**Solid organ transplantation and survival among**

**individuals with a history of cancer**

**Supplementary material**

**Supplemental Table 1. Cancer patients excluded because transplant could be considered part of cancer treatment**

|  |  |  |
| --- | --- | --- |
| Cancer site | Transplanted organ(s) | N |
| Colorectum | KI, LI | 4 |
| Colorectum | LI | 209 |
| Colorectum | PA, LI, IN | 3 |
| Kidney | KI | 1428 |
| Kidney | KI, HR | 5 |
| Kidney | KI, LI | 23 |
| Kidney | KP | 10 |
| Liver | KI, LI | 219 |
| Liver | LI | 8967 |
| Liver | LI, HR | 3 |
| Liver | LI, LU | 3 |
| Liver | PA, LI, IN | 3 |
| Lung | HL | 2 |
| Lung | LU | 58 |
| Soft Tissue Including Heart | HL | 3 |
| Soft Tissue Including Heart | HR | 22 |

Table notes

Abbreviations: HL heart-lung, HR heart, IN intestine, KI kidney, KP kidney-pancreas, LI liver, LU lung, PA pancreas.

Cancer patients were excluded based on the combination of cancer site and transplanted organ, regardless of the indication for transplantation indicated in the Scientific Registry of Transplant Recipients.

**Supplemental Table 2. Details of transplanted cancer patients regarding cancer stage and time from cancer diagnosis to transplantation**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Cancer site | All transplanted cancer patients | | Proportion of patients (median years to transplant) | | | | |
|  | **Number of patients** | **Years to transplant,**  **median (IQR)** | **Localized** | **Regional** | **Distant** | **Unstaged** | **Unknown** |
| Overall | 5425 | 4.17 (1.75, 7.58) | 0.69 (4.17) | 0.13 (4.25) | 0.01 (4.62) | 0.11 (3.83) | 0.06 (4.58) |
| Oral cavity/pharynx | 130 | 3.92 (1.75, 7.73) | 0.62 (4.46) | 0.28 (3.67) | 0.02 (0.50) |  | 0.08 (3.17) |
| Stomach | 76 | 4.33 (0.83, 7.62) | 0.57 (5.17) | 0.16 (4.12) | 0.07 (1.17) |  | 0.21 (2.50) |
| Colorectum | 538 | 4.42 (2.08, 7.92) | 0.67 (4.67) | 0.27 (4.33) | 0.01 (7.62) |  | 0.06 (3.54) |
| Lung | 100 | 3.42 (1.79, 7.27) | 0.72 (3.29) | 0.14 (5.00) | 0.05 (2.00) |  | 0.09 (7.08) |
| Soft tissue including heart | 46 | 4.17 (2.35, 8.90) | 0.57 (5.17) | 0.17 (2.46) | 0.13 (4.83) |  | 0.13 (1.58) |
| Melanoma | 277 | 4.33 (1.67, 7.50) | 0.87 (4.33) | 0.03 (6.08) |  |  | 0.10 (4.25) |
| Breast | 829 | 4.00 (1.58, 7.92) | 0.71 (4.17) | 0.24 (3.46) | 0.01 (4.92) |  | 0.04 (5.75) |
| Cervix | 92 | 5.12 (2.06, 9.29) | 0.82 (5.58) | 0.11 (4.58) |  |  | 0.08 (4.83) |
| Uterus | 213 | 5.08 (2.00, 8.75) | 0.78 (4.67) | 0.12 (5.83) | 0.01 (3.00) |  | 0.08 (7.96) |
| Ovary | 47 | 4.17 (1.79, 7.12) | 0.57 (4.58) | 0.09 (4.04) | 0.21 (4.42) |  | 0.13 (3.38) |
| Prostate | 1632 | 3.83 (1.58, 7.00) | 0.86 (3.75) | 0.08 (4.67) | 0.00 (9.25) |  | 0.06 (4.00) |
| Testis | 121 | 6.17 (3.58, 9.83) | 0.60 (6.33) | 0.18 (6.17) | 0.16 (4.83) |  | 0.06 (8.58) |
| Bladder | 204 | 4.17 (1.83, 8.10) | 0.81 (3.92) | 0.05 (4.75) | 0.00 (2.17) |  | 0.14 (6.21) |
| Kidney | 142 | 4.54 (1.92, 8.21) | 0.84 (4.58) | 0.07 (1.38) | 0.04 (6.67) |  | 0.05 (12.58) |
| Thyroid | 395 | 5.00 (2.33, 8.17) | 0.72 (4.67) | 0.24 (5.33) | 0.01 (5.58) |  | 0.03 (8.50) |
| Non-Hodgkin lymphoma | 432 | 4.04 (1.67, 7.35) |  |  |  | 1.00 (4.04) |  |
| Myeloma | 151 | 3.50 (1.42, 5.83) |  |  |  | 1.00 (3.50) |  |

Table notes

Abbreviations: IQR interquartile range, NHL non-Hodgkin lymphoma

**Supplemental Table 3. Association of transplantation with cancer-specific mortality among cancer patients after additional adjustment for race/ethnicity**

|  |  |  |
| --- | --- | --- |
| **Cancer site** | **Cohort analysis**  **Adjusted HR (95% CI)a** | **Matched analysis**  **Adjusted HR (95% CI)b** |
| Oral cavity/pharynx | 1.16 (0.67, 1.99) | 1.15 (0.59, 2.23) |
| Stomach | 0.39 (0.16, 0.94) | 0.49 (0.19, 1.29) |
| Colorectum | 0.64 (0.43, 0.97) | 0.70 (0.42, 1.16) |
| Lung | 0.64 (0.40, 1.03) | 0.72 (0.39, 1.31) |
| Soft tissue including heart | 1.14 (0.57, 2.28) | 1.50 (0.64, 3.53) |
| Melanoma | 1.23 (0.74, 2.04) | 0.86 (0.43, 1.72) |
| Breast | 0.67 (0.47, 0.95) | 0.81 (0.54, 1.21) |
| Cervix | 0.98 (0.32, 3.05) | 1.10 (0.26, 4.71) |
| Uterus | 0.67 (0.25, 1.80) | 0.58 (0.18, 1.92) |
| Ovary | 0.30 (0.04, 2.16) | Did not converge |
| Prostate | 0.77 (0.58, 1.02) | 0.78 (0.54, 1.12) |
| Testis | 1.98 (0.49, 7.96) | 2.22 (0.35, 14.17) |
| Bladder | 0.89 (0.51, 1.57) | 1.40 (0.76, 2.56) |
| Kidney | 0.29 (0.09, 0.89) | 0.38 (0.11, 1.23) |
| Thyroid | 0.97 (0.36, 2.59) | 0.87 (0.26, 2.94) |
| Non-Hodgkin lymphoma | 0.51 (0.33, 0.78) | 0.51 (0.31, 0.84) |
| Myeloma | 0.41 (0.26, 0.66) | 0.46 (0.27, 0.78) |

a Hazard ratios in the cohort analysis are based on Cox models in which the baseline hazard is stratified by sex, calendar year of diagnosis (5-year intervals), and cancer stage, and are adjusted for age at cancer diagnosis using a cubic spline and race/ethnicity (non-Hispanic White, Hispanic, non-Hispanic Black, Asian/Pacific Islander, other/unknown).

b Hazard ratios in the matched analysis are based on Cox models stratified on matched set and further adjusted for age using a cubic spline and race/ethnicity (non-Hispanic White, Hispanic, non-Hispanic Black, Asian/Pacific Islander, other/unknown).

**Supplemental Table 4: Association of transplantation with cancer-specific mortality among cancer patients, comparing results of Cox models and competing risk models**

|  |  |  |  |
| --- | --- | --- | --- |
| **Cancer site** | **Cohort analysis**  **Adjusted HR (95% CI)a** | **Matched analysis**  **Adjusted HR (95% CI)b** | **Competing risk analysis**  **Adjusted SDHR (95%CI)c** |
| Oral cavity/pharynx | 1.16 (0.67, 2.00) | 1.14 (0.63, 2.04) | 0.99 (0.56, 1.75) |
| Stomach | 0.42 (0.18, 1.01) | 0.45 (0.18, 1.13) | 0.51 (0.22, 1.20) |
| Colorectum | 0.66 (0.44, 0.99) | 0.68 (0.44, 1.04) | 0.63 (0.41, 0.97) |
| Lung | 0.63 (0.39, 1.02) | 0.85 (0.50, 1.42) | 0.71 (0.41, 1.24) |
| Soft tissue including heart | 1.12 (0.56, 2.25) | 1.75 (0.94, 3.25) | 1.77 (0.85, 3.67) |
| Melanoma | 1.31 (0.79, 2.18) | 0.87 (0.44, 1.75) | 0.68 (0.34, 1.34) |
| Breast | 0.67 (0.47, 0.96) | 0.65 (0.45, 0.94) | 0.57 (0.40, 0.82) |
| Cervix | 1.00 (0.32, 3.10) | 0.91 (0.27, 3.10) | 1.11 (0.34, 3.62) |
| Uterus | 0.69 (0.26, 1.83) | 0.62 (0.22, 1.71) | 0.53 (0.19, 1.48) |
| Ovary | 0.29 (0.04, 2.05) | 0.37 (0.05, 2.74) | 0.22 (0.03, 1.74) |
| Prostate | 0.79 (0.60, 1.05) | 0.91 (0.67, 1.23) | 0.71 (0.53, 0.96) |
| Testis | 2.01 (0.50, 8.05) | 2.71 (0.47, 15.4) | 2.25 (0.45, 11.3) |
| Bladder | 0.90 (0.51, 1.59) | 1.18 (0.66, 2.14) | 0.72 (0.40, 1.32) |
| Kidney | 0.28 (0.09, 0.88) | 0.32 (0.10, 1.03) | 0.23 (0.08, 0.72) |
| Thyroid | 1.01 (0.38, 2.71) | 0.70 (0.25, 1.95) | 0.64 (0.23, 1.77) |
| Non-Hodgkin lymphoma | 0.50 (0.33, 0.77) | 0.51 (0.32, 0.80) | 0.45 (0.29, 0.70) |
| Myeloma | 0.42 (0.26, 0.68) | 0.39 (0.23, 0.65) | 0.42 (0.26, 0.67) |

Table notes

Abbreviations: CI confidence interval, HR hazard ratio, SDHR subdistribution hazard ratio

a Hazard ratios in the cohort analysis are based on Cox models in which the baseline hazard is stratified by sex, calendar year of diagnosis (5-year intervals), and cancer stage, and are adjusted for age at cancer diagnosis using a cubic spline.

b Hazard ratios in the matched analysis are based on Cox models stratified on matched set and further adjusted for age using a cubic spline.

C Subdistribution hazard ratios are calculated from the matched analysis dataset using the competing risk method of Fine and Gray, and are adjusted for stage, sex, age at diagnosis (cubic spline), calendar year of diagnosis (1986-1992, 1993-1997, 1998-2002, 2003-2007, 2008-2012, 2013-2017), and end year of cancer registry coverage (2007-2009,2010-2012, 2013-2015, 2016-2017). See Fine JP and Gray RJ (1999). A proportional hazards model for the subdistribution of a competing risk. Journal of the American Statistical Association, 94(446), 496-509.