**Supplemental Table 1. SEER and Medicare Claims Codes for diagnostic, treatment or event**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diagnosis, Treatment, or Event | | | | |  | | Sources | | | | Code(s) | |
| **Treatment** | | | | |  | |  | |  | |  | |
| Any Radiation Related Claims | |  | |  | | | | ICD-9-CM Diagnosis code | | V58.0, V66.1, V67.1 | |
|  |  | |  | | |  | ICD-9-CM Procedure codes | | | | 92.2, 92.20-92.27, 92.29, 92.3, 92.30-92.39, 92.4, 92.41 | |
|  |  | |  | | |  | HCPCS codes | | | | 77373-77373, 77401-77525, 77761-77799, G0174, G0251, G0339, G0340 | |
|  |  | |  | | |  | Revenue Center Codes | | | | 0330, 0333 | |
|  |  | |  | | |  |  | |  | |  | |
| Radiation Brachytherapy Claims | | | | |  | | HCPCS codes | | | | 77761-77799 | |
| Radiation Delivery IMRT Claims | | | | |  | | HCPCS codes | | | | 77418, G0174 | |
| Radiation Delivery 2D3D Claims | | | | |  | | HCPCS codes | | | | 77401-77416 | |
|  |  | |  | | |  |  | |  | |  | |
| ChemoTherapy | | |  | | |  | ICD-9-CM Diagnosis code | | | | V58.1, V66.2, V67.2 | |
|  |  | |  | | |  | ICD-9-CM Procedure codes | | | | 99.25 | |
|  |  | |  | | |  | HCPCS codes | | | | 96400-96549, J9000-J9999, Q0083-Q0085, J8520, J8521, J8530, J8540, J8560, J8597, J8610, J8999; Exclude J9003, J9165, J9175, J9202, J9209, J9212-J9226, J9240, J9295, J9381, J9395 | |
|  |  | |  | | |  | Revenue Center Codes | | | | 0331,0 332, 0335 | |
|  |  | |  | | |  |  | |  | |  | |
| Surgery After Radiation Treatment | | | | | | | HCPCS codes | | | | 43100, 43101, 43107, 43108, 43112,43113, 43116 - 43118, 43121 - 43124, 43360, 43361, 43401, 43496, 43620 - 43622 | |
|  |  | |  | | |  |  | |  | |  | |
| **Specific Comorbidity Disease** | | | | |  | |  | |  | |  | |
|  | Ischemic Heart Disease | | | | | | ICD-9-CM Diagnosis Codes | | | | 410-414; Exclude 414.1 | |
|  |  | |  | | |  | ICD-9-CM Procedure codes | | | | 360, 361, | |
|  | Other forms of heart disease | | | | | | ICD-9-CM Diagnosis Codes | | | | 420-429 | |
|  | HBP | |  | | |  | ICD-9-CM Diagnosis Codes | | | | 401-409, Exclude 40211, 40291 | |
|  | Diabetes | |  | | |  | ICD-9-CM Diagnosis Codes | | | | 250 | |
|  | Respiratory Diseases | | | |  | | ICD-9-CM Diagnosis Codes | | | | 460-519 | |
|  |  | |  | | |  |  | |  | |  | |
| **Cause of Death** | | |  | | |  |  | |  | |  | |
|  | Esophageal cancer | | | |  | | PEDSF (CODPUB) | | | | 11 | |
|  | Heart Diseases | | | |  | | PEDSF (CODPUB) | | | | 154 | |
|  | Lung Diseases | | | |  | | PEDSF (CODPUB) | | | | 172, 175 | |
|  | Other | |  | | |  | PEDSF (CODPUB) | | | | All Death Except 011, 154, 172, 175 | |
|  | Alive | |  | | |  | PEDSF (CODPUB) | | | | 0 | |

**Supplemental Table 2. Esophageal Cancer Cohort Selection**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **SEER**  **1973-2009** | | **CERCIT-Texas**  **1995-2007** | |
| **Step** | **Criteria** | **Included** | **Excluded** | **Included** | **Excluded** |
|  |  |  |  |  |  |
| 1 | Esophageal Cancer as the First Primary Cancer Diagnosed | 31,101 | **-** | 6,856 | - |
| 2 | Histology confirmed and Diagnosis not from autopsy or death certificate | 26,357 | 4,744 | 5,566 | 1,290 |
| 3 | Year of first diagnosis between 1997-2009 (SEER) or 2001-2007 (TCR) and no unknown diagnosis months | 20,966 | 5,391 | 3,168 | 2,398 |
| 4 | Age of diagnosis ≥ 66 and no second cancer diagnosed within first year of diagnosis | 15,397 | 5,569 | 2,312 | 856 |
| 5 | Full Medicare A&B coverage and not HMO member 1 year before or after diagnosis, or until deaths if died within 1 year of diagnosis | 10,527 | 4,870 | 1,883 | 429 |
| 6 | Stage I-III, no unknown stage | 5,868 | 4,659 | 1,012 | 871 |
| 7 | Started radiation therapy within 6 months of diagnosis, but no brachytherapy within first year of diagnosis | 3,102 | 2,766 | 595 | 507 |

**Supplemental Table 3. Distinguishing IMRT and 3D Patient Cohorts**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | | | | **SEER+TCR (N=3697)** | | |
| **Steps** | **Criteria and approach** | | | | **3D** | **IMRT** | **Excluded** |
| 1 | For patients with only one type of claims during their entire Medicare coverage period, separating them into 3D or IMRT groups using delivery codes. | | | | 2996 | 269 | - |
| 2 | For patients who had both 3D & IMRT treatment codes during Medicare coverage period (hybrid patients), only consider their treatment claims within 6 months of diagnosis and a stepwise approach to distinguish and allocate hybrid patients into 3D or IMRT cohorts, by using criteria involving radiation course delivery time, comparison between number of fractions between the two types of treatment course, and between the first treatment delivery date. Patients were excluded that did not have either 3D or IMRT treatment claims within 6 months of diagnosis or could not be distinguishable based on the approach taken. | | | | 92 | 46 | 294 |
| 3  4  5 | Final number of patients distinguished  Keep only patients with year of diagnosis 2002 and after  Delete 2D patients | | | | 3088  2265  2240 | 315  313  313 | -  825  - |
|  |  |  |  |

**Supplemental Table 4. Patient demographics, clinical and tumor characteristics (IPTW adjusted)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Overall Cohort** | **3D** | | **IMRT** | | **Chi-sq *P*** | |
|  | **N = 2553 (100%)** | **N=2240 (100%)** | | **N=313 (100%)** | |  | |
| **Age** |  |  | |  | |  | |
| 66-70 | 29.13 | 28.63 | | 32.53 | | 0.0165 | |
| 71-75 | 25.28 | 26.03 | | 20.19 | |  | |
| 76-80 | 21.58 | 22.01 | | 18.66 | |  | |
| >80 | 24.02 | 23.34 | | 28.62 | |  | |
| **Year of Diagnosis** |  |  | |  | |  | |
| 2002 | 12.25 | 11.91 | | 14.56 | | 0.7925 | |
| 2003 | 15.61 | 15.33 | | 17.54 | |  | |
| 2004 | 14.42 | 14.46 | | 14.2 | |  | |
| 2005 | 12.16 | 12.26 | | 11.52 | |  | |
| 2006 | 13.43 | 13.64 | | 12.01 | |  | |
| 2007 | 13.91 | 14.12 | | 12.5 | |  | |
| 2008 | 8.47 | 8.5 | | 8.3 | |  | |
| 2009 | 9.74 | 9.79 | | 9.38 | |  | |
| **Marital status** |  |  | |  | |  | |
| Married | 48.5 | 48.17 | | 50.7 | | 0.3451 | |
| Not married | 30.28 | 30.16 | | 31.13 | |  | |
| Unknown\* | 21.22 | 21.67 | | 18.17 | |  | |
| **Histology** |  |  | |  | |  | |
| Adeno | 54.73 | 56.28 | | 44.25 | | <.0001 | |
| SCCA | 45.27 | 43.72 | | 55.75 | |  | |
| **Race/Ethnicity** |  |  | |  | |  | |
| White | 81.45 | 81.83 | | 78.85 | | 0.5571 | |
| Hispanic | 5.66 | 5.45 | | 7.07 | |  | |
| Black/Other | 12.89 | 12.72 | | 14.09 | |  | |
| **Stage** |  |  | |  | |  | |
| Localized | 39.25 | 38.18 | | 46.46 | | 0.004 | |
| Regional | 60.75 | 61.82 | | 53.54 | |  | |
| **Gender** |  |  | |  | |  | |
| Female | 29.18 | 29.31 | | 28.29 | | 0.7029 | |
| Male | 70.82 | 70.69 | | 71.71 | |  | |
| **Patients receiving Surgery After Radiation Treatment** |  |  | |  | |  | |
| No | 82.44 | 82.75 | | 80.32 | | 0.277 | |
| Yes | 17.56 | 17.25 | | 19.68 | |  | |
| **Tumor Grade** |  |  | |  | |  | |
| Well differentiated | 4.91 | 4.74 | | 6.06 | | 0.118 | |
| Moderately differentiated | 37.37 | 37.35 | | 37.53 | |  | |
| Poorly differentiate | 8.15 | 8.33 | | 6.91 | |  | |
| Undifferentiated | 32.9 | 32.31 | | 36.9 | |  | |
| Unknown | 16.67 | 17.27 | | 12.61 | |  | |
| **Charlson Score** |  |  | |  | |  | |
| 0 | 59.65 | 58.37 | | 68.32 | | 0.0017 | |
| 1 | 26.07 | 26.67 | | 21.99 | |  | |
| 2+ | 14.28 | 14.96 | | 9.69 | |  | |
| **Regions (SEER + Texas)** |  |  | |  | |  | |
| California + Hawaii | 22.5 | 21.38 | | 30.12 | | <.0001 | |
| 6 SEER regions\*\* | 24.38 | 25.57 | | 16.34 | |  | |
| Greater Georgia | 10.2 | 10.29 | | 9.64 | |  | |
| Kentucky | 6.55 | 6.37 | | 7.77 | |  | |
| Louisiana | 5.7 | 5.19 | | 9.16 | |  | |
| New Jersey | 12.61 | 12.78 | | 11.47 | |  | |
| Texas | 18.05 | 18.42 | | 15.51 | |  | |
| **Patients receiving Chemotherapy** |  |  | |  | | 0.0225 | |
| No | 16.75 | 16.1 | | 21.12 | |  | |
| Yes | 83.25 | 83.9 | | 78.88 | |  | |
| **Urban/Rural** |  |  | |  | |  | |
| Big Metro | 50.26 | 50.02 | | 51.86 | | 0.1726 | |
| Less Urban | 9.38 | 9.87 | | 6.06 | |  | |
| Metro | 31.72 | 31.35 | | 34.2 | |  | |
| Rural/Urban | 8.64 | 8.76 | | 7.88 | |  | |
| **% of adults with <12 y of Education** |  |  | |  | |  | |
| Lowest Quartile | 24.37 | 24.22 | | 25.37 | | 0.0948 | |
| 2nd Quartile | 22.77 | 23.56 | | 17.41 | |  | |
| 3rd Quartile | 25.25 | 25.02 | | 26.84 | |  | |
| Highest Quartile | 27.61 | 27.2 | | 30.38 | |  | |
| **% of Family living below poverty line** |  |  | |  | |  | |
| Lowest Quartile | 24.23 | 24.51 | | 22.34 | | 0.0082 | |
| 2nd Quartile | 24.52 | 24.82 | | 22.46 | |  | |
| 3rd Quartile | 24.44 | 24.99 | | 20.7 | |  | |
| Highest Quartile | 26.81 | 25.67 | | 34.5 | |  | |
| **Pre-CHF\*\*\*** |  |  | |  | |  | |
| No | 80.4 | 80.45 | | 80.07 | | 0.8721 | |
| Yes | 19.6 | 19.55 | | 19.93 | |  | |
| **Pre-Other Heart Disease\*\*\*** |  |  | |  | |  | |
| No | 80.01 | 79.62 | | 82.65 | | 0.1985 | |
| Yes | 19.99 | 20.38 | | 17.35 | |  | |
| **Pre-Hypertension\*\*\*** |  |  | |  | |  | |
| No | 51.62 | 51.42 | | 52.97 | | 0.5991 | |
| Yes | 48.38 | 48.58 | | 47.03 | |  | |
| **Pre-Diabetes\*\*\*** |  |  | |  | |  | |
| No | 82.37 | 82.24 | | 83.23 | | 0.6592 | |
| Yes | 17.63 | 17.76 | | 16.77 | |  | |
| **Pre-Respiratory Dz \*\*\*** |  |  | |  | |  | |
| No | 79.83 | 79.31 | | 83.39 | | 0.0837 | |
| Yes | 20.17 | 20.69 | | 16.61 | |  | |
| **Number of radiation fractions** |  |  | |  | |  | |
| Mean ± SD | 24±8.5 | 24±8.5 | | 25±8.1 | | 0.1433 | |
| Median | 26 | 26 | | 28 | |  | |
|  |  | |  | |  | |  | |
| \* All TCR Patients Marital Status were Unknown | | |  | |  | |  | |
| \*\* The six SEER regions include: Conneticut, Detroit, Iowa, New Mexico, Seattle, Utah | | | | | | | | |
| \*\*\* Pre-disease within one-year before Esophageal Cancer Diagnosis, parts of Comorbidity disease, therefore not included into Cox Modeling that has adjusted for Charlson Score. | | | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Supplemental Table 5. Physician Characteristics (IPTW adjusted)**   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Overall Cohort** | **3D** | **IMRT** | **Chi-sq *P*** | |  | N = 2553 (100%) | N=2240(100%) | N=313 (100%) |  | | **Board Certified** |  |  |  |  | | No | 2.89 | 2.57 | 5.07 | 0.04 | | Yes | 85.48 | 85.8 | 83.34 |  | | Unknown | 11.63 | 11.63 | 11.6 |  | | **Graduation Years** |  |  |  |  | | Prior to 1980 | 25.75 | 25.72 | 25.96 | 0.935 | | 1980-1989 | 36.88 | 37.09 | 35.49 |  | | After 1990 | 25.74 | 25.56 | 26.95 |  | | Unknown | 11.63 | 11.63 | 11.6 |  | | **Physician Gender** |  |  |  |  | | F | 15.17 | 15.35 | 13.97 | 0.8033 | | M | 73.2 | 73.02 | 74.43 |  | | Unknown | 11.63 | 11.63 | 11.6 |  | | **US Trained** |  |  |  |  | | No | 14.34 | 14.7 | 11.9 | 0.3952 | | Yes | 10.82 | 10.8 | 10.9 |  | | Unknown | 74.84 | 74.5 | 77.19 |  | | **Physician Type** |  |  |  |  | | DO | 1.44 | 1.36 | 2.01 | 0.6471 | | MD | 87.75 | 87.84 | 87.09 |  | | Unknown | 10.82 | 10.8 | 10.9 |  | | **Physician Age** |  |  |  |  | | 34-46 | 16.12 | 15.71 | 18.87 | 0.4422 | | 46-52 | 23.74 | 24.07 | 21.51 |  | | 52-60 | 26.74 | 27.06 | 24.58 |  | | 60-85 | 21.77 | 21.52 | 23.44 |  | | Unknown | 11.63 | 11.63 | 11.6 |  | | **Physician Training Years** |  |  |  |  | | 3-13 | 18.32 | 17.89 | 21.23 | 0.1156 | | 13-19 | 21.73 | 22.52 | 16.36 |  | | 19-28 | 25.74 | 25.66 | 26.22 |  | | 28-61 | 20.29 | 20.2 | 20.9 |  | | Unknown | 13.93 | 13.73 | 15.3 |  | |

**Supplemental Table 5.** Chemotherapy agents identified proximal to EC diagnosis

|  |  |  |
| --- | --- | --- |
| **DRUG** | **Percent** | **Cumulative** |
| **Percent** |
| **Capecitabine** | 0.34 | 0.34 |
| **Carboplatin** | **16.64** | 16.98 |
| **Cetuximab** | 0.32 | 17.30 |
| **Cisplatin** | **24.02** | 41.32 |
| **Docetaxel** | **5.99** | 47.31 |
| **Epirubicin** | 0.15 | 47.46 |
| **Etoposide** | 0.44 | 47.90 |
| **Fluorouracil (5FU)** | **31.18** | 79.08 |
| **Gemcitabine** | 0.20 | 79.28 |
| **Irinotecan** | 3.19 | 82.47 |
| **Methotrexate** | 0.13 | 82.59 |
| **Oxaliplatin** | 0.56 | 83.15 |
| **Paclitaxel** | **16.43** | 99.58 |
| **Nab-Paclitaxel** | **0.10** | 99.68 |
| **Others\*** | 0.32 | 100 |
| **Regimen** | **Percent** | **Cumulative Percent** |
| **Carboplatin-Paclitaxel** | 22.64 | 21.69 |
| **Cisplatin-5FU** | 37.19 | 57.31 |
| **Docetaxel-5FU** | 5.95 | 63.01 |
| **Other** | 38.62 | 100 |
| **5FU-based** | 43.56 | 43.56 |
| **Non 5FU-based** | 40.19 | 83.75 |
| **No chemotherapy** | 16.25 | 100 |
|  |  |  |
| \*Agents used <0.1%: Avastin, Bleomycin, Cladribine, Cyclophosphamide, Doxorubicin, Floxuridine, Fludarabine, Mechlorethamine, Mitomycin, Mitoxantrone, Porfimer sodium, Rituximab, Trastuzumab, Vinblastine, Vincristine, Vinorelbine | | | |