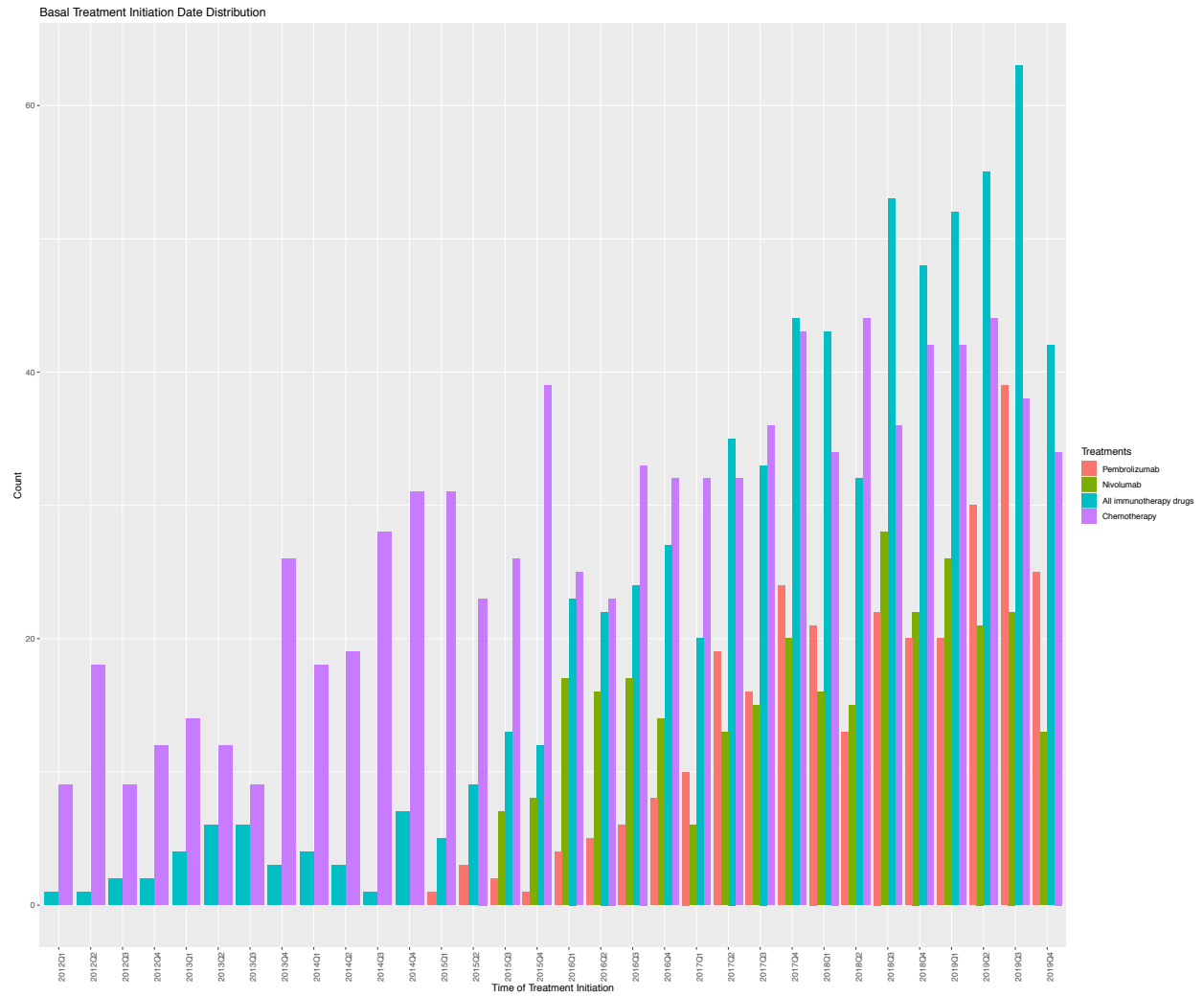


Real-World Data Analyses Unveiled the Immune-Related Adverse Effects of Immune Checkpoint Inhibitors across Cancer Types

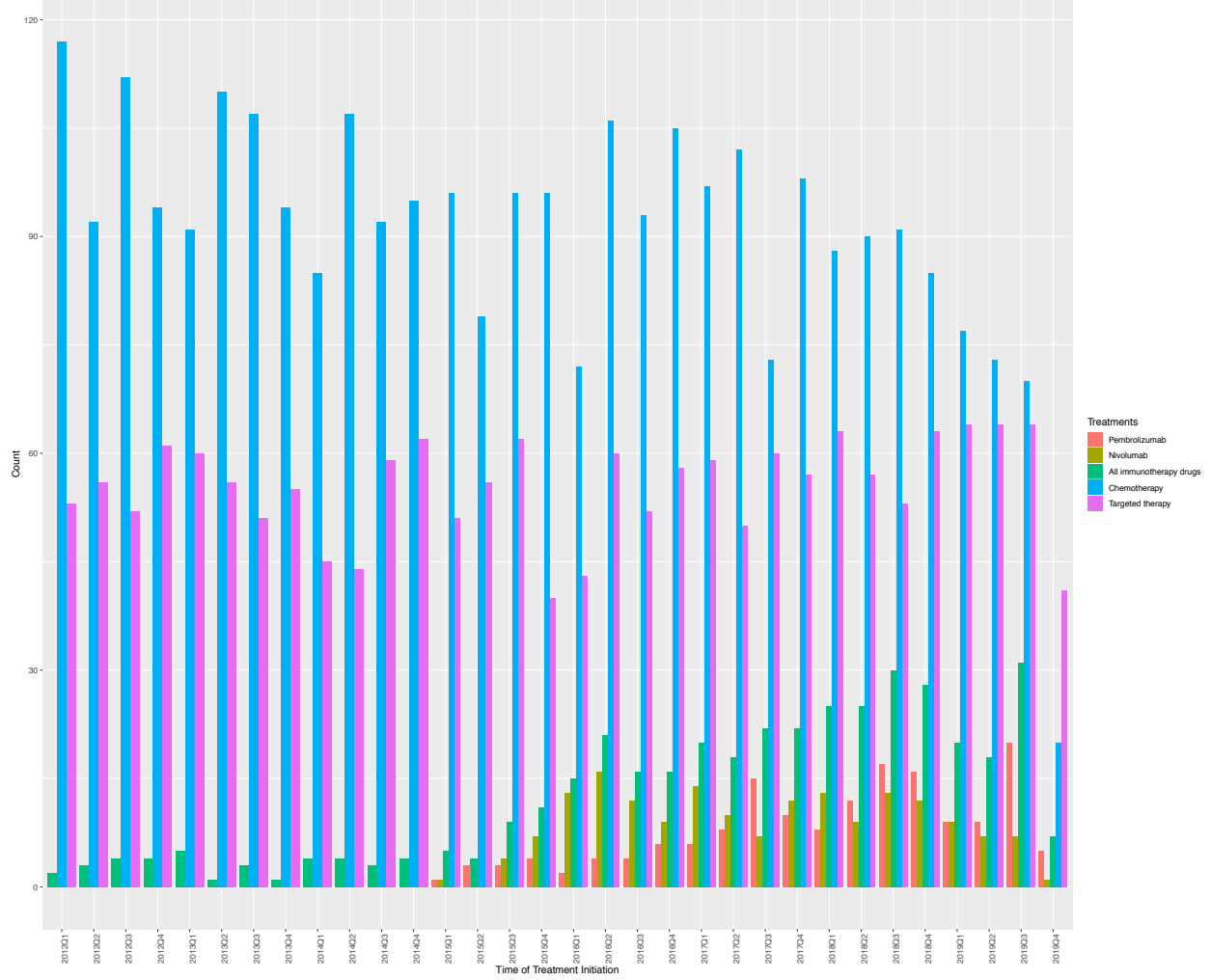
Supporting Information

The organization of this supporting information is as follows: (1) the distribution of the initiation date of chemotherapy, targeted therapy, and immunotherapy for all seven cancer types (Figure S1); (2) time-to-event plot showing the time between treatment initiation and the development of specific autoimmune diseases within 15 months for all seven cancer types (Figure S2); (3) examination of covariate balance (Figure S3); (4) time to autoimmunity analysis with the full time horizon (Figures S4-S5); (5) detailed results of additional sensitivity and robustness studies (Figures S6-S9); (6) additional subpopulation analyses (Figures S10-S13); (7) the number of patients undergoing chemotherapy, targeted therapy, and immunotherapy across 7 different types of cancers (Figure S14); (8) time-to-event plot showing the time between treatment initiation and the development of immune adverse event groups (Figures S15-S16); (9) sensitivity analysis excluding the patients with multiple treatments (ex. immunotherapy and chemotherapy) and patients with multiple immunotherapies (ex. nivolumab and ipilimumab) (Figures S17-S18); (10) detailed data summary (Tables S1-S11).

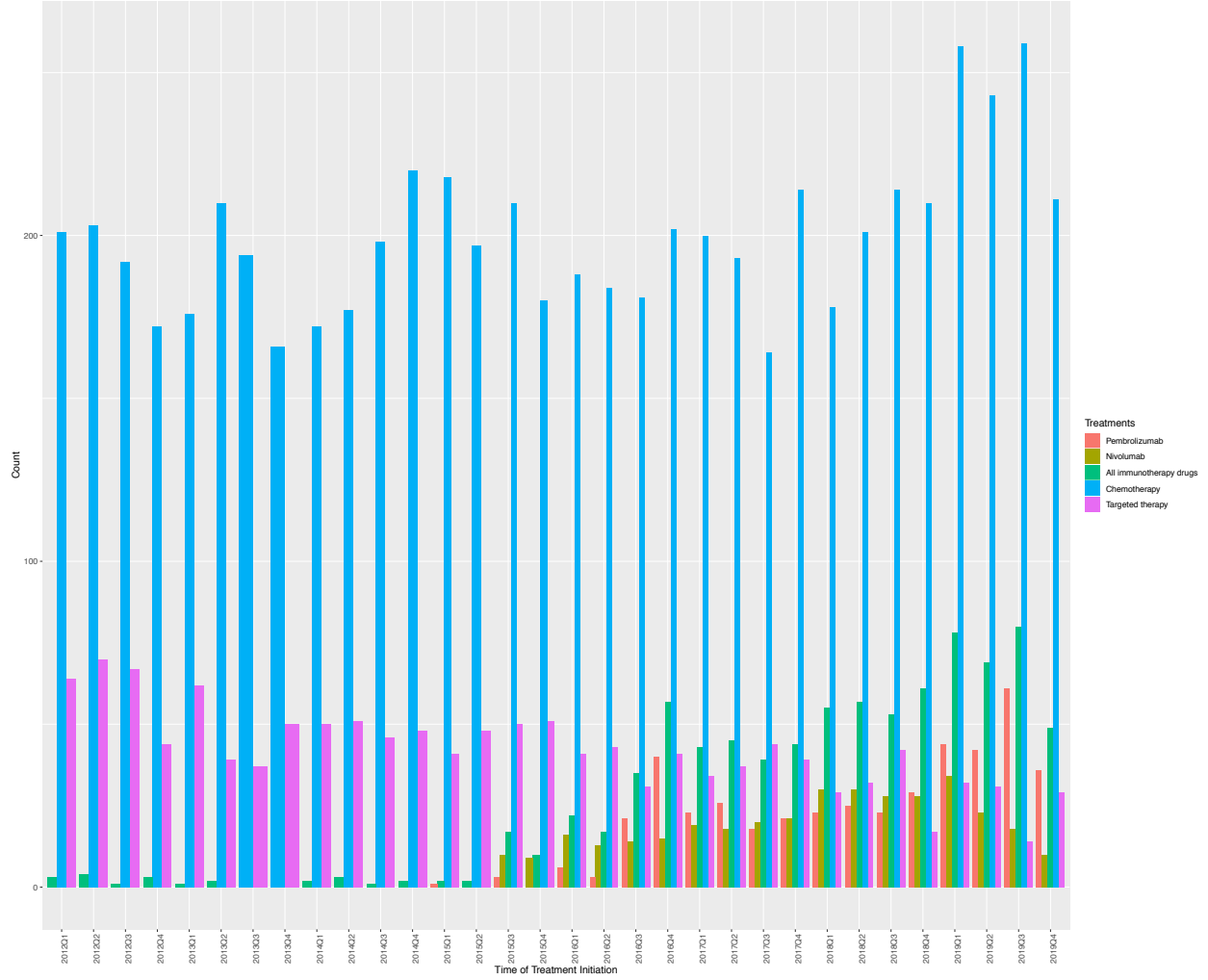
Figure S1. The distribution of the initiation date of chemotherapy, targeted therapy, and immunotherapy for 7 different cancers after 2012.



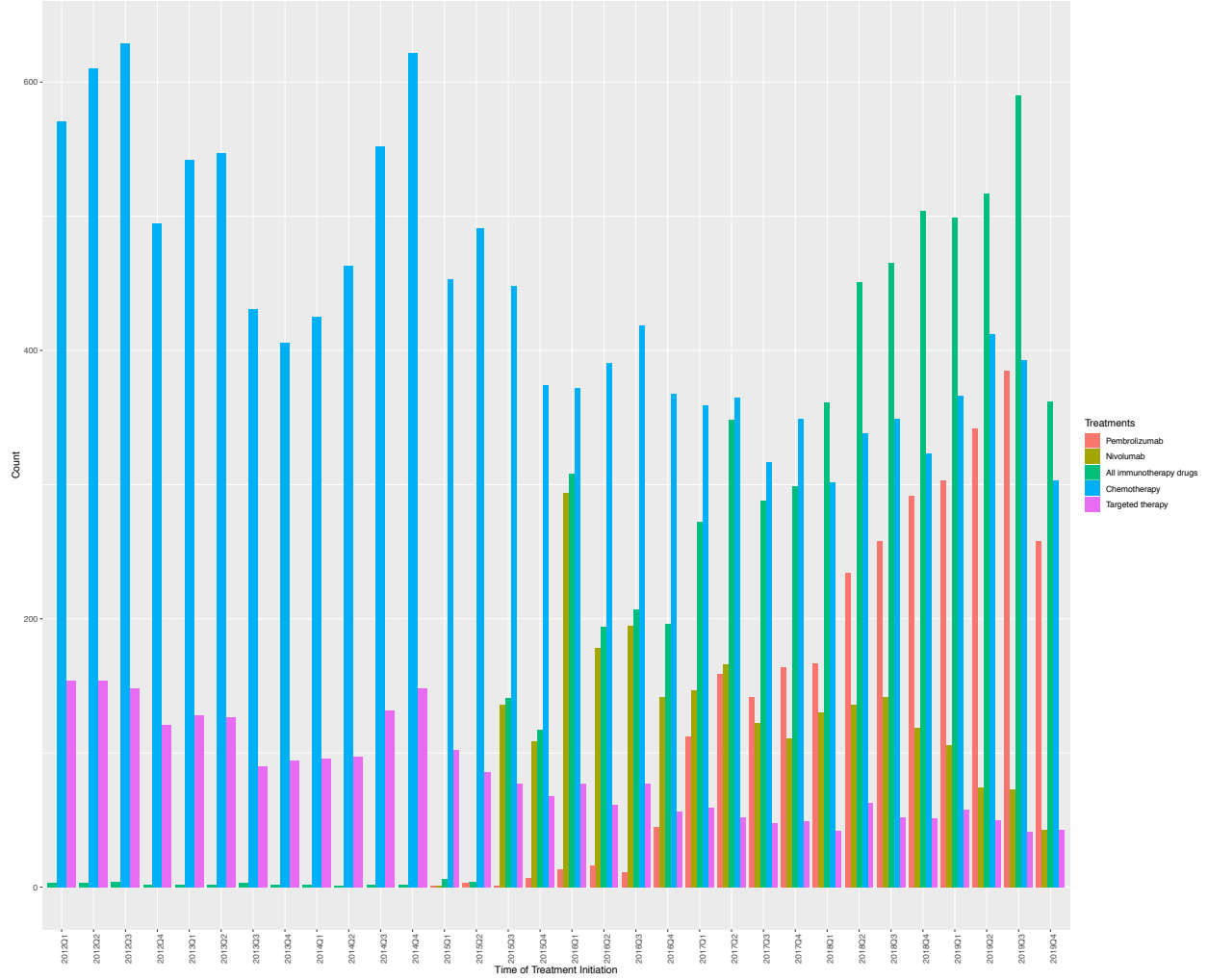
Brain Treatment Initiation Date Distribution



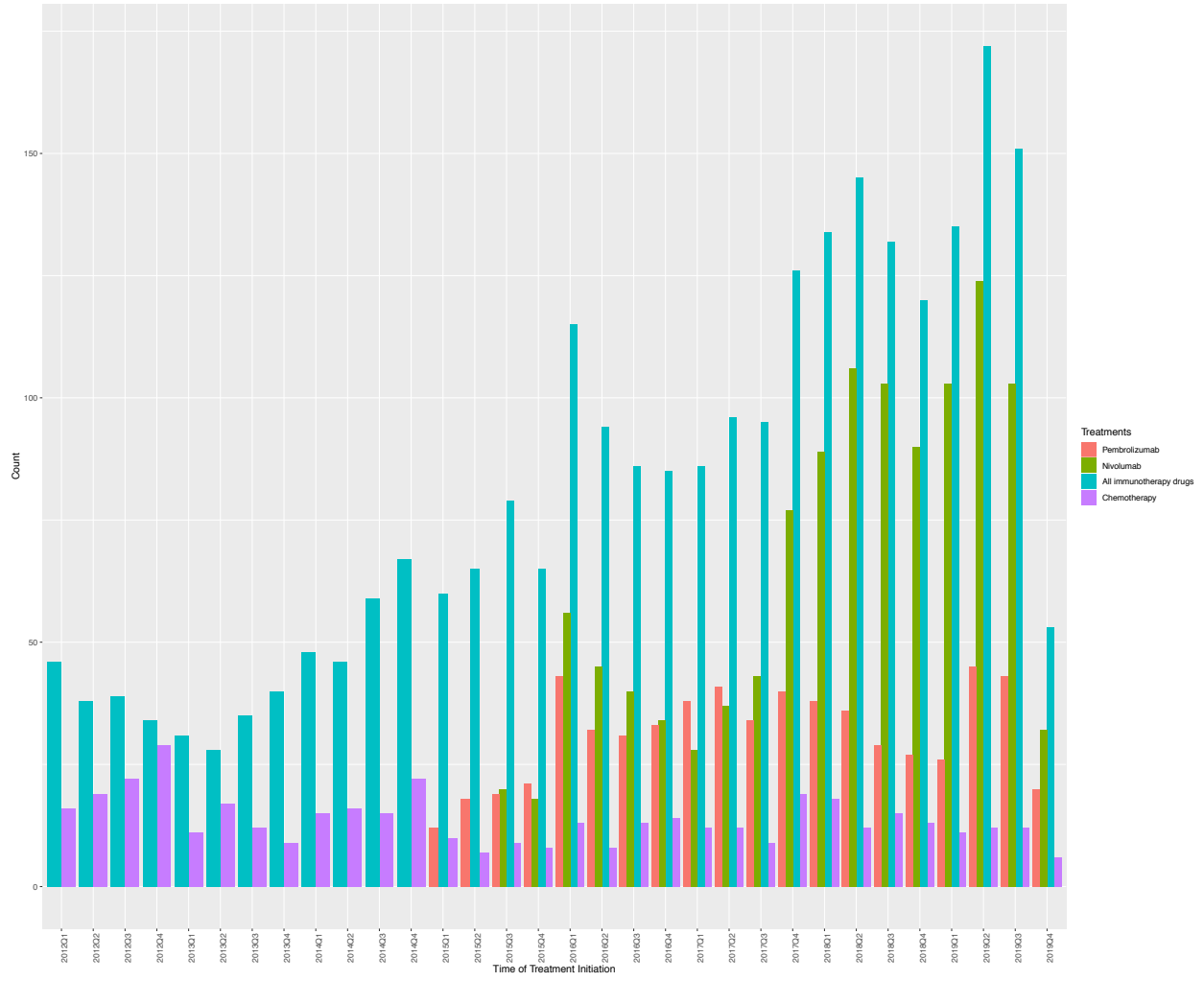
HeadAndNeck Treatment Initiation Date Distribution



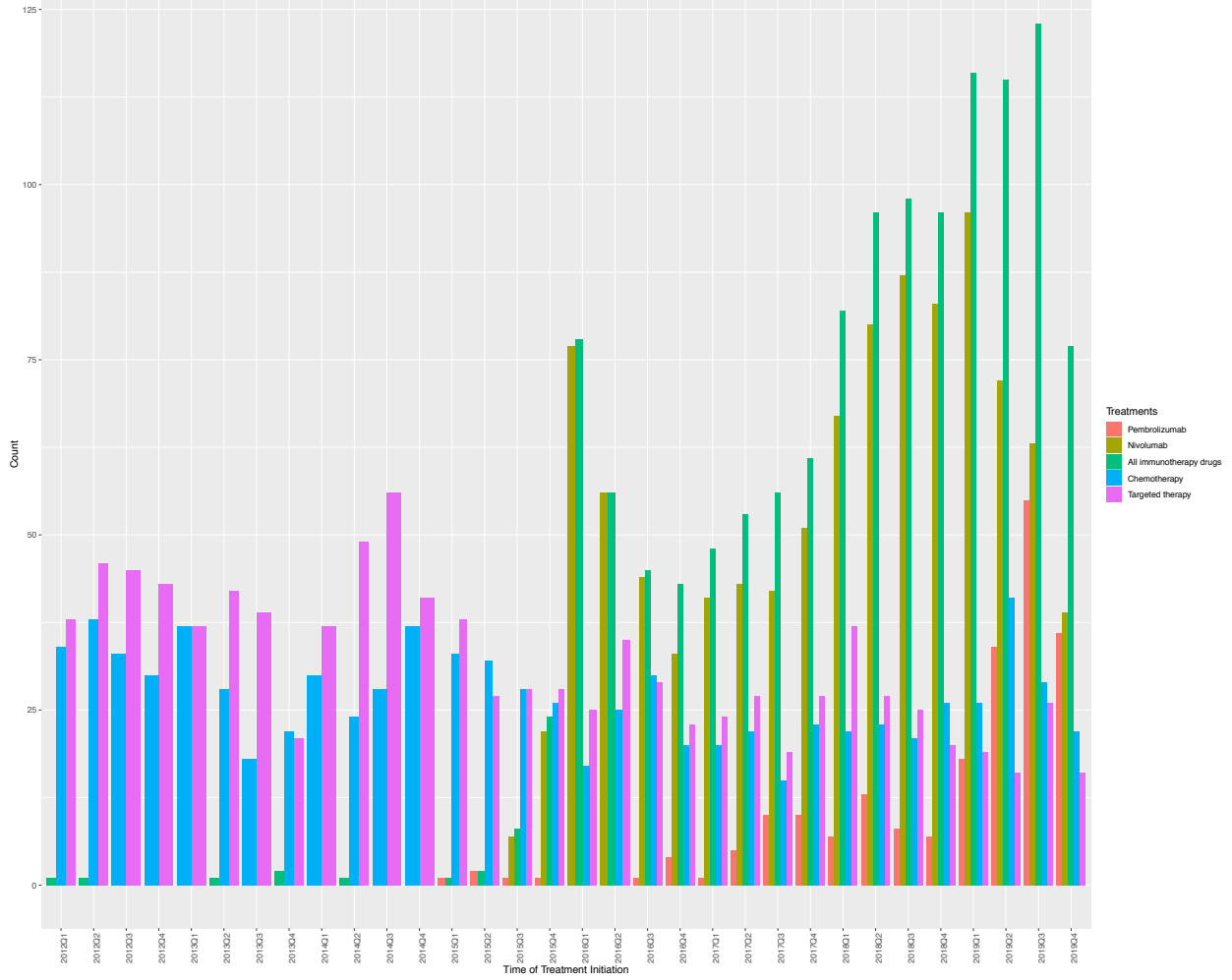
Lung Treatment Initiation Date Distribution



Melanoma Treatment Initiation Date Distribution



Renal Treatment Initiation Date Distribution



Squamous Treatment Initiation Date Distribution

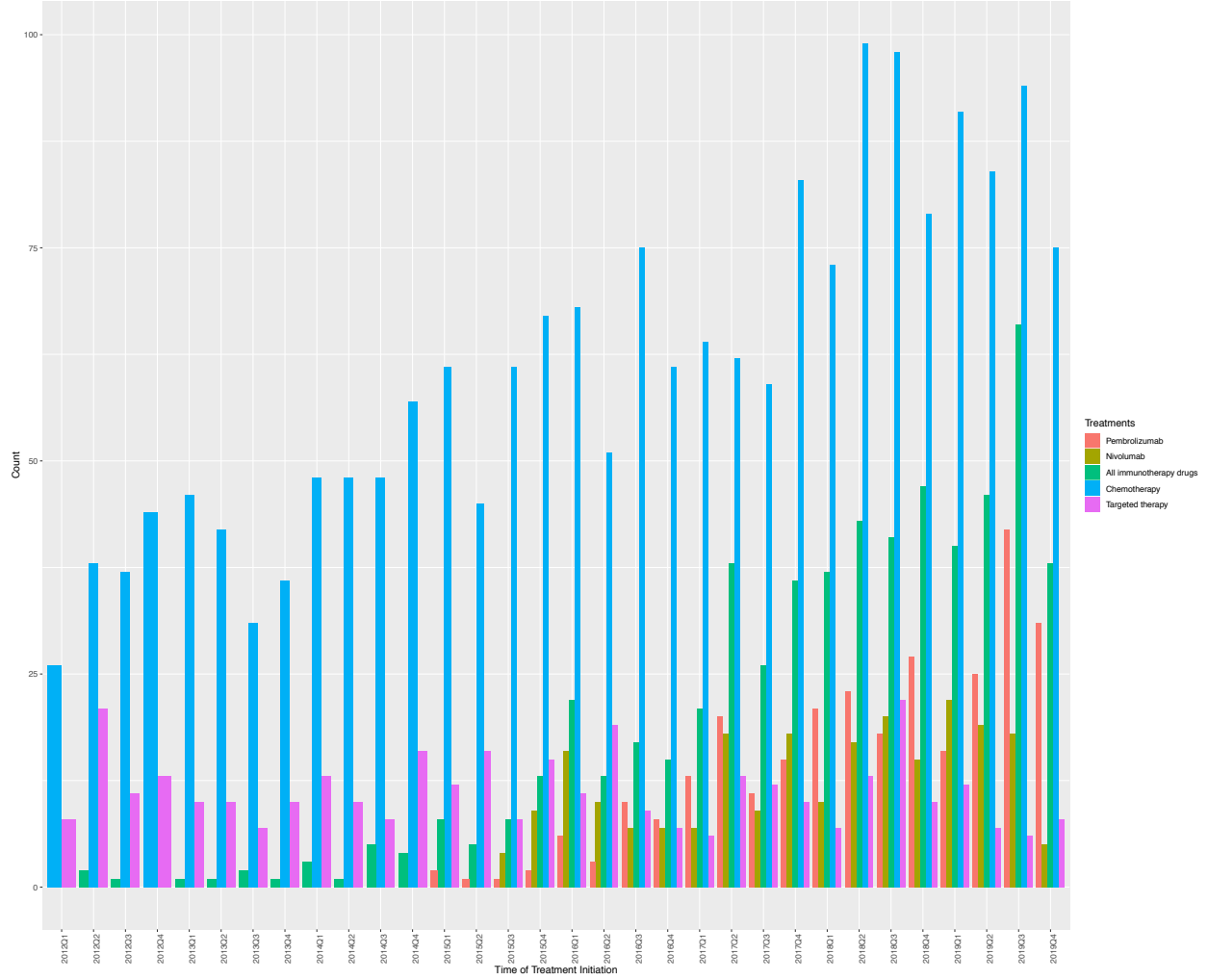
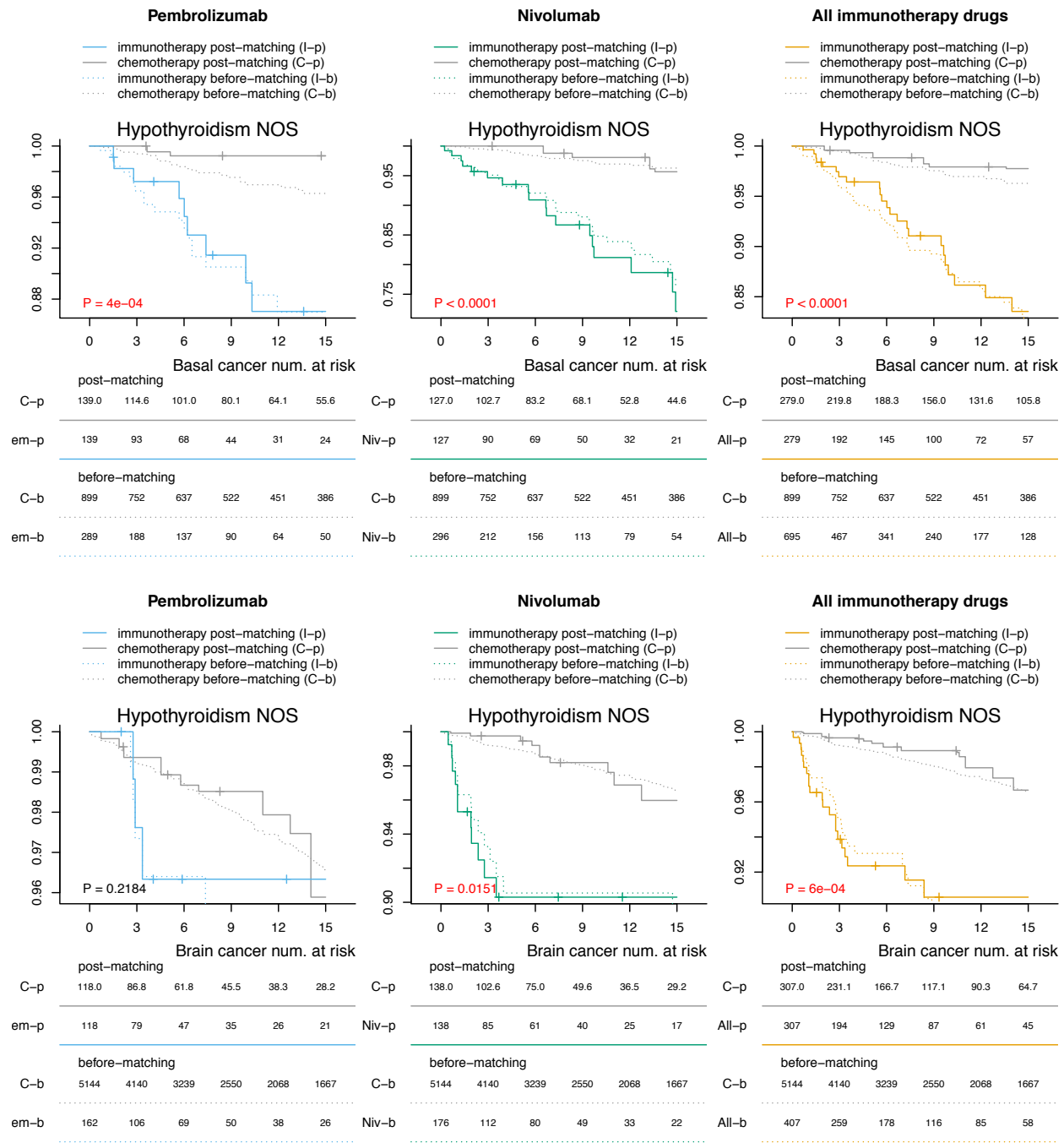


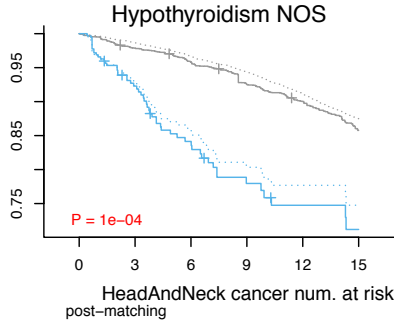
Figure S2. (Extending Figure 4 in the main text) Time-to-event plot showing the time between treatment initiation and the development of specific autoimmune diseases within 15 months.

Chemotherapy



Pembrolizumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

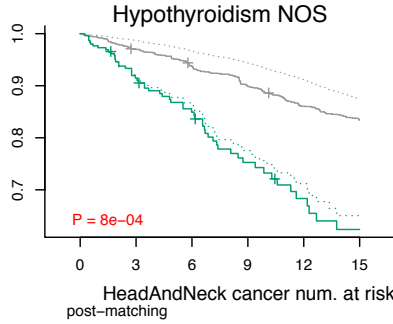


HeadAndNeck cancer num. at risk post-matching

C-p	371.0	296.1	233.8	177.6	142.9	114.7
em-p	371	216	141	85	54	37
before-matching						
C-b	10082	8530	7073	5778	4718	3936
em-b	445	264	170	106	66	47

Nivolumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

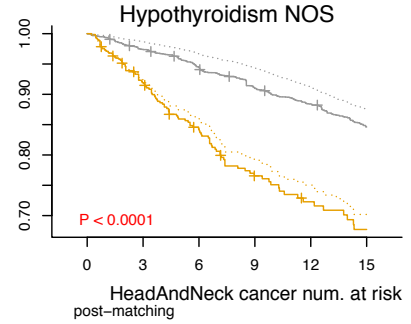


HeadAndNeck cancer num. at risk post-matching

C-p	312.0	247.1	193.3	148.8	118.4	99.9
Niv-p	312	192	132	82	49	37
before-matching						
C-b	10082	8530	7073	5778	4718	3936
Niv-b	356	228	160	103	63	44

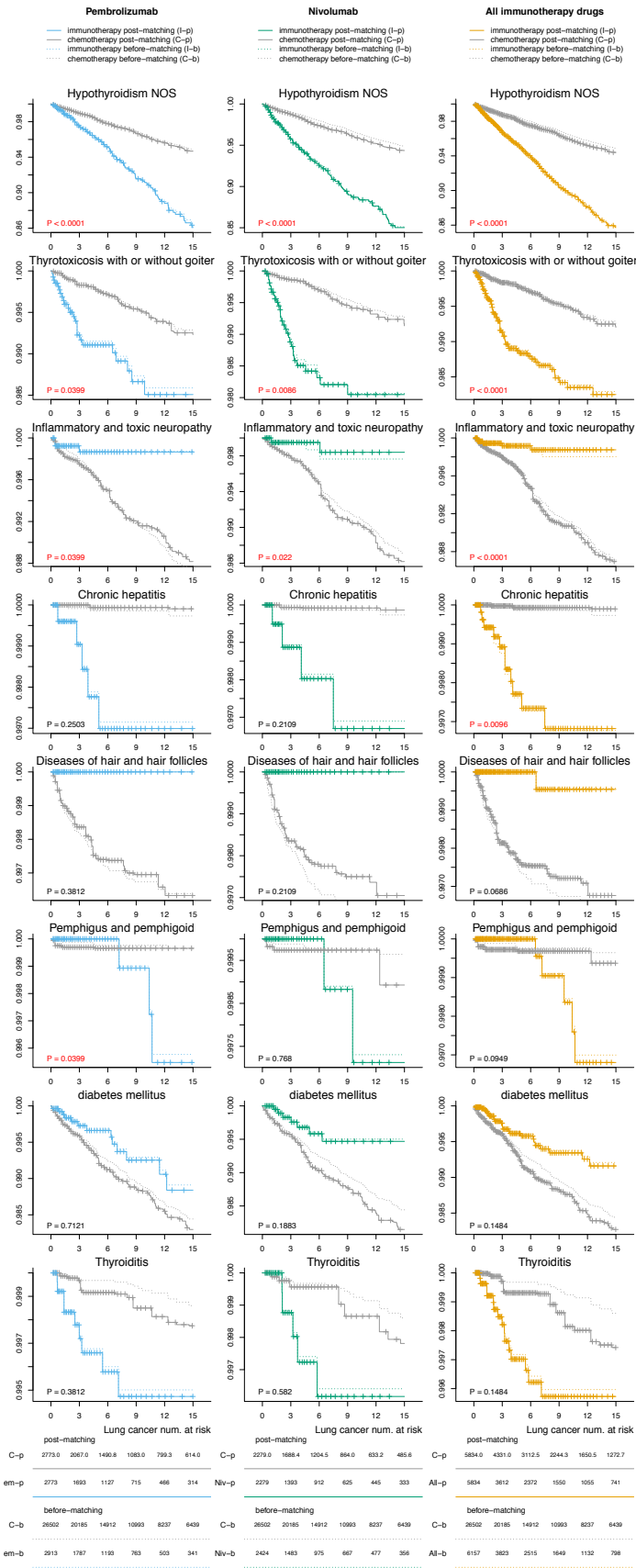
All immunotherapy drugs

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



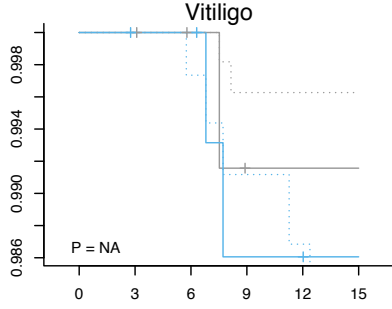
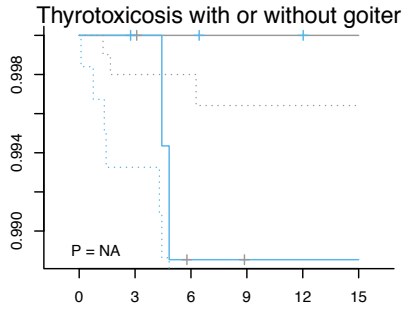
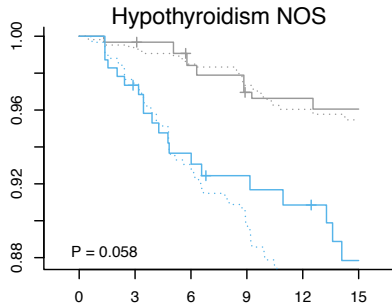
HeadAndNeck cancer num. at risk post-matching

C-p	731.0	579.5	449.9	346.0	278.6	226.6
All-p	731	436	292	176	111	79
before-matching						
C-b	10082	8530	7073	5778	4718	3936
All-b	857	529	358	227	144	101



Pembrolizumab

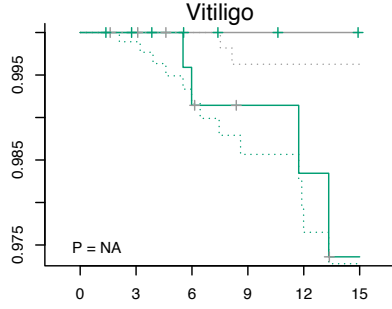
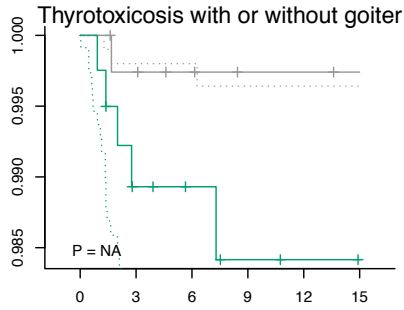
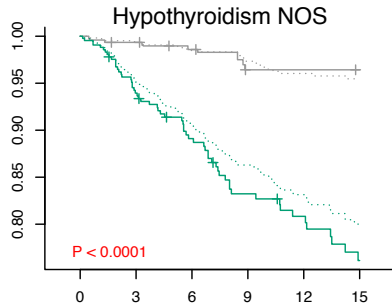
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



	Melanoma cancer num. at risk					
	post-matching					
C-p	252.0	205.9	147.2	99.4	85.0	68.0
em-p	252	197	158	126	101	77
	before-matching					
C-b	1118	868	651	475	369	302
em-b	626	482	367	276	218	167

Nivolumab

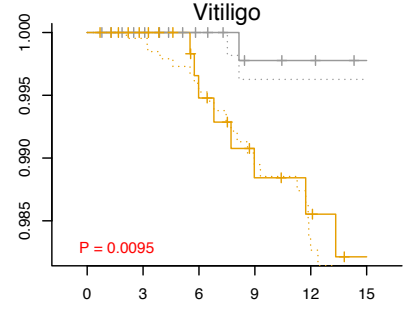
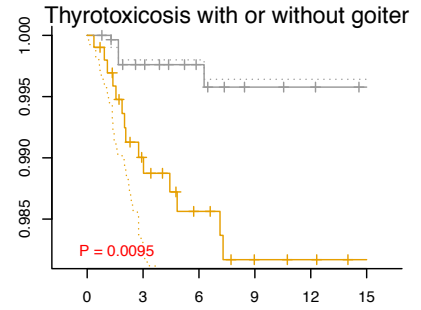
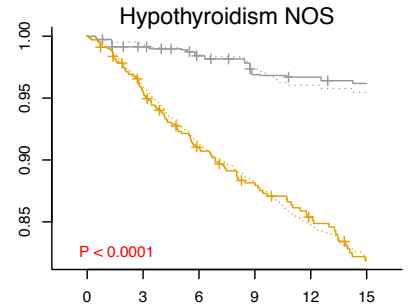
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



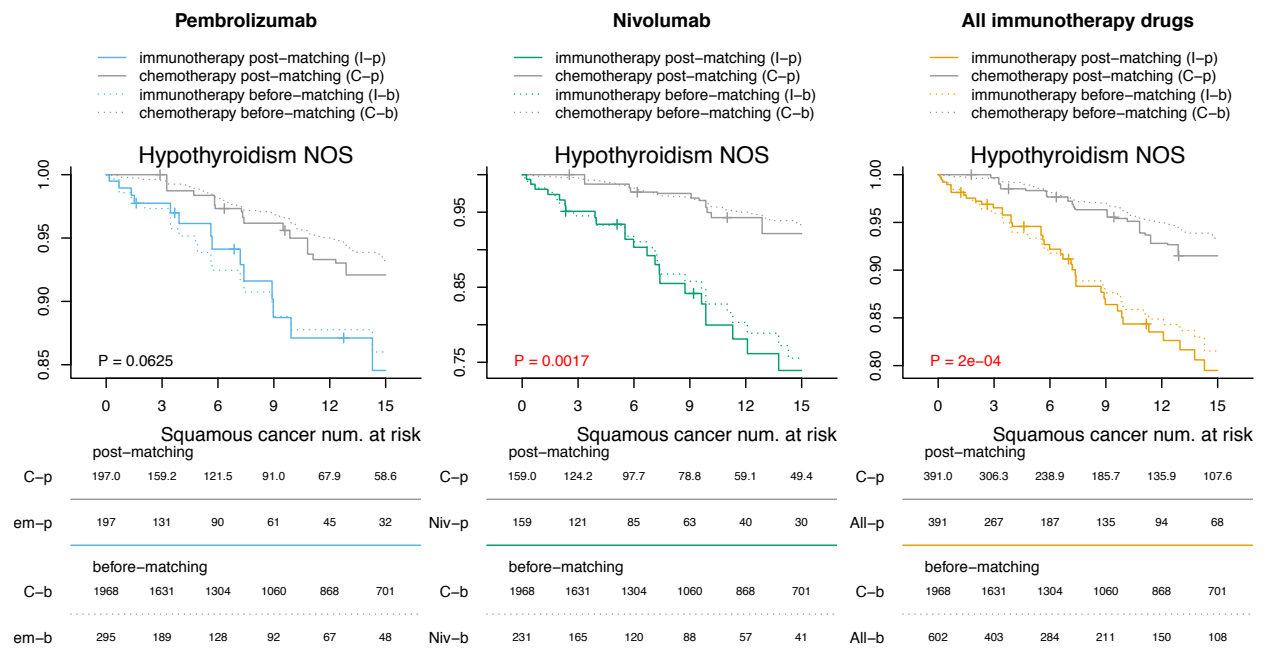
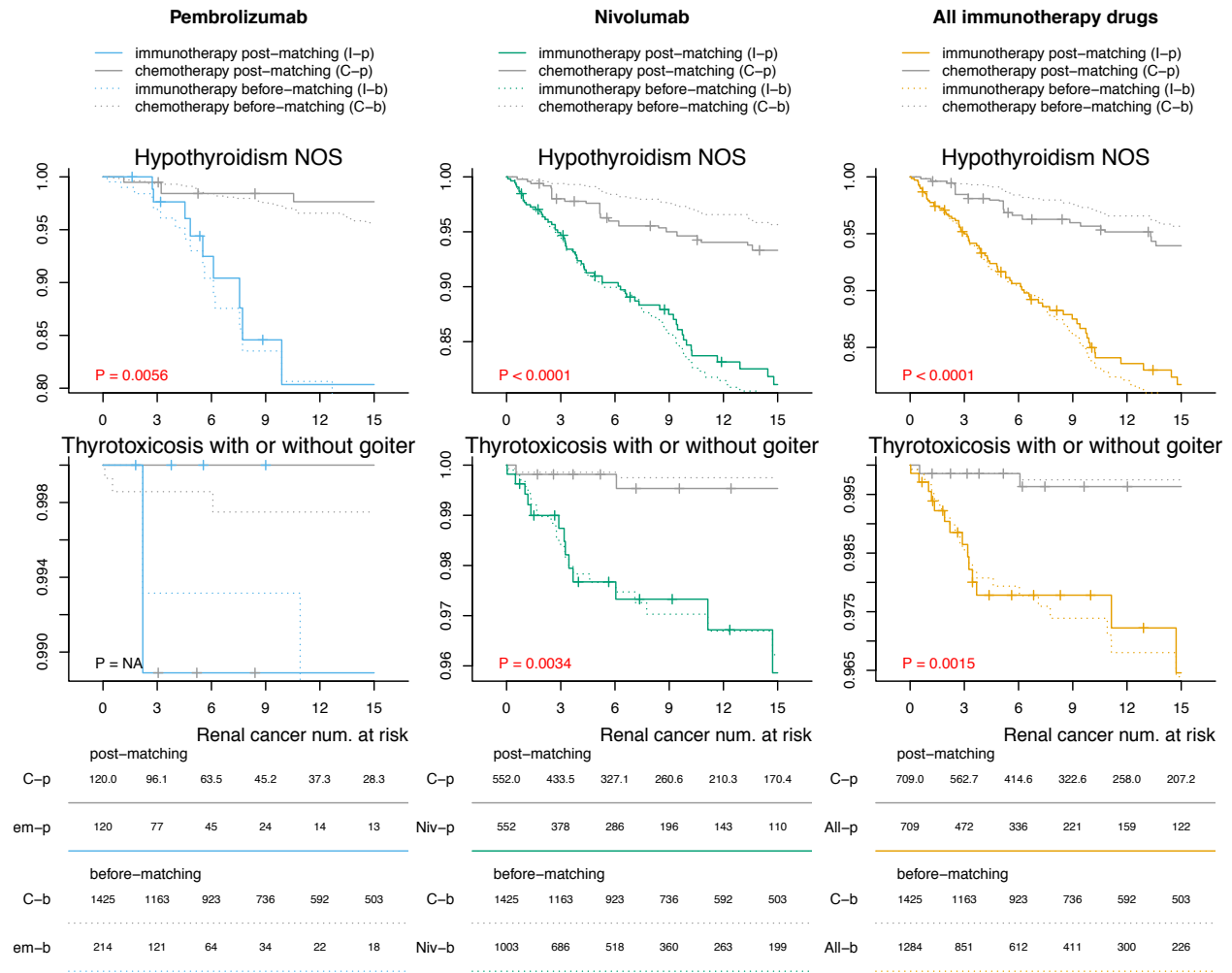
	Melanoma cancer num. at risk					
	post-matching					
C-p	438.0	342.7	242.3	176.1	152.3	126.2
Niv-p	438	319	221	155	120	83
	before-matching					
C-b	1118	868	651	475	369	302
Niv-b	1148	824	586	427	314	219

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



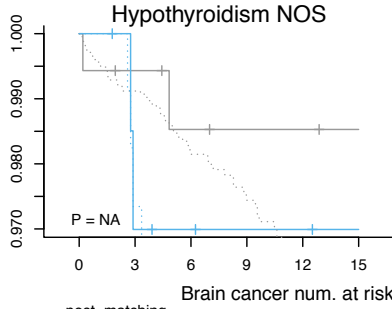
	Melanoma cancer num. at risk					
	post-matching					
C-p	1035.0	795.1	564.8	403.8	337.4	272.6
All-p	1035	762	556	420	331	253
	before-matching					
C-b	1118	868	651	475	369	302
All-b	2657	1936	1423	1070	817	622



Targeted therapy

Pembrolizumab

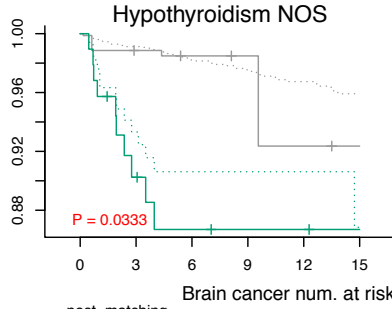
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



	post-matching					
C-p	95.0	67.6	43.5	25.9	21.1	11.0
em-p	95	63	39	28	21	19
	before-matching					
C-b	2814	2125	1441	955	689	453
em-b	162	106	69	50	38	26

Nivolumab

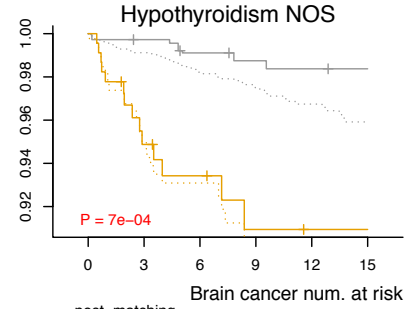
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



	post-matching					
C-p	100.0	78.0	54.5	34.3	25.9	15.2
Niv-p	100	58	41	27	19	10
	before-matching					
C-b	2814	2125	1441	955	689	453
Niv-b	177	113	80	49	33	22

All immunotherapy drugs

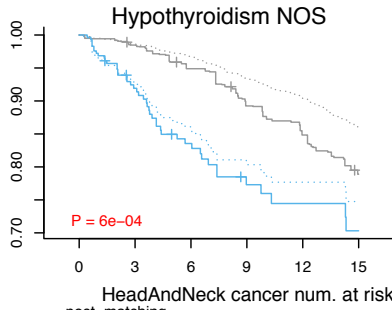
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



	post-matching					
C-p	235.0	176.2	119.2	70.6	52.9	29.0
All-p	235	147	97	62	45	31
	before-matching					
C-b	2814	2125	1441	955	689	453
All-b	408	260	178	116	85	58

Pembrolizumab

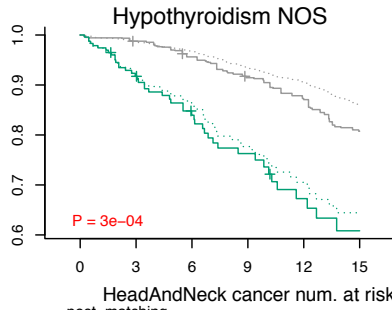
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



	post-matching					
C-p	308.0	242.9	179.2	126.0	96.8	74.0
em-p	308	172	112	65	41	30
	before-matching					
C-b	2455	1966	1570	1201	969	783
em-b	444	264	170	106	66	47

Nivolumab

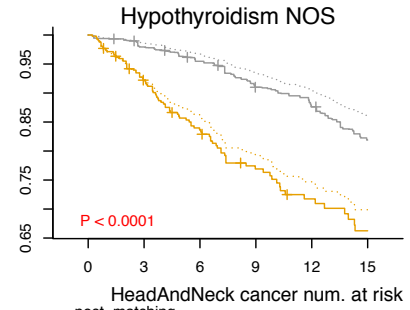
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



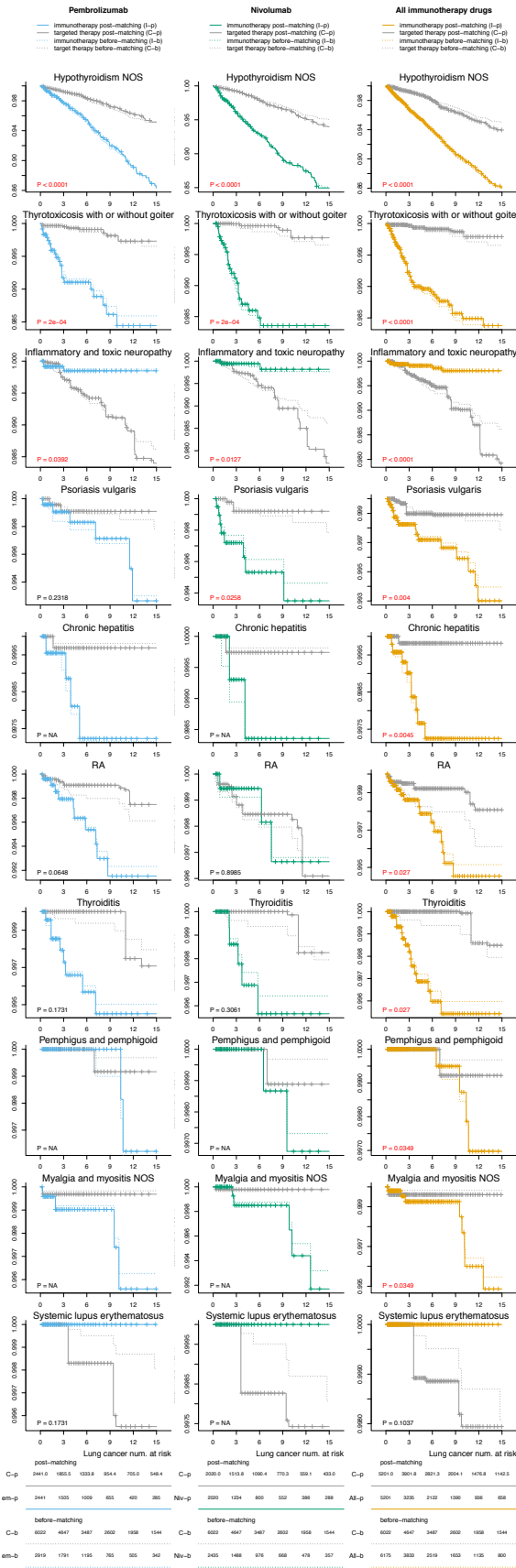
	post-matching					
C-p	247.0	198.5	147.7	104.4	78.8	58.8
Niv-p	247	151	99	64	36	24
	before-matching					
C-b	2455	1966	1570	1201	969	783
Niv-b	358	229	161	104	63	44

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)

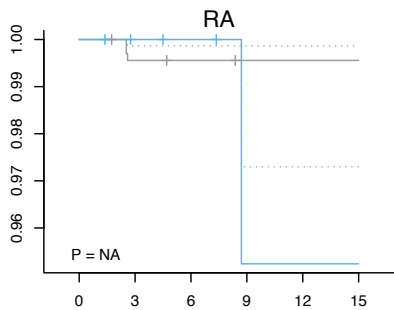
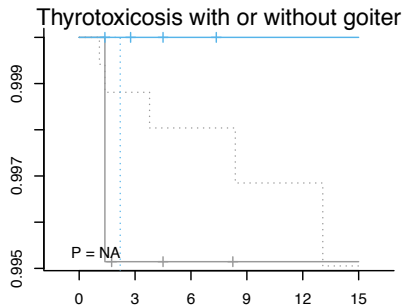
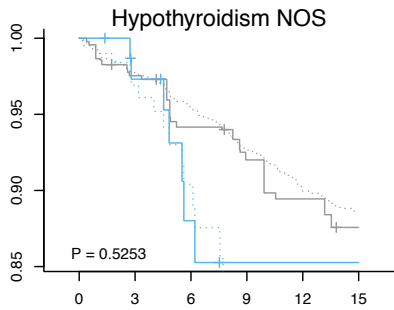


	post-matching					
C-p	595.0	459.9	353.6	259.4	202.9	154.2
All-p	595	353	232	145	91	63
	before-matching					
C-b	2455	1966	1570	1201	969	783
All-b	858	530	359	228	144	101



Pembrolizumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



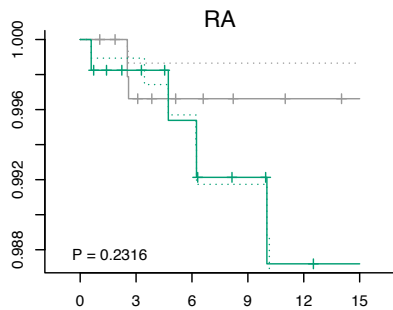
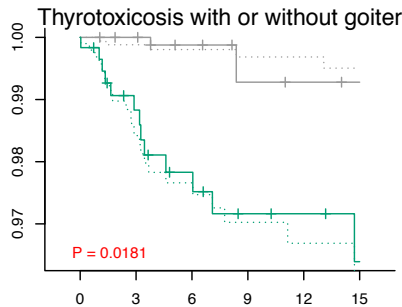
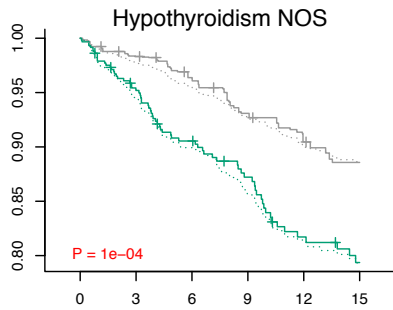
Renal cancer num. at risk

	post-matching					
	120.0	85.7	62.1	45.5	31.3	25.6
C-p	-----					
em-p	120	67	32	19	11	9

	before-matching					
C-b	1868	1412	1041	794	597	486
em-b	214	121	64	34	22	18

Nivolumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



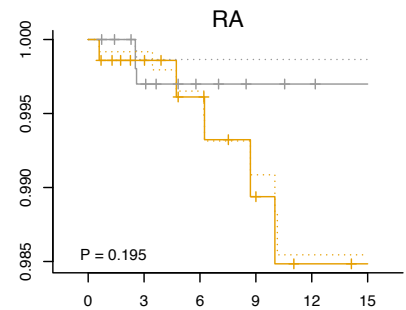
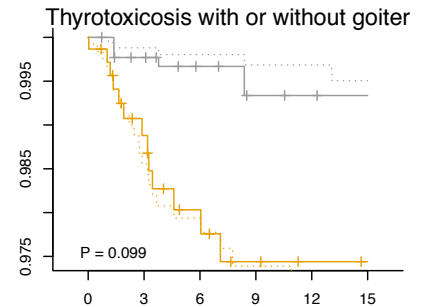
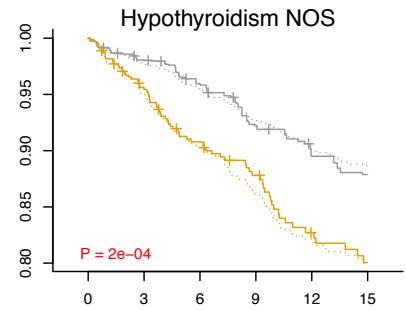
Renal cancer num. at risk

	post-matching					
	606.0	459.4	322.4	236.2	174.7	141.2
C-p	-----					
Niv-p	606	417	315	222	161	121

	before-matching					
C-b	1868	1412	1041	794	597	486
Niv-b	1002	685	517	359	262	198

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



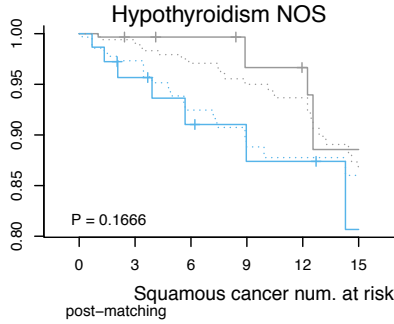
Renal cancer num. at risk

	post-matching					
	749.0	555.1	388.2	280.0	201.4	161.1
C-p	-----					
All-p	749	500	358	246	175	131

	before-matching					
C-b	1868	1412	1041	794	597	486
All-b	1284	851	612	411	300	225

Pembrolizumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)

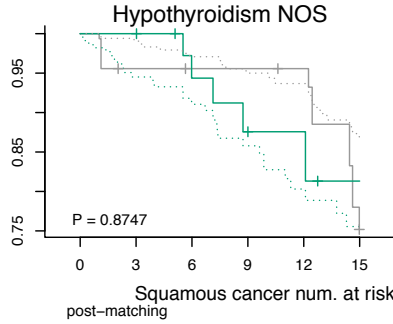


Squamous cancer num. at risk post-matching

C-p	79.0	52.2	40.9	30.6	17.9	15.4
em-p	79	53	34	24	20	11
before-matching						
C-b	366	274	222	168	125	94
em-b	295	189	128	92	67	48

Nivolumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)

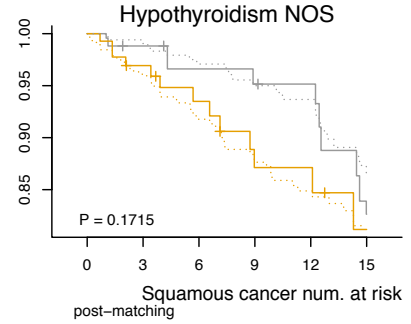


Squamous cancer num. at risk post-matching

C-p	59.0	41.7	35.2	30.8	20.3	12.3
Niv-p	59	49	33	24	14	8
before-matching						
C-b	366	274	222	168	125	94
Niv-b	231	165	120	88	57	41

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



Squamous cancer num. at risk post-matching

C-p	148.0	95.9	79.2	63.8	42.2	31.9
All-p	148	103	69	50	37	21
before-matching						
C-b	366	274	222	168	125	94
All-b	602	403	284	211	150	108

Figure S3. Covariate balance before and after matching. We achieved near perfect balance on gender, age, average income, the annual frequency of hospital visits prior to treatment initialization, and the annual frequency of ICD code counts prior to treatment initialization. Some ethnicity groups have extreme values because they are rare. Since we allowed patients with unknown ethnicity to match with participants in any ethnicity group, the results of covariate balance on ethnicity varied.

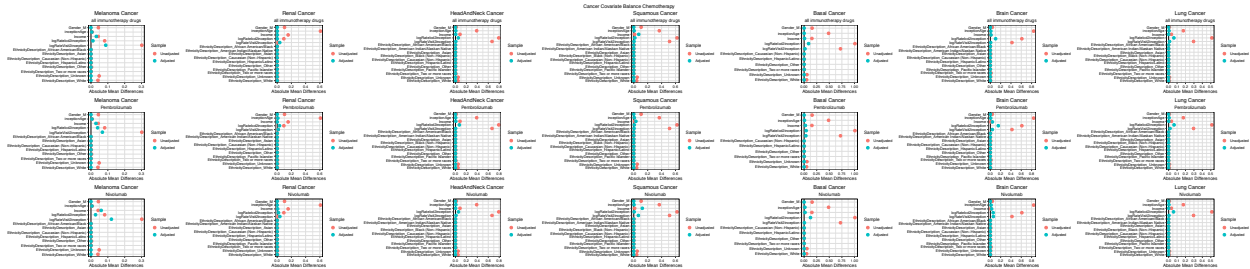
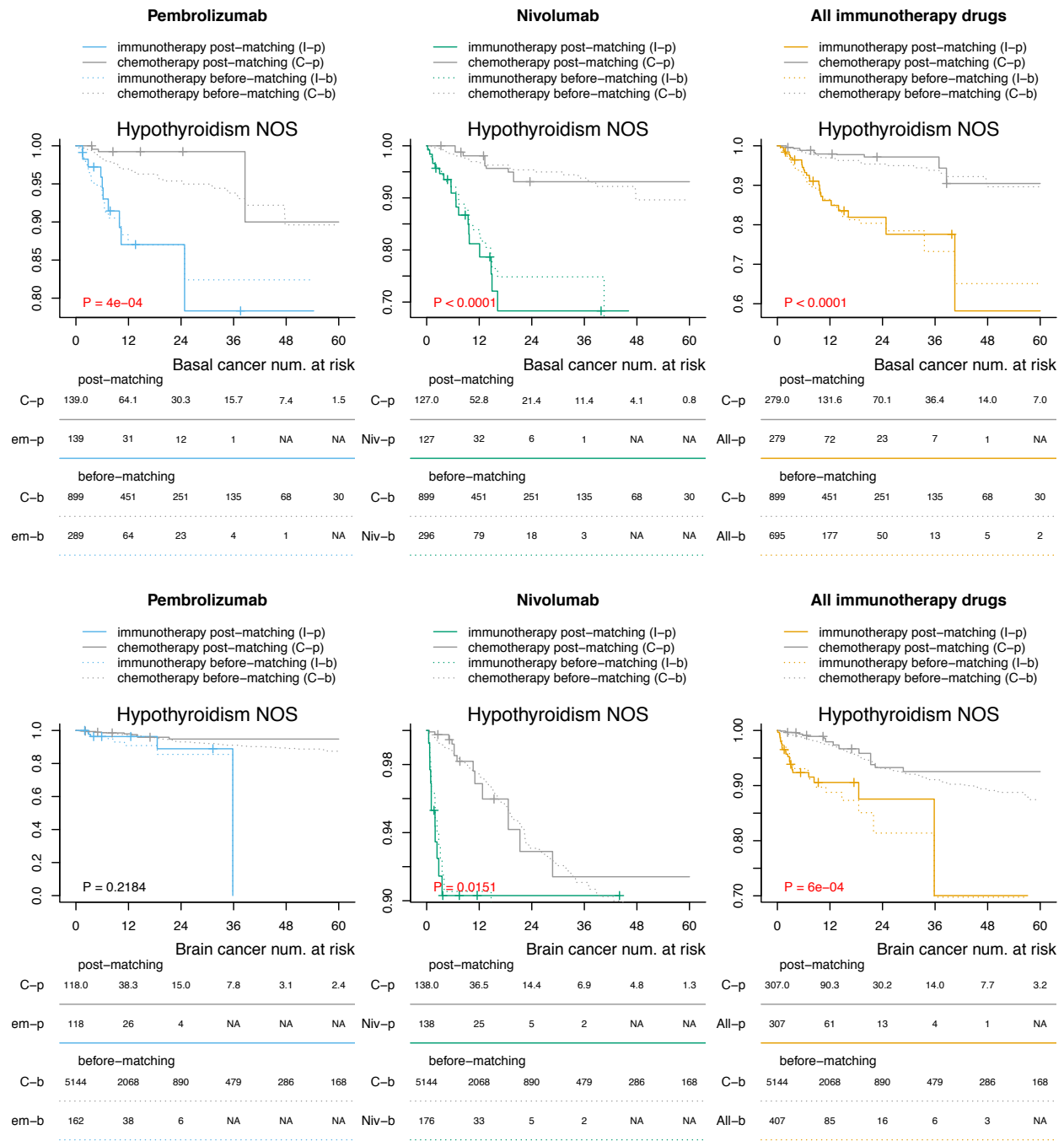


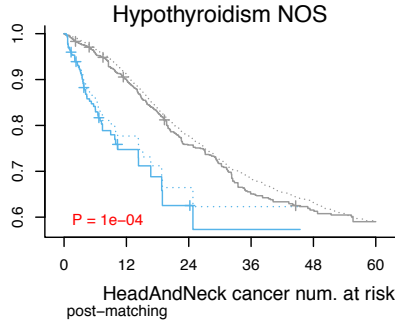
Figure S4. Time-to-event plot showing the time between treatment initiation and the development of specific autoimmune diseases within 5 years.

Chemotherapy



Pembrolizumab

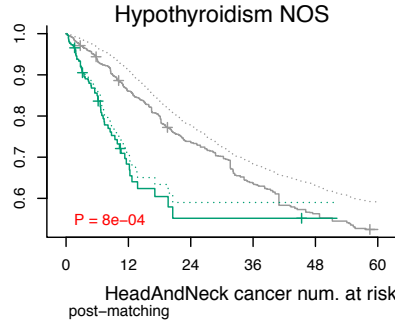
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



	HeadAndNeck cancer num. at risk					
	post-matching					
C-p	371.0	142.9	63.4	31.6	19.7	10.0
em-p	371	54	14	5	NA	NA
	before-matching					
C-b	10082	4718	2341	1292	791	439
em-b	445	66	19	6	NA	NA

Nivolumab

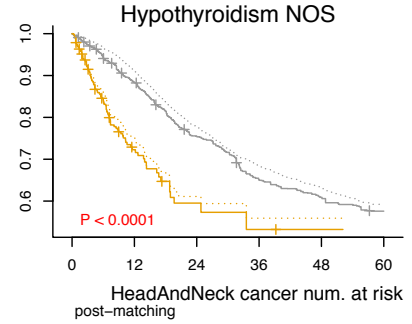
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



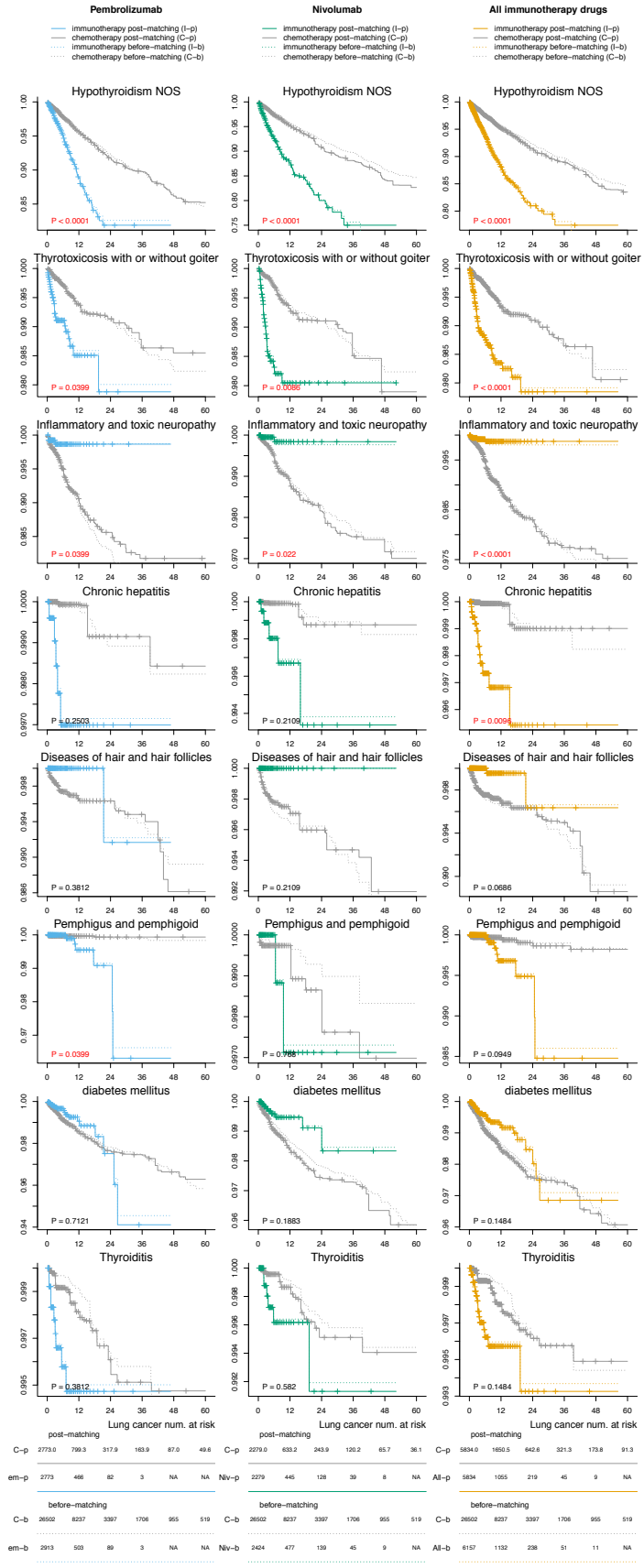
	HeadAndNeck cancer num. at risk					
	post-matching					
C-p	312.0	118.4	57.1	29.8	16.8	10.2
Niv-p	312	49	15	7	1	NA
	before-matching					
C-b	10082	4718	2341	1292	791	439
Niv-b	356	63	20	8	1	NA

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

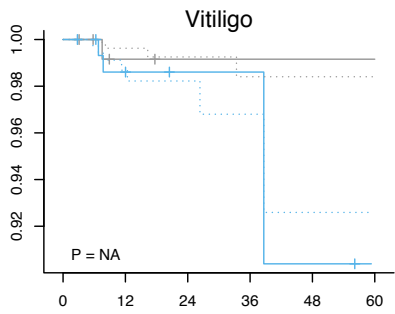
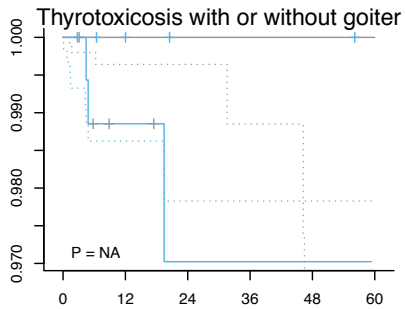
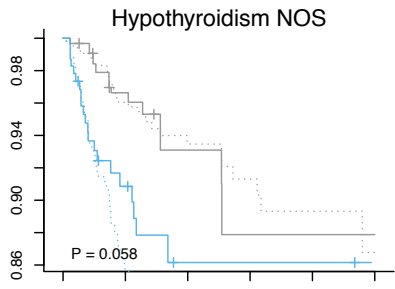


	HeadAndNeck cancer num. at risk					
	post-matching					
C-p	731.0	278.6	131.0	65.3	41.2	22.8
All-p	731	111	30	12	1	NA
	before-matching					
C-b	10082	4718	2341	1292	791	439
All-b	857	144	40	14	1	NA



Pembrolizumab

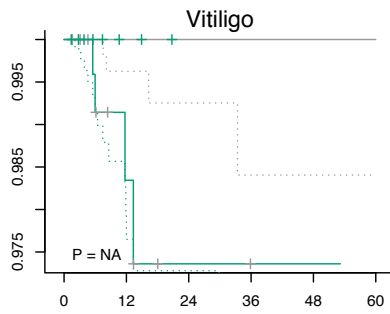
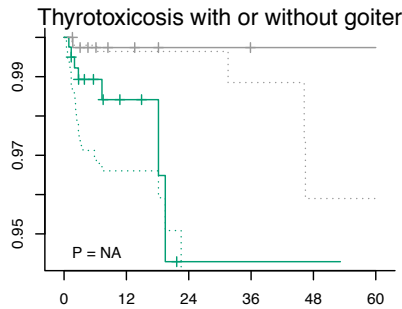
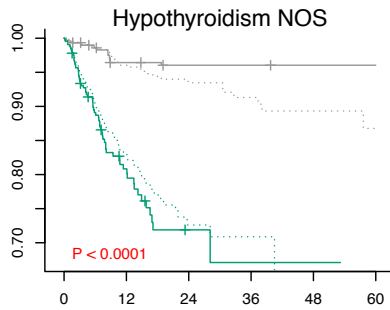
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



	Melanoma cancer num. at risk					
	post-matching					
C-p	252.0	85.0	35.8	20.1	9.3	4.8
em-p	252	101	34	12	4	NA
	before-matching					
C-b	1118	369	178	102	61	30
em-b	626	218	86	28	9	NA

Nivolumab

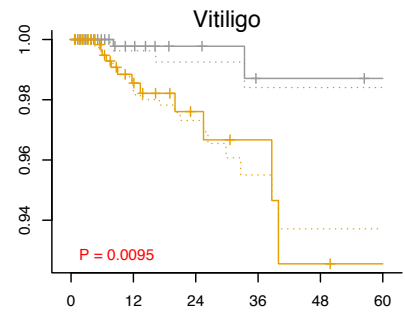
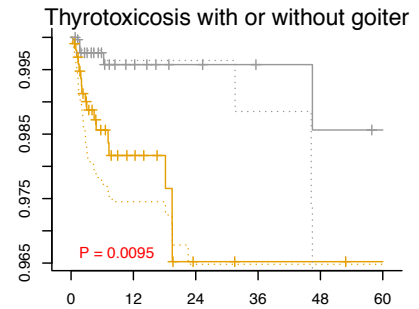
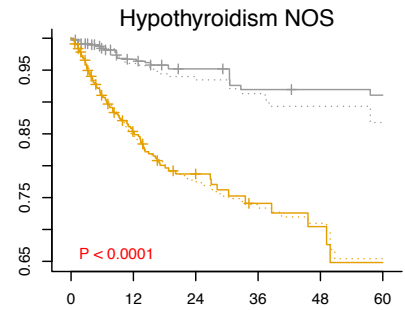
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



	Melanoma cancer num. at risk					
	post-matching					
C-p	438.0	152.3	62.6	35.6	20.4	10.9
Niv-p	438	120	21	6	2	NA
	before-matching					
C-b	1118	369	178	102	61	30
Niv-b	1148	314	60	22	2	NA

All immunotherapy drugs

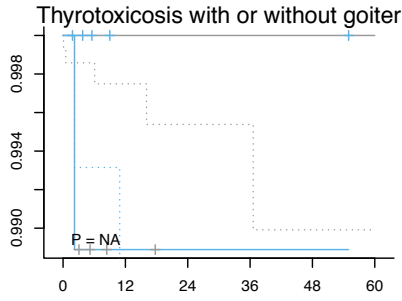
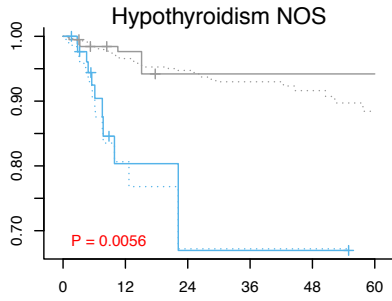
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



	Melanoma cancer num. at risk					
	post-matching					
C-p	1035.0	337.4	138.0	78.5	48.6	26.8
All-p	1035	331	115	51	26	7
	before-matching					
C-b	1118	369	178	102	61	30
All-b	2657	817	287	128	54	20

Pembrolizumab

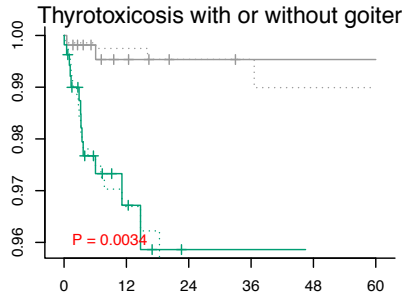
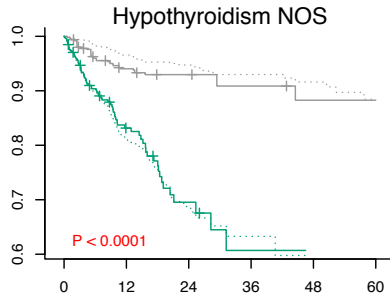
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Renal cancer num. at risk						
		post-matching						
C-p	em-p	120.0	37.3	12.5	5.8	3.6	2.2	
before-matching		C-b	1425	592	304	185	110	63
		em-b	214	22	4	1	1	NA

Nivolumab

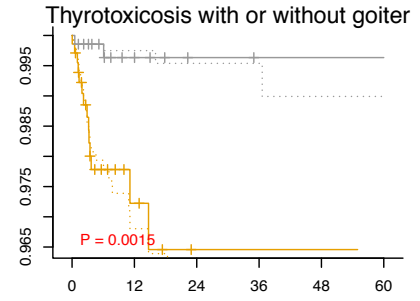
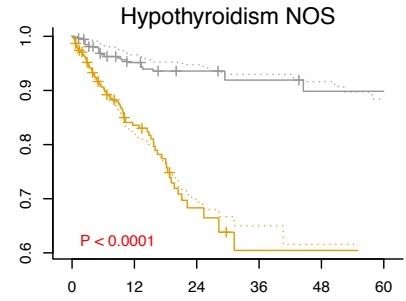
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Renal cancer num. at risk						
		post-matching						
C-p	em-p	552.0	210.3	80.2	42.4	19.8	12.6	
before-matching		C-b	1425	592	304	185	110	63
		Niv-b	1003	263	70	23	NA	NA

All immunotherapy drugs

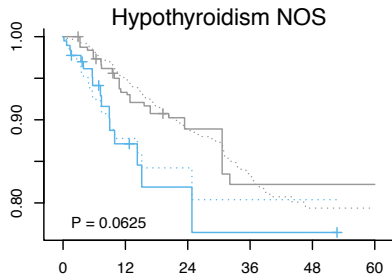
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Renal cancer num. at risk						
		post-matching						
C-p	em-p	709.0	258.0	99.1	56.4	24.8	14.9	
before-matching		C-b	1425	592	304	185	110	63
		All-b	1284	300	79	25	1	NA

Pembrolizumab

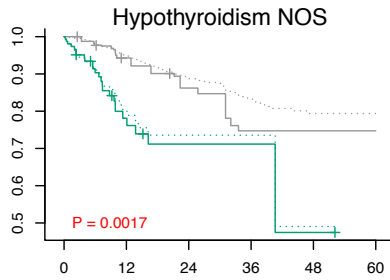
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Squamous cancer num. at risk						
		post-matching						
C-p	em-p	197.0	67.9	32.3	10.5	4.2	1.4	
before-matching		C-b	1968	868	420	200	99	37
		em-b	295	67	24	6	1	NA

Nivolumab

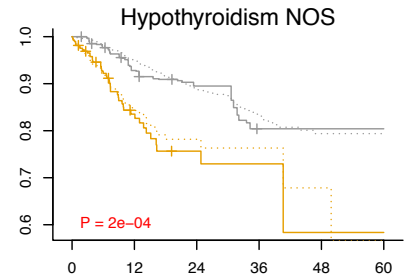
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Squamous cancer num. at risk						
		post-matching						
C-p	em-p	159.0	59.1	23.1	10.2	4.3	1.5	
before-matching		C-b	1968	868	420	200	99	37
		Niv-b	231	57	15	6	1	NA

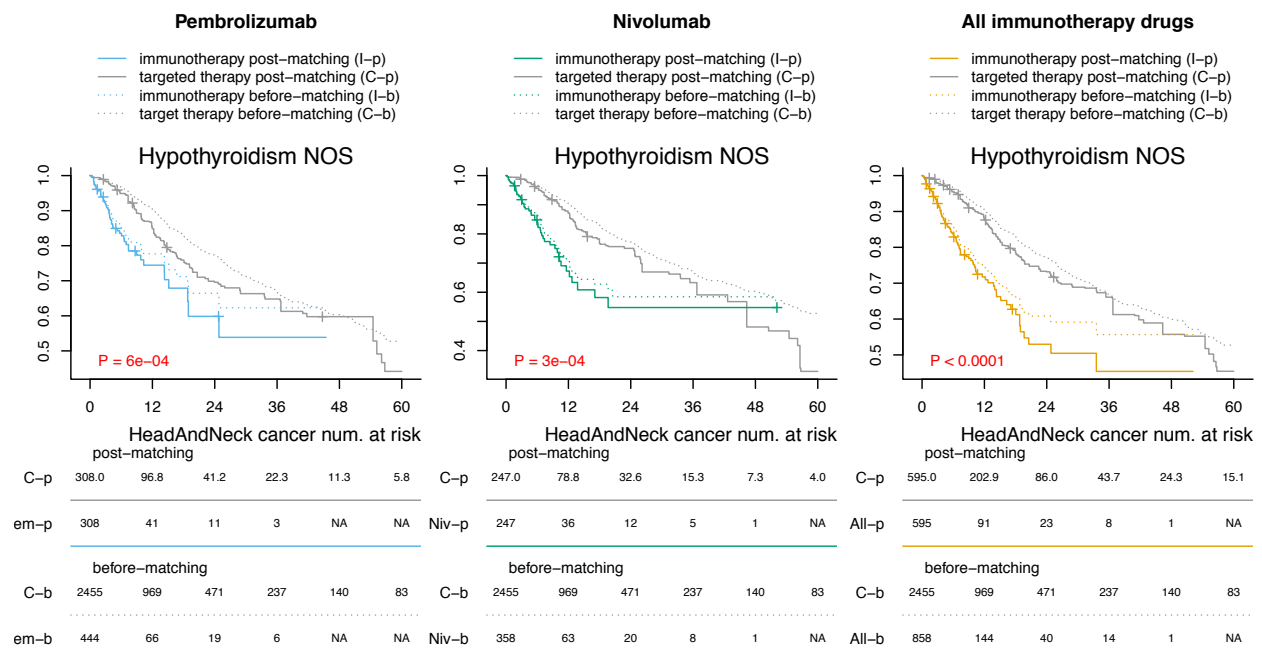
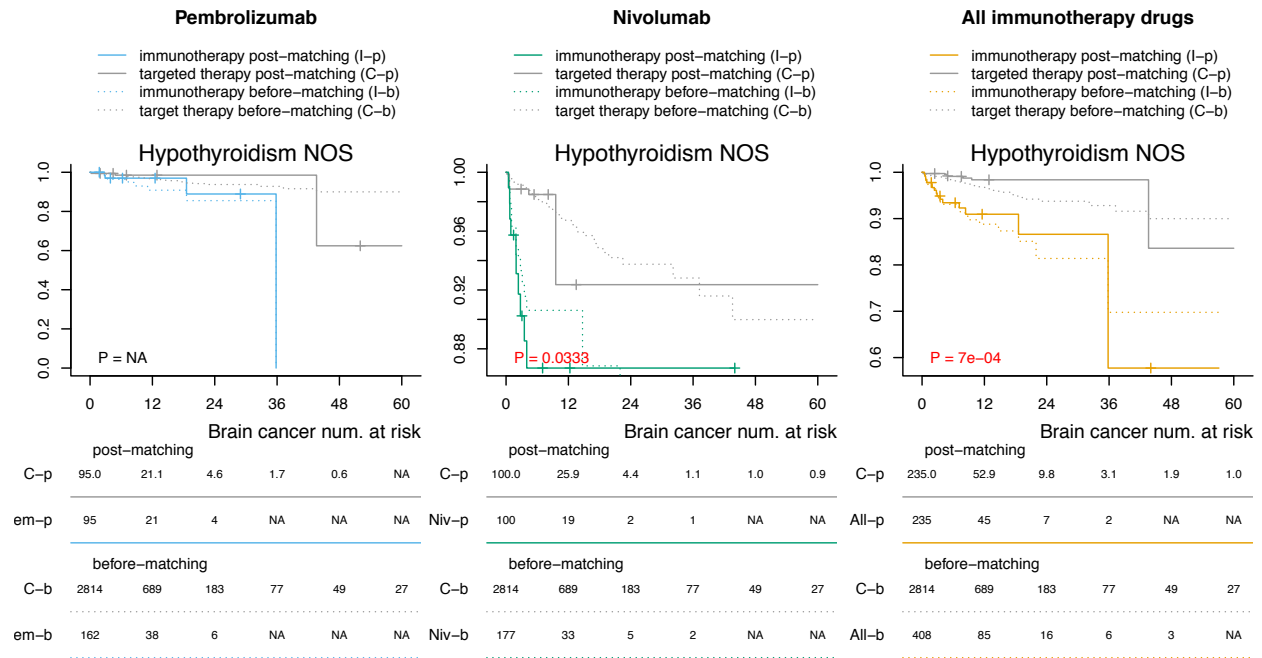
All immunotherapy drugs

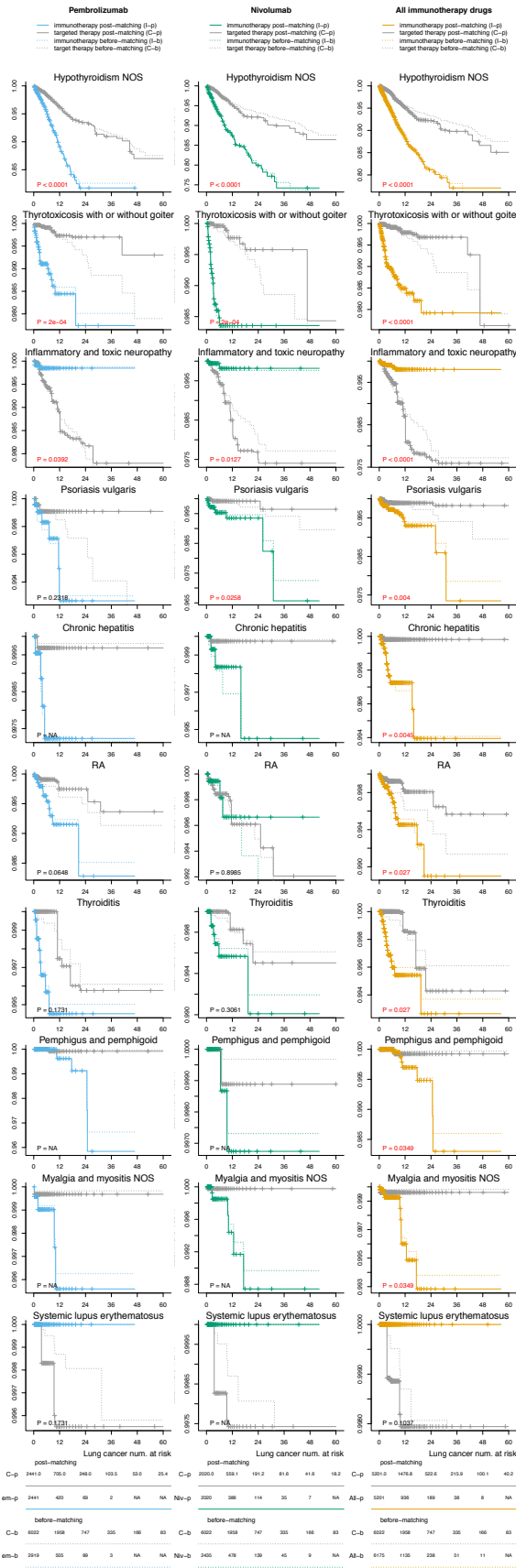
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Squamous cancer num. at risk						
		post-matching						
C-p	em-p	391.0	135.9	53.8	18.9	9.5	4.5	
before-matching		C-b	1968	868	420	200	99	37
		All-b	602	150	45	16	6	1

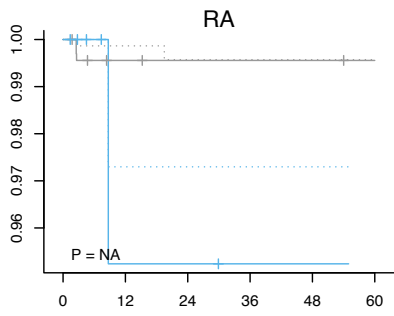
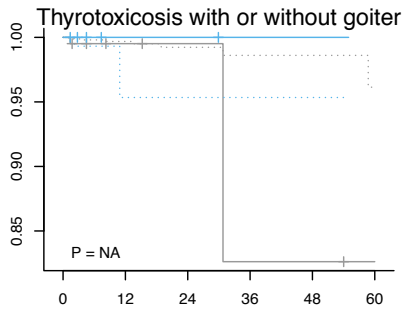
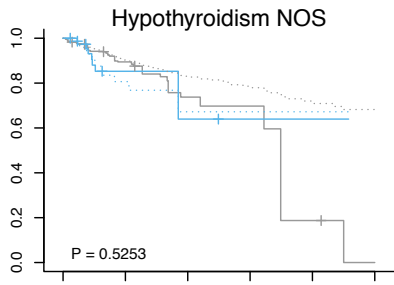
Targeted therapy





Pembrolizumab

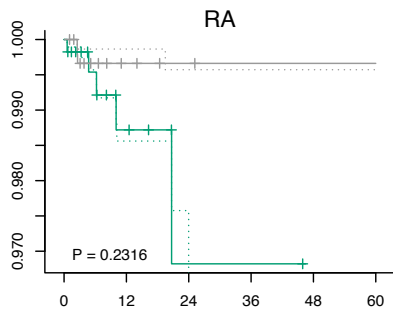
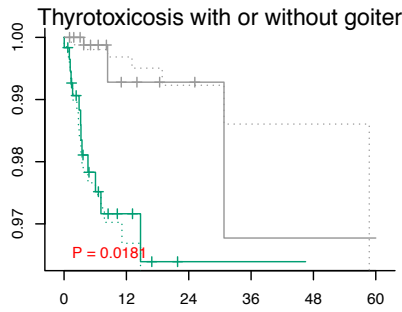
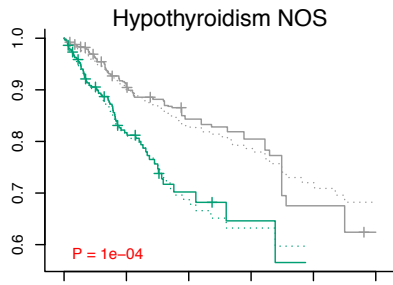
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



		Renal cancer num. at risk					
		post-matching					
		120.0	31.3	9.3	3.8	0.5	NA
C-p							
em-p		120	11	1	NA	NA	NA
		before-matching					
C-b		1868	597	232	117	65	37
em-b		214	22	4	1	1	NA

Nivolumab

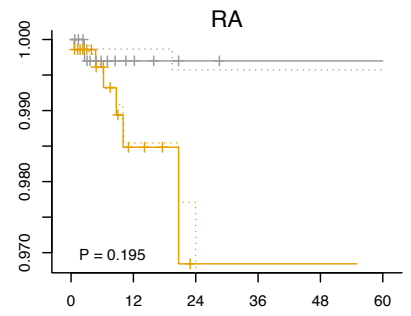
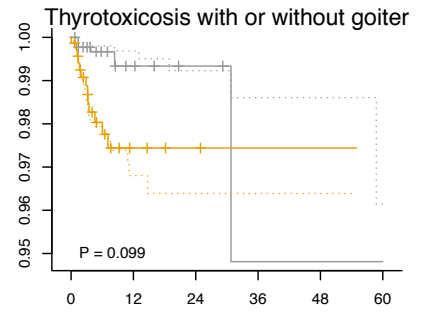
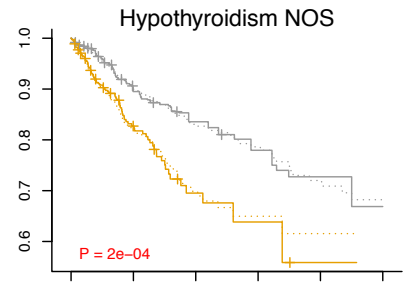
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



		Renal cancer num. at risk					
		post-matching					
		606.0	174.7	56.9	29.2	14.6	8.8
C-p							
Niv-p		606	161	39	11	NA	NA
		before-matching					
C-b		1868	597	232	117	65	37
Niv-b		1002	262	70	23	NA	NA

All immunotherapy drugs

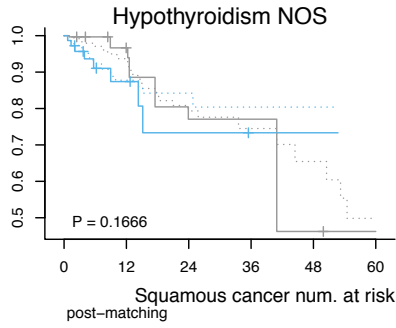
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



		Renal cancer num. at risk					
		post-matching					
		749.0	201.4	65.9	30.8	16.6	9.1
C-p							
All-p		749	175	40	10	NA	NA
		before-matching					
C-b		1868	597	232	117	65	37
All-b		1284	300	79	25	1	NA

Pembrolizumab

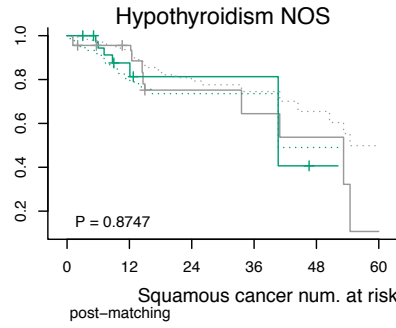
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



	Squamous cancer num. at risk					
	post-matching					
C-p	79.0	17.9	7.6	0.8	0.5	NA
em-p	79	20	4	NA	NA	NA
	before-matching					
C-b	366	125	53	21	14	7
em-b	295	67	24	6	1	NA

Nivolumab

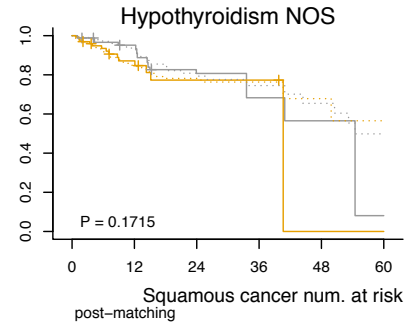
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



	Squamous cancer num. at risk					
	post-matching					
C-p	59.0	20.3	4.8	3.0	2.5	0.5
Niv-p	59	14	4	3	NA	NA
	before-matching					
C-b	366	125	53	21	14	7
Niv-b	231	57	15	6	1	NA

All immunotherapy drugs

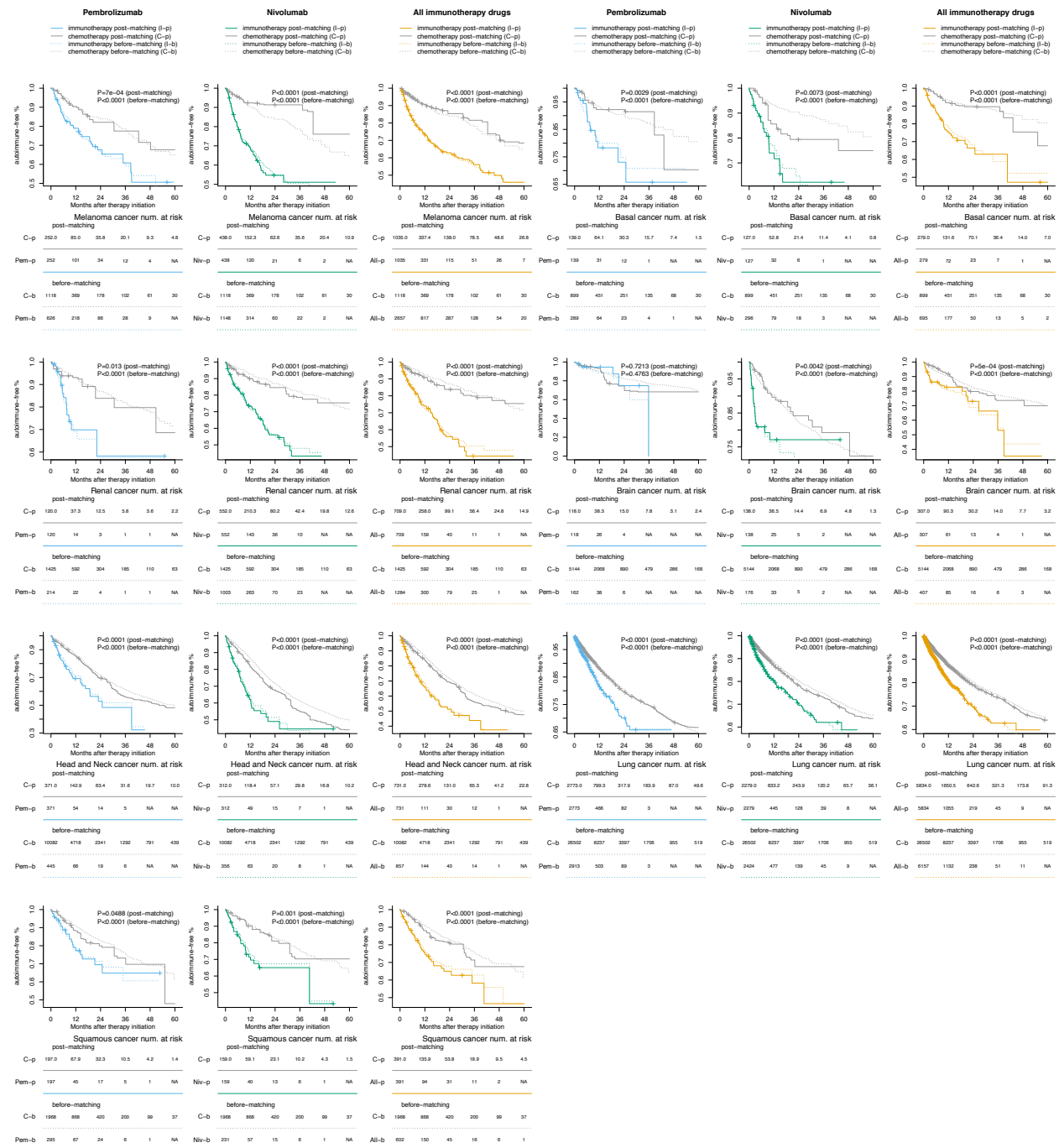
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



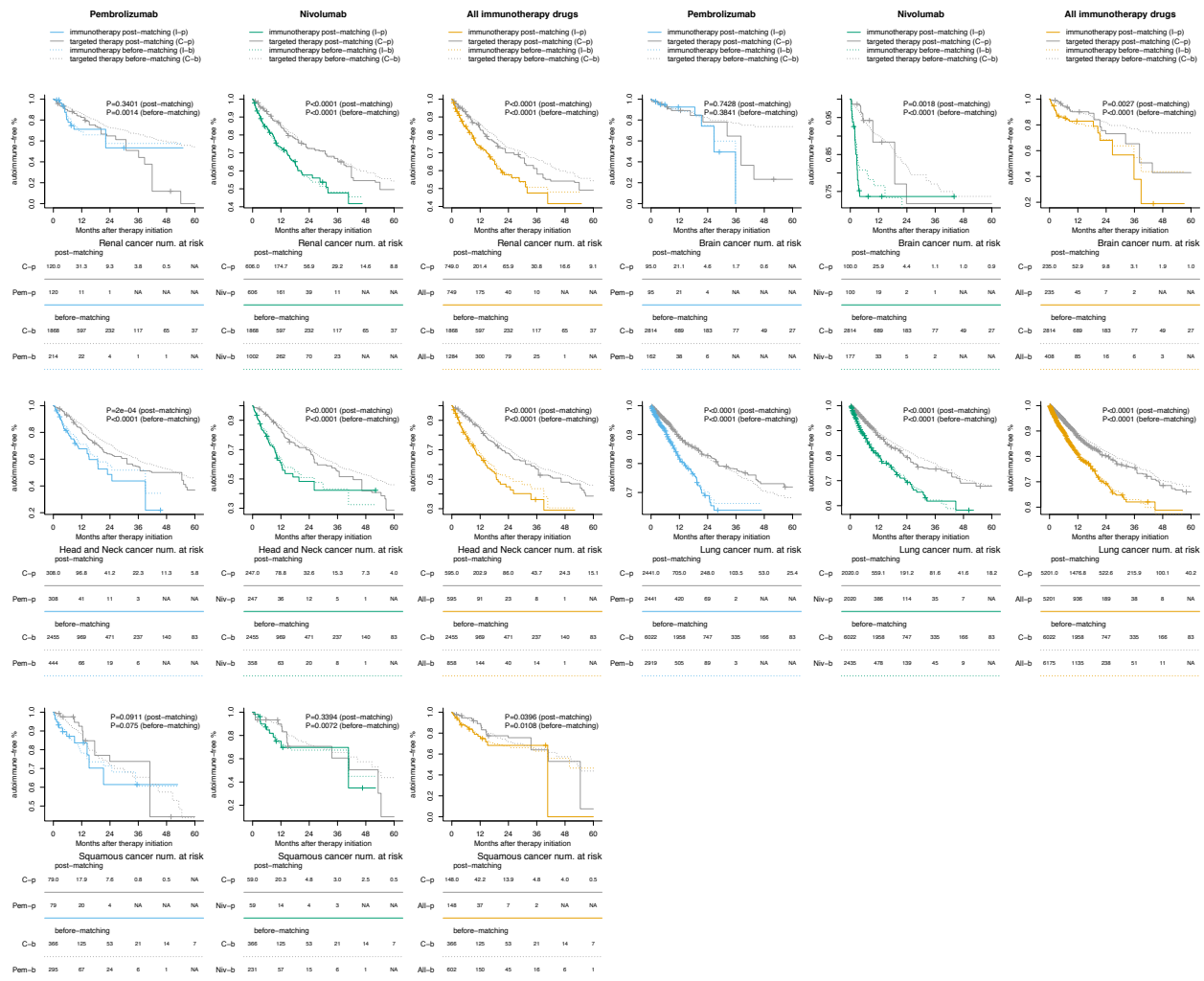
	Squamous cancer num. at risk					
	post-matching					
C-p	148.0	42.2	13.9	4.8	4.0	0.5
All-p	148	37	7	2	NA	NA
	before-matching					
C-b	366	125	53	21	14	7
All-b	602	150	45	16	6	1

Figure S5. Time-to-event plot showing the time between treatment initiation and the development of autoimmune diseases in seven cancer types. The comparisons between chemotherapy with pembrolizumab, nivolumab, and all immune checkpoint inhibitors combined are shown in the three columns respectively. For each cancer type, we showed the time-to-event plot for all autoimmune diseases, with a log-rank test p-value reported in the top right corner for both matched and unmatched samples. (The p-values are the same as the 15 months horizon in the main text because they are both calculated based on all observations.) Each tick represents 50 censored patients. The curves offer a full time horizon up to 5 years after treatment initiation. The tabulate information at the bottom shows the number of patients without censored information at 0, 1, 2, 3, 4, and 5 years.

Chemotherapy



Targeted therapy

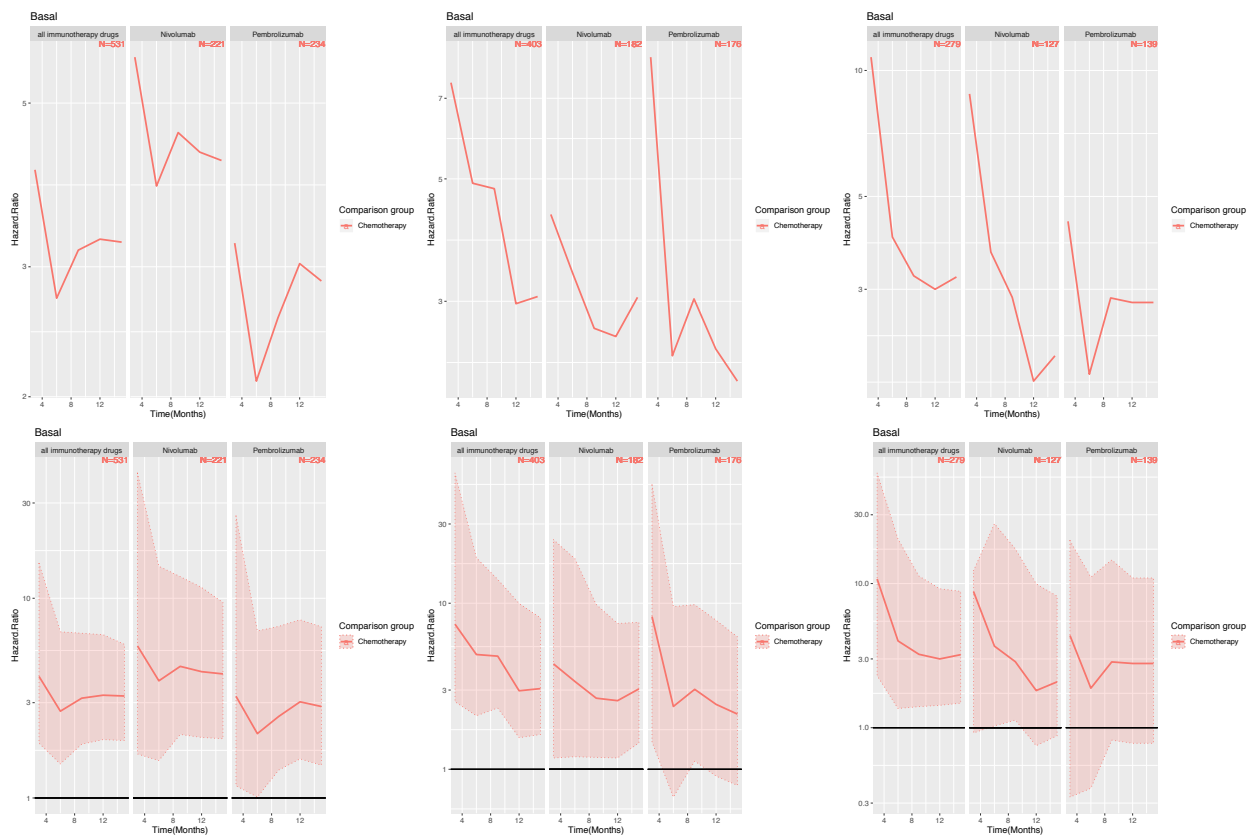


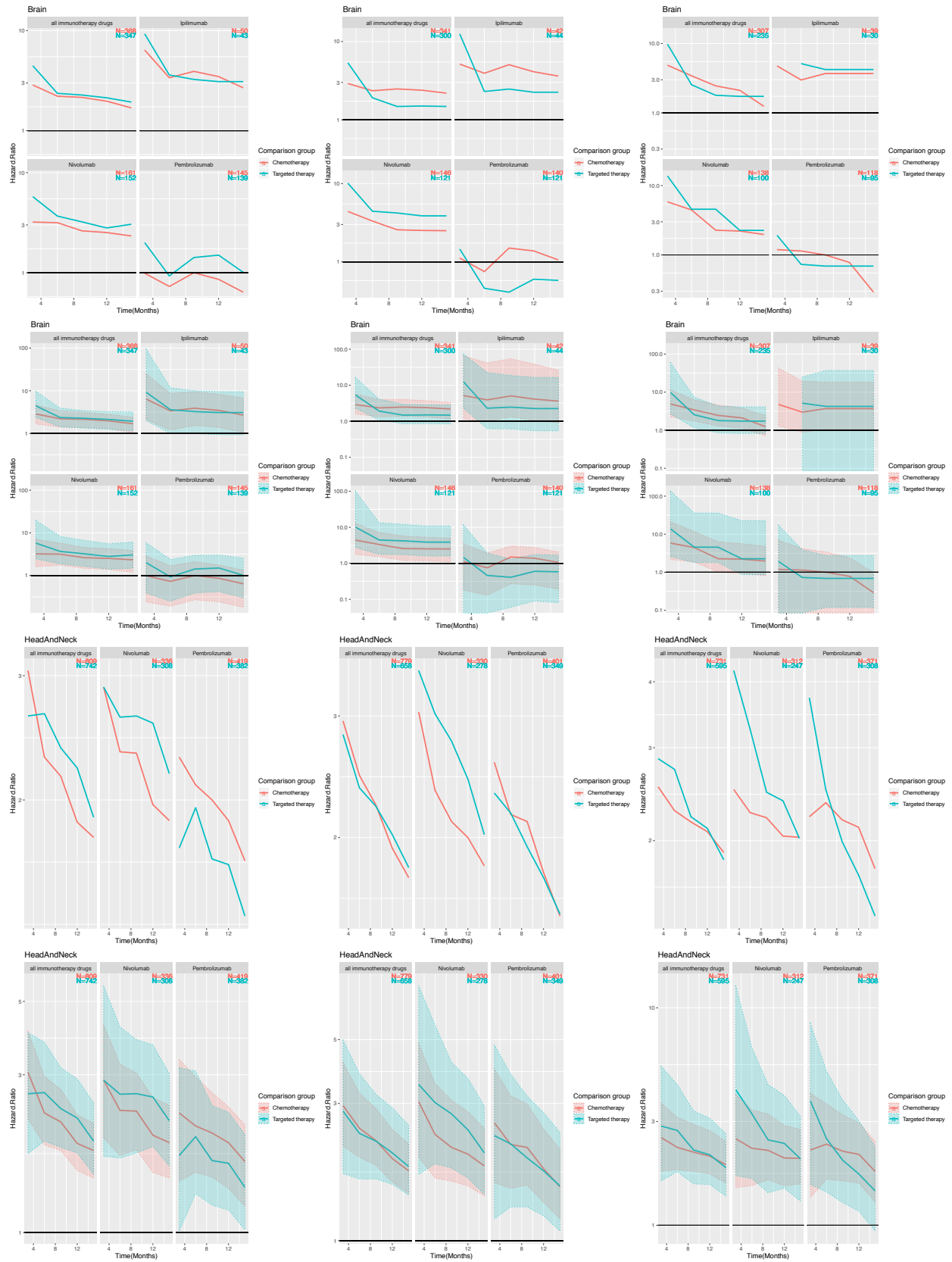
Sensitivity Analyses

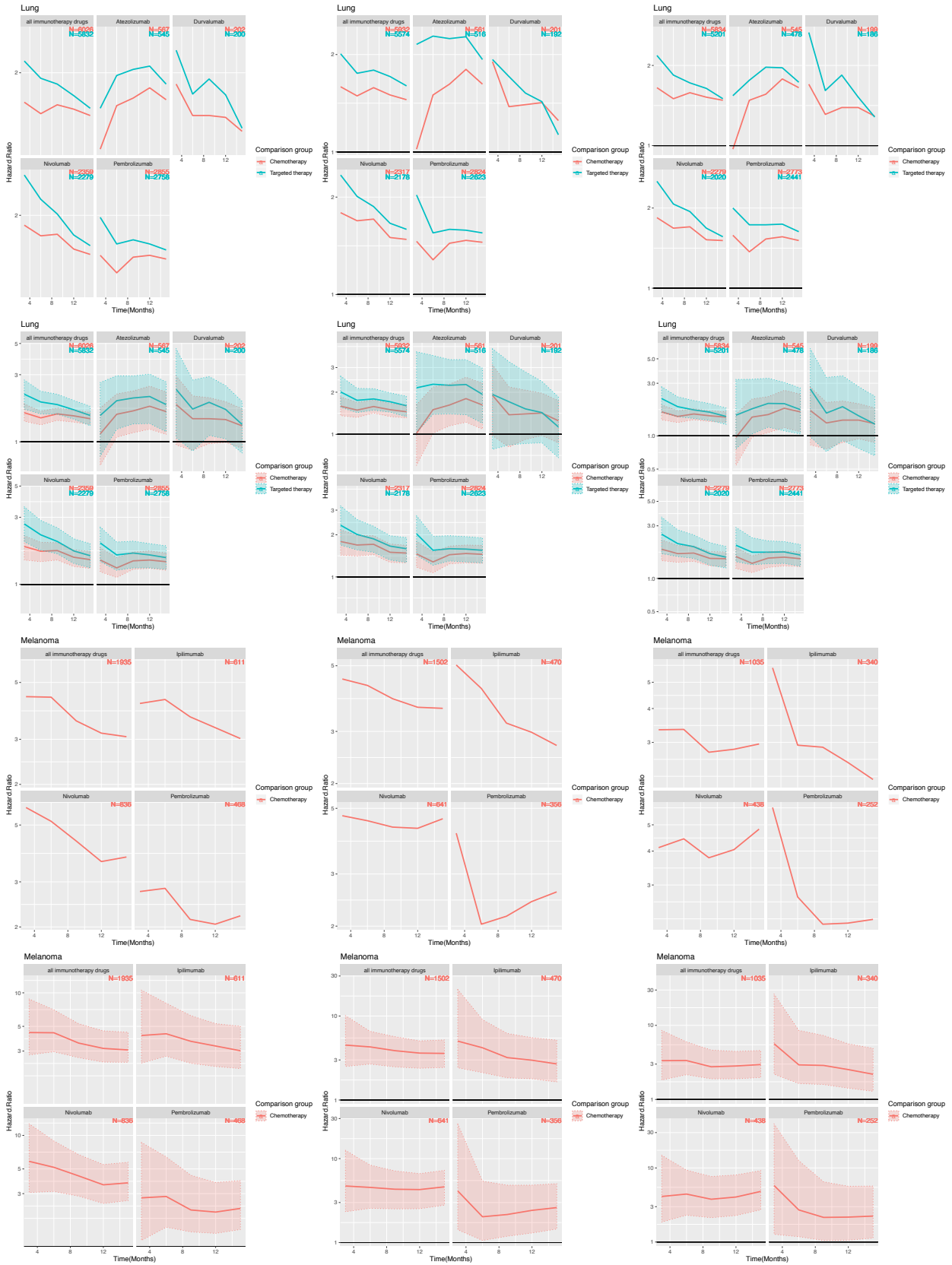
Different Categorization of Continuous Variables for Matching

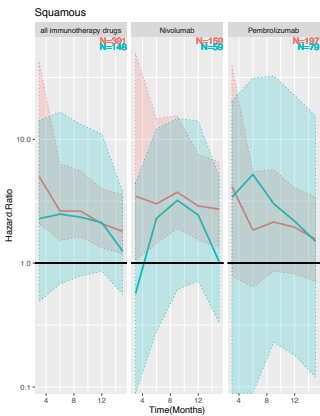
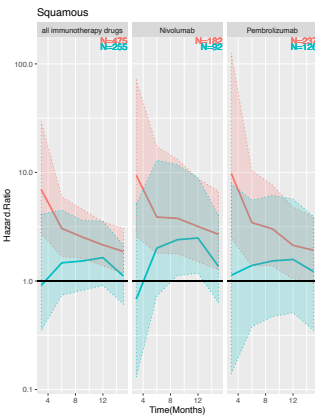
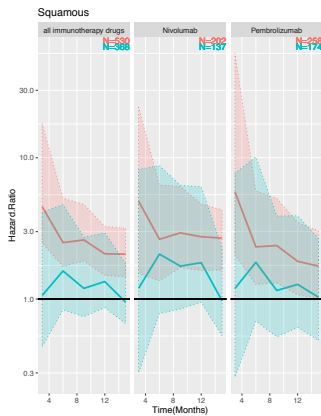
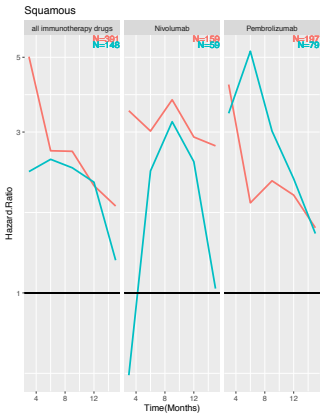
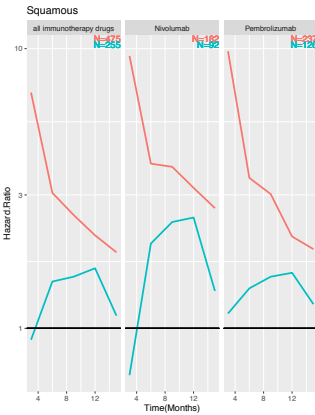
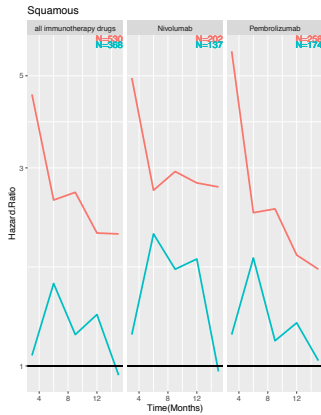
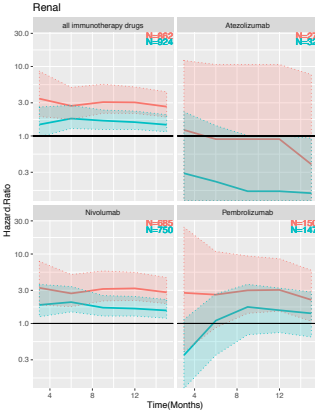
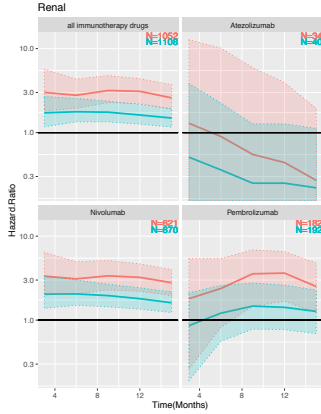
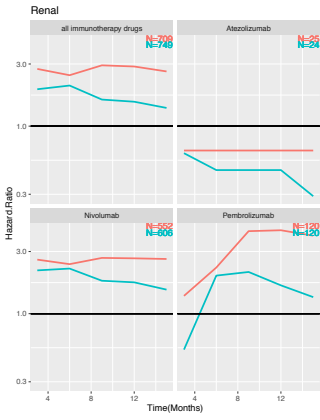
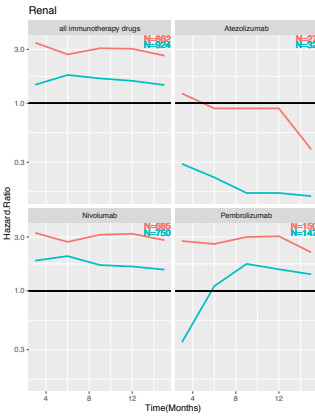
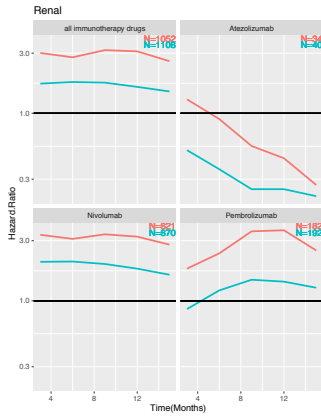
In the main analyses, we categorized the continuous variables (i.e., zip-code-defined median income, the annual frequency of hospital visits prior to treatment initialization, and the annual frequency of ICD code counts prior to treatment initialization) into 5 categories with equal proportions (20%) for matching. In the following sensitivity analyses, we compared the hazard ratio results when using 3, 4, and 5 bins to categorize the continuous variables.

Figure S6. Sensitivity to the number of categories for binning the continuous variables. The point estimates of the hazard ratios comparing the immunotherapy group with the conventional treatment groups in 3, 6, 9, 12, and 15 months after treatment initiation are shown. The number on the top right indicates the number of matched patients in the treatment group. The left, middle and right panels correspond to 3, 4, and 5 categories, respectively. The top panel displays the hazard ratio estimates, and the bottom panel displays the 95% CI. The hazard ratio estimates did not vary much when we used different numbers of bins.







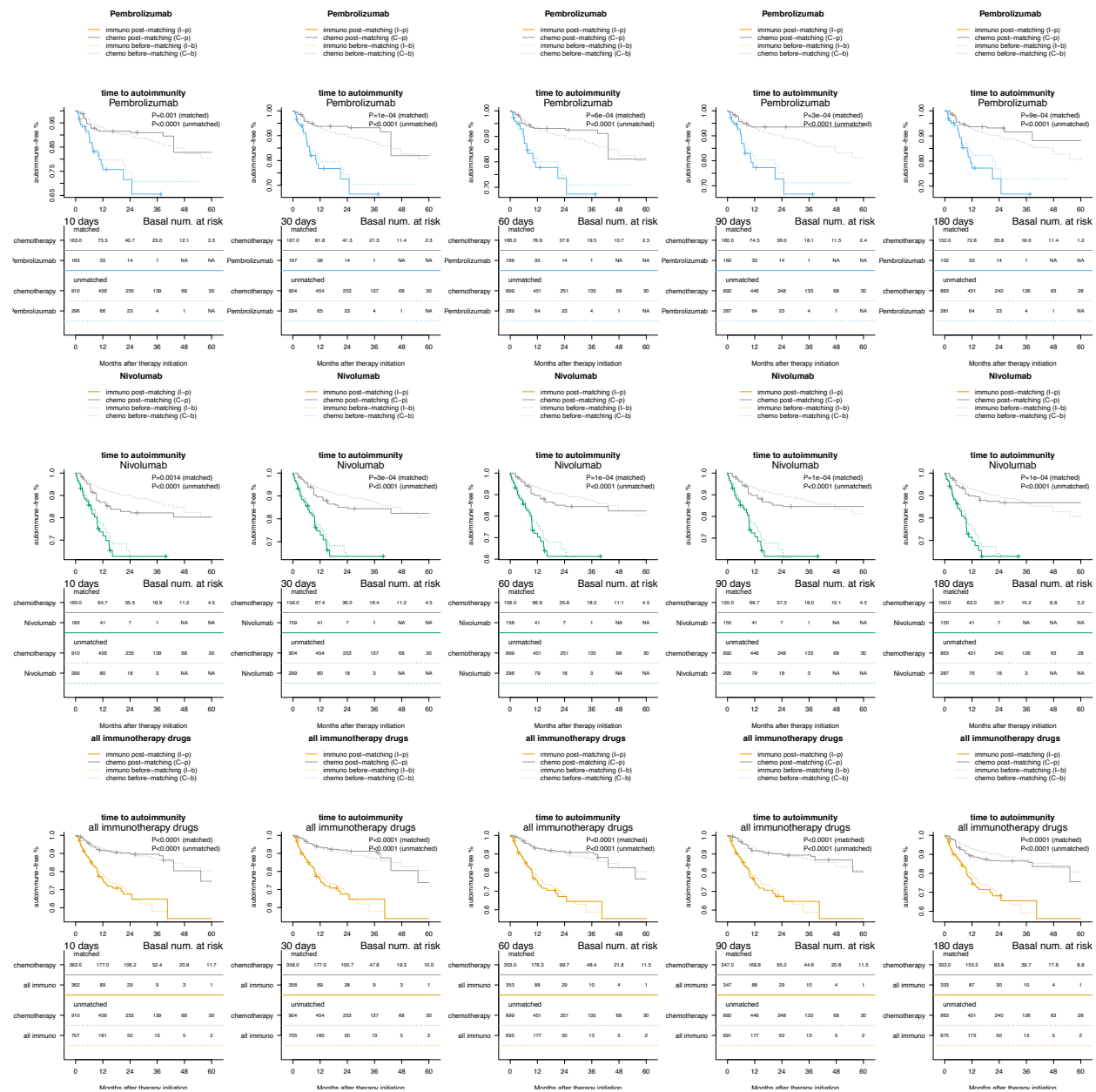


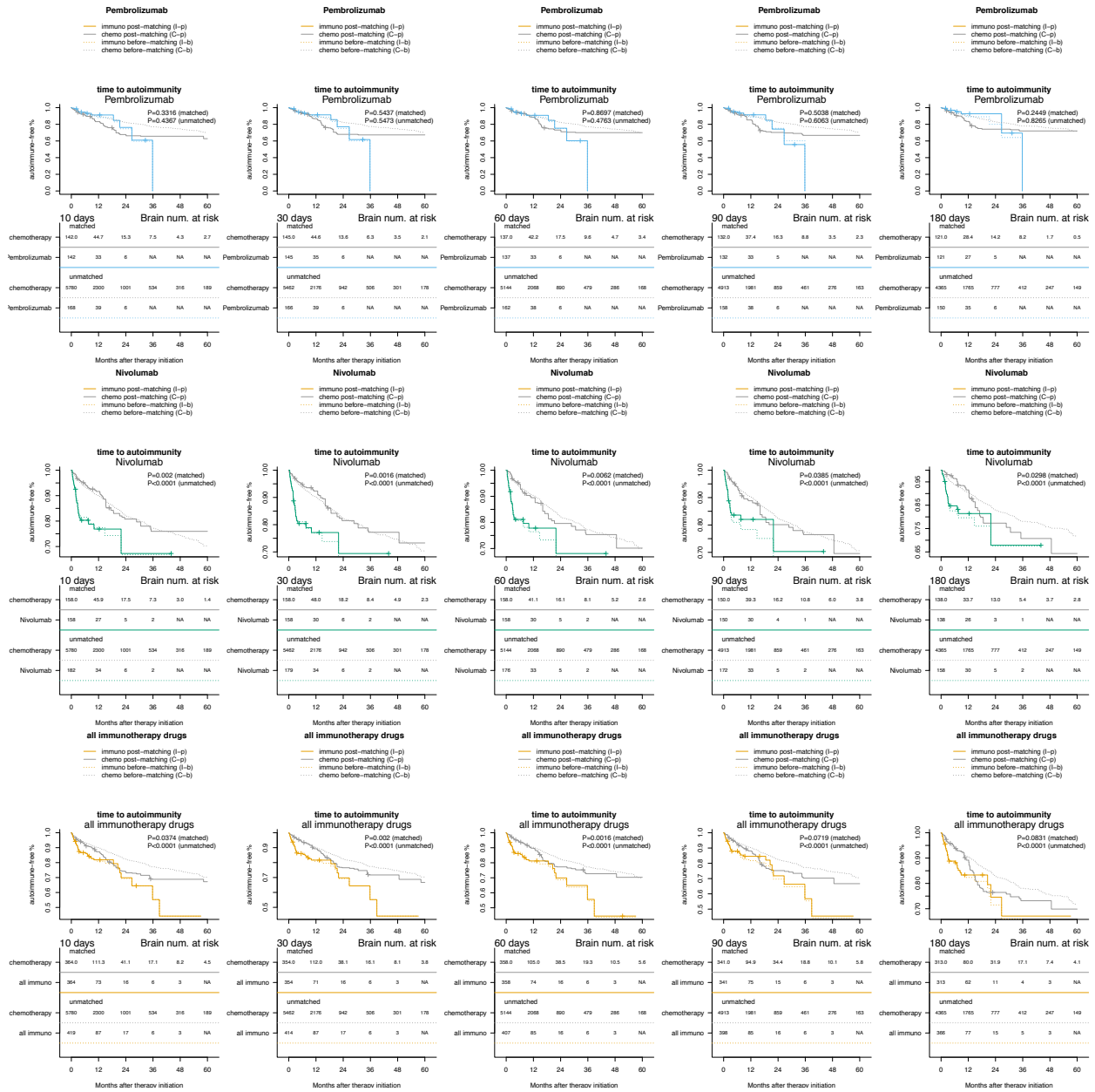
Different Quiescence Period Requirement

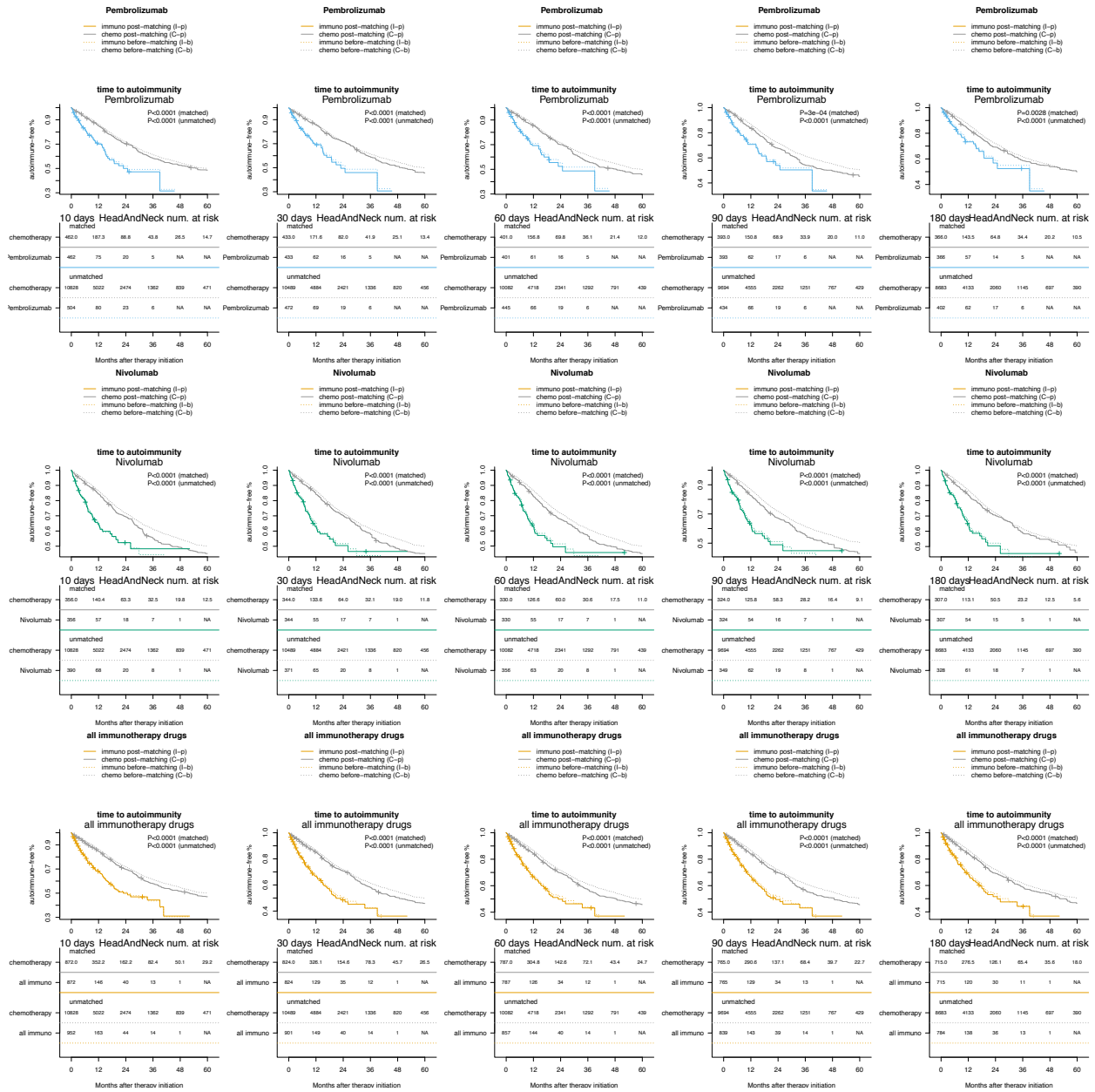
We examined the statistical models with different quiescence period requirements in this section. In particular, we fitted the same time-to-autoimmunity models and require the treatment initiation dates to be at least 10, 30, 60, 90, 180 days after the insurance enrollment. Figure S7 shows the sensitivity analysis results. The increased hazards for autoimmune diseases in the immunotherapy group are consistent throughout different quiescence period requirements.

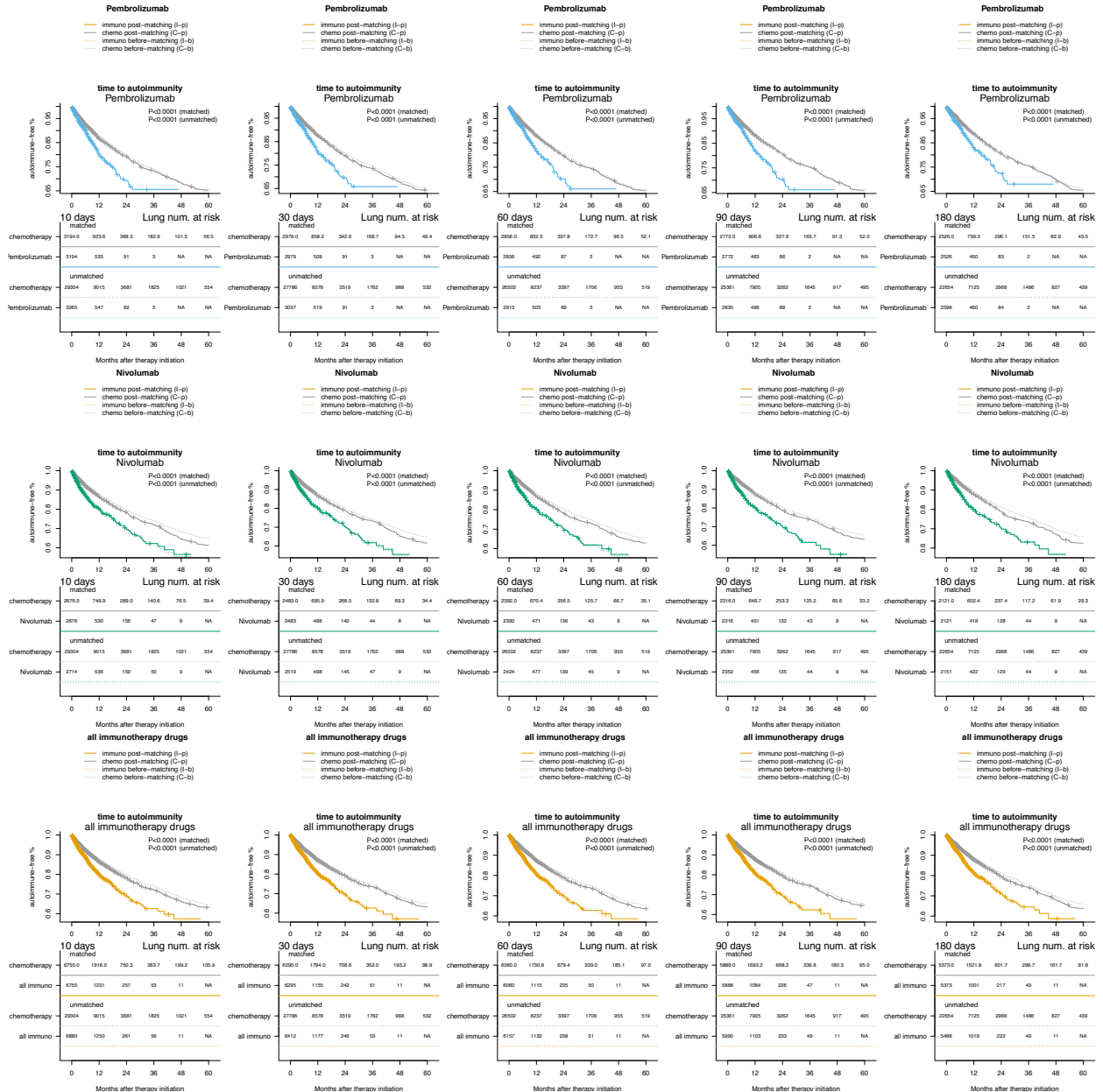
Figure S7. Sensitivity analyses on the quiescence period requirement for renal cancer.

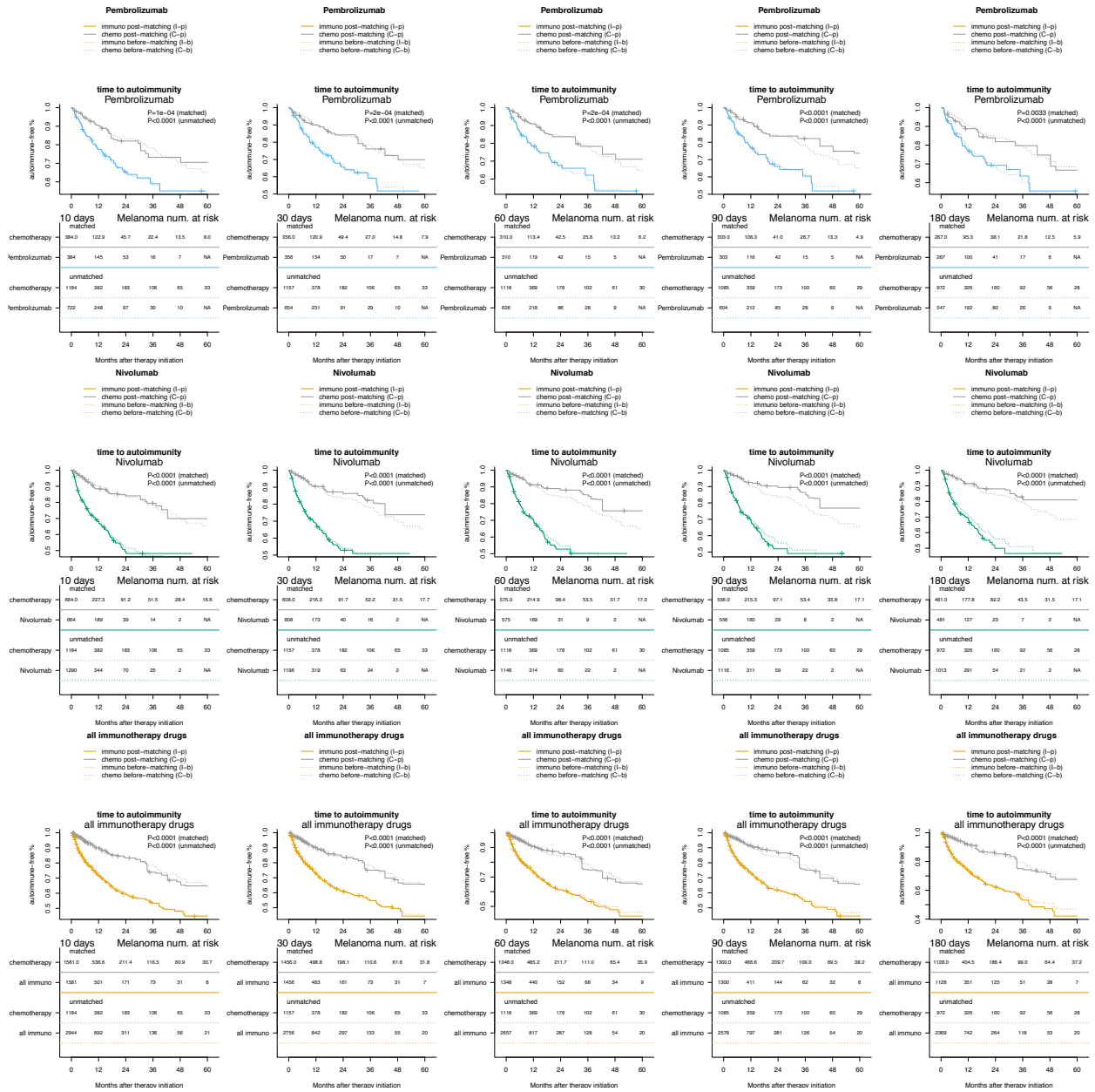
Chemotherapy

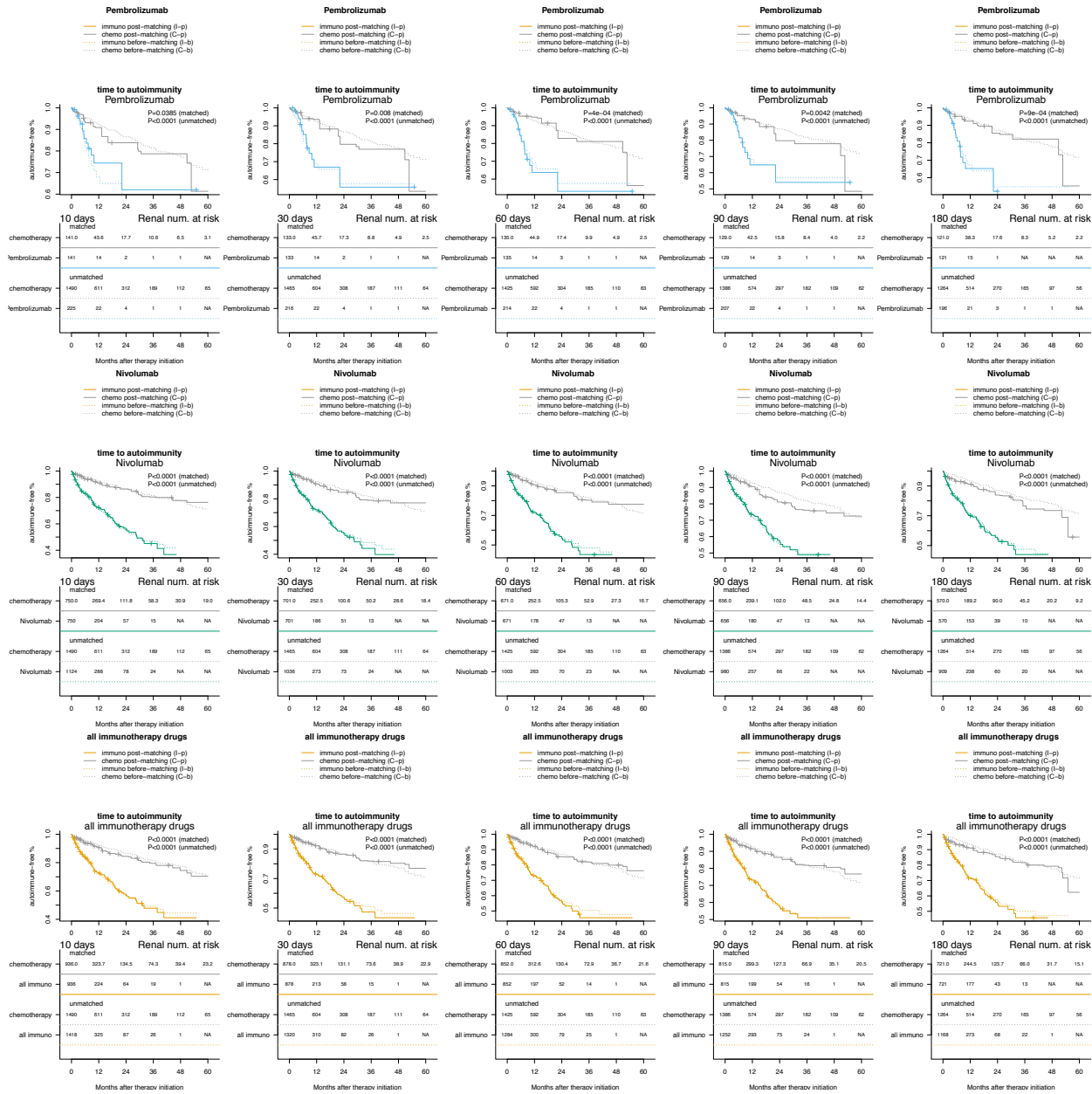


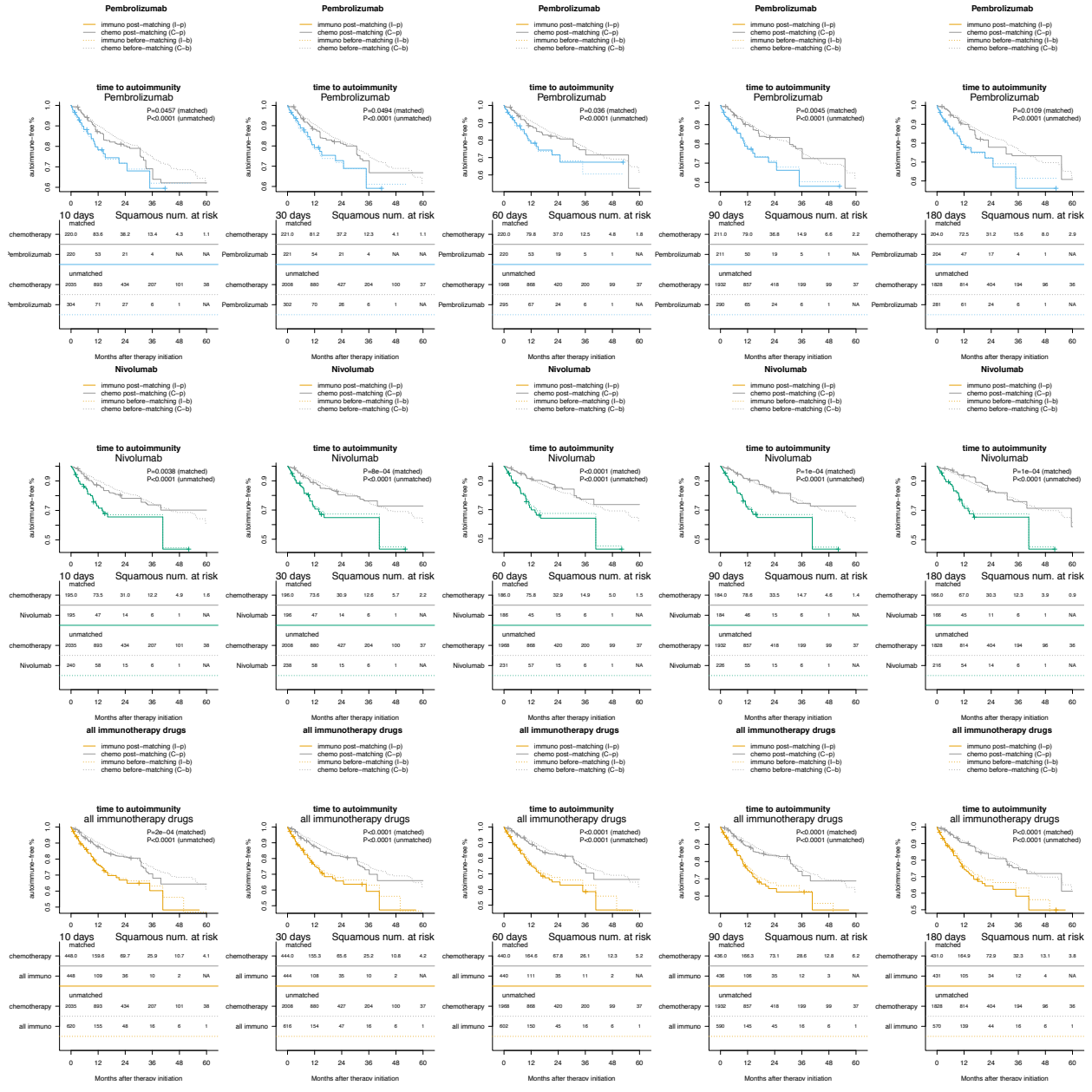




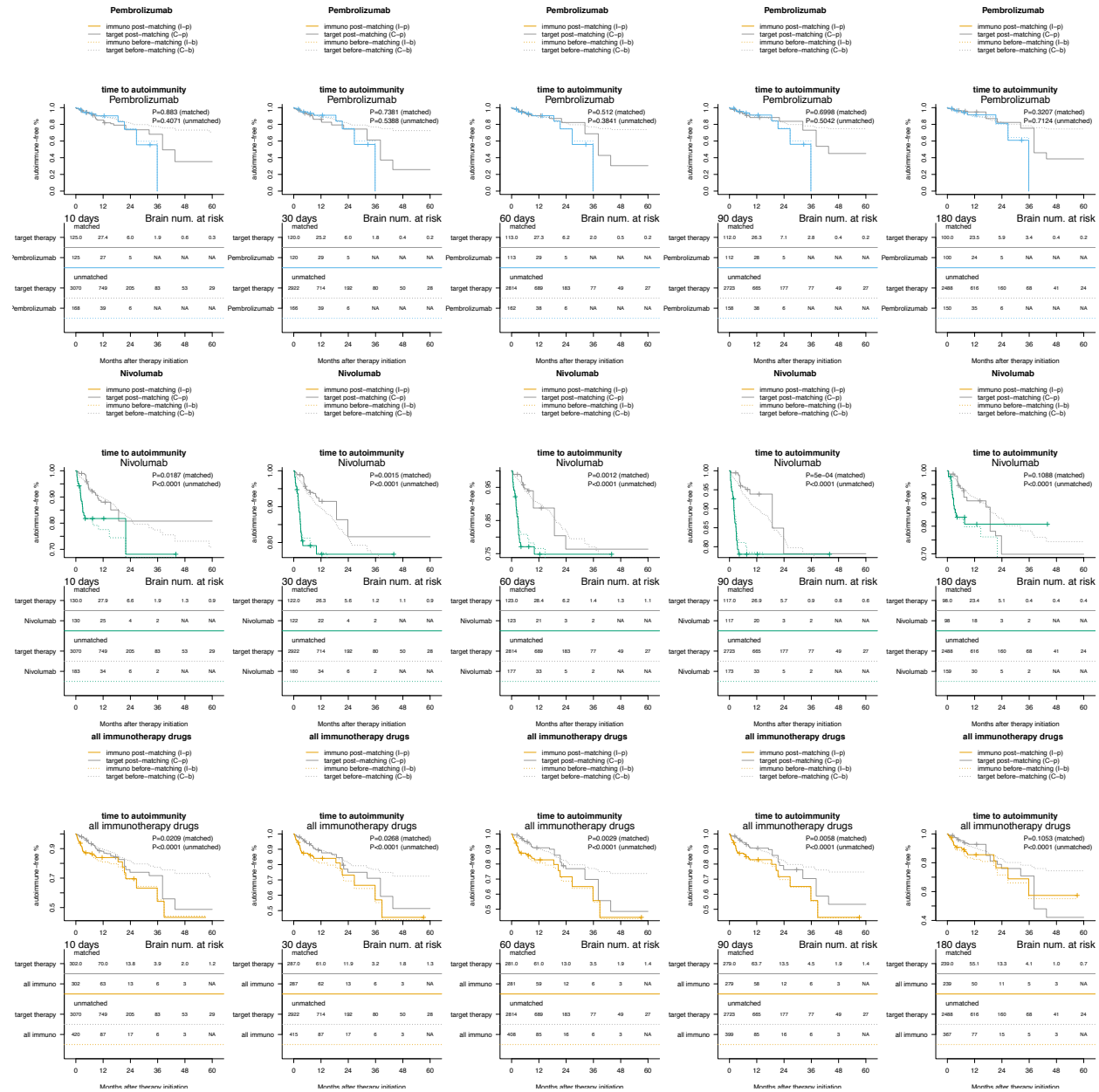


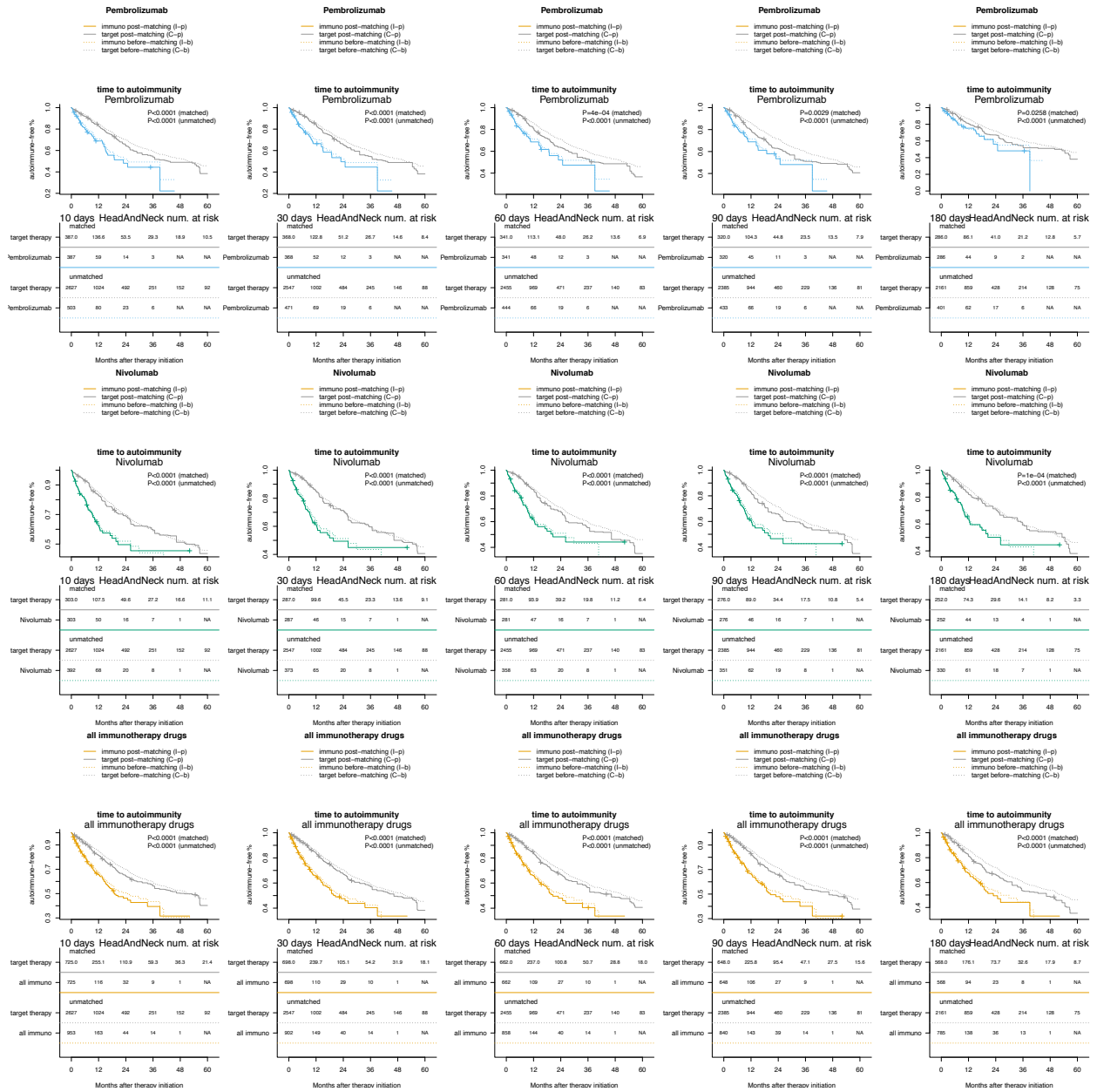


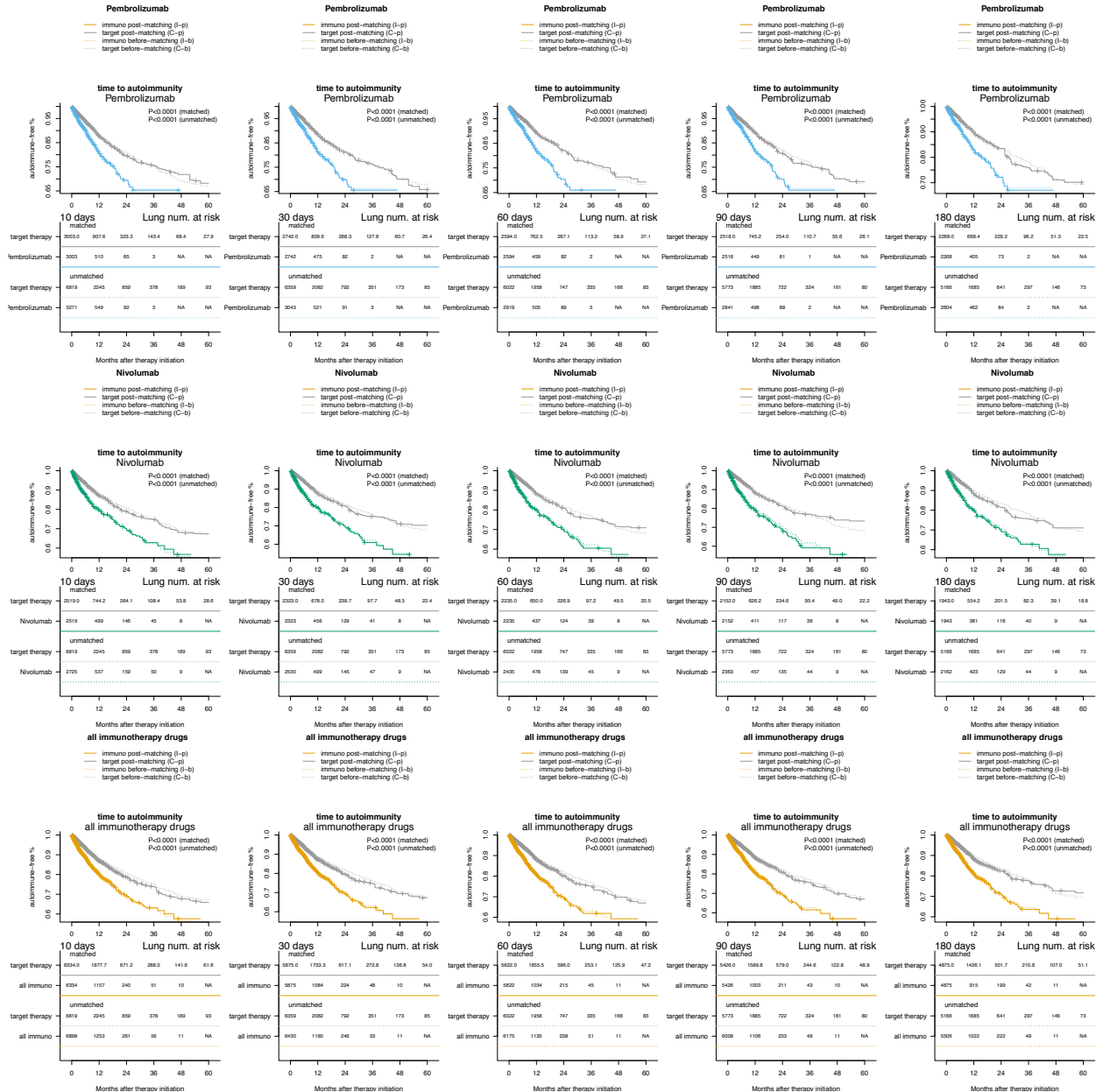


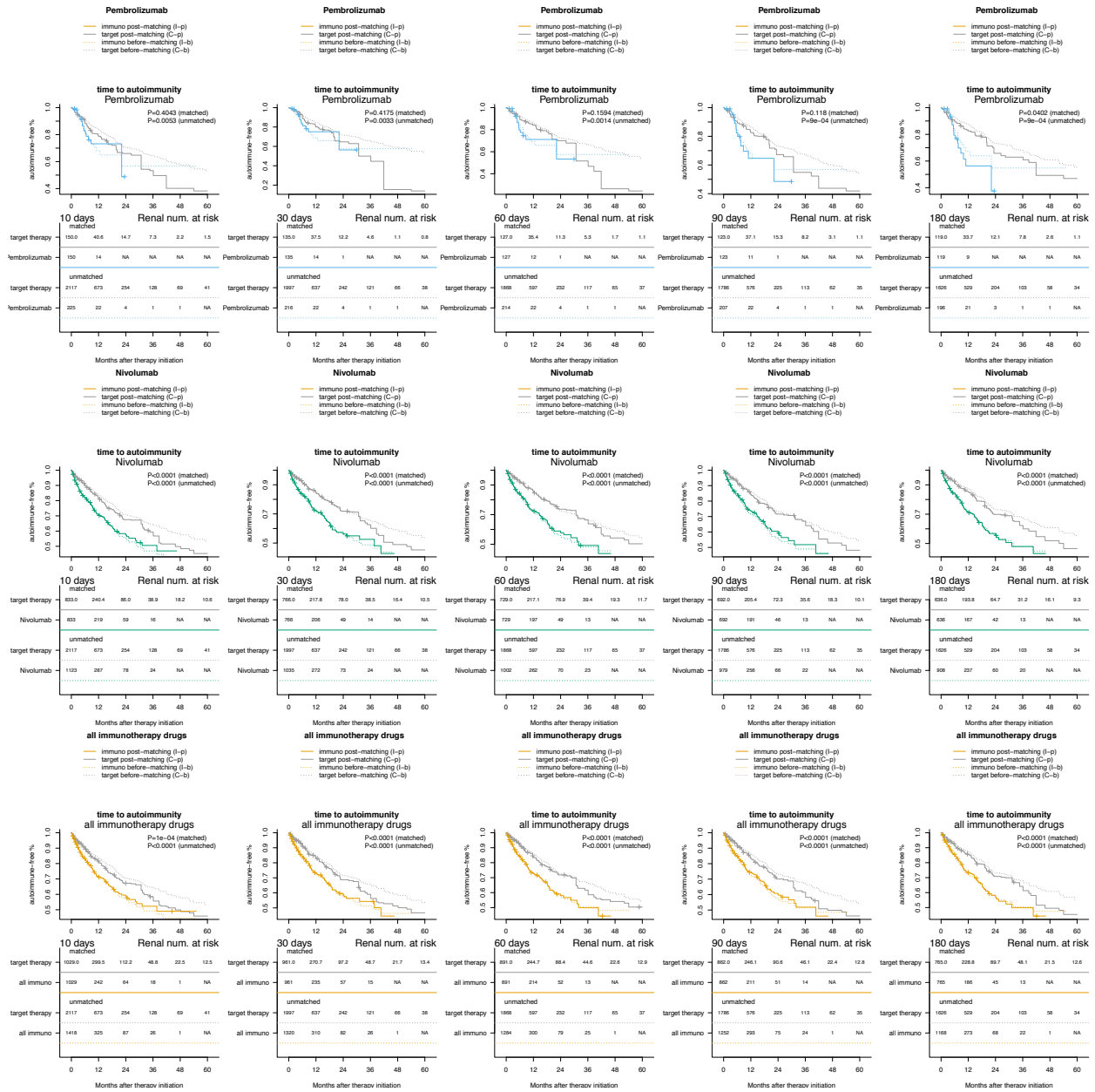


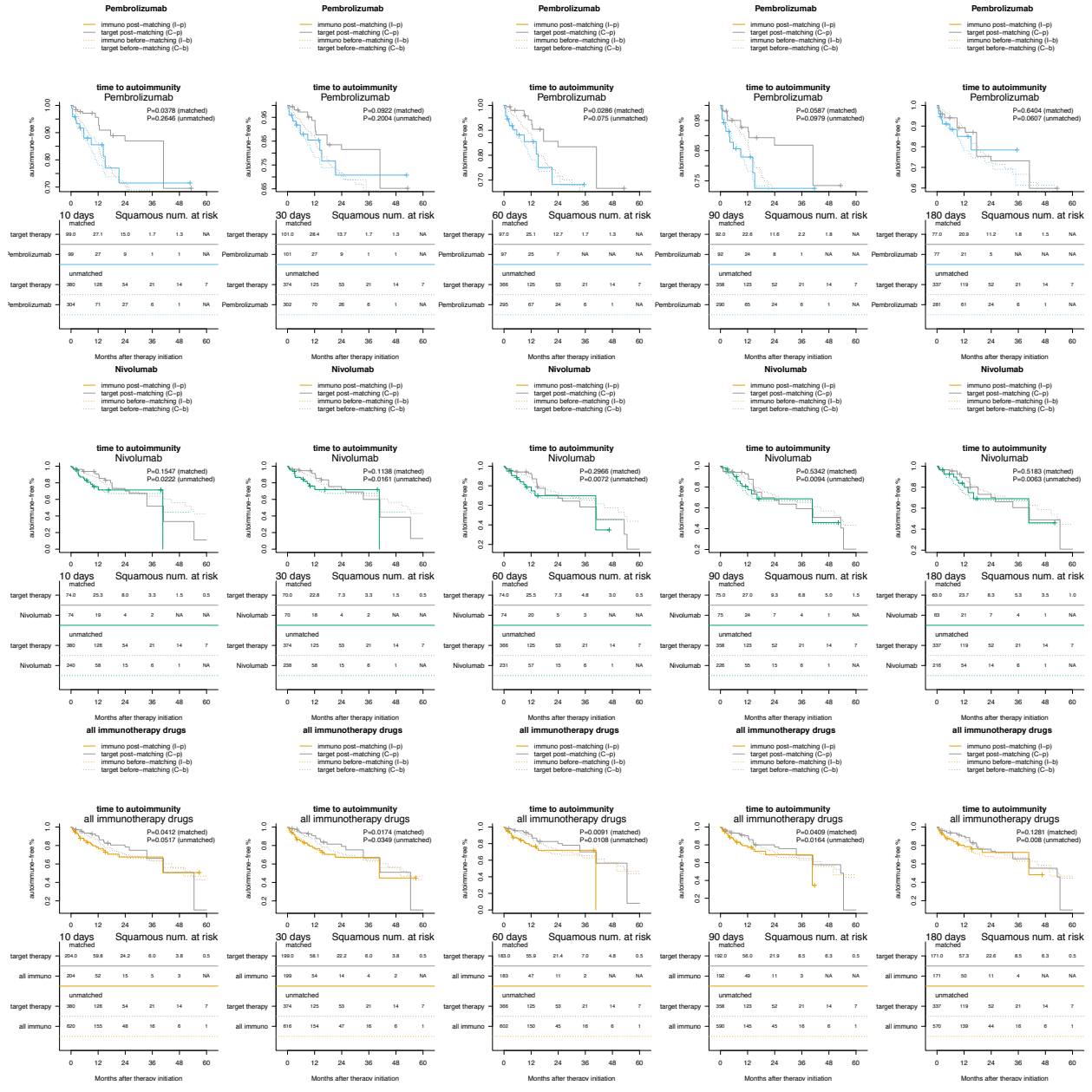
Targeted therapy











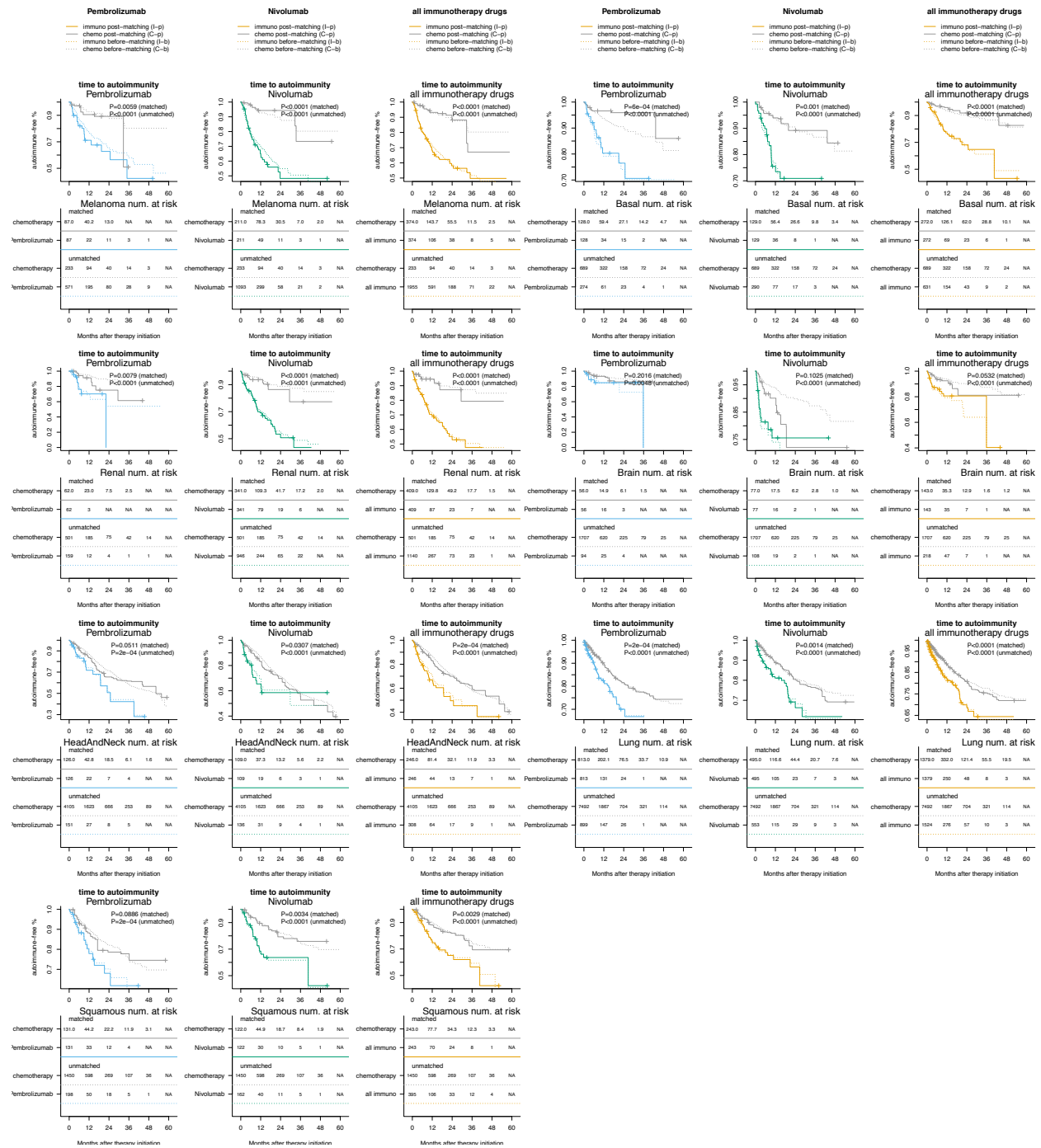
Additional Time-Frame Requirement

Most patients in the treatment group started their first therapy only after 2015. However, the control group patients spread out quite evenly throughout the entire study period. To address the potential impact of comparing the treatment group after 2015 with the control group in 2008-2019, we conducted additional analyses restricting both the control and the treatment group to those who started treatment after 2015.

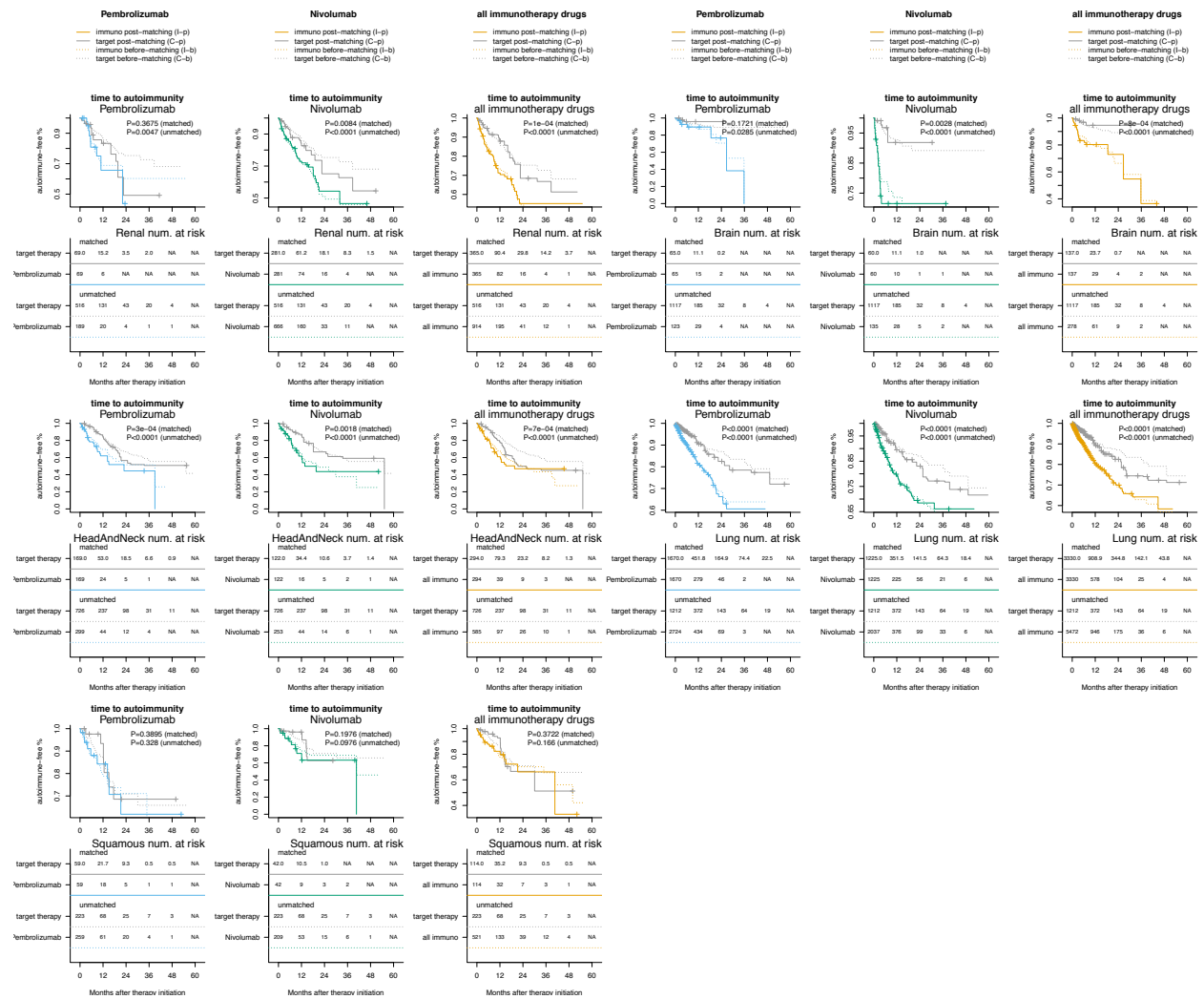
Figure S8 presents the results in detail. We observe similar estimates as in the main text but with reduced statistical power due to the exclusion of pre-2015 patients.

Figure S8. Imposing an additional time-frame requirement that the patients must have chemotherapy or immunotherapy initiation dates after 2015.

Chemotherapy



Targeted therapy



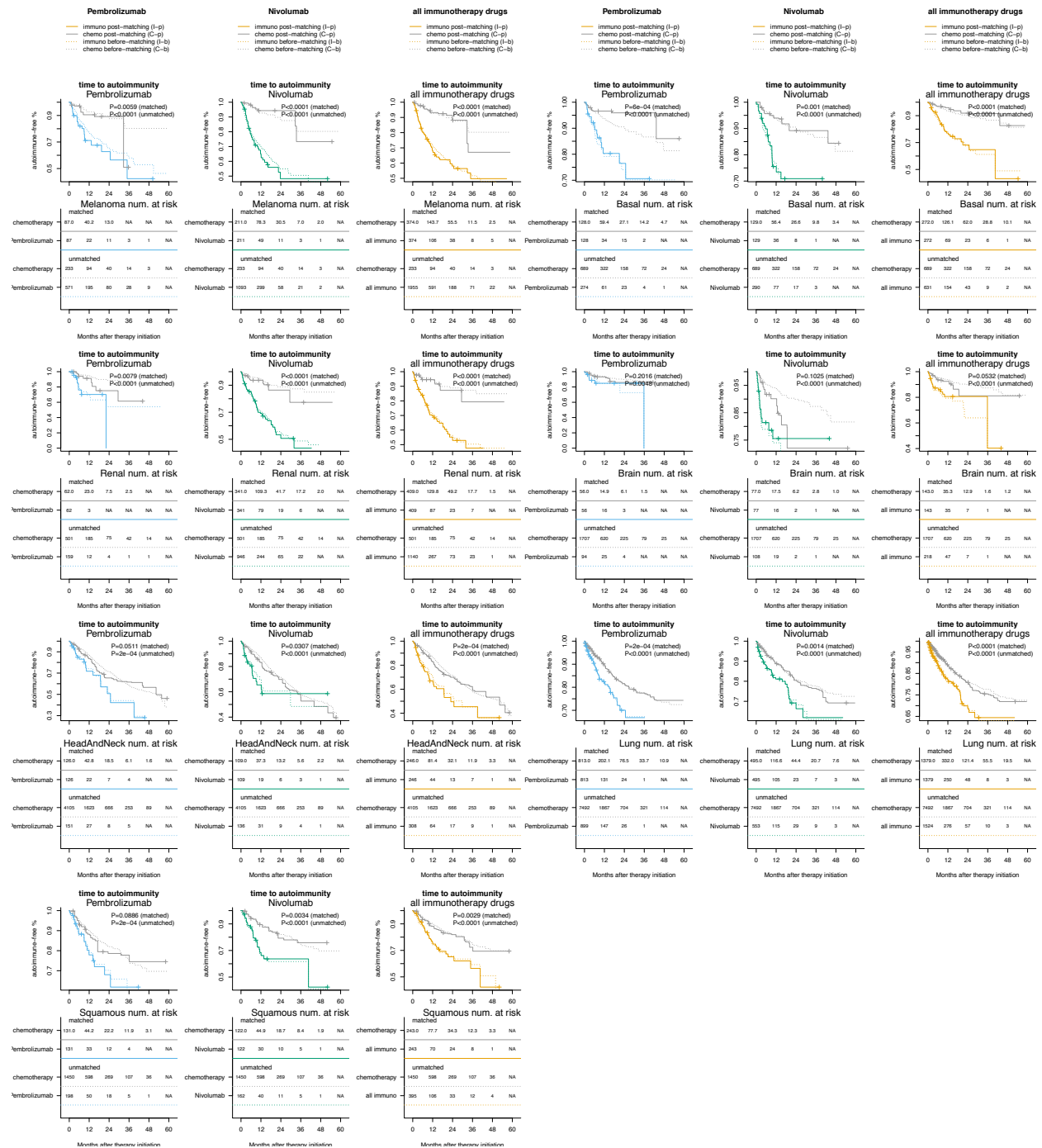
Excluding patients from the immunotherapy group if they have received chemotherapy or targeted therapy before immunotherapy

In our main results, the treatment initiation date of immunotherapy patients is defined to be the date of the first immunotherapy administration, even in the case where the immunotherapy is used after chemotherapy as second-line therapy. One might argue if the previous chemotherapy (or targeted therapy) would affect the hazard ratio after immunotherapy. In this section, we address this issue by excluding patients from the immunotherapy group if they have received chemotherapy or targeted therapy before immunotherapy.

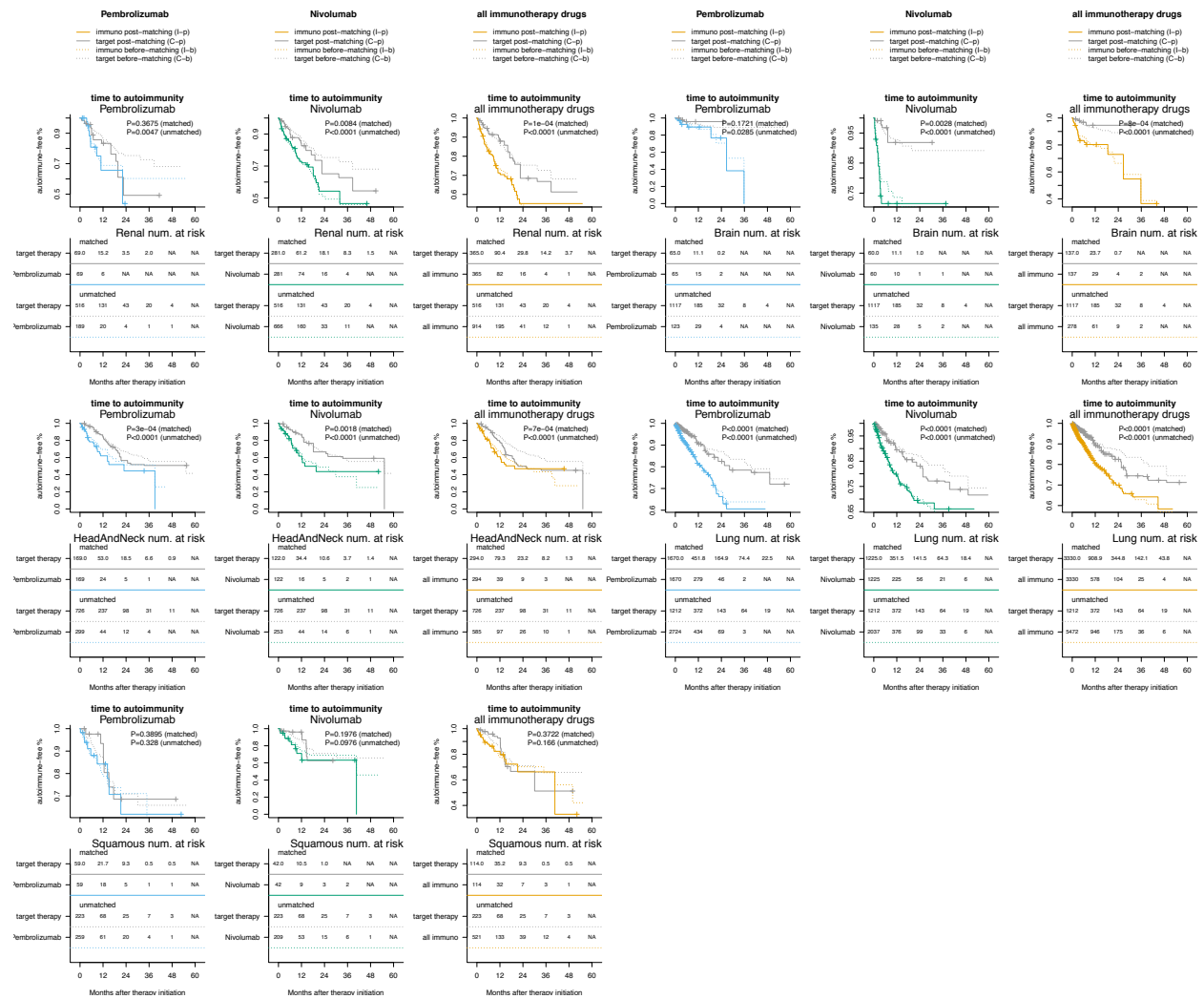
Figure S9 shows a consistent risk difference between the treatment group and the control group when these additional exclusion criteria are applied. Due to the smaller sample size, the statistical power is weaker in this analysis.

Figure S9. Sensitivity studies on the impact of excluding patients from the immunotherapy group if they have received chemotherapy or targeted therapy before immunotherapy.

Chemotherapy



Targeted therapy



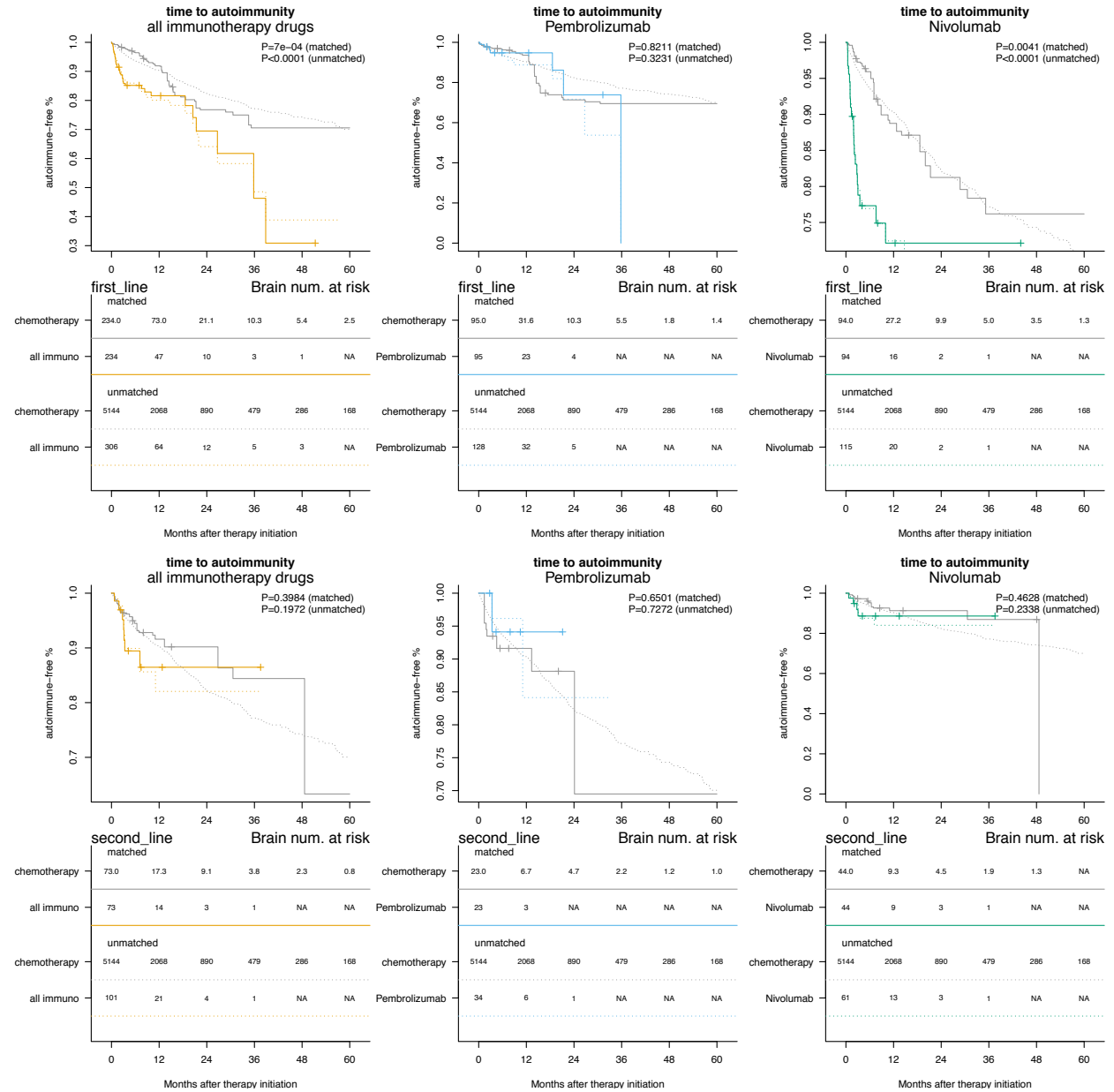
Subpopulation Analyses

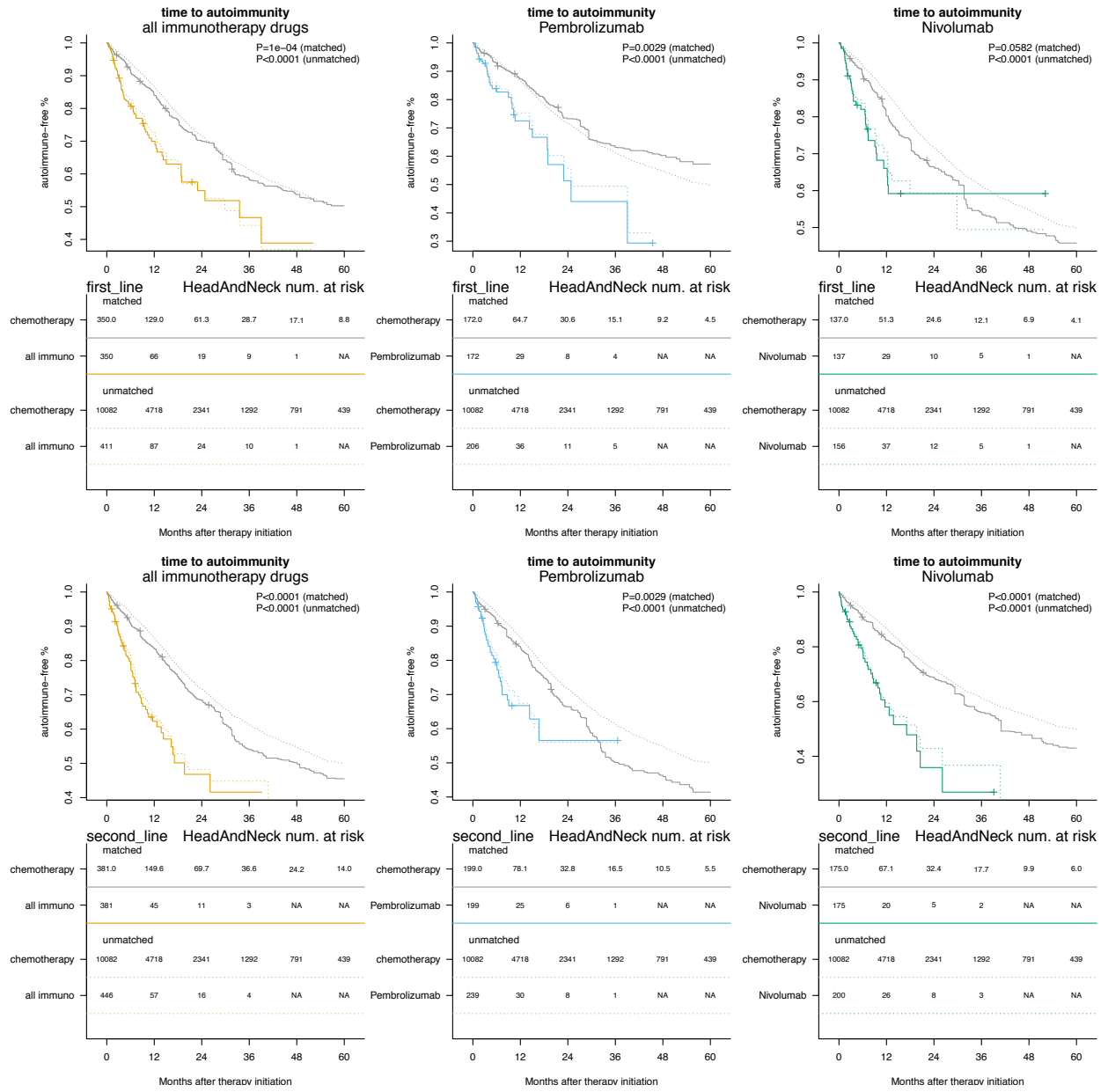
Lines of Immunotherapy

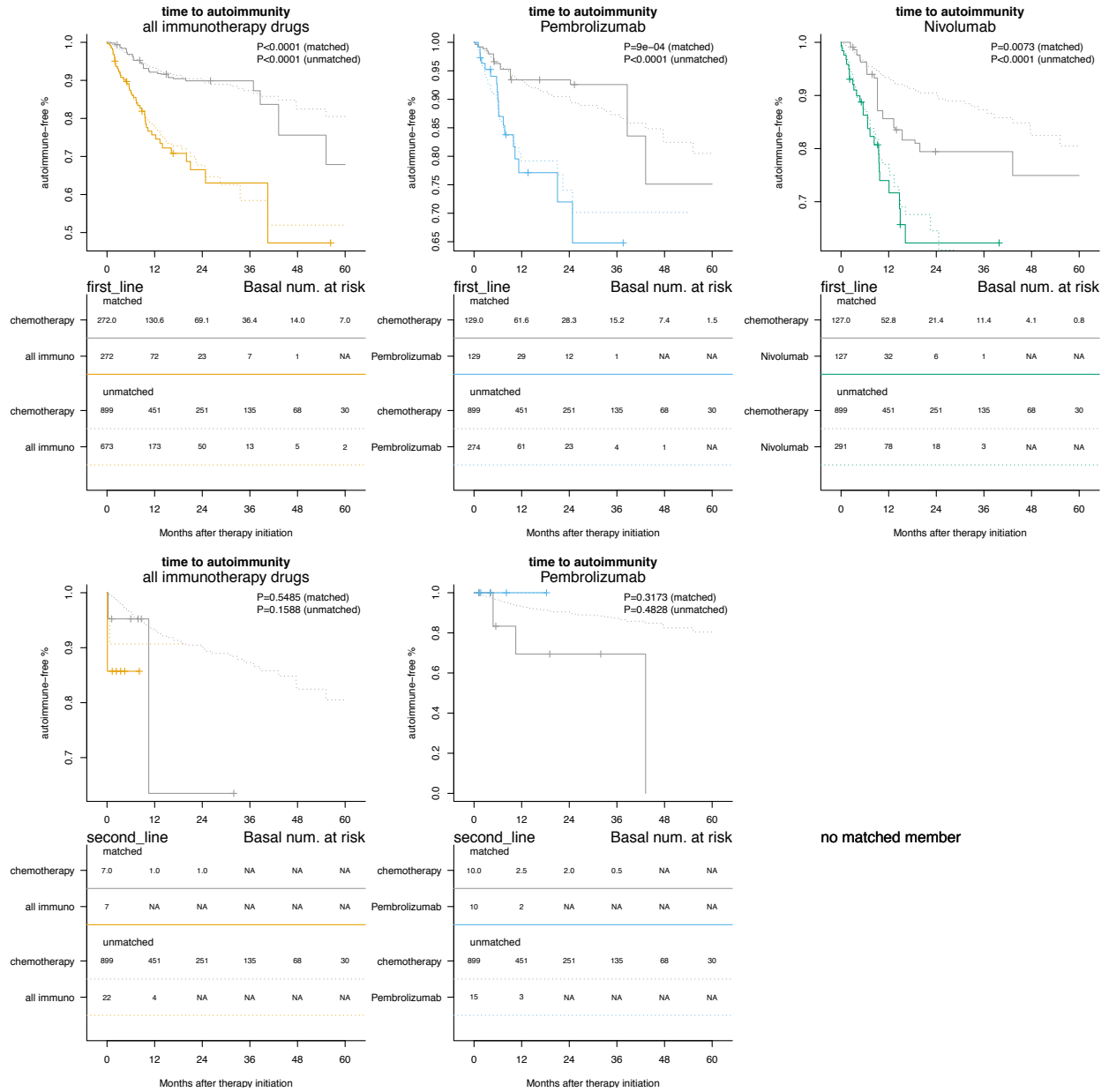
We conducted stratified analyses by separating the patients into two sub-groups based on the lines of immunotherapy. Those receiving immunotherapy without prior chemotherapy are classified as the first-line immunotherapy group, and those receiving immunotherapy after chemotherapy administration are classified as the second-line immunotherapy group. Figure S10 presents the results in detail. Nivolumab is more frequently used as a second-line therapy, while Pembrolizumab is more often used as first-line therapy. The difference might be due to the recency of Pembrolizumab approval and that the drug is approved as a first-line treatment for metastatic non-small cell lung cancer. The risk of autoimmune disease is similar regardless of the lines of immunotherapy.

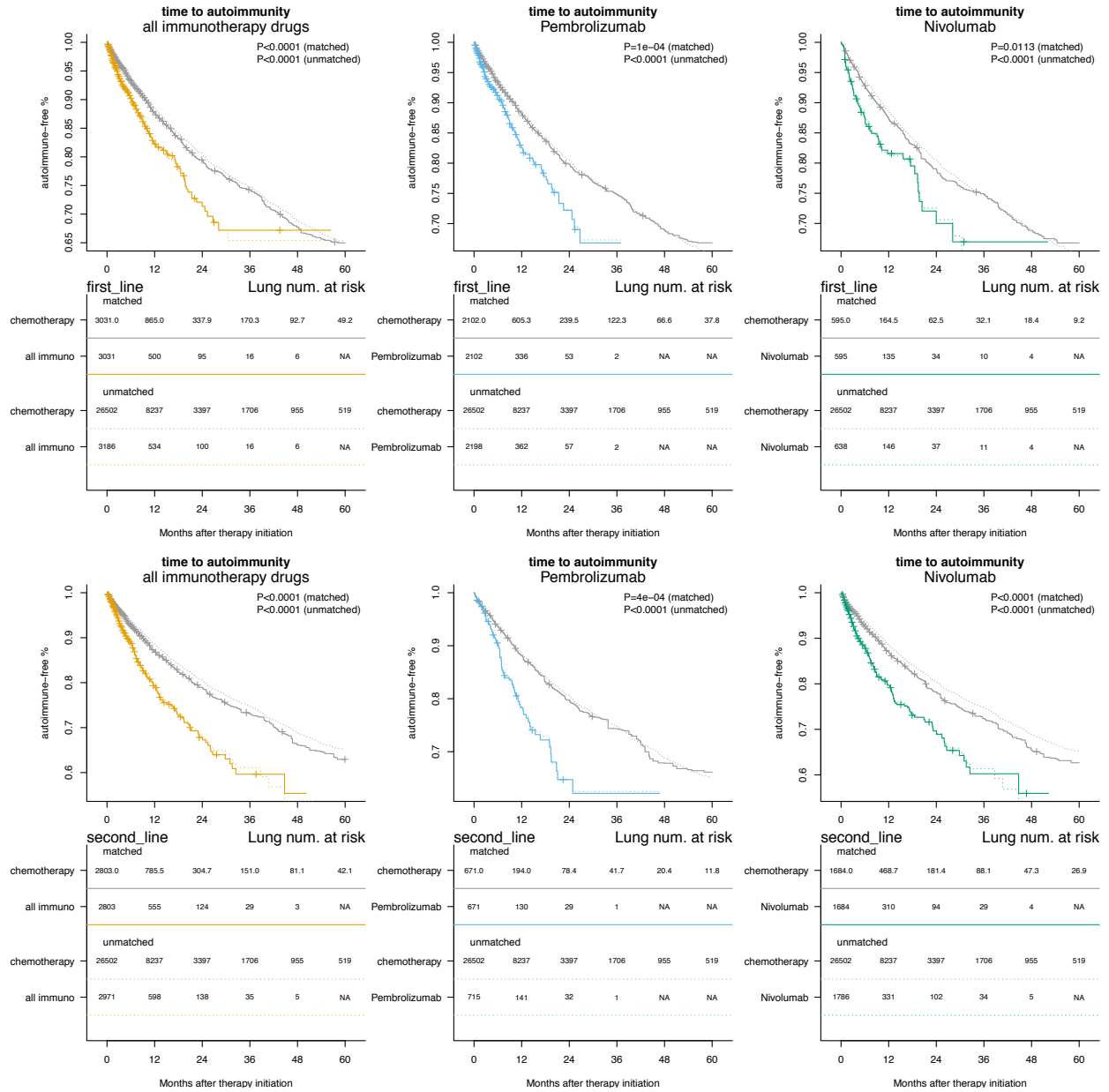
Figure S10. Results stratified by the lines of immunotherapy. The top panel compares the first-line immunotherapy group with the chemotherapy group, and the bottom panel compares the second-line immunotherapy group with the chemotherapy group. It turns out that we have most patients from the first-line immunotherapy group, and in that case, we don't need to worry about the first or second-line because the proportion of people in the second-line is negligible compared to the whole immunotherapy group. For lung cancer and renal cancer, the population is quite evenly distributed between two categories, and the risk of autoimmune disease is similar regardless of the lines of immunotherapy.

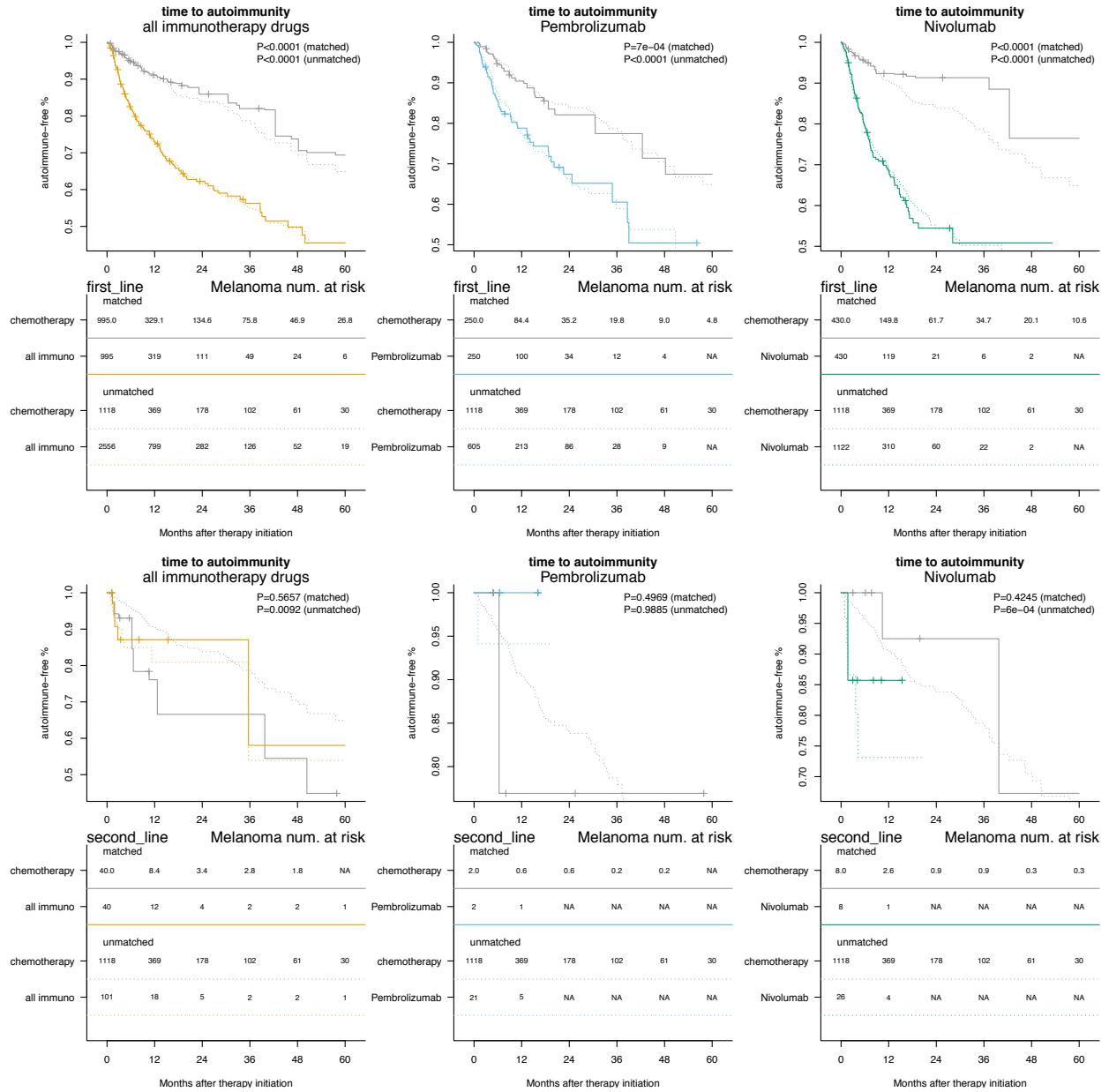
Chemotherapy

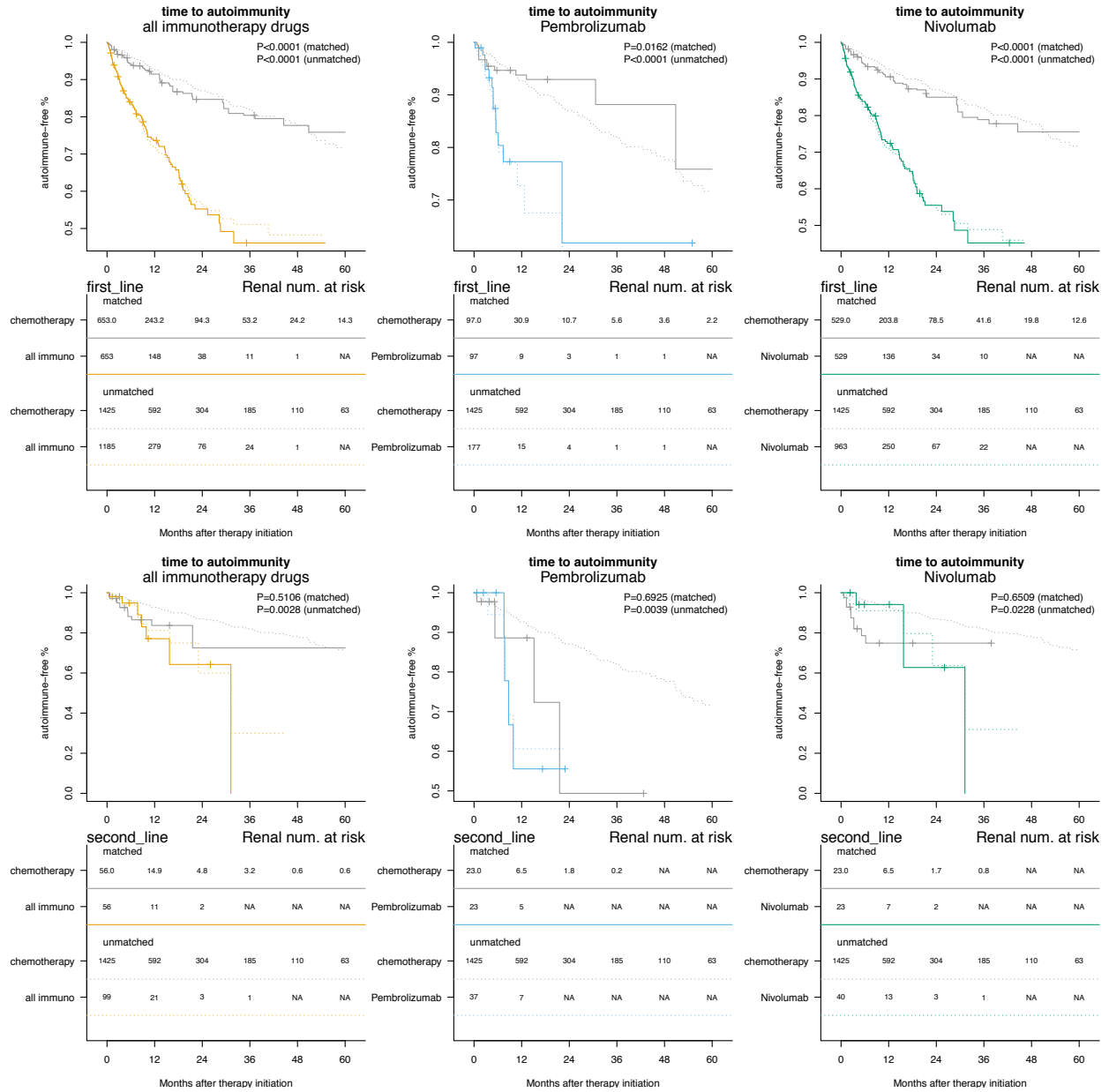


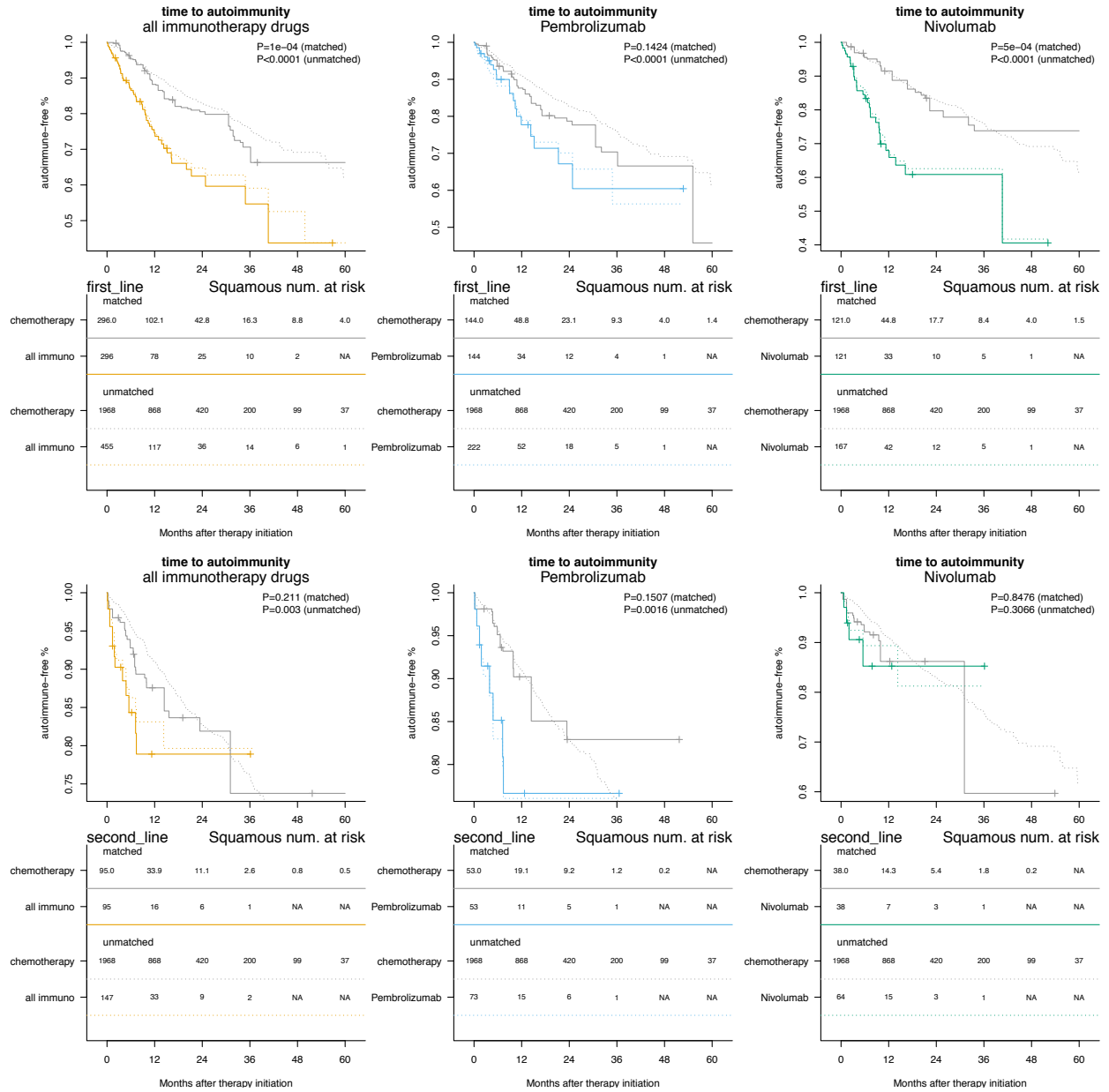




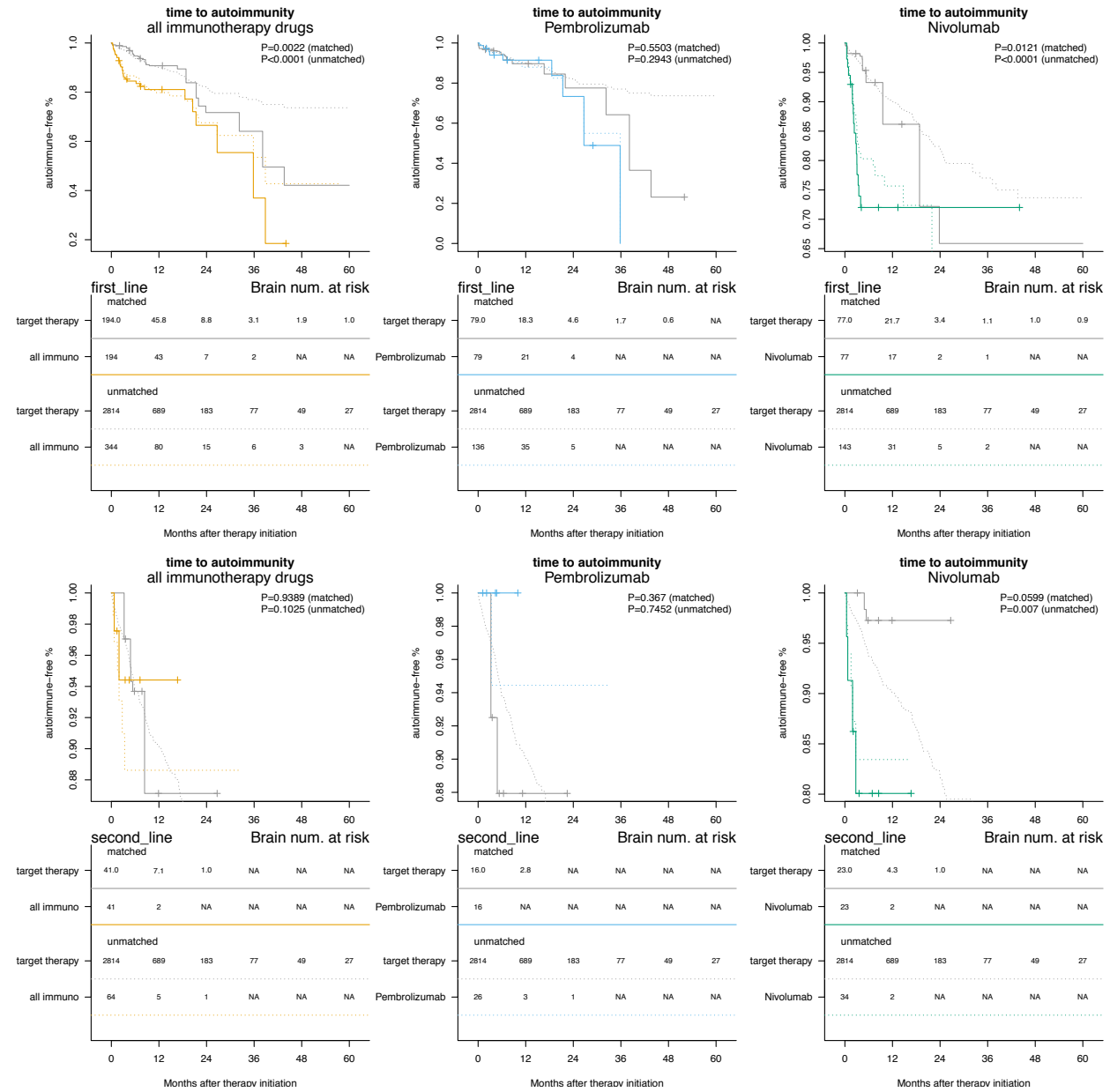


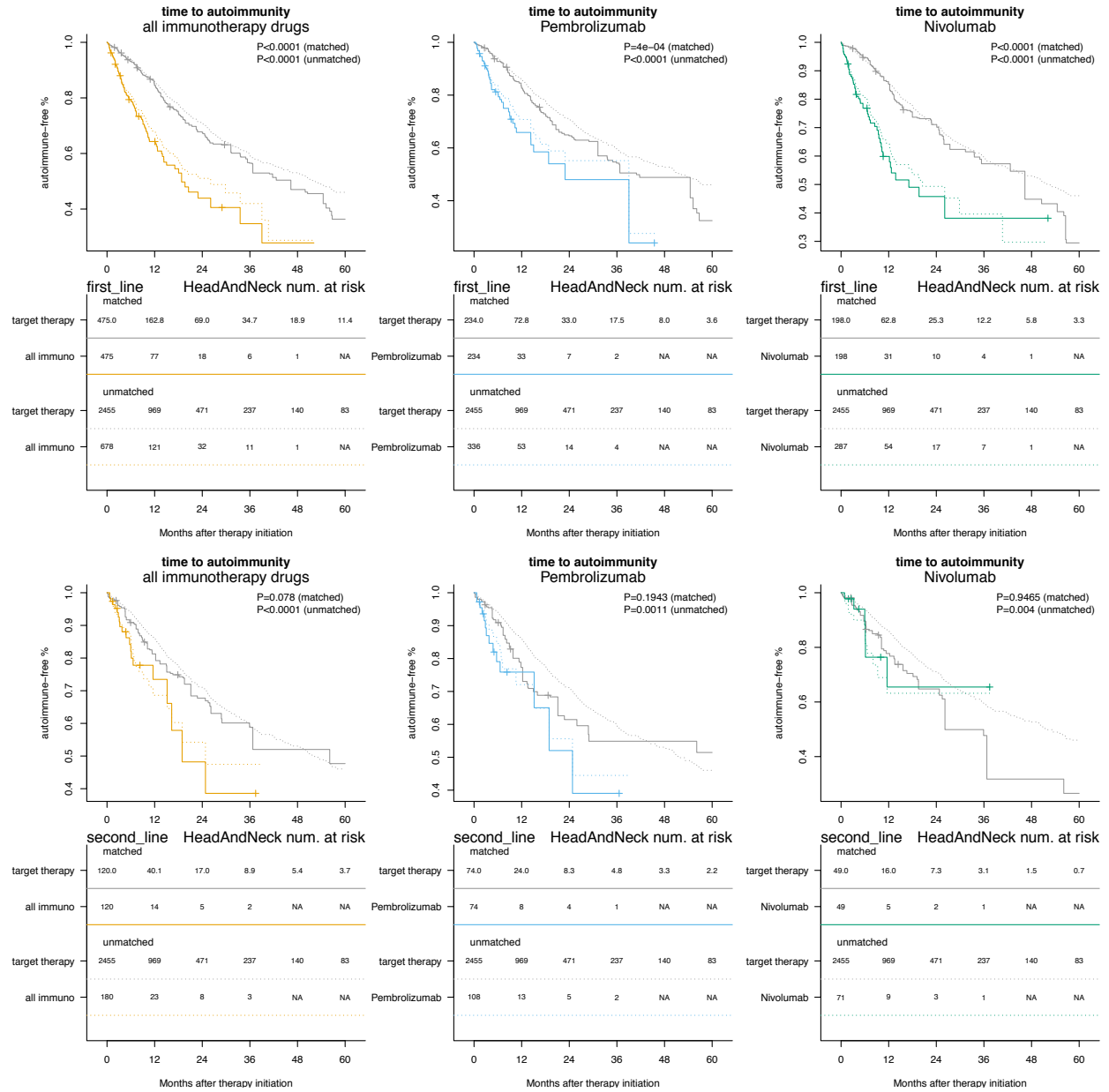


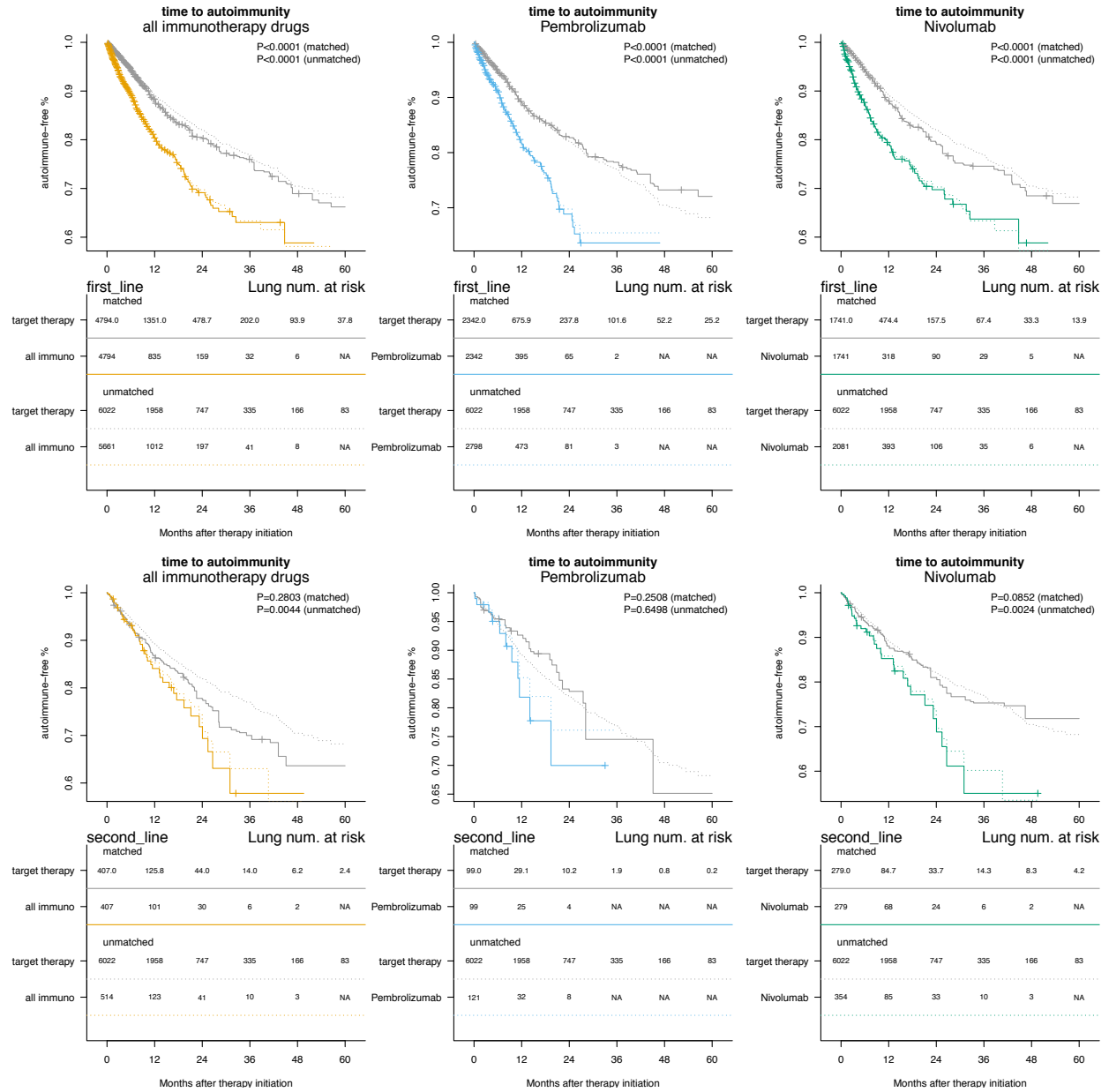


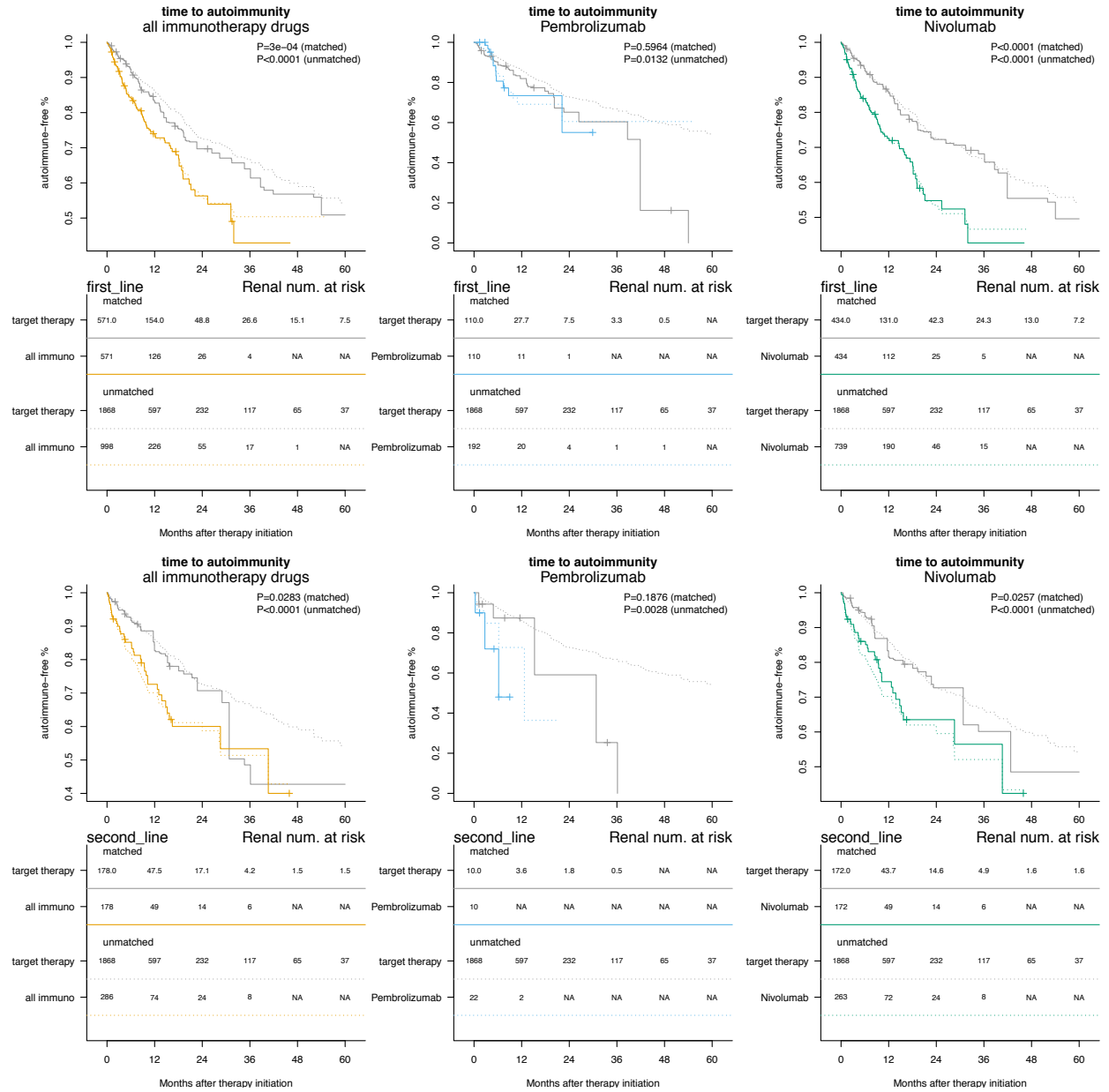


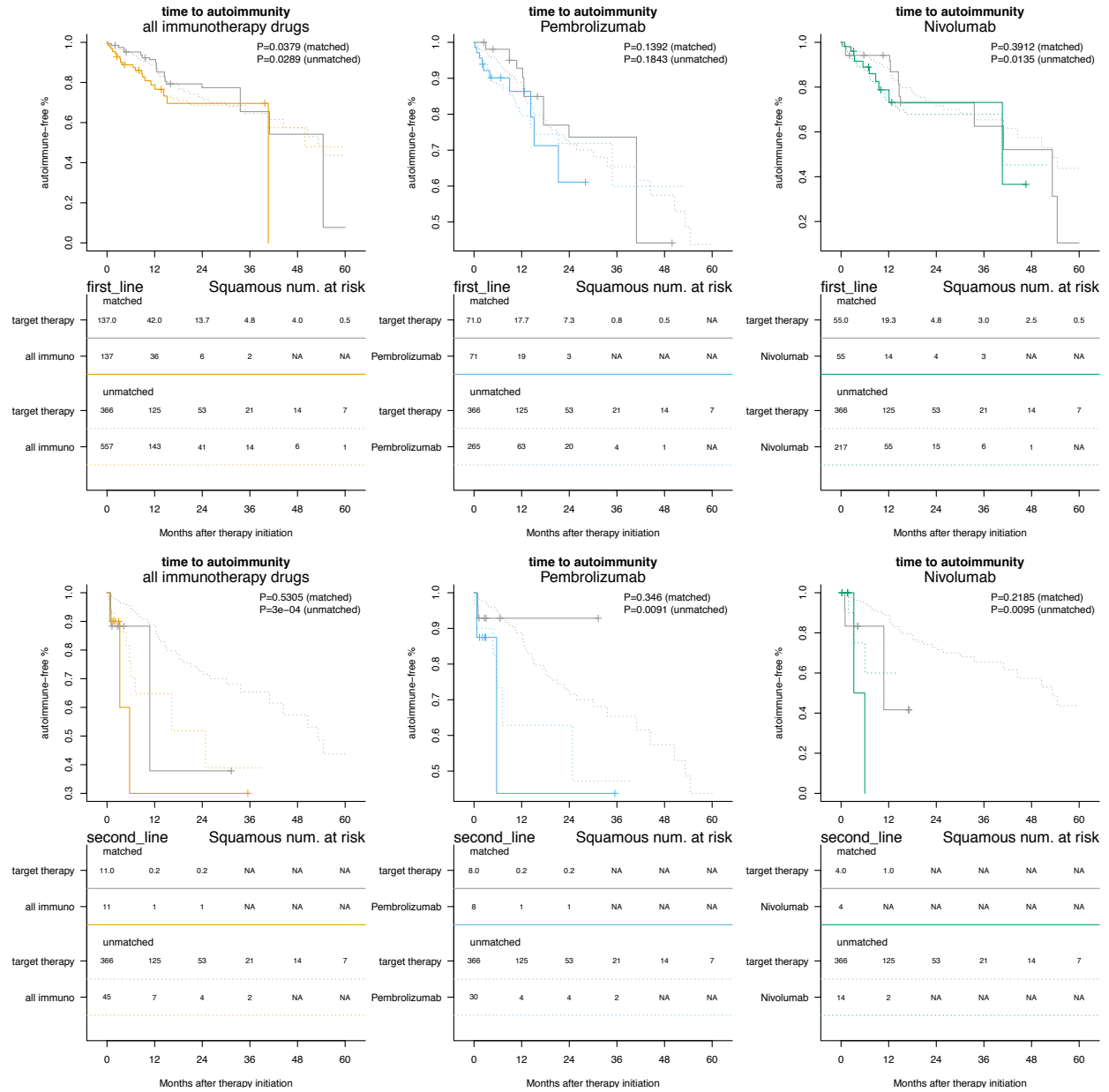
Targeted therapy









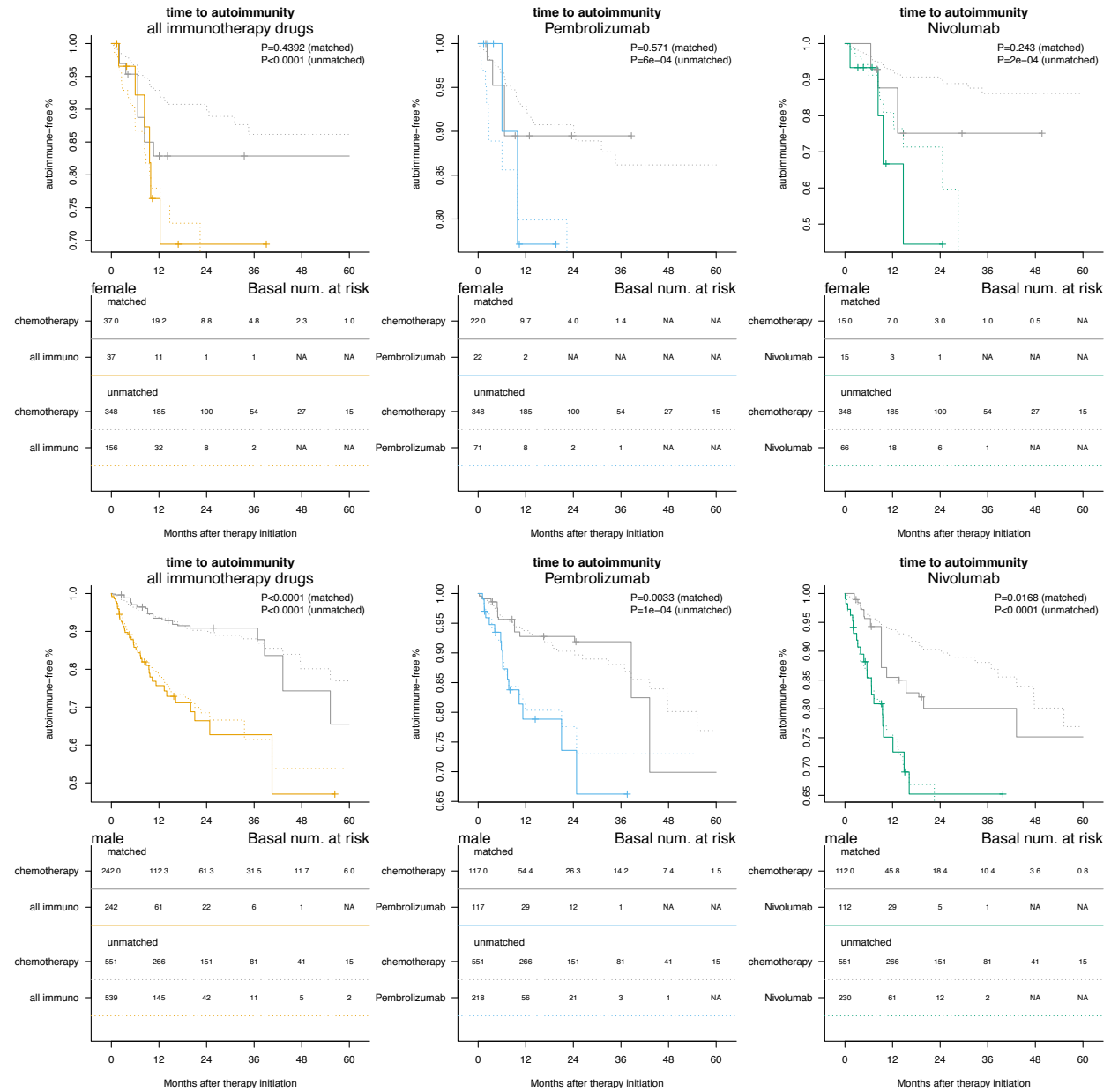


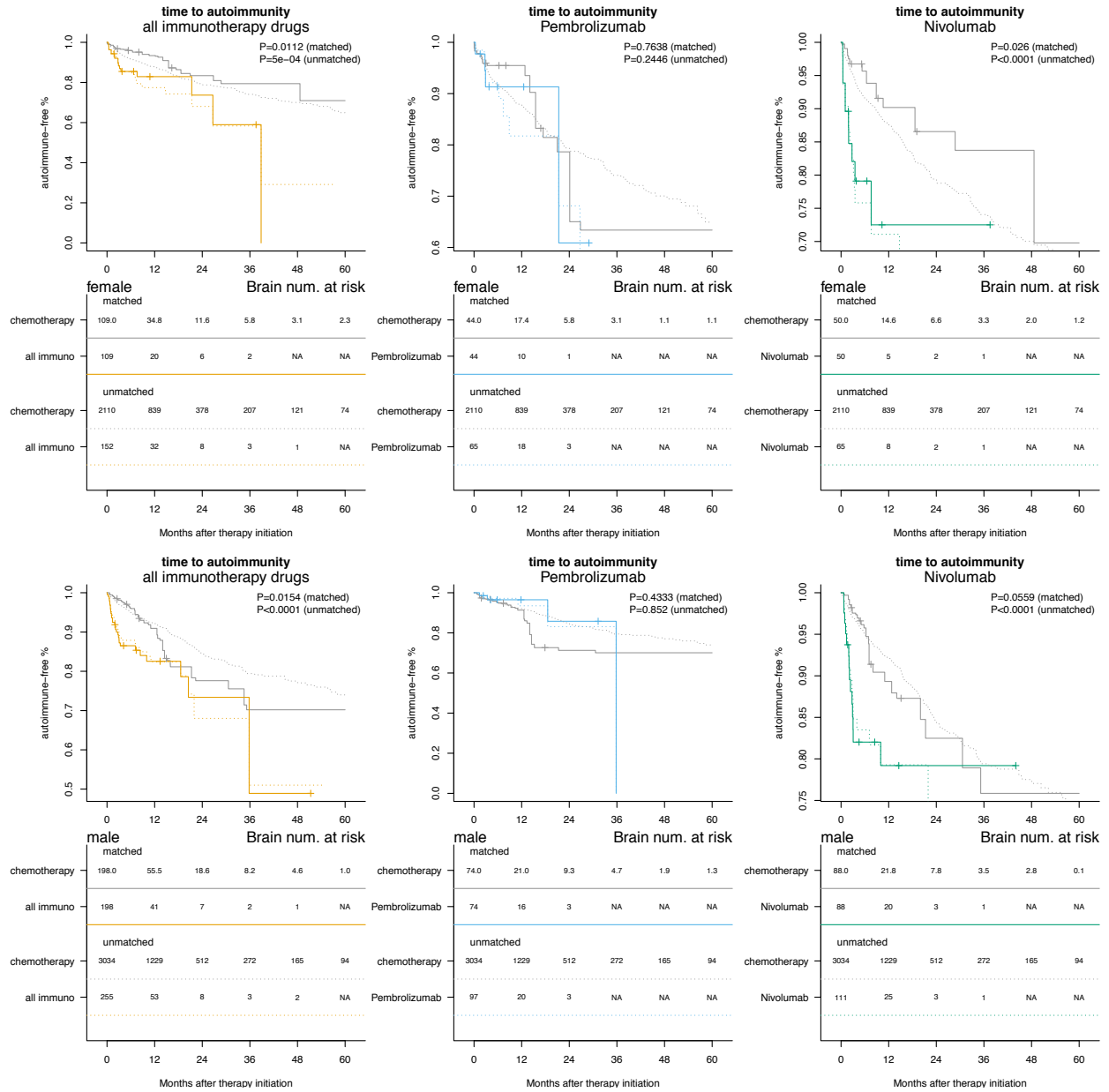
Sex Stratification

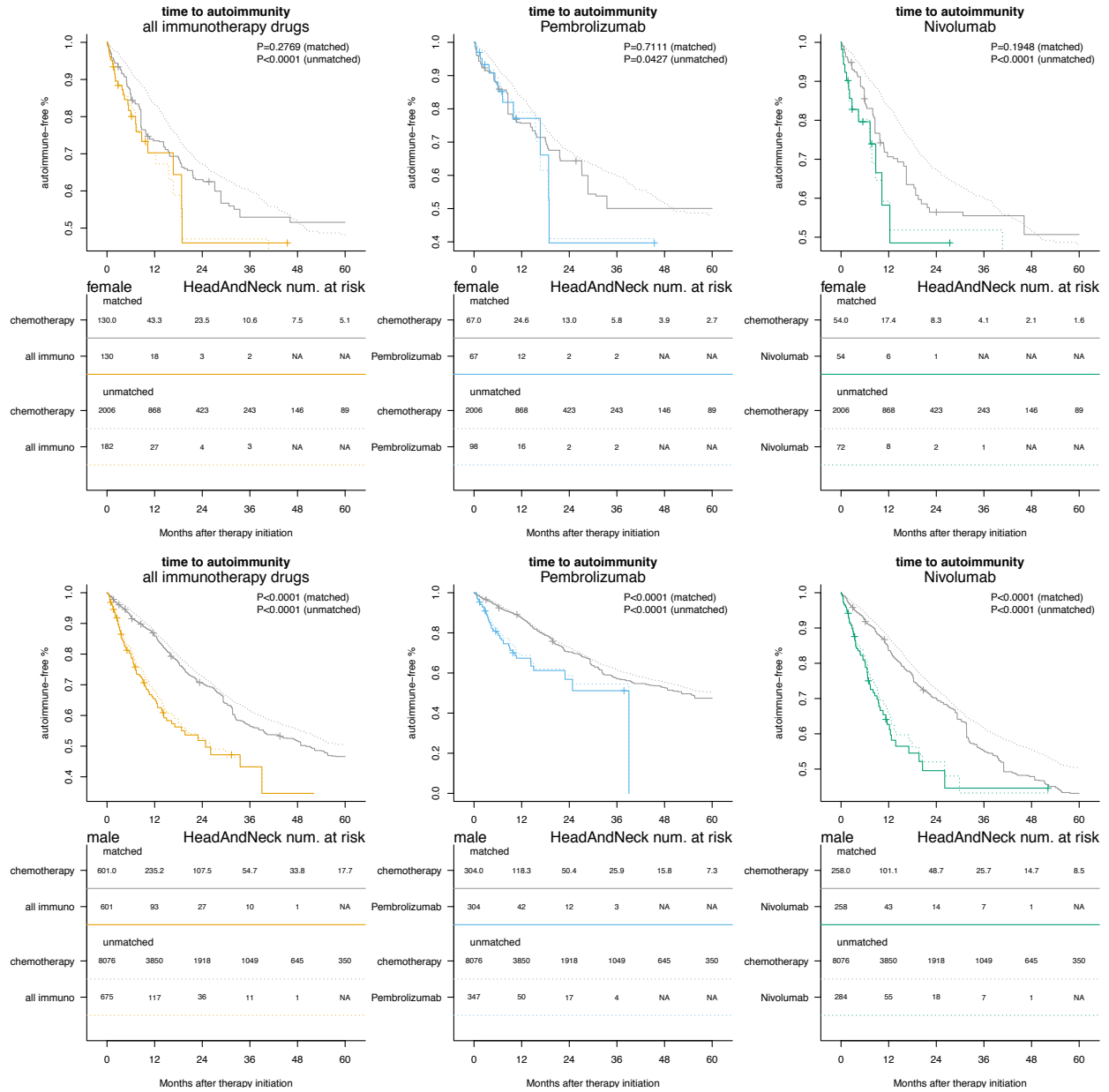
We conducted a stratified analysis based on sex. The risk of developing autoimmune adverse events in the immunotherapy group is similar in male and female patients (Figure S11).

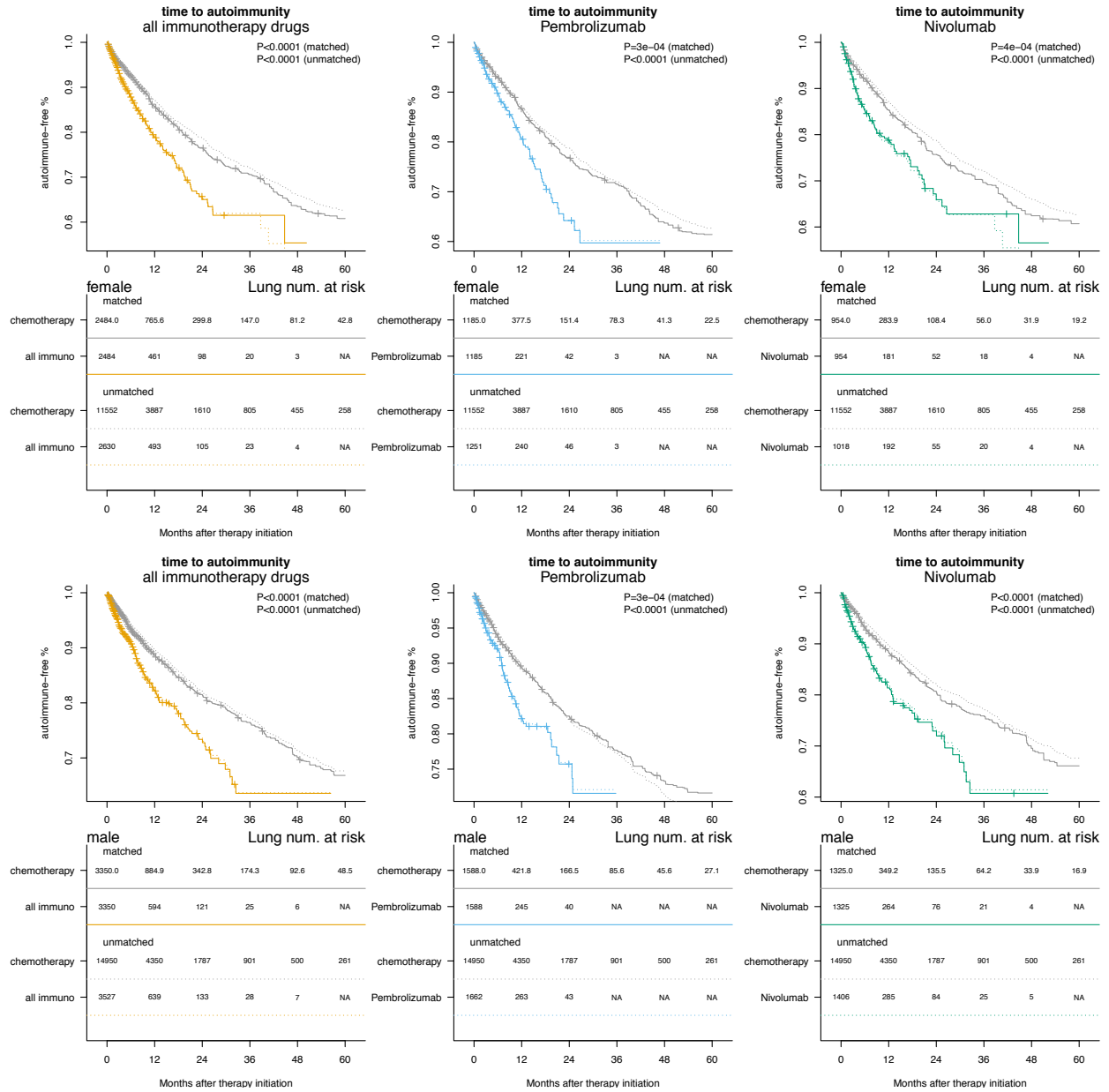
Figure S11. Results stratified by gender.

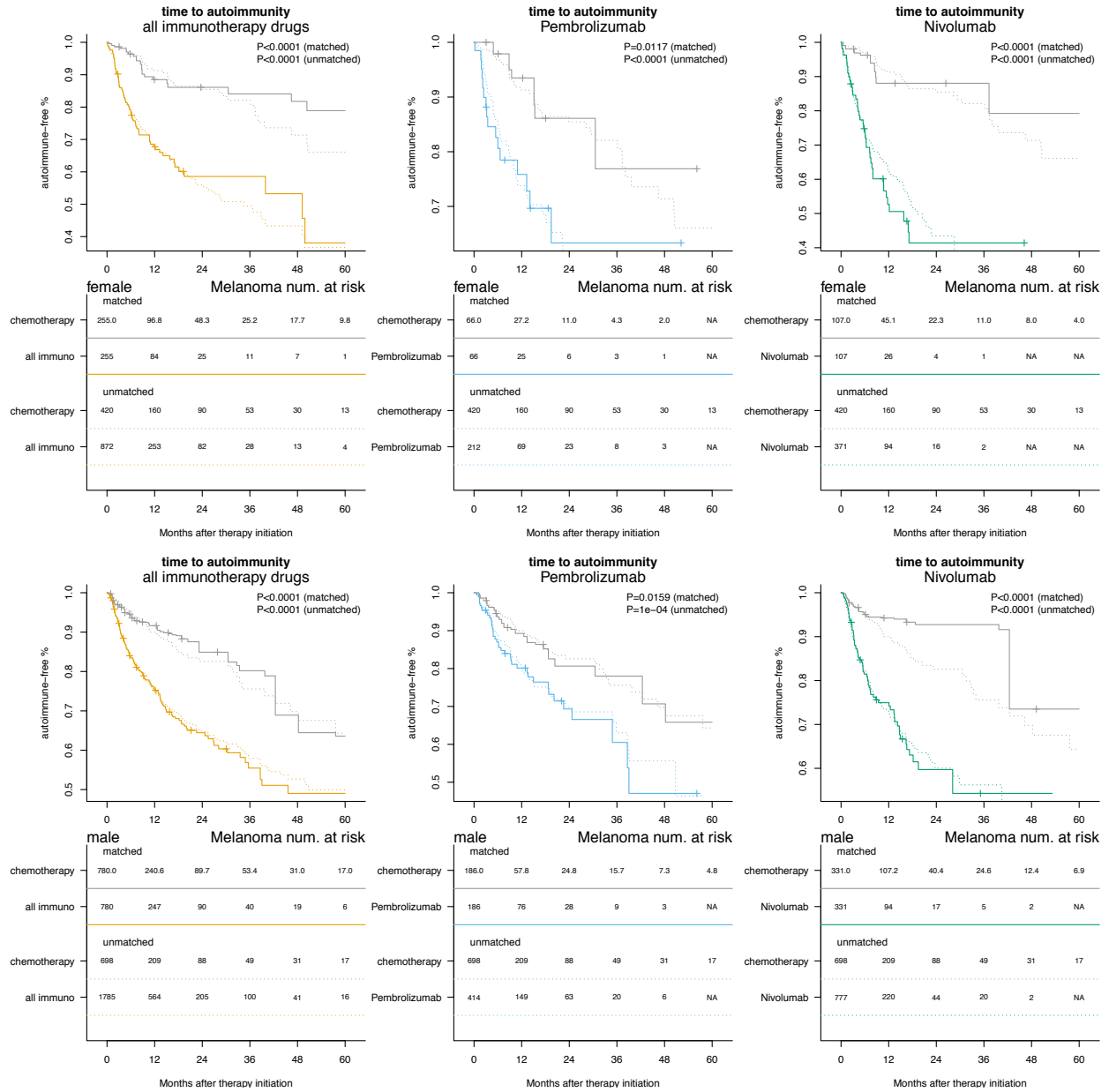
Chemotherapy

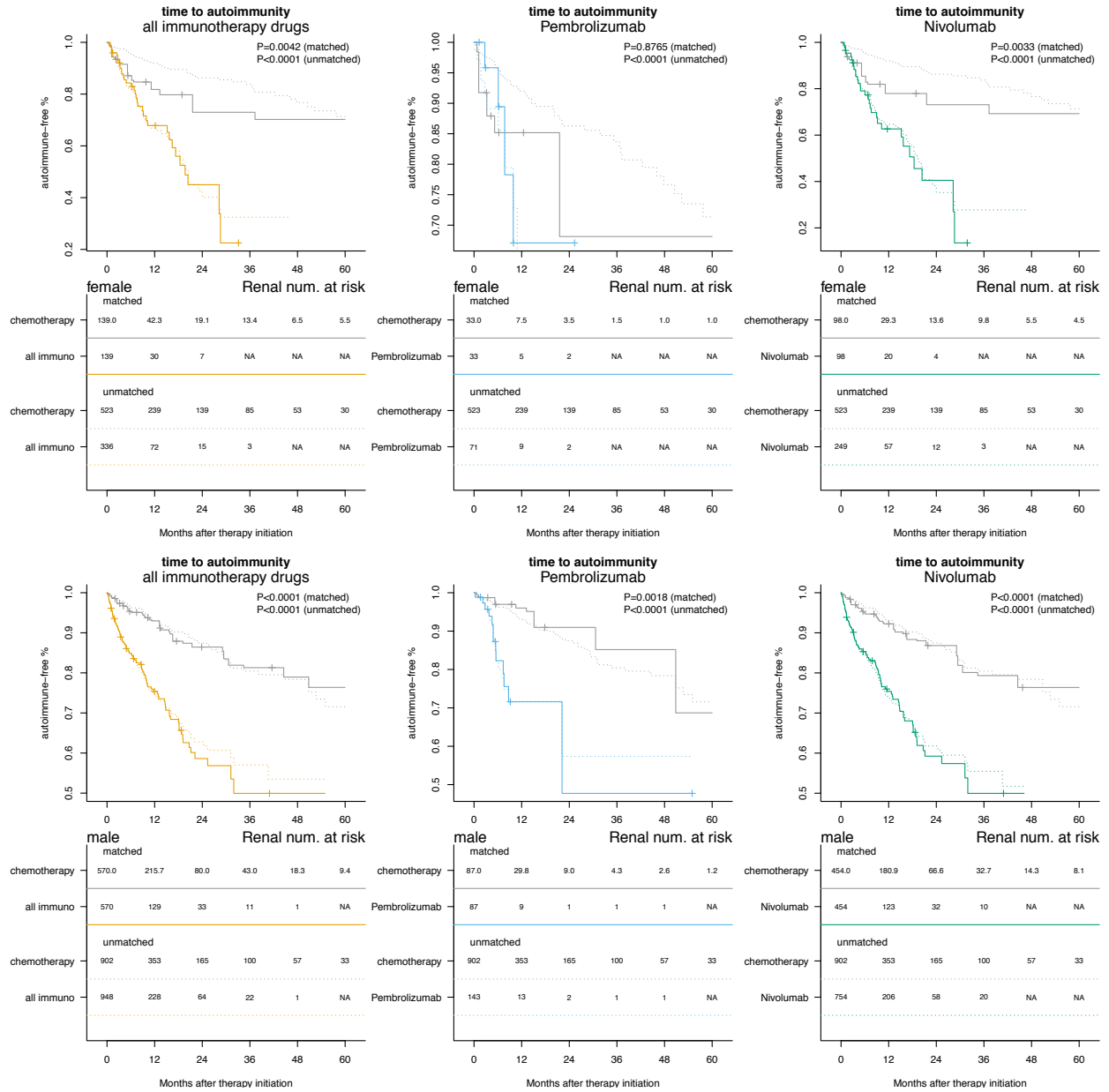


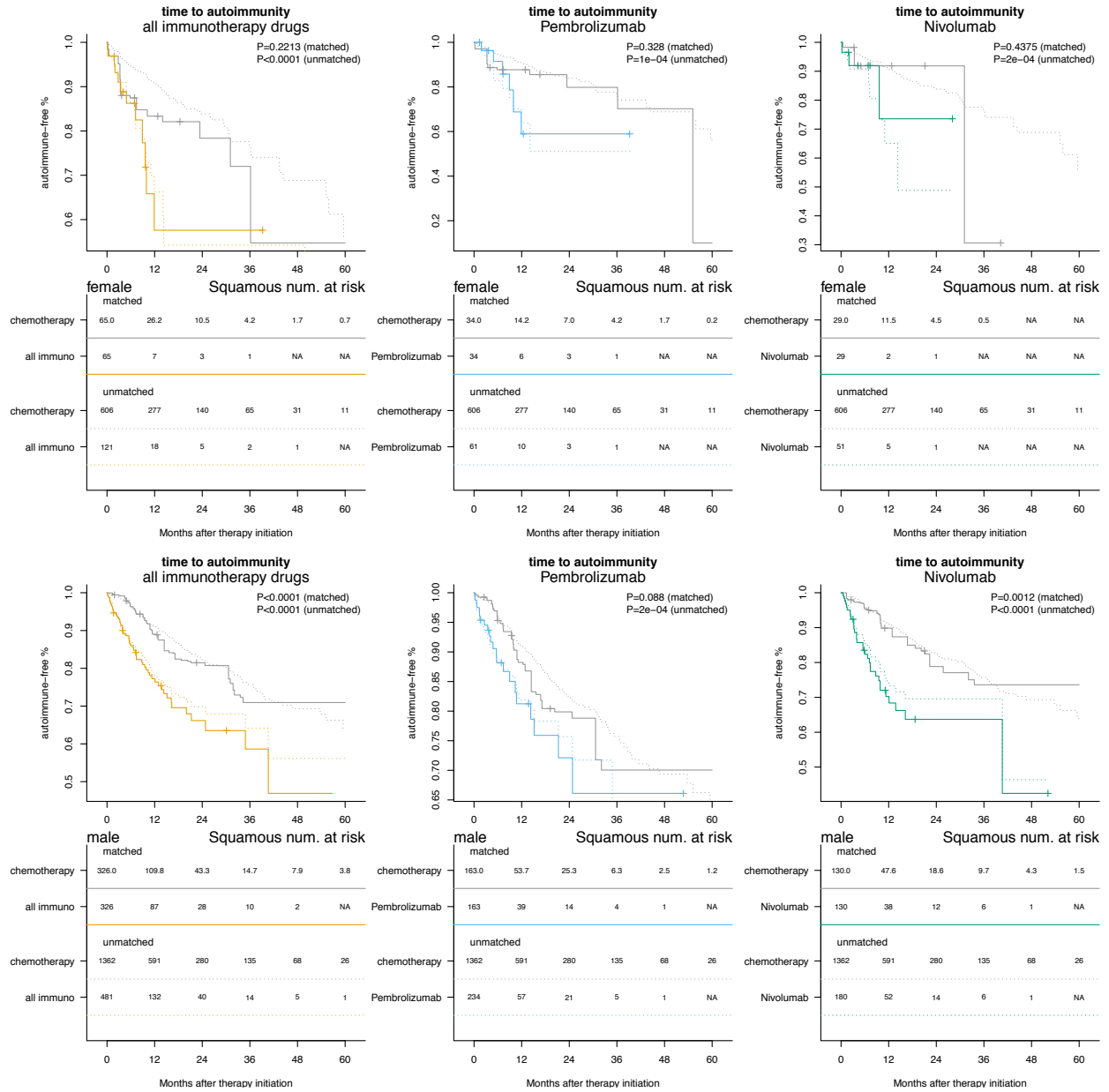




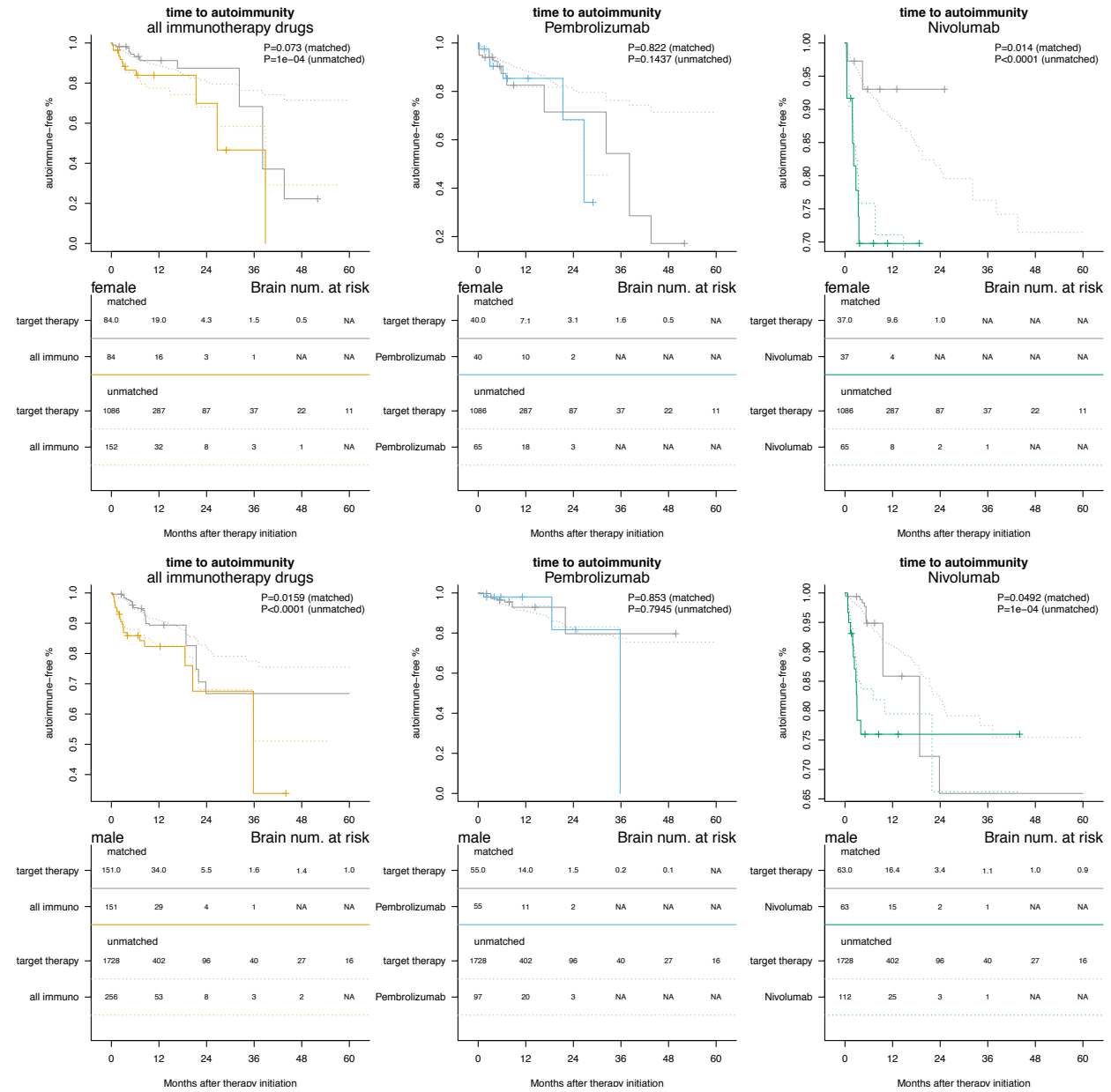


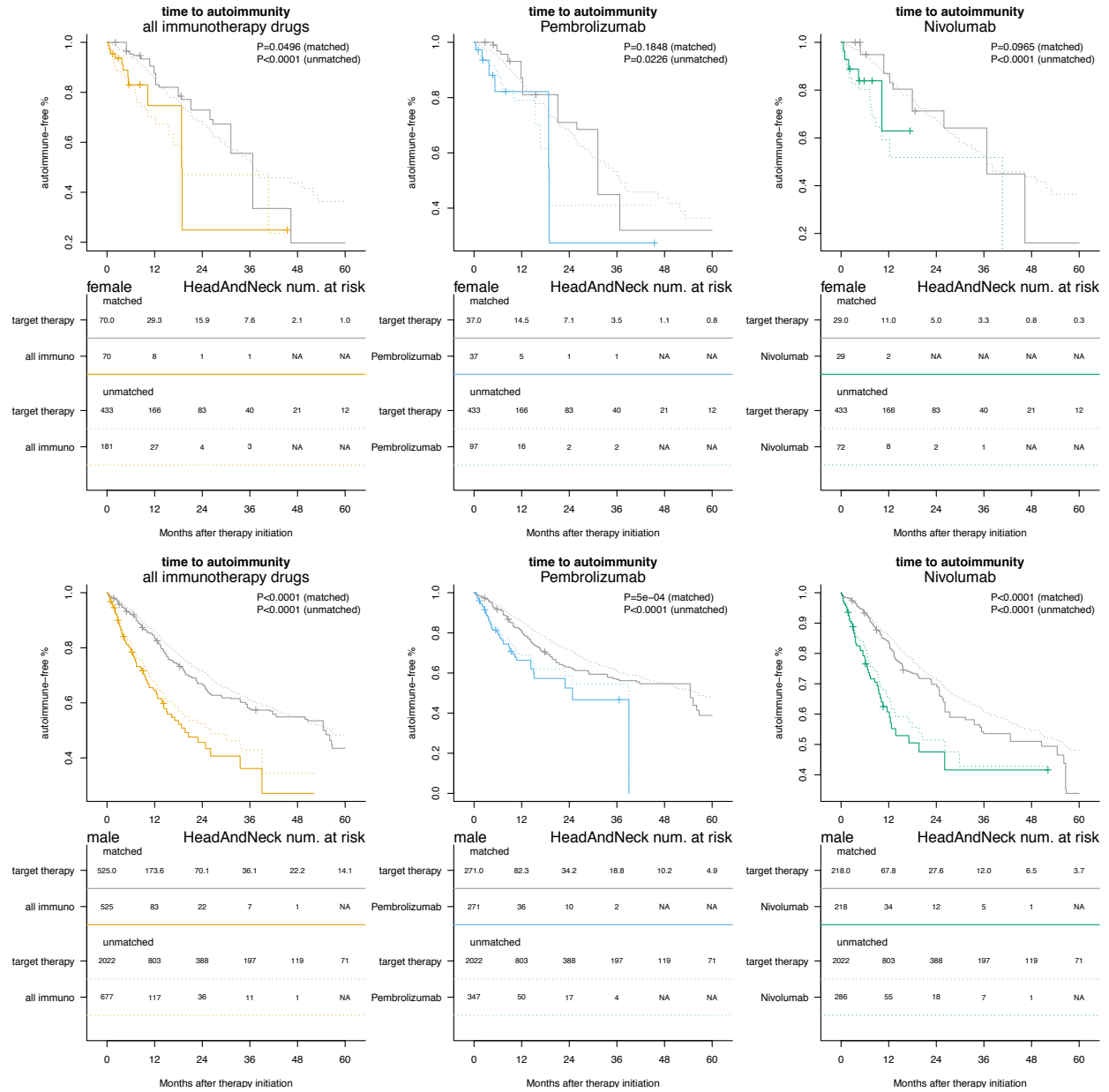


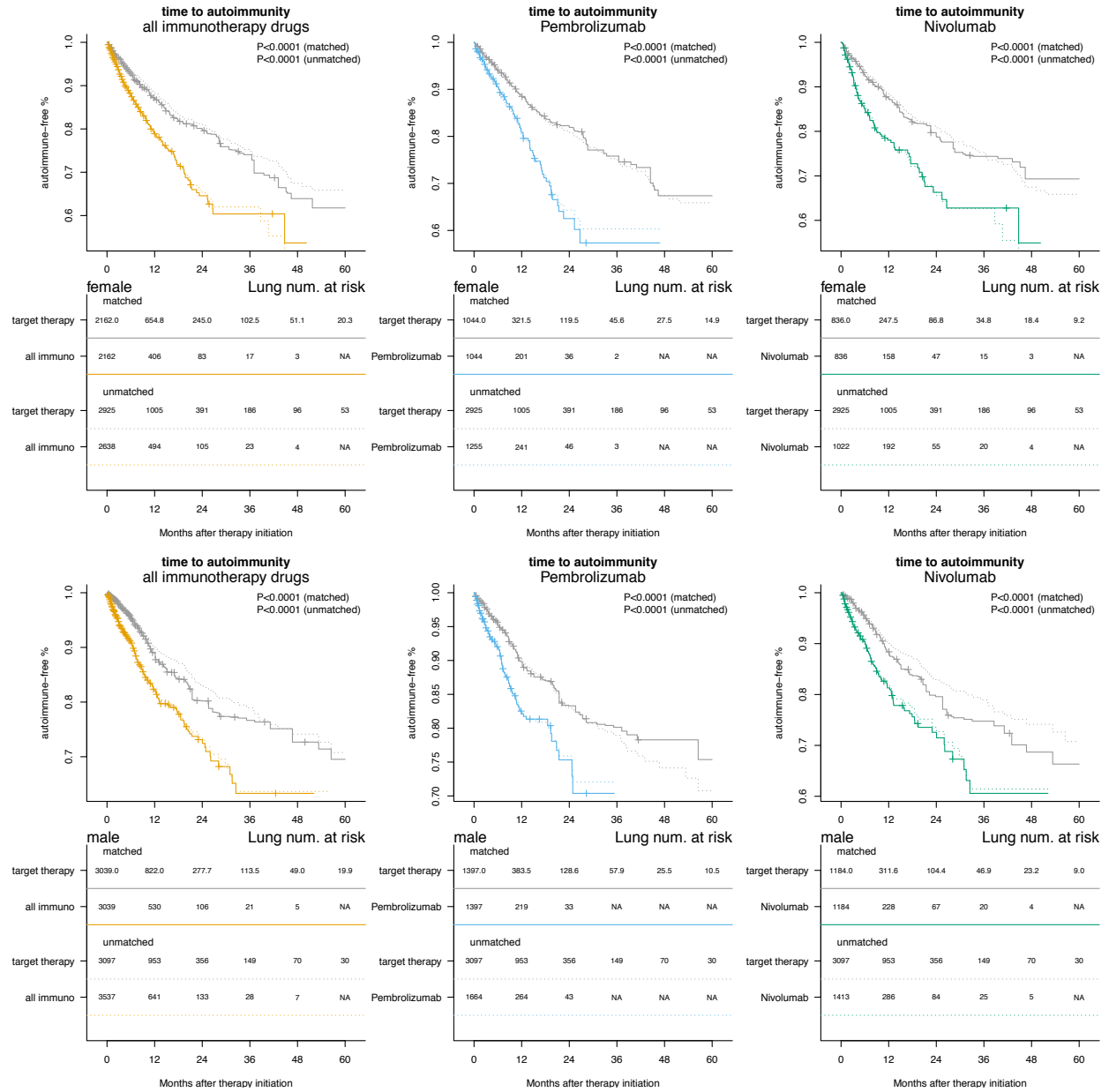


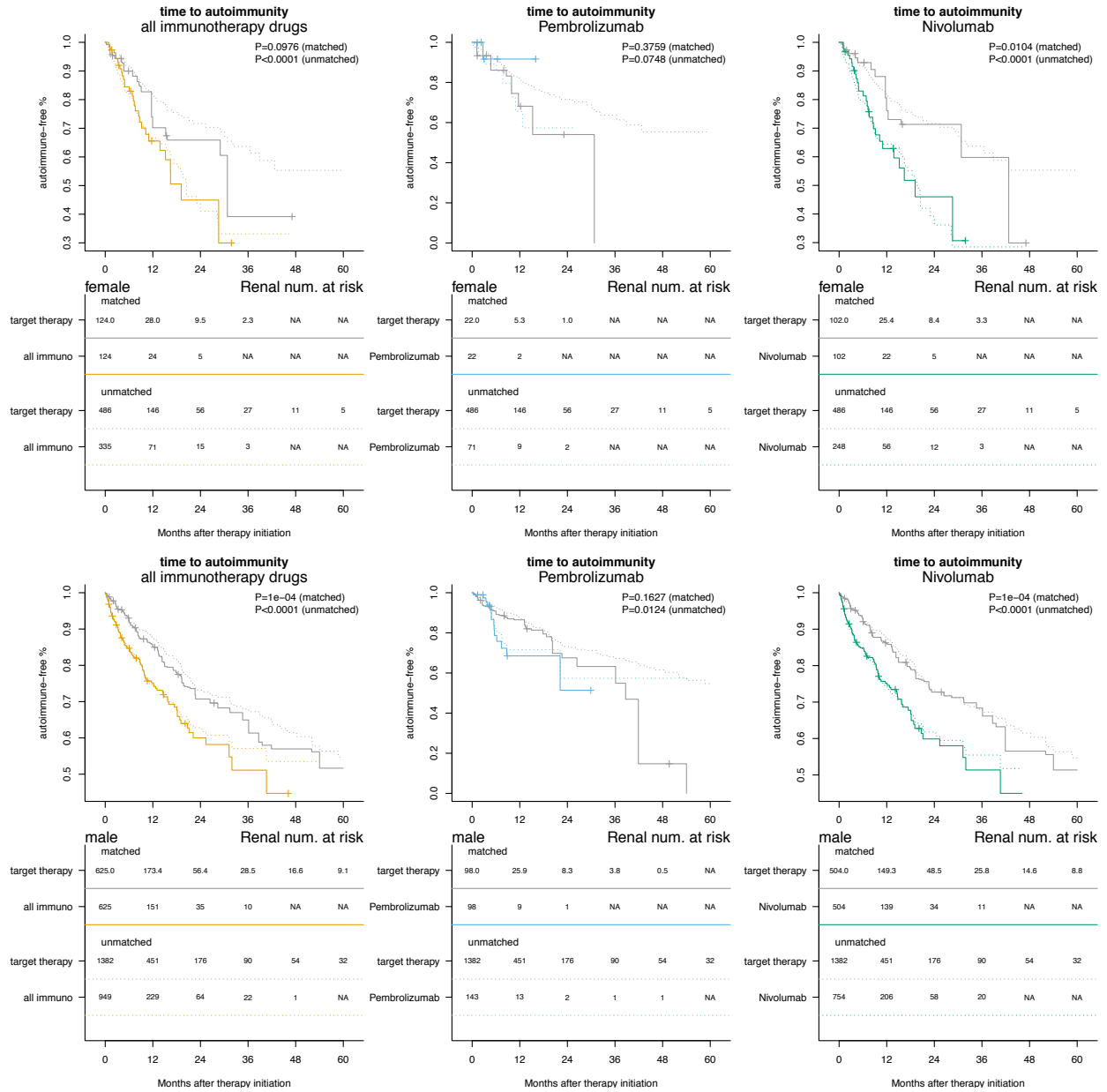


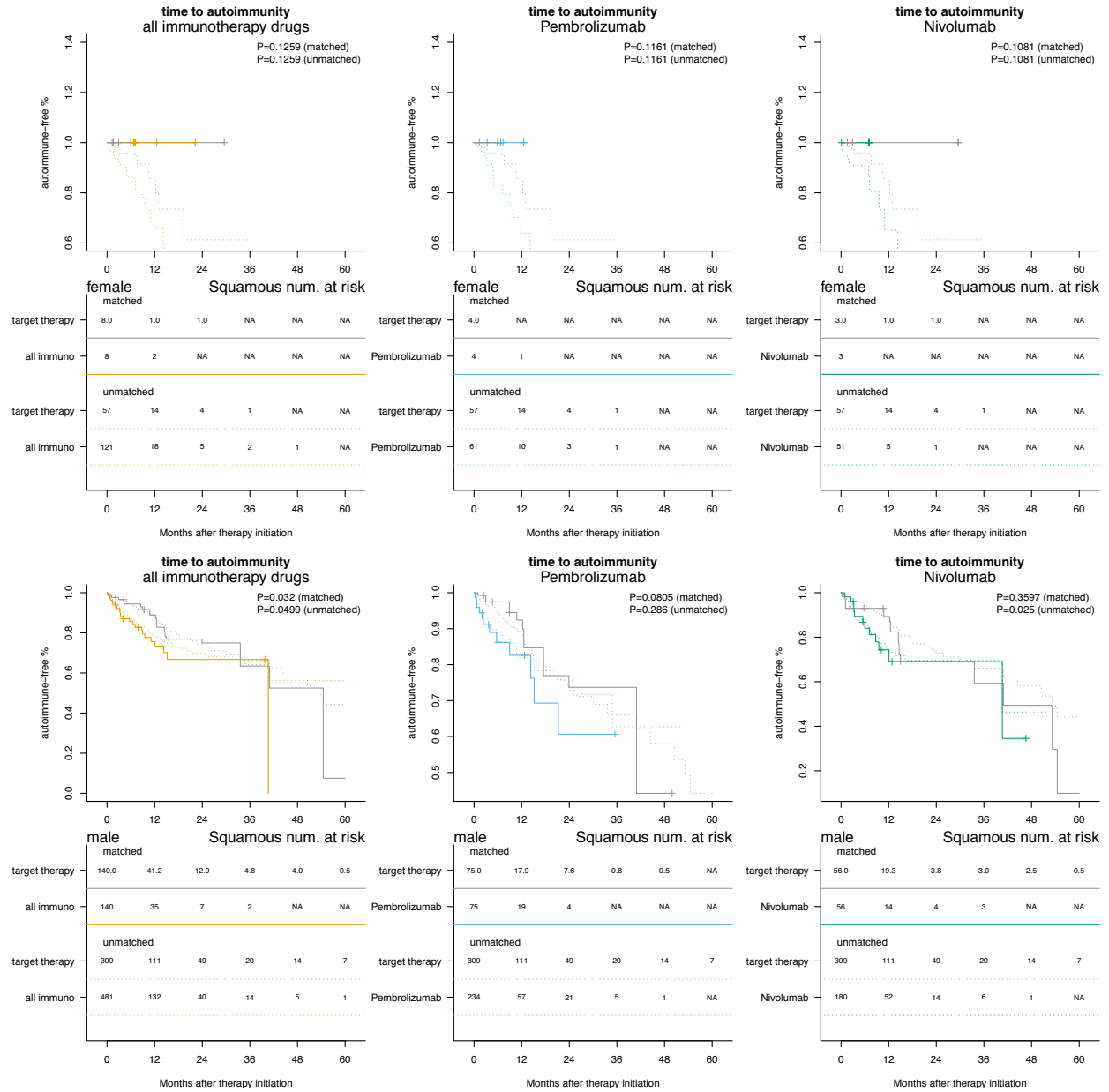
Targeted therapy







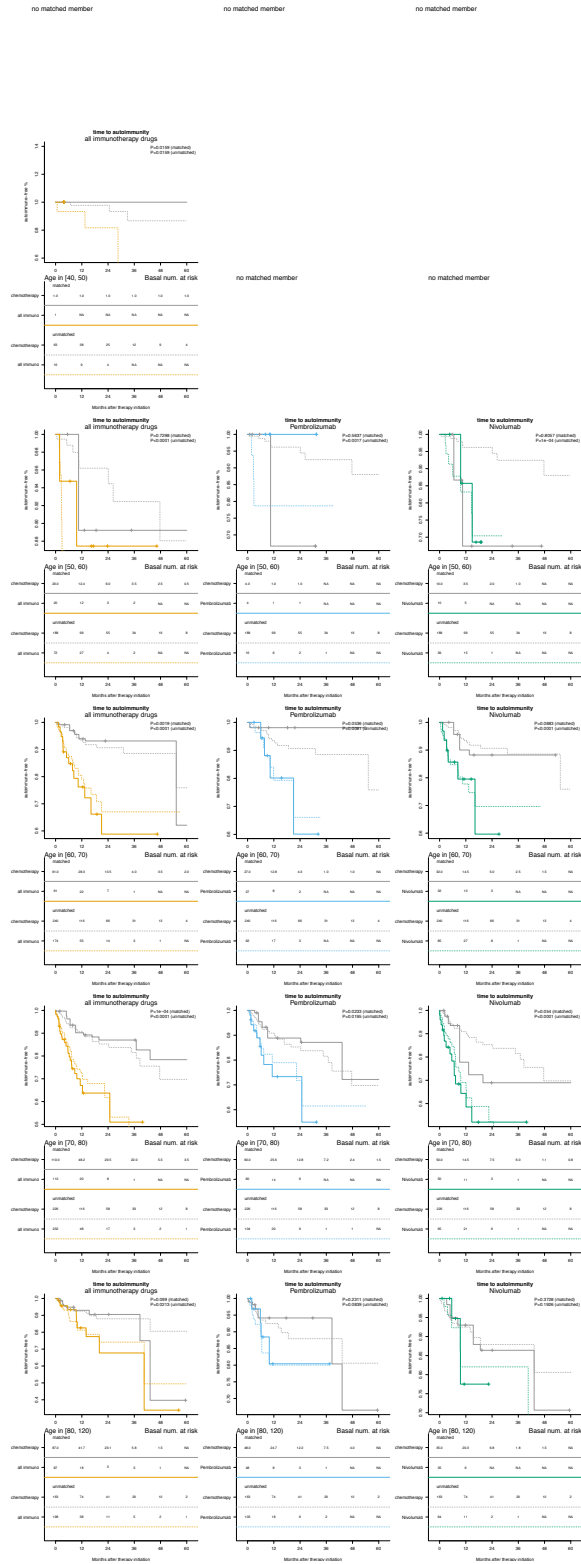




Age Stratification

We further stratified the results by looking at patients in different age groups separately. The trends of our main results are consistent across the age groups (Figure S12).

Figure S12. Results stratified by age groups.
Chemotherapy









Targeted therapy



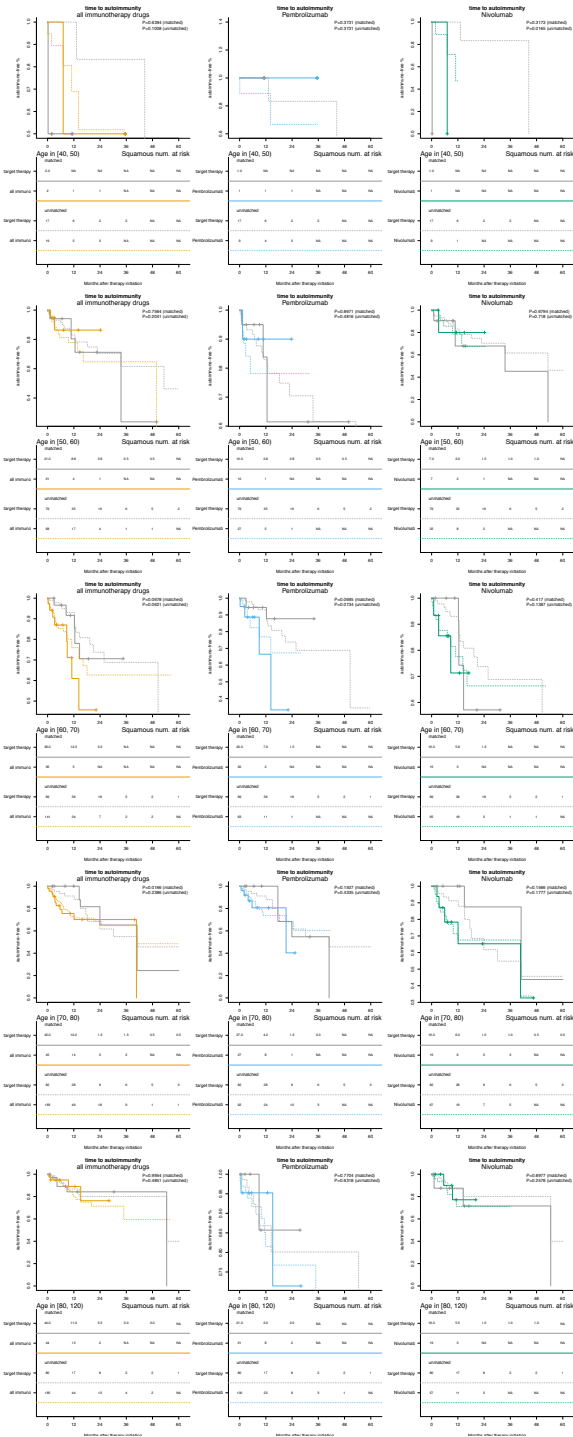
no matched member



no matched member

no matched member

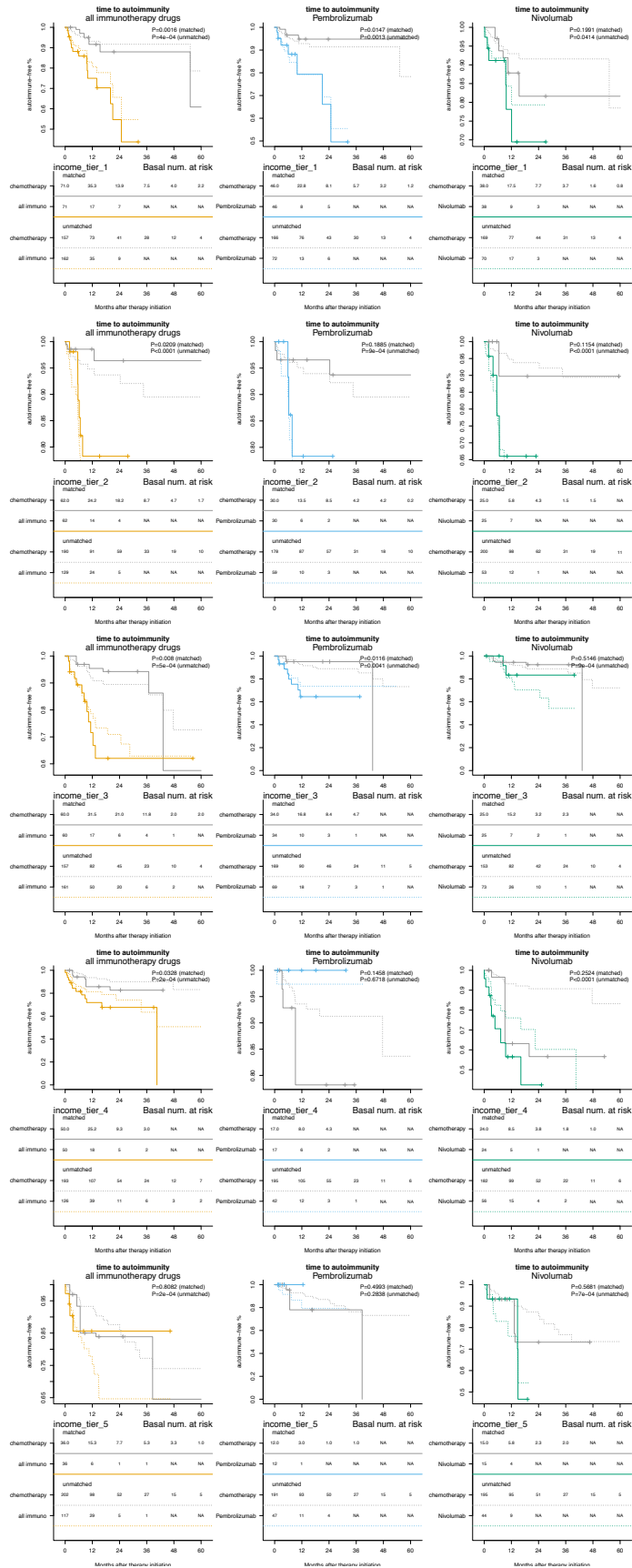
no matched member

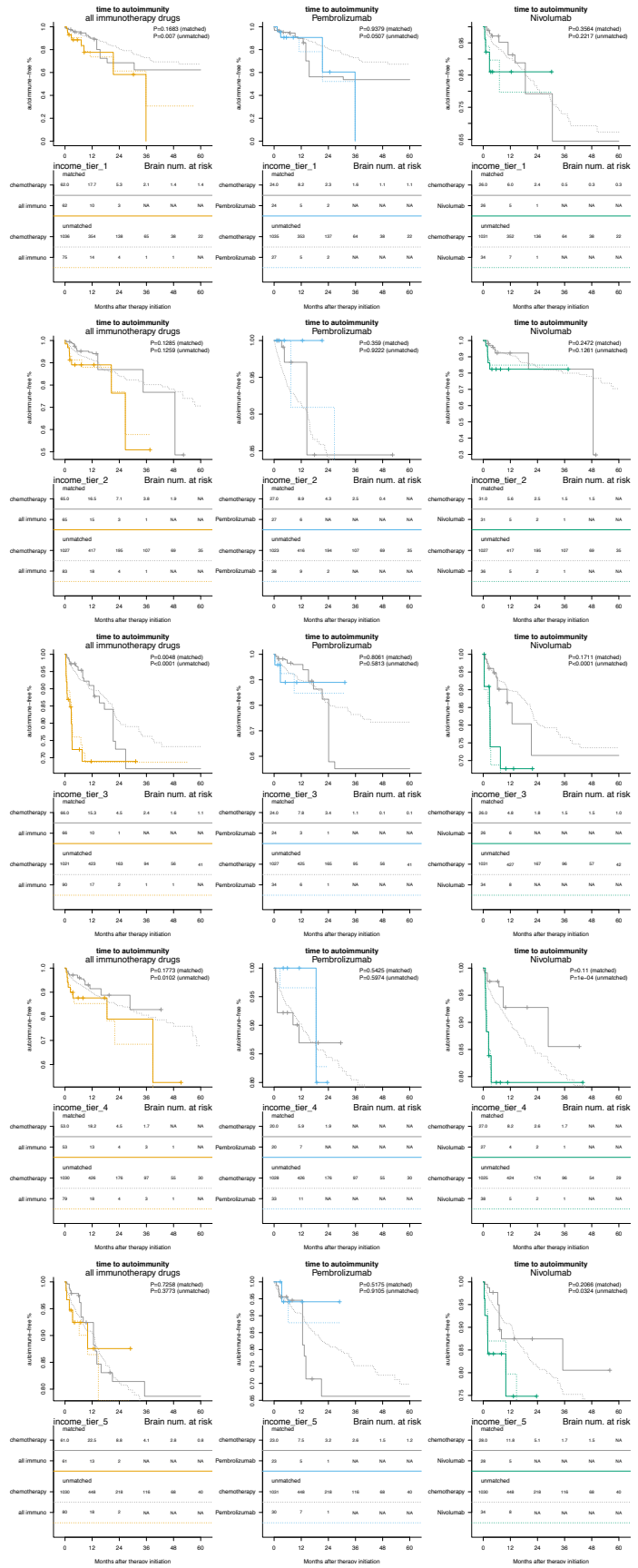


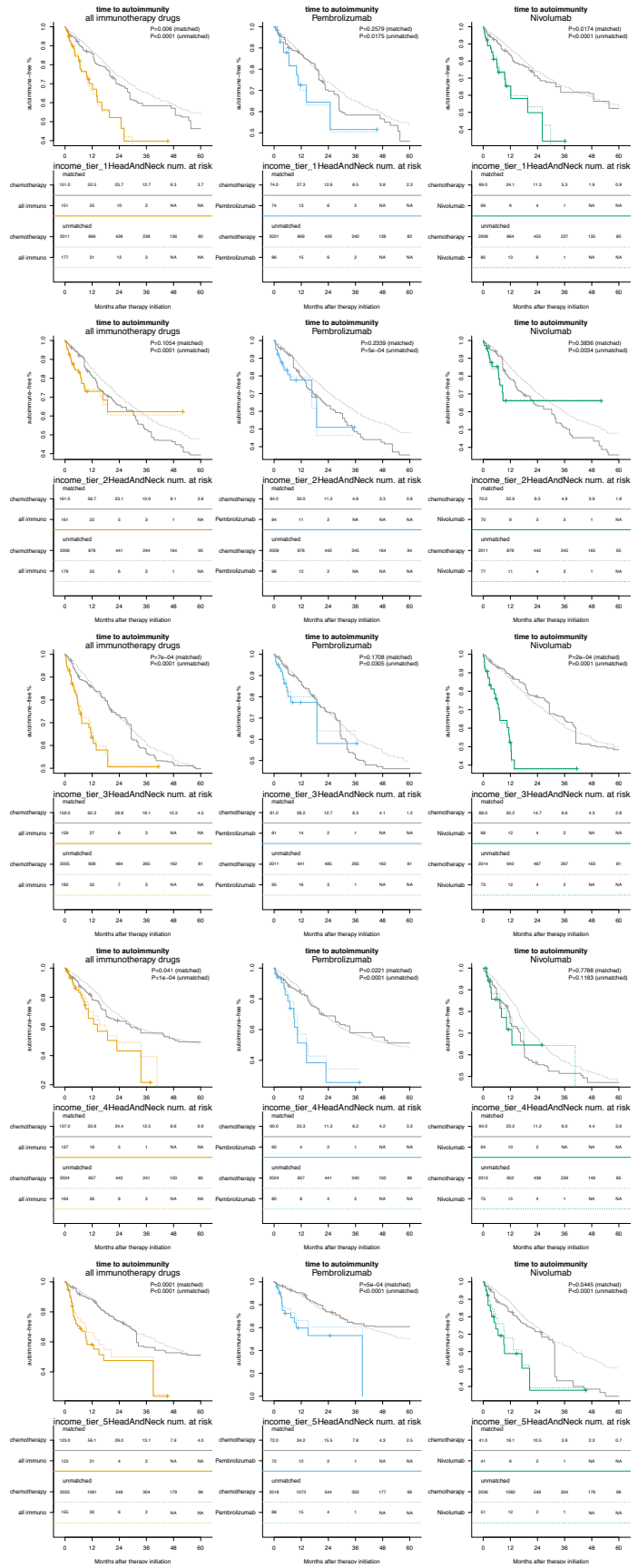
Income Stratification

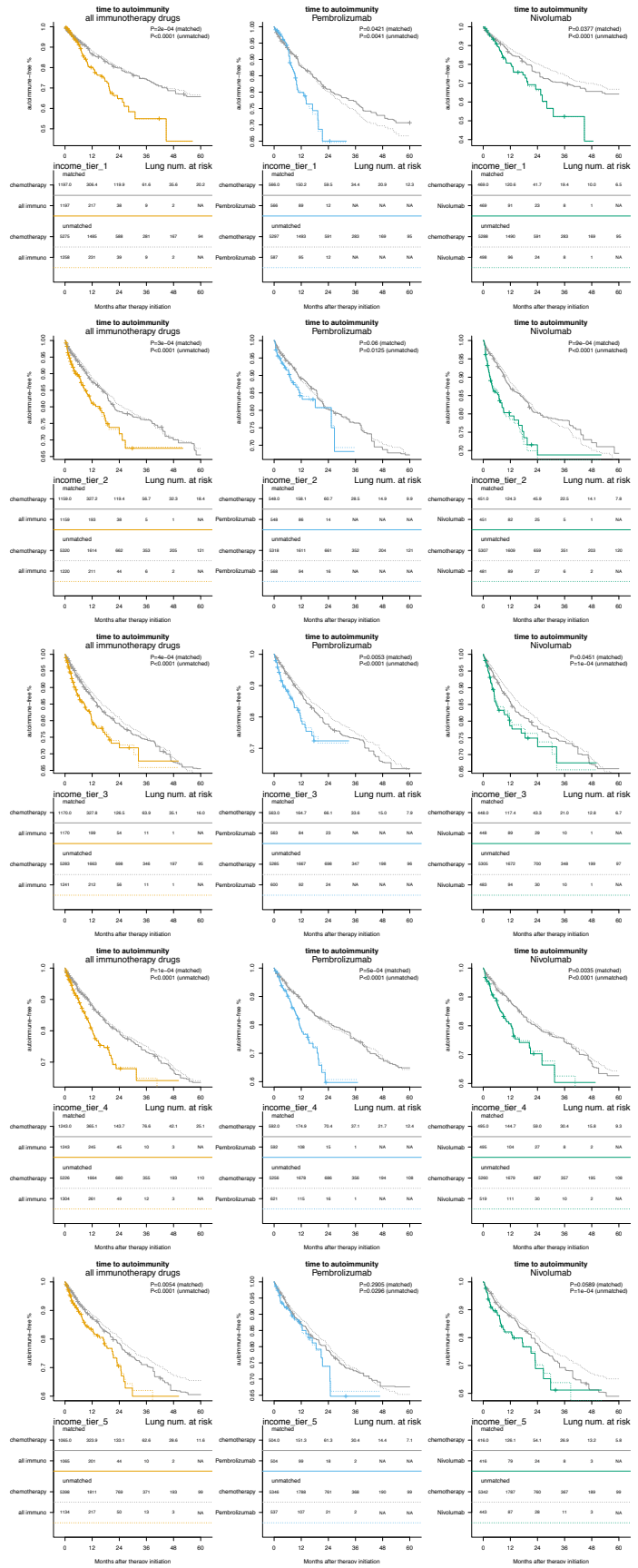
Lastly, we conducted stratified analyses based on imputed income groups. The whole study population is separated into 5 quintiles using the zip-code-imputed income. The trends of our main results are consistent across the income groups (Figure S13).

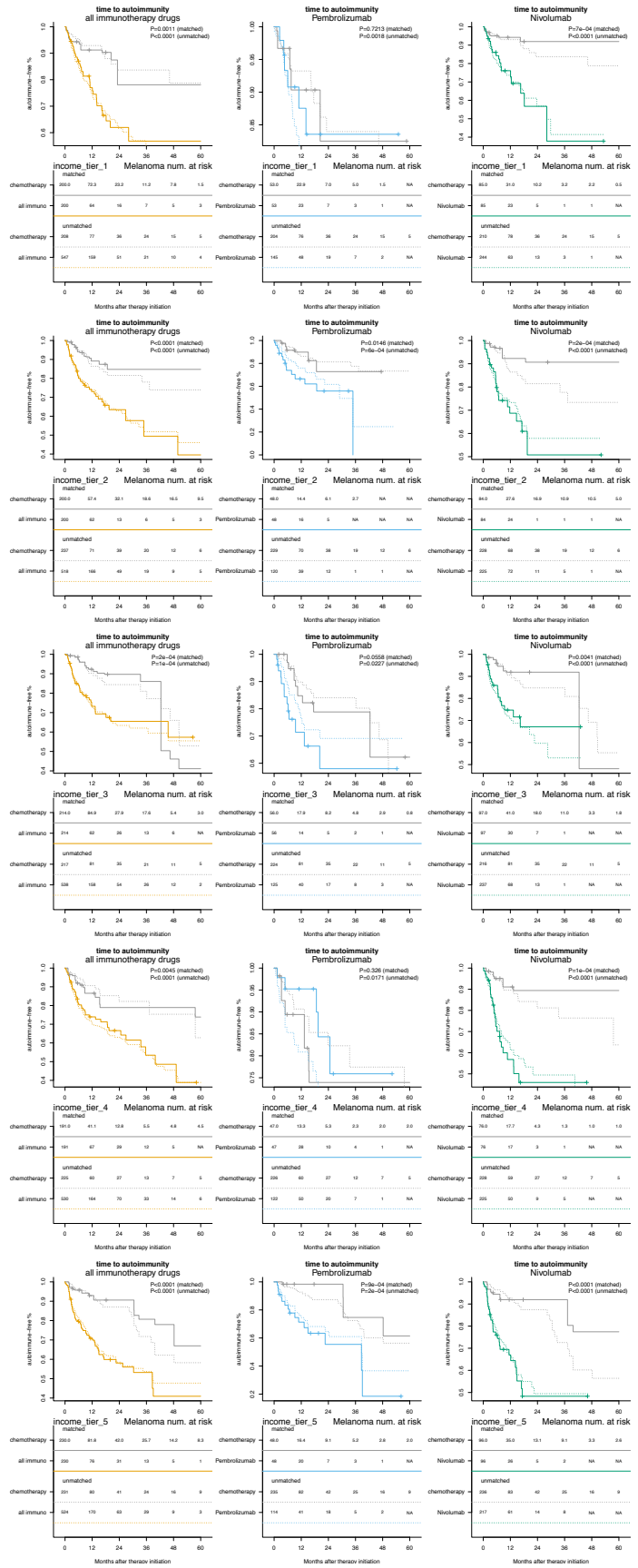
Figure S13. Results stratified by income groups.
Chemotherapy

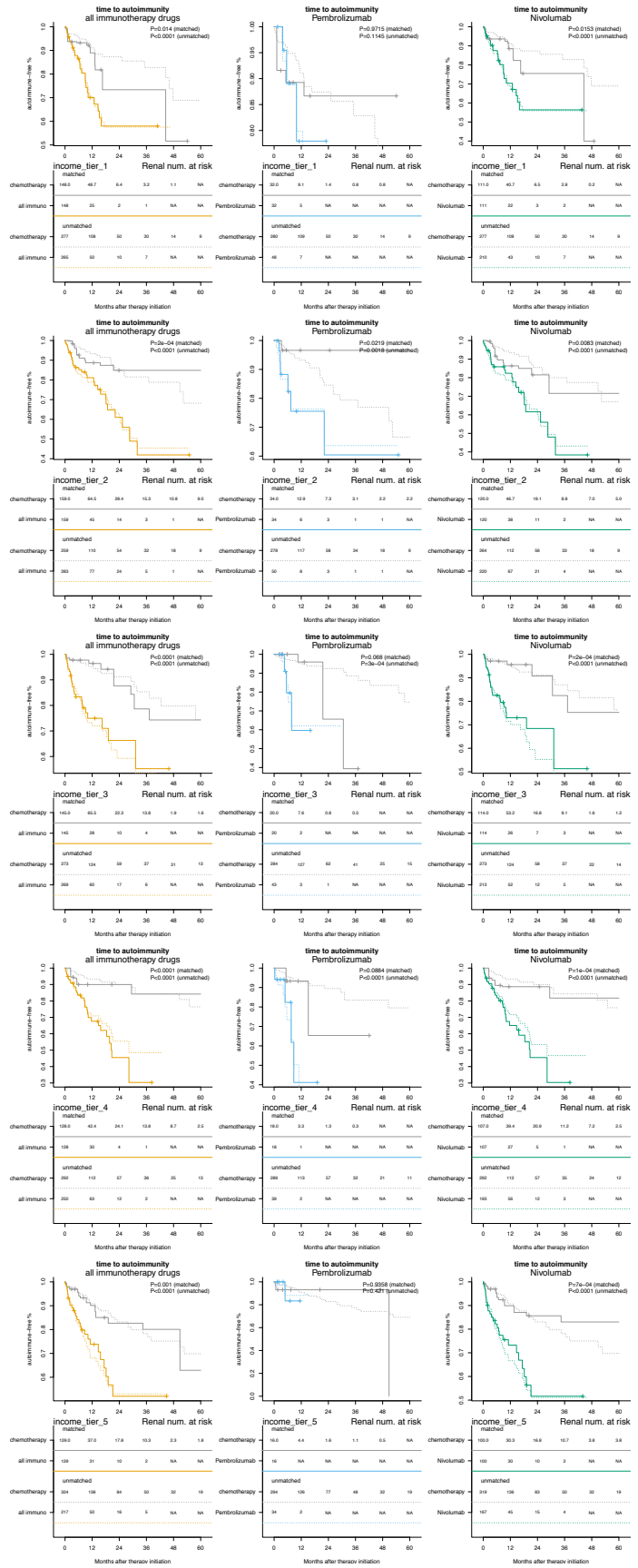


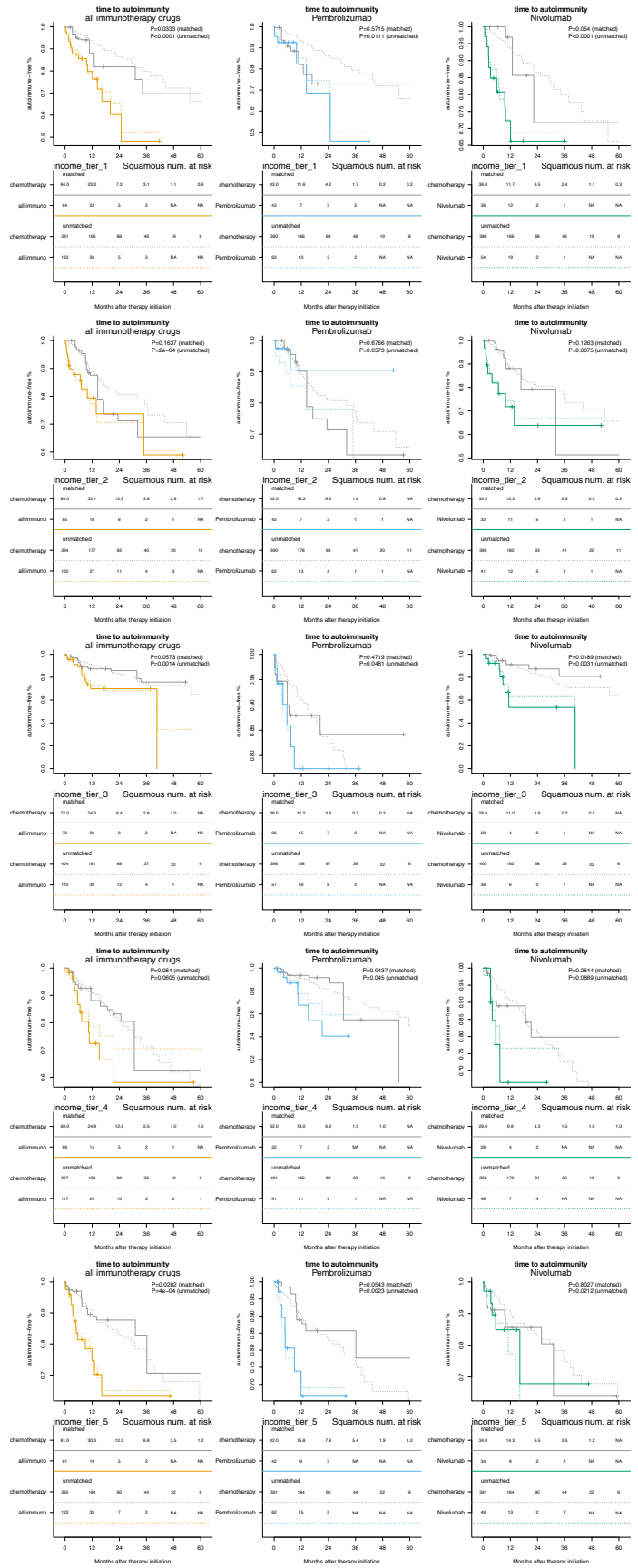




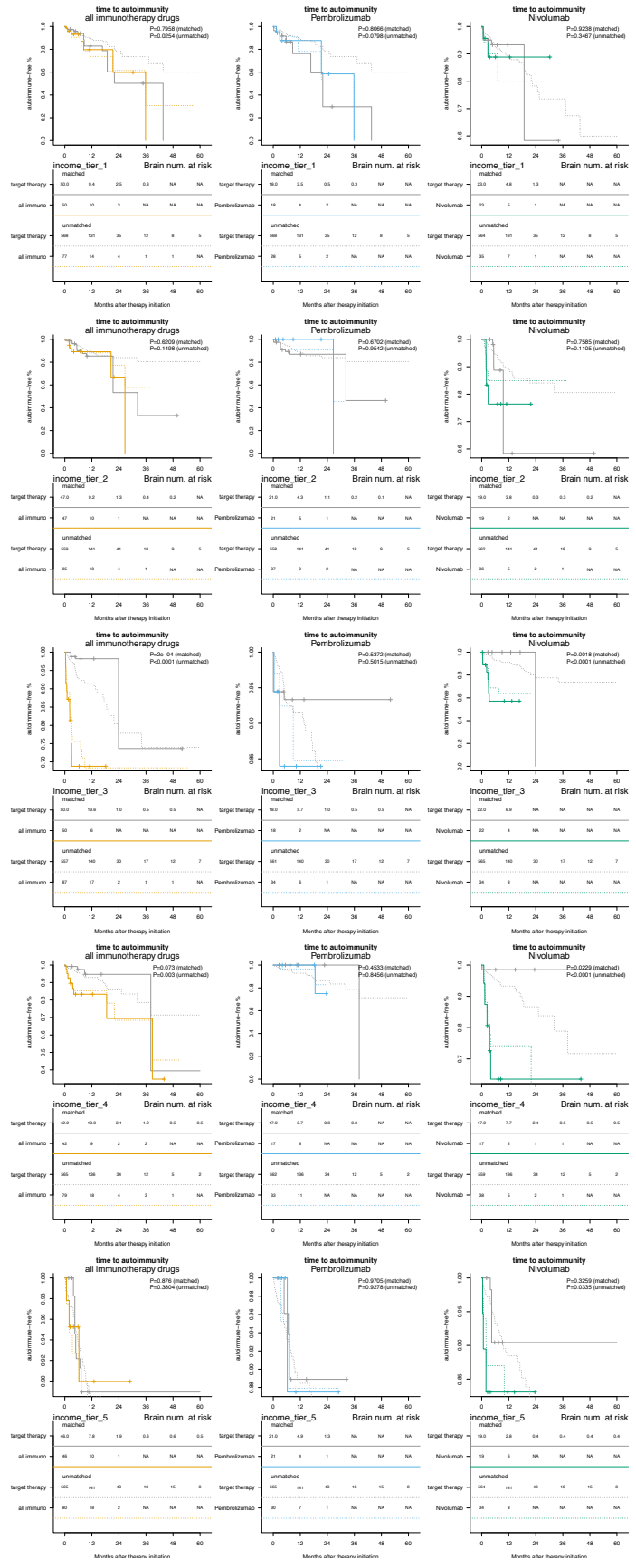


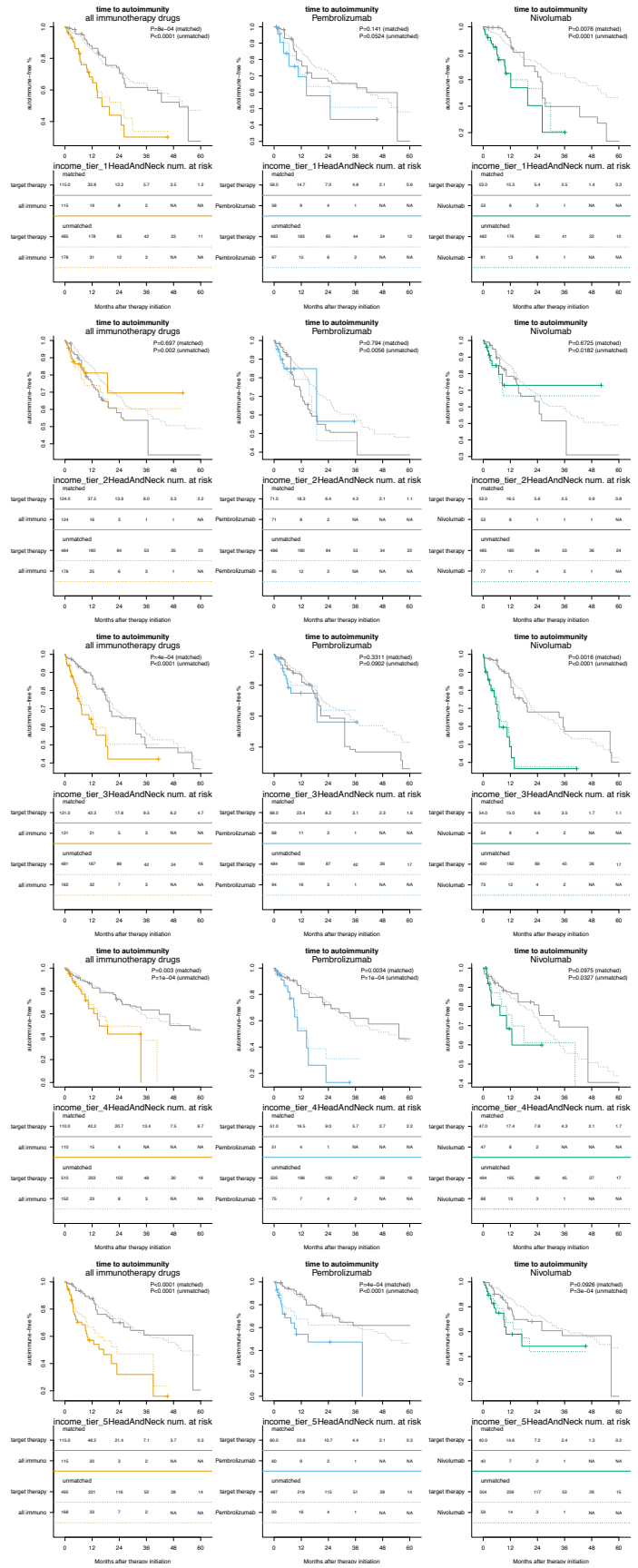


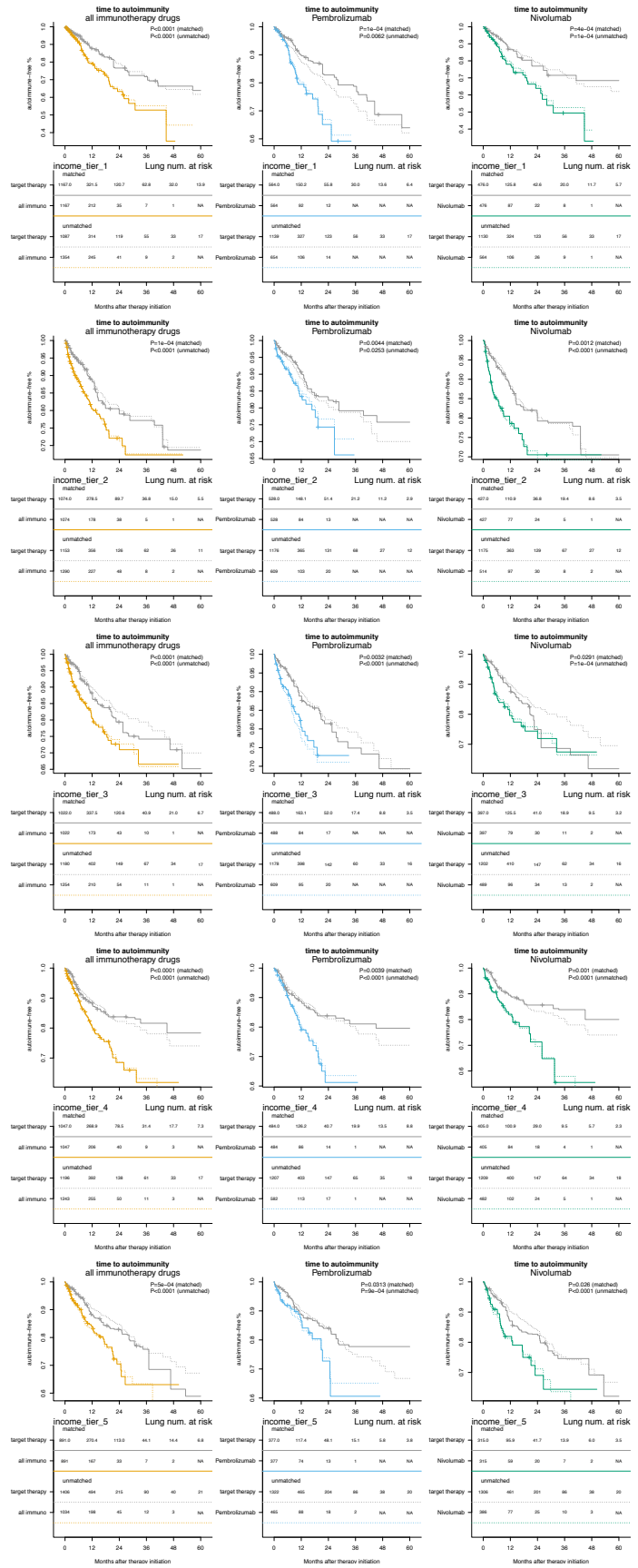


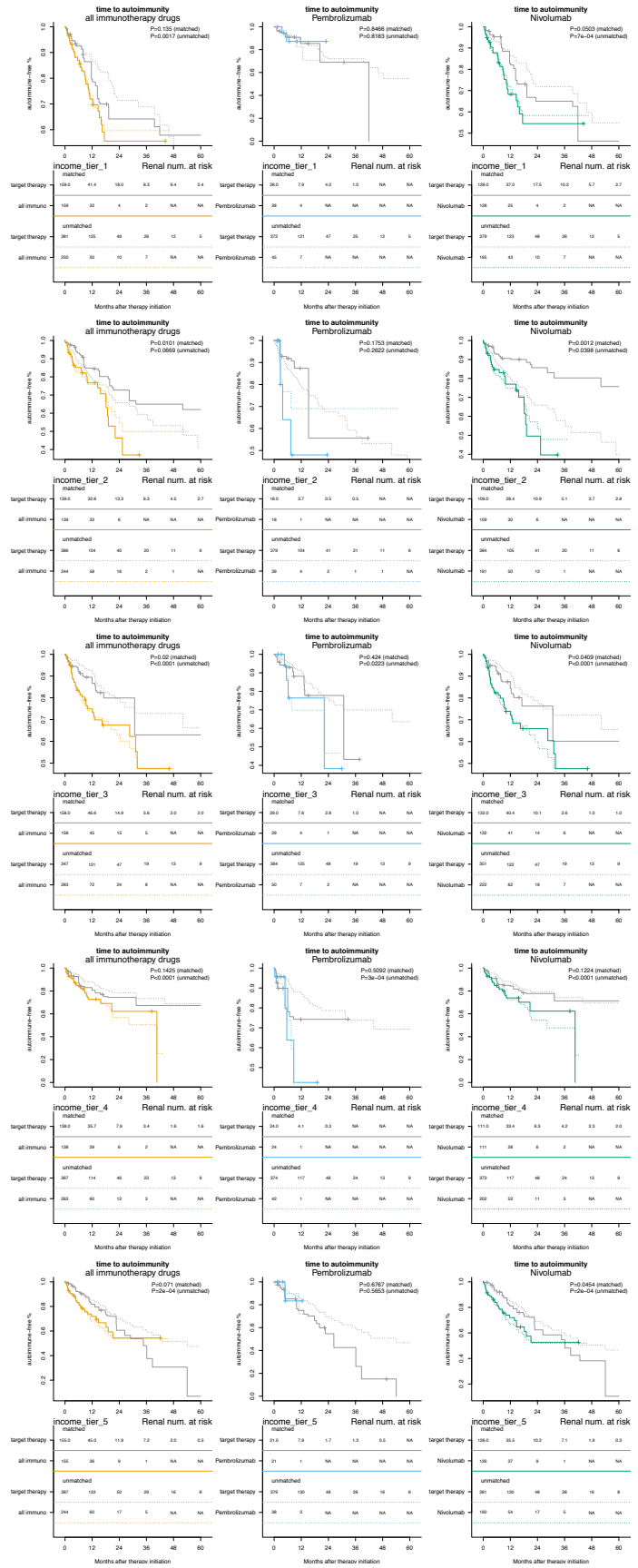


Targeted therapy









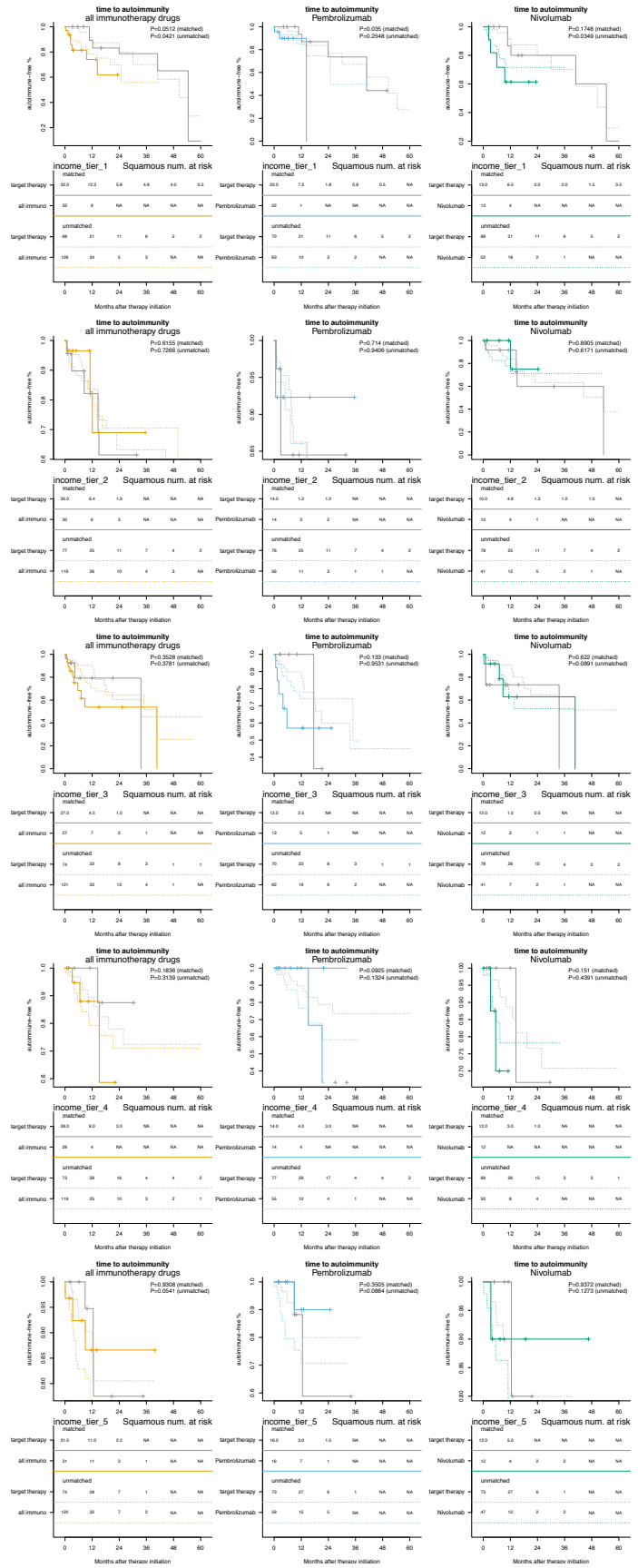


Figure S14. The number of patients undergoing chemotherapy, targeted therapy, and immunotherapy across different types of cancers. The seven colors of bars represent the number of patients who are treated with chemotherapy, targeted therapy, chemotherapy/ targeted therapy, immunotherapy, and the number of matched immunotherapy patients when matching with three corresponding control groups. The horizontal line indicates a patient count of 200.

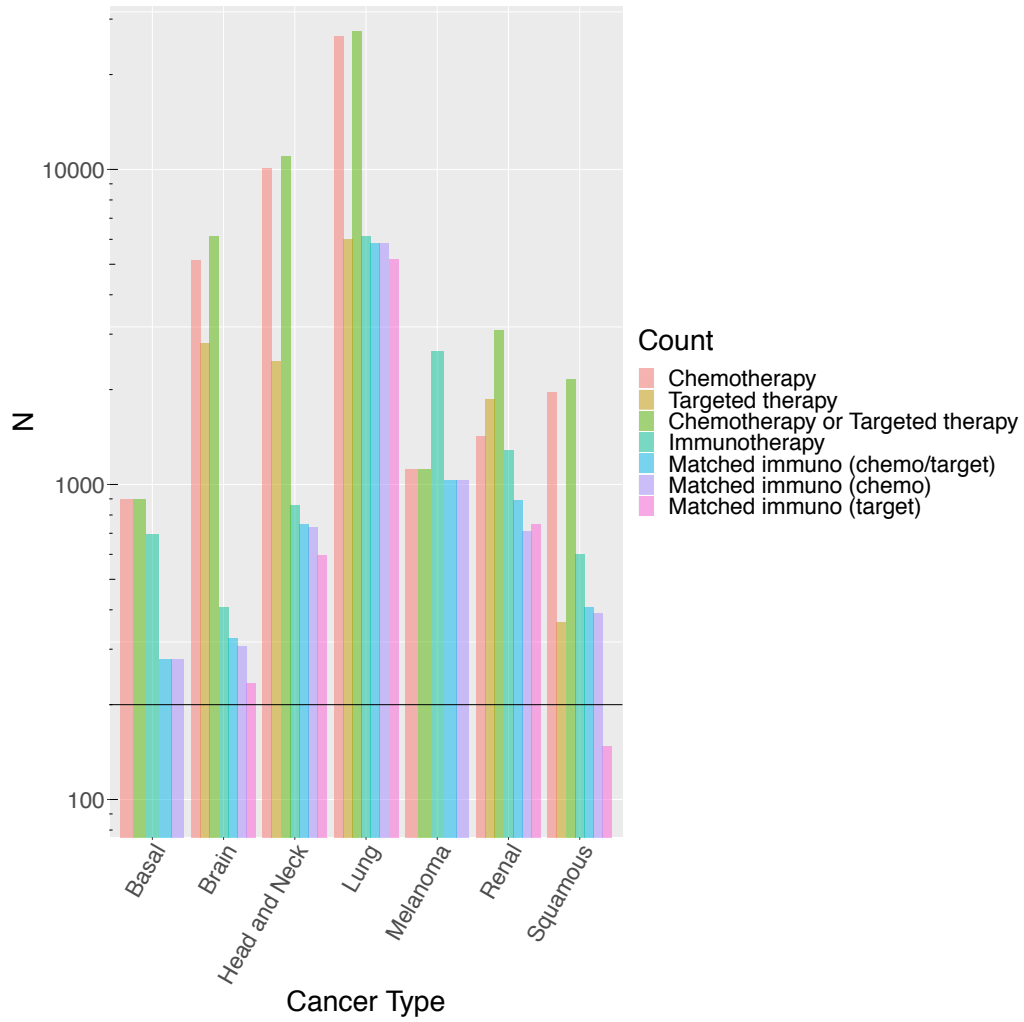
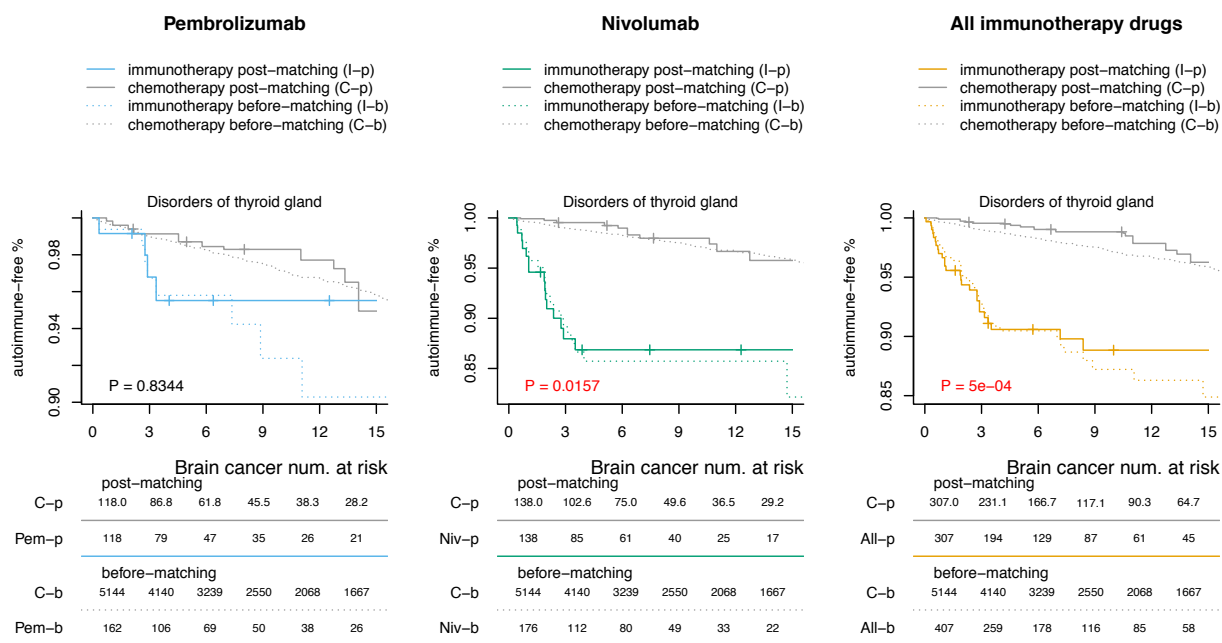
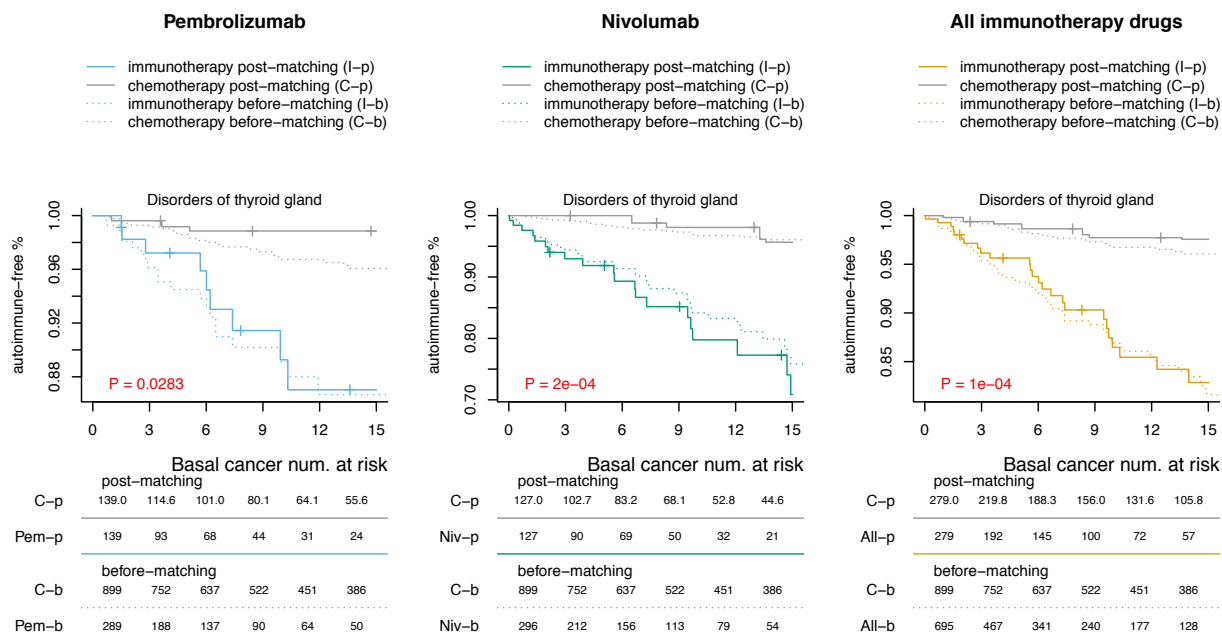


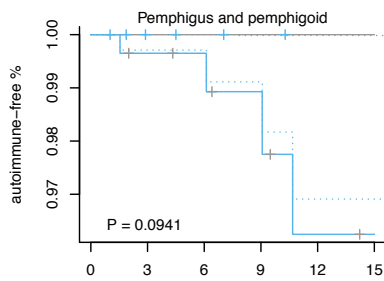
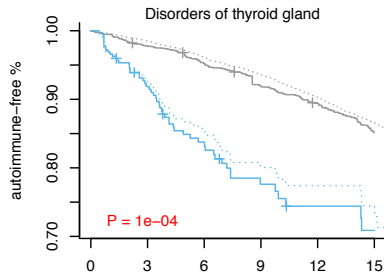
Figure S15. Time-to-event plot showing the time between treatment initiation and the development of immune adverse events with disorders of the thyroid gland as one group.

Chemotherapy



Pembrolizumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

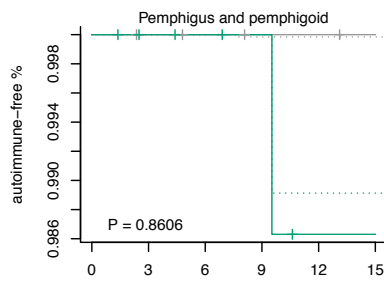
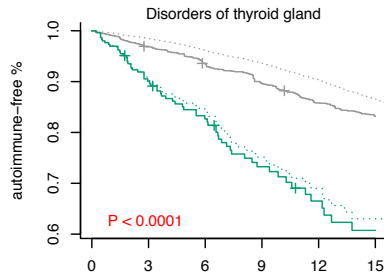


HeadAndNeck cancer num. at risk post-matching

C-p	371.0	296.1	233.8	177.6	142.9	114.7
Pem-p	371	216	141	85	54	37
before-matching						
C-b	10082	8530	7073	5778	4718	3936
Pem-b	445	264	170	106	66	47

Nivolumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

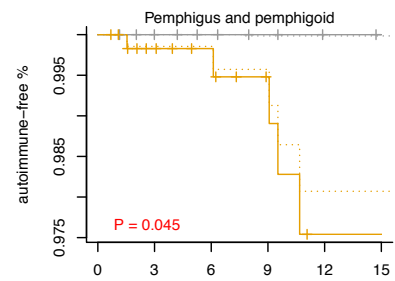
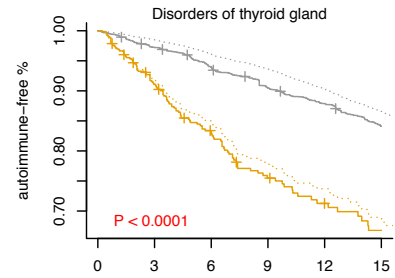


HeadAndNeck cancer num. at risk post-matching

C-p	312.0	247.1	193.3	148.8	118.4	99.9
Niv-p	312	192	132	82	49	37
before-matching						
C-b	10082	8530	7073	5778	4718	3936
Niv-b	356	228	160	103	63	44

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

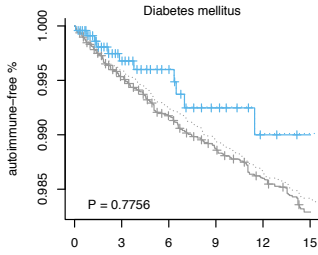
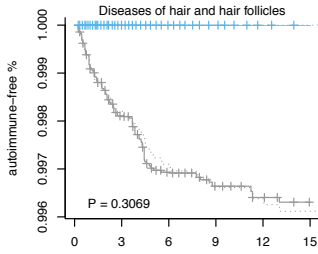
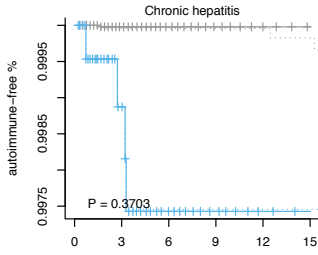
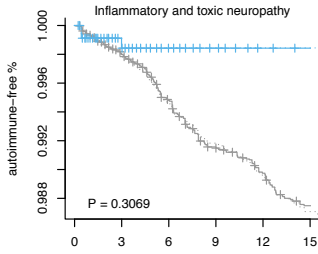
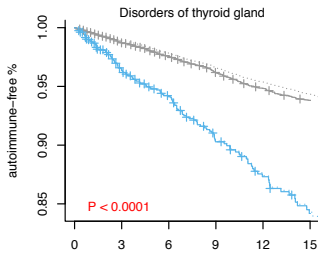


HeadAndNeck cancer num. at risk post-matching

C-p	731.0	579.5	449.9	346.0	278.6	226.6
All-p	731	436	292	176	111	79
before-matching						
C-b	10082	8530	7073	5778	4718	3936
All-b	857	529	358	227	144	101

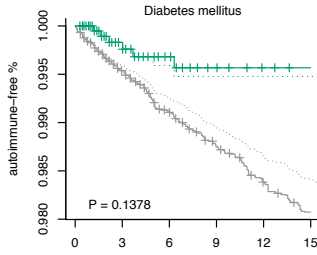
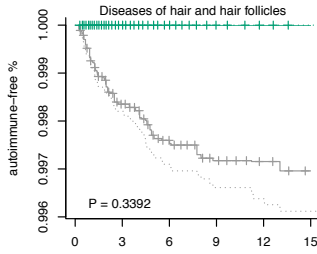
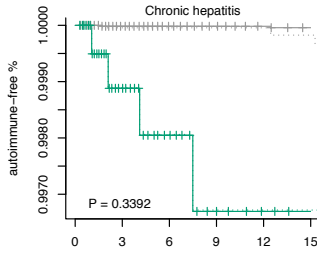
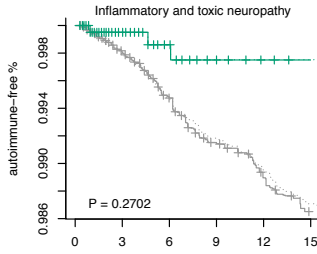
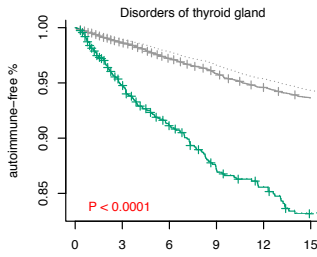
Pembrolizumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



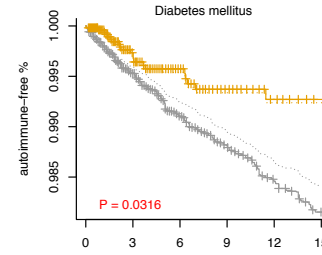
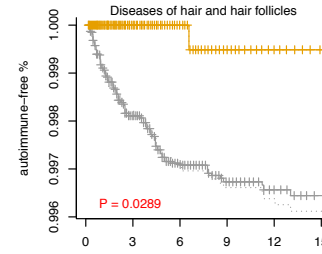
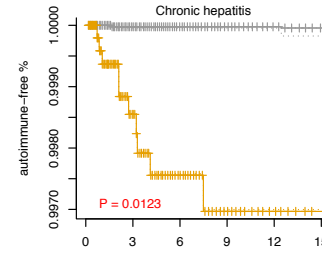
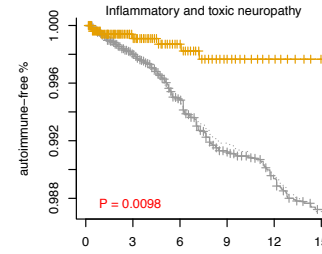
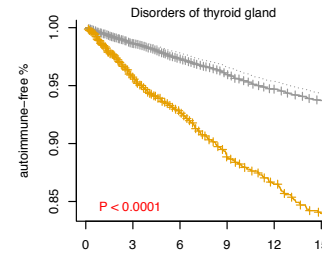
Nivolumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



All immunotherapy drugs

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



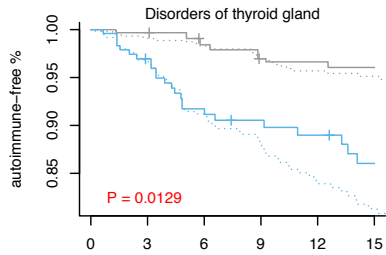
	Lung cancer num. at risk					
	post-matching					
	C-p	I-p	I-b	C-p	I-b	C-b
Pem-p	2773.0	2067.0	1490.8	1083.0	799.3	614.0
Pem-b	2773	1693	1127	715	466	314
	before-matching					
	C-b	I-b	I-p	C-p	I-b	C-b
C-b	26502	20185	14912	10993	8237	6439
Pem-b	2913	1787	1193	763	503	341

	Lung cancer num. at risk					
	post-matching					
	C-p	I-p	I-b	C-p	I-b	C-b
Niv-p	2279.0	1688.4	1204.5	864.0	633.2	485.6
Niv-b	2279	1393	912	625	445	333
	before-matching					
	C-b	I-b	I-p	C-p	I-b	C-b
C-b	26502	20185	14912	10993	8237	6439
Niv-b	2424	1483	975	667	477	356

	Lung cancer num. at risk					
	post-matching					
	C-p	I-p	I-b	C-p	I-b	C-b
All-p	5834.0	4331.0	3112.5	2244.3	1650.5	1272.7
All-b	5834	3612	2372	1550	1055	741
	before-matching					
	C-b	I-b	I-p	C-p	I-b	C-b
C-b	26502	20185	14912	10993	8237	6439
All-b	6157	3823	2515	1649	1132	798

Pembrolizumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

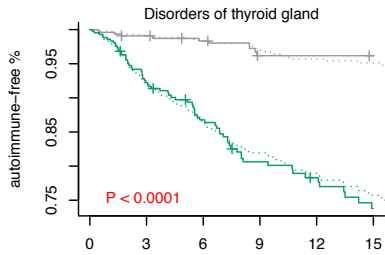


Melanoma cancer num. at risk post-matching

C-p	0	3	6	9	12	15
C-p	252.0	205.9	147.2	99.4	85.0	68.0
Pem-p	252	197	158	126	101	77
C-b	1118	868	651	475	369	302
Pem-b	626	482	367	276	218	167

Nivolumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

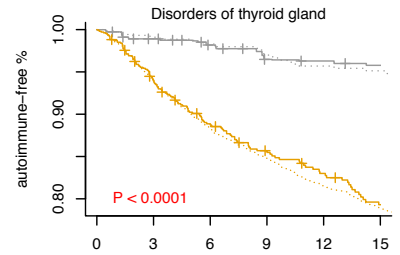


Melanoma cancer num. at risk post-matching

C-p	0	3	6	9	12	15
C-p	438.0	342.7	242.3	176.1	152.3	126.2
Niv-p	438	319	221	155	120	83
C-b	1118	868	651	475	369	302
Niv-b	1148	824	586	427	314	219

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

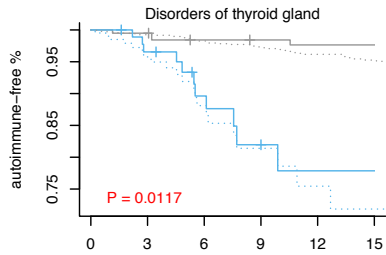


Melanoma cancer num. at risk post-matching

C-p	0	3	6	9	12	15
C-p	1035.0	795.1	564.8	403.8	337.4	272.6
All-p	1035	762	556	420	331	253
C-b	1118	868	651	475	369	302
All-b	2657	1936	1423	1070	817	622

Pembrolizumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

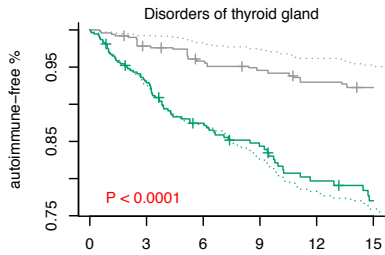


Renal cancer num. at risk post-matching

C-p	0	3	6	9	12	15
C-p	120.0	96.1	63.5	45.2	37.3	28.3
Pem-p	120	77	45	24	14	13
C-b	1425	1163	923	736	592	503
Pem-b	214	121	64	34	22	18

Nivolumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

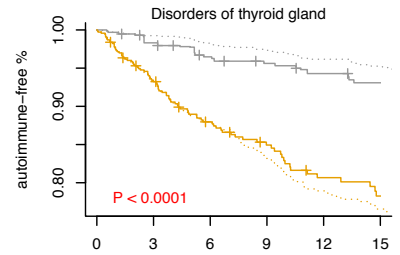


Renal cancer num. at risk post-matching

C-p	0	3	6	9	12	15
C-p	552.0	433.5	327.1	260.6	210.3	170.4
Niv-p	552	378	286	196	143	110
C-b	1425	1163	923	736	592	503
Niv-b	1003	686	518	360	263	199

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

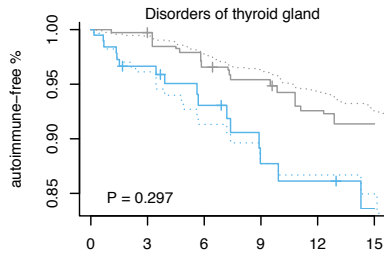


Renal cancer num. at risk post-matching

C-p	0	3	6	9	12	15
C-p	709.0	562.7	414.6	322.6	258.0	207.2
All-p	709	472	336	221	159	122
C-b	1425	1163	923	736	592	503
All-b	1284	851	612	411	300	226

Pembrolizumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

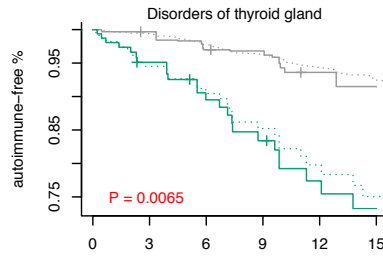


Squamous cancer num. at risk

	0	3	6	9	12	15
C-p	197.0	159.2	121.5	91.0	67.9	58.6
Pem-p	197	131	90	61	45	32
	before-matching					
C-b	1968	1631	1304	1060	868	701
Pem-b	295	189	128	92	67	48

Nivolumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

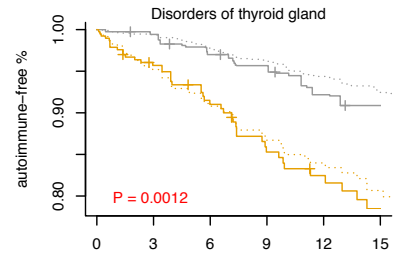


Squamous cancer num. at risk

	0	3	6	9	12	15
C-p	159.0	124.2	97.7	78.8	59.1	49.4
Niv-p	159	121	85	63	40	30
	before-matching					
C-b	1968	1631	1304	1060	868	701
Niv-b	231	165	120	88	57	41

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



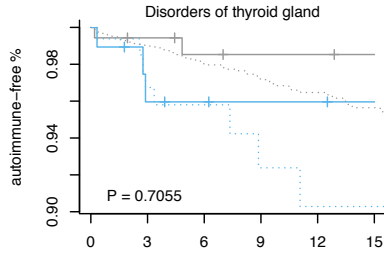
Squamous cancer num. at risk

	0	3	6	9	12	15
C-p	391.0	306.3	238.9	185.7	135.9	107.6
All-p	391	267	187	135	94	68
	before-matching					
C-b	1968	1631	1304	1060	868	701
All-b	602	403	284	211	150	108

Targeted therapy

Pembrolizumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)
- target therapy before-matching (C-b)

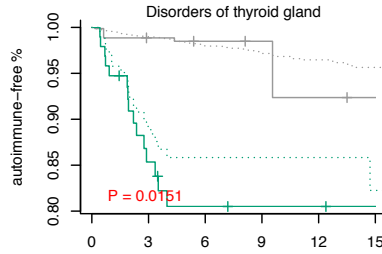


Brain cancer num. at risk

	post-matching					
C-p	95.0	67.6	43.5	25.9	21.1	11.0
Pem-p	95	63	39	28	21	19
	before-matching					
C-b	2814	2125	1441	955	689	453
Pem-b	162	106	69	50	38	26

Nivolumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)
- target therapy before-matching (C-b)

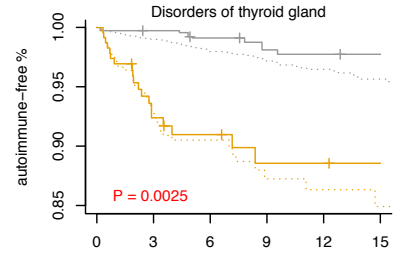


Brain cancer num. at risk

	post-matching					
C-p	100.0	78.0	54.5	34.3	25.9	15.2
Niv-p	100	58	41	27	19	10
	before-matching					
C-b	2814	2125	1441	955	689	453
Niv-b	177	113	80	49	33	22

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)
- target therapy before-matching (C-b)

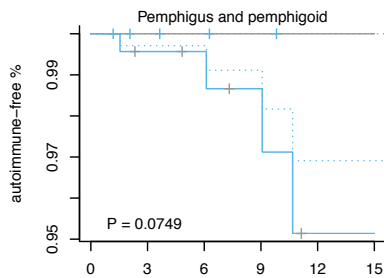
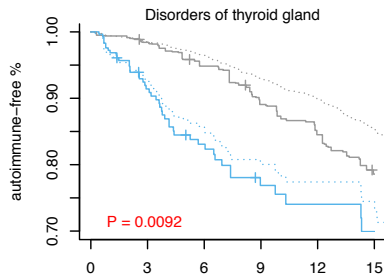


Brain cancer num. at risk

	post-matching					
C-p	235.0	176.2	119.2	70.6	52.9	29.0
All-p	235	147	97	62	45	31
	before-matching					
C-b	2814	2125	1441	955	689	453
All-b	408	260	178	116	85	58

Pembrolizumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)
- target therapy before-matching (C-b)

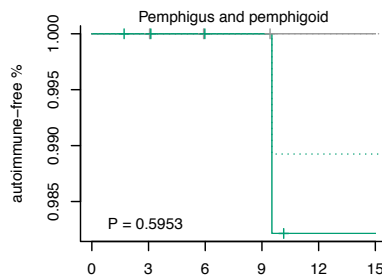
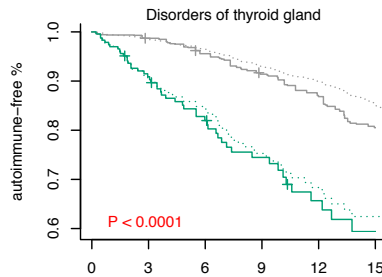


HeadAndNeck cancer num. at risk

	post-matching					
C-p	308.0	242.9	179.2	126.0	96.8	74.0
Pem-p	308	172	112	65	41	30
	before-matching					
C-b	2455	1966	1570	1201	969	783
Pem-b	444	284	170	106	66	47

Nivolumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)
- target therapy before-matching (C-b)

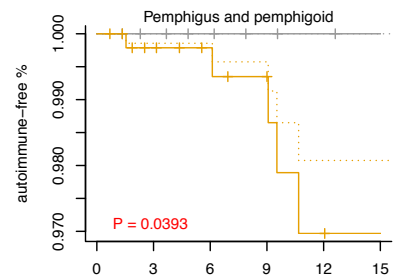
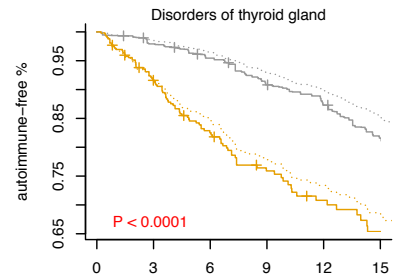


HeadAndNeck cancer num. at risk

	post-matching					
C-p	247.0	198.5	147.7	104.4	78.8	58.8
Niv-p	247	151	99	64	36	24
	before-matching					
C-b	2455	1966	1570	1201	969	783
Niv-b	358	229	161	104	63	44

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)
- target therapy before-matching (C-b)

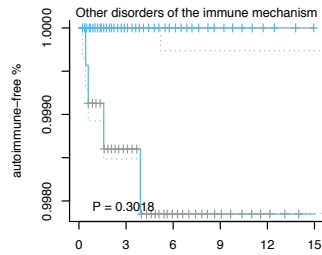
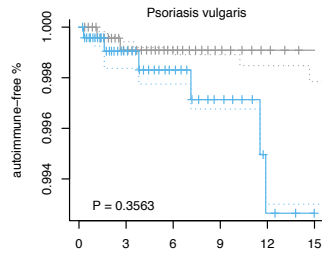
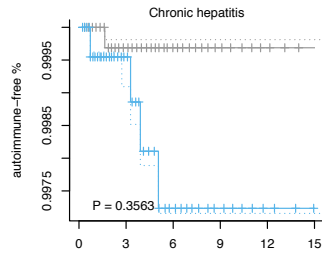
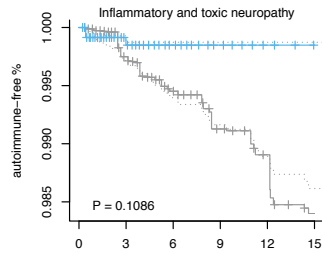
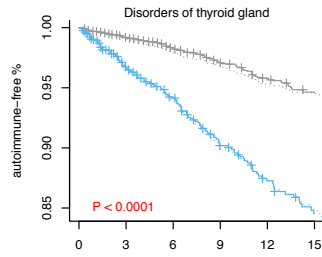


HeadAndNeck cancer num. at risk

	post-matching					
C-p	595.0	459.9	353.6	259.4	202.9	154.2
All-p	595	353	232	145	91	63
	before-matching					
C-b	2455	1966	1570	1201	969	783
All-b	858	530	359	228	144	101

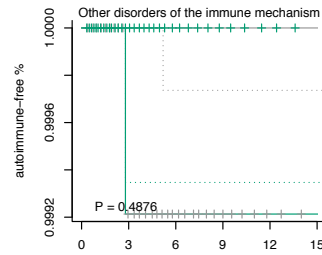
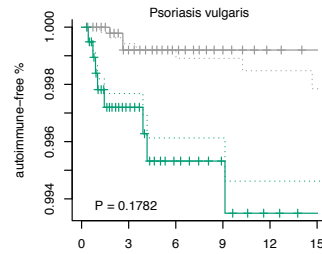
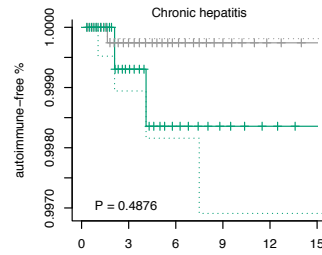
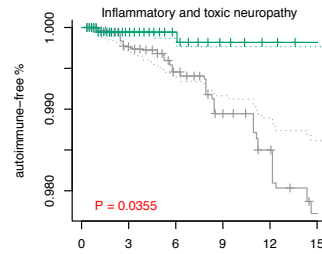
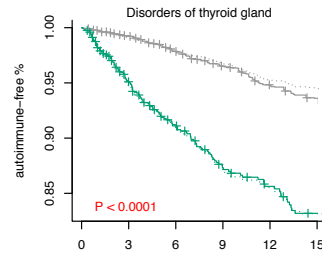
Pembrolizumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)
- target therapy before-matching (C-b)



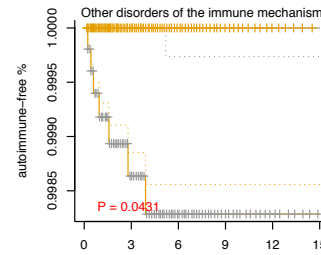
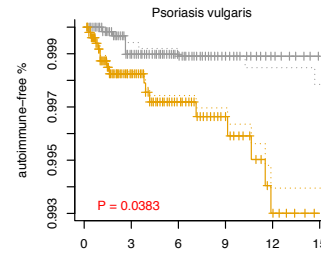
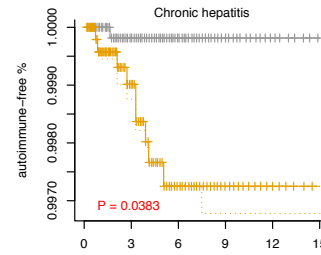
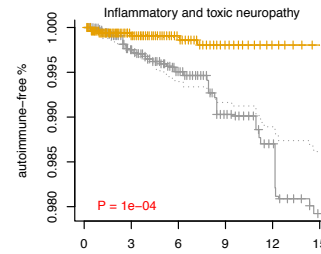
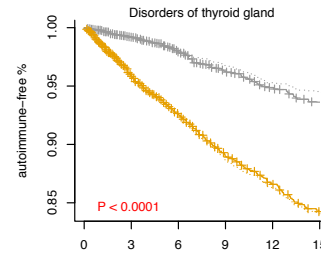
Nivolumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)
- target therapy before-matching (C-b)



All immunotherapy drugs

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)
- target therapy before-matching (C-b)



Lung cancer num. at risk

post-matching	
C-p	I-p
2441.0	1855.5
1333.8	954.4
705.0	548.4
before-matching	
C-b	I-b
6022	4647
3487	2602
1958	1544
Pembrolizumab	
C-b	I-b
2919	1791
1195	765
505	342

Lung cancer num. at risk

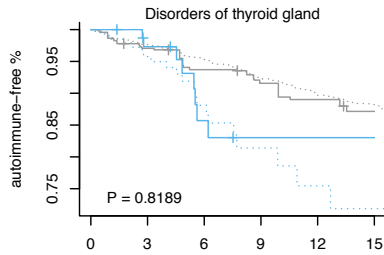
post-matching	
C-p	I-p
2020.0	1513.8
1090.4	770.3
559.1	433.0
before-matching	
C-b	I-b
6022	4647
3487	2602
1958	1544
Nivolumab	
C-b	I-b
2435	1488
976	668
478	357

Lung cancer num. at risk

post-matching	
C-p	I-p
5201.0	3901.8
2821.3	2004.1
1476.8	1142.5
before-matching	
C-b	I-b
6175	3833
2519	1653
1135	800
All immunotherapy drugs	
C-b	I-b
5201	3235
2122	1390
936	658

Pembrolizumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)
- target therapy before-matching (C-b)

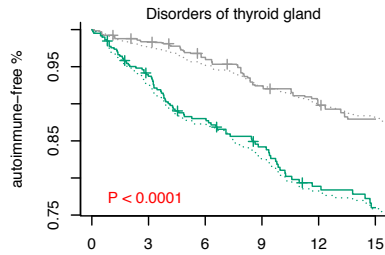


Renal cancer num. at risk

	post-matching					
C-p	120.0	85.7	62.1	45.5	31.3	25.6
Pem-p	120	67	32	19	11	9
	before-matching					
C-b	1868	1412	1041	794	597	486
Pem-b	214	121	64	34	22	18

Nivolumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)
- target therapy before-matching (C-b)

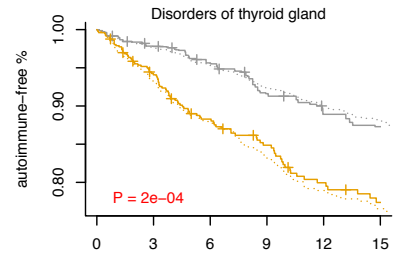


Renal cancer num. at risk

	post-matching					
C-p	606.0	459.4	322.4	236.2	174.7	141.2
Niv-p	606	417	315	222	161	121
	before-matching					
C-b	1868	1412	1041	794	597	486
Niv-b	1002	685	517	359	262	198

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)
- target therapy before-matching (C-b)



Renal cancer num. at risk

	post-matching					
C-p	749.0	555.1	388.2	280.0	201.4	161.1
All-p	749	500	358	246	175	131
	before-matching					
C-b	1868	1412	1041	794	597	486
All-b	1284	851	612	411	300	225

Pembrolizumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)

Squamous cancer num. at risk

	post-matching					
C-p	79.0	52.2	40.9	30.6	17.9	15.4
Pem-p	79	53	34	24	20	11
	before-matching					
C-b	366	274	222	168	125	94
Pem-b	295	189	128	92	67	48

Nivolumab

- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)

Squamous cancer num. at risk

	post-matching					
C-p	59.0	41.7	35.2	30.8	20.3	12.3
Niv-p	59	49	33	24	14	8
	before-matching					
C-b	366	274	222	168	125	94
Niv-b	231	165	120	88	57	41

All immunotherapy drugs

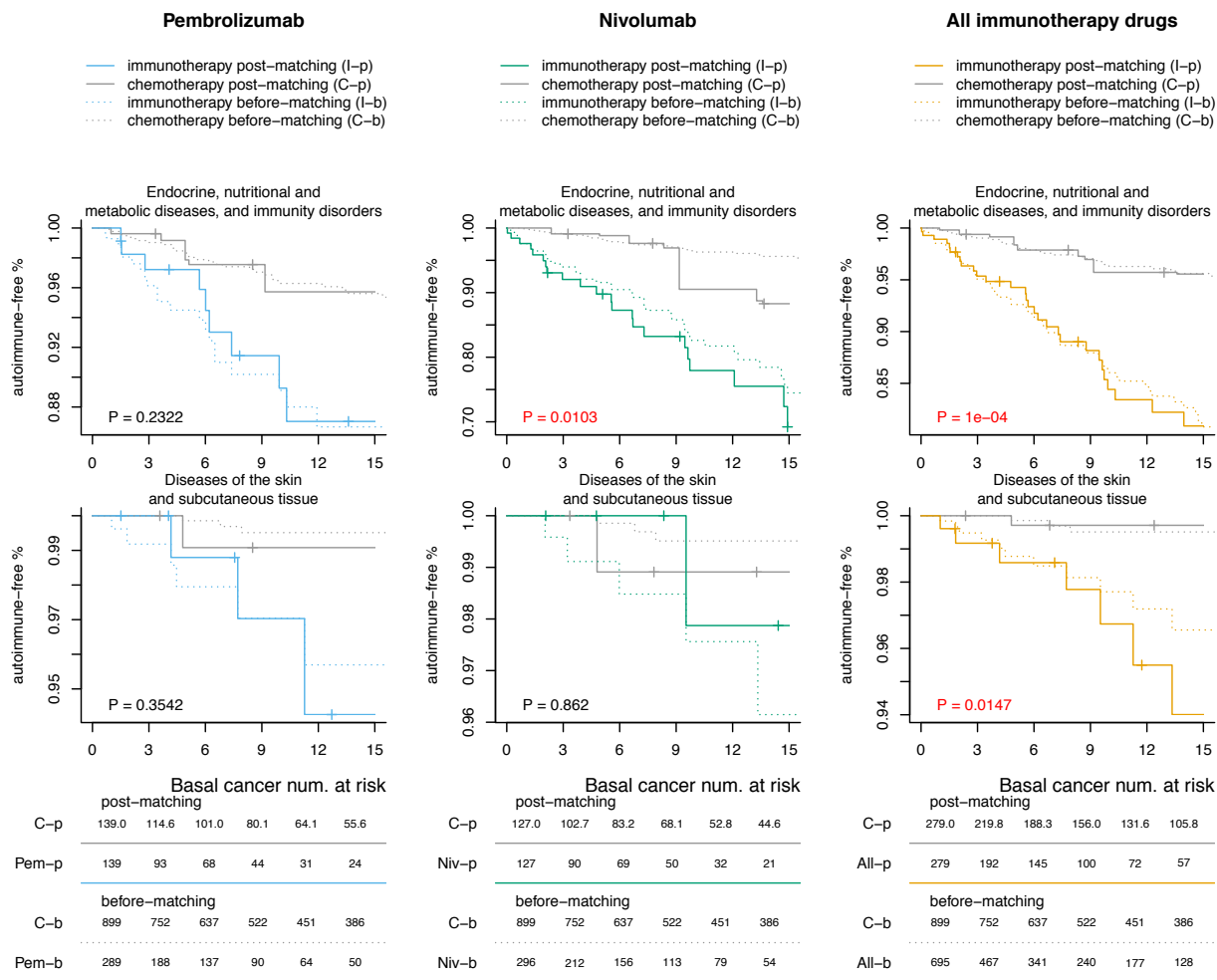
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- immunotherapy before-matching (I-b)

Squamous cancer num. at risk

	post-matching					
C-p	148.0	95.9	79.2	63.8	42.2	31.9
All-p	148	103	69	50	37	21
	before-matching					
C-b	366	274	222	168	125	94
All-b	602	403	284	211	150	108

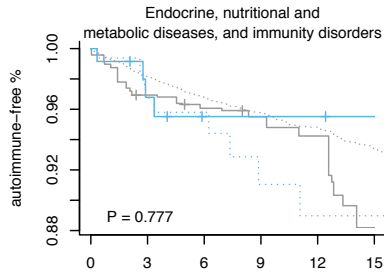
Figure S16. Time-to-event plot showing the time between treatment initiation and the development of immune adverse event groups.

Chemotherapy



Pembrolizumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

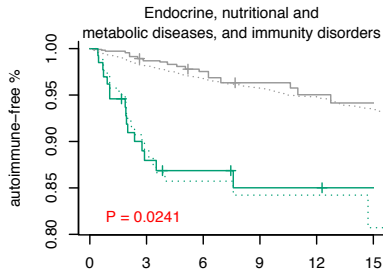


Brain cancer num. at risk post-matching

C-p	118.0	86.8	61.8	45.5	38.3	28.2
Pem-p	118	79	47	35	26	21
C-b	5144	4140	3239	2550	2068	1667
Pem-b	162	106	69	50	38	26

Nivolumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

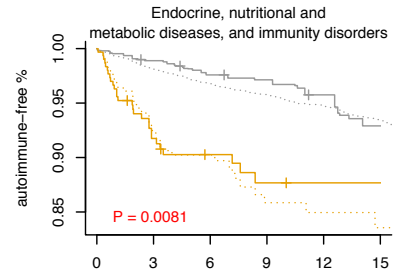


Brain cancer num. at risk post-matching

C-p	138.0	102.6	75.0	49.6	36.5	29.2
Niv-p	138	85	61	40	25	17
C-b	5144	4140	3239	2550	2068	1667
Niv-b	176	112	80	49	33	22

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

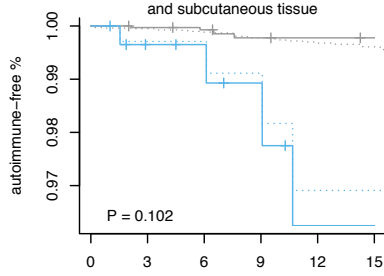
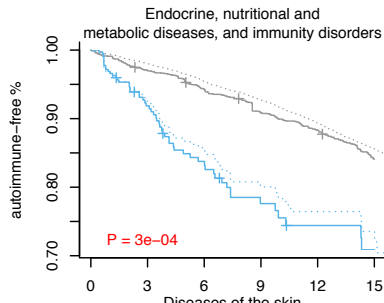


Brain cancer num. at risk post-matching

C-p	307.0	231.1	166.7	117.1	90.3	64.7
All-p	307	194	129	87	61	45
C-b	5144	4140	3239	2550	2068	1667
All-b	407	259	178	116	85	58

Pembrolizumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

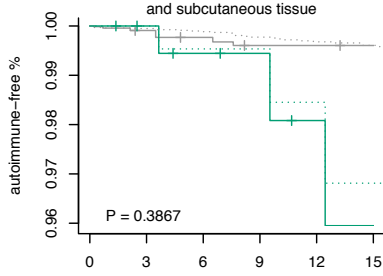
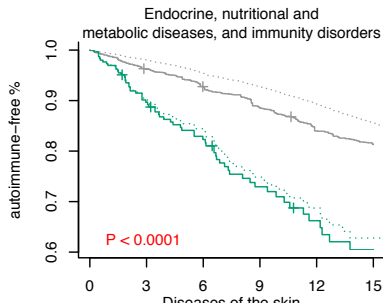


HeadAndNeck cancer num. at risk post-matching

C-p	371.0	296.1	233.8	177.6	142.9	114.7
Pem-p	371	216	141	85	54	37
C-b	10082	8530	7073	5778	4718	3936
Pem-b	445	264	170	106	66	47

Nivolumab

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

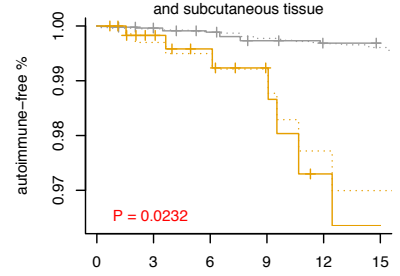
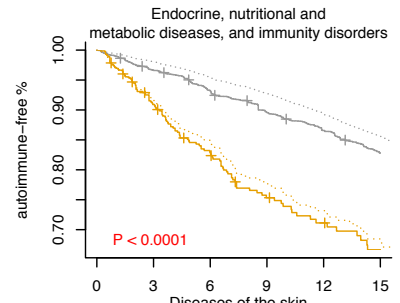


HeadAndNeck cancer num. at risk post-matching

C-p	312.0	247.1	193.3	148.8	118.4	99.9
Niv-p	312	192	132	82	49	37
C-b	10082	8530	7073	5778	4718	3936
Niv-b	356	228	160	103	63	44

All immunotherapy drugs

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)

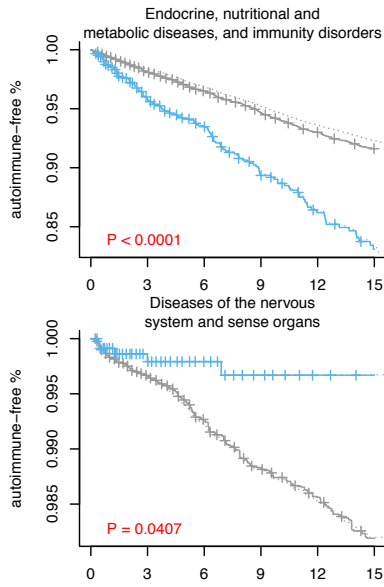


HeadAndNeck cancer num. at risk post-matching

C-p	731.0	579.5	449.9	346.0	278.6	226.6
All-p	731	436	292	176	111	79
C-b	10082	8530	7073	5778	4718	3936
All-b	857	529	358	227	144	101

Pembrolizumab

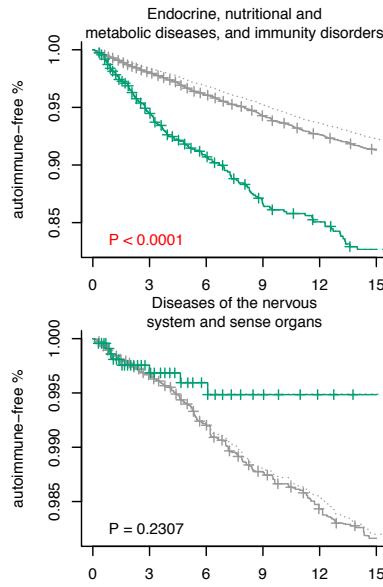
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Lung cancer num. at risk					
		post-matching					
C-p		2773.0	2067.0	1490.8	1083.0	799.3	614.0
Pem-p		2773	1693	1127	715	466	314
		before-matching					
C-b		26502	20185	14912	10993	8237	6439
Pem-b		2913	1787	1193	763	503	341

Nivolumab

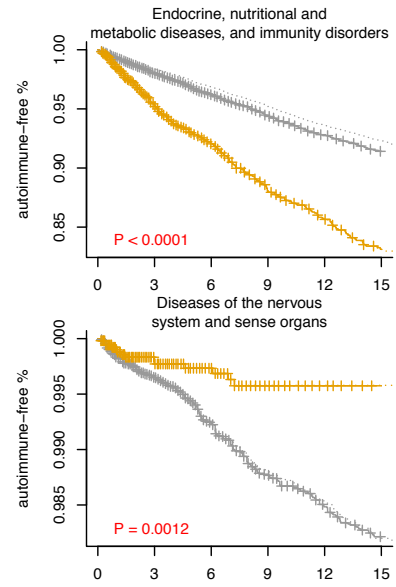
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Lung cancer num. at risk					
		post-matching					
C-p		2279.0	1688.4	1204.5	864.0	633.2	485.6
Niv-p		2279	1393	912	625	445	333
		before-matching					
C-b		26502	20185	14912	10993	8237	6439
Niv-b		2424	1483	975	667	477	356

All immunotherapy drugs

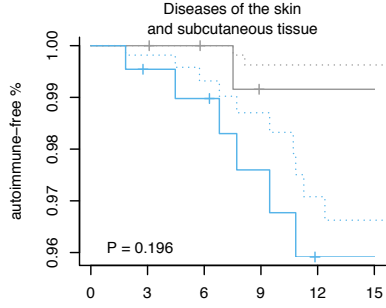
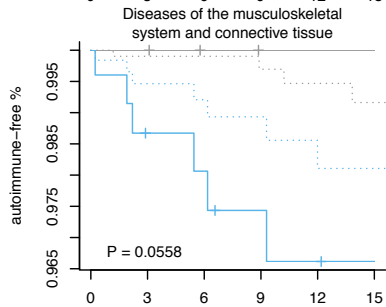
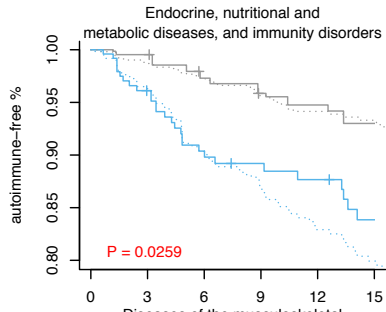
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Lung cancer num. at risk					
		post-matching					
C-p		5834.0	4331.0	3112.5	2244.3	1650.5	1272.7
All-p		5834	3612	2372	1550	1055	741
		before-matching					
C-b		26502	20185	14912	10993	8237	6439
All-b		6157	3823	2515	1649	1132	798

Pembrolizumab

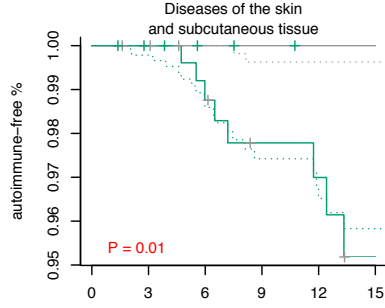
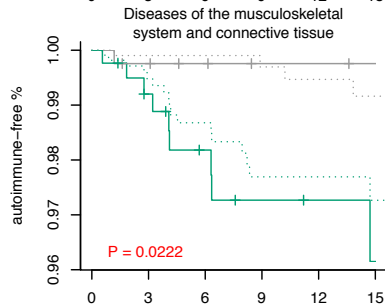
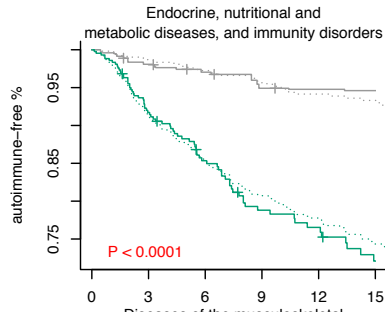
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



Melanoma cancer num. at risk		post-matching					
C-p		252.0	205.9	147.2	99.4	85.0	68.0
Pem-p		252	197	158	126	101	77
before-matching							
C-b		1118	868	651	475	369	302
Pem-b		626	482	367	276	218	167

Nivolumab

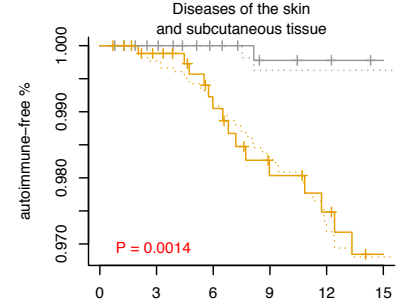
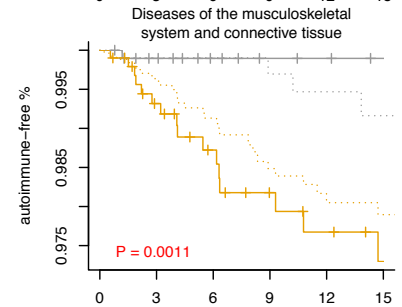
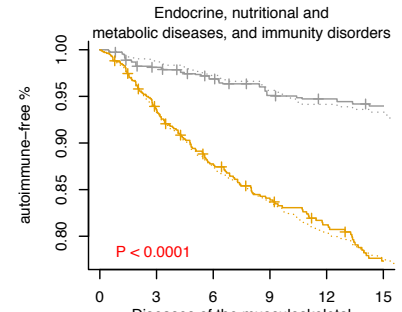
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



Melanoma cancer num. at risk		post-matching					
C-p		438.0	342.7	242.3	176.1	152.3	126.2
Niv-p		438	319	221	155	120	83
before-matching							
C-b		1118	868	651	475	369	302
Niv-b		1148	824	586	427	314	219

All immunotherapy drugs

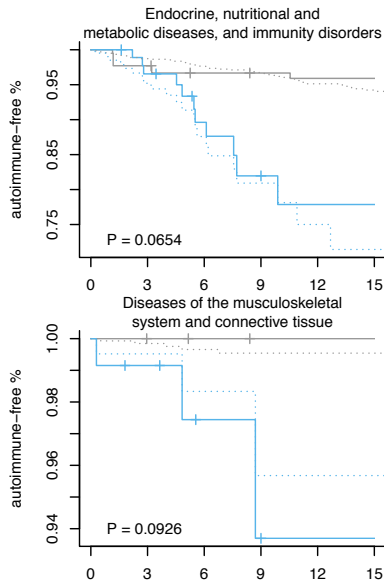
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



Melanoma cancer num. at risk		post-matching					
C-p		1035.0	795.1	564.8	403.8	337.4	272.6
All-p		1035	762	556	420	331	253
before-matching							
C-b		1118	868	651	475	369	302
All-b		2657	1936	1423	1070	817	622

Pembrolizumab

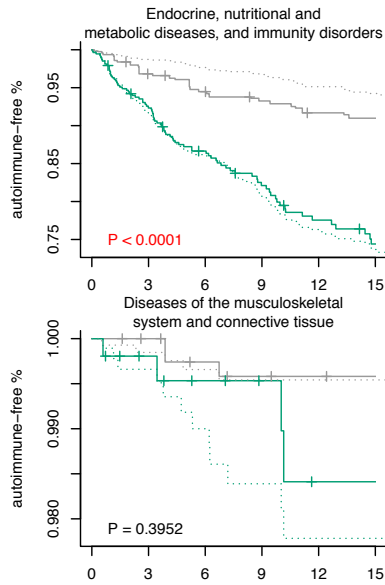
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Renal cancer num. at risk					
		post-matching					
C-p		120.0	96.1	63.5	45.2	37.3	28.3
Pem-p		120	77	45	24	14	13
		before-matching					
C-b		1425	1163	923	736	592	503
Pem-b		214	121	64	34	22	18

Nivolumab

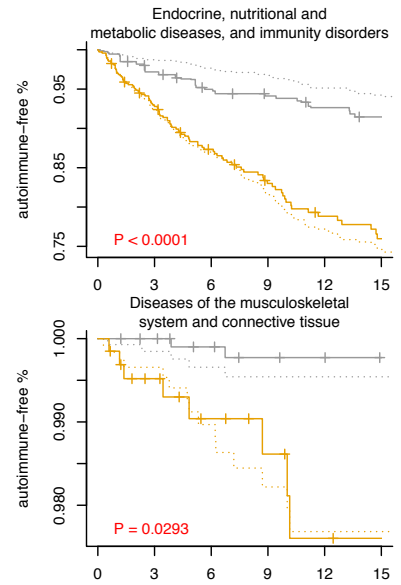
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Renal cancer num. at risk					
		post-matching					
C-p		552.0	433.5	327.1	260.6	210.3	170.4
Niv-p		552	378	286	196	143	110
		before-matching					
C-b		1425	1163	923	736	592	503
Niv-b		1003	686	518	360	263	199

All immunotherapy drugs

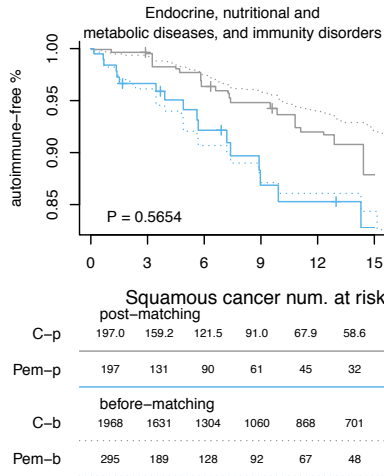
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Renal cancer num. at risk					
		post-matching					
C-p		709.0	562.7	414.6	322.6	258.0	207.2
All-p		709	472	336	221	159	122
		before-matching					
C-b		1425	1163	923	736	592	503
All-b		1284	851	612	411	300	226

Pembrolizumab

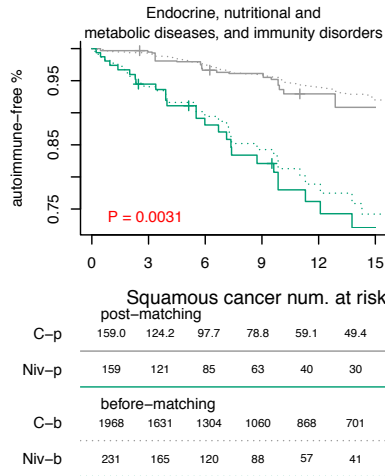
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Squamous cancer num. at risk					
		post-matching					
C-p		197.0	159.2	121.5	91.0	67.9	58.6
Pem-p		197	131	90	61	45	32
		before-matching					
C-b		1968	1631	1304	1060	868	701
Pem-b		295	189	128	92	67	48

Nivolumab

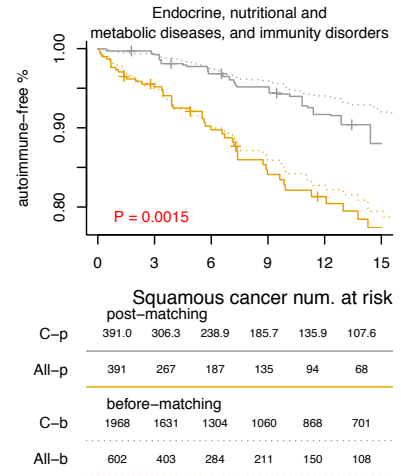
- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



		Squamous cancer num. at risk					
		post-matching					
C-p		159.0	124.2	97.7	78.8	59.1	49.4
Niv-p		159	121	85	63	40	30
		before-matching					
C-b		1968	1631	1304	1060	868	701
Niv-b		231	165	120	88	57	41

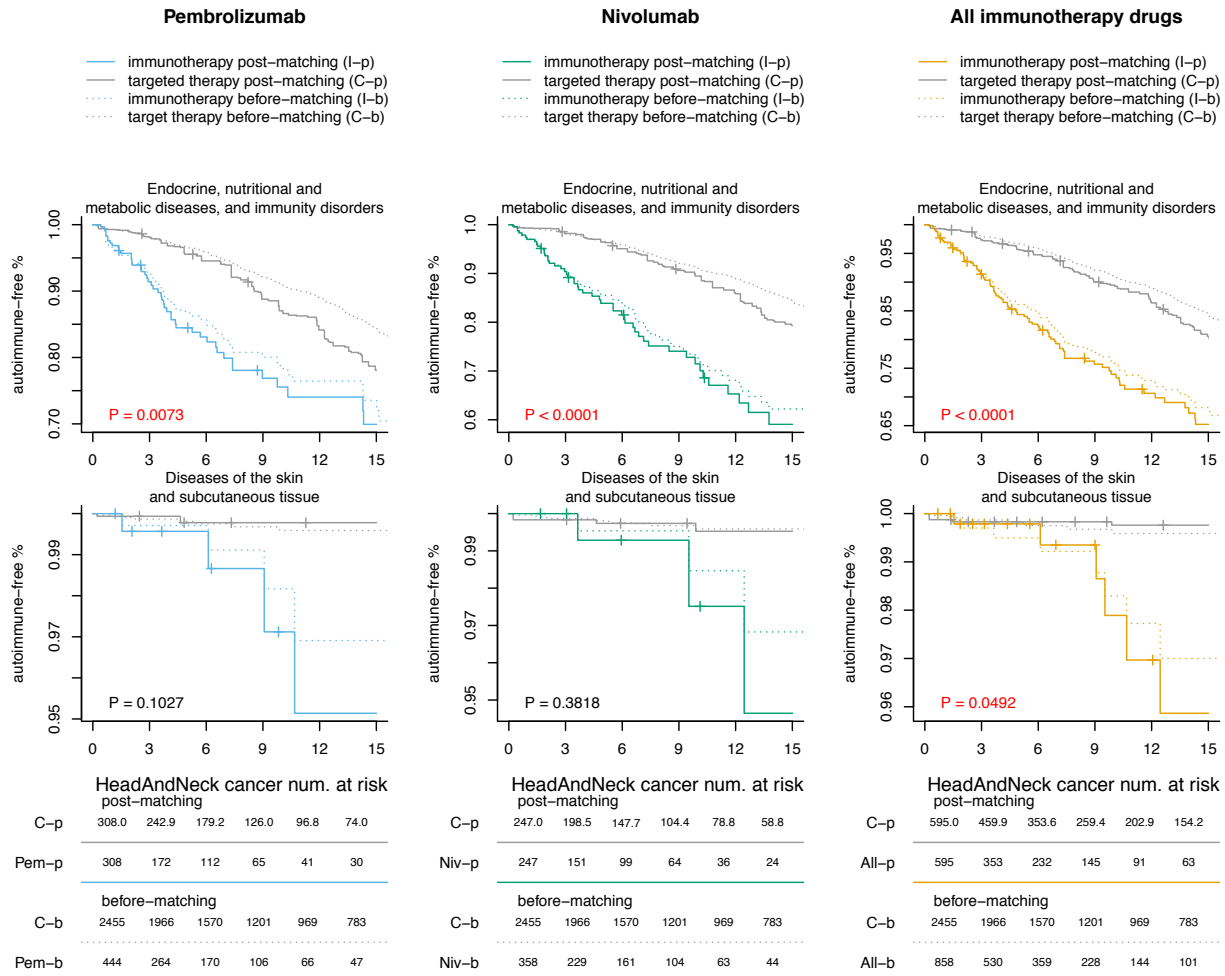
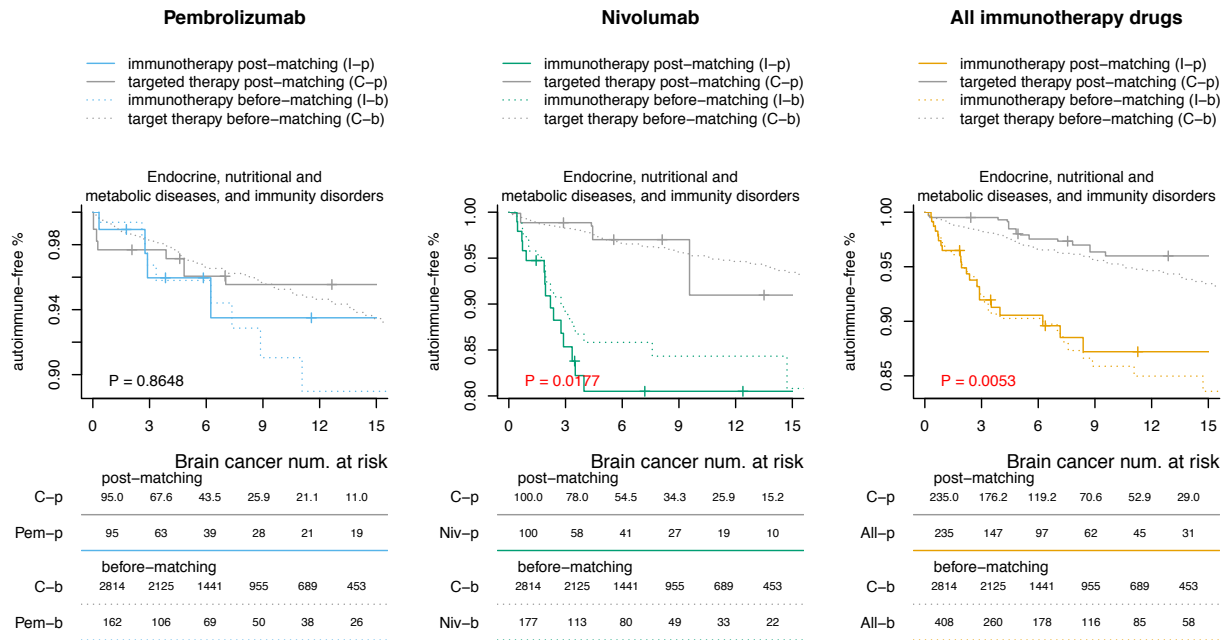
All immunotherapy drugs

- immunotherapy post-matching (I-p)
- chemotherapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ chemotherapy before-matching (C-b)



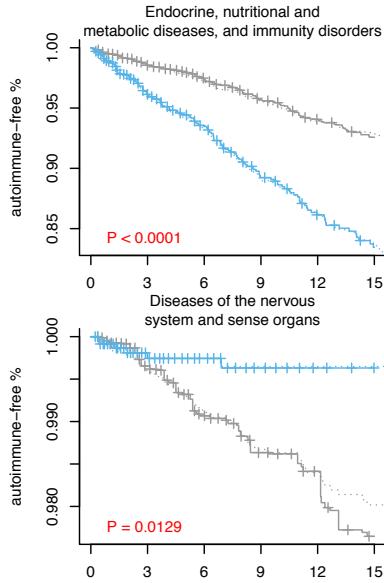
		Squamous cancer num. at risk					
		post-matching					
C-p		391.0	306.3	238.9	185.7	135.9	107.6
All-p		391	267	187	135	94	68
		before-matching					
C-b		1968	1631	1304	1060	868	701
All-b		602	403	284	211	150	108

Targeted therapy



Pembrolizumab

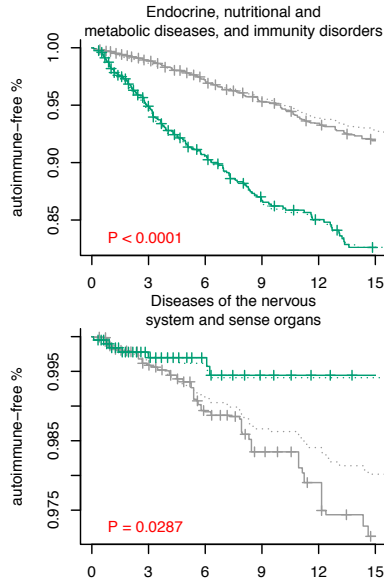
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



Lung cancer num. at risk						
post-matching						
C-p	2441.0	1855.5	1333.8	954.4	705.0	548.4
Pem-p	2441	1505	1009	655	420	285
before-matching						
C-b	6022	4647	3487	2602	1958	1544
Pem-b	2919	1791	1195	765	505	342

Nivolumab

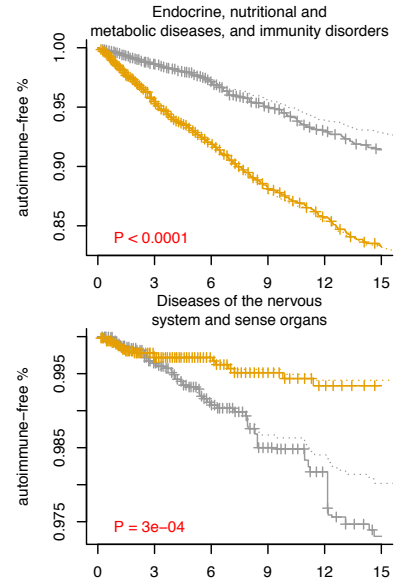
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



Lung cancer num. at risk						
post-matching						
C-p	2020.0	1513.8	1090.4	770.3	559.1	433.0
Niv-p	2020	1234	800	552	386	288
before-matching						
C-b	6022	4647	3487	2602	1958	1544
Niv-b	2435	1488	976	668	478	357

All immunotherapy drugs

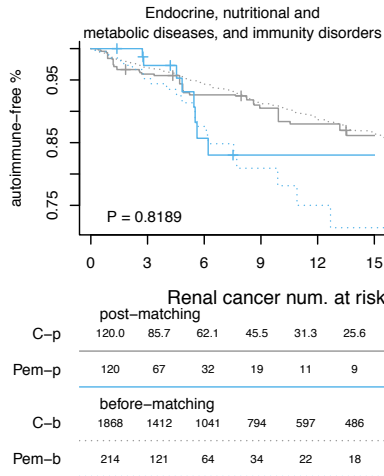
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



Lung cancer num. at risk						
post-matching						
C-p	5201.0	3901.8	2821.3	2004.1	1476.8	1142.5
All-p	5201	3235	2122	1390	936	658
before-matching						
C-b	6022	4647	3487	2602	1958	1544
All-b	6175	3833	2519	1653	1135	800

Pembrolizumab

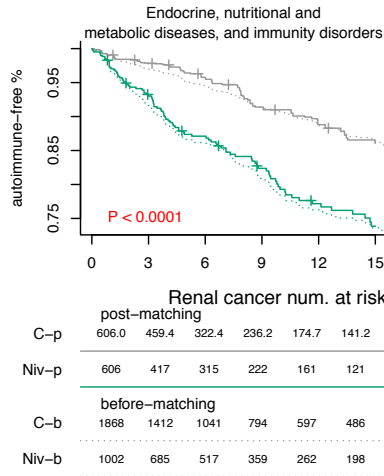
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



Renal cancer num. at risk						
post-matching						
C-p	120.0	85.7	62.1	45.5	31.3	25.6
Pem-p	120	67	32	19	11	9
before-matching						
C-b	1868	1412	1041	794	597	486
Pem-b	214	121	64	34	22	18

Nivolumab

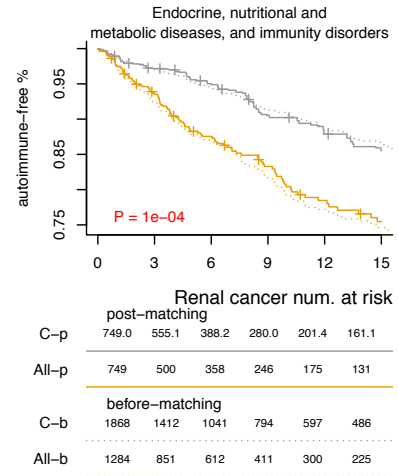
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



Renal cancer num. at risk						
post-matching						
C-p	606.0	459.4	322.4	236.2	174.7	141.2
Niv-p	606	417	315	222	161	121
before-matching						
C-b	1868	1412	1041	794	597	486
Niv-b	1002	685	517	359	262	198

All immunotherapy drugs

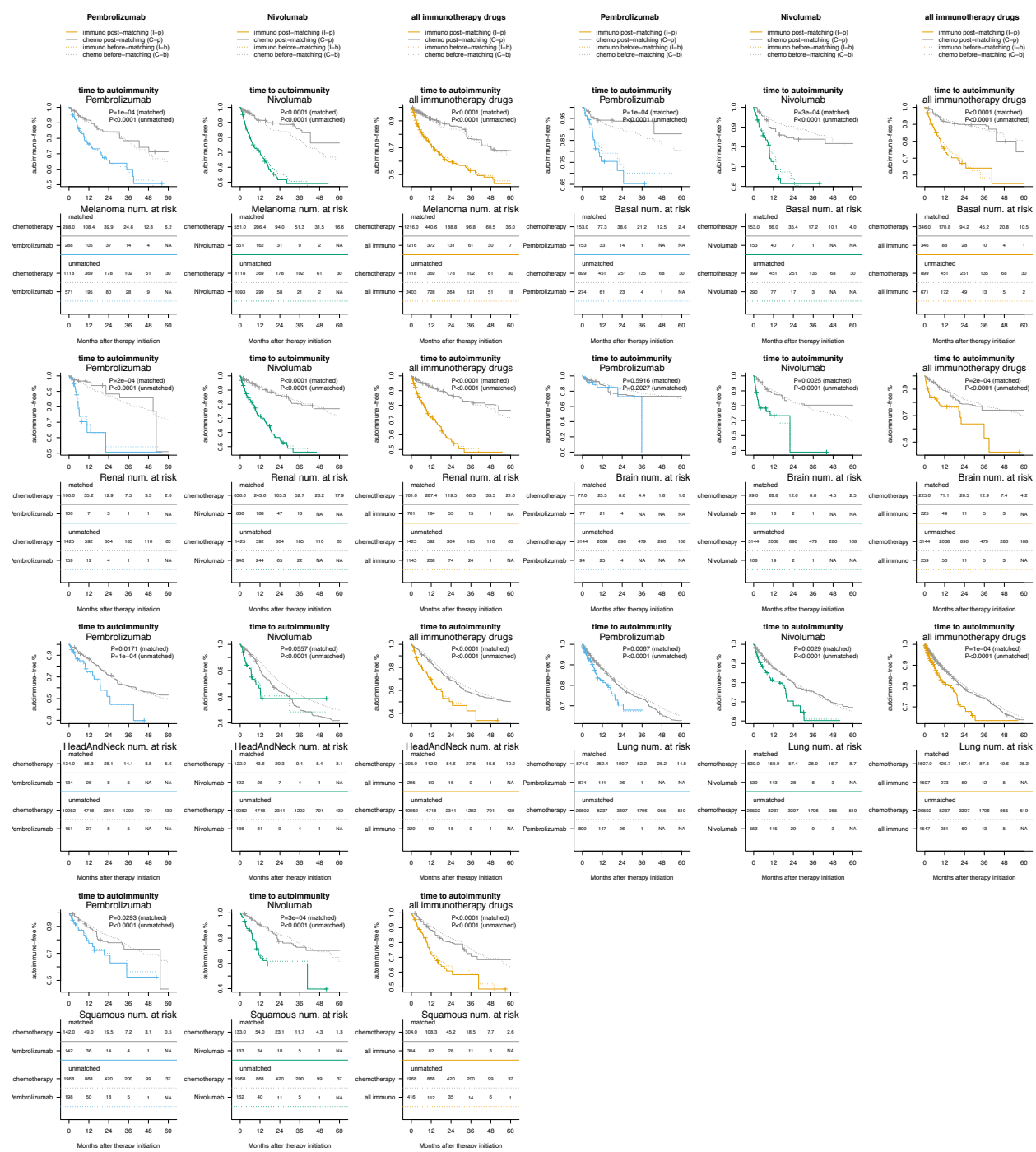
- immunotherapy post-matching (I-p)
- targeted therapy post-matching (C-p)
- ⋯ immunotherapy before-matching (I-b)
- ⋯ target therapy before-matching (C-b)



Renal cancer num. at risk						
post-matching						
C-p	749.0	555.1	388.2	280.0	201.4	161.1
All-p	749	500	358	246	175	131
before-matching						
C-b	1868	1412	1041	794	597	486
All-b	1284	851	612	411	300	225

Figure S17. Results comparing the patients with only immunotherapy with patients who only have chemotherapy or only have targeted therapy.

Chemotherapy



Targeted therapy

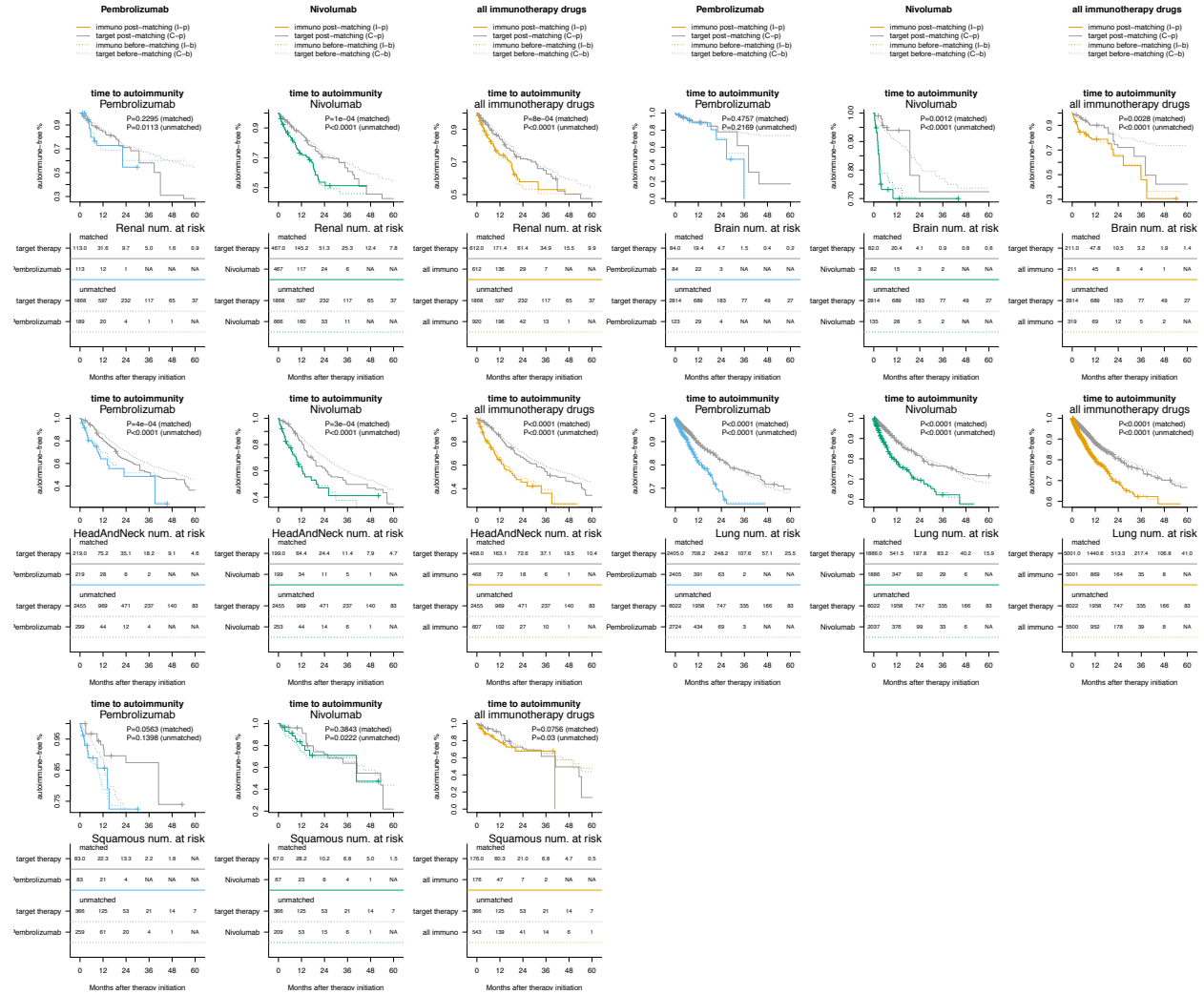


Figure S18. Kaplan-Meier curves where treatment group patients can have only one immunotherapy.

Chemotherapy



Targeted therapy

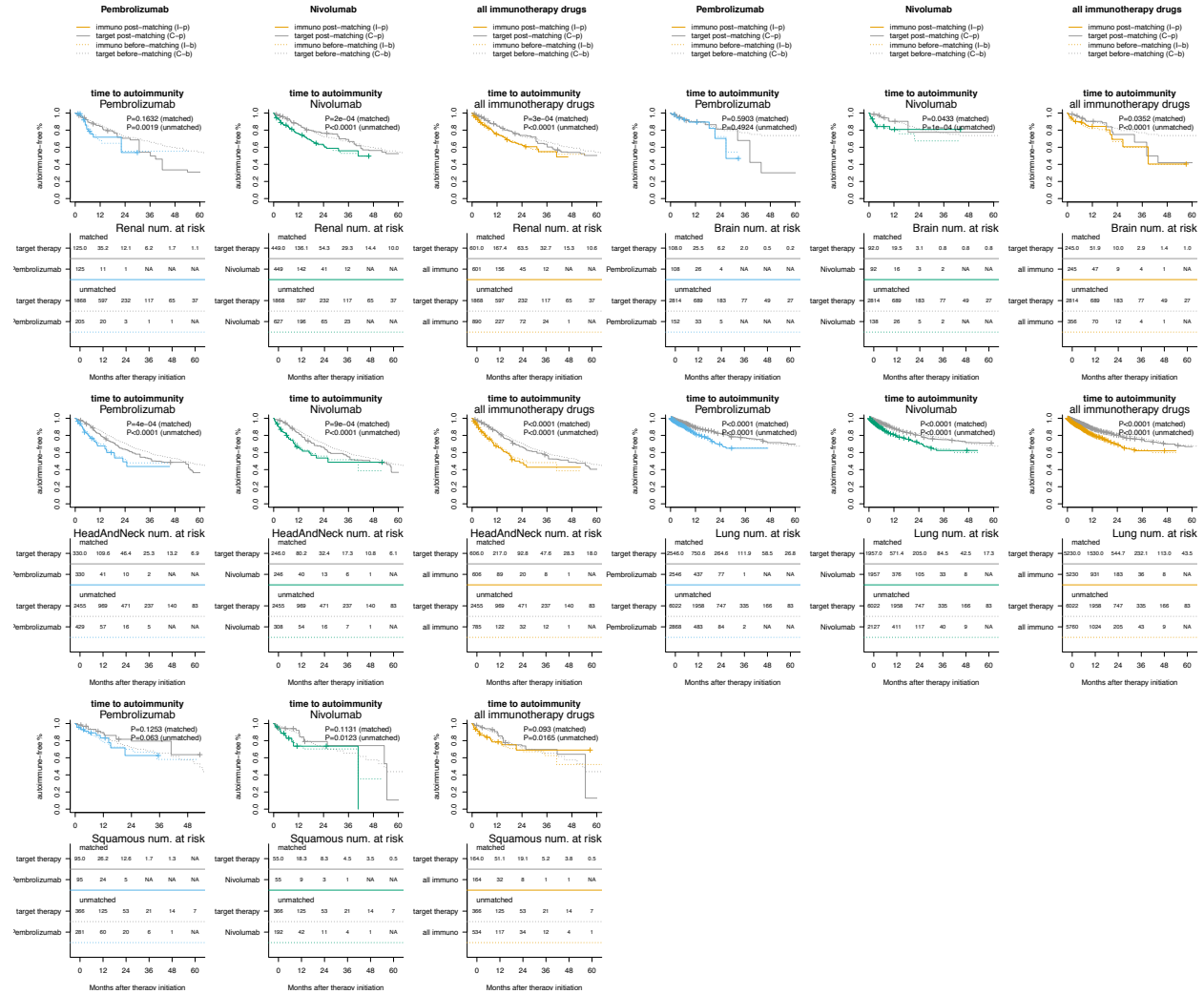


Table S1. Diagnosis codes included in this study.

Renal Cancer

IcdCode	PheWASCode	IcdString
189	189.11	Malignant neoplasm of kidney, except pelvis
C64	189.11	Malignant neoplasm of kidney, except renal pelvis
C64.1	189.11	Malignant neoplasm of right kidney, except renal pelvis
C64.2	189.11	Malignant neoplasm of left kidney, except renal pelvis
C64.9	189.11	Malignant neoplasm of unspecified kidney, except renal pelvis

Brain Cancer

IcdCode	PheWASCode	IcdString
191	191.11	Malignant neoplasm of brain
191	191.11	Malignant neoplasm of cerebrum, except lobes and ventricles
191.1	191.11	Malignant neoplasm of frontal lobe
191.2	191.11	Malignant neoplasm of temporal lobe
191.3	191.11	Malignant neoplasm of parietal lobe
191.4	191.11	Malignant neoplasm of occipital lobe
191.5	191.11	Malignant neoplasm of ventricles

191.6	191.11	Malignant neoplasm of cerebellum NOS
191.7	191.11	Malignant neoplasm of brain stem
191.8	191.11	Malignant neoplasm of other parts of brain
191.9	191.11	Malignant neoplasm of brain, unspecified
C71	191.11	Malignant neoplasm of brain
C71.0	191.11	Malignant neoplasm of supratentorial NOS
C71.1	191.11	Malignant neoplasm of frontal lobe
C71.2	191.11	Malignant neoplasm of temporal lobe
C71.3	191.11	Malignant neoplasm of parietal lobe
C71.4	191.11	Malignant neoplasm of occipital lobe
C71.5	191.11	Malignant neoplasm of cerebral ventricle
C71.6	191.11	Malignant neoplasm of cerebellum
C71.7	191.11	Malignant neoplasm of fourth cerebral ventricle
C71.8	191.11	Malignant neoplasm of overlapping sites of brain
C71.9	191.11	Malignant neoplasm of brain, unspecified

Squamous Cancer

IcdCode	PheWASCode	IcdString
173.02	172.22	Squamous cell carcinoma of skin of lip
173.12	172.22	Squamous cell carcinoma of eyelid, including canthus
173.22	172.22	Squamous cell carcinoma of skin of ear and external auditory canal
173.32	172.22	Squamous cell carcinoma of skin of other and unspecified parts of face
173.42	172.22	Squamous cell carcinoma of scalp and skin of neck
173.52	172.22	Squamous cell carcinoma of skin of trunk, except scrotum
173.62	172.22	Squamous cell carcinoma of skin of upper limb, including shoulder
173.72	172.22	Squamous cell carcinoma of skin of lower limb, including hip
173.82	172.22	Squamous cell carcinoma of other specified sites of skin
173.92	172.22	Squamous cell carcinoma of skin, site unspecified
C44.02	172.22	Squamous cell carcinoma of skin of lip
C44.121	172.22	Squamous cell carcinoma skin/ unsp eyelid, including canthus
C44.122	172.22	Squamous cell carcinoma skin/ right eyelid, inc canthus
C44.129	172.22	Squamous cell carcinoma skin/ left eyelid, including canthus
C44.221	172.22	Squamous cell carcinoma skin/ unsp ear and extrn auric canal
C44.222	172.22	Squamous cell carcinoma skin/ r ear and external auric canal

C44.229	172.22	Squamous cell carcinoma skin/ left ear and extrn auric canal
C44.320	172.22	Squamous cell carcinoma of skin of unspecified parts of face
C44.321	172.22	Squamous cell carcinoma of skin of nose
C44.329	172.22	Squamous cell carcinoma of skin of other parts of face
C44.42	172.22	Squamous cell carcinoma of skin of scalp and neck
C44.520	172.22	Squamous cell carcinoma of perianal skin
C44.521	172.22	Squamous cell carcinoma of skin of breast
C44.529	172.22	Squamous cell carcinoma of skin of other part of trunk
C44.621	172.22	Squamous cell carcinoma skin/ unsp upper limb, inc shoulder
C44.622	172.22	Squamous cell carcinoma skin/ right upper limb, inc shoulder
C44.629	172.22	Squamous cell carcinoma skin/ left upper limb, inc shoulder
C44.721	172.22	Squamous cell carcinoma skin/ unsp lower limb, including hip
C44.722	172.22	Squamous cell carcinoma skin/ right lower limb, inc hip
C44.729	172.22	Squamous cell carcinoma skin/ left lower limb, including hip
C44.82	172.22	Squamous cell carcinoma of overlapping sites of skin
C44.92	172.22	Squamous cell carcinoma of skin, unspecified

Basal Cancer

IcdCode	PheWASCode	IcdString
173.01	172.21	Basal cell carcinoma of skin of lip
173.11	172.21	Basal cell carcinoma of eyelid, including canthus
173.21	172.21	Basal cell carcinoma of skin of ear and external auditory canal
173.31	172.21	Basal cell carcinoma of skin of other and unspecified parts of face
173.41	172.21	Basal cell carcinoma of scalp and skin of neck
173.51	172.21	Basal cell carcinoma of skin of trunk, except scrotum
173.61	172.21	Basal cell carcinoma of skin of upper limb, including shoulder
173.71	172.21	Basal cell carcinoma of skin of lower limb, including hip
173.81	172.21	Basal cell carcinoma of other specified sites of skin
173.91	172.21	Basal cell carcinoma of skin, site unspecified
C44.01	172.21	Basal cell carcinoma of skin of lip
C44.111	172.21	Basal cell carcinoma skin/ unsp eyelid, including canthus
C44.112	172.21	Basal cell carcinoma skin/ right eyelid, including canthus
C44.119	172.21	Basal cell carcinoma skin/ left eyelid, including canthus
C44.211	172.21	Basal cell carcinoma skin/ unsp ear and external auric canal
C44.212	172.21	Basal cell carcinoma skin/ r ear and external auric canal

C44.219	172.21	Basal cell carcinoma skin/ left ear and external auric canal
C44.310	172.21	Basal cell carcinoma of skin of unspecified parts of face
C44.311	172.21	Basal cell carcinoma of skin of nose
C44.319	172.21	Basal cell carcinoma of skin of other parts of face
C44.41	172.21	Basal cell carcinoma of skin of scalp and neck
C44.510	172.21	Basal cell carcinoma of perianal skin
C44.511	172.21	Basal cell carcinoma of skin of breast
C44.519	172.21	Basal cell carcinoma of skin of other part of trunk
C44.611	172.21	Basal cell carcinoma skin/ unsp upper limb, inc shoulder
C44.612	172.21	Basal cell carcinoma skin/ right upper limb, inc shoulder
C44.619	172.21	Basal cell carcinoma skin/ left upper limb, inc shoulder
C44.711	172.21	Basal cell carcinoma skin/ unsp lower limb, including hip
C44.712	172.21	Basal cell carcinoma skin/ right lower limb, including hip
C44.719	172.21	Basal cell carcinoma skin/ left lower limb, including hip
C44.81	172.21	Basal cell carcinoma of overlapping sites of skin
C44.91	172.21	Basal cell carcinoma of skin, unspecified

HeadAndNeck Cancer

IcdCode	PheWASCode	IcdString
140	145.1	Malignant neoplasm of lip
140.0	145.1	Malignant neoplasm of upper lip, vermilion border
140.1	145.1	Malignant neoplasm of lower lip, vermilion border
140.3	145.1	Malignant neoplasm of upper lip, inner aspect
140.4	145.1	Malignant neoplasm of lower lip, inner aspect
140.5	145.1	Malignant neoplasm of lip, unspecified, inner aspect
140.6	145.1	Malignant neoplasm of commissure of lip
140.8	145.1	Malignant neoplasm of other sites of lip
140.9	145.1	Malignant neoplasm of lip, unspecified, vermilion border
141	145.2	Malignant neoplasm of tongue
141	145.2	Malignant neoplasm of base of tongue
141.1	145.2	Malignant neoplasm of dorsal surface of tongue
141.2	145.2	Malignant neoplasm of tip and lateral border of tongue
141.3	145.2	Malignant neoplasm of ventral surface of tongue
141.4	145.2	Malignant neoplasm of anterior two-thirds of tongue, part unspecified
141.5	145.2	Malignant neoplasm of junctional zone of tongue

141.6	145.2	Malignant neoplasm of lingual tonsil
141.8	145.2	Malignant neoplasm of other sites of tongue
141.9	145.2	Malignant neoplasm of tongue, unspecified
142	145.3	Malignant neoplasm of major salivary glands
142	145.3	Malignant neoplasm of parotid gland
142.1	145.3	Malignant neoplasm of submandibular gland
142.2	145.3	Malignant neoplasm of sublingual gland
142.8	145.3	Malignant neoplasm of other major salivary glands
142.9	145.3	Malignant neoplasm of salivary gland, unspecified
143	145.4	Malignant neoplasm of gum
143	145.4	Malignant neoplasm of upper gum
143.1	145.4	Malignant neoplasm of lower gum
143.8	145.4	Malignant neoplasm of other sites of gum
143.9	145.4	Malignant neoplasm of gum, unspecified
144	145.5	Malignant neoplasm of floor of mouth
144	145.5	Malignant neoplasm of anterior portion of floor of mouth
144.1	145.5	Malignant neoplasm of lateral portion of floor of mouth
144.8	145.5	Malignant neoplasm of other sites of floor of mouth

144.9	145.5	Malignant neoplasm of floor of mouth, part unspecified
145	145	Malignant neoplasm of other and unspecified parts of mouth
145	145	Malignant neoplasm of cheek mucosa
145.1	145	Malignant neoplasm of vestibule of mouth
145.2	145	Malignant neoplasm of hard palate
145.3	145	Malignant neoplasm of soft palate
145.4	145	Malignant neoplasm of uvula
145.5	145	Malignant neoplasm of palate, unspecified
145.6	145	Malignant neoplasm of retromolar area
145.8	145	Malignant neoplasm of other specified parts of mouth
145.9	145	Malignant neoplasm of mouth, unspecified
146	149.1	Malignant neoplasm of oropharynx
146	149.1	Malignant neoplasm of tonsil
146.1	149.1	Malignant neoplasm of tonsillar fossa
146.2	149.1	Malignant neoplasm of tonsillar pillars (anterior) (posterior)
146.3	149.1	Malignant neoplasm of vallecula
146.4	149.1	Malignant neoplasm of anterior aspect of epiglottis
146.5	149.1	Malignant neoplasm of junctional region of oropharynx

146.6	149.1	Malignant neoplasm of lateral wall of oropharynx
146.7	149.1	Malignant neoplasm of posterior wall of oropharynx
146.8	149.1	Malignant neoplasm of other specified sites of oropharynx
146.9	149.1	Malignant neoplasm of oropharynx, unspecified
147	149.2	Malignant neoplasm of nasopharynx
147	149.2	Malignant neoplasm of superior wall of nasopharynx
147.1	149.2	Malignant neoplasm of posterior wall of nasopharynx
147.2	149.2	Malignant neoplasm of lateral wall of nasopharynx
147.3	149.2	Malignant neoplasm of anterior wall of nasopharynx
147.8	149.2	Malignant neoplasm of other specified sites of nasopharynx
147.9	149.2	Malignant neoplasm of nasopharynx, unspecified
148	149.3	Malignant neoplasm of hypopharynx
148	149.3	Malignant neoplasm of postcricoid region of hypopharynx
148.1	149.3	Malignant neoplasm of pyriform sinus
148.2	149.3	Malignant neoplasm of aryepiglottic fold, hypopharyngeal aspect
148.3	149.3	Malignant neoplasm of posterior hypopharyngeal wall
148.8	149.3	Malignant neoplasm of other specified sites of hypopharynx
148.9	149.3	Malignant neoplasm of hypopharynx, unspecified

149	149	Malignant neoplasm of other and ill-defined sites within the lip, oral cavity, and pharynx
149	149	Malignant neoplasm of pharynx, unspecified
149.1	149	Malignant neoplasm of waldeyer's ring
149.8	149	Malignant neoplasm of other sites within the lip and oral cavity
149.9	149	Malignant neoplasm of ill-defined sites within the lip and oral cavity
160	149.9	Malignant neoplasm of nasal cavities, middle ear, and accessory sinuses
160	149.9	Malignant neoplasm of nasal cavities
160.1	149.9	Malignant neoplasm of auditory tube, middle ear, and mastoid air cells
160.2	149.9	Malignant neoplasm of maxillary sinus
160.3	149.9	Malignant neoplasm of ethmoidal sinus
160.4	149.9	Malignant neoplasm of frontal sinus
160.5	149.9	Malignant neoplasm of sphenoidal sinus
160.8	149.9	Malignant neoplasm of other accessory sinuses
160.9	149.9	Malignant neoplasm of accessory sinus, unspecified
161	149.4	Malignant neoplasm of larynx
C06.2	145	Malignant neoplasm of retromolar area
C05.9	145	Malignant neoplasm of roof of mouth
C08	145.3	malignant neoplasm of salivary ducts

C08.9	145.3	Malignant neoplasm of salivary gland (major) NOS
C05.1	145	Malignant neoplasm of soft palate
C31.3	149.9	Malignant neoplasm of sphenoid sinus
C32.2	149.4	Malignant neoplasm of subglottis
C08.1	145.3	Malignant neoplasm of sublingual gland
C08.0	145.3	Malignant neoplasm of submaxillary gland
C11.0	149.2	Malignant neoplasm of superior wall of nasopharynx
C02.1	145.2	Malignant neoplasm of tip of tongue
C02.9	145.2	Malignant neoplasm of tongue, unspecified
C09	149.1	Malignant neoplasm of tonsil
C09.9	149.1	Malignant neoplasm of tonsil, unspecified
C09.0	149.1	Malignant neoplasm of tonsillar fossa
C09.1	149.1	Malignant neoplasm of tonsillar pillar (anterior) (posterior)
C02.8	145.2	Malignant neoplasm of two or more contiguous sites of tongue
C30.1	149.9	Malignant neoplasm of tympanic cavity
C03.0	145.4	Malignant neoplasm of upper gum
C00.3	145.1	Malignant neoplasm of upper lip, inner aspect
C05.2	145	Malignant neoplasm of uvula

C10.0	149.1	Malignant neoplasm of vallecula
C02.2	145.2	Malignant neoplasm of ventral surface of tongue
C32.1	149.4	Malignant neoplasm of ventricular bands
C00.2	145.1	Malignant neoplasm of vermilion border of lip NOS
C00.1	145.1	Malignant neoplasm of vermilion border of lower lip
C00.0	145.1	Malignant neoplasm of vermilion border of upper lip
C06.1	145	Malignant neoplasm of vestibule of mouth
C30.0	149.9	Malignant neoplasm of vestibule of nose
C32.0	149.4	Malignant neoplasm of vocal cord (true) NOS
C14.2	149	Malignant neoplasm of Waldeyer's ring
Z85.0 3	145.2	Personal history of malignant neoplasm of large intestine
Z85.2 1	149.4	Personal history of malignant neoplasm of larynx
Z85.0 2	145.2	Personal history of malignant neoplasm of stomach
Z85.8 10	145.2	Personal history of malignant neoplasm of tongue
C14.8	149	Primary malignant neoplasm of two or more contiguous sites of lip, oral cavity and pharynx
Z85.2 2	149.9	Prsnl hx of malig neoplasm of nasal cav, mid ear, & access sinus
Z85.8 18	149.5	Prsnl hx of malig neoplasm of site of lip, oral cav, & pharynx

Z85.8 19	149.5	Prsnl hx of malig neoplasm of unsp site lip,oral cav,& pharynx
161	149.4	Malignant neoplasm of glottis
161.1	149.4	Malignant neoplasm of supraglottis
161.2	149.4	Malignant neoplasm of subglottis
161.3	149.4	Malignant neoplasm of laryngeal cartilages
161.8	149.4	Malignant neoplasm of other specified sites of larynx
161.9	149.4	Malignant neoplasm of larynx, unspecified
195	149.4	Malignant neoplasm of head, face, and neck
230	145	Carcinoma in situ of lip, oral cavity, and pharynx
231	149.4	Carcinoma in situ of larynx
V10.0 1	145.2	Personal history of malignant neoplasm of tongue
V10.0 2	149.5	Personal history of malignant neoplasm of other and unspecified parts of oral cavity and pharynx
V10.2 1	149.4	Personal history of malignant neoplasm of larynx
V10.2 2	149.9	Personal history of malignant neoplasm of nasal cavities, middle ear, and accessory sinuses
D00.0 2	145	Carcinoma in situ of buccal mucosa
D00.0 6	145	Carcinoma in situ of floor of mouth
D00.0 3	145	Carcinoma in situ of gingiva and edentulous alveolar ridge

D00.0 5	145	Carcinoma in situ of hard palate
D00.0 1	145	Carcinoma in situ of labial mucosa and vermilion border
D02.0	149.4	Carcinoma in situ of larynx
D00.0	145	Carcinoma in situ of lip, oral cavity and pharynx
D00.0 0	145	Carcinoma in situ of oral cavity, unspecified site
D00.0 8	145	Carcinoma in situ of pharynx
D00.0 4	145	Carcinoma in situ of soft palate
D00.0 7	145	Carcinoma in situ of tongue
C31.9	149.9	Malignant neoplasm of accessory sinus, unspecified
C31	149.9	Malignant neoplasm of accessory sinuses
C04.0	145.5	Malignant neoplasm of anterior to the premolar-canine junction
C10.4	149.1	Malignant neoplasm of branchial cyst [site of neoplasm]
C00.6	145.1	Malignant neoplasm of commissure of lip, unspecified
C02.0	145.2	Malignant neoplasm of dorsal surface of tongue
C31.1	149.9	Malignant neoplasm of ethmoidal sinus
C04	145.5	Malignant neoplasm of floor of mouth
C04.9	145.5	Malignant neoplasm of floor of mouth, unspecified

C31.2	149.9	Malignant neoplasm of frontal sinus
C03	145.4	malignant neoplasm of gingiva
C10.1	149.1	Malignant neoplasm of glossoepiglottic fold(s)
C03.9	145.4	Malignant neoplasm of gum, unspecified
C05.0	145	Malignant neoplasm of hard palate
C13	149.3	Malignant neoplasm of hypopharynx
C13.9	149.3	Malignant neoplasm of hypopharynx, unspecified
C13.1	149.3	Malignant neoplasm of interarytenoid fold, marginal zone
C06.0	145	Malignant neoplasm of internal cheek
C32.3	149.4	Malignant neoplasm of laryngeal cartilage
C32	149.4	Malignant neoplasm of larynx
C32.9	149.4	Malignant neoplasm of larynx, unspecified
C04.1	145.5	Malignant neoplasm of lateral floor of mouth
C10.2	149.1	Malignant neoplasm of lateral wall of oropharynx
C02.4	145.2	Malignant neoplasm of lingual tonsil
C00	145.1	Malignant neoplasm of lip
C00.9	145.1	Malignant neoplasm of lip, unspecified
C03.1	145.4	Malignant neoplasm of lower gum

C31.0	149.9	Malignant neoplasm of maxillary sinus
C02.3	145.2	Malignant neoplasm of mobile part of tongue NOS
C11	149.2	Malignant neoplasm of nasopharynx
C11.9	149.2	Malignant neoplasm of nasopharynx, unspecified
C76.0	195.3	Malignant neoplasm of nose NOS
C00.5	145.1	Malignant neoplasm of oral aspect of lip, unspecified
C00.4	145.1	Malignant neoplasm of oral aspect of lower lip
C06.9	145	Malignant neoplasm of oral cavity NOS
C10	149.1	Malignant neoplasm of oropharynx
C10.9	149.1	Malignant neoplasm of oropharynx, unspecified
C14	149	Malignant neoplasm of other and ill-defined sites in the lip, oral cavity and pharynx
C06	145	Malignant neoplasm of other and unspecified parts of mouth
C02	145.2	Malignant neoplasm of other and unspecified parts of tongue
C31.8	149.9	Malignant neoplasm of overlapping sites of accessory sinuses
C04.8	145.5	Malignant neoplasm of overlapping sites of floor of mouth
C13.8	149.3	Malignant neoplasm of overlapping sites of hypopharynx
C32.8	149.4	Malignant neoplasm of overlapping sites of larynx
C00.8	145.1	Malignant neoplasm of overlapping sites of lip

C11.8	149.2	Malignant neoplasm of overlapping sites of nasopharynx
C10.8	149.1	Malignant neoplasm of overlapping sites of oropharynx
C06.8	145	Malignant neoplasm of overlapping sites of other and unspecified parts of mouth
C06.8 9	145	Malignant neoplasm of overlapping sites of other parts of mouth
C05.8	145	Malignant neoplasm of overlapping sites of palate
C09.8	149.1	Malignant neoplasm of overlapping sites of tonsil
C06.8 0	145	Malignant neoplasm of overl p sites of unsp parts of mouth
C05	145	Malignant neoplasm of palate
C07	145.3	Malignant neoplasm of parotid gland
C11.2	149.2	Malignant neoplasm of pharyngeal recess
C14.0	149	Malignant neoplasm of pharynx, unspecified
C13.0	149.3	Malignant neoplasm of postcricoid region
C11.3	149.2	Malignant neoplasm of posterior margin of nasal septum
C01	145.2	Malignant neoplasm of posterior third of tongue
C13.2	149.3	Malignant neoplasm of posterior wall of hypopharynx
C11.1	149.2	Malignant neoplasm of posterior wall of nasopharynx
C10.3	149.1	Malignant neoplasm of posterior wall of oropharynx

C12	149.3	Malignant neoplasm of pyriform sinus
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Melanoma Cancer

IcdCode	PheWASCode	IcdString
172	172.11	Malignant melanoma of skin
172.0	172.11	Malignant melanoma of skin of lip
172.1	172.11	Malignant melanoma of skin of eyelid, including canthus
172.2	172.11	Malignant melanoma of skin of ear and external auditory canal
172.3	172.11	Malignant melanoma of skin of other and unspecified parts of face
172.4	172.11	Malignant melanoma of skin of scalp and neck
172.5	172.11	Malignant melanoma of skin of trunk, except scrotum
172.6	172.11	Malignant melanoma of skin of upper limb, including shoulder
172.7	172.11	Malignant melanoma of skin of lower limb, including hip
172.8	172.11	Malignant melanoma of other specified sites of skin
172.9	172.11	Melanoma of skin, site unspecified
C43	172.11	Malignant melanoma of skin
C43.0	172.11	Malignant melanoma of lip

C43.1	172.11	Malignant melanoma of eyelid, including canthus
C43.10	172.11	Malignant melanoma of unspecified eyelid, including canthus
C43.11	172.11	Malignant melanoma of right eyelid, including canthus
C43.12	172.11	Malignant melanoma of left eyelid, including canthus
C43.2	172.11	Malignant melanoma of ear and external auricular canal
C43.20	172.11	Malignant melanoma of unspecified ear and external auricular canal
C43.21	172.11	Malignant melanoma of right ear and external auricular canal
C43.22	172.11	Malignant melanoma of left ear and external auricular canal
C43.3	172.11	Malignant melanoma of other and unspecified parts of face
C43.30	172.11	Malignant melanoma of unspecified part of face
C43.31	172.11	Malignant melanoma of nose
C43.39	172.11	Malignant melanoma of other parts of face
C43.4	172.11	Malignant melanoma of scalp and neck
C43.5	172.11	Malignant melanoma of trunk
C43.51	172.11	Malignant melanoma of perianal skin
C43.52	172.11	Malignant melanoma of skin of breast
C43.59	172.11	Malignant melanoma of other part of trunk
C43.6	172.11	Malignant melanoma of upper limb, including shoulder

C43.60	172.11	Malignant melanoma of unspecified upper limb, including shoulder
C43.61	172.11	Malignant melanoma of right upper limb, including shoulder
C43.62	172.11	Malignant melanoma of left upper limb, including shoulder
C43.7	172.11	Malignant melanoma of lower limb, including hip
C43.70	172.11	Malignant melanoma of unspecified lower limb, including hip
C43.71	172.11	Malignant melanoma of right lower limb, including hip
C43.72	172.11	Malignant melanoma of left lower limb, including hip
C43.8	172.11	Malignant melanoma of overlapping sites of skin
C43.9	172.11	Melanoma (malignant) NOS
D03	172.11	Melanoma in situ
D03.0	172.11	Melanoma in situ of lip
D03.1	172.11	Melanoma in situ of eyelid, including canthus
D03.10	172.11	Melanoma in situ of unspecified eyelid, including canthus
D03.11	172.11	Melanoma in situ of right eyelid, including canthus
D03.12	172.11	Melanoma in situ of left eyelid, including canthus
D03.2	172.11	Melanoma in situ of ear and external auricular canal
D03.20	172.11	Melanoma in situ of unspecified ear and external auricular canal
D03.21	172.11	Melanoma in situ of right ear and external auricular canal

D03.22	172.11	Melanoma in situ of left ear and external auricular canal
D03.3	172.11	Melanoma in situ of other and unspecified parts of face
D03.30	172.11	Melanoma in situ of unspecified part of face
D03.39	172.11	Melanoma in situ of other parts of face
D03.4	172.11	Melanoma in situ of scalp and neck
D03.5	172.11	Melanoma in situ of trunk
D03.51	172.11	Melanoma in situ of perianal skin
D03.52	172.11	Melanoma in situ of breast (skin) (soft tissue)
D03.59	172.11	Melanoma in situ of other part of trunk
D03.6	172.11	Melanoma in situ of upper limb, including shoulder
D03.60	172.11	Melanoma in situ of unspecified upper limb, including shoulder
D03.61	172.11	Melanoma in situ of right upper limb, including shoulder
D03.62	172.11	Melanoma in situ of left upper limb, including shoulder
D03.7	172.11	Melanoma in situ of lower limb, including hip
D03.70	172.11	Melanoma in situ of unspecified lower limb, including hip
D03.71	172.11	Melanoma in situ of right lower limb, including hip
D03.72	172.11	Melanoma in situ of left lower limb, including hip
D03.8	172.11	Melanoma in situ of scrotum

D03.9	172.11	Melanoma in situ, unspecified
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Table S2. Immune checkpoint inhibitors included in this study.

name	checkpoint	HCPCS.code	NDC.code
Nivolumab.Opdivo	PD-1	C9453,J9299	00003373413 00003377211 00003377412
Pembrolizumab.Keytruda	PD-1	C9027,J9271	00006302602 00006302902
Ipilimumab.Yervoy	CTLA-4	C9284,J9228	00003232711 00003232822
Atezolizumab.Tecentriq	PD-L1	C9483,J9022	05024291701 05024291786
Avelumab.Bavencio	PD-L1	C9491,J9023	04408735351
Durvalumab.Imfinzi	PD-L1	C9492	00310450012 00310461150

Table S3. Chemotherapy CPT/HCPCS procedure codes. Codes for renal cancer are shown as examples.

PX2	CHEMOCAT	CODE_TYPE	DESCRIPTION
J9045	CARBOPLATIN	HCPC	Carboplatin, 50 mg
J9062	CISPLATIN	HCPC	Cisplatin, 50 mg
C9418	CISPLATIN	HCPC	CISPLATIN, POWDER OR SOLUTION, BRAND NAME, PER 10 MG
J9060	CISPLATIN	HCPC	Cisplatin, powder or solution, per 10 mg
209622	CISPLATIN	HCPC	REIMB CISPLATIN 10 MG VIAL (PLATINOL).
J9000	DOXORUBICIN	HCPC	Doxorubicin HCl, 10 mg A
J9001	DOXORUBICIN	HCPC	Doxorubicin HCl, all lipid formulations, 10 mg A
C9415	DOXORUBICIN	HCPC	DOXORUBICIN HCL, BRAND NAME, 10 MG
J9002	DOXORUBICIN	HCPC	DOXORUBICIN HCL, LIPOSOMAL, 10 MG IV
Q2049	DOXORUBICIN	HCPC	DOXORUBICIN HCL, LIPOSOMAL, 10 MG IV
Q2048	DOXORUBICIN	HCPC	INJ DOXORUBICIN HYDROCHLORIDE LIP DOXIL 10 MG
Q2050	DOXORUBICIN	HCPC	INJECTION DOXORUBICIN HCL LIPOSOMAL NOS 10 MG
J9190	FLUOROURACIL	HCPC	Fluorouracil, 500 mg
J9201	GEMCITABINE	HCPC	Gemcitabine HCl, 200 mg
J9264	PACLITAXEL	HCPC	Injection, paclitaxel protein-bound particles, 1 mg

J9267	PACLITAXEL	HCPC	INJECTION, PACLITAXEL, 1 MG
J9265	PACLITAXEL	HCPC	Paclitaxel, 30 mg
C9431	PACLITAXEL	HCPC	PACLITAXEL, BRAND NAME, 30 MG

Table S4. Chemotherapy National Drug Codes.

National Drug Code	CHEMOCAT	GENERIC_NAME	BRAND_NAME	DATE_ADDED
16714046701	CAPECITABINE	CAPECITABINE	CAPECITABINE	3/31/2016
16714046801	CAPECITABINE	CAPECITABINE	CAPECITABINE	3/31/2016
00179019570	CAPECITABINE	CAPECITABINE	CAPECITABINE 500 MG TABLET (UD)	3/31/2016
00093747306	CAPECITABINE	CAPECITABINE	CAPECITABINE TAB 150 MG	6/16/2014
00093747489	CAPECITABINE	CAPECITABINE	CAPECITABINE TAB 500 MG	6/16/2014
54569571700	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
54868414300	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
54868414301	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
54868414302	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
54868526000	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
54868526001	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
54868526002	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
54868526003	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
54868526004	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011

54868526005	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
54868526006	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
54868526007	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
54868526008	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
54868526009	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
68258903601	CAPECITABINE	CAPECITABINE	XELODA	4/25/2011
00004110020	CAPECITABINE	CAPECITABINE	XELODA TAB 150MG	4/25/2011
00004110051	CAPECITABINE	CAPECITABINE	XELODA TAB 150MG	4/25/2011
00004110116	CAPECITABINE	CAPECITABINE	XELODA TAB 500MG	4/25/2011
00004110150	CAPECITABINE	CAPECITABINE	XELODA TAB 500MG	4/25/2011
00004110175	CAPECITABINE	CAPECITABINE	XELODA TAB 500MG	5/31/2012
16729007212	CAPECITABINE	CAPECITABINE 150 MG TABLET	CAPECITABINE 150 MG ORAL TAB	7/17/2015
64980027606	CAPECITABINE	CAPECITABINE 150 MG TABLET	CAPECITABINE 150 MG ORAL TAB	4/10/2017
65162084306	CAPECITABINE	CAPECITABINE 150 MG TABLET	CAPECITABINE 150 MG ORAL TAB	4/10/2017
01671446701	CAPECITABINE	CAPECITABINE 150 MG TABLET	CAPECITABINE 150 MG TABLET	3/31/2016
01672907212	CAPECITABINE	CAPECITABINE 150 MG TABLET	CAPECITABINE 150 MG TABLET	3/31/2016

04229119060	CAPECITABINE	CAPECITABINE 150 MG TABLET	CAPECITABINE 150 MG TABLET	3/31/2016
00179014970	CAPECITABINE	CAPECITABINE 500 MG TABLET	CAPECITABINE 500 MG ORAL TAB	7/17/2015
00179022970	CAPECITABINE	CAPECITABINE 500 MG TABLET	CAPECITABINE 500 MG ORAL TAB	3/12/2018
16729007329	CAPECITABINE	CAPECITABINE 500 MG TABLET	CAPECITABINE 500 MG ORAL TAB	7/17/2015
64980027712	CAPECITABINE	CAPECITABINE 500 MG TABLET	CAPECITABINE 500 MG ORAL TAB	4/10/2017
65162084416	CAPECITABINE	CAPECITABINE 500 MG TABLET	CAPECITABINE 500 MG ORAL TAB	4/10/2017
01671446801	CAPECITABINE	CAPECITABINE 500 MG TABLET	CAPECITABINE 500 MG TABLET	3/31/2016
01672907329	CAPECITABINE	CAPECITABINE 500 MG TABLET	CAPECITABINE 500 MG TABLET	3/31/2016
04229119112	CAPECITABINE	CAPECITABINE 500 MG TABLET	CAPECITABINE 500 MG TABLET	3/31/2016
05107951001	CAPECITABINE	CAPECITABINE 500 MG TABLET	CAPECITABINE 500 MG TABLET	3/31/2016
05107951005	CAPECITABINE	CAPECITABINE 500 MG TABLET	CAPECITABINE 500 MG TABLET	3/31/2016
00179156770	CAPECITABINE	CAPECITABINE 500 MG TABLET	XELODA 500 MG ORAL TAB	7/17/2015
05486852600	CAPECITABINE	CAPECITABINE 500 MG TABLET	XELODA 500 MG TABLET	3/31/2016
05486852601	CAPECITABINE	CAPECITABINE 500 MG TABLET	XELODA 500 MG TABLET	3/31/2016
05486852602	CAPECITABINE	CAPECITABINE 500 MG TABLET	XELODA 500 MG TABLET	3/31/2016
05486852603	CAPECITABINE	CAPECITABINE 500 MG TABLET	XELODA 500 MG TABLET	3/31/2016

05486852605	CAPECITABINE	CAPECITABINE 500 MG TABLET	XELODA 500 MG TABLET	3/31/2016
05486852609	CAPECITABINE	CAPECITABINE 500 MG TABLET	XELODA 500 MG TABLET	3/31/2016
00054027121	CAPECITABINE	Capecitabine Tab 150 MG	#N/A	2/1/2017
00378251191	CAPECITABINE	Capecitabine Tab 150 MG	#N/A	7/17/2015
42291019060	CAPECITABINE	Capecitabine Tab 150 MG	#N/A	7/17/2015
42291016712	CAPECITABINE	CAPECITABINE TAB 500 MG	CAPECITABINE	3/12/2018
00054027223	CAPECITABINE	Capecitabine Tab 500 MG	#N/A	2/1/2017
00378251278	CAPECITABINE	Capecitabine Tab 500 MG	#N/A	7/17/2015
42291019112	CAPECITABINE	Capecitabine Tab 500 MG	#N/A	7/17/2015
51079051001	CAPECITABINE	Capecitabine Tab 500 MG	#N/A	7/17/2015
51079051005	CAPECITABINE	Capecitabine Tab 500 MG	#N/A	7/17/2015
60687014911	CAPECITABINE	Capecitabine Tab 500 MG	#N/A	2/1/2017
60687014994	CAPECITABINE	Capecitabine Tab 500 MG	#N/A	2/1/2017
54868414303	CAPECITABINE	XELODA 150 MG	XELODA	4/25/2011
49452317504	FLUOROURACIL	5-FLUOROURACIL (U.S.P.)	5-FLUOROURACIL	4/25/2011
44778007701	FLUOROURACIL	5-FLUOROURACIL 10 MG/0.2 ML INTRAVITREAL INJ	5-FLUOROURACIL 10 MG/0.2 ML INTRAVITREAL INJ	7/17/2015

007033018 11	FLUOROUR ACIL	ADRUCIL	Fluorouracil Inj 2.5 GM/50ML (50 MG/ML)	6/16/201 4
007033019 11	FLUOROUR ACIL	ADRUCIL	Fluorouracil Inj 5 GM/100ML (50 MG/ML)	6/16/201 4
007033015 11	FLUOROUR ACIL	ADRUCIL	Fluorouracil Inj 500 MG/10ML (50 MG/ML)	6/16/201 4
000041904 06	FLUOROUR ACIL	FLUOROURACIL	[Generic]	3/31/201 6
494523175 02	FLUOROUR ACIL	FLUOROURACIL	5-FLUOROURACIL	4/25/201 1
494523175 03	FLUOROUR ACIL	FLUOROURACIL	5-FLUOROURACIL	4/25/201 1
629911486 02	FLUOROUR ACIL	FLUOROURACIL	5-FLUOROURACIL	4/25/201 1
633700095 15	FLUOROUR ACIL	FLUOROURACIL	5-FLUOROURACIL	4/25/201 1
633700095 25	FLUOROUR ACIL	FLUOROURACIL	5-FLUOROURACIL	4/25/201 1
633700095 35	FLUOROUR ACIL	FLUOROURACIL	5-FLUOROURACIL	4/25/201 1
494523175 01	FLUOROUR ACIL	FLUOROURACIL	5-FLUOROURACIL POW	4/25/201 1
000131026 91	FLUOROUR ACIL	FLUOROURACIL	ADRUCIL	3/31/201 6
000131036 01	FLUOROUR ACIL	FLUOROURACIL	ADRUCIL	3/31/201 6
000131046 01	FLUOROUR ACIL	FLUOROURACIL	ADRUCIL	3/31/201 6
000131056 02	FLUOROUR ACIL	FLUOROURACIL	ADRUCIL	3/31/201 6
000131056 91	FLUOROUR ACIL	FLUOROURACIL	ADRUCIL	3/31/201 6

007033015 13	FLUOROUR ACIL	FLUOROURACIL	ADRUCIL	4/25/201 1
007033018 12	FLUOROUR ACIL	FLUOROURACIL	ADRUCIL	4/25/201 1
007033019 12	FLUOROUR ACIL	FLUOROURACIL	ADRUCIL	4/25/201 1
000131056 94	FLUOROUR ACIL	FLUOROURACIL	ADRUCIL INJ 50MG/ML	4/25/201 1
548685450 00	FLUOROUR ACIL	FLUOROURACIL	CARAC	4/10/201 7
001873203 02	FLUOROUR ACIL	FLUOROURACIL	EFUDEX 5% SOLUTION	3/12/201 8
003042174 22	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL	3/31/201 6
101390063 01	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL	4/25/201 1
101390063 11	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL	4/25/201 1
101390063 12	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL	4/25/201 1
101390063 50	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL	4/25/201 1
387790025 01	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL	4/25/201 1
387790025 04	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL	4/25/201 1
387790025 05	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL	4/25/201 1
387790025 09	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL	4/25/201 1
515520733 01	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL	4/25/201 1

51552073302	FLUOROURACIL	FLUOROURACIL	FLUOROURACIL	4/25/2011
51552073304	FLUOROURACIL	FLUOROURACIL	FLUOROURACIL	4/25/2011
51552073305	FLUOROURACIL	FLUOROURACIL	FLUOROURACIL	4/25/2011
51927108500	FLUOROURACIL	FLUOROURACIL	FLUOROURACIL	4/25/2011
53638059980	FLUOROURACIL	FLUOROURACIL	FLUOROURACIL	3/31/2016
54569140600	FLUOROURACIL	FLUOROURACIL	FLUOROURACIL	3/31/2016
68682008531	FLUOROURACIL	FLUOROURACIL	FLUOROURACIL	4/25/2011
39769001250	FLUOROURACIL	FLUOROURACIL	FLUOROURACIL 50MG/ML AMPUL	3/31/2016
00004197701	FLUOROURACIL	FLUOROURACIL	FLUOROURACIL 50MG/ML VIAL	4/25/2011
00469171060	FLUOROURACIL	FLUOROURACIL	FLUOROURACIL 50MG/ML VIAL	4/25/2011
00069017301	FLUOROURACIL	FLUOROURACIL	Fluorouracil Inj 1 GM/20ML (50 MG/ML)	6/16/2014
00069017302	FLUOROURACIL	FLUOROURACIL	Fluorouracil Inj 1 GM/20ML (50 MG/ML)	6/16/2014
10139006320	FLUOROURACIL	FLUOROURACIL	FLUOROURACIL INJ 1 GM/20ML (50 MG/ML)	4/22/2013
16729027667	FLUOROURACIL	FLUOROURACIL	Fluorouracil Inj 1 GM/20ML (50 MG/ML)	6/16/2014
00069017401	FLUOROURACIL	FLUOROURACIL	Fluorouracil Inj 2.5 GM/50ML (50 MG/ML)	6/16/2014
16729027611	FLUOROURACIL	FLUOROURACIL	Fluorouracil Inj 2.5 GM/50ML (50 MG/ML)	6/16/2014

000690176 01	FLUOROUR ACIL	FLUOROURACIL	Fluorouracil Inj 5 GM/100ML (50 MG/ML)	6/16/201 4
167290276 38	FLUOROUR ACIL	FLUOROURACIL	Fluorouracil Inj 5 GM/100ML (50 MG/ML)	6/16/201 4
000690169 01	FLUOROUR ACIL	FLUOROURACIL	Fluorouracil Inj 500 MG/10ML (50 MG/ML)	6/16/201 4
101390063 10	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL INJ 500 MG/10ML (50 MG/ML)	4/22/201 3
167290276 68	FLUOROUR ACIL	FLUOROURACIL	Fluorouracil Inj 500 MG/10ML (50 MG/ML)	6/16/201 4
001873953 64	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL INJ 50MG/ML	4/25/201 1
633230117 51	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL INJ 50MG/ML	4/25/201 1
633230117 61	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL INJ 50MG/ML	4/25/201 1
633230117 10	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL INJ 50MG/ML UD	4/25/201 1
633230117 20	FLUOROUR ACIL	FLUOROURACIL	FLUOROURACIL INJ 50MG/ML UD	4/25/201 1
387790025 03	FLUOROUR ACIL	FLUOROURACIL	FLUOROURCCIL (BULK) POWDER	4/22/201 3
387790025 06	FLUOROUR ACIL	FLUOROURACIL	FLUOROURCCIL (BULK) POWDER	4/22/201 3
629911486 04	FLUOROUR ACIL	FLUOROURACIL	FLUOROURCCIL (BULK) POWDER	4/22/201 3
000131036 91	FLUOROUR ACIL	FLUOROURACIL	#N/A	4/25/201 1
000131036 95	FLUOROUR ACIL	FLUOROURACIL	#N/A	4/25/201 1
000131046 94	FLUOROUR ACIL	FLUOROURACIL	#N/A	4/25/201 1

00081039001	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
00081039003	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
00182306863	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
00418017110	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
00469171030	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
00469171040	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
00469171100	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
00702171030	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
10019095002	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
38779002510	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
38779002525	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
39769001210	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
39769001240	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
39769001290	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
51309021710	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011
51309021720	FLUOROURACIL	FLUOROURACIL	#N/A	4/25/2011

513090217 50	FLUOROUR ACIL	FLUOROURACIL	#N/A	4/25/201 1
513090217 98	FLUOROUR ACIL	FLUOROURACIL	#N/A	4/25/201 1
514320409 10	FLUOROUR ACIL	FLUOROURACIL	#N/A	4/25/201 1
514320470 10	FLUOROUR ACIL	FLUOROURACIL	#N/A	4/25/201 1
532581710 03	FLUOROUR ACIL	FLUOROURACIL	#N/A	4/25/201 1
532581711 00	FLUOROUR ACIL	FLUOROURACIL	#N/A	4/25/201 1
539050111 10	FLUOROUR ACIL	FLUOROURACIL	#N/A	4/25/201 1
617030409 32	FLUOROUR ACIL	FLUOROURACIL	#N/A	4/25/201 1
617030409 53	FLUOROUR ACIL	FLUOROURACIL	#N/A	4/25/201 1
617030409 67	FLUOROUR ACIL	FLUOROURACIL	#N/A	4/25/201 1
494523175 05	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % MISC POWD	5/23/201 7
609660133 04	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % MISC POWD	7/17/201 5
609660233 03	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % MISC POWD	7/17/201 5
609660333 02	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % MISC POWD	7/17/201 5
609660433 01	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 %	FLUOROURACIL (BULK) 100 % MISC POWD	7/17/201 5

		POWDER		
038779002 51	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
038779002 53	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
038779002 54	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
038779002 55	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
038779002 56	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
038779002 59	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
049452317 51	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
049452317 52	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
049452317 53	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
049452317 54	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
051552073 31	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6

051552073 32	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
051552073 34	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
051552073 35	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
051927108 50	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
060966133 04	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
060966233 03	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
060966333 02	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
060966433 01	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
062991148 61	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
062991148 62	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
062991148 63	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6
062991148 64	FLUOROUR ACIL	FLUOROURACIL (BULK) 100 % POWDER	FLUOROURACIL (BULK) 100 % POWDER	3/31/201 6

629911486 01	FLUOROUR ACIL	FLUOROURACIL (U.S.P.)	5-FLUOROURACIL	4/25/201 1
629911486 03	FLUOROUR ACIL	FLUOROURACIL (U.S.P.)	5-FLUOROURACIL	4/25/201 1
010139063 12	FLUOROUR ACIL	FLUOROURACIL 1 GRAM/20 ML INTRAVENOUS SO	FLUOROURACIL 1 GRAM/20 ML INTRAVENOU	3/31/201 6
010139063 20	FLUOROUR ACIL	FLUOROURACIL 1 GRAM/20 ML INTRAVENOUS SO	FLUOROURACIL 1 GRAM/20 ML INTRAVENOU	3/31/201 6
016729276 05	FLUOROUR ACIL	FLUOROURACIL 1 GRAM/20 ML INTRAVENOUS SO	FLUOROURACIL 1 GRAM/20 ML INTRAVENOU	3/31/201 6
016729276 67	FLUOROUR ACIL	FLUOROURACIL 1 GRAM/20 ML INTRAVENOUS SO	FLUOROURACIL 1 GRAM/20 ML INTRAVENOU	3/31/201 6
063323117 20	FLUOROUR ACIL	FLUOROURACIL 1 GRAM/20 ML INTRAVENOUS SO	FLUOROURACIL 1 GRAM/20 ML INTRAVENOU	3/31/201 6
063323117 28	FLUOROUR ACIL	FLUOROURACIL 1 GRAM/20 ML INTRAVENOUS SO	FLUOROURACIL 1 GRAM/20 ML INTRAVENOU	3/31/201 6
068001266 29	FLUOROUR ACIL	FLUOROURACIL 1 GRAM/20 ML INTRAVENOUS SO	FLUOROURACIL 1 GRAM/20 ML INTRAVENOU	3/31/201 6
068001266 31	FLUOROUR ACIL	FLUOROURACIL 1 GRAM/20 ML INTRAVENOUS SO	FLUOROURACIL 1 GRAM/20 ML INTRAVENOU	3/31/201 6
010139063 50	FLUOROUR ACIL	FLUOROURACIL 2.5 GRAM/50 ML INTRAVENOUS	FLUOROURACIL 2.5 GRAM/50 ML INTRAVEN	3/31/201 6
016729276 11	FLUOROUR ACIL	FLUOROURACIL 2.5 GRAM/50 ML INTRAVENOUS	FLUOROURACIL 2.5 GRAM/50 ML INTRAVEN	3/31/201 6

063323117 51	FLUOROUR ACIL	FLUOROURACIL 2.5 GRAM/50 ML INTRAVENOUS	FLUOROURACIL 2.5 GRAM/50 ML INTRAVEN	3/31/201 6
063323117 58	FLUOROUR ACIL	FLUOROURACIL 2.5 GRAM/50 ML INTRAVENOUS	FLUOROURACIL 2.5 GRAM/50 ML INTRAVEN	3/31/201 6
063323117 59	FLUOROUR ACIL	FLUOROURACIL 2.5 GRAM/50 ML INTRAVENOUS	FLUOROURACIL 2.5 GRAM/50 ML INTRAVEN	3/31/201 6
068001266 24	FLUOROUR ACIL	FLUOROURACIL 2.5 GRAM/50 ML INTRAVENOUS	FLUOROURACIL 2.5 GRAM/50 ML INTRAVEN	3/31/201 6
068001266 27	FLUOROUR ACIL	FLUOROURACIL 2.5 GRAM/50 ML INTRAVENOUS	FLUOROURACIL 2.5 GRAM/50 ML INTRAVEN	3/31/201 6
250210215 98	FLUOROUR ACIL	FLUOROURACIL 2.5 GRAM/50 ML INTRAVENOUS SOLUTION	FLUOROURACIL 2.5 GRAM/50 ML IV SOLN	2/1/2017
633230117 59	FLUOROUR ACIL	FLUOROURACIL 2.5 GRAM/50 ML INTRAVENOUS SOLUTION	FLUOROURACIL 2.5 GRAM/50 ML IV SOLN	7/17/201 5
010139063 01	FLUOROUR ACIL	FLUOROURACIL 5 GRAM/100 ML INTRAVENOUS S	FLUOROURACIL 5 GRAM/100 ML INTRAVENO	3/31/201 6
016729276 38	FLUOROUR ACIL	FLUOROURACIL 5 GRAM/100 ML INTRAVENOUS S	FLUOROURACIL 5 GRAM/100 ML INTRAVENO	3/31/201 6
063323117 61	FLUOROUR ACIL	FLUOROURACIL 5 GRAM/100 ML INTRAVENOUS S	FLUOROURACIL 5 GRAM/100 ML INTRAVENO	3/31/201 6
063323117 68	FLUOROUR ACIL	FLUOROURACIL 5 GRAM/100 ML INTRAVENOUS S	FLUOROURACIL 5 GRAM/100 ML INTRAVENO	3/31/201 6

063323117 69	FLUOROUR ACIL	FLUOROURACIL 5 GRAM/100 ML INTRAVENOUS S	FLUOROURACIL 5 GRAM/100 ML INTRAVENO	3/31/201 6
068001266 32	FLUOROUR ACIL	FLUOROURACIL 5 GRAM/100 ML INTRAVENOUS S	FLUOROURACIL 5 GRAM/100 ML INTRAVENO	3/31/201 6
068001266 33	FLUOROUR ACIL	FLUOROURACIL 5 GRAM/100 ML INTRAVENOUS S	FLUOROURACIL 5 GRAM/100 ML INTRAVENO	3/31/201 6
250210215 99	FLUOROUR ACIL	FLUOROURACIL 5 GRAM/100 ML INTRAVENOUS SOLUTION	FLUOROURACIL 5 GRAM/100 ML IV SOLN	2/1/2017
633230117 69	FLUOROUR ACIL	FLUOROURACIL 5 GRAM/100 ML INTRAVENOUS SOLUTION	FLUOROURACIL 5 GRAM/100 ML IV SOLN	7/17/201 5
010139063 10	FLUOROUR ACIL	FLUOROURACIL 500 MG/10 ML INTRAVENOUS SO	FLUOROURACIL 500 MG/10 ML INTRAVENOU	3/31/201 6
010139063 11	FLUOROUR ACIL	FLUOROURACIL 500 MG/10 ML INTRAVENOUS SO	FLUOROURACIL 500 MG/10 ML INTRAVENOU	3/31/201 6
016729276 03	FLUOROUR ACIL	FLUOROURACIL 500 MG/10 ML INTRAVENOUS SO	FLUOROURACIL 500 MG/10 ML INTRAVENOU	3/31/201 6
016729276 68	FLUOROUR ACIL	FLUOROURACIL 500 MG/10 ML INTRAVENOUS SO	FLUOROURACIL 500 MG/10 ML INTRAVENOU	3/31/201 6
063323117 10	FLUOROUR ACIL	FLUOROURACIL 500 MG/10 ML INTRAVENOUS SO	FLUOROURACIL 500 MG/10 ML INTRAVENOU	3/31/201 6
063323117 18	FLUOROUR ACIL	FLUOROURACIL 500 MG/10 ML INTRAVENOUS SO	FLUOROURACIL 500 MG/10 ML INTRAVENOU	3/31/201 6

063323117 19	FLUOROUR ACIL	FLUOROURACIL 500 MG/10 ML INTRAVENOUS SO	FLUOROURACIL 500 MG/10 ML INTRAVENOU	3/31/201 6
068001266 28	FLUOROUR ACIL	FLUOROURACIL 500 MG/10 ML INTRAVENOUS SO	FLUOROURACIL 500 MG/10 ML INTRAVENOU	3/31/201 6
068001266 30	FLUOROUR ACIL	FLUOROURACIL 500 MG/10 ML INTRAVENOUS SO	FLUOROURACIL 500 MG/10 ML INTRAVENOU	3/31/201 6
633230117 19	FLUOROUR ACIL	FLUOROURACIL 500 MG/10 ML INTRAVENOUS SOLUTION	FLUOROURACIL 500 MG/10 ML IV SOLN	7/17/201 5
167290276 05	FLUOROUR ACIL	Fluorouracil Inj 1 GM/20ML (50 MG/ML)	#N/A	7/17/201 5
633230117 28	FLUOROUR ACIL	Fluorouracil Inj 1 GM/20ML (50 MG/ML)	#N/A	7/17/201 5
680010266 29	FLUOROUR ACIL	Fluorouracil Inj 1 GM/20ML (50 MG/ML)	#N/A	7/17/201 5
680010266 31	FLUOROUR ACIL	Fluorouracil Inj 1 GM/20ML (50 MG/ML)	#N/A	7/17/201 5
633230117 58	FLUOROUR ACIL	Fluorouracil Inj 2.5 GM/50ML (50 MG/ML)	#N/A	7/17/201 5
680010266 24	FLUOROUR ACIL	Fluorouracil Inj 2.5 GM/50ML (50 MG/ML)	#N/A	7/17/201 5
680010266 27	FLUOROUR ACIL	Fluorouracil Inj 2.5 GM/50ML (50 MG/ML)	#N/A	7/17/201 5
633230117 68	FLUOROUR ACIL	Fluorouracil Inj 5 GM/100ML (50	#N/A	7/17/201 5

		MG/ML)		
680010266 32	FLUOROUR ACIL	Fluorouracil Inj 5 GM/100ML (50 MG/ML)	#N/A	7/17/201 5
680010266 33	FLUOROUR ACIL	Fluorouracil Inj 5 GM/100ML (50 MG/ML)	#N/A	7/17/201 5
667580044 01	FLUOROUR ACIL	FLUOROURACIL INJ 50 MG/ML	FLUOROURACIL	5/31/201 2
667580044 03	FLUOROUR ACIL	FLUOROURACIL INJ 50 MG/ML	FLUOROURACIL	5/31/201 2
000690169 02	FLUOROUR ACIL	Fluorouracil Inj 500 MG/10ML (50 MG/ML)	#N/A	7/17/201 5
167290276 03	FLUOROUR ACIL	Fluorouracil Inj 500 MG/10ML (50 MG/ML)	#N/A	7/17/201 5
633230117 18	FLUOROUR ACIL	Fluorouracil Inj 500 MG/10ML (50 MG/ML)	#N/A	7/17/201 5
680010266 28	FLUOROUR ACIL	Fluorouracil Inj 500 MG/10ML (50 MG/ML)	#N/A	7/17/201 5
680010266 30	FLUOROUR ACIL	Fluorouracil Inj 500 MG/10ML (50 MG/ML)	#N/A	7/17/201 5
550452103 08	FLUOROUR ACIL	FLUOROURACIL SOLN 1%	FLUROPLEX SOLN 1 % EX	3/12/201 8
516724062 01	FLUOROUR ACIL	FLUOROURACIL SOLN 2 %	FLUOROURACIL 2 % SOL TARO	3/12/201 8
001873202 02	FLUOROUR ACIL	FLUOROURACIL SOLN 2 % VALE	EFUDEX 2 % SOL VALE	3/12/201 8
001873202 10	FLUOROUR ACIL	FLUOROURACIL SOLN 2 % VALE	EFUDEX 2 % SOL VALE	3/12/201 8

516724063 01	FLUOROUR ACIL	FLUOROURACIL SOLN 5 %	FLUOROURACIL 5 % SOL TARO	3/12/201 8
435470258 01	FLUOROUR ACIL	FLUOROURACIL SOLN 5 % DRO SOLC	FLUOROURACIL 5 % DRO SOLC	3/12/201 8
001873203 10	FLUOROUR ACIL	FLUOROURACIL SOLN 5 % VALE	EFUDEX 5 % SOL VALE	3/12/201 8
000041705 06	FLUOROUR ACIL	FLUOROURACIL SOLN 5%	EFUDEX 5PC SOLUTION	3/12/201 8
216950829 40	FLUOROUR ACIL	#N/A	FLUOROURACIL	3/31/201 6
545696279 00	FLUOROUR ACIL	#N/A	FLUOROURACIL	3/31/201 6
548686293 00	FLUOROUR ACIL	#N/A	FLUOROURACIL	3/31/201 6
447780171 01	FLUOROUR ACIL	#N/A	FLUOROURACIL- TRIAMCINOLONE 20-1 MG/0.5 ML INTRALESIONAL INJ	2/1/2017

Table S5. Targeted therapy CPT/HCPCS procedure codes.

PX2	CHEMOCAT	CODE_TYPE	DESCRIPTION
S0116	BEVACIZUMAB	HCPC	BEVACIZUMAB 100 MG
C9257	BEVACIZUMAB	HCPC	Injection, bevacizumab, 0.25 mg
Q2024	BEVACIZUMAB	HCPC	Injection, bevacizumab, 0.25 mg
J9035	BEVACIZUMAB	HCPC	Injection, bevacizumab, 10 mg
C9214	BEVACIZUMAB	HCPC	INJECTION, BEVACIZUMAB, PER 10 MG
J9330	TEMSIROLIMUS	HCPC	INJECTION, TEMSIROLIMUS, 1 MG

Table S6. Targeted therapy National Drug Codes.

National Drug Code	CHEMOCAT	GENERIC_NAME	BRAND_NAME	DATE_ADDED
00069014501	AXITINIB	AXITINIB	INLYTA	5/21/2012
00069015111	AXITINIB	AXITINIB	INLYTA	5/21/2012
42388001214	CABOZANTINIB	CABOZANTINIB	CABOZANTINIB S-MALCAP 1 X 80 MG & 1 X 20 MG (100 Dose) Kit	4/22/2013
42388001114	CABOZANTINIB	CABOZANTINIB	CABOZANTINIB S-MALCAP 1 X 80 MG & 3 X 20 MG (140 Dose) Kit	4/22/2013
42388001314	CABOZANTINIB	CABOZANTINIB	CABOZANTINIB S-MALATE CAP 3 X 20 MG (60 MG Dose) Kit	4/22/2013
04238801214	CABOZANTINIB	CABOZANTINIB 100 MG/DAY (80 MG	COMETRIQ 100 MG/DAY(80 MG[1]-20 MG[1	3/31/2016
04238801114	CABOZANTINIB	CABOZANTINIB 140 MG/DAY (80 MG	COMETRIQ 140 MG/DAY(80 MG[1]-20 MG[3	3/31/2016
04238801314	CABOZANTINIB	CABOZANTINIB 60 MG/DAY (20 MG	COMETRIQ 60 MG/DAY (20 MG [3]/DAY) C	3/31/2016
42388002426	CABOZANTINIB	Cabozantinib S-Malate Tab 20 MG (Base Equivalent)	#N/A	2/1/2017
42388002526	CABOZANTINIB	Cabozantinib S-Malate Tab 40 MG (Base Equivalent)	#N/A	2/1/2017
42388002326	CABOZANTINIB	Cabozantinib S-Malate Tab 60 MG (Base Equivalent)	#N/A	2/1/2017

05024206 301	ERLOTINIB	ERLOTINIB 100 MG TABLET	TARCEVA 100 MG TABLET	3/31/2016
05486854 740	ERLOTINIB	ERLOTINIB 100 MG TABLET	TARCEVA 100 MG TABLET	3/31/2016
05024206 401	ERLOTINIB	ERLOTINIB 150 MG TABLET	TARCEVA 150 MG TABLET	3/31/2016
05486854 470	ERLOTINIB	ERLOTINIB 150 MG TABLET	TARCEVA 150 MG TABLET	3/31/2016
05024206 201	ERLOTINIB	ERLOTINIB 25 MG TABLET	TARCEVA 25 MG TABLET	3/31/2016
05486852 900	ERLOTINIB	ERLOTINIB 25 MG TABLET	TARCEVA 25 MG TABLET	3/31/2016
54868529 000	ERLOTINIB	ERLOTINIB HCL	TARCEVA	4/25/2011
54868544 700	ERLOTINIB	ERLOTINIB HCL	TARCEVA	4/25/2011
54868547 400	ERLOTINIB	ERLOTINIB HCL	TARCEVA	4/25/2011
50242006 301	ERLOTINIB	ERLOTINIB HCL	TARCEVA TAB 100MG	4/25/2011
54569584 700	ERLOTINIB	ERLOTINIB HCL	TARCEVA TAB 100MG	5/31/2012
50242006 401	ERLOTINIB	ERLOTINIB HCL	TARCEVA TAB 150MG	4/25/2011
54569584 800	ERLOTINIB	ERLOTINIB HCL	TARCEVA TAB 150MG	5/31/2012
50242006 201	ERLOTINIB	ERLOTINIB HCL	TARCEVA TAB 25MG	4/25/2011
00078062 651	EVEROLIMUS	AFINITOR DISPERZ	Everolimus Tab for Oral Susp 2 MG	6/16/2014
00078062 661	EVEROLIMUS	AFINITOR DISPERZ	Everolimus Tab for Oral Susp 2 MG	6/16/2014

00078062 751	EVEROLIMUS	AFINITOR DISPERZ	Everolimus Tab for Oral Susp 3 MG	6/16/2014
00078062 761	EVEROLIMUS	AFINITOR DISPERZ	Everolimus Tab for Oral Susp 3 MG	6/16/2014
00078062 851	EVEROLIMUS	AFINITOR DISPERZ	Everolimus Tab for Oral Susp 5 MG	6/16/2014
00078062 861	EVEROLIMUS	AFINITOR DISPERZ	Everolimus Tab for Oral Susp 5 MG	6/16/2014
00078056 751	EVEROLIMUS	EVEROLIMUS	AFINITOR TAB 10MG	4/25/2011
00078056 651	EVEROLIMUS	EVEROLIMUS	AFINITOR TAB 5MG	4/25/2011
00078041 761	EVEROLIMUS	EVEROLIMUS	EVEROLIMUS TAB 0.25 MG	5/31/2012
00078041 461	EVEROLIMUS	EVEROLIMUS	EVEROLIMUS TAB 0.5 MG	5/31/2012
00078041 561	EVEROLIMUS	EVEROLIMUS	EVEROLIMUS TAB 0.75 MG	5/31/2012
00078056 761	EVEROLIMUS	EVEROLIMUS	EVEROLIMUS TAB 10 MG	5/31/2012
00078059 451	EVEROLIMUS	EVEROLIMUS	EVEROLIMUS TAB 2.5 MG	5/31/2012
00078059 461	EVEROLIMUS	EVEROLIMUS	EVEROLIMUS TAB 2.5 MG	5/31/2012
00078056 661	EVEROLIMUS	EVEROLIMUS	EVEROLIMUS TAB 5 MG	5/31/2012
00078062 051	EVEROLIMUS	EVEROLIMUS	EVEROLIMUS TAB 7.5 MG	5/31/2012
00078062 061	EVEROLIMUS	EVEROLIMUS	EVEROLIMUS TAB 7.5 MG	5/31/2012
00078041 720	EVEROLIMUS	EVEROLIMUS	ZORTRESS TAB 0.25MG	5/21/2012

00078041 420	EVEROLIMUS	EVEROLIMUS	ZORTRESS TAB 0.5MG	5/21/2012
00078041 520	EVEROLIMUS	EVEROLIMUS	ZORTRESS TAB 0.75MG	5/21/2012
00173080 409	PAZOPANIB	PAZOPANIB HCL	VOTRIENT TAB 200MG	4/25/2011
00078067 066	PAZOPANIB	Pazopanib HCl Tab 200 MG (Base Equiv)	#N/A	2/1/2017
05041948 858	SORAFENIB	SORAFENIB 200 MG TABLET	NEXAVAR 200 MG TABLET	3/31/2016
00026848 858	SORAFENIB	SORAFENIB TOSYLATE	NEXAVAR TAB 200MG	4/25/2011
50419048 858	SORAFENIB	SORAFENIB TOSYLATE TAB 200 MG (BASE EQUIVALENT)	NEXAVAR	5/31/2012
99999090 198	SORAFENIB	#N/A	STUDY E-2805: SORAFENIB 200	6/16/2014
99999090 078	SORAFENIB	#N/A	STUDY RENAL CELL- BAY: SORAFENIB	6/16/2014
54569598 200	SUNITINIB	SUNITINIB MALATE	SUTENT	4/25/2011
54569598 300	SUNITINIB	SUNITINIB MALATE	SUTENT	4/25/2011
54868557 300	SUNITINIB	SUNITINIB MALATE	SUTENT	3/31/2016
00069055 038	SUNITINIB	SUNITINIB MALATE	SUTENT CAP 12.5MG	4/25/2011
00069077 030	SUNITINIB	SUNITINIB MALATE	SUTENT CAP 25MG	4/25/2011
00069077 038	SUNITINIB	SUNITINIB MALATE	SUTENT CAP 25MG	4/25/2011

00069098 030	SUNITINIB	SUNITINIB MALATE	SUTENT CAP 50MG	4/25/2011
00069098 038	SUNITINIB	SUNITINIB MALATE	SUTENT CAP 50MG	4/25/2011
00069055 030	SUNITINIB	SUNITINIB MALATE	#N/A	4/25/2011
00069083 038	SUNITINIB	Sunitinib Malate Cap 37.5 MG (Base Equivalent)	#N/A	7/17/2015
99999090 321	SUNITINIB	#N/A	STUDY E-2805: SUNITINIB 50M	6/16/2014

Table S7. Autoimmune disease ICD diagnosis codes. 56 categories of ICD codes associated with autoimmune diseases, including those for thyroiditis, type I diabetes mellitus, myalgia and myositis, chronic hepatitis, psoriasis vulgaris, inflammatory bowel disease (IBD, including ulcerative colitis and Crohn’s disease), rheumatoid arthritis, Raynaud's syndrome, polymyalgia rheumatica, sarcoidosis, ankylosing spondylitis, autoimmune hemolytic anemias, systemic lupus erythematosus, biliary cirrhosis, celiac disease, diffuse diseases of connective tissue, peripheral autonomic neuropathy, psoriatic arthropathy, sicca syndrome, systemic sclerosis, autoimmune disease not elsewhere classified (NEC), “other immunological findings”, “other disorders of the immune mechanism”, acute rheumatic heart disease, alopecia, arthropathy, Behcet's syndrome, bullous dermatoses, dermatomyositis, diseases of hair and hair follicles, encephalitis, endocarditis, giant cell arteritis, glomerulonephritis, glucocorticoid deficiency, graves' disease, hypothyroidism NOS, inflammatory and toxic neuropathy, multiple sclerosis, myoneural disorders, nephritis, “other demyelinating diseases of central nervous system”, “other diseases of lung”, “other endocrine disorders”, “other specified diffuse diseases of connective tissue”, pemphigus and pemphigoid, polyarteritis nodosa and allied conditions, polymyositis, primary thrombocytopenia, Reiter's disease, rheumatic fever / chorea, thrombotic microangiopathy, thyrotoxicosis with or without goiter, toxic erythema, vitiligo, and Wegener's granulomatosis were examined.

ICD-version	ICD-code	ICD-description	PheWAS-code	PheWAS-string	disease-category
ICD9 CM	135	Sarcoidosis	697	Sarcoidosis	Sarcoidosis
ICD9 CM	245	Thyroiditis	245	Thyroiditis	Thyroiditis
ICD9 CM	245	Acute thyroiditis	245.1	Thyroiditis, acute and subacute	Thyroiditis
ICD9 CM	245.1	Subacute thyroiditis	245.1	Thyroiditis, acute and subacute	Thyroiditis
ICD9 CM	245.2	Chronic lymphocytic thyroiditis	245.2	Chronic lymphocytic thyroiditis	Thyroiditis
ICD9 CM	245.3	Chronic fibrous thyroiditis	245	Thyroiditis	Thyroiditis
ICD9 CM	245.8	Other and unspecified chronic thyroiditis	245	Thyroiditis	Thyroiditis
ICD9 CM	245.9	Thyroiditis, unspecified	245	Thyroiditis	Thyroiditis

ICD9 CM	250.01	Diabetes mellitus without mention of complication, type I [juvenile type], not stated as uncontrolled	250.1	Type 1 diabetes	DM
ICD9 CM	250.03	Diabetes mellitus without mention of complication, type I [juvenile type], uncontrolled	250.1 1	Type 1 diabetic ketoacidosis	DM
ICD9 CM	250.1	Diabetes with ketoacidosis	250	Diabetes mellitus	DM
ICD9 CM	250.11	Diabetes with ketoacidosis, type I [juvenile type], not stated as uncontrolled	250.1 1	Type 1 diabetic ketoacidosis	DM
ICD9 CM	250.13	Diabetes with ketoacidosis, type I [juvenile type], uncontrolled	250.1 1	Type 1 diabetic ketoacidosis	DM
ICD9 CM	250.21	Diabetes with hyperosmolarity, type I [juvenile type], not stated as uncontrolled	250.1	Type 1 diabetes	DM
ICD9 CM	250.23	Diabetes with hyperosmolarity, type I [juvenile type], uncontrolled	250.1	Type 1 diabetes	DM
ICD9 CM	250.31	Diabetes with other coma, type I [juvenile type], not stated as uncontrolled	250.1	Type 1 diabetes	DM
ICD9 CM	250.33	Diabetes with other coma, type I [juvenile type], uncontrolled	250.1	Type 1 diabetes	DM
ICD9 CM	250.41	Diabetes with renal manifestations, type I [juvenile type], not stated as uncontrolled	250.1 2	Type 1 diabetes nephropathy	DM
ICD9 CM	250.43	Diabetes with renal manifestations, type I	250.1 2	Type 1 diabetes nephropathy	DM

		[juvenile type], uncontrolled			
ICD9 CM	250.51	Diabetes with ophthalmic manifestations, type I [juvenile type], not stated as uncontrolled	250.13	Type 1 diabetic retinopathy	DM
ICD9 CM	250.53	Diabetes with ophthalmic manifestations, type I [juvenile type], uncontrolled	250.13	Type 1 diabetic retinopathy	DM
ICD9 CM	250.61	Diabetes with neurological manifestations, type I [juvenile type], not stated as uncontrolled	250.14	Type 1 diabetic neuropathy	DM
ICD9 CM	250.63	Diabetes with neurological manifestations, type I [juvenile type], uncontrolled	250.14	Type 1 diabetic neuropathy	DM
ICD9 CM	250.71	Diabetes with peripheral circulatory disorders, type I [juvenile type], not stated as uncontrolled	250.15	Type 1 diabetic peripheral circulatory disorders	DM
ICD9 CM	250.73	Diabetes with peripheral circulatory disorders, type I [juvenile type], uncontrolled	250.15	Type 1 diabetic peripheral circulatory disorders	DM
ICD9 CM	250.81	Diabetes with other specified manifestations, type I [juvenile type], not stated as uncontrolled	250.1	Type 1 diabetes	DM
ICD9 CM	250.83	Diabetes with other specified manifestations, type I [juvenile type], uncontrolled	250.1	Type 1 diabetes	DM
ICD9 CM	250.91	Diabetes with unspecified complication, type I [juvenile type], not stated	250.1	Type 1 diabetes	DM

		as uncontrolled			
ICD9 CM	250.93	Diabetes with unspecified complication, type I [juvenile type], uncontrolled	250.1	Type 1 diabetes	DM
ICD9 CM	279.49	Autoimmune disease, not elsewhere classified	279.2	Autoimmune disease NEC	Autoimmune disease NEC
ICD9 CM	283	Autoimmune hemolytic anemias	283.1	Autoimmune hemolytic anemias	Autoimmune hemolytic anemias
ICD9 CM	337.1	Peripheral autonomic neuropathy in disorders classified elsewhere	337.1	Peripheral autonomic neuropathy	Peripheral autonomic neuropathy
ICD9 CM	443	Raynaud's syndrome	443.1	Raynaud's syndrome	Raynaud's syndrome
ICD9 CM	555	Regional enteritis of small intestine	555.1	Crohn's disease	IBD
ICD9 CM	555.1	Regional enteritis of large intestine	555.1	Crohn's disease	IBD
ICD9 CM	555.2	Regional enteritis of small intestine with large intestine	555.1	Crohn's disease	IBD
ICD9 CM	555.9	Regional enteritis of unspecified site	555.1	Crohn's disease	IBD
ICD9 CM	556	Ulcerative colitis	555.2	Ulcerative colitis	IBD
ICD9 CM	556	Ulcerative (chronic) enterocolitis	555.2	Ulcerative colitis	IBD
ICD9 CM	556.1	Ulcerative (chronic) ileocolitis	555.2	Ulcerative colitis	IBD
ICD9 CM	556.2	Ulcerative (chronic) proctitis	555.2	Ulcerative colitis	IBD

ICD9 CM	556.3	Ulcerative (chronic) proctosigmoiditis	555.2	Ulcerative colitis	IBD
ICD9 CM	556.4	Pseudopolyposis of colon	555.2	Ulcerative colitis	IBD
ICD9 CM	556.5	Left-sided ulcerative (chronic) colitis	555.2	Ulcerative colitis	IBD
ICD9 CM	556.6	Universal ulcerative (chronic) colitis	555.2	Ulcerative colitis	IBD
ICD9 CM	556.8	Other ulcerative colitis	555.2	Ulcerative colitis	IBD
ICD9 CM	556.9	Ulcerative colitis, unspecified	555.2	Ulcerative colitis	IBD
ICD9 CM	571.42	Autoimmune hepatitis	70.4	Chronic hepatitis	Chronic hepatitis
ICD9 CM	571.6	Biliary cirrhosis	571.6	Biliary cirrhosis	Biliary cirrhosis
ICD9 CM	579	Celiac disease	557.1 1	Celiac disease	Celiac disease
ICD9 CM	696	Psoriatic arthropathy	696.4 2	Psoriatic arthropathy	Psoriatic arthropathy
ICD9 CM	696.1	Other psoriasis	696.4 1	Psoriasis vulgaris	Psoriasis vulgaris
ICD9 CM	710	Systemic lupus erythematosus	695.4 2	Systemic lupus erythematosus	Systemic lupus erythematosus
ICD9 CM	710.1	Systemic sclerosis	709.3	Systemic sclerosis	Systemic sclerosis
ICD9 CM	710.2	Sicca syndrome	709.2	Sicca syndrome	Sicca syndrome
ICD9 CM	710.9	Unspecified diffuse connective tissue disease	709	Diffuse diseases of connective tissue	Diffuse diseases of connective tissue

ICD9 CM	714	Rheumatoid arthritis	714.1	Rheumatoid arthritis	RA
ICD9 CM	714.3	Polyarticular juvenile rheumatoid arthritis, chronic or unspecified	714.2	Juvenile rheumatoid arthritis	RA
ICD9 CM	720	Ankylosing spondylitis	715.2	Ankylosing spondylitis	Ankylosing spondylitis
ICD9 CM	725	Polymyalgia rheumatica	717	Polymyalgia Rheumatica	Polymyalgia Rheumatica
ICD9 CM	795.79	Other and unspecified nonspecific immunological findings	279.7	Other immunological findings	Other immunological findings
ICD10 CM	D59.0	Drug-induced autoimmune hemolytic anemia	283.1	Autoimmune hemolytic anemias	Autoimmune hemolytic anemias
ICD10 CM	D59.1	Cold type (secondary) (symptomatic) hemolytic anemia	283.1	Autoimmune hemolytic anemias	Autoimmune hemolytic anemias
ICD10 CM	D86.9	Sarcoidosis, unspecified	697	Sarcoidosis	Sarcoidosis
ICD10 CM	D89.89	Other specified disorders involving the immune mechanism, not elsewhere classified	279.8	Other disorders of the immune mechanism	Other disorders of the immune mechanism
ICD10 CM	E06.1	Nonsuppurative thyroiditis	245.1	Thyroiditis, acute and subacute	Thyroiditis
ICD10 CM	E06.3	Hashitoxicosis (transient)	245.2	Chronic lymphocytic thyroiditis	Thyroiditis
ICD10 CM	E06.5	Chronic fibrous thyroiditis	245	Thyroiditis	Thyroiditis
ICD10 CM	E06.9	Thyroiditis, unspecified	245	Thyroiditis	Thyroiditis
ICD10 CM	E10.10	Type 1 diabetes mellitus with ketoacidosis without	250.1 1	Type 1 diabetic ketoacidosis	DM

		coma			
ICD10 CM	E10.21	Type 1 diabetes mellitus with intercapillary glomerulosclerosis	250.1 2	Type 1 diabetes nephropathy	DM
ICD10 CM	E10.29	Type 1 diabetes mellitus with other diabetic kidney complication	250.1 2	Type 1 diabetes nephropathy	DM
ICD10 CM	E10.31 1	Type 1 diabetes mellitus with unspecified diabetic retinopathy with macular edema	250.1 3	Type 1 diabetic retinopathy	DM
ICD10 CM	E10.31 9	Type 1 diabetes mellitus with unspecified diabetic retinopathy without macular edema	250.1 3	Type 1 diabetic retinopathy	DM
ICD10 CM	E10.36	Type 1 diabetes mellitus with diabetic cataract	250.1 3	Type 1 diabetic retinopathy	DM
ICD10 CM	E10.37 X1	Type 1 diabetes mellitus with diabetic macular edema, resolved following treatment, right eye	250.1 3	Type 1 diabetic retinopathy	DM
ICD10 CM	E10.37 X2	Type 1 diabetes mellitus with diabetic macular edema, resolved following treatment, left eye	250.1 3	Type 1 diabetic retinopathy	DM
ICD10 CM	E10.37 X3	Type 1 diabetes mellitus with diabetic macular edema, resolved following treatment, bilateral	250.1 3	Type 1 diabetic retinopathy	DM
ICD10 CM	E10.37 X9	Type 1 diabetes mellitus with diabetic macular edema, resolved following treatment, unspecified eye	250.1 3	Type 1 diabetic retinopathy	DM
ICD10 CM	E10.39	Type 1 diabetes mellitus with other diabetic ophthalmic complication	250.1 3	Type 1 diabetic retinopathy	DM

ICD10 CM	E10.40	Type 1 diabetes mellitus with diabetic neuropathy, unspecified	250.1 4	Type 1 diabetic neuropathy	DM
ICD10 CM	E10.42	Type 1 diabetes mellitus with diabetic polyneuropathy	250.6	Polyneuropathy in diabetes	DM
ICD10 CM	E10.51	Type 1 diabetes mellitus with diabetic peripheral angiopathy without gangrene	250.1 5	Type 1 diabetic peripheral circulatory disorders	DM
ICD10 CM	E10.65	Type 1 diabetes mellitus with hyperglycemia	250.1	Type 1 diabetes	DM
ICD10 CM	E10.8	Type 1 diabetes mellitus with unspecified complications	250.1	Type 1 diabetes	DM
ICD10 CM	E10.9	Type 1 diabetes mellitus without complications	250.1	Type 1 diabetes	DM
ICD10 CM	I73.00	Raynaud's syndrome without gangrene	443.1	Raynaud's syndrome	Raynaud's syndrome
ICD10 CM	I73.01	Raynaud's syndrome with gangrene	443.1	Raynaud's syndrome	Raynaud's syndrome
ICD10 CM	K50.00	Crohn's disease of small intestine without complications	555.1	Crohn's disease	IBD
ICD10 CM	K50.10	Crohn's disease of large intestine without complications	555.1	Crohn's disease	IBD
ICD10 CM	K50.80	Crohn's disease of both small and large intestine without complications	555.1	Crohn's disease	IBD
ICD10 CM	K50.90	Crohn's disease, unspecified, without complications	555.1	Crohn's disease	IBD
ICD10 CM	K51.00	Ulcerative (chronic) pancolitis without	555.2	Ulcerative colitis	IBD

		complications			
ICD10 CM	K51.20	Ulcerative (chronic) proctitis without complications	555.2	Ulcerative colitis	IBD
ICD10 CM	K51.30	Ulcerative (chronic) rectosigmoiditis without complications	555.2	Ulcerative colitis	IBD
ICD10 CM	K51.40	Inflammatory polyps of colon without complications	555.2	Ulcerative colitis	IBD
ICD10 CM	K51.50	Left sided colitis without complications	555.2	Ulcerative colitis	IBD
ICD10 CM	K51.80	Other ulcerative colitis without complications	555.2	Ulcerative colitis	IBD
ICD10 CM	K51.90	Ulcerative colitis, unspecified, without complications	555.2	Ulcerative colitis	IBD
ICD10 CM	K74.3	Chronic nonsuppurative destructive cholangitis	571.6	Biliary cirrhosis	Biliary cirrhosis
ICD10 CM	K74.4	Secondary biliary cirrhosis	571.6	Biliary cirrhosis	Biliary cirrhosis
ICD10 CM	K74.5	Biliary cirrhosis, unspecified	571.6	Biliary cirrhosis	Biliary cirrhosis
ICD10 CM	K75.4	Autoimmune hepatitis	70.4	Chronic hepatitis	Chronic hepatitis
ICD10 CM	K90.0	Celiac disease with steatorrhea	557.1 1	Celiac disease	Celiac disease
ICD10 CM	L40.0	Psoriasis vulgaris	696.4 1	Psoriasis vulgaris	Psoriasis vulgaris
ICD10 CM	L40.1	Generalized pustular psoriasis	696.4 1	Psoriasis vulgaris	Psoriasis vulgaris
ICD10 CM	L40.2	Acrodermatitis continua	696.4 1	Psoriasis vulgaris	Psoriasis vulgaris

ICD10 CM	L40.3	Pustulosis palmaris et plantaris	696.4 1	Psoriasis vulgaris	Psoriasis vulgaris
ICD10 CM	L40.4	Guttate psoriasis	696.4 1	Psoriasis vulgaris	Psoriasis vulgaris
ICD10 CM	L40.50	Arthropathic psoriasis, unspecified	696.4 2	Psoriatic arthropathy	Psoriatic arthropathy
ICD10 CM	L40.54	Psoriatic juvenile arthropathy	696.4 2	Psoriatic arthropathy	Psoriatic arthropathy
ICD10 CM	L40.59	Other psoriatic arthropathy	696.4 2	Psoriatic arthropathy	Psoriatic arthropathy
ICD10 CM	L40.8	Flexural psoriasis	696.4 1	Psoriasis vulgaris	Psoriasis vulgaris
ICD10 CM	M06.9	Rheumatoid arthritis, unspecified	714.1	Rheumatoid arthritis	RA
ICD10 CM	M08.00	Unspecified juvenile rheumatoid arthritis of unspecified site	714.2	Juvenile rheumatoid arthritis	RA
ICD10 CM	M32.10	Systemic lupus erythematosus, organ or system involvement unspecified	695.4 2	Systemic lupus erythematosus	Systemic lupus erythematosus
ICD10 CM	M34.0	Progressive systemic sclerosis	709.3	Systemic sclerosis	Systemic sclerosis
ICD10 CM	M34.1	Combination of calcinosis, Raynaud's phenomenon, esophageal dysfunction, sclerodactyly, telangiectasia	709.3	Systemic sclerosis	Systemic sclerosis
ICD10 CM	M34.2	Systemic sclerosis induced by drug and chemical	709.3	Systemic sclerosis	Systemic sclerosis
ICD10 CM	M34.81	Systemic sclerosis with lung involvement	510.1	Lung involvement in conditions classified elsewhere	Lung involvement in conditions classified elsewhere

ICD10 CM	M34.82	Systemic sclerosis with myopathy	709.3	Systemic sclerosis	Systemic sclerosis
ICD10 CM	M34.83	Systemic sclerosis with polyneuropathy	709.3	Systemic sclerosis	Systemic sclerosis
ICD10 CM	M34.89	Other systemic sclerosis	709.3	Systemic sclerosis	Systemic sclerosis
ICD10 CM	M34.9	Systemic sclerosis, unspecified	709.3	Systemic sclerosis	Systemic sclerosis
ICD10 CM	M35.00	Sicca syndrome, unspecified	709.2	Sicca syndrome	Sicca syndrome
ICD10 CM	M35.01	Sicca syndrome with keratoconjunctivitis	709.2	Sicca syndrome	Sicca syndrome
ICD10 CM	M35.02	Sicca syndrome with lung involvement	709.2	Sicca syndrome	Sicca syndrome
ICD10 CM	M35.03	Sicca syndrome with myopathy	709.2	Sicca syndrome	Sicca syndrome
ICD10 CM	M35.04	Sicca syndrome with tubulo-interstitial nephropathy	709.2	Sicca syndrome	Sicca syndrome
ICD10 CM	M35.09	Sicca syndrome with other organ involvement	709.2	Sicca syndrome	Sicca syndrome
ICD10 CM	M35.3	Polymyalgia rheumatica	717	Polymyalgia Rheumatica	Polymyalgia Rheumatica
ICD10 CM	M35.9	Systemic involvement of connective tissue, unspecified	709	Diffuse diseases of connective tissue	Diffuse diseases of connective tissue
ICD10 CM	M45.9	Ankylosing spondylitis of unspecified sites in spine	715.2	Ankylosing spondylitis	Ankylosing spondylitis
ICD10 CM	M60.9	Myositis, unspecified	770	Myalgia and myositis NOS	Myalgia and myositis NOS
ICD10 CM	M79.7	Fibromyositis	770	Myalgia and myositis NOS	Myalgia and myositis NOS

ICD10 CM	R76.8	Other specified abnormal immunological findings in serum	279.7	Other immunological findings	Other immunological findings
ICD10 CM	R76.9	Abnormal immunological finding in serum, unspecified	279.7	Other immunological findings	Other immunological findings
	99.3	Reiter's disease	711.2	Reiter's disease	Reiter's disease
	136.1	Behcet's syndrome	711.3	Behcet's syndrome	Behcet's syndrome
	242	Toxic diffuse goiter without mention of thyrotoxic crisis or storm	242	Thyrotoxicosis with or without goiter	Thyrotoxicosis with or without goiter
	242.01	Toxic diffuse goiter with mention of thyrotoxic crisis or storm	242.1	Graves' disease	Graves' disease
	242.9	Thyrotoxicosis without mention of goiter or other cause, and without mention of thyrotoxic crisis or storm	242	Thyrotoxicosis with or without goiter	Thyrotoxicosis with or without goiter
	242.91	Thyrotoxicosis without mention of goiter or other cause, with mention of thyrotoxic crisis or storm	242	Thyrotoxicosis with or without goiter	Thyrotoxicosis with or without goiter
	244.9	Unspecified acquired hypothyroidism	244.4	Hypothyroidism NOS	Hypothyroidism NOS
	255.41	Glucocorticoid deficiency	255.21	Glucocorticoid deficiency	Glucocorticoid deficiency
	258.1	Other combinations of endocrine dysfunction	259	Other endocrine disorders	Other endocrine disorders
	287.31	Immune thrombocytopenic purpura	287.31	Primary thrombocytopenia	Primary thrombocytopenia
	323.51	Encephalitis and	323	Encephalitis	Encephalitis

		encephalomyelitis following immunization procedures			
	323.61	Infectious acute disseminated encephalomyelitis (ADEM)	323	Encephalitis	Encephalitis
	323.62	Other postinfectious encephalitis and encephalomyelitis	323	Encephalitis	Encephalitis
	323.81	Other causes of encephalitis and encephalomyelitis	323.8	Encephalitis, non-infectious	Encephalitis
	323.82	Other causes of myelitis	323.8	Encephalitis, non-infectious	Encephalitis
	323.9	Unspecified causes of encephalitis, myelitis, and encephalomyelitis	323.8	Encephalitis, non-infectious	Encephalitis
	340	Multiple sclerosis	335	Multiple sclerosis	Multiple sclerosis
	341	Neuromyelitis optica	341	Other demyelinating diseases of central nervous system	Other demyelinating diseases of central nervous system
	341.8	Other demyelinating diseases of central nervous system	341	Other demyelinating diseases of central nervous system	Other demyelinating diseases of central nervous system
	341.9	Demyelinating disease of central nervous system, unspecified	341	Other demyelinating diseases of central nervous system	Other demyelinating diseases of central nervous system
	357	Acute infective	357	Inflammatory and toxic	Inflammatory

		polyneuritis		neuropathy	and toxic neuropathy
	357.1	Polyneuropathy in collagen vascular disease	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy
	357.3	Polyneuropathy in malignant disease	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy
	357.4	Polyneuropathy in other diseases classified elsewhere	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy
	357.7	Polyneuropathy due to other toxic agents	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy
	357.81	Chronic inflammatory demyelinating polyneuritis	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy
	357.89	Other inflammatory and toxic neuropathy	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy
	357.9	Unspecified inflammatory and toxic neuropathy	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy
	358	Myasthenia gravis without (acute) exacerbation	358	Myoneural disorders	Myoneural disorders
	358.01	Myasthenia gravis with (acute) exacerbation	358.1	Myasthenia gravis	Myasthenia gravis
	359.6	Symptomatic inflammatory myopathy in diseases classified elsewhere	359.2	Myopathy	Myopathy
	390	Rheumatic fever without mention of heart involvement	41.21	Rheumatic fever / chorea	Rheumatic fever / chorea
	391	Acute rheumatic pericarditis	41.21	Rheumatic fever / chorea	Rheumatic fever / chorea

	391.1	Acute rheumatic endocarditis	420.3	Endocarditis	Endocarditis
	391.2	Acute rheumatic myocarditis	420.1	Myocarditis	Myocarditis
	391.8	Other acute rheumatic heart disease	394.4	Acute rheumatic heart disease	Acute rheumatic heart disease
	391.9	Acute rheumatic heart disease, unspecified	394.4	Acute rheumatic heart disease	Acute rheumatic heart disease
	392	Rheumatic chorea with heart involvement	41.21	Rheumatic fever / chorea	Rheumatic fever / chorea
	392.9	Rheumatic chorea without mention of heart involvement	41.21	Rheumatic fever / chorea	Rheumatic fever / chorea
	446	Polyarteritis nodosa	446	Polyarteritis nodosa and allied conditions	Polyarteritis nodosa and allied conditions
	446.1	Acute febrile mucocutaneous lymph node syndrome [MCLS]	446.2	Acute febrile mucocutaneous lymph node syndrome (Kawasaki disease)	Acute febrile mucocutaneous lymph node syndrome (Kawasaki disease)
	446.4	Wegener's granulomatosis	446.4	Wegener's granulomatosis	Wegener's granulomatosis
	446.5	Giant cell arteritis	446.5	Giant cell arteritis	Giant cell arteritis
	446.6	Thrombotic microangiopathy	446.8	Thrombotic microangiopathy	Thrombotic microangiopathy
	517.2	Lung involvement in systemic sclerosis	709.3	Systemic sclerosis	Systemic sclerosis

517.8	Lung involvement in other diseases classified elsewhere	510	Other diseases of lung	Other diseases of lung
580	Acute glomerulonephritis with lesion of proliferative glomerulonephritis	580	Nephritis; nephrosis; renal sclerosis	Nephritis
580.4	Acute glomerulonephritis with lesion of rapidly progressive glomerulonephritis	580.1 1	Proliferative glomerulonephritis	Glomerulonephritis
580.89	Acute glomerulonephritis with other specified pathological lesion in kidney	580.1 3	Acute glomerulonephritis, NOS	Glomerulonephritis
580.9	Acute glomerulonephritis with unspecified pathological lesion in kidney	580.1 3	Acute glomerulonephritis, NOS	Glomerulonephritis
582	Chronic glomerulonephritis with lesion of proliferative glomerulonephritis	580.1	Glomerulonephritis	Glomerulonephritis
582.1	Chronic glomerulonephritis with lesion of membranous glomerulonephritis	580.1 2	Non-proliferative glomerulonephritis	Glomerulonephritis
582.2	Chronic glomerulonephritis with lesion of membranoproliferative glomerulonephritis	580.1 1	Proliferative glomerulonephritis	Glomerulonephritis
582.4	Chronic glomerulonephritis with lesion of rapidly progressive glomerulonephritis	580.1 1	Proliferative glomerulonephritis	Glomerulonephritis
582.89	Chronic glomerulonephritis with other specified pathological lesion in kidney	580.1 4	Chronic glomerulonephritis, NOS	Glomerulonephritis

582.9	Chronic glomerulonephritis with unspecified pathological lesion in kidney	580.14	Chronic glomerulonephritis, NOS	Glomerulonephritis
583	Nephritis and nephropathy, not specified as acute or chronic, with lesion of proliferative glomerulonephritis	580	Nephritis; nephrosis; renal sclerosis	Nephritis
583.1	Nephritis and nephropathy, not specified as acute or chronic, with lesion of membranous glomerulonephritis	580.12	Non-proliferative glomerulonephritis	Glomerulonephritis
583.2	Nephritis and nephropathy, not specified as acute or chronic, with lesion of membranoproliferative glomerulonephritis	580.11	Proliferative glomerulonephritis	Glomerulonephritis
583.81	Nephritis and nephropathy, not specified as acute or chronic, in diseases classified elsewhere	580.31	Nephritis and nephropathy in diseases classified elsewhere	Nephritis
583.89	Nephritis and nephropathy, not specified as acute or chronic, with other specified pathological lesion in kidney	580.32	Nephritis and nephropathy with pathological lesion	Nephritis
694	Dermatitis herpetiformis	695.2	Bullous dermatoses	Bullous dermatoses
694.2	Juvenile dermatitis herpetiformis	695.21	Dermatitis herpetiformis	Dermatitis herpetiformis
694.3	Impetigo herpetiformis	695.21	Dermatitis herpetiformis	Dermatitis herpetiformis
694.4	Pemphigus	695.22	Pemphigus and pemphigoid	Pemphigus and pemphigoid

	694.5	Pemphigoid	695.2 2	Pemphigus and pemphigoid	Pemphigus and pemphigoid
	694.6	Benign mucous membrane pemphigoid without mention of ocular involvement	695.2 2	Pemphigus and pemphigoid	Pemphigus and pemphigoid
	695.15	Toxic epidermal necrolysis	695.1	Toxic erythema	Toxic erythema
	704	Alopecia, unspecified	704	Diseases of hair and hair follicles	Diseases of hair and hair follicles
	704.09	Other alopecia	704.1	Alopecia	Alopecia
	709.01	Vitiligo	694.1	Vitiligo	Vitiligo
	710.3	Dermatomyositis	709.5	Dermatomyositis	Dermatomyositis
	710.4	Polymyositis	709.4	Polymyositis	Polymyositis
	710.8	Other specified diffuse diseases of connective tissue	709.6	Other specified diffuse diseases of connective tissue	Other specified diffuse diseases of connective tissue
	711.4	Arthropathy associated with other bacterial diseases, site unspecified	711	Arthropathy associated with infections	Arthropathy
	711.41	Arthropathy associated with other bacterial diseases, shoulder region	711	Arthropathy associated with infections	Arthropathy
	711.42	Arthropathy associated with other bacterial diseases, upper arm	711	Arthropathy associated with infections	Arthropathy
	711.43	Arthropathy associated with other bacterial diseases, forearm	711	Arthropathy associated with infections	Arthropathy

	711.44	Arthropathy associated with other bacterial diseases, hand	711	Arthropathy associated with infections	Arthropathy
	711.45	Arthropathy associated with other bacterial diseases, pelvic region and thigh	711	Arthropathy associated with infections	Arthropathy
	711.46	Arthropathy associated with other bacterial diseases, lower leg	711	Arthropathy associated with infections	Arthropathy
	711.47	Arthropathy associated with other bacterial diseases, ankle and foot	711	Arthropathy associated with infections	Arthropathy
	711.48	Arthropathy associated with other bacterial diseases, other specified sites	711	Arthropathy associated with infections	Arthropathy
	711.49	Arthropathy associated with other bacterial diseases, multiple sites	711	Arthropathy associated with infections	Arthropathy
	713.7	Other general diseases with articular involvement	713	Arthropathy associated with other disorders classified elsewhere	Arthropathy
	714.1	Felty's syndrome	714.1	Rheumatoid arthritis	RA
	714.2	Other rheumatoid arthritis with visceral or systemic involvement	714.1	Rheumatoid arthritis	RA
	714.32	Pauciarticular juvenile rheumatoid arthritis	714.2	Juvenile rheumatoid arthritis	RA
	714.81	Rheumatoid lung	714.1	Rheumatoid arthritis	RA
	714.89	Other specified inflammatory polyarthropathies	714	Rheumatoid arthritis and other inflammatory polyarthropathies	RA

	M02.30	Reiter's disease	711.2	Reiter's disease	Reiter's disease
	D86.0	Sarcoidosis	697	Sarcoidosis	Sarcoidosis
	M35.2	Behcet's syndrome	711.3	Behcet's syndrome	Behcet's syndrome
	E05.00	Toxic diffuse goiter without mention of thyrotoxic crisis or storm	242	Thyrotoxicosis with or without goiter	Thyrotoxicosis with or without goiter
	E05.01	Toxic diffuse goiter with mention of thyrotoxic crisis or storm	242.1	Graves' disease	Graves' disease
	E05.90	Thyrotoxicosis without mention of goiter or other cause, and without mention of thyrotoxic crisis or storm	242	Thyrotoxicosis with or without goiter	Thyrotoxicosis with or without goiter
	E05.91	Thyrotoxicosis without mention of goiter or other cause, with mention of thyrotoxic crisis or storm	242	Thyrotoxicosis with or without goiter	Thyrotoxicosis with or without goiter
	E03.9	Unspecified acquired hypothyroidism	244.4	Hypothyroidism NOS	Hypothyroidism NOS
	E10.11	Diabetes with other coma, type I [juvenile type], not stated as uncontrolled	250.1	Type 1 diabetes	DM
	E10.618	Diabetes with other specified manifestations, type I [juvenile type], not stated as uncontrolled	250.1	Type 1 diabetes	DM
	E27.1	Glucocorticoid deficiency	255.21	Glucocorticoid deficiency	Glucocorticoid deficiency
	E31.0	Other combinations of endocrine dysfunction	259	Other endocrine disorders	Other endocrine disorders
	D69.3	Immune thrombocytopenic purpura	287.31	Primary thrombocytopenia	Primary thrombocytopenia

					nia
G04.02	Encephalitis and encephalomyelitis following immunization procedures	323	Encephalitis	Encephalitis	
G04.00	Infectious acute disseminated encephalomyelitis (ADEM)	323	Encephalitis	Encephalitis	
G04.30	Other postinfectious encephalitis and encephalomyelitis	323	Encephalitis	Encephalitis	
G04.81	Other causes of encephalitis and encephalomyelitis	323.8	Encephalitis, non-infectious	Encephalitis	
G04.89	Other causes of myelitis	323.8	Encephalitis, non-infectious	Encephalitis	
G04.90	Unspecified causes of encephalitis, myelitis, and encephalomyelitis	323.8	Encephalitis, non-infectious	Encephalitis	
G35	Multiple sclerosis	335	Multiple sclerosis	Multiple sclerosis	
G36.0	Neuromyelitis optica	341	Other demyelinating diseases of central nervous system	Other demyelinating diseases of central nervous system	
G36.1	Other demyelinating diseases of central nervous system	341	Other demyelinating diseases of central nervous system	Other demyelinating diseases of central nervous system	
G36.9	Demyelinating disease of central nervous system, unspecified	341	Other demyelinating diseases of central nervous system	Other demyelinating diseases of central nervous	

					system
G04.1	Tropical spastic paraplegia	344	Other paralytic syndromes	Other paralytic syndromes	
G61.0	Acute infective polyneuritis	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy	
M05.50	Polyneuropathy in collagen vascular disease	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy	
G13.1	Polyneuropathy in malignant disease	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy	
G61.1	Polyneuropathy due to other toxic agents	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy	
G61.81	Chronic inflammatory demyelinating polyneuritis	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy	
G61.89	Other inflammatory and toxic neuropathy	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy	
G61.9	Unspecified inflammatory and toxic neuropathy	357	Inflammatory and toxic neuropathy	Inflammatory and toxic neuropathy	
G70.00	Myasthenia gravis without (acute) exacerbation	358	Myoneural disorders	Myoneural disorders	
G70.01	Myasthenia gravis with (acute) exacerbation	358.1	Myasthenia gravis	Myasthenia gravis	
M05.40	Symptomatic inflammatory myopathy in diseases classified elsewhere	359.2	Myopathy	Myopathy	
I00	Rheumatic fever without mention of heart involvement	41.21	Rheumatic fever / chorea	Rheumatic fever / chorea	

	I01.0	Acute rheumatic pericarditis	41.21	Rheumatic fever / chorea	Rheumatic fever / chorea
	I01.1	Acute rheumatic endocarditis	420.3	Endocarditis	Endocarditis
	I01.2	Acute rheumatic myocarditis	420.1	Myocarditis	Myocarditis
	I01.8	Other acute rheumatic heart disease	394.4	Acute rheumatic heart disease	Acute rheumatic heart disease
	I01.9	Acute rheumatic heart disease, unspecified	394.4	Acute rheumatic heart disease	Acute rheumatic heart disease
	I02.0	Rheumatic chorea with heart involvement	41.21	Rheumatic fever / chorea	Rheumatic fever / chorea
	I02.9	Rheumatic chorea without mention of heart involvement	41.21	Rheumatic fever / chorea	Rheumatic fever / chorea
	M32.12	Pericarditis in systemic lupus erythematosus	420.21	Acute pericarditis	Acute pericarditis
	M32.11	Endocarditis in systemic lupus erythematosus	395	Heart valve disorders	Heart valve disorders
	M30.0	Polyarteritis nodosa	446	Polyarteritis nodosa and allied conditions	Polyarteritis nodosa and allied conditions
	M30.3	Acute febrile mucocutaneous lymph node syndrome [MCLS]	446.2	Acute febrile mucocutaneous lymph node syndrome (Kawasaki disease)	Acute febrile mucocutaneous lymph node syndrome (Kawasaki disease)
	M30.1	Wegener's granulomatosis	446.4	Wegener's granulomatosis	Wegener's granulomatosis
	M31.5	Giant cell arteritis	446.5	Giant cell arteritis	Giant cell arteritis

	M31.1	Thrombotic microangiopathy	446.8	Thrombotic microangiopathy	Thrombotic microangiopathy
	M32.13	Lung involvement in other diseases classified elsewhere	510	Other diseases of lung	Other diseases of lung
	N00.0	Acute glomerulonephritis with lesion of proliferative glomerulonephritis	580	Nephritis; nephrosis; renal sclerosis	Nephritis
	N01.0	Acute glomerulonephritis with lesion of rapidly progressive glomerulonephritis	580.11	Proliferative glomerulonephritis	Glomerulonephritis
	N00.8	Acute glomerulonephritis with other specified pathological lesion in kidney	580.13	Acute glomerulonephritis, NOS	Glomerulonephritis
	N00.9	Acute glomerulonephritis with unspecified pathological lesion in kidney	580.13	Acute glomerulonephritis, NOS	Glomerulonephritis
	N03.2	Chronic glomerulonephritis with lesion of proliferative glomerulonephritis	580.1	Glomerulonephritis	Glomerulonephritis
	N03.1	Chronic glomerulonephritis with lesion of membranous glomerulonephritis	580.12	Non-proliferative glomerulonephritis	Glomerulonephritis
	N03.4	Chronic glomerulonephritis with lesion of membranoproliferative glomerulonephritis	580.11	Proliferative glomerulonephritis	Glomerulonephritis
	N03.8	Chronic glomerulonephritis with lesion of rapidly progressive glomerulonephritis	580.11	Proliferative glomerulonephritis	Glomerulonephritis
	N03.0	Chronic glomerulonephritis	580.1	Chronic	Glomeruloneph

		with other specified pathological lesion in kidney	4	glomerulonephritis, NOS	ritis
	N03.9	Chronic glomerulonephritis with unspecified pathological lesion in kidney	580.14	Chronic glomerulonephritis, NOS	Glomerulonephritis
	N05.9	Nephritis and nephropathy, not specified as acute or chronic, with lesion of proliferative glomerulonephritis	580	Nephritis; nephrosis; renal sclerosis	Nephritis
	N05.2	Nephritis and nephropathy, not specified as acute or chronic, with lesion of membranous glomerulonephritis	580.12	Non-proliferative glomerulonephritis	Glomerulonephritis
	N05.3	Nephritis and nephropathy, not specified as acute or chronic, with lesion of membranoproliferative glomerulonephritis	580.11	Proliferative glomerulonephritis	Glomerulonephritis
	M32.14	Nephritis and nephropathy, not specified as acute or chronic, in diseases classified elsewhere	580.31	Nephritis and nephropathy in diseases classified elsewhere	Nephritis
	N05.0	Nephritis and nephropathy, not specified as acute or chronic, with other specified pathological lesion in kidney	580.32	Nephritis and nephropathy with pathological lesion	Nephritis
	L13.0	Dermatitis herpetiformis	695.2	Bullous dermatoses	Bullous dermatoses
	L12.2	Juvenile dermatitis herpetiformis	695.21	Dermatitis herpetiformis	Dermatitis herpetiformis
	L10.0	Pemphigus	695.22	Pemphigus and pemphigoid	Pemphigus and pemphigoid

L12.0	Pemphigoid	695.2 2	Pemphigus and pemphigoid	Pemphigus and pemphigoid
L12.1	Benign mucous membrane pemphigoid without mention of ocular involvement	695.2 2	Pemphigus and pemphigoid	Pemphigus and pemphigoid
L12.30	Toxic epidermal necrolysis	695.1	Toxic erythema	Toxic erythema
L64.9	Alopecia, unspecified	704	Diseases of hair and hair follicles	Diseases of hair and hair follicles
L64.0	Other alopecia	704.1	Alopecia	Alopecia
L80	Vitiligo	694.1	Vitiligo	Vitiligo
M32.0	Systemic lupus erythematosus	709	Diffuse diseases of connective tissue	Diffuse diseases of connective tissue
M33.00	Dermatomyositis	709.5	Dermatomyositis	Dermatomyositis
M33.20	Polymyositis	709.4	Polymyositis	Polymyositis
M35.1	Other specified diffuse diseases of connective tissue	709.6	Other specified diffuse diseases of connective tissue	Other specified diffuse diseases of connective tissue
M02.80	Arthropathy associated with other bacterial diseases, site unspecified	711	Arthropathy associated with infections	Arthropathy
M02.81 1	Arthropathy associated with other bacterial diseases, shoulder region	711	Arthropathy associated with infections	Arthropathy
M02.82 1	Arthropathy associated with other bacterial diseases, upper arm	711	Arthropathy associated with infections	Arthropathy

M02.83 1	Arthropathy associated with other bacterial diseases, forearm	711	Arthropathy associated with infections	Arthropathy
M02.84 1	Arthropathy associated with other bacterial diseases, hand	711	Arthropathy associated with infections	Arthropathy
M02.85 1	Arthropathy associated with other bacterial diseases, pelvic region and thigh	711	Arthropathy associated with infections	Arthropathy
M02.86 1	Arthropathy associated with other bacterial diseases, lower leg	711	Arthropathy associated with infections	Arthropathy
M02.87 1	Arthropathy associated with other bacterial diseases, ankle and foot	711	Arthropathy associated with infections	Arthropathy
M02.88	Arthropathy associated with other bacterial diseases, other specified sites	711	Arthropathy associated with infections	Arthropathy
M02.89	Arthropathy associated with other bacterial diseases, multiple sites	711	Arthropathy associated with infections	Arthropathy
M02.9	Other general diseases with articular involvement	713	Arthropathy associated with other disorders classified elsewhere	Arthropathy
M05.70	Rheumatoid arthritis	714	Rheumatoid arthritis and other inflammatory polyarthropathies	RA
M05.00	Felty's syndrome	714.1	Rheumatoid arthritis	RA
M05.20	Other rheumatoid arthritis with visceral or systemic involvement	714.1	Rheumatoid arthritis	RA
M08.40	Pauciarticular juvenile rheumatoid arthritis	714.2	Juvenile rheumatoid arthritis	RA

	M05.10	Rheumatoid lung	714.1	Rheumatoid arthritis	RA
	M06.4	Other specified inflammatory polyarthropathies	714	Rheumatoid arthritis and other inflammatory polyarthropathies	RA
	M08.1	Ankylosing spondylitis	715	Other inflammatory spondylopathies	Other inflammatory spondylopathies
	E03.5	Myxedema coma	348.7	Coma	Coma

Table S8. Patient characteristics of the immunotherapy and chemotherapy groups.

Melanoma

Feature	Nivolumab.N %		Ipilimumab.N %		Pembrolizumab.N %		all.immunotherapy.drugs.N %		chemo.N %	
All	1148	100.00	871	100.00	626	100.00	2657	100.00	1118	100.00
F	371	32.32	285	32.72	212	33.87	872	32.82	420	37.57
M	777	67.68	586	67.28	414	66.13	1785	67.18	698	62.43
Sex p value	p=0.0114		p=0.0313		p=0.1371		p=0.0061		Control Group	
1	124	10.80	83	9.53	26	4.15	233	8.77	69	6.17
2	133	11.59	123	14.12	56	8.95	313	11.78	128	11.45
3	257	22.39	232	26.64	110	17.57	601	22.62	308	27.55
4	308	26.83	231	26.52	164	26.20	705	26.53	291	26.03
5	215	18.73	139	15.96	156	24.92	514	19.35	217	19.41
6	111	9.67	63	7.23	114	18.21	291	10.95	105	9.39
Age p value	p=9e-04		p=0.0068		p<1e-04		p=0.0048		Control Group	
Matched	438	38.15	340	39.04	252	40.26	1035	38.95	Control Group	

Renal

Feature	Pembrolizumab.N %		Nivolumab.N %		all.immunotherapy.drugs.N %		chemo.N %	
All	214	100.00	1003	100.00	1284	100.00	1425	100.00
F	71	33.18	249	24.83	336	26.17	523	36.70
M	143	66.82	754	75.17	948	73.83	902	63.30
Gender.pvalue	p=0.3205		p<1e-04		p<1e-04		Control Group	
[0,40)	<5	2.33	29	2.89	34	2.65	195	13.68
[40,50)	7	3.26	76	7.58	86	6.70	109	7.65
[50,60)	29	13.49	256	25.52	295	22.98	301	21.12
[60,70)	72	33.49	358	35.69	449	34.97	413	28.98
[70,80)	64	29.77	217	21.64	304	23.68	291	20.42
[80,120)	38	17.67	67	6.68	116	9.03	116	8.14
Age.pvalue	p<1e-04		p<1e-04		p<1e-04		Control Group	
Matched	120	56.07	552	55.03	709	55.22	Control Group	

Head and Neck

Feature	Nivolumab.N %		Pembrolizumab.N %		all.immunotherapy.drugs.N %		chemo.N %	
All	356	100.00	445	100.00	857	100.00	10082	100.00
F	72	20.22	98	22.02	182	21.24	2006	19.90
M	284	79.78	347	77.98	675	78.76	8076	80.10
Gender.pvalue	p=0.8942		p=0.2676		p=0.3482		Control Group	
[0,40)	11	3.09	22	4.94	36	4.20	521	5.17

[40,50)	26	7.30	32	7.19	62	7.23	1313	13.03
[50,60)	97	27.25	112	25.17	218	25.44	3457	34.30
[60,70)	117	32.87	136	30.56	276	32.21	3127	31.02
[70,80)	76	21.35	91	20.45	181	21.12	1247	12.37
[80,120)	29	8.15	52	11.69	84	9.80	415	4.12
Age.pvalue	p<1e-04		p<1e-04		p<1e-04		Control Group	
Matched	312	87.64	371	83.37	731	85.30	Control Group	

Squamous

Feature	Nivolumab.N %		Pembrolizumab.N %		all.immunotherapy.drugs.N %		chemo.N %	
All	231	100.00	295	100.00	602	100.00	1968	100.00
F	51	22.08	61	20.68	121	20.10	606	30.79
M	180	77.92	234	79.32	481	79.90	1362	69.21
Gender.pvalue	p=0.0065		p=5e-04		p<1e-04		Control Group	
[0,40)	<5	2.13	6	2.03	8	1.33	27	1.37
[40,50)	11	4.68	7	2.37	19	3.16	130	6.61
[50,60)	35	14.89	31	10.51	76	12.62	425	21.60
[60,70)	67	28.51	70	23.73	151	25.08	557	28.30
[70,80)	65	27.66	85	28.81	175	29.07	496	25.20
[80,120)	52	22.13	96	32.54	173	28.74	333	16.92
Age.pvalue	p=0.0662		p<1e-04		p<1e-04		Control Group	
Matched	159	68.83	197	66.78	391	64.95	Control Group	

Basal

Feature	Nivolumab.N %		Pembrolizumab.N %		Ipilimumab.N %		all.immunotherapy.drugs.N %		chemo.N %	
All	296	100.00	289	100.00	71	100.00	695	100.00	899	100.00
F	66	22.30	71	24.57	9	12.68	156	22.45	348	38.71
M	230	77.70	218	75.43	62	87.32	539	77.55	551	61.29
Gender.pvalue	p<1e-04		p<1e-04		p<1e-04		p<1e-04		Control Group	
[0,40)	<5	1.68	<5	1.69	<5	6.33	<5	0.72	23	2.56
[40,50)	12	4.04	<5	1.69	<5	6.33	18	2.59	71	7.90
[50,60)	51	17.17	19	6.44	16	20.25	91	13.07	202	22.47
[60,70)	80	26.94	68	23.05	20	25.32	175	25.14	229	25.47
[70,80)	92	30.98	104	35.25	19	24.05	231	33.19	233	25.92
[80,120)	57	19.19	94	31.86	14	17.72	176	25.29	141	15.68
Age.pvalue	p=0.0308		p<1e-04		p=0.5169		p<1e-04		Control Group	
Matched	127	42.91	139	48.10	31	43.66	279	40.14	Control Group	

Brain

Feature	Pembrolizumab.N %		Nivolumab.N %		Ipilimumab.N %		all.immunotherapy.drugs.N %		chemo.N %	
All	162	100.00	176	100.00	54	100.00	407	100.00	5144	100.00

F	65	40.12	65	36.93	14	25.93	152	37.35	2110	41.02
M	97	59.88	111	63.07	40	74.07	255	62.65	3034	58.98
Gender.pvalue	p=0.8717		p=0.3078		p=0.0277		p=0.1612		Control Group	
[0,40)	16	9.88	22	12.36	<5	8.33	42	10.32	1492	29.03
[40,50)	25	15.43	18	10.11	6	10.00	50	12.29	862	16.77
[50,60)	40	24.69	47	26.40	23	38.33	117	28.75	1401	27.26
[60,70)	50	30.86	59	33.15	10	16.67	124	30.47	1018	19.81
[70,80)	20	12.35	27	15.17	11	18.33	59	14.50	314	6.11
[80,120)	11	6.79	<5	2.81	<5	8.33	15	3.69	53	1.03
Age.pvalue	p<1e-04		p<1e-04		p<1e-04		p<1e-04		Control Group	
Matched	118	72.84	138	78.41	39	72.22	307	75.43	Control Group	

Lung

Feature	Pembrolizumab.N %		Nivolumab.N %		Atezolizumab.N %		Durvalumab.N %		all.immunotherapy.drugs.N %		chemo.N %	
All	2913	100.00	2424	100.00	574	100.00	203	100.00	6157	100.00	26502	100.00
F	1251	42.95	1018	42.00	258	44.95	89	43.84	2630	42.72	11552	43.59
M	1662	57.05	1406	58.00	316	55.05	114	56.16	3527	57.28	14950	56.41
Gender.pvalue	p=0.5153		p=0.136		p=0.5277		p=0.9426		p=0.2109		Control Group	
[0,40)	34	1.17	22	0.91	<5	0.87	<5	2.40	60	0.97	357	1.35
[40,50)	127	4.36	94	3.88	25	4.34	6	2.88	256	4.16	1607	6.06
[50,60)	520	17.85	511	21.08	119	20.66	39	18.75	1205	19.57	6388	24.10
[60,70)	1012	34.74	859	35.44	212	36.81	86	41.35	2179	35.39	9198	34.71
[70,80)	873	29.97	698	28.80	164	28.47	63	30.29	1808	29.36	6737	25.42
[80,120)	347	11.91	240	9.90	51	8.85	9	4.33	649	10.54	2215	8.36
Age.pvalue	p<1e-04		p<1e-04		p=0.087		p=0.007		p<1e-04		Control Group	
Matched	2773	95.19	2279	94.02	545	94.95	199	98.03	5834	94.75	Control Group	

Table S9. Patient characteristics of the immunotherapy and targeted therapy groups.

Renal

Feature	Pembrolizumab.N %		Nivolumab.N %		Atezolizumab.N %		all.immunotherapy.drugs.N %		target.N %	
All	214	100.00	1002	100.00	52	100.00	1284	100.00	1868	100.00
F	71	33.18	248	24.75	12	23.08	335	26.09	486	26.02
M	143	66.82	754	75.25	40	76.92	949	73.91	1382	73.98
Gender.pvalue	p=0.0275		p=0.4718		p=0.7444		p=0.9692		Control Group	
[0,40)	<5	2.33	29	2.89	<5	8.47	34	2.65	56	3.00
[40,50)	7	3.26	76	7.58	<5	8.47	86	6.70	181	9.69
[50,60)	29	13.49	256	25.55	6	10.17	295	22.98	540	28.91
[60,70)	72	33.49	357	35.63	15	25.42	449	34.97	637	34.10
[70,80)	64	29.77	217	21.66	19	32.20	304	23.68	301	16.11
[80,120)	38	17.67	67	6.69	9	15.25	116	9.03	153	8.19
Age.pvalue	p<1e-04		p=0.0013		p=3e-04		p<1e-04		Control Group	
Matched	120	56.07	606	60.48	24	46.15	749	58.33	Control Group	

Head and Neck

Feature	Nivolumab.N %		Pembrolizumab.N %		all.immunotherapy.drugs.N %		target.N %	
All	358	100.00	444	100.00	858	100.00	2455	100.00
F	72	20.11	97	21.85	181	21.10	433	17.64
M	286	79.89	347	78.15	677	78.90	2022	82.36
Gender.pvalue	p=0.2669		p=0.0385		p=0.028		Control Group	
[0,40)	12	3.35	22	4.95	37	4.31	54	2.20
[40,50)	26	7.26	32	7.21	62	7.23	251	10.22
[50,60)	98	27.37	111	25.00	218	25.41	714	29.08
[60,70)	117	32.68	136	30.63	276	32.17	773	31.49
[70,80)	76	21.23	91	20.50	181	21.10	402	16.37
[80,120)	29	8.10	52	11.71	84	9.79	261	10.63
Age.pvalue	p=0.0446		p=0.0013		p<1e-04		Control Group	
Matched	247	68.99	308	69.37	595	69.35	Control Group	

Squamous

Feature	Nivolumab.N %		Pembrolizumab.N %		all.immunotherapy.drugs.N %		target.N %	
All	231	100.00	295	100.00	602	100.00	366	100.00
F	51	22.08	61	20.68	121	20.10	57	15.57
M	180	77.92	234	79.32	481	79.90	309	84.43
Gender.pvalue	p=0.0482		p=0.096		p=0.0895		Control Group	
[0,40)	<5	2.13	6	2.03	8	1.33	10	2.73
[40,50)	11	4.68	7	2.37	19	3.16	21	5.74
[50,60)	35	14.89	31	10.51	76	12.62	81	22.13

[60,70)	67	28.51	70	23.73	151	25.08	99	27.05
[70,80)	65	27.66	85	28.81	175	29.07	80	21.86
[80,120)	52	22.13	96	32.54	173	28.74	75	20.49
Age.pvalue	p=0.2467		p<1e-04		p<1e-04		Control Group	
Matched	59	25.54	79	26.78	148	24.58	Control Group	

Brain

Feature	Nivolumab.N %		Pembrolizumab.N %		Ipilimumab.N %		all.immunotherapy.drugs.N %		target.N %	
All	162	100.00	177	100.00	54	100.00	408	100.00	2814	100.00
F	65	40.12	65	36.72	14	25.93	152	37.25	1086	38.59
M	97	59.88	112	63.28	40	74.07	256	62.75	1728	61.41
Gender.pvalue	p=0.7437		p=0.6334		p=0.0688		p=0.6237		Control Group	
African American/Black	<5	2.48	<5	2.33	<5	5.15	<5	1.13	19	0.67
American Indian/Alaskan Native	<5	2.48	<5	2.33	<5	5.15	<5	1.13	<5	0.18
Asian	<5	2.48	<5	2.33	<5	5.15	<5	1.13	22	0.78
Black (Non-Hispanic)	<5	2.48	<5	2.33	<5	5.15	<5	1.13	<5	0.18
Caucasian (Non-Hispanic)	<5	2.48	<5	2.33	<5	5.15	<5	1.13	<5	0.18
Hispanic/Latino	<5	2.48	<5	2.33	<5	5.15	<5	1.13	19	0.67
Other	<5	2.48	<5	2.33	<5	5.15	<5	1.13	8	0.28
Pacific Islander	<5	2.48	<5	2.33	<5	5.15	<5	1.13	<5	0.18
Two or more races	<5	2.48	<5	2.33	<5	5.15	10	2.25	31	1.10
White	18	8.91	20	9.30	12	12.37	50	11.26	374	13.21
Unknown	139	68.81	150	69.77	40	41.24	344	77.48	2338	82.59
Ethnicity.pvalue	p=0.3882		p=0.2436		p=0.3604		p=0.1247		Control Group	
[0,40)	16	9.88	23	12.85	<5	8.33	43	10.54	465	16.52
[40,50)	25	15.43	18	10.06	6	10.00	50	12.25	515	18.30
[50,60)	40	24.69	47	26.26	23	38.33	117	28.68	882	31.34
[60,70)	50	30.86	59	32.96	10	16.67	124	30.39	671	23.85
[70,80)	20	12.35	27	15.08	11	18.33	59	14.46	242	8.60
[80,120)	11	6.79	<5	2.79	<5	8.33	15	3.68	39	1.39
Age.pvalue	p<1e-04		p=2e-04		p=2e-04		p<1e-04		Control Group	
Matched	95	58.64	100	56.50	30	55.56	235	Control Group		

Lung

Feature	Nivolumab.N %		Pembrolizumab.N %		Atezolizumab.N %		Durvalumab.N %		all.immunotherapy.drugs.N %		target.N %	
All	2919	100.00	2435	100.00	574	100.00	204	100.00	6175	100.00	6022	100.00
F	1255	42.99	1022	41.97	258	44.95	89	43.63	2638	42.72	2925	48.57
M	1664	57.01	1413	58.03	316	55.05	115	56.37	3537	57.28	3097	51.43
Gender.pvalue	p<1e-04		p<1e-04		p=0.1133		p=0.1768		p<1e-04		Control Group	
[0,40)	34	1.16	22	0.90	<5	0.87	<5	2.39	60	0.97	133	2.21
[40,50)	128	4.39	94	3.86	25	4.34	6	2.87	257	4.16	589	9.78

[50,60)	521	17.85	516	21.19	119	20.66	39	18.66	1211	19.61	1700	28.23
[60,70)	1016	34.81	865	35.52	212	36.81	87	41.63	2190	35.47	1898	31.52
[70,80)	873	29.91	698	28.67	164	28.47	63	30.14	1808	29.28	1212	20.13
[80,120)	347	11.89	240	9.86	51	8.85	9	4.31	649	10.51	490	8.14
Age.pvalue	p<1e-04		p<1e-04		p<1e-04		p<1e-04		p<1e-04		Control Group	
Matched	2441	83.62	2020	82.96	478	83.28	186		5201		Control Group	

Table S10. The cumulative incidence rate (%) of autoimmune diseases of the immunotherapy and the chemotherapy groups.

Melanoma

time	matched					unmatched				
	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N
Pembrolizumab										
month=3	6.03[2.91, 9.05]	1.04[0, 2.34]	5.79[1.27, 39.43]	5.86E-05	252	5.09[3.26, 6.88]	2.01[1.13, 2.88]	2.53[1.24, 5.31]	7.37E-11	626
month=6	14.16[9.29, 18.76]	5.23[2, 8.36]	2.71[1.18, 12.55]	5.86E-05	252	12.4[9.45, 15.24]	4.21[2.85, 5.54]	2.95[1.94, 4.94]	7.37E-11	626
month=9	17.52[12.09, 22.62]	8.15[3.8, 12.3]	2.15[1.05, 6.51]	5.86E-05	252	16.62[13.13, 19.98]	7.01[5.11, 8.88]	2.37[1.74, 3.55]	7.37E-11	626
month=12	21.01[14.93, 26.66]	9.68[4.75, 14.35]	2.17[1.06, 5.66]	5.86E-05	252	22.56[18.31, 26.59]	9.53[7.19, 11.81]	2.37[1.74, 3.24]	7.37E-11	626
month=15	25.42[18.42, 31.82]	11.35[5.78, 16.59]	2.24[1.13, 5.7]	5.86E-05	252	26.14[21.43, 30.57]	10.86[8.27, 13.38]	2.41[1.83, 3.31]	7.37E-11	626
Nivolumab										
month=3	10.21[7.15, 13.17]	2.48[0.94, 3.99]	4.12[1.86, 14.8]	1.27E-23	438	11.85[9.85, 13.81]	2.01[1.13, 2.88]	5.9[3.73, 11.39]	0.00E+00	1148
month=6	20.52[16.14, 24.67]	4.62[2.4, 6.8]	4.44[2.3, 9.35]	1.27E-23	438	20.6[17.95, 23.16]	4.21[2.85, 5.54]	4.9[3.42, 7.07]	0.00E+00	1148
month=9	28.4[23.16, 33.28]	7.52[4.34, 10.59]	3.78[2.13, 7.67]	1.27E-23	438	26.75[23.68, 29.71]	7.01[5.11, 8.88]	3.82[2.95, 5.02]	0.00E+00	1148
month=12	31.03[25.44, 36.19]	7.66[4.44, 10.77]	4.05[2.28, 8.05]	1.27E-23	438	30.64[27.26, 33.87]	9.53[7.19, 11.81]	3.22[2.55, 4.05]	0.00E+00	1148
month=15	37.7[31.11, 43.65]	7.82[4.54, 11]	4.82[2.72, 9.19]	1.27E-23	438	34.74[30.96, 38.32]	10.86[8.27, 13.38]	3.2[2.59, 3.98]	0.00E+00	1148
Ipilimumab										
month=3	11.77[8.01, 15.38]	2.09[0.46, 3.68]	5.65[2.19, 26.42]	5.88E-09	340	10.09[7.93, 12.19]	2.01[1.13, 2.88]	5.02[3.49, 8.18]	0.00E+00	871
month=6	18.75[13.96, 23.28]	6.4[3.27, 9.42]	2.93[1.64, 8.56]	5.88E-09	340	17.99[15.08, 20.8]	4.21[2.85, 5.54]	4.28[3.06, 6.25]	0.00E+00	871
month=9	21.39[16.18, 26.28]	7.42[3.98, 10.73]	2.88[1.59, 7.3]	5.88E-09	340	22.37[19.06, 25.54]	7.01[5.11, 8.88]	3.19[2.3, 4.27]	0.00E+00	871
month=12	25.83[19.86, 31.35]	10.19[5.73, 14.44]	2.53[1.42, 5.64]	5.88E-09	340	27.53[23.76, 31.12]	9.53[7.19, 11.81]	2.89[2.2, 3.93]	0.00E+00	871
month=15	29.69[23.03, 35.77]	13.57[8.01, 18.8]	2.19[1.29, 4.9]	5.88E-09	340	29.79[25.8, 33.57]	10.86[8.27, 13.38]	2.74[2.06, 3.74]	0.00E+00	871
all immunotherapy drugs										
month=3	8.99[7.12, 10.82]	2.69[1.64, 3.72]	3.34[1.83, 8.55]	3.14E-27	1035	9.62[8.43, 10.8]	2.01[1.13, 2.88]	4.79[3.16, 7.92]	0.00E+00	2657
month=6	17.64[15, 20.2]	5.27[3.71, 6.8]	3.35[2.16, 5.99]	3.14E-27	1035	17.72[16.08, 19.32]	4.21[2.85, 5.54]	4.21[3.16, 6.39]	0.00E+00	2657
month=9	22.65[19.6, 25.57]	8.19[6.06, 10.28]	2.76[1.9, 4.64]	3.14E-27	1035	22.81[20.91, 24.66]	7.01[5.11, 8.88]	3.25[2.67, 4.54]	0.00E+00	2657
month=12	26.48[23.1, 29.7]	9.34[6.99, 11.63]	2.83[1.9, 4.45]	3.14E-27	1035	27.62[25.47, 29.7]	9.53[7.19, 11.81]	2.9[2.44, 3.97]	0.00E+00	2657
month=15	31.49[27.65, 35.13]	10.62[8.01, 13.15]	2.96[1.98, 4.58]	3.14E-27	1035	30.92[28.58, 33.18]	10.86[8.27, 13.38]	2.85[2.37, 3.75]	0.00E+00	2657

Renal

time	matched					unmatched				
	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N
Pembrolizumab										
month=3	4.27[0.05, 8.31]	3.13[0, 6.26]	1.37[0, 12.25]	2.30E-05	120	5.25[1.8, 8.59]	2.08[1.32, 2.84]	2.52[1.1, 5.26]	9.80E-12	214
month=6	13.91[5.25, 21.78]	6.15[1.19, 10.86]	2.26[0.57, 15.6]	2.30E-05	120	15.43[8.38, 21.94]	3.82[2.72, 4.9]	4.04[2.29, 7.91]	9.80E-12	214

month=9	26.46[12.84, 37.95]	6.15[1.19, 10.86]	4.3[1.49, 27.45]	2.30E-05	120	25.53[15.1, 34.68]	5.08[3.76, 6.38]	5.03[3.03, 7.97]	9.80E-12	214
month=12	30.14[14.89, 42.65]	6.89[1.32, 12.15]	4.37[1.49, 24.54]	2.30E-05	120	30.97[18.32, 41.66]	7.34[5.64, 9.01]	4.22[2.41, 6.46]	9.80E-12	214
month=15	30.14[14.89, 42.65]	7.58[1.37, 13.41]	3.97[1.4, 18.61]	2.30E-05	120	34.26[20.22, 45.83]	8.89[6.93, 10.8]	3.86[2.34, 5.65]	9.80E-12	214
Nivolumab										
month=3	9.66[6.98, 12.26]	3.71[2.05, 5.34]	2.6[1.47, 8.89]	7.54E-23	552	10.44[8.39, 12.45]	2.08[1.32, 2.84]	5.02[3.13, 8.69]	0.00E+00	1003
month=6	15.71[12.25, 19.05]	6.55[4.22, 8.83]	2.4[1.47, 5.57]	7.54E-23	552	16.63[14, 19.17]	3.82[2.72, 4.9]	4.36[3.24, 6.06]	0.00E+00	1003
month=9	21.18[16.96, 25.19]	7.91[5.27, 10.48]	2.68[1.7, 5.62]	7.54E-23	552	23.13[19.9, 26.23]	5.08[3.76, 6.38]	4.56[3.32, 6.4]	0.00E+00	1003
month=12	26.77[21.79, 31.44]	10.05[6.91, 13.09]	2.66[1.74, 4.99]	7.54E-23	552	28.2[24.51, 31.71]	7.34[5.64, 9.01]	3.84[2.89, 4.82]	0.00E+00	1003
month=15	30.89[25.24, 36.12]	11.73[8.17, 15.16]	2.63[1.66, 4.63]	7.54E-23	552	31.3[27.26, 35.11]	8.89[6.93, 10.8]	3.52[2.82, 4.4]	0.00E+00	1003
all immunotherapy drugs										
month=3	9.25[6.92, 11.53]	3.37[1.97, 4.74]	2.75[1.54, 9.43]	2.16E-28	709	9.42[7.67, 11.12]	2.08[1.32, 2.84]	4.52[3.13, 7.5]	0.00E+00	1284
month=6	15.2[12.11, 18.19]	6.18[4.18, 8.15]	2.46[1.54, 5.45]	2.16E-28	709	15.77[13.44, 18.03]	3.82[2.72, 4.9]	4.13[3.07, 5.67]	0.00E+00	1284
month=9	20.95[17.07, 24.65]	7.14[4.93, 9.29]	2.93[1.88, 5.81]	2.16E-28	709	22.4[19.46, 25.23]	5.08[3.76, 6.38]	4.41[3.44, 5.68]	0.00E+00	1284
month=12	26.04[21.46, 30.35]	9.08[6.42, 11.67]	2.87[1.86, 5.05]	2.16E-28	709	27.35[23.96, 30.59]	7.34[5.64, 9.01]	3.73[2.86, 4.79]	0.00E+00	1284
month=15	29.76[24.57, 34.59]	11.29[8.11, 14.37]	2.63[1.71, 4.42]	2.16E-28	709	30.34[26.63, 33.87]	8.89[6.93, 10.8]	3.41[2.53, 4.06]	0.00E+00	1284

Head and Neck

time	matched					unmatched				
	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N
Pembrolizumab										
month=3	9.46[6.08, 12.72]	4.27[2.12, 6.37]	2.22[1.34, 4.05]	8.50E-82	371	8.57[5.65, 11.39]	2.83[2.5, 3.16]	3.03[1.83, 4.04]	5.83E-14	445
month=6	18.43[13.41, 23.16]	7.82[4.79, 10.76]	2.36[1.63, 3.62]	8.50E-82	371	16.09[11.79, 20.18]	6.11[5.6, 6.61]	2.63[1.96, 3.39]	5.83E-14	445
month=9	25.81[19.43, 31.69]	11.76[7.85, 15.51]	2.19[1.6, 3.22]	8.50E-82	371	22.85[17.32, 28.02]	9.49[8.85, 10.14]	2.41[1.82, 2.88]	5.83E-14	445
month=12	30.8[23.31, 37.55]	14.53[10.01, 18.83]	2.12[1.56, 2.96]	8.50E-82	371	28.95[22.06, 35.23]	13.42[12.63, 14.21]	2.16[1.74, 2.61]	5.83E-14	445
month=15	34.09[25.47, 41.72]	19.29[13.75, 24.47]	1.77[1.28, 2.44]	8.50E-82	371	31.63[23.92, 38.56]	17.38[16.46, 18.3]	1.82[1.42, 2.19]	5.83E-14	445
Nivolumab										
month=3	11.85[7.87, 15.66]	4.73[2.24, 7.16]	2.5[1.49, 4]	4.87E-73	312	11.5[7.87, 14.99]	2.83[2.5, 3.16]	4.06[2.81, 5.67]	0.00E+00	356
month=6	19.98[14.6, 25.02]	8.84[5.3, 12.25]	2.26[1.52, 3.39]	4.87E-73	312	18.37[13.61, 22.86]	6.11[5.6, 6.61]	3.01[2.33, 3.96]	0.00E+00	356
month=9	29.78[22.8, 36.13]	13.46[8.89, 17.8]	2.21[1.62, 3.25]	4.87E-73	312	27.75[21.52, 33.47]	9.49[8.85, 10.14]	2.92[2.33, 3.6]	0.00E+00	356
month=12	37.91[29.42, 45.37]	18.54[12.93, 23.79]	2.04[1.52, 2.88]	4.87E-73	312	35.03[27.6, 41.7]	13.42[12.63, 14.21]	2.61[2.12, 3.17]	0.00E+00	356
month=15	44.54[34.78, 52.84]	21.93[15.67, 27.72]	2.03[1.55, 2.76]	4.87E-73	312	41.64[32.97, 49.18]	17.38[16.46, 18.3]	2.39[2.02, 2.9]	0.00E+00	356
all immunotherapy drugs										
month=3	11.13[8.57, 13.61]	4.4[2.84, 5.94]	2.53[1.77, 3.65]	2.31E-163	731	10.41[8.15, 12.62]	2.83[2.5, 3.16]	3.68[2.79, 4.79]	0.00E+00	857

month=6	19.77[16.22, 23.17]	8.68[6.4, 10.91]	2.28[1.8, 3.14]	2.31E-163	731	17.84[14.74, 20.83]	6.11[5.6, 6.61]	2.92[2.35, 3.48]	0.00E+00	857
month=9	28.08[23.58, 32.32]	12.97[10.06, 15.78]	2.17[1.77, 2.91]	2.31E-163	731	25.47[21.53, 29.21]	9.49[8.85, 10.14]	2.68[2.22, 3.17]	0.00E+00	857
month=12	33.81[28.52, 38.71]	16.24[12.86, 19.48]	2.08[1.72, 2.73]	2.31E-163	731	31.59[26.88, 36]	13.42[12.63, 14.21]	2.35[1.97, 2.82]	0.00E+00	857
month=15	39.2[33.01, 44.83]	20.65[16.67, 24.43]	1.9[1.56, 2.43]	2.31E-163	731	36.96[31.45, 42.02]	17.38[16.46, 18.3]	2.13[1.83, 2.46]	0.00E+00	857

Squamous

time	matched					unmatched				
	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N
Pembrolizumab										
month=3	5.17[1.8, 8.42]	1.24[0, 2.81]	4.15[0.79, 38.91]	6.42E-03	197	6.62[3.5, 9.64]	1.62[1.04, 2.19]	4.09[1.87, 6.41]	4.21E-07	295
month=6	11.24[5.72, 16.44]	6.07[2.19, 9.8]	1.85[0.64, 5.5]	6.42E-03	197	13.06[8.26, 17.61]	4.28[3.29, 5.26]	3.05[1.73, 4.2]	4.21E-07	295
month=9	16.33[9.02, 23.06]	7.58[3.14, 11.82]	2.15[0.86, 5.68]	6.42E-03	197	16.48[10.72, 21.86]	6.16[4.93, 7.38]	2.67[1.6, 3.77]	4.21E-07	295
month=12	22.73[13.35, 31.09]	11.64[5.58, 17.32]	1.95[0.82, 4.05]	6.42E-03	197	21.83[14.6, 28.45]	9.02[7.45, 10.56]	2.42[1.67, 3.26]	4.21E-07	295
month=15	25[14.71, 34.06]	16.04[8.42, 23.02]	1.56[0.71, 3.43]	6.42E-03	197	24.86[16.62, 32.29]	11.44[9.59, 13.25]	2.17[1.47, 2.88]	4.21E-07	295
Nivolumab										
month=3	7.63[3.18, 11.87]	2.2[0, 4.56]	3.47[1.06, 49.64]	9.08E-12	159	7.44[3.73, 11.01]	1.62[1.04, 2.19]	4.6[2.09, 10.83]	4.38E-10	231
month=6	16.08[9.45, 22.23]	5.33[1.29, 9.19]	3.02[1.44, 14.74]	9.08E-12	159	13.64[8.44, 18.53]	4.28[3.29, 5.26]	3.19[1.92, 5.06]	4.38E-10	231
month=9	21.8[13.73, 29.12]	5.83[1.57, 9.9]	3.74[1.91, 15.48]	9.08E-12	159	19.35[12.86, 25.36]	6.16[4.93, 7.38]	3.14[2.08, 4.45]	4.38E-10	231
month=12	28.63[18.94, 37.16]	9.86[3.76, 15.58]	2.9[1.54, 7.57]	9.08E-12	159	26.42[18.41, 33.64]	9.02[7.45, 10.56]	2.93[1.8, 3.88]	4.38E-10	231
month=15	32.46[21.64, 41.78]	11.9[4.87, 18.41]	2.73[1.33, 6.56]	9.08E-12	159	30.77[21.6, 38.87]	11.44[9.59, 13.25]	2.69[1.72, 3.66]	4.38E-10	231
all immunotherapy drugs										
month=3	7.25[4.45, 9.96]	1.44[0.19, 2.68]	5.02[2.09, 41.61]	8.21E-15	391	7.23[4.98, 9.44]	1.62[1.04, 2.19]	4.47[2.63, 7.26]	1.90E-14	602
month=6	13.97[9.86, 17.89]	5.29[2.7, 7.81]	2.64[1.53, 6.34]	8.21E-15	391	13.2[9.98, 16.3]	4.28[3.29, 5.26]	3.08[2.05, 4.26]	1.90E-14	602
month=9	19.38[14.24, 24.21]	7.36[4.21, 10.4]	2.63[1.63, 5.56]	8.21E-15	391	17.81[13.86, 21.59]	6.16[4.93, 7.38]	2.89[2.1, 3.61]	1.90E-14	602
month=12	24.78[18.64, 30.45]	11.91[7.56, 16.05]	2.08[1.33, 3.99]	8.21E-15	391	23.53[18.69, 28.08]	9.02[7.45, 10.56]	2.61[1.96, 3.36]	1.90E-14	602
month=15	28.41[21.49, 34.73]	15.67[10.34, 20.68]	1.81[1.19, 3.56]	8.21E-15	391	27.17[21.67, 32.28]	11.44[9.59, 13.25]	2.37[1.76, 2.96]	1.90E-14	602

Basal

time	matched					unmatched				
	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N
Pembrolizumab										
month=3	4.46[0.54, 8.23]	1.02[0, 2.74]	4.36[0.33, 19.83]	1.84E-05	139	5.91[2.84, 8.89]	1.81[0.9, 2.71]	3.27[1.45, 6.87]	2.43E-07	289
month=6	8.24[2.48, 13.66]	4.39[0.57, 8.06]	1.88[0.38, 11.07]	1.84E-05	139	9.95[5.73, 13.98]	3.49[2.18, 4.78]	2.85[1.67, 4.23]	2.43E-07	289
month=9	15.33[7.05, 22.88]	5.36[1.11, 9.43]	2.86[0.82, 14.59]	1.84E-05	139	15.63[10.02, 20.9]	5.28[3.62, 6.92]	2.96[1.72, 4.74]	2.43E-07	289
month=12	21.72[10.94, 31.19]	7.79[2.39, 12.88]	2.79[0.78, 10.93]	1.84E-05	139	20.05[13.1, 26.45]	6.61[4.69, 8.49]	3.03[1.95, 4.3]	2.43E-07	289
month=15	21.72[10.94, 31.19]	7.79[2.39, 12.88]	2.79[0.78, 10.93]	1.84E-05	139	20.05[13.1, 26.45]	7.92[5.75, 10.04]	2.53[1.59, 3.63]	2.43E-07	289

Nivolumab										
month=3	7.96[2.8, 12.84]	0.91[0, 2.66]	8.79[0.92, 12.29]	9.49E-05	127	6.85[3.73, 9.88]	1.81[0.9, 2.71]	3.79[1.9, 8.4]	1.11E-16	296
month=6	13.7[6.64, 20.22]	3.72[0, 7.36]	3.68[1.03, 26.02]	9.49E-05	127	13.14[8.64, 17.41]	3.49[2.18, 4.78]	3.77[2.4, 6.29]	1.11E-16	296
month=9	19.29[10.56, 27.17]	6.71[1.44, 11.7]	2.87[1.13, 17.41]	9.49E-05	127	18.3[12.72, 23.52]	5.28[3.62, 6.92]	3.46[2.4, 5.39]	1.11E-16	296
month=12	26.02[15.45, 35.26]	14.37[6.27, 21.76]	1.81[0.75, 9.95]	9.49E-05	127	22.89[16.41, 28.87]	6.61[4.69, 8.49]	3.46[2.37, 5.12]	1.11E-16	296
month=15	34.3[20.52, 45.69]	16.47[7.66, 24.44]	2.08[0.88, 8.17]	9.49E-05	127	30.76[22.42, 38.21]	7.92[5.75, 10.04]	3.89[2.81, 5.72]	1.11E-16	296
all immunotherapy drugs										
month=3	7.96[2.8, 12.84]	0.91[0, 2.66]	8.79[0.92, 12.29]	9.49E-05	127	7.35[5.19, 9.45]	1.81[0.9, 2.71]	4.06[2.23, 8.11]	0.00E+00	695
month=6	13.7[6.64, 20.22]	3.72[0, 7.36]	3.68[1.03, 26.02]	9.49E-05	127	12.96[9.98, 15.84]	3.49[2.18, 4.78]	3.72[2.05, 5.85]	0.00E+00	695
month=9	19.29[10.56, 27.17]	6.71[1.44, 11.7]	2.87[1.13, 17.41]	9.49E-05	127	17.86[14.2, 21.36]	5.28[3.62, 6.92]	3.38[2.05, 5.1]	0.00E+00	695
month=12	26.02[15.45, 35.26]	14.37[6.27, 21.76]	1.81[0.75, 9.95]	9.49E-05	127	21.62[17.4, 25.62]	6.61[4.69, 8.49]	3.27[2.13, 4.86]	0.00E+00	695
month=15	34.3[20.52, 45.69]	16.47[7.66, 24.44]	2.08[0.88, 8.17]	9.49E-05	127	26.22[21.2, 30.91]	7.92[5.75, 10.04]	3.31[2.19, 4.47]	0.00E+00	695

Brain

time	matched					unmatched				
	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N
Pembrolizumab										
month=3	4.15[0.04, 8.09]	3.48[0, 6.89]	1.19[0, 6.97]	1.46E-01	118	3.95[0.46, 7.32]	3.77[3.23, 4.31]	1.05[0.18, 2.25]	4.76E-01	162
month=6	5.41[0.63, 9.96]	4.75[0.4, 8.91]	1.14[0, 4.19]	1.46E-01	118	4.88[0.95, 8.66]	6.41[5.68, 7.13]	0.76[0.15, 1.55]	4.76E-01	162
month=9	5.41[0.63, 9.96]	5.41[0.52, 10.05]	1[0, 3.41]	1.46E-01	118	9.61[2.97, 15.79]	8.08[7.23, 8.92]	1.19[0.36, 2.12]	4.76E-01	162
month=12	5.41[0.63, 9.96]	6.9[0.87, 12.58]	0.78[0, 2.41]	1.46E-01	118	11.66[3.93, 18.77]	9.67[8.71, 10.63]	1.21[0.54, 2.22]	4.76E-01	162
month=15	5.41[0.63, 9.96]	18.93[6.43, 29.76]	0.29[0, 0.97]	1.46E-01	118	11.66[3.93, 18.77]	11.4[10.3, 12.49]	1.02[0.45, 1.88]	4.76E-01	162
Nivolumab										
month=3	16.07[9.11, 22.49]	2.76[0, 5.62]	5.83[2.16, 21.26]	5.29E-05	138	14.55[8.69, 20.03]	3.77[3.23, 4.31]	3.86[2.36, 5.83]	2.30E-09	176
month=6	19.07[11.48, 26]	4.28[0.37, 8.05]	4.45[1.86, 11.8]	5.29E-05	138	19.3[12.52, 25.54]	6.41[5.68, 7.13]	3.01[2.14, 4.15]	2.30E-09	176
month=9	20.79[12.54, 28.26]	9.15[2.53, 15.32]	2.27[1, 6.31]	5.29E-05	138	21.9[14.32, 28.8]	8.08[7.23, 8.92]	2.71[1.98, 3.77]	2.30E-09	176
month=12	22.87[13.73, 31.04]	10.37[3.03, 17.16]	2.21[0.93, 5.62]	5.29E-05	138	23.56[15.37, 30.95]	9.67[8.71, 10.63]	2.44[1.71, 3.29]	2.30E-09	176
month=15	22.87[13.73, 31.04]	11.6[3.47, 19.05]	1.97[0.81, 4.84]	5.29E-05	138	26.74[16.44, 35.77]	11.4[10.3, 12.49]	2.35[1.61, 3.38]	2.30E-09	176
all immunotherapy drugs										
month=3	11.5[7.57, 15.26]	2.36[0.56, 4.13]	4.87[2.25, 11.42]	2.35E-07	307	10.23[6.98, 13.37]	3.77[3.23, 4.31]	2.71[2.03, 3.88]	3.09E-09	407
month=6	13.83[9.47, 17.98]	4.04[1.51, 6.51]	3.42[1.73, 6.33]	2.35E-07	307	13.09[9.35, 16.67]	6.41[5.68, 7.13]	2.04[1.39, 2.66]	3.09E-09	407
month=9	16.31[11.18, 21.13]	6.66[3.01, 10.16]	2.45[1.29, 4.59]	2.35E-07	307	17.85[12.98, 22.45]	8.08[7.23, 8.92]	2.21[1.68, 2.72]	3.09E-09	407
month=12	17.31[11.85, 22.44]	8.19[3.91, 12.28]	2.11[1.12, 3.83]	2.35E-07	307	19.44[14.14, 24.41]	9.67[8.71, 10.63]	2.01[1.54, 2.6]	3.09E-09	407
month=15	17.31[11.85, 22.44]	13.92[7.36, 20.01]	1.24[0.71, 2.43]	2.35E-07	307	20.76[14.89, 26.23]	11.4[10.3, 12.49]	1.82[1.34, 2.36]	3.09E-09	407

Lung

	matched	unmatched
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time	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N
Pembrolizumab										
month=3	5.67[4.7, 6.63]	3.59[2.85, 4.32]	1.58[1.23, 1.91]	5.47E-104	2773	5.51[4.58, 6.43]	3.25[3.03, 3.48]	1.69[1.47, 2.01]	3.77E-15	2913
month=6	9.04[7.73, 10.34]	6.58[5.52, 7.63]	1.37[1.13, 1.6]	5.47E-104	2773	8.82[7.56, 10.07]	6.09[5.77, 6.42]	1.45[1.27, 1.69]	3.77E-15	2913
month=9	14.19[12.33, 16]	9.26[7.91, 10.58]	1.53[1.26, 1.75]	5.47E-104	2773	14.03[12.24, 15.79]	8.76[8.35, 9.18]	1.6[1.38, 1.84]	3.77E-15	2913
month=12	18.56[16.21, 20.85]	11.91[10.28, 13.52]	1.56[1.3, 1.77]	5.47E-104	2773	18.43[16.15, 20.65]	11.46[10.96, 11.97]	1.61[1.41, 1.86]	3.77E-15	2913
month=15	21.48[18.73, 24.13]	14.22[12.31, 16.09]	1.51[1.28, 1.74]	5.47E-104	2773	21.12[18.49, 23.67]	13.74[13.15, 14.33]	1.54[1.33, 1.79]	3.77E-15	2913
Nivolumab										
month=3	7.19[6, 8.37]	3.9[3.06, 4.74]	1.84[1.45, 2.23]	1.59E-106	2279	6.91[5.77, 8.03]	3.25[3.03, 3.48]	2.12[1.79, 2.5]	0.00E+00	2424
month=6	12.23[10.57, 13.85]	7.27[6.04, 8.48]	1.68[1.4, 1.99]	1.59E-106	2279	11.88[10.29, 13.45]	6.09[5.77, 6.42]	1.95[1.7, 2.22]	0.00E+00	2424
month=9	17.18[15.04, 19.26]	10.08[8.54, 11.59]	1.7[1.43, 1.97]	1.59E-106	2279	17[14.92, 19.02]	8.76[8.35, 9.18]	1.94[1.7, 2.18]	0.00E+00	2424
month=12	19.74[17.33, 22.08]	12.99[11.1, 14.84]	1.52[1.3, 1.75]	1.59E-106	2279	19.66[17.32, 21.94]	11.46[10.96, 11.97]	1.72[1.5, 1.95]	0.00E+00	2424
month=15	22.71[19.94, 25.39]	15.06[12.91, 17.16]	1.51[1.28, 1.74]	1.59E-106	2279	22.44[19.77, 25.02]	13.74[13.15, 14.33]	1.63[1.41, 1.84]	0.00E+00	2424
all immunotherapy drugs										
month=3	6.15[5.46, 6.83]	3.72[3.2, 4.23]	1.65[1.4, 1.91]	4.85E-242	5834	6.04[5.38, 6.7]	3.25[3.03, 3.48]	1.86[1.61, 2.09]	0.00E+00	6157
month=6	10.47[9.5, 11.42]	6.96[6.21, 7.7]	1.5[1.32, 1.69]	4.85E-242	5834	10.3[9.36, 11.22]	6.09[5.77, 6.42]	1.69[1.5, 1.86]	0.00E+00	6157
month=9	15.45[14.16, 16.73]	9.75[8.81, 10.69]	1.58[1.4, 1.76]	4.85E-242	5834	15.47[14.21, 16.71]	8.76[8.35, 9.18]	1.77[1.65, 1.95]	0.00E+00	6157
month=12	19.24[17.67, 20.78]	12.7[11.53, 13.85]	1.52[1.35, 1.69]	4.85E-242	5834	19.26[17.74, 20.76]	11.46[10.96, 11.97]	1.68[1.53, 1.84]	0.00E+00	6157
month=15	21.94[20.15, 23.69]	14.78[13.45, 16.09]	1.48[1.33, 1.65]	4.85E-242	5834	21.77[20.05, 23.46]	13.74[13.15, 14.33]	1.58[1.45, 1.7]	0.00E+00	6157

Table S11. The cumulative incidence rate (%) of autoimmune diseases of the immunotherapy and the targeted therapy groups.

Renal

time	matched					unmatched				
	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N
Pembrolizumab										
month=3	3.51[0, 7.41]	6.68[1.71, 11.4]	0.53[0, 1.58]	1.09E-02	120	5.25[1.8, 8.59]	4.24[3.27, 5.21]	1.24[0.47, 2.85]	1.42E-03	214
month=6	19.7[8, 29.92]	10.03[3.65, 15.99]	1.96[0.63, 4.92]	1.09E-02	120	15.43[8.38, 21.94]	7.47[6.11, 8.81]	2.07[1.16, 3.26]	1.42E-03	214
month=9	28.88[13.59, 41.47]	13.83[5.84, 21.13]	2.09[0.83, 4.96]	1.09E-02	120	25.53[15.1, 34.68]	11.26[9.48, 12.99]	2.27[1.35, 3.46]	1.42E-03	214
month=12	28.88[13.59, 41.47]	17.49[7.83, 26.14]	1.65[0.62, 3.71]	1.09E-02	120	30.97[18.32, 41.66]	13.99[11.91, 16.02]	2.21[1.16, 3.09]	1.42E-03	214
month=15	28.88[13.59, 41.47]	21.54[9.83, 31.73]	1.34[0.47, 2.68]	1.09E-02	120	34.26[20.22, 45.83]	17.58[15.11, 19.99]	1.95[1.07, 3.01]	1.42E-03	214
Nivolumab										
month=3	9.16[6.67, 11.58]	4.26[2.52, 5.97]	2.15[1.27, 4.78]	4.24E-18	606	10.46[8.4, 12.47]	4.24[3.27, 5.21]	2.47[1.82, 3.38]	3.33E-16	1002
month=6	15.43[12.13, 18.6]	6.95[4.61, 9.23]	2.22[1.38, 4.03]	4.24E-18	606	16.65[14.02, 19.2]	7.47[6.11, 8.81]	2.23[1.78, 3]	3.33E-16	1002
month=9	21.2[17.17, 25.03]	11.86[8.53, 15.06]	1.79[1.23, 2.87]	4.24E-18	606	23.16[19.93, 26.26]	11.26[9.48, 12.99]	2.06[1.67, 2.64]	3.33E-16	1002
month=12	26.87[22.15, 31.31]	15.48[11.42, 19.35]	1.74[1.22, 2.74]	4.24E-18	606	28.25[24.55, 31.76]	13.99[11.91, 16.02]	2.02[1.69, 2.48]	3.33E-16	1002
month=15	31.03[25.68, 35.99]	20.33[15.35, 25.01]	1.53[1.1, 2.34]	4.24E-18	606	31.36[27.31, 35.18]	17.58[15.11, 19.99]	1.78[1.48, 2.21]	3.33E-16	1002
all immunotherapy drugs										
month=3	8.7[6.5, 10.84]	4.53[2.92, 6.12]	1.92[1.13, 3.68]	6.48E-15	749	9.42[7.67, 11.12]	4.24[3.27, 5.21]	2.22[1.6, 2.78]	1.07E-14	1284
month=6	15.35[12.32, 18.28]	7.5[5.3, 9.64]	2.05[1.33, 3.3]	6.48E-15	749	15.77[13.44, 18.03]	7.47[6.11, 8.81]	2.11[1.67, 2.73]	1.07E-14	1284
month=9	21.1[17.35, 24.68]	13.18[10.01, 16.24]	1.6[1.15, 2.49]	6.48E-15	749	22.4[19.46, 25.23]	11.26[9.48, 12.99]	1.99[1.59, 2.51]	1.07E-14	1284
month=12	26.32[21.92, 30.48]	17.09[13.22, 20.79]	1.54[1.14, 2.41]	6.48E-15	749	27.35[23.96, 30.59]	13.99[11.91, 16.02]	1.95[1.63, 2.48]	1.07E-14	1284
month=15	30.09[25.13, 34.72]	21.83[17.16, 26.24]	1.38[1.01, 2.02]	6.48E-15	749	30.35[26.63, 33.88]	17.58[15.11, 19.99]	1.73[1.49, 2.22]	1.07E-14	1284

Head and Neck

time	matched					unmatched				
	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N
Pembrolizumab										
month=3	9.84[5.97, 13.55]	2.64[0.75, 4.49]	3.73[1.54, 8.5]	6.32E-10	308	8.57[5.66, 11.4]	3.02[2.31, 3.72]	2.84[1.86, 4.3]	2.28E-10	444
month=6	19.26[13.52, 24.62]	7.7[4.27, 11]	2.5[1.42, 5.12]	6.32E-10	308	16.1[11.8, 20.19]	5.96[4.92, 6.99]	2.7[1.97, 3.63]	2.28E-10	444
month=9	27.06[19.68, 33.77]	13.61[8.67, 18.29]	1.99[1.27, 3.77]	6.32E-10	308	22.86[17.32, 28.03]	10.52[9.06, 11.95]	2.17[1.57, 2.99]	2.28E-10	444
month=12	32.26[23.56, 39.97]	18.75[12.62, 24.44]	1.72[1.16, 3.03]	6.32E-10	308	28.95[22.06, 35.24]	14.19[12.43, 15.91]	2.04[1.42, 2.71]	2.28E-10	444
month=15	36.02[26.08, 44.63]	25.08[17.66, 31.83]	1.44[0.94, 2.3]	6.32E-10	308	31.63[23.93, 38.56]	18.96[16.84, 21.02]	1.67[1.18, 2.18]	2.28E-10	444
Nivolumab										
month=3	11.2[6.84, 15.35]	2.67[0.55, 4.74]	4.2[1.69, 12.65]	3.59E-17	247	11.43[7.82, 14.9]	3.02[2.31, 3.72]	3.79[2.6, 5.47]	0.00E+00	358

month=6	21.04[14.74, 26.87]	6.48[2.95, 9.87]	3.25[1.64, 6.56]	3.59E-17	247	18.27[13.53, 22.74]	5.96[4.92, 6.99]	3.07[2.16, 4.04]	0.00E+00	358
month=9	28.26[20.57, 35.2]	11.46[6.43, 16.21]	2.47[1.41, 4.44]	3.59E-17	247	27.59[21.4, 33.29]	10.52[9.06, 11.95]	2.62[1.87, 3.42]	0.00E+00	358
month=12	38.87[28.86, 47.46]	16.33[9.9, 22.31]	2.38[1.48, 3.96]	3.59E-17	247	35.61[28.11, 42.32]	14.19[12.43, 15.91]	2.51[1.77, 3.22]	0.00E+00	358
month=15	46.34[34.52, 56.03]	22.92[14.79, 30.27]	2.02[1.29, 3.17]	3.59E-17	247	42.15[33.47, 49.69]	18.96[16.84, 21.02]	2.22[1.71, 2.79]	0.00E+00	358
all immunotherapy drugs										
month=3	10.36[7.6, 13.04]	3.63[2.02, 5.2]	2.86[1.6, 5.39]	1.34E-28	595	10.39[8.13, 12.59]	3.02[2.31, 3.72]	3.44[2.37, 5.42]	0.00E+00	858
month=6	20.05[16.02, 23.89]	7.34[4.96, 9.66]	2.73[1.76, 4.44]	1.34E-28	595	17.81[14.71, 20.79]	5.96[4.92, 6.99]	2.99[2.25, 3.86]	0.00E+00	858
month=9	27.28[22.3, 31.93]	12.28[8.99, 15.46]	2.22[1.55, 3.36]	1.34E-28	595	25.41[21.48, 29.14]	10.52[9.06, 11.95]	2.42[1.85, 2.99]	0.00E+00	858
month=12	34.25[28.24, 39.77]	16.21[12.23, 20.01]	2.11[1.54, 3.11]	1.34E-28	595	31.88[27.14, 36.31]	14.19[12.43, 15.91]	2.25[1.81, 2.74]	0.00E+00	858
month=15	40.69[33.57, 47.04]	22.1[17.19, 26.72]	1.84[1.36, 2.64]	1.34E-28	595	37.22[31.7, 42.3]	18.96[16.84, 21.02]	1.96[1.6, 2.35]	0.00E+00	858

Squamous

time	matched					unmatched				
	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N
Pembrolizumab										
month=3	8.41[1.7, 14.66]	2.46[0, 6.32]	3.41[0, 20.42]	1.11E-01	79	6.62[3.5, 9.64]	3.07[1.17, 4.93]	2.16[0.9, 5.15]	7.50E-02	295
month=6	12.85[3.76, 21.07]	2.46[0, 6.32]	5.21[0, 31.18]	1.11E-01	79	13.06[8.26, 17.61]	5.42[2.77, 7.99]	2.41[1.21, 5.19]	7.50E-02	295
month=9	16.33[4.96, 26.34]	5.41[0, 12.02]	3.02[0.23, 32.59]	1.11E-01	79	16.48[10.72, 21.86]	9.26[5.56, 12.81]	1.78[0.99, 3.13]	7.50E-02	295
month=12	16.33[4.96, 26.34]	7.48[0, 15.84]	2.18[0.18, 22.72]	1.11E-01	79	21.83[14.6, 28.45]	11.17[6.93, 15.22]	1.95[1.19, 3.28]	7.50E-02	295
month=15	22.77[5.47, 36.9]	15.22[0, 28.41]	1.5[0.12, 15.51]	1.11E-01	79	24.86[16.62, 32.29]	19.42[13.21, 25.19]	1.28[0.79, 1.93]	7.50E-02	295
Nivolumab										
month=3	3.78[0, 8.79]	6.63[0, 12.97]	0.57[0, 4.44]	1.91E-01	59	7.44[3.73, 11.01]	3.07[1.17, 4.93]	2.42[1.26, 6.58]	7.22E-03	231
month=6	15.26[4.05, 25.16]	6.63[0, 12.97]	2.3[0.28, 12.15]	1.91E-01	59	13.64[8.44, 18.53]	5.42[2.77, 7.99]	2.52[1.66, 5.13]	7.22E-03	231
month=9	21.36[7.53, 33.12]	6.63[0, 12.97]	3.22[0.61, 14.8]	1.91E-01	59	19.35[12.86, 25.36]	9.26[5.56, 12.81]	2.09[1.38, 3.83]	7.22E-03	231
month=12	24.93[9.6, 37.67]	10.18[0.38, 19]	2.45[0.72, 14.13]	1.91E-01	59	26.42[18.41, 33.64]	11.17[6.93, 15.22]	2.36[1.57, 4.43]	7.22E-03	231
month=15	30.3[11.75, 44.95]	29.34[8.47, 45.45]	1.03[0.33, 5.05]	1.91E-01	59	30.77[21.6, 38.87]	19.42[13.21, 25.19]	1.58[0.97, 2.86]	7.22E-03	231
all immunotherapy drugs										
month=3	7.45[2.88, 11.8]	3.26[0.09, 6.33]	2.29[0.49, 14.14]	3.02E-02	148	7.23[4.98, 9.44]	3.07[1.17, 4.93]	2.36[1.13, 5.73]	1.08E-02	602
month=6	13.48[6.96, 19.54]	5.42[1.07, 9.57]	2.49[0.68, 16.66]	3.02E-02	148	13.2[9.98, 16.3]	5.42[2.77, 7.99]	2.44[1.36, 4.09]	1.08E-02	602
month=9	19.37[10.84, 27.08]	8.23[2.42, 13.7]	2.35[0.79, 13.2]	3.02E-02	148	17.81[13.86, 21.59]	9.26[5.56, 12.81]	1.92[1.18, 3.34]	1.08E-02	602
month=12	23.06[13.27, 31.75]	10.85[3.72, 17.45]	2.13[0.86, 11.11]	3.02E-02	148	23.53[18.69, 28.08]	11.17[6.93, 15.22]	2.11[1.29, 3.09]	1.08E-02	602
month=15	28.31[16.2, 38.67]	22.57[10.71, 32.86]	1.25[0.56, 3.8]	3.02E-02	148	27.17[21.67, 32.28]	19.42[13.21, 25.19]	1.4[0.93, 2.05]	1.08E-02	602

Brain

time	matched					unmatched				
	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N
Pembrolizumab										
month=3	5.18[0.05, 10.05]	2.69[0, 5.91]	1.92[0, 17.29]	3.23E-01	95	3.95[0.46, 7.32]	2.79[2.15, 3.43]	1.41[0.28, 2.81]	3.84E-01	162
month=6	5.18[0.05, 10.05]	7.05[0.77, 12.93]	0.73[0, 3.9]	3.23E-01	95	4.88[0.95, 8.66]	6.3[5.24, 7.34]	0.78[0.13, 1.47]	3.84E-01	162
month=9	7.61[0.59, 14.14]	10.96[1.97, 19.12]	0.69[0.12, 2.76]	3.23E-01	95	9.61[2.97, 15.79]	8.43[7.11, 9.73]	1.14[0.32, 2.19]	3.84E-01	162
month=12	7.61[0.59, 14.14]	10.96[1.97, 19.12]	0.69[0.12, 2.76]	3.23E-01	95	11.66[3.93, 18.77]	9.85[8.34, 11.33]	1.18[0.42, 2.18]	3.84E-01	162
month=15	7.61[0.59, 14.14]	10.96[1.97, 19.12]	0.69[0.12, 2.76]	3.23E-01	95	11.66[3.93, 18.77]	11.44[9.65, 13.19]	1.02[0.36, 1.93]	3.84E-01	162
Nivolumab										
month=3	19.14[10.14, 27.24]	1.39[0, 3.67]	13.78[2.58, 135.92]	2.19E-08	100	14.45[8.63, 19.9]	2.79[2.15, 3.43]	5.18[3.03, 7.9]	1.52E-09	177
month=6	26.36[15.82, 35.58]	5.78[0.22, 11.03]	4.56[1.8, 36.12]	2.19E-08	100	19.16[12.43, 25.37]	6.3[5.24, 7.34]	3.04[1.79, 4.22]	1.52E-09	177
month=9	26.36[15.82, 35.58]	5.78[0.22, 11.03]	4.56[1.8, 36.12]	2.19E-08	100	21.76[14.23, 28.64]	8.43[7.11, 9.73]	2.58[1.42, 3.45]	1.52E-09	177
month=12	26.36[15.82, 35.58]	11.64[1.77, 20.52]	2.26[0.86, 22.76]	2.19E-08	100	23.43[15.28, 30.8]	9.85[8.34, 11.33]	2.38[1.37, 3.25]	1.52E-09	177
month=15	26.36[15.82, 35.58]	11.64[1.77, 20.52]	2.26[0.86, 22.76]	2.19E-08	100	26.62[16.34, 35.64]	11.44[9.65, 13.19]	2.33[1.32, 3.29]	1.52E-09	177
all immunotherapy drugs										
month=3	11.38[6.85, 15.7]	1.16[0, 2.57]	9.8[2.67, 60.13]	2.65E-08	235	10.2[6.96, 13.33]	2.79[2.15, 3.43]	3.65[2.55, 5.18]	3.39E-09	408
month=6	13.93[8.83, 18.74]	5.48[1.87, 8.96]	2.54[1.15, 7.39]	2.65E-08	235	13.05[9.32, 16.62]	6.3[5.24, 7.34]	2.07[1.66, 2.96]	3.39E-09	408
month=9	17.11[10.93, 22.85]	9.54[4.1, 14.66]	1.79[0.85, 4.33]	2.65E-08	235	17.81[12.95, 22.41]	8.43[7.11, 9.73]	2.11[1.61, 2.85]	3.39E-09	408
month=12	17.11[10.93, 22.85]	9.88[4.29, 15.14]	1.73[0.82, 4.11]	2.65E-08	235	19.4[14.11, 24.37]	9.85[8.34, 11.33]	1.97[1.59, 2.56]	3.39E-09	408
month=15	17.11[10.93, 22.85]	9.88[4.29, 15.14]	1.73[0.82, 4.11]	2.65E-08	235	20.73[14.86, 26.19]	11.44[9.65, 13.19]	1.81[1.34, 2.36]	3.39E-09	408

Lung

time	matched					unmatched				
	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N	immunotherapy	chemotherapy	Hazard-Ratio	Log-rank test p value	Immuno.N
Pembrolizumab										
month=3	5.33[4.33, 6.32]	2.66[1.98, 3.34]	2[1.42, 2.9]	7.72E-43	2441	5.5[4.57, 6.42]	2.75[2.32, 3.19]	2[1.49, 2.45]	3.33E-16	2919
month=6	8.7[7.32, 10.05]	5.03[4.04, 6.01]	1.73[1.33, 2.34]	7.72E-43	2441	8.86[7.59, 10.11]	5.34[4.69, 5.97]	1.66[1.4, 1.97]	3.33E-16	2919
month=9	13.77[11.83, 15.67]	7.96[6.59, 9.31]	1.73[1.36, 2.19]	7.72E-43	2441	14.06[12.26, 15.81]	8.04[7.2, 8.88]	1.75[1.47, 2.03]	3.33E-16	2919
month=12	18.44[15.94, 20.87]	10.62[8.92, 12.28]	1.74[1.37, 2.16]	7.72E-43	2441	18.44[16.16, 20.66]	10.74[9.7, 11.77]	1.72[1.44, 2.05]	3.33E-16	2919
month=15	21.24[18.34, 24.04]	13.04[11.03, 15]	1.63[1.29, 2.03]	7.72E-43	2441	21.12[18.5, 23.66]	12.87[11.67, 14.06]	1.64[1.38, 1.93]	3.33E-16	2919
Nivolumab										
month=3	6.69[5.46, 7.9]	2.65[1.9, 3.4]	2.52[1.68, 3.6]	5.26E-45	2020	6.88[5.75, 7.99]	2.75[2.32, 3.19]	2.5[2, 3.07]	0.00E+00	2435
month=6	11.94[10.19, 13.66]	5.77[4.59, 6.94]	2.07[1.58, 2.76]	5.26E-45	2020	11.91[10.32, 13.47]	5.34[4.69, 5.97]	2.23[1.91, 2.61]	0.00E+00	2435
month=9	17.31[15.01, 19.56]	8.91[7.32, 10.47]	1.94[1.52, 2.48]	5.26E-45	2020	17.01[14.94, 19.04]	8.04[7.2, 8.88]	2.11[1.82, 2.44]	0.00E+00	2435
month=12	20.08[17.47, 22.62]	11.94[9.95, 13.88]	1.68[1.32, 2.11]	5.26E-45	2020	19.68[17.33, 21.95]	10.74[9.7, 11.77]	1.83[1.58, 2.16]	0.00E+00	2435
month=15	23.02[20.03, 25.9]	14.78[12.4, 17.09]	1.56[1.24, 1.95]	5.26E-45	2020	22.45[19.78, 25.03]	12.87[11.67, 14.06]	1.74[1.5, 2.07]	0.00E+00	2435

all immunotherapy drugs										
month=3	6.03[5.31, 6.75]	2.76[2.29, 3.24]	2.18[1.64, 2.79]	1.60E-88	5201	6.02[5.36, 6.68]	2.75[2.32, 3.19]	2.19[1.82, 2.62]	0.00E+00	6175
month=6	10.39[9.37, 11.4]	5.65[4.93, 6.37]	1.84[1.49, 2.26]	1.60E-88	5201	10.32[9.39, 11.24]	5.34[4.69, 5.97]	1.93[1.64, 2.3]	0.00E+00	6175
month=9	15.4[14.04, 16.75]	8.97[7.98, 9.95]	1.72[1.44, 2.09]	1.60E-88	5201	15.48[14.22, 16.73]	8.04[7.2, 8.88]	1.92[1.64, 2.25]	0.00E+00	6175
month=12	19.31[17.64, 20.94]	11.79[10.57, 12.99]	1.64[1.38, 1.96]	1.60E-88	5201	19.27[17.74, 20.76]	10.74[9.7, 11.77]	1.79[1.51, 2.02]	0.00E+00	6175
month=15	22.04[20.14, 23.9]	14.67[13.21, 16.09]	1.5[1.27, 1.79]	1.60E-88	5201	21.77[20.05, 23.45]	12.87[11.67, 14.06]	1.69[1.48, 1.89]	0.00E+00	6175