



Figure 4: **Model Validation Results.** **Panel A:** time-dependent area under the receiver operating characteristic curve or AUC (measure of discrimination). AUC at year one is not shown because we do not intend to replace the confirmatory biopsy at year one. **Panel B:** calibration-at-large indicates model miscalibration. This is because solid lines depicting the non-parametric estimate of the cause-specific cumulative upgrading-risk [29], and dashed lines showing the average cause-specific cumulative upgrading-risk obtained using the joint model fitted to the PRIAS dataset, are not overlapping. Recalibrating the baseline hazard of upgrading resolved this issue (Supplementary Figure 6). Full names of Cohorts are *PRIAS*: Prostate Cancer International Active Surveillance, *Toronto*: University of Toronto Active Surveillance, *Hopkins*: Johns Hopkins Active Surveillance, *MSKCC*: Memorial Sloan Kettering Cancer Center Active Surveillance, *KCL*: King's College London Active Surveillance, *MUSIC*: Michigan Urological Surgery Improvement Collaborative Active Surveillance, *UCSF*: University of California San Francisco AS.