HEARTwise ML

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2025-11-05

HEARTwise
REFINED TRIAGE FOR SMART EVALUATION

Hospital and Home **E**arly Warning
AI-**R**efined **T**riage with **W**earables and **I**nstruments for **S**mart **E**valuation

Introduction - HEARTwise

- Belgian Project approved within FOD innovation initiatives
- Duration: July 2024 – December 2025
- Collaboration between 4 Belgian hospitals:
  - Jan Yperman Hospital: coordinating hospital
  - University Hospital Antwerp
  - AZ West Veurne
  - Sint-Andries Tielt

UZA azWest TIELT SINT-ANDRIES ZIEKENHUIS Uw gezondheid, onze zorg. JYZ Jan Yperman Ziekenhuis

Project scope:
Improving the Early Warning Score (EWS) process

- EWS: A standardized method used in healthcare to assess a patient's clinical condition

Physiological Parameters	3	2	1	0	1	2	3
Respiration Rate (BPM)	≤8		9-11	12-20		21-24	≥25
Oxygen Saturat (%)							
Any Supplemen Oxygen							
Temperature (°							
Systolic Blood Pressure (mmH							20
Heart Rate (BPM)	≤40		41-50	51-90	91-110	111-130	≥131
Level of Consciousness				A			V, P or U

NEWS Scores	Clinical Risk
0 Aggregate 1 - 4	Low
RED Score* (Individual parameter scoring 3) Aggregate 5 - 6	Medium
Aggregate 7 or more	High

Projectscope:
Improving the Early Warning Score (EWS) process

- How?

Automatic

EWS in the hospital:
Increase frequency
Automtic/semi-continuous
Mesurement via WEARABLES

Telemonitoring

EWS care pathway in the home setting:
Patient goes home with **wearables** and
is monitored at home for **10 days**
Follow-up via **patient platform/application**
and **dashboard**

Visual

Better visualization of EWS data
via dashboard

Smarter

Developing an ML model to
predict patient condition
deterioration

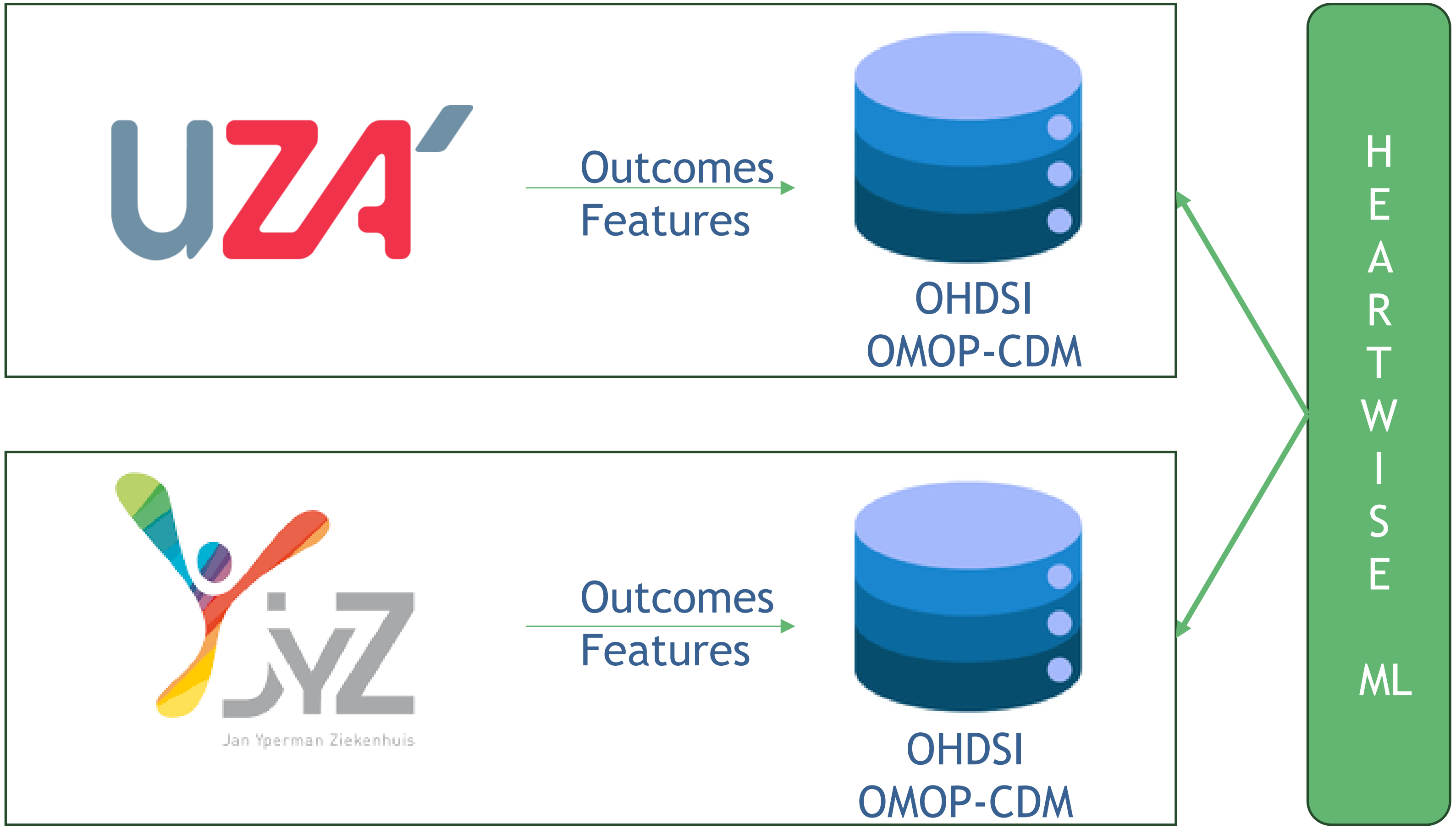
UZA

JYZ
Jan Yperman Ziekenhuis

edenceHealth

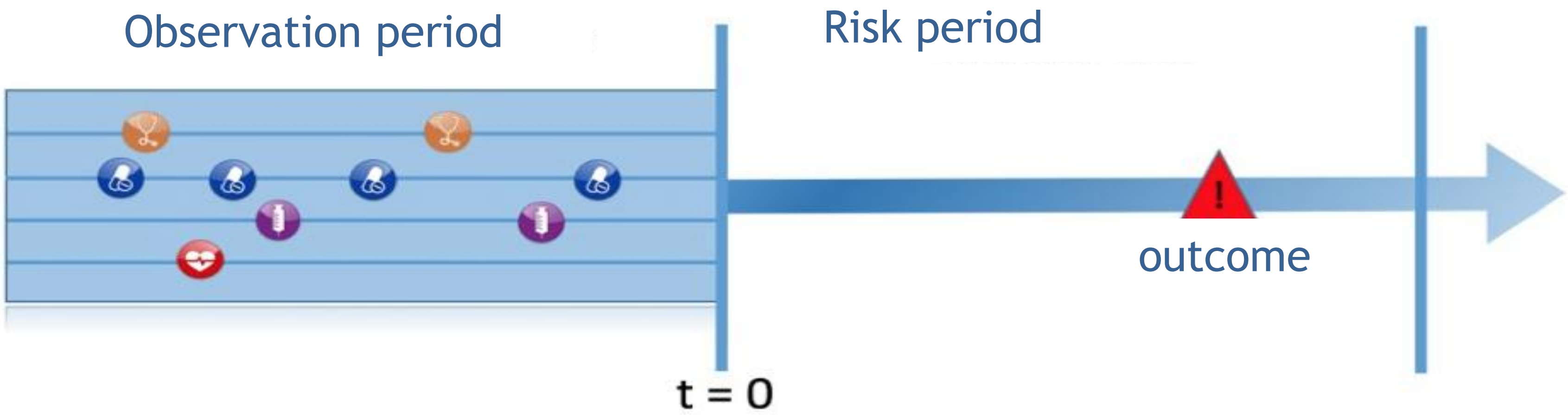
HEARTwise ML

- Leverage OMOP to develop ML framework that can be used to train models at both hospitals



Develop one framework that can be deployed against any OMOP-CDM instance

The challenge of predictive models

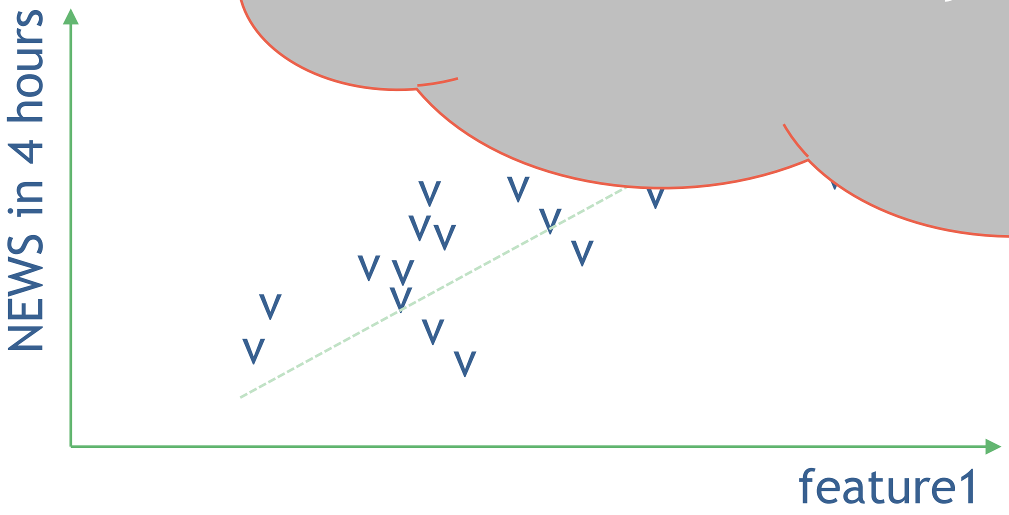


- Can we, using available clinical observations, predict an outcome at t=0 (index date) within a defined risk period?
- Target cohort: Patients with at least one visit and more than one NEWS score, aged over 18 years. Pediatric and pregnant patients are excluded. NEWS data collected after April 1, 2021.
- Outcome cohort: Patients experiencing deterioration (various definitions possible).
- Risk period: For example, the next 4, 8, or 12 hours.
- Models: Regression and classification based on age, gender, NEWS, comorbidities, etc.

Image from https://ohdsi.github.io/TheBookOfOhdsi/

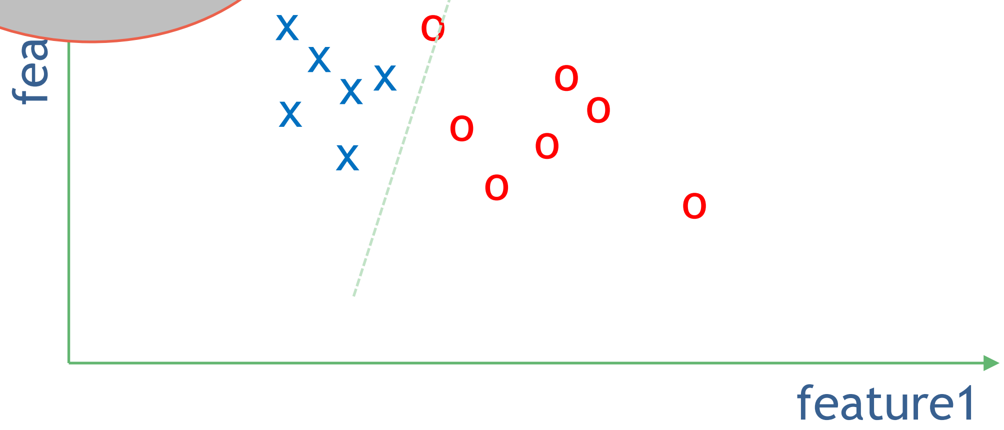
Regression

- **Goal:** Predicting a continuous value over time.
- **Example:** Accu
  NEWS score
  12 hours ba
  previo
  oxyge



Classification

- **Goal:** Predict whether a patient will fall into a risk category within 4, 8, s.
- ct whether a patient
  rtain NEWS
  4, 8, or 12 hours.

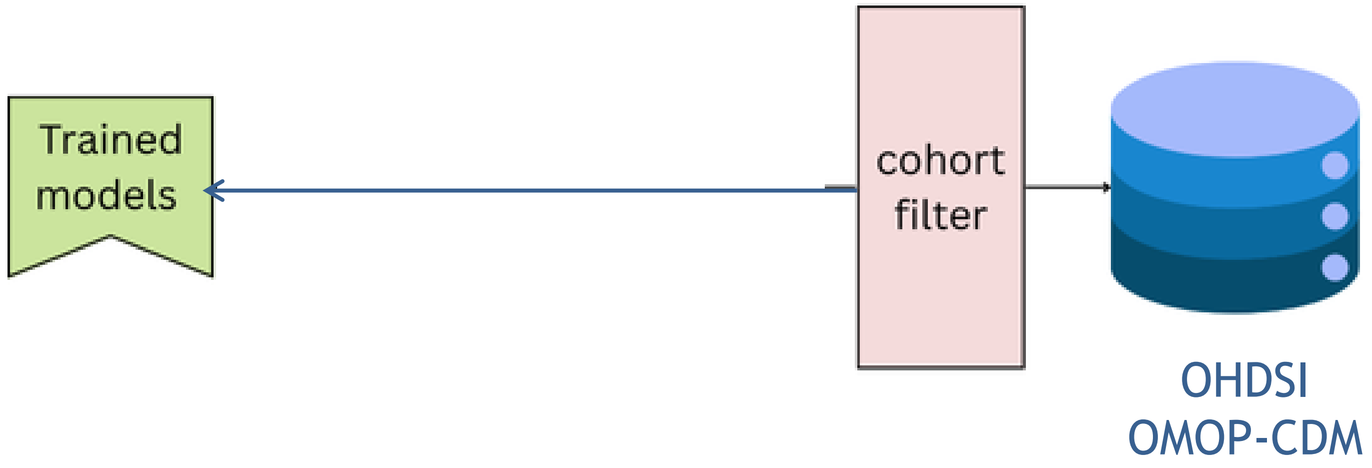


We want to implement different models, features, outcomes, and feature-engineering steps in a flexible, reusable, and scalable way…

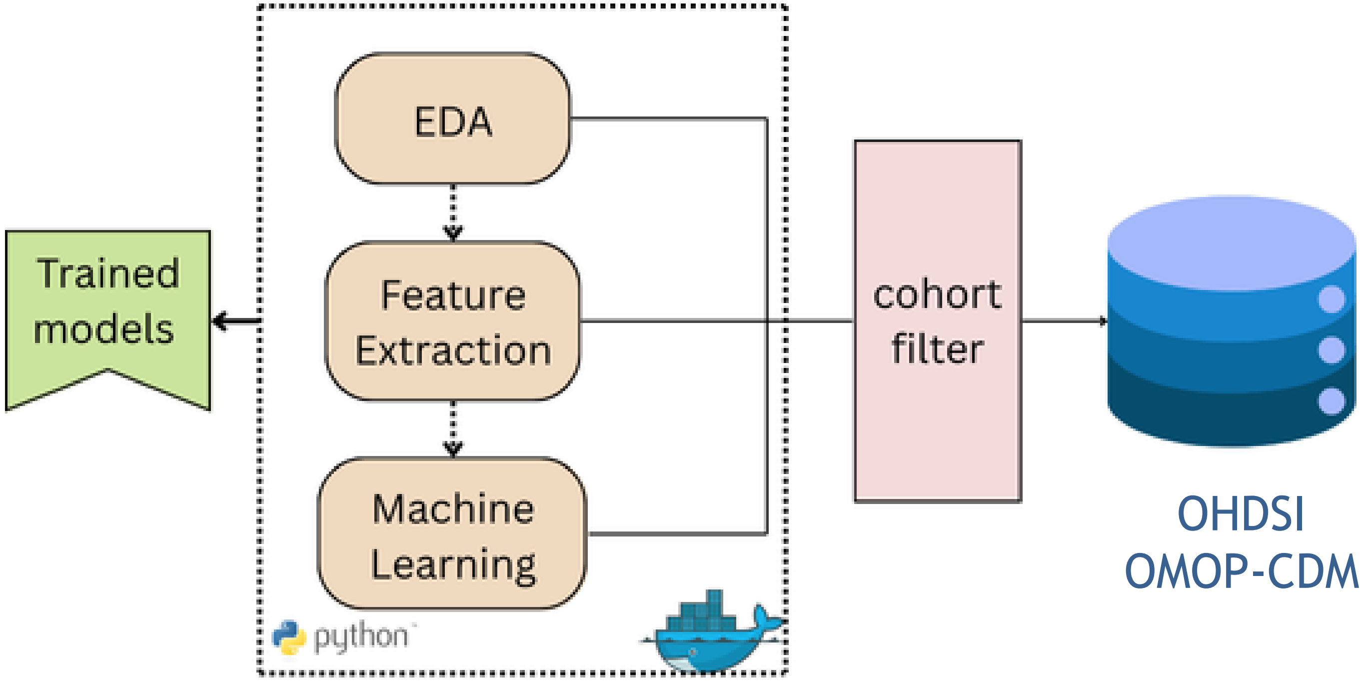
HEARTwise ML framework

- Leverage OMOP to develop ML framework that can be used to train models at both hospitals

HEARTwise ML framework



HEARTwise ML framework

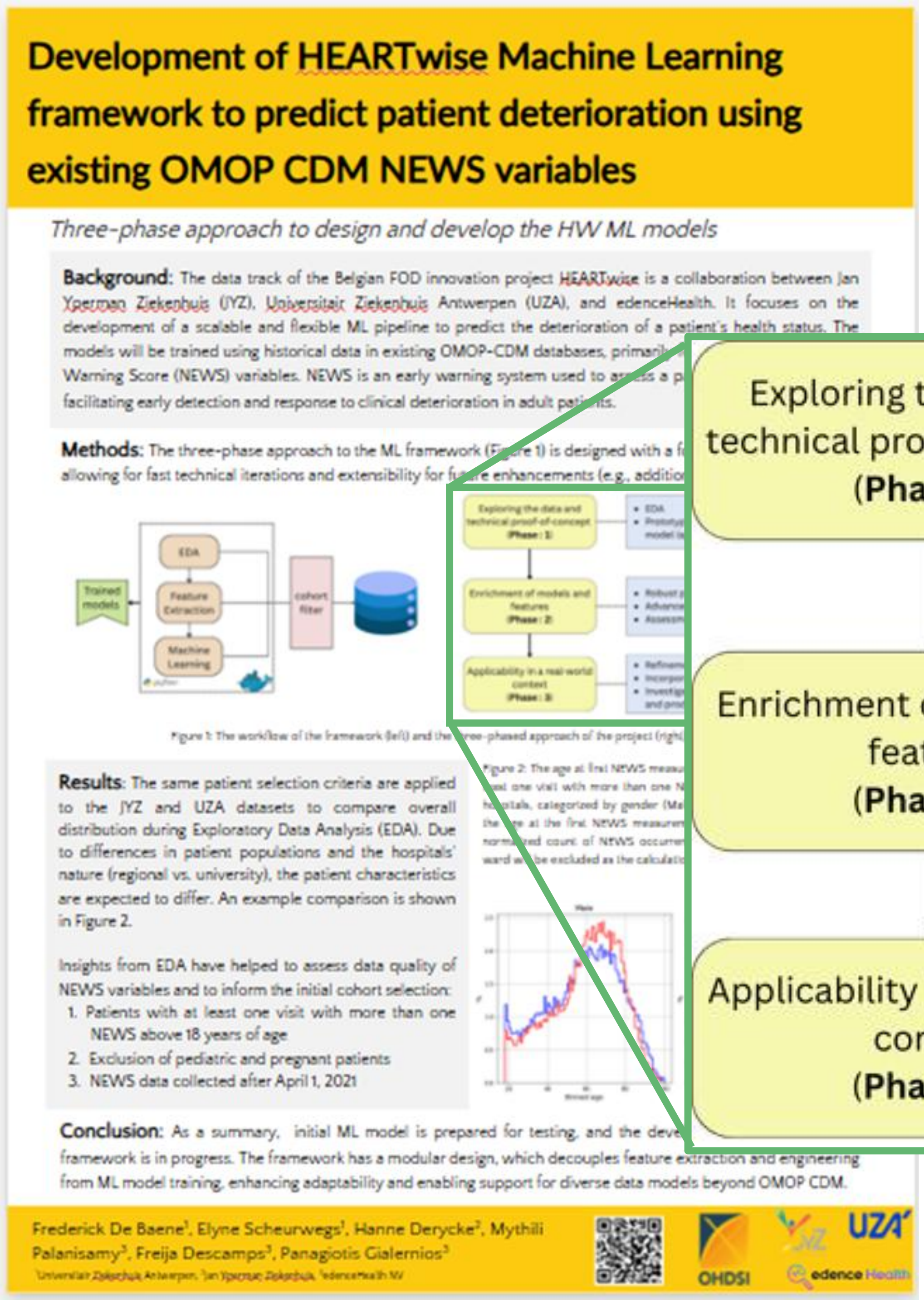


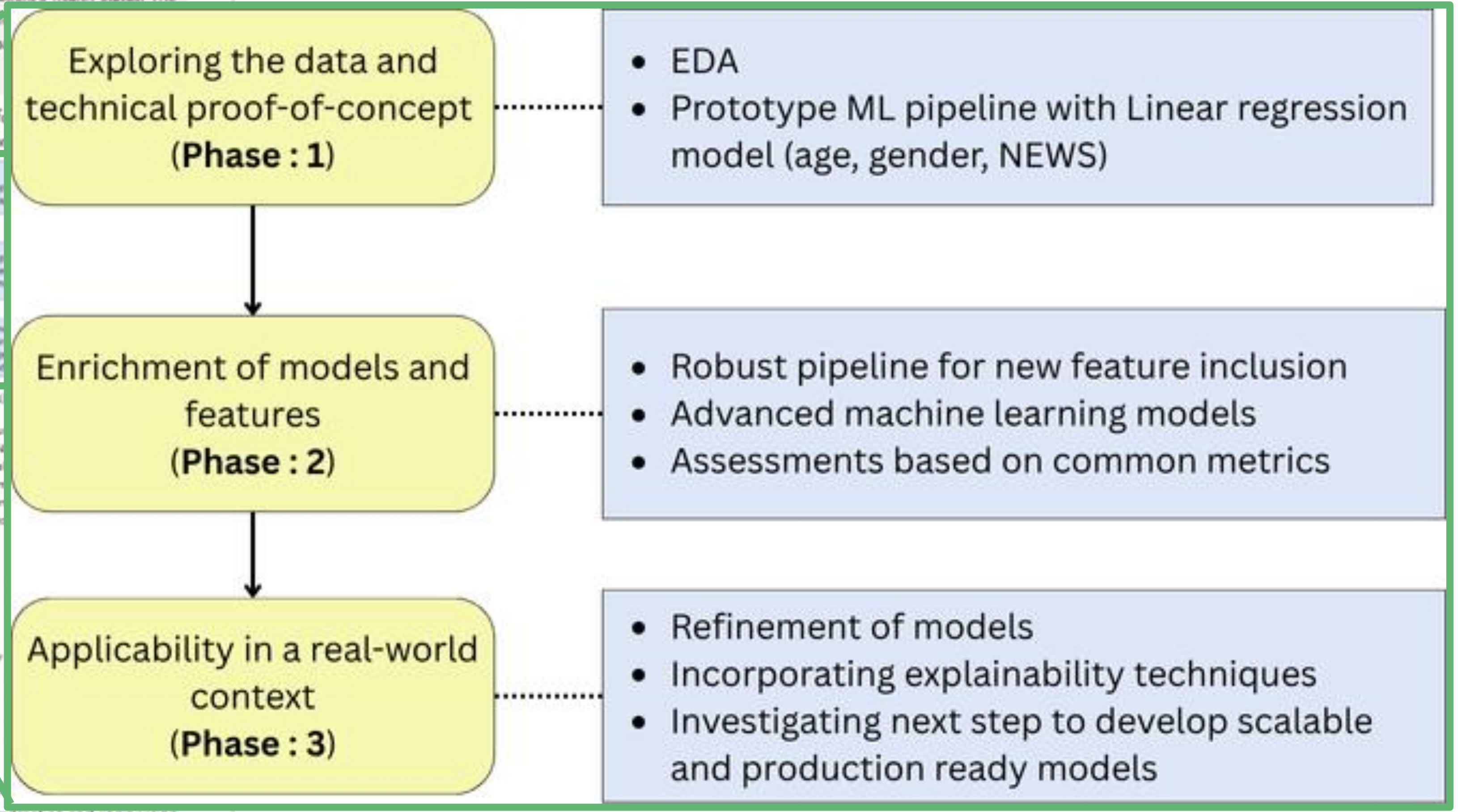
Modular framework with three main components: Exploratory data analysis, Feature extraction, Machine learning (training)

- Each component can be executed independently
- Containerized and version control applied
- Data analysts can add new features and models

JAN YPERMAN ZIEKENHUIS

HEARTwise poster at the OHDSI Europe 2025 symposium



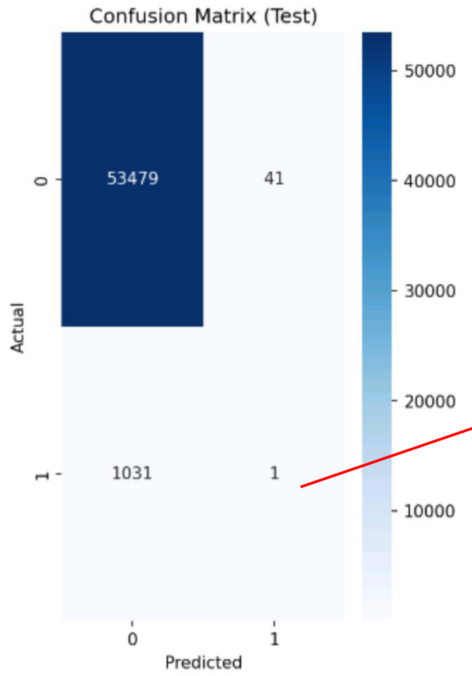


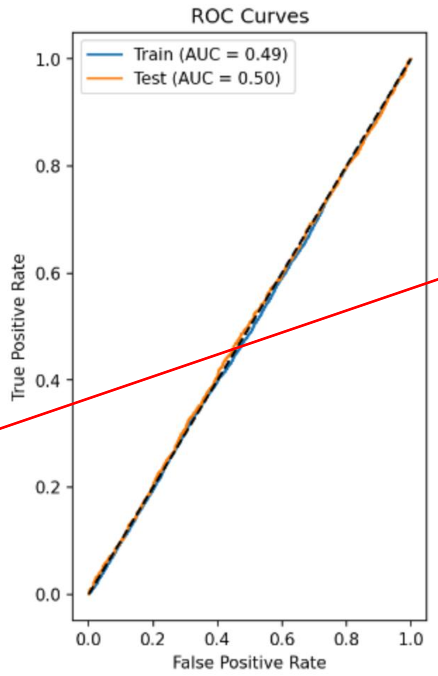
Example: predicting patient deterioration

Developing a flexible framework:

- Run multiple models on multiple outcomes and feature sets.
- Compare model performance.
- Execute a QA suite after each training round.

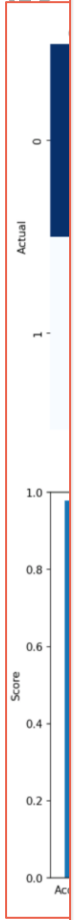
Examples of automated QA output for a random classifier:

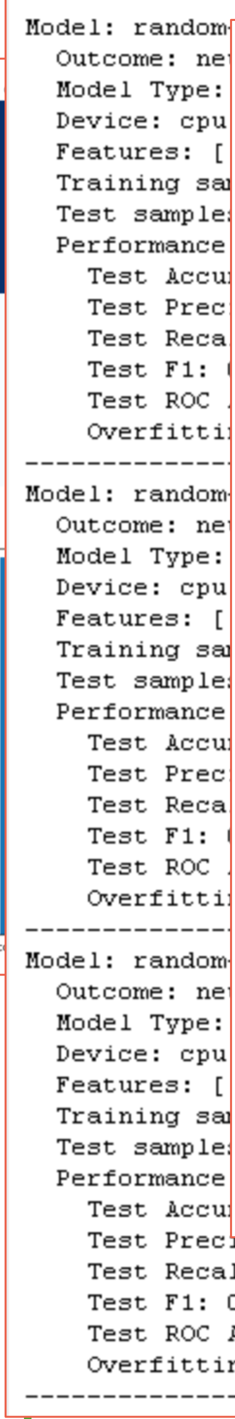




In the test set: the random model correctly predicted the >7 NEWS within 4 hours outcome only once.

A output





```
Model: random
  Outcome: ne
  Model Type:
  Device: cpu
  Features: [
  Training sa
  Test sample
  Performance
    Test Accu
    Test Prec
    Test Reca
    Test F1:
    Test ROC
    Overfitti
--------------
Model: random
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Model: random
  Outcome: ne
  Model Type:
  Device: cpu
  Features: [
  Training sa
  Test sample
  Performance
    Test Accu
    Test Precision: 0.0182
    Test Recall: 0.0007
    Test F1: 0.0014
    Test ROC AUC: 0.4945
    Overfitting: No
-----------------------------------------------------------
```
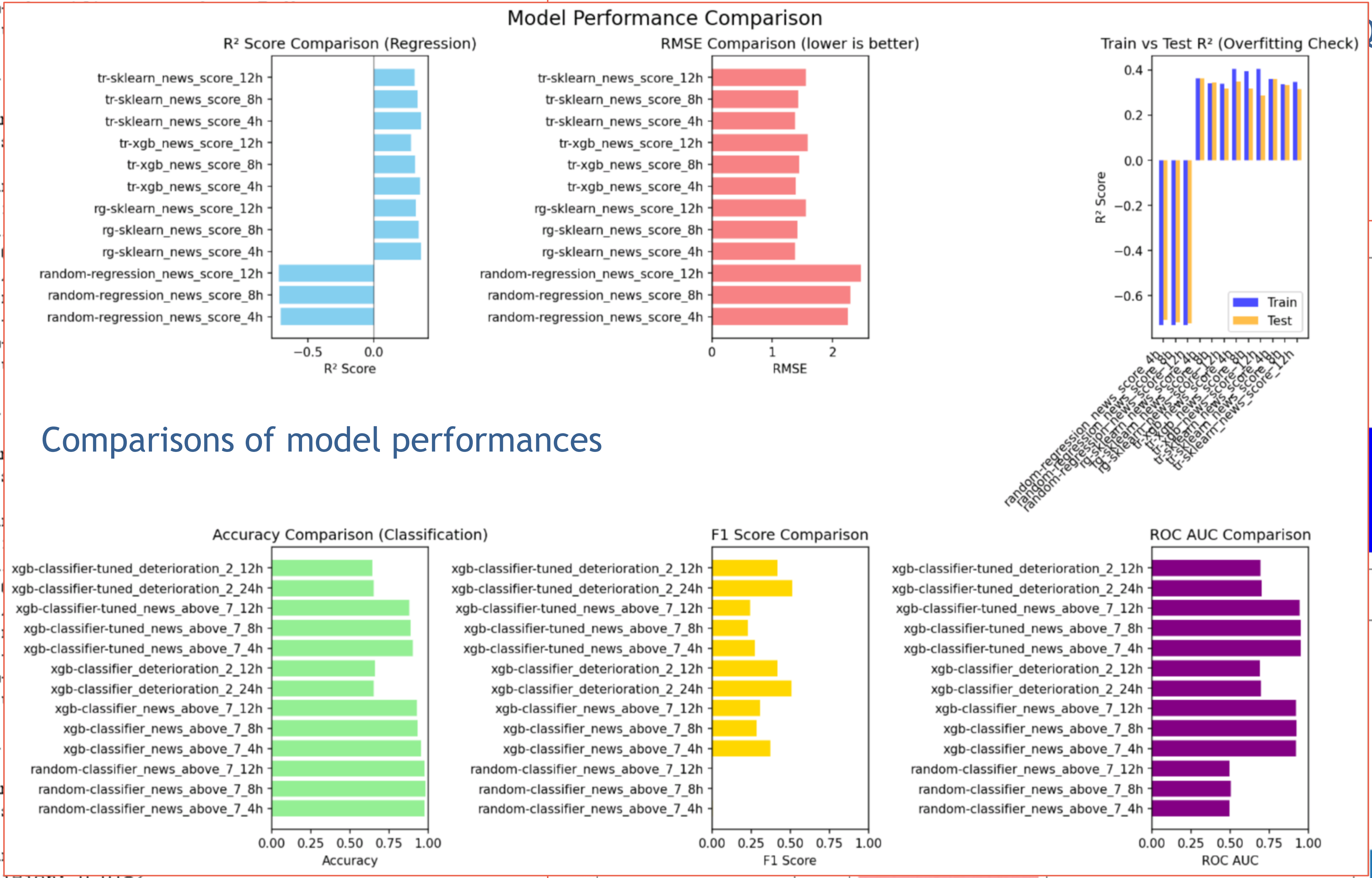
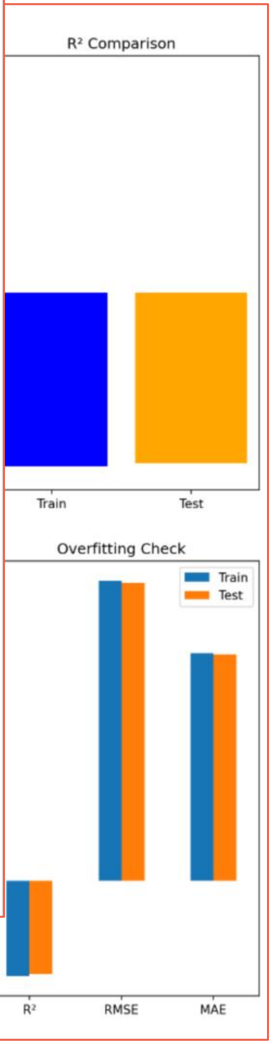



Comparisons of model performances



Automated models

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Current status …

0. Literature review → 1. Selecting data sources → 2. Data access + OMOP → 3. Setting up ML framework → 4. ML model training → 5. Clinical validation ML models → 6. Desired outcome + next steps

We are here: iterating and model explainability/validation

… and next steps

- Validation and explainability: workshop with clinicians
- Investigation and reporting on path to production/useage
- Dissimination and onboarding

Jan Yperman Ziekenhuis

Thank you!

HEARTwise

REFINED TRIAGE FOR SMART EVALUATION

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