Adaptation of the Charlson Comorbidity Index for Register-Based Research in Sweden

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Purpose: Comorbidity indices are often used to measure comorbidities in register-based research. We aimed to adapt the Charlson comorbidity index (CCI) to a Swedish setting.

Methods: Four versions of the CCI were compared and evaluated by disease-specific experts.

Results: We created a cohesive coding system for CCI to 1) harmonize the content between different international classification of disease codes (ICD-7,8,9,10), 2) delete incorrect codes, 3) enhance the distinction between mild, moderate or severe disease (and between diabetes with and without end-organ damage), 4) minimize duplication of codes, and 5) briefly explain the meaning of individual codes in writing.

Conclusion: This work may provide an integrated and efficient coding algorithm for CCI to be used in medical register-based research in Sweden.

Keywords: Charlson comorbidity score, comorbidity, disease, epidemiology, public health, Sweden

Plain Language Summary
The Charlson co-morbidity index (CCI) is a disease index that was originally created to predict short-term mortality. The CCI is a list of international classification of disease (ICD) codes from the following diseases: myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, pulmonary diseases, rheumatic disease, dementia, hemiplegia, diabetes, chronic kidney disease, liver disease, peptic ulcer disease, cancer and HIV/AIDS. Over time the CCI has been increasingly used as a proxy for comorbidity burden and is often used as a co-variate, for instance, in regression models.

There are currently several available versions of the CCI. This creates confusion, increases the risk of mistakes and requires individual researchers to spend considerable time examining included codes.

In this study, we reviewed the four CCI versions to harmonise them into one version adapted to register-based research in Sweden. When doing so we aimed to delete incorrect codes, better distinguish between mild and moderate-severe disease, as well as to minimise the duplication of codes. Finally, we provide explanations of all included ICD codes.

Introduction
Comorbidities often play an important role in health outcomes and survival. They may also influence the relationship between various exposures and other health outcomes as well as quality of life for a given condition. In epidemiology, two main approaches to adjust for comorbidity can be discerned: (I) adjusting for separate disorders or (II) creating a numeric index that can be included in a statistical model.
Numerical indices resulting in scores have the additional advantage that they enable researchers to stratify results according to comorbidity burden. One of the most used scores in the world is the Charlson comorbidity index (CCI). The original paper from 1987 in which Charlson et al describe their approach to measure comorbidity has been cited over 4000 times.

The CCI was created to predict 1-year-mortality but has further been used to predict a range of outcomes. This numerical score is also used to adjust for comorbidity. The original CCI assigned different scores for different comorbidities, ranging from 1 point for each of myocardial infarction, congestive heart failure, peripheral vascular disease, dementia, cerebrovascular disease, chronic lung disease, connective tissue disease, ulcer, chronic liver disease, diabetes; 2 points for each of hemiplegia, moderate or severe kidney disease, diabetes with end-organ damage, tumor, leukemia, lymphoma; 3 points for moderate or severe liver disease; and 6 points for tumor metastasis or AIDS.

Over time, the CCI has been modified, revised and simplified, with some versions receiving their own names (Charlson/Deyo, Charlson/Romano, Charlson/Manitoba, Charlson/D’Hooore, Charlson/Ghali and Charlson/Quan). These versions often use different models based on weighting of comorbidities. For instance, Quan et al also included leukemia and lymphoma among malignancies and widened “hemiplegia” to “paresis/plegia”, including conditions affecting symmetrical parts as well as the whole body.

In addition, individual researchers have constructed their own comorbidity indices based on the CCI with the risk of errors entering algorithms. Existing algorithms often contain long lists of international classification of disease (ICD) codes but rarely explain the underlying meaning of individual codes. Finally, although there are algorithms (such as ICD-8, 9 and 10 codes), ICD-7 codes are often missing despite frequent use in epidemiological research in Sweden.

This work sought to adapt the CCI to Swedish settings and the Swedish versions of ICD, including ICD-7.

Methods
We compared four CCI algorithms used in Sweden to suggest one unique system.

We retrieved the coding lists for the Charlson/Quan index and compared their ICD codes to those of two unofficial CCI versions used in Sweden (one used at Uppsala University based on the Charlson/Quan index and one used at Karolinska Institutet, likely based on the Charlson/Deyo index, and finally, to a Harvard algorithm (ICD-9 and ICD-10) that has previously been applied to Swedish data.

Codes from the four systems were listed according to the comorbidity they belonged to (eg, myocardial infarction, rheumatic disease, moderate or severe liver disease) and according to ICD version used. Only the Karolinska Institutet CCI version contained ICD-7 codes.

JFL (first author) and a research assistant added Swedish and English descriptions (eg, ICD-9 250B: “Diabetes med ketoacidos” in Swedish, “diabetes with ketoacidosis”) to all individual codes (Table 1) to facilitate their review.

Disease-specific experts or specialists were then contacted and invited to review the ICD-7, 8, 9 and 10 codes in their field: myocardial infarction (SJ), congestive heart failure (JS), peripheral vascular disease (JFL), cerebrovascular disease (PA), pulmonary disease (ME and BJ), rheumatology (JA), dementia (NLP), hemiplegia (HS), diabetes (JFL), kidney disease (JJC), liver disease (HH), peptic ulcer disease (JFL), cancer (KES), metastatic cancer (KES) and HIV/AIDS (AME). All co-authors were then invited to review the complete Table 1, to offer comments on the coding.

We sought to construct a CCI adapted to Swedish settings and ICD codes based on the Quan version of the Charlson index, with the following specific aims: to (I) create a cohesive system in which the contents of ICD-7, 8, 9 and 10 are as similar as possible, (II) delete incorrect codes, (III) better distinguish between mild, moderate or severe disease (and between diabetes with and without end-organ damage), (IV) avoid duplication of codes since this creates a falsely high comorbidity score (eg, if “diabetes with kidney disease” is listed both under diabetes and under kidney disease that will yield points in both categories) and (V) to list codes with Swedish and English explanations to increase the transparency and understanding of the codes (Table 1). Furthermore, we harmonized the content of each disease area, so that the ICD-7, 8, and 10 lists corresponded to the ICD-9 content of the Charlson/Quan index.

Ethics
Because this study did not involve individual patient data, no ethical approval or informed consent was required under Swedish law.
| ICD-7          | ICD-8          | ICD-9          | ICD-10         |
|---------------|---------------|---------------|---------------|
|               | Up to 1968    | 1969–1986     | 1987–1996     | 1997–          |
| Myocardial    | 420.1 (Hjärtinfarkt med eller utan ruptur, myocardial infarction with or without rupture) | 410 (Akut hjärtinfarkt, acute myocardial infarction). | 410 (Akut hjärtinfarkt, acute myocardial infarction), | 411 (Akut/subakut ischemisk hjärt sjukdom, acute/subacute ischemic heart disease), |
| infarction    |               |               |               | 412 (Gamma hjärtinfarkt, old myocardial        | 412 (Gamma hjärtinfarkt, old myocardial infarction), |
|               |               |               |               | infarction), |               |
|               |               |               |               | 412.91 (Post-infarkt syndrom utan hypertoni, post-infarction syndrome without hypertension) | 412.91 (Post-infarkt syndrom utan hypertoni, post-infarction syndrome without hypertension) |

| ICD-7          | ICD-8          | ICD-9          | ICD-10         |
|---------------|---------------|---------------|---------------|
|               | Up to 1968    | 1969–1986     | 1987–1996     | 1997–          |
| Congestive heart failure | 422.21 (Hjärtatrof, myocardial atrophy) | 425.08 (Kardiomyopati, andra definitioner, cardiomypathy other definitions). | 402A (Malign hypertoni med hjärt sjukdom, malignant hypertension with heart disease), | 402.0 (Malign hypertoni med hjärt sjukdom, malignant hypertension with heart disease), |
|               | 422.22 (Amyloidpåverkat myokard, myocardial amyloid degeneration) | 425.09 (Kardiomyopati UNS, cardiomypathy unspecified) | malignant hypertensive heart and kidney disease), | malignant hypertensive heart and kidney disease), |
|               | 434.1 (Hjärtsvikt, heart failure) | 427.0 (Hjärtsvikt, heart failure) | 402B (Benign hypertoni med hjärt sjukdom, benign hypertensive heart disease), | 402B (Benign hypertoni med hjärt sjukdom, benign hypertensive heart disease), |
|               | 434.2 (Vänstersidig ventrikulär hjärt svikt, left ventricular heart failure) | 427.1 (Akut lungödem, acute pulmonary edema) | 402X (Hypertoni, ospecificerad, med hjärt sjukdom, unspecified hypertensive heart disease), | 402X (Hypertoni, ospecificerad, med hjärt sjukdom, unspecified hypertensive heart disease), |
|               |               | 428 (Andra myokardinsufficienser, other myocardial insufficiencies) | 404A (Malign hypertoni med hjärt- och njursjukdom, malignant hypertensive heart and kidney disease), | 404A (Malign hypertoni med hjärt- och njursjukdom, malignant hypertensive heart and kidney disease), |
|               |               |               | 404B (Benign hypertoni med hjärt- och njursjukdom med hjärt svikt och njursvikt, benign hypertensive heart and kidney disease with heart failure and kidney failure) | 404B (Benign hypertoni med hjärt- och njursjukdom med hjärt svikt och njursvikt, benign hypertensive heart and kidney disease with heart failure and kidney failure) |
|               |               |               | 404X (Hypertoni, ospecificerad, med hjärt- och njursjukdom, unspecified Hypertensive heart and kidney disease), | 404X (Hypertoni, ospecificerad, med hjärt- och njursjukdom, unspecified Hypertensive heart and kidney disease), |
|               |               |               | 425E (Annan primär kardiomyopati, Other primary cardiomyopathies) | 425E (Annan primär kardiomyopati, Other primary cardiomyopathies), |
|               |               |               | 425F (Alkoholkardiomyopati, Alcoholic cardiomyopathy) | 425F (Alkoholkardiomyopati, Alcoholic cardiomyopathy), |
|               |               |               | 425H (Kardiomyopati vid nutritions- och ämnesomsättningsrubbing, Nutritional and metabolic cardiomyopathies) | 425H (Kardiomyopati vid nutritions- och ämnesomsättningsrubbing, Nutritional and metabolic cardiomyopathies), |
|               |               |               | 425W (Kardiomyopati vid andra sjukdomar, Cardiomyopathy in other diseases classified elsewhere) | 425W (Kardiomyopati vid andra sjukdomar, Cardiomyopathy in other diseases classified elsewhere), |
|               |               |               | 425X (Sekundär kardiomyopati, icke specifiserad, Secondary cardiomyopathy, unspecified) | 425X (Sekundär kardiomyopati, icke specifiserad, Secondary cardiomyopathy, unspecified), |
|               |               |               | 428 (Hjärt svikt, heart failure) | 428 (Hjärt svikt, heart failure), |

(Continued)
| ICD-7                      | ICD-8                              | ICD-9                              | ICD-10                             |
|---------------------------|------------------------------------|------------------------------------|------------------------------------|
| **Peripheral vascular disease** |                                    |                                    |                                    |
| Up to 1968                | 1969-1986                          | 1987-1996                          | 1997-1998                          |
| 450.1 (Arterioskleros med eller utan gangrän, arterosclerosis with or without gangrene)  | 440 (Arterioskleros, Atherosclerosis) | 440 (Atherosclerosis)              | 470 (Atherosclerosis, Atherosclerosis) |
| 451 (Icke syftad aortaaneurysm eller aorta-ekas, non syphilitic aortic aneurysm or aneurysm) | 441 (Aortaaneurysm med dissection, aortic aneurysm dissection) | 441 (Aortic aneurysm, Aortic aneurysm and dissection) | 471 (Aortic aneurysm, Aortic aneurysm and dissection) |
| 452 (Perifer arteriell sjukdom, peripheral arterial disease) | 443.1 (Thrombangiitis obliterans, Thromboangiitis obliterans) | 443.1 (Thrombangiitis obliterans, Thromboangiitis obliterans) | 473.1 (Thrombangiitis obliterans, Thromboangiitis obliterans) |
| 452.9 (Föstertertangjuk, Intermittent claudication) | 443X (annan sjukdom i perifera kärl, other peripheral vascular disease) | 443X (annan sjukdom i perifera kärl, other peripheral vascular disease) | 473.8 (Andra specificerade sjukdomar i perifera kärl, Other specified peripheral vascular diseases) |
| 447B (arterinsluts, stenosis of artery) | 557 (kärlsjukdomar i tarmen, vascular disorders of the intestine) | 170 (Atherosclerosis)              | 170.1 (Arterinsluts, Stenosis of artery) |
| **Cerebrovascular disease** |                                    |                                    |                                    |
| Up to 1968                |                                    |                                    |                                    |
| 330 (Subaraknoidal blödning, subarachnoid hemorrhage) | 430 (Subarachnoid hemorrhage, subarachnoid hemorrhage) | 430 (Subarachnoid hemorrhage, subarachnoid hemorrhage) | 453 (Overgångande cerebral ischemi (Ostförråklig blodflytning till hjärnan) och besläktade syndrom, Transient cerebral ischemia and related syndromes) |
| 331 (Hjälmblödning, cerebral hemorrhage) | 431 (Hjälmblödning, cerebral hemorrhage) | 431 (Hjälmblödning, cerebral hemorrhage) | 453.1 (Hjälmblödning, cerebral hemorrhage) |
| 332 (Hjälmemboli, brain embolism) | 432 (Oclusion (Emboli, tromboi) av precerebra vessels arterieres, occlusion (Emboli, thrombosis) of the precerebral arteries) | 432 (Oclusion (Emboli, tromboi) av precerebral vessels arterieres, occlusion (Emboli, thrombosis) of the precerebral arteries) | 453.2 (Hjälmblödning, Intracerebral hemorrhage) |
| 333 (Spasm i hjärtarterna, spasm of the cerebral arteries) | 433 (Hjärttrombos, cerebral thrombosis) | 433 (Hjärttrombos, cerebral thrombosis) | 453.2 (Hjälmblödning, Intracerebral hemorrhage) |
| 334 (Sjukdomar i hjärnan eller ryggmärgens kärl, diseases of the vessels of the brain or spinal cord) | 434 (Hjärmemboli, cerebral embolism) | 434 (Hjärmemboli, cerebral embolism) | 453.2 (Hjemlåsare, Intracerebral hemorrhage) |
| 436 (Akut, ej tillräckligt specificerad cerebrovasculär sjukdom, acute unspecified cerebrovascular disease) | 435 (Transitorisk ischemisk attack, transient ischemic attack) | 435 (Transitorisk ischemisk attack, transient ischemic attack) | 453.2 (Hjemlåsare, Intracerebral hemorrhage) |
| 437 (Utbredd ischemisk cerebrovasculär sjukdom, Widespread ischemic cerebrovascular disease) | 436 (Akut, ej tillräckligt specificerad cerebrovasculär sjukdom, acute unspecified cerebrovascular disease) | 436 (Akut, ej tillräckligt specificerad cerebrovasculär sjukdom, acute unspecified cerebrovascular disease) | 453.2 (Hjemlåsare, Intracerebral hemorrhage) |
| 438 (Andra och oefterlärdt specificerad cerebrovasculära sjukdomar, other unspecified cerebrovascular diseases) | 439 (Oclusion av cerebralt arterieres, occlusion of the cerebral arteries) | 439 (Oclusion av cerebralt arterieres, occlusion of the cerebral arteries) | 453.2 (Hjemlåsare, Intracerebral hemorrhage) |
| 443 (Sjukdomar i hjärnans eller ryggmärgens kärl, diseases of the vessels of the brain or spinal cord) | 454 (Sjukdomar i hjärnans eller ryggmärgens kärl, diseases of the vessels of the brain or spinal cord) | 454 (Sjukdomar i hjärnans eller ryggmärgens kärl, diseases of the vessels of the brain or spinal cord) | 453.2 (Hjemlåsare, Intracerebral hemorrhage) |
| 455 (Oclusion av cerebrovascular vessels arterieres, occlusion of the cerebral arteries) | 456 (Akut, ej tillräckligt specificerad cerebrovasculär sjukdom, acute unspecified cerebrovascular disease) | 456 (Akut, ej tillräckligt specificerad cerebrovasculär sjukdom, acute unspecified cerebrovascular disease) | 453.2 (Hjemlåsare, Intracerebral hemorrhage) |
| 457 (Oclusion av cerebrovascular vessels arterieres, occlusion of the cerebral arteries) | 458 (Andra och oefterlärdt specificerad cerebrovasculär sjukdom, other unspecified cerebrovascular diseases) | 458 (Andra och oefterlärdt specificerad cerebrovasculär sjukdom, other unspecified cerebrovascular diseases) | 453.2 (Hjemlåsare, Intracerebral hemorrhage) |
| 459 (Sjukdomar i hjärnans eller ryggmärgens kärl, diseases of the vessels of the brain or spinal cord) | 4510 (Sjukdomar i hjärnans eller ryggmärgens kärl, diseases of the vessels of the brain or spinal cord) | 4510 (Sjukdomar i hjärnans eller ryggmärgens kärl, diseases of the vessels of the brain or spinal cord) | 453.2 (Hjemlåsare, Intracerebral hemorrhage) |
| ICD-7 | ICD-8 | ICD-9 | ICD-10 |
|-------|-------|-------|--------|
| up to 1968 | 1969–1986 | 1987–1996 | 1997–|
| **Chronic obstructive pulmonary disease (COPD)** | **Chronic obstructive pulmonary disease (COPD)** | **Chronic obstructive pulmonary disease (COPD)** | **Chronic obstructive pulmonary disease (COPD)** |
| 502 (Kronisk bronkit med emfysem, chronic bronchitis with emphysema) | 491 (Kronisk bronkit, chronic bronchitis) | 491 (Kronisk luftöverladdning, chronic bronchitis) | J43 (Lungemfysem, Emphysema) |
| 527.1 (Emfysem utan bronkit, emphysema without bronchitis) | 492 (Emfysem, emphysema) | 492 (Lungemfysem, emphysema) | J44 (Kronisk obstruktiv lungsjukdom, Other chronic obstructive pulmonary disease) |
| **Other chronic pulmonary disease** | **Other chronic pulmonary disease** | **Other chronic pulmonary disease** | **Other chronic pulmonary disease** |
| 501 (Bronkit specificerad, unspecified bronchitis) | 490 (Bronkit specifiserad, unspecified bronchitis) | 490 (Bronkit – akut eller kronisk, Bronchitis, not specified as acute or chronic) | J41 (Kronisk bronkit utan luftvägsobstruktion, Chronic bronchitis without airway obstruction) |
| 241 (Astrma, asthma) | 493 (Astrma, asthma) | 493 (Astrma, asthma) | J42 (Idi-specified kronisk bronkit, unspecified chronic bronchitis) |
| 523 (Silikos, siliosis) | 515 (Pneumokoniosos genom silikat, Pneumoconiosis Silicos) | 494 (Bronkiectasier, Bronchiectasis) | J45 (Astrma, asthma) |
| 524 (Pneumokoniosos och professionell lungfibros, pneumoconiosis and professional pulmonary fibrosis) | 516 (Annan pneumokoniosos och besläktade sjukdomar, other pneumoconioses and related diseases) | 495 (Extrinsic allergic alveolitis, Hypersensitivitetspneumonitis) | J46 (Akut svår astrma, Acute severe asthma) |
| 525 (Annan kronisk interstitial pneumoni, other chronic interstitial lung disease) | 517 (Annan kronisk interstitial pneumoni, other chronic interstitial pneumonia) | 500 (Pneumoconiosis, pneumoconiosis) | J47 (Bronkiectasier, Bronchiectasis) |
| 526 (Bronkiectasier, bronchiectasis) | 518 (Bronkiectasier, bronchiectasis) | 501 (Asbestos, Asbestosis) | J60 (Pneumoconiosis (Dammlunga) orsakad av silikoa, damm, Asbestosis due to asbestos) |
| 502 (Pneumokoniosos (Dammlunga) orsakad av silikos, Pneumoconiosis due to other silica or silicates) | 502 (Pneumokoniosos (Dammlunga) orsakad av silikos, Pneumoconiosis due to other silica or silicates) | 503 (Pneumokoniosos (Dammlunga) orsakad av annat organiskt damm, Pneumoconiosis due to other inorganic dust) | J61 (Pneumoconiosis (Dammlunga) orsakad av silikos, Pneumoconiosis due to inorganic dust) |
| 503 (Pneumokoniosos (Dammlunga) orsakad av annat organiskt damm, Pneumoconiosis due to other inorganic dust) | 504 (Lungsjukdom orsakad av inandning av annat damm, Pneumopathy due to inhalation of other dust) | 505 (Idi-specified pneumoconiosos (Dammlunga), Pneumoconiosis, unspecified) | J62 (Pneumoconiosis (Dammlunga) orsakad av damm innehållande silikos, Pneumoconiosis due to dust containing silica) |
| 506 (Sjukliga tillstånd i lungorna orsakade av rök eller ånga, Respiratory conditions due to smoke and vapours) | 507 (Pneumonit orsakad av föda eller uppsprängt morgelförrättning, pneumonitis due to food or vomits) | 508 (Lungmanifestationer av yttre orsaker, Pulmonary conditions due to external agents) | J63 (Pneumoconiosis (Dammlunga) orsakad av annat organiskt damm, Pneumoconiosis due to other inorganic dust) |
| 516 (Postinflamatorisk lungfibros, post-inflammatory lung fibrosis) | 517 (Lungväverkan vid annan sjukdom t.ex. reumatisk sjukdom och sarcoidosis; pulmonary disease due to other disease including rheumatic conditions and sarcoidosis) | 519 (Lungväverkan vid annan sjukdom t.ex. reumatisk sjukdom och sarcoidosis; pulmonary disease due to other disease including rheumatic conditions and sarcoidosis) | J64 (Idi-specified pneumoconiosos (Dammlunga), Unspecified pneumoconiosis) |
| **(Continued)** | **(Continued)** | **(Continued)** | **(Continued)** |
| ICD-7 | ICD-8 | ICD-9 | ICD-10 |
|------|-------|-------|--------|
| Up to 1968 | 1969–1986 | 1987–1996 | 1997–2013 |
| Rheumatic disease | Rheumatic disease | Rheumatic disease | Rheumatic disease |
| 710.0 (Dermatomyositis or scleroderma) | 446 (Polyarteritis nodosa) | 446 (Polyarteritis nodosa) | M05: M06, M12.3 (Reumatoid arthritis, rheumatoid arthritis) |
| 722.0 (Reumatoid arthritis, rheumatoid arthritis) | 696.00 (Psoriasis-arthrit, psoriatic arthritis) | 696A (Psoriasis-arthrit, psoriatic arthritis) | M070–3 (Psoriasis-arthrit, psoriatic arthritis) |
| 722.3 (Ankylosing spondylitis, ankylosing spondylitis) | 712.0–712.3 (Reumatoid arthritis, rheumatoid arthritis and ankylosing spondylitis) | 710A-E (SLE, skleroderma, Sjögrens syndrome, dermatomyositis, polyomyositis; SLE, scleroderma, sicca syndrome, dermatomyositis and polymyositis) | M08 (Juvenile idiopathic arthritis, juvenile idiopathic arthritis) |
| 456.0–456.3 (Temporal arteritis, SEN, Takayasu, temporal arteritis; giant cell arteritis, SEN, Takayasu arteritis) | 712.5 (Ankylosing spondylitis, ankylosing spondylitis) | 714 (Reumatoid arthritis, rheumatoid arthritis including juvenile idiopathic arthritis) | M13 (Polyarthritis, poly arthritis) |
| 716 (Dermatomyositis och polyomyositis, dermatomyositis and polymyositis) | 734.0 (Systemisk skleros, systemisk sclerosis) | 719D (Palindrom rheumatoid arthritis, polyarticular rheumatoid arthritis) | M30 (Polyarteritis nodosa) |
| 734.1 (SLE) | 734.2 | 734.3 | M31.3–M31.6 (Andra nukleotiserande vaskulopatier, Neotizing vasculitides including giant cell arteritis) |
| 734.9 (Sjögrens syndrom, Sjögren syndrome) | 734.9 | 734.9 | M32 (SLE) |
| 734.9 | 734.9 | 734.9 | M33 (Dermatopolymyositis, Dermato- and polymyositis) |
| 734.9 | 734.9 | 734.9 | M34 (Systemisk skleros, Systemic sclerosis) |
| 735.0 (Sjögrens syndrome, Sjögren syndrome) | 735.1 | 735.1 | M35.0 (Sjögrens syndrome, Sjögren syndrome) |
| 735.1 | 735.1 | 735.1 | M35.1 (Andra overlap-syndrom, Other overlap syndromes) |
| 735.2 (Polymyalgia rheumatica, Polymyalgia rheumatica) | 735.3 | 735.3 | M35.3 (Polymyalgia rheumatica, Polymyalgia rheumatica) |
| 735.3 | 735.3 | 735.3 | M45–46 (Ankylosing spondylitis, ankylosing spondylitis) |
| 735.9 | 735.9 | 735.9 |  |
| Dementia | Dementia | Dementia | Dementia |
| 304 (Senil psykos, senile psychosis) | 290 (Senil psykos, senile psychosis) | 290 (Olika typer av demens inklusive alzheimers, various forms of dementia including alzheimer’s disease) | F00 (Demens vid Alzheimers sjukdom, Dementia in Alzheimer’s disease) |
| 305 (Alzheimers sjukdom, Alzheimers disease) | 305 (Alzheimers sjukdom, Alzheimers disease) | 2948 (Demens på grund av somatisk sjukdom; dementia due to somatic disease) | F01 (Vaskulär demens, Vascular dementia) |
| 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | F02 (Demens vid andra sjukdomar som klassificeras annerställdes, Dementia in other diseases classified elsewhere) |
| 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | F03 (Ospecifikera demens, Unspecified dementia) |
| 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | F05.1 (Delirium med underliggande demenssjukdom, Delirium superimposed on dementia) |
| 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | G30 (Alzheimers sjukdom, Alzheimers disease) |
| 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | G31.1 (Senil degeneration av hjärtan som ej klassificeras aneraställdes, Senile degeneration of brain, not elsewhere classified) |
| 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | 331A–C, 331X (Presenil och senil degeneration inclusive Pick’s sjukdom;presenten/senile dementia including Pick’s disease) | G31.9 (Degenerativ sjukdom i nervsystemet, degenerative disease of the nervous system) |
| ICD-7         | ICD-8                        | ICD-9                        | ICD-10                        |
|--------------|------------------------------|------------------------------|-------------------------------|
| up to 1968   | 1969–1986                    | 1987–1996                    | 1997–                         |
| Hemiplegia,  | 343–44 (Paralysis cerebralis, cerebral palsy) | 342 (Ensidig förlamning, Hemiplegia) | G11.4 (Hereditär spasisk paraplegi, hereditary spastic paraplegia) |
| tetraplegia  | 351–352 (Paralysis cerebralis, cerebral palsy) | 343 (Cerebral pares, cerebral palsy) | G80 (Cerebral pares, cerebral palsy) |
|              | 357.00 (Ataxia familiaris, Hereditary spastic paraplegia) | 344A-F (Paralysis cerebralis alta,Andra förlamningsyndrom från monoplegi till tetraplegi,Monoplegia ranging to tetraplegia) | G81 (Ensidig förlamning, hemiplegia) |
|              |                              |                              | G82 (parapares/tetrapares, paraplegia and tetraplegia) |
|              |                              |                              | G83.0-G83.3 (Andra förlamningsyndrom,Monoplegia to tetraplegia) |
|              |                              |                              | G83.8 (Andra specificerade förlamningsyndrom,tetraplegia) |
| Diabetes     | 260.09 (Diabetes utan komplikationer, diabetes mellitus without complications) | 250.00 (Diabetes utan komplikationer, diabetes mellitus without complications) | E10.0 (Insulinberoende diabetes med koma. Diabetes mellitus with coma) |
|              | 250.07 (Diabeteskoma, diabetic coma) | 250.08 (Diabetes med andra komplikationer, diabetes with other complications) | E10.1 (Insulinberoende diabetes med ketoacidosis, Diabetes mellitus with ketoacidosis) |
|              | 250.08 (Diabetes med andra komplikationer, diabetes with other complications) | 250A (Diabetes, diabetes mellitus) | PLUS other forms of diabetes without End-stage organ damage |
|              |                              | 250B (Diabetes med ketoacidosis, diabetes with ketoacidosis) | E11.0-E11.1 |
|              |                              | 250C (Diabetes med koma, diabetes with coma) | E12.0-E12.1 |
|              |                              |                              | E13.0-E13.1 |
|              |                              |                              | E14.0-E14.1 |

(Continued)
| Condition | ICD-7 Up to 1968 | ICD-8 1969–1986 | ICD-9 1987–1996 | ICD-10 1997–2013 |
|-----------|-----------------|-----------------|-----------------|------------------|
| Diabetes with end organ damage | 260.20 (Diabeteskatarakt, diabetic cataracts) 260.21 (Diabetesretinopati, diabetic retinopathy) 260.29 (Diabetes med andra ögonkomplicationer, diabetes mellitus with other eye complications) 260.30 (Diabetesnefropati, diabetic nephropathy) 260.40 (Diabetespolyneurit, diabetic polyneuropathy) 260.49 (Diabetesneuroopaati, diabetic neuropathy) 260.99 (Diabetes mellitus med flera komplicationer, diabetes mellitus with multiple complications) | 250.01 (Diabeteskatarakt, diabetic cataracts) 250.02 (Diabetesretinopati, diabetic retinopathy) 250.03 (Diabetes med andra ögonkomplicationer, diabetes mellitus with other eye complications) 250.04 (Diabetesnefropati, diabetic nephropathy) 250.05; (Diabetespolyneurit, diabetic polyneuropathy) | 250D (Diabetes med njurkomplication, diabetes with kidney complications) 250E (Diabetes med ögonkomplication, Diabetes with eye manifestations) 250F (Diabetes med neurologisk komplication, Diabetes with neurological manifestations) 250G (Diabetes med perifer cirkulationsrubningar, Diabetes with peripheral vascular disorders) | E10.2 (Insulinberoende diabetes med njurkomplicationer, Diabetes mellitus renal complications) E10.3 (Insulinberoende diabetes med ögonkomplicationer, Diabetes mellitus with eye complications) E10.4 (Insulinberoende diabetes med neurologiska komplicationer, Diabetes mellitus with neurological complications) E10.5 (Insulinberoende diabetes med perifera cirkulationsrubningar, Diabetes mellitus with peripheral vascular complications) E10.7 (Insulinberoende diabetes med flera komplicationer, Diabetes mellitus with multiple complications) (AND (other forms of diabetes with same End-stage organ damage)) E1.2.111.7 E1.2.212.7 E1.3.213.7 E1.4.214.7 |
| ICD-7 up to 1968 | ICD-8 1969-1986 | ICD-9 1987-1996 | ICD-10 1997-  |
|-----------------|-----------------|-----------------|--------------|
| Moderate or severe kidney disease | 592 (Kronisk nefrit, chronic nephritis) 593 (Nefrit utan uppgift om akut eller kronisk fall, nephritis without information on whether it is chronic or acute) 792 (Uremi, uremia) | 582 (Kronisk nefrit med uremi, chronic nephritis with uremia) 583 (Nefrit, nephritis) 584 (Njurskleros, nephrosclerosis) 792 (Uremi, uremia) 593.0 (Njurorskadad skelettsjukdom, renal rikets) 403.99 (Essentiell hypertoni med njursjukdom, essential hypertension with kidney disease) 404.99 (Essentiell hypertoni med (Både) hjärt- och njursjukdom, essential hypertension with both heart and kidney disease) 792.99 (Uremi, uremia) Y29.01 (Dialys, dialysis) | 403A (Malign hypertoni med njursjukdom, malignant hypertensive kidney disease) 403B (Benign hypertoni med njursjukdom, Hypertensive kidney disease) 403X (Hypertoni, aspecificerad, med njursjukdom, Hypertensive kidney disease) 582 (Kronisk glomerulonefrit, chronic glomerulonephritis) 583 (Nefrit eller nephropati med påvisade anatomisk/patologiska förändringar, nephritis or nephropathy with confirmed anatomical or histopathological changes) 585 (Kronisk njursvikt, chronic kidney failure) 586 (Icke specificerad njursvikt, unspecified kidney failure) 588A (Renal osteodystrof, Renal osteodystrophy) V42A (Njursvikt motverkade, kidney transplantation) V45B (Hjälp belastningsfördjupade njursvikt, Kidney dialysis) V56 (Eftervård med återkommande dialys, Aftercare involving intermittent dialysis) | N03.2-N03.7 (Kronisk glomerulonefrit – ej minimal change eller fokal, Chronic glomerulonephritis – not minimal change or focal) N05.2-N05.7 (Icke-specificerad glomerulonefrit – ej minimal change eller fokal, Unspecified glomerulonephritis – not minimal change or focal) N11 (Kronisk pyelonefrit, chronic pyelonephritis) N18 (Kronisk njursvikt, Chronic kidney failure) N19 (Njursvikt, ide specificerad som akut eller kronisk, Unspecified kidney failure) N25.0 (Renal osteodystrof orsakade av nedarbetad funktion i njurutboli, Renal osteodystrophy resulting from impaired renal tubular function) N12.0 (Hypertensiiv njursjukdom med njursvikt, Hypertensive kidney disease with kidney failure) N13.1 (Hypertensiiv hjärt- och njursjukdom med njursvikt, Hypertensive heart and kidney disease with kidney failure) Q61.1-Q61.4 (Autosomal polyzystisk njursjukdom, autosomal polycystic kidney disease) Z49 (Förberedande vår för dialys/ Extrakorporal D/Annan D Preparatory care for dialysis, Extracorporeal/Other dialysis) Z94.0 (Njursvikt motverkade, kidney transplantation) Z99.2 (Beroende av njursvikt, need for kidney dialysis) |

(Continued)
| ICD-9 | 1977–1978 | ICD-8 | 1977–1986 | ICD-7 | 1969–1986 | ICD-7 | up to 1988 | Table 1 (Continued). |
|-------|-----------|-------|-----------|-------|-----------|-------|-----------|---------------------|
| 567.4 | [Liver cancer] | 567.8 | [Liver cancer] | 567.8 | [Liver cancer] | 567.8 | [Liver cancer] | 567.8 | [Liver cancer] |
| 567.9 | [Other malignant neoplasms of liver] | 567.9 | [Other malignant neoplasms of liver] | 567.9 | [Other malignant neoplasms of liver] | 567.9 | [Other malignant neoplasms of liver] | 567.9 | [Other malignant neoplasms of liver] |
| 571 | (Liver cirrhosis) | 571.5 | [Liver cirrhosis] | 571.5 | [Liver cirrhosis] | 571.5 | [Liver cirrhosis] | 571.5 | [Liver cirrhosis] |
| 571.6 | [Liver cirrhosis, alcoholic] | 571.6 | [Liver cirrhosis, alcoholic] | 571.6 | [Liver cirrhosis, alcoholic] | 571.6 | [Liver cirrhosis, alcoholic] | 571.6 | [Liver cirrhosis, alcoholic] |
| 571.7 | [Liver cirrhosis, other causes] | 571.7 | [Liver cirrhosis, other causes] | 571.7 | [Liver cirrhosis, other causes] | 571.7 | [Liver cirrhosis, other causes] | 571.7 | [Liver cirrhosis, other causes] |
| 573 | (Liver cancer) | 573.0 | [Malignant neoplasms of liver] | 573.0 | [Malignant neoplasms of liver] | 573.0 | [Malignant neoplasms of liver] | 573.0 | [Malignant neoplasms of liver] |
| 573.1 | [Other malignant neoplasms of liver] | 573.1 | [Other malignant neoplasms of liver] | 573.1 | [Other malignant neoplasms of liver] | 573.1 | [Other malignant neoplasms of liver] | 573.1 | [Other malignant neoplasms of liver] |
| 573.9 | [Other malignant neoplasms of liver] | 573.9 | [Other malignant neoplasms of liver] | 573.9 | [Other malignant neoplasms of liver] | 573.9 | [Other malignant neoplasms of liver] | 573.9 | [Other malignant neoplasms of liver] |
| 575 | (Liver cirrhosis) | 575.5 | [Liver cirrhosis] | 575.5 | [Liver cirrhosis] | 575.5 | [Liver cirrhosis] | 575.5 | [Liver cirrhosis] |
| 575.6 | [Liver cirrhosis, alcoholic] | 575.6 | [Liver cirrhosis, alcoholic] | 575.6 | [Liver cirrhosis, alcoholic] | 575.6 | [Liver cirrhosis, alcoholic] | 575.6 | [Liver cirrhosis, alcoholic] |
| 575.7 | [Liver cirrhosis, other causes] | 575.7 | [Liver cirrhosis, other causes] | 575.7 | [Liver cirrhosis, other causes] | 575.7 | [Liver cirrhosis, other causes] | 575.7 | [Liver cirrhosis, other causes] |
| 577 | (Liver cancer) | 577.0 | [Malignant neoplasms of liver] | 577.0 | [Malignant neoplasms of liver] | 577.0 | [Malignant neoplasms of liver] | 577.0 | [Malignant neoplasms of liver] |
| 577.1 | [Other malignant neoplasms of liver] | 577.1 | [Other malignant neoplasms of liver] | 577.1 | [Other malignant neoplasms of liver] | 577.1 | [Other malignant neoplasms of liver] | 577.1 | [Other malignant neoplasms of liver] |
| 577.9 | [Other malignant neoplasms of liver] | 577.9 | [Other malignant neoplasms of liver] | 577.9 | [Other malignant neoplasms of liver] | 577.9 | [Other malignant neoplasms of liver] | 577.9 | [Other malignant neoplasms of liver] |

**Table 1** (Continued).

Moderation or severe liver disease

- **ICD-9**: Liver disease specified by location, hepatic encephalopathy
- **ICD-8**: Liver disease specified by location, hepatic encephalopathy
- **ICD-7**: Liver disease specified by location, hepatic encephalopathy

**Svenska**

Tabell 1 (Fortfarande).

Moderation eller stortvetydighet i leverns sjukdom

- **ICD-9**: Leversjukdom, specificerad av plats, Hepatisk encefalopati
- **ICD-8**: Leversjukdom, specificerad av plats, Hepatisk encefalopati
- **ICD-7**: Leversjukdom, specificerad av plats, Hepatisk encefalopati

**English**

Table 1 (Continued).

Moderation or severe liver disease

- **ICD-9**: Liver disease specified by location, hepatic encephalopathy
- **ICD-8**: Liver disease specified by location, hepatic encephalopathy
- **ICD-7**: Liver disease specified by location, hepatic encephalopathy
| ICD-7 up to 1968 | ICD-8 1969-1986 | ICD-9 1987-1996 | ICD-10 1997-2013 |
|------------------|------------------|------------------|-----------------|
| Any malignancy, including leukemia and lymphoma* | 140-204, not 191 | 140-209, not 173, 175-179 or 208 | 140-208 |
| (Tumör på läpp, neoplasm of the lip) | 140 (Malign tumör på läpp, malignant neoplasm of the lip) | 140 (Malign tumör i läpp, Malignant neoplasm of the lip) | 140 (Malign tumör i läpp, Malignant neoplasm of the lip) |
| (Tumör på tungan, neoplasm of the tongue) | 141 (Malign tumör på tungan, malignant neoplasm of the tongue) | 141 (Malign tumör i tungan, Malignant neoplasm of the tongue) | 141 (Malign tumör i tungan, Malignant neoplasm of the tongue) |
| (Tumör på öronspottskörtel, malignant neoplasm of the parotid gland) | 142 (Malign tumör i spottkörtel, malignant neoplasm of the parotid gland) | 142 (Malign tumör i de stora spottkörtlame, Malignant neoplasm of the major salivary glands) | 142 (Malign tumör i de stora spottkörtlame, Malignant neoplasm of the major salivary glands) |
| (Tumör i munbotten, malignant neoplasm of the mouth floor) | 143 (Malign tumör i tandkörtet, malignant neoplasm of the gums) | 143 (Malign tumör i tandkörtet, Malignant neoplasm of the gums) | 143 (Malign tumör i tandkörtet, Malignant neoplasm of the gums) |
| (Tumör i munnen, malignant neoplasm of the mouth) | 144 (Malign tumör i munbotten, malignant neoplasm of the floor of mouth) | 144 (Malign tumör i munbotten, Malignant neoplasm of the floor of mouth) | 144 (Malign tumör i munbotten, Malignant neoplasm of the floor of mouth) |
| (Tumör i tonsill, malignant neoplasm of the tonsil) | 145 (Malign tumör i munnens, andra delar eller UNS, malignant neoplasm of the mouth, other parts) | 145 (Malign tumör i annan och icke specificerad del av munhålan, Malignant neoplasm of other and unspecified parts of mouth) | 145 (Malign tumör i annan och icke specificerad del av munhålan, Malignant neoplasm of other and unspecified parts of mouth) |
| (Tumör i nasofarynx, malignant neoplasm of the nasopharynx) | 146 (Malign tumör i mellansvalget, malignant neoplasm of the oropharynx) | 146 (Malign tumör i orofarynx, Malignant neoplasm of the oropharynx) | 146 (Malign tumör i orofarynx, Malignant neoplasm of the oropharynx) |
| (Tumör i hypofarynx, malignant neoplasm of the hypopharynx) | 147 (Malign tumör i nässvalgrummet, malignant neoplasm of the nasopharynx) | 147 (Malign tumör i rinofarynx, Malignant neoplasm of the nasopharynx) | 147 (Malign tumör i rinofarynx, Malignant neoplasm of the nasopharynx) |
| (Tumör i farynx, malignant neoplasm of the pharynx) | 148 (Malign tumör i svalget bakom struphuvudet, Malignant neoplasm of the pharynx behind the larynx) | 148 (Malign tumör i hypofarynx, Malignant neoplasm of the hypopharynx) | 148 (Malign tumör i hypofarynx, Malignant neoplasm of the hypopharynx) |
| (Tumör i oesofagus, malignant neoplasm of the oesophagus) | 149 (Malign tumör i svalget UNS, malignant neoplasm of the pharynx) | 149 (Malign tumör i annan och ofullständig angiven lokalisation i läpp, munhåla och svalg, Malignant neoplasm of other and ill-defined sites within the lip, oral cavity and pharynx) | 149 (Malign tumör i annan och ofullständig angiven lokalisation i läpp, munhåla och svalg, Malignant neoplasm of other and ill-defined sites within the lip, oral cavity and pharynx) |
| (Tumör i ventrikel, malignant neoplasm of the stomach) | 150 (Malign tumör i magstruppen, Malignant neoplasm of the oesophagus) | 150 (Malign tumör i magstruppen, Malignant neoplasm of the oesophagus) | 150 (Malign tumör i magstruppen, Malignant neoplasm of the oesophagus) |
| (Duodenal tumör, malignant neoplasm of the small intestine, including the duodenum) | 151 (Malign tumör i magstruppen, Malignant neoplasm of the oesophagus) | 151 (Malign tumör i magstruppen, Malignant neoplasm of the oesophagus) | 151 (Malign tumör i magstruppen, Malignant neoplasm of the oesophagus) |
| (Tumör i tyckten, malignant neoplasm of the large intestine) | 152 (Malign tumör i tunnstrump, inklusive tolvfingertarmen, Malignant neoplasm of the small intestine, including the duodenum) | 152 (Malign tumör i tunnstrump, inklusive tolvfingertarmen, Malignant neoplasm of the small intestine, including the duodenum) | 152 (Malign tumör i tunnstrump, inklusive tolvfingertarmen, Malignant neoplasm of the small intestine, including the duodenum) |
| (Tumör i riktum, malignant neoplasm of the rectum) | 153 (Malign tumör i grovstrumpen, inklusive ändtarmen, malignant neoplasm of large intestine, excluding the rectum) | 153 (Malign tumör i grovstrumpen, inklusive ändtarmen, malignant neoplasm of large intestine, excluding the rectum) | 153 (Malign tumör i grovstrumpen, inklusive ändtarmen, malignant neoplasm of large intestine, excluding the rectum) |

*Continued*
Table 1 (Continued).

| ICD-7 | ICD-8 | ICD-9 | ICD-10 |
|-------|-------|-------|--------|
|       | Up to 1968 | 1969–1986 | 1987–1996 | 1997– |
| 155 (Tumör i lever, malignant neoplasm of the liver) | 154 (Malignant tumour in liver and gallbladder, Malignant neoplasm of the liver) | 153 (Malignant tumour in large intestine, Malignant neoplasm of the large intestine) | C14 (Malignant tumour with one or more of the following anatomical sites: liver, gallbladder or other parts of the bile ducts) |
| 157 (Tumör i pancreas, malignant neoplasm of the pancreas) | 155 (Primary malignant tumour in pancreas and portal vein) | 154 (Malignant tumour in portal vein and hepatic vein, Malignant neoplasm of the liver and intrahepatic bile ducts) | C15 (Malignant tumour in stomach, Malignant neoplasm of the stomach) |
| 158 (Tumör i peritoneum, malignant neoplasm of the peritoneum) | 156 (Malignant tumour in gallbladder and biliary tract) | 155 (Malignant tumour in gallbladder and biliary tract) | C16 (Malignant tumour in pancreas, Malignant neoplasm of the pancreas) |
| 159 (Tumör i digestionsorganen, malignant neoplasm of the digestive organ) | 157 (Malignant tumour in gastric and duodenal mucosa) | 156 (Malignant tumour in gallbladder and extrahepatic bile ducts) | C17 (Malignant tumour in small intestine, Malignant neoplasm of the small intestine) |
| 160 (Tumör i näshall, malignant neoplasm of the nasal cavity) | 158 (Malignant tumour in buccal cavity) | 157 (Malignant tumour in buccal cavity) | C18 (Malignant tumour in large intestine, Malignant neoplasm of the large intestine) |
| 161 (Tumör i larynx, malignant neoplasm of the larynx) | 159 (Malignant tumour in digestive organ, Malignant neoplasm of the digestive organ) | 158 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) | C19 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) |
| 162 (Tumör i trakea, malignant neoplasm of the trachea) | 160 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) | 159 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) | C20 (Malignant tumour in anatomical site, Malignant neoplasm of the respiratory system) |
| 163 (Tumör i lunga, malignant neoplasm of the lung) | 161 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) | 160 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) | C21 (Malignant tumour in other respiratory organs, Malignant neoplasm of the respiratory system) |
| 164 (Tumör i mediastinum, malignant neoplasm of the mediastinum) | 162 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) | 161 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) | C22 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) |
| 170 (Tumör i bronr, malignant neoplasm of the bronchus) | 163 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) | 162 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) | C23 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) |
| 171 (Tumör i uterus, malignant neoplasm of the uterus) | 164 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) | 163 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) | C24 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) |
| 172 (Tumör i corpus uteri, Malignant neoplasm of the corpus uteri) | 165 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) | 164 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) | C25 (Malignant tumour in respiratory system, Malignant neoplasm of the respiratory system) |
| No. | Swedish Description |
|-----|---------------------|
| 173 | Tumör i annan del av uterus, malignant neoplasm of other part of uterus |
| 174 | Tumör i uterus, malignant neoplasm of the uterus |
| 175 | Tumör i ovarium, malignant neoplasm of the ovary |
| 176 | Tumör i vula, malignant neoplasm of the vula |
| 177 | Tumör i prostatas, malignant neoplasm of the prostate |
| 178 | Tumör i testikel, malignant neoplasm of the testicle |
| 179 | Tumör i manliga genitalorganen, malignant neoplasm of the male genital organ |
| 180 | Tumör i njure, malignant neoplasm of the kidney |
| 181 | Tumör i urinblåsan, malignant neoplasm of the bladder |
| 190 | (Melanoma på läpp, melanoma on lip) |
| 192 | (Ogontumör; malignant neoplasm of the eye) |
| 193 | (Hjärtmutör, malignant neoplasm of the brain) |
| 194 | Tumör i sköldkörteln, malignant neoplasm of the thyroid |
| 195 | Tumör i benjuren, malignant neoplasm of the adrenal gland |
| 196 | Tumör i skullens och ansiktets ben, malignant neoplasm of the skull and facial bones |
| 172 | (Malign melanom i huden, Malignant melanoma of the skin) |
| 174 | (Malign tumör i bröstkörteln, Malignant neoplasm of the mammary gland) |
| 180 | (Malign tumör i urogenitalorganen, Malignant neoplasm of the urogenital organs) |
| 181 | (Chorioepitheliom, chorioepithelioma) |
| 182 | (Malign tumör i uterus med annan lokalisation, Malignant neoplasm of the uterus with other location) |
| 183 | (Malign tumör i ovarium, äggledare och breda ligamentet, Malignant neoplasm of the ovary, fallopian tubes and broad ligament) |
| 184 | (Malign tumör i kvinnliga genitalorganen, annan lokalisation eller UNS, Malignant neoplasm of the female genital organs, other location) |
| 185 | (Malign tumör i prostatas, Malignant neoplasm of the prostate) |
| 186 | (Malign tumör i testikel, Malignant neoplasm of the testicle) |
| 187 | (Malign tumör i annat manligt genitalorgan eller UNS, Malignant neoplasm of other male genital organ) |
| 188 | (Malign tumör i urinblåsan, Malignant neoplasm of the bladder) |
| 189 | (Malign tumör i andra och icke specificerade urinorgan, Malignant neoplasm of other and unspecified urinary organs) |
| 190 | (Malign tumör på öga, Malignant neoplasm of the eye) |
| 191 | (Malign hjärtmutör, Malignant neoplasm of the heart) |
| 192 | (Malign tumör på andra stallen inom nervsystemet, Malignant tumour elsewhere in the nervous system) |
| 193 | (Malign tumör i genomgående och andra med livmodern sammanhängande organ, Malignant neoplasm of the ovary and other uterine adnexa) |
| 194 | (Malign tumör på andra stallen inom nervsystemet, Malignant tumour elsewhere in the nervous system) |
| 195 | (Malign tumör i prostatas (Blishalskörteln), Malignant neoplasm of the prostate) |
| 196 | (Malign tumör i testikel, Malignant neoplasm of the testis) |
| 165 | (Malign tumör med andra och ofullständigt angivna lokalisationer i andningsorganen och brösthälsans organ, Malignant neoplasm of other and ill-defined sites within the respiratory system and intrathoracic organs) |
| 170 | (Malign tumör i ben och ledbrok, Malignant neoplasm of the bone and articular cartilage) |
| 171 | (Malign tumör i bindväv och annan mjukvävnad, Malignant neoplasm of connective and other soft tissue) |
| 172 | (Malign melanom (pigmentsvulst) i huden, Malignant melanoma of skin) |
| 173 | (Andra maligna tumörer i huden, Other malignant neoplasm of the skin) |
| 174 | (Malign tumör i kunnlig bröstkörtel, Malignant neoplasm of the female breast) |
| 175 | (Malign tumör i manlig bröstkörtel, Malignant neoplasm of the male breast) |
| 179 | (Malign tumör i livmodern med icke specificerad lokalisation, Malignant neoplasm of the uterus, part unspecified) |
| 180 | (Malign tumör i livmoderhalsen, Malignant neoplasm of the cervix uteri) |
| 181 | (Malign tumör i modernkulan, Malignant neoplasm of the placenta) |
| 182 | (Malign tumör i livmoderkroppen, Malignant neoplasm of the body of the uterus) |
| 183 | (Malign tumör i äggspocket och andra med livmodern sammanhängande organ, Malignant neoplasm of the ovary and other uterine adnexa) |
| 184 | (Malign tumör i andra och icke specificerade kvinnliga könsorgan, Malignant neoplasm of other and unspecified female genital organs) |
| 185 | (Malign tumör i prostatas (Blishalskörteln), Malignant neoplasm of the prostate) |
| 186 | (Malign tumör i testikel, Malignant neoplasm of the testis) |

(Continued)
Table 1 (Continued).

| ICD-7 Up to 1968 | ICD-8 1969–1986 | ICD-9 1997–1996 | ICD-10 1997–2000 |
|------------------|------------------|-----------------|-----------------|
| 197 (Tumör på hals, neoplasm of the neck) | 193 (Malign tumör i sköldkörteln, Malignant neoplasm of the thyroid gland) | 187 (Malign tumör i penis och andra manliga könssubsträden, Malignant neoplasm of the penis and other male genital organs) | C46 (Kaposi's sarcoma, Kaposi's sarcoma) |
| 200 (Retikelloidtumör, reticulosiscarcoma) | 194 (Malign tumör i andra endokrina körtärl, Malignant neoplasm of other endocrine glands) | 188 (Malign tumör i urinblåsan, Malignant neoplasm of the bladder) | C47 (Malign tumör i periphere nervor och autonome nervsystem, Malignant neoplasm of the peripheral nerves and autonomic nervous system) |
| 201 (Lymphogranulomatos, lymphogranulomatis) | 195 (Tumör på ofullständigt angivet ställe, Tumor in incompletely specified place) | 189 (Malign tumör i njuare samt andra och icke specifiserade urinorgan, Malignant neoplasm of the kidney and other and unspecified urinary organs) | C48 (Malign tumör i bukhinnan och retroperitonealmasset (avymmet bakom bukhinnan), Malignant neoplasm of the retroperitoneum and peritoneum) |
| 202 (Follikulärt lymphom, follicular lymphoma) | 200 (Tumörer i lymphatisk och blodbildande vävnad, Tumors in lymphatic and blood-forming tissue) | 190 (Malign tumör i öga, Malignant neoplasm of the eye) | C49 (Malign tumör i anna bindväv och muskulärvävnad, Malignant neoplasm of other connective and soft tissue) |
| 203 (Multipelt myelom, multiple myeloma) | 201 (Malign lymphogranulomatos, Malignant lymphogranulomatis) | 191 (Malign tumör i hjärtan, Malignant neoplasm of the heart) | C50 (Malign tumör i bröstkörteln, Malignant neoplasm of the breast) |
| 204 (Akut lymphatisk leukemi, acute lymphatic leukemia) | 202 (Andra tumörer i lymphatisk vävnad, Other tumors in lymphatic tissue) | 192 (Malign tumör i andra och icke specifiserade delar av nervsystemet, Malignant neoplasm of other and unspecified parts of nervous system) | C51 (Malign tumör i vulva, Malignant neoplasm of the vulva) |
| 203 (Multipelt myelom, multiple myeloma) | 204 (Lymphatisk leukemi, Lymphatic leukemia) | 193 (Malign tumör i tyreoidea (sköldkörteln), Malignant neoplasm of the thyroid gland) | C52 (Malign tumör i vagina, Malignant neoplasm of the vagina) |
| 204 (Lymphatisk leukemi, Lymphatic leukemia) | 205 (Myeloisk leukemi, Myeloid leukemia) | 194 (Malign tumör i andra endokrina körtärl och dårmed) | C53 (Malign tumör i livmoderhalsen, Malignant neoplasm of the cervix uteri) |
| 205 (Myeloisk leukemi, Myeloid leukemia) | 206 (Monocytkleukemi, monocytic leukemia) | 195 (Malign tumör med annan och ofullständigt angiven lokalisation, Malignant neoplasm of other and ill-defined sites) | C54 (Malign tumör i livmoderkroppen, Malignant neoplasm of the corpus uteri) |
| 206 (Monocytkleukemi, monocytic leukemia) | 207 (Annan leukemi och UNS, Other leukemia) | 196 (Malign tumör med annan och icke specifiserade lokalisationer, Malignant neoplasm of other and unspecified sites) | C55 (Malign tumör i livmoder i endometrium, Malignant neoplasm of the uterus, part unspecified) |
| 207 (Annan leukemi och UNS, Other leukemia) | 209 (Myelofibros, myelofibrosis) | 197 (Malign tumör med annan och icke angiven lokalisation, Malignant neoplasm of other and unspecified sites) | C56 (Malign tumör i äggmässig, Malignant neoplasm of the ovary) |
| 208 (Myelofibros, myelofibrosis) | 209 (Myelofibros, myelofibrosis) | 198 (Malign tumör i livmoder i endometrium, Malignant neoplasm of the uterus, part unspecified) | C57 (Malign tumör i andra och icke specifiserade kvinnoriga könssubsträden, Malignant neoplasm of other and unspecified female genital organs) |
| 209 (Myelofibros, myelofibrosis) | 202 (Annal malign tumör i lymphoid och histiocytisk vävnad, Other malignant neoplasm of the lymphoid and histiocytic tissue) | 199 (Malign tumör i andra och icke specifiserade kvinnliga könssubsträden, Malignant neoplasm of other and unspecified female genital organs) | C58 (Malign tumör i moderhalsen, Malignant neoplasm of the placenta) |
| 203 (Multipelt myelom och immunoproliktativa tumörer, Multiple myeloma and immunoproliferative neoplasms) | 203 (Multipelt myelom och immunoproliktativa tumörer, Multiple myeloma and immunoproliferative neoplasms) | 200 (Non-Hodgkin-lymfom, non-hodgkin lymphoma) | C60 (Malign tumör i penis, Malignant neoplasm of the penis) |
| 204 (Multipelt myelom och immunoproliktativa tumörer, Multiple myeloma and immunoproliferative neoplasms) | 205 (Myeloisk leukemi, Myeloid leukemia) | 201 (Hodgkin-sjukdom, Hodgkin lymphoma) | C61 (Malign tumör i prostata, Malignant neoplasm of the prostate) |
| Code | Description |
|------|-------------|
| 204 | Lymphatisk leukemi, Lymphoid leukaemia |
| 205 | Myeloisk leukemi, Myeloid leukaemia |
| 206 | Monocytleukemi, Monocytic leukaemia |
| 207 | Annan specificerad leukemi, Other specified leukaemia |
| 208 | Leukaemia med icke specificerad celltyp, Leukaemia of unspecified cell type |
| C62 | Malign tumör i testikel, Malignant neoplasm of the testicle |
| C63 | Malign tumör i andra och icke specificerade manliga könsorgan, Malignant neoplasm of other and unspecified male genital organs |
| C64 | Malign tumör i njure med undantag för njurbäcken, Malignant neoplasm of the kidney, except renal pelvis |
| C65 | Malign tumör i njurbäcken, Malignant neoplasm of the renal pelvis |
| C66 | Malign tumör i uretär (urinledare), Malignant neoplasm of the ureter |
| C67 | Malign tumör i urinblåsan, Malignant neoplasm of the bladder |
| C68 | Malign tumör i andra och icke specificerade urinorgan, Malignant neoplasm of other and unspecified urinary organs |
| C69 | Malign tumör i ögorna och närliggande vävnader, Malignant neoplasm of the eye and adnexa |
| C70 | Malign tumör i centrala nervsystemets hinnor, Malignant neoplasm of the meninges |
| C71 | Malign tumör i hjärnan, Malignant neoplasm of the brain |
| C72 | Malign tumör i ryggmärgen, kranialnerver och andra delar av centrala nervsystemet, Malignant neoplasm of the spinal cord, cranial nerves and other parts of the central nervous system |
| C73 | Malign tumör i thyroidea, Malignant neoplasm of the thyroid gland |
| C74 | Malign tumör i binjure, Malignant neoplasm of the adrenal gland |
| C75 | Malign tumör i andra endokrina körtlar och därmed besläktade vävnader, Malignant neoplasm of the other endocrine glands and related structures |
| C76 | Malign tumör med annan och ofullständigt angiven lokalisation, Malignant neoplasm of other and ill-defined sites |
| C81 | Hodgkins sjukdom, Hodgkin lymphoma |
| C82 | Follikulärt non-Hodgkin-lymfom (B-cell), Follicular (nodular) non-Hodgkin lymphoma |
| Table I (Continued). |
|----------------------|
|                  | ICD-7 | ICD-8           | ICD-9 | ICD-10               |
|                  | Up to 1968 | 1969–1986       | 1987–1996 | 1997–2017 |
| Metastatic cancer | 156.91 (Tumor i lever, malignant neoplasm of the liver) | 196 (Malign tumors i lymfkörtlar, sekundär eller UNS, Malignant neoplasm of the lymph nodes, secondary) | 196 (Sekundär och icke specifiserad malign tumor i lymfkörtlarna, Secondary and unspecified malignant neoplasm of the lymph nodes) | C77 (Sekundär malign tumor (metastas) och icke specifiserad malign tumor i lymfkörtlarna, Secondary and unspecified malignant neoplasm of the lymph nodes) |
|                  | 198 (Tumor i huvudets, ansiktes och halsens lymfkörtlar, malignant neoplasm of the head, face and neck lymph nodes) | 198 (Annan sekundär malign tumor, other secondary malignant tumor) | 198 (Sekundär malign tumor i ändningsorganen och mesatmätningsorganen, Secondary malignant neoplasm of the respiratory and digestive organs) | C78 (Sekundär malign tumor (metastas) i ändningsorganen och mesatmätningsorganen, Secondary malignant neoplasm of the respiratory and digestive organs) |
|                  | 199 (Tumor på annat ställe, Malignant neoplasm in other location) | 198 (Malign tumor på icke angivet ställe, Malignant tumor at unspecified location) | 198 (Sekundär malign tumor med andra specificerade lokalisationer, Secondary malignant neoplasm of other specified sites) | C79 (Sekundär malign tumor (metastas) med andra lokalisationer, Secondary malignant neoplasm of other sites) |
|                  |       | 199A (Malign tumor utan specificerad lokalisation, Malignant neoplasm without specification of site) | 199B (Annan lokalisation, other localization) | C80 (Malign tumor utan specificerad lokalisation, Malignant neoplasm without specification of site) |
| ICD-7 up to 1968 | ICD-8 1969–1986 | ICD-9 1987–1996 | ICD-10 1997–2013 |
|----------------|----------------|----------------|------------------|
| HIV/AIDS       | not applicable | not applicable | 079 (Sjukdom orsakad av HTLV-III virus, disease caused by the HTLV-III virus) |
|                |                |                | 279K (Human immunodeficiency virus (HIV) disease) |
|                |                |                | 820 (Sjukdom orsakad av human immunobristvirus (HIV) tillsammans med infektions- och parasitsjukdom, Human immunodeficiency virus (HIV) disease resulting in infectious and parasitic disease) |
|                |                |                | 821 (Sjukdom orsakad av human immunobristvirus (HIV) tillsammans med maligna tumörer, Human immunodeficiency virus (HIV) disease resulting in malignant neoplasms) |
|                |                |                | 822 (Sjukdom orsakad av human immunobristvirus (HIV) tillsammans med andra specificerade sjukdomar, Human immunodeficiency virus (HIV) disease resulting in other specified diseases) |
|                |                |                | 823 (Sjukdom orsakad av human immunobristvirus (HIV) tillsammans med andra tillstånd, Human immunodeficiency virus (HIV) disease resulting in other conditions) |
|                |                |                | 824 (Idé specificerad sjukdom orsakad av human immunobristvirus (HIV), Unspecified human immunodeficiency virus (HIV) disease) |
|                |                |                | F02.4 (Demens vid sjukdom orsakad av human immunobristvirus (HIV), HIV dementia) |
|                |                |                | C98.7 (HIV som komplicerande faktor hos gravid kvinna, HIV as complicating factor in pregnant woman) |
|                |                |                | R75 (Positive HIV test, positive HIV test) |
|                |                |                | Z11.4 (Kläckad hälsokontroll avseende human immunobristvirus (HIV), Health check-up for HIV) |
|                |                |                | Z21.9 (Asymptomatisk infection med human immunobristvirus (HIV), asymptomatic HIV infection) |
|                |                |                | Z71.1 (Rådgivning vid HIV, Human immunodeficiency virus (HIV) counseling) |

Notes: UNS (Swedish: utan närmare specifikation; English: unspecified). *Does not include non-melanoma skin cancer.
Results
Four coding lists were compared and a new collective list was created (Table 1). Besides adding ICD-7 codes for several conditions, we also list ICD-9 codes with letters rather than digits (Table 1). Below we review the addition and removal of codes based on the above expert review.

Organ-Specific Comments
Myocardial Infarction
We added ICD-8 codes 412.01 and 412.91, representing post-infarction syndrome with and without hypertension. These post-infarction codes mean the diagnosis occurred several weeks earlier, leaving no exact date of diagnosis. Other ICD-8 codes, beginning with 412, were not included in our classification because they represent heart atherosclerosis with no infarction.

Heart Failure
We chose not to include cardiomyopathy caused by Chagas disease because of its rarity in Sweden; nor did we include restrictive cardiomyopathy and non-specific rheumatoid heart disease as these conditions rarely cause heart failure. Finally, we chose not to include neonatal heart failure in that the relevance of this for adult heart function is unclear (and the CCI is usually used in studies of adults). The code P29.0 for neonatal heart failure was otherwise included in Quan’s enhanced ICD-10, but no corresponding code was listed for Quan’s enhanced ICD-9.11 We excluded ICD-8 code 782.40 as it suggests acute (transient) disease rather than the usual heart failure and is typically part of cardiogenic shock. Also, ICD-9 code 414X was omitted as it is not specific enough to qualify as heart failure.

Peripheral Vascular Disease
Neither did we specifically include cerebral aneurysm since it was already included among the cerebrovascular diseases in our classification. Quan et al11 include the ICD-9 code 47.1. This is probably a typo and this code was therefore excluded.

Cerebrovascular Disease
We chose not to include H34 (retinal occlusion). While this condition has similar treatment recommendations to stroke, it is not regarded as stroke in Sweden (as defined by the Swedish Stroke Quality Register18). We omitted ICD-10 code I65 given that this code (occlusion and stenosis of pre-cerebral arteries) is not conditional on stroke, but should only be used post-transient ischemic attack (TIA) when carotid stenosis is discovered. Hence, these patients are likely to be discovered through relevant ICD codes for TIA. Moreover, we did not include ICD-10 code I66, given that it is not equal to cerebral infarction. I68 and G46 are only used as secondary diagnoses when other stroke ICD codes have already been used and were thus not included.

Chronic Obstructive Pulmonary Disease (COPD)
We added ICD-7 code 501 (unspecific bronchitis), but only listed ICD-10 codes J41-J42 under “other chronic pulmonary diseases” to minimize duplication.

Other Chronic Pulmonary Diseases (Including Pneumoconiosis and Chronic Respiratory Conditions Due to Fumes and Vapors)
Here, we added the ICD-7 code for asthma (241), but also extended the ICD-7-codes to include not only 523–524 (pneumoconiosis) but also 523–526 (other interstitial lung disorders and bronchiectasis). Similarly, we added the ICD-8-code for bronchiectasis (518).

We did not include pulmonary heart disease because the pathogenesis of this disease is cardiovascular (ICD-9: 416). We chose to include all ICD-9 codes beginning with 506 and 508 (506, respiratory conditions due to fumes and vapors; 508, respiratory conditions due to non-specified external causes), instead of the 506E/508E codes, which are limited to chronic conditions (and similarly for ICD-10 codes J68 and J70).

Rheumatic Disease
We chose not to include myalgia and fibrositis (ICD-7: 726.3) for lack of specificity, or non-specific rheumatic disease (ICD-7: 727) but included 456.0–456.3 (ICD-7) for systemic lupus erythematosus (SLE) and various less common rheumatic disorders.

Chronic interstitial lung disease was moved to the chapter “Other chronic pulmonary diseases”. We did not include dermatomyositis that was secondary to cancer (ICD-10: M36.0). Osteoarthritis (ICD-10-codes M15-M19 and equivalent) was not included either.

Dementia
We added vascular dementia from ICD7-10. We did not include dementia secondary to brain tumor (ICD-7: 308) as such conditions should be coded in the cancer chapter. Nor did we include transient dementia due to brain infections (ICD-9: 309) or ICD-8 codes 293.0–1 since they do not represent vascular dementia.
Diabetes
We included different diabetes types, including diabetes with emergency complications that did not automatically cause end-stage kidney disease. We also included diabetes with coma in this category rather than in diabetes with end-organ damage in that coma does not necessarily indicate end-stage organ damage.

Diabetes with End-Organ Damage
We restricted ICD codes to complications. Moreover, “only diabetes” (eg, ICD-7 code 260.09) or “unspecified diabetes” (ICD-8 code 250.00) was not included in the end-organ damage category. Of note is that not all diabetic complications lead to end-stage organ damage. For that reason, our list does not include emergency complications (eg, diabetic ketoacidosis or diabetes with hypoglycemia), even if life-threatening. Nor did we include E10.8-E14.8 (position x.8) as they represent non-specified complications and it is not clear whether such complications are acute or chronic and to what extent they involve end-stage organ damage.

Liver Disease
We included viral hepatitis (independently of chronicity) and autoimmune hepatitis in mild liver disease but did not include other chronic liver diseases as the original CCI only lists “hepatitis”; nor did we include the following liver diseases among moderate or severe liver diseases: other sequelae of chronic liver disease (ICD-9: 572W), or gastric varices (ICD-10: I86.4). ICD codes for cirrhosis without portal hypertension were also defined as mild liver disease (as well as cirrhosis when portal hypertension was not mentioned). When an ICD code for mild liver disease was coded with a code for ascites, we suggest that the patient is reclassified as having moderate or severe liver disease. Additional codes for moderate or severe liver disease encompassed specific codes associated with portal hypertension.

Hemiplegia
The original CCI only included hemiplegia/hemiparesis and not the conditions affecting symmetrical parts (paraplegia/paraparesis) or the whole body (tetraplegia/tetraparesis). In their enhanced ICD-9 and ICD-10 algorithm, Quan et al chose to incorporate these conditions and, therefore, we also included their ICD codes. In addition, we decided to include all subcategories of cerebral palsy as many patients have mixed forms and the choice of a subcategory is not always correct. We excluded cauda equina syndrome and paralysis unspecified as these conditions include diseases with different etiology and degree and nature of disability.

Moderate or Severe Kidney Disease
We chose not to include kidney hyperplasia (ICD-7 code 603) or kidney cysts (ICD-8 code 593.21) because these conditions alone do not necessarily represent moderate or severe kidney disease. We included the ICD-9 code 583 (nephritis). This code does not specify whether the condition is acute or chronic (which is no requirement in the CCI) but requires that anatomical or histopathological changes in the kidney have been confirmed. In contrast, pyelonephritis was not regarded as moderate or severe kidney disease.

Any Malignancy Including Leukemia and Lymphoma
The cancer code list is long and can be summarized with some notable exceptions (Table 1). For instance, Sweden never used codes 175–179 in ICD-8 or C87 in ICD-10. We omitted non-melanoma skin cancer from the Swedish CCI. Finally, the ICD-10 code C86 was added, which represents aggressive T-cell lymphoma.

Cancer Metastases
We assumed that the ICD-9 199 and the ICD-10 C80 codes mostly represent metastatic disease; hence, they were included in our list.

HIV/AIDS
Sweden did not use ICD-9 codes 042–044 to record HIV/AIDS (personal communication, Swedish National Board of Health and Welfare, April 28, 2020). While B23.2 is the most commonly used ICD-10 code for HIV/AIDS, Swedish physicians have also used less common codes to record HIV/AIDS, including having a positive HIV test, encounter for screening for HIV and HIV complicating pregnancy (Table 1).

Scripts in R, SAS and STATA corresponding to the ICD codes in Table 1 can be accessed through Github.com.

Discussion
This paper reviewed four versions of the CCI to create a cohesive Swedish CCI system, spanning ICD-7 to ICD-10 versions.

To make our algorithm more cohesive we both added (eg, asthma) and omitted codes (eg, restrictive cardiomyopathy) to better correlate Swedish coding with the original
Charlson/Quan index.11 Our review efforts also found that over time a number of incorrect ICD codes had been added to various coding lists, including osteoarthritis, which should not be part of the CCI.

We aimed to avoid duplication to reduce the risk of overestimation of comorbidity and inflation of the scoring index. To achieve this result, we listed diabetic nephropathy under “diabetes with end-organ damage” and not under moderate or severe kidney disease. Some may consider this a biological view of comorbidity rather than reflecting the burden of disease. Yet, this way of classifying conditions is most consistent with other versions of the CCI in which the same ICD code should not occur in several disease categories.

While not incorporated into our revised CCI, drugs can also be used to ascertain comorbidity. For instance, ATC codes N06DA02, N06DA04 and N06DX01 are sometimes applied to identify Alzheimer’s disease and A10 diabetes. In Sweden, prescription data (but not hospital-administered drugs) are available through the Swedish Prescribed Drug Register since July 2005.19

Our intent was not to compare different comorbidity indices given the wealth of papers that have already done so.20–24 Neither did we attempt to validate any codes.

We chose to widen “hemiplegia” to “paresis/plegia” because of the similarities concerning both etiologies and degree of disability. Even though the term paresis refers to weakness and the term plegia to a loss of all voluntary movements, the terms are used interchangeably. Cerebral palsy is often referred to as paresis but also plegia. Severe hemiplegia may lead to a higher degree of disability than mild tetraplegia.

Finally, coding is not the only issue when using the CCI or other comorbidity scores. It is also a matter of timing. While most chronic disorders persist throughout life, some do not (eg, cancer may be cured). Researchers will have to consider this aspect.

This paper has some limitations. First, we did not evaluate the predictive value of our suggested CCI, because that is beyond the scope of this paper. However, we hope our work to create an updated more cohesive and useful index, will inspire other researchers to make similar revisions of their own national coding systems, and we encourage future research into the predictive gains of the new index.

Second, while all 16 co-authors were invited to comment on the complete algorithm, different experts can have different understanding of the codes, and we cannot rule out that a choice of more/other experts could have impacted on our selection of codes.

In conclusion, this extensive work may provide a cohesive coding algorithm for CCI to be used in Swedish settings.

Abbreviations
CCI, Charlson comorbidity index; ICD, International Classification of Disease.

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https://github.com/bjoroeKI/Charlson-comorbidity-index-revisited

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