**Supplementary Table 1: Concordance of Medicare claims and SRTR malignancy reports for BCC and SCC, 2011 to 2013\***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
|  | BCC | SCC |
|  | Identified in SRTR | Identified in SRTR |
|  | No | Yes | No | Yes |
| Medicare claims† | n (row %) | n (row %) | n (row %) | n (row %) |
| No | 23688 (99.8) | 41 (0.2) | 23478 (99.7) | 71 (0.3) |
| Yes | 608 (85.6) | 102 (14.4) ‡ | 694 (78.0) | 196 (22.0) ‡ |
|  |  |  |  |  |
| KC cases/non-cases identified in SRTR validated in Medicare (column %) | 97.5 | 71.3 | 97.1 | 73.4 |

 |

Abbreviations: SRTR = Scientific Registry of Transplant Recipients; KC= keratinocytic carcinoma; BCC= basal cell carcinoma; SCC= squamous cell carcinoma.

\*The years 2011-2013 do not overlap with the time period of the study since Medicare did not distinguish between BCC and SCC before 2011. These years are used solely to describe the validity of the KC data. This sub-population included individuals in the SRTR with Medicare coverage and at least 1 Medicare claim after the date of transplantation (n=24,439). For people with multiple diagnoses in either SRTR or Medicare, only the first BCC and first SCC diagnoses after transplant were used.

†Keratinocyte carcinomas were identified in Medicare by the presence of at least one claim for a skin cancer procedure code (11600-11606, 11620-11626, 11640-11646, 17260-17266, 17270-17276, 17280-17286, 17304, 17311, or 17313) associated with a ICD-9 diagnosis for non-melanoma skin cancer (173.00-173.99). BCCs were specifically defined as those cases with an ICD-9 code of 173.x1, while SCCs were specifically defined as cases with an ICD-9 code of 173.x2.[33]

‡ Among those recipients with the same diagnosis (either SCC or BCC) identified in both sources, the median time (interquartile range) from Medicare claim to SRTR diagnosis date was -10.5 days (-44 to 8) for BCC and -8 days (-34 to 22) for SCC.

**Supplementary Table 2: SEER diagnoses codes and diagnosis groupings**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| Diagnosis | **SEER site recode** |
| Oral cavity and pharynx | 20010, 20020, 20030, 20040, 20050, 20060, 20070, 20080, 20090, 20100 |
|  | Lip | 20010 |
|  | Tongue | 20020 |
| Esophagus | 21010 |
| Stomach | 21020 |
| Colon | 21041-21049 |
| Rectum | 21051, 21052 |
| Anus | 21060 |
| Pancreas | 21100 |
| Larynx | 22020 |
| Lung | 22030 |
| Kidney | 29020 |
| Bladder | 29010 |
| Prostate | 28010 |
| Breast | 26000 |
| Uterus | 27020, 27030 |
| Female HPV-related genital | 27010, 27050, 27060 |
| Thyroid | 32010 |
| Melanoma | 25010 |
| Other skin | 25020 |
| NHL |  | 33041, 33042, 35012 |
| Myeloma | 34000 |
| Acute leukemia | 35011, 35021, 35031, 35041 |

 |

**Supplementary Table 3: Hazard ratios for selected SEER diagnoses by diagnosis of KC among 118,440 solid organ transplant recipients**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |  |
| --- | --- | --- | --- |
|  | **BCC only** | **SCC only** | **BCC+SCC** |
|  | **n (BCC)** | **HR (95%CI)\*** | **n (SCC)** | **HR (95%CI)\*** | **n (BCC+SCC)** | **HR (95%CI)\*** |
| **Overall malignancies** | 202 | 1.03 | (0.87 -  | 1.22) | 712 | ***1.47*** | ***(1.32 -***  | ***1.63)*** | 289 | ***1.37*** | ***(1.16 -***  | ***1.62)*** |
| **Oral cavity and pharynx** | 11 | 1.24 | (0.59 -  | 2.63) | 129 | ***5.77*** | ***(4.34 -***  | ***7.66)*** | 26 | ***2.27*** | ***(1.20 -***  | ***4.29)*** |
|  Squamous† | 7 | 0.58 | (0.19 -  | 1.80) | 118 | ***5.70*** | ***(4.24 -***  | ***7.66)*** | 24 | ***2.22*** | ***(1.14 -***  | ***4.34)*** |
|  Non-squamous | 4 | ***8.88*** | ***(3.04 -***  | ***25.92)*** | 11 | ***6.60*** | ***(2.45 -***  | ***17.76)*** | 2 | 2.85 | (0.38 -  | 21.34) |
|  Lip | 5 | 0.52 | (0.07 -  | 3.70) | 40 | ***3.97*** | ***(2.30 -***  | ***6.85)*** | 14 | 2.49 | (0.91 -  | 6.85) |
|  Tongue | 2 | 1.47 | (0.36 -  | 6.04) | 25 | ***3.90*** | ***(1.97 -***  | ***7.70)*** | 5 | 1.95 | (0.47 -  | 8.05) |
| **Esophagus** | 1 | 0.47 | (0.07 -  | 3.40) | 8 | 0.70 | (0.22 -  | 2.23) | 2 | 1.10 | (0.27 -  | 4.51) |
| **Stomach** | 1 | 0.53 | (0.07 -  | 3.78) | 6 | 1.05 | (0.38 -  | 2.91) | 2 | 0.66 | (0.09 -  | 4.79) |
| **Colon** | 3 | 0.44 | (0.14 -  | 1.37) | 23 | 1.18 | (0.71 -  | 1.96) | 4 | 0.36 | (0.09 -  | 1.43) |
| **Rectum** | 0 | 0.00 | - |  | 8 | 0.64 | (0.16 -  | 2.63) | 2 | 0.80 | (0.11 -  | 5.83) |
| **Anus** | 4 | 2.41 | (0.75 -  | 7.72) | 18 | ***3.56*** | ***(1.68 -***  | ***7.54)*** | 4 | 1.21 | (0.17 -  | 8.78) |
| **Pancreas** | 3 | 1.75 | (0.64 -  | 4.79) | 3 | 0.70 | (0.22 -  | 2.23) | 3 | 1.13 | (0.28 -  | 4.62) |
| **Larynx** | 1 | 0.73 | (0.10 -  | 5.29) | 10 | 1.06 | (0.33 -  | 3.41) | 6 | 0.91 | (0.12 -  | 6.59) |
| **Lung** | 28 | 1.03 | (0.69 -  | 1.55) | 78 | 1.26 | (0.96 -  | 1.65) | 30 | 1.22 | (0.79 -  | 1.86) |
|  Squamous† | 9 | 1.07 | (0.55 -  | 2.09) | 39 | ***1.72*** | ***(1.17 -***  | ***2.52)*** | 15 | 1.45 | (0.77 -  | 2.75) |
|  Non-squamous | 19 | 1.01 | (0.60 -  | 1.68) | 39 | 0.98 | (0.67 -  | 1.43) | 15 | 1.06 | (0.60 -  | 1.89) |
| **Kidney** | 16 | 0.99 | (0.51 -  | 1.91) | 27 | 0.75 | (0.43 -  | 1.31) | 14 | 0.68 | (0.28 -  | 1.64) |
| **Bladder** | 4 | 1.04 | (0.43 -  | 2.54) | 17 | 1.62 | (0.95 -  | 2.76) | 14 | 1.51 | (0.66 -  | 3.43) |
| **Prostate** | 52 | 1.45 | (1.00 -  | 2.10) | 98 | 0.91 | (0.65 -  | 1.28) | 48 | 1.11 | (0.70 -  | 1.76) |
| **Breast (female)** | 10 | 0.86 | (0.32 -  | 2.32) | 16 | 0.80 | (0.35 -  | 1.79) | 8 | ***2.35*** | ***(1.04 -***  | ***5.28)*** |
| **Uterus** | 3 | 2.48 | (0.61 -  | 10.16) | 4 | 0.66 | (0.09 -  | 4.80) | 3 | 0.00 | - |  |
| **Female HPV-related genital** | 1 | 0.99 | (0.14 - | 7.14) | 17 | ***3.89*** | ***(1.67 -*** | ***9.05)*** | 2 | 0.00 | - |  |
| **Thyroid** | 3 | 0.00 | - |  | 11 | 1.80 | (0.79 -  | 4.11) | 4 | 0.77 | (0.11 -  | 5.50) |
| **Melanoma** | 20 | 1.74 | (0.95 -  | 3.19) | 47 | ***1.97*** | ***(1.28 -***  | ***3.03)*** | 24 | 1.89 | (0.97 -  | 3.69) |
| **Other skin**‡ | 11 | 2.14 | (1.00 -  | 4.59) | 46 | ***3.92*** | ***(2.53 -***  | ***6.10)*** | 28 | ***6.01*** | ***(3.57 -***  | ***10.09)*** |
|  Merkel | 6 | 2.66 | (0.97 -  | 7.34) | 16 | ***3.91*** | ***(2.03 -***  | ***7.53)*** | 14 | ***6.88*** | ***(3.36 -***  | ***14.09)*** |
| **NHL** | 11 | ***0.43*** | ***(0.19 -***  | ***0.97)*** | 38 | 0.68 | (0.43 -  | 1.07) | 16 | 0.81 | (0.42 -  | 1.57) |
|  DLBCL§ | 7 | 0.40 | (0.13 -  | 1.23) | 26 | 1.05 | (0.63 -  | 1.74) | 9 | 0.83 | (0.34 -  | 2.01) |
|  Other NHL | 4 | 0.48 | (0.15 -  | 1.50) | 12 | ***0.23*** | ***(0.08 -***  | ***0.73)*** | 7 | 0.78 | (0.29 -  | 2.11) |
| **Myeloma** | 1 | 1.17 | (0.29 -  | 4.79) | 7 | 1.21 | (0.44 -  | 3.37) | 3 | 1.48 | (0.36 -  | 6.13) |
| **Acute leukemia** | 1 | 0.72 | (0.10 -  | 5.18) | 3 | 1.06 | (0.33 -  | 3.44) | 0 | 0.00 | - |  |

 |

Abbreviations: KC= keratinocytic carcinoma; BCC= basal cell carcinoma; SCC= squamous cell carcinoma; HPV = human papillomavirus; MCC = Merkel cell carcinoma; NHL = non-Hodgkin lymphoma; DLBCL = diffuse large B-cell lymphoma

\* Cox regression models with age as the time scale, adjusted for sex, organ, year of transplant, and time since transplant. BCC, SCC, and BCC+SCC are time-dependent variables.

† Internal squamous cell cancers were identified using SEER histology codes 8052, 8070-8078, 8083, and 8084.

‡ Histology codes were used to define Merkel cell carcinoma (8247) and other types of skin cancer (8123, 8140, 8200, 8390, 8400-8402, 8407, 8409, 8410, 8413, 8560, 8800-8802, 8830, 8832, 8890, and 9120).

§ Histology codes were used to define DLBCL (9678-9680, 9684, 9688, 9712, 9737, 9738).