# **Table S1.** Detailed breast cancer specific survival rates according to hormone receptor subtype

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Follow up time | 　 | ER(+)/PR(+) | 　 | ER(+)/PR(-) | 　 | ER(-)/PR(+) | 　 | ER(-)/PR(-) | 　 | ER/PR Unknown | 　 | Total |
| 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate |
|  60 months | 　 | 496,279  | 17,834  | 95.3% | 　 | 86,858  | 6,563  | 90.6% | 　 | 11,545  | 1,442  | 85.7% | 　 | 135,441  | 20,653  | 82.0% | 　 | 80,464  | 7,298  | 90.2% | 　 | 810,587  | 53,790  | 91.8% |
|  120 months | 　 | 293,456  | 31,981  | 89.3% | 　 | 51,660  | 9,929  | 83.2% | 　 | 7,499  | 1,918  | 79.6% | 　 | 76,512  | 24,736  | 76.7% | 　 | 61,764  | 10,984  | 84.2% | 　 | 490,891  | 79,548  | 85.8% |
|  180 months | 　 | 146,270  | 37,678  | 84.3% | 　 | 25,938  | 10,974  | 78.4% | 　 | 4,988  | 2,105  | 75.9% | 　 | 41,181  | 25,677  | 74.2% | 　 | 43,296  | 12,636  | 80.1% | 　 | 261,673  | 89,070  | 81.4% |
|  240 months | 　 | 53,455  | 39,420  | 79.7% | 　 | 8,937  | 11,223  | 74.8% | 　 | 2,749  | 2,187  | 72.8% | 　 | 16,168  | 25,974  | 72.1% | 　 | 20,117  | 13,181  | 76.7% | 　 | 101,426  | 91,985  | 77.6% |
|  300 months | 　 | 15,724  | 39,796  | 76.1% | 　 | 2,808  | 11,265  | 72.8% | 　 | 1,224  | 2,208  | 70.5% | 　 | 5,704  | 26,048  | 70.3% | 　 | 7,315  | 13,322  | 74.1% | 　 | 32,775  | 92,639  | 74.8% |

Abbreviations: ER, estrogen receptor; PR, progesterone receptor.

\*Cumulative number of events.

# **Table S2.** Detailed breast cancer specific survival rates according to hormone receptor, estrogen receptor, and progesterone receptor status

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Follow up time | 　 | Hormone receptor (-) | 　 | Hormone receptor (+) | 　 | Hormone receptor unknown | 　 | Total |
| 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate |
|  60 months | 　 | 135,441  | 20,653  | 82.0% | 　 | 607,321  | 26,596  | 94.4% | 　 | 67,825  | 6,541  | 89.6% | 　 | 810,587  | 53,790  | 91.8% |
|  120 months | 　 | 76,512  | 24,736  | 76.7% | 　 | 363,027  | 45,185  | 88.2% | 　 | 51,352  | 9,627  | 83.6% | 　 | 490,891  | 79,548  | 85.8% |
|  180 months | 　 | 41,181  | 25,677  | 74.2% | 　 | 184,027  | 52,397  | 83.2% | 　 | 36,465  | 10,996  | 79.6% | 　 | 261,673  | 89,070  | 81.4% |
|  240 months | 　 | 16,168  | 25,974  | 72.1% | 　 | 68,211  | 54,561  | 78.9% | 　 | 17,047  | 11,450  | 76.3% | 　 | 101,426  | 91,985  | 77.6% |
|  300 months | 　 | 5,704  | 26,048  | 70.3% | 　 | 20,747  | 55,009  | 75.7% | 　 | 6,324  | 11,582  | 73.6% | 　 | 32,775  | 92,639  | 74.8% |
| 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 |
| Follow up time | 　 | ER(-) | 　 | ER(+) | 　 | ER unknown | 　 | Total |
| 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate |
|  60 months | 　 | 148,640  | 22,365  | 82.3% | 　 | 594,836  | 25,052  | 94.6% | 　 | 67,111  | 6,373  | 89.7% | 　 | 810,587  | 53,790  | 91.8% |
|  120 months | 　 | 85,234  | 26,995  | 77.0% | 　 | 354,762  | 43,113  | 88.4% | 　 | 50,895  | 9,440  | 83.7% | 　 | 490,891  | 79,548  | 85.8% |
|  180 months | 　 | 47,089  | 28,150  | 74.3% | 　 | 178,440  | 50,116  | 83.3% | 　 | 36,144  | 10,804  | 79.7% | 　 | 261,673  | 89,070  | 81.4% |
|  240 months | 　 | 19,472  | 28,550  | 72.0% | 　 | 65,087  | 52,183  | 79.0% | 　 | 16,867  | 11,252  | 76.4% | 　 | 101,426  | 91,985  | 77.6% |
|  300 months | 　 | 7,238  | 28,649  | 70.2% | 　 | 19,297  | 52,606  | 75.7% | 　 | 6,240  | 11,384  | 73.7% | 　 | 32,775  | 92,639  | 74.8% |
| 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 |
| Follow up time | 　 | PR(-) | 　 | PR(+) | 　 | PR unknown | 　 | Total |
| 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate |
|  60 months | 　 | 223,254  | 27,374  | 85.3% | 　 | 508,764  | 19,378  | 95.1% | 　 | 78,569  | 7,038  | 90.4% | 　 | 810,587  | 53,790  | 91.8% |
|  120 months | 　 | 128,849  | 34,862  | 79.2% | 　 | 301,721  | 34,053  | 89.0% | 　 | 60,321  | 10,633  | 84.3% | 　 | 490,891  | 79,548  | 85.8% |
|  180 months | 　 | 67,560  | 36,860  | 75.9% | 　 | 151,857  | 39,959  | 84.1% | 　 | 42,256  | 12,251  | 80.2% | 　 | 261,673  | 89,070  | 81.4% |
|  240 months | 　 | 25,343  | 37,412  | 73.3% | 　 | 56,579  | 41,798  | 79.6% | 　 | 19,504  | 12,775  | 76.8% | 　 | 101,426  | 91,985  | 77.6% |
|  300 months | 　 | 8,656  | 37,532  | 71.3% | 　 | 17,174  | 42,199  | 76.1% | 　 | 6,945  | 12,908  | 74.3% | 　 | 32,775  | 92,639  | 74.8% |

Abbreviations: ER, estrogen receptor; PR, progesterone receptor.

\*Cumulative number of events.

# **Table S3.** Detailed breast cancer specific survival rates according to hormone receptor subtype in each stage group

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Follow up time | 　 | ER(+)/PR(+) | 　 | ER(+)/PR(-) | 　 | ER(-)/PR(+) | 　 | ER(-)/PR(-) | 　 | ER/PR Unknown | 　 | Total |
| 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate | 　 | Subject No | Event No\* | Rate |
| Stage I | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 |
|  60 months | 　 | 267,806  | 3,183  | 98.4% | 　 | 41,934  | 901  | 97.3% | 　 | 4,746  | 188  | 95.5% | 　 | 50,106  | 2,438  | 94.1% | 　 | 41,691  | 1,048  | 97.3% | 　 | 406,283  | 7,758  | 97.6% |
|  120 months | 　 | 163,398  | 6,621  | 95.7% | 　 | 27,471  | 1,678  | 93.8% | 　 | 3,573  | 305  | 92.0% | 　 | 32,943  | 3,533  | 90.3% | 　 | 35,092  | 2,105  | 94.0% | 　 | 262,477  | 14,242  | 94.5% |
|  180 months | 　 | 84,285  | 8,488  | 92.6% | 　 | 14,651  | 2,039  | 90.5% | 　 | 2,547  | 357  | 89.6% | 　 | 18,340  | 3,863  | 88.0% | 　 | 25,616  | 2,719  | 91.1% | 　 | 145,439  | 17,466  | 91.5% |
|  240 months | 　 | 31,745  | 9,177  | 89.2% | 　 | 5,278  | 2,144  | 87.5% | 　 | 1,465  | 389  | 87.0% | 　 | 7,455  | 3,989  | 85.6% | 　 | 12,321  | 2,969  | 88.3% | 　 | 58,264  | 18,668  | 88.5% |
|  300 months | 　 | 9,360  | 9,346  | 86.1% | 　 | 1,691  | 2,169  | 85.3% | 　 | 671  | 396  | 85.0% | 　 | 2,665  | 4,021  | 83.8% | 　 | 4,619  | 3,043  | 85.6% | 　 | 19,006  | 18,975  | 85.8% |
| Stage II | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 |
|  60 months | 　 | 171,694  | 6,489  | 95.0% | 　 | 31,836  | 2,518  | 89.9% | 　 | 4,733  | 549  | 86.3% | 　 | 59,572  | 8,381  | 83.1% | 　 | 27,543  | 2,567  | 89.8% | 　 | 295,378  | 20,504  | 91.3% |
|  120 months | 　 | 99,786  | 12,246  | 87.8% | 　 | 18,088  | 3,948  | 80.8% | 　 | 2,935  | 741  | 79.9% | 　 | 33,530  | 10,183  | 77.6% | 　 | 20,599  | 4,001  | 82.8% | 　 | 174,938  | 31,119  | 84.3% |
|  180 months | 　 | 48,910  | 14,628  | 81.5% | 　 | 8,760  | 4,374  | 75.1% | 　 | 1,881  | 823  | 75.6% | 　 | 17,961  | 10,607  | 75.0% | 　 | 14,065  | 4,656  | 77.8% | 　 | 91,577  | 35,088  | 79.1% |
|  240 months | 　 | 17,211  | 15,315  | 76.1% | 　 | 2,869  | 4,473  | 70.9% | 　 | 1,004  | 854  | 72.3% | 　 | 6,896  | 10,719  | 73.1% | 　 | 6,264  | 4,854  | 73.8% | 　 | 34,244  | 36,215  | 74.9% |
|  300 months | 　 | 5,080  | 15,455  | 72.3% | 　 | 865  | 4,484  | 69.1% | 　 | 434  | 863  | 69.9% | 　 | 2,435  | 10,750  | 71.2% | 　 | 2,127  | 4,900  | 71.5% | 　 | 10,941  | 36,452  | 72.0% |
| Stage III | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 |
|  60 months | 　 | 56,779  | 8,162  | 81.9% | 　 | 13,088  | 3,144  | 70.7% | 　 | 2,066  | 705  | 61.8% | 　 | 25,763  | 9,834  | 56.0% | 　 | 11,230  | 3,683  | 64.6% | 　 | 108,926  | 25,528  | 72.1% |
|  120 months | 　 | 30,272  | 13,114  | 64.9% | 　 | 6,101  | 4,303  | 54.2% | 　 | 991  | 872  | 49.9% | 　 | 10,039  | 11,020  | 48.2% | 　 | 6,073  | 4,878  | 50.5% | 　 | 53,476  | 34,187  | 57.8% |
|  180 months | 　 | 13,075  | 14,562  | 54.9% | 　 | 2,527  | 4,561  | 46.3% | 　 | 560  | 925  | 44.1% | 　 | 4,880  | 11,207  | 45.6% | 　 | 3,615  | 5,261  | 43.7% | 　 | 24,657  | 36,516  | 50.2% |
|  240 months | 　 | 4,499  | 14,928  | 47.8% | 　 | 790  | 4,606  | 42.1% | 　 | 280  | 944  | 40.2% | 　 | 1,817  | 11,266  | 43.2% | 　 | 1,532  | 5,358  | 39.6% | 　 | 8,918  | 37,102  | 45.1% |
|  300 months | 　 | 1,284  | 14,995  | 42.7% | 　 | 252  | 4,612  | 40.6% | 　 | 119  | 949  | 37.3% | 　 | 604  | 11,277  | 41.8% | 　 | 569  | 5,379  | 37.0% | 　 | 2,828  | 37,212  | 41.7% |

Abbreviations: ER, estrogen receptor; PR, progesterone receptor.

\*Cumulative number of events.

# **Table S4.** Univariable and multivariable analyses for estrogen receptor and progesterone receptor

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Characteristics | 　 | Univariable Analysis | 　 | Multivariable Analysis\* |
| 　 | HR | 　 | CI (95%) | 　 | *p* | 　 | HR | 　 | CI (95%) | 　 | *p* |
| T category | 　 | 　 | 　 | 　 | 　 | 　 | <0.001 | 　 | 　 | 　 | 　 | 　 | 　 | <0.001 |
|  T1 | 　 | Reference | 　 | 　 | 　 | 　 | 　 | 　 | Reference | 　 | 　 | 　 | 　 | 　 |
|  T2 | 　 | 3.010  | 　 | 2.966  | 3.055  | 　 | <0.001 | 　 | 1.995  | 　 | 1.953  | 2.038  | 　 | <0.001 |
|  T3 | 　 | 5.344  | 　 | 5.225  | 5.466  | 　 | <0.001 | 　 | 2.875  | 　 | 2.786  | 2.968  | 　 | <0.001 |
|  T4 | 　 | 11.413  | 　 | 11.161  | 11.671  | 　 | <0.001 | 　 | 4.400  | 　 | 4.253  | 4.552  | 　 | <0.001 |
| N category | 　 | 　 | 　 | 　 | 　 | 　 | <0.001 | 　 | 　 | 　 | 　 | 　 | 　 | <0.001 |
|  N0 | 　 | Reference | 　 | 　 | 　 | 　 | 　 | 　 | Reference | 　 | 　 | 　 | 　 | 　 |
|  N1 | 　 | 2.474  | 　 | 2.435  | 2.514  | 　 | <0.001 | 　 | 1.931  | 　 | 1.889  | 1.974  | 　 | <0.001 |
|  N2 | 　 | 5.288  | 　 | 5.190  | 5.388  | 　 | <0.001 | 　 | 3.351  | 　 | 3.260  | 3.444  | 　 | <0.001 |
|  N3 | 　 | 9.484  | 　 | 9.295  | 9.676  | 　 | <0.001 | 　 | 5.265  | 　 | 5.110  | 5.425  | 　 | <0.001 |
| ER | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 |   |
|  Negative | 　 | Reference | 　 | 　 | 　 | 　 | 　 | 　 | Reference | 　 | 　 | 　 | 　 | 　 |
|  Positive | 　 | 0.461  | 　 | 0.454  | 0.467  | 　 | <0.001 | 　 | 0.750  | 　 | 0.731  | 0.769  | 　 | <0.001　 |
| PR | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 |   |
|  Negative | 　 | Reference | 　 | 　 | 　 | 　 | 　 | 　 | Reference | 　 | 　 | 　 | 　 | 　 |
|  Positive | 　 | 0.489  | 　 | 0.483  | 0.496  | 　 | <0.001 | 　 | 0.728  | 　 | 0.711  | 0.746  | 　 | <0.001 |
| Histologic grade | 　 | 　 | 　 | 　 | 　 | 　 | <0.001 | 　 | 　 | 　 | 　 | 　 | 　 | <0.001 |
|  Well differentiated | 　 | Reference | 　 | 　 | 　 | 　 | 　 | 　 | Reference | 　 | 　 | 　 | 　 | 　 |
|  Moderately differentiated | 　 | 2.461  | 　 | 2.392  | 2.532  | 　 | <0.001 | 　 | 1.756  | 　 | 1.695  | 1.821  | 　 | <0.001 |
|  Poorly differentiated | 　 | 5.209  | 　 | 5.067  | 5.353  | 　 | <0.001 | 　 | 2.576  | 　 | 2.484  | 2.673  | 　 | <0.001 |
|  Undifferentiated | 　 | 5.068  | 　 | 4.834  | 5.315  | 　 | <0.001 | 　 | 2.525  | 　 | 2.361  | 2.699  | 　 | <0.001 |
| Race | 　 | 　 | 　 | 　 | 　 | 　 | <0.001 | 　 | 　 | 　 | 　 | 　 | 　 | <0.001 |
|  Caucasian | 　 | Reference | 　 | 　 | 　 | 　 | 　 | 　 | Reference | 　 | 　 | 　 | 　 | 　 |
|  African-American | 　 | 1.753  | 　 | 1.721  | 1.785  | 　 | <0.001 | 　 | 1.367  | 　 | 1.335  | 1.400  | 　 | <0.001 |
|  Other races | 　 | 0.855  | 　 | 0.833  | 0.878  | 　 | <0.001 | 　 | 0.836  | 　 | 0.808  | 0.865  | 　 | <0.001 |
| Age group (years) | 　 | 　 | 　 | 　 | 　 | 　 | <0.001 | 　 | 　 | 　 | 　 | 　 | 　 | <0.001 |
|  ≤50 | 　 | Reference | 　 | 　 | 　 | 　 | 　 | 　 | Reference | 　 | 　 | 　 | 　 | 　 |
|  >50, ≤65 | 　 | 0.827  | 　 | 0.814  | 0.840  | 　 | <0.001 | 　 | 1.020  | 　 | 0.998  | 1.042  | 　 | 0.070  |
|  >65 | 　 | 1.110  | 　 | 1.092  | 1.127  | 　 | <0.001 | 　 | 1.674  | 　 | 1.637  | 1.713  | 　 | <0.001 |
| Year of diagnosis | 　 | 　 | 　 | 　 | 　 | 　 | <0.001 | 　 | 　 | 　 | 　 | 　 | 　 | <0.001 |
|  1990-2000 | 　 | Reference | 　 | 　 | 　 | 　 | 　 | 　 | Reference | 　 | 　 | 　 | 　 | 　 |
|  2001-2009 | 　 | 0.744  | 　 | 0.734  | 0.755  | 　 | <0.001 | 　 | 0.853  | 　 | 0.834  | 0.873  | 　 | <0.001 |
|  2010-2015 | 　 | 0.587  | 　 | 0.572  | 0.602  | 　 | <0.001 | 　 | 0.755  | 　 | 0.732  | 0.780  | 　 | <0.001 |
| Operation | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 |
|  Breast conserving surgery | 　 | Reference | 　 | 　 | 　 | 　 | 　 | 　 | Reference | 　 | 　 | 　 | 　 | 　 |
|  Mastectomy | 　 | 2.306  | 　 | 2.270  | 2.343  | 　 | <0.001 | 　 | 1.078  | 　 | 1.056  | 1.100  | 　 | <0.001 |
| Radiation therapy | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 |
|  No | 　 | Reference | 　 | 　 | 　 | 　 | 　 | 　 | Reference | 　 | 　 | 　 | 　 | 　 |
|  Yes | 　 | 0.754  | 　 | 0.744  | 0.763  | 　 | <0.001 | 　 | 0.790  | 　 | 0.775  | 0.805  | 　 | <0.001 |
| Chemotherapy | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 | 　 |
|  No | 　 | Reference | 　 | 　 | 　 | 　 | 　 | 　 | Reference | 　 | 　 | 　 | 　 | 　 |
|  Yes | 　 | 1.919  | 　 | 1.894  | 1.944  | 　 | <0.001 | 　 | 0.885  | 　 | 0.866  | 0.904  | 　 | <0.001 |

Abbreviations: CI, confidence interval, ER, estrogen receptor; HR, hazard ratio, PR, progesterone receptor.

\*ER and PR was adjusted with 9 factors such as T category, N category, histologic grade, race, age group, year of diagnosis, operation, radiation therapy, and chemotherapy.

# **Fig. S1** Subject selection.


# **Fig. S2** Survival curves and subject proportions according to hormone receptor subtype in each race group. Breast cancer specific survival curves according to hormone receptor subtype in Caucasian (A), African-American (B), and other races (C). Subject proportions according to hormone receptor subtype in Caucasian (D), African-American (E), and other races (F).

Abbreviations: ER, estrogen receptor; PR, progesterone receptor.

# **Fig. S3** Survival curves and subject proportions according to hormone receptor subtype in each race group. Breast cancer specific survival curves according to hormone receptor subtype in age ≤ 50 years (A), 50 < age ≤ 65 years (B), and age > 65 years (C). Subject proportions according to hormone receptor subtype in age ≤ 50 years (D), 50 < age ≤ 65 years (E), and age > 65 years (F).

Abbreviations: ER, estrogen receptor; PR, progesterone receptor.

# **Fig. S4** Survival curves and subject proportions according to hormone receptor subtype in each race group. Breast cancer specific survival curves according to hormone receptor subtype in year of diagnosis ≤ 2000 (A), 2001 ≤ year of diagnosis ≤ 2009 (B), and year of diagnosis ≥ 2010 (C). Subject proportions according to hormone receptor subtype in year of diagnosis ≤ 2000 (D), 2001 ≤ year of diagnosis ≤ 2009 (E), and year of diagnosis ≥ 2010 (F).

Abbreviations: Dx, diagnosis; ER, estrogen receptor; PR, progesterone receptor.