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Health Solutions

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*Transitioning to ICD-10:  
International Lessons Learned and Strategies for  
Moving Forward*

Manel Pladevall-Vila, MD, MS

The power of **knowledge.**  
The value of **understanding.**

# DISCLOSURE

RTI International, of which RTI Health Solutions is a business unit, is an independent nonprofit research organization that conducts work for government, public, and private organizations, including pharmaceutical companies.

# ICD-9 AND ICD-10 CODING SYSTEMS AND THEIR IMPACT WHEN CONDUCTING MULTICOUNTRY DATABASE STUDIES

# OUTLINE

- Different ICD-10 coding systems used in Europe and the United States (World Health Organization [WHO], ICD-10-CM, WHO European adaptations)
- Disease-specific examples where the different ICD-10 systems diverge
- Different coding mapping tools from the ICD-9 to the different ICD-10 systems
- Our research experience working in multidatabase studies in the US/Europe and how we deal with the different coding systems
- Conclusions

CM = Clinical Modification; ICD = International Classification of Diseases.

# Differences Between ICD-10 and ICD-10-CM

## ICD-10

- Developed by the WHO (1990)
- Less granularity (up to 16,000 codes)
- Used mainly in other countries, and there are several European adaptations
- ICD-10-AM in Australia (1998) and ICD-10-CA in Canada (2000)

## ICD-10-CM

- Developed by the US National Center for Health Statistics
- More granularity (70,000 codes, 155,000 with PCS):
  - Addition of 6th and 7th digit classification
  - Classification specific to laterality
- Used mainly in the US

AM = Australian Modification; CA = Canada; PCS = Procedure Coding System.

# Oesophageal Varices vs. Esophageal

ICD-10

VS.

ICD-10-CM

- |                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• I85.0 with bleeding</li> <li>• <b>I85.9</b> without bleeding</li> </ul> | <ul style="list-style-type: none"> <li>• <b>I85.0</b> E. varices             <ul style="list-style-type: none"> <li>– 0 w/o bleeding</li> <li>– 1 with bleeding</li> </ul> </li> <li>• <b>I85.1</b> secondary O. varices             <ul style="list-style-type: none"> <li>– 0 w/o bleeding</li> <li>– 1 with bleeding</li> </ul> </li> </ul> |
|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

# ICD-10 Adaptations Worldwide

|                                         | ICD-10                                  | ICD-10-CM                                                                              | ICD-10-AM                                              | ICD-10-CA                         | ICD-10-GM<br>(Formerly<br>ICD-10 SGB-V) | ICD-10-TM                                  |
|-----------------------------------------|-----------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------|-----------------------------------|-----------------------------------------|--------------------------------------------|
| Country                                 | WHO                                     | United States                                                                          | Australia                                              | Canada                            | Germany                                 | Thailand                                   |
| Year first released                     | 1989                                    | 1999, not used for morbidity coding yet                                                | 1998                                                   | 2001                              | 2000 (as ICD-10 SGB-V)                  | 2000                                       |
| No. revisions                           | Every year since 2000                   | 2 revisions: 2007, 2009                                                                | Every 2 years; 6 revisions so far (last in 2008)       | Every 3 years; 3 revisions so far | Every year since version 2004           | 2 (last in 2006)                           |
| Date of last revision                   | 2008                                    | 2009                                                                                   | 2007                                                   | 2009                              | 2010                                    | 2006                                       |
| Countries that are using it             | Most countries for mortality statistics | United States not yet implemented                                                      | Australia, New Zealand, Ireland, Romania, Saudi Arabia | Canada                            | Germany                                 | Thailand                                   |
| Total no. codes                         | 12,420                                  | 68,105 (refers to total no. valid codable codes)                                       | 16,308                                                 | 16,041                            | 13,315                                  | 36,586                                     |
| No. chapters                            | 21                                      | 21                                                                                     | 22                                                     | 23                                | 22                                      | 21 in first edition; 22 in second edition  |
| No. categories (3-digit codes)          | 2,036                                   | 270                                                                                    | 2,059                                                  | 2,067                             | 268                                     | 1 category more than ICD-10 second edition |
| No. subcategories (4-digit codes)       | 12,159; 6 optional (T08, T10, T12)      | 5,471                                                                                  | 10,341                                                 | 8,890                             | 7,982                                   | 12,082                                     |
| No. sub-classifications (5-digit codes) | 280 optional                            | 5,701                                                                                  | 6,404                                                  | 4,589                             | 5,065                                   | 24,249                                     |
| Intervention classification             | Yes (ICPM) but never updated            | Yes (ICD-10-PCS) not yet implemented but planned as a replacement to ICD-9-CM volume 3 | Yes (ACHI)                                             | Yes (CCI)                         | Yes (OPS)                               | Yes Vol. 3-4 of ICD-10-TM procedure codes  |

ACHI = Australian Classification of Health Interventions; CCI = Chronic Condition Indicator; GM = German Modification; ICPM = International Classification of Procedures in Medicine; OPS = German Procedural Classification; SGB-V = Social Law Book, Number Five; TM = Thai Modification.

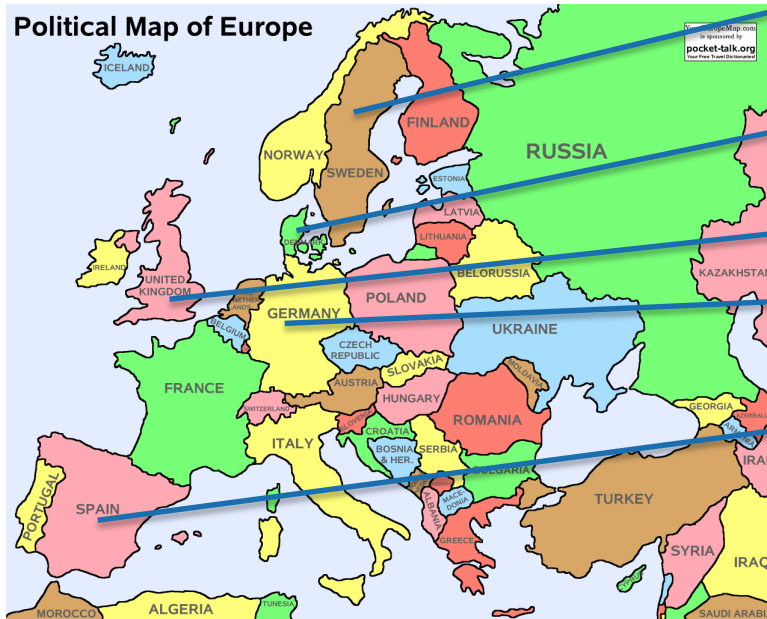
Source: Jette N, Quan H, Hemmelgarn B, Drosler S, Maass C, Moskal L, et al. The development, evolution, and modifications of ICD-10: challenges to the international comparability of morbidity data. *Med Care*. 2010;48(12):1105-10.

# Some of the Granularity of ICD-10-CM is Controversial

| Code    | Descriptor                                                                        |
|---------|-----------------------------------------------------------------------------------|
| W55.21  | Bitten by a cow                                                                   |
| W61.33  | Pecked by a chicken                                                               |
| V00.01  | Pedestrian on foot injured in collision with roller-skater                        |
| Y92.146 | Swimming pool of prison as the place of occurrence of the external cause          |
| Z63.1   | Problems in relationship with in-laws                                             |
| Y92.241 | Hurt at the library                                                               |
| Y92.253 | Hurt at the opera                                                                 |
| Y93.D1  | Accident while knitting or crocheting                                             |
| W56.22  | Struck by Orca, initial encounter                                                 |
| W56.32  | Struck by marine mammals                                                          |
| W56.11  | Bitten by sea lion                                                                |
| V91.07  | Burn due to water-skis on fire                                                    |
| V91.35  | Hit or struck by falling object due to accident by canoe or kayak                 |
| V94.810 | Civilian watercraft involved in water transport accident with military watercraft |
| W61.12  | Struck by macaw                                                                   |
| W61.01  | Bitten by parrot                                                                  |
| V97.33  | Sucked into jet engine                                                            |
| X52     | Prolonged stay in weightless environment                                          |
| V96.00  | Unspecific balloon accident injuring occupant                                     |
| V95.40  | Unspecific spacecraft accident injuring occupant                                  |



# Some ICD-10 Coding Adaptations in Europe



ICD-10-SE (WHO based)

ICD-10-SKS (WHO adaptation)

ICD-10 (WHO 5th edition)

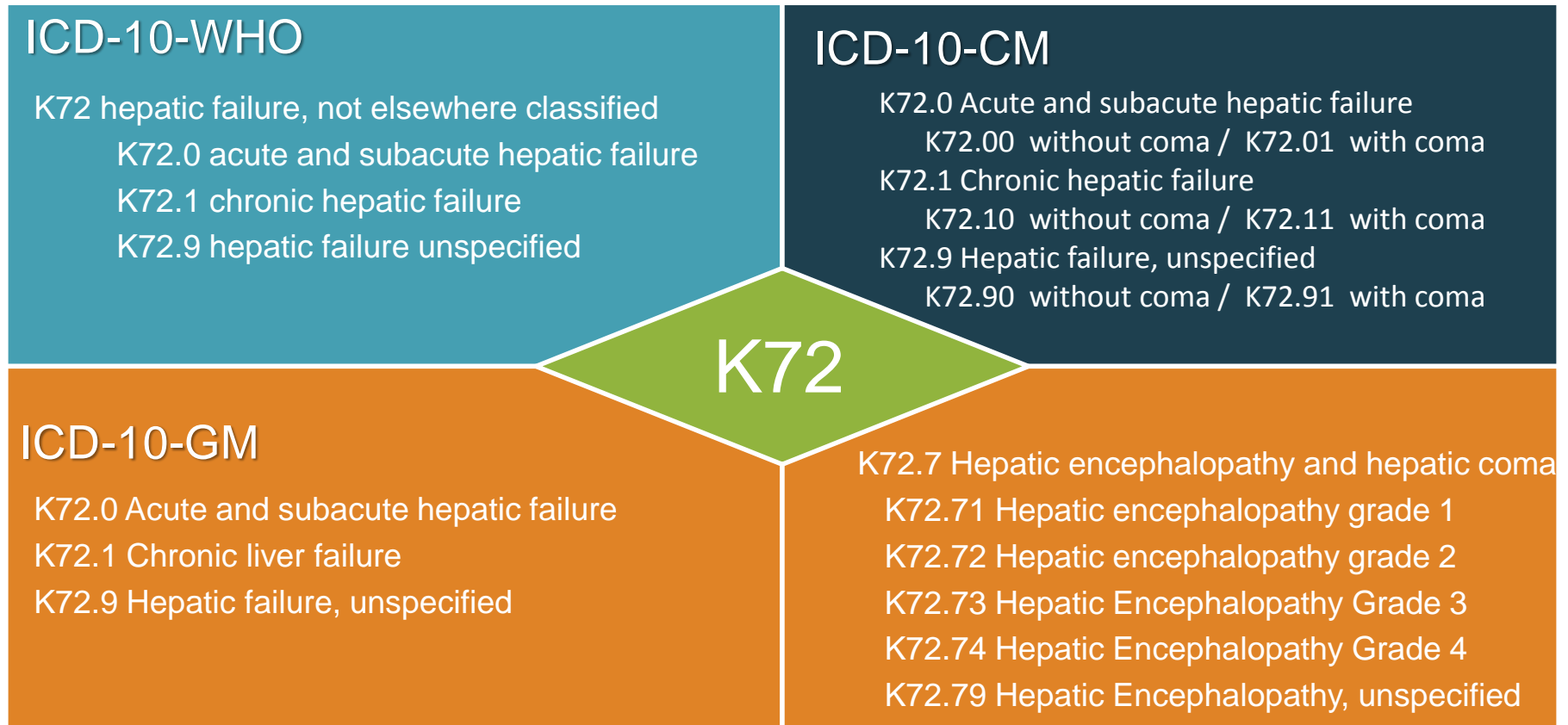
ICD-10-GM (WHO adaptation)

ICD-10-ES (CM adaptation)

# RESEARCH EXAMPLE

# Hospitalized Acute Liver Injury (ALI) and Antidepressants<sup>a</sup>

ICD-9 code 572.2 (hepatic coma) has been used in algorithms to identify ALI (PPV 13%-48%)



<sup>a</sup>[Post-Authorisation Safety Study of Agomelatine and the Risk of Hospitalisation for Acute Liver Injury \(EUPAS10446\)](#)

## MAPPING TOOLS

- <https://www.cms.gov/Medicare/Coding/ICD10/2016-ICD-10-CM-and-GEMs.html>
- <http://www.icd10codesearch.com/>
- <http://www.icd10data.com/Convert>
- Observational Medical Outcomes Partnership (OMOP) has some tools available on request
- Codes Repository: <https://clinicalcodes.rss.mhs.man.ac.uk/>
- Not aware of mapping tools for WHO ICD systems

The screenshot shows the CMS.gov website interface. At the top, there is a navigation bar with links for Home, About CMS, Newsroom, FAQs, Archive, Share, Help, and Print. Below this is the CMS.gov logo and the text "Centers for Medicare & Medicaid Services". A search bar is located on the right side of the header. A horizontal menu contains several categories: Medicare, Medicaid/CHIP, Medicare-Medicaid Coordination, Private Insurance, Innovation Center, Regulations & Guidance, Research, Statistics, Data & Systems, and Outreach & Education. The main content area is titled "2016 ICD-10-CM and GEMs" and includes a brief description of the new coding system. A "Downloads" section lists various files for download, such as code descriptions, tables, and guidelines. A left sidebar provides additional resources and navigation options.

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**CMS.gov**  
Centers for Medicare & Medicaid Services

Medicare Medicaid/CHIP Medicare-Medicaid Coordination Private Insurance Innovation Center Regulations & Guidance Research, Statistics, Data & Systems Outreach & Education

Home > Medicare > ICD-10 > 2016 ICD-10-CM and GEMs

## ICD-10

- Latest News
- [ICD-10 Ombudsman and ICD-10 Coordination Center \(ICC\)](#)
- [CMS ICD-10 Industry Email Updates](#)
- [CMS Regional Offices](#)
- [Provider Resources](#)
- [Medicare Fee-For-Service Provider Resources](#)
- [State Medicaid ICD-10 Readiness](#)
- [Payer Resources](#)
- [Vendor Resources](#)
- [Statute and Regulations](#)
- [ICD-10-CM/PCS Frequently Asked Questions](#)
- [2017 ICD-10-CM and GEMs](#)
- [2017 ICD-10 PCS and GEMs](#)

## 2016 ICD-10-CM and GEMs

The 2016 ICD-10-CM files below contain information on the new diagnosis coding system, ICD-10-CM, that is a replacement for ICD-9-CM, Volumes 1 and 2. These 2016 ICD-10-CM codes are to be used for services provided from October 1, 2015 through September 30, 2016.

### Downloads

- [2016 Code Descriptions in Tabular Order \[ZIP, 2MB\]](#)
- [2016 Code Tables and Index \[ZIP, 16MB\]](#)
- [2016 ICD-10-CM Duplicate Code Numbers \[ZIP, 64KB\]](#)
- [2016 Addendum \[PDF, 79KB\]](#)
- [2016 General Equivalence Mappings \(GEMs\) – Diagnosis Codes and Guide \[ZIP, 1MB\]](#)
- [FY 2016 Present On Admission \(POA\) Exempt List \(Updated 8/20/2015\) \[ZIP, 1MB\]](#)
- [2016 ICD-10-CM Guidelines \[PDF, 1MB\]](#)
- [2016 Reimbursement Mappings – Diagnosis Codes and Guides \[ZIP, 449KB\]](#)

Page last Modified: 10/08/2015 8:47 AM  
[Help with File Formats and Plug-Ins](#)

The screenshot shows the ICD-10 Code Search website interface. At the top, there is a navigation menu with links for Code Search, Implementation, Training, and Coding. The main heading is "The ICD-9 to ICD-10 Crosswalk made Easy: ICD-10 Code Lookup". Below the heading is a paragraph explaining the transition from ICD-9 to ICD-10. A search bar contains the text "572.2" and a checkbox for "Display ICD long descriptions" is checked. Below the search bar is a table with two columns: "ICD-9" and "Description". The table lists the ICD-9 code 5722 and its description "HEPATIC ENCEPHALOPATHY". To the right of this entry are two blue arrows pointing to the ICD-10 codes K7290 and K7291, with their respective descriptions: "HEPATIC FAILURE, UNSPECIFIED WITHOUT COMA" and "HEPATIC FAILURE, UNSPECIFIED WITH COMA".

ICD-10 Code Search

Code Search Implementation Training Coding

### The ICD-9 to ICD-10 Crosswalk made Easy: ICD-10 Code Lookup

As of October 1, 2015, a new ICD code set, ICD-10, has replaced the now obsolete ICD-9 code set. It is crucial that healthcare organizations train and prepare for the ICD-9 to ICD-10 transition to avoid costly delays or penalties. The conversion from ICD-9 to ICD-10 adds increased specificity to clinical diagnoses, thus creating a multitude of new codes to learn and implement. To aid the ICD-10 transition, we have created an ICD-10 code lookup, or mapping tool, which will allow you to translate ICD-9 codes into ICD-10 codes and vice versa. Our ICD-9 to ICD-10 crosswalk is meant to help healthcare organizations through the current change, and allow practitioners to train and learn the new diagnosis coding system during the [implementation](#) of ICD-10.

ICD-9 to ICD-10 ICD-10 to ICD-9

572.2  Display ICD long descriptions

| ICD-9 | Description            | ICD-10  | Description                               |
|-------|------------------------|---------|-------------------------------------------|
| 5722  | HEPATIC ENCEPHALOPATHY | → K7290 | HEPATIC FAILURE, UNSPECIFIED WITHOUT COMA |
|       |                        | → K7291 | HEPATIC FAILURE, UNSPECIFIED WITH COMA    |



Search

[ICD-10-CM Codes](#)

[ICD-10-CM Indexes](#)

[Conversion](#)

[Coding Rules](#)

[ICD-10-PCS Codes](#)

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## Convert ICD-9-CM Codes to ICD-10-CM/PCS, or Convert ICD-10-CM/PCS Codes to ICD-9-CM

Type any single ICD-9-CM or ICD-10-CM/PCS code into the search box below to convert it, for example:

- 250.00 (ICD-9-CM Diagnosis)
- E11.9 (ICD-10-CM Diagnosis)
- 00.01 (ICD-9-CM Procedure)
- 6A750Z4 (ICD-10-PCS Procedure)

572.2

Convert Code

### Convert ICD-9-CM 572.2 to ICD-10-CM

ICD-9-CM 572.2 converts approximately to:

- 2016 [ICD-10-CM K72.90](#) Hepatic failure, unspecified without coma
- or:
- 2016 [ICD-10-CM K72.91](#) Hepatic failure, unspecified with coma

**Note:** approximate conversions between ICD-9-CM codes and ICD-10-CM codes may require clinical interpretation in order to determine the most appropriate conversion code(s) for your specific coding situation.

**Source:** 2016 ICD-10-CM CMS General Equivalence Mappings.

## Regarding mapping from ICD-9 to ICD-10

- Most tools map from ICD-9-CM to ICD-10-CM
- Do not trust the results: Look at how the disease is coded in both systems, use clinical judgement, and consult with research partners to make sure the ICD-10 code is available in their systems

## Regarding ICD-10 codes and variable creation

- Consider the level of granularity of the different coding systems
- Consider coding practices in each country
- Work with research partners to adapt the common statistical analysis plan (SAP) to each data source. Consider using both ICD-10 and ICD-10-CM in the common SAP. Verify code translation from SAP to the adaptations



# Conclusions for Researchers

- ICD-10 coding systems are not uniform across countries. Very different level of granularity. When mapping from ICD-9, consider whether the validated codes were in CM or WHO versions.
- In the multicountry database study context, consider carefully from the beginning the different ICD coding systems in use locally.
- Consider whether codes are used for reimbursement.
- Include in the SAP adaptations by research partners code lists that map codes listed in the common SAP.
- Do not trust mapping tools; verify the code suggested by the translation tool.
- Work sooner than later on the codes lists for variable creation.

THANK YOU!

QUESTIONS?

# BACKUP SLIDES

# ICD 10 and Pharmacoepidemiology Research: Other Issues

- Alternatives to ICD-10 coding systems:
  - Systematized Nomenclature of Medicine—Clinical Terms (SNOMED- CT)
  - Being used by OMOP
  - Access to researchers might become an issue
  - Developed for e-records
- Reimbursement coding
- Increasing difficulties to access free-text and other granular clinical data (complete lists of medications for patients).  
Increasing problems to access medical records. All of those factors complicate validation of diagnosis codes being used in pharmacoepidemiology research.

## ClinicalCodes.org

An online clinical codes repository to improve validity and reproducibility of medical database research

The ClinicalCodes repository aims to hold code lists for all published electronic medical record studies, irrespective of code type (e.g. Read, ICD9-10, SNOMED) and database (CPRD, QResearch, THIN etc.). Once deposited, code lists will be freely available, with no login needed to download codes.

### Clinical codes

Large Primary Care Databases (PCD's) are increasingly being used to address a wide range of research questions in healthcare. Much research has been done into establishing the internal validity of such studies, but PCD studies also rely on clinical codes to provide standardised means for medical professionals to record clinical information. The validity of PCD studies depends upon the validity of the clinical codes used to define the population of interest, their disease conditions, exposures, treatments and outcomes.

However, there is currently no obligation on researchers to publish clinical code lists by journals or research councils and no centralised repository to hold archived clinical code lists. ClinicalCodes.org was set up to address this problem.

### Why an online clinical codes repository?

- Clinical codes can be held to scrutiny and peer-review in the same way as any other research methods
- Replication of previously published studies (e.g. in different databases) is facilitated
- Access to historical code-lists allows researchers and clinicians to make incremental improvements to disease (and other) definitions, building on and avoiding unnecessary replication of previous work
- Clinical code lists can become a resource for future research in their own right (e.g. tracking disease definitions through time)

### Quick links:

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The University of Manchester  
ClinicalCodes is a project at the  
University of Manchester Institute of  
Population Health



**National Institute for  
Health Research**

The ClinicalCodes project is funded by  
the National Institute for Health  
Research (NIHR) School for Primary Care  
Research (SPCR)

# Atrial Fibrillation and Flutter<sup>a</sup>

In ICD-10 WHO (2010) only I48 (3 digits) available  
In ICD-10-CM and WHO (2016):

## I48 Atrial fibrillation and flutter

- ▶ [I48.0](#) Paroxysmal atrial fibrillation
- ▶ [I48.1](#) Persistent atrial fibrillation
- ▶ [I48.2](#) Chronic atrial fibrillation
- ▶ [I48.3](#) Typical atrial flutter
- ▶ [I48.4](#) Atypical atrial flutter
- ▶ [I48.9](#) Unspecified atrial fibrillation and atrial flutter
  - ▶ [I48.91](#) **Unspecified atrial fibrillation**
  - ▶ [I48.92](#) Unspecified atrial flutter

In ICD-10-SKS: I48.9A and I48.9B – A and B specify whether chronic or paroxysmal, but there is no 5th digit

<sup>a</sup>[Evaluation of potential off-label use of dabigatran etexilate in Europe \(EUPAS7591\)](#)