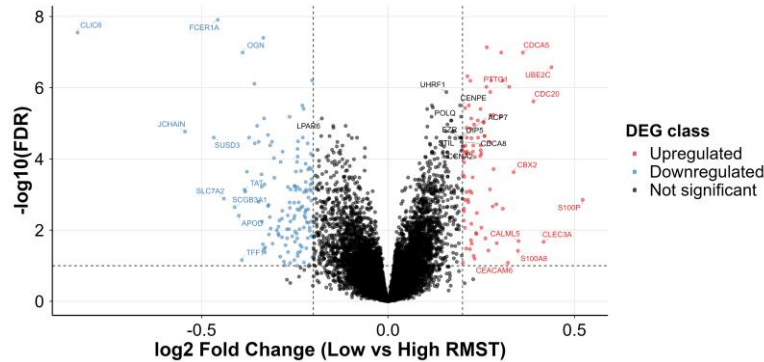
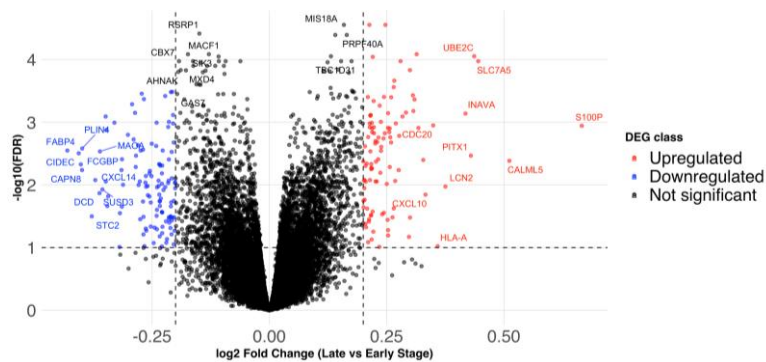
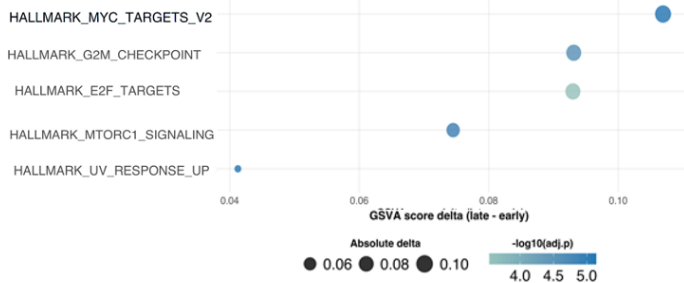


a**b**

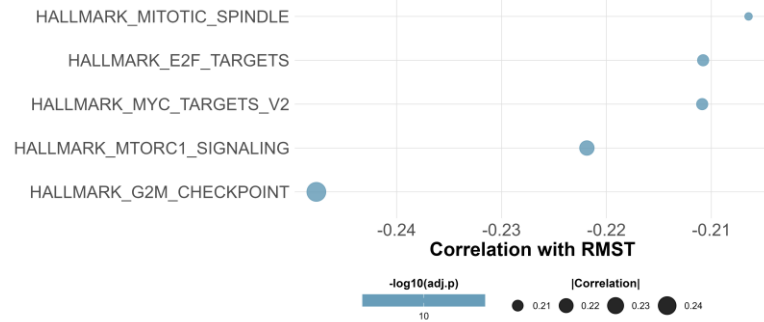
Breast cancer relevant GSVA ranking

Top 5 pathways by GSVA score contrast (late vs early)



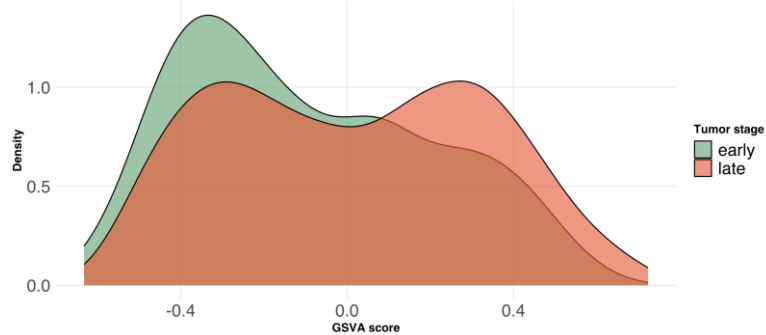
Top Breast Cancer Pathways by GSVA Ranking

Ranked by correlation with RMST pseudo-outcome

**c**

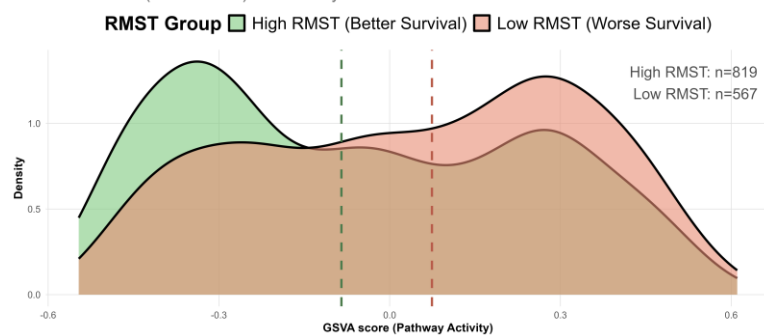
GSVA distribution for HALLMARK_MYC_TARGETS_V2

Treatment D (GSVA score)



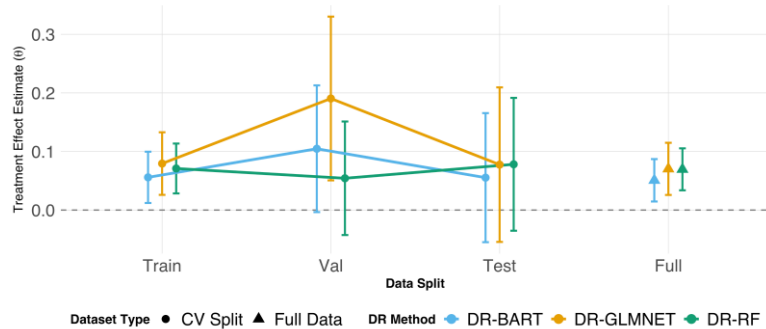
GSVA Distribution for HALLMARK_G2M_CHECKPOINT

Treatment D (GSVA score) stratified by RMST outcome

**d**

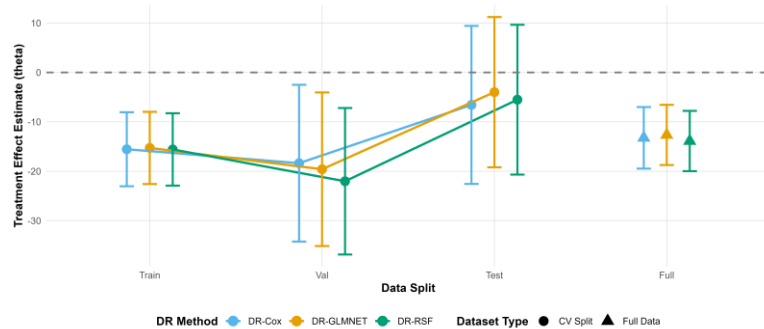
Model Stability of Tumor Stage Prediction Across Data Splits

Consistent estimates indicate robust causal effect

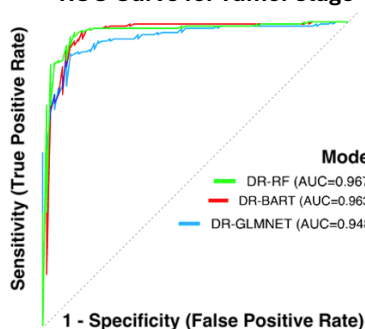


Model Stability Across Data Splits

Consistent estimates indicate robust causal effect

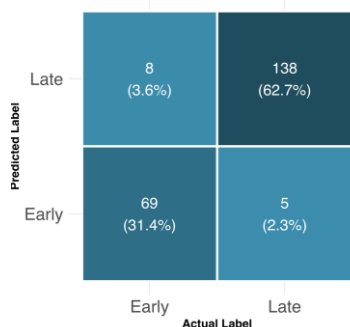
**e**

ROC Curve for Tumor stage

**f**

Confusion Matrix: DR-RF (Test)

Threshold: 0.629 (Youden)

**g**

Survival by Pathway Activity (Test Set)

HALLMARK_G2M_CHECKPOINT

