

Mapping three versions of the international classification of diseases to categories of chronic conditions

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Submission History

Submitted:	25/09/2020
Accepted:	25/02/2021
Published:	13/04/2021

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Abstract

Introduction

Administrative health data capture diagnoses using the International Classification of Diseases (ICD), which has multiple versions over time. To facilitate longitudinal investigations using these data, we aimed to map diagnoses identified in three ICD versions – ICD-8 with adaptations (ICDA-8), ICD-9 with clinical modifications (ICD-9-CM), and ICD-10 with Canadian adaptations (ICD-10-CA) – to mutually exclusive chronic health condition categories adapted from the open source Clinical Classifications Software (CCS).

Methods

We adapted the CCS crosswalk to 3-digit ICD-9-CM codes for chronic conditions and resolved the one-to-many mappings in ICD-9-CM codes. Using this adapted CCS crosswalk as the reference and referring to existing crosswalks between ICD versions, we extended the mapping to ICDA-8 and ICD-10-CA. Each mapping step was conducted independently by two reviewers and discrepancies were resolved by consensus through deliberation and reference to prior research. We report the frequencies, agreement percentages and 95% confidence intervals (CI) from each step.

Results

We identified 354 3-digit ICD-9-CM codes for chronic conditions. Of those, 77 (22%) codes had one-to-many mappings; 36 (10%) codes were mapped to a single CCS category and 41 (12%) codes were mapped to combined CCS categories. In total, the codes were mapped to 130 adapted CCS categories with an agreement percentage of 92% (95% CI: 86%–98%). Then, 321 3-digit ICDA-8 codes were mapped to CCS categories with an agreement percentage of 92% (95% CI: 89%–95%). Finally, 3583 ICD-10-CA codes were mapped to CCS categories; 111 (3%) had a fair or poor mapping quality; these were reviewed to keep or move to another category (agreement percentage = 77% [95% CI: 69%–85%]).

Conclusions

We developed crosswalks for three ICD versions (ICDA-8, ICD-9-CM, and ICD-10-CA) to 130 clinically meaningful categories of chronic health conditions by adapting the CCS classification. These crosswalks will benefit chronic disease studies spanning multiple decades of administrative health data.

Keywords

international classification of diseases; ICDA-8; ICD-9-CM; ICD-10-CA; mapping; crosswalk; administrative data; chronic health conditions

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Introduction

Administrative health data include routinely-collected electronic healthcare records of encounters with the healthcare system such as physician office visits, hospitalizations, and drug dispensations [1, 2]. These data are collected for the purposes of managing and monitoring the healthcare system, but also offer a cost-effective and timely resource for population-based chronic disease research and surveillance investigations [1–4]. Rates of common chronic diseases are increasing worldwide. Chronic diseases account for over 70% of all deaths worldwide and are also a major driver of rising healthcare costs [5–7]. Therefore, there is a need to accurately and efficiently estimate the prevalence and incidence of chronic diseases; these goals can be achieved using administrative health data.

Administrative database content now extends over many decades in multiple countries. For example, Canada, Denmark, and Finland have over 40 years of administrative health data from physician visits and hospitalizations that are frequently used in longitudinal studies [8–12]. Many countries and regions across the world, such as the United States of America (US), the United Kingdom (UK), Germany, Sweden, Netherlands, Hungary, Italy, Hong Kong, Australia, and Taiwan, have electronic healthcare records [13]. Among these countries and regions, those that are members of the World Health Organization (WHO) collectively use the International Classification of Diseases (ICD), which was developed by the WHO and is subject to regular updates [14]. Many electronic healthcare records contain medical diagnoses recorded using multiple versions of the ICD system [8–10, 15, 16], and therefore researchers will benefit from mapping the ICD coding systems into a standard classification system to support research and collaboration opportunities amongst countries. In Canada, three ICD versions are captured in many of these databases: eighth revision (ICD-8), ninth revision (ICD-9), and tenth revision (ICD-10) [8, 9, 15, 16]. ICD-8 was first introduced in 1965, ICD-9 in 1975, and ICD-10 in 1993, with each version having a greater number of ICD codes. For example, the number of diagnosis codes increased fivefold from 14,000 in ICD-9 to over 70,000 in ICD-10 [17, 18]. An increase in the number and variety of diagnosis codes is attributable to knowledge advances in health and medical sciences, resulting in new diseases being added, recategorized, removed, or combined [19]. For example, autism, which is captured in ICD-9 and ICD-10 was not a recognized health condition in ICD-8. Intellectual disability in ICD-9 and ICD-10 was referred to as mental retardation in ICD-8; this term was replaced due to its negative connotations.

Though the increasing level of detail with each update of the ICD system is essential for diagnostic or administrative purposes, it presents a challenge in disease surveillance and health outcome studies that incorporate data for multiple ICD versions. Researchers typically focus on clinically-relevant conditions in order to achieve timely and clinically meaningful analyses and reports. For example, ICD-9 and ICD-10 with clinical modifications (i.e., ICD-9-CM and ICD-10-CM) have been mapped to the Abbreviated Injury Scale (AIS) in order to use hospitalization records to study a clinically meaningful construct, the severity of the injury [20]. Other crosswalks exist to map ICD codes in different nomenclature systems, such as crosswalks for ICD-9 and ICD-10 to the

Systematized Nomenclature of Medicine – Clinical Terms (SNOMED CT) [21, 22]. Researchers who use electronic healthcare records must decide which mappings of ICD codes to adopt. Additionally, up until now, there were no available crosswalks, that is, lists of equivalent codes that mapped ICD-8, ICD-9, and ICD-10 codes into the same clinically meaningful categories of health conditions, which hinders chronic disease research spanning multiple decades. Historically, tracking chronic conditions can contribute to answering questions related to the heritability of chronic conditions and the individual and generational impacts experienced by those living with chronic conditions, including, health-outcomes, education attainment, employment, and socioeconomic status [23, 24].

Our research aimed to address this issue by developing crosswalks for all chronic diseases captured in ICD versions 8, 9 and 10 to map these diseases into clinically meaningful categories. Our proposed approach is to adapt the Clinical Classifications Software (CCS), developed for the US-based Agency for Healthcare Research and Quality [25]. The CCS provides validated crosswalks for categorizing diagnoses captured in ICD-9-CM and ICD-10-CM into mutually exclusive and broad classes of health conditions, which enables health outcome assessment and disease cohort development. The CCS has previously been used to report interpretable and clinically meaningful information about diseases, including their prevalence and associated medical expenditures [26, 27]. Extending such a crosswalk to other versions of the ICD (i.e. ICD-8) would open opportunities for longitudinal studies in chronic disease surveillance. Additionally, the CCS crosswalks are based on 5-digit ICD codes; however, in many administrative health databases, it is common for diagnoses to appear in truncated 3-digit versions [19]. This is the case with physician visit codes in the majority of provinces in Canada [28].

Therefore, our aim was to create mutually exclusive chronic health condition categories from three versions of the ICD system (ICD-8, ICD-9, and ICD-10). To achieve this aim, we adapted the CCS categorizations of the 5-digit ICD-9-CM codes to the subordinate 3-digit codes and extended the adapted CCS crosswalk to include ICD-8 with adaptations (ICDA-8) and ICD-10 with Canadian adaptation (ICD-10-CA). This will facilitate chronic disease research and surveillance that relies on electronic healthcare records from multiple decades of an individual's life and across generations.

Methods

Setting and data sources

This study was conducted in the context of administrative databases from the Manitoba Population Research Data Repository [16, 29]. The Repository includes all encounters of Manitoba residents within the healthcare system, including inpatient hospitalizations and outpatient physician visits. The Medical Services database contained in the Repository includes claims for outpatient physician visits and captures diagnoses using 3-digit codes for ICDA-8 from 1970 to 1979, 3-digit codes for ICD-9-CM from 1979 to 2015, and 5-digit codes for ICD-9-CM since 2015. The Hospital Abstracts database includes hospitalization records with 25 diagnoses

fields captured using 4-digit codes for ICDA-8 from 1970 to 1979, 5-digit codes for ICD-9-CM from 1979 to 2004, and 5-digit codes for ICD-10-CA in subsequent years [16]. The study was approved by the Health Research Ethics Board of the University of Manitoba and the Manitoba Health Information Privacy Committee granted permission for data access.

The list of ICD-9-CM codes for this study, the Chronic Condition Indicator (CCI), and the CCS for ICD-9-CM crosswalk were all obtained from the Healthcare Cost and Utilization Project (HCUP) sponsored by the Agency for Healthcare Research and Quality [30]. The list of ICDA-8 codes was obtained from the US Department of Health, Education, and Welfare [31]. The list of ICD-10-CA codes was generated from the Manitoba Hospital Abstracts database from 2005 to 2018 (in the primary diagnosis position).

The CCI provides an enhancement of a previous classification system from Hwang et al. and categorizes 5-digit ICD-9-CM diagnosis codes into chronic or non-chronic conditions [32, 33]. The CCI defines a chronic condition as “a condition that lasts 12 months or longer and meets one or both of the following tests: (a) it places limitations on self-care, independent living, and social interactions; (b) it results in the need for ongoing intervention with medical products, services, and special equipment” [33]. It was used in this study to identify ICD codes of chronic health conditions.

The CCS was selected because it is an open source that provides validated crosswalks for categorizing the entire list of ICD-9-CM and ICD-10-CM codes into a smaller number of mutually exclusive and clinically relevant health condition categories [25]. The CCS includes 285 clusters of health conditions that are composed of mostly clinically homogeneous categories with a few heterogeneous categories of less common conditions within a body system.

Mapping process

The term “crosswalk” in this study refers to the complete list of equivalent matching codes and “mapping” refers to the processes of translating from source to target codes [34]. Because of the availability of a CCS crosswalk for ICD-9-CM as well as previous crosswalks that map ICD-10-CA and ICDA-8 to ICD-9-CM, we used ICD-9-CM as the reference coding system for mapping the three ICD versions. The mapping was conducted independently by two reviewers (AH & VV) with clinical and methodology expertise and included four steps: 1. Identifying ICD-9-CM codes for chronic conditions; 2. Creating a crosswalk between 3-digit ICD-9-CM and CCS categories; 3. Creating a crosswalk between ICDA-8 and CCS categories; and 4. Creating a crosswalk between ICD-10-CA and CCS categories (Figure 1). Discrepancies in mappings between the two reviewers were resolved through deliberation amongst the reviewers until consensus was reached. Deliberation included reviewing the detailed description of the codes for information on condition, symptomology, body systems, complications, and age of onset and referring to available crosswalks and published literature, which provided a peer-reviewed third-party decision. The two reviewers used independent resources to guide the mapping process, which were not shared until they met to discuss and resolve mapping discrepancies. Since ICD-9-CM and ICDA-8 diagnosis codes were captured as 3-digit codes during most data years in physician visit claims, our

mappings were targeted to the 3-digit level code categories. Below we describe the four mapping steps in detail (See also in Figure 1).

Step 1: Identifying ICD-9-CM codes for chronic conditions

Starting with the entire list of ICD-9-CM codes, we excluded ICD-9-CM chapters (categories based on body system and health conditions) that did not capture specific chronic conditions, including 1. Infectious and Parasitic Diseases (001-139), 2. Symptoms, Signs, and Ill-Defined Conditions (780-799), 3. Injuries and Poisoning (800-999) and 4. Supplementary Codes of Factors Influencing Health Status (V01-V91). Then, we applied the CCI to exclude the remaining ICD-9-CM codes for acute conditions. Finally, we truncated the codes to three digits to match the form available in most data years in physician visit claims. The final list included 3-digit ICD-9-CM codes for chronic conditions only.

Step 2: Creating a crosswalk between 3-digit ICD-9-CM codes and CCS categories

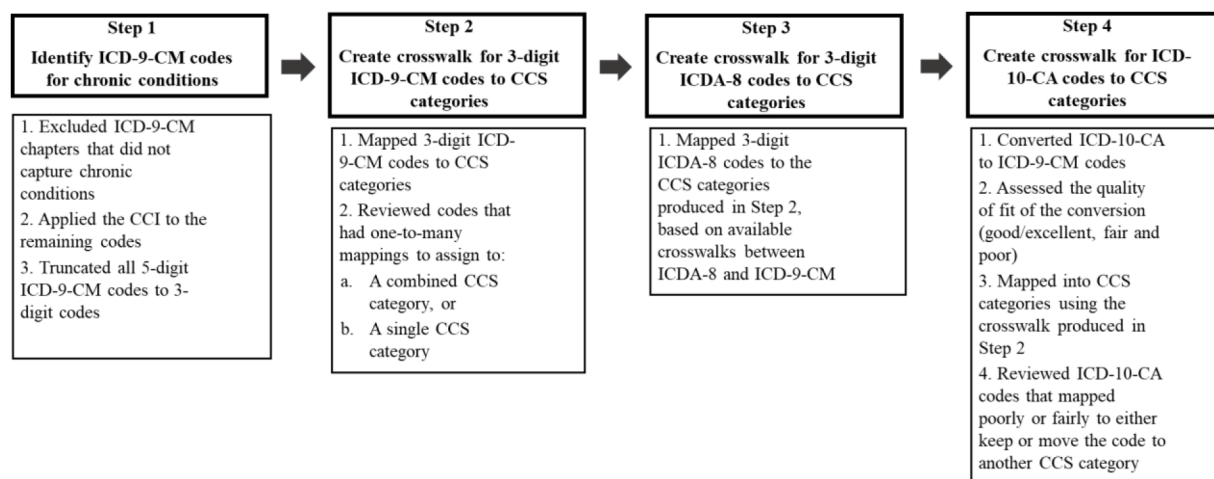
The existing CCS crosswalk maps 5-digit ICD-9-CM to CCS categories in a many-to-one manner (i.e. several 5-digit ICD-9-CM codes map to one CCS category). Truncating the ICD-9-CM codes into their 3-digit form resulted in many instances where a single 3-digit ICD-9-CM code was mapped to multiple CCS categories (i.e., one-to-many mapping). This overlap would occur because some of the medical characteristics provided in the full 5-digit code of a condition (e.g., symptomology, complications, and body system) are lost at the 3-digit level. ICD-9-CM codes that mapped to multiple CCS categories were reviewed by two team members who made one of two decisions: 1. Assign the code to a modified CCS category that combines the overlapping CCS categories or 2. Assign the code to a single CCS category. CCS categories were combined if there was a significant overlap in the conditions, symptomology, body system, and/or age of onset between the categories. The choice to map the overlapping ICD-9-CM code into a single CCS category was made when the ICD-9-CM code description fit primarily with one CCS category and less with other categories.

Though the CCS includes a total of 285 mutually exclusive groups of health conditions, we expected to end with a smaller number, given that we limited our attention to chronic conditions and combined some CCS categories. The final list of CCS categories based on categorizing ICD-9-CM codes was the master reference list that was subsequently used to map ICDA-8 and ICD-10-CA codes to their respective CCS categories. The original CCS categories were numbered by the developers; we adopted these same numbers for each CCS category. When the original CCS categories were combined in our crosswalks, we combined the assigned numbers.

Step 3: Creating a crosswalk between 3-digit ICDA-8 codes and CCS categories

The objective of this step was to map truncated (i.e., 3-digit) ICDA-8 to the new list of modified CCS categories produced in Step 2 using existing crosswalks between ICDA-8 and ICD-9-CM from the Swedish National Board of Health and Welfare, the US Department of Health and Human Services, the Manitoba Centre for Health Policy (MCHP), and additional published literature [35–42]. The crosswalks were used to guide the choice of the CCS category that best fits the

Figure 1: Diagram depicting the four steps in the mapping process



ICD-9-CM: International Classification of Diseases 9th revision with clinical modifications; CCI: Chronic Condition Indicator; CCS: Clinical Classifications Software; ICDA-8: International Classification of Diseases 8th revision with adaptations; ICD-10-CA: The International Classification of Diseases 10th revision with Canadian adaptations.

ICDA-8 code based on reference of where the equivalent ICD-9-CM code had been already mapped. An ICDA-8 code was excluded if it did not capture a chronic condition, according to the CCI and its corresponding ICD-9-CM code.

Step 4: Creating a crosswalk between ICD-10-CA and CCS categories

To map ICD-10-CA codes to the modified CCS categories, the codes were first mapped to ICD-9-CM codes based on a crosswalk developed by the Canadian Institute for Health Information (CIHI), a national healthcare organization that enhanced ICD-10 to meet the morbidity coding needs of Canadian healthcare data [43, 44]. The mapping output included an assessment of the quality of fit of each ICD-10-CA code to its corresponding ICD-9-CM codes, with grades of good/excellent (1), fair (2), and poor (3) fit. The resulting ICD-10-CA codes were then mapped to CCS categories based on where their equivalent ICD-9-CM codes were placed. ICD-10-CA codes that had mapping grades of fair or poor were reviewed by the two team members independently for CCS category assignment based on the publically-available ICD-10-CM, an adaptation of ICD-10 intended for use in the US, to CCS crosswalk [18].

Data analysis

Results from these mapping steps include frequencies and percentages of the codes and categories used and produced at each mapping step. Additionally, to quantify the reliability of each mapping step, we calculated agreement percentages and 95% confidence intervals (CI; using the normal distribution approximation) between the two reviewers for each task where mapping decisions were made: assigning ICD-9-CM codes that mapped to multiple categories, mapping ICDA-8 codes to CCS categories, and assigning ICD-10-CA codes that mapped to a category different from the one suggested by the ICD-10-CM to CCS crosswalk. Agreement percentage was calculated as the frequency of reviewer agreements on mapping decisions divided by the total number of mapping decisions. Data

analysis was conducted using SAS version 9.4 statistical software (SAS Institute; Cary, NC).

Results

Identifying ICD-9-CM codes for chronic conditions

There were 13,769 ICD-9-CM codes in the initial list. The number was reduced to 8231 codes after excluding chapters that mainly captured acute conditions. The number was further reduced to 4280 codes after applying the CCI criteria. After truncating the list of 5-digit ICD-9-CM codes into their superordinate 3-digit codes, 354 ICD-9-CM codes for chronic conditions were retained (See Supplementary Appendix 1).

Creating a crosswalk between 3-digit ICD-9-CM codes and CCS categories

The 354 ICD-9-CM codes produced in Step 1 were mapped to 151 of the original 285 CCS categories. Of the 354 ICD-9-CM codes, a total of 77 (22%) codes had a one-to-many relationship with 11 chapters. The highest conflict was observed for chapters corresponding to codes 320-389 *Diseases of the Nervous System and Sense Organs* with 15 codes; 390-459 *Diseases of the Circulatory System* with 13 codes; and 140-239 *Neoplasms* with 11 codes. 36 (10%) codes were mapped to a single CCS category and 41 (12%) codes were mapped to combined CCS categories (See Table 1 for examples). The two reviewers agreed on 71 out of the 77 mapping decisions, resulting in an agreement percentage of 92% (95% CI: 86%-98%) (See Supplementary Appendix 2). The overlapping codes resulted in combining 40 of the 151 CCS categories into 19 broader categories for a final tally of 130 CCS categories (See Supplementary Appendix 1).

Table 1: Example list of ICD-9-CM codes that mapped to multiple CCS categories

ICD-9-CM code	ICD-9-CM code description	Overlapping CCS categories	Assigned CCS category	CCS category #
Codes that mapped to multiple CCS categories				
203	Multiple myeloma and immunoproliferative neoplasms	Leukemias	Multiple myeloma and leukemias	39, 40
203	Multiple myeloma and immunoproliferative neoplasms	Multiple myeloma	Multiple myeloma and leukemias	39, 40
250	Diabetes mellitus	Diabetes mellitus without complication	Diabetes mellitus	49, 50
250	Diabetes mellitus	Diabetes mellitus with complications	Diabetes mellitus	49, 50
Codes that mapped to a single CCS category				
332	Parkinson's disease	Parkinson's disease	Parkinson's disease	79
332	Parkinson's disease	Other nervous system disorders	Parkinson's disease	79
425	Cardiomyopathy	Alcohol-related disorders	Peri-; endo-; and myocarditis; cardiomyopathy	97
425	Cardiomyopathy	Peri-; endo-; and myocarditis; cardiomyopathy (except that caused by tuberculosis or sexually transmitted disease)	Peri-; endo-; and myocarditis; cardiomyopathy	97

ICD-9-CM: International Classification of Diseases 9th revision with clinical modifications; CCS: Clinical Classifications Software.

Table 2: Examples of discrepancies and final decisions in mapping ICDA-8 to CCS categories

ICDA-8	ICD-8 code description	Reviewer chosen CCS categories	Assigned CCS category	CCS category #
230	Neoplasm of unspecified nature of digestive organs	Cancer of other GI organs; peritoneum	Neoplasms of unspecified nature	44
230	Neoplasm of unspecified nature of digestive organs	Neoplasms of unspecified nature	Neoplasms of unspecified nature	44
209	Myelofibrosis	Other hematologic conditions	Neoplasms of unspecified nature	44
209	Myelofibrosis	Neoplasms of unspecified nature	Neoplasms of unspecified nature	44
307	Transient situational disturbances	Adjustment disorders	Adjustment disorders	650
307	Transient situational disturbances	Mood and anxiety disorders	Adjustment disorders	650
412	Chronic ischaemic heart disease	Other and ill-defined heart disease	Coronary atherosclerosis and other heart diseases	101
412	Chronic ischaemic heart disease	Coronary atherosclerosis and other heart diseases	Coronary atherosclerosis and other heart diseases	101

ICDA-8: International Classification of Diseases 8th revision with adaptations; CCS: Clinical Classifications Software.

Creating a crosswalk between ICDA-8 codes and CCS categories

A total of 321 3-digit ICDA-8 codes were mapped to CCS categories based on the ICD-9-CM equivalent codes (See Supplementary Appendix 3). The two reviewers mapped 296 of the 321 codes to the same CCS category, giving an agreement percentage of 92% (95% CI: 89%-95%) (See Supplementary Appendix 4). The majority of the mapping discrepancies

involved ICDA-8 codes that mapped to multiple ICD-9-CM codes and those ICD-9-CM codes mapped to multiple CCS categories (See Table 2 for examples).

Creating a crosswalk between ICD-10-CA codes and CCS categories

3583 ICD-10-CA codes were identified in the Hospital Abstracts database over the study observation period. The

Table 3: Examples of ICD-10-CA codes that were graded 2 or 3 and final mapping decisions

ICD-10-CA Code	ICD-10- CA code description	Original CCS category	New CCS category	CCS category #
Grade 2				
N158	Other specified renal tubulo-interstitial diseases	Urinary tract infections	Chronic kidney disease and related conditions	156, 157, 158
M8790	Osteonecrosis, unspecified, multiple sites	Infective arthritis and osteomyelitis	Osteoporosis and other bone diseases	206, 212
K850	Idiopathic acute pancreatitis	Pancreatic disorders (excluding diabetes)	Pancreatic disorders (excluding diabetes)	152
Grade 3				
I088	Other multiple valve diseases	Peri-; endo-; and myocarditis; cardiomyopathy	Heart valve disorders	96
N160	Renal tubulo-interstitial disorders in infectious and parasitic diseases classified elsewhere	Urinary tract infections	Other diseases of kidney and ureters	161
K710	Toxic liver disease with cholestasis	Hepatitis and other liver diseases	Hepatitis and other liver diseases	6, 151

Grade 2 = fair; grade 3 = poor. ICD-10-CA: The International Classification of Diseases 10th revision with Canadian adaptations; CCS: Clinical Classifications Software.

codes were converted to ICD-9-CM with 984 (27%) graded fair or poor. After independently reviewing the codes with these grades, 111 (3%) did not map to the correct CCS category according to the ICD-10-CM to CCS crosswalk [18]. The mapping suggestion from the crosswalk was voided for 74 (2%) codes and kept where originally mapped based on the equivalent ICD-9-CM code, and 37 (1%) were moved to the recommended CCS category (See Table 3 for examples). The two reviewers agreed on 86 of the 111 mapping decisions resulting in an agreement percentage of 77% (95% CI: 69%–85%) (See Supplementary Appendix 5). The majority of mapping discrepancies resulted from the trade-off between focusing on making the same decisions that were made in Step 2 to accommodate the loss of granularity of truncated ICD-9-CM codes and maintaining the details from the 4 and 5-digit ICD-10-CA codes (See Supplementary Appendix 6).

Discussion

We mapped three ICD versions, ICDA-8, ICD-9-CM, and ICD-10-CA, into 130 clinically meaningful categories of chronic health conditions by adapting and extending the open-source CCS. Using ICD-9-CM as the reference, the mapping process included: 1. Identifying diagnosis codes of chronic conditions; 2. Adapting the CCS to classify 3-digit ICD-9-CM codes and resolving one-to-many mappings resulting in 130 clinically meaningful condition categories; 3. Translating ICDA-8 codes into those same categories aided by available crosswalks; and 4. Mapping ICD-10-CA codes to the CCS categories using the available crosswalk between ICD-10-CA and ICD-9-CM.

The developed crosswalks provide researchers with an efficient and convenient tool to aggregate thousands of diagnosis codes in different ICD versions into clinically meaningful categories of chronic health conditions while using the entire span of data years from administrative and other

electronic healthcare records. Covering three ICD versions will, therefore, be especially valuable in chronic disease surveillance and longitudinal studies of disease risk that extend over decades at the population level. Furthermore, these crosswalks can aid in longitudinal studies that develop and apply prediction models to study the progression of conditions that would benefit from early detection. Such research has been previously done to identify trajectories of conditions such as gout and chronic obstructive pulmonary disease by analyzing the entire list of diagnostic codes present prior to the diagnosis of the target condition [45].

This study is unique because it translates all chronic condition diagnosis codes from multiple ICD versions to health condition categories. We included ICDA-8 in the mapping process, which has been a knowledge gap in previous mapping research. Such mapping resources are essential to advance health analytics but have been lacking. Most previous mappings have covered ICD-9 codes only [26, 27, 46–49], or focused on a single condition or category of conditions (e.g., respiratory diseases, cancer, and cardiovascular diseases) [35, 36, 50–55]. These prior classifications of ICD codes to clinically meaningful categories have highlighted the fact that each crosswalk is curated for a specific context, varying in the objectives, process, and results. Similar restrictions are met between different nomenclature systems. For example, providing a focus on medical terminology in SNOMED CT resulted in the inclusion of SNOMED CT as reference terminology in the Foundation Component of ICD-11 [56]. Moreover, future plans include further collaboration between WHO and SNOMED CT owners to provide more efficient and easier data entry using clinically meaningful terms from SNOMED CT. However, SNOMED CT includes extensive terminology about symptoms, signs, procedures, observations, some laboratory tests, drugs, and devices [57]. Further, SNOMED CT is currently identified for use as a reference tool for ICD coding, leaving electronic healthcare

records to use the ICD system [56]. Therefore, it remains necessary to refine each crosswalk to the particular user and research settings required. The crosswalks we have created provide a comprehensive categorization of multiple ICD versions and chronic health conditions, which can be incorporated to achieve a wide range of health research goals in a variety of settings. Further, these crosswalks can potentially be used by researchers in other countries, such as Australia, UK, and the US, where ICD-coded data are widely available.

This study has several strengths. We incorporated three different ICD versions spanning over 50 years of electronic healthcare records. Therefore, the produced crosswalks are generalizable to settings and jurisdictions where diagnoses are captured in one or more of the three mapped ICD versions, such as Canada, Sweden, Finland and Denmark, among many others. Second, the three crosswalks included all chronic conditions and were not limited to a subcategory or type of chronic condition. Third, each ICD version was mapped to the same 130 CCS categories, which provides an opportunity for longitudinal research covering multiple ICD versions. Furthermore, the mapping was completed by two reviewers and inter-reviewer agreement was calculated for each ICD version mapping. Additionally, we used available crosswalks to aid in the mapping decisions and provide a third-party peer reviewed decision when reviewers faced discrepancies.

Despite these strengths, we note a few limitations. The ICD-10-CA crosswalk was based on ICD codes that appeared in the Manitoba Hospital Abstracts database over a defined period of time; therefore, it may not include the entire list of ICD-10-CA codes. However, the codes were identified using 14 years of data for the entire population, and it is unlikely that the data are significantly different from those that would be captured in other jurisdictions. Additionally, the loss of granularity in the truncated 3-digit ICD codes may have resulted in the loss of details of the condition relating to various subcategories. This could affect the mapping decisions. For example, the 3-digit ICD-9-CM 250 captures diabetes mellitus. However, details on diabetes type and the presence of complications can only be identified using the 5 and 4-digit ICD-9-CM codes, respectively. This may not have been particularly disadvantageous to our objective of mapping three versions of ICD codes into clinically meaningful categories as that required us to focus on broader categories of conditions but would limit the crosswalks' utility if more specific diagnoses are of interest. Mapping based on the broader 3-digit diagnosis level simplified the scope of the conditions between older ICD versions that included a smaller number of subcategories and newer ICD versions with growing subcategorization. Yet, developing crosswalks based on the full-length (e.g., 5-digit) ICD codes is recommended in data sources where these codes are available, such as in electronic healthcare records. The mappings were developed using ICD versions relevant to the province of Manitoba in Canada. There are some barriers associated with the application of our mappings to ICD versions used in other countries. However, these barriers would be minor and version-specific since the ICD system is universal to WHO member countries [58]. The crosswalks we have produced have not been independently validated. Future studies are recommended to evaluate the quality of

the crosswalks within Manitoba, Canada, as well as in other jurisdictions.

Conclusion

This study described the development of crosswalks between three ICD versions: ICDA-8, ICD-9-CM, and ICD-10-CA into 130 clinically meaningful categories of chronic health conditions based on the open-source CCS classification. These crosswalks will benefit chronic disease research and surveillance that relies on electronic healthcare records spanning multiple decades. Future studies are recommended to independently validate the produced crosswalks.

Acknowledgments

This study was supported by funding from the Winnipeg Foundation Innovation Fund of the Rady Faculty of Health Sciences. We acknowledge the Manitoba Centre for Health Policy for use of data contained in the Population Health Research Data Repository (HIPC #: 2019/2020-52; MCHP Project #: 2020-005). The results and conclusions are those of authors and no official endorsement by the Manitoba Centre for Health Policy, Manitoba Health, Healthy Living, and Seniors, or other data providers is intended or should be inferred, or other data providers is intended or should be inferred. LML is supported by a Tier 1 Canada Research Chair.

Conflicts of interest

All authors declare that they have no conflict of interest.

Ethics approval

The study was approved by the Health Research Ethics Board of the University of Manitoba; data access approval was provided by the Manitoba Health Information Privacy Committee

Supplementary appendices

Supplementary Appendix 1. Crosswalk of ICD-9-CM codes to CCS categories

Supplementary Appendix 2. Discrepancies in ICD-9-CM mappings between the two reviewers

Supplementary Appendix 3. Crosswalk of ICDA-8 codes to CCS categories

Supplementary Appendix 4. Discrepancies in ICDA-8 mappings between the two reviewers

Supplementary Appendix 5. Discrepancies in ICD-10-CA mappings between the two reviewers

Supplementary Appendix 6. Crosswalk of ICD-10-CA codes to CCS categories

References

- Gavrielov-Yusim N, Friger M. Use of administrative medical databases in population-based research. *J Epidemiol Community Health* 2014;68:283–7. <https://doi.org/10.1136/jech-2013-202744>
- Cadarette SM, Wong L. An Introduction to Health Care Administrative Data. *Can J Hosp Pharm* 2015;68:232–3. <http://doi.org/10.4212/cjhp.v68i3.1457>
- Jutte DP, Roos LL, Brownell MD. Administrative record linkage as a tool for public health research. *Annu Rev Public Health* 2011;32:91–108. <https://doi.org/10.1146/annurev-publhealth-031210-100700>
- Roos LL, Nicol JP, Cageorge SM. Using administrative data for longitudinal research: comparisons with primary data collection. *J Chronic Dis* 1987;40:41–9. [https://doi.org/10.1016/0021-9681\(87\)90095-6](https://doi.org/10.1016/0021-9681(87)90095-6)
- Noncommunicable diseases progress monitor 2020. Geneva: World Health Organization; 2020.
- Buttorff C, Ruder T, Bauman M. Multiple Chronic Conditions in the United States. Santa Monica, CA: RAND Corporation; 2017.
- Health at a Glance: Europe 2018: State of Health in the EU Cycle. Paris: OECD Publishing; 2018.
- Sund R. Quality of the Finnish Hospital Discharge Register: A systematic review. *Scand J Public Health* 2012;40:505–15. <https://doi.org/10.1177/1403494812456637>
- Lynge E, Sandegaard JL, Rebolj M. The Danish National Patient Register. *Scand J Public Health* 2011;39:30–3. <https://doi.org/10.1177/1403494811401482>
- Lucyk K, Lu M, Sajobi T, Quan H. Administrative health data in Canada: lessons from history. *BMC Med Inform Decis Mak* 2015;15:69. <https://doi.org/10.1186/s12911-015-0196-9>
- Bernstein CN, Burchill C, Targownik LE, Singh H, Ghia JE, Roos LL. Maternal Infections That Would Warrant Antibiotic Use Antepartum or Peripartum Are Not a Risk Factor for the Development of IBD: A Population-Based Analysis. *Inflamm Bowel Dis* 2017;23:635–40. <https://doi.org/10.1097/MIB.0000000000001042>
- Lix LM, Leslie WD, Yang S, Yan L, Walld R, Morin SN, et al. Accuracy of Offspring-Reported Parental Hip Fractures: A Novel Population-Based Parent-Offspring Record Linkage Study. *Am J Epidemiol* 2017;185:974–81. <https://doi.org/10.1093/aje/kww197>
- Häyrinen K, Saranto K, Nykänen P. Definition, structure, content, use and impacts of electronic health records: a review of the research literature. *Int J Med Inf* 2008;77:291–304. <https://doi.org/10.1016/j.ijmedinf.2007.09.001>
- World Health Organization. International Statistical Classification of Diseases and Related Health Problems (ICD) 2021. <https://www.who.int/standards/classifications/classification-of-diseases> (accessed February 2, 2021).
- Lindström U, Exarchou S, Sigurdardottir V, Sundström B, Askling J, Eriksson JK, et al. Validity of ankylosing spondylitis and undifferentiated spondyloarthritis diagnoses in the Swedish National Patient Register. *Scand J Rheumatol* 2015;44:369–76. <https://doi.org/10.3109/03009742.2015.1010572>
- University of Manitoba - Faculty of Medicine - Community Health Sciences - Manitoba Centre for Health Policy - Concept Dictionary and Glossary for Population Based Research n.d. <http://mchp-appserv.cpe.umanitoba.ca/viewConcept.php?conceptID=1028> (accessed August 5, 2020).
- US Centers for Disease Control and Prevention; National Center for Health Statistics. International Classification of Diseases (ICD-10-CM/PCS) transition—background 2015. http://www.cdc.gov/nchs/icd/icd10cm_pcs_background.htm (accessed July 24, 2020).
- Clinical Classifications Software (CCS) for ICD-10-PCS (beta version) n.d. <https://hcup-us.ahrq.gov/toolssoftware/ccs10/ccs10.jsp> (accessed July 23, 2020).
- WHO |International Classification of Diseases, 11th Revision (ICD-11). WHO n.d. <http://www.who.int/classifications/icd/en/> (accessed July 29, 2020).
- Glerum KM, Zonfrillo MR. Validation of an ICD-9-CM and ICD-10-CM map to AIS 2005 Update 2008. *Inj Prev J Int Soc Child Adolesc Inj Prev* 2019;25:90–2. <https://doi.org/10.1136/injuryprev-2017-042519>
- Nadkarni PM, Darer JA. Migrating existing clinical content from ICD-9 to SNOMED. *J Am Med Inform Assoc JAMIA* 2010;17:602–7. <https://doi.org/10.1136/jamia.2009.001057>
- Bowman SE. Coordinating SNOMED-CT and ICD-10: Getting the Most out of Electronic Health Record Systems. *Am Health Inf Manag Assoc* 2005;76:60–1.
- Wehby GL, Domingue BW, Wolinsky FD. Genetic Risks for Chronic Conditions: Implications for Long-term Wellbeing. *J Gerontol A Biol Sci Med Sci* 2018;73:477–83. <https://doi.org/10.1093/gerona/glx154>
- Rappaport SM. Genetic Factors Are Not the Major Causes of Chronic Diseases. *PLOS ONE* 2016;11:e0154387. <https://doi.org/10.1371/journal.pone.0154387>
- Elixhauser A, Steiner C, Palmer L. Clinical Classifications Software (CCS). U.S. Agency for Healthcare Research and Quality; 2015.

26. Chi M, Lee C, Wu S. The prevalence of chronic conditions and medical expenditures of the elderly by chronic condition indicator (CCI). *Arch Gerontol Geriatr* 2011;52:284–9. <https://doi.org/10.1016/j.archger.2010.04.017>
27. Kannan VC, Andriamalala CN, Reynolds TA. The burden of acute disease in Mahajanga, Madagascar - a 21 month study. *PLoS One* 2015;10:e0119029. <https://doi.org/10.1371/journal.pone.0119029>
28. Lix LM, Walker R, Quan H, Nesdole R, Yang J, Chen G, et al. Features of physician services databases in Canada. *Chronic Dis Inj Can* 2012;32:186–93.
29. Roos LL, Nicol JP. A Research Registry: Uses, Development, and Accuracy. *J Clin Epidemiol* 1999;52:39–47. [https://doi.org/10.1016/S0895-4356\(98\)00126-7](https://doi.org/10.1016/S0895-4356(98)00126-7)
30. HCUP-US Tools & Software Page n.d. https://hcup-us.ahrq.gov/tools_software.jsp (accessed July 14, 2020).
31. The US Department of health, Education and Welfare. Eighth Revision International Classification of Diseases. 1969.
32. Hwang W, Weller W, Ireys H, Anderson G. Out-of-pocket medical spending for care of chronic conditions. *Health Aff Proj Hope* 2001;20:267–78. <https://doi.org/10.1377/hlthaff.20.6.267>
33. Chronic Condition Indicator (CCI) for ICD-9-CM n.d. <https://hcup-us.ahrq.gov/toolssoftware/chronic/chronic.jsp> (accessed July 14, 2020).
34. De S. 8 steps to success in ICD-10-CM/PCS mapping: best practices to establish precise mapping between old and new ICD code sets. *J AHIMA Am Health Inf Manag Assoc* 2012;83.
35. Andersen MN, Olsen A-MS, Madsen JC, Faber J, Torp-Pedersen C, Gislason GH, et al. Levothyroxine Substitution in Patients with Subclinical Hypothyroidism and the Risk of Myocardial Infarction and Mortality. *PLOS ONE* 2015;10:e0129793. <https://doi.org/10.1371/journal.pone.0129793>
36. Van Dyke M, Greer S, Odom E, Schieb L, Vaughan A, Kramer M, et al. Heart disease death rates among blacks and whites aged ≥35 years - United States, 1968-2015. *MMWR Surveill Summ* 2018;67:1–11. <https://doi.org/10.15585/mmwr.ss6705a1>
37. Fazel SB, Grann M, Carlström E, Lichtenstein P, Långström N. Risk factors for violent crime in schizophrenia: A national cohort study of 13,806 patients. *J Clin Psychiatry* 2009;70:362–9. <https://doi.org/10.4088/JCP.08m04274>
38. Duggar BC, Lewis WF. Comparability of diagnostic data. Coded by the 8th and 9th Revisions of the International Classification of Diseases. *Vital Health Stat* 2 1987:1–31.
39. Janssen F, Kunst AE. ICD coding changes and discontinuities in trends in cause-specific mortality in six European countries, 1950-99. *Bull World Health Organ* 2004;82:904–13. <https://doi.org/S0042-96862004001200006>
40. Smith DP, Bradshaw B. Reconciling heart disease mortality and ICD codes. *Soc Biol* 2003;50:127–47. <https://doi.org/10.1080/19485565.2003.9989068>
41. Quach S, Blais C, Quan H. Administrative data have high variation in validity for recording heart failure. *Can J Cardiol* 2010;26:e306–12. [https://doi.org/10.1016/S0828-282X\(10\)70438-4](https://doi.org/10.1016/S0828-282X(10)70438-4)
42. Christensen J, Vestergaard M, Olsen J, Sidenius P. Validation of epilepsy diagnoses in the Danish National Hospital Register. *Epilepsy Res* 2007;75:162–70. <https://doi.org/10.1016/j.eplepsyres.2007.05.009>
43. University of Manitoba - Faculty of Medicine - Community Health Sciences - Manitoba Centre for Health Policy - Concept Dictionary and Glossary for Population Based Research n.d. <http://mchp-appserv.cpe.umanitoba.ca/viewConcept.php?conceptID=1157> (accessed August 5, 2020).
44. The Canadian Institute for Health Information (CIHI). ICD-10-CA and CCI 2019. <https://secure.cihi.ca/estore/productFamily.htm?pf=PFC3971&lang=en&media=0> (accessed September 11, 2020).
45. Jensen AB, Moseley PL, Oprea TI, Ellesøe SG, Eriksson R, Schmock H, et al. Temporal disease trajectories condensed from population-wide registry data covering 6.2 million patients. *Nat Commun* 2014;5:4022. <https://doi.org/10.1038/ncomms5022>
46. Cook CB, Tsui C, Ziemer DC, Naylor DB, Miller WJ. Common reasons for hospitalization among adult patients with diabetes. *Endocr Pract Off J Am Coll Endocrinol Am Assoc Clin Endocrinol* 2006;12:363–70. <https://doi.org/10.4158/EP.12.4.363>
47. Kindermann DR, Mutter RL, Houchens RL, Barrett ML, Pines JM. Emergency Department Transfers and Transfer Relationships in United States Hospitals. *Acad Emerg Med* 2015;22:157–65. <https://doi.org/10.1111/acem.12586>
48. Kourtis AP, Paramsothy P, Posner SF, Meikle SF, Jamieson DJ. National estimates of hospital use by children with HIV infection in the United States: analysis of data from the 2000 KIDS Inpatient Database. *Pediatrics* 2006;118:e167–173. <https://doi.org/10.1542/peds.2005-2780>
49. Magnan E. Algorithm for Identifying Patients with Multiple Chronic Conditions (Multimorbidity). University of Wisconsin - Madison Department of Family Medicine, the University of California - Davis Department of Family and Community Medicine, and the UW Health Innovation Program; 2015.

50. Lix L, Smith M, Pitz M, Ahmed R, Quon H, Griffith J, et al. Cancer Data Linkage in Manitoba: Expanding the Infrastructure for Research. Winnipeg, MB: Manitoba Centre for Health Policy; 2016.
51. Rück C, Larsson KJ, Lind K, Perez-Vigil A, Isomura K, Sariaslan A, et al. Validity and reliability of chronic tic disorder and obsessive-compulsive disorder diagnoses in the Swedish National Patient Register. *BMJ Open* 2015;5:e007520. <https://doi.org/10.1136/bmjopen-2014-007520>
52. Sellgren C, Landén M, Lichtenstein P, Hultman CM, Långström N. Validity of bipolar disorder hospital discharge diagnoses: file review and multiple register linkage in Sweden. *Acta Psychiatr Scand* 2011;124:447–53. <https://doi.org/10.1111/j.1600-0447.2011.01747.x>
53. Tüchsen F, Hannerz H, Burr H. A 12 year prospective study of circulatory disease among Danish shift workers. *Occup Environ Med* 2006;63:451–5. <https://doi.org/10.1136/oem.2006.026716>
54. Harpsøe MC, Basit S, Andersson M, Nielsen NM, Frisch M, Wohlfahrt J, et al. Body mass index and risk of autoimmune diseases: a study within the Danish National Birth Cohort. *Int J Epidemiol* 2014;43:843–55. <https://doi.org/10.1093/ije/dyu045>
55. Nielsen EH, Lindholm J, Laurberg P. Use of combined search criteria improved validity of rare disease (craniopharyngioma) diagnosis in a national registry. *J Clin Epidemiol* 2011;64:1118–26. <https://doi.org/10.1016/j.jclinepi.2010.12.016>
56. Roberts R, Greenberg M, Richardsson H. Report of ICD-11 Revision Review. Consultancy Interim Assessment of 11th ICD Revision. WHO; 2015.
57. Bodenreider O, Cornet R, Vreeman DJ. Recent Developments in Clinical Terminologies - SNOMED CT,

LOINC, and RxNorm. *Yearb Med Inform* 2018;27:129–39. <https://doi.org/10.1055/s-0038-1667077>

58. World Health Organization. International Classification of Diseases, (ICD-10-CM/PCS) Transition – Background 2015. https://www.cdc.gov/nchs/icd/icd10cm_pcs_background.htm (accessed February 2, 2021).

Abbreviations

US:	The United States of America
UK:	The United Kingdom
WHO:	The World Health Organization
ICD:	The International Classification of Diseases
ICD-8:	The International Classification of Diseases 8 th revision
ICD-9:	The International Classification of Diseases 9 th revision
ICD-10:	The International Classification of Diseases 10 th revision
ICDA-8:	The International Classification of Diseases 8 th revision with adaptations
ICD-9-CM:	The International Classification of Diseases 9 th revision with clinical modifications
ICD-10-CM:	The International Classification of Diseases 10 th revision with clinical modifications
ICD-10-CA:	The International Classification of Diseases 10 th revision with Canadian adaptations
AIS:	The Abbreviated Injury Scale
SNOMED CT:	Systematized Nomenclature of Medicine – Clinical Terms
CCS:	The Clinical Classifications Software
CCI:	The Chronic Condition Indicator
HCUP:	The Healthcare Cost and Utilization Project
MCHP:	The Manitoba Centre for Health Policy
CIHI:	The Canadian Institute of Health Information
CI:	Confidence interval



Supplementary Appendix 1: Crosswalk of ICD-9-CM codes to CCS categories

CCS category #	CCS category description	ICD-9-CM code	ICD-9-CM code label
11	Cancer of head and neck	140	Malignant neoplasm of lip
		141	Malignant neoplasm of tongue
		142	Malignant neoplasm of major salivary glands
		143	Malignant neoplasm of gum
		144	Malignant neoplasm of floor of mouth
		145	Malignant neoplasm of other and unspecified parts of mouth
		146	Malignant neoplasm of oropharynx
		147	Malignant neoplasm of nasopharynx
		148	Malignant neoplasm of hypopharynx
		149	Malignant neoplasm of other and ill-defined sites within the lip oral cavity and pharynx
		160	Malignant neoplasm of nasal cavities middle ear and accessory sinuses
12	Cancer of esophagus	161	Malignant neoplasm of larynx
		150	Malignant neoplasm of esophagus
		151	Malignant neoplasm of stomach
		152	Malignant neoplasm of small intestine including duodenum
		156	Malignant neoplasm of gallbladder and extrahepatic bile ducts
13	Cancer of stomach	158	Malignant neoplasm of retroperitoneum and peritoneum
		159	Malignant neoplasm of other and ill-defined sites within the digestive organs and peritoneum
		230	Carcinoma in situ of digestive organs
14	Cancer of colon	153	Malignant neoplasm of colon
		154	Malignant neoplasm of rectum rectosigmoid junction and anus
15	Cancer of rectum and anus	155	Malignant neoplasm of liver and intrahepatic bile ducts
16	Cancer of liver and intrahepatic bile duct	157	Malignant neoplasm of pancreas
17	Cancer of pancreas	162	Malignant neoplasm of trachea bronchus and lung
		163	Malignant neoplasm of pleura
		165	Malignant neoplasm of other and ill-defined sites within the respiratory system and intrathoracic organs
		231	Carcinoma in situ of respiratory system
19, 20	Cancer of bronchus, lung and other respiratory and intrathoracic organs	164	Malignant neoplasm of thymus heart and mediastinum
		176	Kaposi's sarcoma
		190	Malignant neoplasm of eye
		194	Malignant neoplasm of other endocrine glands and related structures
		195	Malignant neoplasm of other and ill-defined sites
41	Other and unspecified cancers	209	Neuroendocrine tumors
		233	Carcinoma in situ of breast and genitourinary system
		234	Carcinoma in situ of other and unspecified sites
		170	Malignant neoplasm of bone and articular cartilage
		171	Malignant neoplasm of connective and other soft tissue
21	Cancer of bone and connective tissue	172	Malignant melanoma of skin
22	Melanoma of skin	174	Malignant neoplasm of female breast
		175	Malignant neoplasm of male breast
24	Cancer of breast	179	Malignant neoplasm of uterus, part unspecified
		182	Malignant neoplasm of body of uterus
25	Cancer of uterus	180	Malignant neoplasm of cervix uteri
26	Cancer of cervix	181	Malignant neoplasm of placenta
		181	Malignant neoplasm of placenta
27, 28	Cancer of ovary and other female genital organs		

Continued

Supplementary Appendix 1: Continued

CCS category #	CCS category description	ICD-9-CM code	ICD-9-CM code label
		183	Malignant neoplasm of ovary and other uterine adnexa
		184	Malignant neoplasm of other and unspecified female genital organs
29	Cancer of prostate	185	Malignant neoplasm of prostate
30	Cancer of testis	186	Malignant neoplasm of testis
31	Cancer of other male genital organs	187	Malignant neoplasm of penis and other male genital organs
32	Cancer of bladder	188	Malignant neoplasm of bladder
33, 34	Cancer of kidney and other urinary organs	189	Malignant neoplasm of kidney and other and unspecified urinary organs
35	Cancer of brain and nervous system	191	Malignant neoplasm of brain
		192	Malignant neoplasm of other and unspecified parts of nervous system
36	Cancer of thyroid	193	Malignant neoplasm of thyroid gland
42	Secondary malignancies	196	Secondary and unspecified malignant neoplasm of lymph nodes
		197	Secondary malignant neoplasm of respiratory and digestive systems
		198	Secondary malignant neoplasm of other specified sites
43	Malignant neoplasm without specification of site	199	Malignant neoplasm without specification of site
38	Non-Hodgkin's lymphoma	200	Lymphosarcoma and reticulosarcoma and other specified malignant tumors of lymphatic tissue
		202	Other malignant neoplasms of lymphoid and histiocytic tissue
37	Hodgkin's disease	201	Hodgkin's disease
39, 40	Multiple myeloma and leukemias	203	Multiple myeloma and immunoproliferative neoplasms
		204	Lymphoid leukemia
		205	Myeloid leukemia
		206	Monocytic leukemia
		207	Other specified leukemia
		208	Leukemia of unspecified cell type
47	Other and unspecified benign neoplasm	225	Benign neoplasm of brain and other parts of nervous system
44	Neoplasms of unspecified nature or uncertain behavior	237	Neoplasm of uncertain behavior of endocrine glands and nervous system
		238	Neoplasm of uncertain behavior of other and unspecified sites and tissues
		239	Neoplasms of unspecified nature
48	Thyroid disorders	240	Simple and unspecified goiter
		241	Nontoxic nodular goiter
		242	Thyrotoxicosis with or without goiter
		243	Congenital hypothyroidism
		244	Acquired hypothyroidism
		245	Thyroiditis
		246	Other disorders of thyroid
49, 50	Diabetes mellitus	249	Secondary diabetes mellitus
		250	Diabetes mellitus
51	Other endocrine disorders	251	Other disorders of pancreatic internal secretion
		252	Disorders of parathyroid gland
		253	Disorders of the pituitary gland and its hypothalamic control
		254	Diseases of thymus gland
		255	Disorders of adrenal glands
		256	Ovarian dysfunction

Continued

Supplementary Appendix 1: Continued

CCS category #	CCS category description	ICD-9-CM code	ICD-9-CM code label
		257	Testicular dysfunction
		258	Polyglandular dysfunction and related disorders
		259	Other endocrine disorders
52	Nutritional deficiencies	260	Kwashiorkor
		261	Nutritional marasmus
		262	Other severe protein-calorie malnutrition
		263	Other and unspecified protein-calorie malnutrition
		268	Vitamin d deficiency
57, 58	Other nutritional, endocrine, immunity, and metabolic disorders	270	Disorders of amino-acid transport and metabolism
		271	Disorders of carbohydrate transport and metabolism
		273	Disorders of plasma protein metabolism
		275	Disorders of mineral metabolism
		277	Other and unspecified disorders of metabolism
		278	Overweight, obesity and other hyperalimentation
		279	Disorders involving the immune mechanism
53	Disorders of lipid metabolism	272	Disorders of lipoid metabolism
54	Gout and other crystal arthropathies	274	Gout
		712	Crystal arthropathies
59, 61	Deficiency, sickle cell and other anemia	280	Iron deficiency anemias
		282	Hereditary hemolytic anemias
		283	Acquired hemolytic anemias
		284	Aplastic anemia and other bone marrow failure syndromes
		285	Other and unspecified anemias
62, 63, 64, 247	Other hematologic conditions	286	Coagulation defects
		287	Purpura and other hemorrhagic conditions
		288	Diseases of white blood cells
		289	Other diseases of blood and blood-forming organs
653	Delirium, dementia and other cognitive disorders	290	Dementias
		294	Persistent mental disorders due to conditions classified elsewhere
		331	Other cerebral degenerations
660, 661	Alcohol and substance-related disorders	291	Alcohol-induced mental disorders
		292	Drug-induced mental disorders
		303	Alcohol dependence syndrome
		304	Drug dependence
		305	Nondependent abuse of drugs
659	Schizophrenia and other psychotic disorders	295	Schizophrenic disorders
		297	Delusional disorders
		298	Other nonorganic psychoses
651, 657	Mood and anxiety disorders	296	Episodic mood disorders
		300	Anxiety, dissociative and somatoform disorders
		308	Acute reaction to stress
		311	Depressive disorder, not elsewhere classified
655	Disorders usually diagnosed in infancy, childhood, or adolescence	299	Pervasive developmental disorders
658	Personality disorders	301	Personality disorders
670	Miscellaneous mental health disorders	306	Physiological malfunction arising from mental factors
		307	Special symptoms or syndromes not elsewhere classified
		310	Specific nonpsychotic mental disorders due to brain damage
		316	Psychic factors associated with diseases classified elsewhere
650	Adjustment disorders	309	Adjustment reaction

Continued

Supplementary Appendix 1: Continued

CCS category #	CCS category description	ICD-9-CM code	ICD-9-CM code label
652	Attention-deficit, conduct, and disruptive behavior disorders	312	Disturbance of conduct not elsewhere classified
		314	Hyperkinetic syndrome of childhood
654	Developmental disorders	315	Specific delays in development
		317	Mild intellectual disabilities
		318	Other specified intellectual disabilities
		319	Unspecified intellectual disabilities
81, 95	Other nervous system conditions	327	Organic sleep disorders
		330	Cerebral degenerations usually manifest in childhood
		333	Other extrapyramidal disease and abnormal movement disorders
		334	Spinocerebellar disease
		335	Anterior horn cell disease
		336	Other diseases of spinal cord
		337	Disorders of the autonomic nervous system
		338	Pain, not elsewhere classified
		341	Other demyelinating diseases of central nervous system
		347	Cataplexy and narcolepsy
		348	Other conditions of brain
		353	Nerve root and plexus disorders
		354	Mononeuritis of upper limb and mononeuritis multiplex
		355	Mononeuritis of lower limb and unspecified site
		356	Hereditary and idiopathic peripheral neuropathy
		357	Inflammatory and toxic neuropathy
		358	Myoneural disorders
	359	Muscular dystrophies and other myopathies	
79	Parkinson's disease	332	Parkinson's disease
84	Headache; including migraine	339	Other headache syndromes
		346	Migraine
80	Multiple sclerosis	340	Multiple sclerosis
82	Paralysis	342	Hemiplegia and hemiparesis
		343	Infantile cerebral palsy
		344	Other paralytic syndromes
		345	Epilepsy and recurrent seizures
83	Epilepsy, convulsions	345	Epilepsy and recurrent seizures
90, 91	Inflammation infection and other eye disorders	360	Disorders of the globe
		363	Chorioretinal inflammations scars and other disorders of choroid
		364	Disorders of iris and ciliary body
		370	Keratitis
		371	Corneal opacity and other disorders of cornea
		372	Disorders of conjunctiva
		376	Disorders of the orbit
		377	Disorders of optic nerve and visual pathways
		379	Other disorders of eye
87	Retinal detachments, defects, vascular occlusion, and retinopathy	361	Retinal detachments and defects
		362	Other retinal disorders
88	Glaucoma	365	Glaucoma
86	Cataract	366	Cataract
89	Blindness and vision defects	369	Blindness and low vision
94	Other ear and sense organ disorders	380	Disorders of external ear
		384	Other disorders of tympanic membrane
		389	Hearing loss
92	Otitis media and related conditions	381	Nonsuppurative otitis media and eustachian tube disorders
		382	Suppurative and unspecified otitis media
		383	Mastoiditis and related conditions

Continued

Supplementary Appendix 1: Continued

CCS category #	CCS category description	ICD-9-CM code	ICD-9-CM code label
93	Conditions associated with dizziness or vertigo	386	Vertiginous syndromes and other disorders of vestibular system
97	Peri-; endo-; and myocarditis, cardiomyopathy	393	Chronic rheumatic pericarditis
		398	Other rheumatic heart disease
		423	Other diseases of pericardium
		425	Cardiomyopathy
96	Heart valve disorders	394	Diseases of mitral valve
		395	Diseases of aortic valve
		396	Diseases of mitral and aortic valves
		397	Diseases of other endocardial structures
		424	Other diseases of endocardium
		401	Essential hypertension
98	Essential hypertension	401	Essential hypertension
99	Hypertension with complications and secondary hypertension	402	Hypertensive heart disease
		403	Hypertensive chronic kidney disease
		404	Hypertensive heart and chronic kidney disease
		405	Secondary hypertension
100	Acute myocardial infarction	410	Acute myocardial infarction
101	Coronary atherosclerosis and other heart disease	411	Other acute and subacute forms of ischemic heart disease
		412	Old myocardial infarction
		413	Angina pectoris
		414	Other forms of chronic ischemic heart disease
103	Pulmonary heart disease	415	Acute pulmonary heart disease
		416	Chronic pulmonary heart disease
		417	Other diseases of pulmonary circulation
105	Conduction disorders	426	Conduction disorders
106, 107, 108	Cardiac dysrhythmias, arrest, ventricular fibrillation and congestive heart failure	427	Cardiac dysrhythmias
		428	Heart failure
104	Other and ill-defined heart disease	429	Ill-defined descriptions and complications of heart disease
109, 110	Acute Cerebrovascular disease, occlusion or stenosis of precerebral arteries	430	Subarachnoid hemorrhage
		431	Intracerebral hemorrhage
		432	Other and unspecified intracranial hemorrhage
		433	Occlusion and stenosis of precerebral arteries
		434	Occlusion of cerebral arteries
436	Acute, but ill-defined, cerebrovascular disease		
112	Transient cerebral ischemia	435	Transient cerebral ischemia
111	Other and ill-defined cerebrovascular disease	437	Other and ill-defined cerebrovascular disease
		438	Late effects of cerebrovascular disease
114, 115, 117	Other circulatory disease	440	Atherosclerosis
		441	Aortic aneurysm and dissection
		442	Other aneurysm
		443	Other peripheral vascular disease
		446	Polyarteritis nodosa and allied conditions
		447	Other disorders of arteries and arterioles
		448	Disease of capillaries
		557	Vascular insufficiency of intestine
		444	Arterial embolism and thrombosis
		445	Atheroembolism
		453	Other venous embolism and thrombosis
116	Aortic and peripheral arterial embolism or thrombosis	456	Varicose veins of other sites
		457	Noninfectious disorders of lymphatic channels
118	Phlebitis, thrombophlebitis and thromboembolism	459	Other disorders of circulatory system
		459	Other disorders of circulatory system
121	Other diseases of veins and lymphatics	456	Varicose veins of other sites
		457	Noninfectious disorders of lymphatic channels
		459	Other disorders of circulatory system

Continued

Supplementary Appendix 1: Continued

CCS category #	CCS category description	ICD-9-CM code	ICD-9-CM code label
134	Other upper respiratory disease	472	Chronic pharyngitis and nasopharyngitis
		476	Chronic laryngitis and laryngotracheitis
		477	Allergic rhinitis
		478	Other diseases of upper respiratory tract
126	Other upper respiratory infections	473	Chronic sinusitis
124	Acute and chronic tonsillitis	474	Chronic disease of tonsils and adenoids
127	Chronic obstructive pulmonary disease and bronchiectasis	491	Chronic bronchitis
		492	Emphysema
		494	Bronchiectasis
		496	Chronic airway obstruction, not elsewhere classified
128	Asthma	493	Asthma
132	Lung disease due to external agents	495	Extrinsic allergic alveolitis
		500	Coal workers' pneumoconiosis
		501	Asbestosis
		502	Pneumoconiosis due to other silica or silicates
		503	Pneumoconiosis due to other inorganic dust
		504	Pneumonopathy due to inhalation of other dust
		505	Pneumoconiosis, unspecified
		506	Respiratory conditions due to chemical fumes and vapors
	508	Respiratory conditions due to other and unspecified external agents	
133	Other lower respiratory disease	512	Pneumothorax and air leak
		514	Pulmonary congestion and hypostasis
		515	Postinflammatory pulmonary fibrosis
		516	Other alveolar and parietoalveolar pneumonopathy
		517	Lung involvement in conditions classified elsewhere
131	Respiratory failure, insufficiency or arrest	518	Other diseases of lung
136	Disorders of teeth and jaw	523	Gingival and periodontal diseases
		525	Other diseases and conditions of the teeth and supporting structures
138	Esophageal disorders	530	Diseases of esophagus
139, 153	Gastroduodenal ulcer, gastrointestinal hemorrhage	531	Gastric ulcer
		532	Duodenal ulcer
		533	Peptic ulcer, site unspecified
		534	Gastrojejunal ulcer
140	Gastritis and duodenitis	535	Gastritis and duodenitis
141	Other disorders of stomach and duodenum	537	Other diseases of stomach and duodenum
144	Regional enteritis and ulcerative colitis	555	Regional enteritis
		556	Ulcerative colitis
154	Noninfectious gastroenteritis	558	Other and unspecified noninfectious gastroenteritis and colitis
146	Diverticulosis and diverticulitis	562	Diverticula of intestine
155	Other gastrointestinal disorders	564	Functional digestive disorders not elsewhere classified
		579	Intestinal malabsorption
6, 151	Hepatitis and Other liver diseases	571	Chronic liver disease and cirrhosis
		572	Liver abscess and sequelae of chronic liver disease
		573	Other diseases of liver
149	Biliary tract disease	575	Other disorders of gallbladder
		576	Other disorders of biliary tract
152	Pancreatic disorders (excluding diabetes)	577	Diseases of pancreas

Continued

Supplementary Appendix 1: Continued

CCS category #	CCS category description	ICD-9-CM code	ICD-9-CM code label
156, 157, 158	Chronic kidney disease and related conditions	581	Nephrotic syndrome
		582	Chronic glomerulonephritis
		583	Nephritis and nephropathy not specified as acute or chronic
		585	Chronic kidney disease
		586	Renal failure, unspecified
		587	Renal sclerosis, unspecified
161	Other diseases of kidney and ureters	588	Disorders resulting from impaired renal function
159	Urinary tract infections	590	Infections of kidney
162	Other diseases of bladder and urethra	595	Cystitis
		596	Other disorders of bladder
164	Hyperplasia of prostate	599	Other disorders of urethra and urinary tract
		600	Hyperplasia of prostate
165, 166	Inflammatory and other male genital disorders	601	Inflammatory diseases of prostate
		607	Disorders of penis
167	Nonmalignant breast conditions	610	Benign mammary dysplasias
175	Other female genital disorders	614	Inflammatory disease of ovary fallopian tube pelvic cellular tissue and peritoneum
		615	Inflammatory diseases of uterus except cervix
		617	Endometriosis
		619	Fistula involving female genital tract
		621	Disorders of uterus not elsewhere classified
		625	Pain and other symptoms associated with female genital organs
		629	Other disorders of female genital organs
171	Menstrual disorders	626	Disorders of menstruation and other abnormal bleeding from female genital tract
170	Prolapse of female genital organs	618	Genital prolapse
173	Menopausal disorders	627	Menopausal and postmenopausal disorders
174	Female infertility	628	Female infertility
253	Allergic reactions	691	Atopic dermatitis and related conditions
198	Other inflammatory condition of skin	694	Bullous dermatoses
		695	Erythematous conditions
		696	Psoriasis and similar disorders
		701	Other hypertrophic and atrophic conditions of skin
200	Other skin disorders	705	Diseases of sweat glands
199	Chronic ulcer of skin	707	Chronic ulcer of skin
210	Systemic lupus erythematosus and connective tissue disorders	710	Diffuse diseases of connective tissue
204, 225	Joint disorders	713	Arthropathy associated with other disorders classified elsewhere
		716	Other and unspecified arthropathies
		717	Internal derangement of knee
		718	Other derangement of joint
		719	Other and unspecified disorders of joint
		714	Rheumatoid arthritis and other inflammatory polyarthropathies
202	Rheumatoid arthritis and related disease	715	Osteoarthritis and allied disorders
203	Osteoarthritis	720	Ankylosing spondylitis and other inflammatory spondylopathies
205	Spondylosis, intervertebral disc disorders and other back problems		

Continued

Supplementary Appendix 1: Continued

CCS category #	CCS category description	ICD-9-CM code	ICD-9-CM code label
		721	Spondylosis and allied disorders
		722	Intervertebral disc disorders
201	Infective arthritis and osteomyelitis	730	Osteomyelitis periostitis and other infections involving bone
206, 212	Osteoporosis and other bone disease	731	Osteitis deformans and osteopathies associated with other disorders classified elsewhere
		732	Osteochondropathies
		733	Other disorders of bone and cartilage
208	Acquired foot deformities	735	Acquired deformities of toe
209	Other acquired deformities	737	Curvature of spine
216	Nervous system congenital anomalies	740	Anencephalus and similar anomalies
		741	Spina bifida
		742	Other congenital anomalies of nervous system
217	Other congenital anomalies	743	Congenital anomalies of eye
		744	Congenital anomalies of ear face and neck
		748	Congenital anomalies of respiratory system
		749	Cleft palate and cleft lip
		754	Certain congenital musculoskeletal deformities
		755	Other congenital anomalies of limbs
		756	Other congenital musculoskeletal anomalies
		757	Congenital anomalies of the integument
		758	Chromosomal anomalies
		759	Other and unspecified congenital anomalies
213	Cardiac and circulatory congenital anomalies	745	Bulbus cordis anomalies and anomalies of cardiac septal closure
		746	Other congenital anomalies of heart
		747	Other congenital anomalies of circulatory system
214	Digestive congenital anomalies	750	Other congenital anomalies of upper alimentary tract
		751	Other congenital anomalies of digestive system
215	Genitourinary congenital anomalies	752	Congenital anomalies of genital organs
		753	Congenital anomalies of urinary system

Supplementary Appendix 2: Discrepancies in ICD-9-CM mappings between the two reviewers

ICD-9-CM code	ICD-9-CM code label	Assigned CCS category description	
		Reviewer 1	Reviewer 2
310	Specific nonpsychotic mental disorders due to brain damage	Delirium, dementia, and amnesic and other cognitive disorders	Miscellaneous mental health disorders
312	Disturbance of conduct not elsewhere classified	Attention-deficit, conduct, and disruptive behavior disorders	Impulse control disorders, NEC
440	Atherosclerosis	Other circulatory disease	Acute cerebrovascular disease
477	Allergic rhinitis	Other upper respiratory disease	Allergic reactions
626	Disorders of menstruation and other abnormal bleeding from female genital tract	Other female genital disorders	Menstrual disorders
710	Diffuse diseases of connective tissue	Systemic lupus erythematosus and connective tissue disorders	Other connective tissue disease

Supplementary Appendix 3: Crosswalk of ICDA-8 codes to CCS categories

CCS category #	CCS category description	ICDA-8-code	ICDA-8-CM code label
11	Cancer of head and neck	140	Malignant neoplasm of lip
		141	Malignant neoplasm of tongue
		142	Malignant neoplasm of salivary gland
		143	Malignant neoplasm of gum
		144	Malignant neoplasm of floor of mouth
		145	Malignant neoplasm of other and unspecified parts of mouth
		146	Malignant neoplasm of oropharynx
		147	Malignant neoplasm of nasopharynx
		148	Malignant neoplasm of hypopharynx
		149	Malignant neoplasm of pharynx, unspecified
		160	Malignant neoplasm of nose, nasal cavities, middle ear and accessory sinuses
161	Malignant neoplasm of larynx		
12	Cancer of esophagus	150	Malignant neoplasm of esophagus
13	Cancer of stomach	151	Malignant neoplasm of stomach
18	Cancer of other GI organs; peritoneum	152	Malignant neoplasm of small intestine, including duodenum
		156	Malignant neoplasm of gallbladder and bile ducts
		158	Malignant neoplasm of peritoneum and retroperitoneal tissue
159	Malignant neoplasm of unspecified digestive organs		
14	Cancer of colon	153	Malignant neoplasm of large intestine, except rectum
15	Cancer of rectum and anus	154	Malignant neoplasm of rectum and rectosigmoid junction
16	Cancer of liver and intrahepatic bile duct	155	Malignant neoplasm of liver and intrahepatic bile ducts, specified as primary
17	Cancer of pancreas	157	Malignant neoplasm of pancreas
19, 20	Cancer of bronchus, lung and other respiratory and intrathoracic organs	162	Malignant neoplasm of trachea, bronchus and lung
		163	Malignant neoplasm of other and unspecified respiratory organs
41	Other and unspecified cancers	190	Malignant neoplasm of eye
		194	Malignant neoplasm of other endocrine glands
		195	Malignant neoplasm of ill-defined sites
21	Cancer of bone and connective tissue	170	Malignant neoplasm of bone
		171	Malignant neoplasm of connective and other soft tissue
22	Melanoma of skin	172	Malignant melanoma of skin
24	Cancer of breast	174	Malignant neoplasm of breast
25	Cancer of uterus	182	Other malignant neoplasm of uterus
26	Cancer of cervix	180	Malignant neoplasm of cervix uteri
27, 28	Cancer of ovary and other female genital organs	181	Chorionepithelioma
		183	Malignant neoplasm of ovary, Fallopian tube and broad ligament
		184	Malignant neoplasm of other and unspecified female genital organs
29	Cancer of prostate	185	Malignant neoplasm of prostate
30	Cancer of testis	186	Malignant neoplasm of testis
31	Cancer of other male genital organs	187	Malignant neoplasm of other and unspecified male genital organs
32	Cancer of bladder	188	Malignant neoplasm of bladder
33, 34	Cancer of kidney and other urinary organs	189	Malignant neoplasm of other and unspecified urinary organs
35	Cancer of brain and nervous system	191	Malignant neoplasm of brain
		192	Malignant neoplasm of other part of nervous system
36	Cancer of thyroid	193	Malignant neoplasm of thyroid gland
42	Secondary malignancies	196	Secondary and unspecified malignant neoplasm of lymph nodes

Continued

Supplementary Appendix 3: Continued

CCS category #	CCS category description	ICDA-8-code	ICDA-8-CM code label
		197	Secondary malignant neoplasm of respiratory and digestive systems
		198	Other secondary malignant neoplasm
43	Malignant neoplasm without specification of site	199	Malignant neoplasm without specification of site
38	Non-Hodgkin's lymphoma	200	Lymphosarcoma and reticulum-cell sarcoma
		202	Other neoplasms of lymphoid tissue
37	Hodgkin's disease	201	Hodgkin's disease
39, 40	Multiple myeloma and leukemias	203	Multiple myeloma
		204	Lymphatic leukemia
		205	Myeloid leukemia
		206	Monocytic leukemia
		207	Other and unspecified leukemia
47	Other and unspecified benign neoplasm	225	Benign neoplasm of brain and other parts of nervous system
44	Neoplasms of unspecified nature or uncertain behavior	208	Polycythemia vera
		209	Myelofibrosis
		230	Neoplasm of unspecified nature of digestive organs
		231	Neoplasm of unspecified nature of respiratory organs
		232	Neoplasm of unspecified nature of skin and musculoskeletal system
		233	Neoplasm of unspecified nature of breast
		234	Neoplasm of unspecified nature of uterus
		235	Neoplasm of unspecified nature of ovary
		236	Neoplasm of unspecified nature of other female genital organs
		237	Neoplasm of unspecified nature of other genito-urinary organs
		238	Neoplasm of unspecified nature of eye, brain and other parts of nervous system
		239	Neoplasm of unspecified nature of other and unspecified organs
48	Thyroid disorders	240	Simple goiter
		241	Non-toxic nodular goiter
		242	Thyrotoxicosis with or without goitre
		243	Cretinism of congenital origin
		244	Myxoedema
		245	Thyroiditis
		246	Other diseases of thyroid gland
49, 50	Diabetes mellitus	250	Diabetes mellitus
51	Other endocrine disorders	251	Disorders of pancreatic internal secretion other than diabetes mellitus
		252	Diseases of parathyroid gland
		253	Diseases of pituitary gland
		254	Diseases of thymus gland
		255	Disorders of adrenal glands
		256	Ovarian dysfunction
		257	Testicular dysfunction
		258	Polyglandular dysfunction and other diseases of endocrine glands
52	Nutritional deficiencies	265	Vitamin D deficiency
		267	Protein malnutrition
		268	Nutritional marasmus

Continued

Supplementary Appendix 3: Continued

CCS category #	CCS category description	ICDA-8-code	ICDA-8-CM code label
57, 58	Other nutritional, endocrine, immunity, and metabolic disorders	270 271 273 275 276 277 278 279 272	Congenital disorders of amino-acid metabolism Congenital disorders of carbohydrate metabolism Other and unspecified congenital disorders of metabolism Plasma protein abnormalities Amyloidosis Obesity not specified as of endocrine origin Other hyperalimentation Other and unspecified metabolic diseases Congenital disorders of lipid metabolism
53	Disorders of lipid metabolism		
54	Gout and other crystal arthropathies	274	Gout
59, 61	Deficiency, sickle cell and other anemia	280 282 283 284 285	Iron deficiency anemias Hereditary hemolytic anemias Acquired hemolytic anemias Aplastic anemia Other and unspecified anemias
62, 63, 64, 247	Other hematologic conditions	286 287 288 289	Coagulation defects Purpura and other hemorrhagic conditions Agranulocytosis Other diseases of blood and blood-forming organs
653	Delirium, dementia and other cognitive disorders	290	Senile and presenile dementia
660, 661	Alcohol and substance-related disorders	291 303 304	Alcoholic psychosis Alcoholism Drug dependence
659	Schizophrenia and other psychotic disorders	293 294 295 297 298 299	Psychosis associated with other cerebral condition Psychosis associated with other physical conditions Schizophrenic disorders Paranoid states Other psychosis Unspecified psychosis
651, 657	Mood and anxiety disorders	296 300	Affective psychosis Neuroses
655	Disorders usually diagnosed in infancy, childhood, or adolescence	NA	
658	Personality disorders	301	Personality disorders
670	Miscellaneous mental health disorders	305 306 309	Physical disorders of presumably psychogenic origin Special symptoms not elsewhere classified Mental disorders not specified as psychotic associated with physical conditions
650	Adjustment disorders	307	Transient situational disturbances
652	Attention-deficit, conduct, and disruptive behavior disorders	308	Behaviour disorders of childhood
654	Developmental disorders	310 311 312 313 314 315	Borderline mental retardation Mild mental retardation Moderate mental retardation Severe mental retardation Profound mental retardation Unspecified mental retardation
81, 95	Other nervous system conditions	330 331 332	Hereditary neuromuscular disorders Hereditary diseases of the striatopallidal system Hereditary ataxia

Continued

Supplementary Appendix 3: Continued

CCS category #	CCS category description	ICDA-8-code	ICDA-8-CM code label
		333	Other hereditary and familial diseases of nervous system
		341	Other demyelinating diseases of central nervous system
		347	Other diseases of brain
		348	Motor Neuron Disease
		349	Other diseases of spinal cord
		354	Polyneuritis and polyradiculitis
		355	Other and unspecified forms of neuralgia and neuritis
		357	Other diseases of peripheral nerves except autonomic
		358	Diseases of peripheral autonomic nervous system
		733	Other diseases of muscle, tendon and fascia
79	Parkinson's disease	342	Paralysis agitans
84	Headache; including migraine	346	Migraine
		791	Headache
80	Multiple sclerosis	340	Multiple sclerosis
82	Paralysis	343	Cerebral spastic infantile paralysis
		344	Other cerebral paralysis
83	Epilepsy, convulsions	345	Epilepsy
90, 91	Inflammation infection and other eye disorders	363	Keratitis
		364	Iritis
		365	Choroiditis
		366	Other inflammation of uveal tract
		367	Inflammation of optic nerve and retina
		369	Other inflammatory diseases of eye
		371	Corneal opacity
		378	Other diseases of eye
87	Retinal detachments, defects, vascular occlusion, and retinopathy	376	Detachment of retina
		377	Other diseases of retina and optic nerve
88	Glaucoma	375	Glaucoma
86	Cataract	374	Cataract
89	Blindness and vision defects	379	Blindness
94	Other ear and sense organ disorders	380	Otitis externa
		387	Other disease of ear and mastoid process
		388	Deaf mutism
		389	Other deafness
92	Otitis media and related conditions	381	Otitis media without mention of mastoiditis
		382	Otitis media with mastoiditis
		383	Mastoiditis without mention of otitis media
93	Conditions associated with dizziness or vertigo	384	Other inflammatory diseases of ear
		385	Ménière's disease
97	Peri-; endo-; and myocarditis, cardiomyopathy	393	Diseases of pericardium
		398	Other heart disease, specified as rheumatic
		423	Chronic disease of pericardium, non-rheumatic
		425	Cardiomyopathy
96	Heart valve disorders	394	Diseases of mitral valve
		395	Diseases of aortic valve
		396	Diseases of mitral and aortic valves
		397	Diseases of other endocardial structures
		424	Chronic disease of endocardium
98	Essential hypertension	400	Malignant hypertension
		401	Essential benign hypertension
99	Hypertension with complications and secondary hypertension	402	Hypertensive heart disease
		403	Hypertensive renal disease
		404	Hypertensive heart and renal disease
100	Acute myocardial infarction	410	Acute myocardial infarction

Continued

Supplementary Appendix 3: Continued

CCS category #	CCS category description	ICDA-8-code	ICDA-8-CM code label
101	Coronary atherosclerosis and other heart disease	411 412 413 414	Other acute and subacute forms of ischemic heart disease Chronic ischemic heart disease Angina pectoris Asymptomatic ischemic heart disease
103	Pulmonary heart disease	426 450	Pulmonary heart disease Pulmonary embolism and infarction
105	Conduction disorders	NA	NA
106, 107, 108	Cardiac dysrhythmias, arrest, ventricular fibrillation and congestive heart failure	427 428	Symptomatic heart disease Other myocardial insufficiency
104	Other and ill-defined heart disease	429	Ill-defined heart disease
109, 110	Acute cerebrovascular disease, occlusion or stenosis of precerebral arteries	430 431 432 433 434 436	Subarachnoid hemorrhage Cerebral Hemorrhage Occlusion of precerebral arteries Cerebral Thrombosis Cerebral embolism Acute, but ill-defined, cerebrovascular disease
112	Transient cerebral ischemia	435	Transient cerebral ischemia
111	Other and ill-defined cerebrovascular disease	437 438	Generalized ischemic cerebrovascular disease Other and ill-defined cerebrovascular disease
114, 115, 117	Other circulatory disease	440 441 442 443 445 446 447 448 444	Arteriosclerosis Aortic aneurysm (nonsyphilitic) Other aneurysm Other peripheral vascular disease Gangrene Polyarteritis nodosa and allied conditions Other diseases of arteries and arterioles Diseases of capillaries Arterial embolism and thrombosis
116	Aortic and peripheral arterial embolism or thrombosis	444	Arterial embolism and thrombosis
118	Phlebitis, thrombophlebitis and thromboembolism	453	Other venous embolism and thrombosis
121	Other diseases of veins and lymphatics	456 457 458	Varicose veins of other sites Noninfective disease of lymphatic channels Other diseases of circulatory system
134	Other upper respiratory disease	502 506 507 508	Chronic pharyngitis and nasopharyngitis Chronic laryngitis Hay fever Other diseases of upper respiratory tract
126	Other upper respiratory infections	503	Chronic sinusitis
124	Acute and chronic tonsillitis	500	Hypertrophy of tonsils and adenoids
127	Chronic obstructive pulmonary disease and bronchiectasis	491 492 518	Chronic bronchitis Emphysema Bronchiectasis
128	Asthma	493	Asthma
132	Lung disease due to external agents	515 516	Pneumoconiosis due to other silica or silicates Other pneumoconioses and related diseases
133	Other lower respiratory disease	512 514 517	Spontaneous pneumothorax Pulmonary congestion and hypostasis Other chronic interstitial pneumonia
131	Respiratory failure, insufficiency or arrest	519	Other diseases of respiratory system

Continued

Supplementary Appendix 3: Continued

CCS category #	CCS category description	ICDA-8-code	ICDA-8-CM code label
136	Disorders of teeth and jaw	523 525	Gingival and periodontal diseases Other diseases and conditions of the teeth and supporting structures
138	Esophageal disorders	530	Diseases of esophagus
139, 153	Gastroduodenal ulcer, gastrointestinal hemorrhage	531 532 533 534	Ulcer of stomach Ulcer of duodenum Peptic ulcer, site unspecified Gastrojejunal ulcer
140	Gastritis and duodenitis	535	Gastritis and duodenitis
141	Other disorders of stomach and duodenum	537	Other diseases of stomach and duodenum
144	Regional enteritis and ulcerative colitis	563	Chronic enteritis and ulcerative colitis
154	Noninfectious gastroenteritis	561	Gastro-enteritis and colitis, except ulcerative, of noninfectious origin
146	Diverticulosis and diverticulitis	562	Diverticula of intestine
155	Other gastrointestinal disorders	564 269	Functional disorders of intestines Other nutritional deficiency
6, 151	Hepatitis and Other liver diseases	571 572 573	Cirrhosis of liver Suppurative hepatitis and liver abscess Other diseases of liver
149	Biliary tract disease	575 576	Cholecystitis and cholangitis, without mention of calculus Other diseases of gallbladder and biliary ducts
152	Pancreatic disorders (excluding diabetes)	577	Diseases of pancreas
156, 157, 158	Chronic kidney disease and related conditions	581 582 583 584	Nephrotic syndrome Chronic nephritis Nephritis, unqualified Renal sclerosis, unqualified
161	Other diseases of kidney and ureters	NA	NA
159	Urinary tract infections	590 595	Infections of kidney Cystitis
162	Other diseases of bladder and urethra	596 599	Other disorders of bladder Other diseases of urinary tract
164	Hyperplasia of prostate	600	Hyperplasia of prostate
165, 166	Inflammatory and other male genital disorders	601 607	Prostatitis Other diseases of male genital organs
167	Nonmalignant breast conditions	610	Chronic cystic disease of breast
175	Other female genital disorders	612 613 614 616 625 629	Acute salpingitis and oophoritis Chronic salpingitis and oophoritis Salpingitis and oophoritis, unqualified Diseases of parametrium and pelvic peritoneum (female) Other diseases of uterus Other disorders of female genital organs
171	Menstrual disorders	626	Disorders of menstruation
170	Prolapse of female genital organs	623	Uterovaginal prolapse
173	Menopausal disorders	627	Menopausal symptoms
174	Female infertility	628	Sterility, female
253	Allergic reactions	691	Infantile eczema and related conditions
198	Other inflammatory condition of skin	693 694	Dermatitis herpetiformis Pemphigus

Continued

Supplementary Appendix 3: Continued

CCS category #	CCS category description	ICDA-8-code	ICDA-8-CM code label
		695	Erythematous conditions
		696	Psoriasis and similar disorders
200	Other skin disorders	701	Other hypertrophic and atrophic conditions of skin
		705	Diseases of sweat glands
199	Chronic ulcer of skin	707	Chronic ulcer of skin
210	Systemic lupus erythematosus and connective tissue disorders	716	Polymyositis and dermatomyositis
		734	Diffuse diseases of connective tissue
204, 225	Joint disorders	714	Other specified forms of arthritis
		715	Arthritis, unspecified
		724	Internal derangement of joint
		727	Ankylosis of joint
		729	Other diseases of joint
202	Rheumatoid arthritis and related disease	712	Rheumatoid arthritis and allied conditions
203	Osteoarthritis	713	Osteoarthritis and allied conditions
205	Spondylosis, intervertebral disc disorders and other back problems	725	Displacement of intervertebral disk
201	Infective arthritis and osteomyelitis	720	Osteomyelitis and periostitis
206, 212	Osteoporosis and other bone disease	721	Osteitis deformans
		722	Osteochondrosis
		723	Other diseases of bone
208	Acquired foot deformities	737	Hallux valgus and varus
209	Other acquired deformities	735	Curvature of spine
216	Nervous system congenital anomalies	740	Anencephalus
		741	Spina bifida
		742	Congenital hydrocephalus
		743	Other congenital anomalies of nervous system
217	Other congenital anomalies	738	Other deformities
		744	Congenital anomalies of eye
		745	Congenital anomalies of ear, face and neck
		748	Congenital anomalies of respiratory system
		749	Cleft palate and cleft lip
		755	Other congenital anomalies of limbs
		756	Other congenital anomalies of musculoskeletal system
		757	Congenital anomalies of skin, hair and nails
		758	Other and unspecified congenital anomalies
		759	Congenital syndromes affecting multiple systems
213	Cardiac and circulatory congenital anomalies	746	Congenital anomalies of heart
		747	Other congenital anomalies of circulatory system
214	Digestive congenital anomalies	750	Other congenital anomalies of upper alimentary tract
		751	Other congenital anomalies of digestive system
215	Genitourinary congenital anomalies	752	Congenital anomalies of genital organs
		753	Congenital anomalies of urinary system

Supplementary Appendix 4: Discrepancies in ICDA-8 mappings between the two reviewers

ICDA-8 code	ICDA-8 code label	Assigned CCS category description	
		Reviewer 1	Reviewer 2
209	Myelofibrosis	Neoplasms of unspecified nature	Other hematologic conditions
230	Neoplasm of unspecified nature of digestive organs	Neoplasms of unspecified nature	Cancer of other GI organs; peritoneum
231	Neoplasm of unspecified nature of respiratory organs	Neoplasms of unspecified nature	Lung and other respiratory cancer
232	Neoplasm of unspecified nature of skin and musculoskeletal system	Neoplasms of unspecified nature	Not mapped
233	Neoplasm of unspecified nature of breast	Neoplasms of unspecified nature	Other cancers
234	Neoplasm of unspecified nature of uterus	Neoplasms of unspecified nature	Other cancers
235	Neoplasm of unspecified nature of ovary	Neoplasms of unspecified nature	Other cancers
236	Neoplasm of unspecified nature of other female genital organs	Neoplasms of unspecified nature	Other cancers
237	Neoplasm of unspecified nature of other genito-urinary organs	Neoplasms of unspecified nature	Other cancers
269	Other nutritional deficiency	Not mapped	Other gastrointestinal disorders
275	Plasma protein abnormalities	Other nutritional; endocrine; and metabolic disorders	Immunity disorders
293	Psychosis associated with other cerebral condition	Schizophrenia and other psychotic disorders	Delirium, dementia and other cognitive disorders
294	Psychosis associated with other physical conditions	Schizophrenia and other psychotic disorders	Delirium, dementia and other cognitive disorders
307	Transient situational disturbances	Mood and anxiety disorders	Adjustment disorders
309	Mental disorders not specified as psychotic associated with physical conditions	Miscellaneous mental health disorders	Delirium, dementia and other cognitive disorders
355	Other and unspecified forms of neuralgia and neuritis	Not mapped	Other nervous system conditions
382	Otitis media with mastoiditis	Otitis media and related conditions	Not mapped
412	Chronic ischaemic heart disease	Coronary atherosclerosis and other heart disease	Other and ill-defined heart disease
445	Gangrene	Peripheral and visceral atherosclerosis	Not mapped
450	Pulmonary embolism and infarction	Pulmonary heart disease	Not mapped
575	Cholecystitis and cholangitis, without mention of calculus	Not mapped	Biliary tract disease
616	Diseases of parametrium and pelvic peritoneum (female)	Not mapped	Other female genital disorders
733	Other diseases of muscle, tendon and fascia	Other nervous system conditions	Not mapped
738	Other deformities	Not mapped	Acquired foot deformities
791	Headache	Headache; including migraine	Not mapped

Note: Some codes were not mapped by a reviewer because they do not capture a chronic condition. A consensus decision was made to include these codes because they present conditions that were mapped in the developed ICD-9-CM crosswalk.

Supplementary Appendix 5: Discrepancies in ICD-10-CA mappings between the two reviewers

ICD-10-CA code	ICD-10-CA code label	Assigned CCS category description	
		Reviewer 1	Reviewer 2
F842	Rett's syndrome	Disorders usually diagnosed in infancy, childhood, or adolescence	Other nervous system conditions
G319	Degenerative disease of nervous system, unspecified	Delirium, dementia and other cognitive disorders	Other nervous system conditions
G453	Amaurosis fugax	Retinal detachments; defects; vascular occlusion; and retinopathy	Transient cerebral ischemia
G912	Normal-pressure hydrocephalus	Delirium, dementia and other cognitive disorders	Other nervous system conditions
G913	Post-traumatic hydrocephalus, unspecified	Delirium, dementia and other cognitive disorders	Other nervous system conditions
G918	Other hydrocephalus	Delirium, dementia and other cognitive disorders	Other nervous system conditions
I088	Other multiple valve diseases	Heart valve disorders	Peri-; endo-; and myocarditis; cardiomyopathy
I253	Aneurysm of heart	Other circulatory disease	Coronary atherosclerosis and other heart disease
I254	Coronary artery aneurysm and dissection	Other circulatory disease	Coronary atherosclerosis and other heart disease
I99	Other and unspecified disorders of circulatory system	Other diseases of veins and lymphatic	Other circulatory disease
K292	Gastrointestinal haemorrhage, unspecified	Gastritis and duodenitis	Alcohol and substance-related disorders
K702	Alcoholic fibrosis and sclerosis of liver	Hepatitis and Other liver diseases	Alcohol and substance-related disorders
M081	Juvenile ankylosing spondylitis	Spondylosis; intervertebral disc disorders; other back problems	Rheumatoid arthritis and related disease
M308	Other conditions related to polyarteritis nodosa	Other circulatory disease	Systemic lupus erythematosus and connective tissue disorders
M317	Microscopic polyangiitis	Other circulatory disease	Systemic lupus erythematosus and connective tissue disorders
M318	Other specified necrotizing vasculopathies	Other circulatory disease	Systemic lupus erythematosus and connective tissue disorders
N020	Recurrent and persistent hematuria with minor glomerular abnormality	Other diseases of bladder and urethra	Chronic Kidney disease and related conditions
N021	Recurrent and persistent hematuria with focal and segmental glomerular lesions	Other diseases of bladder and urethra	Chronic Kidney disease and related conditions
N022	Recurrent and persistent hematuria with diffuse membranous glomerulonephritis	Other diseases of bladder and urethra	Chronic Kidney disease and related conditions
N023	Recurrent and persistent hematuria with diffuse mesangial proliferative glomerulonephritis	Other diseases of bladder and urethra	Chronic Kidney disease and related conditions
N025	Recurrent and persistent hematuria with diffuse mesangiocapillary glomerulonephritis	Other diseases of bladder and urethra	Chronic Kidney disease and related conditions
N027	Recurrent and persistent hematuria with diffuse crescentic glomerulonephritis	Other diseases of bladder and urethra	Chronic Kidney disease and related conditions
N028	Recurrent and persistent hematuria with other morphologic changes	Other diseases of bladder and urethra	Chronic Kidney disease and related conditions
N029	Recurrent and persistent hematuria with unspecified morphologic changes	Other diseases of bladder and urethra	Chronic Kidney disease and related conditions
N160	Renal tubulo-interstitial disorders in infectious and parasitic diseases classified elsewhere	Other diseases of kidney and ureters	Urinary tract infections

Supplementary Appendix 6: Crosswalk of ICD-10-CA codes to CCS categories

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
11	Cancer of head and neck	C00(0,1,2,4,5,9) C01 C02(0,1,2,3,4,8,9) C07 C08(0,1,9) C03(0,1) C04(0,1,8,9) C05(0,1) C06(0,1,2,8,9) C09(0,1,8,9) C10(0,3,4,8,9) C11(1,2,3,8,9) C12 C13(0,1,2,8,9) C14(0,8) C30(00,01) C31(0,2,8,9) C32(0,1,3,8,9)	Malignant neoplasm of lip Malignant neoplasm of base of tongue Malignant neoplasm of other and unspecified parts of tongue Malignant neoplasm of parotid gland Malignant neoplasm of other and unspecified major salivary glands Malignant neoplasm of gum Malignant neoplasm of floor of mouth Malignant neoplasm of palate Malignant neoplasm of other and unspecified parts of mouth Malignant neoplasm of tonsil Malignant neoplasm of oropharynx Malignant neoplasm of nasopharynx Malignant neoplasm of piriform sinus Malignant neoplasm of hypopharynx Malignant neoplasm of other and ill-defined sites in the lip, oral cavity and pharynx Malignant neoplasm of nasal cavity and middle ear Malignant neoplasm of accessory sinuses Malignant neoplasm of larynx
12	Cancer of esophagus	C15(0,3,4,5,8,9)	Malignant neoplasm of esophagus
13	Cancer of stomach	C16(0,1,2,3,4,5,6,8,9)	Malignant neoplasm of stomach
18	Cancer of other GI organs; peritoneum	C17(0,1,2,3,8,9) C23 C24(0,1,9) C45(1) C48(0,1,2)	Malignant neoplasm of small intestine Malignant neoplasm of gallbladder Malignant neoplasm of other and unspecified parts of biliary tract Mesothelioma Malignant neoplasm of retroperitoneum and peritoneum
14	Cancer of colon	C18(0,1,2,3,4,5,6,7,8,9)	Malignant neoplasm of colon
15	Cancer of rectum and anus	C19 C20 C21(0,1,2,8) D01(3)	Malignant neoplasm of rectosigmoid junction Malignant neoplasm of rectum Malignant neoplasm of anus and anal canal Carcinoma in situ of other and unspecified digestive organs
16	Cancer of liver and intrahepatic bile duct	C22(0,1,2,4,7,9)	Malignant neoplasm of liver and intrahepatic bile ducts
17	Cancer of pancreas	C25(0,1,2,3,4,7,8,9)	Malignant neoplasm of pancreas
19, 20	Cancer of bronchus, lung and other respiratory and intrathoracic organs	C33 C34(00,01,09,10,11,19,2,30,31,39,80,81,89,90,91,99) C38(4) C39(0) C45(0) C46(71) D02(0,2,3)	Malignant neoplasm of trachea Malignant neoplasm of bronchus and lung Malignant neoplasm of heart, mediastinum and pleura Malignant neoplasm of other and ill-defined sites in the respiratory system and intrathoracic organs Mesothelioma Kaposi sarcoma Carcinoma in situ of middle ear and respiratory system
41	Other and unspecified cancers	C05(8,9) C37 C38(0,1,2,3)	Malignant neoplasm of palate Malignant neoplasm of thymus Malignant neoplasm of heart, mediastinum and pleura

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
		C45(7)	Mesothelioma
		C69(0,2,3,4,5,6,8,9)	Malignant neoplasm of eye and adnexa
		C74(0,1,9)	Malignant neoplasm of adrenal gland
		C75(0,1,3,9)	Malignant neoplasm of other endocrine glands and related structures
		C76(0,1,2,3,4,5,7,8)	Malignant neoplasm of other and ill-defined sites
		D05(0,1,7,9)	Carcinoma in situ of breast
		D06(0,1,7,9)	Carcinoma in situ of cervix uteri
		D07(0,1,2,3,4,5,6)	Carcinoma in situ of other and unspecified genital organs
		D09(0,1,2,3,7)	Carcinoma in situ of other and unspecified sites
21	Cancer of bone and connective tissue	C40(0,1,2,3,9)	Malignant neoplasm of bone and articular cartilage of limbs
		C41(00,01,1,2,3,4,8,9)	Malignant neoplasm of bone and articular cartilage of other and unspecified sites
		C47(0,2,3,4,5,6,8,9)	Malignant neoplasm of peripheral nerves and autonomic nervous system
		C49(0,1,2,3,4,5,6,8,9)	Malignant neoplasm of other connective and soft tissue
22	Melanoma of skin	C43(1,2,3,4,5,6,7,8,9)	Malignant melanoma of skin
24	Cancer of breast	C50(00,01,09,10,11,20,21,30,31,40,41,49,50,51,60,61,80,81,89,90,91,99)	Malignant neoplasm of breast
25	Cancer of uterus	C54(0,1,2,3,8,9)	Malignant neoplasm of corpus uteri
		C55	Malignant neoplasm of uterus, part unspecified
26	Cancer of cervix	C53(0,1,8,9)	Malignant neoplasm of cervix uteri
27, 28	Cancer of ovary and other female genital organs	C51(0,1,8,9)	Malignant neoplasm of vulva
		C52	Malignant neoplasm of vagina
		C56(0,1,9)	Malignant neoplasm of ovary
		C57(00,01,09,1,3,4,8,9)	Malignant neoplasm of other and unspecified female genital organs
		C58	Malignant neoplasm of placenta
29	Cancer of prostate	C61	Malignant neoplasm of prostate
30	Cancer of testis	C62(00,01,10,11,90,91,99)	Malignant neoplasm of testis
31	Cancer of other male genital organs	C60(0,1,2,8,9)	Malignant neoplasm of penis
		C63(1,7,8)	Malignant neoplasm of other and unspecified male genital organs
32	Cancer of bladder	C67(0,1,2,3,4,5,6,7,8,9)	Malignant neoplasm of bladder
33, 34	Cancer of kidney and other urinary organs	C64	Malignant neoplasm of kidney, except renal pelvis
		C65	Malignant neoplasm of renal pelvis
		C66	Malignant neoplasm of ureter
		C68(0,1,8,9)	Malignant neoplasm of other and unspecified urinary organs
35	Cancer of brain and nervous system	C70(0,1)	Malignant neoplasm of meninges
		C71(0,1,2,3,4,5,6,7,8,9)	Malignant neoplasm of brain
		C72(0,3,5,8,9)	Malignant neoplasm of spinal cord, cranial nerves and other parts of central nervous system
36	Cancer of thyroid	C73	Malignant neoplasm of thyroid gland
42	Secondary malignancies	C77(0,1,2,3,4,5,8)	Secondary and unspecified malignant neoplasm of lymph nodes

Continued

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
		C78(0,1,2,3,4,5,6,7,8)	Secondary malignant neoplasm of respiratory and digestive organs
		C79(0,1,2,3,4,5,6,7,80,88)	Secondary malignant neoplasm of other and unspecified sites
43	Malignant neoplasm without specification of site	C45(9) C80	Mesothelioma Malignant neoplasm, without specification of site
38	Non-Hodgkin's lymphoma	C82(0,1,2,7,9) C83(0,1,2,3,5,7,8,9) C84(0,4,5) C85(1,7,9)	Follicular lymphoma Non-follicular lymphoma Mature T/NK-cell lymphomas Other and unspecified types of non-Hodgkin lymphoma
		C91(4) C96(3,7,9)	Lymphoid leukaemia Other and unspecified malignant neoplasms of lymphoid, haematopoietic and related tissue
37	Hodgkin's disease	C81(0,1,2,3,7,9)	Hodgkin lymphoma
39, 40	Multiple myeloma and Leukemias	C90(0,1,20,21) C91(0,1,3,5,7,9) C92(0,1,3,4,5,7,9) C93(0) C94(0,2) C95(0,1,9)	Multiple myeloma and malignant plasma cell neoplasms Lymphoid leukaemia Myeloid leukaemia Monocytic leukaemia Other leukaemias of specified cell type Leukaemia of unspecified cell type
47	Other and unspecified benign neoplasm	D32(0,1,9) D33(0,1,2,3,4,9)	Benign neoplasm of meninges Benign neoplasm of brain and other parts of central nervous system
44	Neoplasms of unspecified nature or uncertain behavior	D42(0,1,9) D43(0,1,2,3,4,7,9) D44(0,1,2,3,4,5,6,7,8,9) D45 D46(7,9) D47(0,1,7,9)	Neoplasm of uncertain or unknown behaviour of meninges Neoplasm of uncertain or unknown behaviour of brain and central nervous system Neoplasm of uncertain or unknown behaviour of endocrine glands Polycythemia vera Myelodysplastic syndromes Other neoplasms of uncertain or unknown behaviour of lymphoid, haematopoietic and related tissue
		D48(0,1,2,5,6,7,9)	Neoplasm of uncertain or unknown behaviour of other and unspecified sites
48	Thyroid disorders	Q85(0) E03(0,1,2,4,5,8,9) E04(0,1,2,8,9) E05(0,1,2,5,8,9) E06(0,1,3,5,9) E07(0,1,88,9) E89(0)	Phakomatoses, not elsewhere classified Other hypothyroidism Other nontoxic goitre Thyrotoxicosis [hyperthyroidism] Thyroiditis Other disorders of thyroid
			Postprocedural endocrine and metabolic disorders, not elsewhere classified
49, 50	Diabetes mellitus	E10(0,10,11,12,20,21,22,28,32,33,35,38,40,41,42,50,51,52,60,61,62,63,68,70,71,78,9) E11(0,10,11,12,20,21,22,28,30,31,32,33,35,38,40,41,42,50,51,52,60,61,62,63,68,70,71,78,9) E13(0,10,20,22,28,40,41,42,50,51,63,70,71,78,9)	Type 1 diabetes mellitus Type 2 diabetes mellitus Other specified diabetes mellitus

Continued

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
51	Other endocrine disorders	E14(0,10,11,12,20,21,22,28,33,40,41,42,50,51,52,60,62,63,68,70,71,78,9)	Unspecified diabetes mellitus
		E15	Nondiabetic hypoglycaemic coma
		E16(0,1,2,4,8)	Other disorders of pancreatic internal secretion
		E20(8,9)	Hypoparathyroidism
		E21(0,1,2,3,4)	Hyperparathyroidism and other disorders of parathyroid gland
		E22(0,2,9)	Hyperfunction of pituitary gland
		E23(0,1,2,6,7)	Hypofunction and other disorders of pituitary gland
		E24(0,8,9)	Cushing syndrome
		E25(0,8,9)	Adrenogenital disorders
		E26(0,8,9)	Hyperaldosteronism
		E27(0,1,2,3,4,8,9)	Other disorders of adrenal gland
		E28(2,3,9)	Ovarian dysfunction
		E29(0,1,8,9)	Testicular dysfunction
		E30(1)	Disorders of puberty, not elsewhere classified
		E31(0,9)	Polyglandular dysfunction
		E32(0,8,9)	Diseases of thymus
		E34(0,2,5,8,9)	Other endocrine disorders
E89(1,2,3)	Postprocedural endocrine and metabolic disorders, not elsewhere classified		
52	Nutritional deficiencies	E41	Nutritional marasmus
		E42	Marasmic kwashiorkor
		E43	Unspecified severe protein-energy malnutrition
		E46	Unspecified protein-energy malnutrition
		E55(0,9)	Vitamin D deficiency
57, 58	Other nutritional, endocrine, immunity, and metabolic disorders	M83(8,9)	Adult osteomalacia
		C88(00)	Malignant immunoproliferative diseases
		D47(2)	Other neoplasms of uncertain or unknown behaviour of lymphoid, haematopoietic and related tissue
		D76(0)	Other specified diseases with participation of lymphoreticular and reticulohistiocytic tissue
		D80(1,2,3,4)	Immunodeficiency with predominantly antibody defects
		D81(1,2,3,8,9)	Combined immunodeficiencies
		D82(1,3,9)	Immunodeficiency associated with other major defects
		D83(1,9)	Common variable immunodeficiency
		D84(1,8,9)	Other immunodeficiencies
		D89(1,9)	Other disorders involving the immune mechanism, not elsewhere classified
		E65	Localized adiposity
		E66(0,2,8,9)	Obesity
		E67(3)	Other hyperalimentation
		E70(1,2,3)	Disorders of aromatic amino-acid metabolism
		E71(0,3)	Disorders of branched-chain amino-acid metabolism and fatty-acid metabolism
		E72(0,1,2,3,4,5,8)	Other disorders of amino-acid metabolism
		E73(0,9)	Lactose intolerance
E74(0,2,3,4,8)	Other disorders of carbohydrate metabolism		
E76(0)	Disorders of glycosaminoglycan metabolism		
E77(1,8)	Disorders of glycoprotein metabolism		

Continued

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
		E80(0,1,2,4,6,7)	Disorders of porphyrin and bilirubin metabolism
		E83(0,10,18,3,4,5)	Disorders of mineral metabolism
		E84(0,1,8,9)	Cystic fibrosis
		E85(0,1,3,4,8,9)	Amyloidosis
		E88(0,8,9)	Other metabolic disorders
		E89(8)	Postprocedural endocrine and metabolic disorders, not elsewhere classified
53	Disorders of lipid metabolism	R73(802,812)	Elevated blood glucose level
		E75(2,5)	Disorders of sphingolipid metabolism and other lipid storage disorders
		E78(0,1,3,6,8)	Disorders of lipoprotein metabolism and other lipidaemias
54	Gout and other crystal arthropathies	E88(1,2)	Other metabolic disorders
		M10(00,01,02,03,04,05,06,07,08,09,39,44,90,92,93,94,95,96,97,98,99)	Gout
59, 61	Deficiency, sickle cell and other anemia	M11(06, 22,23,26,27,86,90,96)	Other crystal arthropathies
		D46(1,2,4)	Myelodysplastic syndromes
		D50(0,8,9)	Iron deficiency anaemia
		D55(0,9)	Anaemia due to enzyme disorders
		D56(0,1,9)	Thalassaemia
		D57(0,1,2,3,8)	Sickle-cell disorders
		D58(0,1,2,9)	Other hereditary haemolytic anaemias
		D59(0,1,2,3,4,5,6,8,9)	Acquired haemolytic anaemia
		D60(0,1,9)	Acquired pure red cell aplasia [erythroblastopenia]
		D61(0,1,2,3,8,9)	Other aplastic anaemias
		D62	Acute posthaemorrhagic anaemia
62, 63, 64, 247	Other hematologic conditions	D64(0,1,2,3,4,8,9)	Other anaemias
		D65	Disseminated intravascular coagulation [defibrination syndrome]
		D66	Hereditary factor VIII deficiency
		D67	Hereditary factor IX deficiency
		D68(0,2,3,4,80,81,88,9)	Other coagulation defects
		D69(0,1,2,30,38,4,5,6,8,9)	Purpura and other haemorrhagic conditions
		D70(0,8)	Agranulocytosis
		D71	Functional disorders of polymorphonuclear neutrophils
		D72(1,8,9)	Other disorders of white blood cells
		D73(0,1,2,3,4,5,8,9)	Diseases of spleen
		D74(8,9)	Methaemoglobinaemia
		D75(1,9)	Other diseases of blood and blood-forming organs
		D76(1,2,3)	Other specified diseases with participation of lymphoreticular and reticulohistiocytic tissue
		D89(2)	Other disorders involving the immune mechanism, not elsewhere classified
		I88(0,1,8,9)	Nonspecific lymphadenitis
		R72	Abnormality of white blood cells, not elsewhere classified
653	Delirium, dementia and other cognitive disorders	F01(1,9)	Vascular dementia
		F03	Unspecified dementia
		F04	Organic amnesic syndrome, not induced by alcohol and other psychoactive substances

Continued

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
660, 661	Alcohol and substance-related disorders	F05(1)	Delirium, not induced by alcohol and other psychoactive substances
		F06(5,6,8,9)	Other mental disorders due to brain damage and dysfunction and to physical disease
		F09	Unspecified organic or symptomatic mental disorder
		G30(0,8,9)	Alzheimer disease
		G31(0,8,9)	Other degenerative diseases of nervous system, not elsewhere classified
		G91(0,1,2,3,8,9)	Hydrocephalus
		F10(0,1,2,3,4,5,6,7,8,9)	Mental and behavioural disorders due to use of alcohol
		F11(0,1,2,3,4,5,6,7,8,9)	Mental and behavioural disorders due to use of opioids
		F12(0,1,2,3,4,5,6,7,8,9)	Mental and behavioural disorders due to use of cannabinoids
		F13(0,1,2,3,4,5,6,7,8,9)	Mental and behavioural disorders due to use of sedatives or hypnotics
		F14(0,1,2,3,4,5,6,7,8,9)	Mental and behavioural disorders due to use of cocaine
		F15(0,1,2,3,4,5,6,7,8,9)	Mental and behavioural disorders due to use of other stimulants, including caffeine
		F16(0,1,2,3,4,5,7,8)	Mental and behavioural disorders due to use of hallucinogens
		F17(2,3)	Mental and behavioural disorders due to use of tobacco
		F18(0,1,2,5,7)	Mental and behavioural disorders due to use of volatile solvents
F19(0,1,2,3,4,5,6,7,8,9)	Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances		
659	Schizophrenia and other psychotic disorders	F55	Abuse of non-dependence-producing substances
		G31(2)	Other degenerative diseases of nervous system, not elsewhere classified
		F20(0,1,2,3,4,5,6,8,9)	Schizophrenia
651, 657	Mood and anxiety disorders	F21	Schizotypal disorder
		F22(0,8,9)	Persistent delusional disorders
		F23(0,1,2,3,8,9)	Acute and transient psychotic disorders
		F24	Induced delusional disorder
		F25(0,1,2,8,9)	Schizoaffective disorders
		F28	Other nonorganic psychotic disorders
		F29	Unspecified nonorganic psychosis
		F32(1)	Depressive episode
		F30(0,1,2,8,9)	Manic episode
		F31(0,1,2,3,4,5,6,7,8,9)	Bipolar affective disorder
		F32(0,2,3,8,9)	Depressive episode
		F33(0,1,2,3,4,8,9)	Recurrent depressive disorder
		F34(1,8,9)	Persistent mood [affective] disorders
		F38(0,1,8)	Other mood [affective] disorders
		F39	Unspecified mood [affective] disorder
F40(0,1,2,8,9)	Phobic anxiety disorders		
F41(0,1,2,3,8,9)	Other anxiety disorders		
F42(0,1,2,8,9)	Obsessive-compulsive disorder		

Continued

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
		F43(0,9)	Reaction to severe stress, and adjustment disorders
		F44(0,1,2,4,5,6,7,8,9)	Dissociative [conversion] disorders
		F45(0,1,2)	Somatoform disorders
		F48(0,1,8,9)	Other neurotic disorders
		F53(0)	Mental and behavioural disorders associated with the puerperium, not elsewhere classified
655	Disorders usually diagnosed in infancy, childhood, or adolescence	F99	Mental disorder, not otherwise specified
		F84(0,1,2,5,8,9)	Pervasive developmental disorders
		F93(2,8,9)	Emotional disorders with onset specific to childhood
		F94(1,2,8)	Disorders of social functioning with onset specific to childhood and adolescence
		F98(2,8,9)	Other behavioural and emotional disorders with onset usually occurring in childhood and adolescence
658	Personality disorders	F34(0)	Persistent mood [affective] disorders
		F60(0,1,2,3,4,5,6,7,8,9)	Specific personality disorders
		F61	Mixed and other personality disorders
		F62(0,8,9)	Enduring personality changes, not attributable to brain damage and disease
		F68(1,8)	Other disorders of adult personality and behaviour
		F69()	Unspecified disorder of adult personality and behaviour
670	Miscellaneous mental health disorders	F06(7)	Other mental disorders due to brain damage and dysfunction and to physical disease
		F07(0,1,2,8,9)	Personality and behavioural disorders due to brain disease, damage and dysfunction
		F45(3,4,8,9)	Somatoform disorders
		F50(0,1,2,3,5,8,9)	Eating disorders
		F51(0,3,4,9)	Nonorganic sleep disorders
		F52(2,8,9)	Sexual dysfunction, not caused by organic disorder or disease
		F54	Psychological and behavioural factors associated with disorders or diseases classified elsewhere
		F59	Unspecified behavioural syndromes associated with physiological disturbances and physical factors
		F66(9)	Psychological and behavioural disorders associated with sexual development and orientation
		F95(2,8,9)	Tic disorders
		F98(1,4,5)	Other behavioural and emotional disorders with onset usually occurring in childhood and adolescence
650	Adjustment disorders	G44(2)	Other headache syndromes
		F43(1,2,8)	Reaction to severe stress, and adjustment disorders
		F93(0)	Emotional disorders with onset specific to childhood
652	Attention-deficit, conduct, and disruptive behavior disorders	F63(0,8,9)	Habit and impulse disorders
		F91(0,1,3,8,9)	Conduct disorders
		F92(0,8,9)	Mixed disorders of conduct and emotions

Continued

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
654	Developmental disorders	F70(0,1,8,9) F72(1,8,9) F73(9) F78(1,8) F79(0,1) F80(1,2,9) F81(9) F82 F88 F89	Mild mental retardation Severe mental retardation Profound mental retardation Other mental retardation Unspecified mental retardation Specific developmental disorders of speech and language Specific developmental disorders of scholastic skills Specific developmental disorder of motor function Other disorders of psychological development Unspecified disorder of psychological development
81, 95	Other nervous system conditions	E75(4) G10 G11(0,1,2,3,4,8,9) G12(0,1,2,9) G21(0) G23(1) G24(0,3,8,9) G25(0,1,2,3,4,5,6,8,9) G36(0,9) G37(1,2,5,8,9) G47(4) G54(0,1,2,4,6,8,9) G56(0,1,2,3,4,8,9) G57(0,1,3,4,5,6,7,8,9) G58(0,7,8,9) G60(0,1,9) G61(0,1,8,9) G62(0,1,2,8,9) G70(0,8,9) G71(0,1,2,3,9) G72(0,1,2,3,4,8,9) G80(3) G90(0,2,3,4,8) G93(0,1,2,4,5,6,81,88,9) G95(0,1,2,8,9)	Disorders of sphingolipid metabolism and other lipid storage disorders Huntington disease Hereditary ataxia Spinal muscular atrophy and related syndromes Secondary parkinsonism Other degenerative diseases of basal ganglia Dystonia Other extrapyramidal and movement disorders Other acute disseminated demyelination Other demyelinating diseases of central nervous system Sleep disorders Nerve root and plexus disorders Mononeuropathies of upper limb Mononeuropathies of lower limb Other mononeuropathies Hereditary and idiopathic neuropathy Inflammatory polyneuropathy Other polyneuropathies Myasthenia gravis and other myoneural disorders Primary disorders of muscles Other myopathies Cerebral palsy Disorders of autonomic nervous system Other disorders of brain Other diseases of spinal cord
79	Parkinson's disease	G20 G21(1,2,9)	Parkinson disease Secondary parkinsonism
84	Headache; including migraine	G43(0,1,2,3,8,9)	Migraine
80	Multiple sclerosis	G44(0)	Other headache syndromes
82	Paralysis	G35 G80(0,1,2,4,8,9) G81(01,09,10,19,90,91,99) G82(092,191,193,222,223,291,293,390,391,490,491,510,511,591) G83(0,1,22,3,4,5,8,9)	Multiple sclerosis Cerebral palsy Hemiplegia Paraplegia and tetraplegia
83	Epilepsy, convulsions	F80(3)	Other paralytic syndromes Specific developmental disorders of speech and language

Continued

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
90, 91	Inflammation infection and other eye disorders	G40(0,1,2,3,4,5,6,7,8,9)	Epilepsy
		G41(0,1,2,8,9)	Status epilepticus
		H05(0,1,2,3,4,5,8,9)	Disorders of orbit
		H10(1,2,3,4,5,8,9)	Conjunctivitis
		H11(0,1,3,4,8,9)	Other disorders of conjunctiva
		H15(8)	Disorders of sclera
		H16(0,1,2,3,8,9)	Keratitis
		H17(0,8,9)	Corneal scars and opacities
		H18(1,2,3,4,5,6,7,8,9)	Other disorders of cornea
		H20(0,1,8,9)	Iridocyclitis
		H21(0,3,4,5,8,9)	Other disorders of iris and ciliary body
		H27(0,1,8,9)	Other disorders of lens
		H30(2,8,9)	Chorioretinal inflammation
		H31(3,4,8)	Other disorders of choroid
		H43(0,1,2,3,8,9)	Disorders of vitreous body
		H44(0,1,2,4,5,6,7,8)	Disorders of globe
		87	Retinal detachments, defects, vascular occlusion, and retinopathy
H47(0,1,28,3,4,7)	Other disorders of optic [2nd] nerve and visual pathways		
H55	Nystagmus and other irregular eye movements		
H57(0,1,8)	Other disorders of eye and adnexa		
G45(3)	Transient cerebral ischaemic attacks and related syndromes		
H33(0,1,2,3,4,5)	Retinal detachments and breaks		
H34(1,2,8)	Retinal vascular occlusions		
H35(0,1,2,3,4,5,6,8)	Other retinal disorders		
H59(81)	Postprocedural disorders of eye and adnexa, not elsewhere classified		
88	Glaucoma		
		Q15(0)	Other congenital malformations of eye
86	Cataract	H25(0,1,2,8,9)	Senile cataract
		H26(0,1,2,3,4,8,9)	Other cataract
89	Blindness and vision defects	H54(0,1,2,4,5,7)	Visual impairment including blindness (binocular or monocular)
94	Other ear and sense organ disorders	H60(0,1,2,3,4,5,8,9)	Otitis externa
		H61(0,1,2,3,8,9)	Other disorders of external ear
		H72(0,1,2,8,9)	Perforation of tympanic membrane
		H73(1,8,9)	Other disorders of tympanic membrane
		H90(0,1,2,3,4,5,6,7,8)	Conductive and sensorineural hearing loss
		H91(3,8,9)	Other hearing loss
92	Otitis media and related conditions	H65(0,1,2,3,4,9)	Nonsuppurative otitis media
		H66(0,1,2,3,4,9)	Suppurative and unspecified otitis media
		H68(0,1)	Eustachian salpingitis and obstruction
		H69(8,9)	Other disorders of Eustachian tube
		H70(0,1,2,8,9)	Mastoiditis and related conditions
		H95(0,1)	Postprocedural disorders of ear and mastoid process, not elsewhere classified
93	Conditions associated with dizziness or vertigo	H81(0,1,2,3,4,8,9)	Disorders of vestibular function
97	Peri-; endo-; and myocarditis, cardiomyopathy	H83(0,1,2)	Other diseases of inner ear
		I09(2,8,9)	Other rheumatic heart diseases
		I23(0)	Certain current complications following acute myocardial infarction
		I31(1,2,3,8,9)	Other diseases of pericardium
		I42(0,1,2,3,4,5,6,7,8,9)	Cardiomyopathy

Continued

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
96	Heart valve disorders	I05(0,1,2,8,9) I06(0,1,2) I07(1,2,8,9) I08(0,1,2,3,8) I34(0,1,2,8,9) I35(0,1,2,8,9) I36(1,8) I37(0,1,2) I38 I39(1)	Rheumatic mitral valve diseases Rheumatic aortic valve diseases Rheumatic tricuspid valve diseases Multiple valve diseases Nonrheumatic mitral valve disorders Nonrheumatic aortic valve disorders Nonrheumatic tricuspid valve disorders Pulmonary valve disorders Endocarditis, valve unspecified Endocarditis and heart valve disorders in diseases classified elsewhere
98	Essential hypertension	I10(0,1)	Essential (primary) hypertension
99	Hypertension with complications and secondary hypertension	I11 I12 I13 I15(00,10,11,20,21,80,90)	Hypertensive heart disease Hypertensive renal disease Hypertensive heart and renal disease Secondary hypertension
100	Acute myocardial infarction	I21(0,1,2,3, 40,41,42,49, 9) I22(0,1,8,9)	Acute myocardial infarction Subsequent myocardial infarction
101	Coronary atherosclerosis and other heart disease	I20(0,1,80,88,9) I24(0,1,8,9) I25(10,11,12,13,14,15,19, 5,6,8,9)	Angina pectoris Other acute ischaemic heart diseases Chronic ischaemic heart disease
103	Pulmonary heart disease	I26(0,9) I27(0,1,2,8,9) I28(0,1,8,9)	Pulmonary embolism Other pulmonary heart diseases Other diseases of pulmonary vessels
105	Conduction disorders	I44(0,1,2,3,4,6,7) I45(0,1,2,5,6,8,9)	Atrioventricular and left bundle-branch block Other conduction disorders
106, 107, 108	Cardiac dysrhythmias, arrest, ventricular fibrillation and congestive heart failure	I46(0,1,9) I47(0,1,2,9) I48(0,1) I49(00,1,2,3,4,5,8,9) I50(0,1,9) R00(1)	Cardiac arrest Paroxysmal tachycardia Atrial fibrillation and flutter Other cardiac arrhythmias Heart failure Abnormalities of heart beat
104	Other and ill-defined heart disease	I23(2,3,6, 81, 82,88) I25(0,3,4) I51(0,3,4,6,7,8,9) I97(0,1)	Certain current complications following acute myocardial infarction Chronic ischaemic heart disease Complications and ill-defined descriptions of heart disease Postprocedural disorders of circulatory system, not elsewhere classified
109, 110	Acute cerebrovascular disease, occlusion or stenosis of precerebral arteries	I60(0,1,2,3,4,5,6,7,8,9) I61(0,1,2,3,4,5,6,8,9) I62(0,1,9) I63(0,1,2, 3,4,5,6,8,9) I64 I65(0,1,2,3,8) I66(0,1,2,3,4,8,9)	Subarachnoid haemorrhage Intracerebral haemorrhage Other nontraumatic intracranial haemorrhage Cerebral infarction Stroke, not specified as haemorrhage or infarction Occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction
112	Transient cerebral ischemia	G45(0,1,8,9)	Transient cerebral ischaemic attacks and related syndromes
111	Other and ill-defined cerebrovascular disease	G45(4) I67(0,1,2,3,4,5,6,7,8,9)	Transient cerebral ischaemic attacks and related syndromes Other cerebrovascular diseases
114, 115, 117	Other circulatory disease	I70(0,1,2,8,9) I71(0,1,2,3,4,6,8,9)	Atherosclerosis Aortic aneurysm and dissection

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
		I72(0,1,2,3,4,8,9)	Other aneurysm and dissection
		I73(0,1,8,9)	Other peripheral vascular diseases
		I77(0,1,2,3,6,8,9)	Other disorders of arteries and arterioles
		I78(0,1,8)	Diseases of capillaries
		K55(0,1,9)	Vascular disorders of intestine
		M30(0,1,3,8)	Polyarteritis nodosa and related conditions
		M31(0,1,3,4,5,6,7,8)	Other necrotizing vasculopathies
116	Aortic and peripheral arterial embolism or thrombosis	I74(0,1,2,3,4,5,8,9)	Arterial embolism and thrombosis
118	Phlebitis, thrombophlebitis and thromboembolism	I82(0,1,2,3,8,9)	Other venous embolism and thrombosis
121	Other diseases of veins and lymphatics	I85(0,9)	Oesophageal varices
		I86(0,1,2,3,4,8)	Varicose veins of other sites
		I87(02,08,1,2,8,9)	Other disorders of veins
		I89(0,1,8,9)	Other noninfective disorders of lymphatic vessels and lymph nodes
		I97(2)	Postprocedural disorders of circulatory system, not elsewhere classified
		I99	Other and unspecified disorders of circulatory system
134	Other upper respiratory disease	R58	Haemorrhage, not elsewhere classified
		J30(0,1,3,4)	Vasomotor and allergic rhinitis
		J31(0,1,2)	Chronic rhinitis, nasopharyngitis and pharyngitis
		J34(0,1,3,8)	Other disorders of nose and nasal sinuses
		J37(0)	Chronic laryngitis and laryngotracheitis
		J38(01,02,09, 1,2,3,4,5,6,7)	Diseases of vocal cords and larynx, not elsewhere classified
		J39(0,1,2,3,8)	Other diseases of upper respiratory tract
126	Other upper respiratory infections	J32(0,1,2,3,4,8,9)	Chronic sinusitis
124	Acute and chronic tonsillitis	J35(0,1,2,3,8,9)	Chronic diseases of tonsils and adenoids
127	Chronic obstructive pulmonary disease and bronchiectasis	J41(8)	Simple and mucopurulent chronic bronchitis
		J42	Unspecified chronic bronchitis
		J43(1,8,9)	Emphysema
		J44(1)	Other chronic obstructive pulmonary disease
		J47	Bronchiectasis
128	Asthma	J45(00,01,10,11,80,90,91)	Asthma
132	Lung disease due to external agents	J60	Coalworker pneumoconiosis
		J61	Pneumoconiosis due to asbestos and other mineral fibres
		J62(0,8)	Pneumoconiosis due to dust containing silica
		J63(2)	Pneumoconiosis due to other inorganic dusts
		J66(8)	Airway disease due to specific organic dust
		J67(0,2,8,99)	Hypersensitivity pneumonitis due to organic dust
		J68(0,1,3,4,8,9)	Respiratory conditions due to inhalation of chemicals, gases, fumes and vapours
		J70(0,1,2,3,4,8,9)	Respiratory conditions due to other external agents
133	Other lower respiratory disease	J18(2)	Pneumonia, organism unspecified
		J84(0,1,8,9)	Other interstitial pulmonary diseases
		J93(0,1)	Pneumothorax
		J95(80)	Postprocedural respiratory disorders, not elsewhere classified

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Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
131	Respiratory failure, insufficiency or arrest	J80 J81 J82 J95(1,2,3) J96(0,1,9) J98(10,18,2,4)	Adult respiratory distress syndrome Pulmonary oedema Pulmonary eosinophilia, not elsewhere classified Postprocedural respiratory disorders, not elsewhere classified Respiratory failure, not elsewhere classified Other respiratory disorders
136	Disorders of teeth and jaw	K03(6) K05(0,1,2,3,4,5,6) K06(0,1,2,8,9) K08(1,2,3,80,81,82,83,87,88,9)	Other diseases of hard tissues of teeth Gingivitis and periodontal diseases Other disorders of gingiva and edentulous alveolar ridge Other disorders of teeth and supporting structures
138	Esophageal disorders	K20 K21(0,9) K22(0,10,11,12,13,14,15,16,17,19,2,3,4,5,6,7,8,9)	Oesophagitis Gastro-oesophageal reflux disease Other diseases of oesophagus
139, 153	Gastroduodenal ulcer, gastrointestinal hemorrhage	K25(0,1,2,3,4,5,6,7,9) K26(0,1,2,3,4,5,6,7,9) K27(0,1,2,3,4,5,7,9) K28(0,1,3,4,5,6,7,9)	Gastric ulcer Duodenal ulcer Peptic ulcer, site unspecified Gastrojejunal ulcer
140	Gastritis and duodenitis	K29(0,1,2,3,4,5,6,7,8,9)	Gastritis and duodenitis
141	Other disorders of stomach and duodenum	K31(1,2,3,4,5,6, 80,81,88,9)	Other diseases of stomach and duodenum
144	Regional enteritis and ulcerative colitis	K50(0,1,8,9) K51(0,1,2,3,4,5,8,9)	Crohn disease [regional enteritis] Ulcerative colitis
154	Noninfectious gastroenteritis	K52(0,1,2,8,9)	Other noninfective gastroenteritis and colitis
146	Diverticulosis and diverticulitis	K57(0,1,2,3,4,5,8,9)	Diverticular disease of intestine
155	Other gastrointestinal disorders	K58(0,9) K59(0,1,2,3,4,8,9) K90(0,1,4,8,9) K91(0,1,2)	Irritable bowel syndrome Other functional intestinal disorders Intestinal malabsorption Postprocedural disorders of digestive system, not elsewhere classified
6, 151	Hepatitis and Other liver diseases	K70(0,1,2,3,4,9) K71(0,1,2,6,8,9) K72(1,9) K73(0,1,2,8,9) K74(0,1,3,4,5,6) K75(0,1, 2,3,4,8,9) K76(0, 1,3,5,6,7,8,9)	Alcoholic liver disease Toxic liver disease Hepatic failure, not elsewhere classified Chronic hepatitis, not elsewhere classified Fibrosis and cirrhosis of liver Other inflammatory liver diseases Other diseases of liver
149	Biliary tract disease	K81(0,1,8,9) K82(0,1,2,3,4,8,9) K83(0,1,2,3,4,5,8,9) K91(5)	Cholecystitis Other diseases of gallbladder Other diseases of biliary tract Postprocedural disorders of digestive system, not elsewhere classified
152	Pancreatic disorders (excluding diabetes)	K85(0,1,2,3,8,9) K86(0,1,2,3,8,9)	Acute pancreatitis Other diseases of pancreas
156, 157, 158	Chronic kidney disease and related conditions	N01(7,8,9) N03(1,2,3,5,7,8,9) N04(0,1,2,3,4,5,7,8,9) N05(0,1,2,3,5,6,7,8,9) N07(1,8,9)	Rapidly progressive nephritic syndrome Chronic nephritic syndrome Nephrotic syndrome Unspecified nephritic syndrome Hereditary nephropathy, not elsewhere classified

Continued

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
		N14(0,1,2)	Drug- and heavy-metal-induced tubulo-interstitial and tubular conditions
		N15(8)	Other renal tubulo-interstitial diseases
		N18(0,8,9)	Chronic kidney disease
		N19	Unspecified kidney failure
		N26	Unspecified contracted kidney
161	Other diseases of kidney and ureters	N25(0,1,8,9)	Disorders resulting from impaired renal tubular function
		N16(0)	Renal tubulo-interstitial disorders in diseases classified elsewhere
159	Urinary tract infections	N10	Acute tubulo-interstitial nephritis
		N11(0,1,8,9)	Chronic tubulo-interstitial nephritis
		N12	Tubulo-interstitial nephritis, not specified as acute or chronic
		N13(6)	Obstructive and reflux uropathy
		N15(1,9)	Other renal tubulo-interstitial diseases
		N28(84,85)	Other disorders of kidney and ureter, not elsewhere classified
		N30(0,1,2,3,4,8,9)	Cystitis
162	Other diseases of bladder and urethra	N02(0,1,2,3,5,7,8,9)	Recurrent and persistent haematuria
		N13(8,9)	Obstructive and reflux uropathy
		N31(2,8,9)	Neuromuscular dysfunction of bladder, not elsewhere classified
		N32(0,1,2,3,4,8,9)	Other disorders of bladder
		N36(0,1,2,3,8,9)	Other disorders of urethra
		N39(0,8,9)	Other disorders of urinary system
		R31(0,1,8)	Unspecified haematuria
164	Hyperplasia of prostate	N40	Hyperplasia of prostate
165, 166	Inflammatory and other male genital disorders	N41(0,1,2,3,8,9)	Inflammatory diseases of prostate
		N48(0,1,20,21,28,3,48,49,5,6,8,9)	Other disorders of penis
167	Nonmalignant breast conditions	N60(0,1,2,3,4,8,9)	Benign mammary dysplasia
175	Other female genital disorders	N39(39)	Other disorders of urinary system
		N70(0,1,9)	Salpingitis and oophoritis
		N71(0,1,9)	Inflammatory disease of uterus, except cervix
		N73(0,1,2,3,4,5,6,8,9)	Other female pelvic inflammatory diseases
		N80(0,1,2,3,4,5,6,8,9)	Endometriosis
		N82(0,1,2,3,4,5,8,9)	Fistulae involving female genital tract
		N84(0,8,9)	Polyp of female genital tract
		N85(0,1,2,4,5,6,7,8,9)	Other noninflammatory disorders of uterus, except cervix
		N94(0,1,2,3,4,5,6,8,9)	Pain and other conditions associated with female genital organs and menstrual cycle
		N96	Habitual aborter
		N99(4)	Postprocedural disorders of genitourinary system, not elsewhere classified
171	Menstrual disorders	N89(7)	Other noninflammatory disorders of vagina
		N91(0,1,2,5)	Absent, scanty and rare menstruation
		N92(0,1,2,3,5,6)	Excessive, frequent and irregular menstruation
		N93(0,8,9)	Other abnormal uterine and vaginal bleeding
170	Prolapse of female genital organs	N81(0,1,2,3,4,5,6,8,9)	Female genital prolapse
		N99(3)	Postprocedural disorders of genitourinary system, not elsewhere classified
173	Menopausal disorders	N92(4)	Excessive, frequent and irregular menstruation
		N95(0,1,2,8,9)	Menopausal and other perimenopausal disorders

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Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
174	Female infertility	N97(0,1,2,3,4,8,9)	Female infertility
253	Allergic reactions	L20(8,9)	Atopic dermatitis
		L22	Diaper [napkin] dermatitis
198	Other inflammatory condition of skin	L00	Staphylococcal scalded skin syndrome
		L10(0,4,9)	Pemphigus
		L12(0,2,3,9)	Pemphigoid
		L13(0,8,9)	Other bullous disorders
		L26	Exfoliative dermatitis
		L30(4)	Other dermatitis
		L40(1,3,5,8,9)	Psoriasis
		L41(0)	Parapsoriasis
		L42	Pityriasis rosea
		L51(1,2,8,9)	Erythema multiforme
		L52	Erythema nodosum
		L53(0,8,9)	Other erythematous conditions
		L71(1,9)	Rosacea
		L92(0)	Granulomatous disorders of skin and subcutaneous tissue
		L93(0,2)	Lupus erythematosus
		L95(1)	Vasculitis limited to skin, not elsewhere classified
		L98(2)	Other disorders of skin and subcutaneous tissue, not elsewhere classified
200	Other skin disorders	L11(0)	Other acantholytic disorders
		L30(1)	Other dermatitis
		L57(4)	Skin changes due to chronic exposure to nonionizing radiation
		L73(2)	Other follicular disorders
		L74(4,9)	Eccrine sweat disorders
		L83	Acanthosis nigricans
		L85(9)	Other epidermal thickening
		L87(2)	Transepidermal elimination disorders
		L90(0,2,6,9)	Atrophic disorders of skin
		L91(0,8,9)	Hypertrophic disorders of skin
		L94(0,1)	Other localized connective tissue disorders
199	Chronic ulcer of skin	L89(0,1,2,3,4,5,8,9)	Decubitus ulcer and pressure area
		L97(0,1,2,4,8,9)	Ulcer of lower limb, not elsewhere classified
		L98(4)	Other disorders of skin and subcutaneous tissue, not elsewhere classified
210	Systemic lupus erythematosus and connective tissue disorders	M32(0,1,8,9)	Systemic lupus erythematosus
		M33(0,1,2,9)	Dermatopolymyositis
		M34(1,2,8,9)	Systemic sclerosis
		M35(0,1,8,9)	Other systemic involvement of connective tissue
204, 225	Joint disorders	M02(80,81,83,84,86,89,90,96,97,99)	Reactive arthropathies
		M12(21,22,24,25,26,27,49,51,52,53,54,55,56,57,80,89)	Other specific arthropathies
		M13(00,06,07,08,09,13,14,16,17,19,80,81,83,84,85,86,87,89,90,91,92,93,94,95,96,97,98,99)	Other arthritis
		M15(3,8,9)	Polyarthrosis
		M22(0,1,2,3,4,8,9)	Disorders of patella
		M23(00,01,02,03,05,06,10,12,14,15,16,20,21,22,23,24,25,26,29,30,31,32,33,34,35,36,39,4,5,60,61,62,63,64,8,9)	Internal derangement of knee



Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
		M24(01,02,03,04,05,07,08,10,11,12,13,14,15,17,18,31,33,34,35,37,38,40,41,42,43,44,45,46,47,48,50,51,52,53,54,55,56,57,58,61,62,63,64,66,67,7,81,82,83,84,85,86,87,91,93,94,95,97)	Other specific joint derangements
		M25(02,05,06,13,16,17,21,23,27,28,31,32,33,34,35,36,37,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,66,67,68,81,82,83,84,85,86,87,88,91,93,95,96,97,99)	Other joint disorders, not elsewhere classified
		R26(2)	Abnormalities of gait and mobility
		R29(4)	Other symptoms and signs involving the nervous and musculoskeletal systems
202	Rheumatoid arthritis and related disease	M05(1,2,3,8,9)	Seropositive rheumatoid arthritis
		M06(0,1,2,3,4,8,9)	Other rheumatoid arthritis
		M08(0,2,3,4,8,9)	Juvenile arthritis
		M12(07,09)	Other specific arthropathies
203	Osteoarthritis	M15(0,1,2,4)	Polyarthrosis
		M16(0,1,2,3,4,5,6,7,9)	Coxarthrosis [arthrosis of hip]
		M17(0,1,2,3,4,5,9)	Gonarthrosis [arthrosis of knee]
		M18(0,1,2,3,5,9)	Arthrosis of first carpometacarpal joint
		M19(0,1,2,8,9)	Other arthrosis
205	Spondylosis, intervertebral disc disorders and other back problems	M08(1)	Juvenile arthritis
		M45	Ankylosing spondylitis
		M46(04,08,1,32,34,35,36,37,40,43,44,45,46,47,49,52,53,54,56,57,59,90,96,97,98,99)	Other inflammatory spondylopathies
		M47(02,04,10,12,13,14,16,17,20,22,23,25,26,27,80,82,83,85,86,87,88,89,90,92,96,97,99)	Spondylosis
		M48(38,82,85,86,92,96,97,99)	Other spondylopathies
		M50(0,1,2,3,8,9)	Cervical disc disorders
		M51(0,1,2,3,8,9)	Other intervertebral disc disorders
		M96(1)	Postprocedural musculoskeletal disorders, not elsewhere classified
201	Infective arthritis and osteomyelitis	M46(20,22,25,28,29)	Other inflammatory spondylopathies
		M86(07,10,11,12,13,14,15,16,17,18,19,20,21,24,25,26,27,28,30,35,36,38,42,43,44,45,46,47,48,60,61,62,63,64,65,66,67,68,80,81,82,84,85,86,87,88,90,91,92,93,94,95,96,97,98,99)	Osteomyelitis
		M87(11,15,16,18,22,24,25,27,35,37,38,83,85,87)	Osteonecrosis
206, 212	Osteoporosis and other bone disease	M42(05,09)	Spinal osteochondrosis
		M48(40,45,46,48,54,55,56)	Other spondylopathies
		M80(08,10,25,48,82,86,88,90,95,96,98)	Osteoporosis with pathological fracture
		M81(9)	Osteoporosis without pathological fracture
		M84(00,01,02,03,04,05,06,07,08,11,12,13,14,15,16,17,18,21,22,23,24,25,26,27,28,35,36,37,38,40,41,42,43,44,45,46,47,48,84,86,87,95,97)	Disorders of continuity of bone

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
		M85(01,04,05,06,08,41,42,43,45,46,54,55,56,57,58,61,62,63,64,65,66,67,68,81,85,86,87,88,93)	Other disorders of bone density and structure
		M87(02,03,04,05,06,07,90,91,92,93,94,95,96,97,98)	Osteonecrosis
		M89(00,01,02,09,15,23,25,26,28,31,33,34,36,37,38,51,54,55,58,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98)	Other disorders of bone
		M91(0,1)	Juvenile osteochondrosis of hip and pelvis
		M92(0,2,4,5,6,7,8)	Other juvenile osteochondrosis
		M93(0,1,21,22,25,26,27,28,8,9)	Other osteochondropathies
		M94(0,1,20,21,22,23,24,25,27,28,29,31,35,36,81,82,84,85,86,87,88,89,95,96)	Other disorders of cartilage
		M96(0)	Postprocedural musculoskeletal disorders, not elsewhere classified
208	Acquired foot deformities	M20(1,2,3,4,5,6)	Acquired deformities of fingers and toes
209	Other acquired deformities	M40(13,22,23,24,25,29)	Kyphosis and lordosis
		M41(04,05,14,15,19,20,25,34,40,44,45,46,47,49,54,55,80,84,85,86,90,93,94,95,96,99)	Scoliosis
		M43(88)	Other deforming dorsopathies
		M96(2,3)	Postprocedural musculoskeletal disorders, not elsewhere classified
216	Nervous system congenital anomalies	Q00(0)	Anencephaly and similar malformations
		Q01(0,2,8,9)	Encephalocele
		Q02	Microcephaly
		Q03(0,1,8,9)	Congenital hydrocephalus
		Q04(0,2,3,4,6,8,9)	Other congenital malformations of brain
		Q05(1,2,3,4,6,7,8,9)	Spina bifida
		Q06(1,2,4,8,9)	Other congenital malformations of spinal cord
		Q07(0,8,9)	Other congenital malformations of nervous system
217	Other congenital anomalies	Q10(0,3,4,5,6,7)	Congenital malformations of eyelid, lacrimal apparatus and orbit
		Q11(1,2)	Anophthalmos, microphthalmos and macrophthalmos
		Q12(0,1,3,4)	Congenital lens malformations
		Q13(0,1,2,3,4,8)	Congenital malformations of anterior segment of eye
		Q14(0,1,2,8,9)	Congenital malformations of posterior segment of eye
		Q16(0,1,4,5,9)	Congenital malformations of ear causing impairment of hearing
		Q17(0,1,2,3,4,5,8,9)	Other congenital malformations of ear
		Q18(0,1,2,5,6,8,9)	Other congenital malformations of face and neck
		Q30(0,2,8,9)	Congenital malformations of nose
		Q31(0,1,3,5,8)	Congenital malformations of larynx
		Q32(0,10,12,18,2,4)	Congenital malformations of trachea and bronchus
		Q33(0,2,3,4,6,8,9)	Congenital malformations of lung
		Q34(8,9)	Other congenital malformations of respiratory system
		Q35(1,3,5,9)	Cleft palate

Continued

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
		Q36	Cleft lip
		Q37	Cleft palate with cleft lip
		Q65(0,1,2,3,4,5,6,8,9)	Congenital deformities of hip
		Q66(0,1,2,3,4,5,6,7,8,9)	Congenital deformities of feet
		Q67(0,2,3,4,5,6,7,8)	Congenital musculoskeletal deformities of head, face, spine and chest
		Q68(0,1,2,4,8)	Other congenital musculoskeletal deformities
		Q69(0,1,2,9)	Polydactyly
		Q70(0,1,2,3,4,9)	Syndactyly
		Q71(0,1,2,3,4,8)	Reduction defects of upper limb
		Q72(0,3,4,5,6,8,9)	Reduction defects of lower limb
		Q74(0,1,2,3,8,9)	Other congenital malformations of limb(s)
		Q75(0,1,2,3,4,8,9)	Other congenital malformations of skull and face bones
		Q76(0,1,20,3,4,7)	Congenital malformations of spine and bony thorax
		Q77(1,2,3,4)	Osteochondrodysplasia with defects of growth of tubular bones and spine
		Q78(0,1,2,4,6,8)	Other osteochondrodysplasias
		Q79(0,1,2,3,4,5,6,8,9)	Congenital malformations of the musculoskeletal system, not elsewhere classified
		Q80(1,2,8)	Congenital ichthyosis
		Q81(0,8,9)	Epidermolysis bullosa
		Q82(2,3,4,5,8,9)	Other congenital malformations of skin
		Q83(1,3,8,9)	Congenital malformations of breast
		Q84(2,3,4,6,8)	Other congenital malformations of integument
		Q85(1,8,9)	Phakomatoses, not elsewhere classified
		Q86(2,8)	Congenital malformation syndromes due to known exogenous causes, not elsewhere classified
		Q87(0,1,2,3,4,5,8)	Other specified congenital malformation syndromes affecting multiple systems
		Q89(0,1,2,3,7,8,9)	Other congenital malformations, not elsewhere classified
		Q90(1,2,9)	Down syndrome
		Q91(0,2,3,6,7)	Edwards syndrome and Patau syndrome
		Q92(5,8,9)	Other trisomies and partial trisomies of the autosomes, not elsewhere classified
		Q93(3,4,5)	Monosomies and deletions from the autosomes, not elsewhere classified
		Q96(3,9)	Turner syndrome
		Q97(0,8)	Other sex chromosome abnormalities, female phenotype, not elsewhere classified
		Q98(0,4)	Other sex chromosome abnormalities, male phenotype, not elsewhere classified
		Q99(0,1,2,8,9)	Other chromosome abnormalities, not elsewhere classified
213	Cardiac and circulatory congenital anomalies	P29(3)	Cardiovascular disorders originating in the perinatal period
		Q20(0,1,2,30,31,32,38,4,50,58,6,8)	Congenital malformations of cardiac chambers and connections
		Q21(0,1,2,3,4,8,9)	Congenital malformations of cardiac septa
		Q22(0,1,2,3,4,5,6,8,9)	Congenital malformations of pulmonary and tricuspid valves

Continued

Supplementary Appendix 6: Continued

CCS category #	CCS category description	ICD-10-CA code	ICD-10-CA code label
214	Digestive congenital anomalies	Q23(0,1,2,3,4,8,9)	Congenital malformations of aortic and mitral valves
		Q24(0,1,2,4,5,6,8,9)	Other congenital malformations of heart
		Q25(0,1,2,3,4,5,6,7,8)	Congenital malformations of great arteries
		Q26(2,3,4,6,8,9)	Congenital malformations of great veins
		Q27(0,30,31,32,33,38,8,9)	Other congenital malformations of peripheral vascular system
		Q28(0,2,3,8,9)	Other congenital malformations of circulatory system
		Q38(0,1,2,3,4,5,6,8)	Other congenital malformations of tongue, mouth and pharynx
		Q39(0,1,2,3,4,5,8,9)	Congenital malformations of oesophagus
		Q40(0,1,2,8)	Other congenital malformations of upper alimentary tract
		Q41(0,1,2,8,9)	Congenital absence, atresia and stenosis of small intestine
		Q42(0,2,3,8,9)	Congenital absence, atresia and stenosis of large intestine
		Q43(0,1,3,4,5,6,7,8,9)	Other congenital malformations of intestine
		Q44(1,2,4,5,6,7)	Congenital malformations of gallbladder, bile ducts and liver
		Q45(0,2,3,8,9)	Other congenital malformations of digestive system
215	Genitourinary congenital anomalies	Q50(1,2,30,38,4,5,6)	Congenital malformations of ovaries, fallopian tubes and broad ligaments
		Q51(1,2,3,4,8,9)	Congenital malformations of uterus and cervix
		Q52(0,1,2,3,4,5,6,7,8,9)	Other congenital malformations of female genitalia
		Q53(0,1,2,9)	Undescended testicle
		Q54(0,1,2,3,4,8,9)	Hypospadias
		Q55(0,1,2,4,60,68,8,9)	Other congenital malformations of male genital organs
		Q56(0,4)	Indeterminate sex and pseudohermaphroditism
		Q60(0,1,3,6)	Renal agenesis and other reduction defects of kidney
		Q61(0,1,2,3,4,5,9)	Cystic kidney disease
		Q62(0,10,11,18,2,3,5,6,7,8)	Congenital obstructive defects of renal pelvis and congenital malformations of ureter
		Q63(0,1,2,3,8,9)	Other congenital malformations of kidney
		Q64(0,10,18,2,30,31,32,38,4,6,7,8)	Other congenital malformations of urinary system

