

# Autoimmune Effects of Lung Cancer Immunotherapy Revealed by Data-Driven Analysis on a Nationwide Cohort - Supporting Information

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The organization of this supporting information is as following: (1) detailed materials and methods for the study are described, including the identification procedure for lung cancer patients, treatments, patient demographics, and the outcome of autoimmune diseases; (2) detailed procedures of statistical analysis are described; (3) additional results are presented, including matching summary, covariate balance examination, Kaplan-Meier plot with the entire time horizon, and results for all 56 autoimmune disease types; (4) detailed results for the additional sensitivity and robustness studies are presented; (5) additional subpopulation analyses are presented.

## Materials and Method

### Overview of Insurance Claims Data

Using un-identifiable member claims data from Aetna Inc, this study involves de-identified medical claims data, pharmacy claims data, enrollment data and demographics data for 44 million North America insured members.

The medical claims data contain the ICD9 and ICD10 diagnosis codes, as well as CPT treatment procedure code, of a patient for every visit/procedure, together with the date of service. The pharmacy claims data contain the National Drug Code (NDC) for the drug prescribed and the date of dispense, although the data is not comprehensive for all members. The enrollment data have month-to-month enrollment status of the members, together with the associated member zip code for the month. Baseline demographics of birth year and sex information is also available for each member. Ethnicity is available for some members (less than 15%).

### Identification of Lung Cancer Patients

To identify lung cancer patients from the dataset, we first flagged each member based on four criteria: Diagnosis Criterion, Procedure Criterion, Pharmacy NDC Criterion, and Pharmacy HCPCS Criterion. Then we counted the number of hits (a.k.a, data entries) that satisfies each criterion, and we finally labeled a member to be lung cancer patient based on these four criteria. This process ruled out most patients without definitive diagnoses of lung cancer or with miscoded lung cancer-related claims. The detailed procedure is described below.

### Diagnosis Criterion

Table S1 shows the ICD diagnosis codes that are used to identify lung cancer in this study. In medical claims data, we looked up all primary ICD diagnosis code, and the non-primary ICD diagnosis code where the specialty category class was one of Medical, Surgical, or Ob/Gyn, to search for entries with lung cancer diagnosis codes. The specialty category class

restriction was imposed so that non-primary ICD diagnosis code was used only when specialty category class was relevant to lung cancer. After selecting out the medical claims data entries with the related ICD diagnosis codes, we defined a hit in Diagnosis Criterion to be the unique triplet of Member ID, Date of Service, Service Provider ID in the medical claims entries; that is, multiple entries in the medical claims data meeting the ICD diagnosis but having the same tuple (Member ID, Date of Service, Service Provider ID) were counted towards Diagnosis Criterion only once. It is important to count only the unique entries by Member ID, Date of Service, and Service Provider ID because insurance claims data may have multiple billing records for a single medical service or procedure, and that multiple ICD codes can be used for the same lung cancer diagnosis in a single medical service or procedure.

### **Procedure Criterion**

Table S2 shows the CPT procedure codes that are used to identify lung cancer in this study. Similar to Diagnosis Criteria, in medical claims data, we looked up all entries of CPT/HCPCS procedure code, to search for entries with the lung cancer CPT codes defined in Table S2. After selecting out the medical claims data entries with the related CPT codes, we again defined a hit in the Procedure Criteria to be the unique triplet of Member ID, Date of Service, Service Provider ID in the medical claims entries. The reason for counting only the unique entries by Member ID, Date of Service, and Service Provider ID is the same as for the Diagnosis Criterion.

### **Pharmacy NDC Criterion**

Table S3 shows the NDC codes that were used to identify lung-cancer drugs in this study. In pharmacy claims, we looked up all NDC codes to search for entries with the lung-cancer drugs defined in Table S3. Then, each pharmacy claims data entry with the related NDC codes were counted as a hit in the Pharmacy NDC Criteria.

### **Pharmacy HCPCS Criterion**

For the in-hospital-administrated drug, the claim didn't appear in pharmacy claims but rather appeared in medical claims as a procedure because of the in-hospital billing system. Table S4 shows the HCPCS codes for identifying lung-cancer drugs in this study. Similar to Procedure Criteria, in medical claims data, we looked up all five level CPT/HCPCS procedure code, to search for entries with the usage of lung-cancer drugs. After selecting the medical claims data entries with the related HCPCS codes, we defined a hit in Pharmacy HCPCS Criteria to be the unique triplet of Member ID, Date of Service, and Service Provider ID in the medical claims entries identified. Note that we selected unique entries because Medical Claims may have multiple billing records for one single procedure.

### **Combine Hits from Four Criteria**

A member would be identified as a lung cancer patient if he or she had any one of the following combinations: (1) have at least 3 hits in the Diagnosis Criterion; (2) have at least 3 hits in the Procedure Criterion; (3) have at least 1 hit in the Diagnosis Criterion and 1 hit in the Procedure Criterion; or (4) have at least 1 hit in the Diagnosis Criterion or 1 hit in the Procedure Criterion, with additional at least 1 hit in the Pharmacy NDC Criterion or the Pharmacy HCPCS Criterion where the drug must be dispensed/administrated on or after the first hit of the Diagnosis Criterion or the Procedure Criterion. We also required that the

identifying hits (3 hits by either the Diagnosis/Procedure Criterion or 2 hits across two different Criterion) be within 18 months. If the 18-month time window was not satisfied, the first hit would be removed, and the next hit would become the new first hit and we will check again for the 18-month window constraint. We repeated this procedure until a proper first hit was identified; otherwise, the member would not be classified as lung cancer patient. The date of the first hit in the Diagnosis Criterion or the Procedure Criterion was considered as the date of lung cancer diagnosis for the patient. This procedure identified lung cancer patients with a reasonable number of diagnostic and treatment activities in the dataset. Most patients without definitive diagnoses of lung cancer or with miscoded lung cancer-related claims activities would be ruled out this way.

### **Exclusion Criterion**

Patients with pre-existing autoimmune diseases (to be defined in the “Identification of Autoimmune Diseases” section), or with a mention of immunotherapy treatment or chemotherapy treatment (to be defined in the “Identification of Immunotherapy Treatment for Lung Cancer” section and “Identification of Chemotherapy Treatment for Lung Cancer” section) within the first two months of insurance enrollment were excluded from the study. The requirement for the two-month quiescence enrollment without mentions of treatment is to rule out patients with prior cancer treatment billed to other insurance policies.

### **Identification of Immunotherapy Treatment for Lung Cancer**

The usage of immunotherapy drug among the lung cancer patients was identified by the procedure criterion using the HCPCS code and the pharmacy criterion using NDC code. Table S5 presents the immunotherapy drugs studied in this analysis. Lung cancer patients with the HCPCS codes in the Medical Claims data, or with the NDC codes in the Pharmacy Claims data were classified as users of the corresponding immunotherapy drug. The drug initiation date was defined as the first appearance of the corresponding code in the Medical Claims data or the Pharmacy Claims data, and the immunotherapy initiation date was defined as the earliest of initiation date of these immunotherapy drugs.

### **Identification of Chemotherapy Treatment for Lung Cancer**

Chemotherapy treatment was identified through the standard set of chemotherapy drugs used for lung cancer (CARBOPLATIN, CISPLATIN, DOCETAXEL, ETOPOSIDE, GEMCITABINE, IRINOTECAN, MECHLORETHAMINE, METHOTREXATE, PACLITAXEL, PEMETREXED, VINBLASTINE, VINORELBINE). Table S6 shows the detailed codes associated with these drugs. Similar to immunotherapy, lung cancer patients with the HCPCS codes in the Medical Claims data, or with the NDC codes in the Pharmacy Claims data were classified as the user of the corresponding chemotherapy drugs. The drug initiation date was defined as the first date of appearance of the corresponding codes in the Medical Claims data or the Pharmacy Claims data, and the chemotherapy initiation date was defined as the earliest initiation date of these chemotherapy drugs.

## Identification of Autoimmune Diseases

Table S7 shows the ICD codes for the autoimmune diseases investigated in this study and the autoimmune disease category derived from the Phenome-Wide Association Studies (PheWAS) codes. In the medical claims data, we looked up all primary ICD diagnosis codes, and a subset of non-primary ICD diagnosis codes where the specialty category class was one of Medical, Surgical, or Ob/Gyn, to search for entries with autoimmune disease ICD code defined in Table S7. This approach identified patients with autoimmune diseases while minimizing false positives due to miscoding. A patient was flagged for one autoimmune disease category if he or she had the ICD code for the corresponding autoimmune disease category, and the corresponding date would be recorded as the diagnostic date of the autoimmune disease. A patient would be identified as having autoimmunity if he or she were flagged with any one of the autoimmune disease categories, and the autoimmune disease diagnostic date will be defined as the first date of all autoimmune disease categories he or she has been flagged.

## Patient Demographics and Enrollment

Birth year, sex, and month-to-month zip codes and enrollments were available as the member's demographic variables. We obtained two proxies of social economic status -- zip code-derived income and zip code-derived unemployment rate -- by looking up the median income and the median unemployment rate associated with the zip code from the 2009-2013 U.S. Census (for the zip code not reported by the U.S. Census, we filled in the national average). For members with multiple zip codes, we took a weighted average of the zip code income/unemployment rate where the weight was the number of months this member lives in each zip code. We also defined a member's admission date to be the earlier one of the first enrollment month or the first record date in the medical claims data. We defined a member's withdrawal date to be the policy cancellation date, the last day of consecutive enrollment, or the last record activity date in the medical claims data, whichever was earlier. Data after the withdrawal date was discarded.

## Statistical Methods

### Overview on Causal Inference Analysis on Post-treatment Autoimmune Diseases

For statistical analysis, additional independent variables (including age, sex, ethnicity (partially available), zip code, the annualized number of hospital visits prior to treatment initialization, and the annualized number of ICD code counts prior to treatment initialization) were retrieved for each patient. The median income and unemployment rate were identified for each zip code using 2010 US census data.

*Matching* was performed such that each patient in the immune checkpoint inhibitors group was matched to multiple patients in the control group by sex (exactly the same), age (plus minus two years), ethnicity (exactly the same whenever available), zip-code-defined median income (quintile bins), zip-code-defined unemployment rate (quintile bins), the annualized number of hospital visits prior to treatment initialization (quintile bins) and the annualized number of ICD code counts prior to treatment initialization (quintile bins). The

first five matching conditions were proxies for socioeconomic status, whereas the last two were proxies for health care utilization and general sickness levels, and they were calculated for each patient right before the lung cancer treatment initialization. Due to the limitation in sample size, it was not feasible to match for other covariates such as prior medical history or concurrent medications.

Once matching was completed, time-to-event analyses were conducted through inverse probability weighting. Each member of the treatment group was given a weight of 1, and the corresponding matched control group members were given weights inverse to the total number of matches for that treatment group member. For instance, if four participants in the control group were matched to one person in the treatment group, each of the four controls would receive a weight of 0.25. The Kaplan-Meier curves of time to the onset of autoimmune diseases were plotted for both post-matching samples (with inverse probability weighting adjustment) and before-matching samples. The statistical significance was assessed using the weighted log-rank test for both post-matching and before-matching samples. The 95% confidence intervals for Kaplan-Meier estimate of cumulative incidence rates and hazard ratios were constructed using the bootstrap method.

### Matching

Each patient in the treatment group (immunotherapy) was matched with multiple patients in the control group (chemotherapy) by the same sex, plus or minus two years for age at first cancer treatment (i.e, age at immunotherapy versus age at chemotherapy), same median zip code-derived income in 20-th percentile bin, same zip code-derived unemployment rate in 20-th percentile bin. We also matched the ethnicity whenever applicable, and we matched immunotherapy patients with “unknown” ethnicity with chemotherapy patients with “unknown” ethnicity. Matching healthcare utilization and sickness is necessary and important to eliminate the bias introduced by the frequency of healthcare utilization<sup>1</sup>. Therefore, we also obtained proxies for health care utilization or general sickness of the patients by calculating the average number of yearly visit to health care facility, and the average count of ICD diagnosis codes, based on the medical claims data from a patient’s admission date to his or her immunotherapy or chemotherapy initiation date. We then also matched on the healthcare utilization or general sickness by enforcing the patient in the treatment group and the matched patients in the control group to be in the same 20-th percentile bin for both yearly visit counts and yearly ICD code counts. The matching statistics (age, average number of yearly visits, the average count of ICD diagnosis codes, etc.) were calculated for each patient right before the lung cancer treatment initialization.

### Time to Autoimmunity Analysis

After matching, we obtained multiple matched control group members for one treatment group member, where the exact number of matches could vary for each treatment group

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<sup>1</sup> Castro VM, Apperson WK, Gainer VS, et al. Evaluation of matched control algorithms in EHR-based phenotyping studies: a case study of inflammatory bowel disease comorbidities. *J Biomed Inform* 2014; **52**: 105-11.).

member. Each of the treatment group members was given weight of 1, and the corresponding matched control group members were given the same fraction weight such that they sum up to one; in other words, the weight of each multiple matched control group member is equal to the reciprocal of the total number of matches for that treatment group member. As such, we had the weighted-matched time-to-autoimmunity data with possible right censoring. From here we calculated the Kaplan-Meier curve of time to autoimmunity for the treatment group and the control group. The statistical significance was assessed using the log-rank test. For the implementation details, we used score test in weighted Cox proportional hazard model with group membership (treatment or control) being the only explanatory variable. Note that with the binary explanatory variable, score test of Cox proportional hazard model is equivalent to log-rank test. The model was natively implemented in R statistical programming language through the 'coxph' function in package 'Survival.' We specified the treatment group to be the only explanatory variable.

The confidence interval for Kaplan-Meier estimate of cumulative incidence rate and for hazard ratio is constructed using bootstrap. For analyzing the before-matching samples, the treatment group and the control group underwent bootstrap separately and independently. After generating the stratified bootstrap samples, the 95% confidence interval is obtained by plus minus 1.96 times of bootstrap estimate of standard error after bias correction. For analyzing the post-matching samples, the original matching structure was preserved throughout the bootstrap procedure. Specifically, the bootstrap was applied to the matched treatment-control tuple. Operation-wise, this is done by applying the bootstrap to the treatment group only, and then for each treatment group member in the bootstrapped samples, its original multiple matched controls were attached, yielding the bootstrapped treatment-control tuple. Thus, for analyzing the post-matching data, one treatment member and its matched control members get in and out the bootstrapped samples at the same time (the matched observations are hence still matched in the bootstrapped samples). The bootstrap method was implemented in R statistical programming language through the 'boot' function in package 'boot'.

### Sensitivity Analysis

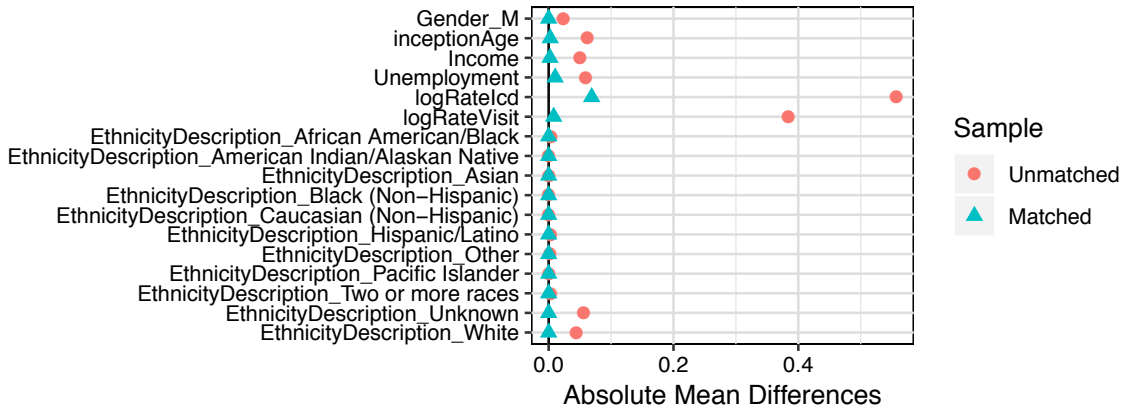
To ensure the robustness of our results, extensive sensitivity analyses were conducted by varying definitions and settings in study design. Statistical models with different definitions of data censoring date (e.g. censor on the last claim activity, insurance policy cancellation, or after 1-month following the last claim activity) were fitted, the percentile specifications were varied when matching for continuous covariates, and the different lengths of quiescence period requirement (1 week, 1 month, 3 months, and 12 months) after insurance enrollment were tested. A sensitivity study is also conducted on the time-frame specification where the patients are additionally required to have chemotherapy or immunotherapy initiation date after 2015. To further validate the results on the risk of clinically-significant thyroid diseases, we conduct sensitivity analysis where the identification of thyroid diseases, in addition to ICD code, must be accompanied by at least of one subsequent NDC drug code or CPT code related to the type of thyroid disease. The corresponding results from these models were examined and compared to those from the primary analyses.

## **Additional Result**

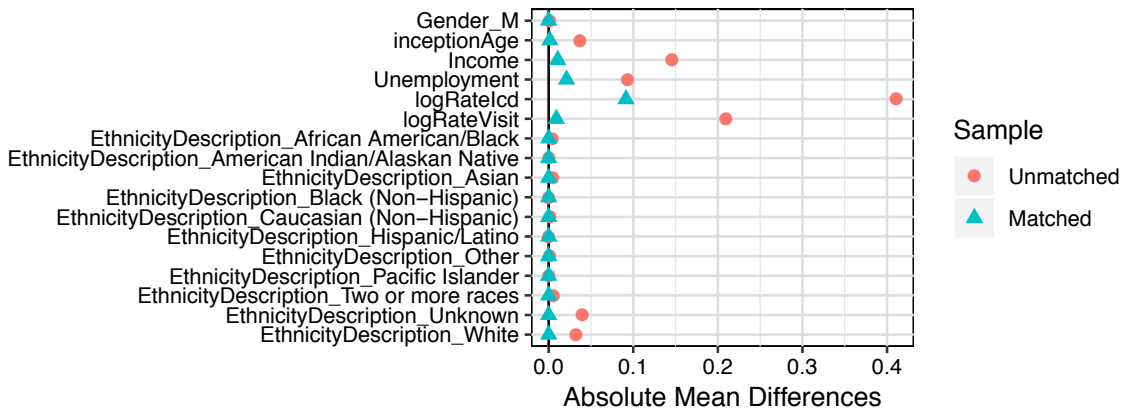
### **Covariate Balance Before and After Matching**

Figure S1. Covariate balance before and after matching.

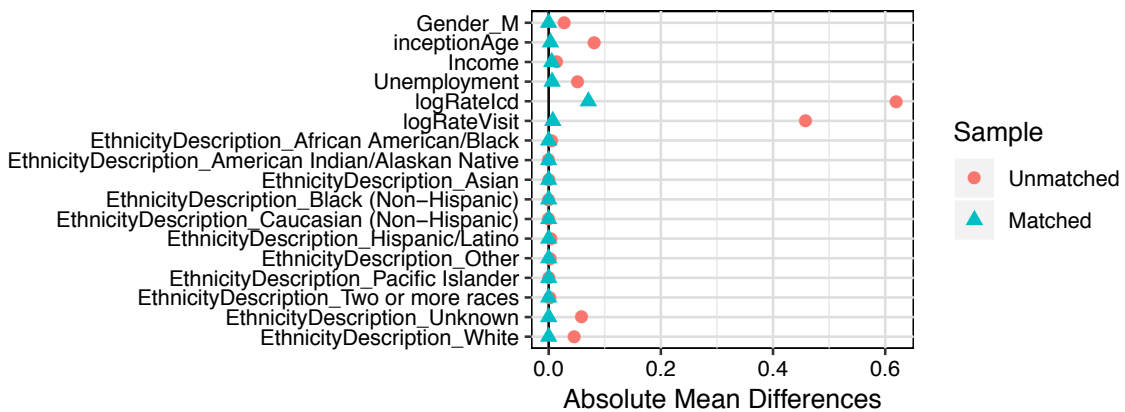
### Covariate Balance all immunotherapy drugs



### Covariate Balance Pembrolizumab



### Covariate Balance Nivolumab





### Time-to-Autoimmunity Analysis with Full Time Horizon

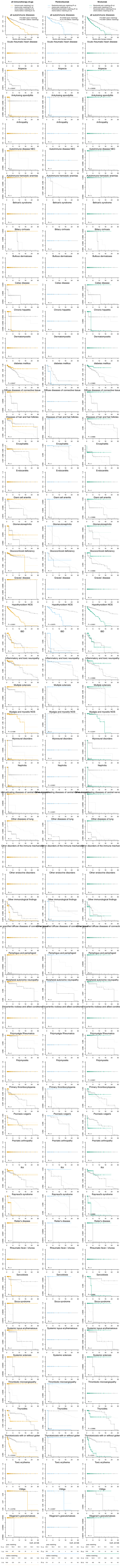
Figure S2. Time-to-autoimmune diseases in patients, comparing those receiving chemotherapy with (a) All immunotherapy drugs in the left column, (b) Pembrolizumab in the middle column, and (c) Nivolumab in the right column. Upper panels are the time-to-event analysis for all autoimmune disease types combined, where log-rank test P-values for the unmatched samples and the matched samples are reported in upper right corner respectively. Lower panels are time-to-event analysis for different categories of autoimmune disease, where P-values are based on the matched log-rank test with Benjamini-Hochberg correction for multiple testing of all 56 autoimmune disease types. Each tick represents 50 censored patients without an autoimmune disease event.

Interestingly, the nivolumab group appears to have a lower risk of developing type I diabetes mellitus compared to the chemotherapy group (Figure S2), although the difference is not statistically significant after multiple testing adjustment (Benjamini & Hochberg adjusted  $P = 0.3665$ ), which could be explained by the pancreatic toxicity<sup>2</sup> or the dysregulation of blood glucose homeostasis<sup>3</sup> associated with chemotherapy agents.

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<sup>2</sup> Ngo D, Jia JB, Green CS, et al. Cancer therapy related complications in the liver, pancreas, and biliary system: an imaging perspective. *Insights Imaging* 2015;6(6):665-77.

<sup>3</sup> Feliu J, Martin G, Lizon J, et al. Sequential therapy in advanced non-small-cell lung cancer with weekly paclitaxel followed by cisplatin-gemcitabine-vinorelbine. A phase II study.



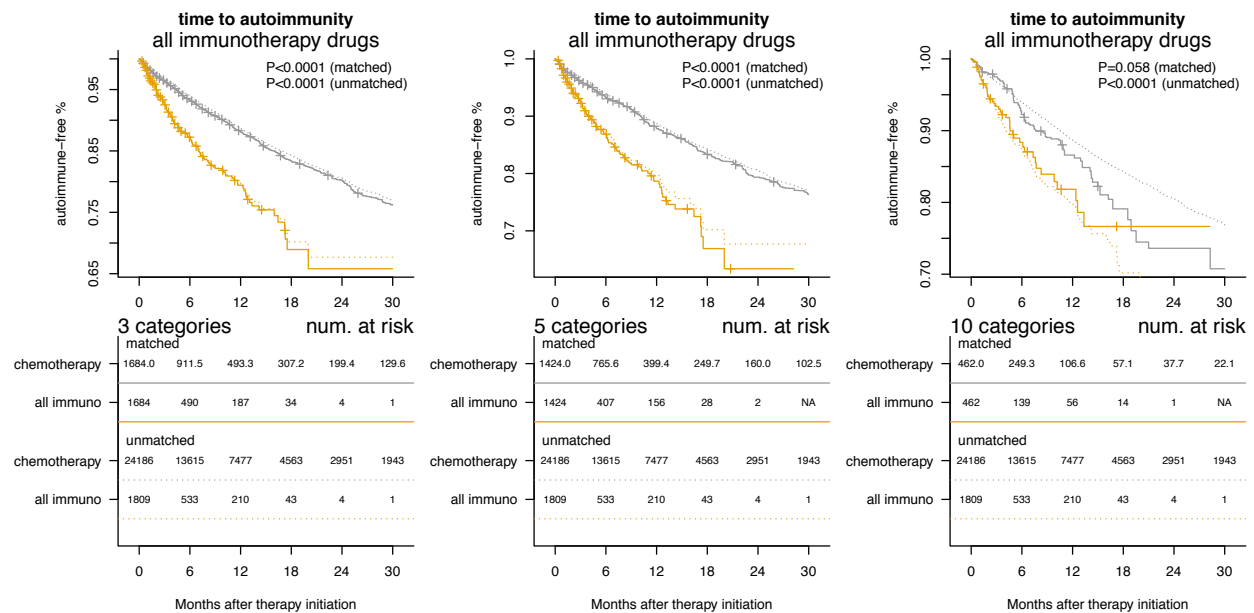
# Sensitivity Analyses

## Different Categorization of Continuous Variables for Matching

Statistical models with two other percentile specifications when matching for the continuous covariates (e.g. zip-code-defined median income, zip-code-defined unemployment rate, the annualized number of hospital visits prior to treatment therapy initialization, and the annualized number of ICD code counts prior to treatment therapy initialization) were fitted and examined in this section.

In particular, we fitted the same time-to-autoimmunity model with modified matching criteria where the continuous covariates are categorized into 3 categories (33.3% percentile), or to 10 categories (10% percentile). We compared the results below with the results shown in the main text where we used 5 categories (20% percentile). We found that the results were consistent with the finding in the main text (Figure S3), despite different sample size and thus different power for the statistical tests. Specifically, for both 3-category result and 10-category, the estimates of the Kaplan-Meier curve are very similar to those reported in the main text.

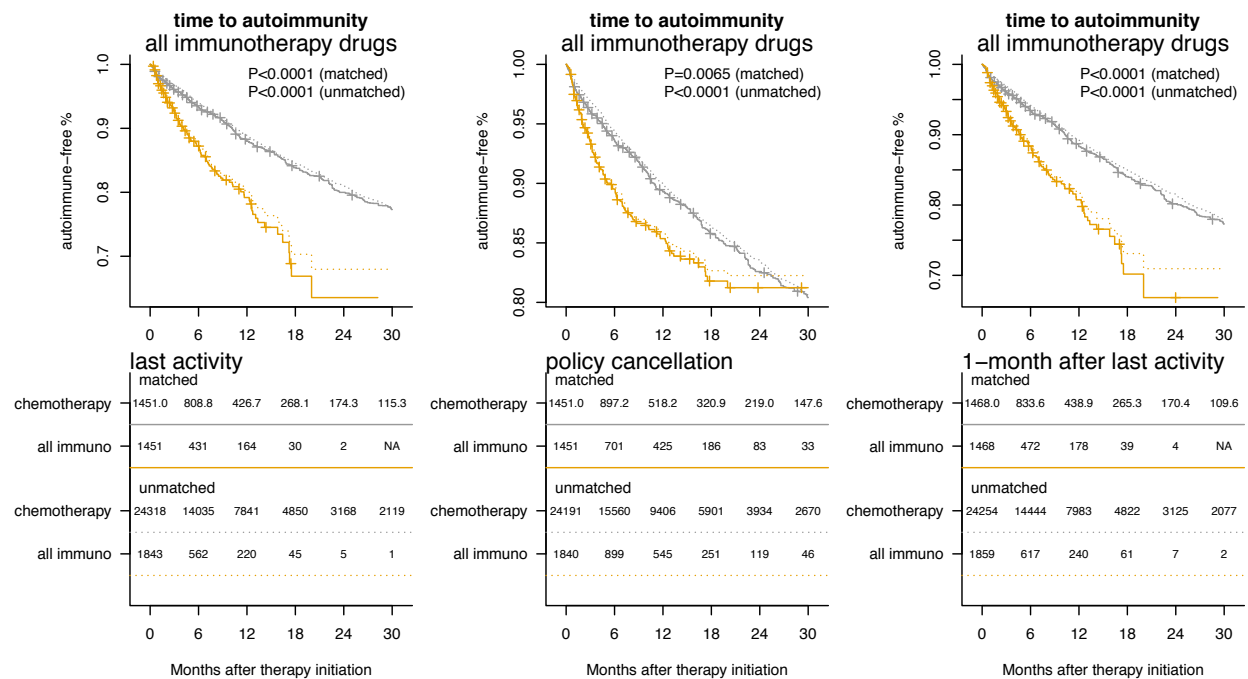
Figure S3. Sensitivity to the categorization of continuous variables for matching.



## Different Definitions of Censoring

Statistical models with different definitions of data censoring date were fitted in this section. We tested the sensitivity to different censoring criteria by defining the at-risk time for patients without any autoimmune diseases ICD codes to be the time from treatment initiation to (1) the last claim activity, (2) policy cancellation date, or (3) 1-month grace period after last claim activity, and compared them with the results in the main text, where the at-risk time for patients was defined as the number of days from lung cancer treatment initiation to the date of the last medical record or the end of continuous enrollment in Aetna, whichever is earlier. Figure S4 presents the sensitivity study results in detail, where the result is shown to be robust to different definitions of censoring.

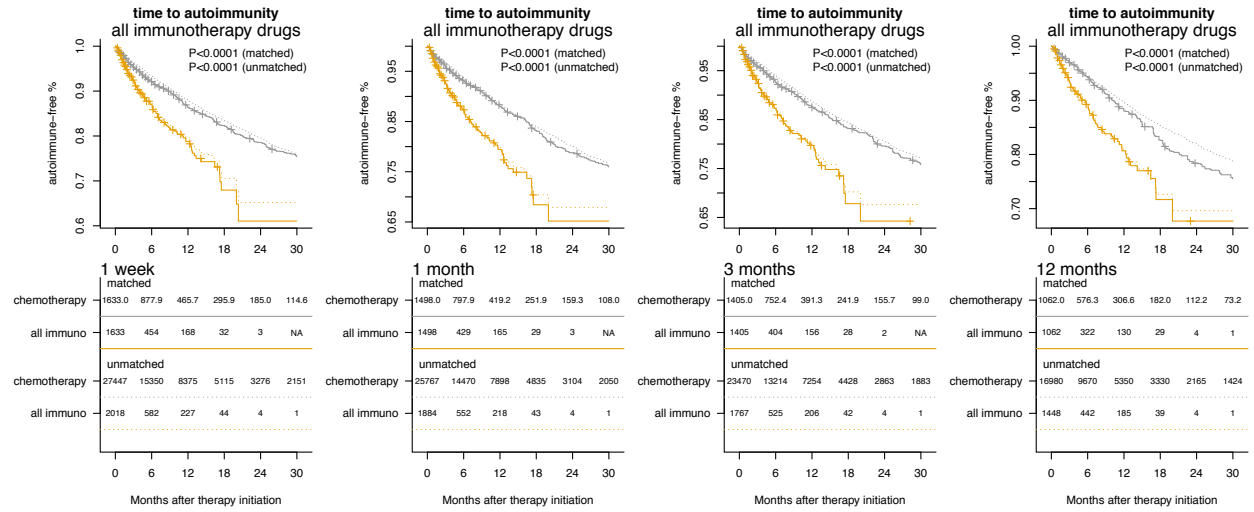
Figure S4. Sensitivity analyses on the definitions of censoring.



## Different Quiescence Period Requirement

Statistical models with different quiescence period requirements are fitted and examined in this section. In particular, we fitted the same time-to-autoimmunity model with a few variants of quiescence period requirements in the “exclusion criteria” section, where treatment initiation dates are required to be at least (1) one week after the insurance enrollment, (2) one month after the insurance enrollment, (3) three months after the insurance enrollment, and (4) one year after the insurance enrollment. Figure S5 presents the sensitivity analyses results, where the increased hazard for autoimmune disease in the immunotherapy group is consistent throughout different quiescence period requirements.

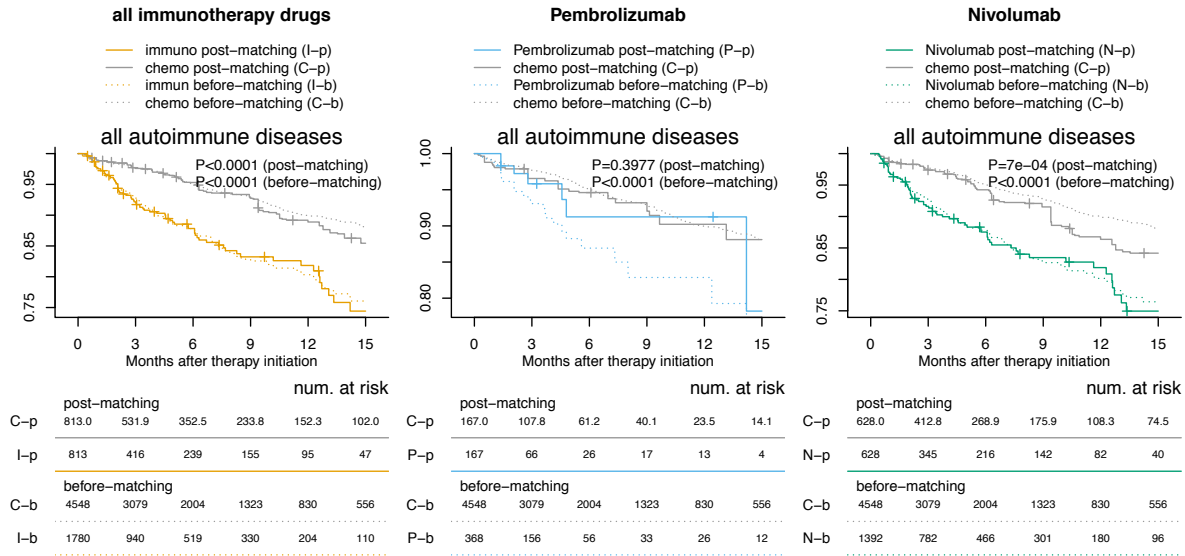
Figure S5. Sensitivity analyses on the quiescence period requirement.



### Additional Time-Frame Requirement

To rule out the possible difference of post-2015 chemotherapy treatment and pre-2015 chemotherapy treatment, we additionally require the control group patients to have chemotherapy initiation date after 2015. The year 2015 is used as cut-off time as most immunotherapy patients have treatment initiation date after 2015. To further rule out the potential differences in the types of patient who received immunotherapy in the pre-market approval period and post-market approval period, we also require the treatment group patients to have immunotherapy initiation date after 2015. Therefore, in this sensitivity study, we imposed additional time frame requirement for both immunotherapy patients and chemotherapy patients such that treatment initiation dates are all after 2015. Figure S6 presents the analysis results in detail. We observe similar results as in the main text but with reduced statistical power due to the exclusion of pre-2015 patients. In particular, patients on Pembrolizumab is no longer statistically significantly different to the control group after matching, although the general trend is similar.

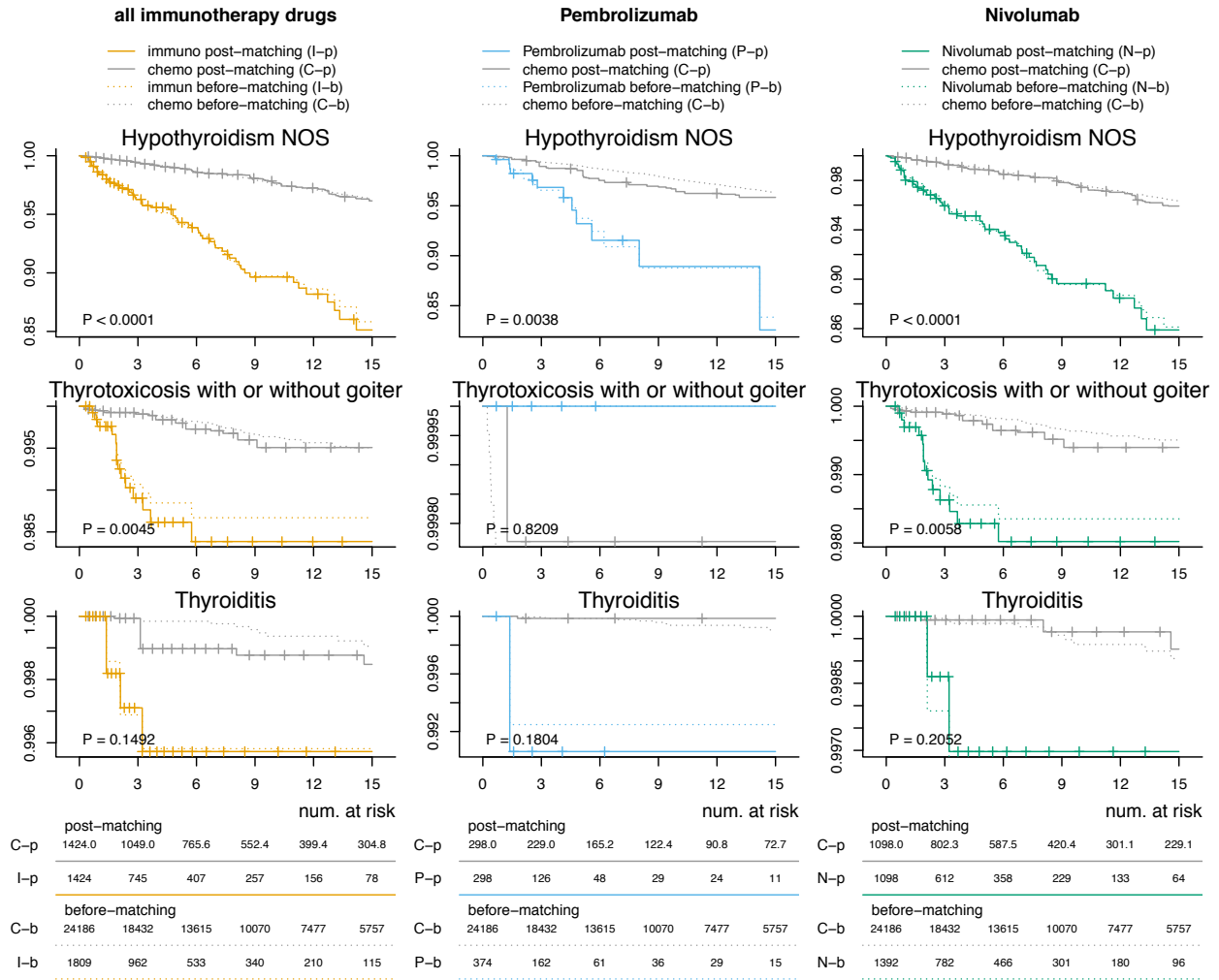
Figure S6. Analyses with additional time-frame requirement that patients must have chemotherapy or immunotherapy initiation date after 2015.



### Additional Requirement for the Identification of Clinically-Significant Thyroid Disorders

Due to the fact that patients treated with immunotherapy drugs appear to have higher risks of developing thyroid disorders, we conduct sensitivity analyses to check if the identified thyroid disorders are clinically-significant and requiring further evaluation or treatment. To study this, we conducted additional analyses where we require patients with “clinically-significant thyroid diseases” to have (1) one entry of relevant ICD codes appeared in the patients’ medical record and (2) one additional subsequent entry of CPT codes (defined in Table S8) or NDC drugs codes (defined in Table S9) related to the thyroid disorder appeared in their record. Figure S6 presents the time-to-thyroid-disease analysis results where the disease identification requires confirmation by CPT or NDC codes as mentioned above. The results are very similar to the one presented in the main text, demonstrating the reliability of our conclusion that patients on immunotherapy have a significantly higher risk for hypothyroidism compared to patients on chemotherapy. The p-value reported below is after Benjamini & Hochberg adjustment within the three thyroid-related diseases.

Figure S7. Sensitivity analyses on the clinically-significant thyroid diseases with further evaluations or treatments.



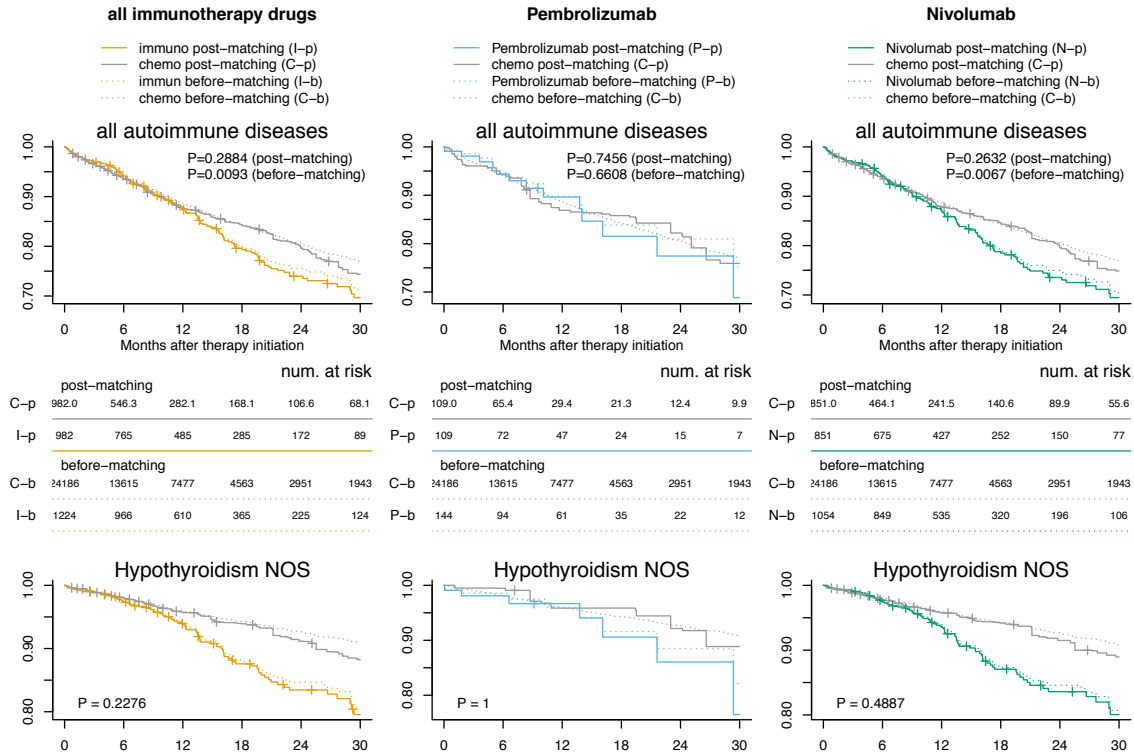
### Treatment Initiation Date Definition for Patients on Second-line Immunotherapy

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. While this is a clean way to study the autoimmune adverse effect of immunotherapy, one might wonder whether the previously administered chemotherapy has any effect. This sensitivity study answers this question by comparing the chemotherapy group with patients receiving first-line chemotherapy and immunotherapy as the second-line treatment, where we define the index date to be the date of the first chemotherapy administration. Note that in this setting our treatment group consists of patients on chemotherapy first and then later switch to the immunotherapy, while the control group consists of patients on chemotherapy throughout. The time-to-event outcome is the time from the first chemotherapy administration to the first autoimmune adverse event for both the treatment group and the control group. Because the treatment group is indistinguishable from the control group before the immunotherapy administration, this gives a conservative estimate of the effects of second-line immunotherapy, i.e., a lower bound for the differential risk of immunotherapy to autoimmune adverse effect.

Figure S8 shows the result. We note that the treatment group and the control group has very similar Kaplan-Meier curves initially. This is expected since the treatment group has not started the second-line immunotherapy during the initial period and thus should have the same risk profile as the control group. Because the median time lag between first-line chemotherapy and second-line immunotherapy is 7.5 months, after 6 months we begin to observe that the Kaplan-Meier curves start to diverge between the treatment group and the control group. Overall, we still observe a differential risk between the treatment group and the control group, which is a conservative estimate of the autoimmune side-effect of second-line immunotherapy patients due to the significant lag time between the first-line therapy and the second-line therapy. However, this conservative estimate is not statistically significant.

Figure S8. Sensitivity studies on the impact of treatment initiation date definition for patients on second-line immunotherapy.





## Subpopulation Analyses

### Lines of Immunotherapy

We stratified the results 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 S9 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 first-line treatment for metastatic non-small cell lung cancer. The differential risk of autoimmune disease is similar in the two groups.

Figure S9. (a) Results stratified by the lines of immunotherapy. This panel shows results where the treatment group are all first-line immunotherapy patients.

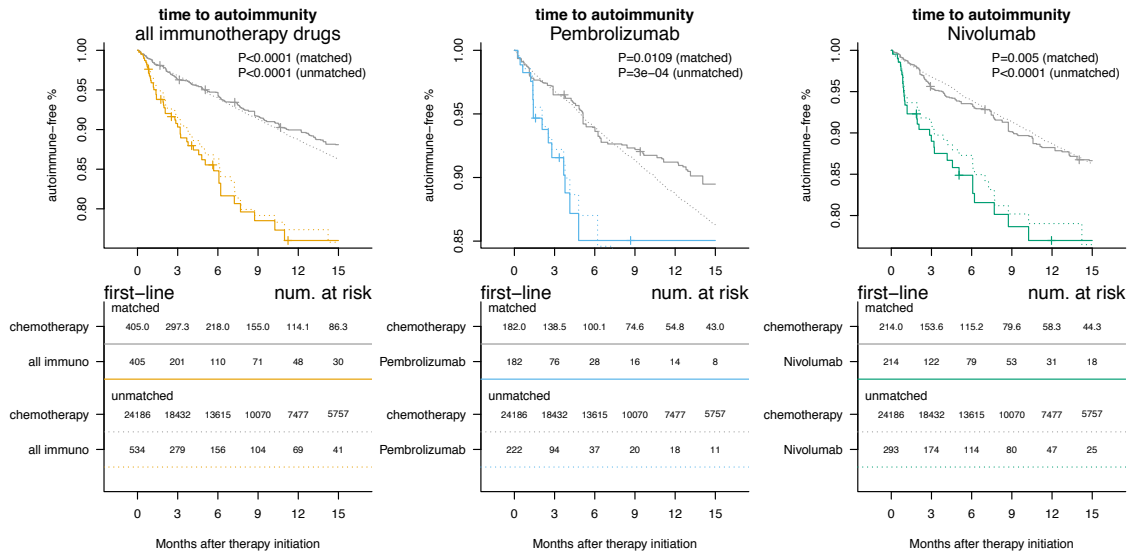
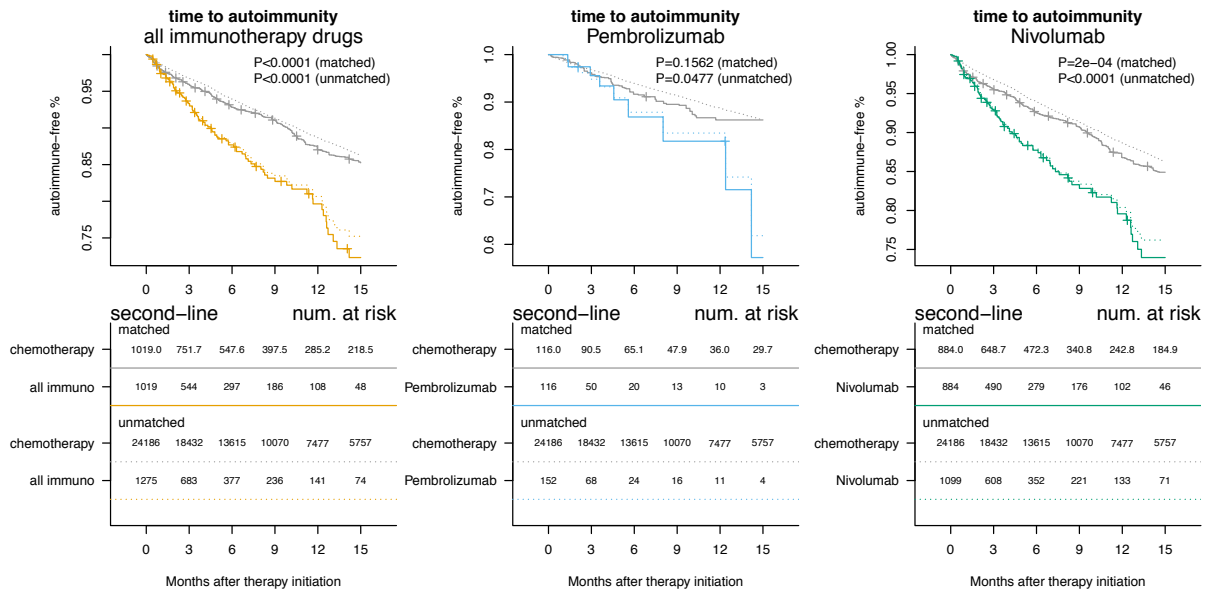


Figure S9. (b). Results stratified by lines of immunotherapy. This panel shows results where the treatment group are all second-line immunotherapy patients.



### Sex Stratification

We stratified the results by looking at male patients and female patients separately. The differential risk of immunotherapy to autoimmune adverse events is similar within the two sexes. See Figure S10 for detail.

Figure S10. (a) Results stratified by sex. This panel shows results where both the treatment group and the control group are all female patients.

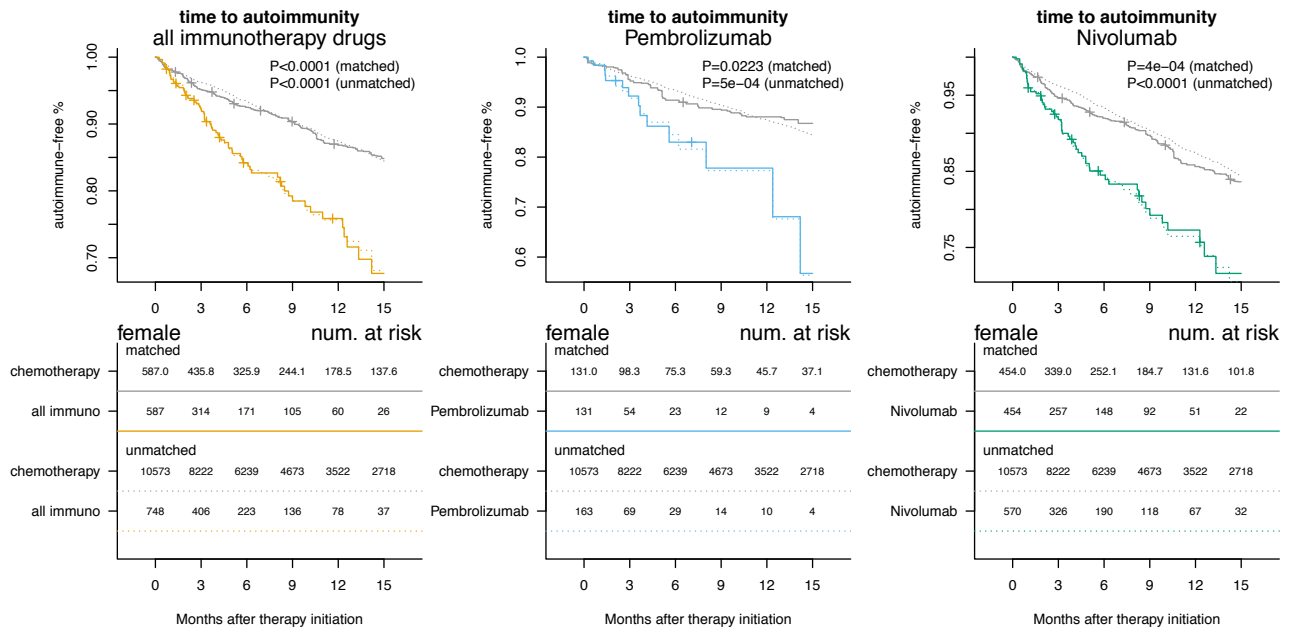
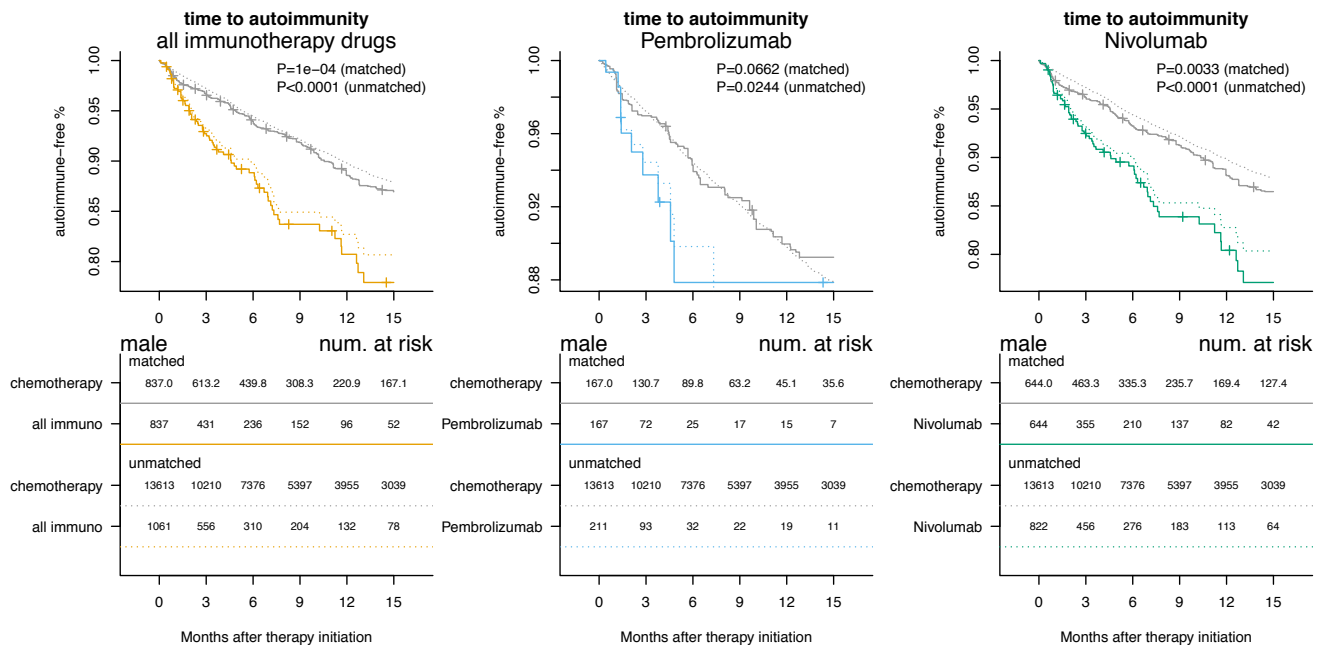


Figure S10. (b) Results stratified by sex. This panel shows results where both the treatment group and the control group are all male patients.



### Age Stratification

We stratified the results by looking at different age groups of patients separately. The differential risk of immunotherapy to the autoimmune adverse event is diminished in the elder age group. See Figure S11 for detail.

Figure S11. (a) Results stratified by age groups. This panel shows results where both the treatment group and the control group are restricted to have age less than 60.

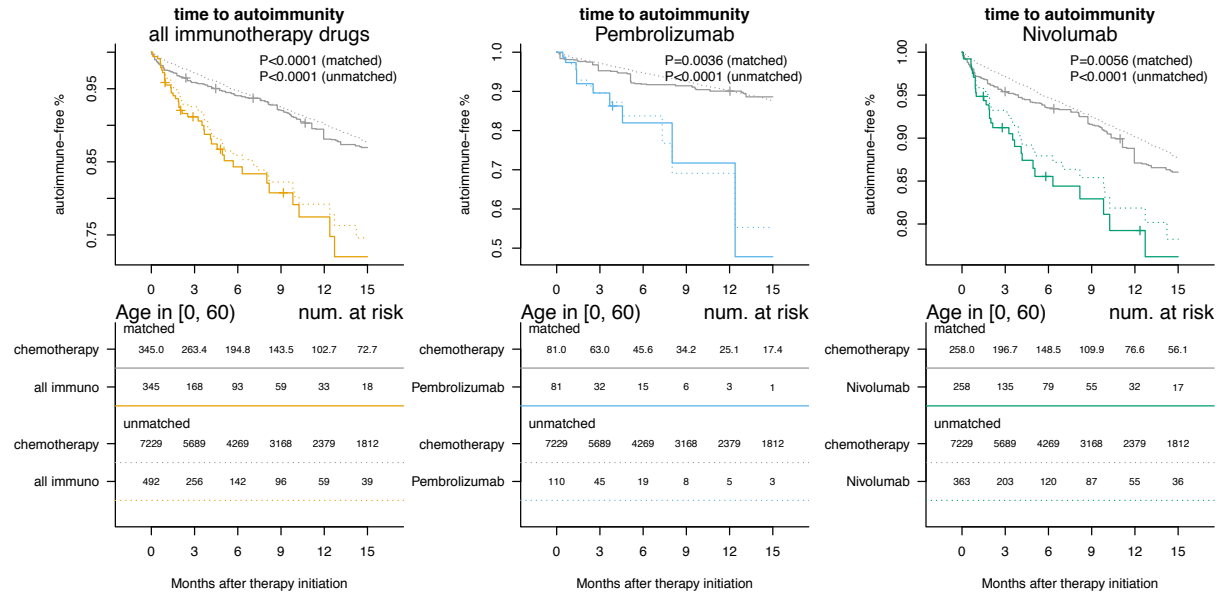


Figure S11. (b) Results stratified by age group. This panel shows results where both the treatment group and the control group are restricted to have age greater or equal to 60 but less than 70.

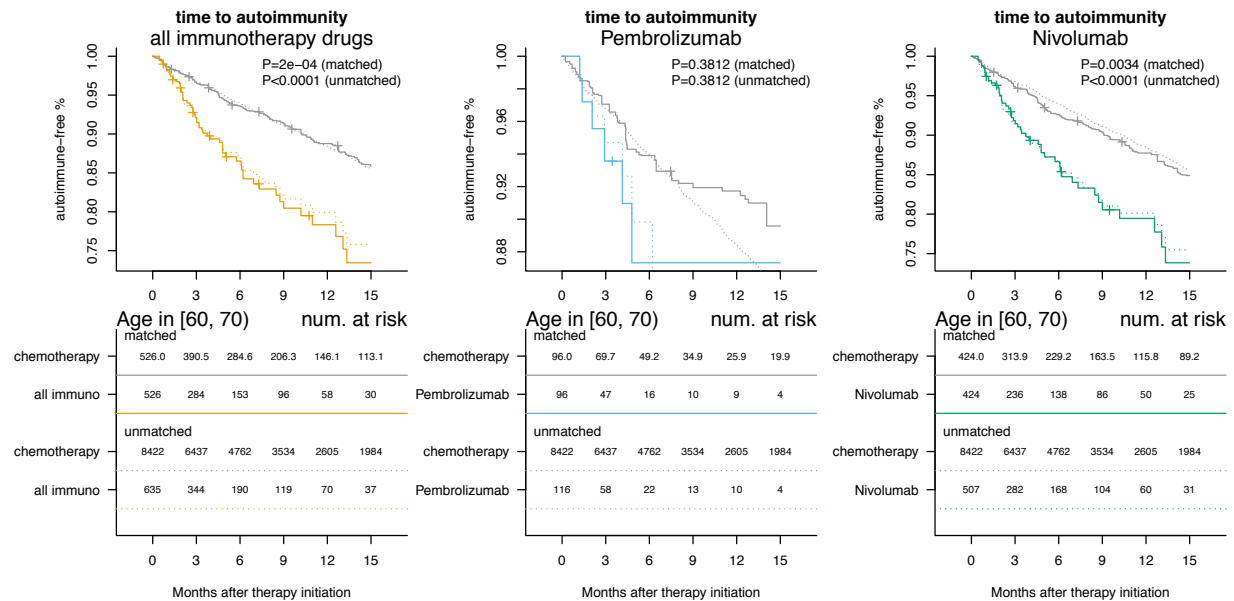


Figure S11. (c) Results stratified by age group. This panel shows results where both the treatment group and the control group are restricted to have age greater or equal to 70 but less than 80.

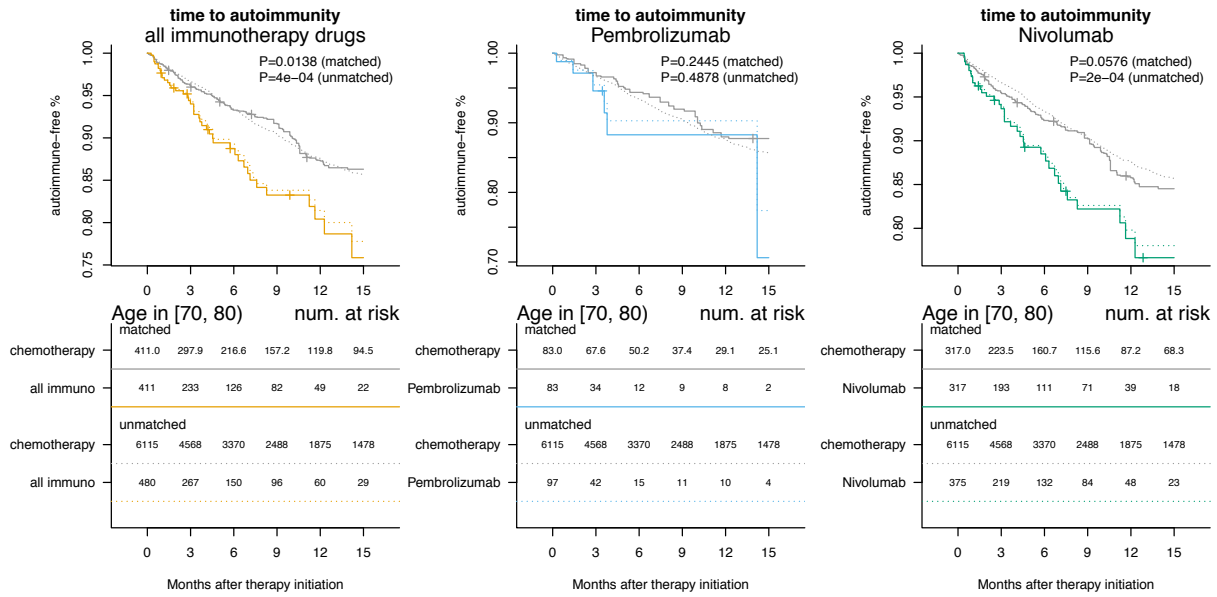
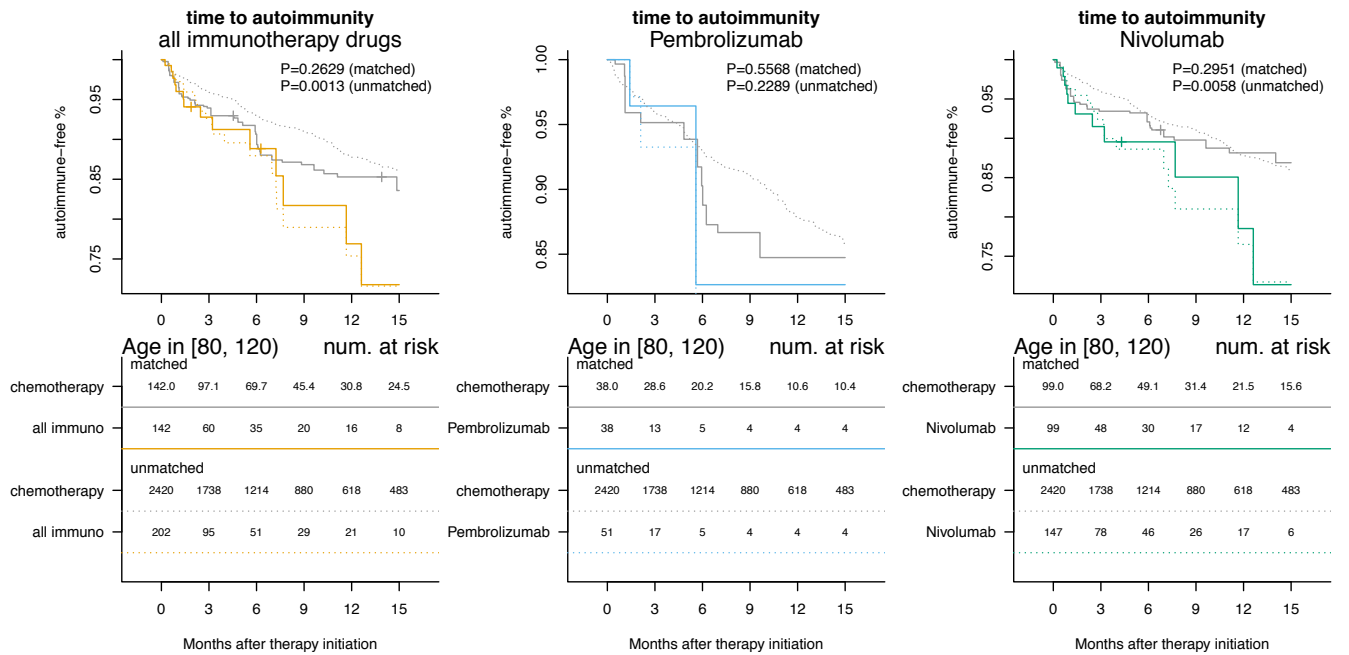


Figure S11. (d) Results stratified by age group. This panel shows results where both the treatment group and the control group are restricted to have age greater or equal to 80.



## Appendix

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### Detailed Definition

#### Lung Cancer

Table S1. Diagnosis criteria.

IcdCode	IcdString
162	Malignant neoplasm of trachea, bronchus, and lung
162.0	Malignant neoplasm of trachea
162.2	Malignant neoplasm of main bronchus
162.3	Malignant neoplasm of upper lobe, bronchus or lung
162.4	Malignant neoplasm of middle lobe, bronchus or lung
162.5	Malignant neoplasm of lower lobe, bronchus or lung
162.8	Malignant neoplasm of other parts of bronchus or lung
162.9	Malignant neoplasm of bronchus and lung, unspecified
209.21	Malignant carcinoid tumor of the bronchus and lung
231.2	Carcinoma in situ of bronchus and lung
C33	Malignant neoplasm of trachea
C34	Malignant neoplasm of bronchus and lung
C34.0	Malignant neoplasm of main bronchus
C34.00	Malignant neoplasm of unspecified main bronchus
C34.01	Malignant neoplasm of right main bronchus
C34.02	Malignant neoplasm of left main bronchus
C34.1	Malignant neoplasm of upper lobe, bronchus or lung
C34.10	Malignant neoplasm of upper lobe, unspecified bronchus or lung
C34.11	Malignant neoplasm of upper lobe, right bronchus or lung
C34.12	Malignant neoplasm of upper lobe, left bronchus or lung
C34.2	Malignant neoplasm of middle lobe, bronchus or lung
C34.3	Malignant neoplasm of lower lobe, bronchus or lung
C34.30	Malignant neoplasm of lower lobe, unspecified bronchus or lung
C34.31	Malignant neoplasm of lower lobe, right bronchus or lung
C34.32	Malignant neoplasm of lower lobe, left bronchus or lung
C34.8	Malignant neoplasm of overlapping sites of bronchus and lung
C34.80	Malignant neoplasm of overlapping sites of unspecified bronchus and lung
C34.81	Malignant neoplasm of overlapping sites of right bronchus and lung
C34.82	Malignant neoplasm of overlapping sites of left bronchus and lung
C34.9	Malignant neoplasm of unspecified part of bronchus or lung
C34.90	Malignant neoplasm of unspecified part of unspecified bronchus or lung
C34.91	Malignant neoplasm of unspecified part of right bronchus or lung
C34.92	Malignant neoplasm of unspecified part of left bronchus or lung
C7A.090	Malignant carcinoid tumor of the bronchus and lung
D02.2	Carcinoma in situ of bronchus and lung
D02.20	Carcinoma in situ of unspecified bronchus and lung

D02.21	Carcinoma in situ of right bronchus and lung
D02.22	Carcinoma in situ of left bronchus and lung

Table S2. Procedure criteria.

CPT4Code	CPT4Desc
G9063	disease status; limited to non-small cell lung cancer; extent of disease initially established as stage i (prior to neo-adjuvant therapy, if any) with no evidence of disease progression, recurrence, or metastases (for use in a medicare-approved demonstration project)
G9064	disease status; limited to non-small cell lung cancer; extent of disease initially established as stage ii (prior to neo-adjuvant therapy, if any) with no evidence of disease progression, recurrence, or metastases (for use in a medicare-approved demonstration project)
G9065	disease status; limited to non-small cell lung cancer; extent of disease initially established as stage iii a (prior to neo-adjuvant therapy, if any) with no evidence of disease progression, recurrence, or metastases (for use in a medicare-approved demonstration project)
G9066	disease status; limited to non-small cell lung cancer; stage iii b- iv at diagnosis, metastatic, locally recurrent, or progressive (for use in a medicare-approved demonstration project)
G9067	disease status; limited to non-small cell lung cancer; extent of disease unknown, staging in progress, or not listed (for use in a medicare-approved demonstration project)
G9068	disease status; limited to small cell and combined small cell/non-small cell; extent of disease initially established as limited with no evidence of disease progression, recurrence, or metastases (for use in a medicare-approved demonstration project)
G9069	disease status; small cell lung cancer, limited to small cell and combined small cell/non-small cell; extensive stage at diagnosis, metastatic, locally recurrent, or progressive (for use in a medicare-approved demonstration project)
G9070	disease status; small cell lung cancer, limited to small cell and combined small cell/non-small; extent of disease unknown, staging in progress, or not listed (for use in a medicare-approved demonstration project)

Table S3. Pharmacy NDC criteria.

PROPRIETARY NAME	NONPROPRIETARY NAME	NDCPACKAGE CODE	PACKAGEDESCRIPTION
OPDIVO	nivolumab	00003377211	1 VIAL, SINGLE-DOSE in 1 CARTON (0003-3772-11) > 4 mL in 1 VIAL, SINGLE-DOSE
OPDIVO	nivolumab	00003377412	1 VIAL, SINGLE-DOSE in 1 CARTON (0003-3774-12) > 10 mL in 1 VIAL, SINGLE-DOSE

KEYTRUDA	pembrolizumab	00006302602	1 VIAL in 1 CARTON (0006-3026-02) > 10 mL in 1 VIAL (0006-3026-01)
KEYTRUDA	pembrolizumab	00006302902	1 VIAL in 1 CARTON (0006-3029-02) > 15 mL in 1 VIAL (0006-3029-01)
Xalkori	CRIZOTINIB	00069814020	60 CAPSULE in 1 BOTTLE (0069-8140-20)
Xalkori	CRIZOTINIB	00069814120	60 CAPSULE in 1 BOTTLE (0069-8141-20)
ZYKADIA	ceritinib	00078064070	70 CAPSULE in 1 BOTTLE (0078-0640-70)
TAGRISSE	osimertinib	00310134930	30 TABLET, FILM COATED in 1 BOTTLE (0310-1349-30)
TAGRISSE	osimertinib	00310135030	30 TABLET, FILM COATED in 1 BOTTLE (0310-1350-30)
Gilotrif	afatinib	00597013730	1 BOTTLE in 1 CARTON (0597-0137-30) > 30 TABLET, FILM COATED in 1 BOTTLE
Gilotrif	afatinib	00597013830	1 BOTTLE in 1 CARTON (0597-0138-30) > 30 TABLET, FILM COATED in 1 BOTTLE
Gilotrif	afatinib	00597014130	1 BOTTLE in 1 CARTON (0597-0141-30) > 30 TABLET, FILM COATED in 1 BOTTLE

Table S4. Pharmacy HCPCS criteria.

name	HCPCS.code
Nivolumab.Opdivo	C9453,J9299
Pembrolizumab.Keytruda	C9027,J9271

Table S5. Immune checkpoint inhibitors identification criteria.

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

## Chemotherapy

Table S6. Part 1. Chemotherapy CPT/HCPCS procedure codes for medical claims data.

CHEMOCAT	PX2	CODE_TYP E	DESCRIPTION
CARBOPLATIN	J9045	HCPC	Carboplatin, 50 mg
CISPLATIN	J9062	HCPC	Cisplatin, 50 mg
CISPLATIN	C9418	HCPC	CISPLATIN, POWDER OR SOLUTION, BRAND NAME, PER 10 MG
CISPLATIN	J9060	HCPC	Cisplatin, powder or solution, per 10 mg
CISPLATIN	20962 2	HCPC	REIMB CISPLATIN 10 MG VIAL (PLATINOL).
DOCETAXEL	J9170	HCPC	Docetaxel, 20 mg
DOCETAXEL	J9171	HCPC	Injection, docetaxel, 1 mg
ETOPOSIDE	J9181	HCPC	Etoposide, 10 mg
ETOPOSIDE	J9182	HCPC	Etoposide, 100 mg
ETOPOSIDE	C9425	HCPC	ETOPOSIDE, BRAND NAME, 10 MG
ETOPOSIDE	C9414	HCPC	ETOPOSIDE, ORAL, BRAND NAME, 50 MG
ETOPOSIDE	J8560	HCPC	Etoposide; oral, 50 mg
GEMCITABINE	J9201	HCPC	Gemcitabine HCl, 200 mg
IRINOTECAN	81350	CPT4	IRINOTECAN TOXICITY, UGT1A1*28, GENOTYPING
IRINOTECAN	J9206	HCPC	Irinotecan, 20 mg
MECHLORETHAMINE	J9230	HCPC	Mechlorethamine HCl, (nitrogen mustard), 10 mg
METHOTREXATE	83520	CPT4	METHOTREXATE LEVEL
METHOTREXATE	J9250	HCPC	Methotrexate sodium, 5 mg
METHOTREXATE	J9260	HCPC	Methotrexate sodium, 50 mg
METHOTREXATE	J8610	HCPC	Methotrexate: oral, 2.5 mg
PACLITAXEL	J9264	HCPC	Injection, paclitaxel protein-bound particles, 1 mg
PACLITAXEL	J9267	HCPC	INJECTION, PACLITAXEL, 1 MG
PACLITAXEL	J9265	HCPC	Paclitaxel, 30 mg
PACLITAXEL	C9431	HCPC	PACLITAXEL, BRAND NAME, 30 MG
PEMETREXED	J9305	HCPC	Injection, pemetrexed, 10 mg
PEMETREXED	C9213	HCPC	INJECTION, PEMETREXED, PER 10 MG
VINBLASTINE	J9360	HCPC	Vinblastine sulfate, 1 mg
VINORELBINE	C9440	HCPC	VINORELBINE TARTRATE, BRAND NAME, PER 10 MG
VINORELBINE	J9390	HCPC	Vinorelbine tartrate, per 10 mg

Table S6. Part 2. Chemotherapy National Drug Code for pharmacy claims data.

National Drug Code	CHEMOCAT	GENERIC_NAME	BRAND_NAME
00002750101	GEMCITABINE	GEMCITABINE HCL	GEMZAR INJ 200MG UD
00002750201	GEMCITABINE	GEMCITABINE HCL	GEMZAR INJ 1 GM UD
00002762301	PEMETREXED	PEMETREXED DISODIUM	ALIMTA INJ 500MG UD
00002764001	PEMETREXED	PEMETREXED DISODIUM	ALIMTA INJ 100MG UD
00006775331	MECHLORETHAMINE	MECHLORETHAMINE HCL	MUSTARGEN 10MG VIAL
00015309145	ETOPOSIDE	ETOPOSIDE	VEPESID 50MG CAPSULE
00054455015	METHOTREXATE	METHOTREXATE SODIUM	METHOTREXATE TAB 2.5MG
00054455025	METHOTREXATE	METHOTREXATE SODIUM	METHOTREXATE
00054855025	METHOTREXATE	METHOTREXATE SODIUM	METHOTREXATE
00069010303	VINORELBINE	VINORELBINE	VINORELBINE TARTRATE INJ 50 MG/5ML (10 MG/ML)
00075800120	DOCETAXEL	DOCETAXEL	TAXOTERE INJ 20/0.5ML UD
00075800180	DOCETAXEL	DOCETAXEL	TAXOTERE 80MG/2ML INJECTION
00075800404	DOCETAXEL	DOCETAXEL	TAXOTERE INJ 80MG/4ML UD
00172375473	PACLITAXEL	PACLITAXEL,SEMI-SYNTHETIC	ONXOL INJ 30MG/5ML
00378001401	METHOTREXATE	METHOTREXATE SODIUM	METHOTREXATE 2.5MG TABLET
00378001450	METHOTREXATE	METHOTREXATE SODIUM	METHOTREXATE
00378326694	ETOPOSIDE	ETOPOSIDE	ETOPOSIDE CAP 50MG UD
00409020102	DOCETAXEL	DOCETAXEL	DOCETAXEL SOLN FOR IV INFUSION 20 MG/2ML
00409020110	DOCETAXEL	DOCETAXEL	DOCETAXEL
00409020120	DOCETAXEL	DOCETAXEL	DOCETAXEL SOLN FOR IV INFUSION 160 MG/16ML

00555057202	METHOTREXATE	METHOTREXATE SODIUM	METHOTREXATE TAB 2.5MG
00555057235	METHOTREXATE	METHOTREXATE SODIUM	METHOTREXATE TAB 2.5MG
00555057245	METHOTREXATE	METHOTREXATE SODIUM	
00555198414	PACLITAXEL	PACLITAXEL (1X16.7ML,USP,MDV) 6 MG/ML	PACLITAXEL
00703324911	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN INJ 600/60ML
00703367103	METHOTREXATE	METHOTREXATE	METHOTREXATE SODIUM INJ PF 25 MG/ML
00703367301	METHOTREXATE	METHOTREXATE	METHOTREXATE SODIUM INJ PF 25 MG/ML
00703367501	METHOTREXATE	METHOTREXATE	METHOTREXATE SODIUM INJ PF 25 MG/ML
00703418301	VINORELBINE	VINORELBINE TARTRATE	VINORELBINE TARTRATE INJ 10MG/ML
00703423901	CARBOPLATIN	Carboplatin IV Soln 600 MG/60ML	
00703424401	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN
00703424481	CARBOPLATIN	CARBOPLATIN 10 MG/ML INTRAVENOUS SOLUTIO	CARBOPLATIN 10 MG/ML IV SOLN
00703424601	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN INJ 150/15ML
00703424801	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN INJ 450/45ML
00703476401	PACLITAXEL	PACLITAXEL	PACLITAXEL IV CONC 30 MG/5ML (6 MG/ML)
00703476601	PACLITAXEL	PACLITAXEL	PACLITAXEL IV CONC 100 MG/16.7ML (6 MG/ML)
00703565301	ETOPOSIDE	ETOPOSIDE	ETOPOSIDE INJ 20MG/ML
00703573001	DOCETAXEL	Docetaxel For Inj Conc 20 MG/ML	DOCETAXEL
00703574711	CISPLATIN	CISPLATIN	CISPLATIN INJ 50/50ML

00703574811	CISPLATIN	CISPLATIN	CISPLATIN INJ 100MG
00904601260	METHOTREXATE	METHOTREXATE SODIUM TAB 2.5 MG (BASE EQUIV)	METHOTREXATE
00955102001	DOCETAXEL	DOCETAXEL	DOCETAXEL FOR INJ CONC 20 MG/ML
00955102104	DOCETAXEL	DOCETAXEL	DOCETAXEL FOR INJ CONC 80 MG/4ML (20 MG/ML)
10139006202	METHOTREXATE	METHOTREXATE SODIUM/PF	METHOTREXATE SODIUM INJ 50MG/2ML UD
10139006210	METHOTREXATE	METHOTREXATE SODIUM/PF	METHOTREXATE SODIUM INJ 250MG/10 UD
16729009203	GEMCITABINE	GEMCITABINE	GEMCITABINE HCL FOR INJ 200 GM
16729011431	ETOPOSIDE	ETOPOSIDE	ETOPOSIDE INJ 20 MG/ML
16729011711	GEMCITABINE	GEMCITABINE	GEMCITABINE HCL FOR INJ 1 GM
16729011838	GEMCITABINE	GEMCITABINE	GEMCITABINE HCL FOR INJ 2 GM
16729027730	METHOTREXATE	METHOTREXATE SODIUM	Methotrexate Sodium Inj PF 25 MG/ML
25021020205	CARBOPLATIN	CARBOPLATIN	Carboplatin IV Soln 50 MG/5ML
25021020215	CARBOPLATIN	CARBOPLATIN	Carboplatin IV Soln 150 MG/15ML
25021020245	CARBOPLATIN	CARBOPLATIN	Carboplatin IV Soln 450 MG/45ML
25021020251	CARBOPLATIN	CARBOPLATIN	Carboplatin IV Soln 50 MG/5ML
25021020401	VINORELBINE	VINORELBINE TARTRATE INJ 10 MG/ML	VINORELBINE TARTRATE
25021020405	VINORELBINE	VINORELBINE TARTRATE INJ 10 MG/ML	VINORELBINE TARTRATE
25021021317	PACLITAXEL	PACLITAXEL	PACLITAXEL IV CONC 100 MG/16.7ML (6 MG/ML)
25021021350	PACLITAXEL	PACLITAXEL	PACLITAXEL IV CONC 300 MG/50ML (6 MG/ML)

25021022204	DOCETAXEL	DOCETAXEL	Docetaxel For Inj Conc 80 MG/4ML (20 MG/ML)
42291059401	METHOTREXATE	Methotrexate Sodium Tab 2.5 MG (Base Equiv)	
43598025811	DOCETAXEL	Docetaxel For Inj Conc 20 MG/ML	
43598025940	DOCETAXEL	Docetaxel For Inj Conc 80 MG/4ML (20 MG/ML)	
45963061959	GEMCITABINE	Gemcitabine HCl For Inj 1 GM	
47335015040	CARBOPLATIN	Carboplatin IV Soln 50 MG/5ML	
47335015340	GEMCITABINE	GEMCITABINE HCL FOR INJ 200 MG	GEMCITABINE HCL
47335015440	GEMCITABINE	GEMCITABINE HCL FOR INJ 1 GM	GEMCITABINE HCL
50111096676	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN
51079067005	METHOTREXATE	METHOTREXATE SODIUM	METHOTREXATE
51079067086	METHOTREXATE	METHOTREXATE SODIUM	
51079096505	ETOPOSIDE	ETOPOSIDE	ETOPOSIDE CAP 50MG UD
51285036601	METHOTREXATE	METHOTREXATE SODIUM	TREXALL TAB 5MG
51285036801	METHOTREXATE	METHOTREXATE SODIUM	TREXALL TAB 10MG
51285036901	METHOTREXATE	METHOTREXATE SODIUM	TREXALL TAB 15MG
54436002504	METHOTREXATE	METHOTREXATE (PF) 25 MG/0.4 ML SUBCUTANEOUS AUTO-INJECTOR	OTREXUP (PF) 25 MG/0.4 ML SUBQ AUTOINJECTOR
55111068607	GEMCITABINE	GEMCITABINE HCL FOR INJ 200 MG	GEMCITABINE HCL
55390003110	METHOTREXATE	METHOTREXATE SODIUM/PF	METHOTREXATE SODIUM INJ 25MG/ML UD
55390003410	METHOTREXATE	METHOTREXATE SODIUM/PF	METHOTREXATE SODIUM INJ 25MG/ML
55390007001	VINORELBINE	VINORELBINE TARTRATE	VINORELBINE TARTRATE
55390011299	CISPLATIN	CISPLATIN	CISPLATIN
55390011405	PACLITAXEL	PACLITAXEL,SEMI- SYNTHETIC	PACLITAXEL
55390011420	PACLITAXEL	PACLITAXEL,SEMI- SYNTHETIC	PACLITAXEL
55390011450	PACLITAXEL	PACLITAXEL,SEMI- SYNTHETIC	PACLITAXEL
55390015601	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN

55390022101	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN
55390022201	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN
55390029101	ETOPOSIDE	ETOPOSIDE	ETOPOSIDE INJ 20MG/ML
55390029201	ETOPOSIDE	ETOPOSIDE	ETOPOSIDE
55390031420	PACLITAXEL	PACLITAXEL,SEMI- SYNTHETIC	PACLITAXEL
59137051504	METHOTREXATE	METHOTREXATE (PF) 12.5 MG/0.25 ML SUBCUTANEOUS AUTO- INJECTOR	RASUVO (PF) 12.5 MG/0.25 ML SUBQ AUTOINJECTOR
59137052004	METHOTREXATE	METHOTREXATE (PF) 15 MG/0.3 ML SUBCUTANEOUS AUTO-INJECTOR	RASUVO (PF) 15 MG/0.3 ML SUBQ AUTOINJECTOR
61703033918	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN
61703033922	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN
61703033950	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN INJ 450/45ML UD
61703033956	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN INJ 600/60ML UD
61703034109	VINORELBINE	VINORELBINE TARTRATE	VINORELBINE TARTRATE
61703034209	PACLITAXEL	PACLITAXEL,SEMI- SYNTHETIC	PACLITAXEL INJ
61703034222	PACLITAXEL	PACLITAXEL,SEMI- SYNTHETIC	PACLITAXEL INJ 100MG
61703034250	PACLITAXEL	PACLITAXEL,SEMI- SYNTHETIC	PACLITAXEL INJ
61703034909	IRINOTECAN	IRINOTECAN HCL	IRINOTECAN
61703035038	METHOTREXATE	METHOTREXATE SODIUM	METHOTREXATE SODIUM INJ 25MG/ML
61703040841	METHOTREXATE	METHOTREXATE SODIUM	METHOTREXATE SODIUM
63323010351	CISPLATIN	CISPLATIN	CISPLATIN INJ 50MG
63323010365	CISPLATIN	CISPLATIN	CISPLATIN INJ 50MG
63323010405	ETOPOSIDE	ETOPOSIDE	ETOPOSIDE
63323012302	METHOTREXATE	METHOTREXATE SODIUM	METHOTREXATE SODIUM INJ 25MG/ML
63323012310	METHOTREXATE	METHOTREXATE SODIUM	METHOTREXATE SODIUM INJ 25MG/ML
63323016610	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN
63323016721	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN

63323017205	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN IV SOLN 10 MG/ML
63323017245	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN
63323017260	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN INJ 600/60ML
63323019302	IRINOTECAN	IRINOTECAN HCL	IRINOTECAN INJ 40MG/2ML UD
63323019305	IRINOTECAN	IRINOTECAN HCL	IRINOTECAN INJ 100/5ML UD
63323019355	IRINOTECAN	IRINOTECAN	Irinotecan HCl Inj 100 MG/5ML (20 MG/ML)
63323076316	PACLITAXEL	PACLITAXEL IV CONC 6 MG/ML	PACLITAXEL
66215001660	MECHLORETHAMINE	Mechlorethamine HCl Gel 0.016% (Base Equivalent)	VALCHLOR 0.016% GEL
66758004002	METHOTREXATE	METHOTREXATE	METHOTREXATE SODIUM INJ 50MG/2ML UD
66758004301	PACLITAXEL	PACLITAXEL,SEMI-SYNTHETIC	PACLITAXEL
66758004302	PACLITAXEL	PACLITAXEL,SEMI-SYNTHETIC	PACLITAXEL
66758004502	VINORELBINE	VINORELBINE TARTRATE	VINORELBINE TARTRATE
66758004702	CARBOPLATIN	CARBOPLATIN	CARBOPLATIN IV SOLN 10 MG/ML
66758004801	IRINOTECAN	IRINOTECAN HCL INJ 20 MG/ML	IRINOTECAN
66758004802	IRINOTECAN	IRINOTECAN HCL INJ 20 MG/ML	IRINOTECAN
66758005001	DOCETAXEL	DOCETAXEL	DOCETAXEL SOLN FOR IV INFUSION 20 MG/2ML
67253032010	METHOTREXATE	METHOTREXATE SODIUM	METHOTREXATE
67253032036	METHOTREXATE	METHOTREXATE SODIUM TAB 2.5 MG (BASE EQUIV)	METHOTREXATE
67457046201	GEMCITABINE	Gemcitabine HCl For Inj 1 GM	
67457046799	METHOTREXATE	Methotrexate Sodium Inj PF 25 MG/ML	
67817006712	CARBOPLATIN	CARBOPLATIN	
68382077501	METHOTREXATE	METHOTREXATE SODIUM 2.5 MG TABLET	METHOTREXATE SODIUM 2.5 MG ORAL TAB

68817013450	PACLITAXEL	PACLITAXEL PROTEIN- BOUND	ABRAXANE INJ 100MG UD
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## Autoimmunity

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
ICD9CM	135	Sarcoidosis	697	Sarcoidosis	Sarcoidosis
ICD9CM	245	Thyroiditis	245	Thyroiditis	Thyroiditis
ICD9CM	245	Acute thyroiditis	245.1	Thyroiditis, acute and subacute	Thyroiditis
ICD9CM	245.1	Subacute thyroiditis	245.1	Thyroiditis, acute and subacute	Thyroiditis
ICD9CM	245.2	Chronic lymphocytic thyroiditis	245.2	Chronic lymphocytic thyroiditis	Thyroiditis
ICD9CM	245.3	Chronic fibrous thyroiditis	245	Thyroiditis	Thyroiditis
ICD9CM	245.8	Other and unspecified chronic thyroiditis	245	Thyroiditis	Thyroiditis
ICD9CM	245.9	Thyroiditis, unspecified	245	Thyroiditis	Thyroiditis
ICD9CM	250.01	Diabetes mellitus without mention of complication, type I [juvenile type], not stated as uncontrolled	250.1	Type 1 diabetes	DM
ICD9CM	250.03	Diabetes mellitus without mention of complication, type I [juvenile type], uncontrolled	250.11	Type 1 diabetic ketoacidosis	DM



ICD9CM	250.1	Diabetes with ketoacidosis	250	Diabetes mellitus	DM
ICD9CM	250.11	Diabetes with ketoacidosis, type I [juvenile type], not stated as uncontrolled	250.11	Type 1 diabetic ketoacidosis	DM
ICD9CM	250.13	Diabetes with ketoacidosis, type I [juvenile type], uncontrolled	250.11	Type 1 diabetic ketoacidosis	DM
ICD9CM	250.21	Diabetes with hyperosmolarity, type I [juvenile type], not stated as uncontrolled	250.1	Type 1 diabetes	DM
ICD9CM	250.23	Diabetes with hyperosmolarity, type I [juvenile type], uncontrolled	250.1	Type 1 diabetes	DM
ICD9CM	250.31	Diabetes with other coma, type I [juvenile type], not stated as uncontrolled	250.1	Type 1 diabetes	DM
ICD9CM	250.33	Diabetes with other coma, type I [juvenile type], uncontrolled	250.1	Type 1 diabetes	DM
ICD9CM	250.41	Diabetes with renal manifestations, type I [juvenile type], not stated as uncontrolled	250.12	Type 1 diabetes nephropathy	DM
ICD9CM	250.43	Diabetes with renal manifestations, type I [juvenile type], uncontrolled	250.12	Type 1 diabetes nephropathy	DM
ICD9CM	250.51	Diabetes with ophthalmic manifestations, type I [juvenile type], not stated as uncontrolled	250.13	Type 1 diabetic retinopathy	DM
ICD9CM	250.53	Diabetes with ophthalmic manifestations, type I [juvenile type], uncontrolled	250.13	Type 1 diabetic retinopathy	DM
ICD9CM	250.61	Diabetes with neurological manifestations, type I [juvenile type], not stated as uncontrolled	250.14	Type 1 diabetic neuropathy	DM
ICD9CM	250.63	Diabetes with neurological manifestations, type I [juvenile type], uncontrolled	250.14	Type 1 diabetic neuropathy	DM
ICD9CM	250.71	Diabetes with peripheral circulatory disorders, type I [juvenile type], not stated as uncontrolled	250.15	Type 1 diabetic peripheral circulatory disorders	DM
ICD9CM	250.73	Diabetes with peripheral circulatory disorders, type I [juvenile type], uncontrolled	250.15	Type 1 diabetic peripheral circulatory disorders	DM
ICD9CM	250.81	Diabetes with other specified	250.1	Type 1 diabetes	DM

		manifestations, type I [juvenile type], not stated as uncontrolled			
ICD9CM	250.83	Diabetes with other specified manifestations, type I [juvenile type], uncontrolled	250.1	Type 1 diabetes	DM
ICD9CM	250.91	Diabetes with unspecified complication, type I [juvenile type], not stated as uncontrolled	250.1	Type 1 diabetes	DM
ICD9CM	250.93	Diabetes with unspecified complication, type I [juvenile type], uncontrolled	250.1	Type 1 diabetes	DM
ICD9CM	279.49	Autoimmune disease, not elsewhere classified	279.2	Autoimmune disease NEC	Autoimmune disease NEC
ICD9CM	283	Autoimmune hemolytic anemias	283.1	Autoimmune hemolytic anemias	Autoimmune hemolytic anemias
ICD9CM	337.1	Peripheral autonomic neuropathy in disorders classified elsewhere	337.1	Peripheral autonomic neuropathy	Peripheral autonomic neuropathy
ICD9CM	443	Raynaud's syndrome	443.1	Raynaud's syndrome	Raynaud's syndrome
ICD9CM	555	Regional enteritis of small intestine	555.1	Crohn's disease	IBD
ICD9CM	555.1	Regional enteritis of large intestine	555.1	Crohn's disease	IBD
ICD9CM	555.2	Regional enteritis of small intestine with large intestine	555.1	Crohn's disease	IBD
ICD9CM	555.9	Regional enteritis of unspecified site	555.1	Crohn's disease	IBD
ICD9CM	556	Ulcerative colitis	555.2	Ulcerative colitis	IBD
ICD9CM	556	Ulcerative (chronic) enterocolitis	555.2	Ulcerative colitis	IBD
ICD9CM	556.1	Ulcerative (chronic) ileocolitis	555.2	Ulcerative colitis	IBD
ICD9CM	556.2	Ulcerative (chronic) proctitis	555.2	Ulcerative colitis	IBD
ICD9CM	556.3	Ulcerative (chronic) proctosigmoiditis	555.2	Ulcerative colitis	IBD
ICD9CM	556.4	Pseudopolypsis of colon	555.2	Ulcerative colitis	IBD
ICD9CM	556.5	Left-sided ulcerative (chronic) colitis	555.2	Ulcerative colitis	IBD
ICD9CM	556.6	Universal ulcerative (chronic) colitis	555.2	Ulcerative colitis	IBD
ICD9CM	556.8	Other ulcerative colitis	555.2	Ulcerative colitis	IBD
ICD9CM	556.9	Ulcerative colitis, unspecified	555.2	Ulcerative colitis	IBD
ICD9CM	571.42	Autoimmune hepatitis	70.4	Chronic hepatitis	Chronic hepatitis
ICD9CM	571.6	Biliary cirrhosis	571.6	Biliary cirrhosis	Biliary cirrhosis
ICD9CM	579	Celiac disease	557.11	Celiac disease	Celiac disease
ICD9CM	696	Psoriatic arthropathy	696.42	Psoriatic arthropathy	Psoriatic arthropathy

ICD9CM	696.1	Other psoriasis	696.41	Psoriasis vulgaris	Psoriasis vulgaris
ICD9CM	710	Systemic lupus erythematosus	695.42	Systemic lupus erythematosus	Systemic lupus erythematosus
ICD9CM	710.1	Systemic sclerosis	709.3	Systemic sclerosis	Systemic sclerosis
ICD9CM	710.2	Sicca syndrome	709.2	Sicca syndrome	Sicca syndrome
ICD9CM	710.9	Unspecified diffuse connective tissue disease	709	Diffuse diseases of connective tissue	Diffuse diseases of connective tissue
ICD9CM	714	Rheumatoid arthritis	714.1	Rheumatoid arthritis	RA
ICD9CM	714.3	Polyarticular juvenile rheumatoid arthritis, chronic or unspecified	714.2	Juvenile rheumatoid arthritis	RA
ICD9CM	720	Ankylosing spondylitis	715.2	Ankylosing spondylitis	Ankylosing spondylitis
ICD9CM	725	Polymyalgia rheumatica	717	Polymyalgia Rheumatica	Polymyalgia Rheumatica
ICD9CM	795.79	Other and unspecified nonspecific immunological findings	279.7	Other immunological findings	Other immunological findings
ICD10CM	D59.0	Drug-induced autoimmune hemolytic anemia	283.1	Autoimmune hemolytic anemias	Autoimmune hemolytic anemias
ICD10CM	D59.1	Cold type (secondary) (symptomatic) hemolytic anemia	283.1	Autoimmune hemolytic anemias	Autoimmune hemolytic anemias
ICD10CM	D86.9	Sarcoidosis, unspecified	697	Sarcoidosis	Sarcoidosis
ICD10CM	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
ICD10CM	E06.1	Nonsuppurative thyroiditis	245.1	Thyroiditis, acute and subacute	Thyroiditis
ICD10CM	E06.3	Hashitoxicosis (transient)	245.2	Chronic lymphocytic thyroiditis	Thyroiditis
ICD10CM	E06.5	Chronic fibrous thyroiditis	245	Thyroiditis	Thyroiditis
ICD10CM	E06.9	Thyroiditis, unspecified	245	Thyroiditis	Thyroiditis
ICD10CM	E10.10	Type 1 diabetes mellitus with ketoacidosis without coma	250.11	Type 1 diabetic ketoacidosis	DM
ICD10CM	E10.21	Type 1 diabetes mellitus with intercapillary glomerulosclerosis	250.12	Type 1 diabetes nephropathy	DM
ICD10CM	E10.29	Type 1 diabetes mellitus with other diabetic kidney complication	250.12	Type 1 diabetes nephropathy	DM
ICD10CM	E10.311	Type 1 diabetes mellitus with unspecified diabetic retinopathy with macular edema	250.13	Type 1 diabetic retinopathy	DM
ICD10CM	E10.319	Type 1 diabetes mellitus with unspecified diabetic	250.13	Type 1 diabetic retinopathy	DM

		retinopathy without macular edema			
ICD10CM	E10.36	Type 1 diabetes mellitus with diabetic cataract	250.13	Type 1 diabetic retinopathy	DM
ICD10CM	E10.37X1	Type 1 diabetes mellitus with diabetic macular edema, resolved following treatment, right eye	250.13	Type 1 diabetic retinopathy	DM
ICD10CM	E10.37X2	Type 1 diabetes mellitus with diabetic macular edema, resolved following treatment, left eye	250.13	Type 1 diabetic retinopathy	DM
ICD10CM	E10.37X3	Type 1 diabetes mellitus with diabetic macular edema, resolved following treatment, bilateral	250.13	Type 1 diabetic retinopathy	DM
ICD10CM	E10.37X9	Type 1 diabetes mellitus with diabetic macular edema, resolved following treatment, unspecified eye	250.13	Type 1 diabetic retinopathy	DM
ICD10CM	E10.39	Type 1 diabetes mellitus with other diabetic ophthalmic complication	250.13	Type 1 diabetic retinopathy	DM
ICD10CM	E10.40	Type 1 diabetes mellitus with diabetic neuropathy, unspecified	250.14	Type 1 diabetic neuropathy	DM
ICD10CM	E10.42	Type 1 diabetes mellitus with diabetic polyneuropathy	250.6	Polyneuropathy in diabetes	DM
ICD10CM	E10.51	Type 1 diabetes mellitus with diabetic peripheral angiopathy without gangrene	250.15	Type 1 diabetic peripheral circulatory disorders	DM
ICD10CM	E10.65	Type 1 diabetes mellitus with hyperglycemia	250.1	Type 1 diabetes	DM
ICD10CM	E10.8	Type 1 diabetes mellitus with unspecified complications	250.1	Type 1 diabetes	DM
ICD10CM	E10.9	Type 1 diabetes mellitus without complications	250.1	Type 1 diabetes	DM
ICD10CM	I73.00	Raynaud's syndrome without gangrene	443.1	Raynaud's syndrome	Raynaud's syndrome
ICD10CM	I73.01	Raynaud's syndrome with gangrene	443.1	Raynaud's syndrome	Raynaud's syndrome
ICD10CM	K50.00	Crohn's disease of small intestine without complications	555.1	Crohn's disease	IBD
ICD10CM	K50.10	Crohn's disease of large intestine without complications	555.1	Crohn's disease	IBD
ICD10CM	K50.80	Crohn's disease of both small and large intestine without complications	555.1	Crohn's disease	IBD

ICD10CM	K50.90	Crohn's disease, unspecified, without complications	555.1	Crohn's disease	IBD
ICD10CM	K51.00	Ulcerative (chronic) pancolitis without complications	555.2	Ulcerative colitis	IBD
ICD10CM	K51.20	Ulcerative (chronic) proctitis without complications	555.2	Ulcerative colitis	IBD
ICD10CM	K51.30	Ulcerative (chronic) rectosigmoiditis without complications	555.2	Ulcerative colitis	IBD
ICD10CM	K51.40	Inflammatory polyps of colon without complications	555.2	Ulcerative colitis	IBD
ICD10CM	K51.50	Left sided colitis without complications	555.2	Ulcerative colitis	IBD
ICD10CM	K51.80	Other ulcerative colitis without complications	555.2	Ulcerative colitis	IBD
ICD10CM	K51.90	Ulcerative colitis, unspecified, without complications	555.2	Ulcerative colitis	IBD
ICD10CM	K74.3	Chronic nonsuppurative destructive cholangitis	571.6	Biliary cirrhosis	Biliary cirrhosis
ICD10CM	K74.4	Secondary biliary cirrhosis	571.6	Biliary cirrhosis	Biliary cirrhosis
ICD10CM	K74.5	Biliary cirrhosis, unspecified	571.6	Biliary cirrhosis	Biliary cirrhosis
ICD10CM	K75.4	Autoimmune hepatitis	70.4	Chronic hepatitis	Chronic hepatitis
ICD10CM	K90.0	Celiac disease with steatorrhea	557.11	Celiac disease	Celiac disease
ICD10CM	L40.0	Psoriasis vulgaris	696.41	Psoriasis vulgaris	Psoriasis vulgaris
ICD10CM	L40.1	Generalized pustular psoriasis	696.41	Psoriasis vulgaris	Psoriasis vulgaris
ICD10CM	L40.2	Acrodermatitis continua	696.41	Psoriasis vulgaris	Psoriasis vulgaris
ICD10CM	L40.3	Pustulosis palmaris et plantaris	696.41	Psoriasis vulgaris	Psoriasis vulgaris
ICD10CM	L40.4	Guttate psoriasis	696.41	Psoriasis vulgaris	Psoriasis vulgaris
ICD10CM	L40.50	Arthropathic psoriasis, unspecified	696.42	Psoriatic arthropathy	Psoriatic arthropathy
ICD10CM	L40.54	Psoriatic juvenile arthropathy	696.42	Psoriatic arthropathy	Psoriatic arthropathy
ICD10CM	L40.59	Other psoriatic arthropathy	696.42	Psoriatic arthropathy	Psoriatic arthropathy
ICD10CM	L40.8	Flexural psoriasis	696.41	Psoriasis vulgaris	Psoriasis vulgaris
ICD10CM	M06.9	Rheumatoid arthritis, unspecified	714.1	Rheumatoid arthritis	RA
ICD10CM	M08.00	Unspecified juvenile rheumatoid arthritis of unspecified site	714.2	Juvenile rheumatoid arthritis	RA
ICD10CM	M32.10	Systemic lupus erythematosus, organ or system involvement unspecified	695.42	Systemic lupus erythematosus	Systemic lupus erythematosus
ICD10CM	M34.0	Progressive systemic sclerosis	709.3	Systemic sclerosis	Systemic sclerosis
ICD10CM	M34.1	Combination of calcinosis, Raynaud's phenomenon, esophageal	709.3	Systemic sclerosis	Systemic sclerosis

		dysfunction, sclerodactyly, telangiectasia			
ICD10CM	M34.2	Systemic sclerosis induced by drug and chemical	709.3	Systemic sclerosis	Systemic sclerosis
ICD10CM	M34.81	Systemic sclerosis with lung involvement	510.1	Lung involvement in conditions classified elsewhere	Lung involvement in conditions classified elsewhere
ICD10CM	M34.82	Systemic sclerosis with myopathy	709.3	Systemic sclerosis	Systemic sclerosis
ICD10CM	M34.83	Systemic sclerosis with polyneuropathy	709.3	Systemic sclerosis	Systemic sclerosis
ICD10CM	M34.89	Other systemic sclerosis	709.3	Systemic sclerosis	Systemic sclerosis
ICD10CM	M34.9	Systemic sclerosis, unspecified	709.3	Systemic sclerosis	Systemic sclerosis
ICD10CM	M35.00	Sicca syndrome, unspecified	709.2	Sicca syndrome	Sicca syndrome
ICD10CM	M35.01	Sicca syndrome with keratoconjunctivitis	709.2	Sicca syndrome	Sicca syndrome
ICD10CM	M35.02	Sicca syndrome with lung involvement	709.2	Sicca syndrome	Sicca syndrome
ICD10CM	M35.03	Sicca syndrome with myopathy	709.2	Sicca syndrome	Sicca syndrome
ICD10CM	M35.04	Sicca syndrome with tubulo-interstitial nephropathy	709.2	Sicca syndrome	Sicca syndrome
ICD10CM	M35.09	Sicca syndrome with other organ involvement	709.2	Sicca syndrome	Sicca syndrome
ICD10CM	M35.3	Polymyalgia rheumatica	717	Polymyalgia Rheumatica	Polymyalgia Rheumatica
ICD10CM	M35.9	Systemic involvement of connective tissue, unspecified	709	Diffuse diseases of connective tissue	Diffuse diseases of connective tissue
ICD10CM	M45.9	Ankylosing spondylitis of unspecified sites in spine	715.2	Ankylosing spondylitis	Ankylosing spondylitis
ICD10CM	M60.9	Myositis, unspecified	770	Myalgia and myositis NOS	Myalgia and myositis NOS
ICD10CM	M79.7	Fibromyositis	770	Myalgia and myositis NOS	Myalgia and myositis NOS
ICD10CM	R76.8	Other specified abnormal immunological findings in serum	279.7	Other immunological findings	Other immunological findings
ICD10CM	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	242	Thyrotoxicosis with or without goiter	Thyrotoxicosis with or without goiter

		other cause, and without mention of thyrotoxic crisis or storm			
	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 encephalomyelitis following immunization procedures	323	Encephalitis	Encephalitis
	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 polyneuritis	357	Inflammatory and toxic neuropathy	Inflammatory 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	580.11	Proliferative glomerulonephritis	Glomerulonephritis



	580.89	Acute glomerulonephritis with other specified pathological lesion in kidney	580.13	Acute glomerulonephritis, NOS	Glomerulonephritis
	580.9	Acute glomerulonephritis with unspecified pathological lesion in kidney	580.13	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	580.12	Non-proliferative glomerulonephritis	Glomerulonephritis
	582.2	Chronic glomerulonephritis with lesion of membranoproliferative glomerulonephritis	580.11	Proliferative glomerulonephritis	Glomerulonephritis
	582.4	Chronic glomerulonephritis with lesion of rapidly progressive glomerulonephritis	580.11	Proliferative glomerulonephritis	Glomerulonephritis
	582.89	Chronic glomerulonephritis with other specified pathological lesion in kidney	580.14	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	695.22	Pemphigus and pemphigoid	Pemphigus and pemphigoid
	694.6	Benign mucous membrane pemphigoid without mention of ocular involvement	695.22	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
	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	359.2	Myopathy	Myopathy

		myopathy in diseases classified elsewhere			
	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	580.1	Glomerulonephritis	Glomerulonephritis

		proliferative 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 with other specified pathological lesion in kidney	580.14	Chronic glomerulonephritis, NOS	Glomerulonephritis
	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	695.22	Pemphigus and pemphigoid	Pemphigus and pemphigoid

	L12.1	Benign mucous membrane pemphigoid without mention of ocular involvement	695.22	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
	M02.811	Arthropathy associated with other bacterial diseases, shoulder region	711	Arthropathy associated with infections	Arthropathy
	M02.821	Arthropathy associated with other bacterial diseases, upper arm	711	Arthropathy associated with infections	Arthropathy
	M02.831	Arthropathy associated with other bacterial diseases, forearm	711	Arthropathy associated with infections	Arthropathy
	M02.841	Arthropathy associated with other bacterial diseases, hand	711	Arthropathy associated with infections	Arthropathy
	M02.851	Arthropathy associated with other bacterial diseases, pelvic region and thigh	711	Arthropathy associated with infections	Arthropathy
	M02.861	Arthropathy associated with other bacterial diseases, lower leg	711	Arthropathy associated with infections	Arthropathy
	M02.871	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. Thyroid-related CPT treatment codes.

<b>CPT</b>	<b>Description</b>	<b>Related to Hypothyroidism</b>	<b>Related to Hyperthyroidism</b>	<b>Related to Thyroiditis</b>
84443	Measurement of thyroid stimulating hormone (TSH)	T	T	T
84439	Thyroxine (thyroid chemical) measurement	T	T	T
80050	General health panel This panel must include the following: Comprehensive metabolic panel (80053) Blood count, complete (CBC), automated and automated differential WBC count (85025 or 85027 and 85004) OR Blood count, complete (CBC), automated (85027) and appropriate manual differential WBC count (85007 or 85009) Thyroid stimulating hormone (TSH) (84443)	T	T	T
84436	Thyroxine (thyroid chemical) measurement	T	T	T
84480	Measurement of total triiodothyronine (TT-3)	T	T	T
84481	Measurement of free triiodothyronine (T3)	T	T	T
76536	Ultrasound, soft tissues of head and neck (eg, thyroid, parathyroid, parotid), real time with image documentation	T	T	T



84479	Thyroid hormone (T3 or T4) uptake or thyroid hormone binding ratio (THBR)	T	T	T
88307	Level V - Surgical pathology, gross and microscopic examination Adrenal, resection Bone - biopsy/curetings Bone fragment(s), pathologic fracture Brain, biopsy Brain/meninges, tumor resection Breast, excision of lesion, requiring microscopic evaluation of surgical margins Breast, mastectomy - partial/simple Cervix, conization Colon, segmental resection, other than for tumor Extremity, amputation, non-traumatic Eye, enucleation Kidney, partial/total nephrectomy Larynx, partial/total resection Liver, biopsy - needle/wedge Liver, partial resection Lung, wedge biopsy Lymph nodes, regional resection Mediastinum, mass Myocardium, biopsy Odontogenic tumor Ovary with or without tube, neoplastic Pancreas, biopsy Placenta, third trimester Prostate, except radical resection Salivary gland Sentinel lymph node Small intestine, resection, other than for tumor Soft tissue mass (except lipoma) - biopsy/simple excision Stomach - subtotal/total resection, other than for tumor Testis, biopsy Thymus, tumor Thyroid, total/lobe Ureter, resection Urinary bladder, TUR Uterus, with or without tubes and ovaries, other than neoplastic/prolapse	T	T	T
86376	Microsomal antibodies (eg, thyroid or liver-kidney), each	T	T	T
86800	Thyroglobulin (thyroid protein) antibody measurement	T	T	T
00320	Anesthesia for all procedures on esophagus, thyroid, larynx, trachea and lymphatic system of neck; not otherwise specified, age 1 year or older	T	T	T
84445	Thyroid stimulating immune globulins (thyroid related protein) level	T	T	T
84432	Thyroglobulin (thyroid related hormone) level	T	T	T
84482	Measurement of reverse triiodothyronine (rT3)	T	T	T

78014	Thyroid imaging (including vascular flow, when performed); with single or multiple uptake(s) quantitative measurement(s) (including stimulation, suppression, or discharge, when performed)	T	T	T
60100	Needle biopsy of thyroid, accessed through the skin	T	T	T
78013	Thyroid imaging (including vascular flow, when performed)	T	T	T
60240	Thyroidectomy, total or complete		T	T
60220	Total thyroid lobectomy, unilateral; with or without isthmusectomy		T	T
60210	Partial thyroid lobectomy, unilateral; with or without isthmusectomy		T	T
80439	Thyrotropin releasing hormone (TRH) stimulation panel; 2 hour This panel must include the following: Thyroid stimulating hormone (TSH) (84443 x 4)	T	T	T

Table S9. Thyroid-related NDC drug codes.

NDC	NONPROPRIETARY NAME	PROPRIETARY NAME	Treat Hypothyroidism	Treat Hyperthyroidism	Treat Thyroiditis
00527134210	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00054418425	Dexamethasone	Dexamethasone	T		T
00074455290	Levothyroxine Sodium	Synthroid	T		T
00456141030	nebivolol hydrochloride	Bystolic		T	T
00378180310	levothyroxine sodium	Levothyroxine Sodium	T		T
00378180910	levothyroxine sodium	Levothyroxine Sodium	T		T
00378180510	levothyroxine sodium	Levothyroxine Sodium	T		T
00172290780	Furosemide	Furosemide		T	T
00172290880	Furosemide	Furosemide		T	T
00527134310	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00527134410	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00093106101	Sotalol Hydrochloride	Sotalol Hydrochloride		T	T
00378003210	metoprolol tartrate	Metoprolol Tartrate		T	T
00074706990	Levothyroxine Sodium	Synthroid	T		T
00378020810	furosemide	Furosemide		T	T
00527134110	Levothyroxine Sodium	Levothyroxine Sodium	T		T

00025152531	Celecoxib	CELEBREX			T
00603533732	Prednisone	Prednisone			T
00078056115	amlodipine valsartan and hydrochlorothiazide	Exforge HCT		T	T
00406055201	oxycodone hydrochloride	OXYCODONE HYDROCHLORIDE			T
00378181510	levothyroxine sodium	Levothyroxine Sodium	T		T
00527134510	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00527134910	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00074706890	Levothyroxine Sodium	Synthroid	T		T
00054327099	Fluticasone Propionate	Fluticasone Propionate			T
00603499828	Oxycodone hydrochloride and Acetaminophen	Oxycodone and Acetaminophen			T
00781196610	Furosemide	Furosemide		T	T
00781282201	Fluoxetine Hydrochloride	Fluoxetine Hydrochloride		T	T
00603459315	methylprednisolone	MethylPREDNISolone			T
00074518290	Levothyroxine Sodium	Synthroid	T		T
00781570192	losartan potassium	Losartan potassium		T	T
00591544201	Prednisone	Prednisone			T
00406324301	hydromorphone hydrochloride	Hydromorphone Hydrochloride			T
00378180710	levothyroxine sodium	Levothyroxine Sodium	T		T
00074434190	Levothyroxine Sodium	Synthroid	T		T
00378001801	metoprolol tartrate	Metoprolol Tartrate		T	T
00378001805	metoprolol tartrate	Metoprolol Tartrate		T	T
00054418325	Dexamethasone	Dexamethasone			T
00603499021	Oxycodone Hydrochloride	Oxycodone Hydrochloride			T
00591505210	Prednisone	Prednisone			T
00378180010	levothyroxine sodium	Levothyroxine Sodium	T		T
00054429931	Furosemide	Furosemide		T	T
00456140530	nebivolol hydrochloride	Bystolic		T	T
00527135101	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00591320201	Hydrocodone Bitartate and Acetaminophen	Hydrocodone Bitartate and Acetaminophen			T
00054001725	PredniSONE	PredniSONE			T
00406051201	oxycodone hydrochloride and acetaminophen	OXYCODONE AND ACETAMINOPHEN			T
00078035834	valsartan	Diovan		T	T
00378207310	lisinopril	Lisinopril		T	T

00378021610	furosemide	Furosemide		T	T
00406035805	HYDROCODONE BITARTRATE AND ACETAMINOPHEN	HYDROCODONE BITARTRATE AND ACETAMINOPHEN			T
00172208380	Hydrochlorothiazide	Hydrochlorothiazide		T	T
00074714890	Levothyroxine Sodium	Synthroid	T		T
00378004710	metoprolol tartrate	Metoprolol Tartrate		T	T
00591319872	Fentanyl	Fentanyl			T
00093078701	Atenolol	Atenolol		T	T
00185020501	Methimazole	Methimazole		T	T
00054429731	Furosemide	Furosemide		T	T
00378363201	carvedilol	Carvedilol		T	T
00603388721	Hydrocodone Bitartrate And Acetaminophen	Hydrocodone Bitartrate And Acetaminophen			T
00054023525	Morphine Sulfate	Morphine Sulfate			T
00074659419	Levothyroxine Sodium	Synthroid	T		T
00093002901	Enalapril Maleate	Enalapril Maleate		T	T
00406324401	hydromorphone hydrochloride	Hydromorphone Hydrochloride			T
00378015210	clonidine hydrochloride	Clonidine Hydrochloride		T	T
00378520905	amlodipine besylate	Amlodipine Besylate		T	T
00603499121	Oxycodone Hydrochloride	Oxycodone Hydrochloride		T	T
00025152031	Celecoxib	CELEBREX			T
00591321372	Fentanyl	Fentanyl			T
00078035934	valsartan	Diovan		T	T
00078048915	amlodipine besylate and valsartan	Exforge		T	T
00378521077	amlodipine besylate	Amlodipine Besylate		T	T
00406036505	HYDROCODONE BITARTRATE AND ACETAMINOPHEN	HYDROCODONE BITARTRATE AND ACETAMINOPHEN			T
00456045801	THYROID, PORCINE	Armour Thyroid	T		T
00456046001	THYROID, PORCINE	Armour Thyroid	T		T
00781518292	Levothyroxine sodium	Levothyroxine sodium	T		T
00781518410	Levothyroxine sodium	Levothyroxine sodium	T		T
00781518192	Levothyroxine sodium	Levothyroxine sodium	T		T
00527134201	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00074929690	Levothyroxine Sodium	Synthroid	T		T
00781518501	Levothyroxine sodium	Levothyroxine sodium	T		T
00378181310	levothyroxine sodium	Levothyroxine Sodium	T		T
00456045901	THYROID, PORCINE	Armour Thyroid	T		T

00781518592	Levothyroxine sodium	Levothyroxine sodium	T		T
00527135001	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00781518892	Levothyroxine sodium	Levothyroxine sodium	T		T
00074455219	Levothyroxine Sodium	Synthroid	T		T
00527134601	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00781518201	Levothyroxine sodium	Levothyroxine sodium	T		T
00781518692	Levothyroxine sodium	Levothyroxine sodium	T		T
00781518210	Levothyroxine sodium	Levothyroxine sodium	T		T
00378181110	levothyroxine sodium	Levothyroxine Sodium	T		T
00378181177	levothyroxine sodium	Levothyroxine Sodium	T		T
00527134401	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00781518101	Levothyroxine sodium	Levothyroxine sodium	T		T
00781518492	Levothyroxine sodium	Levothyroxine sodium	T		T
00074372790	Levothyroxine Sodium	Synthroid	T		T
00185021001	Methimazole	Methimazole		T	
00378180077	levothyroxine sodium	Levothyroxine Sodium	T		T
00378180377	levothyroxine sodium	Levothyroxine Sodium	T		T
00378182377	levothyroxine sodium	Levothyroxine Sodium	T		T
00456046101	THYROID, PORCINE	Armour Thyroid	T		T
00074659490	Levothyroxine Sodium	Synthroid	T		T
00074714819	Levothyroxine Sodium	Synthroid	T		T
00527134710	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00781518092	Levothyroxine sodium	Levothyroxine sodium	T		T
00074706919	Levothyroxine Sodium	Synthroid	T		T
00781518401	Levothyroxine sodium	Levothyroxine sodium	T		T
00527134901	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00527163801	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00781518010	Levothyroxine sodium	Levothyroxine sodium	T		T
00781518301	Levothyroxine sodium	Levothyroxine sodium	T		T
00781518610	Levothyroxine sodium	Levothyroxine sodium	T		T
00074518219	Levothyroxine Sodium	Synthroid	T		T
00074662419	Levothyroxine Sodium	Synthroid	T		T

00074662490	Levothyroxine Sodium	Synthroid	T		T
00378181377	levothyroxine sodium	Levothyroxine Sodium	T		T
00781518110	Levothyroxine sodium	Levothyroxine sodium	T		T
00074706819	Levothyroxine Sodium	Synthroid	T		T
00074706911	Levothyroxine Sodium	Synthroid	T		T
00074929619	Levothyroxine Sodium	Synthroid	T		T
00781518701	Levothyroxine sodium	Levothyroxine sodium	T		T
00074434119	Levothyroxine Sodium	Synthroid	T		T
00527134101	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00527134701	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00781518601	Levothyroxine sodium	Levothyroxine sodium	T		T
00781518792	Levothyroxine sodium	Levothyroxine sodium	T		T
00074706811	Levothyroxine Sodium	Synthroid	T		T
00143148001	Propylthiouracil	Propylthiouracil		T	
00378180977	levothyroxine sodium	Levothyroxine Sodium	T		T
00378181577	levothyroxine sodium	Levothyroxine Sodium	T		T
00378181777	levothyroxine sodium	Levothyroxine Sodium	T		T
00378182310	levothyroxine sodium	Levothyroxine Sodium	T		T
00456046201	THYROID, PORCINE	Armour Thyroid	T		T
00527134501	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00527134610	Levothyroxine Sodium	Levothyroxine Sodium	T		T
00574022001	Liothyronine Sodium	Liothyronine Sodium	T		T
00781519192	Levothyroxine sodium	Levothyroxine sodium	T		T