Utilizing Machine Learning for the Identification of Pre-Treatment Prognostic Non-Imaging Biomarkers of Cancer Therapy-Related Cardiac Dysfunction in Female Patients with Breast Cancer

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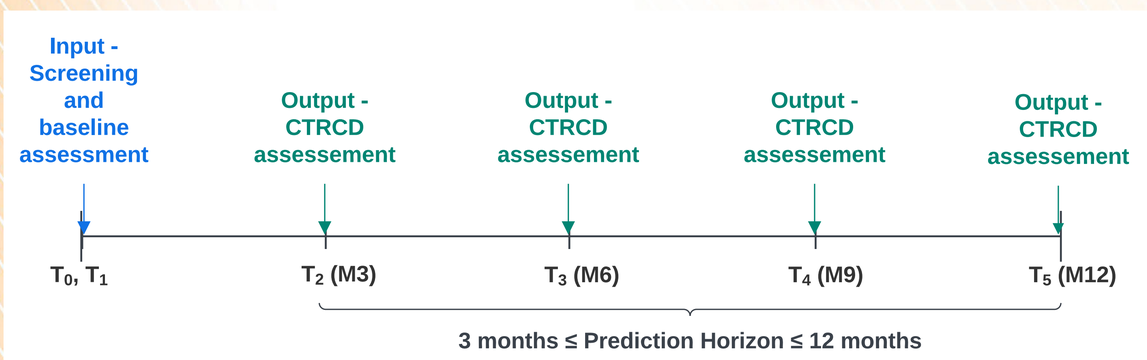
REQUIREMENTS

- **Pre-treatment risk assessment of cancer therapy-related cardiovascular toxicity (CTR-CVT)** can **inform cardiovascular prevention strategies** and **cancer treatment choices**, mitigating CTR-CVT risk and improving adherence to effective cancer treatments and overall survival [1].

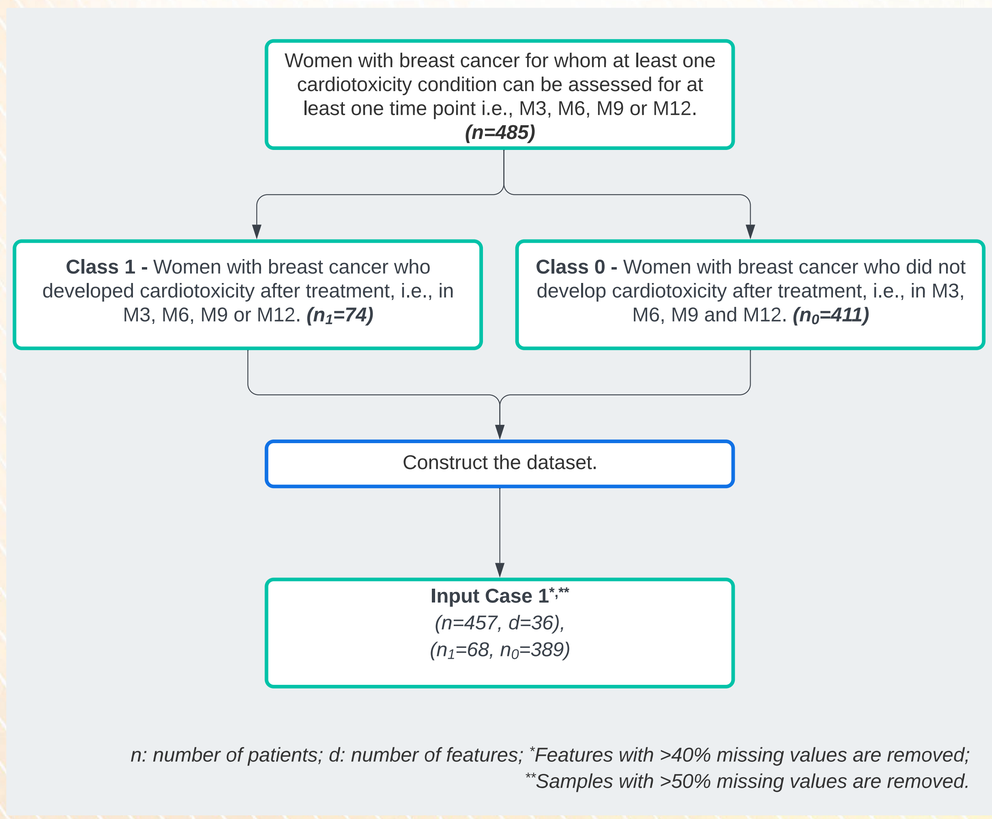
STUDY OBJECTIVE

- **To identify pre-treatment prognostic biomarkers** of **asymptomatic cancer therapy–related cardiac dysfunction (CTRCD)** in women **aged ≥55 years** diagnosed with **breast cancer** [2,3].



DATASET

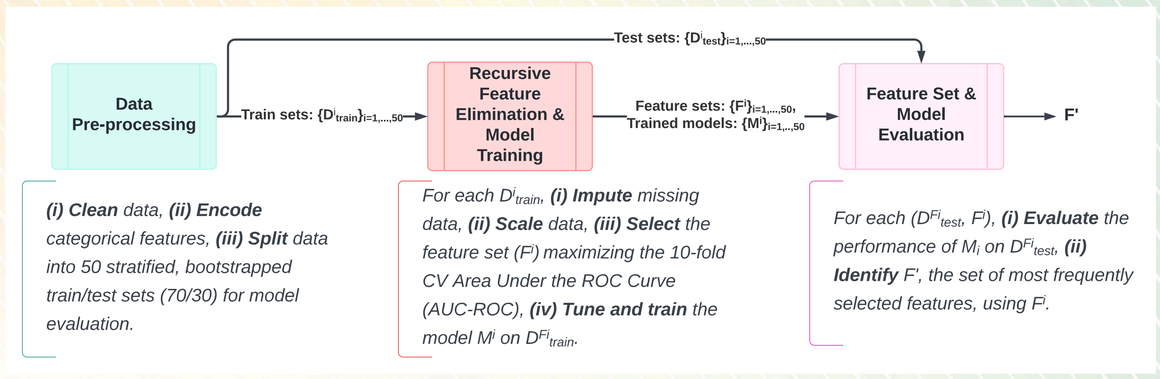
- **CARDIOCARE's Retrospective Data:** The dataset utilized in this study was generated via the CARDIOCARE's retrospective study [4].
- Patients were treated with **anthracyclines and/or anti-HER2 therapies** in adjuvant, neoadjuvant, or metastatic settings.
- **Clinical**, **cardiac imaging**, **biochemical markers**, **demographics**, and **medical history** were systematically collected at screening, baseline, and at 3, 6, 9, and 12 months following treatment initiation, when available.



*n: number of patients; d: number of features; *Features with >40% missing values are removed; **Samples with >50% missing values are removed.*

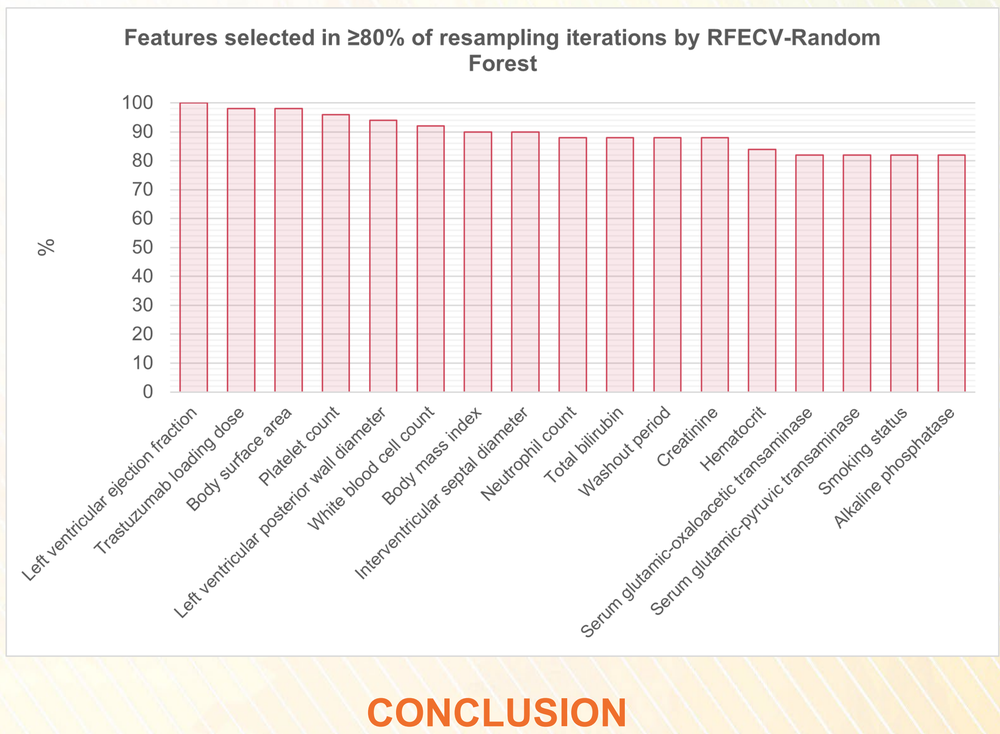
METHODS

- The identification of significant features acting as **prognostic biomarkers of asymptomatic CTRCD** is framed as a **feature selection problem**, addressed using a **Recursive Feature Elimination with Cross-Validation (RFECV)** strategy.



RESULTS

- The **RFECV-Random Forest model** achieved the highest prognostic performance (**ROC-AUC = 0.75 ± 0.07**) among six classifiers.
- Features selected in **>90%** of iterations, including **LVEF**, **trastuzumab loading dose**, **body surface area**, **BMI**, **platelet count**, **WBC count**, and **cardiac imaging parameters** (LV posterior wall and interventricular septal diameters), emerged as **strong prognostic biomarkers** for **asymptomatic CTRCD**.



CONCLUSION

- An **ML–based feature selection approach** identified a **reproducible set of pre-treatment biomarkers** predictive of **asymptomatic CTRCD** in women aged ≥55 years with breast cancer, achieving a mean **ROC-AUC of 0.75 ± 0.07**.
- The results support the utility of **integrating clinical, biochemical, and cardiac imaging data** into ML models for **pre-treatment risk stratification** in cardio-oncology, aligning with recent **ESC and IC-OS recommendations**.

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