

Online Resource 1. Definitions of factors used in statistical analysis

Status	Definition
ER-positive	Guidelines from the American Society of Clinical Oncology (ASCO) and College of American Pathologists (CAP) recommend that nuclear staining should be 1% or more for ER to be considered to be positive.
HER2-positive	According to the 2013 American Society of Clinical Oncology (ASCO) guideline: a. If the immunohistochemical (IHC) result is 3+, the diagnosis is HER2-positive. b. If the IHC result is 2+, ISH should be recounted by an additional observer who is blinded to the previous ISH results. At least 20 cells that include the area of invasion with IHC 2+ staining should be counted.
Stage Classification	Tumor-Node-Metastasis (TNM)-based staging of breast cancers using the Union for International Cancer Control (UICC) 8th edition.
Nuclear grade	Follow general rules for clinical and pathological recording of breast cancer in the 17th edition of the Japanese Breast Cancer Society guidelines. The nuclear grade was 1, 2 and 3 when the sum of scores for nuclear atypia and those for mitotic counts were 2-3, 4 and 5-6, respectively.

ER estrogen receptor, *HER-2* human epidermal growth factor receptor 2
