IRIS - Automated coding system for causes of death: User Guide

Iris version 5 for ICD-10

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List of Content

Introduction

The purpose of this documentation is to provide users with a detailed guide on how to effectively use the Iris automated coding software, which is designed to determine the underlying cause of death based on the updated WHO ICD-10 coding guidelines. This software facilitates the input and analysis of Medical Certification of Cause of Death (MCCD) forms, ensuring accurate identification of the cause of death. It is essential for doctors to complete the MCCD forms according to the prescribed rules to ensure consistency and accuracy in reporting.

Iris Software

- Iris is an **automatic system for coding multiple causes of death and for the selection of the underlying cause of death.**
- Iris software can process death records either in batches or interactively.
- The aim was to develop a common mortality coding system that could be used for coding death certificates in any language and using the latest version of International Classification of Diseases (ICD)

About Iris Institute

- The Iris Institute emerged from an international cooperation for the deployment, maintenance and development of the Iris software, an electronic system for automated coding of causes of death.

Aim of Iris

The aim of Iris is twofold:

- To provide a system in which the language-dependent aspects are separated from the software itself. Moreover, the language-dependent parts are stored in database tables and can easily be modified.
- To improve international comparability. Iris is based on the international death certificate form provided by WHO (World Health Organization) of ICD-10 and the causes of death are coded according to the ICD-10 coding rules. Updates to ICD-10 are included according to the WHO timelines.

Iris Characteristics

- The Iris software uses the Multicausal and Unicausal Selection Engine (MUSE).
- MUSE (multicausal and unicausal selection engine) is a new software tool which supports the implementation of uniform coding practices and reduces daily workload of coding staff.
- MUSE operates based on internationally agreed decision tables which are based on the most recent version of ICD-10.
- The Software is free of charge but not open source.
- The Iris software uses ICD-10-WHO codes and titles. Duplication and distribution of the ICD-10-WHO content are prohibited. All rights to the ICD-10-WHO belong to the WHO, and its use requires an agreement with the WHO.

International decision tables

- Iris/MUSE uses international agreed decision tables (DT).
- The decision tables have been maintained by the Iris Institute according to the WHO official updates of the ICD-10.
- Updates were done after discussion by the Mortality Reference Group (MRG) [including updates by the Table Group (TG)] and decision by the Update and Revision Committee (URC).
- The current decision tables derive from those developed by the NCHS (National Centre for Health Statistics) for the selection of the underlying cause of death used by ACME (Automated Classification of Medical Entities).

Iris Institute Partners

- Iris Institute Partners: DIMDI (German Institute of Medical Documentation and
- Information) and BfArM (Federal Institute for Drugs and Medical Devices) have been merged, the secretariat is hosted by BfArM.
- Canada, France, Germany, Hungary, Italy, Netherlands, USA, England and Wales collaborate as the Core Group in the development of Iris.
- Iris is maintained by the Iris Core Group in the realm of the Iris Institute

Iris User Reference Manual

- Iris user reference manuals are available for different versions of Iris, providing guides on how to use the software.
- Before installing and using the software, the user should read the manual carefully.
- Iris reference manual for Iris version 5 (based on ICD-10) are available on Iris Institute website.

Iris User Reference Manual

Iris Newsletter

- "Iris News" is free of costs and informs you about the latest news concerning Iris.

Iris news subscribe and unsubscribe

Iris users

- Countries that have acquired some knowledge in the use of Iris can help other countries to start their implementation process as well. Therefore, we ask the users of Iris to share some information on their status of implementation.

Iris training

- You can choose prerequisites trainings for Iris implementation, such as:
    - Use of the WHO standard MCCD format
    - Coders trained on manual ICD and decision table-based mortality coding
    - Availability of IT support
    - For the text-entry mode, the availability of a dictionary

- We can coordinate a training program for you. You might choose for example:
  - Advanced Iris features training for coders, IT-people and other staff
  - Standardization with Regular Expression for coders, IT-people and other staff
  - Workshops for coders, IT-people and other staff.

Iris meeting

- Each year the Iris Institute organizes an Iris User Group meeting. At the meeting the participants report about their experience and plans with Iris.
- The participants can share their experiences at the meeting and they can also gain new insights into processes in other countries.

Support

- Iris is maintained by the Iris Core Group in the realm of the Iris Institute. The maintenance supported by the member countries of the Iris Core Group can only be limited and restricted to the basic updates necessary and will not cover the implementation in other countries.
- In order to give users the opportunity to contribute to the maintenance and update of the Iris system and thereby guarantee the long term availability of the Iris software a support model was put in place. Contributing to the Iris development by agreeing to support Iris will give you two advantages:
  - Support Iris: You will help to guarantee availability and up-to-date softwarethat is adapted to ICD updates and software evolvements.
  - Receive support: Additional benefits for your country will help you toimplement and use Iris
- All financial support received by the Iris Institute will be used to maintain, update and further evolve the Iris software.

Iris versions

- The download area of the Iris Institute contains the released versions of the Iris software, Iris manuals, decision tables updates and translated interfaces.

Iris Versions

Download Iris Software

- The download and the use of the Iris software is free, there are no licenses. Except: You must accept the download condition at the time of the download.

Download Iris Software

Installation

Iris Software use System

You can use Iris under these systems:

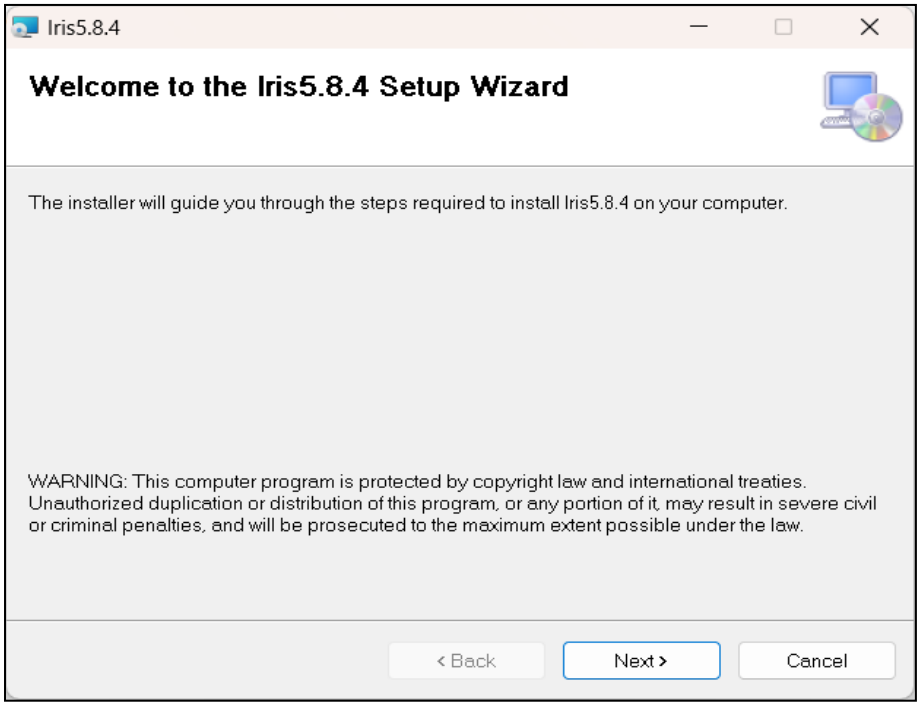
- Microsoft Windows Vista, Windows 7, Windows 8, Windows 8.1 and Windows 10
- Microsoft .Net Framework (since 4.5.2)
- Microsoft Access 2003 or later, if no other database manager is available (it is not possible to use "Apache Open Office" database)
- or a robust relational database server like Oracle, MSSQL, PostgreSQL or MySQL directly
- or any through OLEDB, parameters described on Connection Strings Reference

Iris is independent of your browser and you can use Iris in a server environment for multiple users.

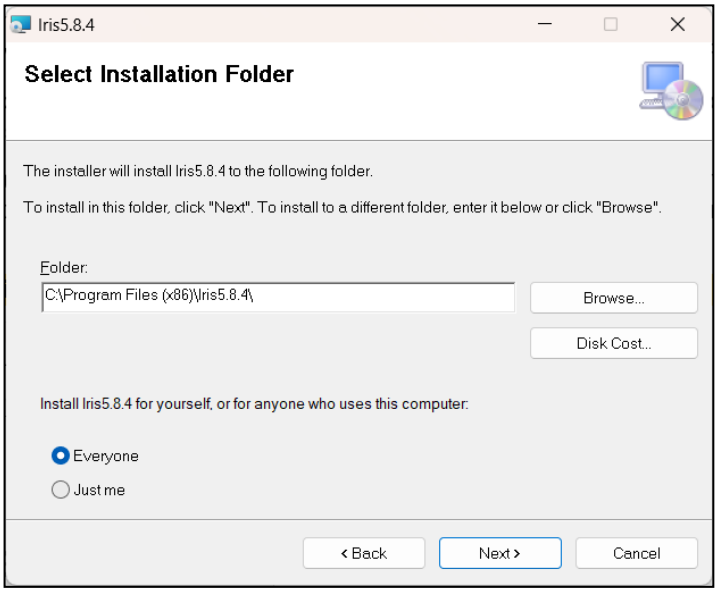
Before you first install Iris, '.Net Framework' should be already installed.

Installation of Iris with Windows installer

Unzip the installation files and place them in a separate folder. Open the installation folder and click on the "IrisInstallation.msi" program. Then follow the instructions of the Iris setup wizard.



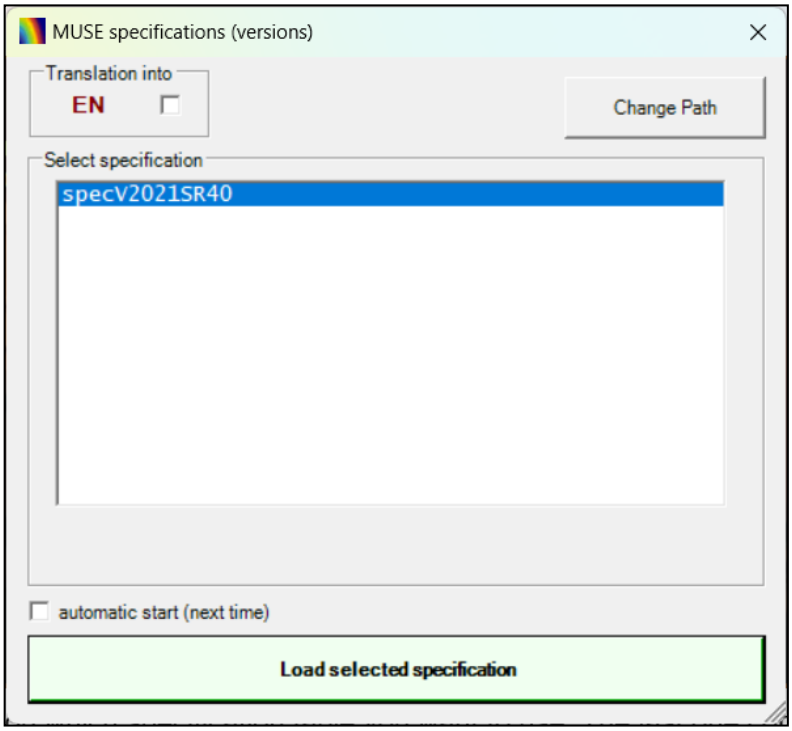
During the installation, you may change the default installation folder and the rights to use Iris on the computer. By default, the installation wizard places Iris in the “C:\Program Files (x86)” folder



When you have installed a new version of Iris and that an older version was used, Iris will ask at first whether you want to keep your settings or not:

During the first start Iris will show the window below: **MUSE window starts first time (content of screen could be different for each version)**

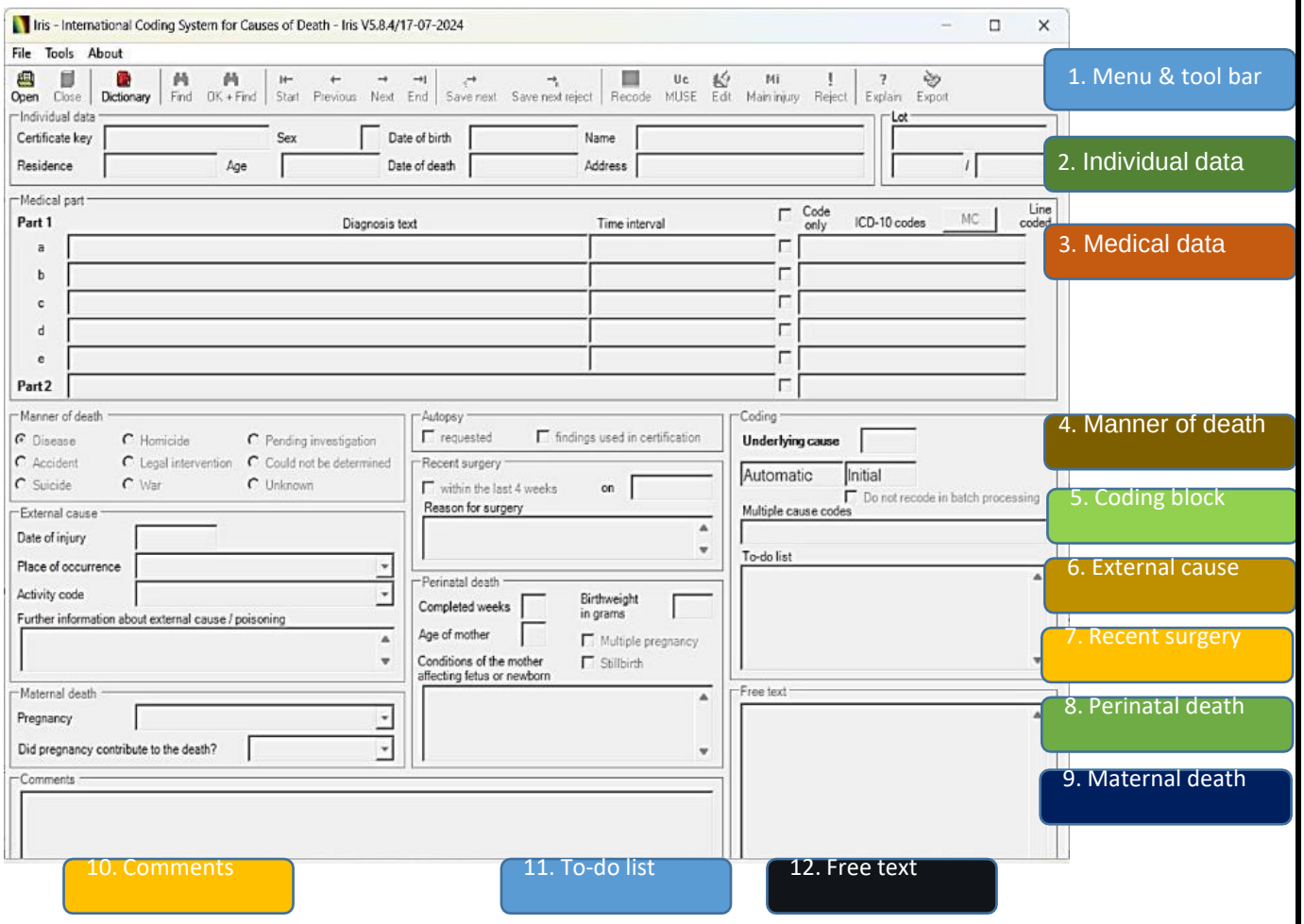
Then Iris will ask you which specification table you want to use. The last one contains the latest decision tables and multicausal tables. Please select a spec file and continue by clicking on “Load selected specification”.



After the selection Iris will load the specification files: During initialization process the specification files are read by Iris and user is informed about the processed entries

Iris User Interface

Iris User Interface opened after the load specification file. The main window has several groups of items.



1. Menu & tool bar

- The upper part of the window includes a menu and a toolbar. The toolbar contains menu items that are frequently used, and you can access them with a single click
- Through the *File menu* you can open and close lots, and exit Iris. You can also launch batch processing and display scanned images of the death certificates.
- The *Tools menu* contains functions for browsing or editing the dictionary and the standardisation tables. Through the Tools menu you also have access to the Options feature, which allows you to define the default features of Iris.
- The toolbar under the menus gives you quick access to the most frequently used items of the menu.

2. Individual data block

- Includes by default read only text boxes that display important background data (demographic data).
- Text boxes with grey background are read only zones and cannot be modified.

3. **Medical Data block**
    - By default, Iris allows you to enter and update only the medical data.
    - Maximum length of medical terms : Number of characters in medical text fields of Part 1 and Part 2 is defaulted to 500, but can be set between 50 and 500.

4. **Manner of Death**
    - The “Manner of Death” block on the left under the Medical part group specifies if the death due to a disease or condition, an accident, a suicide, a homicide, of undetermined intent, etc. If the Manner of Death (MoD) is unknown, there are alternatives for "Pending investigation" or "Not filled in".
    - Generally, the Manner of Death information should be taken from the death certificates when the work lot is prepared, but it can be changed manually.

5. **Coding block**
    - The coding block are shown, the ICD-10-WHO codes Iris used to select the underlying cause of death. These codes also form the basis of the multiple cause output from the Iris system.
    - Iris also shows the status of the record after the selection procedure. If Iris, for some reason, could not select an underlying cause, or if the selected underlying cause is tentative and needs verification, the word “Reject” appears below the underlying cause box.

6. **External cause block**
    - For deaths due to injuries or poisoning, the External cause block displays the date an injury occurred, and codes for the place of occurrence and the activity at the time of the injury.
    - A larger box can be used to display free text about how the external cause or poisoning occurred.

7. **Recent surgery**
    - The Recent surgery block shows whether a surgery has been performed within the last 4 weeks and, if so, the date of surgery and the reason why.

8. **Perinatal death block**
    - Shows additional information on perinatal deaths (completed weeks of pregnancy; birthweight; age of mother; complication of the mother who affected fetus or newborn; tick boxes for multiple pregnancy and stillbirth).

9. **Maternal death block**
    - Shows information about pregnancy and complication with pregnancy. The drop boxes are available only for female decedents.

10. **Comments**
    - Areas can be used as desired by the coder. In the Comment text box the coder may write a short comment on the current death record (field type “Memo” with more than 255 characters).

11. To do list

- The error message is displayed in the To-Do list.

12. Free text

- Field can be used to store or forward larger chunks of text, for example internet citations concerning a specific cause of death. It can also be used to display additional information reported by the physician on the death certificate.

Translating the Iris interface

- Iris labels (name of menus, items in menus, name of tools, etc.) and Iris messages can be translated into any language.
- The translation file must be Unicode (UTF-8) encoded, otherwise characters that are not used in English (such as é, ö, Š) might disappear or get replaced by other characters on the screen.
- Note that space for text is rather restricted in some parts of the Iris screen, and that translations must fit into the space available.
- They are properties files for the interface in Czech, English, French, Portuguese and Spanish language (translated by users) available at the Iris website.
- You can use the Language file field to state the location of a file with translations of all Iris labels. The original file, containing English texts, is called ‘UserInterfaceEnglishVx.x-Y20xxSx.properties’ and is included when you install Iris.

Databases

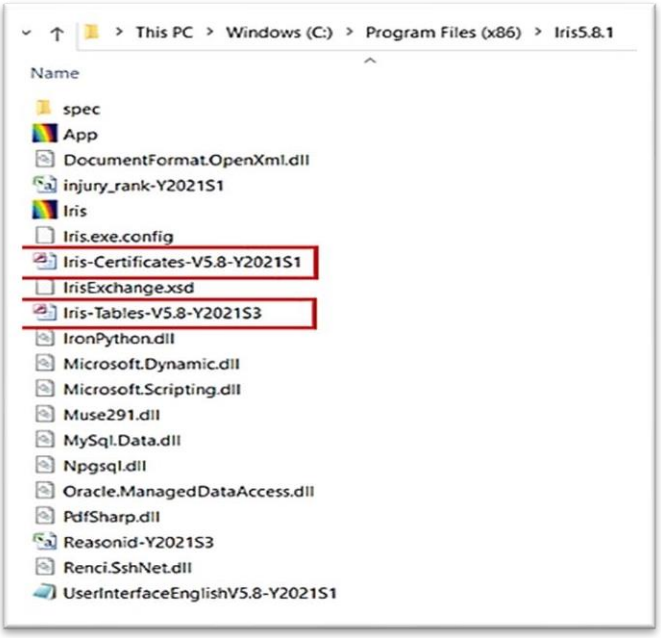
Iris Databases

Iris uses two different databases:

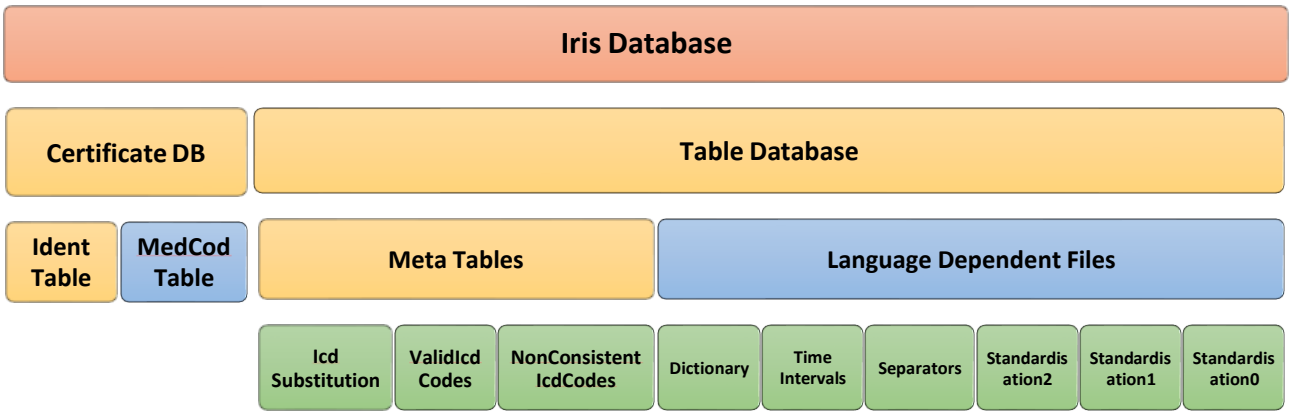
- The **"Certificates"** database contains **death certificate records** (Lots).
- The **"Iris Tables"** database contains all the **tables needed to analyse cause-of - death expressions.**

At the end of the installation, by default databases are available in the installation folder. (C:\Program Files(x86))

You can move these databases to another location on your computer, or you can migrate them to a database server on your network.



Iris database contain tables:



Microsoft Access is the Default Database deployed with Iris setup.

1) The "**Certificates**" database contains two tables: an "Ident" table and a "MedCod" table.

1. The "*Ident "*(Identification) table contains all the individual data except the causes of death
2. The "*MedCod* "(Medical causes of death) table contains the causes of death.

2) There are two types of tables in the "**Iris Tables**" database:

1. *Meta-tables* containing technical data, such as lists of valid codes or code translations ('ValidIcdCodes' and 'IcdSubstitution' table). These tables are necessary for a correct functioning of Iris and you should NOT change or delete them. Exception: you must adapt the 'NonConsistentIcdCodes' tables to the requirements of your country.
    - Iris uses the 'NonConsistentIcdCodes' table to check the causes of death against the individual's sex and age, and whether the assigned underlying cause code is valid as underlying cause. Although the international version of Iris contains a 'NonConsistentIcdCodes' table with basic checks, it might be necessary to modify the table according to the local and regional health situation.
    - The 'ValidIcdCodes' table contains all valid ICD-10 codes and label names.
    - Since Version 5 the 'IcdSubstitution' table contains only a list of created codes.
2. *Language-dependent* files used for standardizing and coding expressions from the death certificates.This concerns the Dictionary, Standardisation0, Standardisation1, Standardisation2, Separators and 'TimeIntervals' table.
    - Dictionary table: If you want to build your own dictionary, copy the dictionary which is available in the Iris installation file to your own "Iris Tables" database and then delete all records. Then enter text expressions in your own language and assign ICD-10-WHO codes to them. The dictionary tool checks that the ICD-10-WHO codes you enter are valid and also ensures that other variables in the dictionary are set correctly.

o Standardization tables: Iris employs "rules" to standardize the text of causes of death. These rules are written by the user and are depending on the language with which causes of death are declared (Swedish, German, French …). A rule is made up of two filters. The first filter (FilterIn) identifies the "context". The content of the second filter (FilterOut) replaces the context when it is recognised. 'FilterIn' and 'FilterOut' syntax is based on a language called "Regular Expressions" (RegEx). standardisation, which very much reduces the size of the dictionary.

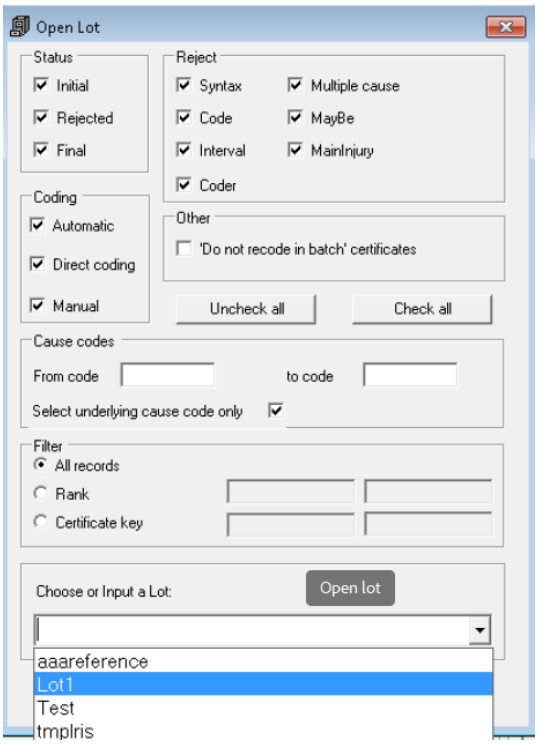
How to use Iris

Lot Preparation

- Before coding with Iris, you must prepare work lots containing death certificates.
- The work lots are stored in the “Iris Certificates” database.
- By default, it is a Microsoft Access database located in the Iris folder.
- The default location can be changed in the Options. The Certificates database may be located anywhere on your computer or on a network.
- A work lot consists of two tables: an "Ident" table and a "MedCod" table:
    - The "Ident" table contains demographic Data (Mentioned on MCCD Death Certificate).
    - The "MedCod" table contains the medical causes of death.

Steps to create lot:

1. Decide on a name for the work lot (e.g. "Lot1"). This name will be used to open the work lot in Iris.
2. Next, create a "Lot1Ident" table and a "Lot1MedCod" table. To do so, copy the tables “aaaReferenceIdent” and “aaaReferenceMedCod” included in the Certificates database and change their name into "Lot1Ident" and "Lot1MedCod" (or whatever name you have chosen). Make sure that the work lot name is followed by the strings "Ident" and "MedCod".
3. The last step is to feed the "Ident" table with records. The following fields must contain data: CertificateKey, Sex and DateBirth, DateDeath or Age if the dates are not presented.
4. It is then possible to open the work lot in Iris. Launch Iris, select Open in the "File" menu (or enter Ctrl + O, or just click on the Open tool). You will be prompted to choose one of the work lot names that now appear in the list box:

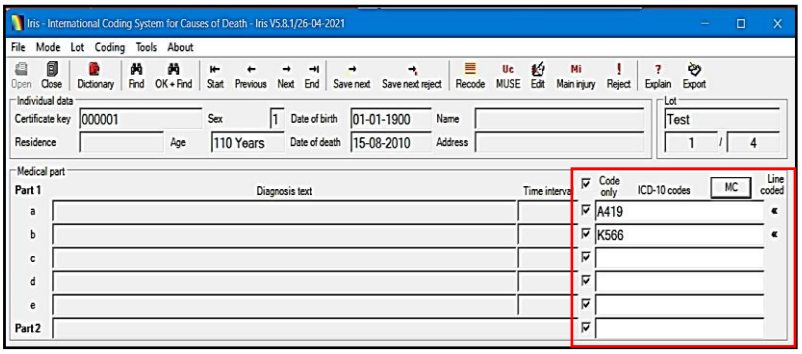


The Iris Certificates database contains a small work lot called Test that you can open and use for testing.

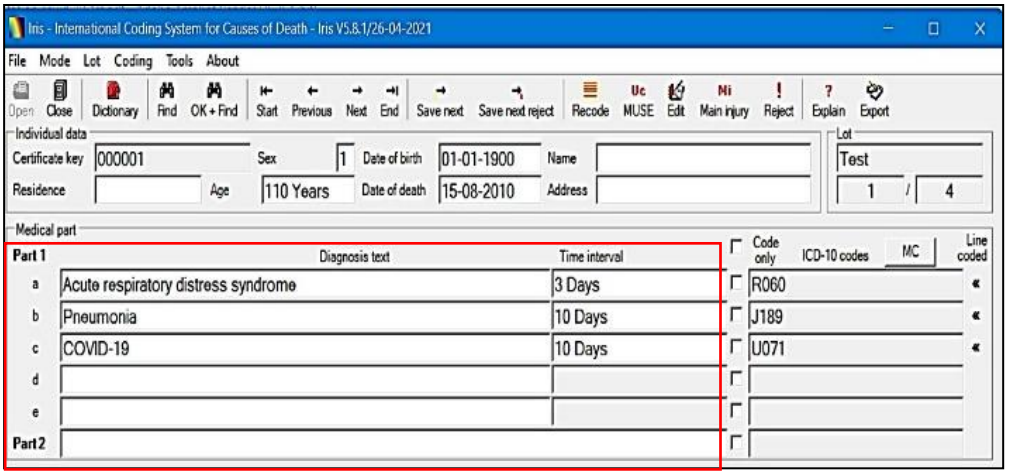
Data Entry in Iris

Iris can be used in two modes.

1) **Code entry mode:**
   - The user enters ICD-10 codes corresponding to the conditions reported on the death certificates.
   - Iris then selects the underlying cause. In this mode Iris is ready for use as soon as it is installed.

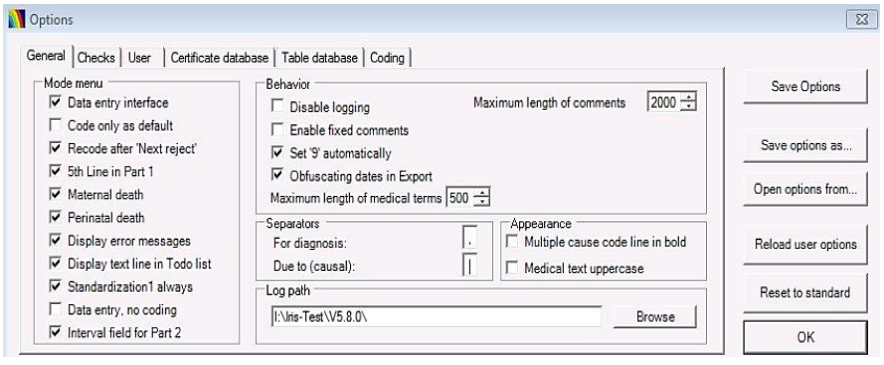


2) **Text entry mode**
   - The user enters the causes of death in free text, as they are reported on the death certificate.
   - You need a dictionary that translates text into ICD-10 codes.
   - The advantage of including a dictionary is that once a decision has been made on which ICD-10 code to use for a specific diagnostic expression, the expression will be coded in the same way each time it occurs on a death certificate.



Iris Options

Through the Options you can set a wide variety of default values and parameters according to your own requirements. The Options window has six tabs.



1. **General Tab**: In this tab, you can access the Mode menu for data entry functions, adjust settings for behaviour, choose separators, and specify the log path.

2. **Checks tab:** You can configure options for handling rejections, as well as set both interactive and batch coding reject options.

3. **User Tab:** In this section, you can adjust user settings, choose the location forlanguage files and upload a certificate image.

4. **Certificate Database Tab:** The “Certificate database” tab contains settings that define the type of database management system used for the “Iris Certificates” database.

5. **Table Database Tab:** The “Table database” tab contains settings that define the typeof database management system used for the “Iris Tables” database

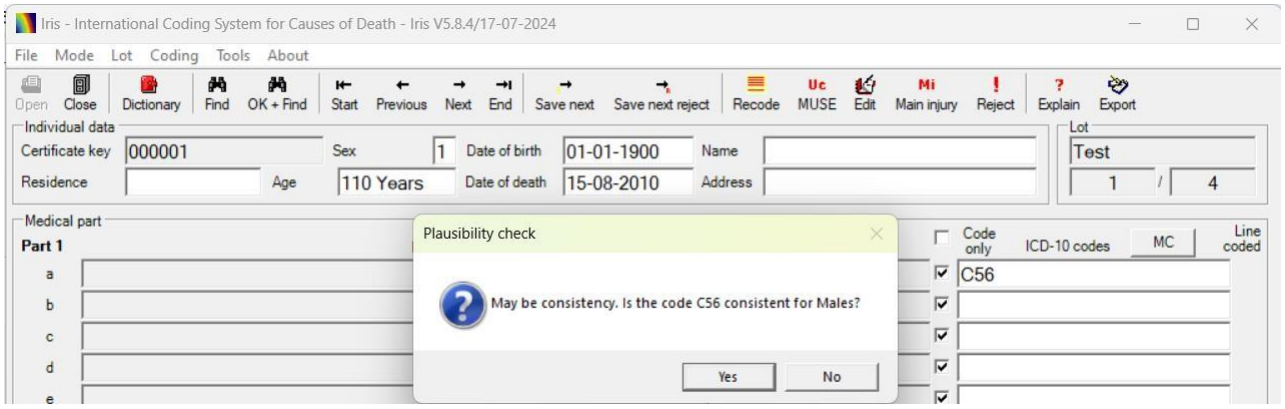
6. **Coding Tab**: The Coding tab contains various settings related to the coding itself.

Examples using Iris Software

- With the **NCIC Browser**, you can adjust parameters such as age, sex consistency, and determine whether a disease is classified as rare. Additionally, you can specify if the disease is considered an underlying cause of death.

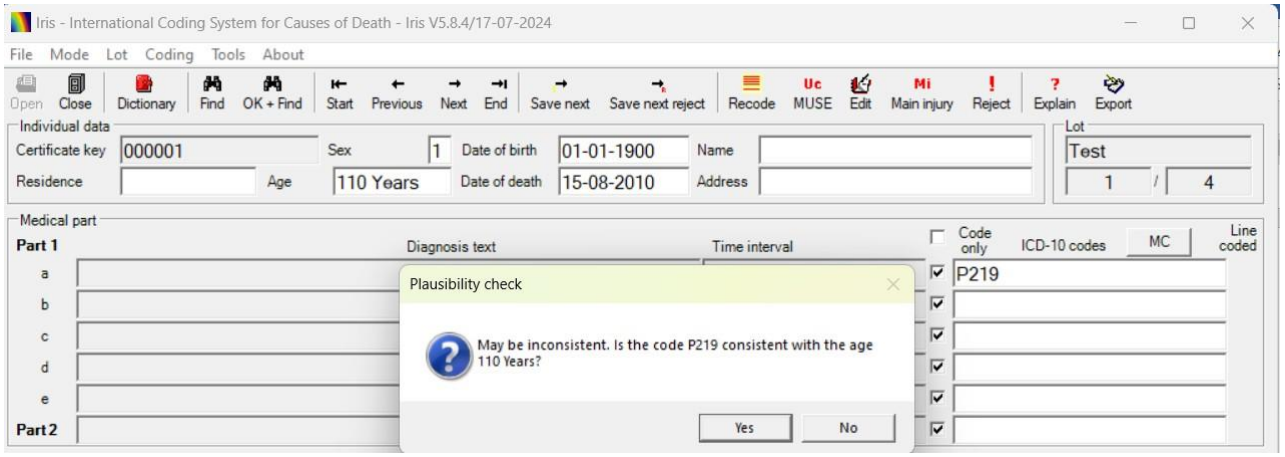
  Example 1: Check for Sex Consistency

  Sex: Male (1) and line 1: Malignant neoplasm of the ovary



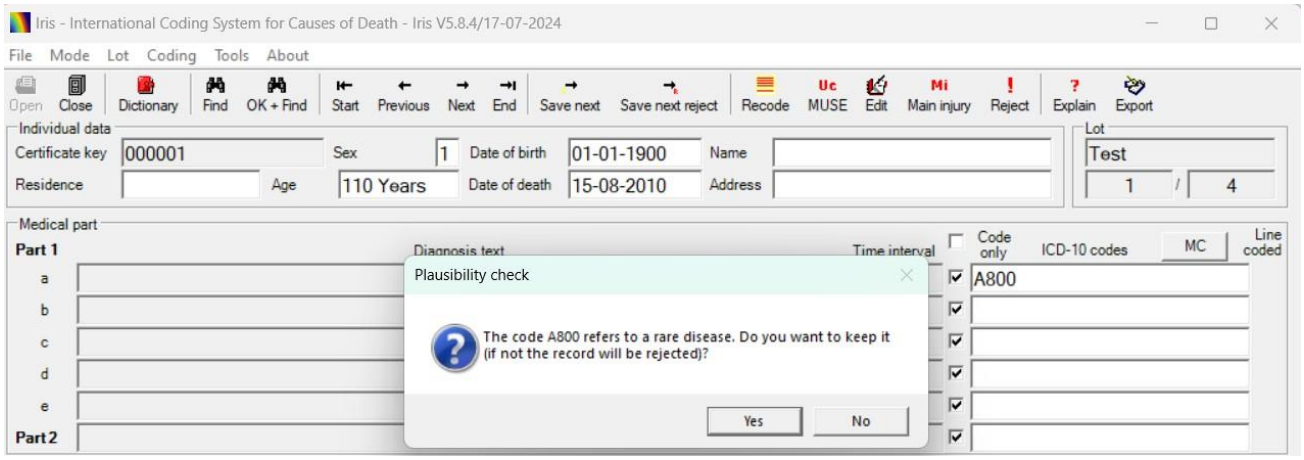
Example 2: Check for Age Consistency

Sex: Male (1) and line 1: unspecified, Birth asphyxia

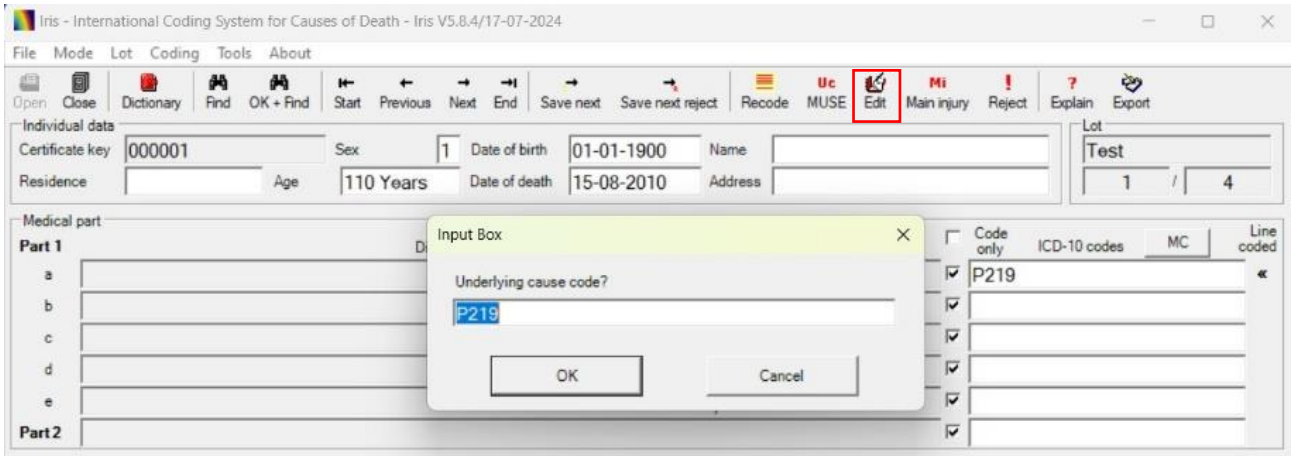


Example 3: Check for rare disease

Sex: Male(1) and line 1: Acute paralytic poliomyelitis, vaccine-associated



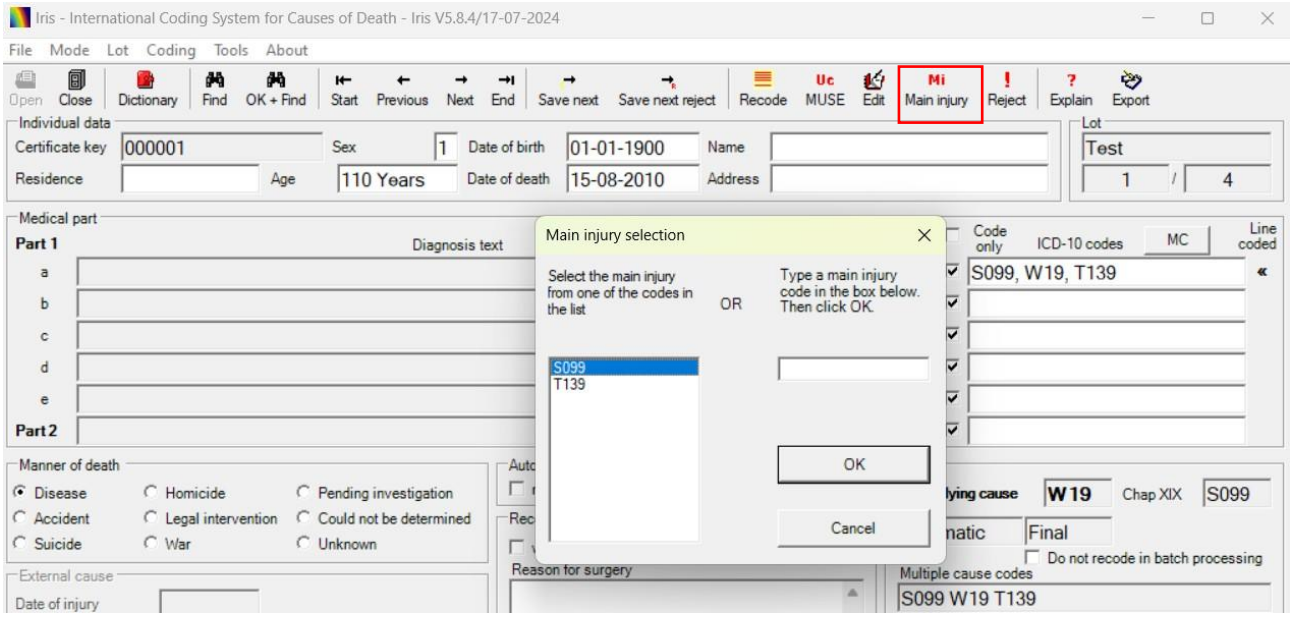
- **Edit Underlying Code**
  The Edit underlying cause command (or pressing Ctrl + E) allows you to change the underlying cause code selected by Iris. The new underlying cause code must be a valid ICD-10-WHO code. The record is then flagged as "Manual", which means that the underlying cause has been selected manually.



- **Select Main Injury**

  This tab is only provided if a chapter XX code is provided as underlying cause of death.

  If for some reason Iris can´t select a main injury automatically and if Options-Checks is set to "main injury required", then the certificate will be rejected for manual review.

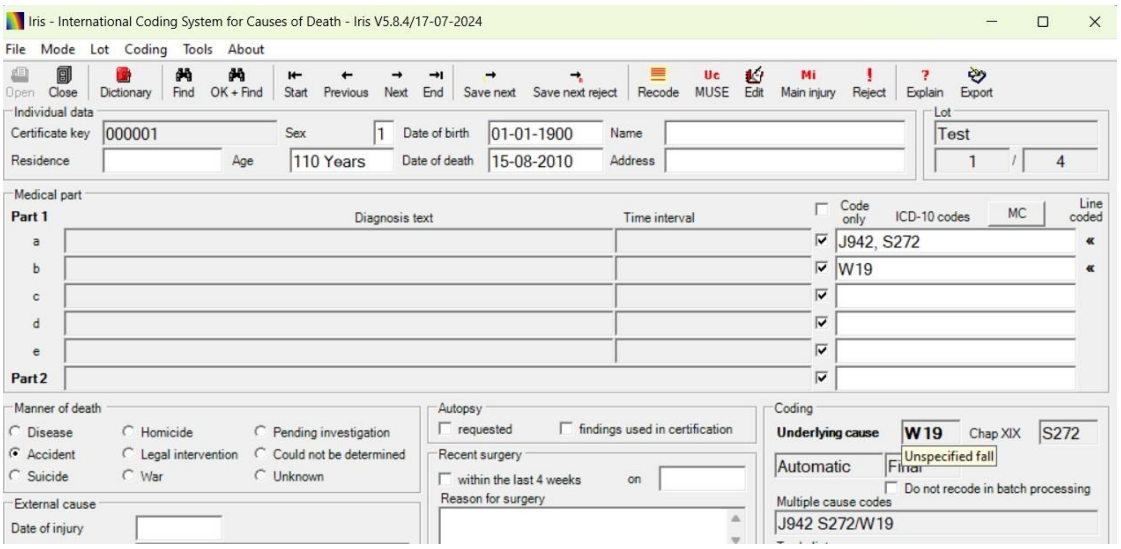


- Iris generates UC according to Manner death.

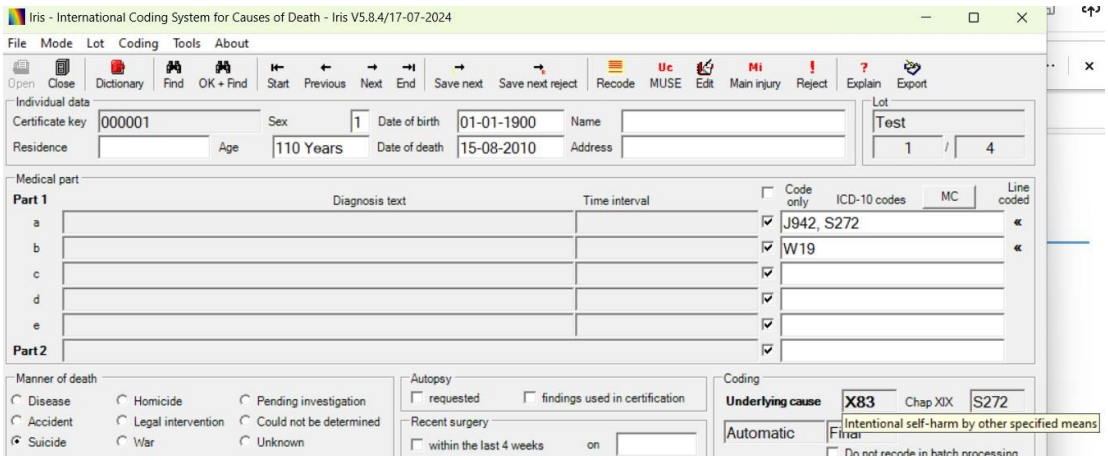
  Example 1: 1a Haemopneumothorax J942S272

  1b Fall W19

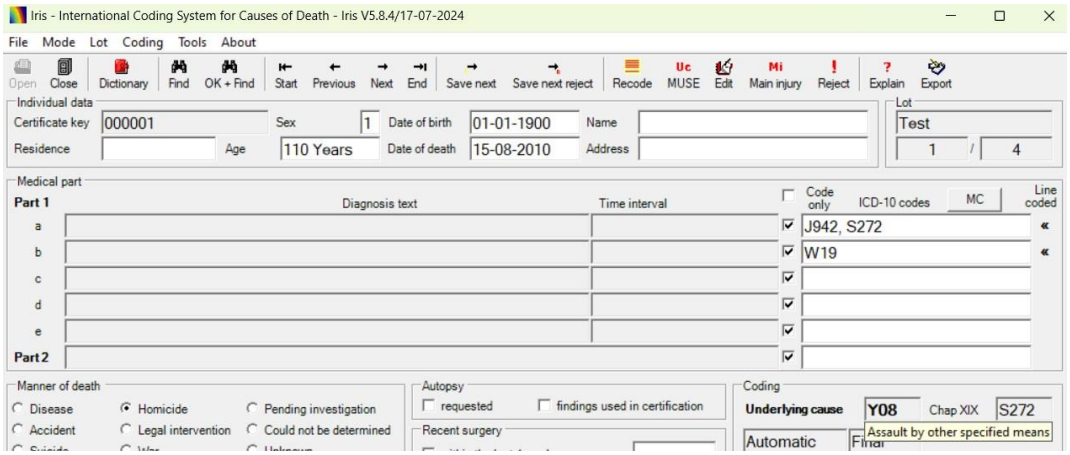
  If Set manner of death Accident then UC W19 with main injury S272



  If Set Manner of Death Suicide then UC X83 with main injury S272



If set manner of death Homicide then UC Y08 with main injury S272

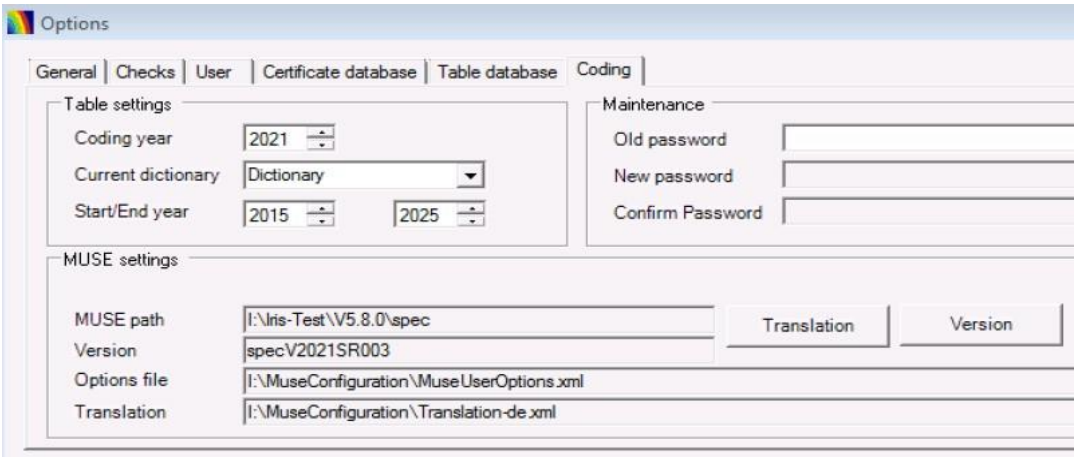


Muse in Iris

MUSE (multicausal and unicausal selection engine) is a rule-based software component which processes electronic death certificates and selects the underlying and multiple causes of death. Data processing is done in accordance with the guidelines of Volume 2 of ICD-10-WHO.

The MUSE configuration is default stored in option file ‘MuseUserOptions.xml’ located in subdirectory ‘MuseConfiguration’ of the user path (C:\Users\YourName\MuseConfiguration).

You can check your changes (MUSE settings) on the environment variables in Iris [via Tools, Options, Codingtab, MUSE settings]:



MUSE specification window

MUSE logic is defined by two specification files (.csv format) being located in the subdirectory ‘spec’ of the installation directory

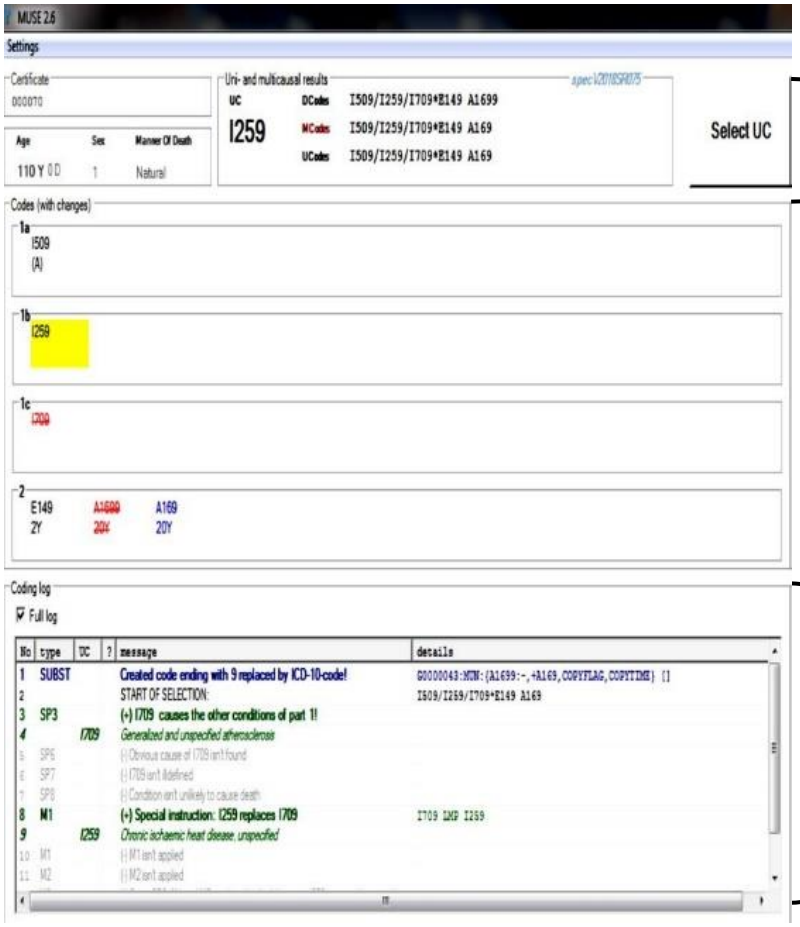
- The file specCodes (specVxxxxSRxx-Codes.csv) contains the valid codes (ICD-10-WHO codes and created codes) for the MUSE logic [there is no change of the ValidIcdCodes table].

- The file specMuse (specVxxxxSRxx-Muse.csv.DES) contains all multiple-cause and underlying cause of death coding instructions used by MUSE (the table entries based on international decisions and should not be modified by users).

MUSE explanation window - overview

Click the “MUSE button” (or "MUSE" in the Coding menu, or use the hotkey Ctrl + U) to open the MUSE explanation window. The underlying cause will recode starting from the displayed ICD-10 codes.

After clicking the “MUSE” button (toolbar at main interface) the correspondent window is presented to the user. Figure below shows an example:



Basic data (certificate number, age, sex and manner of death) are displayed in the first two group boxes of the upper left

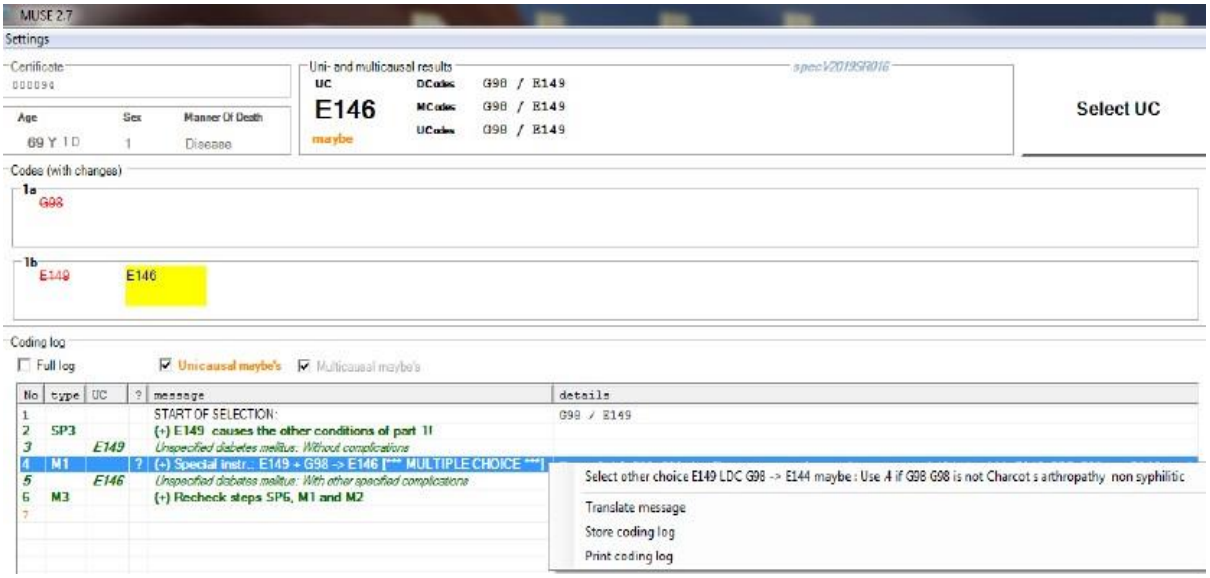
The group box ‘Coding log’ is on the bottom block of the window “MUSE explanation”. It shows MUSE processing steps row by row:

Blue lines (type=SUBST): multiple-cause coding instructions performed by MUSE algorithm

START OF SELECTION: Starting codes used for unicausal selection (see also UCodes) are displayed. The following lines represent unicausal processing steps

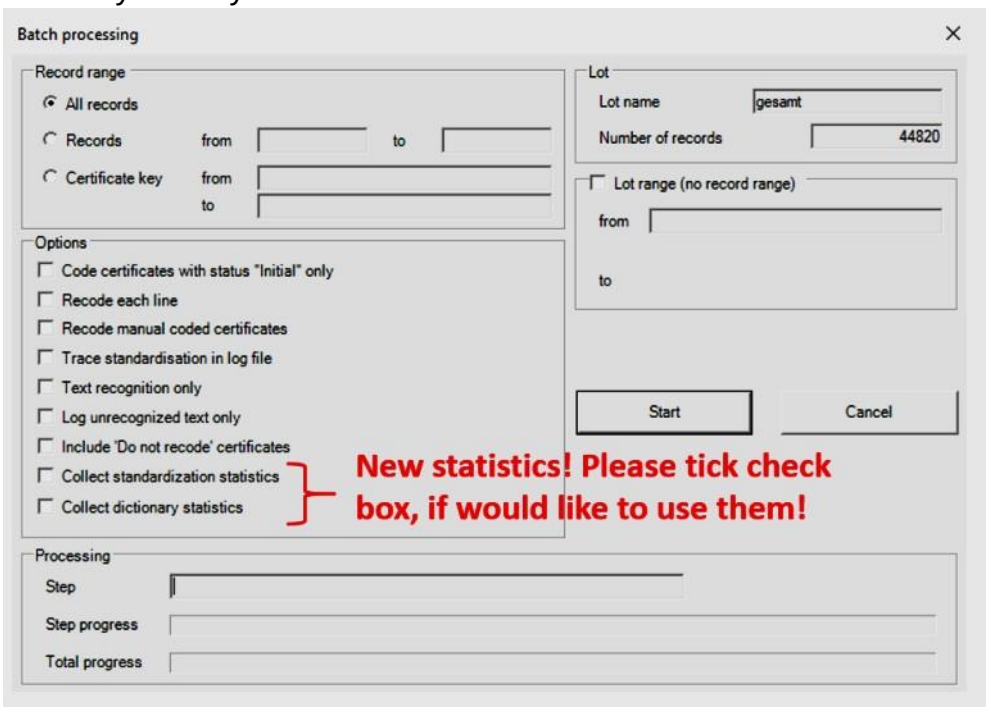
Grey and **green** lines inform users about unicausal processing steps according to the ICD-10-WHO (Volume 2, paragraph 4.2.1 and 4.2.2). In the column type is shown the name of the corresponding starting point rules (**SP1 – SP8**) or modification rules (**M1 – M4**). Successfully applied rules are green.

The certificate is rejected and the coder can select via the **‘Multiple choice’** feature the correct code
Since MUSE 2.7 is also possible to use the ‘Multiple choice’ feature.



Batch Processing

- Use Batch processing command to code an entire work lot, or a subset of it, automatically.
- By default, Iris codes all records in the work lot, except those that have been coded manually already



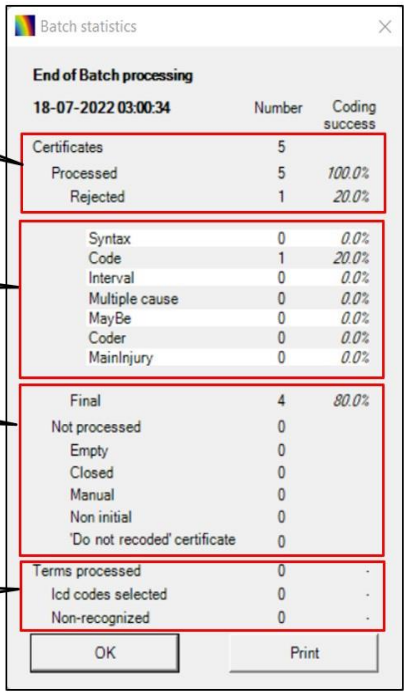
- Iris creates a log file for each batch processing. This log file will be stored in the folder specified in ‘Options’ – ‘General’ tab – ‘Log path’
- By default, the log file includes the name of the lot, the records processed, date and time of start and end of the processing. Example:

Certificate: Total number of certificates in the lot.
Processed: Total number of processed certificates in the lot.
Rejected: Total number of Rejected cases in the lot.

These statistics represents the reasons leading to the **Rejected** cases; the combined total of them should always match with the Total number of Rejected cases displayed above.

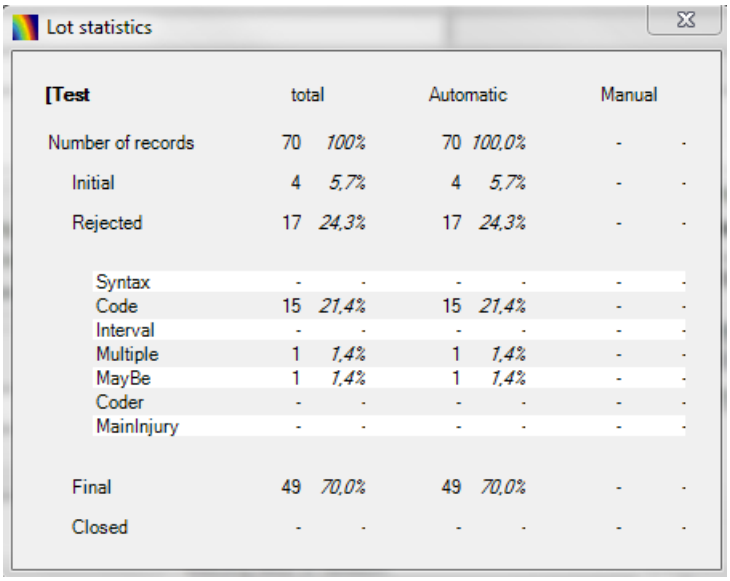
Final: Total number of Certificates with **Final** status.
Not Processed: The total number of Certificates those are not processed in the particular Batch Processing.

Terms Processed: This for the **Text Mode**; the total number of terms processed in lot.
Icd codes selected: The number of ICD codes selected from the Standardization/Dictionary in that lot.
Non-recognized: The terms not matched with the Standardization/Dictionary in that lot.



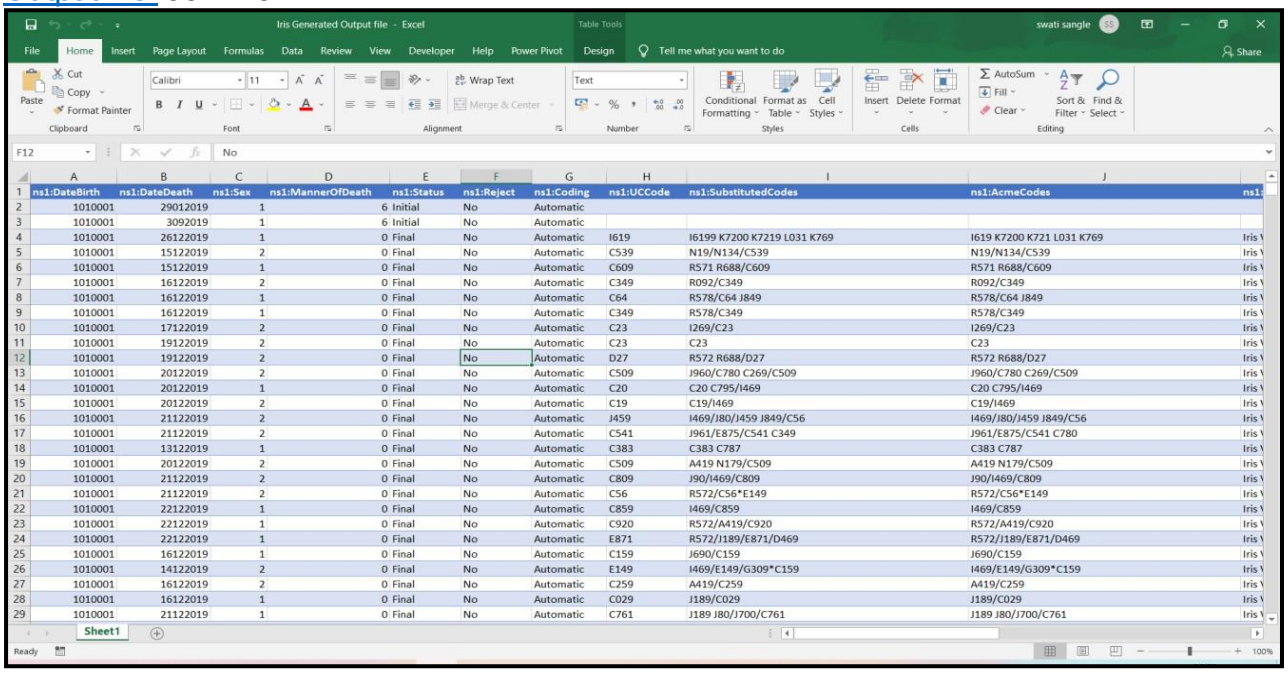
Statistics

The Statistics item displays coding statistics for the current work lot. For instance, the following statistics:



From Iris User Interface using Tools Menu -> Export all option generates report of selected lot.This report is generated in .xml format

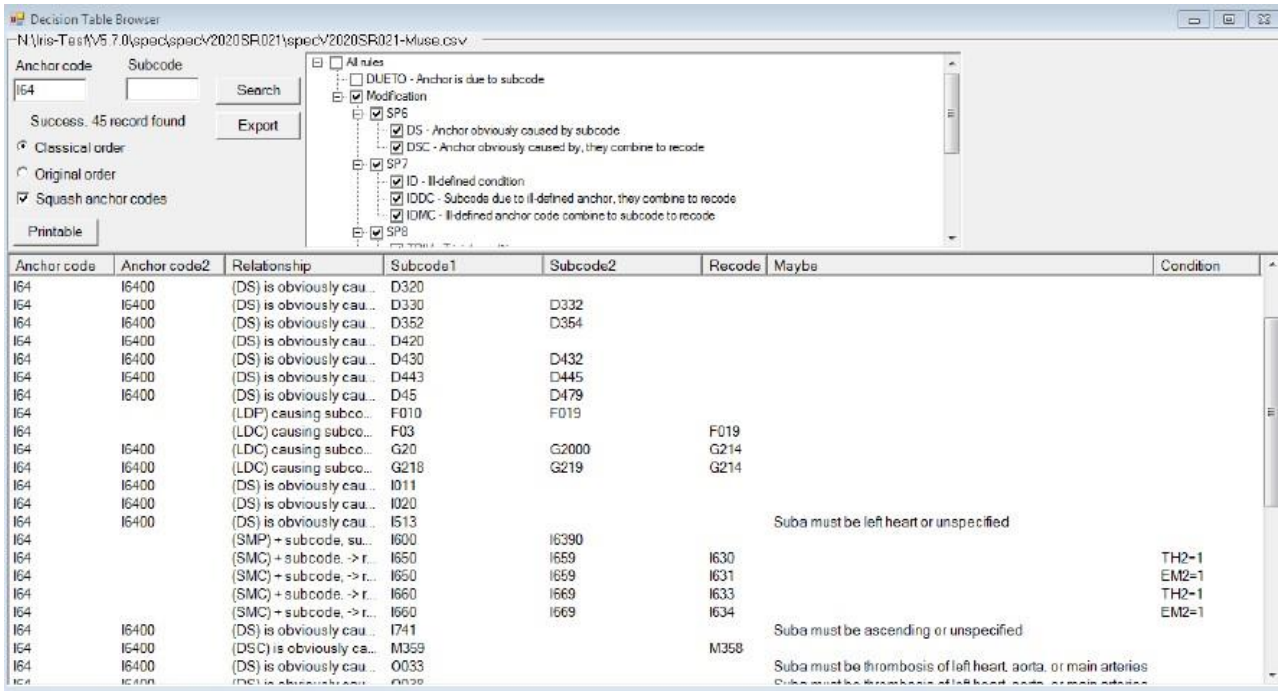
Output file look like:



ns1:DateBirth	ns1:DateDeath	ns1:Sex	ns1:MannerOfDeath	ns1:Status	ns1:Reject	ns1:Coding	ns1:UCCode	ns1:SubstitutedCodes	ns1:AcmeCodes	ns1:
1010001	29012019	1		6 Initial	No	Automatic				
1010001	3092019	1		6 Initial	No	Automatic				
1010001	26122019	1		0 Final	No	Automatic	I619	I6199 K7200 K7219 L031 K769	I619 K7200 K721 L031 K769	Iris
1010001	15122019	2		0 Final	No	Automatic	C539	N19/N134/C539	N19/N134/C539	Iris
1010001	15122019	1		0 Final	No	Automatic	C609	R571 R688/C609	R571 R688/C609	Iris
1010001	16122019	2		0 Final	No	Automatic	C349	R092/C349	R092/C349	Iris
1010001	16122019	1		0 Final	No	Automatic	C64	R578/C64 J849	R578/C64 J849	Iris
1010001	16122019	1		0 Final	No	Automatic	C349	R578/C349	R578/C349	Iris
1010001	17122019	2		0 Final	No	Automatic	C23	I269/C23	I269/C23	Iris
1010001	19122019	2		0 Final	No	Automatic	C23	C23	C23	Iris
1010001	19122019	2		0 Final	No	Automatic	D27	R572 R688/D27	R572 R688/D27	Iris
1010001	20122019	2		0 Final	No	Automatic	C509	J960/C780 C269/C509	J960/C780 C269/C509	Iris
1010001	20122019	1		0 Final	No	Automatic	C20	C20 C795/I469	C20 C795/I469	Iris
1010001	20122019	2		0 Final	No	Automatic	C19	C19/I469	C19/I469	Iris
1010001	21122019	2		0 Final	No	Automatic	J459	I469/J80/J459 J849/C56	I469/J80/J459 J849/C56	Iris
1010001	21122019	2		0 Final	No	Automatic	C541	J961/E875/C541 C349	J961/E875/C541 C780	Iris
1010001	13122019	1		0 Final	No	Automatic	C383	C383 C787	C383 C787	Iris
1010001	20122019	2		0 Final	No	Automatic	C509	A419 N179/C509	A419 N179/C509	Iris
1010001	21122019	2		0 Final	No	Automatic	C809	J90/I469/C809	J90/I469/C809	Iris
1010001	21122019	2		0 Final	No	Automatic	C56	R572/C56*E149	R572/C56*E149	Iris
1010001	22122019	1		0 Final	No	Automatic	C859	I469/C859	I469/C859	Iris
1010001	22122019	1		0 Final	No	Automatic	C920	R572/A419/C920	R572/A419/C920	Iris
1010001	22122019	1		0 Final	No	Automatic	E871	R572/J189/E871/D469	R572/J189/E871/D469	Iris
1010001	16122019	1		0 Final	No	Automatic	C159	J690/C159	J690/C159	Iris
1010001	14122019	2		0 Final	No	Automatic	E149	I469/E149/G309*C159	I469/E149/G309*C159	Iris
1010001	16122019	2		0 Final	No	Automatic	C259	A419/C259	A419/C259	Iris
1010001	16122019	1		0 Final	No	Automatic	C029	J189/C029	J189/C029	Iris
1010001	21122019	1		0 Final	No	Automatic	C761	J189 J80/J700/C761	J189 J80/J700/C761	Iris

Decision table browser (DTB)

This tool is very useful for experimented coders and users. It permits to browse the unicausal decision tables (DT) used for the selection of the underlying cause of death. The following example shows all the relationships using the Anchor code I64.



Anchor code	Anchor code2	Relationship	Subcode1	Subcode2	Recode	Maybe	Condition
I64	I6400	(DS) is obviously cau...	D320				
I64	I6400	(DS) is obviously cau...	D330	D332			
I64	I6400	(DS) is obviously cau...	D352	D354			
I64	I6400	(DS) is obviously cau...	D420				
I64	I6400	(DS) is obviously cau...	D430	D432			
I64	I6400	(DS) is obviously cau...	D443	D445			
I64	I6400	(DS) is obviously cau...	D45	D479			
I64		(LDP) causing subco...	F010	F019			
I64		(LDC) causing subco...	F03		F019		
I64	I6400	(LDC) causing subco...	G20	G2000	G214		
I64	I6400	(LDC) causing subco...	G218	G219	G214		
I64	I6400	(DS) is obviously cau...	I011				
I64	I6400	(DS) is obviously cau...	I020				
I64	I6400	(DS) is obviously cau...	I513			Suba must be left heart or unspecified	
I64		(SMP) + subcode, su...	I600	I6390			
I64		(SMC) + subcode, -> r...	I650	I659	I630		TH2=1
I64		(SMC) + subcode, -> r...	I650	I659	I631		EM2=1
I64		(SMC) + subcode, -> r...	I660	I669	I633		TH2=1
I64		(SMC) + subcode, -> r...	I660	I669	I634		EM2=1
I64	I6400	(DS) is obviously cau...	I741			Suba must be ascending or unspecified	
I64	I6400	(DSC) is obviously ca...	M359		M358		
I64	I6400	(DS) is obviously cau...	O033			Suba must be thrombosis of left heart, aorta, or main arteries	

Iris Software Implementation

Iris Software implementation pre-requirements

- Country uses the WHO recommended format of the MCCD
- All coders are trained in manual mortality coding
- For the text entry version of Iris, a local language is available
- Local IT support is available

Iris Software implementation in Mumbai

- **Mumbai is the pioneer city in India**, to establish a complete- Automated-cause of death ICD-10 coding system.
- Starting from version **IRIS 5.4**, over 6 years, BMC has adapted various updated version of the software, at par with **WHO ICD-10 codes.**
- Currently the **IRIS 5.8.1 with Specification file SpecV2021SR40** (updated coding rules and decision tables) is being used for the Coding and Batch Processing.

In Mumbai there are 24 administrative wards under BrihanMumbai Municipal Corporation (BMC).

For the convenience of city administration, wards have been decentralized.

Need for an Automated Cause of Death Coding System in BMC

- Prior to IRIS software implementation, the coding at BMC was done manually by medical officers at ward level.
- The system was decentralised and quality of data was compromised.
- This affected the quality of cause of death analysis and reporting.
- To streamline and update the process and to aid policy making decisions, the IRIS Automated Cause of Death ICD-10 coding system was introduced in BMC.

Support System

- Data for Health Initiative, an initiative by Bloomberg Philanthropies and CDC Foundation collectively approached Brihanmumbai Municipal Corporation (BMC) to improve quality of Medical Certification of Cause of Death in Mumbai.
- Financial and Technical Partners: CDC Foundation (United States) and Tata Memorial Centre (Mumbai)

System implementing elements

1. **BMC Departments as Data Sources:**
   - MIS Cell: Supplies a soft copy of the CRS Death line list for 24 wards.
   - RBD Department: Provides physical forms for the MCCD (Medical Certificate of Cause of Death).

2. **Automated Coding Software:**
   - Iris Software Version 5.8.1 with specification file SpecV2021SR40 for ICD-10 Coding

3. **Implementation member**
   - Medical Coders
   - IT Consultant
   - Data Entry Clerks

Coding team working steps

Step 1 : CRS death line list collection at MIS cell (Soft Copy)

- All wards in Mumbai (24 wards A to T) send the CRS death line list to MIS Cell (Kasturbha Hospital, Chinchpokli) in Excel sheet format Containing demographic data. (eg. Certificate key, DateOfDeath, Sex, Age, Name, MannerOfDeath, Address, etc.)
- MIS Cell Collects 24 wards CRS death line list and shares it with the RBD IT Department through email.

Step 2 : MCCD forms collection at RBD Department (Physical forms)

- MCCD Physical Forms received at RBD Department sent by 24 wards after completed the month.
- The CRS line list and MCCD forms should be synchronized and verified by the RBD Department clerks.

Step 3 : MCCD forms coded by Medical Coder

- Comply with all requirement as per ICD-10 guideline for coding and underlying cause of death.
- Assign appropriate ICD-10 codes, finding their underlying cause of death using ICD-10 volumes and decision tables.
- Contribute coding information to IRIS (automated coding system) i.e. created codes, connected codes, coding flags
- Resolve cases rejected by system (e.g. external injuries, pregnancy related, operating procedure related)
- Review and qualitative analysis of MCCD certificate of MCGM
- Willing to learn and keep self-updated with latest codes

- Work cohesively in team setting and assist team members to achieve shared goals

Step 4 : Database creation, maintains and Iris Software implementation by IT Consultant

- Received 24 ward monthly CRS death line list in Excel Sheet format by MIS Cell.
- Prepare Iris Certificate database for 24 words. IT Consultant should have to Create a database for every year (Currently using Microsoft Access Database).
  By default after installation of Iris Software Iris database folder created in C:\Program files. By referring default format, you can create/Update new database.
- Prepare lots (Ident and MedCod table) as per Iris specifications and upload them into the Iris death certificate database. Create Ident tables containing demographic data contains (CertificateKey, DateDeath, Age, Sex, Status, Reject, Coding, Residence, Name, Address, PlaceOfOccurrence) using CRS death line list.
- Maintain a record of lots uploaded to the Iris database to avoid duplication.
- Medcod table contains Medical Part (line codes) mentioned on Form type 4,4A and PM form. This data entered by data entry clerks.
- Iris Database ready to use.

Step 5 : Medical Coding data entry in Iris Software by Data Entry Operators

- Data Entry doing in Iris Software as per instructed by IT Consultant recommended Iris Version and Specification file.
- Data Entry doing in Medical Part of Iris User Interface: (Part I : Line codes (A,B,C,D,E), Part II, Time Intervals, Manner of Death ,Free text, Comments, MCCD death form type etc.
- If MCCD forms does not exist, added the record w.r.t ward.
- Also perform a consistency check with the Age column according to the requirements of Iris i.e. to convert the age in Years and Days format.
- To perform Data Entry according to the Instruction Set provided by Team.
- Perform Batch processing on Daily basis.
- Data entry clerks doing entry of MCCD form type (4,4A or PM form with PM form number). Added details from MCCD form like certified doctor details, physically missing forms, duplicate records, blank forms, PI, Civil death etc. in columns Comments and Free text provided by Iris Software.

Step 6 : Rejection Handling by Medical Coders:

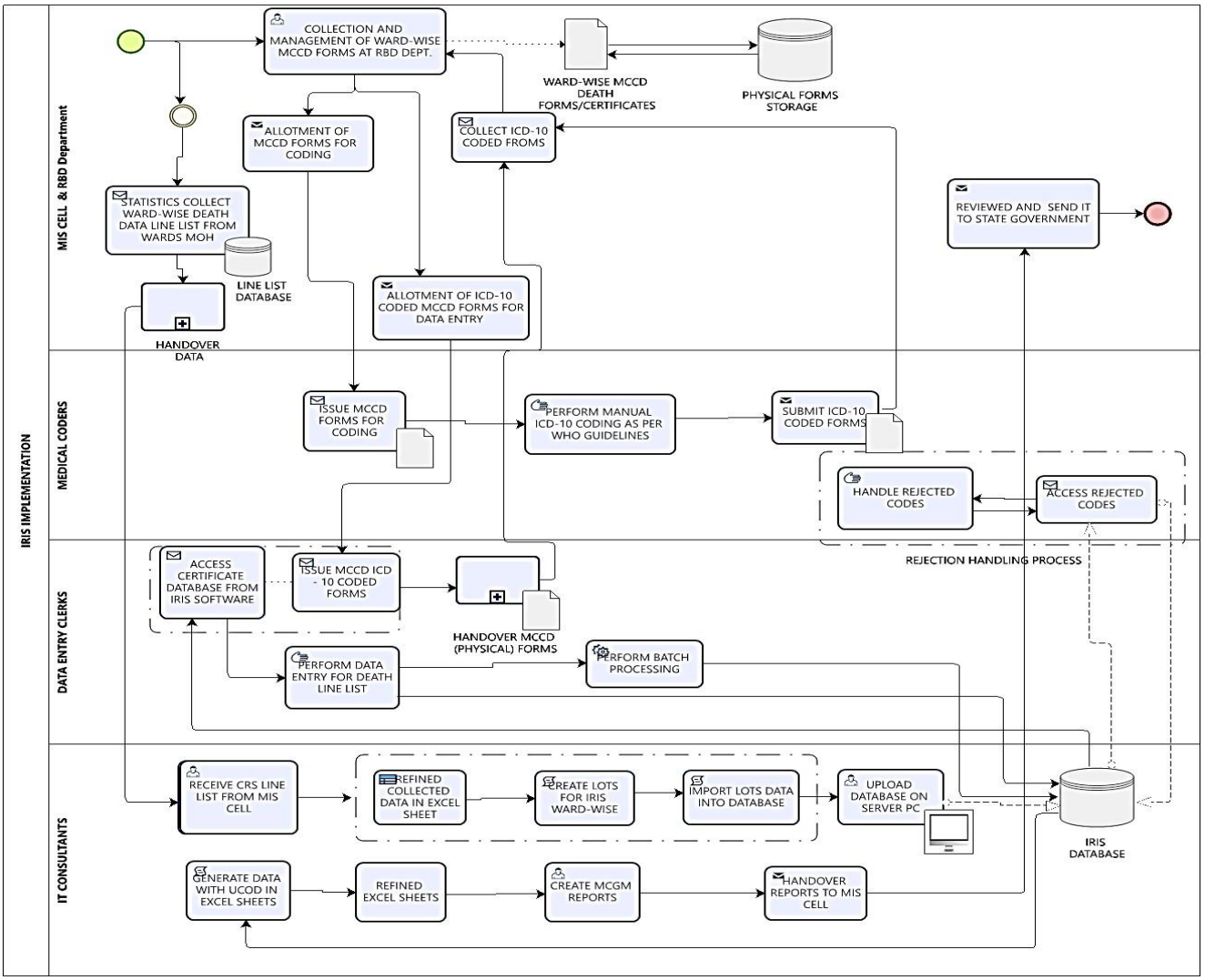
- The rejects resolved by Coders, if any.
- If required resolved with the help of consulting doctors.

Step 7 : Cause of death report preparation by IT Consultant

- Export finalised data from the database in Excel sheet format.
- Should be merge month wise 24 ward data to get Monthly or Yearly data.
- Data Cleaning (to find out the missing entries, duplicates entries, other bugs).

- Extract the Underline cause of Codes from Iris database and prepare various Analysis reports.
- Cause of Death Report (CD4), submitted to Registrar General of India annually.
- Analysis of annual cause of death data by using ANACONDA software, for comparative study.
- Ward wise analysis and reporting by continuous monitoring of quality of MCCD data, done by the medical coders.
- Insights about requirement for training to doctors based on ward-wise supervision for quality improvement.
- Based on the instruction set used for data entry in the IRIS system, the quality of data can be assessed, which helps to take administrative actions on MCCD reporting.
- Create a report as per requirement of RTI received by MIS cell.
- Create a report as per requirement of higher authorities of health department.

IRIS Work Flowchart(CODE ONLY MODE): BMC Mumbai Coding Team (for 24 Wards)



Outcome of IRIS Automated ICD-10 Coding System

- Cause of Death Report (CD4), submitted to Registrar General of India annually.
- Analysis of annual cause of death data for comparative study – noted change in mortality pattern from communicable to non-communicable disease.
- This supported in prioritizing evidence-based efforts at programmatic level.
- Continuous monitoring of quality of MCCD data done by medical coders.
- Insights about requirement for training to doctors based on ward-wise supervision for quality improvement.
- Compulsory e-learning MCCD training for all doctors in Mumbai.
- Improved quality in writing cause of death due to these trainings thereby noted reduction in non-specific causes of death.

Impact of IRIS Implementation

- Improved efficiency of coding system – increased speed of coding from one year to 3 months.
- Increased coding consistency and accuracy
- International compatibility (evidence of success by implementing IRIS ICD-10 coding system - automated coding system, which has ensured international comparability of MCGM ICD 10 coding.
- Data generated can be used for auditing, research, performance studies, etc.
- Enables regular monitoring and feedback.

Appendix: List of abbreviations

Abbreviation/Term	Explanation
.accdb	Microsoft Database [since Access 2007]
.config	A configuration file used to configure the parameters and initial settings for some computer programs. They are used for user applications, server processes and operating system settings.
.csv	Comma-separated values [file format to store data (numbers and text) in plain text]
.dat	A generic data file that stores information specific to the application it refers to
.DES	Data Encryption Standard [symmetric-key algorithm for the encryption of electronic data]
.dll	Dynamic Link Library
.exe	A common filename extension denoting an executable file; the main execution point of a computer program.
.gif	Graphics Interchange Format [a graphic format for pictures]
.ico	An image file format for computer icons in Microsoft Windows.
.jpeg	Joint Photographic Experts Group [method of lossy compression for digital images]
.log	A log file records either events that occur in an operating system or other software runs, or

	messages between different users of communication software.
.mdb	Microsoft Database [since Access 2007 also .accdb]
.msi	Microsoft Installer [a software component and application programming interface (API) of Microsoft Windows used for the installation, maintenance, and removal of software]
.Net	An open source developer platform for building many different types of applications developed by Microsoft.
.Net Framework	A software framework developed by Microsoft
.pdf	Portable Document Format [present documents, including text formatting and images, in a manner independent of application software, hardware and operating systems]
.properties	A file extension for files to store the configurable parameters of an application.
.tif	Tagged Image File Format [file format for storing images]
.xml	Extensible Markup Language [defines a set of rules for encoding documents in a format that is both human-readable and machine-readable]
.xsd	XML Schema Definition [specifies how to formally describe the elements in an Extensible Markup Language (XML) document]
.zip	An archive file format that supports lossless data compression.
ACME	Automated Classification of Medical Entities
ADO.NET	A data access technology from Microsoft .NET Framework that provides communication between relational and non-relational systems through a common set of components.
DCodes	Direct codes
DT	Decision tables
DTB	Decision Table Browser
DTE	Decision Table Editor
ICD-10	International Statistical Classification of Diseases and Related Health Problems, 10th revision (https://www.who.int/standards/classifications/classification-of-diseases)
MC	Multiple cause
MCOD	Multiple cause of death
MCDT	Multicausal decision tables
MCodes	Multiple-cause codes
MICAR	Mortality Medical Indexing, Classification, and Retrieval
MMDS	Mortality Medical Data System (https://www.cdc.gov/nchs/nvss/mmds/about_mmds.htm)

MoD	Manner of Death
MRG	Mortality Reference Group (improves international comparability of mortality data by establishing standardized application of the ICD).
MS Office	Microsoft Office
MSSQL	Microsoft SQL Server [a relational database management system developed by Microsoft]
MUSE	Multicausal and Unicausal Selection Engine
MySQL	An open-source relational database management system (RDBMS).
NCHS	National Center for Health Statistics
NCIC	NonConsistentIcdCodes tables
OLE DB	Object Linking and Embedding, Database [also written as OLEDB or OLE-DB; programming interface designed by Microsoft for access to different data sources]
Oracle	Oracle Database is a multi-model database management system produced and marketed by Oracle Corporation
PostgreSQL	An object-relational database management system (ORDBMS).
MCGM	Municipal Corporation of Greater Mumbai
BMC	Brihanmumbai Municipal Corporation
CDC Foundation	Centres for Disease Control and Prevention Foundation
MCCD	Medical Certification of Cause of Death
CRS	Civil Registration System
RBD	Registration of Births and Deaths

References:

Iris institute website:
https://www.bfarm.de/EN/Code-systems/Collaboration-and-projects/Iris-Institute/_node.html

WHO ICD website:
https://www.who.int/standards/classifications/classification-of-diseases

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