Multi-morbidity and frailty at death: a classification of death records for an aging world

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With increased life expectancy that, to a large extent, is due to better survival to cardiovascular diseases, cancers and other chronic conditions, an ever-growing population is living with several diseases, a situation referred as multi-morbidity. Multi-morbid patients represent a major challenge for health systems and for caregivers. Interactions between diseases may aggravate the patient's situation and makes clinical care more complex, while polypharmacy increases the risk for adverse drug events and non-adherence to treatments. Epidemiologic studies have demonstrated that these patients are at higher risk of dying (Salive 2013). As a consequence, mortality analysis needs to extend to the monitoring of multi-morbidity at death. In this presentation, we present a new classification of death records based on all causes reported on death certificates. Our aim is to summarize this information according to two criteria: multi-morbidity and frailty, which is another symptom of aging populations.

The aim of the medical part of the death certificate is not to capture all the diseases or conditions the person was suffering from. But the idea that some diseases or conditions may contribute to the death process without causing it, is not absent from the WHO recommended death certificate. Table 1 displays the content of seven death records taken from the Italian cause-of-death database. Cases #1 and #2 illustrate the simple situation where one single morbid process is described in part I[1]. In the first case, the underlying cause is a neoplasm, and the additional information in part I allows identifying a metastatic process. In the second case, a cerebrovascular disease (underlying cause) probably caused both dementia and immobility, resulting in decubitus ulcer and pressure area (bedsores). In both cases, additional information is provided in part II (diabetes and hypertension for case #1 and no less than six diseases, including Parkinson's disease for case #2)[2]. These two death records can thus be categorized as lethal processes involving multi-morbidity. This is also true for case #3 (single causal process resulting from a hypertensive disease in part I and several unrelated diseases in part II). It is worth noting that in that case, Alzheimer's disease is mentioned on part II while it is mentioned on part I in the next case, together with a primary and a secondary neoplasm. Case #4 is typical for a situation where the physicians did not report one single process in part I. In case #5, the underlying cause of the death (chronic obstructive pulmonary disease) is taken from part II (no well-defined condition on part I). As another unrelated disease (alcoholic cirrhosis of liver) is mentioned on part II, this death record can also be categorized as a lethal process involving

[1] On part I that is designed to elicit the underlying cause of death, the certifying physician reports the morbid process that directly led to death, from the initial cause that started the sequence to the immediate cause of the death

[2] Part II is for "any other significant condition that unfavorably influenced the course of the morbid process but is not related to the condition directly causing death"

Table 1: Content of seven death certificates taken from the Italian cause-of-death database

#	Age group	Underlying cause (ICD-10 code)	All causes on the certificate (ICD-10 code and corresponding disease/condition)		Part of the certificate
1	50-54	C55	I469	Cardiac arrest, unspecified	I
			J969	Respiratory failure, unspecified	I
			C780	Secondary malignant neoplasm of lung	I
			C55	**Malignant neoplasm of uterus, part unspecified**	I
			E149	Unspecified diabetes mellitus: Without complications	II
			I10	Essential (primary) hypertension	II
2	90-94	I678	R64	Cachexia	I
			R263	Immobility	I
			L89	Decubitus ulcer and pressure area	I
			I678	**Other specified cerebrovascular diseases**	I
			F03	Unspecified dementia	I
			E149	Unspecified diabetes mellitus: Without complications	II
			N189	Chronic kidney disease, unspecified	II
			I515	Myocardial degeneration	II
			G20	Parkinson's disease	II
			E039	Hypothyroidism, unspecified	II
			E669	Obesity, unspecified	II
3	85-89	I119	J81	Pulmonary oedema	I
			I272	Other secondary pulmonary hypertension	I
			I119	**Hypertensive heart disease without (congestive) heart**	I
			I10	Essential (primary) hypertension	I
			G309	Alzheimer's disease, unspecified	II
			I48	Atrial fibrillation and flutter	II
			I050	Mitral stenosis	II
4	60-64	C189	I469	Cardiac arrest, unspecified	I
			K729	Hepatic failure, unspecified	I
			C787	Secondary malignant neoplasm of liver and intrahepatic bile duct	I
			C189	**Malignant neoplasm: Colon, unspecified**	I
			G309	Alzheimer's disease, unspecified	I
5	65-69	J449	J969	Respiratory failure, unspecified	I
			J449	**Chronic obstructive pulmonary disease, unspecified**	II
			K703	Alcoholic cirrhosis of liver	II
6	60-64	I080 (Disorders of both mitral and aortic valves)	N179	Acute renal failure, unspecified	I
			I509	Heart failure, unspecified	I
			R064	Hyperventilation	I
			I091	Rheumatic diseases of endocardium, valve unspecified	I
			I060	Rheumatic aortic stenosis	I
			I051	Rheumatic mitral insufficiency	I
			I48	Atrial fibrillation and flutter	II
7	95-99	F03	R64	Cachexia	I
			R418	Other and unspecified symptoms and signs involving cognitive functions and awareness	I
			F99	Mental disorder, not otherwise specified	I
			E86	Volume depletion	I
			F03	**Unspecified dementia**	I
			R263	Immobility	II
			I509	Heart failure, unspecified	II

The cause on the death certificate that is selected as the underlying cause is in bold.
Source: ISTAT mortality database

multi-morbidity. Case #6 illustrates the particular case where the selected underlying cause is none of the causes mentioned on the death certificate. The corresponding code (I080) synthetized the information contained in two entries on the death certificate (I060 and I051). Lastly, the last record (case #7) concerns a person who died over the age of 95. In the absence of any other severe disease, unspecified dementia has been selected as the underlying cause of the death. This record includes codes that signal several "losses": mobility loss (R263), weight loss (R64), loss in the metabolic equilibrium (E86) and losses in cognitive functions (R418). With other symptoms like weakness and fatigue, they belong to the so-called syndrome of frailty. Frailty is defined as "a state of high vulnerability for diverse health outcomes", including mortality (Fried et al. 2004). But there is no agreement on an operational definition of this concept (De Vries et al. 2011; Rodriguez-Mañas et al. 2013). In the last decades, increased life expectancy has been associated with rising prevalence of frailty, which represents a major challenge for caregivers and for health systems. For that reason, we decided to incorporate this dimension in our classification. We will discuss later in the paper the issue of the quality of the reporting of frailty on death certificates.

These few examples show both the amount of information that is lost when the underlying cause of death only is considered, and the complexity of the categorization of death records according to the criteria of comorbidity. The most difficult task consists in distinguishing between single processes and multiple processes described on part I. At first, it seems that only an expert physician scrutinizing every case could make a decision (a decision that, of course, would be arbitrary to some extent). We will explain now how we were able to develop decision rules that account for these complex situations and to automate them in a SAS program that can be applied to all deaths of a given country.

Data and method

Data

In this study, data are for Italy (excluding the province of Bolzano that has incomplete data on multiple causes of death) and for year 2014. They are produced by the Italian National Vital Statistics Death Registry on causes of death, managed by the Italian National Institute of Statistics (ISTAT). In line with WHO recommendations, the Italian death certificate comprises two parts. According to the instructions given to fill the certificate, part I is for "the sequence of morbid conditions, lesions or poisoning that lead directly to death. When there is more than one sequence, choose the most relevant." The introductory sentence on part II is as follows: "Other significant morbid conditions – Report any other disease or morbid conditions or injuries, excluded from the sequence reported in part 1, but contributing to death."

There is no restriction in the number of causes coded and recorded in the database. Causes of death are automatically coded under the 10th Revision of the International Classification of Diseases (ICD-10) with the Micar-ACME system (2009 version) (WHO 2016). Micar is the module operating the multiple cause coding while ACME performs the selection of the UC. As our classification aims at capturing two features of old-age mortality, analysis is restricted to deaths at age 50 and over, which represent 96.5% of all deaths in Italy in 2014.

Method

We developed a classification of deaths based on the following criteria:

1) Type of causal process reported in part I. We distinguish three subcategories:

- single causal process, defined as the presence in part I of one single cause or a collection of causes that can be considered dependent from one another or that are all dependent from a single cause. Codes referring to frailty or to ill-defined conditions are not considered.

- several causal processes defined as the presence in part I of at least two different causes that are not dependent from each other. Codes referring to frailty or to ill-defined conditions are not considered.

- ill-defined process defined as the absence of causes in part I or the presence of only ill-defined conditions or frailty codes.

2) Presence of contributing causes in Part II. Codes referring to frailty or to ill-defined conditions are not considered.

3) Mention of frailty anywhere on the death certificate. The list of codes indicating frailty we have used (see appendix) derives from that developed by Soong et al. (2015). Out of the nine groups of frailty syndromes in this study, we kept the followings: dementia and other symptoms and signs involving cognitive functions and awareness, functional dependence, mobility problems, decubitus ulcer and pressure area, and senility. We excluded four groups of codes (anxiety and depression, delirium, falls and fractures, and incontinence), and we added codes corresponding to malaise and fatigue (R53) and to malnutrition (R64, E40, E46). In our study, Alzheimer's disease (G30) has a specific status. Contrary to Soong et al., it is included in the frailty list since it is a dementia. However, for the application of the two aforementioned criteria, it is considered as any other well-defined cause. As an example, a death certificate mentioning Alzheimer's disease on part I, will be classified as a single causal process involving frailty.

While the two last criteria could be easily automated, the identification of the type of morbid process in part I resulted quite complex. To put it simply, the program aims at counting the number of independent causes present in part I, which allows distinguishing between certificates with one single process in part I and certificates with several processes in part I. In a preliminary step, the program eliminates all ICD-10 codes referring to frailty or to ill-defined conditions. Then the program analyzes the relations between the remaining ICD codes reported in part I. For that purpose, we used the decision tables embedded in the Iris automated mortality coding system (2018 edition) [3]. Iris is another widely used software for cause-of-death coding and for the selection of the UC according to the provisions of ICD. The decision tables identify

[3] The decision tables are maintained by the Iris Institute -http://www.iris-institute.orga - (Navarra S. et al , 2016) on the basis of the recommendations of groups of international experts, namely the Mortality Reference Group, which operates in the network of the WHO Collaborating Centers for the Family of International Classifications - https://www.who.int/classifications/committees/mrg/en/ -(WHO-FIC) . Information about the coding rule types for mortality coding with Iris are available at : https://www.dimdi.de/dynamic/.downloads/iris-institute/manuals/information-about-coding-rule-types-for-mortality.pdf

various types of relationship between pairs of causes and list the corresponding ICD codes. Among all possible relations included in these tables, we used the following ones: Obvious consequence, Specificity[4] and Linkage[5]. For our purpose, the most important relation is the first one: it corresponds to the situation where a cause can be considered obviously caused by another cause reported on the death certificate. As an example, in case #2 of table 1, decubitus ulcer (L89) mentioned in part I of the death certificate is considered according to the Iris decision tables an obvious consequence of cerebrovascular disorder (I678) also mentioned in part I.

In our study we used these relations for determining if codes can be considered related to one another. Hence, the program verifies if all the possible pairs of codes in part I of a given certificate can be considered as related to one another according to the three aforementioned relations, and it deletes the codes that are considered dependent from another one. In the last step, the similarity of the remaining codes is evaluated using a grouping list called "homogeneity list" (see in the appendix), and codes belonging to the same block of codes are considered as identical. So this last step of the procedure produces conservative estimates in terms of the proportion of death certificates with several causal processes. Finally, the program counts the number of independent codes present in part I.

Results

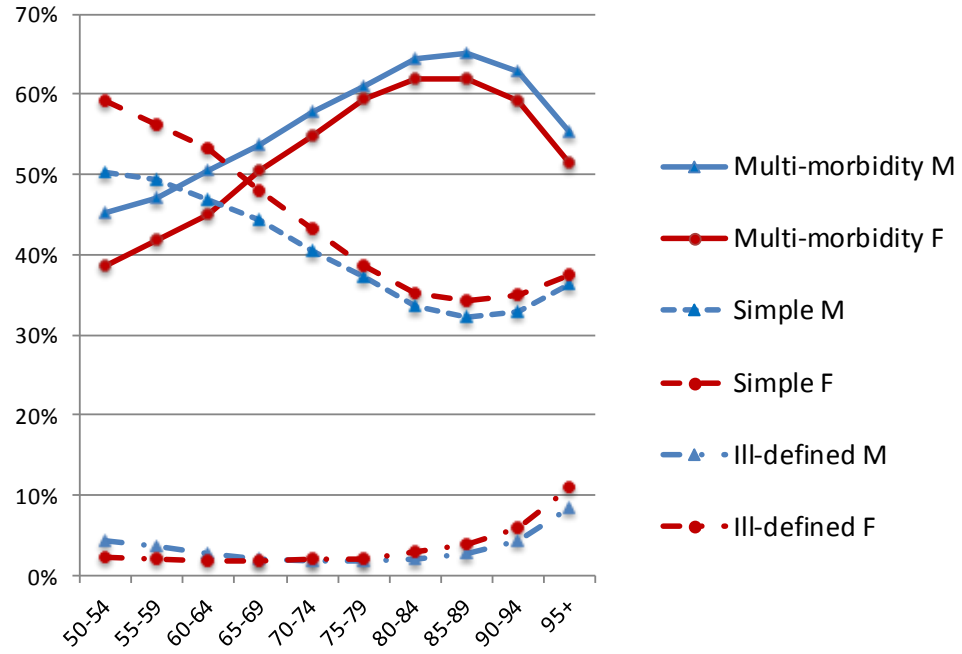
Based on the methodology presented before, we classified the deaths occurred in Italy over the age of 50 in 2014, according to three main types of morbid process:

- Simple morbid process: single causal process in part I without contributing causes;
- Multi-morbid process: single causal process in part I with contributing causes OR several causal processes in part I with or without contributing causes OR ill-defined process in part I with contributing causes;
- lll-defined process: ill-defined process in part I without contributing causes.

Simple morbid processes outnumber other processes at younger ages until 65 years for women (55 for men) when multi-morbid processes take over, reaching a maximum between 80 and 89 years when they cause more than 60% of deaths (Figure 1). After that, the prevalence of multi-morbid processes decreases while both ill-defined and simple processes increase. Multi-morbid processes represent more than 40% of deaths, even at younger ages. It is worth noting that, although simple processes show the expected downward trend with age, their share in total deaths remains rather high causing still more than one in three deaths over the age of 80, when it is minimal. Men and women share similar patterns with higher proportions of multi-morbid processes at all ages among men and ill-defined processes over 80 years among women.

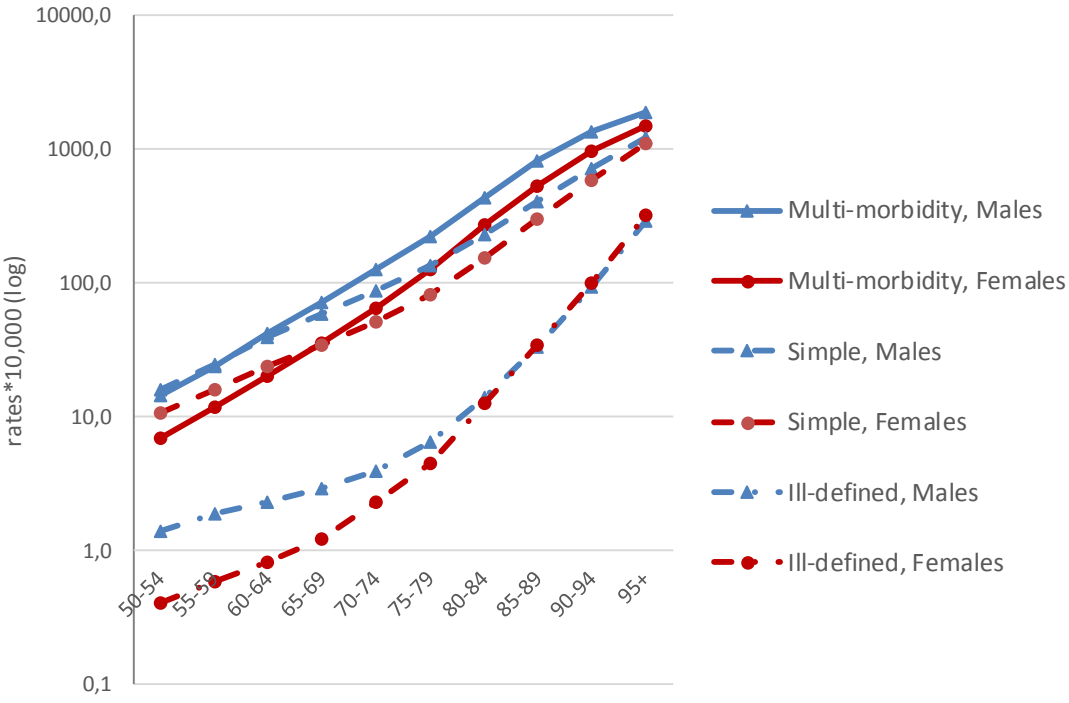
[4] Situation where a cause is considered as belonging to the same nosological group as another cause also present on the death certificate but is less specific.
5 Situation where two causes can be summarized in one ICD code.

Figure 1. Males (M) and females (F) deaths according to the three main morbid processes and by gender and age group (% of all deaths). Deaths over the age of 50, Italy, 2014.



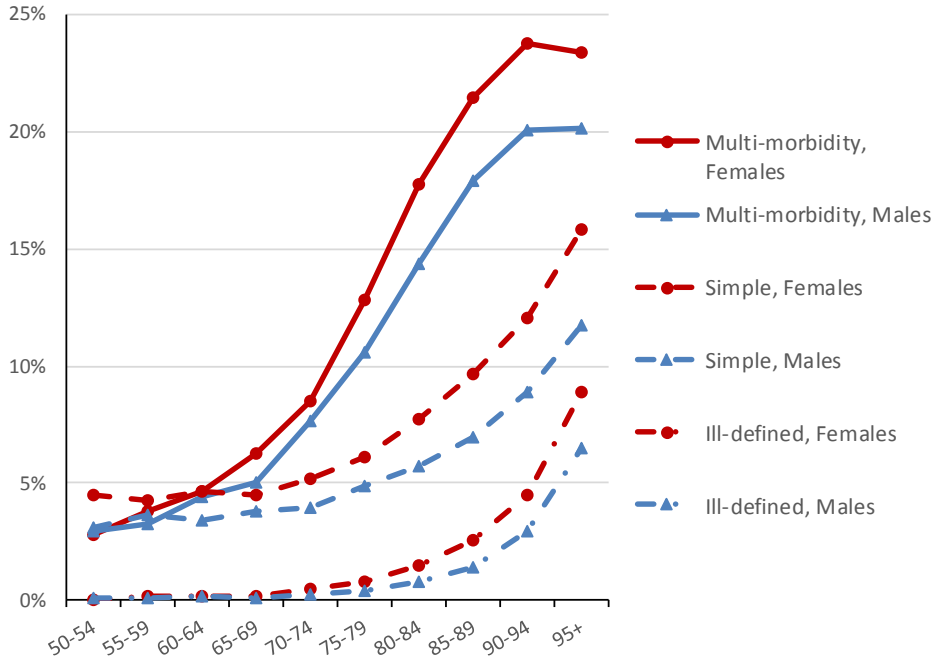
Source: ISTAT mortality database

Figure 2. Mortality rates (per 10,000) by type of morbid process, gender and age group. Deaths over the age of 50, Italy, 2014.



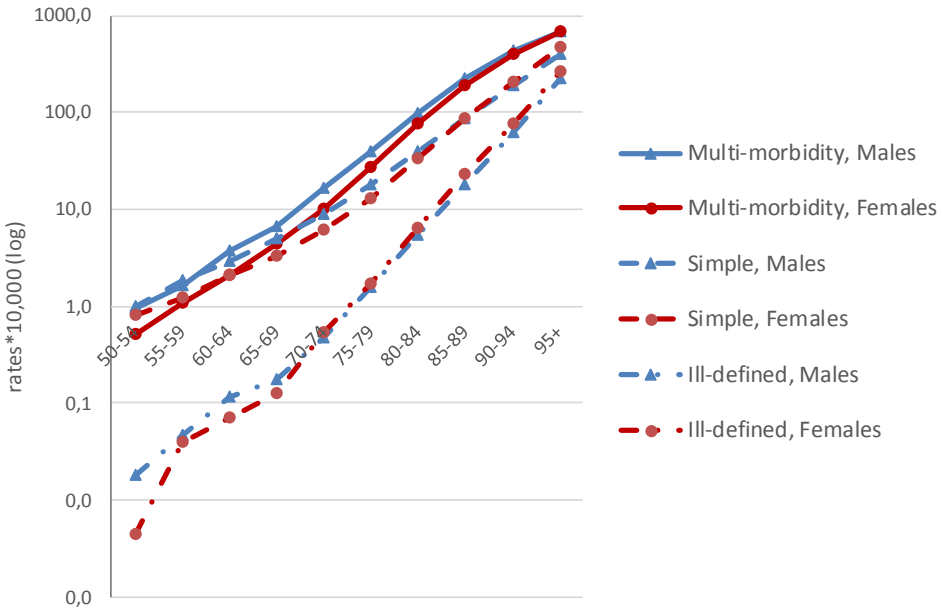
Source: ISTAT mortality database

Figure 3: Deaths involving frailty by type of morbid process, gender and age group (% of all deaths). Deaths over the age of 50, Italy, 2014.



Source: ISTAT mortality database

Figure 4: Mortality rates (per 10,000) for processes involving frailty, by type of morbid process, gender and age group. Deaths over the age of 50, Italy, 2014.



Source: ISTAT mortality database

When rates are considered, mortality is higher for men than for women at all ages for simple and multi-morbid processes (Figure 2). Excess mortality for males is more pronounced at younger ages, especially for multi-morbid processes. It reduces with age but over the age of 95 male mortality is still 25% higher for multi-morbid processes and 11% for simple ones. At old ages levels of mortality for the ill-defined processes are quite similar for males and females, with even a slight female excess mortality over the age of 85, contrasting with a large male excess mortality for these processes below age 70.

Our classification also allows evaluating the contribution of frailty to death processes. Not surprisingly, the share of deaths mentioning frailty increases with age. At 50-59, frailty concerns 7 % of all deaths, and this proportion reaches 46% over the age of 95. The age shape is the same for men and women: at all ages female deaths exhibit higher prevalence of frailty, varying from 7% at 50-54 to 48% over 95 versus 6% to 38% respectively for males. Figure 3 displays the contribution of frailty according to the three main types of morbid processes and according to age. As expected, the proportion of deaths with frailty increases with age for all processes while remaining always less frequent than the same process without frailty, except for ill-defined processes over 85 when deaths with mention of frailty exceed those without frailty. It is also worth emphasizing the rapid increase of the proportion of deaths with frailty starting at quite young ages, particularly among multi-morbid processes. At very old ages, deaths due to multi-morbid processes with frailty become as frequent as those due to simple processes without frailty and only slightly less frequent than those due to multi-morbid processes without frailty. Comparing genders, the proportion of deaths with frailty is always higher for women whatever the morbid process. When rates are considered, differences between genders are very small, especially at oldest ages where levels of mortality with frailty are the same or even lower for men than for women (Figure 4).

References

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APPENDIX

Frailty codes

	ICD-10 Code
Cachexia and protein-energy malnutrition	R64, E40-E46
Dementia and other symptoms and signs involving cognitive functions and awareness	F00-F03, G30*, R41
Delirium and organic amnesic syndrome	F04, F05
Malaise and fatigue	R53
Senility	R54
Functional dependence and mobility problems	R26, R27, Z74
Decubitus ulcer and pressure area	L89

** Alzheimer's disease. Alzheimer's disease is considered in this study as a sign of frailly, like other dementias (F01-F03) but is accounted as other well-defined causes for the determination of the morbid process.*

Ill-defined codes

	ICD-10 Code
Cardiac arrest	I46.-
Ventricular fibrillation and flutter	I49.0
Hypotension, unspecified	I95.9
Other and unspecified disorders of circulatory system	I99
Acute respiratory failure	J96.0
Respiratory failure, unspecified	J96.9
Respiratory failure of newborn	P28.5
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	R00-R99 except R26.-, R27.-, R41.-, R53, R54, R64
Factors influencing health status and contact with health service	Z00-Z99 except Z74.-

Homegeneity list

Chapter I Certain infectious and parasitic diseases (A00-B99)
A00-A09 Intestinal infectious diseases
A15-A19 Tuberculosis
A20-A28 Certain zoonotic bacterial diseases
A30-A49 Other bacterial diseases

A50-A64 Infections with a predominantly sexual mode of transmission
A65-A69 Other spirochaetal diseases
A70-A74 Other diseases caused by chlamydiae
A75-A79 Rickettsioses
A80-A89 Viral infections of the central nervous system
A90-A99 Arthropod-borne viral fevers and viral haemorrhagic fevers
B00-B09 Viral infections characterized by skin and mucous membrane lesions
B15-B19 Viral hepatitis
B20-B24 Human immunodeficiency virus [HIV] disease
B25-B34 Other viral diseases
B35-B49 Mycoses
B50-B64 Protozoal diseases
B65-B83 Helminthiases
B85-B89 Pediculosis, acariasis and other infestations
B90-B94 Sequelae of infectious and parasitic diseases
B95-B98 Bacterial, viral and other infectious agents
B99-B99 Other infectious diseases

Chapter II Neoplasms (C00-D48)
C00-C14 Malignant neoplasms of lip, oral cavity and pharynx
C15-C26 Malignant neoplasms of digestive organs
C30-C39 Malignant neoplasms of respiratory and intrathoracic organs
C40-C41 Malignant neoplasms of bone and articular cartilage
C43-C44 Melanoma and other malignant neoplasms of skin
C45-C49 Malignant neoplasms of mesothelial and soft tissue
C50-C50 Malignant neoplasm of breast
C51-C58 Malignant neoplasms of female genital organs
C60-C63 Malignant neoplasms of male genital organs
C64-C68 Malignant neoplasms of urinary tract
C69-C72 Malignant neoplasms of eye, brain and other parts of central nervous system
C73-C75 Malignant neoplasms of thyroid and other endocrine glands
C76-C80 Malignant neoplasms of ill-defined, secondary and unspecified sites
C81-C96 Malignant neoplasms, stated or presumed to be primary, of lymphoid, haematopoietic and related tissue
C97-C97 Malignant neoplasms of independent (primary) multiple sites
D00-D09 In situ neoplasms
D10-D36 Benign neoplasms
D37-D48 Neoplasms of uncertain or unknown behaviour

Chapter III Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50-D89)
D50-D53 Nutritional anaemias
D55-D59 Haemolytic anaemias
D60-D64 Aplastic and other anaemias
D65-D69 Coagulation defects, purpura and other haemorrhagic conditions
D70-D77 Other diseases of blood and blood-forming organs
D80-D89 Certain disorders involving the immune mechanism

Chapter IV Endocrine, nutritional and metabolic diseases (E00-E90 except E40-46)
E00-E07 Disorders of thyroid gland

E10-E14 Diabetes mellitus
E15-E16 Other disorders of glucose regulation and pancreatic internal secretion
E20-E35 Disorders of other endocrine glands
E50-E64 Other nutritional deficiencies
E65-E68 Obesity and other hyperalimentation
E70-E90 Metabolic disorders

Chapter V Mental and behavioural disorders (F00-F99 except F00-F03)
F05-F09
F10-F19 Mental and behavioural disorders due to psychoactive substance use
F20-F29 Schizophrenia, schizotypal and delusional disorders
F30-F39 Mood [affective] disorders
F40-F48 Neurotic, stress-related and somatoform disorders
F50-F59 Behavioural syndromes associated with physiological disturbances and physical factors
F60-F69 Disorders of adult personality and behaviour
F70-F79 Mental retardation
F80-F89 Disorders of psychological development
F90-F98 Behavioural and emotional disorders with onset usually occurring in childhood and adolescence
F99-F99 Unspecified mental disorder

Chapter VI Diseases of the nervous system (G00-G99)
G00-G09 Inflammatory diseases of the central nervous system
G10-G14 Systemic atrophies primarily affecting the central nervous system
G20-G26 Extrapyramidal and movement disorders
G30-G32 Other degenerative diseases of the nervous system
G35-G37 Demyelinating diseases of the central nervous system
G40-G47 Episodic and paroxysmal disorders
G50-G59 Nerve, nerve root and plexus disorders
G60-G64 Polyneuropathies and other disorders of the peripheral nervous system
G70-G73 Diseases of myoneural junction and muscle
G80-G83 Cerebral palsy and other paralytic syndromes
G90-G99 Other disorders of the nervous system

Chapter VII Diseases of the eye and adnexa (H00-H59)
H00-H06 Disorders of eyelid, lacrimal system and orbit
H10-H13 Disorders of conjunctiva
H15-H22 Disorders of sclera, cornea, iris and ciliary body
H25-H28 Disorders of lens
H30-H36 Disorders of choroid and retina
H40-H42 Glaucoma
H43-H45 Disorders of vitreous body and globe
H46-H48 Disorders of optic nerve and visual pathways
H49-H52 Disorders of ocular muscles, binocular movement, accommodation and refraction
H53-H54 Visual disturbances and blindness
H55-H59 Other disorders of eye and adnexa

Chapter VIII Diseases of the ear and mastoid process (H60-H95)
H60-H62 Diseases of external ear

H65-H75 Diseases of middle ear and mastoid
H80-H83 Diseases of inner ear
H90-H91 Deaf mutism and other hearing losses
H92-H99 Other disorders of ear

Chapter IX Diseases of the circulatory system (I00-I99 except I46, I49.0, I95.9, I99)
I00-I02 Acute rheumatic fever
I05-I09 Chronic rheumatic heart diseases
I10-I15 Hypertensive diseases
I20-I25 Ischaemic heart diseases
I26-I28 Pulmonary heart disease and diseases of pulmonary circulation
I30-I52 except I46, I49.0 Other forms of heart disease
I60-I69 Cerebrovascular diseases
I70-I79 Diseases of arteries, arterioles and capillaries
I80-I89 Diseases of veins, lymphatic vessels and lymph nodes, not elsewhere classified
I95-I98 except I95.9 Other and unspecified disorders of the circulatory system

Chapter X Diseases of the respiratory system (J00-J99 except J96.0, J96.9)
J00-J06 Acute upper respiratory infections
J09-J11 Influenza
J12-J18 Pneumonia
J20-J22 Other acute lower respiratory infections
J30-J39 Other diseases of upper respiratory tract
J40-J47 Chronic lower respiratory diseases
J60-J70 Lung diseases due to external agents
J80-J84 Other respiratory diseases principally affecting the interstitium
J85-J86 Suppurative and necrotic conditions of lower respiratory tract
J90-J94 Other diseases of pleura
J95-J99 except J96.0, J96.9 Other diseases of the respiratory system

Chapter XI Diseases of the digestive system (K00-K93)
K00-K14 Diseases of oral cavity, salivary glands and jaws
K20-K31 Diseases of oesophagus, stomach and duodenum
K35-K38 Diseases of appendix
K40-K46 Hernia
K50-K52 Noninfective enteritis and colitis
K55-K64 Other diseases of intestines
K65-K67 Diseases of peritoneum
K70-K77 Diseases of liver
K80-K87 Disorders of gallbladder, biliary tract and pancreas
K90-K93 Other diseases of the digestive system

Chapter XII Diseases of the skin and subcutaneous tissue (L00-L99 except L89)
L00-L08 Infections of the skin and subcutaneous tissue
L10-L14 Bullous disorders
L20-L30 Dermatitis and eczema
L40-L45 Papulosquamous disorders
L50-L54 Urticaria and erythema
L55-L59 Radiation-related disorders of the skin and subcutaneous tissue
L60-L75 Disorders of skin appendages

L80-L99 except L89 Other disorders of the skin and subcutaneous tissue

Chapter XIII Diseases of the musculoskeletal system and connective tissue (M00-M99)
M00-M25 Arthropathies
M30-M36 Systemic connective tissue disorders
M40-M54 Dorsopathies
M60-M79 Soft tissue disorders
M80-M94 Osteopathies and chondropathies
M95-M99 Other disorders of the musculoskeletal system and connective tissue

Chapter XIV Diseases of the genitourinary system (N00-N99)
N00-N08 Glomerular diseases
N10-N16 Renal tubulo-interstitial diseases
N17-N19 Renal failure
N20-N23 Urolithiasis
N25-N29 Other disorders of kidney and ureter
N30-N39 Other diseases of urinary system
N40-N51 Diseases of male genital organs
N60-N64 Disorders of breast
N70-N77 Inflammatory diseases of female pelvic organs
N80-N98 Noninflammatory disorders of female genital tract
N99-N99 Other disorders of the genitourinary system

Chapter XV Pregnancy, childbirth and the puerperium (O00-O99)
O00-O08 Pregnancy with abortive outcome
O10-O16 Oedema, proteinuria and hypertensive disorders in pregnancy, childbirth and the puerperium
O20-O29 Other maternal disorders predominantly related to pregnancy
O30-O48 Maternal care related to the fetus and amniotic cavity and possible delivery problems
O60-O75 Complications of labour and delivery
O80-O84 Delivery
O85-O92 Complications predominantly related to the puerperium
O94-O99 Other obstetric conditions, not elsewhere classified

Chapter XVI Certain conditions originating in the perinatal period (P00-P96 except P28.5)
P00-P04 Fetus and newborn affected by maternal factors and by complications of pregnancy, labour and delivery
P05-P08 Disorders related to length of gestation and fetal growth
P10-P15 Birth trauma
P20-P29 except P28.5 Respiratory and cardiovascular disorders specific to the perinatal period
P35-P39 Infections specific to the perinatal period
P50-P61 Haemorrhagic and haematological disorders of fetus and newborn
P70-P74 Transitory endocrine and metabolic disorders specific to fetus and newborn
P75-P78 Digestive system disorders of fetus and newborn
P80-P83 Conditions involving the integument and temperature regulation of fetus and newborn
P90-P96 Other disorders originating in the perinatal period

Chapter XVII Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)
Q00-Q07 Congenital malformations of the nervous system
Q10-Q18 Congenital malformations of eye, ear, face and neck
Q20-Q28 Congenital malformations of the circulatory system
Q30-Q34 Congenital malformations of the respiratory system
Q35-Q37 Cleft lip and cleft palate
Q38-Q45 Other congenital malformations of the digestive system
Q50-Q56 Congenital malformations of genital organs
Q60-Q64 Congenital malformations of the urinary system
Q65-Q79 Congenital malformations and deformations of the musculoskeletal system
Q80-Q89 Other congenital malformations
Q90-Q99 Chromosomal abnormalities, not elsewhere classified

Chapter XX External causes of morbidity and mortality (V01-Y98)
V01-V99 Transport accidents
W00-W19 Falls
W20-W49 Exposure to inanimate mechanical forces
W50-W64 Exposure to animate mechanical forces
W65-W74 Accidental drowning and submersion
W75-W84 Other accidental threats to breathing
W85-W99 Exposure to electric current, radiation and extreme ambient air temperature and pressure
X00-X09 Exposure to smoke, fire and flames
X10-X19 Contact with heat and hot substances
X20-X29 Contact with venomous animals and plants
X30-X39 Exposure to forces of nature
X40-X49 Accidental poisoning by and exposure to noxious substances
X50-X57 Overexertion, travel and privation
X58-X59 Accidental exposure to other and unspecified factors
X60-X84 Intentional self-harm
X85-Y09 Assault
Y10-Y34 Event of undetermined intent
Y35-Y36 Legal intervention and operations of war
Y40-Y84 Complications of medical and surgical care
Y85-Y89 Sequelae of external causes of morbidity and mortality
Y90-Y98 Supplementary factors related to causes of morbidity and mortality classified elsewhere