

Machine Learning for Sex-specific PTM Risk Prediction in KTx Patients

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Why does sex-specific prediction matter?

- One model for everyone
  - Assumes similar risk patterns for men and women
  - May overlook subgroup-specific predictors

- Sex-specific models
  - Identify different predictors
  - Capture potentially different risk trajectories
  - Enable more tailored risk stratification

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Aims

1. **Identify sex-specific risk factors for PTMs using ML**
2. **Develop sex-specific clinical prediction models**

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Identify sex-specific risk factors for PTMs using ML

- Genomic Features
- Methylation derived features
- Quality filtering
- CTC outcome (Yes/No)
- Dimensionality reduction using PCA, Clustering

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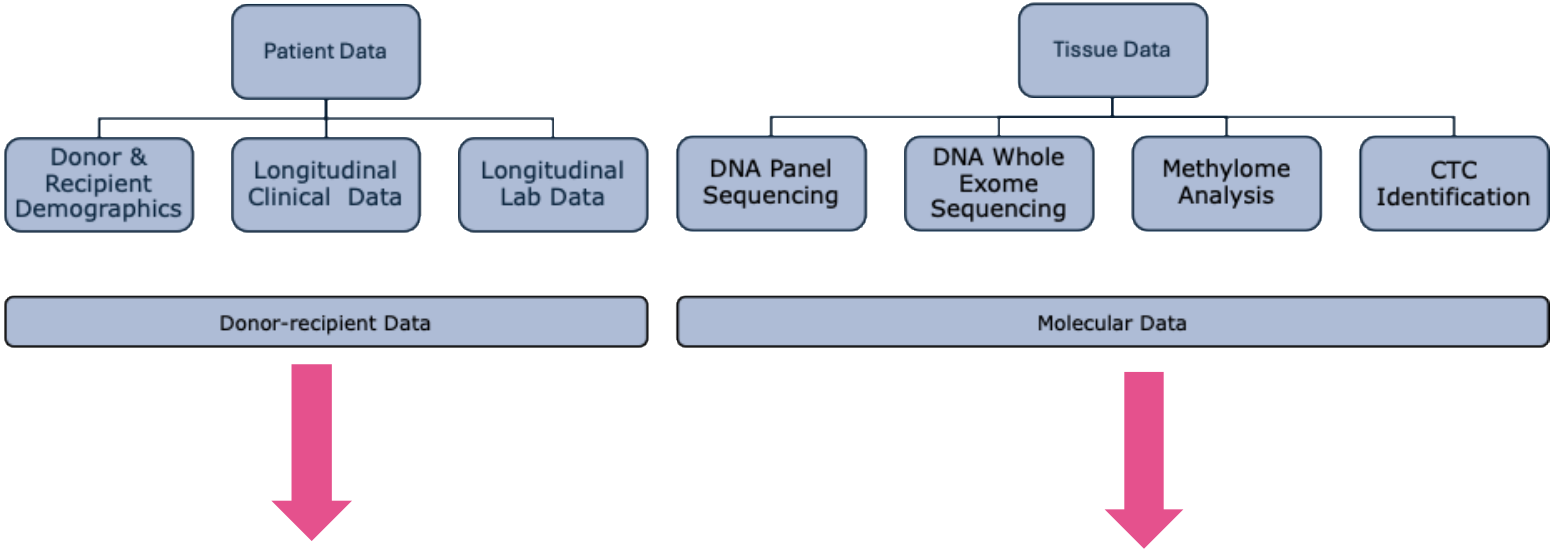
GeGe4Nephro Dataset

- Patients: 5,636 (CHA and UL)
- Period:2000-2026
- Age: 50 ± 14



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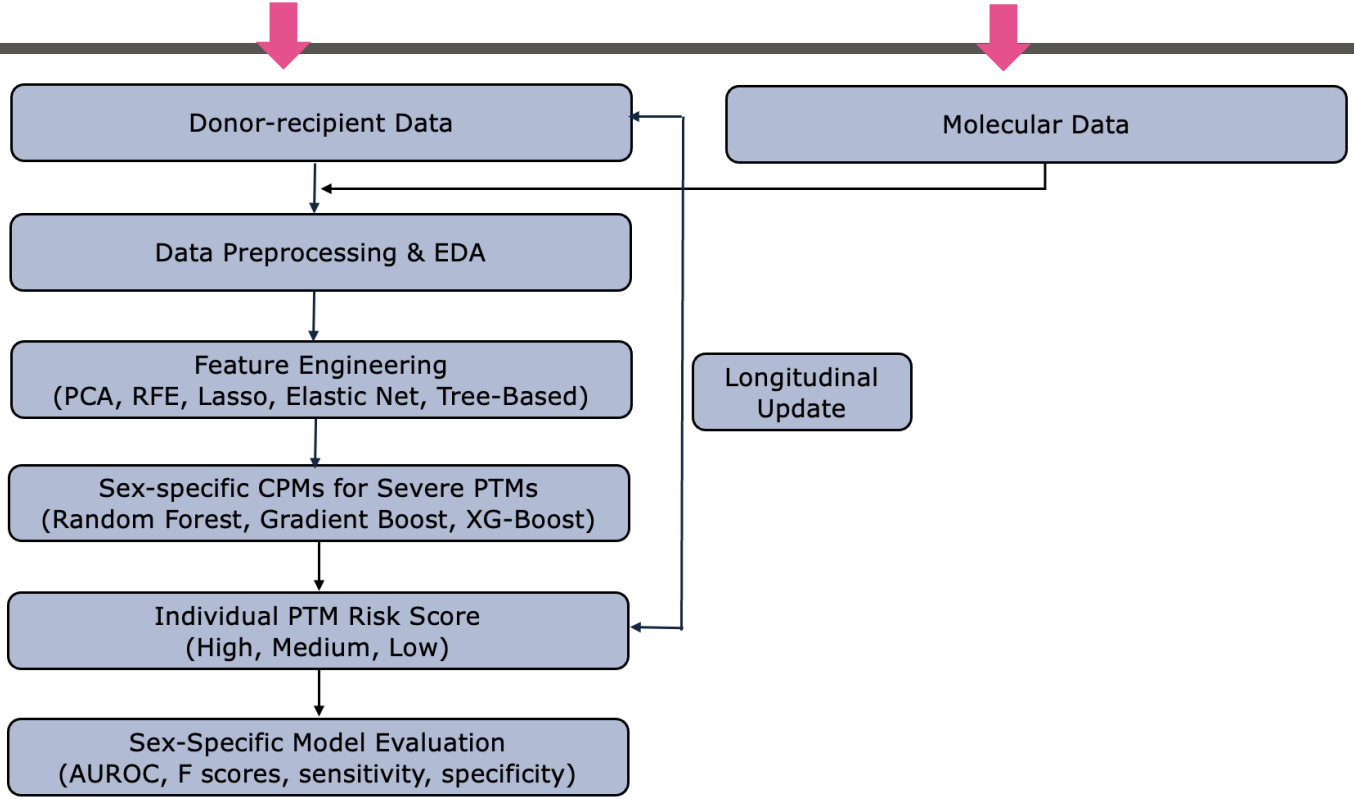
Develop sex-specific clinical prediction models



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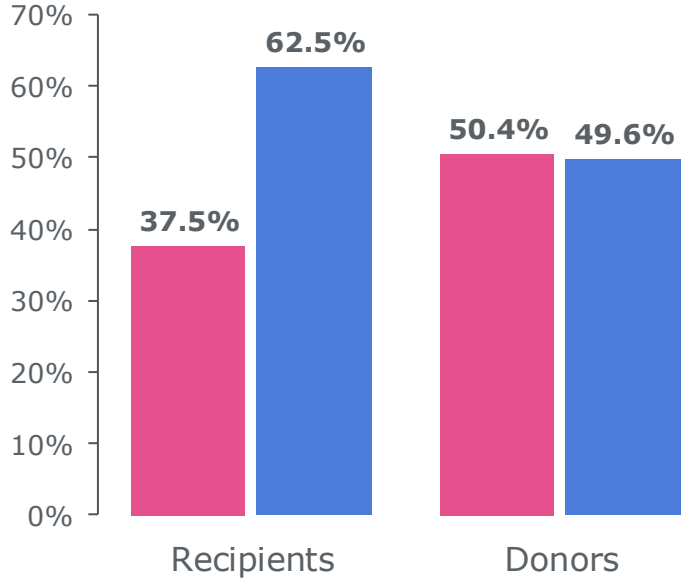
Data preprocessing & EDA

- Harmonizing data from different sources according to the GeGe4Nephro data dictionary
- Statistical analysis, e.g., filling gaps, error assessment
- Encoding categorical variables
- Class imbalance



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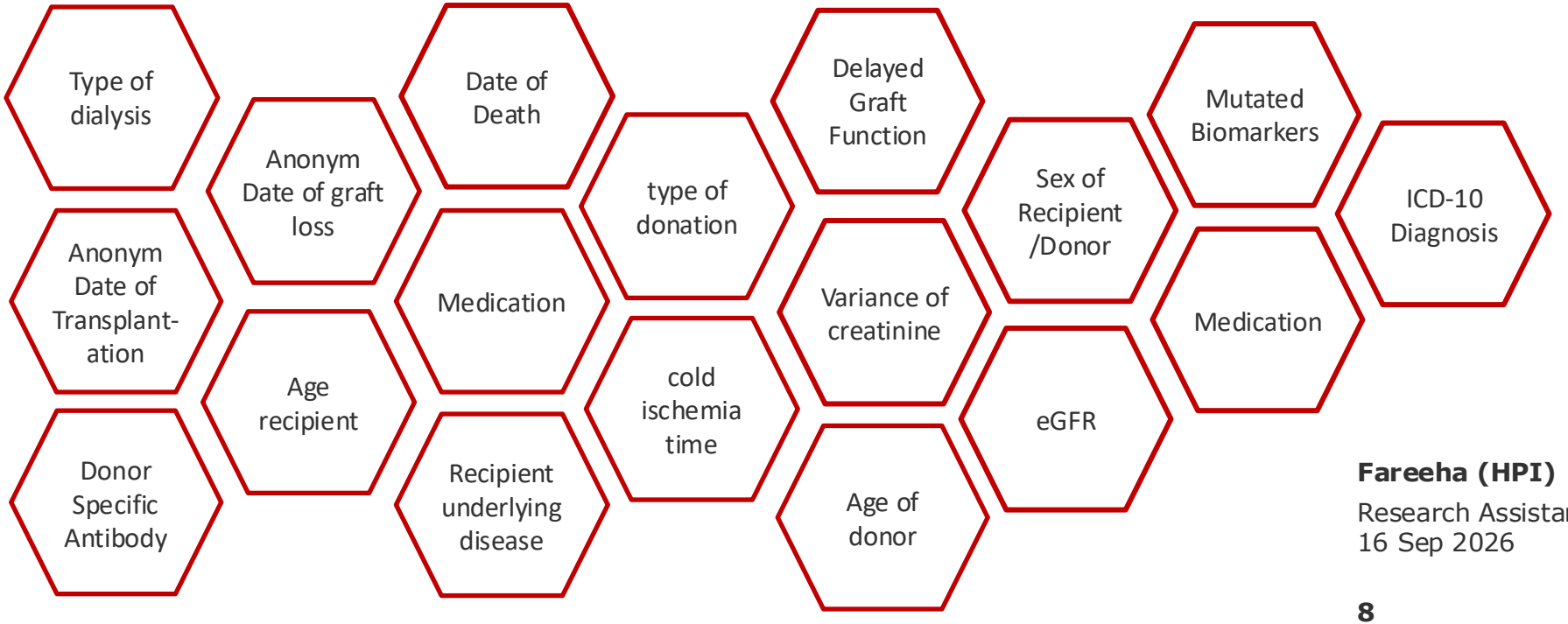
Feature Engineering



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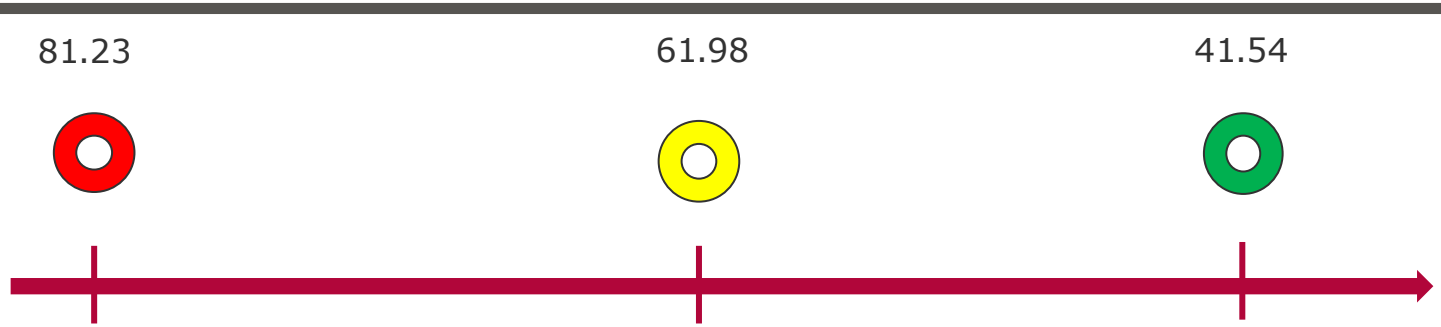
Sex-Specific PTM Risk Score Prediction





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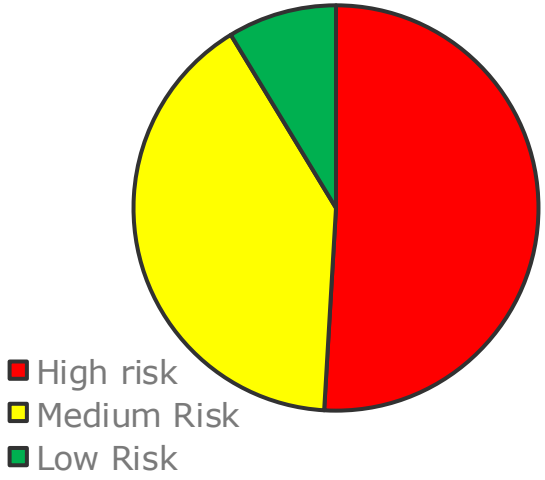
Sex-Specific PTM Risk Score Prediction

- Risk category with the highest predicted probability: model's current predicted class.



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Evaluating the Models

- **AUROC**

  Ability to distinguish patients with and without PTM
- **Sensitivity**

  Ability to correctly identify patients who develop PTM.
- **Specificity**

  Ability to correctly identify patients who do not develop PTM.
- **F1 Score**

  Balance between precision and sensitivity in PTM prediction.

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Potential Impact

- Today
  Identify sex-specific PTM risk factors
- Next
  Improve individualized risk stratification
- Clinical potential
  Help clinicians identify patients who may benefit from closer and early detection and monitoring
- Longer term
  Support more personalized post-transplant management

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