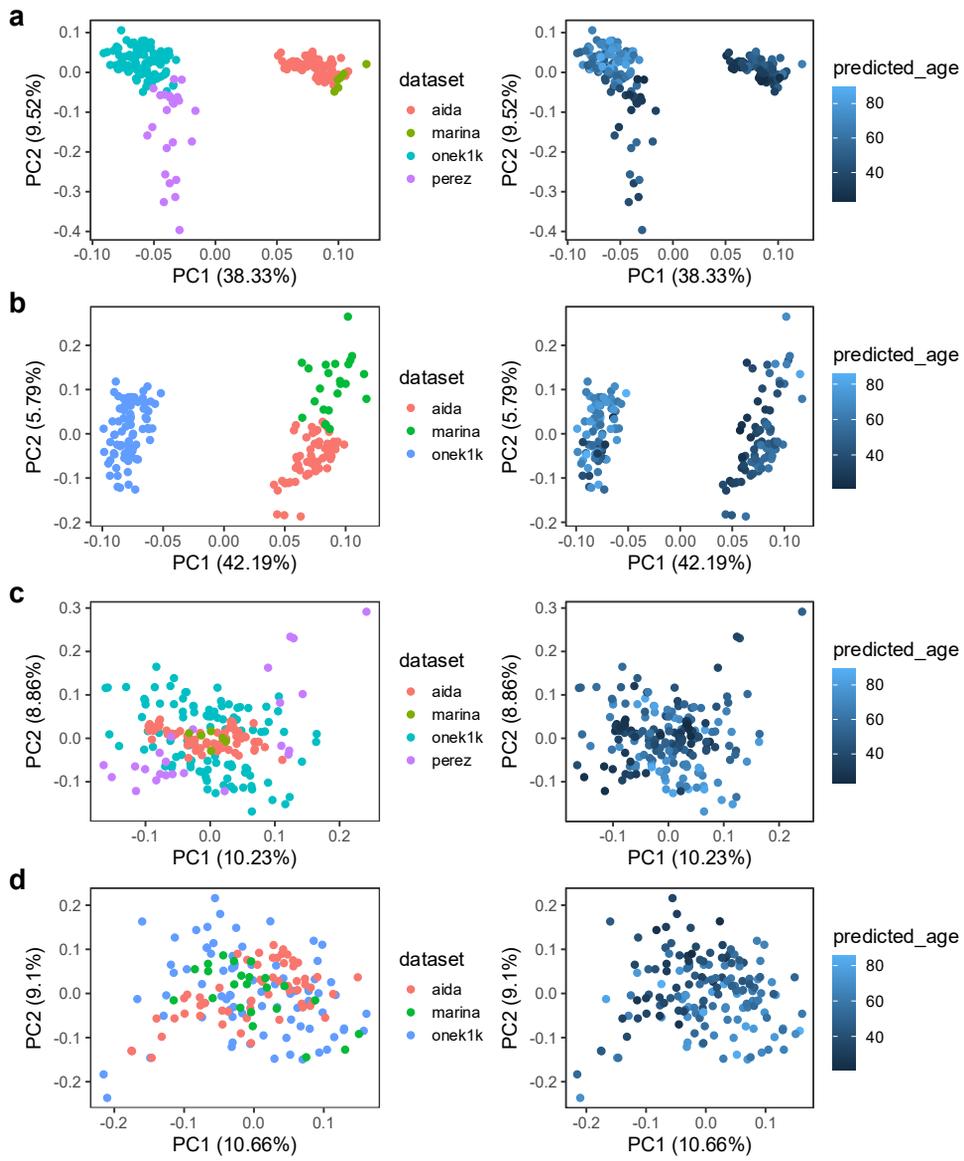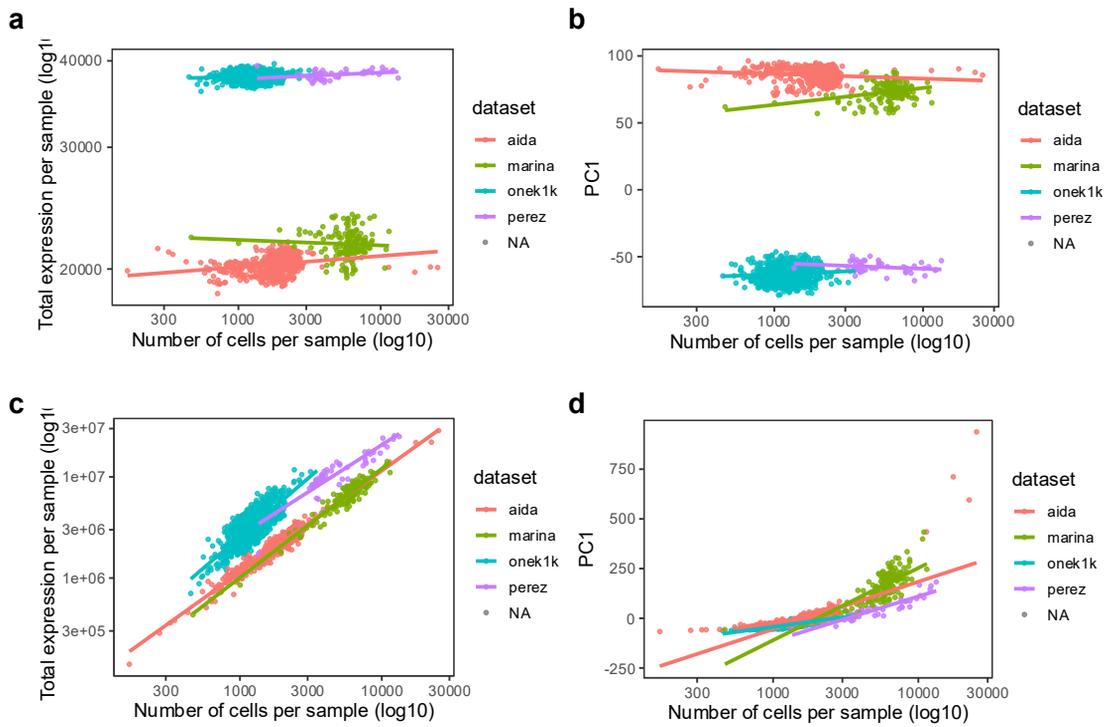**Supplementary Figure 1: Reproducibility of SAF trajectory clustering. a-c**, Final cluster trajectories for both-sex (**a**), female (**b**), and male (**c**) SAFs. **d-i**, Number of clusters and cluster trajectories across 10 independent clustering runs with different random seeds for both-sex (**d-e**), female (**f-g**), and male (**h-i**) SAFs.

Supplementary Figure 2: SHAP value correction for dataset batch effects. a, **b**, PCA of raw SHAP values colored by dataset identity and chronological age for female donors (female-specific clock) (**a**) and male donors (male-specific clock) (**b**). **c**, **d**, PCA of corrected SHAP values colored by dataset identity and chronological age for female donors (female-specific clock) (**c**) and male donors (male-specific clock) (**d**).

Supplementary Figure 3: Comparison of pseudobulk aggregation strategies. a-b, Correlation between cell count per sample and total pseudobulk expression (**a**) or PC1 of final pseudobulk matrix (**b**) when using average expression per cell. **b-c**, Correlation between cell count per sample and total pseudobulk expression (**c**) or PC1 of final pseudobulk matrix (**d**) when using summed counts.