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## Comparison of cancer diagnoses between the US solid organ transplant registry and linked central cancer registries

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### Abstract

US transplant centers are required to report cancers in transplant recipients to the transplant network. The accuracy and completeness of these data, collected in the Scientific Registry of Transplant Recipients (SRTR), are unknown. We compared diagnoses in the SRTR and 15 linked cancer registries, for colorectal, liver, lung, breast, prostate, and kidney cancers, melanoma, and non-Hodgkin lymphoma (NHL). Among 187,384 transplants, 9323 cancers were documented in the SRTR or cancer registries. Only 36.8% of cancers were in both, with 47.5% and 15.7% of

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#### Disclaimer

The views expressed in this paper are those of the authors and should not be interpreted to reflect the views or policies of the National Cancer Institute, Health Resources and Services Administration, SRTR, cancer registries, or their contractors.

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cases additionally documented solely in cancer registries or the SRTR, respectively. Agreement between the SRTR and cancer registries varied (kappa: 0.28 for liver cancer, 0.52–0.66 for lung, prostate, kidney, colorectum and breast cancers). Upon evaluation, some NHLs documented only in cancer registries were identified in the SRTR as another type of post-transplant lymphoproliferative disorder. Some SRTR-only cases were explained by miscoding (colorectal cancer instead of anal cancer, metastases as lung or liver cancers) or missed matches with cancer registries, partly due to out-migration from their catchment areas. Estimated sensitivity for identifying cancer was 52.5% for the SRTR and 84.3% for cancer registries. In conclusion, SRTR cancer data are substantially incomplete, limiting their usefulness for surveillance and research.

## Introduction

Solid organ transplant recipients have elevated cancer risk, largely due to the need for lifelong use of immunosuppressive therapy to prevent rejection<sup>1,2</sup>. In recognition of this heightened risk and the importance of cancer as an adverse outcome of transplantation, the US Organ Procurement and Transplantation Network (OPTN) requires all US transplant centers to report the occurrence of cancer among recipients as part of post-transplant surveillance. These data on cancer are collected in the Scientific Registry of Transplant Recipients (SRTR) and have been used to describe cancer incidence among transplant recipients<sup>3–7</sup>. While cancer reporting is mandatory, it depends on continued efforts by transplant centers to follow recipients for many years after the transplant procedure. The completeness and accuracy of OPTN cancer reports are uncertain.

Population-based central cancer registries (herein referred to simply as “cancer registries”) collect detailed data on all reportable malignancies arising in residents of their defined state or metropolitan region catchment areas. Cancers (other than basal and squamous cell skin cancers) are reportable in all US states, and information on cancer diagnoses is provided to cancer registries by hospitals, pathology laboratories, and physicians who diagnose or treat cancer patients. Given the reporting mandated by law as well as the focus, expertise, and resources expended by cancer registries to actively ascertain and characterize all eligible cancer cases, cancer registry diagnoses are largely complete and accurate<sup>8</sup>.

The Transplant Cancer Match (TCM) Study links the SRTR with multiple US cancer registries to identify the occurrence of cancer in transplant recipients<sup>1</sup>. In the present study, we compare cancer diagnoses recorded by the SRTR and cancer registries within the TCM Study. This information is useful for understanding the quality of cancer reports in both sources, which in turn has implications for cancer surveillance and epidemiologic research that utilize SRTR and cancer registry data.

## Methods

The TCM Study is described elsewhere (<http://transplantmatch.cancer.gov/>)<sup>1</sup>. A computerized linkage was performed between the SRTR and each participating cancer registry, followed by a clerical review to identify valid matches based on name, sex, social security number, and date of birth. Transplant recipients were included if, based on their

address at the time of listing or transplantation, they resided in a region covered by one of 15 participating TCM cancer registries.

SRTR diagnoses of cancer were assessed beginning at transplantation or January 1, 1998 (when cancer reporting was first required of OPTN transplant centers), whichever came later, and ending at the earliest of death, graft failure, retransplant, loss to follow-up, or December 31, 2010. For each cancer registry, we identified cancer diagnoses during the years for which it had population-based case ascertainment. In our analyses, to allow for equivalent ascertainment of cancers by both the SRTR and the linked cancer registries, we then assessed cancer diagnoses for the time interval defined by overlap between follow-up by the SRTR and cancer registries. For recipients who received multiple successive transplants, follow-up time was assessed separately for each transplant.

We analyzed the following invasive malignancies, because they were common and ascertained by both the SRTR and cancer registries: cancers of the colorectum, liver, lung, breast, prostate, and kidney, and melanoma and non-Hodgkin lymphoma (NHL). For liver cancer, we excluded cases within 6 months after a liver transplant to exclude prevalent cancers that were the indication for transplant.

For the included transplants, we report the total number of cases of each cancer identified in either the SRTR or cancer registries, cases reported in only one source (termed “SRTR-only” and “cancer registry-only” cases), and cases reported in both sources. The kappa statistic, a measure of agreement, was calculated using PROC FREQ in SAS (version 9.3, SAS Institute, Cary, NC). We assessed kappa overall and in subgroups defined by transplanted organ (kidney vs. non-kidney) and calendar year of transplantation (1998–2003, 2004–2010). Differences in kappa between subgroups were considered significant when the 95% confidence intervals did not overlap. Also, for cancer cases reported in both the SRTR and cancer registries, we summarize the time interval between diagnosis dates.

We investigated several possible explanations for discrepancies between the SRTR and cancer registries (Figure 1). First, we assessed the number of cancers identified in both sources when we allowed for diagnoses outside the overlapping time interval described above. Second, we assessed the possibility that some cancer diagnoses could be miscoded by searching for similar cancers. Specifically, for NHL we searched for diagnoses of other hematologic malignancies or post-transplant lymphoproliferative disorder (PTLD, a group that encompasses both non-malignant and malignant lymphoid neoplasms, which is captured in the SRTR). We also searched for anal cancers in the cancer registries when colorectal cancer was recorded in the SRTR. Third, for SRTR-only diagnoses of lung cancer or liver cancer, we searched for other cancer diagnoses in cancer registries, under the assumption that SRTR diagnoses could represent miscoding of metastases of these other cancers.

We sought additional explanations for a subset of discrepancies that remained after we excluded these groups (see Figure 1). For this limited “review group,” we considered that some cancer registry-only cases could represent false positive matches between the databases (i.e., that the wrong cancer registry record was linked to a transplant recipient). To assess this possibility, staff at a subset of eight TCM cancer registries re-examined

identifying information from the SRTR and cancer registry on review group cases, and based on this supplementary assessment, determined whether each case should be regarded as a high probability or intermediate probability match, or reclassified as a non-match.

Likewise, we considered that SRTR-only cases could be false negative matches (i.e., the cancer diagnosis is present in a cancer registry, but the linkage missed it). Staff at the same eight cancer registries therefore used the identifying information from the SRTR to perform a focused search of review group cases, to see if there was a possible match that had been missed previously; these SRTR-only cases were rescored by the cancer registries as a match or non-match. In the newly discovered matched cases, we used information in the cancer registries to distinguish between cancers diagnosed in people who resided within the cancer registry catchment areas and those diagnosed outside the catchment areas. This distinction is important because cancer registries consistently ascertain cancers only for their catchment area (a state or metropolitan region), and out-migration following transplantation can lead the cancer registries to miss cases in recipients. Furthermore, for SRTR-only cases in the review group, we separately used data provided by the SRTR on the last known state of residence of the transplant recipients to assess out-migration.

Finally, many transplant recipients who develop cancer die from their cancer. For cancer cases in the three groups (cases documented in both sources, SRTR-only, cancer registry-only) who had died, we assessed SRTR data on whether cancer was the cause of death reported by transplant centers. When cases had cancer listed as a cause of death, this was considered further evidence that the cancer diagnosis was correct.

## Results

### Transplant cohort and measures of agreement regarding cancer diagnoses

We evaluated 187,384 transplants for which recipients resided in 15 US states/metropolitan regions covered by a TCM cancer registry. Most recipients (61%) were male, and the median age at transplantation was 49 years. The most commonly transplanted organs were kidney (58%), liver (22%), heart (10%), and lung (4%).

There were a total of 9323 diagnoses of the eight evaluated cancers, documented in either the SRTR or cancer registries (Table 1), of which the most common were lung cancer (N=1993) and NHL (N=1846), and the least common was liver cancer (N=289). Notably, a much larger fraction of cases was documented only in cancer registries than only in the SRTR (47.5% vs. 15.7%).

Only about a third of cases (36.8%) were documented in both the SRTR and cancer registries; this percentage ranged from 16.3% for liver cancer to 46.4% for lung cancer and 49.5% for breast cancer. Kappa statistics were as low as 0.28 for liver cancer but were above 0.50 for cancers of lung, prostate, kidney, colorectum, and breast (Table 1). When both the SRTR and cancer registries had a diagnosis of the same cancer, the time between the reported diagnoses was usually short (median 14 days), but in 25% of cases the interval was more than 40 days and it was sometimes much longer (Table 1).

As shown in Table 2, agreement between the SRTR and cancer registries was slightly better for non-kidney recipients than kidney recipients for most cancers, although this difference was significant only for kidney and colorectal cancers. Agreement was similar according to calendar year of transplant, with the exception of melanoma, for which the kappa increased for transplants beginning in 2004.

For the total of 9323 cancers diagnosed in either the SRTR or cancer registries, the cancer registries had diagnoses of 7858 (estimated sensitivity 84.3%) and the SRTR had diagnoses for 4892 (estimated sensitivity 52.5%).

### **Evaluation of SRTR-only and cancer registry-only diagnoses**

Figure 1 describes results of additional evaluation of cancer registry-only and SRTR-only cases. For the 4431 cancer registry-only diagnoses, there was an SRTR diagnosis of the same cancer outside the overlapping time window for 534 cases (12.1%). In addition, 185 (4.2%) transplants with a cancer registry-only diagnosis of NHL had another type of PTLN recorded in the SRTR.

For the 1465 SRTR-only diagnoses, there was a cancer registry diagnosis of the same cancer outside the overlapping time window for 165 cases (11.2%) (Figure 1). Also, 41 (2.8%) transplants with SRTR-only diagnoses of NHL or colorectal cancer had related diagnoses of other hematologic malignancies or anal cancer, respectively, in a cancer registry. Finally, 257 recipients (17.5%) had SRTR-only diagnoses of lung or liver cancer but had diagnoses of other cancers in cancer registries, which could represent SRTR miscoding of metastases of these other cancers.

As described in the Methods and depicted in Figure 1, a total of 3654 cancer registry-only cases and 1002 SRTR-only cases were eligible for further review (i.e., the “review group”). Cancer registry staff re-examined identifying information on 1267 cancer registry-only cases from the review group. Of these, 1251 (98.7%) were confirmed to be high probability matches to the SRTR, 13 (1.0%) were intermediate probability matches, and 3 (0.2%) were not confirmed as matches.

Cancer registry staff also examined 502 of the SRTR-only cases in the review group (Figure 1). Among this subset, we identified 118 (23.5%) matching cancer registry records for cancers in people living within the registry catchment areas, and 52 (10.4%) cancer registry records for cancers in people outside the catchment areas; 332 (66.1%) SRTR-only cases were confirmed to lack matching cancer registry records. Further, we assessed the last known address of SRTR-only cases in the full review group. Of 1002 such cases, 187 (18.7%) had, at some point after transplant, moved out of the state in which they were considered to have resided at the time of transplantation.

Finally, among the transplant recipients with cancers documented in both the SRTR and cancer registries, 35.5% were noted in the SRTR to have died due to cancer (Table 3). This proportion ranged from 10.4% for prostate cancer to 57.4% for liver cancer and 69.3% for lung cancer. Among cases documented only in the SRTR, the proportions of deaths from cancer were somewhat similar overall (38.3%) and for most individual cancers, although

they appeared lower for NHL and melanoma than when both the SRTR and cancer registries documented the cancer (Table 3). For cancer registry-only cases, the proportion with a death from cancer documented in the SRTR was lower but not negligible (19.5% overall) and was as high as 37.0% for lung cancer and 42.2% for liver cancer.

## Discussion

In this study, we assessed agreement for diagnoses of eight common cancer types among US transplant recipients from two data sources: the SRTR, which ascertains cancers through reports from transplant centers; and linked cancer registries, which obtain their case information from medical institutions and healthcare providers involved in the diagnosis and treatment of cancer patients. Overall, agreement between these two data sources was fair, although it was quite poor for liver cancer (kappa 0.28) and much better for a number of the others (kappas of 0.52–0.66 for lung, prostate, kidney, colorectal, and breast cancers). Neither the SRTR nor the cancer registries identified all of the cases, but the cancer registries had more cases overall than the SRTR. In light of the discrepancies between the two data sources, and because data on cancer are used for monitoring transplantation outcomes and for epidemiological research, it is important to consider the causes for the differences and the magnitude of any under-ascertainment and inaccuracies in cancer diagnoses.

Cancer registries are a source of highly complete and accurate data on incident cancers<sup>8</sup>. In every US state, reporting of cases to a central cancer registry is mandated by law. Cancer registries expend substantial resources and implement multiple procedures to capture as many cases as possible and ensure high data quality. For example, cancer registries conduct audits of medical care facilities routinely and on a targeted basis when the number of cancer diagnoses appears low or has declined over time. Cancer registries also make special efforts to reach out to physicians who treat cancers (such as melanoma and prostate cancer) that can be managed solely in an outpatient office setting<sup>9,10</sup>, and some registries have begun to receive electronic pathology reports from pathology laboratories for all cancer diagnoses on an automatic basis. Most cancer registries maintain data exchange agreements with neighboring states to obtain reports for individuals who reside in their catchment area but who are diagnosed or treated for cancer out-of-state. In addition, most cancer registries use information from death certificates (recorded in state records and the US National Death Index database) to carry out “death clearance,” in which they contact hospitals and physicians to document cancer diagnoses for deceased residents with cancer specified as a cause of death<sup>11</sup>. Finally, the accuracy of a large fraction of cancer diagnoses in cancer registries is supported by pathology reports that document results of biopsies, cytology tests, and autopsies.

Nonetheless, before concluding that all of the cancer registry diagnoses in the TCM Study were correct, we first considered a possible alternative, i.e., that some matches between the SRTR and cancer registries were false positive matches that identified the wrong person with cancer. However, we excluded this possibility in our re-assessment of the review group, because matches were confirmed with a high probability for 98.7% of cancer registry-only cases. Furthermore, some of these transplant recipients died, and their cause of death was recorded by the SRTR as due to cancer, even though the SRTR had not earlier recorded a

cancer diagnosis. Thus, it appears that the cancer diagnoses identified by linkage with the cancer registries were indeed valid.

Turning to the SRTR-only cases, one contributing factor appears to be missed matches between the SRTR and cancer registries (i.e., false negative matches), some of which probably occurred as a result of registry staff being too conservative in the original data linkage procedures, or due to clerical errors. Another reason why cases may be documented only in the SRTR is that some recipients moved out of the cancer registry catchment areas. Because cancer registries do not attempt to consistently capture cancer diagnoses outside their catchment areas, these cases are incompletely ascertained by data linkages, and the few that are identified are typically deleted from TCM Study analyses. Our assessment determined that 10.4% of SRTR-only cases in the review group were recorded in cancer registries but were not residents of the registries' catchment areas. Out-migration is also suggested by SRTR data that showed that 18.7% of transplant recipients in the SRTR-only review group moved to another state at some point in time.

Finally, differences in disease classification contributed to discrepancies and the low level of agreement for some cancers. Cancer registries follow strict rules in assigning diagnoses to ensure that the anatomic site of the cancer is correctly identified, that the primary site is counted instead of the site of any metastases, and that only initial diagnoses (not recurrences) are counted. It is likely that staff at transplant centers are unaware of these procedures, which could lead to inaccurate reports to the SRTR. For instance, one important category comprises a subset of SRTR-only diagnoses of lung or liver cancer for which we identified another diagnosis in the cancer registries. At least some of these cases, which comprised 17.5% of all SRTR-only cancers, could be misreported lung or liver metastases in the SRTR. This miscoding may explain the especially poor agreement between the SRTR and cancer registries for liver cancer. In addition, some individuals with colorectal cancer in the SRTR were noted to have anal cancer in the cancer registries. These are considered different clinical entities, and because cancer registries invest substantial effort in documenting cancer diagnoses, we believe that the cancer registry diagnoses of anal cancer are probably more accurate. Finally, another category of discrepancy is when one source had an NHL diagnosis and the other had a related hematologic malignancy or PTLN (which is captured in the SRTR). It is likely that centralized review by expert hematopathologists could lead to consensus diagnoses in these cases and resolve the discrepancies, but that was not within the scope of our study.

Other results should also be considered when assessing the level of agreement between the SRTR and cancer registries. When both sources documented the same cancer, the diagnosis dates were usually quite close. Indeed, because cancer registries provided only the month of cancer diagnosis to the TCM Study, differences in diagnosis dates less than 30 days are not meaningful. However, in a minority of cases the difference in dates was very large (Table 1), and in those cases it seems doubtful that the SRTR and cancer registry were recording the same information even though the type of cancer was the same. Some cancer diagnoses were present in both data sources when we assessed diagnoses outside the overlapping time interval. These cases could not be included in our main analyses without introducing bias in comparing the SRTR and cancer registries, but there were relatively few such cases. For

most cancers, our results suggest better agreement between the SRTR and cancer registries for non-kidney transplants than kidney transplants, which may be explained by closer follow-up of non-kidney transplants and better ascertainment of their cancers by transplant centers. Unfortunately, there was little improvement in the level of agreement across the entire calendar interval, which might have occurred if ascertainment of cancers improved over time.

Strengths of our study include its large size and evaluation of a population-based sample of 56% of approximately 333,000 US transplants performed during 1998–2010. Also, we carefully assessed reasons for discrepancies in diagnoses, including differences in classification of cancers, inaccuracies in the data linkages, and out-migration. A limitation of our study is that we did not have a gold standard for cancer ascertainment against which to compare the SRTR and cancer registries. Although we were thus unable to definitively resolve discrepancies in these data sources, our analyses point to potential explanations and help quantify their overall impact. Also, our study results apply directly only to the SRTR and US cancer registries participating in the TCM Study, but the results can help understand cancer data from other sources (e.g., transplant or other medical registries in other countries, and other cancer registry linkages). We did not explicitly account for multiple comparisons, but we used a conservative criterion for statistical significance (i.e., non-overlapping of 95% confidence intervals) when comparing kappa estimates across subgroups.

Overall, these analyses suggest that the linked cancer registry data in the TCM Study identify approximately 84% of cancers in transplant recipients. While some cases were missed due to errors in matching or out-migration, this estimate of sensitivity is conservative because it does not account for some likely mistakes in SRTR coding of cancer diagnoses. Overall, these results indicate that the TCM Study data might modestly underestimate cancer incidence among transplant recipients, but they are sufficiently accurate for comparing cancer incidence between subgroups of transplant recipients.

In contrast, the sensitivity of transplant center reports on cancer in the SRTR appears to be much lower (approximately 53%), and some cancer diagnoses in the SRTR are probably incorrect. Our results therefore suggest that SRTR data on cancers in transplant recipients are not sufficiently complete and accurate for monitoring transplantation outcomes or for epidemiologic research.

It is therefore important to consider how to improve the capture of cancer outcomes in the SRTR. Linkages with cancer registries may not adequately serve for ongoing monitoring of transplant safety, because they do not cover the entire US, but there are efforts to create a national virtual cancer registry that combines data from the state cancer registries<sup>12</sup>. In the meantime, several additional steps could be taken by transplant centers and the OPTN. First, transplant center staff should be educated about the public health and research importance of complete reporting of cancers to the OPTN. Second, centers should commit sufficient resources to ensure full compliance with OPTN requirements for follow-up reporting of transplant outcomes, which include the reporting of malignancies. Third, additional mechanisms for ascertaining cancer diagnoses should be explored. It is intriguing that some recipients whose cause of death was listed in the SRTR as cancer had never had their cancer



reported in the first place. This discrepancy suggests that some transplant centers believe that reporting a death from cancer constitutes adequate documentation of the cancer itself. Instead, in an analogous manner to death clearance procedures utilized by cancer registries, these deaths should prompt transplant centers to obtain additional details documenting the original cancer diagnosis and report this information to the OPTN. Also, linkage of the SRTR with the US National Death Index database could identify additional cancer deaths in transplant recipients, which could similarly initiate follow-back activities by transplant centers. Because cancer continues to be a major adverse outcome of transplantation, the OPTN should ideally make continued efforts to improve ascertainment and registration of cancer in US transplant recipients.

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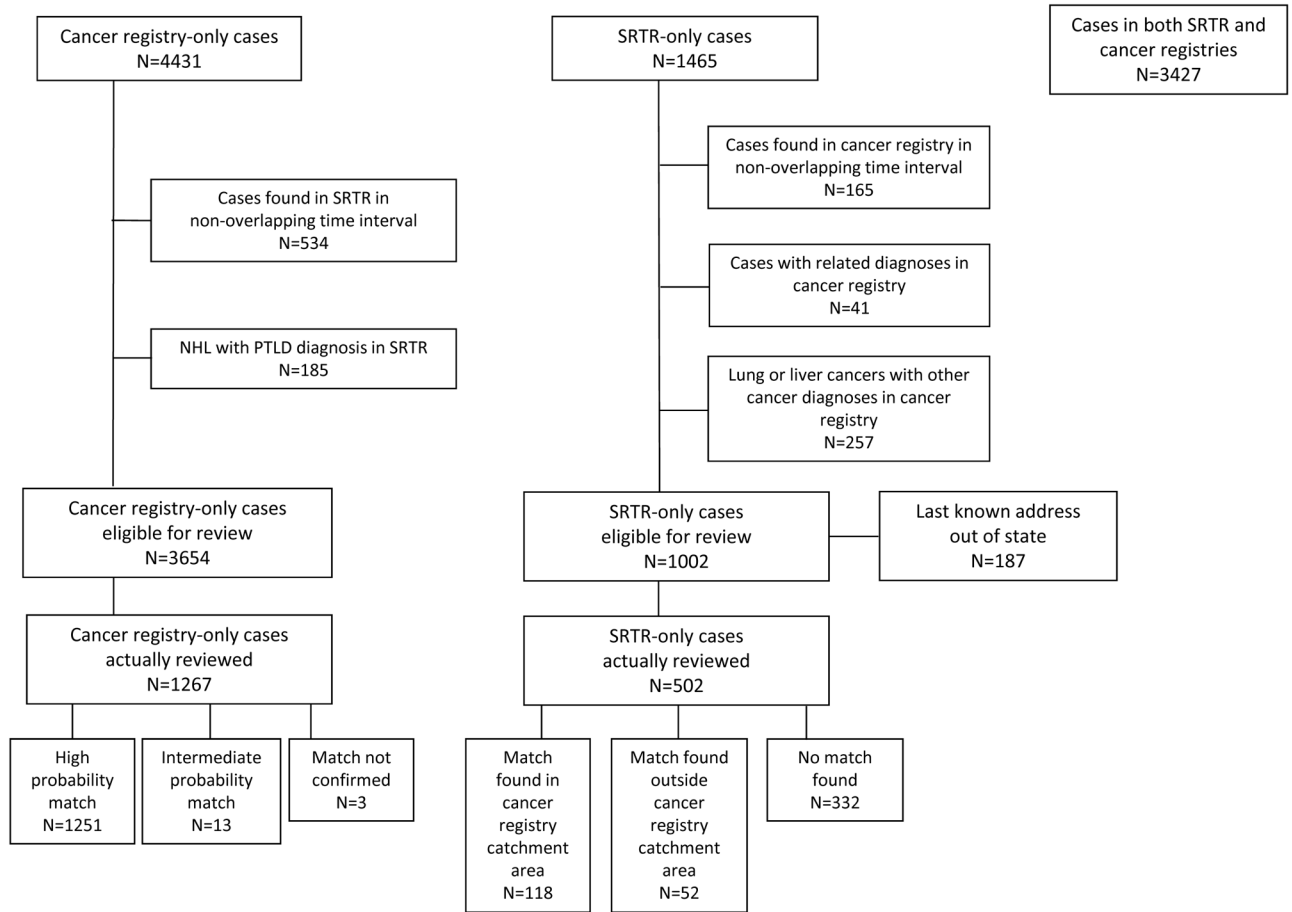
## Abbreviations

<b>NHL</b>	non-Hodgkin lymphoma
<b>OPTN</b>	Organ Procurement and Transplantation Network
<b>PTLD</b>	post-transplant lymphoproliferative disorder
<b>SRTR</b>	Scientific Registry of Transplant Recipients
<b>TCM Study</b>	Transplant Cancer Match Study

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**Figure 1.**

Evaluation of cancer diagnoses in the SRTR and cancer registries. Reading from top to bottom, the figure describes the number of cancer registry-only cases (N=4431 total cases) and SRTR-only cases (N=1465 total cases) that were determined to be in each category. A subset of cancer registry-only and SRTR-only cases were reviewed by staff at eight cancer registries. A total of 3427 cancer cases were documented in both the SRTR and cancer registries. SRTR, Scientific Registry of Transplant Recipients.

**Table 1**  
 Agreement between cancers diagnoses in the SRTR and cancer registries among 187,384 transplant recipients

Cancer Type	Total cancers identified	N (%)			Kappa statistic (95% CI)	Absolute difference in diagnosis dates for cancers in both databases, days		
		Only in cancer registry	Only in SRTR	In both cancer registry and SRTR		Median (IQR)	Minimum, Maximum	99 <sup>th</sup> percentile
Lung	1993	711 (35.7)	357 (17.9)	925 (46.4)	0.63 (0.61–0.65)	14 (6–37)	0, 2506	1103
NHL	1846	1170 (63.4)	234 (12.7)	442 (23.9)	0.38 (0.36–0.41)	10 (4–18)	0, 2597	1564
Prostate	1544	699 (45.3)	183 (11.9)	662 (42.9)	0.60 (0.57–0.62)	16 (7–66)	0, 3822	1559
Kidney	1054	539 (51.1)	124 (11.8)	391 (37.1)	0.54 (0.51–0.57)	12 (6–45)	0, 2996	1959
Colorectum	895	440 (49.2)	141 (15.8)	314 (35.1)	0.52 (0.48–0.55)	13 (5–24)	0, 3035	808
Breast	854	344 (40.3)	87 (10.2)	423 (49.5)	0.66 (0.63–0.69)	16 (8–38)	0, 2822	534
Melanoma	848	419 (49.4)	206 (24.3)	223 (26.3)	0.41 (0.38–0.45)	22 (11–83)	0, 2768	2475
Liver	289	109 (37.7)	133 (46.0)	47 (16.3)	0.28 (0.22–0.34)	14 (5–56)	0, 1261	1261
Total	9323	4431 (47.5)	1465 (15.7)	3427 (36.8)	--	14 (6–40)	0, 3822	1545

Abbreviations: CI confidence interval, IQR interquartile range, NHL non-Hodgkin lymphoma, SRTR Scientific Registry of Transplant Recipients. Cancer types are ordered in decreasing total frequency.

Kappa statistics showing agreement of cancer diagnoses in SRTR and cancer registries, calculated within strata defined by transplanted organ and calendar year of transplantation.

**Table 2**

Cancer Type	Kappa statistic (95% confidence interval)			
	Type of Transplant		Calendar Period of Transplantation	
	Overall	Kidney	Non-Kidney	2004–2010
Lung	0.63 (0.61–0.65)	0.62 (0.58–0.65)	0.64 (0.61–0.66)	0.60 (0.55–0.64)
NHL	0.38 (0.36–0.41)	0.36 (0.32–0.39)	0.41 (0.37–0.44)	0.44 (0.39–0.50)
Prostate	0.60 (0.57–0.62)	0.57 (0.54–0.61)	0.62 (0.59–0.66)	0.62 (0.57–0.67)
Kidney	0.54 (0.51–0.57)	0.50 (0.47–0.54)	0.66 (0.60–0.71)	0.50 (0.43–0.56)
Colorectum	0.52 (0.48–0.55)	0.46 (0.41–0.51)	0.57 (0.52–0.61)	0.49 (0.40–0.57)
Breast	0.66 (0.63–0.69)	0.64 (0.60–0.67)	0.71 (0.66–0.75)	0.71 (0.64–0.77)
Melanoma	0.41 (0.38–0.45)	0.38 (0.33–0.43)	0.46 (0.40–0.51)	0.52 (0.45–0.60)
Liver	0.28 (0.22–0.34)	0.31 (0.22–0.40)	0.22 (0.15–0.30)	0.24 (0.13–0.34)

Abbreviations: NHL, non-Hodgkin lymphoma

Cancer types are ordered in decreasing total frequency (see Table 1).

**Table 3**

Cancer deaths recorded in the SRTR among cancer cases documented only in cancer registries, only in the SRTR, or in both sources.

Cancer Type	Only in cancer registry	Only in SRTR	In both cancer registry and SRTR
<b>Lung</b>			
Cases, N	711	357	925
Died from cancer, N (%)	263 (37.0)	246 (68.9)	641 (69.3)
<b>NHL</b>			
Cases, N	1170	234	442
Died from cancer, N (%)	304 (26.0)	45 (19.2)	128 (29.0)
<b>Prostate</b>			
Cases, N	699	183	662
Died from cancer, N (%)	40 (5.7)	24 (13.1)	69 (10.4)
<b>Kidney</b>			
Cases, N	539	124	391
Died from cancer, N (%)	35 (6.5)	41 (33.1)	74 (18.9)
<b>Colorectum</b>			
Cases, N	440	141	314
Died from cancer, N (%)	87 (19.8)	60 (42.6)	126 (40.1)
<b>Breast</b>			
Cases, N	344	87	423
Died from cancer, N (%)	23 (6.7)	24 (27.6)	73 (17.3)
<b>Melanoma</b>			
Cases, N	419	206	223
Died from cancer, N (%)	67 (16.0)	32 (15.5)	79 (35.4)
<b>Liver</b>			
Cases, N	109	133	47
Died from cancer, N (%)	46 (42.2)	89 (66.9)	27 (57.4)
<b>Total</b>			
Cases, N	4431	1465	3427
Died from cancer, N (%)	865 (19.5)	561 (38.3)	1217 (35.5)

Abbreviations: NHL non-Hodgkin lymphoma

Cancer types are ordered in decreasing total frequency (see Table 1).