

# The impact of pulmonary cachexia on inpatient outcomes: A national study

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**Abstract:**

**BACKGROUND:** Cachexia has been associated with chronic lung disease (pulmonary cachexia syndrome), which is associated with increased mortality. However, studies that looked into this association was relatively small, and national level data are lacking. Herein, we aim to study the association between chronic obstructive lung disease (COPD) and cachexia.

**RESEARCH QUESTION:** Do patients with COPD and cachexia has worse inpatient outcomes in comparison to those with no cachexia?

**STUDY DESIGN AND METHODS:** We used the Nationwide Readmissions Database from 2016 to 2019, extracting adult patients with a primary diagnosis of COPD who were admitted between January and November of each year studied. We excluded patients with missing data on event time or length of stay. Furthermore, we excluded all cases with comorbidities associated with cachexia. We used SAS 9.4 for data exploration and analysis.

**RESULTS:** We included 1,446,431 COPD-related weighted hospitalizations for which 115,276 cases (7.9%) had a concurrent diagnosis of cachexia (or cachexia-related diagnoses). Overall, patients with cachexia (COPD-C), compared to patients with COPD and no cachexia (COPD-NC), were older (mean age 69 vs. 66 years, respectively,  $P < 0.001$ ) with similar gender distribution (58%). COPD-C patients had more inpatient complications including cardiac arrest, and use of mechanical ventilation ( $P < 0.001$ ). Furthermore, they had longer mean lengths of stay (5.2 days vs. 3.8 days,  $P < 0.001$ ). In-hospital mortality during index, admission was significantly higher in these patients at 2.2% compared to 0.5% for COPD-NC ( $P < 0.001$ ).

**CONCLUSION:** COPD-related cachexia is associated with increased inpatient mortality, resource utilization, and prolonged hospitalization.

**Keywords:**

Cachexia, chronic obstructive pulmonary disease, inpatient mortality, Nationwide Readmissions Database

Cachexia is a syndrome of unintended weight loss that cannot be fully reversed with feeding.<sup>[1]</sup> It has been associated with multiple chronic diseases including chronic obstructive pulmonary disease (COPD).<sup>[2,3]</sup> Although the term “pulmonary cachexia” could be used to describe cachexia associated with chronic lung disease, it is most frequently seen and reported in patient with COPD.<sup>[4]</sup> The prevalence of cachexia in patient with COPD is around 25%–50%.<sup>[4-6]</sup> This wide variation could be related to different

study population and definitions. Prior studies suggested that pulmonary cachexia syndrome (COPD-related cachexia) as a poor prognostic factor for mortality independent of disease stage.<sup>[7]</sup> However, most of the studies are either single center, from clinical trials or have focused on outpatient settings.<sup>[7-10]</sup> Data on cachexia as a prognosticator in hospitalized patients with acute COPD exacerbation are sparse. The goal of the study is to evaluate the association of cachexia with inpatient mortality and 30-day readmission in patients hospitalized with a primary diagnosis of COPD.

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## Methods

### Data source

This study is a retrospective population-based study using data from the Healthcare Cost and Utilization Project (HCUP). The Agency for Healthcare Research and Quality (AHRQ) is a federal agency under the Department of Health and Human Services. One of its products is HCUP. HCUP is a comprehensive set of all payer health-care data that are based on billing records (inpatient stays, emergency department visits, and ambulatory care). Nationwide readmission database (NRD) is an HCUP product, i.e., derived from state level data and is meant to study factors affecting inpatient mortality and 30-day readmission for patients of all ages regardless of the payer. It is the largest publicly available database for inpatient populations in the United States containing over 17 million records every year, representing all discharges in a given year (which are close to 35 million yearly).<sup>[11]</sup>

The NRD database from the end of 2015 contains up to 40 variables that includes International Classification of Diseases, 10<sup>th</sup> Edition (ICD-10) codes for medical conditions addressed during hospitalization. It also contains up to 30 variables that include ICD-10 codes for procedures performed during hospital stay. The data were extracted using the ICD-10 codes to identify subjects.

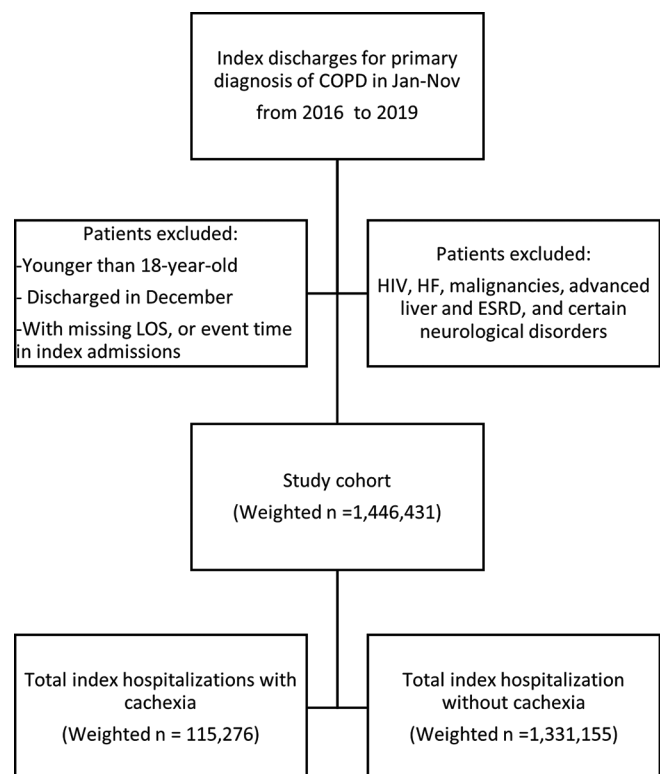
For this study, we utilized the NRD database for the years 2016–2019. We followed the data use agreement and guidelines recommended by AHRQ. The database is publicly available and contains de-identified information. Hence, the study was deemed exempt by our institutional review board.

### Study population

The inclusion criteria included all adult patients (older than 18 years) with a primary diagnosis (I10\_Dx1) of COPD who were discharged from January to November in years 2016–2019, with a concurrent diagnosis of cachexia or other weight loss-related diagnoses [Supplementary Tables 1-12 for codes used for case definition). To increase study specificity for COPD cachexia syndrome, we excluded all patients with a concurrent diagnosis of acquired immunodeficiency syndrome (AIDS), heart failure, malignancy (including hematological and solid cancers), advanced liver disease, end-stage renal disease, and certain neurological disorders [Supplementary Tables 1-12 for codes used for definition). Thus, pulmonary cachexia is identified if the patient had a primary diagnosis of COPD in addition to a weight loss-related diagnosis after applying the exclusions above. The HCUP team had validated these ICD-10 codes for such diagnoses.<sup>[12]</sup> Since we cannot

follow-up the patient across the years using the NRD database and because we are interested in assessing readmission outcomes, we did not include discharges in December of each year. We also excluded patients with missing values for length of stay (LOS) or event time (NRD days to event) which are necessary for evaluating readmissions. When calculating readmission rate, we did not include patients who died during index hospitalization in the denominator [Figure 1].

We studied the comorbidities that affect the risk of inpatient mortality and readmissions by utilizing Elixhauser comorbidity mortality index that has been validated to predict inpatient mortality. It is a continuous variable that ranges from 59 to 171 (the higher the score, the higher association with inpatient mortality).<sup>[13]</sup> In addition, we considered the effect of presence of acute respiratory failure and demographics (age and gender). Ethnicity is not available in the NRD database. We calculated readmission rate, mortality rate for patients who had a primary diagnosis of COPD with cachexia (COPD-C) and for patients with a primary diagnosis of COPD with no concurrent documentation of cachexia (COPD-NC). Survey procedures in SAS were used to adjust for complex survey design of NRD to produce nationwide estimates for analysis. Categorical and continuous variables were reported as percentage and mean  $\pm$  standard deviation, respectively. Differences in mean and percentage were assessed using the least



**Figure 1:** Flow diagram showing study enrollments. HIV: Human immunodeficiency virus. HF: Heart failure. ESRD: End-stage renal disease

square means and Chi-square tests, respectively. Logistic regression was used to analyze the independent impact of cachexia on inpatient mortality (binary outcome). The outcome was adjusted for age, gender, presence of acute respiratory failure, and Elixhauser mortality index, which has been validated in the NRD database.<sup>[14]</sup> Statistical significance was considered as a two-sided  $P = 0.05$  for all analyses. All analyses were performed using Statistical Analysis Software (SAS) version 9.4 (SAS 9.4, SAS Institute Inc., Cary, NC, USA).

## Results

The study cohort consisted of 1,446,431 discharges with a primary diagnosis of COPD identified between January and November 2016–2019. Of these, almost 8% (115,276 cases) had a concurrent diagnosis of cachexia (COPD-C) [Figure 1].

Tables 1 and 2 provide the baseline demographic and clinical characteristics of the study population categorized into COPD-C and COPD-NC. When comparing both groups, in contrast to COPD-NC patients, COPD-C patients were slightly older (mean age of 69.3 vs. 66.6 years,  $P < 0.0001$ ). Fifty-eight percent of the patient population were female. Patients with pulmonary cachexia were associated with a higher prevalence of alcohol use, drug use, cerebrovascular disease, dementia, and depression. In contrast, COPD-NC patients had a higher prevalence of diabetes mellitus, hypertension, thyroid disorders, and obesity.

The primary payor for the study population was Medicare, followed by Medicaid. The majority of patients with a primary diagnosis of COPD were admitted to

hospitals located in large or medium metropolitan counties. The majority consisted of individuals of low socio-economic status.

Table 3 shows the outcome during index admission, and first subsequent 30-day readmission in the same year, in the same state. Compared to patients with COPD-NC, COPD-C patients had higher inpatient mortality (2.2% vs. 0.5%,  $P < 0.0001$ ). Furthermore, they had a higher incidence of acute respiratory failure, intubation, ventricular tachycardia (VT), and sudden cardiac arrest ( $P < 0.001$ ). Subsequently, they had a longer LOS (mean of 5.2 vs. 3.8 days,  $P < 0.0001$ ) and higher total charges for the hospitalization (mean of \$43,723 vs. \$31,110 U.S Dollars,  $P < 0.0001$ ).

When examining discharges from the hospital, the majority of patients with COPD-NC were discharged to home/self-care, while patients with COPD-C had higher rates of discharge to a facility or with home health services (42.6% vs. 24.9%).

Compared to patients with COPD-NC, patients with COPD-C had higher inpatient mortality during first readmission within the 30-day index discharge (1.1% vs. 0.4%,  $P < 0.0001$ ).

Figure 2 displays variables associated with inpatient mortality. Acute respiratory failure is the most important predictor of inpatient mortality for patients admitted primarily with COPD after applying the exclusions mentioned above (OR 7.2, CI 95% 6.7–7.8). Patients with cachexia had 3 times higher odds of inpatient mortality in comparison to patient with no cachexia

**Table 1: Baseline characteristics**

Baseline characteristics	COPD with cachexia, n (%)	COPD without cachexia, n (%)	P
n	115,276 (8)	1,331,155 (92)	N/A
Age (years), mean±SD	69.3 (15.0)	66.6 (16.2)	<0.0001
Female	67,093 (58.2)	781,555 (58.7)	0.0472
Comorbidities			
Alcohol use	9472 (8.2)	72,098 (5.4)	<0.0001
Drug abuse	6576 (5.7)	62,469 (4.7)	<0.0001
CBVD	1795 (1.6)	18,327 (1.4)	0.0007
Dementia	7777 (6.7)	54,637 (4.1)	<0.0001
Paralysis	1305 (1.1)	14,229 (1.1)	0.1679
Depression	21,787 (18.9)	235,729 (17.7)	<0.0001
DM	14,051 (12.2)	364,736 (27.4)	<0.0001
HTN	64,910 (56.3)	896,146 (67.3)	<0.0001
Thyroid disorder	15,750 (13.7)	195,568 (14.7)	<0.0001
Valvular disease	811 (0.7)	12,220 (0.9)	<0.0001
PVD	10,746 (9.3)	83,004 (6.2)	<0.0001
Obesity	3592 (3.1)	233,222 (17.5)	<0.0001
Autoimmune disease	4321 (3.7)	51,308 (3.9)	0.2708
Elixhauser mortality index	-1.5 (6.8)	-2.6 (7.4)	<0.0001
Elixhauser readmission index	2.8 (4.0)	2.7 (4.1)	<0.0001

SD=Standard deviation, CBVD=Cerebrovascular disease, DM=Diabetes mellitus, HTN=Hypertension, PVD=Peripheral vascular disease, COPD=Chronic obstructive lung disease, N/A=Not available

**Table 2: Baseline characteristics (cont.)**

Baseline characteristics	COPD with cachexia	COPD without cachexia	P
Payor			
Medicare	84,647 (73.4)	880,204 (66.1)	<0.0001
Medicaid	14,532 (12.6)	201,810 (15.2)	
Private	10,358 (9.0)	164,105 (12.3)	
Self-pay	2663 (2.3)	44,930 (3.4)	
No charge	455 (0.4)	6908 (0.5)	
Other	2506 (2.2)	31,313 (2.4)	
Hospital area			
Central large metropolitan counties	25,621 (22.2)	276,512 (20.8)	<0.0001
Fringe large metropolitan counties	26,664 (23.1)	322,172 (24.2)	
Medium metropolitan counties	26,748 (23.2)	287,890 (21.6)	
Small metropolitan counties	12,204 (10.6)	137,822 (10.4)	
Micro metropolitan counties	13,699 (11.9)	159,787 (12.0)	
Not micro metropolitan counties	9661 (8.4)	140,510 (10.6)	
Socioeconomic status			
0–25 <sup>th</sup> percentile	42,173 (36.6)	506,450 (38.0)	<0.0001
26 <sup>th</sup> –50 <sup>th</sup> percentile (median)	32,653 (28.3)	383,960 (28.8)	
51 <sup>st</sup> –75 <sup>th</sup> percentile	24,205 (21.0)	267,683 (20.1)	
76 <sup>th</sup> –100 <sup>th</sup> percentile	14,754 (12.8)	155,285 (11.7)	

COPD=Chronic obstructive lung disease

**Table 3: Outcomes**

Outcome	COPD with cachexia, n (%)	COPD without cachexia, n (%)	P
During index admission			
Mortality during index admission	2538 (2.2)	7026 (0.5)	<0.0001
Mean index LOS, mean±SD	5.2±8.2	3.8±4.8	<0.0001
Total charges, mean±SD	43,723.7±125,599.2	31,110.9±53,133.6	
Acute respiratory failure	45,641 (39.6)	382,841 (28.8)	<0.0001
Intubation	14,204 (12.3)	107,863 (8.1)	<0.0001
VT	795 (0.7)	7397 (0.6)	<0.0001
SCA	418 (0.4)	2084 (0.2)	<0.0001
Cardiogenic shock	7 (0.0)	19 (0.0)	0.0036
Disposition of patient			
Discharged to self-care	61,002 (52.9)	955,445 (71.8)	
SNF, ICF or other facility	21,209 (18.4)	115,309 (8.7)	
Discharged with HHC	27,883 (24.2)	215,912 (16.2)	
During 30-day readmission			
Mortality during first readmission	1300 (1.1)	5901 (0.4)	<0.0001
Days to readmission, mean±SD	13.4±11.9	13.6±11.8	<0.0001
Mean readmission LOS, mean±SD	6.0±9.5	5.4±7.8	0.0194
Total readmissions	23,234 (20.2)	220,597 (16.6)	<0.0001
0	92,042 (79.8)	1,110,558 (83.4)	<0.0001
1	19,687 (17.1)	186,389 (14.0)	
2	3016 (2.6)	29,139 (2.2)	
3	452 (0.4)	4211 (0.3)	

SD=Standard deviation, VT=Ventricular tachycardia, SCA=Sudden cardiac arrest, SNF=Skilled nursing facility, ICF=Intermediate care facility, HHC=Home health care, LOS=Length of stay, COPD=Chronic obstructive lung disease

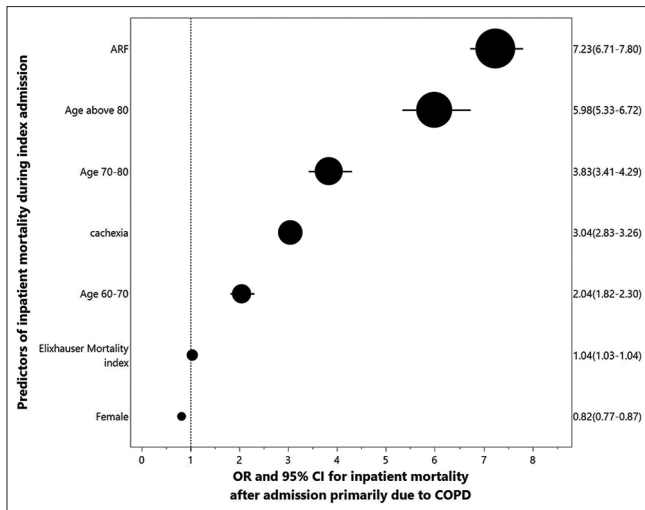
(OR 3, CI 95% 2.8–3.2). Elderly male patients with a higher Elixhauser mortality index have higher odds of inpatient mortality in comparison to younger female patients with a lower mortality index.

## Discussion

In our study, we intended to increase the accuracy of identifying pulmonary cachexia cases by increasing

diagnosis specificity (excluding patients who have other comorbidities associated with cachexia) and limiting case definition to patients with a primary diagnosis of COPD. We also tried to obtain as many cases as possible by increasing the sensitivity of the diagnosis of cachexia.

Multiple etiologies are associated with cachexia. The most common ones are cancer-related cachexia, pulmonary cachexia, human immunodeficiency virus-related



**Figure 2:** Odds of inpatient mortality during index hospitalization. The reference age group is 18–60-year-old. ARF: Acute respiratory failure, CI: Confidence interval. The figure was done using JMP® Pro 15.1.0

cachexia, end-stage renal disease-associated cachexia, and heart failure-associated cachexia (cardiac cachexia).<sup>[5]</sup>

Cachexia is usually associated with anorexia (decreased caloric intake) and is typically called anorexia-cachexia syndrome, which is described more in patients with malignancies.<sup>[15]</sup> Increasing caloric intake in anorexia-cachexia syndrome can improve nutrition by overcoming anorexia rather than cachexia pathophysiology. The pathogenesis of cachexia is related to an inflammatory process that is driven by cytokines that promote catabolism<sup>[16,17]</sup> and increase resting metabolic rate.<sup>[4]</sup>

In COPD, destruction of normal anatomy due to local increase of inflammatory processes in the lungs leads to altered pulmonary mechanics and subsequent decrease efficiency (increase activity-related energy expenditure). In addition, the latter may be enhanced by increased anaerobic metabolism noticed in COPD.<sup>[4]</sup> Wilson *et al.* noted that the body weight was directly related to forced expiratory volume (FEV) in the 1<sup>st</sup> s (FEV<sub>1</sub>) and that body weight is independent from FEV<sub>1</sub> as a predictor of mortality.<sup>[7]</sup>

The main finding of our study is that admitted patients with a primary diagnosis of COPD and concurrent weight loss (pulmonary cachexia) have a significantly higher inpatient mortality during index admission and subsequent readmission.

COPD is the fourth principal diagnoses associated with 30-day readmission in the United States with significant health and economic burden.<sup>[18]</sup> A limited number of studies have assessed the prognostic significance of weight loss and COPD in-hospital mortality. We found that cachexia was a strong predictor of inpatient

mortality and prolonged hospitalization. To the best of our knowledge, ours is the only study that reports a strong correlation of cachexia with in-hospital mortality in patients admitted with a primary diagnosis of COPD.

A higher percentage of patients admitted with COPD and cachexia were discharged to a facility or with home health services in comparison with patients without pulmonary cachexia suggesting further increases in the course of care even after discharge.

Our study has some limitations. First, the design of the study is retrospective. Retrospective data collected from an administrative database have a risk of bias related to hospital documentation. Second, the case definition is not 100% specific. The identification of comorbidities is primarily related to their documentation rather than their actual presence, i.e., a comorbidity is defined as absent unless it is documented present. Further, prospective studies are recommended to validate the findings of this study. No anthropometric measurements, laboratory results, imaging reports, or pulmonary function tests are contained in NRD.

## Conclusion

Pulmonary cachexia is associated with increased inpatient mortality, prolonged hospital stays, and increased resource utilization. Patients with COPD should have consideration for the evaluation of malnutrition and unintentional weight loss during their hospital stay. As cachexia is a multifactorial condition and the pathophysiological mechanisms are not completely understood, studies designed to develop specific prevention and treatment therapies are needed.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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**Supplementary Table 1: Case definition based on Internation Classification for Diseases, Tenth Revision (ICD-10) codes for Chronic Obstructive Lung Disease (COPD)**

<b>ICD-10-CM for COPD diagnosis</b>	<b>ICD-10-CM code description</b>
J411	Mucopurulent chronic bronchitis
J418	Mixed simple and mucopurulent chronic bronchitis
J42	Unspecified chronic bronchitis
J431	Panlobular emphysema
J432	Centrilobular emphysema
J438	Other emphysema
J439	Emphysema, unspecified
J440	Chronic obstructive pulmonary disease with (acute) lower respiratory infection
J441	Chronic obstructive pulmonary disease with (acute) exacerbation
J449	Chronic obstructive pulmonary disease, unspecified

COPD=Chronic obstructive lung disease, ICD-10-CM=International Classification of Diseases, 10<sup>th</sup> Edition Clinical Modification

**Supplementary Table 2: Case definition based on Internation Classification for Diseases, Tenth Revision (ICD-10) codes for cachexia and cachexia-related diagnoses**

<b>Code for malnutrition</b>	<b>Description</b>
E40	Kwashiorkor
E41	Nutritional marasmus
E42	Marasmic kwashiorkor
E43	Unspecified severe protein-calorie malnutrition
E440	Moderate protein-calorie malnutrition
E441	Mild protein-calorie malnutrition
E46	Unspecified protein-calorie malnutrition
E640	Sequelae of protein-calorie malnutrition
M6284	Sarcopenia
R627	Adult failure to thrive
R634	Abnormal weight loss
R636	Underweight
R64	Cachexia
Z681	BMI 19 or less, adult

BMI=Body mass index, ICD-10-CM=International Classification of Diseases, 10<sup>th</sup> Edition Clinical Modification

**Supplementary Table 3: Case definition based on Internation Classification for Diseases, Tenth Revision (ICD-10) codes for heart failure**

ICD-10-CM diagnosis to define heart failure	ICD-10-CM code description
I0981	Rheumatic heart failure
I110	Hypertensive heart disease with heart failure
I130	Hypertensive heart and chronic kidney disease with heart failure and stage 1 through stage 4 chronic kidney disease or unspecified chronic kidney disease
I132	Hypertensive heart and chronic kidney disease with heart failure and with stage 5 chronic kidney disease or end-stage renal disease
I501	Left ventricular failure, unspecified
I5020	Unspecified systolic (congestive) heart failure
I5021	Acute systolic (congestive) heart failure
I5022	Chronic systolic (congestive) heart failure
I5023	Acute on chronic systolic (congestive) heart failure
I5030	Unspecified diastolic (congestive) heart failure
I5031	Acute diastolic (congestive) heart failure
I5032	Chronic diastolic (congestive) heart failure
I5033	Acute on chronic diastolic (congestive) heart failure
I5040	Unspecified combined systolic (congestive) and diastolic (congestive) heart failure
I5041	Acute combined systolic (congestive) and diastolic (congestive) heart failure
I5042	Chronic combined systolic (congestive) and diastolic (congestive) heart failure
I5043	Acute on chronic combined systolic (congestive) and diastolic (congestive) heart failure
I50810	Right heart failure, unspecified
I50811	Acute right heart failure
I50812	Chronic right heart failure
I50813	Acute on chronic right heart failure
I50814	Right heart failure due to left heart failure
I5082	Biventricular heart failure
I5083	High-output heart failure
I5084	End-stage heart failure
I5089	Other heart failure
I509	Heart failure, unspecified
I5181	Takotsubo syndrome
I97130	Postprocedural heart failure following cardiac surgery
I97131	Postprocedural heart failure following other surgery
O29121	Cardiac failure due to anesthesia during pregnancy, first trimester
O29122	Cardiac failure due to anesthesia during pregnancy, second trimester
O29123	Cardiac failure due to anesthesia during pregnancy, third trimester
O29129	Cardiac failure due to anesthesia during pregnancy, unspecified trimester
R570	Cardiogenic shock

ICD-10-CM=International Classification of Diseases, 10<sup>th</sup> Edition Clinical Modification



**Supplementary Table 4: Case definition based on International Classification for Diseases, Tenth Revision (ICD-10) codes for encephalopathies**

ICD-10-CM diagnosis of specific neurological conditions excluded	ICD-10-CM code description
E7500	GM2 gangliosidosis, unspecified
E7501	Sandhoff disease
E7502	Tay-Sachs disease
E7509	Other GM2 gangliosidosis
E7510	Unspecified gangliosidosis
E7511	Mucopolipidosis IV
E7519	Other gangliosidosis
E7523	Krabbe disease
E7525	Metachromatic leukodystrophy
E7526	Sulfatase deficiency
E7529	Other sphingolipidoses
E754	Neuronal ceroid lipofuscinosis
F05	Delirium due to known physiological condition
F842	Rett's syndrome
G35	Multiple sclerosis
G360	Neuromyelitis optica (Devic)
G368	Other specified acute disseminated demyelination
G369	Acute disseminated demyelination, unspecified
G370	Diffuse sclerosis of the central nervous system
G371	Central demyelination of corpus callosum
G372	Central pontine myelinolysis
G373	Acute transverse myelitis in demyelinating disease of central nervous system
G374	Subacute necrotizing myelitis of central nervous system
G375	Concentric sclerosis (Balo) of central nervous system
G378	Other specified demyelinating diseases of central nervous system
G379	Demyelinating disease of central nervous system, unspecified
G47411	Narcolepsy with cataplexy
G47419	Narcolepsy without cataplexy
G47421	Narcolepsy in conditions classified elsewhere with cataplexy
G47429	Narcolepsy in conditions classified elsewhere without cataplexy
G890	Central pain syndrome
G910	Communicating hydrocephalus
G911	Obstructive hydrocephalus
G912	Idiopathic normal pressure hydrocephalus
G913	Posttraumatic hydrocephalus, unspecified
G914	Hydrocephalus in diseases classified elsewhere
G918	Other hydrocephalus
G919	Hydrocephalus, unspecified
G930	Cerebral cysts
G9340	Encephalopathy, unspecified
G9341	Metabolic encephalopathy
G9349	Other encephalopathies
G935	Compression of brain
G936	Cerebral edema
G937	Reye's syndrome
G9381	Temporal sclerosis
G9382	Brain death
G9389	Other specified disorders of the brain
G939	Disorder of brain, unspecified
G94	Other disorders of the brain in diseases classified elsewhere
O99350	Diseases of the nervous system complicating pregnancy, unspecified trimester
O99351	Diseases of the nervous system complicating pregnancy, first trimester
O99352	Diseases of the nervous system complicating pregnancy, second trimester
O99353	Diseases of the nervous system complicating pregnancy, third trimester

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#### Supplementary Table 4: Contd...

ICD-10-CM diagnosis of specific neurological conditions excluded	ICD-10-CM code description
O99354	Diseases of the nervous system complicating childbirth
O99355	Diseases of the nervous system complicating the puerperium
P9160	HIE, unspecified
P9161	Mild HIE
P9162	Moderate HIE
P9163	Severe HIE

HIE=Hypoxic ischemic encephalopathy, ICD-10-CM=International Classification of Diseases, 10<sup>th</sup> Edition Clinical Modification

#### Supplementary Table 5: Case definition based on Internation Classification for Diseases, Tenth Revision (ICD-10) codes for liver failure

ICD-10-CM diagnosis for liver failure	ICD-10-CM code description
B190	Unspecified viral hepatitis with hepatic coma
B1911	Unspecified viral hepatitis B with hepatic coma
B1921	Unspecified viral hepatitis C with hepatic coma
I8500	Esophageal varices without bleeding
I8501	Esophageal varices with bleeding
I8510	Secondary esophageal varices without bleeding
I8511	Secondary esophageal varices with bleeding
I864	Gastric varices
K7040	Alcoholic hepatic failure without coma
K7041	Alcoholic hepatic failure with coma
K7210	Chronic hepatic failure without coma
K7211	Chronic hepatic failure with coma
K7290	Hepatic failure, unspecified without coma
K7291	Hepatic failure, unspecified with coma
K765	Hepatic veno-occlusive disease
K766	Portal hypertension
K767	Hepatorenal syndrome
K9182	Postprocedural hepatic failure
Z944	Liver transplant status

ICD-10-CM=International Classification of Diseases, 10<sup>th</sup> Edition Clinical Modification

**Supplementary Table 6: Case definition based on International Classification for Diseases, Tenth Revision (ICD-10) codes for end-stage renal failure**

<b>ICD-10-CM diagnosis for ESRD</b>	<b>ICD-10-CM code description</b>
I120	Hypertensive chronic kidney disease with stage 5 chronic kidney disease or end-stage renal disease
I1311	Hypertensive heart and chronic kidney disease without heart failure, with stage 5 chronic kidney disease or end-stage renal disease
I132	Hypertensive heart and chronic kidney disease with heart failure and with stage 5 chronic kidney disease, or end-stage renal disease
N184	Chronic kidney disease, stage 4 (severe)
N185	Chronic kidney disease, stage 5
N186	End-stage renal disease
Z4901	Encounter for fitting and adjustment of extracorporeal dialysis catheter
Z4902	Encounter for fitting and adjustment of peritoneal dialysis catheter
Z4931	Encounter for adequacy testing for hemodialysis
Z4932	Encounter for adequacy testing for peritoneal dialysis
Z9115	Patient's noncompliance with renal dialysis
Z940	Kidney transplant status
Z992	Dependence on renal dialysis

ESRD=End-stage renal disease, ICD-10-CM=International Classification of Diseases, 10<sup>th</sup> Edition Clinical Modification

**Supplementary Table 7: Case definition based on International Classification for Diseases, Tenth Revision (ICD-10) codes for Human Immunodeficiency Virus (HIV)**

<b>ICD-10-CM diagnosis for HIV</b>	<b>ICD-10-CM code description</b>
B20	HIV disease
O98711	HIV disease complicating pregnancy, first trimester
O98712	HIV disease complicating pregnancy, second trimester
O98713	HIV disease complicating pregnancy, third trimester
O98719	HIV disease complicating pregnancy, unspecified trimester
O9872	HIV disease complicating childbirth
O9873	HIV disease complicating the puerperium
Z21	Asymptomatic HIV infection status

HIV=Human immunodeficiency virus, ICD-10-CM=International Classification of Diseases, 10<sup>th</sup> Edition Clinical Modification

**Supplementary Table 8: Case definition based on International Classification for Diseases, Tenth Revision (ICD-10) codes for leukemias**

ICD-10-CM diagnosis of leukemia	ICD-10-CM code description
C9010	Plasma cell leukemia not having achieved remission
C9011	Plasma cell leukemia in remission
C9012	Plasma cell leukemia in relapse
C9100	Acute lymphoblastic leukemia not having achieved remission
C9101	Acute lymphoblastic leukemia, in remission
C9102	Acute lymphoblastic leukemia, in relapse
C9110	Chronic lymphocytic leukemia of B-cell type not having achieved remission
C9111	Chronic lymphocytic leukemia of B-cell type in remission
C9112	Chronic lymphocytic leukemia of B-cell type in relapse
C9130	Prolymphocytic leukemia of B-cell type not having achieved remission
C9131	Prolymphocytic leukemia of B-cell type, in remission
C9132	Prolymphocytic leukemia of B-cell type, in relapse
C9140	Hairy cell leukemia not having achieved remission
C9141	Hairy cell leukemia, in remission
C9142	Hairy cell leukemia, in relapse
C9150	Adult T-cell lymphoma/leukemia (HTLV-1-associated) not having achieved remission
C9151	Adult T-cell lymphoma/leukemia (HTLV-1-associated), in remission
C9152	Adult T-cell lymphoma/leukemia (HTLV-1-associated), in relapse
C9160	Prolymphocytic leukemia of T-cell type not having achieved remission
C9161	Prolymphocytic leukemia of T-cell type, in remission
C9162	Prolymphocytic leukemia of T-cell type, in relapse
C9190	Lymphoid leukemia, unspecified not having achieved remission
C9191	Lymphoid leukemia, unspecified, in remission
C9192	Lymphoid leukemia, unspecified, in relapse
C91A0	Mature B-cell leukemia Burkitt-type not having achieved remission
C91A1	Mature B-cell leukemia Burkitt-type, in remission
C91A2	Mature B-cell leukemia Burkitt-type, in relapse
C91Z0	Other lymphoid leukemia not having achieved remission
C91Z1	Other lymphoid leukemia, in remission
C91Z2	Other lymphoid leukemia, in relapse
C9200	Acute myeloblastic leukemia, not having achieved remission
C9201	Acute myeloblastic leukemia, in remission
C9202	Acute myeloblastic leukemia, in relapse
C9210	Chronic myeloid leukemia, BCR/ABL - positive, not having achieved remission
C9211	Chronic myeloid leukemia, BCR/ABL - positive, in remission
C9212	Chronic myeloid leukemia, BCR/ABL - positive, in relapse
C9220	Atypical chronic myeloid leukemia, BCR/ABL - negative, not having achieved remission
C9221	Atypical chronic myeloid leukemia, BCR/ABL - negative, in remission
C9222	Atypical chronic myeloid leukemia, BCR/ABL - negative, in relapse
C9230	Myeloid sarcoma, not having achieved remission
C9231	Myeloid sarcoma, in remission
C9232	Myeloid sarcoma, in relapse
C9240	Acute promyelocytic leukemia, not having achieved remission
C9241	Acute promyelocytic leukemia, in remission
C9242	Acute promyelocytic leukemia, in relapse
C9250	Acute myelomonocytic leukemia, not having achieved remission
C9251	Acute myelomonocytic leukemia, in remission
C9252	Acute myelomonocytic leukemia, in relapse
C9260	Acute myeloid leukemia with 11q23-abnormality not having achieved remission
C9261	Acute myeloid leukemia with 11q23-abnormality in remission
C9262	Acute myeloid leukemia with 11q23-abnormality in relapse
C9290	Myeloid leukemia, unspecified, not having achieved remission
C9291	Myeloid leukemia, unspecified in remission
C9292	Myeloid leukemia, unspecified in relapse
C92A0	Acute myeloid leukemia with multilineage dysplasia, not having achieved remission

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**Supplementary Table 8: Contd...**

<b>ICD-10-CM diagnosis of leukemia</b>	<b>ICD-10-CM code description</b>
C92A1	Acute myeloid leukemia with multilineage dysplasia, in remission
C92A2	Acute myeloid leukemia with multilineage dysplasia, in relapse
C92Z0	Other myeloid leukemia not having achieved remission
C92Z1	Other myeloid leukemia, in remission
C92Z2	Other myeloid leukemia, in relapse
C9300	Acute monoblastic/monocytic leukemia, not having achieved remission
C9301	Acute monoblastic/monocytic leukemia, in remission
C9302	Acute monoblastic/monocytic leukemia, in relapse
C9310	Chronic myelomonocytic leukemia not having achieved remission
C9311	Chronic myelomonocytic leukemia, in remission
C9312	Chronic myelomonocytic leukemia, in relapse
C9330	Juvenile myelomonocytic leukemia, not having achieved remission
C9331	Juvenile myelomonocytic leukemia, in remission
C9332	Juvenile myelomonocytic leukemia, in relapse
C9390	Monocytic leukemia, unspecified, not having achieved remission
C9391	Monocytic leukemia, unspecified in remission
C9392	Monocytic leukemia, unspecified in relapse
C93Z0	Other monocytic leukemia, not having achieved remission
C93Z1	Other monocytic leukemia, in remission
C93Z2	Other monocytic leukemia, in relapse
C9400	Acute erythroid leukemia, not having achieved remission
C9401	Acute erythroid leukemia, in remission
C9402	Acute erythroid leukemia, in relapse
C9420	Acute megakaryoblastic leukemia not having achieved remission
C9421	Acute megakaryoblastic leukemia, in remission
C9422	Acute megakaryoblastic leukemia, in relapse
C9430	Mast cell leukemia not having achieved remission
C9431	Mast cell leukemia, in remission
C9432	Mast cell leukemia, in relapse
C9440	Acute panmyelosis with myelofibrosis not having achieved remission
C9441	Acute panmyelosis with myelofibrosis, in remission
C9442	Acute panmyelosis with myelofibrosis, in relapse
C946	Myelodysplastic disease, not classified
C9480	Other specified leukemias not having achieved remission
C9481	Other specified leukemias, in remission
C9482	Other specified leukemias, in relapse
C9500	Acute leukemia of unspecified cell type not having achieved remission
C9501	Acute leukemia of unspecified cell type, in remission
C9502	Acute leukemia of unspecified cell type, in relapse
C9510	Chronic leukemia of unspecified cell type not having achieved remission
C9511	Chronic leukemia of unspecified cell type, in remission
C9512	Chronic leukemia of unspecified cell type, in relapse
C9590	Leukemia, unspecified not having achieved remission
C9591	Leukemia, unspecified, in remission
C9592	Leukemia, unspecified, in relapse

HTLV-1=Human T-cell leukemia/lymphotropic virus type 1, ICD-10-CM=International Classification of Diseases, 10<sup>th</sup> Edition Clinical Modification

**Supplementary Table 9: Case definition based on International Classification for Diseases, Tenth Revision (ICD-10) codes for lymphomas**

ICD-10-CM diagnosis of lymphoma	ICD-10-CM code description
C8100	Nodular lymphocyte predominant Hodgkin's lymphoma, unspecified site
C8101	Nodular lymphocyte predominant Hodgkin's lymphoma, lymph nodes of head, face, and neck
C8102	Nodular lymphocyte predominant Hodgkin's lymphoma, intrathoracic lymph nodes
C8103	Nodular lymphocyte predominant Hodgkin's lymphoma, intra-abdominal lymph nodes
C8104	Nodular lymphocyte predominant Hodgkin's lymphoma, lymph nodes of axilla and upper limb
C8105	Nodular lymphocyte predominant Hodgkin's lymphoma, lymph nodes of inguinal region and lower limb
C8106	Nodular lymphocyte predominant Hodgkin's lymphoma, intrapelvic lymph nodes
C8107	Nodular lymphocyte predominant Hodgkin's lymphoma, spleen
C8108	Nodular lymphocyte predominant Hodgkin's lymphoma, lymph nodes of multiple sites
C8109	Nodular lymphocyte predominant Hodgkin's lymphoma, extranodal and solid organ sites
C8110	Nodular sclerosis Hodgkin's lymphoma, unspecified site
C8111	Nodular sclerosis Hodgkin's lymphoma, lymph nodes of head, face, and neck
C8112	Nodular sclerosis Hodgkin's lymphoma, intrathoracic lymph nodes
C8113	Nodular sclerosis Hodgkin's lymphoma, intra-abdominal lymph nodes
C8114	Nodular sclerosis Hodgkin's lymphoma, lymph nodes of axilla and upper limb
C8115	Nodular sclerosis Hodgkin's lymphoma, lymph nodes of inguinal region and lower limb
C8116	Nodular sclerosis Hodgkin's lymphoma, intrapelvic lymph nodes
C8117	Nodular sclerosis Hodgkin's lymphoma, spleen
C8118	Nodular sclerosis Hodgkin's lymphoma, lymph nodes of multiple sites
C8119	Nodular sclerosis Hodgkin's lymphoma, extranodal and solid organ sites
C8120	Mixed cellularity Hodgkin's lymphoma, unspecified site
C8121	Mixed cellularity Hodgkin's lymphoma, lymph nodes of head, face, and neck
C8122	Mixed cellularity Hodgkin's lymphoma, intrathoracic lymph nodes
C8123	Mixed cellularity Hodgkin's lymphoma, intra-abdominal lymph nodes
C8124	Mixed cellularity Hodgkin's lymphoma, lymph nodes of axilla and upper limb
C8125	Mixed cellularity Hodgkin's lymphoma, lymph nodes of inguinal region and lower limb
C8126	Mixed cellularity Hodgkin's lymphoma, intrapelvic lymph nodes
C8127	Mixed cellularity Hodgkin's lymphoma, spleen
C8128	Mixed cellularity Hodgkin's lymphoma, lymph nodes of multiple sites
C8129	Mixed cellularity Hodgkin's lymphoma, extranodal and solid organ sites
C8130	Lymphocyte-depleted Hodgkin's lymphoma, unspecified site
C8131	Lymphocyte-depleted Hodgkin's lymphoma, lymph nodes of head, face, and neck
C8132	Lymphocyte depleted Hodgkin's lymphoma, intrathoracic lymph nodes
C8133	Lymphocyte depleted Hodgkin's lymphoma, intra-abdominal lymph nodes
C8134	Lymphocyte-depleted Hodgkin's lymphoma, lymph nodes of axilla and upper limb
C8135	Lymphocyte-depleted Hodgkin's lymphoma, lymph nodes of inguinal region and lower limb
C8136	Lymphocyte-depleted Hodgkin's lymphoma, intrapelvic lymph nodes
C8137	Lymphocyte-depleted Hodgkin's lymphoma, spleen
C8138	Lymphocyte-depleted Hodgkin's lymphoma, lymph nodes of multiple sites
C8139	Lymphocyte-depleted Hodgkin's lymphoma, extranodal and solid organ sites
C8140	Lymphocyte-rich Hodgkin's lymphoma, unspecified site
C8141	Lymphocyte-rich Hodgkin's lymphoma, lymph nodes of head, face, and neck
C8142	Lymphocyte-rich Hodgkin's lymphoma, intrathoracic lymph nodes
C8143	Lymphocyte-rich Hodgkin's lymphoma, intra-abdominal lymph nodes
C8144	Lymphocyte-rich Hodgkin's lymphoma, lymph nodes of axilla and upper limb
C8145	Lymphocyte-rich Hodgkin's lymphoma, lymph nodes of inguinal region and lower limb
C8146	Lymphocyte-rich Hodgkin's lymphoma, intrapelvic lymph nodes
C8147	Lymphocyte-rich Hodgkin's lymphoma, spleen
C8148	Lymphocyte-rich Hodgkin's lymphoma, lymph nodes of multiple sites
C8149	Lymphocyte-rich Hodgkin's lymphoma, extranodal and solid organ sites
C8170	Other Hodgkin's lymphoma, unspecified site
C8171	Other Hodgkin's lymphoma, lymph nodes of head, face, and neck
C8172	Other Hodgkin's lymphoma, intrathoracic lymph nodes
C8173	Other Hodgkin's lymphoma, intra-abdominal lymph nodes
C8174	Other Hodgkin's lymphoma, lymph nodes of axilla and upper limb

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**Supplementary Table 9: Contd...**

<b>ICD-10-CM diagnosis of lymphoma</b>	<b>ICD-10-CM code description</b>
C8175	Other Hodgkin's lymphoma, lymph nodes of inguinal region and lower limb
C8176	Other Hodgkin's lymphoma, intrapelvic lymph nodes
C8177	Other Hodgkin's lymphoma, spleen
C8178	Other Hodgkin's lymphoma, lymph nodes of multiple sites
C8179	Other Hodgkin's lymphoma, extranodal and solid organ sites
C8190	Hodgkin's lymphoma, unspecified, unspecified site
C8191	Hodgkin's lymphoma, unspecified, lymph nodes of head, face, and neck
C8192	Hodgkin's lymphoma, unspecified, intrathoracic lymph nodes
C8193	Hodgkin's lymphoma, unspecified, intra-abdominal lymph nodes
C8194	Hodgkin's lymphoma, unspecified, lymph nodes of axilla and upper limb
C8195	Hodgkin's lymphoma, unspecified, lymph nodes of inguinal region and lower limb
C8196	Hodgkin's lymphoma, unspecified, intrapelvic lymph nodes
C8197	Hodgkin's lymphoma, unspecified, spleen
C8198	Hodgkin's lymphoma, unspecified, lymph nodes of multiple sites
C8199	Hodgkin's lymphoma, unspecified, extranodal and solid organ sites
C8200	Follicular lymphoma grade I, unspecified site
C8201	Follicular lymphoma grade I, lymph nodes of head, face and neck
C8202	Follicular lymphoma grade I, intrathoracic lymph nodes
C8203	Follicular lymphoma grade I, intra-abdominal lymph nodes
C8204	Follicular lymphoma grade I, lymph nodes of axilla and upper limb
C8205	Follicular lymphoma grade I, lymph nodes of inguinal region and lower limb
C8206	Follicular lymphoma grade I, intrapelvic lymph nodes
C8207	Follicular lymphoma grade I, spleen
C8208	Follicular lymphoma grade I, lymph nodes of multiple sites
C8209	Follicular lymphoma grade I, extranodal and solid organ sites
C8210	Follicular lymphoma grade II, unspecified site
C8211	Follicular lymphoma grade II, lymph nodes of head, face and neck
C8212	Follicular lymphoma grade II, intrathoracic lymph nodes
C8213	Follicular lymphoma grade II, intra-abdominal lymph nodes
C8214	Follicular lymphoma grade II, lymph nodes of axilla and upper limb
C8215	Follicular lymphoma grade II, lymph nodes of inguinal region and lower limb
C8216	Follicular lymphoma grade II, intrapelvic lymph nodes
C8217	Follicular lymphoma grade II, spleen
C8218	Follicular lymphoma grade II, lymph nodes of multiple sites
C8219	Follicular lymphoma grade II, extranodal and solid organ sites
C8220	Follicular lymphoma grade III, unspecified, unspecified site
C8221	Follicular lymphoma grade III, unspecified, lymph nodes of head, face and neck
C8222	Follicular lymphoma grade III, unspecified, intrathoracic lymph nodes
C8223	Follicular lymphoma grade III, unspecified, intra-abdominal lymph nodes
C8224	Follicular lymphoma grade III, unspecified, lymph nodes of axilla and upper limb
C8225	Follicular lymphoma grade III, unspecified, lymph nodes of inguinal region and lower limb
C8226	Follicular lymphoma grade III, unspecified, intrapelvic lymph nodes
C8227	Follicular lymphoma grade III, unspecified, spleen
C8228	Follicular lymphoma grade III, unspecified, lymph nodes of multiple sites
C8229	Follicular lymphoma grade III, unspecified, extranodal and solid organ sites
C8230	Follicular lymphoma grade IIIa, unspecified site
C8231	Follicular lymphoma grade IIIa, lymph nodes of head, face and neck
C8232	Follicular lymphoma grade IIIa, intrathoracic lymph nodes
C8233	Follicular lymphoma grade IIIa, intra-abdominal lymph nodes
C8234	Follicular lymphoma grade IIIa, lymph nodes of axilla and upper limb
C8235	Follicular lymphoma grade IIIa, lymph nodes of inguinal region and lower limb
C8236	Follicular lymphoma grade IIIa, intrapelvic lymph nodes
C8237	Follicular lymphoma grade IIIa, spleen
C8238	Follicular lymphoma grade IIIa, lymph nodes of multiple sites
C8239	Follicular lymphoma grade IIIa, extranodal and solid organ sites

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**Supplementary Table 9: Contd...**

<b>ICD-10-CM diagnosis of lymphoma</b>	<b>ICD-10-CM code description</b>
C8240	Follicular lymphoma grade IIIb, unspecified site
C8241	Follicular lymphoma grade IIIb, lymph nodes of head, face, and neck
C8242	Follicular lymphoma grade IIIb, intrathoracic lymph nodes
C8243	Follicular lymphoma grade IIIb, intra-abdominal lymph nodes
C8244	Follicular lymphoma grade IIIb, lymph nodes of axilla and upper limb
C8245	Follicular lymphoma grade IIIb, lymph nodes of inguinal region and lower limb
C8246	Follicular lymphoma grade IIIb, intrapelvic lymph nodes
C8247	Follicular lymphoma grade IIIb, spleen
C8248	Follicular lymphoma grade IIIb, lymph nodes of multiple sites
C8249	Follicular lymphoma grade IIIb, extranodal and solid organ sites
C8250	Diffuse follicle center lymphoma, unspecified site
C8251	Diffuse follicle center lymphoma, lymph nodes of head, face and neck
C8252	Diffuse follicle center lymphoma, intrathoracic lymph nodes
C8253	Diffuse follicle center lymphoma, intra-abdominal lymph nodes
C8254	Diffuse follicle center lymphoma, lymph nodes of axilla and upper limb
C8255	Diffuse follicle center lymphoma, lymph nodes of inguinal region and lower limb
C8256	Diffuse follicle center lymphoma, intrapelvic lymph nodes
C8257	Diffuse follicle center lymphoma, spleen
C8258	Diffuse follicle center lymphoma, lymph nodes of multiple sites
C8259	Diffuse follicle center lymphoma, extranodal and solid organ sites
C8260	Cutaneous follicle center lymphoma, unspecified site
C8261	Cutaneous follicle center lymphoma, lymph nodes of head, face and neck
C8262	Cutaneous follicle center lymphoma, intrathoracic lymph nodes
C8263	Cutaneous follicle center lymphoma, intra-abdominal lymph nodes
C8264	Cutaneous follicle center lymphoma, lymph nodes of axilla and upper limb
C8265	Cutaneous follicle center lymphoma, lymph nodes of inguinal region and lower limb
C8266	Cutaneous follicle center lymphoma, intrapelvic lymph nodes
C8267	Cutaneous follicle center lymphoma, spleen
C8268	Cutaneous follicle center lymphoma, lymph nodes of multiple sites
C8269	Cutaneous follicle center lymphoma, extranodal and solid organ sites
C8280	Other types of follicular lymphoma, unspecified site
C8281	Other types of follicular lymphoma, lymph nodes of head, face and neck
C8282	Other types of follicular lymphoma, intrathoracic lymph nodes
C8283	Other types of follicular lymphoma, intra-abdominal lymph nodes
C8284	Other types of follicular lymphoma, lymph nodes of axilla and upper limb
C8285	Other types of follicular lymphoma, lymph nodes of inguinal region and lower limb
C8286	Other types of follicular lymphoma, intrapelvic lymph nodes
C8287	Other types of follicular lymphoma, spleen
C8288	Other types of follicular lymphoma, lymph nodes of multiple sites
C8289	Other types of follicular lymphoma, extranodal and solid organ sites
C8290	Follicular lymphoma, unspecified, unspecified site
C8291	Follicular lymphoma, unspecified, lymph nodes of head, face and neck
C8292	Follicular lymphoma, unspecified, intrathoracic lymph nodes
C8293	Follicular lymphoma, unspecified, intra-abdominal lymph nodes
C8294	Follicular lymphoma, unspecified, lymph nodes of axilla and upper limb
C8295	Follicular lymphoma, unspecified, lymph nodes of inguinal region and lower limb
C8296	Follicular lymphoma, unspecified, intrapelvic lymph nodes
C8297	Follicular lymphoma, unspecified, spleen
C8298	Follicular lymphoma, unspecified, lymph nodes of multiple sites
C8299	Follicular lymphoma, unspecified, extranodal and solid organ sites
C8300	Small cell B-cell lymphoma, unspecified site
C8301	Small cell B-cell lymphoma, lymph nodes of head, face and neck
C8302	Small cell B-cell lymphoma, intrathoracic lymph nodes
C8303	Small cell B-cell lymphoma, intra-abdominal lymph nodes
C8304	Small cell B-cell lymphoma, lymph nodes of axilla and upper limb

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**Supplementary Table 9: Contd...**

<b>ICD-10-CM diagnosis of lymphoma</b>	<b>ICD-10-CM code description</b>
C8305	Small cell B-cell lymphoma, lymph nodes of inguinal region and lower limb
C8306	Small cell B-cell lymphoma, intrapelvic lymph nodes
C8307	Small cell B-cell lymphoma, spleen
C8308	Small cell B-cell lymphoma, lymph nodes of multiple sites
C8309	Small cell B-cell lymphoma, extranodal and solid organ sites
C8310	Mantle cell lymphoma, unspecified site
C8311	Mantle cell lymphoma, lymph nodes of head, face and neck
C8312	Mantle cell lymphoma, intrathoracic lymph nodes
C8313	Mantle cell lymphoma, intra-abdominal lymph nodes
C8314	Mantle cell lymphoma, lymph nodes of axilla and upper limb
C8315	Mantle cell lymphoma, lymph nodes of inguinal region and lower limb
C8316	Mantle cell lymphoma, intrapelvic lymph nodes
C8317	Mantle cell lymphoma, spleen
C8318	Mantle cell lymphoma, lymph nodes of multiple sites
C8319	Mantle cell lymphoma, extranodal and solid organ sites
C8330	Diffuse large B-cell lymphoma, unspecified site
C8331	Diffuse large B-cell lymphoma, lymph nodes of head, face and neck
C8332	Diffuse large B-cell lymphoma, intrathoracic lymph nodes
C8333	Diffuse large B-cell lymphoma, intra-abdominal lymph nodes
C8334	Diffuse large B-cell lymphoma, lymph nodes of axilla and upper limb
C8335	Diffuse large B-cell lymphoma, lymph nodes of inguinal region and lower limb
C8336	Diffuse large B-cell lymphoma, intrapelvic lymph nodes
C8337	Diffuse large B-cell lymphoma, spleen
C8338	Diffuse large B-cell lymphoma, lymph nodes of multiple sites
C8339	Diffuse large B-cell lymphoma, extranodal and solid organ sites
C8350	Lymphoblastic (diffuse) lymphoma, unspecified site
C8351	Lymphoblastic (diffuse) lymphoma, lymph nodes of head, face and neck
C8352	Lymphoblastic (diffuse) lymphoma, intrathoracic lymph nodes
C8353	Lymphoblastic (diffuse) lymphoma, intra-abdominal lymph nodes
C8354	Lymphoblastic (diffuse) lymphoma, lymph nodes of axilla and upper limb
C8355	Lymphoblastic (diffuse) lymphoma, lymph nodes of inguinal region and lower limb
C8356	Lymphoblastic (diffuse) lymphoma, intrapelvic lymph nodes
C8357	Lymphoblastic (diffuse) lymphoma, spleen
C8358	Lymphoblastic (diffuse) lymphoma, lymph nodes of multiple sites
C8359	Lymphoblastic (diffuse) lymphoma, extranodal and solid organ sites
C8370	Burkitt lymphoma, unspecified site
C8371	Burkitt lymphoma, lymph nodes of head, face and neck
C8372	Burkitt lymphoma, intrathoracic lymph nodes
C8373	Burkitt lymphoma, intra-abdominal lymph nodes
C8374	Burkitt lymphoma, lymph nodes of axilla and upper limb
C8375	Burkitt lymphoma, lymph nodes of inguinal region and lower limb
C8376	Burkitt lymphoma, intrapelvic lymph nodes
C8377	Burkitt lymphoma, spleen
C8378	Burkitt lymphoma, lymph nodes of multiple sites
C8379	Burkitt lymphoma, extranodal and solid organ sites
C8380	Other nonfollicular lymphoma, unspecified site
C8381	Other nonfollicular lymphoma, lymph nodes of head, face and neck
C8382	Other nonfollicular lymphoma, intrathoracic lymph nodes
C8383	Other nonfollicular lymphoma, intra-abdominal lymph nodes
C8384	Other nonfollicular lymphoma, lymph nodes of axilla and upper limb
C8385	Other nonfollicular lymphoma, lymph nodes of inguinal region and lower limb
C8386	Other nonfollicular lymphoma, intrapelvic lymph nodes
C8387	Other nonfollicular lymphoma, spleen
C8388	Other nonfollicular lymphoma, lymph nodes of multiple sites
C8389	Other nonfollicular lymphoma, extranodal and solid organ sites

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**Supplementary Table 9: Contd...**

<b>ICD-10-CM diagnosis of lymphoma</b>	<b>ICD-10-CM code description</b>
C8390	Nonfollicular (diffuse) lymphoma, unspecified, unspecified site
C8391	Nonfollicular (diffuse) lymphoma, unspecified, lymph nodes of head, face and neck
C8392	Nonfollicular (diffuse) lymphoma, unspecified, intrathoracic lymph nodes
C8393	Nonfollicular (diffuse) lymphoma, unspecified, intra-abdominal lymph nodes
C8394	Nonfollicular (diffuse) lymphoma, unspecified, lymph nodes of axilla and upper limb
C8395	Nonfollicular (diffuse) lymphoma, unspecified, lymph nodes of inguinal region and lower limb
C8396	Nonfollicular (diffuse) lymphoma, unspecified, intrapelvic lymph nodes
C8397	Nonfollicular (diffuse) lymphoma, unspecified, spleen
C8398	Nonfollicular (diffuse) lymphoma, unspecified, lymph nodes of multiple sites
C8399	Nonfollicular (diffuse) lymphoma, unspecified, extranodal and solid organ sites
C8400	Mycosis fungoides, unspecified site
C8401	Mycosis fungoides, lymph nodes of head, face and neck
C8402	Mycosis fungoides, intrathoracic lymph nodes
C8403	Mycosis fungoides, intra-abdominal lymph nodes
C8404	Mycosis fungoides, lymph nodes of axilla and upper limb
C8405	Mycosis fungoides, lymph nodes of inguinal region and lower limb
C8406	Mycosis fungoides, intrapelvic lymph nodes
C8407	Mycosis fungoides, spleen
C8408	Mycosis fungoides, lymph nodes of multiple sites
C8409	Mycosis fungoides, extranodal and solid organ sites
C8410	Sezary disease, unspecified site
C8411	Sezary disease, lymph nodes of head, face and neck
C8412	Sezary disease, intrathoracic lymph nodes
C8413	Sezary disease, intra-abdominal lymph nodes
C8414	Sezary disease, lymph nodes of axilla and upper limb
C8415	Sezary disease, lymph nodes of inguinal region and lower limb
C8416	Sezary disease, intrapelvic lymph nodes
C8417	Sezary disease, spleen
C8418	Sezary disease, lymph nodes of multiple sites
C8419	Sezary disease, extranodal and solid organ sites
C8440	Peripheral T-cell lymphoma, not classified, unspecified site
C8441	Peripheral T-cell lymphoma, not classified, lymph nodes of head, face and neck
C8442	Peripheral T-cell lymphoma, not classified, intrathoracic lymph nodes
C8443	Peripheral T-cell lymphoma, not classified, intra-abdominal lymph nodes
C8444	Peripheral T-cell lymphoma, not classified, lymph nodes of axilla and upper limb
C8445	Peripheral T-cell lymphoma, not classified, lymph nodes of inguinal region and lower limb
C8446	Peripheral T-cell lymphoma, not classified, intrapelvic lymph nodes
C8447	Peripheral T-cell lymphoma, not classified, spleen
C8448	Peripheral T-cell lymphoma, not classified, lymph nodes of multiple sites
C8449	Peripheral T-cell lymphoma, not classified, extranodal and solid organ sites
C8460	Anaplastic large cell lymphoma, ALK-positive, unspecified site
C8461	Anaplastic large cell lymphoma, ALK-positive, lymph nodes of head, face and neck
C8462	Anaplastic large cell lymphoma, ALK-positive, intrathoracic lymph nodes
C8463	Anaplastic large cell lymphoma, ALK-positive, intra-abdominal lymph nodes
C8464	Anaplastic large cell lymphoma, ALK-positive, lymph nodes of axilla and upper limb
C8465	Anaplastic large cell lymphoma, ALK-positive, lymph nodes of inguinal region and lower limb
C8466	Anaplastic large cell lymphoma, ALK-positive, intrapelvic lymph nodes
C8467	Anaplastic large cell lymphoma, ALK-positive, spleen
C8468	Anaplastic large cell lymphoma, ALK-positive, lymph nodes of multiple sites
C8469	Anaplastic large cell lymphoma, ALK-positive, extranodal and solid organ sites
C8470	Anaplastic large cell lymphoma, ALK-negative, unspecified site
C8471	Anaplastic large cell lymphoma, ALK-negative, lymph nodes of head, face and neck
C8472	Anaplastic large cell lymphoma, ALK-negative, intrathoracic lymph nodes
C8473	Anaplastic large cell lymphoma, ALK-negative, intra-abdominal lymph nodes
C8474	Anaplastic large cell lymphoma, ALK-negative, lymph nodes of axilla and upper limb

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**Supplementary Table 9: Contd...**

<b>ICD-10-CM diagnosis of lymphoma</b>	<b>ICD-10-CM code description</b>
C8475	Anaplastic large cell lymphoma, ALK-negative, lymph nodes of inguinal region and lower limb
C8476	Anaplastic large cell lymphoma, ALK-negative, intrapelvic lymph nodes
C8477	Anaplastic large cell lymphoma, ALK-negative, spleen
C8478	Anaplastic large cell lymphoma, ALK-negative, lymph nodes of multiple sites
C8479	Anaplastic large cell lymphoma, ALK-negative, extranodal and solid organ sites
C847A	Anaplastic large cell lymphoma, ALK-negative, breast
C8490	Mature T/NK-cell lymphomas, unspecified, unspecified site
C8491	Mature T/NK-cell lymphomas, unspecified, lymph nodes of head, face and neck
C8492	Mature T/NK-cell lymphomas, unspecified, intrathoracic lymph nodes
C8493	Mature T/NK-cell lymphomas, unspecified, intra-abdominal lymph nodes
C8494	Mature T/NK-cell lymphomas, unspecified, lymph nodes of axilla and upper limb
C8495	Mature T/NK-cell lymphomas, unspecified, lymph nodes of inguinal region and lower limb
C8496	Mature T/NK-cell lymphomas, unspecified, intrapelvic lymph nodes
C8497	Mature T/NK-cell lymphomas, unspecified, spleen
C8498	Mature T/NK-cell lymphomas, unspecified, lymph nodes of multiple sites
C8499	Mature T/NK-cell lymphomas, unspecified, extranodal and solid organ sites
C84A0	Cutaneous T-cell lymphoma, unspecified, unspecified site
C84A1	Cutaneous T-cell lymphoma, unspecified lymph nodes of head, face and neck
C84A2	Cutaneous T-cell lymphoma, unspecified, intrathoracic lymph nodes
C84A3	Cutaneous T-cell lymphoma, unspecified, intra-abdominal lymph nodes
C84A4	Cutaneous T-cell lymphoma, unspecified, lymph nodes of axilla and upper limb
C84A5	Cutaneous T-cell lymphoma, unspecified, lymph nodes of inguinal region and lower limb
C84A6	Cutaneous T-cell lymphoma, unspecified, intrapelvic lymph nodes
C84A7	Cutaneous T-cell lymphoma, unspecified, spleen
C84A8	Cutaneous T-cell lymphoma, unspecified, lymph nodes of multiple sites
C84A9	Cutaneous T-cell lymphoma, unspecified, extranodal and solid organ sites
C84Z0	Other mature T/NK-cell lymphomas, unspecified site
C84Z1	Other mature T/NK-cell lymphomas, lymph nodes of head, face and neck
C84Z2	Other mature T/NK-cell lymphomas, intrathoracic lymph nodes
C84Z3	Other mature T/NK-cell lymphomas, intra-abdominal lymph nodes
C84Z4	Other mature T/NK-cell lymphomas, lymph nodes of axilla and upper limb
C84Z5	Other mature T/NK-cell lymphomas, lymph nodes of inguinal region and lower limb
C84Z6	Other mature T/NK-cell lymphomas, intrapelvic lymph nodes
C84Z7	Other mature T/NK-cell lymphomas, spleen
C84Z8	Other mature T/NK-cell lymphomas, lymph nodes of multiple sites
C84Z9	Other mature T/NK-cell lymphomas, extranodal and solid organ sites
C8510	Unspecified B-cell lymphoma, unspecified site
C8511	Unspecified B-cell lymphoma, lymph nodes of head, face and neck
C8512	Unspecified B-cell lymphoma, intrathoracic lymph nodes
C8513	Unspecified B-cell lymphoma, intra-abdominal lymph nodes
C8514	Unspecified B-cell lymphoma, lymph nodes of axilla and upper limb
C8515	Unspecified B-cell lymphoma, lymph nodes of inguinal region and lower limb
C8516	Unspecified B-cell lymphoma, intrapelvic lymph nodes
C8517	Unspecified B-cell lymphoma, spleen
C8518	Unspecified B-cell lymphoma, lymph nodes of multiple sites
C8519	Unspecified B-cell lymphoma, extranodal and solid organ sites
C8520	Mediastinal (thymic) large B-cell lymphoma, unspecified site
C8521	Mediastinal (thymic) large B-cell lymphoma, lymph nodes of head, face and neck
C8522	Mediastinal (thymic) large B-cell lymphoma, intrathoracic lymph nodes
C8523	Mediastinal (thymic) large B-cell lymphoma, intra-abdominal lymph nodes
C8524	Mediastinal (thymic) large B-cell lymphoma, lymph nodes of axilla and upper limb
C8525	Mediastinal (thymic) large B-cell lymphoma, lymph nodes of inguinal region and lower limb
C8526	Mediastinal (thymic) large B-cell lymphoma, intrapelvic lymph nodes
C8527	Mediastinal (thymic) large B-cell lymphoma, spleen
C8528	Mediastinal (thymic) large B-cell lymphoma, lymph nodes of multiple sites

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**Supplementary Table 9: Contd...**

<b>ICD-10-CM diagnosis of lymphoma</b>	<b>ICD-10-CM code description</b>
C8529	Mediastinal (thymic) large B-cell lymphoma, extranodal and solid organ sites
C8580	Other specified types of non-Hodgkin's lymphoma, unspecified site
C8581	Other specified types of non-Hodgkin's lymphoma, lymph nodes of head, face and neck
C8582	Other specified types of non-Hodgkin's lymphoma, intrathoracic lymph nodes
C8583	Other specified types of non-Hodgkin's lymphoma, intra-abdominal lymph nodes
C8584	Other specified types of non-Hodgkin's lymphoma, lymph nodes of axilla and upper limb
C8585	Other specified types of non-Hodgkin's lymphoma, lymph nodes of inguinal region and lower limb
C8586	Other specified types of non-Hodgkin's lymphoma, intrapelvic lymph nodes
C8587	Other specified types of non-Hodgkin's lymphoma, spleen
C8588	Other specified types of non-Hodgkin's lymphoma, lymph nodes of multiple sites
C8589	Other specified types of non-Hodgkin's lymphoma, extranodal and solid organ sites
C8590	Non-Hodgkin's lymphoma, unspecified, unspecified site
C8591	Non-Hodgkin's lymphoma, unspecified, lymph nodes of head, face, and neck
C8592	Non-Hodgkin's lymphoma, unspecified, intrathoracic lymph nodes
C8593	Non-Hodgkin's lymphoma, unspecified, intra-abdominal lymph nodes
C8594	Non-Hodgkin's lymphoma, unspecified, lymph nodes of axilla and upper limb
C8595	Non-Hodgkin's lymphoma, unspecified, lymph nodes of inguinal region and lower limb
C8596	Non-Hodgkin's lymphoma, unspecified, intrapelvic lymph nodes
C8597	Non-Hodgkin's lymphoma, unspecified, spleen
C8598	Non-Hodgkin's lymphoma, unspecified, lymph nodes of multiple sites
C8599	Non-Hodgkin's lymphoma, unspecified, extranodal and solid organ sites
C860	Extranodal NK/T-cell lymphoma, nasal type
C861	Hepatosplenic T-cell lymphoma
C862	Enteropathy-type (intestinal) T-cell lymphoma
C863	Subcutaneous panniculitis-like T-cell lymphoma
C864	Blastic NK-cell lymphoma
C865	Angioimmunoblastic T-cell lymphoma
C866	Primary cutaneous CD30-positive T-cell proliferations
C880	Waldenstrom macroglobulinemia
C882	Heavy chain disease
C883	Immunoproliferative small intestinal disease
C884	Extranodal MALT-lymphoma
C888	Other malignant immunoproliferative diseases
C889	Malignant immunoproliferative disease, unspecified
C9000	Multiple myeloma not having achieved remission
C9001	Multiple myeloma in remission
C9002	Multiple myeloma in relapse
C9020	Extramedullary plasmacytoma not having achieved remission
C9021	Extramedullary plasmacytoma in remission
C9022	Extramedullary plasmacytoma in relapse
C9030	Solitary plasmacytoma not having achieved remission
C9031	Solitary plasmacytoma in remission
C9032	Solitary plasmacytoma in relapse
C960	Multifocal and multisystemic (disseminated) Langerhans-cell histiocytosis
C962	Malignant mast cell tumor
C9620	Malignant mast cell neoplasm, unspecified
C9621	Aggressive systemic mastocytosis
C9622	Mast cell sarcoma
C9629	Other malignant mast cell neoplasm
C964	Sarcoma of dendritic cells (accessory cells)
C969	Malignant neoplasm of lymphoid, hematopoietic and related tissue, unspecified
C96A	Histiocytic sarcoma
C96Z	Other specified malignant neoplasms of lymphoid, hematopoietic, and related tissue
D47Z9	Other specified neoplasms of uncertain behavior of lymphoid, hematopoietic, and related tissue

MALT=Marginal zone B-cell lymphoma of mucosa-associated lymphoid tissue, NK=Natural killer, ALK=Anaplastic lymphoma kinase, ICD-10-CM=International Classification of Diseases, 10<sup>th</sup> Edition Clinical Modification

**Supplementary Table 10: Case definition based on International Classification for Diseases, Tenth Revision (ICD-10) codes for metastatic disease**

ICD-10-CM diagnosis of metastatic cancer	ICD-10-CM code description
C770	Secondary and unspecified malignant neoplasm of lymph nodes of head, face and neck
C771	Secondary and unspecified malignant neoplasm of intrathoracic lymph nodes
C772	Secondary and unspecified malignant neoplasm of intra-abdominal lymph nodes
C773	Secondary and unspecified malignant neoplasm of axilla and upper limb lymph nodes
C774	Secondary and unspecified malignant neoplasm of inguinal and lower limb lymph nodes
C775	Secondary and unspecified malignant neoplasm of intrapelvic lymph nodes
C778	Secondary and unspecified malignant neoplasm of lymph nodes of multiple regions
C779	Secondary and unspecified malignant neoplasm of lymph node, unspecified
C7800	Secondary malignant neoplasm of unspecified lung
C7801	Secondary malignant neoplasm of right lung
C7802	Secondary malignant neoplasm of left lung
C781	Secondary malignant neoplasm of mediastinum
C782	Secondary malignant neoplasm of pleura
C7830	Secondary malignant neoplasm of unspecified respiratory organ
C7839	Secondary malignant neoplasm of other respiratory organs
C784	Secondary malignant neoplasm of small intestine
C785	Secondary malignant neoplasm of large intestine and rectum
C786	Secondary malignant neoplasm of retroperitoneum and peritoneum
C787	Secondary malignant neoplasm of liver and intrahepatic bile duct
C7880	Secondary malignant neoplasm of unspecified digestive organ
C7889	Secondary malignant neoplasm of other digestive organs
C7900	Secondary malignant neoplasm of unspecified kidney and renal pelvis
C7901	Secondary malignant neoplasm of right kidney and renal pelvis
C7902	Secondary malignant neoplasm of left kidney and renal pelvis
C7910	Secondary malignant neoplasm of unspecified urinary organs
C7911	Secondary malignant neoplasm of bladder
C7919	Secondary malignant neoplasm of other urinary organs
C792	Secondary malignant neoplasm of skin
C7931	Secondary malignant neoplasm of brain
C7932	Secondary malignant neoplasm of cerebral meninges
C7940	Secondary malignant neoplasm of unspecified part of nervous system
C7949	Secondary malignant neoplasm of other parts of nervous system
C7951	Secondary malignant neoplasm of bone
C7952	Secondary malignant neoplasm of bone marrow
C7960	Secondary malignant neoplasm of unspecified ovary
C7961	Secondary malignant neoplasm of right ovary
C7962	Secondary malignant neoplasm of left ovary
C7963	Secondary malignant neoplasm of bilateral ovaries
C7970	Secondary malignant neoplasm of unspecified adrenal gland
C7971	Secondary malignant neoplasm of right adrenal gland
C7972	Secondary malignant neoplasm of left adrenal gland
C7981	Secondary malignant neoplasm of breast
C7982	Secondary malignant neoplasm of genital organs
C7989	Secondary malignant neoplasm of other specified sites
C799	Secondary malignant neoplasm of unspecified site
C7B00	Secondary carcinoid tumors, unspecified site
C7B01	Secondary carcinoid tumors of distant lymph nodes
C7B02	Secondary carcinoid tumors of liver
C7B03	Secondary carcinoid tumors of bone
C7B04	Secondary carcinoid tumors of peritoneum
C7B09	Secondary carcinoid tumors of other sites
C7B1	Secondary Merkel cell carcinoma
C7B8	Other secondary neuroendocrine tumors
C800	Disseminated malignant neoplasm, unspecified

**Supplementary Table 11: Case definition based on International Classification for Diseases, Tenth Revision (ICD-10) codes for carcinoma *in situ***

ICD-10-CM diagnosis of carcinoma <i>in situ</i>	ICD-10-CM code description
D0000	Carcinoma <i>in situ</i> of oral cavity, unspecified site
D0001	Carcinoma <i>in situ</i> of labial mucosa and vermilion border
D0002	Carcinoma <i>in situ</i> of buccal mucosa
D0003	Carcinoma <i>in situ</i> of gingiva and edentulous alveolar ridge
D0004	Carcinoma <i>in situ</i> of soft palate
D0005	Carcinoma <i>in situ</i> of hard palate
D0006	Carcinoma <i>in situ</i> of floor of mouth
D0007	Carcinoma <i>in situ</i> of tongue
D0008	Carcinoma <i>in situ</i> of pharynx
D001	Carcinoma <i>in situ</i> of esophagus
D002	Carcinoma <i>in situ</i> of stomach
D010	Carcinoma <i>in situ</i> of colon
D011	Carcinoma <i>in situ</i> of rectosigmoid junction
D012	Carcinoma <i>in situ</i> of rectum
D013	Carcinoma <i>in situ</i> of anus and anal canal
D0140	Carcinoma <i>in situ</i> of unspecified part of intestine
D0149	Carcinoma <i>in situ</i> of other parts of intestine
D015	Carcinoma <i>in situ</i> of liver, gallbladder and bile ducts
D017	Carcinoma <i>in situ</i> of other specified digestive organs
D019	Carcinoma <i>in situ</i> of digestive organ, unspecified
D020	Carcinoma <i>in situ</i> of larynx
D021	Carcinoma <i>in situ</i> of trachea
D0220	Carcinoma <i>in situ</i> of unspecified bronchus and lung
D0221	Carcinoma <i>in situ</i> of right bronchus and lung
D0222	Carcinoma <i>in situ</i> of left bronchus and lung
D023	Carcinoma <i>in situ</i> of other parts of respiratory system
D024	Carcinoma <i>in situ</i> of respiratory system, unspecified
D030	Melanoma <i>in situ</i> of lip
D0310	Melanoma <i>in situ</i> of unspecified eyelid, including canthus
D0311	Melanoma <i>in situ</i> of right eyelid, including canthus
D03111	Melanoma <i>in situ</i> of right upper eyelid, including canthus
D03112	Melanoma <i>in situ</i> of right lower eyelid, including canthus
D0312	Melanoma <i>in situ</i> of left eyelid, including canthus
D03121	Melanoma <i>in situ</i> of left upper eyelid, including canthus
D03122	Melanoma <i>in situ</i> of left lower eyelid, including canthus
D0320	Melanoma <i>in situ</i> of unspecified ear and external auricular canal
D0321	Melanoma <i>in situ</i> of right ear and external auricular canal
D0322	Melanoma <i>in situ</i> of left ear and external auricular canal
D0330	Melanoma <i>in situ</i> of unspecified part of face
D0339	Melanoma <i>in situ</i> of other parts of face
D034	Melanoma <i>in situ</i> of scalp and neck
D0351	Melanoma <i>in situ</i> of anal skin
D0352	Melanoma <i>in situ</i> of breast (skin) (soft tissue)
D0359	Melanoma <i>in situ</i> of other part of trunk
D0360	Melanoma <i>in situ</i> of unspecified upper limb, including shoulder
D0361	Melanoma <i>in situ</i> of right upper limb, including shoulder
D0362	Melanoma <i>in situ</i> of left upper limb, including shoulder
D0370	Melanoma <i>in situ</i> of unspecified lower limb, including hip
D0371	Melanoma <i>in situ</i> of right lower limb, including hip
D0372	Melanoma <i>in situ</i> of left lower limb, including hip
D038	Melanoma <i>in situ</i> of other sites
D039	Melanoma <i>in situ</i> , unspecified
D040	Carcinoma <i>in situ</i> of skin of lip
D0410	Carcinoma <i>in situ</i> of skin of unspecified eyelid, including canthus
D0411	Carcinoma <i>in situ</i> of skin of right eyelid, including canthus

Contd...

**Supplementary Table 11: Contd...**

ICD-10-CM diagnosis of carcinoma <i>in situ</i>	ICD-10-CM code description
D04111	Carcinoma <i>in situ</i> of skin of right upper eyelid, including canthus
D04112	Carcinoma <i>in situ</i> of skin of right lower eyelid, including canthus
D0412	Carcinoma <i>in situ</i> of skin of left eyelid, including canthus
D04121	Carcinoma <i>in situ</i> of skin of left upper eyelid, including canthus
D04122	Carcinoma <i>in situ</i> of skin of left lower eyelid, including canthus
D0420	Carcinoma <i>in situ</i> of skin of unspecified ear and external auricular canal
D0421	Carcinoma <i>in situ</i> of skin of right ear and external auricular canal
D0422	Carcinoma <i>in situ</i> of skin of left ear and external auricular canal
D0430	Carcinoma <i>in situ</i> of skin of unspecified part of face
D0439	Carcinoma <i>in situ</i> of skin of other parts of face
D044	Carcinoma <i>in situ</i> of skin of scalp and neck
D045	Carcinoma <i>in situ</i> of skin of trunk
D0460	Carcinoma <i>in situ</i> of skin of unspecified upper limb, including shoulder
D0461	Carcinoma <i>in situ</i> of skin of right upper limb, including shoulder
D0462	Carcinoma <i>in situ</i> of skin of left upper limb, including shoulder
D0470	Carcinoma <i>in situ</i> of skin of unspecified lower limb, including hip
D0471	Carcinoma <i>in situ</i> of skin of right lower limb, including hip
D0472	Carcinoma <i>in situ</i> of skin of left lower limb, including hip
D048	Carcinoma <i>in situ</i> of skin of other sites
D049	Carcinoma <i>in situ</i> of skin, unspecified
D0500	Lobular carcinoma <i>in situ</i> of unspecified breast
D0501	Lobular carcinoma <i>in situ</i> of right breast
D0502	Lobular carcinoma <i>in situ</i> of left breast
D0510	Intraductal carcinoma <i>in situ</i> of unspecified breast
D0511	Intraductal carcinoma <i>in situ</i> of right breast
D0512	Intraductal carcinoma <i>in situ</i> of left breast
D0580	Other specified type of carcinoma <i>in situ</i> of unspecified breast
D0581	Other specified type of carcinoma <i>in situ</i> of right breast
D0582	Other specified type of carcinoma <i>in situ</i> of left breast
D0590	Unspecified type of carcinoma <i>in situ</i> of unspecified breast
D0591	Unspecified type of carcinoma <i>in situ</i> of right breast
D0592	Unspecified type of carcinoma <i>in situ</i> of left breast
D060	Carcinoma <i>in situ</i> of endocervix
D061	Carcinoma <i>in situ</i> of exocervix
D067	Carcinoma <i>in situ</i> of other parts of cervix
D069	Carcinoma <i>in situ</i> of cervix, unspecified
D070	Carcinoma <i>in situ</i> of endometrium
D071	Carcinoma <i>in situ</i> of vulva
D072	Carcinoma <i>in situ</i> of vagina
D0730	Carcinoma <i>in situ</i> of unspecified female genital organs
D0739	Carcinoma <i>in situ</i> of other female genital organs
D074	Carcinoma <i>in situ</i> of penis
D075	Carcinoma <i>in situ</i> of prostate
D0760	Carcinoma <i>in situ</i> of unspecified male genital organs
D0761	Carcinoma <i>in situ</i> of scrotum
D0769	Carcinoma <i>in situ</i> of other male genital organs
D090	Carcinoma <i>in situ</i> of bladder
D0910	Carcinoma <i>in situ</i> of unspecified urinary organ
D0919	Carcinoma <i>in situ</i> of other urinary organs
D0920	Carcinoma <i>in situ</i> of unspecified eye
D0921	Carcinoma <i>in situ</i> of right eye
D0922	Carcinoma <i>in situ</i> of left eye
D093	Carcinoma <i>in situ</i> of thyroid and other endocrine glands
D098	Carcinoma <i>in situ</i> of other specified sites
D099	Carcinoma <i>in situ</i> , unspecified

**Supplementary Table 12: Case definition based on International Classification for Diseases, Tenth Revision (ICD-10) codes for solid cancers**

ICD-10-CM diagnosis of solid cancer	ICD-10-CM code description
C000	Malignant neoplasm of external upper lip
C001	Malignant neoplasm of external lower lip
C002	Malignant neoplasm of external lip, unspecified
C003	Malignant neoplasm of upper lip, inner aspect
C004	Malignant neoplasm of lower lip, inner aspect
C005	Malignant neoplasm of lip, unspecified, inner aspect
C006	Malignant neoplasm of commissure of lip, unspecified
C008	Malignant neoplasm of overlapping sites of lip
C009	Malignant neoplasm of lip, unspecified
C01	Malignant neoplasm of base of tongue
C020	Malignant neoplasm of dorsal surface of tongue
C021	Malignant neoplasm of border of tongue
C022	Malignant neoplasm of ventral surface of tongue
C023	Malignant neoplasm of anterior two-thirds of tongue, part unspecified
C024	Malignant neoplasm of lingual tonsil
C028	Malignant neoplasm of overlapping sites of tongue
C029	Malignant neoplasm of tongue, unspecified
C030	Malignant neoplasm of upper gum
C031	Malignant neoplasm of lower gum
C039	Malignant neoplasm of gum, unspecified
C040	Malignant neoplasm of anterior floor of mouth
C041	Malignant neoplasm of lateral floor of mouth
C048	Malignant neoplasm of overlapping sites of floor of mouth
C049	Malignant neoplasm of floor of mouth, unspecified
C050	Malignant neoplasm of hard palate
C051	Malignant neoplasm of soft palate
C052	Malignant neoplasm of uvula
C058	Malignant neoplasm of overlapping sites of palate
C059	Malignant neoplasm of palate, unspecified
C060	Malignant neoplasm of cheek mucosa
C061	Malignant neoplasm of vestibule of mouth
C062	Malignant neoplasm of retromolar area
C0680	Malignant neoplasm of overlapping sites of unspecified parts of mouth
C0689	Malignant neoplasm of overlapping sites of other parts of mouth
C069	Malignant neoplasm of mouth, unspecified
C07	Malignant neoplasm of parotid gland
C080	Malignant neoplasm of submandibular gland
C081	Malignant neoplasm of sublingual gland
C089	Malignant neoplasm of major salivary gland, unspecified
C090	Malignant neoplasm of tonsillar fossa
C091	Malignant neoplasm of tonsillar pillar (anterior) (posterior)
C098	Malignant neoplasm of overlapping sites of tonsil
C099	Malignant neoplasm of tonsil, unspecified
C100	Malignant neoplasm of vallecula
C101	Malignant neoplasm of anterior surface of epiglottis
C102	Malignant neoplasm of lateral wall of oropharynx
C103	Malignant neoplasm of posterior wall of oropharynx
C104	Malignant neoplasm of branchial cleft
C108	Malignant neoplasm of overlapping sites of oropharynx
C109	Malignant neoplasm of oropharynx, unspecified
C110	Malignant neoplasm of superior wall of nasopharynx
C111	Malignant neoplasm of posterior wall of nasopharynx
C112	Malignant neoplasm of lateral wall of nasopharynx
C113	Malignant neoplasm of anterior wall of nasopharynx
C118	Malignant neoplasm of overlapping sites of nasopharynx

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**Supplementary Table 12: Contd...**

<b>ICD-10-CM diagnosis of solid cancer</b>	<b>ICD-10-CM code description</b>
C119	Malignant neoplasm of nasopharynx, unspecified
C12	Malignant neoplasm of pyriform sinus
C130	Malignant neoplasm of postcricoid region
C131	Malignant neoplasm of aryepiglottic fold, hypopharyngeal aspect
C132	Malignant neoplasm of posterior wall of hypopharynx
C138	Malignant neoplasm of overlapping sites of hypopharynx
C139	Malignant neoplasm of hypopharynx, unspecified
C140	Malignant neoplasm of pharynx, unspecified
C142	Malignant neoplasm of Waldeyer's ring
C148	Malignant neoplasm of overlapping sites of lip, oral cavity and pharynx
C153	Malignant neoplasm of upper third of esophagus
C154	Malignant neoplasm of middle third of esophagus
C155	Malignant neoplasm of lower third of esophagus
C158	Malignant neoplasm of overlapping sites of esophagus
C159	Malignant neoplasm of esophagus, unspecified
C160	Malignant neoplasm of cardia
C161	Malignant neoplasm of fundus of stomach
C162	Malignant neoplasm of body of stomach
C163	Malignant neoplasm of pyloric antrum
C164	Malignant neoplasm of pylorus
C165	Malignant neoplasm of lesser curvature of stomach, unspecified
C166	Malignant neoplasm of greater curvature of stomach, unspecified
C168	Malignant neoplasm of overlapping sites of stomach
C169	Malignant neoplasm of stomach, unspecified
C170	Malignant neoplasm of duodenum
C171	Malignant neoplasm of jejunum
C172	Malignant neoplasm of ileum
C173	Meckel's diverticulum, malignant
C178	Malignant neoplasm of overlapping sites of small intestine
C179	Malignant neoplasm of small intestine, unspecified
C180	Malignant neoplasm of cecum
C181	Malignant neoplasm of appendix
C182	Malignant neoplasm of ascending colon
C183	Malignant neoplasm of hepatic flexure
C184	Malignant neoplasm of transverse colon
C185	Malignant neoplasm of splenic flexure
C186	Malignant neoplasm of descending colon
C187	Malignant neoplasm of sigmoid colon
C188	Malignant neoplasm of overlapping sites of colon
C189	Malignant neoplasm of colon, unspecified
C19	Malignant neoplasm of rectosigmoid junction
C20	Malignant neoplasm of rectum
C210	Malignant neoplasm of anus, unspecified
C211	Malignant neoplasm of anal canal
C212	Malignant neoplasm of cloacogenic zone
C218	Malignant neoplasm of overlapping sites of rectum, anus and anal canal
C220	Liver cell carcinoma
C221	Intrahepatic bile duct carcinoma
C222	Hepatoblastoma
C223	Angiosarcoma of liver
C224	Other sarcomas of liver
C227	Other specified carcinomas of liver
C228	Malignant neoplasm of liver, primary, unspecified as to type
C229	Malignant neoplasm of liver, not specified as primary or secondary
C23	Malignant neoplasm of gallbladder

*Contd...*

**Supplementary Table 12: Contd...**

<b>ICD-10-CM diagnosis of solid cancer</b>	<b>ICD-10-CM code description</b>
C240	Malignant neoplasm of extrahepatic bile duct
C241	Malignant neoplasm of ampulla of Vater
C248	Malignant neoplasm of overlapping sites of biliary tract
C249	Malignant neoplasm of biliary tract, unspecified
C250	Malignant neoplasm of head of pancreas
C251	Malignant neoplasm of body of pancreas
C252	Malignant neoplasm of tail of pancreas
C253	Malignant neoplasm of pancreatic duct
C254	Malignant neoplasm of endocrine pancreas
C257	Malignant neoplasm of other parts of pancreas
C258	Malignant neoplasm of overlapping sites of pancreas
C259	Malignant neoplasm of pancreas, unspecified
C260	Malignant neoplasm of intestinal tract, part unspecified
C261	Malignant neoplasm of spleen
C269	Malignant neoplasm of ill-defined sites within the digestive system
C300	Malignant neoplasm of nasal cavity
C301	Malignant neoplasm of middle ear
C310	Malignant neoplasm of maxillary sinus
C311	Malignant neoplasm of ethmoidal sinus
C312	Malignant neoplasm of frontal sinus
C313	Malignant neoplasm of sphenoid sinus
C318	Malignant neoplasm of overlapping sites of accessory sinuses
C319	Malignant neoplasm of accessory sinus, unspecified
C320	Malignant neoplasm of glottis
C321	Malignant neoplasm of supraglottis
C322	Malignant neoplasm of subglottis
C323	Malignant neoplasm of laryngeal cartilage
C328	Malignant neoplasm of overlapping sites of larynx
C329	Malignant neoplasm of larynx, unspecified
C33	Malignant neoplasm of trachea
C3400	Malignant neoplasm of unspecified main bronchus
C3401	Malignant neoplasm of right main bronchus
C3402	Malignant neoplasm of left main bronchus
C3410	Malignant neoplasm of upper lobe, unspecified bronchus or lung
C3411	Malignant neoplasm of upper lobe, right bronchus or lung
C3412	Malignant neoplasm of upper lobe, left bronchus or lung
C342	Malignant neoplasm of middle lobe, bronchus or lung
C3430	Malignant neoplasm of lower lobe, unspecified bronchus or lung
C3431	Malignant neoplasm of lower lobe, right bronchus or lung
C3432	Malignant neoplasm of lower lobe, left bronchus or lung
C3480	Malignant neoplasm of overlapping sites of unspecified bronchus and lung
C3481	Malignant neoplasm of overlapping sites of right bronchus and lung
C3482	Malignant neoplasm of overlapping sites of left bronchus and lung
C3490	Malignant neoplasm of unspecified part of unspecified bronchus or lung
C3491	Malignant neoplasm of unspecified part of right bronchus or lung
C3492	Malignant neoplasm of unspecified part of left bronchus or lung
C37	Malignant neoplasm of thymus
C380	Malignant neoplasm of heart
C381	Malignant neoplasm of anterior mediastinum
C382	Malignant neoplasm of posterior mediastinum
C383	Malignant neoplasm of mediastinum, part unspecified
C384	Malignant neoplasm of pleura
C388	Malignant neoplasm of overlapping sites of heart, mediastinum and pleura
C390	Malignant neoplasm of upper respiratory tract, part unspecified
C399	Malignant neoplasm of lower respiratory tract, part unspecified

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**Supplementary Table 12: Contd...**

<b>ICD-10-CM diagnosis of solid cancer</b>	<b>ICD-10-CM code description</b>
C4000	Malignant neoplasm of scapula and long bones of unspecified upper limb
C4001	Malignant neoplasm of scapula and long bones of right upper limb
C4002	Malignant neoplasm of scapula and long bones of left upper limb
C4010	Malignant neoplasm of short bones of unspecified upper limb
C4011	Malignant neoplasm of short bones of right upper limb
C4012	Malignant neoplasm of short bones of left upper limb
C4020	Malignant neoplasm of long bones of unspecified lower limb
C4021	Malignant neoplasm of long bones of right lower limb
C4022	Malignant neoplasm of long bones of left lower limb
C4030	Malignant neoplasm of short bones of unspecified lower limb
C4031	Malignant neoplasm of short bones of right lower limb
C4032	Malignant neoplasm of short bones of left lower limb
C4080	Malignant neoplasm of overlapping sites of bone and articular cartilage of unspecified limb
C4081	Malignant neoplasm of overlapping sites of bone and articular cartilage of right limb
C4082	Malignant neoplasm of overlapping sites of bone and articular cartilage of left limb
C4090	Malignant neoplasm of unspecified bones and articular cartilage of unspecified limb
C4091	Malignant neoplasm of unspecified bones and articular cartilage of right limb
C4092	Malignant neoplasm of unspecified bones and articular cartilage of left limb
C410	Malignant neoplasm of bones of skull and face
C411	Malignant neoplasm of mandible
C412	Malignant neoplasm of vertebral column
C413	Malignant neoplasm of ribs, sternum and clavicle
C414	Malignant neoplasm of pelvic bones, sacrum and coccyx
C419	Malignant neoplasm of bone and articular cartilage, unspecified
C430	Malignant melanoma of lip
C4310	Malignant melanoma of unspecified eyelid, including canthus
C4311	Malignant melanoma of right eyelid, including canthus
C43111	Malignant melanoma of right upper eyelid, including canthus
C43112	Malignant melanoma of right lower eyelid, including canthus
C4312	Malignant melanoma of left eyelid, including canthus
C43121	Malignant melanoma of left upper eyelid, including canthus
C43122	Malignant melanoma of left lower eyelid, including canthus
C4320	Malignant melanoma of unspecified ear and external auricular canal
C4321	Malignant melanoma of right ear and external auricular canal
C4322	Malignant melanoma of left ear and external auricular canal
C4330	Malignant melanoma of unspecified part of face
C4331	Malignant melanoma of nose
C4339	Malignant melanoma of other parts of face
C434	Malignant melanoma of scalp and neck
C4351	Malignant melanoma of anal skin
C4352	Malignant melanoma of skin of breast
C4359	Malignant melanoma of other part of trunk
C4360	Malignant melanoma of unspecified upper limb, including shoulder
C4361	Malignant melanoma of right upper limb, including shoulder
C4362	Malignant melanoma of left upper limb, including shoulder
C4370	Malignant melanoma of unspecified lower limb, including hip
C4371	Malignant melanoma of right lower limb, including hip
C4372	Malignant melanoma of left lower limb, including hip
C438	Malignant melanoma of overlapping sites of skin
C439	Malignant melanoma of skin, unspecified
C4400	Unspecified malignant neoplasm of skin of lip
C4409	Other specified malignant neoplasm of skin of lip
C44101	Unspecified malignant neoplasm of skin of unspecified eyelid, including canthus
C44102	Unspecified malignant neoplasm of skin of right eyelid, including canthus
C441021	Unspecified malignant neoplasm of skin of right upper eyelid, including canthus

*Contd...*

**Supplementary Table 12: Contd...**

<b>ICD-10-CM diagnosis of solid cancer</b>	<b>ICD-10-CM code description</b>
C441022	Unspecified malignant neoplasm of skin of right lower eyelid, including canthus
C44109	Unspecified malignant neoplasm of skin of left eyelid, including canthus
C441091	Unspecified malignant neoplasm of skin of left upper eyelid, including canthus
C441092	Unspecified malignant neoplasm of skin of left lower eyelid, including canthus
C44131	Sebaceous cell carcinoma of skin of unspecified eyelid, including canthus
C441321	Sebaceous cell carcinoma of skin of right upper eyelid, including canthus
C441322	Sebaceous cell carcinoma of skin of right lower eyelid, including canthus
C441391	Sebaceous cell carcinoma of skin of left upper eyelid, including canthus
C441392	Sebaceous cell carcinoma of skin of left lower eyelid, including canthus
C44191	Other specified malignant neoplasm of skin of unspecified eyelid, including canthus
C44192	Other specified malignant neoplasm of skin of right eyelid, including canthus
C441921	Other specified malignant neoplasm of skin of right upper eyelid, including canthus
C441922	Other specified malignant neoplasm of skin of right lower eyelid, including canthus
C44199	Other specified malignant neoplasm of skin of left eyelid, including canthus
C441991	Other specified malignant neoplasm of skin of left upper eyelid, including canthus
C441992	Other specified malignant neoplasm of skin of left lower eyelid, including canthus
C44201	Unspecified malignant neoplasm of skin of unspecified ear and external auricular canal
C44202	Unspecified malignant neoplasm of skin of right ear and external auricular canal
C44209	Unspecified malignant neoplasm of skin of left ear and external auricular canal
C44291	Other specified malignant neoplasm of skin of unspecified ear and external auricular canal
C44292	Other specified malignant neoplasm of skin of right ear and external auricular canal
C44299	Other specified malignant neoplasm of skin of left ear and external auricular canal
C44300	Unspecified malignant neoplasm of skin of unspecified part of face
C44301	Unspecified malignant neoplasm of skin of nose
C44309	Unspecified malignant neoplasm of skin of other parts of face
C44390	Other specified malignant neoplasm of skin of unspecified parts of face
C44391	Other specified malignant neoplasm of skin of nose
C44399	Other specified malignant neoplasm of skin of other parts of face
C4440	Unspecified malignant neoplasm of skin of scalp and neck
C4449	Other specified malignant neoplasm of skin of scalp and neck
C44500	Unspecified malignant neoplasm of anal skin
C44501	Unspecified malignant neoplasm of skin of breast
C44509	Unspecified malignant neoplasm of skin of other part of trunk
C44590	Other specified malignant neoplasm of anal skin
C44591	Other specified malignant neoplasm of skin of breast
C44599	Other specified malignant neoplasm of skin of other part of trunk
C44601	Unspecified malignant neoplasm of skin of unspecified upper limb, including shoulder
C44602	Unspecified malignant neoplasm of skin of right upper limb, including shoulder
C44609	Unspecified malignant neoplasm of skin of left upper limb, including shoulder
C44691	Other specified malignant neoplasm of skin of unspecified upper limb, including shoulder
C44692	Other specified malignant neoplasm of skin of right upper limb, including shoulder
C44699	Other specified malignant neoplasm of skin of left upper limb, including shoulder
C44701	Unspecified malignant neoplasm of skin of unspecified lower limb, including hip
C44702	Unspecified malignant neoplasm of skin of right lower limb, including hip
C44709	Unspecified malignant neoplasm of skin of left lower limb, including hip
C44791	Other specified malignant neoplasm of skin of unspecified lower limb, including hip
C44792	Other specified malignant neoplasm of skin of right lower limb, including hip
C44799	Other specified malignant neoplasm of skin of left lower limb, including hip
C4480	Unspecified malignant neoplasm of overlapping sites of skin
C4489	Other specified malignant neoplasm of overlapping sites of skin
C4490	Unspecified malignant neoplasm of skin, unspecified
C4499	Other specified malignant neoplasm of skin, unspecified
C450	Mesothelioma of pleura
C451	Mesothelioma of peritoneum
C452	Mesothelioma of pericardium

*Contd...*

**Supplementary Table 12: Contd...**

<b>ICD-10-CM diagnosis of solid cancer</b>	<b>ICD-10-CM code description</b>
C457	Mesothelioma of other sites
C459	Mesothelioma, unspecified
C460	Kaposi's sarcoma of skin
C461	Kaposi's sarcoma of soft tissue
C462	Kaposi's sarcoma of palate
C463	Kaposi's sarcoma of lymph nodes
C464	Kaposi's sarcoma of gastrointestinal sites
C4650	Kaposi's sarcoma of unspecified lung
C4651	Kaposi's sarcoma of right lung
C4652	Kaposi's sarcoma of left lung
C467	Kaposi's sarcoma of other sites
C469	Kaposi's sarcoma, unspecified
C470	Malignant neoplasm of peripheral nerves of head, face and neck
C4710	Malignant neoplasm of peripheral nerves of unspecified upper limb, including shoulder
C4711	Malignant neoplasm of peripheral nerves of right upper limb, including shoulder
C4712	Malignant neoplasm of peripheral nerves of left upper limb, including shoulder
C4720	Malignant neoplasm of peripheral nerves of unspecified lower limb, including hip
C4721	Malignant neoplasm of peripheral nerves of right lower limb, including hip
C4722	Malignant neoplasm of peripheral nerves of left lower limb, including hip
C473	Malignant neoplasm of peripheral nerves of thorax
C474	Malignant neoplasm of peripheral nerves of abdomen
C475	Malignant neoplasm of peripheral nerves of pelvis
C476	Malignant neoplasm of peripheral nerves of trunk, unspecified
C478	Malignant neoplasm of overlapping sites of peripheral nerves and autonomic nervous system
C479	Malignant neoplasm of peripheral nerves and autonomic nervous system, unspecified
C480	Malignant neoplasm of retroperitoneum
C481	Malignant neoplasm of specified parts of peritoneum
C482	Malignant neoplasm of peritoneum, unspecified
C488	Malignant neoplasm of overlapping sites of retroperitoneum and peritoneum
C490	Malignant neoplasm of connective and soft tissue of head, face and neck
C4910	Malignant neoplasm of connective and soft tissue of unspecified upper limb, including shoulder
C4911	Malignant neoplasm of connective and soft tissue of right upper limb, including shoulder
C4912	Malignant neoplasm of connective and soft tissue of left upper limb, including shoulder
C4920	Malignant neoplasm of connective and soft tissue of unspecified lower limb, including hip
C4921	Malignant neoplasm of connective and soft tissue of right lower limb, including hip
C4922	Malignant neoplasm of connective and soft tissue of left lower limb, including hip
C493	Malignant neoplasm of connective and soft tissue of thorax
C494	Malignant neoplasm of connective and soft tissue of abdomen
C495	Malignant neoplasm of connective and soft tissue of pelvis
C496	Malignant neoplasm of connective and soft tissue of trunk, unspecified
C498	Malignant neoplasm of overlapping sites of connective and soft tissue
C499	Malignant neoplasm of connective and soft tissue, unspecified
C49A0	Gastrointestinal stromal tumor, unspecified site
C49A1	Gastrointestinal stromal tumor of esophagus
C49A2	Gastrointestinal stromal tumor of stomach
C49A3	Gastrointestinal stromal tumor of small intestine
C49A4	Gastrointestinal stromal tumor of large intestine
C49A5	Gastrointestinal stromal tumor of rectum
C49A9	Gastrointestinal stromal tumor of other sites
C4A0	Merkel cell carcinoma of lip
C4A10	Merkel cell carcinoma of unspecified eyelid, including canthus
C4A11	Merkel cell carcinoma of right eyelid, including canthus
C4A111	Merkel cell carcinoma of right upper eyelid, including canthus
C4A112	Merkel cell carcinoma of right lower eyelid, including canthus
C4A12	Merkel cell carcinoma of left eyelid, including canthus

*Contd...*

**Supplementary Table 12: Contd...**

<b>ICD-10-CM diagnosis of solid cancer</b>	<b>ICD-10-CM code description</b>
C4A121	Merkel cell carcinoma of left upper eyelid, including canthus
C4A122	Merkel cell carcinoma of left lower eyelid, including canthus
C4A20	Merkel cell carcinoma of unspecified ear and external auricular canal
C4A21	Merkel cell carcinoma of right ear and external auricular canal
C4A22	Merkel cell carcinoma of left ear and external auricular canal
C4A30	Merkel cell carcinoma of unspecified part of face
C4A31	Merkel cell carcinoma of nose
C4A39	Merkel cell carcinoma of other parts of face
C4A4	Merkel cell carcinoma of scalp and neck
C4A51	Merkel cell carcinoma of anal skin
C4A52	Merkel cell carcinoma of skin of breast
C4A59	Merkel cell carcinoma of other part of trunk
C4A60	Merkel cell carcinoma of unspecified upper limb, including shoulder
C4A61	Merkel cell carcinoma of right upper limb, including shoulder
C4A62	Merkel cell carcinoma of left upper limb, including shoulder
C4A70	Merkel cell carcinoma of unspecified lower limb, including hip
C4A71	Merkel cell carcinoma of right lower limb, including hip
C4A72	Merkel cell carcinoma of left lower limb, including hip
C4A8	Merkel cell carcinoma of overlapping sites
C4A9	Merkel cell carcinoma, unspecified
C50011	Malignant neoplasm of nipple and areola, right female breast
C50012	Malignant neoplasm of nipple and areola, left female breast
C50019	Malignant neoplasm of nipple and areola, unspecified female breast
C50021	Malignant neoplasm of nipple and areola, right male breast
C50022	Malignant neoplasm of nipple and areola, left male breast
C50029	Malignant neoplasm of nipple and areola, unspecified male breast
C50111	Malignant neoplasm of central portion of right female breast
C50112	Malignant neoplasm of central portion of left female breast
C50119	Malignant neoplasm of central portion of unspecified female breast
C50121	Malignant neoplasm of central portion of right male breast
C50122	Malignant neoplasm of central portion of left male breast
C50129	Malignant neoplasm of central portion of unspecified male breast
C50211	Malignant neoplasm of upper-inner quadrant of right female breast
C50212	Malignant neoplasm of upper-inner quadrant of left female breast
C50219	Malignant neoplasm of upper-inner quadrant of unspecified female breast
C50221	Malignant neoplasm of upper-inner quadrant of right male breast
C50222	Malignant neoplasm of upper-inner quadrant of left male breast
C50229	Malignant neoplasm of upper-inner quadrant of unspecified male breast
C50311	Malignant neoplasm of lower-inner quadrant of right female breast
C50312	Malignant neoplasm of lower-inner quadrant of left female breast
C50319	Malignant neoplasm of lower-inner quadrant of unspecified female breast
C50321	Malignant neoplasm of lower-inner quadrant of right male breast
C50322	Malignant neoplasm of lower-inner quadrant of left male breast
C50329	Malignant neoplasm of lower-inner quadrant of unspecified male breast
C50411	Malignant neoplasm of upper-outer quadrant of right female breast
C50412	Malignant neoplasm of upper-outer quadrant of left female breast
C50419	Malignant neoplasm of upper-outer quadrant of unspecified female breast
C50421	Malignant neoplasm of upper-outer quadrant of right male breast
C50422	Malignant neoplasm of upper-outer quadrant of left male breast
C50429	Malignant neoplasm of upper-outer quadrant of unspecified male breast
C50511	Malignant neoplasm of lower-outer quadrant of right female breast
C50512	Malignant neoplasm of lower-outer quadrant of left female breast
C50519	Malignant neoplasm of lower-outer quadrant of unspecified female breast
C50521	Malignant neoplasm of lower-outer quadrant of right male breast
C50522	Malignant neoplasm of lower-outer quadrant of left male breast

*Contd...*

**Supplementary Table 12: Contd...**

<b>ICD-10-CM diagnosis of solid cancer</b>	<b>ICD-10-CM code description</b>
C50529	Malignant neoplasm of lower-outer quadrant of unspecified male breast
C50611	Malignant neoplasm of axillary tail of right female breast
C50612	Malignant neoplasm of axillary tail of left female breast
C50619	Malignant neoplasm of axillary tail of unspecified female breast
C50621	Malignant neoplasm of axillary tail of right male breast
C50622	Malignant neoplasm of axillary tail of left male breast
C50629	Malignant neoplasm of axillary tail of unspecified male breast
C50811	Malignant neoplasm of overlapping sites of right female breast
C50812	Malignant neoplasm of overlapping sites of left female breast
C50819	Malignant neoplasm of overlapping sites of unspecified female breast
C50821	Malignant neoplasm of overlapping sites of right male breast
C50822	Malignant neoplasm of overlapping sites of left male breast
C50829	Malignant neoplasm of overlapping sites of unspecified male breast
C50911	Malignant neoplasm of unspecified site of right female breast
C50912	Malignant neoplasm of unspecified site of left female breast
C50919	Malignant neoplasm of unspecified site of unspecified female breast
C50921	Malignant neoplasm of unspecified site of right male breast
C50922	Malignant neoplasm of unspecified site of left male breast
C50929	Malignant neoplasm of unspecified site of unspecified male breast
C510	Malignant neoplasm of labium majus
C511	Malignant neoplasm of labium minus
C512	Malignant neoplasm of clitoris
C518	Malignant neoplasm of overlapping sites of vulva
C519	Malignant neoplasm of vulva, unspecified
C52	Malignant neoplasm of vagina
C530	Malignant neoplasm of endocervix
C531	Malignant neoplasm of exocervix
C538	Malignant neoplasm of overlapping sites of cervix uteri
C539	Malignant neoplasm of cervix uteri, unspecified
C540	Malignant neoplasm of isthmus uteri
C541	Malignant neoplasm of endometrium
C542	Malignant neoplasm of myometrium
C543	Malignant neoplasm of fundus uteri
C548	Malignant neoplasm of overlapping sites of corpus uteri
C549	Malignant neoplasm of corpus uteri, unspecified
C55	Malignant neoplasm of uterus, part unspecified
C561	Malignant neoplasm of right ovary
C562	Malignant neoplasm of left ovary
C563	Malignant neoplasm of bilateral ovaries
C569	Malignant neoplasm of unspecified ovary
C5700	Malignant neoplasm of unspecified fallopian tube
C5701	Malignant neoplasm of right fallopian tube
C5702	Malignant neoplasm of left fallopian tube
C5710	Malignant neoplasm of unspecified broad ligament
C5711	Malignant neoplasm of right broad ligament
C5712	Malignant neoplasm of left broad ligament
C5720	Malignant neoplasm of unspecified round ligament
C5721	Malignant neoplasm of right round ligament
C5722	Malignant neoplasm of left round ligament
C573	Malignant neoplasm of parametrium
C574	Malignant neoplasm of uterine adnexa, unspecified
C577	Malignant neoplasm of other specified female genital organs
C578	Malignant neoplasm of overlapping sites of female genital organs
C579	Malignant neoplasm of female genital organ, unspecified
C58	Malignant neoplasm of placenta

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**Supplementary Table 12: Contd...**

<b>ICD-10-CM diagnosis of solid cancer</b>	<b>ICD-10-CM code description</b>
C600	Malignant neoplasm of prepuce
C601	Malignant neoplasm of glans penis
C602	Malignant neoplasm of body of penis
C608	Malignant neoplasm of overlapping sites of penis
C609	Malignant neoplasm of penis, unspecified
C61	Malignant neoplasm of prostate
C6200	Malignant neoplasm of unspecified undescended testis
C6201	Malignant neoplasm of undescended right testis
C6202	Malignant neoplasm of undescended left testis
C6210	Malignant neoplasm of unspecified descended testis
C6211	Malignant neoplasm of descended right testis
C6212	Malignant neoplasm of descended left testis
C6290	Malignant neoplasm of unspecified testis, unspecified whether descended or undescended
C6291	Malignant neoplasm of right testis, unspecified whether descended or undescended
C6292	Malignant neoplasm of left testis, unspecified whether descended or undescended
C6300	Malignant neoplasm of unspecified epididymis
C6301	Malignant neoplasm of right epididymis
C6302	Malignant neoplasm of left epididymis
C6310	Malignant neoplasm of unspecified spermatic cord
C6311	Malignant neoplasm of right spermatic cord
C6312	Malignant neoplasm of left spermatic cord
C632	Malignant neoplasm of scrotum
C637	Malignant neoplasm of other specified male genital organs
C638	Malignant neoplasm of overlapping sites of male genital organs
C639	Malignant neoplasm of male genital organ, unspecified
C641	Malignant neoplasm of right kidney, except renal pelvis
C642	Malignant neoplasm of left kidney, except renal pelvis
C649	Malignant neoplasm of unspecified kidney, except renal pelvis
C651	Malignant neoplasm of right renal pelvis
C652	Malignant neoplasm of left renal pelvis
C659	Malignant neoplasm of unspecified renal pelvis
C661	Malignant neoplasm of right ureter
C662	Malignant neoplasm of left ureter
C669	Malignant neoplasm of unspecified ureter
C670	Malignant neoplasm of trigone of bladder
C671	Malignant neoplasm of dome of bladder
C672	Malignant neoplasm of lateral wall of bladder
C673	Malignant neoplasm of anterior wall of bladder
C674	Malignant neoplasm of posterior wall of bladder
C675	Malignant neoplasm of bladder neck
C676	Malignant neoplasm of ureteric orifice
C677	Malignant neoplasm of urachus
C678	Malignant neoplasm of overlapping sites of bladder
C679	Malignant neoplasm of bladder, unspecified
C680	Malignant neoplasm of urethra
C681	Malignant neoplasm of paraurethral glands
C688	Malignant neoplasm of overlapping sites of urinary organs
C689	Malignant neoplasm of urinary organ, unspecified
C6900	Malignant neoplasm of unspecified conjunctiva
C6901	Malignant neoplasm of right conjunctiva
C6902	Malignant neoplasm of left conjunctiva
C6910	Malignant neoplasm of unspecified cornea
C6911	Malignant neoplasm of right cornea
C6912	Malignant neoplasm of left cornea
C6920	Malignant neoplasm of unspecified retina

*Contd...*



**Supplementary Table 12: Contd...**

<b>ICD-10-CM diagnosis of solid cancer</b>	<b>ICD-10-CM code description</b>
C6921	Malignant neoplasm of right retina
C6922	Malignant neoplasm of left retina
C6930	Malignant neoplasm of unspecified choroid
C6931	Malignant neoplasm of right choroid
C6932	Malignant neoplasm of left choroid
C6940	Malignant neoplasm of unspecified ciliary body
C6941	Malignant neoplasm of right ciliary body
C6942	Malignant neoplasm of left ciliary body
C6950	Malignant neoplasm of unspecified lacrimal gland and duct
C6951	Malignant neoplasm of right lacrimal gland and duct
C6952	Malignant neoplasm of left lacrimal gland and duct
C6960	Malignant neoplasm of unspecified orbit
C6961	Malignant neoplasm of right orbit
C6962	Malignant neoplasm of left orbit
C6980	Malignant neoplasm of overlapping sites of unspecified eye and adnexa
C6981	Malignant neoplasm of overlapping sites of right eye and adnexa
C6982	Malignant neoplasm of overlapping sites of left eye and adnexa
C6990	Malignant neoplasm of unspecified site of unspecified eye
C6991	Malignant neoplasm of unspecified site of right eye
C6992	Malignant neoplasm of unspecified site of left eye
C700	Malignant neoplasm of cerebral meninges
C701	Malignant neoplasm of spinal meninges
C709	Malignant neoplasm of meninges, unspecified
C710	Malignant neoplasm of cerebrum, except lobes and ventricles
C711	Malignant neoplasm of frontal lobe
C712	Malignant neoplasm of temporal lobe
C713	Malignant neoplasm of parietal lobe
C714	Malignant neoplasm of occipital lobe
C715	Malignant neoplasm of cerebral ventricle
C716	Malignant neoplasm of cerebellum
C717	Malignant neoplasm of brain stem
C718	Malignant neoplasm of overlapping sites of brain
C719	Malignant neoplasm of brain, unspecified
C720	Malignant neoplasm of spinal cord
C721	Malignant neoplasm of cauda equina
C7220	Malignant neoplasm of unspecified olfactory nerve
C7221	Malignant neoplasm of right olfactory nerve
C7222	Malignant neoplasm of left olfactory nerve
C7230	Malignant neoplasm of unspecified optic nerve
C7231	Malignant neoplasm of right optic nerve
C7232	Malignant neoplasm of left optic nerve
C7240	Malignant neoplasm of unspecified acoustic nerve
C7241	Malignant neoplasm of right acoustic nerve
C7242	Malignant neoplasm of left acoustic nerve
C7250	Malignant neoplasm of unspecified cranial nerve
C7259	Malignant neoplasm of other cranial nerves
C729	Malignant neoplasm of central nervous system, unspecified
C73	Malignant neoplasm of thyroid gland
C7400	Malignant neoplasm of cortex of unspecified adrenal gland
C7401	Malignant neoplasm of cortex of right adrenal gland
C7402	Malignant neoplasm of cortex of left adrenal gland
C7410	Malignant neoplasm of medulla of unspecified adrenal gland
C7411	Malignant neoplasm of medulla of right adrenal gland
C7412	Malignant neoplasm of medulla of left adrenal gland
C7490	Malignant neoplasm of unspecified part of unspecified adrenal gland

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**Supplementary Table 12: Contd...**

<b>ICD-10-CM diagnosis of solid cancer</b>	<b>ICD-10-CM code description</b>
C7491	Malignant neoplasm of unspecified part of right adrenal gland
C7492	Malignant neoplasm of unspecified part of left adrenal gland
C750	Malignant neoplasm of parathyroid gland
C751	Malignant neoplasm of pituitary gland
C752	Malignant neoplasm of craniopharyngeal duct
C753	Malignant neoplasm of pineal gland
C754	Malignant neoplasm of carotid body
C755	Malignant neoplasm of aortic body and other paraganglia
C758	Malignant neoplasm with pluriglandular involvement, unspecified
C759	Malignant neoplasm of endocrine gland, unspecified
C760	Malignant neoplasm of head, face and neck
C761	Malignant neoplasm of thorax
C762	Malignant neoplasm of abdomen
C763	Malignant neoplasm of pelvis
C7640	Malignant neoplasm of unspecified upper limb
C7641	Malignant neoplasm of right upper limb
C7642	Malignant neoplasm of left upper limb
C7650	Malignant neoplasm of unspecified lower limb
C7651	Malignant neoplasm of right lower limb
C7652	Malignant neoplasm of left lower limb
C768	Malignant neoplasm of other specified ill-defined sites
C7A00	Malignant carcinoid tumor of unspecified site
C7A010	Malignant carcinoid tumor of the duodenum
C7A011	Malignant carcinoid tumor of the jejunum
C7A012	Malignant carcinoid tumor of the ileum
C7A019	Malignant carcinoid tumor of the small intestine, unspecified portion
C7A020	Malignant carcinoid tumor of the appendix
C7A021	Malignant carcinoid tumor of the cecum
C7A022	Malignant carcinoid tumor of the ascending colon
C7A023	Malignant carcinoid tumor of the transverse colon
C7A024	Malignant carcinoid tumor of the descending colon
C7A025	Malignant carcinoid tumor of the sigmoid colon
C7A026	Malignant carcinoid tumor of the rectum
C7A029	Malignant carcinoid tumor of the large intestine, unspecified portion
C7A090	Malignant carcinoid tumor of the bronchus and lung
C7A091	Malignant carcinoid tumor of the thymus
C7A092	Malignant carcinoid tumor of the stomach
C7A093	Malignant carcinoid tumor of the kidney
C7A094	Malignant carcinoid tumor of the foregut, unspecified
C7A095	Malignant carcinoid tumor of the midgut, unspecified
C7A096	Malignant carcinoid tumor of the hindgut, unspecified
C7A098	Malignant carcinoid tumors of other sites
C7A1	Malignant poorly differentiated neuroendocrine tumors
C7A8	Other malignant neuroendocrine tumors
D469	Myelodysplastic syndrome, unspecified
E3121	MEN type I
E3122	MEN type IIA
E3123	MEN type IIB

MEN=Multiple endocrine neoplasia, ICD-10-CM=International Classification of Diseases, 10<sup>th</sup> Edition Clinical Modification