

# **Report for the Standardized Transfusion Ratio NQF #2979**

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## Introduction

As mandated by the Affordable Care Act (ACA), assuring delivery of high quality and affordable care requires reliable and meaningful quality measures that focus on important outcomes and processes, including patient experience, across the breadth of the healthcare system (CMS, 2013). This view has reinforced CMS' stated goal of providing the highest quality of evidence-based care, which is personalized, prevention-oriented and patient-centered. Achieving this goal requires development of measures that incorporate heterogeneities at both population and individual levels, across traditional institutional or provider domains to address coordination and continuity of care, and focus on outcomes most important to patients. In addition, measures ought to address the efficiency of care delivery at the individual and population levels in order to support value-based purchasing initiatives, and to foster a delivery system that works efficiently for providers by reducing their administrative burdens, while facilitating coordinated care. Most importantly, measures should incorporate the evidence-based results of the latest high quality research and scientific advances in health outcomes research, clinical medicine, public health, and health care delivery. Anemia management in chronic dialysis patients is a complex clinical issue of importance to patients, providers and healthcare administrators. Development of quality measures for this clinical topic reflecting the aforementioned principles is necessary and appropriate in this time of rapidly evolving understanding of the risks and potential benefits of anemia treatments in this population.

Anemia is a complication of end stage renal disease (ESRD), affecting most patients with this condition. Management of anemia in ESRD patients is the responsibility of the patient's dialysis facility as specified in CMS' ESRD Conditions for Coverage and paid for as part of the Medicare ESRD Prospective Payment System. According to FDA Prescribing Information, goals of successful treatment should include minimization of blood transfusion risk. According to some, additional potential benefits of anemia treatment may include improvement of the quality of life and health of dialysis patients.

Several recent scientific findings and Medicare ESRD Program policy changes likely impacted anemia management in dialysis facilities. These include identification of safety concerns associated with aggressive erythropoiesis-stimulating agent (ESA) use, expansion of the ESRD prospective payment System bundled payment to include payment for ESAs, and the development of the ESRD Quality Incentive Program. Potential unintended consequences of these events include possible underutilization of ESAs by dialysis facilities and, consequently, increasing frequency of red blood cell transfusion in the US chronic dialysis population.

The inverse relationship between achieved hemoglobin and transfusion events has been reported previously for Medicare dialysis patients (Ma, 1999; Collins, 2014) and for non-dialysis CKD patients treated in the Veterans Administration system (Lawler, 2010). Unpublished analyses of Medicare Claims data presented at CMS Technical Expert Panel in May 2012 demonstrate an inverse association between achieved hemoglobin and subsequent transfusion rise using more recent data from 2008-2011. In early 2012, a highly publicized USRDS study presented at the NKF Clinical meeting reported increased dialysis patient transfusion rates in 2011 compared to 2010. UM-KECC and Arbor Research collaborators have recently presented an analysis of transfusion events in Medicare dialysis patients from 2009-2011, observing increased transfusions in 2011, although the magnitude of change in transfusion rates was much lower than reported by the USRDS. (Hirth, 2014).

The national trend toward increased use of transfusion in dialysis patients has raised several concerns. First, blood transfusion carries a defined risk of transmitted blood borne infections and development of

transfusion reactions. In addition, use of transfusions to treat anemia of CKD is wasteful of precious healthcare resources, including our finite blood supply used for emergent medical indications. Lastly, greater exposure to human leukocyte antigens, present in transfused blood, may increase anti-HLA antibodies in kidney transplant candidates, resulting in reduced access to kidney transplantation.

At the patient level, blood transfusion may be an indicator for underutilization of treatments that increase endogenous red blood cell production (e.g. ESA, iron). Monitoring the risk-adjusted transfusion rate at the dialysis facility level, relative to a national standard, is of particular importance for the following reasons. First, it will identify facilities with extraordinary transfusion rates. As providers use fewer ESAs in an effort to minimize the risks associated with aggressive anemia treatment, it becomes more important to monitor anemia management practices that may demonstrate an overreliance on transfusions. Second, implementation of the transfusion measure at the facility level will provide valuable feedback to dialysis facilities and nephrologists and bring increased transparency to anemia management care processes. This is especially vital for small and independent facilities as they continue to provide anemia management care to dialysis patients, working to prevent unnecessary transfusions.

## Measure Revision

In response to feedback from the dialysis community, the revised STrR measure incorporates a more restricted definition of transfusion events than the original version of STrR (reported in the ESRD QIP for PY2018-2020). The revised definition excludes inpatient transfusion events for claims that include only 038 or 039 revenue codes without an accompanying ICD-9 (or ICD-10) Procedure Code or Value Code. In the revised measure, all inpatient transfusion events include, at a minimum, an appropriate ICD-9 (or ICD-10) Procedure Code or Value Code. This more conservative definition of transfusion events is used to calculate the revised STrR. This more restricted definition of transfusion events results in a reduced total number of events identified as well as the range of total events for dialysis facilities.

## Methods

### Overview

In April 2012, a CMS Technical Expert Panel (TEP) on anemia management recommended development of a risk-adjusted, facility-level standardized transfusion measure. We subsequently developed the STrR, a measure of transfusion at the facility level for the purpose of dialysis patient anemia management in the U.S. We identify Medicare-covered transfusions and exclude ineligible cases associated with each patient's comorbidity and transplant hospitalization history, using Medicare administrative data, which we derived from inpatient, outpatient institutional, home health, hospice and skilled nursing facility claims.

The Standardized Transfusion Ratio (STrR) for all adult dialysis patients is designed to reflect the number of eligible red blood cell transfusion events occurring in patients dialyzing at a facility, relative to the number of eligible transfusions that would be expected under a national norm, after accounting for the patient characteristics within each facility. Specifically, the STrR is calculated as the ratio of two numbers: the numerator ("observed") is the actual number of transfusion events over a year period, and the denominator ("expected") is the number of transfusion events that would be expected if patients at that facility experienced transfusion events at the national average rate for patients with similar characteristics.

## Data Sources

Data are derived from an extensive national ESRD patient database, which is primarily based on the CMS Consolidated Renal Operations in a Web-enabled Network (CROWN) system. The CROWN data include the Renal Management Information System (REMIS), CROWNWeb facility-reported clinical and administrative data (including CMS-2728 Medical Evidence Form, CMS-2746 Death Notification Form, and CMS-2744 Annual Facility Survey Form data), the historical Standard Information Management System (SIMS) database (formerly maintained by the 18 ESRD Networks until replaced by CROWNWeb in May 2012), the National Vascular Access Improvement Initiative's Fistula First Catheter Last project (in CROWNWeb since May 2012), Medicare dialysis and hospital payment records, transplant data from the Organ Procurement and Transplant Network (OPTN), the Nursing Home Minimum Dataset, the Quality Improvement Evaluation System (QIES) Workbench, which includes data from the Certification and Survey Provider Enhanced Report System (CASPER), the Dialysis Facility Compare (DFC) and the Social Security Death Master File. The database is comprehensive for Medicare patients. Non-Medicare patients are included in all sources except for the Medicare payment records. CROWNWeb provides tracking by dialysis provider and treatment modality for non-Medicare patients. Information on hospitalizations is obtained from Part A Medicare Inpatient Claims Standard Analysis Files (SAFs), and past-year comorbidity is obtained from multiple Part A types (inpatient, home health, hospice, skilled nursing facility claims) and Part B outpatient types of Medicare Claims SAFs.

Information on transfusions is obtained from Medicare Inpatient and Outpatient Claims Standard Analysis Files (SAFs).

## Outcome Definition

The outcome for this measure is the risk adjusted facility level transfusion event count among adult Medicare eligible dialysis patients.

## Identification of Transfusion Events

Our method for counting transfusion events relies on a conservative counting algorithm and, because of the way transfusion information is reported in Medicare claims, we use different rules for counting transfusion events, depending on whether or not the event occurs in the inpatient setting, or an outpatient setting. The most common way that events are reported on claims is by reporting a revenue center, procedure, or value code (inpatient claims) or for outpatient claims, reporting Healthcare Common Procedure Coding System (HCPCS) codes with at least one revenue center codes.

One "transfusion event" is counted per inpatient claim if one or more transfusion-related procedure or value codes are present. We only count a single transfusion event for an inpatient claim regardless of the number of transfusion procedure and value codes reported so that the number of discrete events counted is the same whether the claim indicates 1 unit of blood or multiple units of blood. This results in a very conservative estimate of blood transfusions from inpatient claims.

Transfusion events are not common in outpatient settings, but similar rules apply. One or more transfusion-related HCPCS codes with at least one transfusion-related revenue center codes, or one or more transfusion-related value codes listed on an outpatient claim are counted as a single transfusion event regardless of the number of units of blood recorded. In other words, 3 units of blood would be counted as a single transfusion event. The detailed procedures to determine unique transfusion events at the claim level are included in Appendix II.

## Cohort Definition

### Assignment of Patients to Facilities

As patients can receive dialysis treatment at more than one facility in a given year, we assign each patient day to a facility (or no facility, in some cases) based on a set of conventions below, which largely align with those for the Standardized Mortality Ratio (SMR) and Standardized Hospitalization Ratio (SHR). We detail patient inclusion criteria, facility assignment and how to count days at risk, all of which are required for the risk adjustment model.

### General Inclusion Criteria for Dialysis Patients

Though a patient's follow-up in the database can be incomplete during the first 90 days of ESRD therapy, we only include a patient's follow-up into the tabulations after that patient has received chronic renal replacement therapy for at least 90 days. Thus, hospitalizations, mortality and survival during the first 90 days of ESRD do not enter into the calculations. This minimum 90-day period also assures that most patients are eligible for Medicare, either as their primary or secondary insurer. It also excludes from analysis patients who die or recover during the first 90 days of ESRD.

In order to exclude patients who only received temporary dialysis therapy, we assigned patients to a facility only after they had been on dialysis there for at least 60 days. This 60 day period is used any time a patient begins therapy at a new facility whether the patient transferred from another facility, started ESRD for the first time, or returned to dialysis after a transplant. That is, transfusion events during the first 60 days of dialysis at a facility do not affect the STR of that facility.

### Identifying Facility Treatment Histories for Each Patient

For each patient, we identify the dialysis provider at each point in time. Starting with day 91 after onset of ESRD, we attribute patients to facilities according to the following rules. A patient is attributed to a facility once the patient has been treated there for 60 days. When a patient transfers from one facility to another, the patient continues to be attributed to the original facility for 60 days and then is attributed to the destination facility. In particular, a patient is attributed to their current facility on day 91 of ESRD if that facility had treated him or her for at least 60 days. If on day 91, the facility had treated a patient for fewer than 60 days, we wait until the patient reaches day 60 of treatment at that facility before attributing the patient to that facility. When a patient is not treated in a single facility for a span of 60 days (for instance, if there were two switches within 60 days of each other), we do not attribute that patient to any facility. Patients are removed from facilities three days prior to transplant in order to exclude the transplant hospitalization. Patients who withdrew from dialysis or recovered renal function remain assigned to their treatment facility for 60 days after withdrawal or recovery.

If a period of one year passes with neither dialysis claims nor CROWNWEB/SIMS information to indicate that a patient was receiving dialysis treatment, we consider the patient lost to follow-up and do not include that patient in the analysis. If dialysis claims or other evidence of dialysis reappears, the patient is entered into analysis after 60 days of continuous therapy at a single facility.

### Days at Risk for Medicare Dialysis Patients

After patient treatment histories are defined as described above, periods of follow-up in time since ESRD onset are created for each patient. In order to adjust for duration of ESRD appropriately, we define 6 time intervals with cut points at 6 months, 1 year, 2 years, 3 years and 5 years. A new time period

begins each time the patient is determined to be at a different facility, or at the start of each calendar year or when crossing any of the above cut points.

Transfusion rates are similar to hospitalization rates in that patients can be transfused more than once during a year and transfusion data are not always as complete as mortality data. As with the hospitalization statistics, this measure should ideally include only patients whose Medicare billing records include all transfusions for the period. To achieve this goal, we apply the same rules as for the hospitalization measure and require that patients reach a certain level of Medicare dialysis bills to be included in transfusion statistics, or patients have a Medicare inpatient claim during the period. For the purpose of analysis, each patient's follow-up time is broken into periods defined by time since dialysis initiation. For each patient, months within a given period are included if that month in the period is considered 'eligible'; a month is deemed eligible if it is within two month of a month having at least \$900 of Medicare-paid dialysis claims or at least one Medicare inpatient claim. In setting this criterion, our aim is to achieve completeness of information on transfusions for all patients included in the analysis.

The number of days at risk in each of these patient-ESRD-year-facility time periods is used to calculate the expected number of transfusions for the patient during that period. The STTrR for a facility is the ratio of the total number of observed transfusions to the total number of expected transfusions during all time periods at the facility.

## Risk Adjustment

### Choosing Adjustment Factors

Some general considerations played an important role in the selection of risk factors for which adjustment was to be made. For example, the literature suggests that transfusions are more common in patients with higher overall comorbidity burden, and occur most often during hospitalizations. From this perspective, it is appropriate to risk adjust the model for characteristics that are generally associated with comorbidity burden. Adjustment factors included in the calculation of the STTrR are those included in the model for CMS' NQF-endorsed Standardized Hospitalization Ratio (SHR) for admissions, (<http://www.dialysisreports.org/pdf/esrd/public/shrmodel.xls>; NQF #1463 <http://www.qualityforum.org/QPS/1463>), with one exception: sex is adjusted for in the SHR but not included in the STTrR model. The STTrR adjustments include age, years on dialysis, patient comorbidities at incidence, patient BMI at incidence, and nursing home status of patient.

We developed the model to align with CMS' existing dialysis facility measures of hospitalization and mortality (SHR and SMR). STTrR includes the following adjusters:

- patient age
- diabetes mellitus as the primary cause of ESRD
- at incidence of ESRD, comorbidity status
- at incidence of ESRD, BMI
- duration of ESRD treatment
- an indicator for whether a patient was in a nursing home in the previous calendar year
- categorical indicators for missing values for cause of ESRD, comorbidities at incidence, and BMI. Another categorical indicator variable is included as a covariate in the stage 1 model to flag records where the patient has at least one of the incident comorbidities.
- calendar year

- two way interaction terms
  - diabetes as cause of ESRD \* time on ESRD
  - age \* diabetes as cause of ESRD

Analyses of the STrR by race, sex and ethnicity indicate relatively little variation and no disparities substantial to the measure among these groups. Although females are somewhat more likely to receive transfusions than males, analyses showed that a model with variables for race and sex included and a model without these variables yielded very similar results for the facility STrR as well as similar parameter estimates for the other covariates. The data below shows the parameter estimates for the race, sex and ethnicity variables included in the model containing the other covariates listed above.

**Table 1. Parameter estimates for the race, sex and ethnicity variables.**

| Race/Sex/Ethnicity | Estimate | Standard Error | P-Value |
|--------------------|----------|----------------|---------|
| Females            | 0.168    | 0.004          | <.0001  |
| Native American*   | -0.075   | 0.023          | 0.001   |
| Asian*             | -0.207   | 0.012          | <.0001  |
| Black*             | -0.046   | 0.005          | <.0001  |
| Other Race*        | 0.090    | 0.045          | 0.044   |
| Hispanic #         | -0.181   | 0.007          | <.0001  |

\*White as reference

# Non-Hispanic as reference

### Adjustment in STrR

The regression model used to compute a facility's "expected" number of transfusions for the STrR measure contains many factors associated with frequency of hospitalization and thought to be associated with transfusion event rates. Specifically, the model adjusts for patient age, diabetes, duration of ESRD, nursing home status, BMI at incidence, comorbidities at incidence, and calendar year. This model allows the baseline transfusion rates to vary between strata (facilities), but assumes that the regression coefficients are the same across all strata; this approach is robust to possible differences between facilities in the patient mix being treated.

The patient characteristics included in the stage 1 model as covariates are

- Age: We determine each patient's age from the birth date provided in the CROWNWeb and REMIS databases. Medicare claims and his/her Medical Evidence Form (CMS-2728) are used as check to verify birthdate (in the event of an error in the first three sources). Patients are grouped into the following categories: 18-24 years old, 25-44 years old, 45-59 years old, 60-74 years old, or 75+ years old.
- Diabetes as cause of ESRD: We determine each patient's primary cause of ESRD from his/her CMS-2728, and the CROWNWeb and REMIS databases.
- Duration of ESRD: We determine each patient's length of time since start of ESRD treatment using his/her CMS-2728, claims history (all claim types), the SIMS database and the STrR database and categorize as 91 days-6 months, 6 months-1 year, 1-2 years, 2-3 years, 3-5 years, or 5+ years as of the period start date.



- Nursing home status: Using the Nursing Home Minimum Dataset, we determine if a patient was in a nursing home the previous year.
- BMI at incidence: We calculate each patient's BMI as the height and weight provided on his/her CMS 2728. BMI is included as a log-linear term.
- Comorbidities at incidence are determined using a selection of comorbidities reported on the CMS-2728 namely, alcohol dependence, atherosclerotic heart disease, cerebrovascular disease, chronic obstructive pulmonary disease, congestive heart failure, diabetes (includes currently on insulin, on oral medications, without medications, and diabetic retinopathy), drug dependence, inability to ambulate, inability to transfer, malignant neoplasm, cancer, other cardiac disease, peripheral vascular disease, and tobacco use (current smoker). Each comorbidity is included as a separate covariate in the model.
- Calendar year
- Categorical indicator variables are included as covariates in the stage I model to account for records with missing values for cause of ESRD, comorbidities at incidence (missing CMS-2728), and BMI. These variables have a value of 1 if the patient is missing the corresponding variable and a value of 0 otherwise. Another categorical indicator variable is included as a covariate in the stage 1 model to flag records where the patient has at least one of the incident comorbidities listed earlier. This variable has a value of 1 if the patient has at least one of the comorbidities and a value of 0 otherwise.

Beside main effects, two-way interaction terms between age and duration and cause of ESRD are also included:

- Diabetes as cause of ESRD\*Duration of ESRD
- Diabetes as cause of ESRD\*Age

## Comorbidity Exclusions

In addition to the aforementioned general risk-adjustments, the STrR risk adjustment paradigm utilizes several exclusions described here. For all patients, time at risk began at the start of the facility treatment period and continued until the earliest occurrence of the following: three days prior to a transplant; date of death; end of facility treatment; or December 31 of the year. This convention is used with other dialysis facility measures developed and previously endorsed by NQF (like SHR NQF #1463 <http://www.qualityforum.org/QPS/1463>).

Patient time at risk is also excluded if there is a Medicare claim (Part A inpatient, home health, hospice, and skilled and nursing facility claims; Part B outpatient and physician supplier) for hemolytic and aplastic anemia, solid organ cancer (breast, prostate, lung, digestive tract and others), lymphoma, carcinoma in situ, coagulation disorders, multiple myeloma, myelodysplastic syndrome and myelofibrosis, leukemia, head and neck cancer, other cancers (connective tissue, skin, and others), metastatic cancer, or sickle cell anemia within one year of their patient at risk time. The 2012 Anemia TEP felt that development of a risk-adjustment strategy encompassing these specific comorbidity categories for use in the facility-level transfusion metric was critically important. These prevalent comorbidities define a sub-population of patients who are at increased risk of blood transfusions, and in addition, are less likely to respond to recommended doses of exogenous ESAs. Furthermore, they are likely at increased risk for ESA-related complications. Lastly, the TEP members agreed that the aforementioned comorbidities were outside the sphere of influence of the dialysis facilities. The TEP considered additional comorbidities but recommended against their use in the risk-adjustment paradigm if the comorbidity could potentially be the result of care provided by the dialysis facility. A full

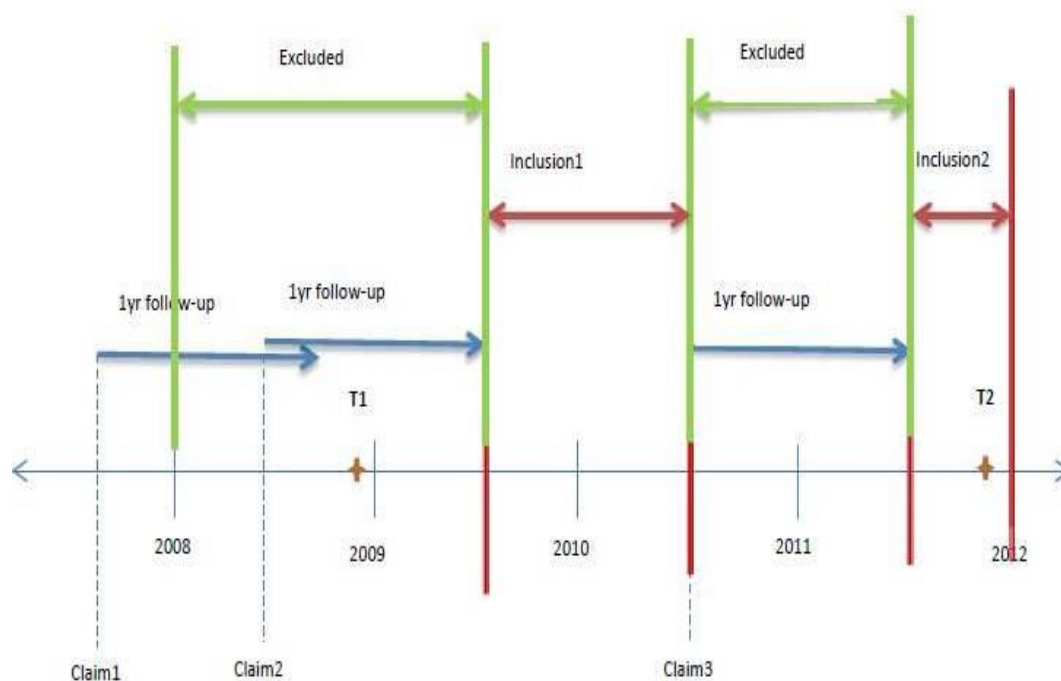
list of ICD-9 and 10 codes used for exclusions can be found here:

<https://dialysisdata.org/sites/default/files/content/Methodology/CodesForDFC.pdf>

Since these comorbidities are associated with higher risk of transfusion and require different anemia management practices that this measure is not intended to address, every patient's risk window is modified to have at least 1 year free of claims that contain diagnoses on the exclusion list. We assessed the predictive power of comorbidities on future transfusions, as a function of the time interval between development of the comorbidity and the occurrence of the transfusion by performing multivariate logistic regression with transfusion count as the dependent variable. Results showed that 1-year look back period for each of the above mentioned comorbidities was the most predictive of one or more RBC transfusions.

Figure 1 describes the inclusion and exclusion period of a hypothetical patient.

**Figure 1: Algorithm for exclusion of periods of time within 1 year of an exclusion comorbidity**



In the figure, a hypothetical patient has patient years at risk at a facility from 1/1/2008 to 12/31/2011. Review of Medicare claims identified presence of one or more exclusion comorbidities in 2007 (Claim1), 2008 (Claim2) and 2010 (Claim3). Each claim is followed by a one year exclusion period. The revised inclusion periods are defined as risk windows with at least 1 year of claim-free period (Inclusion1 and Inclusion2 in figure). The patient has two transfusion events, marked as T1 and T2 in late 2008 and late 2011 respectively. However, since T1 falls in the exclusion period, it will not be counted towards the facility's transfusion count as presence of exclusion comorbidity claims within a year might have increased the risk of transfusion unrelated to dialysis facility anemia management practice. However, T2, which occurs in late 2011 and in Inclusion2 period, will be counted since there is at least a year gap between this transfusion event and the last claim observed.

## Calculating Expected Number of Transfusions

The denominator of the STrR stems from a proportional rates model (Lawless and Nadeau, 1995; Lin et al., 2000; Kalbfleisch and Prentice, 2002). This is the recurrent event analog of the well-known proportional hazards or Cox model (Cox, 1972; Kalbfleisch and Prentice, 2002). To accommodate large-scale data, we adopt a model with piecewise constant baseline rates (e.g. Cook and Lawless, 2007) and the computational methodology developed in Liu, Schaubel and Kalbfleisch (2012).

The modeling process has two stages. At **stage I**, a stratified model is fitted to the national data with piecewise-constant baseline rates and stratification by facility. Specifically, the model is of the following form

$$Pr(\text{transfusion on day } t \text{ given covariates } X) = r_{ok}(t)\exp(\boldsymbol{\beta}'\mathbf{X}_{ik})$$

where  $\mathbf{X}_{ik}$  is the vector of covariates for the  $(i,k)$ th patient and  $\boldsymbol{\beta}$  is the vector of regression coefficients. The baseline rate function  $r_{ok}(t)$  is assumed specific to the  $k^{\text{th}}$  facility, which is assumed to be a step function with break points at 6 months, 1 year, 2 years, 3 years and 5 years since the onset of dialysis. This model allows the baseline transfusion rates to vary between strata (facilities), but assumes that the regression coefficients are the same across all strata; this approach is robust to possible differences between facilities in the patient mix being treated. The stratification on facilities is important in this phase to avoid bias due to possible confounding between covariates and facility effects.

- The patient characteristics  $\mathbf{X}_{ik}$  included in the stage I model are age (18-24 years old, 25-44 years old, 45-59 years old, 60-74 years old, or 75+ years old), cause of ESRD (diabetes or other), duration of ESRD (91 days-6 months, 6 months-1 year, 1-2 years, 2-3 years, 3-5 years, or 5+ years as of the period start date), nursing home status, BMI at incidence, comorbidities at incidence, calendar year, and two-way interaction terms between age and duration and cause of ESRD. Nursing home status is identified as in or not in a nursing home in the previous calendar year. Each status of comorbidities at incidence is included as a separate covariate in the model. BMI is included as a log-linear term. Categorical indicator variables are included as covariates in the stage I model to account for records with missing values for cause of ESRD, comorbidities at incidence (missing CMS-2728), and BMI. These variables have a value of 1 if the patient is missing the corresponding piece of information and a value of 0 otherwise. These variables have a value of 1 if the patient is missing the corresponding piece of information and a value of 0 otherwise. Another two categorical indicator variables are included to flag records with having no comorbidities and having at least one comorbidity at incidence reported on the Medical Evidence Form. These variables have a value of 1 if the patient is having no comorbidities or having at least one comorbidity and a value of 0 otherwise.

At **stage II**, the relative risk estimates from the first stage are used to create offsets and an unstratified model is fitted to obtain estimates of an overall baseline rate function. That is, we estimate a common baseline rate of transfusions,  $r_o(t)$ , across all facilities by considering the model

$$Pr(\text{transfusion on day } t \text{ given covariates } X) = r_o(t) R_{ik}$$

where  $R_{ik} = \exp(\boldsymbol{\beta}'\mathbf{X}_{ik})$  is the estimated relative risk for patient  $i$  in facility  $k$  estimated from the stage I. In our computation, we assume the baseline to be a step function with 6 unknown parameters,  $\alpha_1, \dots, \alpha_6$ ,

to estimate. These estimates are used to compute the expected number of transfusions given a patient's characteristics.

Specifically, let  $t_{iks}$  represent the number of days that patient  $i$  from facility  $k$  is under observation in the  $s$ th time interval with estimated rate  $\alpha_s$ . The corresponding expected number of transfusions in the  $s$ th interval for this patient is calculated as

$$E_{iks} = \alpha_s t_{iks} R_{ik}$$

It should be noted that  $t_{iks}$  and hence  $E_{iks}$  can be 0 if patient  $i$  from facility  $k$  is never at risk during the  $s$ th time interval. Summing the  $E_{iks}$  over all 6 intervals and all  $N_k$  patients in a given facility,  $k$ , gives

$$E = \sum_{i=1}^N \sum_{s=1}^6 E_{iks} = \sum_{i=1}^N \sum_{s=1}^6 \alpha_s t_{iks} R_{ik},$$

which is the expected number of transfusions during follow-up at that facility.

Let  $O$  be the observed total number of transfusions at this facility. The STTr for transfusions is the ratio of the observed total transfusions to this expected value, or

$$\text{STTr} = O/E$$

### Missing Data

Patients with missing data are not excluded from the model. For the purposes of calculation, missing values for BMI are replaced with mean values for patients of similar age and identical race, sex, and cause of ESRD. Missing values for cause of ESRD are replaced with the other/unknown category. No patients were missing age, sex, or date of first ESRD treatment. Indicator variables identifying patients with missing values for cause of ESRD, comorbidities at incidence (missing CMS-2728), and BMI are also included as covariates in the model.

### Calculation of STTr P-Values and Confidence Intervals

To overcome the possible over-dispersion of the data, we compute the p-value for our estimates using the empirical null distribution, an approach that possesses more robustness (Efron, 2004; Kalbfleisch and Wolfe, 2013). Our algorithm consists of the following concrete steps. First, we fit an over-dispersed Poisson model (e.g., SAS PROC GENMOD with link=log, dist=poisson and scale=dscale) for the number of transfusions

$$\log(E[n_{ik}]) = \log(E_{ik}) + \theta_k,$$

where  $n_{ik}$  is the observed number of event for patient  $i$  in facility  $k$ ,  $E_{ik}$  is the expected number of events for patient  $i$  in facility  $k$  and  $\theta_k$  is the facility-specific intercept. Here,  $i$  ranges over the number of patients  $n_{ik}$  who are treated in the  $k$ th facility. The natural log of the STTr for the  $k$ th facility is then given by the corresponding estimate of  $\theta_k$ . The standard error of  $\theta_k$  is obtained from the robust estimate of variance arising from the overdispersed Poisson model.

Second, we obtain a z-score for each facility by dividing the natural log of its STTr by the standard error from the general linear model described above. These z-scores are then grouped into quartiles based on the number of patient years at risk for Medicare patients in each facility. Finally, using robust estimates

of location and scale based on the normal curve fitted to the center of the z-scores for the STrR, we derive the mean and variance of a normal empirical null distribution for each quartile. This empirical null distribution is then used to calculate the p-value for a facility's STrR.

### Example

The uncertainty or confidence intervals are obtained by applying the following steps:

- From the general linear model we obtain the natural log of the STrR ( $\ln \text{STrR}$ ) as well as its standard error, (SE). From the empirical null, we obtain a mean ( $\mu$ ) and a standard deviation ( $\sigma$ ). The 95% uncertainty interval for the 'true' log standardized transfusion ratio for this facility is

$$\ln \text{STrR} - \mu * SE \pm 1.96 * \sigma * SE.$$

Note that 1.96 is the critical point from the standard normal distribution for a 95% interval.

- Exponentiating the endpoints of this interval gives the uncertainty interval for the true STrR.

For example, consider a hypothetical facility whose STrR is 0.927 for which  $\ln \text{STrR} = -0.076$  with corresponding standard error,  $SE = 0.118$ . This facility falls in a quartile where the empirical null has  $\mu = -0.143$  and  $\sigma = 1.479$ . The corresponding uncertainty interval for the log STrR is

$$-0.076 - (-0.143)*0.118 \pm 1.96 * 0.118*1.479 = (-0.401, 0.283).$$

The 95% interval for the true STrR is then 0.67 to 1.33.

## Results

### Population Characteristics\*, Data Years 2011–2014

**Table 2. Count of facilities, patients, and total patient years at risk.**

| Year | # of facilities | # of Patients | Total Patients Years at risk |
|------|-----------------|---------------|------------------------------|
| 2011 | 5774            | 387097        | 227935.62                    |
| 2012 | 5943            | 398769        | 234847.09                    |
| 2013 | 6170            | 415576        | 241082.06                    |
| 2014 | 6415            | 429241        | 246710.49                    |

**Table 3. Parameter estimates for covariates in STrR model.**

| Covariate            | Coefficient | P-value |
|----------------------|-------------|---------|
| <b>Cause of ESRD</b> |             |         |
| Diabetes             | -0.118      | <.0001  |
| Missing              | 0.188       | <.0001  |
| <b>Age</b>           |             |         |

| <b>Covariate</b>   | <b>Coefficient</b> | <b>P-value</b> |
|--|--------------------|----------------|
| 18-24  | 0.084              | <.0001         |
| 25-44  | -0.196             | <.0001         |
| 45-59  | -0.180             | <.0001         |
| 60-74  | Reference          |                |
| 75+  | 0.035              | <.0001         |
| <b>BMI</b>   |                    |                |
| Log BMI  | -0.247             | <.0001         |
| BMI missing  | 0.024              | 0.190          |
| <b>Calendar year</b>   |                    |                |
| 2011   | Reference          |                |
| 2012   | 0.068              | <.0001         |
| 2013   | 0.027              | <.0001         |
| 2014   | -0.080             | <.0001         |
| <b>In nursing home the previous year</b>                             | 0.489              | <.0001         |
| <b>Diabetes as cause of ESRD &amp; time on ESRD interaction term</b> |                    |                |
| 91 days-6 months   | Reference          |                |
| 6 months-1 year  | 0.068              | 0.001          |
| 1-2 years  | 0.128              | <.0001         |
| 2-3 years  | 0.135              | <.0001         |
| 3-5 years  | 0.090              | <.0001         |
| 5+ years   | 0.044              | 0.014          |
| <b>Age &amp; diabetes as cause of ESRD interaction term</b>          |                    |                |
| 0-14   |                    |                |
| 15-24  | 0.166              | 0.090          |
| 25-44  | 0.228              | <.0001         |
| 45-59  | 0.098              | <.0001         |
| 60-74  | Reference          |                |
| 75+  | 0.008              | 0.445          |
| <b>Incident comorbidities</b>  |                    |                |
| atherosclerotic heart disease  | 0.071              | <.0001         |
| other cardiac disease  | 0.065              | <.0001         |
| congestive heart failure   | 0.049              | <.0001         |
| Inability to ambulate  | 0.108              | <.0001         |
| Chronic obstructive pulmonary disease                                | 0.168              | <.0001         |
| Inability to transfer  | 0.097              | <.0001         |
| Cancer   | 0.008              | 0.541          |

| Covariate                         | Coefficient | P-value |
|-----------------------------------|-------------|---------|
| Diabetes                          | 0.085       | <.0001  |
| Peripheral vascular disease       | 0.134       | <.0001  |
| Cerebrovascular disease           | 0.020       | 0.005   |
| Tobacco use (current smoker)      | 0.135       | <.0001  |
| Alcohol dependence                | 0.117       | <.0001  |
| Drug dependence                   | 0.097       | <.0001  |
| At least one incident comorbidity | 0.088       | <.0001  |
| Incident comorbidity missing      | 0.068       | 0.008   |

Table 4. Model Coefficients

| Covariate  | Coefficient | P-value |
|--|-------------|---------|
| <b>Cause of ESRD</b>   |             |         |
| Diabetes   | -0.118      | <.0001  |
| Missing  | 0.188       | <.0001  |
| <b>Age</b>   |             |         |
| 18-24  | 0.084       | <.0001  |
| 25-44  | -0.196      | <.0001  |
| 45-59  | -0.18       | <.0001  |
| 60-74  | Reference   |         |
| 75+  | 0.035       | <.0001  |
| <b>BMI</b>   |             |         |
| Log BMI  | -0.247      | <.0001  |
| BMI missing  | 0.024       | 0.19    |
| <b>Calendar year</b>   |             |         |
| 2011   | Reference   |         |
| 2012   | 0.068       | <.0001  |
| 2013   | 0.027       | <.0001  |
| 2014   | -0.08       | <.0001  |
| <b>In nursing home the previous year</b>                             | 0.489       | <.0001  |
| <b>Diabetes as cause of ESRD &amp; time on ESRD interaction term</b> |             |         |
| 91 days-6 months   | Reference   |         |
| 6 months-1 year  | 0.068       | 0.001   |
| 1-2 years  | 0.128       | <.0001  |
| 2-3 years  | 0.135       | <.0001  |
| 3-5 years  | 0.09        | <.0001  |
| 5+ years   | 0.044       | 0.014   |
| <b>Age &amp; diabetes as cause of ESRD interaction term</b>          |             |         |

| Covariate                             | Coefficient | P-value |
|---------------------------------------|-------------|---------|
| 0-14                                  |             |         |
| 15-24                                 | 0.166       | 0.09    |
| 25-44                                 | 0.228       | <.0001  |
| 45-59                                 | 0.098       | <.0001  |
| 60-74                                 | Reference   |         |
| 75+                                   | 0.008       | 0.445   |
| <b>Incident comorbidities</b>         |             |         |
| atherosclerotic heart disease         | 0.071       | <.0001  |
| other cardiac disease                 | 0.065       | <.0001  |
| congestive heart failure              | 0.049       | <.0001  |
| inability to ambulate                 | 0.108       | <.0001  |
| chronic obstructive pulmonary disease | 0.168       | <.0001  |
| inability to transfer                 | 0.097       | <.0001  |
| cancer                                | 0.008       | 0.541   |
| diabetes                              | 0.085       | <.0001  |
| peripheral vascular disease           | 0.134       | <.0001  |
| cerebrovascular disease               | 0.02        | 0.005   |
| tobacco use (current smoker)          | 0.135       | <.0001  |
| alcohol dependence                    | 0.117       | <.0001  |
| drug dependence                       | 0.097       | <.0001  |
| At least one incident comorbidity     | 0.088       | <.0001  |
| Incident comorbidity missing          | 0.068       | 0.008   |

## Reliability Testing

The reliability of the STrR was assessed using data among ESRD dialysis patients during 2011-2014. If the measure were a simple average across individuals in the facility, the usual approach for determining measure reliability would be a one-way analysis of variance (ANOVA), in which the between and within facility variation in the measure is determined. The inter-unit reliability (IUR) measures the proportion of the measure variability that is attributable to the between-facility variance. The STrR, however, is not a simple average and we instead estimate the IUR using a bootstrap approach, which uses a resampling scheme to estimate the within facility variation that cannot be directly estimated by ANOVA. A small IUR (near 0) reveals that most of the variation of the measures between facilities is driven by random noise, indicating the measure would not be a good characterization of the differences among facilities, whereas a large IUR (near 1) indicates that most of the variation between facilities is due to the real difference between facilities.

Here we describe our approach to calculating IUR. Let  $T_1, \dots, T_N$  be the STrR for these facilities. Within each facility, select at random and with replacement  $B = 100$  bootstrap samples. That is, if the  $i$ th facility has  $n_i$  subjects, randomly draw with replacement  $n_i$  subjects from those in the same facility, find their corresponding STrR <sub>$i$</sub>  and repeat the process 100 times. Thus, for the  $i$ th facility, we have bootstrapped STrRs of  $T_{i1}^*, \dots, T_{i100}^*$ . Let  $S_i^*$  be the sample variance of this bootstrap sample. From this it can be seen that



$$s_{t,w}^2 = \frac{\sum_{i=1}^N [(n_i - 1)S_i^{*2}]}{\sum_{i=1}^N (n_i - 1)}$$

is a bootstrap estimate of the within-facility variance in the STTr, namely  $\sigma_{t,w}^2$ . Calling on formulas from the one way analysis of variance, an estimate of the overall variance of  $T_i$  is

$$s_t^2 = \frac{1}{n'(N-1)} \sum_{i=1}^N n_i (T_i - \bar{T})^2$$

where

$$\bar{T} = \sum n_i T_i / \sum n_i$$

is the weighted mean of the observed STTr and

$$n' = \frac{1}{N-1} (\sum n_i - \sum n_i^2 / \sum n_i)$$

is approximately the average facility size (number of patients per facility). Note that  $s_t^2$  is an estimate of  $\sigma_b^2 + \sigma_{t,w}^2$  where  $\sigma_b^2$  is the between-facility variance, the true signal reflecting the differences across facilities. Thus, the IUR, which is defined by

$$IUR = \frac{\sigma_b^2}{\sigma_b^2 + \sigma_{t,w}^2}$$

can be estimated with  $(s_t^2 - s_{t,w}^2) / s_t^2$

The STTr calculation only included facilities with at least 10 patient years at risk. Overall, we found that IURs for the one-year STTr have a range of 0.60-0.66 across the years 2011, 2012, 2013 and 2014, which indicates that around two-thirds of the variation in the one-year STTr can be attributed to the between-facility differences and one-third to within-facility variation. This value of IUR indicates a **moderate degree of reliability**. When stratified by facility size, we find that, as expected, larger facilities have greater IUR.

**Table 5: IUR for One-year STTr, Overall and by Facility Size, 2011-2014.**

|                | 2011 |      | 2012 |      | 2013 |      | 2014 |      |
|----------------|------|------|------|------|------|------|------|------|
| Facility Size  | IUR  | N    | IUR  | N    | IUR  | N    | IUR  | N    |
| all            | 0.64 | 5142 | 0.66 | 5319 | 0.65 | 5442 | 0.60 | 5651 |
| Small (<=46)   | 0.41 | 1714 | 0.41 | 1828 | 0.39 | 1840 | 0.30 | 1934 |
| Medium (47–78) | 0.55 | 1699 | 0.56 | 1753 | 0.55 | 1823 | 0.50 | 1941 |
| Large (>=79)   | 0.78 | 1729 | 0.79 | 1738 | 0.79 | 1779 | 0.78 | 1776 |

## Validity Testing

We examined STrR's correlations with the other measures of quality among ESRD population and reported significant correlation estimates. We assessed the validity of the measure through various comparisons of this measure with other quality measures in use, and in May 2012 there was an assessment of face validity based on polling of a CMS Technical Expert Panel (TEP).

## Face Validity

Six out of six voting members of CMS's 2012 Technical Expert Panel voted to recommend development of a facility-level Standardized Transfusion Ratio measure. The consensus recommendation of that clinical expert panel included the recommendation to include risk adjustment for conditions that are associated with an increased risk of blood transfusion and in some cases, increased risk of ESA-associated adverse events, such as hereditary anemia, chronic bone marrow failure conditions and active cancer.

## Association of STrR with other facility-level outcomes

Validity was assessed using Poisson regression models to measure the association between facility level the 2014 Standardized Mortality Ratio (SMR, NQF 0369) and 2014 Standardized Hospitalization Ratio (SHR, NQF 1463) and tertiles of STrR. Facility-level STrR were divided into tertiles (T1 to T3) and the relative risk (RR) of mortality (and hospitalization, separately) was calculated for each tertile, using the T1 as the reference group. Thus, a RR>1.0 would indicate a higher relative risk of mortality or hospitalization, compared to the highest performance tertile (T1) of STrR.

Tertiles of STrR were defined as follows:

T1: 0-<0.66

T2: 0.66-<1.15

T3: 1.15-<5.66

\*T1 as Reference

Results from the Poisson model indicated that the STrR tertiles were significantly associated with both SMR and SHR.

For the 2014 SMR, the relative risk of mortality increased as the STeR tertiles increased from the reference group (tertile 1). For tertile 2, RR=1.06 (95% CI: 1.04, 1.08;  $p<0.001$ ), and for tertile 3, RR=1.14 (95% CI: 1.12, 1.16;  $p<0.001$ ).

Similarly for 2014 SHR, the relative risk of hospitalization increased as the STeR tertiles increased from the reference group (tertile 1) with the lowest risk in tertile 1. For tertile 2, RR=1.11 (95% CI: 1.10, 1.11;  $p<0.001$ ), and for tertile 3, RR=1.29 (95% CI: 1.29, 1.30;  $p<0.001$ ).

## Association of STeR with facility-level intermediate anemia management outcome

Validity was also assessed using a Poisson regression model to measure the association between facility level STeR and tertiles of % of patients with Hgb < 10. Facility-level % of patients with Hgb < 10 were divided into tertiles (T1 to T3) and relative risk (RR) of transfusions were calculated for each tertile, using the T1 as the reference group. Thus, a RR>1.0 would indicate a higher relative risk of transfusion, compared to the highest performance tertile(T1) of % of patients with Hgb < 10.

Tertiles of % of patients with Hgb < 10 were defined as follows:

T1: 0-<9.5%

T2: 9.5%-<16.5%

T3: 16.5%-<85.3%

\*T1 as Reference

Results from the Poisson model indicated that the % of patients with Hgb < 10 was significantly associated with the risks of transfusion.

The relative risk of transfusions increased as the tertiles of % of patients with Hgb < 10 increased from the reference group (tertile 1). For tertile 2, RR=1.15 (95% CI: 1.13, 1.18;  $p<0.001$ ), and for tertile 3, RR=1.31 (95% CI: 1.28, 1.33;  $p<0.001$ ).

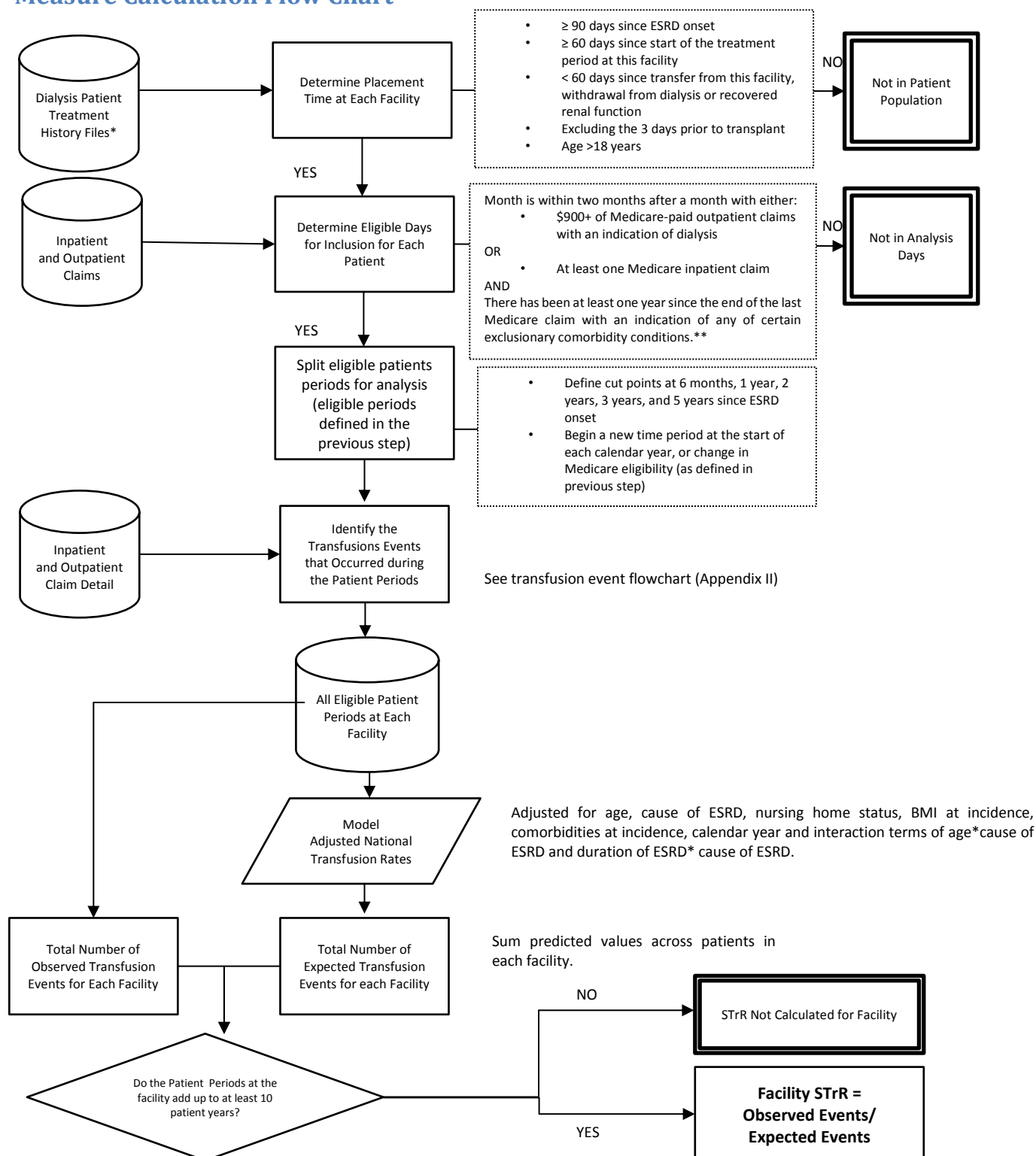
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## Appendix

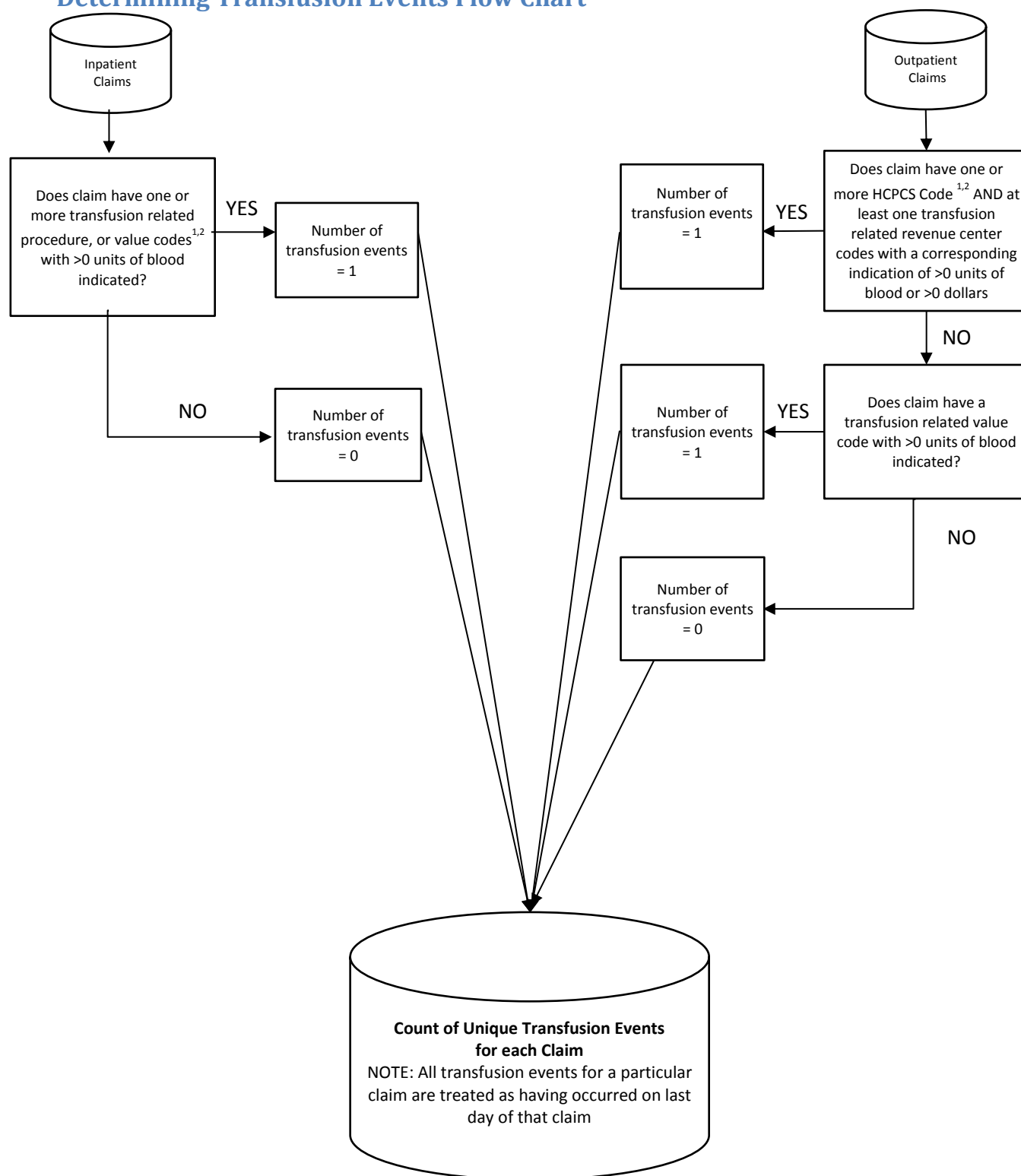
### Measure Calculation Flow Chart



\*Multiple data sources include CMS Consolidated Renal Operations in a Web-enabled Network (CROWNWeb), the CMS Annual Facility Survey (Form CMS-2744), Medicare dialysis and hospital payment records, the CMS Medical Evidence Form (Form CMS-2728), transplant data from the Organ Procurement and Transplant Network (OPTN), the Death Notification Form (Form CMS-2746), the Dialysis Facility Compare (DFC) and the Social Security Death Master File.

\*\* Exclusionary comorbidity conditions: hemolytic and aplastic anemia, solid organ cancer (breast, prostate, lung, digestive tract and others), lymphoma, carcinoma in situ, coagulation disorders, multiple myeloma, myelodysplastic syndrome and myelofibrosis, leukemia, head and neck cancer, other cancers (connective tissue, skin, and others), metastatic cancer, sickle cell anemia.

## Determining Transfusion Events Flow Chart



<sup>1</sup> See Appendix III for the description of relevant revenue center codes, procedure codes, value codes and HCPCS codes.

<sup>2</sup> Transfusion related revenue center codes: 0380, 0381, 0382, 0389, 0390, 0391, 0392, 0399

Transfusion related procedure codes: 9903, 9904, 30230H1, 30233H1, 30240H1, 30243H1, 30250H1, 30253H1, 30260H1, 30263H1, 30230N1, 30230P1, 30233N1, 30233P1, 30240N1, 30240P1, 30243N1, 30243P1, 30250N1, 30250P1, 30253N1, 30253P1, 30260N1, 30260P1, 30263N1, and 30263P1

Transfusion related HCPCS codes: P9010, P9011, P9016, P9021, P9022, P9038, P9039, P9040, P9051, P9054, P9056, P9057, P9058, 36430

## Description of Relevant Revenue Center Codes, Procedure Codes, Value Codes and HCPCS Codes.

| Field                       | Value   | Meaning  |
|-----------------------------|---------|--|
| <b>Revenue Center Codes</b> | 0380    | Blood - General Classification   |
|                             | 0381    | Blood - Packed Red Cells   |
|                             | 0382    | Blood - Whole Blood  |
|                             | 0389    | Blood - Other Blood  |
|                             | 0390    | Blood Storage and Processing - General Classification                                    |
|                             | 0391    | Blood Storage and Processing - Administration  |
|                             | 0392    | Blood Storage and Processing - Blood Processing and Storage                              |
|                             | 0399    | Blood Storage and Processing - Other Storage & Processing                                |
| <b>Procedure Codes</b>      | 9903    | Other Transfusion Of Whole Blood   |
|                             | 9904    | Transfusion Of Packed Cells  |
|                             | 30230H1 | Transfusion of Nonautologous Whole Blood into Peripheral Vein, Open Approach             |
|                             | 30233H1 | Transfusion of Nonautologous Whole Blood into Peripheral Vein, Percutaneous Approach     |
|                             | 30240H1 | Transfusion of Nonautologous Whole Blood into Central Vein, Open Approach                |
|                             | 30243H1 | Transfusion of Nonautologous Whole Blood into Central Vein, Percutaneous Approach        |
|                             | 30250H1 | Transfusion of Nonautologous Whole Blood into Peripheral Artery, Open Approach           |
|                             | 30253H1 | Transfusion of Nonautologous Whole Blood into Peripheral Artery, Percutaneous Approach   |
|                             | 30260H1 | Transfusion of Nonautologous Whole Blood into Central Artery, Open Approach              |
|                             | 30263H1 | Transfusion of Nonautologous Whole Blood into Central Artery, Percutaneous Approach      |
|                             | 30230N1 | Transfusion of Nonautologous Red Blood Cells into Peripheral Vein, Open Approach         |
|                             | 30230P1 | Transfusion of Nonautologous Frozen Red Cells into Peripheral Vein, Open Approach        |
|                             | 30233N1 | Transfusion of Nonautologous Red Blood Cells into Peripheral Vein, Percutaneous Approach |
|                             | 30240N1 | Transfusion of Nonautologous Red Blood Cells into Central Vein, Open Approach            |
|                             | 30240P1 | Transfusion of Nonautologous Frozen Red Cells into Central Vein, Open Approach           |

|                    |         |   |
|--------------------|---------|---|
|                    | 30243N1 | Transfusion of Nonautologous Red Blood Cells into Central Vein, Percutaneous Approach       |
|                    | 30243P1 | Transfusion of Nonautologous Frozen Red Cells into Central Vein, Percutaneous Approach      |
|                    | 30250N1 | Transfusion of Nonautologous Red Blood Cells into Peripheral Artery, Open Approach          |
|                    | 30250P1 | Transfusion of Nonautologous Frozen Red Cells into Peripheral Artery, Open Approach         |
|                    | 30253N1 | Transfusion of Nonautologous Red Blood Cells into Peripheral Artery, Percutaneous Approach  |
|                    | 30253P1 | Transfusion of Nonautologous Frozen Red Cells into Peripheral Artery, Percutaneous Approach |
|                    | 30260N1 | Transfusion of Nonautologous Red Blood Cells into Central Artery, Open Approach             |
|                    | 30260P1 | Transfusion of Nonautologous Frozen Red Cells into Central Artery, Open Approach            |
|                    | 30263N1 | Transfusion of Nonautologous Red Blood Cells into Central Artery, Percutaneous Approach     |
|                    | 30263P1 | Transfusion of Nonautologous Frozen Red Cells into Central Artery, Percutaneous Approach    |
| <b>Value Code</b>  | 37      | Pints of blood furnished  |
| <b>HCPCS Codes</b> | P9010   | Whole blood for transfusion   |
|                    | P9011   | Blood split unit  |
|                    | P9016   | RBC leukocytes reduced  |
|                    | P9021   | Red blood cells unit  |
|                    | P9022   | Washed red blood cells unit   |
|                    | P9038   | RBC irradiated  |
|                    | P9039   | RBC deglycerolized  |
|                    | P9040   | RBC leukoreduced irradiated   |
|                    | P9051   | Blood, l/r, cmv-neg   |
|                    | P9054   | Blood, l/r, froz/degly/wash   |
|                    | P9056   | Blood, l/r, irradiated  |
|                    | P9057   | Red blood cells, frozen/deglycerolized/washed, leukocytes reduced, irradiated, each unit    |
|                    | P9058   | RBC, l/r, cmv-neg, irrad  |
|                    | 36430   | Current Procedural Terminology (CPT) code (transfusion, blood or blood components)          |



# List of ICD-9 codes used for exclusions

| Comorbidity      | ICD-10 Diagnosis Code | Description   |
|------------------|-----------------------|---|
| Carcinoma        | 2300                  | Carcinoma in situ of lip, oral cavity, and pharynx  |
| Carcinoma        | 2301                  | Carcinoma in situ of esophagus  |
| Carcinoma        | 2302                  | Carcinoma in situ of stomach  |
| Carcinoma        | 2303                  | Carcinoma in situ of colon  |
| Carcinoma        | 2304                  | Carcinoma in situ of rectum   |
| Carcinoma        | 2305                  | Carcinoma in situ of anal canal   |
| Carcinoma        | 2306                  | Carcinoma in situ of anus, unspecified  |
| Carcinoma        | 2307                  | Carcinoma in situ of other and unspecified parts of intestine                                     |
| Carcinoma        | 2308                  | Carcinoma in situ of liver and biliary system   |
| Carcinoma        | 2309                  | Carcinoma in situ of other and unspecified digestive organs                                       |
| Carcinoma        | 2310                  | Carcinoma in situ of larynx   |
| Carcinoma        | 2311                  | Carcinoma in situ of trachea  |
| Carcinoma        | 2312                  | Carcinoma in situ of bronchus and lung  |
| Carcinoma        | 2318                  | Carcinoma in situ of other specified parts of respiratory system                                  |
| Carcinoma        | 2319                  | Carcinoma in situ of respiratory system, part unspecified   |
| Carcinoma        | 2330                  | Carcinoma in situ of breast   |
| Carcinoma        | 2331                  | Carcinoma in situ of cervix uteri   |
| Carcinoma        | 2332                  | Carcinoma in situ of other and unspecified parts of uterus  |
| Carcinoma        | 2333                  | Carcinoma in situ, unspecified female genital organ   |
| Carcinoma        | 23330                 | Carcinoma in situ, unspecified female genital organ   |
| Carcinoma        | 23331                 | Carcinoma in situ, vagina   |
| Carcinoma        | 23332                 | Carcinoma in situ, vulva  |
| Carcinoma        | 23339                 | Carcinoma in situ, other female genital organ   |
| Carcinoma        | 2334                  | Carcinoma in situ of prostate   |
| Carcinoma        | 2335                  | Carcinoma in situ of penis  |
| Carcinoma        | 2336                  | Carcinoma in situ of other and unspecified male genital organs                                    |
| Carcinoma        | 2337                  | Carcinoma in situ of bladder  |
| Carcinoma        | 2339                  | Carcinoma in situ of other and unspecified urinary organs   |
| Carcinoma        | 2340                  | Carcinoma in situ of eye  |
| Carcinoma        | 2348                  | Carcinoma in situ of other specified sites  |
| Carcinoma        | 2349                  | Carcinoma in situ, site unspecified   |
| Coagulation      | 2860                  | Congenital factor VIII disorder   |
| Coagulation      | 2861                  | Congenital factor IX disorder   |
| Coagulation      | 2862                  | Congenital factor XI deficiency   |
| Coagulation      | 2863                  | Congenital deficiency of other clotting factors   |
| Coagulation      | 2864                  | Von Willebrand's disease  |
| Coagulation      | 2865                  | Hemorrhagic disorder due to intrinsic circulating anticoagulants                                  |
| Coagulation      | 28652                 | Acquired hemophilia   |
| Coagulation      | 28653                 | Antiphospholipid antibody with hemorrhagic disorder   |
| Coagulation      | 28659                 | Other hemorrhagic disorder due to intrinsic circulating anticoagulants, antibodies, or inhibitors |
| Coagulation      | 2866                  | Defibrination syndrome  |
| Coagulation      | 2867                  | Acquired coagulation factor deficiency  |
| Coagulation      | 2869                  | Other and unspecified coagulation defects   |
| Head/Neck Cancer | 140                   | Malignant neoplasm of lip   |
| Head/Neck Cancer | 1400                  | Malignant neoplasm of upper lip, vermilion border   |
| Head/Neck Cancer | 1401                  | Malignant neoplasm of lower lip, vermilion border   |
| Head/Neck Cancer | 1402                  |   |
| Head/Neck Cancer | 1403                  | Malignant neoplasm of upper lip, inner aspect   |
| Head/Neck Cancer | 1404                  | Malignant neoplasm of lower lip, inner aspect   |
| Head/Neck Cancer | 1405                  | Malignant neoplasm of lip, unspecified, inner aspect  |
| Head/Neck Cancer | 1406                  | Malignant neoplasm of commissure of lip   |
| Head/Neck Cancer | 1408                  | Malignant neoplasm of other sites of lip  |
| Head/Neck Cancer | 1409                  | Malignant neoplasm of lip, unspecified, vermilion border  |
| Head/Neck Cancer | 141                   | Malignant neoplasm of tongue  |
| Head/Neck Cancer | 1410                  | Malignant neoplasm of base of tongue  |
| Head/Neck Cancer | 1411                  | Malignant neoplasm of dorsal surface of tongue  |
| Head/Neck Cancer | 1412                  | Malignant neoplasm of tip and lateral border of tongue  |
| Head/Neck Cancer | 1413                  | Malignant neoplasm of ventral surface of tongue   |
| Head/Neck Cancer | 1414                  | Malignant neoplasm of anterior two-thirds of tongue, part unspecified                             |
| Head/Neck Cancer | 1415                  | Malignant neoplasm of junctional zone of tongue   |
| Head/Neck Cancer | 1416                  | Malignant neoplasm of lingual tonsil  |
| Head/Neck Cancer | 1418                  | Malignant neoplasm of other sites of tongue   |
| Head/Neck Cancer | 1419                  | Malignant neoplasm of tongue, unspecified   |
| Head/Neck Cancer | 142                   | Malignant neoplasm of major salivary glands   |
| Head/Neck Cancer | 1420                  | Malignant neoplasm of parotid gland   |
| Head/Neck Cancer | 1421                  | Malignant neoplasm of submandibular gland   |
| Head/Neck Cancer | 1422                  | Malignant neoplasm of sublingual gland  |
| Head/Neck Cancer | 1428                  | Malignant neoplasm of other major salivary glands   |
| Head/Neck Cancer | 1429                  | Malignant neoplasm of salivary gland, unspecified   |
| Head/Neck Cancer | 143                   | Malignant neoplasm of gum   |
| Head/Neck Cancer | 1430                  | Malignant neoplasm of upper gum   |
| Head/Neck Cancer | 1431                  | Malignant neoplasm of lower gum   |
| Head/Neck Cancer | 1438                  | Malignant neoplasm of other sites of gum  |
| Head/Neck Cancer | 1439                  | Malignant neoplasm of gum, unspecified  |
| Head/Neck Cancer | 144                   | Malignant neoplasm of floor of mouth  |
| Head/Neck Cancer | 1440                  | Malignant neoplasm of anterior portion of floor of mouth  |
| Head/Neck Cancer | 1441                  | Malignant neoplasm of lateral portion of floor of mouth   |
| Head/Neck Cancer | 1448                  | Malignant neoplasm of other sites of floor of mouth   |

# List of ICD-9 codes used for exclusions

| Comorbidity                  | ICD-10 Diagnosis Code | Description  |
|------------------------------|-----------------------|--|
| Head/Neck Cancer             | 1449                  | Malignant neoplasm of floor of mouth, part unspecified   |
| Head/Neck Cancer             | 145                   | Malignant neoplasm of other and unspecified parts of mouth   |
| Head/Neck Cancer             | 1450                  | Malignant neoplasm of cheek mucosa   |
| Head/Neck Cancer             | 1451                  | Malignant neoplasm of vestibule of mouth   |
| Head/Neck Cancer             | 1452                  | Malignant neoplasm of hard palate  |
| Head/Neck Cancer             | 1453                  | Malignant neoplasm of soft palate  |
| Head/Neck Cancer             | 1454                  | Malignant neoplasm of uvula  |
| Head/Neck Cancer             | 1455                  | Malignant neoplasm of palate, unspecified  |
| Head/Neck Cancer             | 1456                  | Malignant neoplasm of retromolar area  |
| Head/Neck Cancer             | 1458                  | Malignant neoplasm of other specified parts of mouth   |
| Head/Neck Cancer             | 1459                  | Malignant neoplasm of mouth, unspecified   |
| Head/Neck Cancer             | 146                   | Malignant neoplasm of oropharynx   |
| Head/Neck Cancer             | 1460                  | Malignant neoplasm of tonsil   |
| Head/Neck Cancer             | 1461                  | Malignant neoplasm of tonsillar fossa  |
| Head/Neck Cancer             | 1462                  | Malignant neoplasm of tonsillar pillars (anterior) (posterior)   |
| Head/Neck Cancer             | 1463                  | Malignant neoplasm of vallecula epiglottica  |
| Head/Neck Cancer             | 1464                  | Malignant neoplasm of anterior aspect of epiglottis  |
| Head/Neck Cancer             | 1465                  | Malignant neoplasm of junctional region of oropharynx  |
| Head/Neck Cancer             | 1466                  | Malignant neoplasm of lateral wall of oropharynx   |
| Head/Neck Cancer             | 1467                  | Malignant neoplasm of posterior wall of oropharynx   |
| Head/Neck Cancer             | 1468                  | Malignant neoplasm of other specified sites of oropharynx  |
| Head/Neck Cancer             | 1469                  | Malignant neoplasm of oropharynx, unspecified site   |
| Head/Neck Cancer             | 147                   | Malignant neoplasm of nasopharynx  |
| Head/Neck Cancer             | 1470                  | Malignant neoplasm of superior wall of nasopharynx   |
| Head/Neck Cancer             | 1471                  | Malignant neoplasm of posterior wall of nasopharynx  |
| Head/Neck Cancer             | 1472                  | Malignant neoplasm of lateral wall of nasopharynx  |
| Head/Neck Cancer             | 1473                  | Malignant neoplasm of anterior wall of nasopharynx   |
| Head/Neck Cancer             | 1478                  | Malignant neoplasm of other specified sites of nasopharynx   |
| Head/Neck Cancer             | 1479                  | Malignant neoplasm of nasopharynx, unspecified site  |
| Head/Neck Cancer             | 148                   | Malignant neoplasm of hypopharynx  |
| Head/Neck Cancer             | 1480                  | Malignant neoplasm of postcricoid region of hypopharynx  |
| Head/Neck Cancer             | 1481                  | Malignant neoplasm of pyriform sinus   |
| Head/Neck Cancer             | 1482                  | Malignant neoplasm of aryepiglottic fold, hypopharyngeal aspect  |
| Head/Neck Cancer             | 1483                  | Malignant neoplasm of posterior hypopharyngeal wall  |
| Head/Neck Cancer             | 1488                  | Malignant neoplasm of other specified sites of hypopharynx   |
| Head/Neck Cancer             | 1489                  | Malignant neoplasm of hypopharynx, unspecified site  |
| Head/Neck Cancer             | 149                   | Malignant neoplasms of other and ill-defined sites within the lip, oral cavity and pharynx               |
| Head/Neck Cancer             | 1490                  | Malignant neoplasm of pharynx, unspecified   |
| Head/Neck Cancer             | 1491                  | Malignant neoplasm of waldeyer's ring  |
| Head/Neck Cancer             | 1498                  | Malignant neoplasm of other sites within the lip and oral cavity   |
| Head/Neck Cancer             | 1499                  | Malignant neoplasm of ill-defined sites within the lip and oral cavity                                   |
| Head/Neck Cancer             | 160                   | Malignant neoplasm of nasal cavities, middle ear, and accessory sinuses                                  |
| Head/Neck Cancer             | 1600                  | Malignant neoplasm of nasal cavities   |
| Head/Neck Cancer             | 1601                  | Malignant neoplasm of auditory tube, middle ear, and mastoid air cells                                   |
| Head/Neck Cancer             | 1602                  | Malignant neoplasm of maxillary sinus  |
| Head/Neck Cancer             | 1603                  | Malignant neoplasm of ethmoidal sinus  |
| Head/Neck Cancer             | 1604                  | Malignant neoplasm of frontal sinus  |
| Head/Neck Cancer             | 1605                  | Malignant neoplasm of sphenoidal sinus   |
| Head/Neck Cancer             | 1608                  | Malignant neoplasm of other accessory sinuses  |
| Head/Neck Cancer             | 1609                  | Malignant neoplasm of accessory sinus, unspecified   |
| Head/Neck Cancer             | 161                   | Malignant neoplasm of larynx   |
| Head/Neck Cancer             | 1610                  | Malignant neoplasm of glottis  |
| Head/Neck Cancer             | 1611                  | Malignant neoplasm of supraglottis   |
| Head/Neck Cancer             | 1612                  | Malignant neoplasm of subglottis   |
| Head/Neck Cancer             | 1613                  | Malignant neoplasm of laryngeal cartilages   |
| Head/Neck Cancer             | 1618                  | Malignant neoplasm of other specified sites of larynx  |
| Head/Neck Cancer             | 1619                  | Malignant neoplasm of larynx, unspecified  |
| Head/Neck Cancer             | 164                   | Malignant neoplasm of thymus, heart and mediastinum  |
| Head/Neck Cancer             | 1640                  | Malignant neoplasm of thymus   |
| Head/Neck Cancer             | 1641                  | Malignant neoplasm of heart  |
| Head/Neck Cancer             | 1642                  | Malignant neoplasm of anterior mediastinum   |
| Head/Neck Cancer             | 1643                  | Malignant neoplasm of posterior mediastinum  |
| Head/Neck Cancer             | 1648                  | Malignant neoplasm of other parts of mediastinum   |
| Head/Neck Cancer             | 1649                  | Malignant neoplasm of mediastinum, part unspecified  |
| Head/Neck Cancer             | 165                   | Malignant neoplasm of other and ill-defined sites within the respiratory system and intrathoracic organs |
| Head/Neck Cancer             | 1650                  | Malignant neoplasm of upper respiratory tract, part unspecified  |
| Head/Neck Cancer             | 1658                  | Malignant neoplasm of other sites within the respiratory system and intrathoracic organs                 |
| Head/Neck Cancer             | 1659                  | Malignant neoplasm of ill-defined sites within the respiratory system                                    |
| Hemolytic or Aplastic Anemia | 282                   | Hereditary hemolytic anemias   |
| Hemolytic or Aplastic Anemia | 2820                  | Hereditary spherocytosis   |
| Hemolytic or Aplastic Anemia | 2821                  | Hereditary elliptocytosis  |
| Hemolytic or Aplastic Anemia | 2822                  | Anemias due to disorders of glutathione metabolism   |
| Hemolytic or Aplastic Anemia | 2823                  | Other hemolytic anemias due to enzyme deficiency   |
| Hemolytic or Aplastic Anemia | 2824                  | Thalassemias   |
| Hemolytic or Aplastic Anemia | 28240                 | Thalassemia, Unspecified   |
| Hemolytic or Aplastic Anemia | 28241                 | Sickle-cell thalassemia without crisis   |
| Hemolytic or Aplastic Anemia | 28242                 | Sickle-cell thalassemia with crisis  |
| Hemolytic or Aplastic Anemia | 28243                 | Alpha thalassemia  |

### List of ICD-9 codes used for exclusions

| Comorbidity                  | ICD-10 Diagnosis Code | Description   |
|------------------------------|-----------------------|---|
| Hemolytic or Aplastic Anemia | 28244                 | Beta thalassemia  |
| Hemolytic or Aplastic Anemia | 28245                 | Delta-beta thalassemia  |
| Hemolytic or Aplastic Anemia | 28246                 | Thalassemia minor   |
| Hemolytic or Aplastic Anemia | 28247                 | Hemoglobin E-beta thalassemia   |
| Hemolytic or Aplastic Anemia | 28249                 | Other thalassemia   |
| Hemolytic or Aplastic Anemia | 2827                  | Other hemoglobinopathies  |
| Hemolytic or Aplastic Anemia | 2828                  | Other specified hereditary hemolytic anemias                                      |
| Hemolytic or Aplastic Anemia | 2829                  | Hereditary hemolytic anemia, unspecified  |
| Hemolytic or Aplastic Anemia | 283                   | Acquired hemolytic anemias  |
| Hemolytic or Aplastic Anemia | 2830                  | Autoimmune hemolytic anemias  |
| Hemolytic or Aplastic Anemia | 2831                  | Non-autoimmune hemolytic anemias  |
| Hemolytic or Aplastic Anemia | 28310                 | Non-autoimmune hemolytic anemia, unspecified                                      |
| Hemolytic or Aplastic Anemia | 28311                 | Hemolytic-uremic syndrome   |
| Hemolytic or Aplastic Anemia | 28319                 | Other non-autoimmune hemolytic anemias  |
| Hemolytic or Aplastic Anemia | 2832                  | Hemoglobinuria due to hemolysis from external causes                              |
| Hemolytic or Aplastic Anemia | 2839                  | Acquired hemolytic anemia, unspecified  |
| Hemolytic or Aplastic Anemia | 284                   | Constitutional aplastic anemia  |
| Hemolytic or Aplastic Anemia | 2840                  | Constitutional aplastic anemia  |
| Hemolytic or Aplastic Anemia | 28401                 | Constitutional red blood cell aplasia   |
| Hemolytic or Aplastic Anemia | 28409                 | Other constitutional aplastic anemia  |
| Hemolytic or Aplastic Anemia | 2841                  | Pancytopenia  |
| Hemolytic or Aplastic Anemia | 28411                 | Pancytopenia  |
| Hemolytic or Aplastic Anemia | 28412                 | Other drug induced pancytopenia   |
| Hemolytic or Aplastic Anemia | 28419                 | Other pancytopenia  |
| Hemolytic or Aplastic Anemia | 2842                  | Myelophthisis   |
| Hemolytic or Aplastic Anemia | 2848                  | Other specified aplastic anemias  |
| Hemolytic or Aplastic Anemia | 28481                 | Red cell aplasia (acquired)(adult)(with thymoma)                                  |
| Hemolytic or Aplastic Anemia | 28489                 | Other specified aplastic anemias  |
| Hemolytic or Aplastic Anemia | 2849                  | Aplastic anemia, unspecified  |
| Leukemia                     | 2031                  | Plasma cell leukemia  |
| Leukemia                     | 20310                 | Plasma cell leukemia, without mention of having achieved remission                |
| Leukemia                     | 20311                 | Plasma cell leukemia, in remission  |
| Leukemia                     | 2038                  | Other immunoproliferative neoplasms   |
| Leukemia                     | 20380                 | Other immunoproliferative neoplasms, without mention of having achieved remission |
| Leukemia                     | 20381                 | Other immunoproliferative neoplasms, in remission                                 |
| Leukemia                     | 204                   | Lymphoid leukemia   |
| Leukemia                     | 2040                  | Lymphoid leukemia, acute  |
| Leukemia                     | 20400                 | Acute lymphoid leukemia, without mention of having achieved remission             |
| Leukemia                     | 20401                 | Acute lymphoid leukemia, in remission   |
| Leukemia                     | 20402                 | Acute lymphoid leukemia, in relapse   |
| Leukemia                     | 2041                  | Lymphoid leukemia, chronic  |
| Leukemia                     | 20410                 | Chronic lymphoid leukemia, without mention of having achieved remission           |
| Leukemia                     | 20411                 | Chronic lymphoid leukemia, in remission   |
| Leukemia                     | 20412                 | Chronic lymphoid leukemia, in relapse   |
| Leukemia                     | 2042                  | Lymphoid leukemia, subacute   |
| Leukemia                     | 20420                 | Subacute lymphoid leukemia, without mention of having achieved remission          |
| Leukemia                     | 20421                 | Subacute lymphoid leukemia, in remission  |
| Leukemia                     | 20422                 | Subacute lymphoid leukemia, in relapse  |
| Leukemia                     | 2048                  | Lymphoid leukemia, other  |
| Leukemia                     | 20480                 | Other lymphoid leukemia, without mention of having achieved remission             |
| Leukemia                     | 20481                 | Other lymphoid leukemia, in remission   |
| Leukemia                     | 20482                 | Other lymphoid leukemia, in relapse   |
| Leukemia                     | 2049                  | Lymphoid leukemia, unspecified  |
| Leukemia                     | 20490                 | Unspecified lymphoid leukemia, without mention of having achieved remission       |
| Leukemia                     | 20491                 | Unspecified lymphoid leukemia, in remission                                       |
| Leukemia                     | 20492                 | Unspecified lymphoid leukemia, in relapse   |
| Leukemia                     | 205                   | Myeloid leukemia  |
| Leukemia                     | 2050                  | Myeloid leukemia, acute   |
| Leukemia                     | 20500                 | Acute myeloid leukemia, without mention of having achieved remission              |
| Leukemia                     | 20501                 | Acute myeloid leukemia, in remission  |
| Leukemia                     | 20502                 | Acute myeloid leukemia, in relapse  |
| Leukemia                     | 2051                  | Myeloid leukemia, chronic   |
| Leukemia                     | 20510                 | Chronic myeloid leukemia, without mention of having achieved remission            |
| Leukemia                     | 20511                 | Chronic myeloid leukemia, in remission  |
| Leukemia                     | 20512                 | Chronic myeloid leukemia, in relapse  |
| Leukemia                     | 2052                  | Myeloid leukemia, subacute  |
| Leukemia                     | 20520                 | Subacute myeloid leukemia, without mention of having achieved remission           |
| Leukemia                     | 20521                 | Subacute myeloid leukemia, in remission   |
| Leukemia                     | 20522                 | Subacute myeloid leukemia, in relapse   |
| Leukemia                     | 2053                  | Myeloid leukemia, myeloid sarcoma   |
| Leukemia                     | 20530                 | Myeloid sarcoma, without mention of having achieved remission                     |
| Leukemia                     | 20531                 | Myeloid sarcoma, in remission   |
| Leukemia                     | 20532                 | Myeloid sarcoma, in relapse   |
| Leukemia                     | 2058                  | Myeloid leukemia, other   |
| Leukemia                     | 20580                 | Other myeloid leukemia, without mention of having achieved remission              |
| Leukemia                     | 20581                 | Other myeloid leukemia, in remission  |
| Leukemia                     | 20582                 | Other myeloid leukemia, in relapse  |
| Leukemia                     | 2059                  | Myeloid leukemia, unspecified   |

### List of ICD-9 codes used for exclusions

| Comorbidity | ICD-10 Diagnosis Code | Description  |
|-------------|-----------------------|--|
| Leukemia    | 20590                 | Unspecified myeloid leukemia, without mention of having achieved remission               |
| Leukemia    | 20591                 | Unspecified myeloid leukemia, in remission   |
| Leukemia    | 20592                 | Unspecified myeloid leukemia, in relapse   |
| Leukemia    | 206                   | Monocytic leukemia   |
| Leukemia    | 2060                  | Monocytic leukemia, acute  |
| Leukemia    | 20600                 | Acute monocytic leukemia, without mention of having achieved remission                   |
| Leukemia    | 20601                 | Acute monocytic leukemia, in remission   |
| Leukemia    | 20602                 | Acute monocytic leukemia, in relapse   |
| Leukemia    | 2061                  | Monocytic leukemia, chronic  |
| Leukemia    | 20610                 | Chronic monocytic leukemia, without mention of having achieved remission                 |
| Leukemia    | 20611                 | Chronic monocytic leukemia, in remission   |
| Leukemia    | 20612                 | Chronic monocytic leukemia, in relapse   |
| Leukemia    | 2062                  | Monocytic leukemia, subacute   |
| Leukemia    | 20620                 | Subacute monocytic leukemia, without mention of having achieved remission                |
| Leukemia    | 20621                 | Subacute monocytic leukemia, in remission  |
| Leukemia    | 20622                 | Subacute monocytic leukemia, in relapse  |
| Leukemia    | 2068                  | Monocytic leukemia, other  |
| Leukemia    | 20680                 | Other monocytic leukemia, without mention of having achieved remission                   |
| Leukemia    | 20681                 | Other monocytic leukemia, in remission   |
| Leukemia    | 20682                 | Other monocytic leukemia, in relapse   |
| Leukemia    | 2069                  | Monocytic leukemia, unspecified  |
| Leukemia    | 20690                 | Unspecified monocytic leukemia, without mention of having achieved remission             |
| Leukemia    | 20691                 | Unspecified monocytic leukemia, in remission   |
| Leukemia    | 20692                 | Unspecified monocytic leukemia, in relapse   |
| Leukemia    | 207                   | Other specified leukemia   |
| Leukemia    | 2070                  | Other specified leukemia, Acute erythremia and erythroleukemia                           |
| Leukemia    | 20700                 | Acute erythremia and erythroleukemia, without mention of having achieved remission       |
| Leukemia    | 20701                 | Acute erythremia and erythroleukemia, in remission                                       |
| Leukemia    | 20702                 | Acute erythremia and erythroleukemia, in relapse   |
| Leukemia    | 2071                  | Other specified leukemia, Chronic erythremia   |
| Leukemia    | 20710                 | Chronic erythremia, without mention of having achieved remission                         |
| Leukemia    | 20711                 | Chronic erythremia, in remission   |
| Leukemia    | 20712                 | Chronic erythremia, in relapse   |
| Leukemia    | 2072                  | Other specified leukemia, Megakaryocytic leukemia  |
| Leukemia    | 20720                 | Megakaryocytic leukemia, without mention of having achieved remission                    |
| Leukemia    | 20721                 | Megakaryocytic leukemia, in remission  |
| Leukemia    | 20722                 | Megakaryocytic leukemia, in relapse  |
| Leukemia    | 2078                  | Other specified leukemia, other  |
| Leukemia    | 20780                 | Other specified leukemia, without mention of having achieved remission                   |
| Leukemia    | 20781                 | Other specified leukemia, in remission   |
| Leukemia    | 20782                 | Other specified leukemia, in relapse   |
| Leukemia    | 208                   | Leukemia of unspecified cell type  |
| Leukemia    | 2080                  | Leukemia of unspecified cell type, acute   |
| Leukemia    | 20800                 | Acute leukemia of unspecified cell type, without mention of having achieved remission    |
| Leukemia    | 20801                 | Acute leukemia of unspecified cell type, in remission                                    |
| Leukemia    | 20802                 | Acute leukemia of unspecified cell type, in relapse                                      |
| Leukemia    | 2081                  | Leukemia of unspecified cell type, chronic   |
| Leukemia    | 20810                 | Chronic leukemia of unspecified cell type, without mention of having achieved remission  |
| Leukemia    | 20811                 | Chronic leukemia of unspecified cell type, in remission                                  |
| Leukemia    | 20812                 | Chronic leukemia of unspecified cell type, in relapse                                    |
| Leukemia    | 2082                  | Leukemia of unspecified cell type, subacute  |
| Leukemia    | 20820                 | Subacute leukemia of unspecified cell type, without mention of having achieved remission |
| Leukemia    | 20821                 | Subacute leukemia of unspecified cell type, in remission                                 |
| Leukemia    | 20822                 | Subacute leukemia of unspecified cell type, in relapse                                   |
| Leukemia    | 2088                  | Leukemia of unspecified cell type, other   |
| Leukemia    | 20880                 | Other leukemia of unspecified cell type, without mention of having achieved remission    |
| Leukemia    | 20881                 | Other leukemia of unspecified cell type, in remission                                    |
| Leukemia    | 20882                 | Other leukemia of unspecified cell type, in relapse                                      |
| Leukemia    | 2089                  | Leukemia of unspecified cell type, unspecified   |
| Leukemia    | 20890                 | Unspecified leukemia, without mention of having achieved remission                       |
| Leukemia    | 20891                 | Unspecified leukemia, in remission   |
| Leukemia    | 20892                 | Unspecified leukemia, in relapse   |
| Lymphoma    | 200                   | Lymphosarcoma and reticulosarcoma  |
| Lymphoma    | 2000                  | Lymphosarcoma and reticulosarcoma, reticulosarcoma                                       |
| Lymphoma    | 20000                 | Reticulosarcoma, unspecified site, extranodal and solid organ sites                      |
| Lymphoma    | 20001                 | Reticulosarcoma, lymph nodes of head, face, and neck                                     |
| Lymphoma    | 20002                 | Reticulosarcoma, intrathoracic lymph nodes   |
| Lymphoma    | 20003                 | Reticulosarcoma, intra-abdominal lymph nodes   |
| Lymphoma    | 20004                 | Reticulosarcoma, lymph nodes of axilla and upper limb                                    |
| Lymphoma    | 20005                 | Reticulosarcoma, lymph nodes of inguinal region and lower limb                           |
| Lymphoma    | 20006                 | Reticulosarcoma, intrapelvic lymph nodes   |
| Lymphoma    | 20007                 | Reticulosarcoma, spleen  |
| Lymphoma    | 20008                 | Reticulosarcoma, lymph nodes of multiple sites   |
| Lymphoma    | 2001                  | Lymphosarcoma and reticulosarcoma, Lymphosarcoma   |
| Lymphoma    | 20010                 | Lymphosarcoma, unspecified site, extranodal and solid organ sites                        |
| Lymphoma    | 20011                 | Lymphosarcoma, lymph nodes of head, face, and neck                                       |
| Lymphoma    | 20012                 | Lymphosarcoma, intrathoracic lymph nodes   |
| Lymphoma    | 20013                 | Lymphosarcoma, intra-abdominal lymph nodes   |

### List of ICD-9 codes used for exclusions

| Comorbidity | ICD-10 Diagnosis Code | Description  |
|-------------|-----------------------|--|
| Lymphoma    | 20014                 | Lymphosarcoma, lymph nodes of axilla and upper limb  |
| Lymphoma    | 20015                 | Lymphosarcoma, lymph nodes of inguinal region and lower limb   |
| Lymphoma    | 20016                 | Lymphosarcoma, intrapelvic lymph nodes   |
| Lymphoma    | 20017                 | Lymphosarcoma, spleen  |
| Lymphoma    | 20018                 | Lymphosarcoma, lymph nodes of multiple sites   |
| Lymphoma    | 2002                  | Lymphosarcoma and reticulosarcoma, Burkitt's tumor or lymphoma   |
| Lymphoma    | 20020                 | Burkitt's tumor or lymphoma, unspecified site, extranodal and solid organ sites                          |
| Lymphoma    | 20021                 | Burkitt's tumor or lymphoma, lymph nodes of head, face, and neck   |
| Lymphoma    | 20022                 | Burkitt's tumor or lymphoma, intrathoracic lymph nodes   |
| Lymphoma    | 20023                 | Burkitt's tumor or lymphoma, intra-abdominal lymph nodes   |
| Lymphoma    | 20024                 | Burkitt's tumor or lymphoma, lymph nodes of axilla and upper limb  |
| Lymphoma    | 20025                 | Burkitt's tumor or lymphoma, lymph nodes of inguinal region and lower limb                               |
| Lymphoma    | 20026                 | Burkitt's tumor or lymphoma, intrapelvic lymph nodes   |
| Lymphoma    | 20027                 | Burkitt's tumor or lymphoma, spleen  |
| Lymphoma    | 20028                 | Burkitt's tumor or lymphoma, lymph nodes of multiple sites   |
| Lymphoma    | 2003                  | Marginal zone lymphoma   |
| Lymphoma    | 20030                 | Marginal zone lymphoma, unspecified site, extranodal and solid organ sites                               |
| Lymphoma    | 20031                 | Marginal zone lymphoma, lymph nodes of head, face, and neck  |
| Lymphoma    | 20032                 | Marginal zone lymphoma, intrathoracic lymph nodes  |
| Lymphoma    | 20033                 | Marginal zone lymphoma, intraabdominal lymph nodes   |
| Lymphoma    | 20034                 | Marginal zone lymphoma, lymph nodes of axilla and upper limb   |
| Lymphoma    | 20035                 | Marginal zone lymphoma, lymph nodes of inguinal region and lower limb                                    |
| Lymphoma    | 20036                 | Marginal zone lymphoma, intrapelvic lymph nodes  |
| Lymphoma    | 20037                 | Marginal zone lymphoma, spleen   |
| Lymphoma    | 20038                 | Marginal zone lymphoma, lymph nodes of multiple sites  |
| Lymphoma    | 2004                  |  |
| Lymphoma    | 20040                 | Mantle cell lymphoma, unspecified site, extranodal and solid organ sites                                 |
| Lymphoma    | 20041                 | Mantle cell lymphoma, lymph nodes of head, face, and neck  |
| Lymphoma    | 20042                 | Mantle cell lymphoma, intrathoracic lymph nodes  |
| Lymphoma    | 20043                 | Mantle cell lymphoma, intra-abdominal lymph nodes  |
| Lymphoma    | 20044                 | Mantle cell lymphoma, lymph nodes of axilla and upper limb   |
| Lymphoma    | 20045                 | Mantle cell lymphoma, lymph nodes of inguinal region and lower limb                                      |
| Lymphoma    | 20046                 | Mantle cell lymphoma, intrapelvic lymph nodes  |
| Lymphoma    | 20047                 | Mantle cell lymphoma, spleen   |
| Lymphoma    | 20048                 | Mantle cell lymphoma, lymph nodes of multiple sites  |
| Lymphoma    | 2005                  | Primary central nervous system lymphoma  |
| Lymphoma    | 20050                 | Primary central nervous system lymphoma, unspecified site, extranodal and solid organ sites              |
| Lymphoma    | 20051                 | Primary central nervous system lymphoma, lymph nodes of head, face, and neck                             |
| Lymphoma    | 20052                 | Primary central nervous system lymphoma, intrathoracic lymph nodes                                       |
| Lymphoma    | 20053                 | Primary central nervous system lymphoma, intra-abdominal lymph nodes                                     |
| Lymphoma    | 20054                 | Primary central nervous system lymphoma, lymph nodes of axilla and upper limb                            |
| Lymphoma    | 20055                 | Primary central nervous system lymphoma, lymph nodes of inguinal region and lower limb                   |
| Lymphoma    | 20056                 | Primary central nervous system lymphoma, intrapelvic lymph nodes   |
| Lymphoma    | 20057                 | Primary central nervous system lymphoma, spleen  |
| Lymphoma    | 20058                 | Primary central nervous system lymphoma, lymph nodes of multiple sites                                   |
| Lymphoma    | 2006                  | Anaplastic large cell lymphoma   |
| Lymphoma    | 20060                 | Anaplastic large cell lymphoma, unspecified site, extranodal and solid organ sites                       |
| Lymphoma    | 20061                 | Anaplastic large cell lymphoma, lymph nodes of head, face, and neck                                      |
| Lymphoma    | 20062                 | Anaplastic large cell lymphoma, intrathoracic lymph nodes  |
| Lymphoma    | 20063                 | Anaplastic large cell lymphoma, intra-abdominal lymph nodes  |
| Lymphoma    | 20064                 | Anaplastic large cell lymphoma, lymph nodes of axilla and upper limb                                     |
| Lymphoma    | 20065                 | Anaplastic large cell lymphoma, lymph nodes of inguinal region and lower limb                            |
| Lymphoma    | 20066                 | Anaplastic large cell lymphoma, intrapelvic lymph nodes  |
| Lymphoma    | 20067                 | Anaplastic large cell lymphoma, spleen   |
| Lymphoma    | 20068                 | Anaplastic large cell lymphoma, lymph nodes of multiple sites  |
| Lymphoma    | 2007                  | Large cell lymphoma  |
| Lymphoma    | 20070                 | Large cell lymphoma, unspecified site, extranodal and solid organ sites                                  |
| Lymphoma    | 20071                 | Large cell lymphoma, lymph nodes of head, face, and neck   |
| Lymphoma    | 20072                 | Large cell lymphoma, intrathoracic lymph nodes   |
| Lymphoma    | 20073                 | Large cell lymphoma, intra-abdominal lymph nodes   |
| Lymphoma    | 20074                 | Large cell lymphoma, lymph nodes of axilla and upper limb  |
| Lymphoma    | 20075                 | Large cell lymphoma, lymph nodes of inguinal region and lower limb                                       |
| Lymphoma    | 20076                 | Large cell lymphoma, intrapelvic lymph nodes   |
| Lymphoma    | 20077                 | Large cell lymphoma, spleen  |
| Lymphoma    | 20078                 | Large cell lymphoma, lymph nodes of multiple sites   |
| Lymphoma    | 2008                  | Lymphosarcoma and reticulosarcoma, other named variants  |
| Lymphoma    | 20080                 | Other named variants of lymphosarcoma and reticulosarcoma, unspecified site, extranodal and solid organ  |
| Lymphoma    | 20081                 | Other named variants of lymphosarcoma and reticulosarcoma, lymph nodes of head, face, and neck           |
| Lymphoma    | 20082                 | Other named variants of lymphosarcoma and reticulosarcoma, intrathoracic lymph nodes                     |
| Lymphoma    | 20083                 | Other named variants of lymphosarcoma and reticulosarcoma, intra-abdominal lymph nodes                   |
| Lymphoma    | 20084                 | Other named variants of lymphosarcoma and reticulosarcoma, lymph nodes of axilla and upper limb          |
| Lymphoma    | 20085                 | Other named variants of lymphosarcoma and reticulosarcoma, lymph nodes of inguinal region and lower limb |
| Lymphoma    | 20086                 | Other named variants of lymphosarcoma and reticulosarcoma, intrapelvic lymph nodes                       |
| Lymphoma    | 20087                 | Other named variants of lymphosarcoma and reticulosarcoma, spleen  |
| Lymphoma    | 20088                 | Other named variants of lymphosarcoma and reticulosarcoma, lymph nodes of multiple sites                 |
| Lymphoma    | 201                   | Hodgkin's disease  |
| Lymphoma    | 2010                  | Hodgkin's disease, Hodgkin's paraganuloma  |
| Lymphoma    | 20100                 | Hodgkin's paraganuloma, unspecified site, extranodal and solid organ sites                               |

### List of ICD-9 codes used for exclusions

| Comorbidity | ICD-10 Diagnosis Code | Description   |
|-------------|-----------------------|---|
| Lymphoma    | 20101                 | Hodgkin's paraganuloma, lymph nodes of head, face, and neck   |
| Lymphoma    | 20102                 | Hodgkin's paraganuloma, intrathoracic lymph nodes   |
| Lymphoma    | 20103                 | Hodgkin's paraganuloma, intra-abdominal lymph nodes   |
| Lymphoma    | 20104                 | Hodgkin's paraganuloma, lymph nodes of axilla and upper limb  |
| Lymphoma    | 20105                 | Hodgkin's paraganuloma, lymph nodes of inguinal region and lower limb                                       |
| Lymphoma    | 20106                 | Hodgkin's paraganuloma, intrapelvic lymph nodes   |
| Lymphoma    | 20107                 | Hodgkin's paraganuloma, spleen  |
| Lymphoma    | 20108                 | Hodgkin's paraganuloma, lymph nodes of multiple sites   |
| Lymphoma    | 2011                  | Hodgkin's disease, Hodgkin's granuloma  |
| Lymphoma    | 20110                 | Hodgkin's granuloma, unspecified site, extranodal and solid organ sites                                     |
| Lymphoma    | 20111                 | Hodgkin's granuloma, lymph nodes of head, face, and neck  |
| Lymphoma    | 20112                 | Hodgkin's granuloma, intrathoracic lymph nodes  |
| Lymphoma    | 20113                 | Hodgkin's granuloma, intra-abdominal lymph nodes  |
| Lymphoma    | 20114                 | Hodgkin's granuloma, lymph nodes of axilla and upper limb   |
| Lymphoma    | 20115                 | Hodgkin's granuloma, lymph nodes of inguinal region and lower limb  |
| Lymphoma    | 20116                 | Hodgkin's granuloma, intrapelvic lymph nodes  |
| Lymphoma    | 20117                 | Hodgkin's granuloma, spleen   |
| Lymphoma    | 20118                 | Hodgkin's granuloma, lymph nodes of multiple sites  |
| Lymphoma    | 2012                  | Hodgkin's disease, Hodgkin's sarcoma  |
| Lymphoma    | 20120                 | Hodgkin's sarcoma, unspecified site, extranodal and solid organ sites                                       |
| Lymphoma    | 20121                 | Hodgkin's sarcoma, lymph nodes of head, face, and neck  |
| Lymphoma    | 20122                 | Hodgkin's sarcoma, intrathoracic lymph nodes  |
| Lymphoma    | 20123                 | Hodgkin's sarcoma, intra-abdominal lymph nodes  |
| Lymphoma    | 20124                 | Hodgkin's sarcoma, lymph nodes of axilla and upper limb   |
| Lymphoma    | 20125                 | Hodgkin's sarcoma, lymph nodes of inguinal region and lower limb  |
| Lymphoma    | 20126                 | Hodgkin's sarcoma, intrapelvic lymph nodes  |
| Lymphoma    | 20127                 | Hodgkin's sarcoma, spleen   |
| Lymphoma    | 20128                 | Hodgkin's sarcoma, lymph nodes of multiple sites  |
| Lymphoma    | 2014                  | Hodgkin's disease, Lymphocytic-histiocytic predominance   |
| Lymphoma    | 20140                 | Hodgkin's disease, lymphocytic-histiocytic predominance, unspecified site, extranodal and solid organ sites |
| Lymphoma    | 20141                 | Hodgkin's disease, lymphocytic-histiocytic predominance, lymph nodes of head, face, and neck                |
| Lymphoma    | 20142                 | Hodgkin's disease, lymphocytic-histiocytic predominance, intrathoracic lymph nodes                          |
| Lymphoma    | 20143                 | Hodgkin's disease, lymphocytic-histiocytic predominance, intra-abdominal lymph nodes                        |
| Lymphoma    | 20144                 | Hodgkin's disease, lymphocytic-histiocytic predominance, lymph nodes of axilla and upper limb               |
| Lymphoma    | 20145                 | Hodgkin's disease, lymphocytic-histiocytic predominance, lymph nodes of inguinal region and lower limb      |
| Lymphoma    | 20146                 | Hodgkin's disease, lymphocytic-histiocytic predominance, intrapelvic lymph nodes                            |
| Lymphoma    | 20147                 | Hodgkin's disease, lymphocytic-histiocytic predominance, spleen   |
| Lymphoma    | 20148                 | Hodgkin's disease, lymphocytic-histiocytic predominance, lymph nodes of multiple sites                      |
| Lymphoma    | 2015                  | Hodgkin's disease, Nodular sclerosis  |
| Lymphoma    | 20150                 | Hodgkin's disease, nodular sclerosis, unspecified site, extranodal and solid organ sites                    |
| Lymphoma    | 20151                 | Hodgkin's disease, nodular sclerosis, lymph nodes of head, face, and neck                                   |
| Lymphoma    | 20152                 | Hodgkin's disease, nodular sclerosis, intrathoracic lymph nodes   |
| Lymphoma    | 20153                 | Hodgkin's disease, nodular sclerosis, intra-abdominal lymph nodes   |
| Lymphoma    | 20154                 | Hodgkin's disease, nodular sclerosis, lymph nodes of axilla and upper limb                                  |
| Lymphoma    | 20155                 | Hodgkin's disease, nodular sclerosis, lymph nodes of inguinal region and lower limb                         |
| Lymphoma    | 20156                 | Hodgkin's disease, nodular sclerosis, intrapelvic lymph nodes   |
| Lymphoma    | 20157                 | Hodgkin's disease, nodular sclerosis, spleen  |
| Lymphoma    | 20158                 | Hodgkin's disease, nodular sclerosis, lymph nodes of multiple sites   |
| Lymphoma    | 2016                  | Hodgkin's disease, Mixed cellularity  |
| Lymphoma    | 20160                 | Hodgkin's disease, mixed cellularity, unspecified site, extranodal and solid organ sites                    |
| Lymphoma    | 20161                 | Hodgkin's disease, mixed cellularity, lymph nodes of head, face, and neck                                   |
| Lymphoma    | 20162                 | Hodgkin's disease, mixed cellularity, intrathoracic lymph nodes   |
| Lymphoma    | 20163                 | Hodgkin's disease, mixed cellularity, intra-abdominal lymph nodes   |
| Lymphoma    | 20164                 | Hodgkin's disease, mixed cellularity, lymph nodes of axilla and upper limb                                  |
| Lymphoma    | 20165                 | Hodgkin's disease, mixed cellularity, lymph nodes of inguinal region and lower limb                         |
| Lymphoma    | 20166                 | Hodgkin's disease, mixed cellularity, intrapelvic lymph nodes   |
| Lymphoma    | 20167                 | Hodgkin's disease, mixed cellularity, spleen  |
| Lymphoma    | 20168                 | Hodgkin's disease, mixed cellularity, lymph nodes of multiple sites   |
| Lymphoma    | 2017                  | Hodgkin's disease, Lymphocytic depletion  |
| Lymphoma    | 20170                 | Hodgkin's disease, lymphocytic depletion, unspecified site, extranodal and solid organ sites                |
| Lymphoma    | 20171                 | Hodgkin's disease, lymphocytic depletion, lymph nodes of head, face, and neck                               |
| Lymphoma    | 20172                 | Hodgkin's disease, lymphocytic depletion, intrathoracic lymph nodes   |
| Lymphoma    | 20173                 | Hodgkin's disease, lymphocytic depletion, intra-abdominal lymph nodes                                       |
| Lymphoma    | 20174                 | Hodgkin's disease, lymphocytic depletion, lymph nodes of axilla and upper limb                              |
| Lymphoma    | 20175                 | Hodgkin's disease, lymphocytic depletion, lymph nodes of inguinal region and lower limb                     |
| Lymphoma    | 20176                 | Hodgkin's disease, lymphocytic depletion, intrapelvic lymph nodes   |
| Lymphoma    | 20177                 | Hodgkin's disease, lymphocytic depletion, spleen  |
| Lymphoma    | 20178                 | Hodgkin's disease, lymphocytic depletion, lymph nodes of multiple sites                                     |
| Lymphoma    | 2019                  | Hodgkin's disease, unspecified  |
| Lymphoma    | 20190                 | Hodgkin's disease, unspecified type, unspecified site, extranodal and solid organ sites                     |
| Lymphoma    | 20191                 | Hodgkin's disease, unspecified type, lymph nodes of head, face, and neck                                    |
| Lymphoma    | 20192                 | Hodgkin's disease, unspecified type, intrathoracic lymph nodes  |
| Lymphoma    | 20193                 | Hodgkin's disease, unspecified type, intra-abdominal lymph nodes  |
| Lymphoma    | 20194                 | Hodgkin's disease, unspecified type, lymph nodes of axilla and upper limb                                   |
| Lymphoma    | 20195                 | Hodgkin's disease, unspecified type, lymph nodes of inguinal region and lower limb                          |
| Lymphoma    | 20196                 | Hodgkin's disease, unspecified type, intrapelvic lymph nodes  |
| Lymphoma    | 20197                 | Hodgkin's disease, unspecified type, spleen   |
| Lymphoma    | 20198                 | Hodgkin's disease, unspecified type, lymph nodes of multiple sites  |

### List of ICD-9 codes used for exclusions

| Comorbidity | ICD-10 Diagnosis Code | Description  |
|-------------|-----------------------|--|
| Lymphoma    | 202                   | Other malignant neoplasms of lymphoid and histiocytic tissue                                 |
| Lymphoma    | 2020                  | Nodular lymphoma   |
| Lymphoma    | 20200                 | Nodular lymphoma, unspecified site, extranodal and solid organ sites                         |
| Lymphoma    | 20201                 | Nodular lymphoma, lymph nodes of head, face, and neck  |
| Lymphoma    | 20202                 | Nodular lymphoma, intrathoracic lymph nodes  |
| Lymphoma    | 20203                 | Nodular lymphoma, intra-abdominal lymph nodes  |
| Lymphoma    | 20204                 | Nodular lymphoma, lymph nodes of axilla and upper limb                                       |
| Lymphoma    | 20205                 | Nodular lymphoma, lymph nodes of inguinal region and lower limb                              |
| Lymphoma    | 20206                 | Nodular lymphoma, intrapelvic lymph nodes  |
| Lymphoma    | 20207                 | Nodular lymphoma, spleen   |
| Lymphoma    | 20208                 | Nodular lymphoma, lymph nodes of multiple sites  |
| Lymphoma    | 2021                  | Other malignant neoplasms of lymphoid and histiocytic tissue, Mycosis fungoides              |
| Lymphoma    | 20210                 | Mycosis fungoides, unspecified site, extranodal and solid organ sites                        |
| Lymphoma    | 20211                 | Mycosis fungoides, lymph nodes of head, face, and neck                                       |
| Lymphoma    | 20212                 | Mycosis fungoides, intrathoracic lymph nodes   |
| Lymphoma    | 20213                 | Mycosis fungoides, intra-abdominal lymph nodes   |
| Lymphoma    | 20214                 | Mycosis fungoides, lymph nodes of axilla and upper limb                                      |
| Lymphoma    | 20215                 | Mycosis fungoides, lymph nodes of inguinal region and lower limb                             |
| Lymphoma    | 20216                 | Mycosis fungoides, intrapelvic lymph nodes   |
| Lymphoma    | 20217                 | Mycosis fungoides, spleen  |
| Lymphoma    | 20218                 | Mycosis fungoides, lymph nodes of multiple sites   |
| Lymphoma    | 2022                  | Other malignant neoplasms of lymphoid and histiocytic tissue, Sezary's disease               |
| Lymphoma    | 20220                 | Sezary's disease, unspecified site, extranodal and solid organ sites                         |
| Lymphoma    | 20221                 | Sezary's disease, lymph nodes of head, face, and neck  |
| Lymphoma    | 20222                 | Sezary's disease, intrathoracic lymph nodes  |
| Lymphoma    | 20223                 | Sezary's disease, intra-abdominal lymph nodes  |
| Lymphoma    | 20224                 | Sezary's disease, lymph nodes of axilla and upper limb                                       |
| Lymphoma    | 20225                 | Sezary's disease, lymph nodes of inguinal region and lower limb                              |
| Lymphoma    | 20226                 | Sezary's disease, intrapelvic lymph nodes  |
| Lymphoma    | 20227                 | Sezary's disease, spleen   |
| Lymphoma    | 20228                 | Sezary's disease, lymph nodes of multiple sites  |
| Lymphoma    | 2023                  | Other malignant neoplasms of lymphoid and histiocytic tissue, malignant histiocytosis        |
| Lymphoma    | 20230                 | Malignant histiocytosis, unspecified site, extranodal and solid organ sites                  |
| Lymphoma    | 20231                 | Malignant histiocytosis, lymph nodes of head, face, and neck                                 |
| Lymphoma    | 20232                 | Malignant histiocytosis, intrathoracic lymph nodes   |
| Lymphoma    | 20233                 | Malignant histiocytosis, intra-abdominal lymph nodes   |
| Lymphoma    | 20234                 | Malignant histiocytosis, lymph nodes of axilla and upper limb                                |
| Lymphoma    | 20235                 | Malignant histiocytosis, lymph nodes of inguinal region and lower limb                       |
| Lymphoma    | 20236                 | Malignant histiocytosis, intrapelvic lymph nodes   |
| Lymphoma    | 20237                 | Malignant histiocytosis, spleen  |
| Lymphoma    | 20238                 | Malignant histiocytosis, lymph nodes of multiple sites                                       |
| Lymphoma    | 2024                  | Other malignant neoplasms of lymphoid and histiocytic tissue, leukemic reticuloendotheliosis |
| Lymphoma    | 20240                 | Leukemic reticuloendotheliosis, unspecified site, extranodal and solid organ sites           |
| Lymphoma    | 20241                 | Leukemic reticuloendotheliosis, lymph nodes of head, face, and neck                          |
| Lymphoma    | 20242                 | Leukemic reticuloendotheliosis, intrathoracic lymph nodes                                    |
| Lymphoma    | 20243                 | Leukemic reticuloendotheliosis, intra-abdominal lymph nodes                                  |
| Lymphoma    | 20244                 | Leukemic reticuloendotheliosis, lymph nodes of axilla and upper arm                          |
| Lymphoma    | 20245                 | Leukemic reticuloendotheliosis, lymph nodes of inguinal region and lower limb                |
| Lymphoma    | 20246                 | Leukemic reticuloendotheliosis, intrapelvic lymph nodes                                      |
| Lymphoma    | 20247                 | Leukemic reticuloendotheliosis, spleen   |
| Lymphoma    | 20248                 | Leukemic reticuloendotheliosis, lymph nodes of multiples sites                               |
| Lymphoma    | 2025                  | Other malignant neoplasms of lymphoid and histiocytic tissue, Letterer-Siwe disease          |
| Lymphoma    | 20250                 | Letterer-siwe disease, unspecified site, extranodal and solid organ sites                    |
| Lymphoma    | 20251                 | Letterer-siwe disease, lymph nodes of head, face, and neck                                   |
| Lymphoma    | 20252                 | Letterer-siwe disease, intrathoracic lymph nodes   |
| Lymphoma    | 20253                 | Letterer-siwe disease, intra-abdominal lymph nodes   |
| Lymphoma    | 20254                 | Letterer-siwe disease, lymph nodes of axilla and upper limb                                  |
| Lymphoma    | 20255                 | Letterer-siwe disease, lymph nodes of inguinal region and lower limb                         |
| Lymphoma    | 20256                 | Letterer-siwe disease, intrapelvic lymph nodes   |
| Lymphoma    | 20257                 | Letterer-siwe disease, spleen  |
| Lymphoma    | 20258                 | Letterer-siwe disease, lymph nodes of multiple sites   |
| Lymphoma    | 2026                  | Other malignant neoplasms of lymphoid and histiocytic tissue, malignant mast cell tumors     |
| Lymphoma    | 20260                 | Malignant mast cell tumors, unspecified site, extranodal and solid organ sites               |
| Lymphoma    | 20261                 | Malignant mast cell tumors, lymph nodes of head, face, and neck                              |
| Lymphoma    | 20262                 | Malignant mast cell tumors, intrathoracic lymph nodes  |
| Lymphoma    | 20263                 | Malignant mast cell tumors, intra-abdominal lymph nodes                                      |
| Lymphoma    | 20264                 | Malignant mast cell tumors, lymph nodes of axilla and upper limb                             |
| Lymphoma    | 20265                 | Malignant mast cell tumors, lymph nodes of inguinal region and lower limb                    |
| Lymphoma    | 20266                 | Malignant mast cell tumors, intrapelvic lymph nodes  |
| Lymphoma    | 20267                 | Malignant mast cell tumors, spleen   |
| Lymphoma    | 20268                 | Malignant mast cell tumors, lymph nodes of multiple sites                                    |
| Lymphoma    | 2027                  | Peripheral T cell lymphoma   |
| Lymphoma    | 20270                 | Peripheral T cell lymphoma, unspecified site, extranodal and solid organ sites               |
| Lymphoma    | 20271                 | Peripheral T cell lymphoma, lymph nodes of head, face, and neck                              |
| Lymphoma    | 20272                 | Peripheral T cell lymphoma, intrathoracic lymph nodes  |
| Lymphoma    | 20273                 | Peripheral T cell lymphoma, intra-abdominal lymph nodes                                      |
| Lymphoma    | 20274                 | Peripheral T cell lymphoma, lymph nodes of axilla and upper limb                             |
| Lymphoma    | 20275                 | Peripheral T cell lymphoma, lymph nodes of inguinal region and lower limb                    |

### List of ICD-9 codes used for exclusions

| Comorbidity   | ICD-10 Diagnosis Code | Description  |
|---------------|-----------------------|--|
| Lymphoma      | 20276                 | Peripheral T cell lymphoma, intrapelvic lymph nodes  |
| Lymphoma      | 20277                 | Peripheral T cell lymphoma, spleen   |
| Lymphoma      | 20278                 | Peripheral T cell lymphoma, lymph nodes of multiple sites  |
| Lymphoma      | 2028                  | Other lymphomas  |
| Lymphoma      | 20280                 | Other malignant lymphomas, unspecified site, extranodal and solid organ sites                            |
| Lymphoma      | 20281                 | Other malignant lymphomas, lymph nodes of head, face, and neck   |
| Lymphoma      | 20282                 | Other malignant lymphomas, intrathoracic lymph nodes   |
| Lymphoma      | 20283                 | Other malignant lymphomas, intra-abdominal lymph nodes   |
| Lymphoma      | 20284                 | Other malignant lymphomas, lymph nodes of axilla and upper limb  |
| Lymphoma      | 20285                 | Other malignant lymphomas, lymph nodes of inguinal region and lower limb                                 |
| Lymphoma      | 20286                 | Other malignant lymphomas, intrapelvic lymph nodes   |
| Lymphoma      | 20287                 | Other malignant lymphomas, spleen  |
| Lymphoma      | 20288                 | Other malignant lymphomas, lymph nodes of multiple sites   |
| Lymphoma      | 2029                  | Other malignant neoplasms of lymphoid and histiocytic tissue, other and unspecified                      |
| Lymphoma      | 20290                 | Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, unspecified site, extranod |
| Lymphoma      | 20291                 | Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, lymph nodes of head, face, |
| Lymphoma      | 20292                 | Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, intrathoracic lymph nodes  |
| Lymphoma      | 20293                 | Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, intra-abdominal lymph node |
| Lymphoma      | 20294                 | Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, lymph nodes of axilla and  |
| Lymphoma      | 20295                 | Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, lymph nodes of inguinal re |
| Lymphoma      | 20296                 | Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, intrapelvic lymph nodes    |
| Lymphoma      | 20297                 | Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, spleen                     |
| Lymphoma      | 20298                 | Other and unspecified malignant neoplasms of lymphoid and histiocytic tissue, lymph nodes of multiple si |
| Lymphoma      | 203                   | Lymphatic, Head and Neck, Brain and Other Major Cancers  |
| Lymphoma      | 23877                 | Post-transplant lymphoproliferative disorder (PTLD)  |
| Metastatic    | 196                   | Secondary and unspecified malignant neoplasm of lymph nodes  |
| Metastatic    | 1960                  | Secondary and unspecified malignant neoplasm of lymph nodes of head, face, and neck                      |
| Metastatic    | 1961                  | Secondary and unspecified malignant neoplasm of intrathoracic lymph nodes                                |
| Metastatic    | 1962                  | Secondary and unspecified malignant neoplasm of intra-abdominal lymph nodes                              |
| Metastatic    | 1963                  | Secondary and unspecified malignant neoplasm of lymph nodes of axilla and upper limb                     |
| Metastatic    | 1965                  | Secondary and unspecified malignant neoplasm of lymph nodes of inguinal region and lower limb            |
| Metastatic    | 1966                  | Secondary and unspecified malignant neoplasm of intrapelvic lymph nodes                                  |
| Metastatic    | 1968                  | Secondary and unspecified malignant neoplasm of lymph nodes of multiple sites                            |
| Metastatic    | 1969                  | Secondary and unspecified malignant neoplasm of lymph nodes, site unspecified                            |
| Metastatic    | 197                   | Secondary malignant neoplasm of respiratory and digestive systems  |
| Metastatic    | 1970                  | Secondary malignant neoplasm of lung   |
| Metastatic    | 1971                  | Secondary malignant neoplasm of mediastinum  |
| Metastatic    | 1972                  | Secondary malignant neoplasm of pleura   |
| Metastatic    | 1973                  | Secondary malignant neoplasm of other respiratory organs   |
| Metastatic    | 1974                  | Secondary malignant neoplasm of small intestine including duodenum                                       |
| Metastatic    | 1975                  | Secondary malignant neoplasm of large intestine and rectum   |
| Metastatic    | 1976                  | Secondary malignant neoplasm of retroperitoneum and peritoneum   |
| Metastatic    | 1977                  | Malignant neoplasm of liver, secondary   |
| Metastatic    | 1978                  | Secondary malignant neoplasm of other digestive organs and spleen  |
| Metastatic    | 198                   | Secondary malignant neoplasm of other specified sites  |
| Metastatic    | 1980                  | Secondary malignant neoplasm of kidney   |
| Metastatic    | 1981                  | Secondary malignant neoplasm of other urinary organs   |
| Metastatic    | 1982                  | Secondary malignant neoplasm of skin   |
| Metastatic    | 1983                  | Secondary malignant neoplasm of brain and spinal cord  |
| Metastatic    | 1984                  | Secondary malignant neoplasm of other parts of nervous system  |
| Metastatic    | 1985                  | Secondary malignant neoplasm of bone and bone marrow   |
| Metastatic    | 1986                  | Secondary malignant neoplasm of ovary  |
| Metastatic    | 1987                  | Secondary malignant neoplasm of adrenal gland  |
| Metastatic    | 1988                  | Secondary malignant neoplasm of other specified sites, other specified sites                             |
| Metastatic    | 19881                 | Secondary malignant neoplasm of breast   |
| Metastatic    | 19882                 | Secondary malignant neoplasm of genital organs   |
| Metastatic    | 19889                 | Secondary malignant neoplasm of other specified sites  |
| Metastatic    | 199                   | Malignant neoplasm without specification of site   |
| Metastatic    | 1990                  | Disseminated malignant neoplasm without specification of site  |
| Myeloma, Etc. | 203                   | Lymphatic, Head and Neck, Brain and Other Major Cancers  |
| Myeloma, Etc. | 2030                  | Multiple myeloma   |
| Myeloma, Etc. | 20300                 | Multiple myeloma, without mention of having achieved remission   |
| Myeloma, Etc. | 20301                 | Multiple myeloma, in remission   |
| Myeloma, Etc. | 20302                 | Multiple myeloma, in relapse   |
| Myeloma, Etc. | 20310                 | Plasma cell leukemia, without mention of having achieved remission                                       |
| Myeloma, Etc. | 20312                 | Plasma cell leukemia, in relapse   |
| Myeloma, Etc. | 20380                 | Other immunoproliferative neoplasms, without mention of having achieved remission                        |
| Myeloma, Etc. | 20382                 | Other immunoproliferative neoplasms, in relapse  |
| Myeloma, Etc. | 2387                  |  |
| Myeloma, Etc. | 23871                 | Essential thrombocythemia  |
| Myeloma, Etc. | 23872                 | Low grade myelodysplastic syndrome lesions   |
| Myeloma, Etc. | 23873                 | High grade myelodysplastic syndrome lesions  |
| Myeloma, Etc. | 23874                 | Myelodysplastic syndrome with 5q deletion  |
| Myeloma, Etc. | 23875                 | Myelodysplastic syndrome, unspecified  |
| Myeloma, Etc. | 23876                 | Myelofibrosis with myeloid metaplasia  |
| Myeloma, Etc. | 23879                 | Other lymphatic and hematopoietic tissues  |
| Myeloma, Etc. | 28989                 | Other specified diseases of blood and blood-forming organs   |
| Other Cancer  | 170                   | Malignant neoplasm of bone and articular cartilage   |



### List of ICD-9 codes used for exclusions

| Comorbidity        | ICD-10 Diagnosis Code | Description  |
|--------------------|-----------------------|--|
| Other Cancer       | 1700                  | Malignant neoplasm of bones of skull and face, except mandible                           |
| Other Cancer       | 1701                  | Malignant neoplasm of mandible   |
| Other Cancer       | 1702                  | Malignant neoplasm of vertebral column, excluding sacrum and coccyx                      |
| Other Cancer       | 1703                  | Malignant neoplasm of ribs, sternum, and clavicle  |
| Other Cancer       | 1704                  | Malignant neoplasm of scapula and long bones of upper limb                               |
| Other Cancer       | 1705                  | Malignant neoplasm of short bones of upper limb  |
| Other Cancer       | 1706                  | Malignant neoplasm of pelvic bones, sacrum, and coccyx                                   |
| Other Cancer       | 1707                  | Malignant neoplasm of long bones of lower limb   |
| Other Cancer       | 1708                  | Malignant neoplasm of short bones of lower limb  |
| Other Cancer       | 1709                  | Malignant neoplasm of bone and articular cartilage, site unspecified                     |
| Other Cancer       | 171                   | Malignant neoplasm of connective and other soft tissue                                   |
| Other Cancer       | 1710                  | Malignant neoplasm of connective and other soft tissue of head, face, and neck           |
| Other Cancer       | 1712                  | Malignant neoplasm of connective and other soft tissue of upper limb, including shoulder |
| Other Cancer       | 1713                  | Malignant neoplasm of connective and other soft tissue of lower limb, including hip      |
| Other Cancer       | 1714                  | Malignant neoplasm of connective and other soft tissue of thorax                         |
| Other Cancer       | 1715                  | Malignant neoplasm of connective and other soft tissue of abdomen                        |
| Other Cancer       | 1716                  | Malignant neoplasm of connective and other soft tissue of pelvis                         |
| Other Cancer       | 1717                  | Malignant neoplasm of connective and other soft tissue of trunk, unspecified             |
| Other Cancer       | 1718                  | Malignant neoplasm of other specified sites of connective and other soft tissue          |
| Other Cancer       | 1719                  | Malignant neoplasm of connective and other soft tissue, site unspecified                 |
| Other Cancer       | 176                   | Kaposi's sarcoma   |
| Other Cancer       | 1760                  | Kaposi's sarcoma, skin   |
| Other Cancer       | 1761                  | Kaposi's sarcoma, soft tissue  |
| Other Cancer       | 1762                  | Kaposi's sarcoma, palate   |
| Other Cancer       | 1763                  | Kaposi's sarcoma, gastrointestinal sites   |
| Other Cancer       | 1764                  | Kaposi's sarcoma, lung   |
| Other Cancer       | 1765                  | Kaposi's sarcoma, lymph nodes  |
| Other Cancer       | 1768                  | Kaposi's sarcoma, other specified sites  |
| Other Cancer       | 1769                  | Kaposi's sarcoma, unspecified site   |
| Other Cancer       | 181                   | Malignant neoplasm of placenta   |
| Other Cancer       | 183                   | Malignant neoplasm of ovary and other uterine adnexa                                     |
| Other Cancer       | 1830                  | Malignant neoplasm of ovary  |
| Other Cancer       | 1832                  | Malignant neoplasm of fallopian tube   |
| Other Cancer       | 1833                  | Malignant neoplasm of broad ligament of uterus   |
| Other Cancer       | 1834                  | Malignant neoplasm of parametrium  |
| Other Cancer       | 1835                  | Malignant neoplasm of round ligament of uterus   |
| Other Cancer       | 1838                  | Malignant neoplasm of other specified sites of uterine adnexa                            |
| Other Cancer       | 1839                  | Malignant neoplasm of uterine adnexa, unspecified site                                   |
| Other Cancer       | 191                   | Malignant neoplasm of brain  |
| Other Cancer       | 1910                  | Malignant neoplasm of cerebrum, except lobes and ventricles                              |
| Other Cancer       | 1911                  | Malignant neoplasm of frontal lobe   |
| Other Cancer       | 1912                  | Malignant neoplasm of temporal lobe  |
| Other Cancer       | 1913                  | Malignant neoplasm of parietal lobe  |
| Other Cancer       | 1914                  | Malignant neoplasm of occipital lobe   |
| Other Cancer       | 1915                  | Malignant neoplasm of ventricles   |
| Other Cancer       | 1916                  | Malignant neoplasm of cerebellum nos   |
| Other Cancer       | 1917                  | Malignant neoplasm of brain stem   |
| Other Cancer       | 1918                  | Malignant neoplasm of other parts of brain   |
| Other Cancer       | 1919                  | Malignant neoplasm of brain, unspecified   |
| Other Cancer       | 192                   | Malignant neoplasm of other and unspecified parts of nervous system                      |
| Other Cancer       | 1920                  | Malignant neoplasm of cranial nerves   |
| Other Cancer       | 1921                  | Malignant neoplasm of cerebral meninges  |
| Other Cancer       | 1922                  | Malignant neoplasm of spinal cord  |
| Other Cancer       | 1923                  | Malignant neoplasm of spinal meninges  |
| Other Cancer       | 1928                  | Malignant neoplasm of other specified sites of nervous system                            |
| Other Cancer       | 1929                  | Malignant neoplasm of nervous system, part unspecified                                   |
| Other Cancer       | 1940                  | Malignant neoplasm of adrenal gland  |
| Other Cancer       | 1943                  | Malignant neoplasm of pituitary gland and craniopharyngeal duct                          |
| Other Cancer       | 1944                  | Malignant neoplasm of pineal gland   |
| Sickle Cell        | 2826                  | Sickle-cell disease  |
| Sickle Cell        | 28260                 | Sickle-cell disease, unspecified   |
| Sickle Cell        | 28261                 | Hb-SS disease without crisis   |
| Sickle Cell        | 28262                 | Hb-SS disease with crisis  |
| Sickle Cell        | 28263                 | Sickle-cell/Hb-C disease without crisis  |
| Sickle Cell        | 28264                 | Sickle-cell/Hb-C disease with crisis   |
| Sickle Cell        | 28268                 | Other sickle-cell disease without crisis   |
| Sickle Cell        | 28269                 | Other sickle-cell disease with crisis  |
| Solid Organ Cancer | 150                   | Malignant neoplasm of the esophagus  |
| Solid Organ Cancer | 1500                  | Malignant neoplasm of cervical esophagus   |
| Solid Organ Cancer | 1501                  | Malignant neoplasm of thoracic esophagus   |
| Solid Organ Cancer | 1502                  | Malignant neoplasm of abdominal esophagus  |
| Solid Organ Cancer | 1503                  | Malignant neoplasm of upper third of esophagus   |
| Solid Organ Cancer | 1504                  | Malignant neoplasm of middle third of esophagus  |
| Solid Organ Cancer | 1505                  | Malignant neoplasm of lower third of esophagus   |
| Solid Organ Cancer | 1508                  | Malignant neoplasm of other specified part of esophagus                                  |
| Solid Organ Cancer | 1509                  | Malignant neoplasm of esophagus, unspecified site  |
| Solid Organ Cancer | 151                   | Malignant neoplasm of the stomach  |
| Solid Organ Cancer | 1510                  | Malignant neoplasm of cardia   |

### List of ICD-9 codes used for exclusions

| Comorbidity        | ICD-10 Diagnosis Code | Description  |
|--------------------|-----------------------|--|
| Solid Organ Cancer | 1511                  | Malignant neoplasm of pylorus  |
| Solid Organ Cancer | 1512                  | Malignant neoplasm of pyloric antrum   |
| Solid Organ Cancer | 1513                  | Malignant neoplasm of fundus of stomach  |
| Solid Organ Cancer | 1514                  | Malignant neoplasm of body of stomach  |
| Solid Organ Cancer | 1515                  | Malignant neoplasm of lesser curvature of stomach, unspecified                               |
| Solid Organ Cancer | 1516                  | Malignant neoplasm of greater curvature of stomach, unspecified                              |
| Solid Organ Cancer | 1518                  | Malignant neoplasm of other specified sites of stomach                                       |
| Solid Organ Cancer | 1519                  | Malignant neoplasm of stomach, unspecified site  |
| Solid Organ Cancer | 152                   | Malignant neoplasm of the small intestine including duodenum                                 |
| Solid Organ Cancer | 1520                  | Malignant neoplasm of duodenum   |
| Solid Organ Cancer | 1521                  | Malignant neoplasm of jejunum  |
| Solid Organ Cancer | 1522                  | Malignant neoplasm of ileum  |
| Solid Organ Cancer | 1523                  | Malignant neoplasm of Meckel's diverticulum  |
| Solid Organ Cancer | 1528                  | Malignant neoplasm of other specified sites of small intestine                               |
| Solid Organ Cancer | 1529                  | Malignant neoplasm of small intestine, unspecified site                                      |
| Solid Organ Cancer | 153                   | Malignant neoplasm of colon  |
| Solid Organ Cancer | 1530                  | Malignant neoplasm of hepatic flexure  |
| Solid Organ Cancer | 1531                  | Malignant neoplasm of transverse colon   |
| Solid Organ Cancer | 1532                  | Malignant neoplasm of descending colon   |
| Solid Organ Cancer | 1533                  | Malignant neoplasm of sigmoid colon  |
| Solid Organ Cancer | 1534                  | Malignant neoplasm of cecum  |
| Solid Organ Cancer | 1535                  | Malignant neoplasm of appendix vermiformis   |
| Solid Organ Cancer | 1536                  | Malignant neoplasm of ascending colon  |
| Solid Organ Cancer | 1537                  | Malignant neoplasm of splenic flexure  |
| Solid Organ Cancer | 1538                  | Malignant neoplasm of other specified sites of large intestine                               |
| Solid Organ Cancer | 1539                  | Malignant neoplasm of colon, unspecified site  |
| Solid Organ Cancer | 154                   | Malignant neoplasm of rectum, rectosigmoid junction and anus                                 |
| Solid Organ Cancer | 1540                  | Malignant neoplasm of rectosigmoid junction  |
| Solid Organ Cancer | 1541                  | Malignant neoplasm of rectum   |
| Solid Organ Cancer | 1542                  | Malignant neoplasm of anal canal   |
| Solid Organ Cancer | 1543                  | Malignant neoplasm of anus, unspecified site   |
| Solid Organ Cancer | 1548                  | Malignant neoplasm of other sites of rectum, rectosigmoid junction, and anus                 |
| Solid Organ Cancer | 155                   | Malignant neoplasm of the liver and intrahepatic bile ducts                                  |
| Solid Organ Cancer | 1550                  | Malignant neoplasm of liver, primary   |
| Solid Organ Cancer | 1551                  | Malignant neoplasm of intrahepatic bile ducts  |
| Solid Organ Cancer | 1552                  | Malignant neoplasm of liver, not specified as primary or secondary                           |
| Solid Organ Cancer | 156                   | Malignant neoplasm of gall bladder and extrahepatic bile ducts                               |
| Solid Organ Cancer | 1560                  | Malignant neoplasm of gallbladder  |
| Solid Organ Cancer | 1561                  | Malignant neoplasm of extrahepatic bile ducts  |
| Solid Organ Cancer | 1562                  | Malignant neoplasm of ampulla of vater   |
| Solid Organ Cancer | 1568                  | Malignant neoplasm of other specified sites of gallbladder and extrahepatic bile ducts       |
| Solid Organ Cancer | 1569                  | Malignant neoplasm of biliary tract, part unspecified site                                   |
| Solid Organ Cancer | 157                   | Malignant neoplasm of pancreas   |
| Solid Organ Cancer | 1570                  | Malignant neoplasm of head of pancreas   |
| Solid Organ Cancer | 1571                  | Malignant neoplasm of body of pancreas   |
| Solid Organ Cancer | 1572                  | Malignant neoplasm of tail of pancreas   |
| Solid Organ Cancer | 1573                  | Malignant neoplasm of pancreatic duct  |
| Solid Organ Cancer | 1574                  | Malignant neoplasm of islets of langerhans   |
| Solid Organ Cancer | 1578                  | Malignant neoplasm of other specified sites of pancreas                                      |
| Solid Organ Cancer | 1579                  | Malignant neoplasm of pancreas, part unspecified   |
| Solid Organ Cancer | 158                   | Malignant neoplasm of retroperitoneum and peritoneum   |
| Solid Organ Cancer | 1580                  | Malignant neoplasm of retroperitoneum  |
| Solid Organ Cancer | 1588                  | Malignant neoplasm of specified parts of peritoneum  |
| Solid Organ Cancer | 1589                  | Malignant neoplasm of peritoneum, unspecified  |
| Solid Organ Cancer | 159                   | Malignant neoplasm of other and ill-defined sites within the digestive organs and peritoneum |
| Solid Organ Cancer | 1590                  | Malignant neoplasm of intestinal tract, part unspecified                                     |
| Solid Organ Cancer | 1591                  | Malignant neoplasm of spleen, not elsewhere classified                                       |
| Solid Organ Cancer | 1598                  | Malignant neoplasm of other sites of digestive system and intra-abdominal organs             |
| Solid Organ Cancer | 1599                  | Malignant neoplasm of ill-defined sites within the digestive organs and peritoneum           |
| Solid Organ Cancer | 162                   | Malignant neoplasm of trachea, bronchus, and lung  |
| Solid Organ Cancer | 1620                  | Malignant neoplasm of trachea  |
| Solid Organ Cancer | 1622                  | Malignant neoplasm of main bronchus  |
| Solid Organ Cancer | 1623                  | Malignant neoplasm of upper lobe, bronchus or lung   |
| Solid Organ Cancer | 1624                  | Malignant neoplasm of middle lobe, bronchus or lung  |
| Solid Organ Cancer | 1625                  | Malignant neoplasm of lower lobe, bronchus or lung   |
| Solid Organ Cancer | 1628                  | Malignant neoplasm of other parts of bronchus or lung  |
| Solid Organ Cancer | 1629                  | Malignant neoplasm of bronchus and lung, unspecified   |
| Solid Organ Cancer | 163                   | Malignant neoplasm of pleura   |
| Solid Organ Cancer | 1630                  | Malignant neoplasm of parietal pleura  |
| Solid Organ Cancer | 1631                  | Malignant neoplasm of visceral pleura  |
| Solid Organ Cancer | 1638                  | Malignant neoplasm of other specified sites of pleura  |
| Solid Organ Cancer | 1639                  | Malignant neoplasm of pleura, unspecified  |
| Solid Organ Cancer | 172                   | Malignant melanoma of skin   |
| Solid Organ Cancer | 1720                  | Malignant melanoma of skin of lip  |
| Solid Organ Cancer | 1721                  | Malignant melanoma of skin of eyelid, including canthus                                      |
| Solid Organ Cancer | 1722                  | Malignant melanoma of skin of ear and external auditory canal                                |
| Solid Organ Cancer | 1723                  | Malignant melanoma of skin of other and unspecified parts of face                            |
| Solid Organ Cancer | 1724                  | Malignant melanoma of skin of scalp and neck   |

### List of ICD-9 codes used for exclusions

| Comorbidity        | ICD-10 Diagnosis Code | Description  |
|--------------------|-----------------------|--|
| Solid Organ Cancer | 1725                  | Malignant melanoma of skin of trunk, except scrotum                            |
| Solid Organ Cancer | 1726                  | Malignant melanoma of skin of upper limb, including shoulder                   |
| Solid Organ Cancer | 1727                  | Malignant melanoma of skin of lower limb, including hip                        |
| Solid Organ Cancer | 1728                  | Malignant melanoma of other specified sites of skin                            |
| Solid Organ Cancer | 1729                  | Melanoma of skin, site unspecified   |
| Solid Organ Cancer | 174                   | Malignant neoplasm of female breast  |
| Solid Organ Cancer | 1740                  | Malignant neoplasm of nipple and areola of female breast                       |
| Solid Organ Cancer | 1741                  | Malignant neoplasm of central portion of female breast                         |
| Solid Organ Cancer | 1742                  | Malignant neoplasm of upper-inner quadrant of female breast                    |
| Solid Organ Cancer | 1743                  | Malignant neoplasm of lower-inner quadrant of female breast                    |
| Solid Organ Cancer | 1744                  | Malignant neoplasm of upper-outer quadrant of female breast                    |
| Solid Organ Cancer | 1745                  | Malignant neoplasm of lower-outer quadrant of female breast                    |
| Solid Organ Cancer | 1746                  | Malignant neoplasm of axillary tail of female breast                           |
| Solid Organ Cancer | 1748                  | Malignant neoplasm of other specified sites of female breast                   |
| Solid Organ Cancer | 1749                  | Malignant neoplasm of breast (female), unspecified                             |
| Solid Organ Cancer | 175                   | Malignant neoplasm of male breast  |
| Solid Organ Cancer | 1750                  | Malignant neoplasm of nipple and areola of male breast                         |
| Solid Organ Cancer | 1759                  | Malignant neoplasm of other and unspecified sites of male breast               |
| Solid Organ Cancer | 179                   | Malignant neoplasm of uterus, part unspecified                                 |
| Solid Organ Cancer | 180                   | Malignant neoplasm of cervix uteri   |
| Solid Organ Cancer | 1800                  | Malignant neoplasm of endocervix   |
| Solid Organ Cancer | 1801                  | Malignant neoplasm of exocervix  |
| Solid Organ Cancer | 1808                  | Malignant neoplasm of other specified sites of cervix                          |
| Solid Organ Cancer | 1809                  | Malignant neoplasm of cervix uteri, unspecified site                           |
| Solid Organ Cancer | 182                   | Malignant neoplasm of body of uterus   |
| Solid Organ Cancer | 1820                  | Malignant neoplasm of corpus uteri, except isthmus                             |
| Solid Organ Cancer | 1821                  | Malignant neoplasm of isthmus  |
| Solid Organ Cancer | 1828                  | Malignant neoplasm of other specified sites of body of uterus                  |
| Solid Organ Cancer | 184                   | Malignant neoplasm of other and unspecified female genital organs              |
| Solid Organ Cancer | 1840                  | Malignant neoplasm of vagina   |
| Solid Organ Cancer | 1841                  | Malignant neoplasm of labia majora   |
| Solid Organ Cancer | 1842                  | Malignant neoplasm of labia minora   |
| Solid Organ Cancer | 1843                  | Malignant neoplasm of clitoris   |
| Solid Organ Cancer | 1844                  | Malignant neoplasm of vulva, unspecified site                                  |
| Solid Organ Cancer | 1848                  | Malignant neoplasm of other specified sites of female genital organs           |
| Solid Organ Cancer | 1849                  | Malignant neoplasm of female genital organ, site unspecified                   |
| Solid Organ Cancer | 185                   | Malignant neoplasm of prostate   |
| Solid Organ Cancer | 186                   | Malignant neoplasm of testis   |
| Solid Organ Cancer | 1860                  | Malignant neoplasm of undescended testis                                       |
| Solid Organ Cancer | 1869                  | Malignant neoplasm of other and unspecified testis                             |
| Solid Organ Cancer | 187                   | Malignant neoplasm of penis and other male genital organs                      |
| Solid Organ Cancer | 1871                  | Malignant neoplasm of prepuce  |
| Solid Organ Cancer | 1872                  | Malignant neoplasm of glans penis  |
| Solid Organ Cancer | 1873                  | Malignant neoplasm of body of penis  |
| Solid Organ Cancer | 1874                  | Malignant neoplasm of penis, part unspecified                                  |
| Solid Organ Cancer | 1875                  | Malignant neoplasm of epididymis   |
| Solid Organ Cancer | 1876                  | Malignant neoplasm of spermatic cord   |
| Solid Organ Cancer | 1877                  | Malignant neoplasm of scrotum  |
| Solid Organ Cancer | 1878                  | Malignant neoplasm of other specified sites of male genital organs             |
| Solid Organ Cancer | 1879                  | Malignant neoplasm of male genital organ, site unspecified                     |
| Solid Organ Cancer | 188                   | Malignant neoplasm of bladder  |
| Solid Organ Cancer | 1880                  | Malignant neoplasm of trigone of urinary bladder                               |
| Solid Organ Cancer | 1881                  | Malignant neoplasm of dome of urinary bladder                                  |
| Solid Organ Cancer | 1882                  | Malignant neoplasm of lateral wall of urinary bladder                          |
| Solid Organ Cancer | 1883                  | Malignant neoplasm of anterior wall of urinary bladder                         |
| Solid Organ Cancer | 1884                  | Malignant neoplasm of posterior wall of urinary bladder                        |
| Solid Organ Cancer | 1885                  | Malignant neoplasm of bladder neck   |
| Solid Organ Cancer | 1886                  | Malignant neoplasm of ureteric orifice   |
| Solid Organ Cancer | 1887                  | Malignant neoplasm of urachus  |
| Solid Organ Cancer | 1888                  | Malignant neoplasm of other specified sites of bladder                         |
| Solid Organ Cancer | 1889                  | Malignant neoplasm of bladder, part unspecified                                |
| Solid Organ Cancer | 189                   | Malignant neoplasm of kidney and other and unspecified urinary organs          |
| Solid Organ Cancer | 1890                  | Malignant neoplasm of kidney, except pelvis                                    |
| Solid Organ Cancer | 1891                  | Malignant neoplasm of renal pelvis   |
| Solid Organ Cancer | 1892                  | Malignant neoplasm of ureter   |
| Solid Organ Cancer | 1893                  | Malignant neoplasm of urethra  |
| Solid Organ Cancer | 1894                  | Malignant neoplasm of paraurethral glands                                      |
| Solid Organ Cancer | 1898                  | Malignant neoplasm of other specified sites of urinary organs                  |
| Solid Organ Cancer | 1899                  | Malignant neoplasm of urinary organ, site unspecified                          |
| Solid Organ Cancer | 190                   | Malignant neoplasm of eye  |
| Solid Organ Cancer | 1900                  | Malignant neoplasm of eyeball, except conjunctiva, cornea, retina, and choroid |
| Solid Organ Cancer | 1901                  | Malignant neoplasm of orbit  |
| Solid Organ Cancer | 1902                  | Malignant neoplasm of lacrimal gland   |
| Solid Organ Cancer | 1903                  | Malignant neoplasm of conjunctiva  |
| Solid Organ Cancer | 1904                  | Malignant neoplasm of cornea   |
| Solid Organ Cancer | 1905                  | Malignant neoplasm of retina   |
| Solid Organ Cancer | 1906                  | Malignant neoplasm of choroid  |
| Solid Organ Cancer | 1907                  | Malignant neoplasm of lacrimal duct  |

### List of ICD-9 codes used for exclusions

| Comorbidity        | ICD-10 Diagnosis Code | Description   |
|--------------------|-----------------------|---|
| Solid Organ Cancer | 1908                  | Malignant neoplasm of other specified sites of eye                  |
| Solid Organ Cancer | 1909                  | Malignant neoplasm of eye, part unspecified                         |
| Solid Organ Cancer | 193                   | Malignant neoplasm of thyroid gland                                 |
| Solid Organ Cancer | 194                   | Malignant neoplasm of other endocrine glands and related structures |
| Solid Organ Cancer | 1941                  | Malignant neoplasm of parathyroid gland                             |
| Solid Organ Cancer | 1945                  | Malignant neoplasm of carotid body                                  |
| Solid Organ Cancer | 1946                  | Malignant neoplasm of aortic body and other paraganglia             |
| Solid Organ Cancer | 1948                  | Malignant neoplasm of other endocrine glands and related structures |
| Solid Organ Cancer | 1949                  | Malignant neoplasm of endocrine gland, site unspecified             |
| Solid Organ Cancer | 195                   | Malignant neoplasm of other and ill-defined sites                   |
| Solid Organ Cancer | 1950                  | Malignant neoplasm of head, face, and neck                          |
| Solid Organ Cancer | 1951                  | Malignant neoplasm of thorax  |
| Solid Organ Cancer | 1952                  | Malignant neoplasm of abdomen                                       |
| Solid Organ Cancer | 1953                  | Malignant neoplasm of pelvis  |
| Solid Organ Cancer | 1954                  | Malignant neoplasm of upper limb                                    |
| Solid Organ Cancer | 1955                  | Malignant neoplasm of lower limb                                    |
| Solid Organ Cancer | 1958                  | Malignant neoplasm of other specified sites                         |
| Solid Organ Cancer | 199                   | Malignant neoplasm without specification of site                    |
| Solid Organ Cancer | 1991                  | Other malignant neoplasm without specification of site              |
| Solid Organ Cancer | 1992                  | Malignant neoplasm associated with transplant organ                 |

# List of ICD-10 codes used for exclusions

| Comorbidity          | ICD-10 Diagnosis Code | Description  |
|----------------------|-----------------------|--|
| Carcinoma            | D0000                 | D0000 Carcinoma in situ of oral cavity, unspecified site   |
| Carcinoma            | D0001                 | D0001 Carcinoma in situ of labial mucosa and vermillion border   |
| Carcinoma            | D0002                 | D0002 Carcinoma in situ of buccal mucosa   |
| Carcinoma            | D0003                 | D0003 Carcinoma in situ of gingiva and edentulous alveolar ridge   |
| Carcinoma            | D0004                 | D0004 Carcinoma in situ of soft palate   |
| Carcinoma            | D0005                 | D0005 Carcinoma in situ of hard palate   |
| Carcinoma            | D0006                 | D0006 Carcinoma in situ of floor of mouth  |
| Carcinoma            | D0007                 | D0007 Carcinoma in situ of tongue  |
| Carcinoma            | D0008                 | D0008 Carcinoma in situ of pharynx   |
| Carcinoma            | D001                  | D001 Carcinoma in situ of esophagus  |
| Carcinoma            | D002                  | D002 Carcinoma in situ of stomach  |
| Carcinoma            | D010                  | D010 Carcinoma in situ of colon  |
| Carcinoma            | D011                  | D011 Carcinoma in situ of rectosigmoid junction  |
| Carcinoma            | D012                  | D012 Carcinoma in situ of rectum   |
| Carcinoma            | D013                  | D013 Carcinoma in situ of anus and anal canal  |
| Carcinoma            | D0140                 | D0140 Carcinoma in situ of unspecified part of intestine   |
| Carcinoma            | D0149                 | D0149 Carcinoma in situ of other parts of intestine  |
| Carcinoma            | D015                  | D015 Carcinoma in situ of liver, gallbladder and bile ducts  |
| Carcinoma            | D017                  | D017 Carcinoma in situ of other specified digestive organs   |
| Carcinoma            | D019                  | D019 Carcinoma in situ of digestive organ, unspecified   |
| Carcinoma            | D020                  | D020 Carcinoma in situ of larynx   |
| Carcinoma            | D021                  | D021 Carcinoma in situ of trachea  |
| Carcinoma            | D0220                 | D0220 Carcinoma in situ of unspecified bronchus and lung   |
| Carcinoma            | D0221                 | D0221 Carcinoma in situ of right bronchus and lung   |
| Carcinoma            | D0222                 | D0222 Carcinoma in situ of left bronchus and lung  |
| Carcinoma            | D023                  | D023 Carcinoma in situ of other parts of respiratory system  |
| Carcinoma            | D024                  | D024 Carcinoma in situ of respiratory system, unspecified  |
| Carcinoma            | D0500                 | D0500 Lobular carcinoma in situ of unspecified breast  |
| Carcinoma            | D0501                 | D0501 Lobular carcinoma in situ of right breast  |
| Carcinoma            | D0502                 | D0502 Lobular carcinoma in situ of left breast   |
| Carcinoma            | D0510                 | D0510 Intraductal carcinoma in situ of unspecified breast  |
| Carcinoma            | D0511                 | D0511 Intraductal carcinoma in situ of right breast  |
| Carcinoma            | D0512                 | D0512 Intraductal carcinoma in situ of left breast   |
| Carcinoma            | D0580                 | D0580 Other specified type of carcinoma in situ of unspecified breast                                    |
| Carcinoma            | D0581                 | D0581 Other specified type of carcinoma in situ of right breast  |
| Carcinoma            | D0582                 | D0582 Other specified type of carcinoma in situ of left breast   |
| Carcinoma            | D0590                 | D0590 Unspecified type of carcinoma in situ of unspecified breast  |
| Carcinoma            | D0591                 | D0591 Unspecified type of carcinoma in situ of right breast  |
| Carcinoma            | D0592                 | D0592 Unspecified type of carcinoma in situ of left breast   |
| Carcinoma            | D060                  | D060 Carcinoma in situ of endocervix   |
| Carcinoma            | D061                  | D061 Carcinoma in situ of exocervix  |
| Carcinoma            | D067                  | D067 Carcinoma in situ of other parts of cervix  |
| Carcinoma            | D069                  | D069 Carcinoma in situ of cervix, unspecified  |
| Carcinoma            | D070                  | D070 Carcinoma in situ of endometrium  |
| Carcinoma            | D071                  | D071 Carcinoma in situ of vulva  |
| Carcinoma            | D072                  | D072 Carcinoma in situ of vagina   |
| Carcinoma            | D0730                 | D0730 Carcinoma in situ of unspecified female genital organs   |
| Carcinoma            | D0739                 | D0739 Carcinoma in situ of other female genital organs   |
| Carcinoma            | D074                  | D074 Carcinoma in situ of penis  |
| Carcinoma            | D075                  | D075 Carcinoma in situ of prostate   |
| Carcinoma            | D0760                 | D0760 Carcinoma in situ of unspecified male genital organs   |
| Carcinoma            | D0761                 | D0761 Carcinoma in situ of scrotum   |
| Carcinoma            | D0769                 | D0769 Carcinoma in situ of other male genital organs   |
| Carcinoma            | D090                  | D090 Carcinoma in situ of bladder  |
| Carcinoma            | D0910                 | D0910 Carcinoma in situ of unspecified urinary organ   |
| Carcinoma            | D0919                 | D0919 Carcinoma in situ of other urinary organs  |
| Carcinoma            | D0920                 | D0920 Carcinoma in situ of unspecified eye   |
| Carcinoma            | D0921                 | D0921 Carcinoma in situ of right eye   |
| Carcinoma            | D0922                 | D0922 Carcinoma in situ of left eye  |
| Carcinoma            | D093                  | D093 Carcinoma in situ of thyroid and other endocrine glands   |
| Carcinoma            | D098                  | D098 Carcinoma in situ of other specified sites  |
| Carcinoma            | D099                  | D099 Carcinoma in situ, unspecified  |
| Coagulation          | D65                   | D65 Disseminated intravascular coagulation [defibrination syndrome]                                      |
| Coagulation          | D66                   | D66 Hereditary factor VIII deficiency  |
| Coagulation          | D67                   | D67 Hereditary factor IX deficiency  |
| Coagulation          | D680                  | D680 Von Willebrand's disease  |
| Coagulation          | D681                  | D681 Hereditary factor XI deficiency   |
| Coagulation          | D682                  | D682 Hereditary deficiency of other clotting factors   |
| Coagulation          | D68311                | D68311 Acquired hemophilia   |
| Coagulation          | D68312                | D68312 Antiphospholipid antibody with hemorrhagic disorder   |
| Coagulation          | D68318                | D68318 Other hemorrhagic disorder due to intrinsic circulating anticoagulants, antibodies, or inhibitors |
| Coagulation          | D6832                 | D6832 Hemorrhagic disorder due to extrinsic circulating anticoagulants                                   |
| Coagulation          | D684                  | D684 Acquired coagulation factor deficiency  |
| Coagulation          | D688                  | D688 Other specified coagulation defects   |
| Coagulation          | D689                  | D689 Coagulation defect, unspecified   |
| Head and Neck Cancer | C000                  | C000 Malignant neoplasm of external upper lip  |
| Head and Neck Cancer | C001                  | C001 Malignant neoplasm of external lower lip  |
| Head and Neck Cancer | C002                  | C002 Malignant neoplasm of external lip, unspecified   |

# List of ICD-10 codes used for exclusions

| Comorbidity          | ICD-10 Diagnosis Code | Description  |
|----------------------|-----------------------|--|
| Head and Neck Cancer | C003                  | C003 Malignant neoplasm of upper lip, inner aspect                           |
| Head and Neck Cancer | C004                  | C004 Malignant neoplasm of lower lip, inner aspect                           |
| Head and Neck Cancer | C005                  | C005 Malignant neoplasm of lip, unspecified, inner aspect                    |
| Head and Neck Cancer | C006                  | C006 Malignant neoplasm of commissure of lip, unspecified                    |
| Head and Neck Cancer | C008                  | C008 Malignant neoplasm of overlapping sites of lip                          |
| Head and Neck Cancer | C009                  | C009 Malignant neoplasm of lip, unspecified                                  |
| Head and Neck Cancer | C01                   | C01 Malignant neoplasm of base of tongue                                     |
| Head and Neck Cancer | C020                  | C020 Malignant neoplasm of dorsal surface of tongue                          |
| Head and Neck Cancer | C021                  | C021 Malignant neoplasm of border of tongue                                  |
| Head and Neck Cancer | C022                  | C022 Malignant neoplasm of ventral surface of tongue                         |
| Head and Neck Cancer | C023                  | C023 Malignant neoplasm of anterior two-thirds of tongue, part unspecified   |
| Head and Neck Cancer | C024                  | C024 Malignant neoplasm of lingual tonsil                                    |
| Head and Neck Cancer | C028                  | C028 Malignant neoplasm of overlapping sites of tongue                       |
| Head and Neck Cancer | C029                  | C029 Malignant neoplasm of tongue, unspecified                               |
| Head and Neck Cancer | C030                  | C030 Malignant neoplasm of upper gum   |
| Head and Neck Cancer | C031                  | C031 Malignant neoplasm of lower gum   |
| Head and Neck Cancer | C039                  | C039 Malignant neoplasm of gum, unspecified                                  |
| Head and Neck Cancer | C040                  | C040 Malignant neoplasm of anterior floor of mouth                           |
| Head and Neck Cancer | C041                  | C041 Malignant neoplasm of lateral floor of mouth                            |
| Head and Neck Cancer | C048                  | C048 Malignant neoplasm of overlapping sites of floor of mouth               |
| Head and Neck Cancer | C049                  | C049 Malignant neoplasm of floor of mouth, unspecified                       |
| Head and Neck Cancer | C050                  | C050 Malignant neoplasm of hard palate                                       |
| Head and Neck Cancer | C051                  | C051 Malignant neoplasm of soft palate                                       |
| Head and Neck Cancer | C052                  | C052 Malignant neoplasm of uvula   |
| Head and Neck Cancer | C058                  | C058 Malignant neoplasm of overlapping sites of palate                       |
| Head and Neck Cancer | C059                  | C059 Malignant neoplasm of palate, unspecified                               |
| Head and Neck Cancer | C060                  | C060 Malignant neoplasm of cheek mucosa                                      |
| Head and Neck Cancer | C061                  | C061 Malignant neoplasm of vestibule of mouth                                |
| Head and Neck Cancer | C062                  | C062 Malignant neoplasm of retromolar area                                   |
| Head and Neck Cancer | C0680                 | C0680 Malignant neoplasm of overlapping sites of unspecified parts of mouth  |
| Head and Neck Cancer | C0689                 | C0689 Malignant neoplasm of overlapping sites of other parts of mouth        |
| Head and Neck Cancer | C069                  | C069 Malignant neoplasm of mouth, unspecified                                |
| Head and Neck Cancer | C07                   | C07 Malignant neoplasm of parotid gland                                      |
| Head and Neck Cancer | C080                  | C080 Malignant neoplasm of submandibular gland                               |
| Head and Neck Cancer | C081                  | C081 Malignant neoplasm of sublingual gland                                  |
| Head and Neck Cancer | C089                  | C089 Malignant neoplasm of major salivary gland, unspecified                 |
| Head and Neck Cancer | C090                  | C090 Malignant neoplasm of tonsillar fossa                                   |
| Head and Neck Cancer | C091                  | C091 Malignant neoplasm of tonsillar pillar (anterior) (posterior)           |
| Head and Neck Cancer | C098                  | C098 Malignant neoplasm of overlapping sites of tonsil                       |
| Head and Neck Cancer | C099                  | C099 Malignant neoplasm of tonsil, unspecified                               |
| Head and Neck Cancer | C100                  | C100 Malignant neoplasm of vallecula   |
| Head and Neck Cancer | C101                  | C101 Malignant neoplasm of anterior surface of epiglottis                    |
| Head and Neck Cancer | C102                  | C102 Malignant neoplasm of lateral wall of oropharynx                        |
| Head and Neck Cancer | C103                  | C103 Malignant neoplasm of posterior wall of oropharynx                      |
| Head and Neck Cancer | C104                  | C104 Malignant neoplasm of branchial cleft                                   |
| Head and Neck Cancer | C108                  | C108 Malignant neoplasm of overlapping sites of oropharynx                   |
| Head and Neck Cancer | C109                  | C109 Malignant neoplasm of oropharynx, unspecified                           |
| Head and Neck Cancer | C110                  | C110 Malignant neoplasm of superior wall of nasopharynx                      |
| Head and Neck Cancer | C111                  | C111 Malignant neoplasm of posterior wall of nasopharynx                     |
| Head and Neck Cancer | C112                  | C112 Malignant neoplasm of lateral wall of nasopharynx                       |
| Head and Neck Cancer | C113                  | C113 Malignant neoplasm of anterior wall of nasopharynx                      |
| Head and Neck Cancer | C118                  | C118 Malignant neoplasm of overlapping sites of nasopharynx                  |
| Head and Neck Cancer | C119                  | C119 Malignant neoplasm of nasopharynx, unspecified                          |
| Head and Neck Cancer | C12                   | C12 Malignant neoplasm of pyriform sinus                                     |
| Head and Neck Cancer | C130                  | C130 Malignant neoplasm of postcricoid region                                |
| Head and Neck Cancer | C131                  | C131 Malignant neoplasm of aryepiglottic fold, hypopharyngeal aspect         |
| Head and Neck Cancer | C132                  | C132 Malignant neoplasm of posterior wall of hypopharynx                     |
| Head and Neck Cancer | C138                  | C138 Malignant neoplasm of overlapping sites of hypopharynx                  |
| Head and Neck Cancer | C139                  | C139 Malignant neoplasm of hypopharynx, unspecified                          |
| Head and Neck Cancer | C140                  | C140 Malignant neoplasm of pharynx, unspecified                              |
| Head and Neck Cancer | C142                  | C142 Malignant neoplasm of Waldeyer's ring                                   |
| Head and Neck Cancer | C148                  | C148 Malignant neoplasm of overlapping sites of lip, oral cavity and pharynx |
| Head and Neck Cancer | C300                  | C300 Malignant neoplasm of nasal cavity                                      |
| Head and Neck Cancer | C301                  | C301 Malignant neoplasm of middle ear  |
| Head and Neck Cancer | C310                  | C310 Malignant neoplasm of maxillary sinus                                   |
| Head and Neck Cancer | C311                  | C311 Malignant neoplasm of ethmoidal sinus                                   |
| Head and Neck Cancer | C312                  | C312 Malignant neoplasm of frontal sinus                                     |
| Head and Neck Cancer | C313                  | C313 Malignant neoplasm of sphenoid sinus                                    |
| Head and Neck Cancer | C318                  | C318 Malignant neoplasm of overlapping sites of accessory sinuses            |
| Head and Neck Cancer | C319                  | C319 Malignant neoplasm of accessory sinus, unspecified                      |
| Head and Neck Cancer | C320                  | C320 Malignant neoplasm of glottis   |
| Head and Neck Cancer | C321                  | C321 Malignant neoplasm of supraglottis                                      |
| Head and Neck Cancer | C322                  | C322 Malignant neoplasm of subglottis  |
| Head and Neck Cancer | C323                  | C323 Malignant neoplasm of laryngeal cartilage                               |
| Head and Neck Cancer | C328                  | C328 Malignant neoplasm of overlapping sites of larynx                       |
| Head and Neck Cancer | C329                  | C329 Malignant neoplasm of larynx, unspecified                               |
| Head and Neck Cancer | C37                   | C37 Malignant neoplasm of thymus   |
| Head and Neck Cancer | C380                  | C380 Malignant neoplasm of heart   |

### List of ICD-10 codes used for exclusions

| Comorbidity          | ICD-10 Diagnosis Code | Description  |
|----------------------|-----------------------|--|
| Head and Neck Cancer | C381                  | C381 Malignant neoplasm of anterior mediastinum  |
| Head and Neck Cancer | C382                  | C382 Malignant neoplasm of posterior mediastinum                                       |
| Head and Neck Cancer | C383                  | C383 Malignant neoplasm of mediastinum, part unspecified                               |
| Head and Neck Cancer | C388                  | C388 Malignant neoplasm of overlapping sites of heart, mediastinum and pleura          |
| Head and Neck Cancer | C390                  | C390 Malignant neoplasm of upper respiratory tract, part unspecified                   |
| Head and Neck Cancer | C399                  | C399 Malignant neoplasm of lower respiratory tract, part unspecified                   |
| Head and Neck Cancer | C452                  | C452 Mesothelioma of pericardium   |
| Hemolytic Aplastic   | D550                  | D550 Anemia due to glucose-6-phosphate dehydrogenase [G6PD] deficiency                 |
| Hemolytic Aplastic   | D551                  | D551 Anemia due to other disorders of glutathione metabolism                           |
| Hemolytic Aplastic   | D552                  | D552 Anemia due to disorders of glycolytic enzymes                                     |
| Hemolytic Aplastic   | D553                  | D553 Anemia due to disorders of nucleotide metabolism                                  |
| Hemolytic Aplastic   | D558                  | D558 Other anemias due to enzyme disorders   |
| Hemolytic Aplastic   | D559                  | D559 Anemia due to enzyme disorder, unspecified  |
| Hemolytic Aplastic   | D560                  | D560 Alpha thalassemia   |
| Hemolytic Aplastic   | D561                  | D561 Beta thalassemia  |
| Hemolytic Aplastic   | D562                  | D562 Delta-beta thalassemia  |
| Hemolytic Aplastic   | D563                  | D563 Thalassemia minor   |
| Hemolytic Aplastic   | D564                  | D564 Hereditary persistence of fetal hemoglobin [HPFH]                                 |
| Hemolytic Aplastic   | D565                  | D565 Hemoglobin E-beta thalassemia   |
| Hemolytic Aplastic   | D568                  | D568 Other thalassemias  |
| Hemolytic Aplastic   | D569                  | D569 Thalassemia, unspecified  |
| Hemolytic Aplastic   | D5740                 | D5740 Sickle-cell thalassemia without crisis   |
| Hemolytic Aplastic   | D57411                | D57411 Sickle-cell thalassemia with acute chest syndrome                               |
| Hemolytic Aplastic   | D57412                | D57412 Sickle-cell thalassemia with splenic sequestration                              |
| Hemolytic Aplastic   | D57419                | D57419 Sickle-cell thalassemia with crisis, unspecified                                |
| Hemolytic Aplastic   | D580                  | D580 Hereditary spherocytosis  |
| Hemolytic Aplastic   | D581                  | D581 Hereditary elliptocytosis   |
| Hemolytic Aplastic   | D582                  | D582 Other hemoglobinopathies  |
| Hemolytic Aplastic   | D588                  | D588 Other specified hereditary hemolytic anemias                                      |
| Hemolytic Aplastic   | D589                  | D589 Hereditary hemolytic anemia, unspecified  |
| Hemolytic Aplastic   | D590                  | D590 Drug-induced autoimmune hemolytic anemia  |
| Hemolytic Aplastic   | D591                  | D591 Other autoimmune hemolytic anemias  |
| Hemolytic Aplastic   | D592                  | D592 Drug-induced nonautoimmune hemolytic anemia                                       |
| Hemolytic Aplastic   | D593                  | D593 Hemolytic-uremic syndrome   |
| Hemolytic Aplastic   | D594                  | D594 Other nonautoimmune hemolytic anemias   |
| Hemolytic Aplastic   | D595                  | D595 Paroxysmal nocturnal hemoglobinuria [Marchiafava-Micheli]                         |
| Hemolytic Aplastic   | D596                  | D596 Hemoglobinuria due to hemolysis from other external causes                        |
| Hemolytic Aplastic   | D598                  | D598 Other acquired hemolytic anemias  |
| Hemolytic Aplastic   | D599                  | D599 Acquired hemolytic anemia, unspecified  |
| Hemolytic Aplastic   | D600                  | D600 Chronic acquired pure red cell aplasia  |
| Hemolytic Aplastic   | D601                  | D601 Transient acquired pure red cell aplasia  |
| Hemolytic Aplastic   | D608                  | D608 Other acquired pure red cell aplasias   |
| Hemolytic Aplastic   | D609                  | D609 Acquired pure red cell aplasia, unspecified                                       |
| Hemolytic Aplastic   | D6101                 | D6101 Constitutional (pure) red blood cell aplasia                                     |
| Hemolytic Aplastic   | D6109                 | D6109 Other constitutional aplastic anemia   |
| Hemolytic Aplastic   | D611                  | D611 Drug-induced aplastic anemia  |
| Hemolytic Aplastic   | D612                  | D612 Aplastic anemia due to other external agents                                      |
| Hemolytic Aplastic   | D613                  | D613 Idiopathic aplastic anemia  |
| Hemolytic Aplastic   | D61810                | D61810 Antineoplastic chemotherapy induced pancytopenia                                |
| Hemolytic Aplastic   | D61811                | D61811 Other drug-induced pancytopenia   |
| Hemolytic Aplastic   | D61818                | D61818 Other pancytopenia  |
| Hemolytic Aplastic   | D6182                 | D6182 Myelophthisis  |
| Hemolytic Aplastic   | D6189                 | D6189 Other specified aplastic anemias and other bone marrow failure syndromes         |
| Hemolytic Aplastic   | D619                  | D619 Aplastic anemia, unspecified  |
| Leukemia             | C882                  | C882 Heavy chain disease   |
| Leukemia             | C883                  | C883 Immunoproliferative small intestinal disease                                      |
| Leukemia             | C888                  | C888 Other malignant immunoproliferative diseases                                      |
| Leukemia             | C889                  | C889 Malignant immunoproliferative disease, unspecified                                |
| Leukemia             | C9010                 | C9010 Plasma cell leukemia not having achieved remission                               |
| Leukemia             | C9011                 | C9011 Plasma cell leukemia in remission  |
| Leukemia             | C9020                 | C9020 Extramedullary plasmacytoma not having achieved remission                        |
| Leukemia             | C9021                 | C9021 Extramedullary plasmacytoma in remission   |
| Leukemia             | C9030                 | C9030 Solitary plasmacytoma not having achieved remission                              |
| Leukemia             | C9031                 | C9031 Solitary plasmacytoma in remission   |
| Leukemia             | C9100                 | C9100 Acute lymphoblastic leukemia not having achieved remission                       |
| Leukemia             | C9101                 | C9101 Acute lymphoblastic leukemia, in remission                                       |
| Leukemia             | C9102                 | C9102 Acute lymphoblastic leukemia, in relapse   |
| Leukemia             | C9110                 | C9110 Chronic lymphocytic leukemia of B-cell type not having achieved remission        |
| Leukemia             | C9111                 | C9111 Chronic lymphocytic leukemia of B-cell type in remission                         |
| Leukemia             | C9112                 | C9112 Chronic lymphocytic leukemia of B-cell type in relapse                           |
| Leukemia             | C9130                 | C9130 Polymorphocytic leukemia of B-cell type not having achieved remission            |
| Leukemia             | C9131                 | C9131 Polymorphocytic leukemia of B-cell type, in remission                            |
| Leukemia             | C9132                 | C9132 Polymorphocytic leukemia of B-cell type, in relapse                              |
| Leukemia             | C9150                 | C9150 Adult T-cell lymphoma/leukemia (HTLV-1-associated) not having achieved remission |

### List of ICD-10 codes used for exclusions

| Comorbidity | ICD-10 Diagnosis Code | Description  |
|-------------|-----------------------|--|
| Leukemia    | C9151                 | C9151 Adult T-cell lymphoma/leukemia (HTLV-1-associated), in remission                   |
| Leukemia    | C9152                 | C9152 Adult T-cell lymphoma/leukemia (HTLV-1-associated), in relapse                     |
| Leukemia    | C9160                 | C9160 Polymorphocytic leukemia of T-cell type not having achieved remission              |
| Leukemia    | C9161                 | C9161 Polymorphocytic leukemia of T-cell type, in remission                              |
| Leukemia    | C9162                 | C9162 Polymorphocytic leukemia of T-cell type, in relapse                                |
| Leukemia    | C9190                 | C9190 Lymphoid leukemia, unspecified not having achieved remission                       |
| Leukemia    | C9191                 | C9191 Lymphoid leukemia, unspecified, in remission                                       |
| Leukemia    | C9192                 | C9192 Lymphoid leukemia, unspecified, in relapse   |
| Leukemia    | C91A0                 | C91A0 Mature B-cell leukemia Burkitt-type not having achieved remission                  |
| Leukemia    | C91A1                 | C91A1 Mature B-cell leukemia Burkitt-type, in remission                                  |
| Leukemia    | C91A2                 | C91A2 Mature B-cell leukemia Burkitt-type, in relapse                                    |
| Leukemia    | C91Z0                 | C91Z0 Other lymphoid leukemia not having achieved remission                              |
| Leukemia    | C91Z1                 | C91Z1 Other lymphoid leukemia, in remission  |
| Leukemia    | C91Z2                 | C91Z2 Other lymphoid leukemia, in relapse  |
| Leukemia    | C9200                 | C9200 Acute myeloblastic leukemia, not having achieved remission                         |
| Leukemia    | C9201                 | C9201 Acute myeloblastic leukemia, in remission  |
| Leukemia    | C9202                 | C9202 Acute myeloblastic leukemia, in relapse  |
| Leukemia    | C9210                 | C9210 Chronic myeloid leukemia, BCR/ABL-positive, not having achieved remission          |
| Leukemia    | C9211                 | C9211 Chronic myeloid leukemia, BCR/ABL-positive, in remission                           |
| Leukemia    | C9212                 | C9212 Chronic myeloid leukemia, BCR/ABL-positive, in relapse                             |
| Leukemia    | C9220                 | C9220 Atypical chronic myeloid leukemia, BCR/ABL-negative, not having achieved remission |
| Leukemia    | C9221                 | C9221 Atypical chronic myeloid leukemia, BCR/ABL-negative, in remission                  |
| Leukemia    | C9222                 | C9222 Atypical chronic myeloid leukemia, BCR/ABL-negative, in relapse                    |
| Leukemia    | C9230                 | C9230 Myeloid sarcoma, not having achieved remission                                     |
| Leukemia    | C9231                 | C9231 Myeloid sarcoma, in remission  |
| Leukemia    | C9232                 | C9232 Myeloid sarcoma, in relapse  |
| Leukemia    | C9240                 | C9240 Acute promyelocytic leukemia, not having achieved remission                        |
| Leukemia    | C9241                 | C9241 Acute promyelocytic leukemia, in remission   |
| Leukemia    | C9242                 | C9242 Acute promyelocytic leukemia, in relapse   |
| Leukemia    | C9250                 | C9250 Acute myelomonocytic leukemia, not having achieved remission                       |
| Leukemia    | C9251                 | C9251 Acute myelomonocytic leukemia, in remission  |
| Leukemia    | C9252                 | C9252 Acute myelomonocytic leukemia, in relapse  |
| Leukemia    | C9260                 | C9260 Acute myeloid leukemia with 11q23-abnormality not having achieved remission        |
| Leukemia    | C9261                 | C9261 Acute myeloid leukemia with 11q23-abnormality in remission                         |
| Leukemia    | C9262                 | C9262 Acute myeloid leukemia with 11q23-abnormality in relapse                           |
| Leukemia    | C9290                 | C9290 Myeloid leukemia, unspecified, not having achieved remission                       |
| Leukemia    | C9291                 | C9291 Myeloid leukemia, unspecified in remission   |
| Leukemia    | C9292                 | C9292 Myeloid leukemia, unspecified in relapse   |
| Leukemia    | C92A0                 | C92A0 Acute myeloid leukemia with multilineage dysplasia, not having achieved remission  |
| Leukemia    | C92A1                 | C92A1 Acute myeloid leukemia with multilineage dysplasia, in remission                   |
| Leukemia    | C92A2                 | C92A2 Acute myeloid leukemia with multilineage dysplasia, in relapse                     |
| Leukemia    | C92Z0                 | C92Z0 Other myeloid leukemia not having achieved remission                               |
| Leukemia    | C92Z1                 | C92Z1 Other myeloid leukemia, in remission   |
| Leukemia    | C92Z2                 | C92Z2 Other myeloid leukemia, in relapse   |
| Leukemia    | C9300                 | C9300 Acute monoblastic/monocytic leukemia, not having achieved remission                |
| Leukemia    | C9301                 | C9301 Acute monoblastic/monocytic leukemia, in remission                                 |
| Leukemia    | C9302                 | C9302 Acute monoblastic/monocytic leukemia, in relapse                                   |
| Leukemia    | C9310                 | C9310 Chronic myelomonocytic leukemia not having achieved remission                      |
| Leukemia    | C9311                 | C9311 Chronic myelomonocytic leukemia, in remission                                      |
| Leukemia    | C9312                 | C9312 Chronic myelomonocytic leukemia, in relapse  |
| Leukemia    | C9330                 | C9330 Juvenile myelomonocytic leukemia, not having achieved remission                    |
| Leukemia    | C9331                 | C9331 Juvenile myelomonocytic leukemia, in remission                                     |
| Leukemia    | C9332                 | C9332 Juvenile myelomonocytic leukemia, in relapse                                       |
| Leukemia    | C9390                 | C9390 Monocytic leukemia, unspecified, not having achieved remission                     |
| Leukemia    | C9391                 | C9391 Monocytic leukemia, unspecified in remission                                       |
| Leukemia    | C9392                 | C9392 Monocytic leukemia, unspecified in relapse   |
| Leukemia    | C93Z0                 | C93Z0 Other monocytic leukemia, not having achieved remission                            |
| Leukemia    | C93Z1                 | C93Z1 Other monocytic leukemia, in remission   |
| Leukemia    | C93Z2                 | C93Z2 Other monocytic leukemia, in relapse   |
| Leukemia    | C9400                 | C9400 Acute erythroid leukemia, not having achieved remission                            |
| Leukemia    | C9401                 | C9401 Acute erythroid leukemia, in remission   |
| Leukemia    | C9402                 | C9402 Acute erythroid leukemia, in relapse   |
| Leukemia    | C9420                 | C9420 Acute megakaryoblastic leukemia not having achieved remission                      |
| Leukemia    | C9421                 | C9421 Acute megakaryoblastic leukemia, in remission                                      |
| Leukemia    | C9422                 | C9422 Acute megakaryoblastic leukemia, in relapse  |
| Leukemia    | C9430                 | C9430 Mast cell leukemia not having achieved remission                                   |
| Leukemia    | C9431                 | C9431 Mast cell leukemia, in remission   |
| Leukemia    | C9432                 | C9432 Mast cell leukemia, in relapse   |
| Leukemia    | C9480                 | C9480 Other specified leukemias not having achieved remission                            |
| Leukemia    | C9481                 | C9481 Other specified leukemias, in remission  |
| Leukemia    | C9482                 | C9482 Other specified leukemias, in relapse  |
| Leukemia    | C9500                 | C9500 Acute leukemia of unspecified cell type not having achieved remission              |
| Leukemia    | C9501                 | C9501 Acute leukemia of unspecified cell type, in remission                              |



### List of ICD-10 codes used for exclusions

| Comorbidity | ICD-10 Diagnosis Code | Description  |
|-------------|-----------------------|--|
| Leukemia    | C9502                 | C9502 Acute leukemia of unspecified cell type, in relapse  |
| Leukemia    | C9510                 | C9510 Chronic leukemia of unspecified cell type not having achieved remission                        |
| Leukemia    | C9511                 | C9511 Chronic leukemia of unspecified cell type, in remission  |
| Leukemia    | C9512                 | C9512 Chronic leukemia of unspecified cell type, in relapse  |
| Leukemia    | C9590                 | C9590 Leukemia, unspecified not having achieved remission  |
| Leukemia    | C9591                 | C9591 Leukemia, unspecified, in remission  |
| Leukemia    | C9592                 | C9592 Leukemia, unspecified, in relapse  |
| Leukemia    | D45                   | D45 Polycythemia vera  |
| Lymphoma    | C8100                 | C8100 Nodular lymphocyte predominant Hodgkin lymphoma, unspecified site                              |
| Lymphoma    | C8101                 | C8101 Nodular lymphocyte predominant Hodgkin lymphoma, lymph nodes of head, face, and neck           |
| Lymphoma    | C8102                 | C8102 Nodular lymphocyte predominant Hodgkin lymphoma, intrathoracic lymph nodes                     |
| Lymphoma    | C8103                 | C8103 Nodular lymphocyte predominant Hodgkin lymphoma, intra-abdominal lymph nodes                   |
| Lymphoma    | C8104                 | C8104 Nodular lymphocyte predominant Hodgkin lymphoma, lymph nodes of axilla and upper limb          |
| Lymphoma    | C8105                 | C8105 Nodular lymphocyte predominant Hodgkin lymphoma, lymph nodes of inguinal region and lower limb |
| Lymphoma    | C8106                 | C8106 Nodular lymphocyte predominant Hodgkin lymphoma, intrapelvic lymph nodes                       |
| Lymphoma    | C8107                 | C8107 Nodular lymphocyte predominant Hodgkin lymphoma, spleen  |
| Lymphoma    | C8108                 | C8108 Nodular lymphocyte predominant Hodgkin lymphoma, lymph nodes of multiple sites                 |
| Lymphoma    | C8109                 | C8109 Nodular lymphocyte predominant Hodgkin lymphoma, extranodal and solid organ sites              |
| Lymphoma    | C8110                 | C8110 Nodular sclerosis classical Hodgkin lymphoma, unspecified site                                 |
| Lymphoma    | C8111                 | C8111 Nodular sclerosis classical Hodgkin lymphoma, lymph nodes of head, face, and neck              |
| Lymphoma    | C8112                 | C8112 Nodular sclerosis classical Hodgkin lymphoma, intrathoracic lymph nodes                        |
| Lymphoma    | C8113                 | C8113 Nodular sclerosis classical Hodgkin lymphoma, intra-abdominal lymph nodes                      |
| Lymphoma    | C8114                 | C8114 Nodular sclerosis classical Hodgkin lymphoma, lymph nodes of axilla and upper limb             |
| Lymphoma    | C8115                 | C8115 Nodular sclerosis classical Hodgkin lymphoma, lymph nodes of inguinal region and lower limb    |
| Lymphoma    | C8116                 | C8116 Nodular sclerosis classical Hodgkin lymphoma, intrapelvic lymph nodes                          |
| Lymphoma    | C8117                 | C8117 Nodular sclerosis classical Hodgkin lymphoma, spleen   |
| Lymphoma    | C8118                 | C8118 Nodular sclerosis classical Hodgkin lymphoma, lymph nodes of multiple sites                    |
| Lymphoma    | C8119                 | C8119 Nodular sclerosis classical Hodgkin lymphoma, extranodal and solid organ sites                 |
| Lymphoma    | C8120                 | C8120 Mixed cellularity classical Hodgkin lymphoma, unspecified site                                 |
| Lymphoma    | C8121                 | C8121 Mixed cellularity classical Hodgkin lymphoma, lymph nodes of head, face, and neck              |
| Lymphoma    | C8122                 | C8122 Mixed cellularity classical Hodgkin lymphoma, intrathoracic lymph nodes                        |
| Lymphoma    | C8123                 | C8123 Mixed cellularity classical Hodgkin lymphoma, intra-abdominal lymph nodes                      |
| Lymphoma    | C8124                 | C8124 Mixed cellularity classical Hodgkin lymphoma, lymph nodes of axilla and upper limb             |
| Lymphoma    | C8125                 | C8125 Mixed cellularity classical Hodgkin lymphoma, lymph nodes of inguinal region and lower limb    |
| Lymphoma    | C8126                 | C8126 Mixed cellularity classical Hodgkin lymphoma, intrapelvic lymph nodes                          |
| Lymphoma    | C8127                 | C8127 Mixed cellularity classical Hodgkin lymphoma, spleen   |
| Lymphoma    | C8128                 | C8128 Mixed cellularity classical Hodgkin lymphoma, lymph nodes of multiple sites                    |
| Lymphoma    | C8129                 | C8129 Mixed cellularity classical Hodgkin lymphoma, extranodal and solid organ sites                 |
| Lymphoma    | C8130                 | C8130 Lymphocyte depleted classical Hodgkin lymphoma, unspecified site                               |
| Lymphoma    | C8131                 | C8131 Lymphocyte depleted classical Hodgkin lymphoma, lymph nodes of head, face, and neck            |
| Lymphoma    | C8132                 | C8132 Lymphocyte depleted classical Hodgkin lymphoma, intrathoracic lymph nodes                      |
| Lymphoma    | C8133                 | C8133 Lymphocyte depleted classical Hodgkin lymphoma, intra-abdominal lymph nodes                    |
| Lymphoma    | C8134                 | C8134 Lymphocyte depleted classical Hodgkin lymphoma, lymph nodes of axilla and upper limb           |
| Lymphoma    | C8135                 | C8135 Lymphocyte depleted classical Hodgkin lymphoma, lymph nodes of inguinal region and lower limb  |
| Lymphoma    | C8136                 | C8136 Lymphocyte depleted classical Hodgkin lymphoma, intrapelvic lymph nodes                        |
| Lymphoma    | C8137                 | C8137 Lymphocyte depleted classical Hodgkin lymphoma, spleen   |

### List of ICD-10 codes used for exclusions

| Comorbidity | ICD-10 Diagnosis Code | Description   |
|-------------|-----------------------|---|
| Lymphoma    | C8138                 | C8138 Lymphocyte depleted classical Hodgkin lymphoma, lymph nodes of multiple sites             |
| Lymphoma    | C8139                 | C8139 Lymphocyte depleted classical Hodgkin lymphoma, extranodal and solid organ sites          |
| Lymphoma    | C8140                 | C8140 Lymphocyte-rich classical Hodgkin lymphoma, unspecified site                              |
| Lymphoma    | C8141                 | C8141 Lymphocyte-rich classical Hodgkin lymphoma, lymph nodes of head, face, and neck           |
| Lymphoma    | C8142                 | C8142 Lymphocyte-rich classical Hodgkin lymphoma, intrathoracic lymph nodes                     |
| Lymphoma    | C8143                 | C8143 Lymphocyte-rich classical Hodgkin lymphoma, intra-abdominal lymph nodes                   |
| Lymphoma    | C8144                 | C8144 Lymphocyte-rich classical Hodgkin lymphoma, lymph nodes of axilla and upper limb          |
| Lymphoma    | C8145                 | C8145 Lymphocyte-rich classical Hodgkin lymphoma, lymph nodes of inguinal region and lower limb |
| Lymphoma    | C8146                 | C8146 Lymphocyte-rich classical Hodgkin lymphoma, intrapelvic lymph nodes                       |
| Lymphoma    | C8147                 | C8147 Lymphocyte-rich classical Hodgkin lymphoma, spleen  |
| Lymphoma    | C8148                 | C8148 Lymphocyte-rich classical Hodgkin lymphoma, lymph nodes of multiple sites                 |
| Lymphoma    | C8149                 | C8149 Lymphocyte-rich classical Hodgkin lymphoma, extranodal and solid organ sites              |
| Lymphoma    | C8170                 | C8170 Other classical Hodgkin lymphoma, unspecified site  |
| Lymphoma    | C8171                 | C8171 Other classical Hodgkin lymphoma, lymph nodes of head, face, and neck                     |
| Lymphoma    | C8172                 | C8172 Other classical Hodgkin lymphoma, intrathoracic lymph nodes                               |
| Lymphoma    | C8173                 | C8173 Other classical Hodgkin lymphoma, intra-abdominal lymph nodes                             |
| Lymphoma    | C8174                 | C8174 Other classical Hodgkin lymphoma, lymph nodes of axilla and upper limb                    |
| Lymphoma    | C8175                 | C8175 Other classical Hodgkin lymphoma, lymph nodes of inguinal region and lower limb           |
| Lymphoma    | C8176                 | C8176 Other classical Hodgkin lymphoma, intrapelvic lymph nodes                                 |
| Lymphoma    | C8177                 | C8177 Other classical Hodgkin lymphoma, spleen  |
| Lymphoma    | C8178                 | C8178 Other classical Hodgkin lymphoma, lymph nodes of multiple sites                           |
| Lymphoma    | C8179                 | C8179 Other classical Hodgkin lymphoma, extranodal and solid organ sites                        |
| Lymphoma    | C8190                 | C8190 Hodgkin lymphoma, unspecified, unspecified site   |
| Lymphoma    | C8191                 | C8191 Hodgkin lymphoma, unspecified, lymph nodes of head, face, and neck                        |
| Lymphoma    | C8192                 | C8192 Hodgkin lymphoma, unspecified, intrathoracic lymph nodes                                  |
| Lymphoma    | C8193                 | C8193 Hodgkin lymphoma, unspecified, intra-abdominal lymph nodes                                |
| Lymphoma    | C8194                 | C8194 Hodgkin lymphoma, unspecified, lymph nodes of axilla and upper limb                       |
| Lymphoma    | C8195                 | C8195 Hodgkin lymphoma, unspecified, lymph nodes of inguinal region and lower limb              |
| Lymphoma    | C8196                 | C8196 Hodgkin lymphoma, unspecified, intrapelvic lymph nodes                                    |
| Lymphoma    | C8197                 | C8197 Hodgkin lymphoma, unspecified, spleen   |
| Lymphoma    | C8198                 | C8198 Hodgkin lymphoma, unspecified, lymph nodes of multiple sites                              |
| Lymphoma    | C8199                 | C8199 Hodgkin lymphoma, unspecified, extranodal and solid organ sites                           |
| Lymphoma    | C8200                 | C8200 Follicular lymphoma grade I, unspecified site   |
| Lymphoma    | C8201                 | C8201 Follicular lymphoma grade I, lymph nodes of head, face, and neck                          |
| Lymphoma    | C8202                 | C8202 Follicular lymphoma grade I, intrathoracic lymph nodes                                    |
| Lymphoma    | C8203                 | C8203 Follicular lymphoma grade I, intra-abdominal lymph nodes                                  |
| Lymphoma    | C8204                 | C8204 Follicular lymphoma grade I, lymph nodes of axilla and upper limb                         |
| Lymphoma    | C8205                 | C8205 Follicular lymphoma grade I, lymph nodes of inguinal region and lower limb                |
| Lymphoma    | C8206                 | C8206 Follicular lymphoma grade I, intrapelvic lymph nodes                                      |
| Lymphoma    | C8207                 | C8207 Follicular lymphoma grade I, spleen   |
| Lymphoma    | C8208                 | C8208 Follicular lymphoma grade I, lymph nodes of multiple sites                                |
| Lymphoma    | C8209                 | C8209 Follicular lymphoma grade I, extranodal and solid organ sites                             |
| Lymphoma    | C8210                 | C8210 Follicular lymphoma grade II, unspecified site  |
| Lymphoma    | C8211                 | C8211 Follicular lymphoma grade II, lymph nodes of head, face, and neck                         |
| Lymphoma    | C8212                 | C8212 Follicular lymphoma grade II, intrathoracic lymph nodes                                   |
| Lymphoma    | C8213                 | C8213 Follicular lymphoma grade II, intra-abdominal lymph nodes                                 |
| Lymphoma    | C8214                 | C8214 Follicular lymphoma grade II, lymph nodes of axilla and upper limb                        |
| Lymphoma    | C8215                 | C8215 Follicular lymphoma grade II, lymph nodes of inguinal region and lower limb               |
| Lymphoma    | C8216                 | C8216 Follicular lymphoma grade II, intrapelvic lymph nodes                                     |
| Lymphoma    | C8217                 | C8217 Follicular lymphoma grade II, spleen  |
| Lymphoma    | C8218                 | C8218 Follicular lymphoma grade II, lymph nodes of multiple sites                               |
| Lymphoma    | C8219                 | C8219 Follicular lymphoma grade II, extranodal and solid organ sites                            |
| Lymphoma    | C8220                 | C8220 Follicular lymphoma grade III, unspecified, unspecified site                              |
| Lymphoma    | C8221                 | C8221 Follicular lymphoma grade III, unspecified, lymph nodes of head, face, and neck           |
| Lymphoma    | C8222                 | C8222 Follicular lymphoma grade III, unspecified, intrathoracic lymph nodes                     |
| Lymphoma    | C8223                 | C8223 Follicular lymphoma grade III, unspecified, intra-abdominal lymph nodes                   |
| Lymphoma    | C8224                 | C8224 Follicular lymphoma grade III, unspecified, lymph nodes of axilla and upper limb          |
| Lymphoma    | C8225                 | C8225 Follicular lymphoma grade III, unspecified, lymph nodes of inguinal region and lower limb |

### List of ICD-10 codes used for exclusions

| Comorbidity | ICD-10 Diagnosis Code | Description   |
|-------------|-----------------------|---|
| Lymphoma    | C8226                 | C8226 Follicular lymphoma grade III, unspecified, intrapelvic lymph nodes               |
| Lymphoma    | C8227                 | C8227 Follicular lymphoma grade III, unspecified, spleen                                |
| Lymphoma    | C8228                 | C8228 Follicular lymphoma grade III, unspecified, lymph nodes of multiple sites         |
| Lymphoma    | C8229                 | C8229 Follicular lymphoma grade III, unspecified, extranodal and solid organ sites      |
| Lymphoma    | C8230                 | C8230 Follicular lymphoma grade IIIa, unspecified site                                  |
| Lymphoma    | C8231                 | C8231 Follicular lymphoma grade IIIa, lymph nodes of head, face, and neck               |
| Lymphoma    | C8232                 | C8232 Follicular lymphoma grade IIIa, intrathoracic lymph nodes                         |
| Lymphoma    | C8233                 | C8233 Follicular lymphoma grade IIIa, intra-abdominal lymph nodes                       |
| Lymphoma    | C8234                 | C8234 Follicular lymphoma grade IIIa, lymph nodes of axilla and upper limb              |
| Lymphoma    | C8235                 | C8235 Follicular lymphoma grade IIIa, lymph nodes of inguinal region and lower limb     |
| Lymphoma    | C8236                 | C8236 Follicular lymphoma grade IIIa, intrapelvic lymph nodes                           |
| Lymphoma    | C8237                 | C8237 Follicular lymphoma grade IIIa, spleen  |
| Lymphoma    | C8238                 | C8238 Follicular lymphoma grade IIIa, lymph nodes of multiple sites                     |
| Lymphoma    | C8239                 | C8239 Follicular lymphoma grade IIIa, extranodal and solid organ sites                  |
| Lymphoma    | C8240                 | C8240 Follicular lymphoma grade IIIb, unspecified site                                  |
| Lymphoma    | C8241                 | C8241 Follicular lymphoma grade IIIb, lymph nodes of head, face, and neck               |
| Lymphoma    | C8242                 | C8242 Follicular lymphoma grade IIIb, intrathoracic lymph nodes                         |
| Lymphoma    | C8243                 | C8243 Follicular lymphoma grade IIIb, intra-abdominal lymph nodes                       |
| Lymphoma    | C8244                 | C8244 Follicular lymphoma grade IIIb, lymph nodes of axilla and upper limb              |
| Lymphoma    | C8245                 | C8245 Follicular lymphoma grade IIIb, lymph nodes of inguinal region and lower limb     |
| Lymphoma    | C8246                 | C8246 Follicular lymphoma grade IIIb, intrapelvic lymph nodes                           |
| Lymphoma    | C8247                 | C8247 Follicular lymphoma grade IIIb, spleen  |
| Lymphoma    | C8248                 | C8248 Follicular lymphoma grade IIIb, lymph nodes of multiple sites                     |
| Lymphoma    | C8249                 | C8249 Follicular lymphoma grade IIIb, extranodal and solid organ sites                  |
| Lymphoma    | C8250                 | C8250 Diffuse follicle center lymphoma, unspecified site                                |
| Lymphoma    | C8251                 | C8251 Diffuse follicle center lymphoma, lymph nodes of head, face, and neck             |
| Lymphoma    | C8252                 | C8252 Diffuse follicle center lymphoma, intrathoracic lymph nodes                       |
| Lymphoma    | C8253                 | C8253 Diffuse follicle center lymphoma, intra-abdominal lymph nodes                     |
| Lymphoma    | C8254                 | C8254 Diffuse follicle center lymphoma, lymph nodes of axilla and upper limb            |
| Lymphoma    | C8255                 | C8255 Diffuse follicle center lymphoma, lymph nodes of inguinal region and lower limb   |
| Lymphoma    | C8256                 | C8256 Diffuse follicle center lymphoma, intrapelvic lymph nodes                         |
| Lymphoma    | C8257                 | C8257 Diffuse follicle center lymphoma, spleen  |
| Lymphoma    | C8258                 | C8258 Diffuse follicle center lymphoma, lymph nodes of multiple sites                   |
| Lymphoma    | C8259                 | C8259 Diffuse follicle center lymphoma, extranodal and solid organ sites                |
| Lymphoma    | C8260                 | C8260 Cutaneous follicle center lymphoma, unspecified site                              |
| Lymphoma    | C8261                 | C8261 Cutaneous follicle center lymphoma, lymph nodes of head, face, and neck           |
| Lymphoma    | C8262                 | C8262 Cutaneous follicle center lymphoma, intrathoracic lymph nodes                     |
| Lymphoma    | C8263                 | C8263 Cutaneous follicle center lymphoma, intra-abdominal lymph nodes                   |
| Lymphoma    | C8264                 | C8264 Cutaneous follicle center lymphoma, lymph nodes of axilla and upper limb          |
| Lymphoma    | C8265                 | C8265 Cutaneous follicle center lymphoma, lymph nodes of inguinal region and lower limb |
| Lymphoma    | C8266                 | C8266 Cutaneous follicle center lymphoma, intrapelvic lymph nodes                       |
| Lymphoma    | C8267                 | C8267 Cutaneous follicle center lymphoma, spleen  |
| Lymphoma    | C8268                 | C8268 Cutaneous follicle center lymphoma, lymph nodes of multiple sites                 |
| Lymphoma    | C8269                 | C8269 Cutaneous follicle center lymphoma, extranodal and solid organ sites              |
| Lymphoma    | C8280                 | C8280 Other types of follicular lymphoma, unspecified site                              |
| Lymphoma    | C8281                 | C8281 Other types of follicular lymphoma, lymph nodes of head, face, and neck           |
| Lymphoma    | C8282                 | C8282 Other types of follicular lymphoma, intrathoracic lymph nodes                     |
| Lymphoma    | C8283                 | C8283 Other types of follicular lymphoma, intra-abdominal lymph nodes                   |
| Lymphoma    | C8284                 | C8284 Other types of follicular lymphoma, lymph nodes of axilla and upper limb          |
| Lymphoma    | C8285                 | C8285 Other types of follicular lymphoma, lymph nodes of inguinal region and lower limb |
| Lymphoma    | C8286                 | C8286 Other types of follicular lymphoma, intrapelvic lymph nodes                       |
| Lymphoma    | C8287                 | C8287 Other types of follicular lymphoma, spleen  |
| Lymphoma    | C8288                 | C8288 Other types of follicular lymphoma, lymph nodes of multiple sites                 |
| Lymphoma    | C8289                 | C8289 Other types of follicular lymphoma, extranodal and solid organ sites              |
| Lymphoma    | C8290                 | C8290 Follicular lymphoma, unspecified, unspecified site                                |
| Lymphoma    | C8291                 | C8291 Follicular lymphoma, unspecified, lymph nodes of head, face, and neck             |
| Lymphoma    | C8292                 | C8292 Follicular lymphoma, unspecified, intrathoracic lymph nodes                       |
| Lymphoma    | C8293                 | C8293 Follicular lymphoma, unspecified, intra-abdominal lymph nodes                     |
| Lymphoma    | C8294                 | C8294 Follicular lymphoma, unspecified, lymph nodes of axilla and upper limb            |
| Lymphoma    | C8295                 | C8295 Follicular lymphoma, unspecified, lymph nodes of inguinal region and lower limb   |
| Lymphoma    | C8296                 | C8296 Follicular lymphoma, unspecified, intrapelvic lymph nodes                         |
| Lymphoma    | C8297                 | C8297 Follicular lymphoma, unspecified, spleen  |
| Lymphoma    | C8298                 | C8298 Follicular lymphoma, unspecified, lymph nodes of multiple sites                   |

### List of ICD-10 codes used for exclusions

| Comorbidity | ICD-10 Diagnosis Code | Description   |
|-------------|-----------------------|---|
| Lymphoma    | C8299                 | C8299 Follicular lymphoma, unspecified, extranodal and solid organ sites                            |
| Lymphoma    | C8300                 | C8300 Small cell B-cell lymphoma, unspecified site  |
| Lymphoma    | C8301                 | C8301 Small cell B-cell lymphoma, lymph nodes of head, face, and neck                               |
| Lymphoma    | C8302                 | C8302 Small cell B-cell lymphoma, intrathoracic lymph nodes   |
| Lymphoma    | C8303                 | C8303 Small cell B-cell lymphoma, intra-abdominal lymph nodes                                       |
| Lymphoma    | C8304                 | C8304 Small cell B-cell lymphoma, lymph nodes of axilla and upper limb                              |
| Lymphoma    | C8305                 | C8305 Small cell B-cell lymphoma, lymph nodes of inguinal region and lower limb                     |
| Lymphoma    | C8306                 | C8306 Small cell B-cell lymphoma, intrapelvic lymph nodes   |
| Lymphoma    | C8307                 | C8307 Small cell B-cell lymphoma, spleen  |
| Lymphoma    | C8308                 | C8308 Small cell B-cell lymphoma, lymph nodes of multiple sites                                     |
| Lymphoma    | C8309                 | C8309 Small cell B-cell lymphoma, extranodal and solid organ sites                                  |
| Lymphoma    | C8310                 | C8310 Mantle cell lymphoma, unspecified site  |
| Lymphoma    | C8311                 | C8311 Mantle cell lymphoma, lymph nodes of head, face, and neck                                     |
| Lymphoma    | C8312                 | C8312 Mantle cell lymphoma, intrathoracic lymph nodes   |
| Lymphoma    | C8313                 | C8313 Mantle cell lymphoma, intra-abdominal lymph nodes   |
| Lymphoma    | C8314                 | C8314 Mantle cell lymphoma, lymph nodes of axilla and upper limb                                    |
| Lymphoma    | C8315                 | C8315 Mantle cell lymphoma, lymph nodes of inguinal region and lower limb                           |
| Lymphoma    | C8316                 | C8316 Mantle cell lymphoma, intrapelvic lymph nodes   |
| Lymphoma    | C8317                 | C8317 Mantle cell lymphoma, spleen  |
| Lymphoma    | C8318                 | C8318 Mantle cell lymphoma, lymph nodes of multiple sites   |
| Lymphoma    | C8319                 | C8319 Mantle cell lymphoma, extranodal and solid organ sites  |
| Lymphoma    | C8330                 | C8330 Diffuse large B-cell lymphoma, unspecified site   |
| Lymphoma    | C8331                 | C8331 Diffuse large B-cell lymphoma, lymph nodes of head, face, and neck                            |
| Lymphoma    | C8332                 | C8332 Diffuse large B-cell lymphoma, intrathoracic lymph nodes                                      |
| Lymphoma    | C8333                 | C8333 Diffuse large B-cell lymphoma, intra-abdominal lymph nodes                                    |
| Lymphoma    | C8334                 | C8334 Diffuse large B-cell lymphoma, lymph nodes of axilla and upper limb                           |
| Lymphoma    | C8335                 | C8335 Diffuse large B-cell lymphoma, lymph nodes of inguinal region and lower limb                  |
| Lymphoma    | C8336                 | C8336 Diffuse large B-cell lymphoma, intrapelvic lymph nodes  |
| Lymphoma    | C8337                 | C8337 Diffuse large B-cell lymphoma, spleen   |
| Lymphoma    | C8338                 | C8338 Diffuse large B-cell lymphoma, lymph nodes of multiple sites                                  |
| Lymphoma    | C8339                 | C8339 Diffuse large B-cell lymphoma, extranodal and solid organ sites                               |
| Lymphoma    | C8350                 | C8350 Lymphoblastic (diffuse) lymphoma, unspecified site  |
| Lymphoma    | C8351                 | C8351 Lymphoblastic (diffuse) lymphoma, lymph nodes of head, face, and neck                         |
| Lymphoma    | C8352                 | C8352 Lymphoblastic (diffuse) lymphoma, intrathoracic lymph nodes                                   |
| Lymphoma    | C8353                 | C8353 Lymphoblastic (diffuse) lymphoma, intra-abdominal lymph nodes                                 |
| Lymphoma    | C8354                 | C8354 Lymphoblastic (diffuse) lymphoma, lymph nodes of axilla and upper limb                        |
| Lymphoma    | C8355                 | C8355 Lymphoblastic (diffuse) lymphoma, lymph nodes of inguinal region and lower limb               |
| Lymphoma    | C8356                 | C8356 Lymphoblastic (diffuse) lymphoma, intrapelvic lymph nodes                                     |
| Lymphoma    | C8357                 | C8357 Lymphoblastic (diffuse) lymphoma, spleen  |
| Lymphoma    | C8358                 | C8358 Lymphoblastic (diffuse) lymphoma, lymph nodes of multiple sites                               |
| Lymphoma    | C8359                 | C8359 Lymphoblastic (diffuse) lymphoma, extranodal and solid organ sites                            |
| Lymphoma    | C8370                 | C8370 Burkitt lymphoma, unspecified site  |
| Lymphoma    | C8371                 | C8371 Burkitt lymphoma, lymph nodes of head, face, and neck   |
| Lymphoma    | C8372                 | C8372 Burkitt lymphoma, intrathoracic lymph nodes   |
| Lymphoma    | C8373                 | C8373 Burkitt lymphoma, intra-abdominal lymph nodes   |
| Lymphoma    | C8374                 | C8374 Burkitt lymphoma, lymph nodes of axilla and upper limb  |
| Lymphoma    | C8375                 | C8375 Burkitt lymphoma, lymph nodes of inguinal region and lower limb                               |
| Lymphoma    | C8376                 | C8376 Burkitt lymphoma, intrapelvic lymph nodes   |
| Lymphoma    | C8377                 | C8377 Burkitt lymphoma, spleen  |
| Lymphoma    | C8378                 | C8378 Burkitt lymphoma, lymph nodes of multiple sites   |
| Lymphoma    | C8379                 | C8379 Burkitt lymphoma, extranodal and solid organ sites  |
| Lymphoma    | C8380                 | C8380 Other non-follicular lymphoma, unspecified site   |
| Lymphoma    | C8381                 | C8381 Other non-follicular lymphoma, lymph nodes of head, face, and neck                            |
| Lymphoma    | C8382                 | C8382 Other non-follicular lymphoma, intrathoracic lymph nodes                                      |
| Lymphoma    | C8383                 | C8383 Other non-follicular lymphoma, intra-abdominal lymph nodes                                    |
| Lymphoma    | C8384                 | C8384 Other non-follicular lymphoma, lymph nodes of axilla and upper limb                           |
| Lymphoma    | C8385                 | C8385 Other non-follicular lymphoma, lymph nodes of inguinal region and lower limb                  |
| Lymphoma    | C8386                 | C8386 Other non-follicular lymphoma, intrapelvic lymph nodes  |
| Lymphoma    | C8387                 | C8387 Other non-follicular lymphoma, spleen   |
| Lymphoma    | C8388                 | C8388 Other non-follicular lymphoma, lymph nodes of multiple sites                                  |
| Lymphoma    | C8389                 | C8389 Other non-follicular lymphoma, extranodal and solid organ sites                               |
| Lymphoma    | C8390                 | C8390 Non-follicular (diffuse) lymphoma, unspecified, unspecified site                              |
| Lymphoma    | C8391                 | C8391 Non-follicular (diffuse) lymphoma, unspecified, lymph nodes of head, face, and neck           |
| Lymphoma    | C8392                 | C8392 Non-follicular (diffuse) lymphoma, unspecified, intrathoracic lymph nodes                     |
| Lymphoma    | C8393                 | C8393 Non-follicular (diffuse) lymphoma, unspecified, intra-abdominal lymph nodes                   |
| Lymphoma    | C8394                 | C8394 Non-follicular (diffuse) lymphoma, unspecified, lymph nodes of axilla and upper limb          |
| Lymphoma    | C8395                 | C8395 Non-follicular (diffuse) lymphoma, unspecified, lymph nodes of inguinal region and lower limb |

### List of ICD-10 codes used for exclusions

| Comorbidity | ICD-10 Diagnosis Code | Description   |
|-------------|-----------------------|---|
| Lymphoma    | C8396                 | C8396 Non-follicular (diffuse) lymphoma, unspecified, intrapelvic lymph nodes                     |
| Lymphoma    | C8397                 | C8397 Non-follicular (diffuse) lymphoma, unspecified, spleen                                      |
| Lymphoma    | C8398                 | C8398 Non-follicular (diffuse) lymphoma, unspecified, lymph nodes of multiple sites               |
| Lymphoma    | C8399                 | C8399 Non-follicular (diffuse) lymphoma, unspecified, extranodal and solid organ sites            |
| Lymphoma    | C8400                 | C8400 Mycosis fungoides, unspecified site   |
| Lymphoma    | C8401                 | C8401 Mycosis fungoides, lymph nodes of head, face, and neck                                      |
| Lymphoma    | C8402                 | C8402 Mycosis fungoides, intrathoracic lymph nodes  |
| Lymphoma    | C8403                 | C8403 Mycosis fungoides, intra-abdominal lymph nodes  |
| Lymphoma    | C8404                 | C8404 Mycosis fungoides, lymph nodes of axilla and upper limb                                     |
| Lymphoma    | C8405                 | C8405 Mycosis fungoides, lymph nodes of inguinal region and lower limb                            |
| Lymphoma    | C8406                 | C8406 Mycosis fungoides, intrapelvic lymph nodes  |
| Lymphoma    | C8407                 | C8407 Mycosis fungoides, spleen   |
| Lymphoma    | C8408                 | C8408 Mycosis fungoides, lymph nodes of multiple sites  |
| Lymphoma    | C8409                 | C8409 Mycosis fungoides, extranodal and solid organ sites   |
| Lymphoma    | C8410                 | C8410 Sezary disease, unspecified site  |
| Lymphoma    | C8411                 | C8411 Sezary disease, lymph nodes of head, face, and neck   |
| Lymphoma    | C8412                 | C8412 Sezary disease, intrathoracic lymph nodes   |
| Lymphoma    | C8413                 | C8413 Sezary disease, intra-abdominal lymph nodes   |
| Lymphoma    | C8414                 | C8414 Sezary disease, lymph nodes of axilla and upper limb  |
| Lymphoma    | C8415                 | C8415 Sezary disease, lymph nodes of inguinal region and lower limb                               |
| Lymphoma    | C8416                 | C8416 Sezary disease, intrapelvic lymph nodes   |
| Lymphoma    | C8417                 | C8417 Sezary disease, spleen  |
| Lymphoma    | C8418                 | C8418 Sezary disease, lymph nodes of multiple sites   |
| Lymphoma    | C8419                 | C8419 Sezary disease, extranodal and solid organ sites  |
| Lymphoma    | C8440                 | C8440 Peripheral T-cell lymphoma, not classified, unspecified site                                |
| Lymphoma    | C8441                 | C8441 Peripheral T-cell lymphoma, not classified, lymph nodes of head, face, and neck             |
| Lymphoma    | C8442                 | C8442 Peripheral T-cell lymphoma, not classified, intrathoracic lymph nodes                       |
| Lymphoma    | C8443                 | C8443 Peripheral T-cell lymphoma, not classified, intra-abdominal lymph nodes                     |
| Lymphoma    | C8444                 | C8444 Peripheral T-cell lymphoma, not classified, lymph nodes of axilla and upper limb            |
| Lymphoma    | C8445                 | C8445 Peripheral T-cell lymphoma, not classified, lymph nodes of inguinal region and lower limb   |
| Lymphoma    | C8446                 | C8446 Peripheral T-cell lymphoma, not classified, intrapelvic lymph nodes                         |
| Lymphoma    | C8447                 | C8447 Peripheral T-cell lymphoma, not classified, spleen  |
| Lymphoma    | C8448                 | C8448 Peripheral T-cell lymphoma, not classified, lymph nodes of multiple sites                   |
| Lymphoma    | C8449                 | C8449 Peripheral T-cell lymphoma, not classified, extranodal and solid organ sites                |
| Lymphoma    | C8460                 | C8460 Anaplastic large cell lymphoma, ALK-positive, unspecified site                              |
| Lymphoma    | C8461                 | C8461 Anaplastic large cell lymphoma, ALK-positive, lymph nodes of head, face, and neck           |
| Lymphoma    | C8462                 | C8462 Anaplastic large cell lymphoma, ALK-positive, intrathoracic lymph nodes                     |
| Lymphoma    | C8463                 | C8463 Anaplastic large cell lymphoma, ALK-positive, intra-abdominal lymph nodes                   |
| Lymphoma    | C8464                 | C8464 Anaplastic large cell lymphoma, ALK-positive, lymph nodes of axilla and upper limb          |
| Lymphoma    | C8465                 | C8465 Anaplastic large cell lymphoma, ALK-positive, lymph nodes of inguinal region and lower limb |
| Lymphoma    | C8466                 | C8466 Anaplastic large cell lymphoma, ALK-positive, intrapelvic lymph nodes                       |
| Lymphoma    | C8467                 | C8467 Anaplastic large cell lymphoma, ALK-positive, spleen  |
| Lymphoma    | C8468                 | C8468 Anaplastic large cell lymphoma, ALK-positive, lymph nodes of multiple sites                 |
| Lymphoma    | C8469                 | C8469 Anaplastic large cell lymphoma, ALK-positive, extranodal and solid organ sites              |
| Lymphoma    | C8470                 | C8470 Anaplastic large cell lymphoma, ALK-negative, unspecified site                              |
| Lymphoma    | C8471                 | C8471 Anaplastic large cell lymphoma, ALK-negative, lymph nodes of head, face, and neck           |
| Lymphoma    | C8472                 | C8472 Anaplastic large cell lymphoma, ALK-negative, intrathoracic lymph nodes                     |
| Lymphoma    | C8473                 | C8473 Anaplastic large cell lymphoma, ALK-negative, intra-abdominal lymph nodes                   |
| Lymphoma    | C8474                 | C8474 Anaplastic large cell lymphoma, ALK-negative, lymph nodes of axilla and upper limb          |
| Lymphoma    | C8475                 | C8475 Anaplastic large cell lymphoma, ALK-negative, lymph nodes of inguinal region and lower limb |
| Lymphoma    | C8476                 | C8476 Anaplastic large cell lymphoma, ALK-negative, intrapelvic lymph nodes                       |
| Lymphoma    | C8477                 | C8477 Anaplastic large cell lymphoma, ALK-negative, spleen  |
| Lymphoma    | C8478                 | C8478 Anaplastic large cell lymphoma, ALK-negative, lymph nodes of multiple sites                 |
| Lymphoma    | C8479                 | C8479 Anaplastic large cell lymphoma, ALK-negative, extranodal and solid organ sites              |

### List of ICD-10 codes used for exclusions

| Comorbidity | ICD-10 Diagnosis Code | Description   |
|-------------|-----------------------|---|
| Lymphoma    | C8490                 | C8490 Mature T/NK-cell lymphomas, unspecified, unspecified site                                 |
| Lymphoma    | C8491                 | C8491 Mature T/NK-cell lymphomas, unspecified, lymph nodes of head, face, and neck              |
| Lymphoma    | C8492                 | C8492 Mature T/NK-cell lymphomas, unspecified, intrathoracic lymph nodes                        |
| Lymphoma    | C8493                 | C8493 Mature T/NK-cell lymphomas, unspecified, intra-abdominal lymph nodes                      |
| Lymphoma    | C8494                 | C8494 Mature T/NK-cell lymphomas, unspecified, lymph nodes of axilla and upper limb             |
| Lymphoma    | C8495                 | C8495 Mature T/NK-cell lymphomas, unspecified, lymph nodes of inguinal region and lower limb    |
| Lymphoma    | C8496                 | C8496 Mature T/NK-cell lymphomas, unspecified, intrapelvic lymph nodes                          |
| Lymphoma    | C8497                 | C8497 Mature T/NK-cell lymphomas, unspecified, spleen   |
| Lymphoma    | C8498                 | C8498 Mature T/NK-cell lymphomas, unspecified, lymph nodes of multiple sites                    |
| Lymphoma    | C8499                 | C8499 Mature T/NK-cell lymphomas, unspecified, extranodal and solid organ sites                 |
| Lymphoma    | C84A0                 | C84A0 Cutaneous T-cell lymphoma, unspecified, unspecified site                                  |
| Lymphoma    | C84A1                 | C84A1 Cutaneous T-cell lymphoma, unspecified lymph nodes of head, face, and neck                |
| Lymphoma    | C84A2                 | C84A2 Cutaneous T-cell lymphoma, unspecified, intrathoracic lymph nodes                         |
| Lymphoma    | C84A3                 | C84A3 Cutaneous T-cell lymphoma, unspecified, intra-abdominal lymph nodes                       |
| Lymphoma    | C84A4                 | C84A4 Cutaneous T-cell lymphoma, unspecified, lymph nodes of axilla and upper limb              |
| Lymphoma    | C84A5                 | C84A5 Cutaneous T-cell lymphoma, unspecified, lymph nodes of inguinal region and lower limb     |
| Lymphoma    | C84A6                 | C84A6 Cutaneous T-cell lymphoma, unspecified, intrapelvic lymph nodes                           |
| Lymphoma    | C84A7                 | C84A7 Cutaneous T-cell lymphoma, unspecified, spleen  |
| Lymphoma    | C84A8                 | C84A8 Cutaneous T-cell lymphoma, unspecified, lymph nodes of multiple sites                     |
| Lymphoma    | C84A9                 | C84A9 Cutaneous T-cell lymphoma, unspecified, extranodal and solid organ sites                  |
| Lymphoma    | C84Z0                 | C84Z0 Other mature T/NK-cell lymphomas, unspecified site  |
| Lymphoma    | C84Z1                 | C84Z1 Other mature T/NK-cell lymphomas, lymph nodes of head, face, and neck                     |
| Lymphoma    | C84Z2                 | C84Z2 Other mature T/NK-cell lymphomas, intrathoracic lymph nodes                               |
| Lymphoma    | C84Z3                 | C84Z3 Other mature T/NK-cell lymphomas, intra-abdominal lymph nodes                             |
| Lymphoma    | C84Z4                 | C84Z4 Other mature T/NK-cell lymphomas, lymph nodes of axilla and upper limb                    |
| Lymphoma    | C84Z5                 | C84Z5 Other mature T/NK-cell lymphomas, lymph nodes of inguinal region and lower limb           |
| Lymphoma    | C84Z6                 | C84Z6 Other mature T/NK-cell lymphomas, intrapelvic lymph nodes                                 |
| Lymphoma    | C84Z7                 | C84Z7 Other mature T/NK-cell lymphomas, spleen  |
| Lymphoma    | C84Z8                 | C84Z8 Other mature T/NK-cell lymphomas, lymph nodes of multiple sites                           |
| Lymphoma    | C84Z9                 | C84Z9 Other mature T/NK-cell lymphomas, extranodal and solid organ sites                        |
| Lymphoma    | C8510                 | C8510 Unspecified B-cell lymphoma, unspecified site   |
| Lymphoma    | C8511                 | C8511 Unspecified B-cell lymphoma, lymph nodes of head, face, and neck                          |
| Lymphoma    | C8512                 | C8512 Unspecified B-cell lymphoma, intrathoracic lymph nodes                                    |
| Lymphoma    | C8513                 | C8513 Unspecified B-cell lymphoma, intra-abdominal lymph nodes                                  |
| Lymphoma    | C8514                 | C8514 Unspecified B-cell lymphoma, lymph nodes of axilla and upper limb                         |
| Lymphoma    | C8515                 | C8515 Unspecified B-cell lymphoma, lymph nodes of inguinal region and lower limb                |
| Lymphoma    | C8516                 | C8516 Unspecified B-cell lymphoma, intrapelvic lymph nodes                                      |
| Lymphoma    | C8517                 | C8517 Unspecified B-cell lymphoma, spleen   |
| Lymphoma    | C8518                 | C8518 Unspecified B-cell lymphoma, lymph nodes of multiple sites                                |
| Lymphoma    | C8519                 | C8519 Unspecified B-cell lymphoma, extranodal and solid organ sites                             |
| Lymphoma    | C8520                 | C8520 Mediastinal (thymic) large B-cell lymphoma, unspecified site                              |
| Lymphoma    | C8521                 | C8521 Mediastinal (thymic) large B-cell lymphoma, lymph nodes of head, face, and neck           |
| Lymphoma    | C8522                 | C8522 Mediastinal (thymic) large B-cell lymphoma, intrathoracic lymph nodes                     |
| Lymphoma    | C8523                 | C8523 Mediastinal (thymic) large B-cell lymphoma, intra-abdominal lymph nodes                   |
| Lymphoma    | C8524                 | C8524 Mediastinal (thymic) large B-cell lymphoma, lymph nodes of axilla and upper limb          |
| Lymphoma    | C8525                 | C8525 Mediastinal (thymic) large B-cell lymphoma, lymph nodes of inguinal region and lower limb |
| Lymphoma    | C8526                 | C8526 Mediastinal (thymic) large B-cell lymphoma, intrapelvic lymph nodes                       |
| Lymphoma    | C8527                 | C8527 Mediastinal (thymic) large B-cell lymphoma, spleen  |
| Lymphoma    | C8528                 | C8528 Mediastinal (thymic) large B-cell lymphoma, lymph nodes of multiple sites                 |
| Lymphoma    | C8529                 | C8529 Mediastinal (thymic) large B-cell lymphoma, extranodal and solid organ sites              |
| Lymphoma    | C8580                 | C8580 Other specified types of non-Hodgkin lymphoma, unspecified site                           |
| Lymphoma    | C8581                 | C8581 Other specified types of non-Hodgkin lymphoma, lymph nodes of head, face, and neck        |
| Lymphoma    | C8582                 | C8582 Other specified types of non-Hodgkin lymphoma, intrathoracic lymph nodes                  |

### List of ICD-10 codes used for exclusions

| Comorbidity | ICD-10 Diagnosis Code | Description  |
|-------------|-----------------------|--|
| Lymphoma    | C8583                 | C8583 Other specified types of non-Hodgkin lymphoma, intra-abdominal lymph nodes                   |
| Lymphoma    | C8584                 | C8584 Other specified types of non-Hodgkin lymphoma, lymph nodes of axilla and upper limb          |
| Lymphoma    | C8585                 | C8585 Other specified types of non-Hodgkin lymphoma, lymph nodes of inguinal region and lower limb |
| Lymphoma    | C8586                 | C8586 Other specified types of non-Hodgkin lymphoma, intrapelvic lymph nodes                       |
| Lymphoma    | C8587                 | C8587 Other specified types of non-Hodgkin lymphoma, spleen  |
| Lymphoma    | C8588                 | C8588 Other specified types of non-Hodgkin lymphoma, lymph nodes of multiple sites                 |
| Lymphoma    | C8589                 | C8589 Other specified types of non-Hodgkin lymphoma, extranodal and solid organ sites              |
| Lymphoma    | C8590                 | C8590 Non-Hodgkin lymphoma, unspecified, unspecified site  |
| Lymphoma    | C8591                 | C8591 Non-Hodgkin lymphoma, unspecified, lymph nodes of head, face, and neck                       |
| Lymphoma    | C8592                 | C8592 Non-Hodgkin lymphoma, unspecified, intrathoracic lymph nodes                                 |
| Lymphoma    | C8593                 | C8593 Non-Hodgkin lymphoma, unspecified, intra-abdominal lymph nodes                               |
| Lymphoma    | C8594                 | C8594 Non-Hodgkin lymphoma, unspecified, lymph nodes of axilla and upper limb                      |
| Lymphoma    | C8595                 | C8595 Non-Hodgkin lymphoma, unspecified, lymph nodes of inguinal region and lower limb             |
| Lymphoma    | C8596                 | C8596 Non-Hodgkin lymphoma, unspecified, intrapelvic lymph nodes                                   |
| Lymphoma    | C8597                 | C8597 Non-Hodgkin lymphoma, unspecified, spleen  |
| Lymphoma    | C8598                 | C8598 Non-Hodgkin lymphoma, unspecified, lymph nodes of multiple sites                             |
| Lymphoma    | C8599                 | C8599 Non-Hodgkin lymphoma, unspecified, extranodal and solid organ sites                          |
| Lymphoma    | C860                  | C860 Extranodal NK/T-cell lymphoma, nasal type   |
| Lymphoma    | C861                  | C861 Hepatosplenic T-cell lymphoma   |
| Lymphoma    | C862                  | C862 Enteropathy-type (intestinal) T-cell lymphoma   |
| Lymphoma    | C863                  | C863 Subcutaneous panniculitis-like T-cell lymphoma  |
| Lymphoma    | C864                  | C864 Blastic NK-cell lymphoma  |
| Lymphoma    | C865                  | C865 Angioimmunoblastic T-cell lymphoma  |
| Lymphoma    | C866                  | C866 Primary cutaneous CD30-positive T-cell proliferations   |
| Lymphoma    | C884                  | C884 Extranodal marginal zone B-cell lymphoma of mucosa-associated lymphoid tissue [MALT-lymphoma] |
| Lymphoma    | C9140                 | C9140 Hairy cell leukemia not having achieved remission  |
| Lymphoma    | C9141                 | C9141 Hairy cell leukemia, in remission  |
| Lymphoma    | C9142                 | C9142 Hairy cell leukemia, in relapse  |
| Lymphoma    | C960                  | C960 Multifocal and multisystemic (disseminated) Langerhans-cell histiocytosis                     |
| Lymphoma    | C962                  | C962 Malignant mast cell tumor   |
| Lymphoma    | C964                  | C964 Sarcoma of dendritic cells (accessory cells)  |
| Lymphoma    | C969                  | C969 Malignant neoplasm of lymphoid, hematopoietic and related tissue, unspecified                 |
| Lymphoma    | C96A                  | C96A Histiocytic sarcoma   |
| Lymphoma    | C96Z                  | C96Z Other specified malignant neoplasms of lymphoid, hematopoietic and related tissue             |
| Lymphoma    | D4721                 | D4721 Post-transplant lymphoproliferative disorder (PTLD)  |
| Metastatic  | C770                  | C770 Secondary and unspecified malignant neoplasm of lymph nodes of head, face and neck            |
| Metastatic  | C771                  | C771 Secondary and unspecified malignant neoplasm of intrathoracic lymph nodes                     |
| Metastatic  | C772                  | C772 Secondary and unspecified malignant neoplasm of intra-abdominal lymph nodes                   |
| Metastatic  | C773                  | C773 Secondary and unspecified malignant neoplasm of axilla and upper limb lymph nodes             |
| Metastatic  | C774                  | C774 Secondary and unspecified malignant neoplasm of inguinal and lower limb lymph nodes           |
| Metastatic  | C775                  | C775 Secondary and unspecified malignant neoplasm of intrapelvic lymph nodes                       |
| Metastatic  | C778                  | C778 Secondary and unspecified malignant neoplasm of lymph nodes of multiple regions               |
| Metastatic  | C779                  | C779 Secondary and unspecified malignant neoplasm of lymph node, unspecified                       |
| Metastatic  | C7800                 | C7800 Secondary malignant neoplasm of unspecified lung   |
| Metastatic  | C7801                 | C7801 Secondary malignant neoplasm of right lung   |
| Metastatic  | C7802                 | C7802 Secondary malignant neoplasm of left lung  |
| Metastatic  | C781                  | C781 Secondary malignant neoplasm of mediastinum   |
| Metastatic  | C782                  | C782 Secondary malignant neoplasm of pleura  |
| Metastatic  | C7830                 | C7830 Secondary malignant neoplasm of unspecified respiratory organ                                |
| Metastatic  | C7839                 | C7839 Secondary malignant neoplasm of other respiratory organs                                     |
| Metastatic  | C784                  | C784 Secondary malignant neoplasm of small intestine   |
| Metastatic  | C785                  | C785 Secondary malignant neoplasm of large intestine and rectum                                    |
| Metastatic  | C786                  | C786 Secondary malignant neoplasm of retroperitoneum and peritoneum                                |
| Metastatic  | C787                  | C787 Secondary malignant neoplasm of liver and intrahepatic bile duct                              |
| Metastatic  | C7880                 | C7880 Secondary malignant neoplasm of unspecified digestive organ                                  |
| Metastatic  | C7889                 | C7889 Secondary malignant neoplasm of other digestive organs                                       |
| Metastatic  | C7900                 | C7900 Secondary malignant neoplasm of unspecified kidney and renal pelvis                          |

### List of ICD-10 codes used for exclusions

| Comorbidity  | ICD-10 Diagnosis Code | Description   |
|--------------|-----------------------|---|
| Metastatic   | C7901                 | C7901 Secondary malignant neoplasm of right kidney and renal pelvis                                 |
| Metastatic   | C7902                 | C7902 Secondary malignant neoplasm of left kidney and renal pelvis                                  |
| Metastatic   | C7910                 | C7910 Secondary malignant neoplasm of unspecified urinary organs                                    |
| Metastatic   | C7911                 | C7911 Secondary malignant neoplasm of bladder   |
| Metastatic   | C7919                 | C7919 Secondary malignant neoplasm of other urinary organs  |
| Metastatic   | C792                  | C792 Secondary malignant neoplasm of skin   |
| Metastatic   | C7931                 | C7931 Secondary malignant neoplasm of brain   |
| Metastatic   | C7932                 | C7932 Secondary malignant neoplasm of cerebral meninges   |
| Metastatic   | C7940                 | C7940 Secondary malignant neoplasm of unspecified part of nervous system                            |
| Metastatic   | C7949                 | C7949 Secondary malignant neoplasm of other parts of nervous system                                 |
| Metastatic   | C7951                 | C7951 Secondary malignant neoplasm of bone  |
| Metastatic   | C7952                 | C7952 Secondary malignant neoplasm of bone marrow   |
| Metastatic   | C7960                 | C7960 Secondary malignant neoplasm of unspecified ovary   |
| Metastatic   | C7961                 | C7961 Secondary malignant neoplasm of right ovary   |
| Metastatic   | C7962                 | C7962 Secondary malignant neoplasm of left ovary  |
| Metastatic   | C7970                 | C7970 Secondary malignant neoplasm of unspecified adrenal gland                                     |
| Metastatic   | C7971                 | C7971 Secondary malignant neoplasm of right adrenal gland   |
| Metastatic   | C7972                 | C7972 Secondary malignant neoplasm of left adrenal gland  |
| Metastatic   | C7981                 | C7981 Secondary malignant neoplasm of breast  |
| Metastatic   | C7982                 | C7982 Secondary malignant neoplasm of genital organs  |
| Metastatic   | C7989                 | C7989 Secondary malignant neoplasm of other specified sites   |
| Metastatic   | C799                  | C799 Secondary malignant neoplasm of unspecified site   |
| Metastatic   | C800                  | C800 Disseminated malignant neoplasm, unspecified   |
| Myeloma, etc | C882                  | C882 Heavy chain disease  |
| Myeloma, etc | C883                  | C883 Immunoproliferative small intestinal disease   |
| Myeloma, etc | C888                  | C888 Other malignant immunoproliferative diseases   |
| Myeloma, etc | C889                  | C889 Malignant immunoproliferative disease, unspecified   |
| Myeloma, etc | C9000                 | C9000 Multiple myeloma not having achieved remission  |
| Myeloma, etc | C9001                 | C9001 Multiple myeloma in remission   |
| Myeloma, etc | C9002                 | C9002 Multiple myeloma in relapse   |
| Myeloma, etc | C9010                 | C9010 Plasma cell leukemia not having achieved remission  |
| Myeloma, etc | C9012                 | C9012 Plasma cell leukemia in relapse   |
| Myeloma, etc | C9020                 | C9020 Extramedullary plasmacytoma not having achieved remission                                     |
| Myeloma, etc | C9022                 | C9022 Extramedullary plasmacytoma in relapse  |
| Myeloma, etc | C9030                 | C9030 Solitary plasmacytoma not having achieved remission   |
| Myeloma, etc | C9032                 | C9032 Solitary plasmacytoma in relapse  |
| Myeloma, etc | C9440                 | C9440 Acute panmyelosis with myelofibrosis not having achieved remission                            |
| Myeloma, etc | C9441                 | C9441 Acute panmyelosis with myelofibrosis, in remission  |
| Myeloma, etc | C9442                 | C9442 Acute panmyelosis with myelofibrosis, in relapse  |
| Myeloma, etc | C946                  | C946 Myelodysplastic disease, not classified  |
| Myeloma, etc | D460                  | D460 Refractory anemia without ring sideroblasts, so stated   |
| Myeloma, etc | D461                  | D461 Refractory anemia with ring sideroblasts   |
| Myeloma, etc | D4620                 | D4620 Refractory anemia with excess of blasts, unspecified  |
| Myeloma, etc | D4621                 | D4621 Refractory anemia with excess of blasts 1   |
| Myeloma, etc | D4622                 | D4622 Refractory anemia with excess of blasts 2   |
| Myeloma, etc | D464                  | D464 Refractory anemia, unspecified   |
| Myeloma, etc | D469                  | D469 Myelodysplastic syndrome, unspecified  |
| Myeloma, etc | D46A                  | D46A Refractory cytopenia with multilineage dysplasia   |
| Myeloma, etc | D46B                  | D46B Refractory cytopenia with multilineage dysplasia and ring sideroblasts                         |
| Myeloma, etc | D46C                  | D46C Myelodysplastic syndrome with isolated del(5q) chromosomal abnormality                         |
| Myeloma, etc | D46Z                  | D46Z Other myelodysplastic syndromes  |
| Myeloma, etc | D471                  | D471 Chronic myeloproliferative disease   |
| Myeloma, etc | D473                  | D473 Essential (hemorrhagic) thrombocythemia  |
| Myeloma, etc | D474                  | D474 Osteomyelofibrosis   |
| Myeloma, etc | D479                  | D479 Neoplasm of uncertain behavior of lymphoid, hematopoietic and related tissue, unspecified      |
| Myeloma, etc | D4729                 | D4729 Other specified neoplasms of uncertain behavior of lymphoid, hematopoietic and related tissue |
| Myeloma, etc | D7589                 | D7589 Other specified diseases of blood and blood-forming organs                                    |
| Myeloma, etc | D77                   | D77 Other disorders of blood and blood-forming organs in diseases classified elsewhere              |
| Myeloma, etc | D892                  | D892 Hypergammaglobulinemia, unspecified  |
| Other cancer | C4000                 | C4000 Malignant neoplasm of scapula and long bones of unspecified upper limb                        |
| Other cancer | C4001                 | C4001 Malignant neoplasm of scapula and long bones of right upper limb                              |
| Other cancer | C4002                 | C4002 Malignant neoplasm of scapula and long bones of left upper limb                               |
| Other cancer | C4010                 | C4010 Malignant neoplasm of short bones of unspecified upper limb                                   |
| Other cancer | C4011                 | C4011 Malignant neoplasm of short bones of right upper limb   |
| Other cancer | C4012                 | C4012 Malignant neoplasm of short bones of left upper limb  |
| Other cancer | C4020                 | C4020 Malignant neoplasm of long bones of unspecified lower limb                                    |
| Other cancer | C4021                 | C4021 Malignant neoplasm of long bones of right lower limb  |
| Other cancer | C4022                 | C4022 Malignant neoplasm of long bones of left lower limb   |
| Other cancer | C4030                 | C4030 Malignant neoplasm of short bones of unspecified lower limb                                   |
| Other cancer | C4031                 | C4031 Malignant neoplasm of short bones of right lower limb   |
| Other cancer | C4032                 | C4032 Malignant neoplasm of short bones of left lower limb  |
| Other cancer | C4080                 | C4080 Malignant neoplasm of overlapping sites of bone and articular cartilage of unspecified limb   |



### List of ICD-10 codes used for exclusions

| Comorbidity  | ICD-10 Diagnosis Code | Description  |
|--------------|-----------------------|--|
| Other cancer | C4081                 | C4081 Malignant neoplasm of overlapping sites of bone and articular cartilage of right limb          |
| Other cancer | C4082                 | C4082 Malignant neoplasm of overlapping sites of bone and articular cartilage of left limb           |
| Other cancer | C4090                 | C4090 Malignant neoplasm of unspecified bones and articular cartilage of unspecified limb            |
| Other cancer | C4091                 | C4091 Malignant neoplasm of unspecified bones and articular cartilage of right limb                  |
| Other cancer | C4092                 | C4092 Malignant neoplasm of unspecified bones and articular cartilage of left limb                   |
| Other cancer | C410                  | C410 Malignant neoplasm of bones of skull and face   |
| Other cancer | C411                  | C411 Malignant neoplasm of mandible  |
| Other cancer | C412                  | C412 Malignant neoplasm of vertebral column  |
| Other cancer | C413                  | C413 Malignant neoplasm of ribs, sternum and clavicle  |
| Other cancer | C414                  | C414 Malignant neoplasm of pelvic bones, sacrum and coccyx   |
| Other cancer | C419                  | C419 Malignant neoplasm of bone and articular cartilage, unspecified                                 |
| Other cancer | C460                  | C460 Kaposi's sarcoma of skin  |
| Other cancer | C461                  | C461 Kaposi's sarcoma of soft tissue   |
| Other cancer | C462                  | C462 Kaposi's sarcoma of palate  |
| Other cancer | C463                  | C463 Kaposi's sarcoma of lymph nodes   |
| Other cancer | C464                  | C464 Kaposi's sarcoma of gastrointestinal sites  |
| Other cancer | C4650                 | C4650 Kaposi's sarcoma of unspecified lung   |
| Other cancer | C4651                 | C4651 Kaposi's sarcoma of right lung   |
| Other cancer | C4652                 | C4652 Kaposi's sarcoma of left lung  |
| Other cancer | C467                  | C467 Kaposi's sarcoma of other sites   |
| Other cancer | C469                  | C469 Kaposi's sarcoma, unspecified   |
| Other cancer | C470                  | C470 Malignant neoplasm of peripheral nerves of head, face and neck                                  |
| Other cancer | C4710                 | C4710 Malignant neoplasm of peripheral nerves of unspecified upper limb, including shoulder          |
| Other cancer | C4711                 | C4711 Malignant neoplasm of peripheral nerves of right upper limb, including shoulder                |
| Other cancer | C4712                 | C4712 Malignant neoplasm of peripheral nerves of left upper limb, including shoulder                 |
| Other cancer | C4720                 | C4720 Malignant neoplasm of peripheral nerves of unspecified lower limb, including hip               |
| Other cancer | C4721                 | C4721 Malignant neoplasm of peripheral nerves of right lower limb, including hip                     |
| Other cancer | C4722                 | C4722 Malignant neoplasm of peripheral nerves of left lower limb, including hip                      |
| Other cancer | C473                  | C473 Malignant neoplasm of peripheral nerves of thorax   |
| Other cancer | C474                  | C474 Malignant neoplasm of peripheral nerves of abdomen  |
| Other cancer | C475                  | C475 Malignant neoplasm of peripheral nerves of pelvis   |
| Other cancer | C476                  | C476 Malignant neoplasm of peripheral nerves of trunk, unspecified                                   |
| Other cancer | C478                  | C478 Malignant neoplasm of overlapping sites of peripheral nerves and autonomic nervous system       |
| Other cancer | C479                  | C479 Malignant neoplasm of peripheral nerves and autonomic nervous system, unspecified               |
| Other cancer | C490                  | C490 Malignant neoplasm of connective and soft tissue of head, face and neck                         |
| Other cancer | C4910                 | C4910 Malignant neoplasm of connective and soft tissue of unspecified upper limb, including shoulder |
| Other cancer | C4911                 | C4911 Malignant neoplasm of connective and soft tissue of right upper limb, including shoulder       |
| Other cancer | C4912                 | C4912 Malignant neoplasm of connective and soft tissue of left upper limb, including shoulder        |
| Other cancer | C4920                 | C4920 Malignant neoplasm of connective and soft tissue of unspecified lower limb, including hip      |
| Other cancer | C4921                 | C4921 Malignant neoplasm of connective and soft tissue of right lower limb, including hip            |
| Other cancer | C4922                 | C4922 Malignant neoplasm of connective and soft tissue of left lower limb, including hip             |
| Other cancer | C493                  | C493 Malignant neoplasm of connective and soft tissue of thorax                                      |
| Other cancer | C494                  | C494 Malignant neoplasm of connective and soft tissue of abdomen                                     |
| Other cancer | C495                  | C495 Malignant neoplasm of connective and soft tissue of pelvis                                      |
| Other cancer | C496                  | C496 Malignant neoplasm of connective and soft tissue of trunk, unspecified                          |
| Other cancer | C498                  | C498 Malignant neoplasm of overlapping sites of connective and soft tissue                           |
| Other cancer | C499                  | C499 Malignant neoplasm of connective and soft tissue, unspecified                                   |
| Other cancer | C561                  | C561 Malignant neoplasm of right ovary   |
| Other cancer | C562                  | C562 Malignant neoplasm of left ovary  |
| Other cancer | C569                  | C569 Malignant neoplasm of unspecified ovary   |
| Other cancer | C5700                 | C5700 Malignant neoplasm of unspecified fallopian tube   |
| Other cancer | C5701                 | C5701 Malignant neoplasm of right fallopian tube   |
| Other cancer | C5702                 | C5702 Malignant neoplasm of left fallopian tube  |
| Other cancer | C5710                 | C5710 Malignant neoplasm of unspecified broad ligament   |
| Other cancer | C5711                 | C5711 Malignant neoplasm of right broad ligament   |
| Other cancer | C5712                 | C5712 Malignant neoplasm of left broad ligament  |
| Other cancer | C5720                 | C5720 Malignant neoplasm of unspecified round ligament   |
| Other cancer | C5721                 | C5721 Malignant neoplasm of right round ligament   |
| Other cancer | C5722                 | C5722 Malignant neoplasm of left round ligament  |

# List of ICD-10 codes used for exclusions

| Comorbidity        | ICD-10 Diagnosis Code | Description   |
|--------------------|-----------------------|---|
| Other cancer       | C573                  | C573 Malignant neoplasm of parametrium                                    |
| Other cancer       | C574                  | C574 Malignant neoplasm of uterine adnexa, unspecified                    |
| Other cancer       | C58                   | C58 Malignant neoplasm of placenta  |
| Other cancer       | C700                  | C700 Malignant neoplasm of cerebral meninges                              |
| Other cancer       | C701                  | C701 Malignant neoplasm of spinal meninges                                |
| Other cancer       | C709                  | C709 Malignant neoplasm of meninges, unspecified                          |
| Other cancer       | C710                  | C710 Malignant neoplasm of cerebrum, except lobes and ventricles          |
| Other cancer       | C711                  | C711 Malignant neoplasm of frontal lobe                                   |
| Other cancer       | C712                  | C712 Malignant neoplasm of temporal lobe                                  |
| Other cancer       | C713                  | C713 Malignant neoplasm of parietal lobe                                  |
| Other cancer       | C714                  | C714 Malignant neoplasm of occipital lobe                                 |
| Other cancer       | C715                  | C715 Malignant neoplasm of cerebral ventricle                             |
| Other cancer       | C716                  | C716 Malignant neoplasm of cerebellum                                     |
| Other cancer       | C717                  | C717 Malignant neoplasm of brain stem                                     |
| Other cancer       | C718                  | C718 Malignant neoplasm of overlapping sites of brain                     |
| Other cancer       | C719                  | C719 Malignant neoplasm of brain, unspecified                             |
| Other cancer       | C720                  | C720 Malignant neoplasm of spinal cord                                    |
| Other cancer       | C721                  | C721 Malignant neoplasm of cauda equina                                   |
| Other cancer       | C7220                 | C7220 Malignant neoplasm of unspecified olfactory nerve                   |
| Other cancer       | C7221                 | C7221 Malignant neoplasm of right olfactory nerve                         |
| Other cancer       | C7222                 | C7222 Malignant neoplasm of left olfactory nerve                          |
| Other cancer       | C7230                 | C7230 Malignant neoplasm of unspecified optic nerve                       |
| Other cancer       | C7231                 | C7231 Malignant neoplasm of right optic nerve                             |
| Other cancer       | C7232                 | C7232 Malignant neoplasm of left optic nerve                              |
| Other cancer       | C7240                 | C7240 Malignant neoplasm of unspecified acoustic nerve                    |
| Other cancer       | C7241                 | C7241 Malignant neoplasm of right acoustic nerve                          |
| Other cancer       | C7242                 | C7242 Malignant neoplasm of left acoustic nerve                           |
| Other cancer       | C7250                 | C7250 Malignant neoplasm of unspecified cranial nerve                     |
| Other cancer       | C7259                 | C7259 Malignant neoplasm of other cranial nerves                          |
| Other cancer       | C729                  | C729 Malignant neoplasm of central nervous system, unspecified            |
| Other cancer       | C7400                 | C7400 Malignant neoplasm of cortex of unspecified adrenal gland           |
| Other cancer       | C7401                 | C7401 Malignant neoplasm of cortex of right adrenal gland                 |
| Other cancer       | C7402                 | C7402 Malignant neoplasm of cortex of left adrenal gland                  |
| Other cancer       | C7410                 | C7410 Malignant neoplasm of medulla of unspecified adrenal gland          |
| Other cancer       | C7411                 | C7411 Malignant neoplasm of medulla of right adrenal gland                |
| Other cancer       | C7412                 | C7412 Malignant neoplasm of medulla of left adrenal gland                 |
| Other cancer       | C7490                 | C7490 Malignant neoplasm of unspecified part of unspecified adrenal gland |
| Other cancer       | C7491                 | C7491 Malignant neoplasm of unspecified part of right adrenal gland       |
| Other cancer       | C7492                 | C7492 Malignant neoplasm of unspecified part of left adrenal gland        |
| Other cancer       | C751                  | C751 Malignant neoplasm of pituitary gland                                |
| Other cancer       | C752                  | C752 Malignant neoplasm of craniopharyngeal duct                          |
| Other cancer       | C753                  | C753 Malignant neoplasm of pineal gland                                   |
| Sickle Cell        | D5700                 | D5700 Hb-SS disease with crisis, unspecified                              |
| Sickle Cell        | D5701                 | D5701 Hb-SS disease with acute chest syndrome                             |
| Sickle Cell        | D5702                 | D5702 Hb-SS disease with splenic sequestration                            |
| Sickle Cell        | D571                  | D571 Sickle-cell disease without crisis                                   |
| Sickle Cell        | D5720                 | D5720 Sickle-cell/Hb-C disease without crisis                             |
| Sickle Cell        | D57211                | D57211 Sickle-cell/Hb-C disease with acute chest syndrome                 |
| Sickle Cell        | D57212                | D57212 Sickle-cell/Hb-C disease with splenic sequestration                |
| Sickle Cell        | D57219                | D57219 Sickle-cell/Hb-C disease with crisis, unspecified                  |
| Sickle Cell        | D5780                 | D5780 Other sickle-cell disorders without crisis                          |
| Sickle Cell        | D57811                | D57811 Other sickle-cell disorders with acute chest syndrome              |
| Sickle Cell        | D57812                | D57812 Other sickle-cell disorders with splenic sequestration             |
| Sickle Cell        | D57819                | D57819 Other sickle-cell disorders with crisis, unspecified               |
| Solid Organ Cancer | C153                  | C153 Malignant neoplasm of upper third of esophagus                       |
| Solid Organ Cancer | C154                  | C154 Malignant neoplasm of middle third of esophagus                      |
| Solid Organ Cancer | C155                  | C155 Malignant neoplasm of lower third of esophagus                       |
| Solid Organ Cancer | C158                  | C158 Malignant neoplasm of overlapping sites of esophagus                 |
| Solid Organ Cancer | C159                  | C159 Malignant neoplasm of esophagus, unspecified                         |
| Solid Organ Cancer | C160                  | C160 Malignant neoplasm of cardia   |
| Solid Organ Cancer | C161                  | C161 Malignant neoplasm of fundus of stomach                              |
| Solid Organ Cancer | C162                  | C162 Malignant neoplasm of body of stomach                                |
| Solid Organ Cancer | C163                  | C163 Malignant neoplasm of pyloric antrum                                 |
| Solid Organ Cancer | C164                  | C164 Malignant neoplasm of pylorus  |
| Solid Organ Cancer | C165                  | C165 Malignant neoplasm of lesser curvature of stomach, unspecified       |
| Solid Organ Cancer | C166                  | C166 Malignant neoplasm of greater curvature of stomach, unspecified      |
| Solid Organ Cancer | C168                  | C168 Malignant neoplasm of overlapping sites of stomach                   |
| Solid Organ Cancer | C169                  | C169 Malignant neoplasm of stomach, unspecified                           |
| Solid Organ Cancer | C170                  | C170 Malignant neoplasm of duodenum                                       |
| Solid Organ Cancer | C171                  | C171 Malignant neoplasm of jejunum  |
| Solid Organ Cancer | C172                  | C172 Malignant neoplasm of ileum  |
| Solid Organ Cancer | C173                  | C173 Meckel's diverticulum, malignant                                     |
| Solid Organ Cancer | C178                  | C178 Malignant neoplasm of overlapping sites of small intestine           |
| Solid Organ Cancer | C179                  | C179 Malignant neoplasm of small intestine, unspecified                   |
| Solid Organ Cancer | C180                  | C180 Malignant neoplasm of cecum  |
| Solid Organ Cancer | C181                  | C181 Malignant neoplasm of appendix                                       |
| Solid Organ Cancer | C182                  | C182 Malignant neoplasm of ascending colon                                |
| Solid Organ Cancer | C183                  | C183 Malignant neoplasm of hepatic flexure                                |
| Solid Organ Cancer | C184                  | C184 Malignant neoplasm of transverse colon                               |

### List of ICD-10 codes used for exclusions

| Comorbidity        | ICD-10 Diagnosis Code | Description  |
|--------------------|-----------------------|--|
| Solid Organ Cancer | C185                  | C185 Malignant neoplasm of splenic flexure                                     |
| Solid Organ Cancer | C186                  | C186 Malignant neoplasm of descending colon                                    |
| Solid Organ Cancer | C187                  | C187 Malignant neoplasm of sigmoid colon                                       |
| Solid Organ Cancer | C188                  | C188 Malignant neoplasm of overlapping sites of colon                          |
| Solid Organ Cancer | C189                  | C189 Malignant neoplasm of colon, unspecified                                  |
| Solid Organ Cancer | C19                   | C19 Malignant neoplasm of rectosigmoid junction                                |
| Solid Organ Cancer | C20                   | C20 Malignant neoplasm of rectum   |
| Solid Organ Cancer | C210                  | C210 Malignant neoplasm of anus, unspecified                                   |
| Solid Organ Cancer | C211                  | C211 Malignant neoplasm of anal canal  |
| Solid Organ Cancer | C212                  | C212 Malignant neoplasm of cloacogenic zone                                    |
| Solid Organ Cancer | C218                  | C218 Malignant neoplasm of overlapping sites of rectum, anus and anal canal    |
|                    |                       |  |
| Solid Organ Cancer | C220                  | C220 Liver cell carcinoma  |
| Solid Organ Cancer | C221                  | C221 Intrahepatic bile duct carcinoma  |
| Solid Organ Cancer | C222                  | C222 Hepatoblastoma  |
| Solid Organ Cancer | C223                  | C223 Angiosarcoma of liver   |
| Solid Organ Cancer | C224                  | C224 Other sarcomas of liver   |
| Solid Organ Cancer | C227                  | C227 Other specified carcinomas of liver                                       |
| Solid Organ Cancer | C228                  | C228 Malignant neoplasm of liver, primary, unspecified as to type              |
| Solid Organ Cancer | C229                  | C229 Malignant neoplasm of liver, not specified as primary or secondary        |
| Solid Organ Cancer | C23                   | C23 Malignant neoplasm of gallbladder  |
| Solid Organ Cancer | C240                  | C240 Malignant neoplasm of extrahepatic bile duct                              |
| Solid Organ Cancer | C241                  | C241 Malignant neoplasm of ampulla of Vater                                    |
| Solid Organ Cancer | C248                  | C248 Malignant neoplasm of overlapping sites of biliary tract                  |
| Solid Organ Cancer | C249                  | C249 Malignant neoplasm of biliary tract, unspecified                          |
| Solid Organ Cancer | C250                  | C250 Malignant neoplasm of head of pancreas                                    |
| Solid Organ Cancer | C251                  | C251 Malignant neoplasm of body of pancreas                                    |
| Solid Organ Cancer | C252                  | C252 Malignant neoplasm of tail of pancreas                                    |
| Solid Organ Cancer | C253                  | C253 Malignant neoplasm of pancreatic duct                                     |
| Solid Organ Cancer | C254                  | C254 Malignant neoplasm of endocrine pancreas                                  |
| Solid Organ Cancer | C257                  | C257 Malignant neoplasm of other parts of pancreas                             |
| Solid Organ Cancer | C258                  | C258 Malignant neoplasm of overlapping sites of pancreas                       |
| Solid Organ Cancer | C259                  | C259 Malignant neoplasm of pancreas, unspecified                               |
| Solid Organ Cancer | C260                  | C260 Malignant neoplasm of intestinal tract, part unspecified                  |
| Solid Organ Cancer | C261                  | C261 Malignant neoplasm of spleen  |
| Solid Organ Cancer | C269                  | C269 Malignant neoplasm of ill-defined sites within the digestive system       |
| Solid Organ Cancer | C33                   | C33 Malignant neoplasm of trachea  |
| Solid Organ Cancer | C3400                 | C3400 Malignant neoplasm of unspecified main bronchus                          |
| Solid Organ Cancer | C3401                 | C3401 Malignant neoplasm of right main bronchus                                |
| Solid Organ Cancer | C3402                 | C3402 Malignant neoplasm of left main bronchus                                 |
| Solid Organ Cancer | C3410                 | C3410 Malignant neoplasm of upper lobe, unspecified bronchus or lung           |
| Solid Organ Cancer | C3411                 | C3411 Malignant neoplasm of upper lobe, right bronchus or lung                 |
| Solid Organ Cancer | C3412                 | C3412 Malignant neoplasm of upper lobe, left bronchus or lung                  |
| Solid Organ Cancer | C342                  | C342 Malignant neoplasm of middle lobe, bronchus or lung                       |
| Solid Organ Cancer | C3430                 | C3430 Malignant neoplasm of lower lobe, unspecified bronchus or lung           |
| Solid Organ Cancer | C3431                 | C3431 Malignant neoplasm of lower lobe, right bronchus or lung                 |
| Solid Organ Cancer | C3432                 | C3432 Malignant neoplasm of lower lobe, left bronchus or lung                  |
| Solid Organ Cancer | C3480                 | C3480 Malignant neoplasm of overlapping sites of unspecified bronchus and lung |
|                    |                       |  |
| Solid Organ Cancer | C3481                 | C3481 Malignant neoplasm of overlapping sites of right bronchus and lung       |
| Solid Organ Cancer | C3482                 | C3482 Malignant neoplasm of overlapping sites of left bronchus and lung        |
| Solid Organ Cancer | C3490                 | C3490 Malignant neoplasm of unspecified part of unspecified bronchus or lung   |
|                    |                       |  |
| Solid Organ Cancer | C3491                 | C3491 Malignant neoplasm of unspecified part of right bronchus or lung         |
| Solid Organ Cancer | C3492                 | C3492 Malignant neoplasm of unspecified part of left bronchus or lung          |
| Solid Organ Cancer | C384                  | C384 Malignant neoplasm of pleura  |
| Solid Organ Cancer | C430                  | C430 Malignant melanoma of lip   |
| Solid Organ Cancer | C4310                 | C4310 Malignant melanoma of unspecified eyelid, including canthus              |
| Solid Organ Cancer | C4311                 | C4311 Malignant melanoma of right eyelid, including canthus                    |
| Solid Organ Cancer | C4312                 | C4312 Malignant melanoma of left eyelid, including canthus                     |
| Solid Organ Cancer | C4320                 | C4320 Malignant melanoma of unspecified ear and external auricular canal       |
| Solid Organ Cancer | C4321                 | C4321 Malignant melanoma of right ear and external auricular canal             |
| Solid Organ Cancer | C4322                 | C4322 Malignant melanoma of left ear and external auricular canal              |
| Solid Organ Cancer | C4330                 | C4330 Malignant melanoma of unspecified part of face                           |
| Solid Organ Cancer | C4331                 | C4331 Malignant melanoma of nose   |
| Solid Organ Cancer | C4339                 | C4339 Malignant melanoma of other parts of face                                |
| Solid Organ Cancer | C434                  | C434 Malignant melanoma of scalp and neck                                      |
| Solid Organ Cancer | C4351                 | C4351 Malignant melanoma of anal skin  |
| Solid Organ Cancer | C4352                 | C4352 Malignant melanoma of skin of breast                                     |
| Solid Organ Cancer | C4359                 | C4359 Malignant melanoma of other part of trunk                                |
| Solid Organ Cancer | C4360                 | C4360 Malignant melanoma of unspecified upper limb, including shoulder         |
| Solid Organ Cancer | C4361                 | C4361 Malignant melanoma of right upper limb, including shoulder               |
| Solid Organ Cancer | C4362                 | C4362 Malignant melanoma of left upper limb, including shoulder                |
| Solid Organ Cancer | C4370                 | C4370 Malignant melanoma of unspecified lower limb, including hip              |
| Solid Organ Cancer | C4371                 | C4371 Malignant melanoma of right lower limb, including hip                    |
| Solid Organ Cancer | C4372                 | C4372 Malignant melanoma of left lower limb, including hip                     |
| Solid Organ Cancer | C438                  | C438 Malignant melanoma of overlapping sites of skin                           |
| Solid Organ Cancer | C439                  | C439 Malignant melanoma of skin, unspecified                                   |
| Solid Organ Cancer | C450                  | C450 Mesothelioma of pleura  |

### List of ICD-10 codes used for exclusions

| Comorbidity        | ICD-10 Diagnosis Code | Description  |
|--------------------|-----------------------|--|
| Solid Organ Cancer | C451                  | C451 Mesothelioma of peritoneum  |
| Solid Organ Cancer | C457                  | C457 Mesothelioma of other sites   |
| Solid Organ Cancer | C459                  | C459 Mesothelioma, unspecified   |
| Solid Organ Cancer | C480                  | C480 Malignant neoplasm of retroperitoneum                                     |
| Solid Organ Cancer | C481                  | C481 Malignant neoplasm of specified parts of peritoneum                       |
| Solid Organ Cancer | C482                  | C482 Malignant neoplasm of peritoneum, unspecified                             |
| Solid Organ Cancer | C488                  | C488 Malignant neoplasm of overlapping sites of retroperitoneum and peritoneum |
| Solid Organ Cancer | C50011                | C50011 Malignant neoplasm of nipple and areola, right female breast            |
| Solid Organ Cancer | C50012                | C50012 Malignant neoplasm of nipple and areola, left female breast             |
| Solid Organ Cancer | C50019                | C50019 Malignant neoplasm of nipple and areola, unspecified female breast      |
| Solid Organ Cancer | C50021                | C50021 Malignant neoplasm of nipple and areola, right male breast              |
| Solid Organ Cancer | C50022                | C50022 Malignant neoplasm of nipple and areola, left male breast               |
| Solid Organ Cancer | C50029                | C50029 Malignant neoplasm of nipple and areola, unspecified male breast        |
| Solid Organ Cancer | C50111                | C50111 Malignant neoplasm of central portion of right female breast            |
| Solid Organ Cancer | C50112                | C50112 Malignant neoplasm of central portion of left female breast             |
| Solid Organ Cancer | C50119                | C50119 Malignant neoplasm of central portion of unspecified female breast      |
| Solid Organ Cancer | C50121                | C50121 Malignant neoplasm of central portion of right male breast              |
| Solid Organ Cancer | C50122                | C50122 Malignant neoplasm of central portion of left male breast               |
| Solid Organ Cancer | C50129                | C50129 Malignant neoplasm of central portion of unspecified male breast        |
| Solid Organ Cancer | C50211                | C50211 Malignant neoplasm of upper-inner quadrant of right female breast       |
| Solid Organ Cancer | C50212                | C50212 Malignant neoplasm of upper-inner quadrant of left female breast        |
| Solid Organ Cancer | C50219                | C50219 Malignant neoplasm of upper-inner quadrant of unspecified female breast |
| Solid Organ Cancer | C50221                | C50221 Malignant neoplasm of upper-inner quadrant of right male breast         |
| Solid Organ Cancer | C50222                | C50222 Malignant neoplasm of upper-inner quadrant of left male breast          |
| Solid Organ Cancer | C50229                | C50229 Malignant neoplasm of upper-inner quadrant of unspecified male breast   |
| Solid Organ Cancer | C50311                | C50311 Malignant neoplasm of lower-inner quadrant of right female breast       |
| Solid Organ Cancer | C50312                | C50312 Malignant neoplasm of lower-inner quadrant of left female breast        |
| Solid Organ Cancer | C50319                | C50319 Malignant neoplasm of lower-inner quadrant of unspecified female breast |
| Solid Organ Cancer | C50321                | C50321 Malignant neoplasm of lower-inner quadrant of right male breast         |
| Solid Organ Cancer | C50322                | C50322 Malignant neoplasm of lower-inner quadrant of left male breast          |
| Solid Organ Cancer | C50329                | C50329 Malignant neoplasm of lower-inner quadrant of unspecified male breast   |
| Solid Organ Cancer | C50411                | C50411 Malignant neoplasm of upper-outer quadrant of right female breast       |
| Solid Organ Cancer | C50412                | C50412 Malignant neoplasm of upper-outer quadrant of left female breast        |
| Solid Organ Cancer | C50419                | C50419 Malignant neoplasm of upper-outer quadrant of unspecified female breast |
| Solid Organ Cancer | C50421                | C50421 Malignant neoplasm of upper-outer quadrant of right male breast         |
| Solid Organ Cancer | C50422                | C50422 Malignant neoplasm of upper-outer quadrant of left male breast          |
| Solid Organ Cancer | C50429                | C50429 Malignant neoplasm of upper-outer quadrant of unspecified male breast   |
| Solid Organ Cancer | C50511                | C50511 Malignant neoplasm of lower-outer quadrant of right female breast       |
| Solid Organ Cancer | C50512                | C50512 Malignant neoplasm of lower-outer quadrant of left female breast        |
| Solid Organ Cancer | C50519                | C50519 Malignant neoplasm of lower-outer quadrant of unspecified female breast |
| Solid Organ Cancer | C50521                | C50521 Malignant neoplasm of lower-outer quadrant of right male breast         |
| Solid Organ Cancer | C50522                | C50522 Malignant neoplasm of lower-outer quadrant of left male breast          |
| Solid Organ Cancer | C50529                | C50529 Malignant neoplasm of lower-outer quadrant of unspecified male breast   |
| Solid Organ Cancer | C50611                | C50611 Malignant neoplasm of axillary tail of right female breast              |
| Solid Organ Cancer | C50612                | C50612 Malignant neoplasm of axillary tail of left female breast               |
| Solid Organ Cancer | C50619                | C50619 Malignant neoplasm of axillary tail of unspecified female breast        |
| Solid Organ Cancer | C50621                | C50621 Malignant neoplasm of axillary tail of right male breast                |
| Solid Organ Cancer | C50622                | C50622 Malignant neoplasm of axillary tail of left male breast                 |
| Solid Organ Cancer | C50629                | C50629 Malignant neoplasm of axillary tail of unspecified male breast          |
| Solid Organ Cancer | C50811                | C50811 Malignant neoplasm of overlapping sites of right female breast          |
| Solid Organ Cancer | C50812                | C50812 Malignant neoplasm of overlapping sites of left female breast           |
| Solid Organ Cancer | C50819                | C50819 Malignant neoplasm of overlapping sites of unspecified female breast    |
| Solid Organ Cancer | C50821                | C50821 Malignant neoplasm of overlapping sites of right male breast            |
| Solid Organ Cancer | C50822                | C50822 Malignant neoplasm of overlapping sites of left male breast             |
| Solid Organ Cancer | C50829                | C50829 Malignant neoplasm of overlapping sites of unspecified male breast      |
| Solid Organ Cancer | C50911                | C50911 Malignant neoplasm of unspecified site of right female breast           |
| Solid Organ Cancer | C50912                | C50912 Malignant neoplasm of unspecified site of left female breast            |
| Solid Organ Cancer | C50919                | C50919 Malignant neoplasm of unspecified site of unspecified female breast     |
| Solid Organ Cancer | C50921                | C50921 Malignant neoplasm of unspecified site of right male breast             |
| Solid Organ Cancer | C50922                | C50922 Malignant neoplasm of unspecified site of left male breast              |
| Solid Organ Cancer | C50929                | C50929 Malignant neoplasm of unspecified site of unspecified male breast       |
| Solid Organ Cancer | C510                  | C510 Malignant neoplasm of labium majus  |
| Solid Organ Cancer | C511                  | C511 Malignant neoplasm of labium minus  |
| Solid Organ Cancer | C512                  | C512 Malignant neoplasm of clitoris  |
| Solid Organ Cancer | C518                  | C518 Malignant neoplasm of overlapping sites of vulva                          |
| Solid Organ Cancer | C519                  | C519 Malignant neoplasm of vulva, unspecified                                  |
| Solid Organ Cancer | C52                   | C52 Malignant neoplasm of vagina   |
| Solid Organ Cancer | C530                  | C530 Malignant neoplasm of endocervix  |
| Solid Organ Cancer | C531                  | C531 Malignant neoplasm of exocervix   |

### List of ICD-10 codes used for exclusions

| Comorbidity        | ICD-10 Diagnosis Code | Description  |
|--------------------|-----------------------|--|
| Solid Organ Cancer | C538                  | C538 Malignant neoplasm of overlapping sites of cervix uteri                                 |
| Solid Organ Cancer | C539                  | C539 Malignant neoplasm of cervix uteri, unspecified   |
| Solid Organ Cancer | C540                  | C540 Malignant neoplasm of isthmus uteri   |
| Solid Organ Cancer | C541                  | C541 Malignant neoplasm of endometrium   |
| Solid Organ Cancer | C542                  | C542 Malignant neoplasm of myometrium  |
| Solid Organ Cancer | C543                  | C543 Malignant neoplasm of fundus uteri  |
| Solid Organ Cancer | C548                  | C548 Malignant neoplasm of overlapping sites of corpus uteri                                 |
| Solid Organ Cancer | C549                  | C549 Malignant neoplasm of corpus uteri, unspecified   |
| Solid Organ Cancer | C55                   | C55 Malignant neoplasm of uterus, part unspecified   |
| Solid Organ Cancer | C577                  | C577 Malignant neoplasm of other specified female genital organs                             |
| Solid Organ Cancer | C578                  | C578 Malignant neoplasm of overlapping sites of female genital organs                        |
| Solid Organ Cancer | C579                  | C579 Malignant neoplasm of female genital organ, unspecified                                 |
| Solid Organ Cancer | C600                  | C600 Malignant neoplasm of prepuce   |
| Solid Organ Cancer | C601                  | C601 Malignant neoplasm of glans penis   |
| Solid Organ Cancer | C602                  | C602 Malignant neoplasm of body of penis   |
| Solid Organ Cancer | C608                  | C608 Malignant neoplasm of overlapping sites of penis  |
| Solid Organ Cancer | C609                  | C609 Malignant neoplasm of penis, unspecified  |
| Solid Organ Cancer | C61                   | C61 Malignant neoplasm of prostate   |
| Solid Organ Cancer | C6200                 | C6200 Malignant neoplasm of unspecified undescended testis                                   |
| Solid Organ Cancer | C6201                 | C6201 Malignant neoplasm of undescended right testis   |
| Solid Organ Cancer | C6202                 | C6202 Malignant neoplasm of undescended left testis  |
| Solid Organ Cancer | C6210                 | C6210 Malignant neoplasm of unspecified descended testis                                     |
| Solid Organ Cancer | C6211                 | C6211 Malignant neoplasm of descended right testis   |
| Solid Organ Cancer | C6212                 | C6212 Malignant neoplasm of descended left testis  |
| Solid Organ Cancer | C6290                 | C6290 Malignant neoplasm of unspecified testis, unspecified whether descended or undescended |
| Solid Organ Cancer | C6291                 | C6291 Malignant neoplasm of right testis, unspecified whether descended or undescended       |
| Solid Organ Cancer | C6292                 | C6292 Malignant neoplasm of left testis, unspecified whether descended or undescended        |
| Solid Organ Cancer | C6300                 | C6300 Malignant neoplasm of unspecified epididymis   |
| Solid Organ Cancer | C6301                 | C6301 Malignant neoplasm of right epididymis   |
| Solid Organ Cancer | C6302                 | C6302 Malignant neoplasm of left epididymis  |
| Solid Organ Cancer | C6310                 | C6310 Malignant neoplasm of unspecified spermatic cord                                       |
| Solid Organ Cancer | C6311                 | C6311 Malignant neoplasm of right spermatic cord   |
| Solid Organ Cancer | C6312                 | C6312 Malignant neoplasm of left spermatic cord  |
| Solid Organ Cancer | C632                  | C632 Malignant neoplasm of scrotum   |
| Solid Organ Cancer | C637                  | C637 Malignant neoplasm of other specified male genital organs                               |
| Solid Organ Cancer | C638                  | C638 Malignant neoplasm of overlapping sites of male genital organs                          |
| Solid Organ Cancer | C639                  | C639 Malignant neoplasm of male genital organ, unspecified                                   |
| Solid Organ Cancer | C641                  | C641 Malignant neoplasm of right kidney, except renal pelvis                                 |
| Solid Organ Cancer | C642                  | C642 Malignant neoplasm of left kidney, except renal pelvis                                  |
| Solid Organ Cancer | C649                  | C649 Malignant neoplasm of unspecified kidney, except renal pelvis                           |
| Solid Organ Cancer | C651                  | C651 Malignant neoplasm of right renal pelvis  |
| Solid Organ Cancer | C652                  | C652 Malignant neoplasm of left renal pelvis   |
| Solid Organ Cancer | C659                  | C659 Malignant neoplasm of unspecified renal pelvis  |
| Solid Organ Cancer | C661                  | C661 Malignant neoplasm of right ureter  |
| Solid Organ Cancer | C662                  | C662 Malignant neoplasm of left ureter   |
| Solid Organ Cancer | C669                  | C669 Malignant neoplasm of unspecified ureter  |
| Solid Organ Cancer | C670                  | C670 Malignant neoplasm of trigone of bladder  |
| Solid Organ Cancer | C671                  | C671 Malignant neoplasm of dome of bladder   |
| Solid Organ Cancer | C672                  | C672 Malignant neoplasm of lateral wall of bladder   |
| Solid Organ Cancer | C673                  | C673 Malignant neoplasm of anterior wall of bladder  |
| Solid Organ Cancer | C674                  | C674 Malignant neoplasm of posterior wall of bladder   |
| Solid Organ Cancer | C675                  | C675 Malignant neoplasm of bladder neck  |
| Solid Organ Cancer | C676                  | C676 Malignant neoplasm of ureteric orifice  |
| Solid Organ Cancer | C677                  | C677 Malignant neoplasm of urachus   |
| Solid Organ Cancer | C678                  | C678 Malignant neoplasm of overlapping sites of bladder                                      |
| Solid Organ Cancer | C679                  | C679 Malignant neoplasm of bladder, unspecified  |
| Solid Organ Cancer | C680                  | C680 Malignant neoplasm of urethra   |
| Solid Organ Cancer | C681                  | C681 Malignant neoplasm of paraurethral glands   |
| Solid Organ Cancer | C688                  | C688 Malignant neoplasm of overlapping sites of urinary organs                               |
| Solid Organ Cancer | C689                  | C689 Malignant neoplasm of urinary organ, unspecified  |
| Solid Organ Cancer | C6900                 | C6900 Malignant neoplasm of unspecified conjunctiva  |
| Solid Organ Cancer | C6901                 | C6901 Malignant neoplasm of right conjunctiva  |
| Solid Organ Cancer | C6902                 | C6902 Malignant neoplasm of left conjunctiva   |
| Solid Organ Cancer | C6910                 | C6910 Malignant neoplasm of unspecified cornea   |
| Solid Organ Cancer | C6911                 | C6911 Malignant neoplasm of right cornea   |
| Solid Organ Cancer | C6912                 | C6912 Malignant neoplasm of left cornea  |
| Solid Organ Cancer | C6920                 | C6920 Malignant neoplasm of unspecified retina   |
| Solid Organ Cancer | C6921                 | C6921 Malignant neoplasm of right retina   |
| Solid Organ Cancer | C6922                 | C6922 Malignant neoplasm of left retina  |
| Solid Organ Cancer | C6930                 | C6930 Malignant neoplasm of unspecified choroid  |
| Solid Organ Cancer | C6931                 | C6931 Malignant neoplasm of right choroid  |
| Solid Organ Cancer | C6932                 | C6932 Malignant neoplasm of left choroid   |
| Solid Organ Cancer | C6940                 | C6940 Malignant neoplasm of unspecified ciliary body   |
| Solid Organ Cancer | C6941                 | C6941 Malignant neoplasm of right ciliary body   |
| Solid Organ Cancer | C6942                 | C6942 Malignant neoplasm of left ciliary body  |
| Solid Organ Cancer | C6950                 | C6950 Malignant neoplasm of unspecified lacrimal gland and duct                              |

# List of ICD-10 codes used for exclusions

| Comorbidity        | ICD-10 Diagnosis Code | Description   |
|--------------------|-----------------------|---|
| Solid Organ Cancer | C6951                 | C6951 Malignant neoplasm of right lacrimal gland and duct                   |
| Solid Organ Cancer | C6952                 | C6952 Malignant neoplasm of left lacrimal gland and duct                    |
| Solid Organ Cancer | C6960                 | C6960 Malignant neoplasm of unspecified orbit                               |
| Solid Organ Cancer | C6961                 | C6961 Malignant neoplasm of right orbit                                     |
| Solid Organ Cancer | C6962                 | C6962 Malignant neoplasm of left orbit                                      |
| Solid Organ Cancer | C6980                 | C6980 Malignant neoplasm of overlapping sites of unspecified eye and adnexa |
| Solid Organ Cancer | C6981                 | C6981 Malignant neoplasm of overlapping sites of right eye and adnexa       |
| Solid Organ Cancer | C6982                 | C6982 Malignant neoplasm of overlapping sites of left eye and adnexa        |
| Solid Organ Cancer | C6990                 | C6990 Malignant neoplasm of unspecified site of unspecified eye             |
| Solid Organ Cancer | C6991                 | C6991 Malignant neoplasm of unspecified site of right eye                   |
| Solid Organ Cancer | C6992                 | C6992 Malignant neoplasm of unspecified site of left eye                    |
| Solid Organ Cancer | C73                   | C73 Malignant neoplasm of thyroid gland                                     |
| Solid Organ Cancer | C750                  | C750 Malignant neoplasm of parathyroid gland                                |
| Solid Organ Cancer | C754                  | C754 Malignant neoplasm of carotid body                                     |
| Solid Organ Cancer | C755                  | C755 Malignant neoplasm of aortic body and other paraganglia                |
| Solid Organ Cancer | C758                  | C758 Malignant neoplasm with pluriglandular involvement, unspecified        |
| Solid Organ Cancer | C759                  | C759 Malignant neoplasm of endocrine gland, unspecified                     |
| Solid Organ Cancer | C760                  | C760 Malignant neoplasm of head, face and neck                              |
| Solid Organ Cancer | C761                  | C761 Malignant neoplasm of thorax   |
| Solid Organ Cancer | C762                  | C762 Malignant neoplasm of abdomen  |
| Solid Organ Cancer | C763                  | C763 Malignant neoplasm of pelvis   |
| Solid Organ Cancer | C7640                 | C7640 Malignant neoplasm of unspecified upper limb                          |
| Solid Organ Cancer | C7641                 | C7641 Malignant neoplasm of right upper limb                                |
| Solid Organ Cancer | C7642                 | C7642 Malignant neoplasm of left upper limb                                 |
| Solid Organ Cancer | C7650                 | C7650 Malignant neoplasm of unspecified lower limb                          |
| Solid Organ Cancer | C7651                 | C7651 Malignant neoplasm of right lower limb                                |
| Solid Organ Cancer | C7652                 | C7652 Malignant neoplasm of left lower limb                                 |
| Solid Organ Cancer | C768                  | C768 Malignant neoplasm of other specified ill-defined sites                |
| Solid Organ Cancer | C801                  | C801 Malignant (primary) neoplasm, unspecified                              |
| Solid Organ Cancer | C802                  | C802 Malignant neoplasm associated with transplanted organ                  |
| Solid Organ Cancer | D030                  | D030 Melanoma in situ of lip  |
| Solid Organ Cancer | D0310                 | D0310 Melanoma in situ of unspecified eyelid, including canthus             |
| Solid Organ Cancer | D0311                 | D0311 Melanoma in situ of right eyelid, including canthus                   |
| Solid Organ Cancer | D0312                 | D0312 Melanoma in situ of left eyelid, including canthus                    |
| Solid Organ Cancer | D0320                 | D0320 Melanoma in situ of unspecified ear and external auricular canal      |
| Solid Organ Cancer | D0321                 | D0321 Melanoma in situ of right ear and external auricular canal            |
| Solid Organ Cancer | D0322                 | D0322 Melanoma in situ of left ear and external auricular canal             |
| Solid Organ Cancer | D0330                 | D0330 Melanoma in situ of unspecified part of face                          |
| Solid Organ Cancer | D0339                 | D0339 Melanoma in situ of other parts of face                               |
| Solid Organ Cancer | D034                  | D034 Melanoma in situ of scalp and neck                                     |
| Solid Organ Cancer | D0351                 | D0351 Melanoma in situ of anal skin   |
| Solid Organ Cancer | D0352                 | D0352 Melanoma in situ of breast (skin) (soft tissue)                       |
| Solid Organ Cancer | D0359                 | D0359 Melanoma in situ of other part of trunk                               |
| Solid Organ Cancer | D0360                 | D0360 Melanoma in situ of unspecified upper limb, including shoulder        |
| Solid Organ Cancer | D0361                 | D0361 Melanoma in situ of right upper limb, including shoulder              |
| Solid Organ Cancer | D0362                 | D0362 Melanoma in situ of left upper limb, including shoulder               |
| Solid Organ Cancer | D0370                 | D0370 Melanoma in situ of unspecified lower limb, including hip             |
| Solid Organ Cancer | D0371                 | D0371 Melanoma in situ of right lower limb, including hip                   |
| Solid Organ Cancer | D0372                 | D0372 Melanoma in situ of left lower limb, including hip                    |
| Solid Organ Cancer | D038                  | D038 Melanoma in situ of other sites  |
| Solid Organ Cancer | D039                  | D039 Melanoma in situ, unspecified  |
| Solid Organ Cancer | C49A0                 | C49A0 Gastrointestinal stromal tumor, unspecified site                      |
| Solid Organ Cancer | C49A1                 | C49A1 Gastrointestinal stromal tumor of esophagus                           |
| Solid Organ Cancer | C49A2                 | C49A2 Gastrointestinal stromal tumor of stomach                             |
| Solid Organ Cancer | C49A3                 | C49A3 Gastrointestinal stromal tumor of small intestine                     |
| Solid Organ Cancer | C49A4                 | C49A4 Gastrointestinal stromal tumor of large intestine                     |
| Solid Organ Cancer | C49A5                 | C49A5 Gastrointestinal stromal tumor of rectum                              |
| Solid Organ Cancer | C49A9                 | C49A9 Gastrointestinal stromal tumor of other sites                         |