**Table S1.** Cox univariable analysis for DDFS including all patients (n = 909). CI, confidence interval; IGKC, immunoglobulin kappa C; HER2, human epidermal growth factor receptor 2; TNBC, triple-negative breast cancer

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Hazard ratio** | **95% CI** | **P** |
| *IGKC*, continuous | 0.982 | 0.920 – 1.048 | 0.589 |
| *IGKC* |  |  |  |
| < median | 1.000 |  |  |
| ≥ median | 0.948 | 0.685 – 1.312 | 0.748 |
| *IGKC* |  |  |  |
| < 75th quantile | 1.000 |  |  |
| ≥ 75th quantile | 0.862 | 0.585 – 1.270 | 0.453 |
| Age |  |  |  |
| ≤ 50 years | 1.000 |  |  |
| > 50 years | 0.829 | 0.599 – 1.147 | 0.258 |
| ER status |  |  |  |
| Negative | 1.000 |  |  |
| Positive | 0.522 | 0.375 – 0.728 | <0.001 |
| PR status 1 |  |  |  |
| Negative | 1.000 |  |  |
| Positive | 0.667 | 0.482 – 0.922 | 0.014 |
| HER2 status |  |  |  |
| Negative | 1.000 |  |  |
| Positive | 1.744 | 1.233 – 2.469 | 0.002 |
| Molecular subtype |  |  |  |
| Luminal | 1.000 |  |  |
| TNBC | 2.354 | 1.545 – 3.587 | <0.001 |
| HER2+ | 2.143 | 1.476 – 3.112 | <0.001 |
| Ki67 2 |  |  |  |
| ≤ 20% | 1.000 |  |  |
| > 20% | 1.984 | 1.383 – 2.847 | <0.001 |
| pT stage 1 |  |  |  |
| pT1 | 1.000 |  |  |
| pT2-4 | 1.748 | 1.230 – 2.484 | 0.002 |
| pN stage |  |  |  |
| pN0 | 1.000 |  |  |
| pN1-3 | 2.149 | 1.053 – 4.382 | 0.035 |
| Grade 3 |  |  |  |
| Grade I | 1.000 |  |  |
| Grade II-III | 4.331 | 1.911 - 9.814 | <0.001 |

1 n = 908, 2 n = 809, 3 n = 869

**Table S2.** Cox multivariable analysis for DDFS (all patients). 868 patients had complete data for all variables and were included in the multivariable analysis. *IGKC* expression was dichotomized using the median **(a)** or the top quartile **(b)** as cutoff. The results for *IGKC* expression as a continuous variable are shown in Table 2. CI, confidence interval; IGKC, immunoglobulin kappa C; HER2, human epidermal growth factor receptor 2; TNBC, triple-negative breast cancer

**(a)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Hazard ratio** | **95% CI** | **P** |
| *IGKC* |  |  |  |
| < median | 1.000 |  |  |
| ≥ median | 0.815 | 0.580 – 1.145 | 0.238 |
| Age |  |  |  |
| ≤ 50 years | 1.000 |  |  |
| > 50 years | 0.899 | 0.643 – 1.257 | 0.533 |
| Molecular subtype |  |  |  |
| Luminal | 1.000 |  |  |
| TNBC | 2.467 | 1.557 – 3.909 | <0.001 |
| HER2+ | 2.007 | 1.355 – 2.972 | 0.001 |
| pT stage |  |  |  |
| pT1 | 1.000 |  |  |
| pT2-4 | 1.622 | 1.123 – 2.343 | 0.010 |
| pN stage |  |  |  |
| pN0 | 1.000 |  |  |
| pN1-3 | 4.175 | 1.908 – 9.135 | <0.001 |
| Grade |  |  |  |
| Grade I | 1.000 |  |  |
| Grade II-III | 2.834 | 1.219 – 6.592 | 0.016 |

**(b)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Hazard ratio** | **95% CI** | **P** |
| *IGKC* |  |  |  |
| < 75th quantile | 1.000 |  |  |
| ≥ 75th quantile | 0.619 | 0.410 – 0.934 | 0.022 |
| Age |  |  |  |
| ≤ 50 years | 1.000 |  |  |
| > 50 years | 0.904 | 0.646 – 1.263 | 0.553 |
| Molecular subtype |  |  |  |
| Luminal | 1.000 |  |  |
| TNBC | 2.689 | 1.690 – 4.279 | <0.001 |
| HER2+ | 2.087 | 1.410 – 3.090 | <0.001 |
| pT stage |  |  |  |
| pT1 | 1.000 |  |  |
| pT2-4 | 1.604 | 1.111 – 2.316 | 0.012 |
| pN stage |  |  |  |
| pN0 | 1.000 |  |  |
| pN1-3 | 4.322 | 1.974 – 9.464 | <0.001 |
| Grade |  |  |  |
| Grade I | 1.000 |  |  |
| Grade II-III | 2.979 | 1.282 – 6.924 | 0.011 |

**Table S3.** Cox univariable and multivariable analyses for DDFS in patients with TNBC. Median *IGKC* expression for the patients with TNBC **(a)** or the top quartile **(b)** was used as a cut-off to distinguish between low and high *IGKC*. 132 patients had data for IGKC and were included in the univariable analysis. 129 patients had complete data for all variables and were included in the multivariable analysis. CI, confidence interval; IGKC, immunoglobulin kappa C; HER2, human epidermal growth factor receptor 2

**(a)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Univariable analysis** | | | **Multivariable analysis** | | |
| **Variable** | **Hazard ratio** | **95% CI** | **P** | **Hazard ratio** | **95% CI** | **P** |
| *IGKC* |  |  |  |  |  |  |
| < median | 1.000 |  |  | 1.000 |  |  |
| ≥ median | 0.418 | 0.198 – 0.882 | 0.022 | 0.322 | 0.146 – 0.712 | 0.005 |
| Age |  |  |  |  |  |  |
| ≤ 50 years | 1.000 |  |  | 1.000 |  |  |
| > 50 years | 0.427 | 0.209 – 0.874 | 0.020 | 0.324 | 0.150 – 0.701 | 0.004 |
| pT stage |  |  |  |  |  |  |
| pT1 | 1.000 |  |  | 1.000 |  |  |
| pT2-4 | 0.839 | 0.388 – 1.813 | 0.654 | 1.469 | 0.630 – 3.427 | 0.373 |
| pN stage |  |  |  |  |  |  |
| pN0 | 1.000 |  |  | 1.000 |  |  |
| pN1-3 | 2.796 | 1.076 – 7.262 | 0.035 | 3.932 | 1.321 – 11.705 | 0.014 |
| Grade 1 |  |  |  |  |  |  |
| Grade I-II 2 | 1.000 |  |  | 1.000 |  |  |
| Grade III | 0.642 | 0.286 – 1.442 | 0.283 | 0.735 | 0.319 – 1.693 | 0.470 |

1 n = 129; 2 grade was dichotomized as I-II vs III since there was only one TNBC patient with a grade I tumor.

**(b)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Univariable analysis** | | | **Multivariable analysis** | | |
| **Variable** | **Hazard ratio** | **95% CI** | **P** | **Hazard ratio** | **95% CI** | **P** |
| *IGKC* |  |  |  |  |  |  |
| < 75th quantile | 1.000 |  |  | 1.000 |  |  |
| ≥ 75th quantile | 0.172 | 0.041 – 0.719 | 0.016 | 0.197 | 0.045 – 0.852 | 0.030 |
| Age |  |  |  |  |  |  |
| ≤ 50 years | 1.000 |  |  | 1.000 |  |  |
| > 50 years | 0.427 | 0.209 – 0.874 | 0.020 | 0.465 | 0.216 – 1.003 | 0.051 |
| pT stage |  |  |  |  |  |  |
| pT1 | 1.000 |  |  | 1.000 |  |  |
| pT2-4 | 0.839 | 0.388 – 1.813 | 0.654 | 1.193 | 0.510 – 2.789 | 0.684 |
| pN stage |  |  |  |  |  |  |
| pN0 | 1.000 |  |  | 1.000 |  |  |
| pN1-3 | 2.796 | 1.076 – 7.262 | 0.035 | 3.527 | 1.179 – 10.550 | 0.024 |
| Grade 1 |  |  |  |  |  |  |
| Grade I-II 2 | 1.000 |  |  | 1.000 |  |  |
| Grade III | 0.642 | 0.286 – 1.442 | 0.283 | 0.782 | 0.337 – 1.813 | 0.566 |

1 n = 129; 2 grade was dichotomized as I-II vs III since there was only one TNBC patient with a grade I tumor.

**Table S4:** Cox univariable and multivariable analysis for DDFS in patients with luminal breast cancer. 574 patients had data for *IGKC* and were included in the univariable analysis. 540 patients had complete data for all variables and were included in the multivariable analysis. *IGKC* expression was included as a continuous variable **(a)** or the median **(b)** or top quartile **(c)** of *IGKC* expression in patient with luminal breast cancer was used as a cut-off to distinguish between low and high *IGKC*. CI, confidence interval; IGKC, immunoglobulin kappa C; HER2, human epidermal growth factor receptor 2

**(a)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Univariable analysis** | | | **Multivariable analysis** | | |
| **Variable** | **Hazard ratio** | **95% CI** | **P** | **Hazard ratio** | **95% CI** | **P** |
| *IGKC* | 0.968 | 0.876 – 1.070 | 0.524 | 0.960 | 0.868 – 1.061 | 0.419 |
| Age |  |  |  |  |  |  |
| ≤ 50 years | 1.000 |  |  | 1.000 |  |  |
| > 50 years | 0.920 | 0.569 – 1.490 | 0.735 | 1.135 | 0.685 – 1.880 | 0.623 |
| pT stage 1 |  |  |  |  |  |  |
| pT1 | 1.000 |  |  | 1.000 |  |  |
| pT2-4 | 2.454 | 1.454 – 4.142 | 0.001 | 2.228 | 1.285 – 3.865 | 0.004 |
| pN stage |  |  |  |  |  |  |
| pN0 | 1.000 |  |  | 1.000 |  |  |
| pN1-3 | 3.171 | 0.440 – 22.847 | 0.252 | 4.208 | 0.574 – 30.832 | 0.157 |
| Grade 2 |  |  |  |  |  |  |
| Grade I | 1.000 |  |  | 1.000 |  |  |
| Grade II-III | 3.793 | 1.521 – 9.459 | 0.004 | 3.241 | 1.284 – 8.183 | 0.013 |

1 n = 573, 2 n = 541

**(b)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Univariable analysis** | | | **Multivariable analysis** | | |
| **Variable** | **Hazard ratio** | **95% CI** | **P** | **Hazard ratio** | **95% CI** | **P** |
| *IGKC* |  |  |  |  |  |  |
| < median | 1.000 |  |  | 1.000 |  |  |
| ≥ median | 1.000 | 0.619-1.614 | 0.999 | 0.970 | 0.592 – 1.592 | 0.906 |
| Age |  |  |  |  |  |  |
| ≤ 50 years | 1.000 |  |  | 1.000 |  |  |
| > 50 years | 0.920 | 0.569 – 1.490 | 0.735 | 1.137 | 0.686 – 1.884 | 0.618 |
| pT stage 1 |  |  |  |  |  |  |
| pT1 | 1.000 |  |  | 1.000 |  |  |
| pT2-4 | 2.454 | 1.454 – 4.142 | 0.001 | 2.246 | 1.296 – 3.895 | 0.004 |
| pN stage |  |  |  |  |  |  |
| pN0 | 1.000 |  |  | 1.000 |  |  |
| pN1-3 | 3.171 | 0.440 – 22.847 | 0.252 | 4.257 | 0.581 – 31.182 | 0.154 |
| Grade 2 |  |  |  |  |  |  |
| Grade I | 1.000 |  |  | 1.000 |  |  |
| Grade II-III | 3.793 | 1.521 – 9.459 | 0.004 | 3.234 | 1.280 – 8.169 | 0.013 |

1 n = 573, 2 n = 541

**(c)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Univariable analysis** | | | **Multivariable analysis** | | |
| **Variable** | **Hazard ratio** | **95% CI** | **P** | **Hazard ratio** | **95% CI** | **P** |
| *IGKC* |  |  |  |  |  |  |
| < 75th quantile | 1.000 |  |  | 1.000 |  |  |
| ≥ 75th quantile | 0.634 | 0.339 – 1.184 | 0.153 | 0.578 | 0.301 – 1.109 | 0.099 |
| Age |  |  |  |  |  |  |
| ≤ 50 years | 1.000 |  |  | 1.000 |  |  |
| > 50 years | 0.920 | 0.569 – 1.490 | 0.735 | 1.138 | 0.687 – 1.884 | 0.615 |
| pT stage 1 |  |  |  |  |  |  |
| pT1 | 1.000 |  |  | 1.000 |  |  |
| pT2-4 | 2.454 | 1.454 – 4.142 | 0.001 | 2.249 | 1.298 – 3.895 | 0.004 |
| pN stage |  |  |  |  |  |  |
| pN0 | 1.000 |  |  | 1.000 |  |  |
| pN1-3 | 3.171 | 0.440 – 22.847 | 0.252 | 4.309 | 0.589 – 31.538 | 0.150 |
| Grade 2 |  |  |  |  |  |  |
| Grade I | 1.000 |  |  | 1.000 |  |  |
| Grade II-III | 3.793 | 1.521 – 9.459 | 0.004 | 3.305 | 1.308 – 8.349 | 0.011 |

1 n = 573, 2 n = 541

**Table S5:** Cox univariable and multivariable analysis for DDFS in patients with HER2-positive breast cancer. 203 patients had data for *IGKC* and were included in the univariable analysis. 199 patients had complete data for all variables and were included in the multivariable analysis. *IGKC* expression was included as a continuous variable **(a)** or the median **(b)** or top quartile **(c)** of *IGKC* expression in HER2-positive patients was used as a cut-off to distinguish between low and high *IGKC*. CI, confidence interval; IGKC, immunoglobulin kappa C; HER2, human epidermal growth factor receptor 2

**(a)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Univariable analysis** | | | **Multivariable analysis** | | |
| **Variable** | **Hazard ratio** | **95% CI** | **P** | **Hazard ratio** | **95% CI** | **P** |
| *IGKC* | 0.944 | 0.837 – 1.064 | 0.343 | 0.933 | 0.826 – 1.055 | 0.271 |
| Age |  |  |  |  |  |  |
| ≤ 50 years | 1.000 |  |  | 1.000 |  |  |
| > 50 years | 1.159 | 0.650 – 2.067 | 0.616 | 1.219 | 0.675 – 2.201 | 0.512 |
| pT stage |  |  |  |  |  |  |
| pT1 | 1.000 |  |  | 1.000 |  |  |
| pT2-4 | 1.053 | 0.576 – 1.926 | 0.867 | 1.272 | 0.688 – 2.351 | 0.442 |
| pN stage |  |  |  |  |  |  |
| pN0 | 1.000 |  |  | 1.000 |  |  |
| pN1-3 | 4.322 | 1.048 – 17.820 | 0.043 | 4.863 | 1.155 – 20.479 | 0.031 |
| Grade 1 |  |  |  |  |  |  |
| Grade I-II 2 | 1.000 |  |  | 1.000 |  |  |
| Grade III | 0.817 | 0.452 – 1.477 | 0.504 | 0.910 | 0.501 – 1.653 | 0.757 |

1 n = 199; 2 grade was dichotomized as I-II vs III since there was only five HER2-positive patients with a grade I tumor.

**(b)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Univariable analysis** | | | **Multivariable analysis** | | |
| **Variable** | **Hazard ratio** | **95% CI** | **P** | **Hazard ratio** | **95% CI** | **P** |
| *IGKC* |  |  |  |  |  |  |
| < median | 1.000 |  |  | 1.000 |  |  |
| ≥ median | 0.688 | 0.386-1.226 | 0.204 | 0.730 | 0.406 – 1.315 | 0.295 |
| Age |  |  |  |  |  |  |
| ≤ 50 years | 1.000 |  |  | 1.000 |  |  |
| > 50 years | 1.159 | 0.650 – 2.067 | 0.616 | 1.230 | 0.680 – 2.225 | 0.494 |
| pT stage |  |  |  |  |  |  |
| pT1 | 1.000 |  |  | 1.000 |  |  |
| pT2-4 | 1.053 | 0.576 – 1.926 | 0.867 | 1.269 | 0.687 – 2.344 | 0.447 |
| pN stage |  |  |  |  |  |  |
| pN0 | 1.000 |  |  | 1.000 |  |  |
| pN1-3 | 4.322 | 1.048 – 17.820 | 0.043 | 4.584 | 1.091 – 19.258 | 0.038 |
| Grade 1 |  |  |  |  |  |  |
| Grade I-II 2 | 1.000 |  |  | 1.000 |  |  |
| Grade III | 0.817 | 0.452 – 1.477 | 0.504 | 0.930 | 0.510 – 1.696 | 0.813 |

1 n = 199; 2 grade was dichotomized as I-II vs III since there was only five HER2-positive patients with a grade I tumor.

**(c)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Univariable analysis** | | | **Multivariable analysis** | | |
| **Variable** | **Hazard ratio** | **95% CI** | **P** | **Hazard ratio** | **95% CI** | **P** |
| *IGKC* |  |  |  |  |  |  |
| < 75th quantile | 1.000 |  |  | 1.000 |  |  |
| ≥ 75th quantile | 0.949 | 0.527 – 1.709 | 0.862 | 0.910 | 0.500 – 1.656 | 0.757 |
| Age |  |  |  |  |  |  |
| ≤ 50 years | 1.000 |  |  | 1.000 |  |  |
| > 50 years | 1.159 | 0.650 – 2.067 | 0.616 | 1.208 | 0.669 – 2.183 | 0.531 |
| pT stage |  |  |  |  |  |  |
| pT1 | 1.000 |  |  | 1.000 |  |  |
| pT2-4 | 1.053 | 0.576 – 1.926 | 0.867 | 1.264 | 0.684 – 2.336 | 0.455 |
| pN stage |  |  |  |  |  |  |
| pN0 | 1.000 |  |  | 1.000 |  |  |
| pN1-3 | 4.322 | 1.048 – 17.820 | 0.043 | 4.718 | 1.118 – 19.907 | 0.035 |
| Grade 1 |  |  |  |  |  |  |
| Grade I-II 2 | 1.000 |  |  | 1.000 |  |  |
| Grade III | 0.817 | 0.452 – 1.477 | 0.504 | 0.909 | 0.499 – 1.655 | 0.754 |

1 n = 199; 2 grade was dichotomized as I-II vs III since there was only five HER2-positive patients with a grade I tumor.