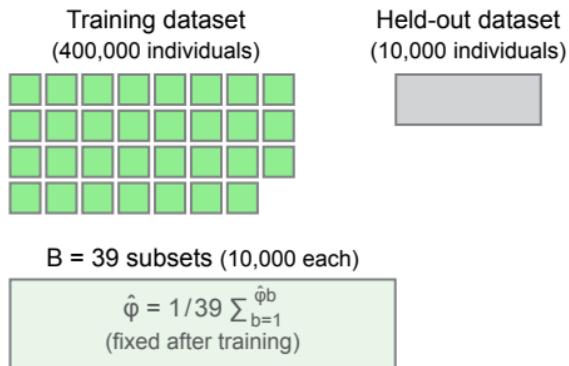


## A Retrospective analysis (Figs. 2–4)

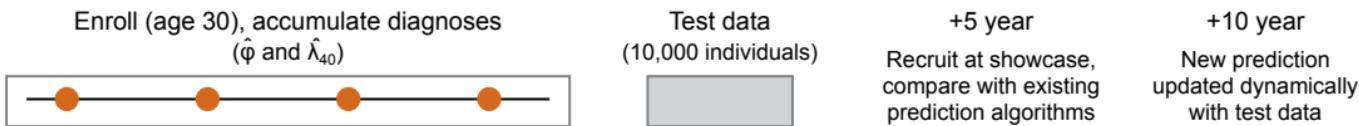
Training approach for  $\hat{\phi}$  and  $\hat{\lambda}$  estimation:

- Use bootstrap resampling for robust  $\hat{\phi}$  estimation
- Apply genetic mean correction for confounding variables
- $\hat{\Phi}_e$  represents estimate from single bootstrap sample



## B Retrospective analysis (Fig. 5)

Prediction evaluation with temporal censoring: estimate  $\hat{\lambda}_{40}$  on test data



## C Cross-study stability of retrospective estimates (Fig. 2D)

UKB

MGB

AOU

$\hat{\Phi}_{uk\beta}, \hat{\Psi}_{uk\beta}$

$\hat{\Phi}_{m\beta\gamma}, \hat{\Psi}_{m\beta\gamma}$

$\hat{\Phi}_{aou}, \hat{\Psi}_{aou}$