A PREDICTIVE APPROACH TO REDUCING NON ATTENANCE

Transforming Outpatient care through data

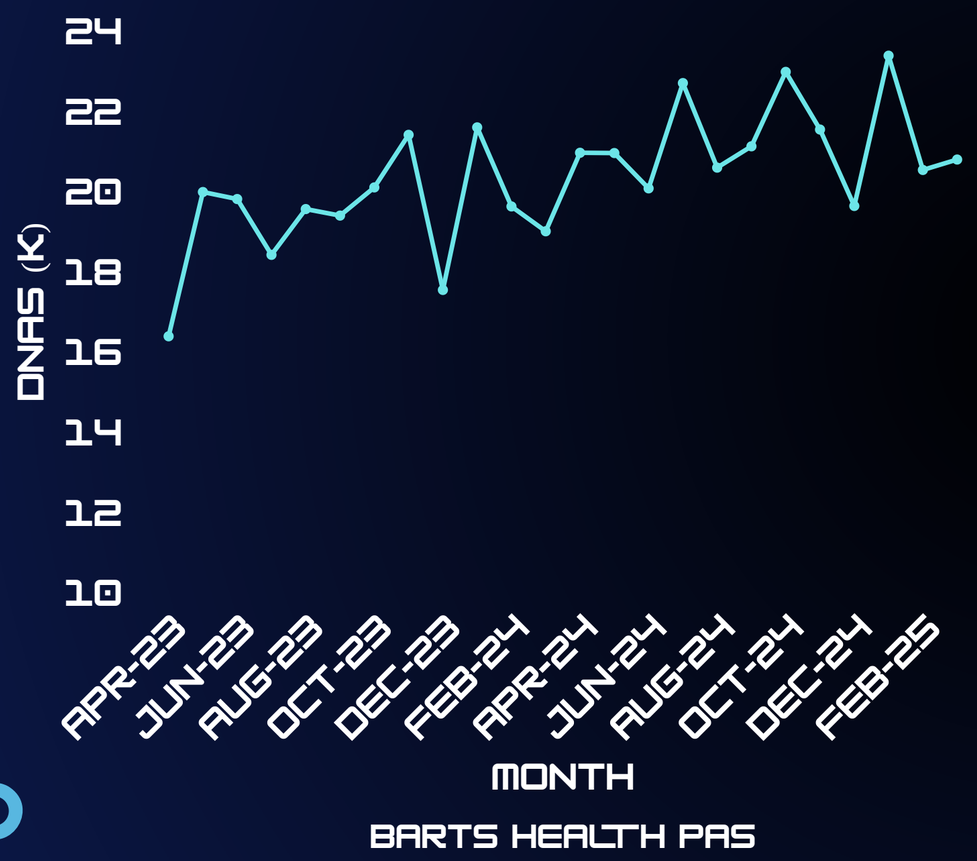
Peter Andrews - Nov 2025

Funded by barts CHARITY

NHS Barts Health 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

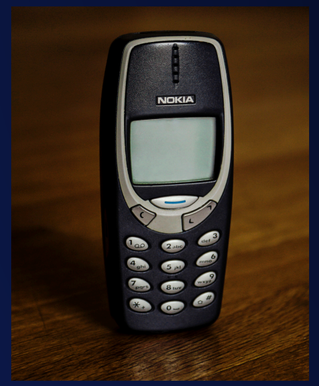
The estimated cost of non attended appointments across London over the past 4 years.

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 SOLUTUON

EXTRACT

(Other data storage solutions are available)

sqlalchemy

parquet files

TRANSFORM

pandas

NumPy

scikit learn machine learning in Python

python

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

TRAIN/ TEST

dmlc XGBoost

scikit learn machine learning in Python

SciPy

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

PRESENT

Streamlit

plotly

matplotlib

- Internally hosted streamlit application
- Graphing through plotly and matplotlib

HOW IT WORKS

BUILT BY THE NHS, FOR THE NHS

APPOINTMENT HISTORIES

DEMOGRAPHICS

SERVICE INTERATIONS

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 identifing 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

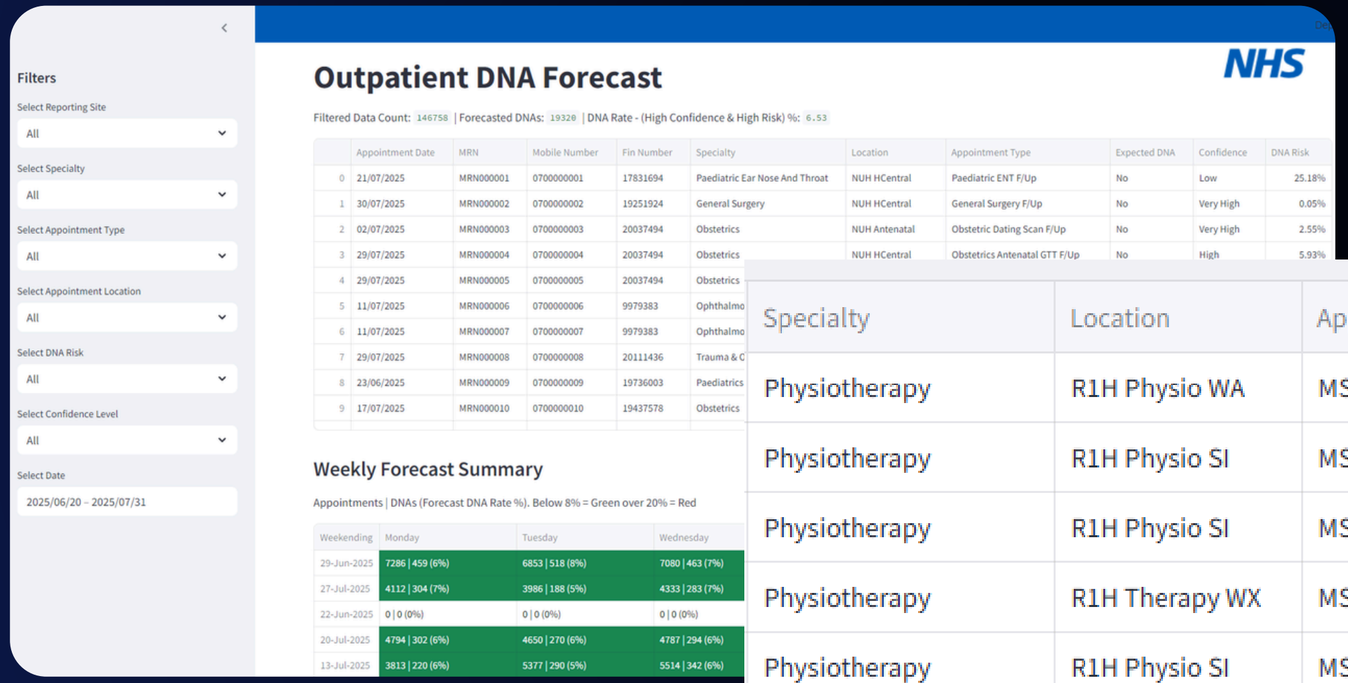
If the appointment was booked a very long time ago there is a much higher risk that the patient will not attend. The model found that this only applies to follow-ups.

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

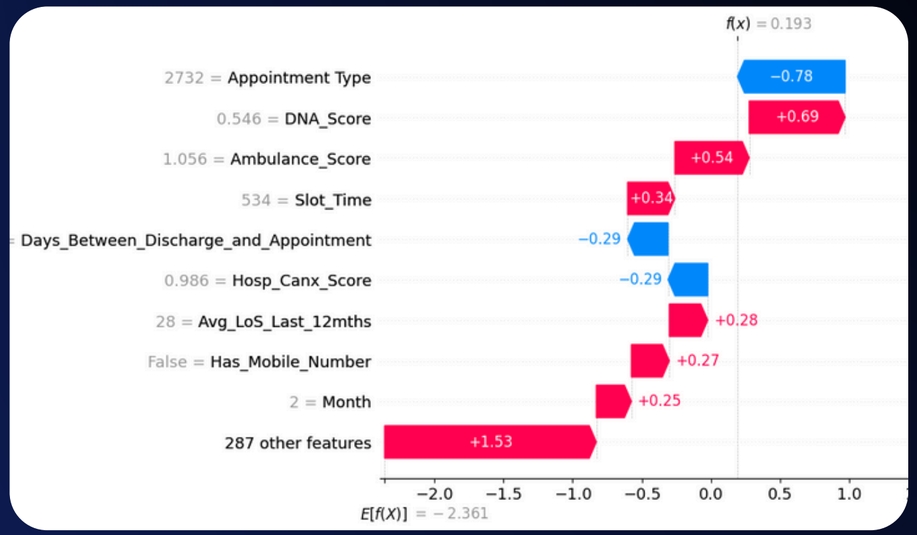


Specialty	Location	Appointment Type	Expected DNA	Confidence	↓ DNA Risk
Physiotherapy	R1H Physio WA	MSK PT Pilates Group F/Up	Yes	Very High	99.91%
Physiotherapy	R1H Physio SI	MSK PT Pilates Group F/Up	Yes	Very High	99.89%
Physiotherapy	R1H Physio SI	MSK PT New	Yes	Very High	99.87%
Physiotherapy	R1H Therapy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

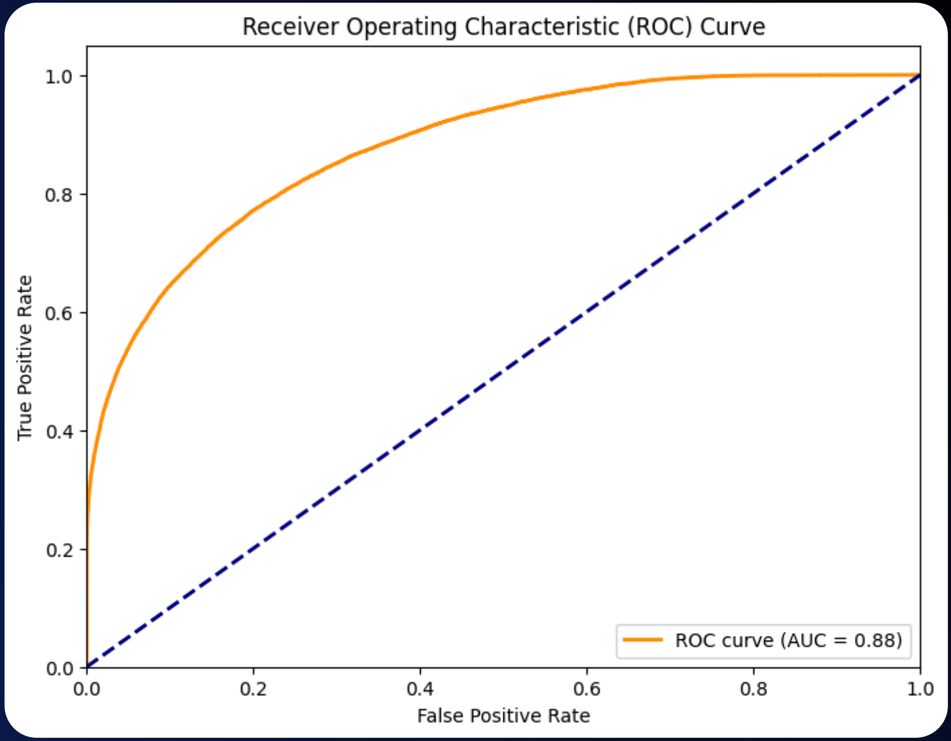
We can see why the model makes a prediction. Based on key features of the future appointment. Predictions can be broken down into the elements that formed the forecast. The model will continue to learn as more data is fed in.

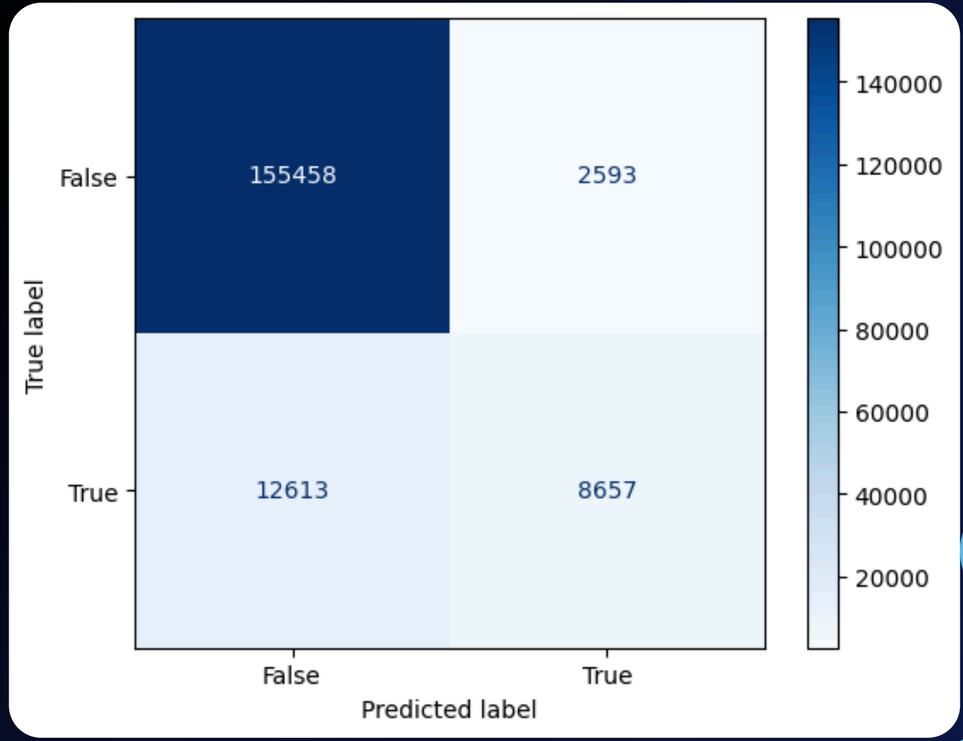


ROBUST & ACCURATE PERFORMANCE

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.

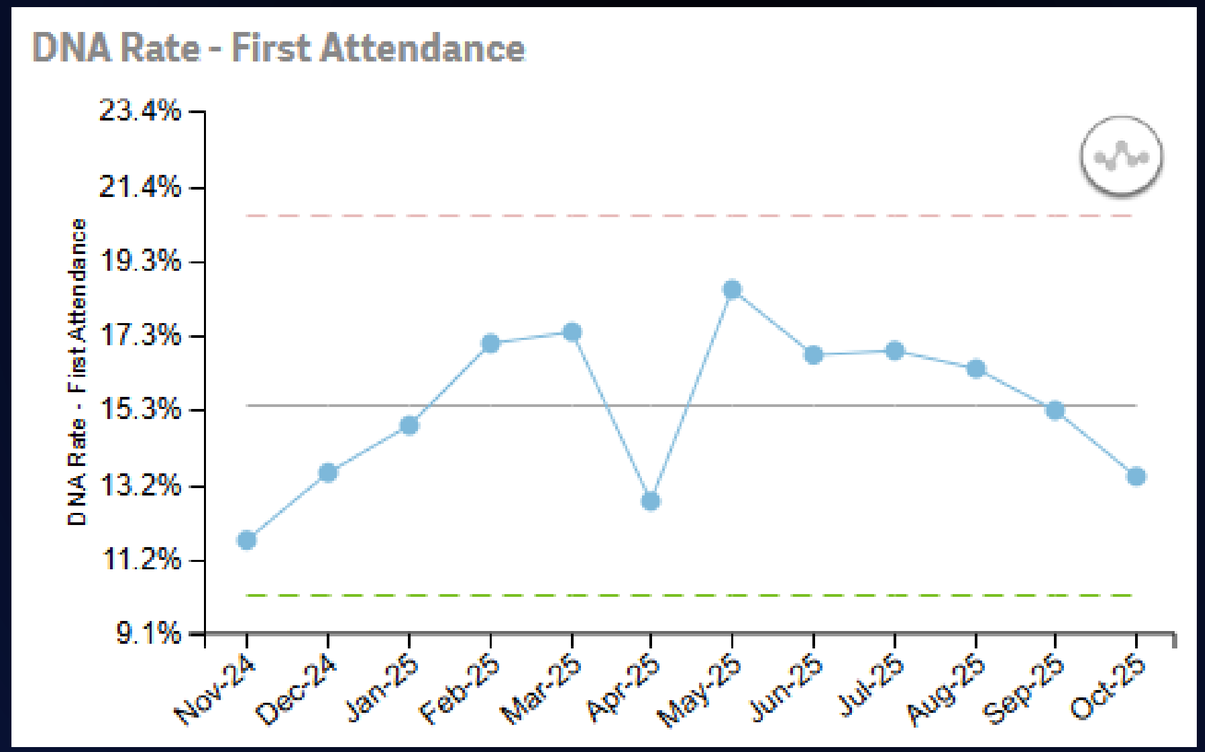




FROM MODEL TO IMPACT

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.

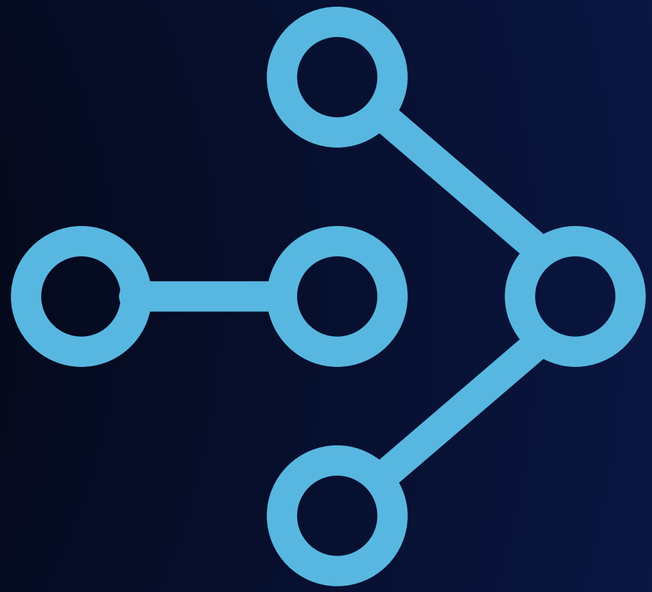
GITHUB.COM/WX-BIU/OUTPATIENT-DNA

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

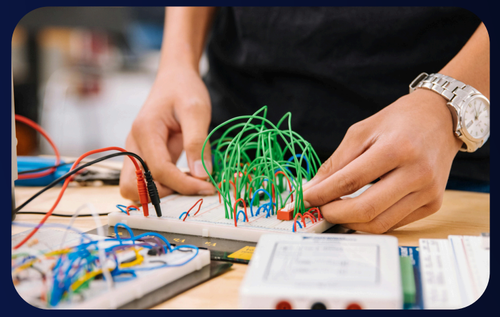
Refine the feature selection, feature engineering and help test the pipeline. Add features to the Streamlit application. Share your evaluation results and help improve the solution



LESSONS LEARNED

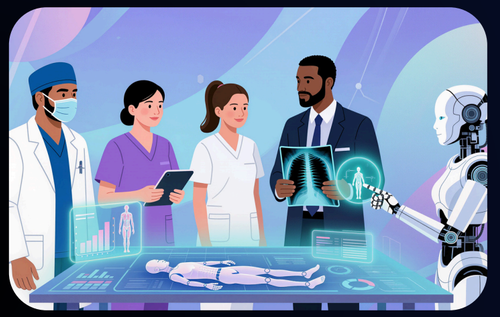
EXPLAINABILITY

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.



SHARE EARLY

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



CLINICAL ENGAGEMENT

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

FINAL MILE

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

NHS
Barts Health
NHS Trust

THANK YOU

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SOURCE CODE

HTTPS://GITHUB.COM/WX-BIU/OUTPATIENT-DNAS