# Predicting Incident Heart Failure from the Microbiome: The DREAM FINRISK challenge

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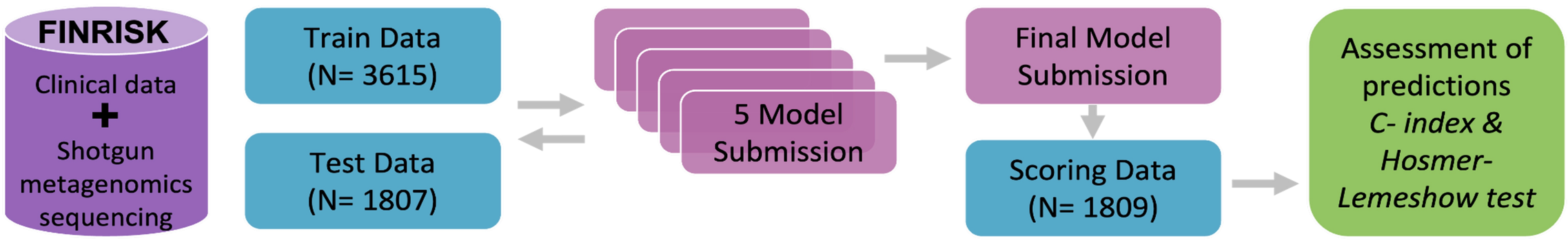


*Fig 1. Dream FINRISK Challenge Overview*

## 1. Motivation and Aim

Heart failure (HF) is a common syndrome resulting in the failure of the heart to pump blood with a lifetime risk of ~20%. Identifying individuals at risk early on is therefore of great medical relevance.

Several studies have found differences in **microbiome composition of HF patients** compared to controls. However, previous studies are limited by the low sample size (<100 HF patients) or lack longitudinal follow-up.

**DREAM Challenges** are competitions accessible to the whole scientific community to advance computational methods and support open collaboration. They are designed to address fundamental questions about systems biology and translational medicine.

## 2. FINRISK Dataset

The **DREAM FINRISK challenge** (Fig 1) focuses on using a combination of **microbiome** and **clinical data** to evaluate the potential of the **gut microbiome** for risk predictions over conventional risk factors in a large population study of Finnish adults[1,2] with 15+ years follow up. **493** out of **6902** participants suffer from HF (Fig 2).

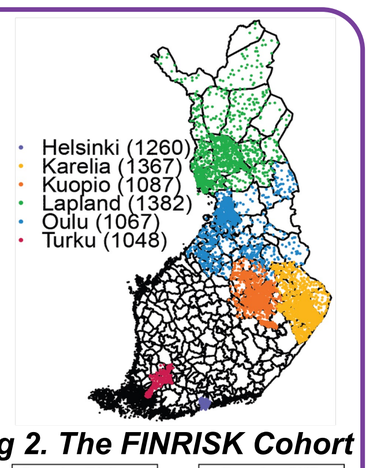


*Fig 2. The FINRISK Cohort*

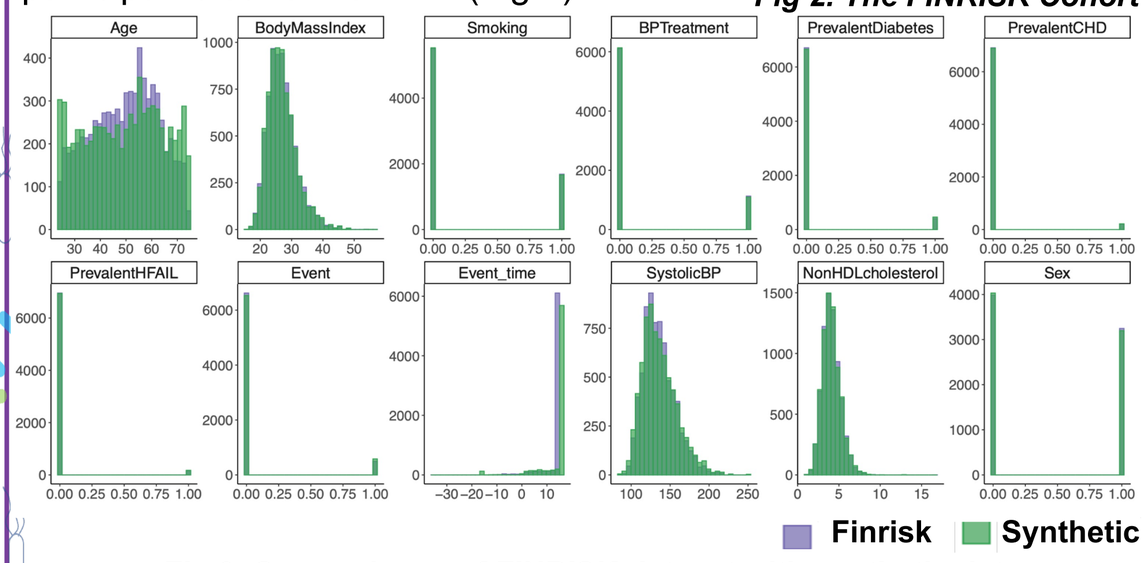


*Fig 3. Comparisons of FINRISK dataset with synthetic data.*

To protect the privacy of individuals, we provide synthetic data created based on multinormal draws from inverse rank normalized data that closely mimics the real data (Fig 3).

## 3. Baseline Model Results

We split the data to 3 groups (train, test, scoring) and used this setup to develop our baseline models:

- Model I: Cox model with only Age + Sex covariates
- Model II: Cox model with all clinical covariates
- Model III: Cox model with all clinical covariates + microbiome

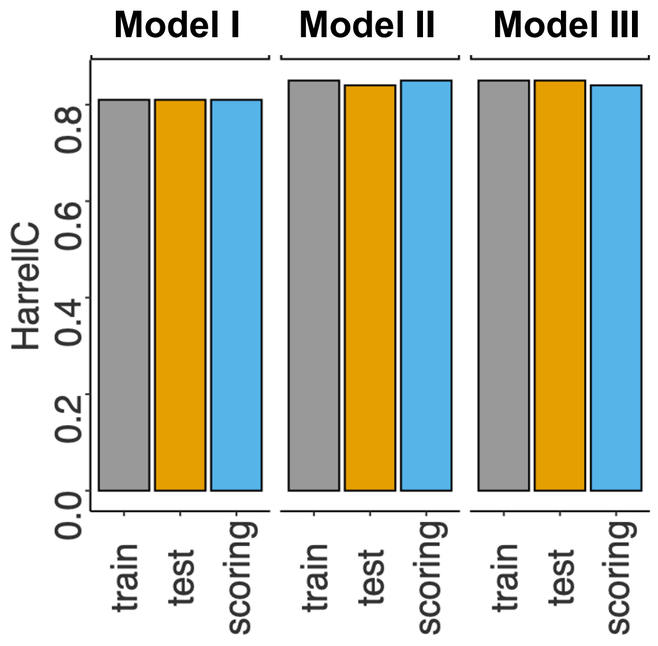


*Fig 4. Harrell's C index of baseline models*

We assess the **model performance** by Harrell's C index[3] and the **model calibration** with the Hosmer-Lemeshov test at 10 years of follow-up. Comparison of our models showed a microbial contribution to predictions, which overall increased the accuracy & the goodness of the model (Fig 4).

## 4. Conclusion

- The baseline models have high Harrel C scores (0.81- 0.85), which can be further improved. For the microbiome field, this is a unique opportunity for exploring **novel approaches for time-to-event analysis**.
- Additionally, this challenge provides a ground for the scientific community to contribute and advance our current understanding of the **incidence in heart failure and microbiome associations**.
- The challenge may also allow us to **detect high risk individuals earlier** and find new risk mitigation measures.

## Learn More

**Top teams will be invited**:

- to attend the *DREAM Conference* in USA, 2023
- to participate in manuscript design & writing & eligible for authorship

for the challenge page > **synapse.org/finrisk**

The DREAM challenge main organizer: COST action network ML4microbiome (CA18131; ml4microbiome.eu)

## References

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