTH

12% of all hospital appointments are not attended by patients. This has consistently been the case since 2020.

2

£30 MILLION

Per year. The cost of providing the outpatient appointments that are not attended by patients at Barts Health

3

£1 BILLION

The estimated cost of non attended appointments across London over the past 4 years.



A NEW, INTELLIGENT APPROACH

MOVING FROM REACTIVE TO PROACTIVE

THE OLD WAY

One approach to communication with every patient. No adjustment for age, language, or technical ability or focus on those that need support the most.



THE NEW WAY

A tool that allows us to identify patients at high risk of non-attendance and target our support to those that need it most. Leveraging cutting edge AI tools and the scale of the Barts Health dataset



OPEN REPRODUCIBLE SOLUTION

EXTRACT



(Other data storage solutions are available)



sqlalchemy



parquet files

TRANSFORM



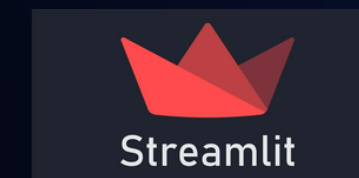
- One Hot Encoding
- Feature engineering
- Label encoding
- String cleaning
- Data type setting

TRAIN/ TEST



- 80/20 split for test and train,
- Grid search optimization
- Prediction performance

PRESENT



- Internally hosted streamlit application
- Graphing through plotly and matplotlib

HOW IT WORKS

BUILT BY THE NHS, FOR THE NHS



APPOINTMENT
HISTORIES



DEMOGRAPHICS



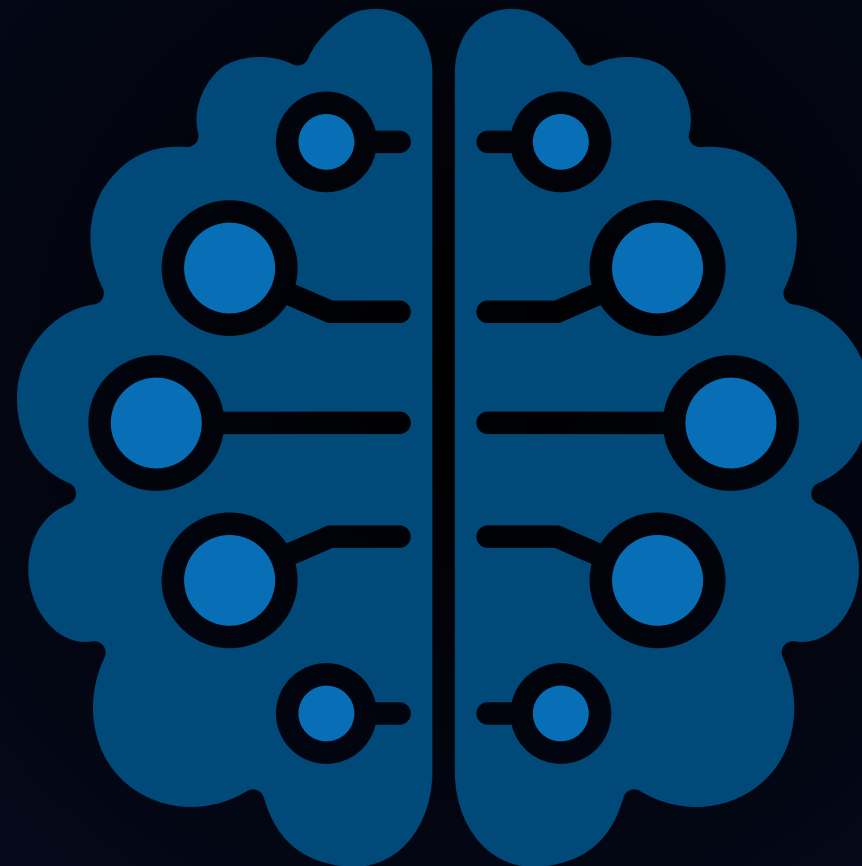
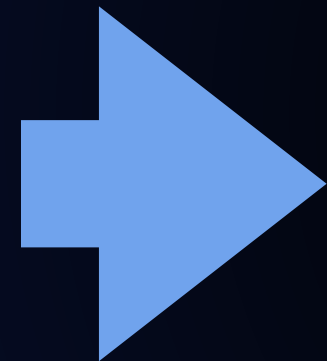
SERVICE
INTERACTIONS



TEST
RESULTS



APPOINTMENT
BOOKING



THE MODEL

Trained on 8.2million Barts
Health appointments and 160
features of that appointment
and patient

WHAT HAS IT LEARNT?

F1 SCORE OF 0.9

Great at both correctly identifying no-shows
and not overpredicting non-attendance.

PREVIOUS APPOINTMENTS

The patients DNA score is the key predictor
of if they are going to attend thier next
appointment or not.

BOOKING DATE

If the appointment was booked a very long
time ago there is a much higher risk that the
patient will not attend. The model found that
this only applies to follow-ups.

PATHWAY STATUS

If the patient has not yet been treated for
thier referred condition then they are much
more likely to attend. Indicating the stage of
treatment is key

THE PREDICTIVE NON-ATTENDANCE TOOL

IDENTIFY, IMPLEMENT, OPTIMISE

Filters

Select Reporting Site

All

Select Specialty

All

Select Appointment Type

All

Select Appointment Location

All

Select DNA Risk

All

Select Confidence Level

All

Select Date

2025/06/20 – 2025/07/31

Outpatient DNA Forecast

Filtered Data Count: 146758 | Forecasted DNAs: 19320 | DNA Rate - (High Confidence & High Risk) %: 6.53

| | Appointment Date | MRN | Mobile Number | Fin Number | Specialty | Location | Appointment Type | Expected DNA | Confidence | DNA Risk |
|---|------------------|-----------|---------------|------------|--------------------------------|---------------|-------------------------------|--------------|------------|----------|
| 0 | 21/07/2025 | MRN000001 | 0700000001 | 17831694 | Paediatric Ear Nose And Throat | NUH HCentral | Paediatric ENT F/Up | No | Low | 25.18% |
| 1 | 30/07/2025 | MRN000002 | 0700000002 | 19251924 | General Surgery | NUH HCentral | General Surgery F/Up | No | Very High | 0.05% |
| 2 | 02/07/2025 | MRN000003 | 0700000003 | 20037494 | Obstetrics | NUH Antenatal | Obstetric Dating Scan F/Up | No | Very High | 2.55% |
| 3 | 29/07/2025 | MRN000004 | 0700000004 | 20037494 | Obstetrics | NUH HCentral | Obstetrics Antenatal GTT F/Up | No | High | 5.93% |
| 4 | 29/07/2025 | MRN000005 | 0700000005 | 20037494 | Obstetrics | | | | | |
| 5 | 11/07/2025 | MRN000006 | 0700000006 | 9979383 | Ophthalmology | | | | | |
| 6 | 11/07/2025 | MRN000007 | 0700000007 | 9979383 | Ophthalmology | | | | | |
| 7 | 29/07/2025 | MRN000008 | 0700000008 | 20111436 | Trauma & Orthopaedics | | | | | |
| 8 | 23/06/2025 | MRN000009 | 0700000009 | 19736003 | Paediatrics | | | | | |
| 9 | 17/07/2025 | MRN000010 | 0700000010 | 19437578 | Obstetrics | | | | | |

Weekly Forecast Summary

Appointments | DNAs (Forecast DNA Rate %). Below 8% = Green over 20% = Red

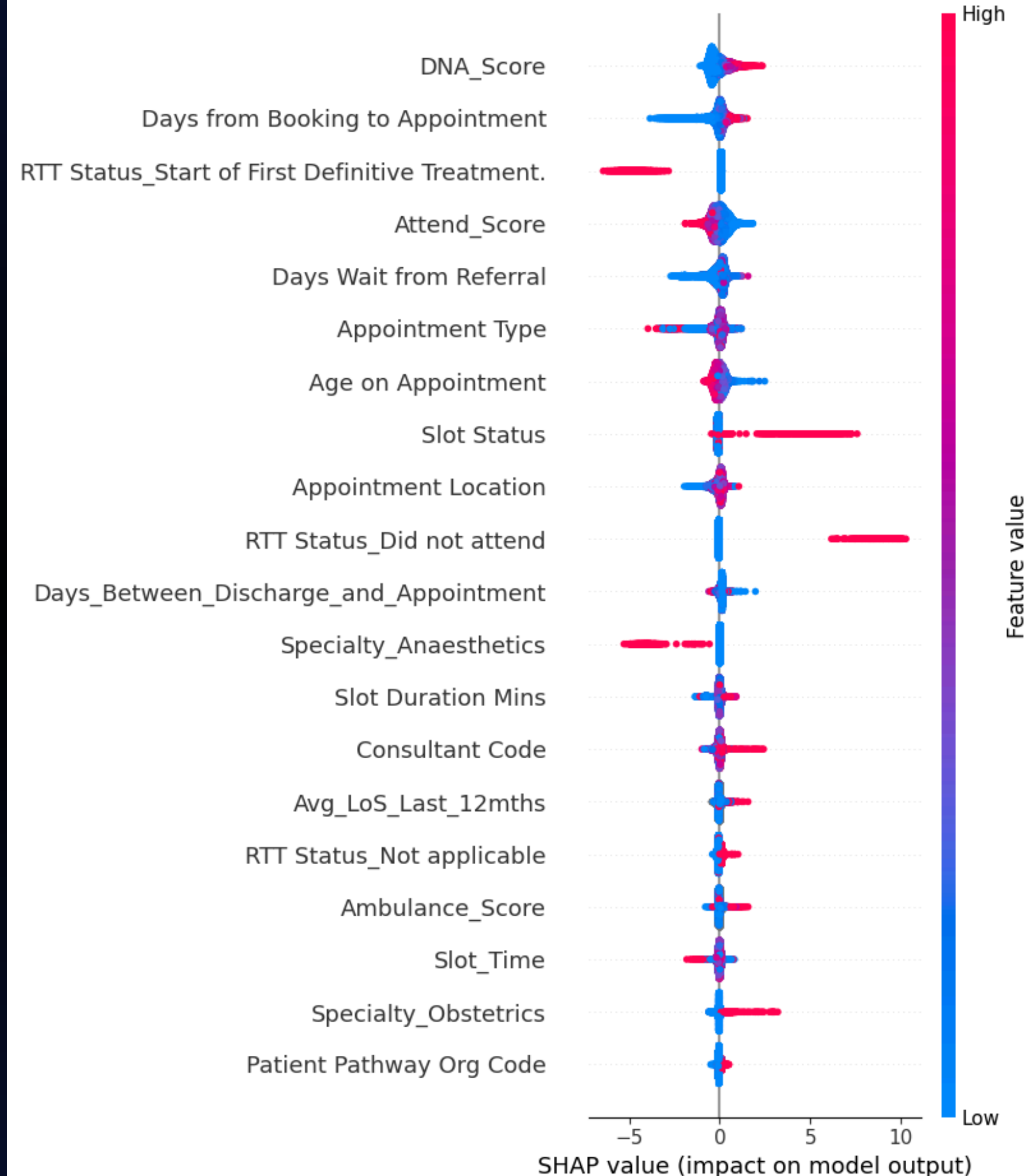
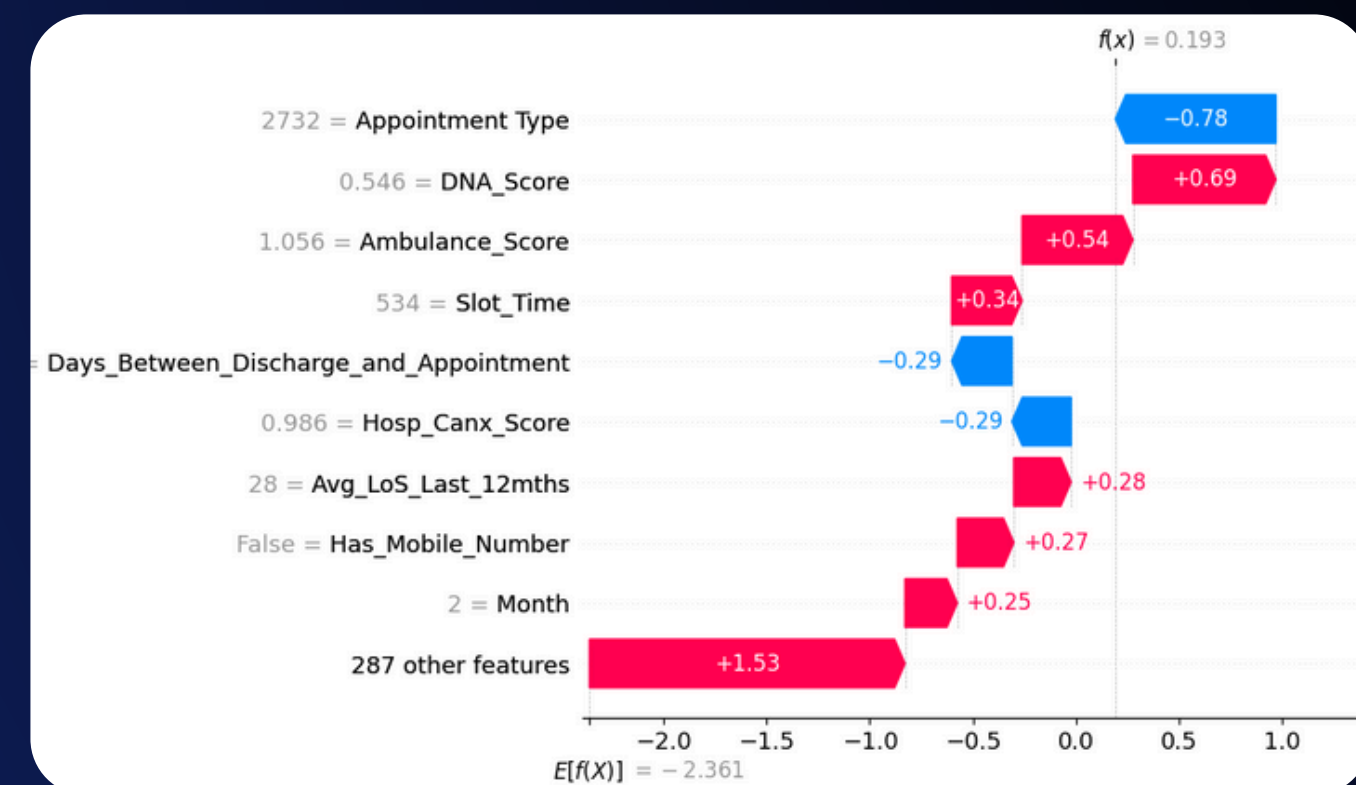
| Weekending | Monday | Tuesday | Wednesday |
|-------------|-----------------|-----------------|-----------------|
| 29-Jun-2025 | 7286 459 (6%) | 6853 518 (8%) | 7080 463 (7%) |
| 27-Jul-2025 | 4112 304 (7%) | 3986 188 (5%) | 4333 283 (7%) |
| 22-Jun-2025 | 0 0 (0%) | 0 0 (0%) | 0 0 (0%) |
| 20-Jul-2025 | 4794 302 (6%) | 4650 270 (6%) | 4787 294 (6%) |
| 13-Jul-2025 | 3813 220 (6%) | 5377 290 (5%) | 5514 342 (6%) |

| Specialty | Location | Appointment Type | Expected DNA | Confidence | ↓ DNA Risk |
|---------------|----------------|---------------------------|--------------|------------|------------|
| Physiotherapy | R1H Physio WA | MSK PT Pilates Group F/Up | Yes | Very High | 99.91% |
| Physiotherapy | R1H Physio SI | MSK PT Pilates Group F/Up | Yes | Very High | 99.89% |
| Physiotherapy | R1H Physio SI | MSK PT New | Yes | Very High | 99.87% |
| Physiotherapy | R1H Therapy WX | MSK PT New | Yes | Very High | 99.86% |
| Physiotherapy | R1H Physio SI | MSK PT Pilates Group F/Up | Yes | Very High | 99.84% |
| Physiotherapy | R1H Physio SI | MSK PT New | Yes | Very High | 99.81% |
| Physiotherapy | R1H Physio WA | MSK PT New | Yes | Very High | 99.77% |
| Physiotherapy | R1H Physio SI | MSK PT New | Yes | Very High | 99.77% |

EXPLAINABLE & TRUSTWORTHY AI

A TRANSPARENT MODEL

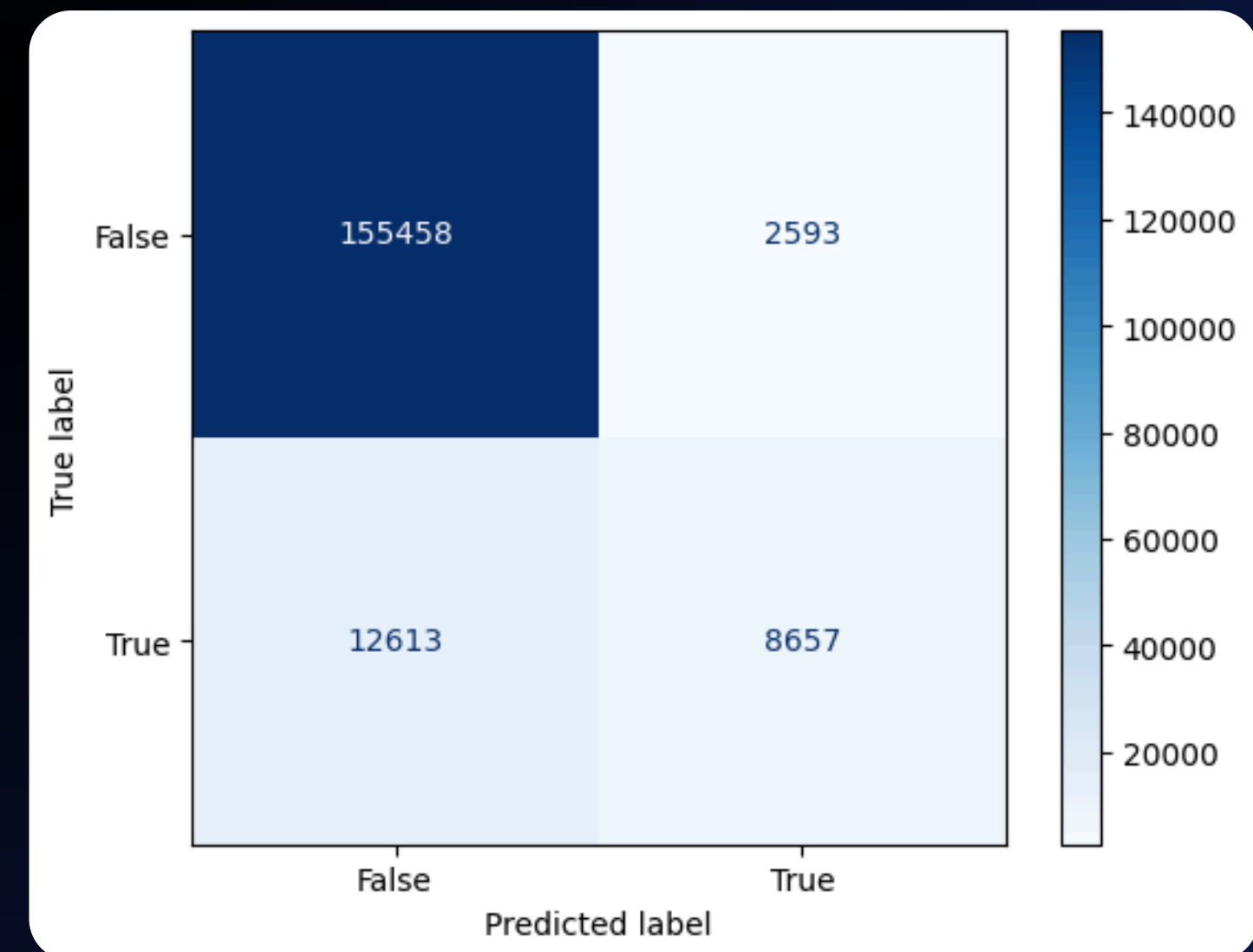
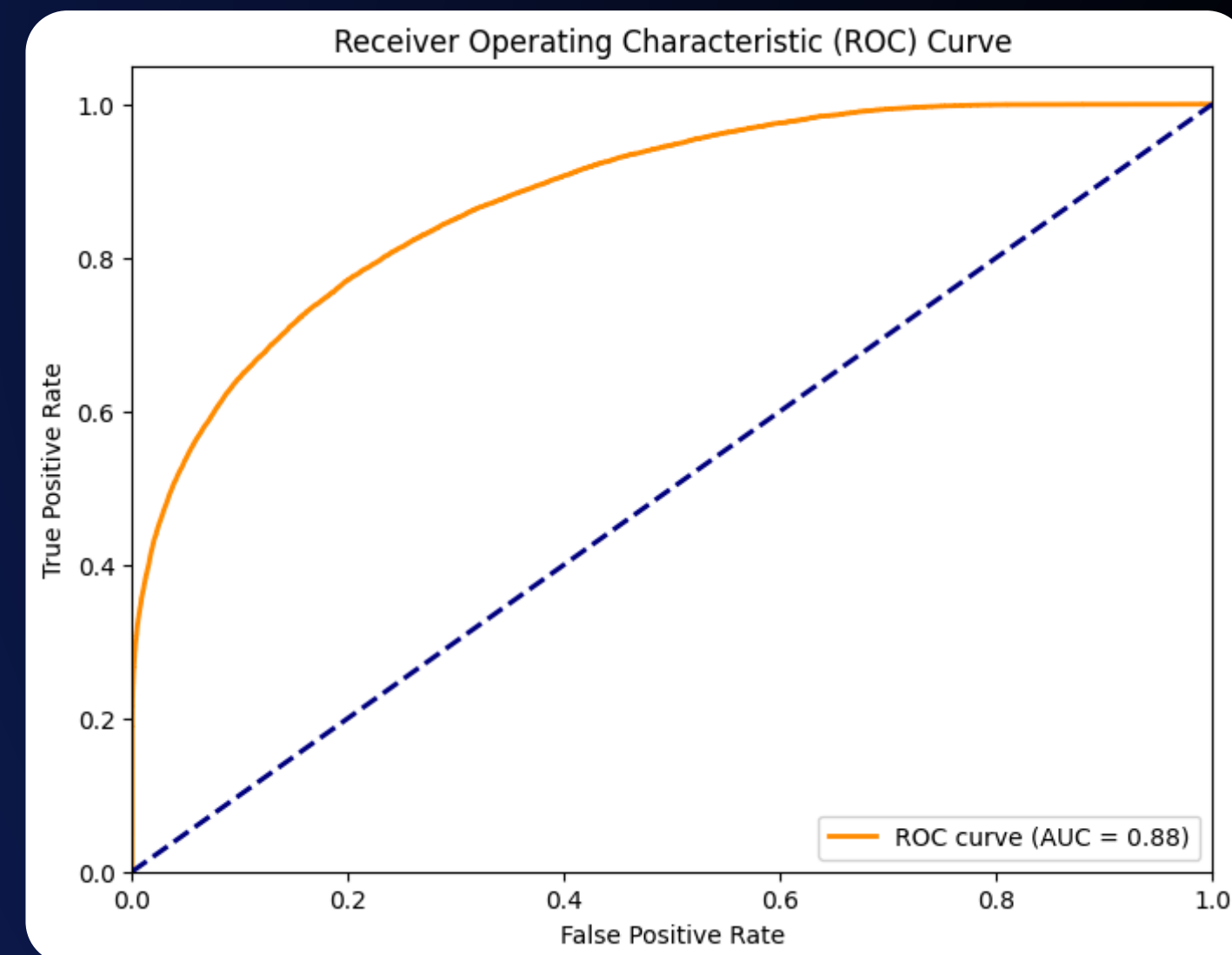
We can see why the model makes a prediction. Based on key features of the future appointment. Predictions can be broken down into the elements that formed the forecast. The model will continue to learn as more data is fed in.



ROBUST & ACCURATE PERFORMANCE

THE MODEL IS HIGHLY ACCURATE

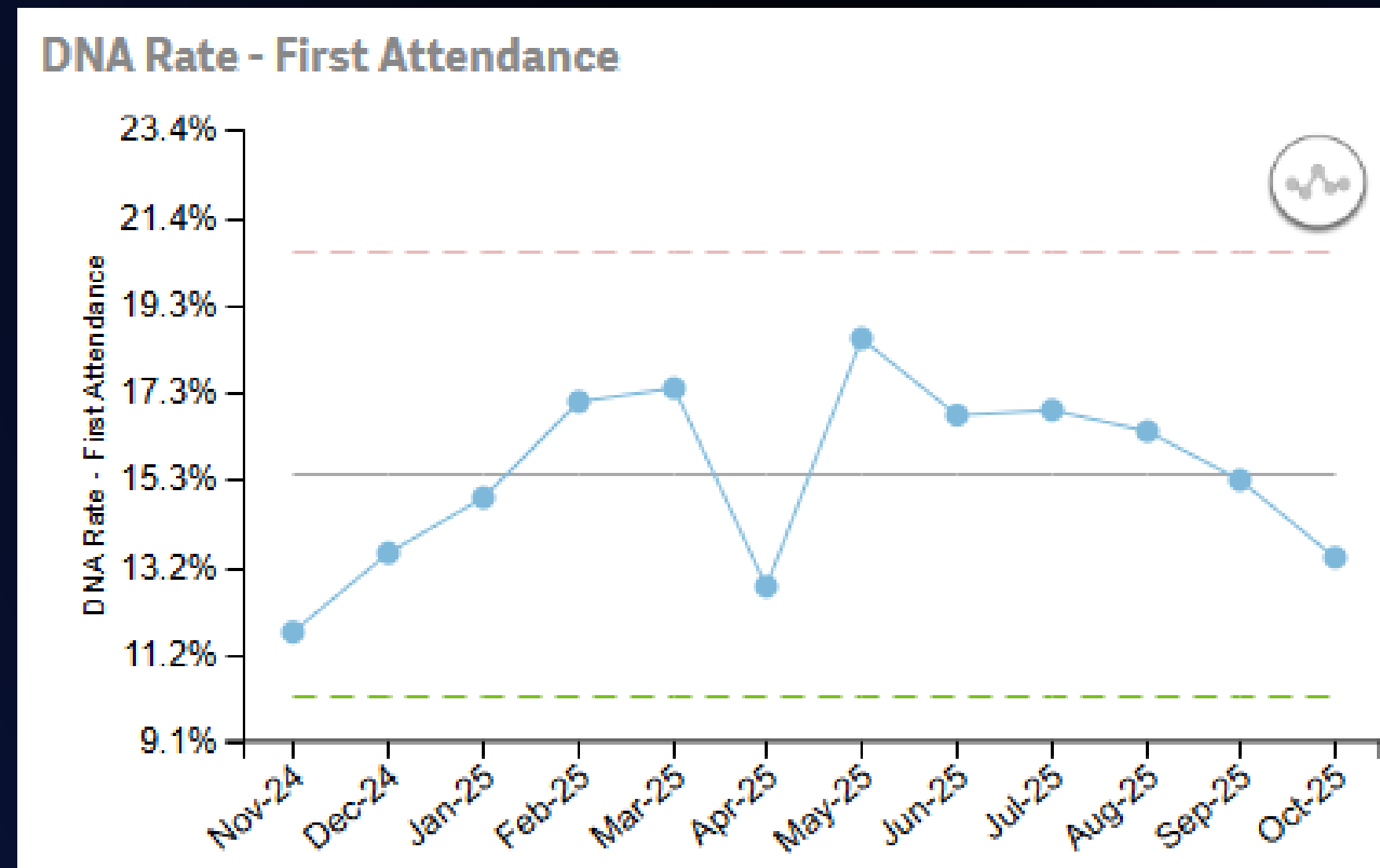
F-1 Score: 0.9; Balanced Accuracy score: 0.69; AUC score: 0.88. Indicating that you can be confident in its predictions and it very good at identifying patients who will not attend and doesn't flag lots of patients who will attend.



FROM MODEL TO IMPACT

EARLY RESULTS FROM PILOT SERVICE

Piloted through call lists for Physio first attendances targeted calls for identified high risk patients. Data shows 6 months of decreasing DNA nearing the threshold for a statistical significance. Achieving a 1% decrease in DNA's would generate ~ 240k of additional income across the Trust.



OPEN COLLABORATION

SHARING THE MODEL

01. CLONE, ADAPT, AND DEPLOY

Download the model, adapt it for your Trust and deploy.

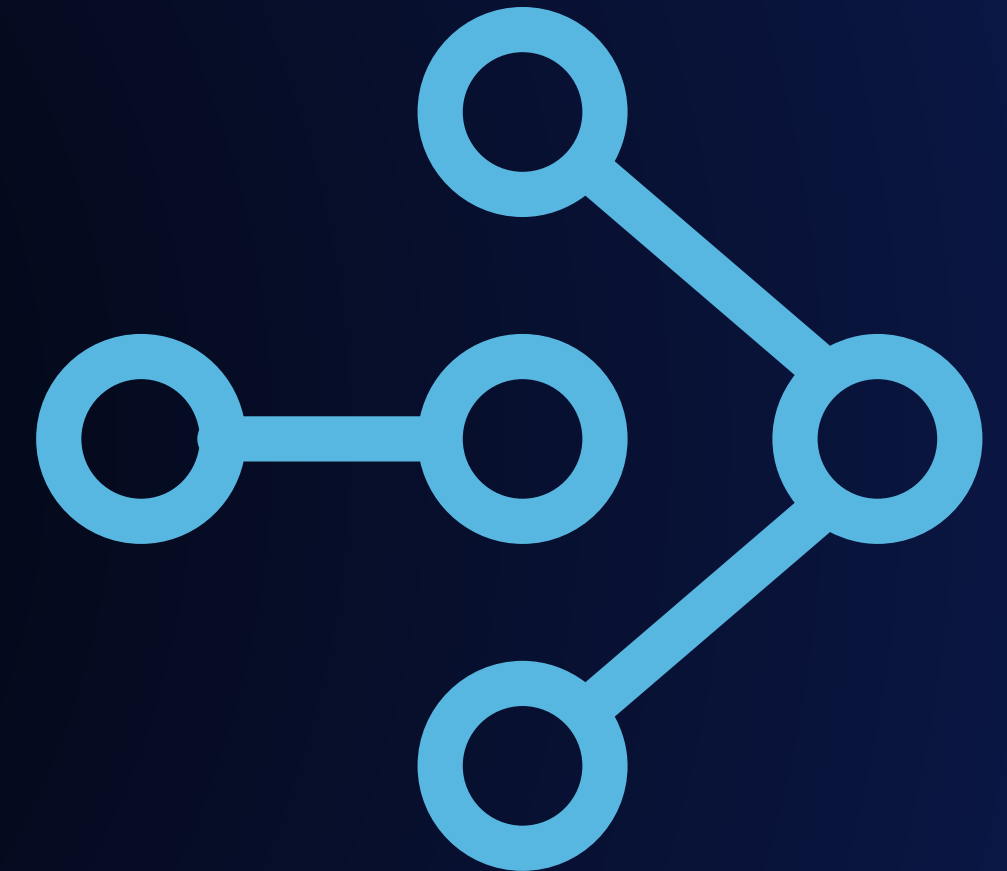
[GITHUB.COM/WX-BIU/OUTPATIENT-DNA](https://github.com/WX-BIU/OUTPATIENT-DNA)

02. ADD FEATURES, TEST LOCALLY

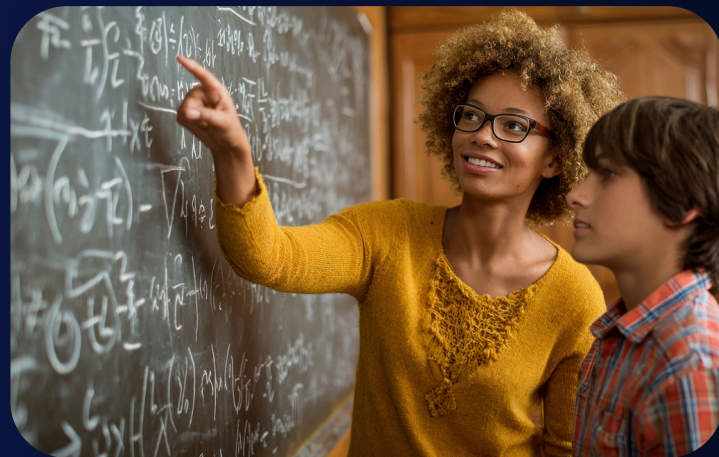
Does the model adjust for different populations? Does it deliver the same performance for your service?

03. BUILD AND REFINE

Refine the feature selection, feature engineering and help test the pipeline. Add features to the Streamlit application. Share your evaluation results and help improve the solution



LESSONS LEARNED



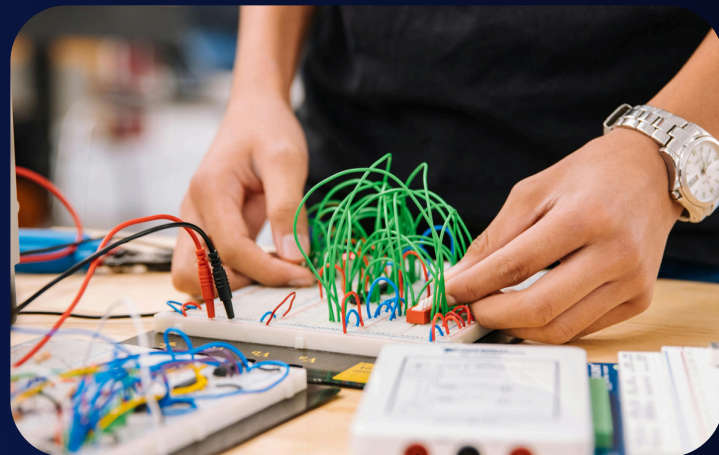
EXPLAINABILITY

People want to understand the reasons why a forecast has been made and what elements contributed to it. Highlighting that data quality change have a large impact on the forecast.



CLINICAL ENGAGEMENT

Clinical input was essential to ensure that predictions made sense within their service context.



SHARE EARLY

Having a working prototype through Streamlit helped to generate ideas, foster excitement and get real feedback.



FINAL MILE

Getting a model into operational use is challenging and getting people to use the tool is more difficult than building it!



Barts Health
NHS Trust

THANK YOU

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SOURCE CODE

[HTTPS://GITHUB.COM/WX-BIU/
OUTPATIENT-DNAS](https://github.com/WX-BIU/OUTPATIENT-DNAS)