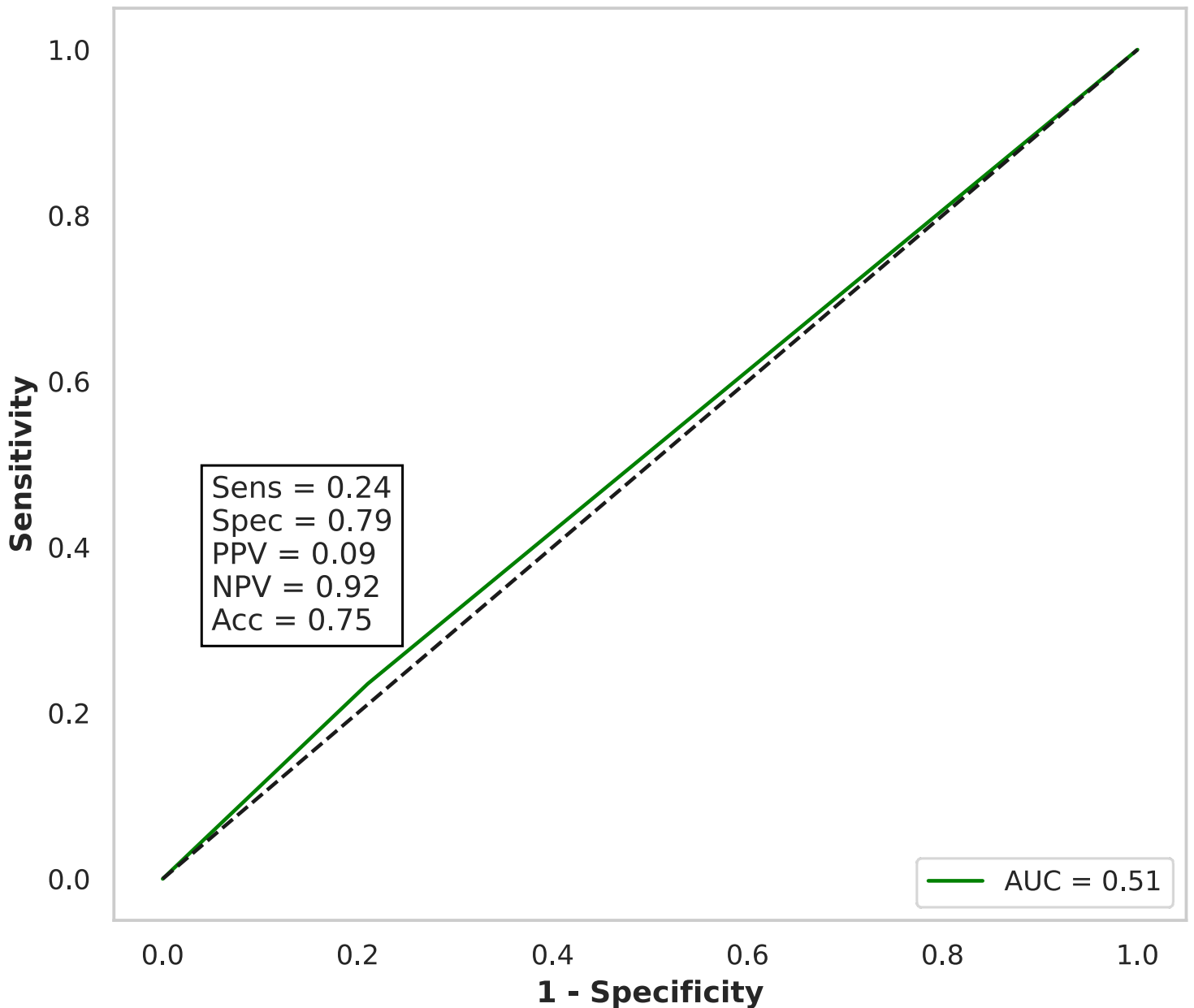
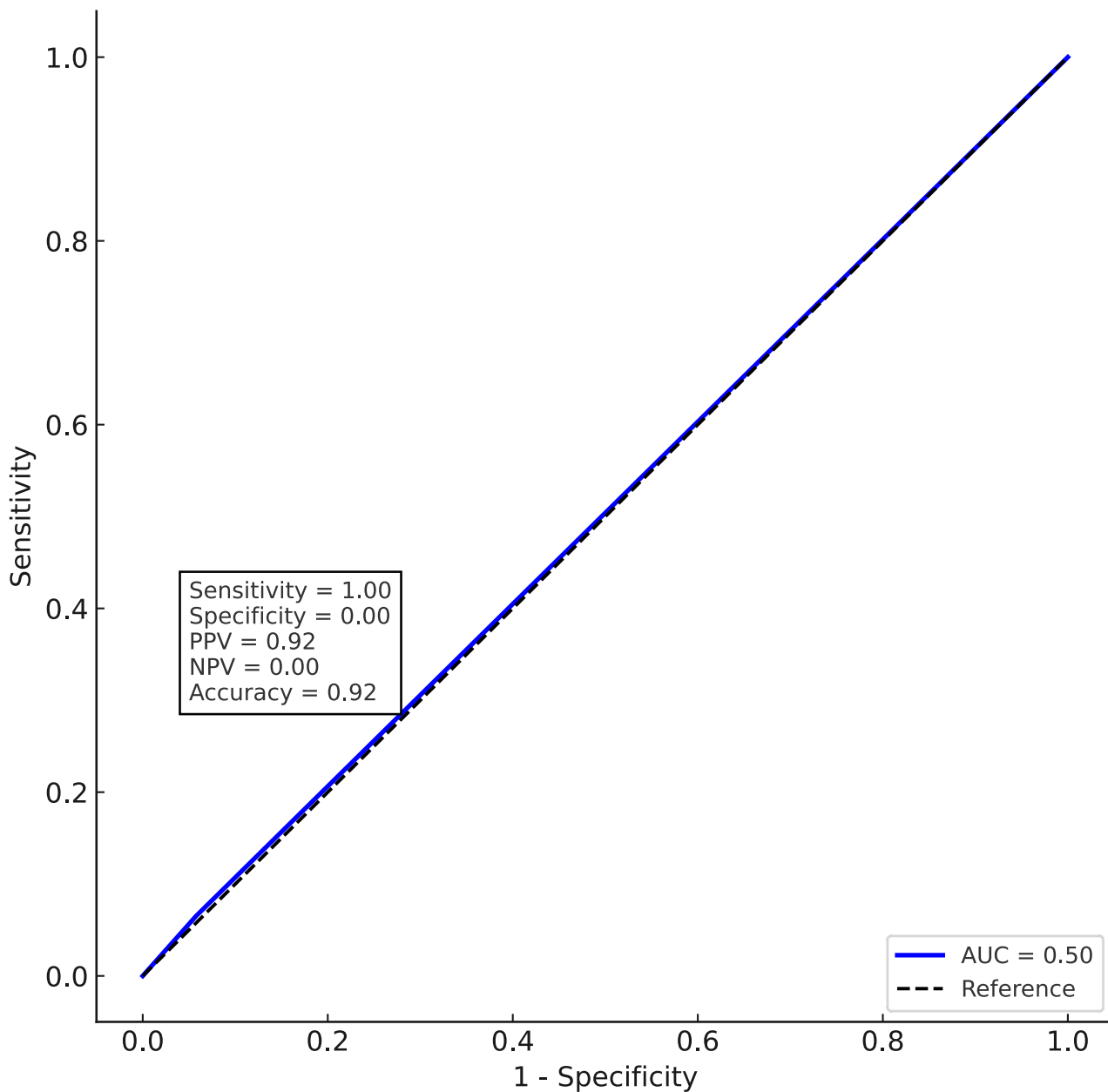


Supplementary Figure 1



Supplementary Figure 1. ROC curve assessing predictive value of HER2 positivity for early-onset BC. Receiver Operating Characteristic (ROC) curve evaluating whether HER2 positivity can distinguish women diagnosed with BC before age 40 from those diagnosed at ≥ 40 years. HER2 positivity showed minimal predictive utility, yielding an area under the curve (AUC) of **0.51**. At the default decision threshold of 0.5, the sensitivity (Sens) was **0.24**, specificity (Spec) **0.79**, positive predictive value (PPV) **0.09**, negative predictive value (NPV) **0.92**, and overall accuracy (Acc) **0.75**. These results demonstrate that HER2 positivity alone is not a reliable marker for age-stratified risk prediction in BC.

Supplementary Figure 2



Supplementary Figure 2. ROC curve evaluating the predictive utility of HER2 positivity status for BC diagnosis age ≥ 40 . The area under the curve (AUC) was 0.50, indicating no significant discriminative ability. The sensitivity was 1.00, specificity 0.00, positive predictive value (PPV) 0.92, negative predictive value (NPV) 0.00, and overall accuracy 0.92. These findings suggest HER2 positivity is not a reliable standalone marker for predicting BC in age ≥ 40 .