**Table 1. Baseline patient and tumour characteristics by centre.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Total (N=4071)** | **Amsterdam (N=983)** | **Berlin (N=1343)** | **Rotterdam (N=566)** | **Warsaw (N=1179)** |
| **Positive SN status** | 889 (21.8%) | 236 (24.0%) | 259 (19.3%) | 170 (30.0%) | 224 (19.0%) |
| **Males** | 1996 (49.0%) | 497 (50.6%) | 753 (56.1%) | 273 (48.2%) | 473 (40.1%) |
| **Age** |  |  |  |  |  |
| Median (Q1, Q3) | 55.0 (43.0, 66.0) | 55.0 (43.0, 65.0) | 62.0 (48.0, 71.0) | 52.0 (40.0, 62.0) | 51.0 (42.0, 62.0) |
| Min - Max | 13.0 - 94.0 | 15.0 - 89.0 | 13.0 - 94.0 | 13.0 - 88.0 | 15.0 - 83.0 |
| **Ulceration** | 1171 (29.8%) | 265 (27.8%) | 263 (20.0%) | 166 (33.3%) | 477 (40.9%) |
| Missing | 141 | 30 | 31 | 68 | 12 |
| **Location** |  |  |  |  |  |
| Arm | 615 (15.6%) | 128 (13.5%) | 217 (16.2%) | 86 (15.2%) | 184 (17.0%) |
| Leg | 1189 (30.2%) | 277 (29.2%) | 324 (24.2%) | 218 (38.5%) | 370 (34.3%) |
| Trunk | 1815 (46.1%) | 407 (42.8%) | 654 (48.9%) | 242 (42.8%) | 512 (47.4%) |
| Head and neck | 314 (8.0%) | 138 (14.5%) | 142 (10.6%) | 20 (3.5%) | 14 (1.3%) |
| Missing | 138 | 33 | 6 | 0 | 99 |
| **Histology** |  |  |  |  |  |
| SSM | 2164 (58.2%) | 598 (62.6%) | 910 (70.0%) | 285 (55.9%) | 371 (39.0%) |
| NM | 1226 (33.0%) | 276 (28.9%) | 290 (22.3%) | 195 (38.2%) | 465 (48.8%) |
| ALM | 126 (3.4%) | 29 (3.0%) | 54 (4.2%) | 16 (3.1%) | 27 (2.8%) |
| LMM | 153 (4.1%) | 18 (1.9%) | 45 (3.5%) | 5 (1.0%) | 85 (8.9%) |
| Other | 49 (1.3%) | 35 (3.7%) | 1 (0.1%) | 9 (1.8%) | 4 (0.4%) |
| Missing | 353 | 27 | 43 | 56 | 227 |
| **Breslow** |  |  |  |  |  |
| Mean (SD) | 2.8 (3.3) | 2.6 (2.0) | 2.3 (2.5) | 2.8 (2.3) | 3.6 (4.9) |
| Min - Max | 0.1 - 90.0 | 0.5 - 22.0 | 0.1 - 30.0 | 0.3 - 20.0 | 0.1 - 90.0 |
| Missing | 59 | 9 | 16 | 6 | 28 |
| **Multiple fields** | 374 (9.2%) | 223 (22.7%) | 41 (3.1%) | 87 (15.4%) | 23 (2.0%) |
| **Total number of negative SN** |  |  |  |  |  |
| Mean (SD) | 1.7 (1.4) | 2.2 (1.6) | 1.6 (1.3) | 1.6 (1.4) | 1.2 (1.0) |
| Min - Max | 0.0 - 15.0 | 0.0 - 15.0 | 0.0 - 13.0 | 0.0 - 10.0 | 0.0 - 9.0 |
| Missing | 162 | 0 | 27 | 1 | 134 |
| **Total number of positive SN** |  |  |  |  |  |
| Mean (SD) | 0.3 (0.6) | 0.3 (0.6) | 0.2 (0.4) | 0.4 (0.7) | 0.3 (0.6) |
| Min - Max | 0.0 - 5.0 | 0.0 - 4.0 | 0.0 - 2.0 | 0.0 - 4.0 | 0.0 - 5.0 |
| Missing | 1 | 0 | 1 | 0 | 0 |
| **SN tumour burden** |  |  |  |  |  |
| Mean (SD) | 1.2 (1.3) | 1.1 (0.8) | 1.0 (0.5) | 1.1 (1.3) | 1.4 (2.0) |
| Min - Max | 0.0 - 38.0 | 0.0 - 8.0 | 0.0 - 8.0 | 0.0 - 15.0 | 0.0 - 38.0 |
| Missing | 301 | 120 | 163 | 18 | 0 |
| **Location metastasis in lymph** |  |  |  |  |  |
| Subcap | 3319 (88.1%) | 793 (92.1%) | 1123 (95.2%) | 440 (80.3%) | 963 (81.7%) |
| Combined | 213 (5.7%) | 39 (4.5%) | 27 (2.3%) | 43 (7.8%) | 104 (8.8%) |
| Parenchymal | 86 (2.3%) | 5 (0.6%) | 11 (0.9%) | 19 (3.5%) | 51 (4.3%) |
| Multifocal | 45 (1.2%) | 6 (0.7%) | 9 (0.8%) | 21 (3.8%) | 9 (0.8%) |
| Extensive | 105 (2.8%) | 18 (2.1%) | 10 (0.8%) | 25 (4.6%) | 52 (4.4%) |
| Missing | 303 | 122 | 163 | 18 | 0 |
| **Recurrence** | 862 (21.2%) | 208 (21.2%) | 175 (13.0%) | 160 (28.3%) | 319 (27.1%) |
| **Deaths** | 606 (14.9%) | 127 (12.9%) | 148 (11.0%) | 115 (20.3%) | 216 (18.3%) |
| **Melanoma specific mortality** | 504 (12.4%) | 98 (10.0%) | 101 (7.5%) | 102 (18.0%) | 203 (17.2%) |

Abbreviations: Q1, first quantile (Q1); Q3, third quantile; SD, standard deviation; SN, sentinel node, SSM, superficial spreading melanoma; NM, nodular melanoma; ALM, acral lentiginous melanoma; LMM, lentigo maligna melanoma.

**Table 2. Hazard ratios of full model predicting 5-year recurrence**. This Table displays the hazard ratios together with the 95 percent confidence intervals of the full Cox proportional hazards model predicting 5-year recurrence.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Negative SN** | | **Positive SN** | |  | |
|  | **HR** | **CI** | **HR** | **CI** | **Main** | **Interactions** |
| **Positive SN status** |  |  | 1.196 | [0.165; 8.649] |  | 35.2 |
| **Male** | 1.229 | [1.016; 1.487] | 0.980 | [0.607; 1.583] | 4.6 | 2.4 |
| **Age** | 1.151 | [0.849; 1.561] | 1.610 | [0.746; 3.476] | 7.7 | 2.0 |
| **Ulceration** | 1.752 | [1.438; 2.136] | 1.364 | [0.827; 2.251] | 38.0 | 2.6 |
| **Location** |  |  |  |  |  |  |
| Arm | (ref) |  | (ref) |  |  |  |
| Leg | 1.394 | [1.034; 1.879] | 1.153 | [0.459; 2.900] | 22.2 | 1.2 |
| Trunk | 1.515 | [1.132; 2.027] | 1.195 | [0.494; 2.889] |  |  |
| Head and neck | 2.319 | [1.593; 3.375] | 1.577 | [0.532; 4.673] |  |  |
| **Histology** |  |  |  |  |  |  |
| SSM | (ref) |  | (ref) |  |  |  |
| NM | 1.243 | [0.973; 1.587] | 1.292 | [0.716; 2.330] | 12.8 | 0.4 |
| ALM | 1.667 | [1.015; 2.738] | 1.453 | [0.428; 4.926] |  |  |
| LMM | 1.089 | [0.642; 1.848] | 1.067 | [0.221; 5.151] |  |  |
| Other | 0.864 | [0.395; 1.891] | 0.596 | [0.033; 10.800] |  |  |
| **Breslow** | 2.132 | [1.847; 2.461] | 1.526 | [1.062; 2.193] | 128.6 | 8.9 |
| **Multiple fields** | 1.314 | [0.957; 1.803] | 1.350 | [0.635; 2.867] | 6.1 | 0.0 |
| **Total number of negative SN** | 0.973 | [0.919; 1.029] |  |  | 0.9 |  |
| **Total number of positive SN** | 0.971 | [0.817; 1.153] |  |  | 0.1 |  |
| **SN tumour burden (Rdamcrit)** | 1.197 | [1.035; 1.385] |  |  | 5.9 |  |
| **Location metastasis in lymph node (Dewar)** |  |  |  |  |  |  |
| Subcap | (ref) |  |  |  |  |  |
| Combined | 1.446 | [0.998; 2.096] |  |  | 6.1 |  |
| Parenchymal | 1.111 | [0.693; 1.784] |  |  |  |  |
| Multifocal | 1.009 | [0.609; 1.673] |  |  |  |  |
| Extensive | 1.194 | [0.665; 2.145] |  |  |  |  |
| *Intercept* | -1.414 | [-1.488; -1.340] |  |  |  |  |
| *Slope* | 0.999 | [0.926; 1.073] |  |  |  |  |
| *C-index* | 0.766 | [0.750; 0.781] |  |  |  |  |
| *C-index recalibrated MSM* | 0.784 | [0.764; 0.804] |  |  |  |  |

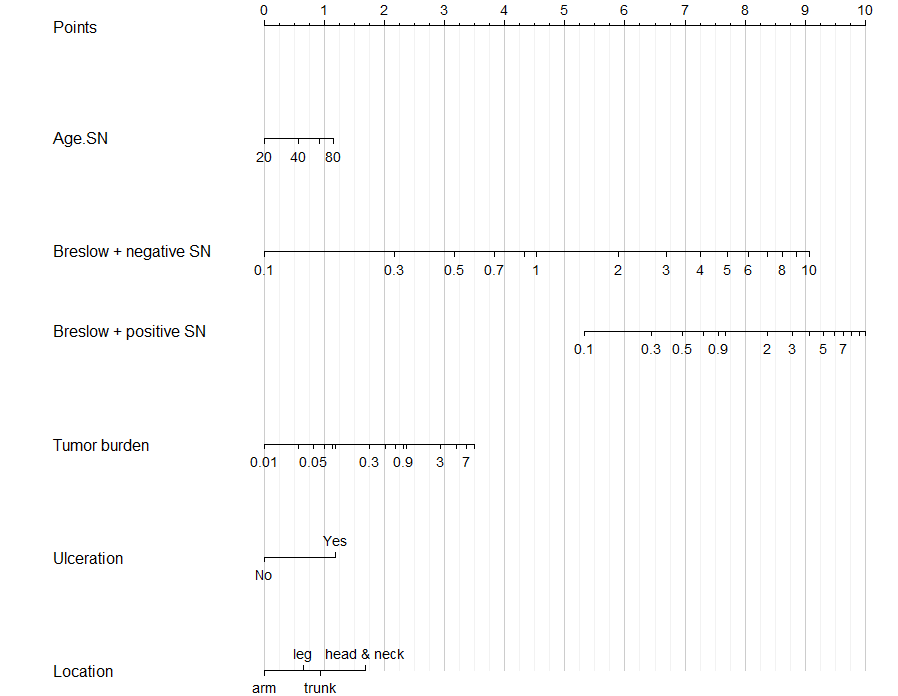
C-index is corrected for optimism. Abbreviations: HR, hazard ratio; CI, 95 percent confidence interval; , chi-square form anova test; Int., the for interaction terms; SN, sentinel node, SSM, superficial spreading melanoma; NM, nodular melanoma; ALM, acral lentiginous melanoma; LMM, lentigo maligna melanoma; MSM, melanoma specific mortality.

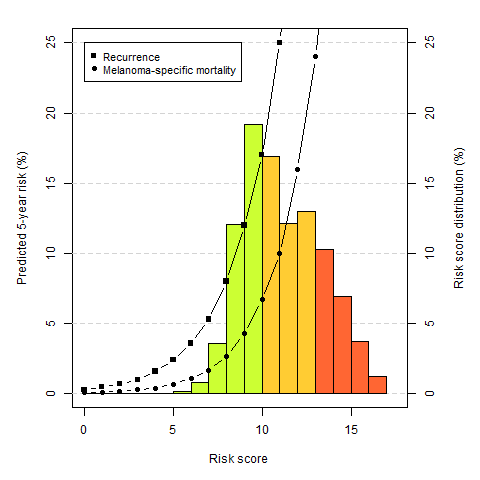
**Table 3. Hazard ratios of final model predicting 5-year recurrence**. This Table displays the hazard ratios together with the 95 percent confidence intervals of the full Cox proportional hazards model predicting 5-year recurrence selected by backward selection with p-values maximum of 0.01.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Negative SN** | | **Positive SN** | |  | |
|  | **HR** | **CI** | **HR** | **CI** | **Main** | **Int.** |
| **Positive SN status** |  |  | 3.664 | [2.776; 4.837] | 132.8 |  |
| **Age** | 1.411 | [1.123; 1.773] | 1.411 | [1.123; 1.773] | 8.7 |  |
| **Ulceration** | 1.639 | [1.415; 1.899] | 1.639 | [1.415; 1.899] | 43.3 |  |
| **Location** |  |  |  |  |  |  |
| Arm | (ref) |  | (ref) |  |  |  |
| Leg | 1.311 | [1.015; 1.693] | 1.311 | [1.015; 1.693] | 21.8 |  |
| Trunk | 1.479 | [1.159; 1.889] | 1.479 | [1.159; 1.889] |  |  |
| Head and neck | 2.007 | [1.476; 2.729] | 2.007 | [1.476; 2.729] |  |  |
| **Breslow** | 2.261 | [2.011; 2.542] | 1.522 | [1.120; 2.068] | 205.7 | 16.7 |
| **SN tumour burden (Rdamcrit)** | 1.238 | [1.132; 1.353] | 1.238 | [1.132; 1.353] | 22.1 |  |
| *Intercept* | -1.390 | [-1.463; -1.316] |  |  |  |  |
| *Slope* | 1.000 | [0.925; 1.074] |  |  |  |  |
| *C-index* | 0.762 | [0.746; 0.777] |  |  |  |  |
| *C-index recalibrated MSM* | 0.781 | [0.761; 0.801] |  |  |  |  |

C-index is corrected for optimism. Abbreviations: HR, hazard ratio; CI, 95 percent confidence interval; , chi-square form anova test; Int., the for interaction terms; SN, sentinel node, SSM, superficial spreading melanoma; NM, nodular melanoma; ALM, acral lentiginous melanoma; LMM, lentigo maligna melanoma; MSM, melanoma specific mortality.

**Figure 1. Risk distribution and nomogram**.





**Figure 1. Calibration curves for final model predicting recurrence and melanoma specific mortality for each centre for patients with positive or negative sentinel nodes.**

|  |  |  |
| --- | --- | --- |
|  | **Recurrence** | **Melanoma specific mortality** |
| **Both positive and negative** |  |  |
| **Only positive** |  |  |
| **Only negative** |  |  |

**SUPPLEMENT**

**Table 2. Hazard ratios of refitted full model predicting 5-year melanoma specific mortality**. This Table displays the hazard ratios together with the 95 percent confidence intervals of the refitted full Cox proportional hazards model predicting 5-year melanoma specific mortality.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Negative SN** | | **Positive SN** | |  | |
|  | **HR** | **CI** | **HR** | **CI** | **Main** | **Int.** |
| **Positive SN status** |  |  | 0.322 | [0.025; 4.083] | 34.4 |  |
| **Male** | 1.361 | [1.057; 1.752] | 1.137 | [0.604; 2.141] | 6.5 | 0.9 |
| **Age** | 0.808 | [0.547; 1.193] | 1.663 | [0.613; 4.507] | 5.7 | 5.4 |
| **Ulceration** | 2.028 | [1.562; 2.632] | 1.588 | [0.827; 3.049] | 37.8 | 1.5 |
| **Location** |  |  |  |  |  |  |
| Arm | (ref) |  | (ref) |  |  |  |
| Leg | 1.047 | [0.701; 1.563] | 0.929 | [0.293; 2.948] | 17.8 | 4.1 |
| Trunk | 1.710 | [1.181; 2.478] | 1.055 | [0.367; 3.036] |  |  |
| Head and neck | 1.672 | [0.978; 2.858] | 1.645 | [0.399; 6.790] |  |  |
| **Histology** |  |  |  |  |  |  |
| SSM | (ref) |  | (ref) |  |  |  |
| NM | 1.191 | [0.873; 1.624] | 1.064 | [0.506; 2.238] | 6.7 | 0.8 |
| ALM | 1.693 | [0.845; 3.391] | 1.784 | [0.335; 9.507] |  |  |
| LMM | 1.033 | [0.508; 2.103] | 0.744 | [0.072; 7.646] |  |  |
| Other | 0.958 | [0.370; 2.481] | 0.011 | [0.000; 67992.739] |  |  |
| **Breslow** | 2.301 | [1.898; 2.789] | 1.594 | [0.980; 2.593] | 93.4 | 6.0 |
| **Multiple fields** | 1.048 | [0.684; 1.607] | 1.375 | [0.502; 3.766] | 2.3 | 0.8 |
| **Total number of negative SN** | 0.956 | [0.885; 1.033] |  | 1.3 |  |  |
| **Total number of positive SN** | 0.933 | [0.747; 1.165] |  | 0.4 |  |  |
| **SN tumour burden (Rdamcrit)** | 1.282 | [1.086; 1.514] |  | 8.6 |  |  |
| **Location metastasis in lymph node (Dewar)** |  |  |  |  |  |  |
| Subcap | (ref) |  |  |  |  |  |
| Combined | 1.189 | [0.738; 1.917] |  | 2.2 |  |  |
| Parenchymal | 1.472 | [0.868; 2.497] |  |  |  |  |
| Multifocal | 1.306 | [0.682; 2.504] |  |  |  |  |
| Extensive | 1.290 | [0.661; 2.516] |  |  |  |  |
| *Intercept* | -1.980 | [-2.076; -1.885] |  |  |  |  |
| *Slope* | 0.999 | [0.911; 1.088] |  |  |  |  |
| *C-index* | 0.790 | [0.771; 0.810] |  |  |  |  |

C-index corrected for optimism. Abbreviations: HR, hazard ratio; CI, 95 percent confidence interval; , chi-square form anova test; Int., the for interaction terms; SN, sentinel node, SSM, superficial spreading melanoma; NM, nodular melanoma; ALM, acral lentiginous melanoma; LMM, lentigo maligna melanoma.

**Table 3. Hazard ratios of refitted final model predicting 5-year melanoma specific mortality**. This Table displays the hazard ratios together with the 95 percent confidence intervals of the refitted full Cox proportional hazards model predicting 5-year recurrence selected by backward selection with p-values maximum of 0.01.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Negative** | | **Positive** | |  | |
|  | **HR** | **CI** | **HR** | **CI** | **Main** | **Int.** |
| **Positive SN status** |  |  | 3.969 | [2.734; 5.761] |  | 88.1 |
| **Age** | 1.381 | [1.157; 1.648] | 1.381 | [1.157; 1.648] | 12.8 |  |
| **Ulceration** | 1.810 | [1.495; 2.191] | 1.810 | [1.495; 2.191] | 37.1 |  |
| **Breslow** | 2.395 | [2.050; 2.797] | 1.568 | [1.046; 2.351] | 138.2 | 11.1 |
| **SN tumour burden (Rdamcrit)** | 1.336 | [1.197; 1.492] | 1.336 | [1.197; 1.492] | 26.7 |  |
| *Intercept* | -1.937 | [-2.032; -1.842] |  |  |  |  |
| *Slope* | 1.000 | [0.911; 1.089] |  |  |  |  |
| *C-index* | 0.782 | [0.762; 0.802] |  |  |  |  |

C-index corrected for optimism. Abbreviations: HR, hazard ratio; CI, 95 percent confidence interval; , chi-square form anova test; Int., the for interaction terms; SN, sentinel node, SSM, superficial spreading melanoma; NM, nodular melanoma; ALM, acral lentiginous melanoma; LMM, lentigo maligna melanoma.