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Use of SNOMED for strengthening Medical Certification of Cause of Death

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Introduction

- Medical Certification of Cause of Death (MCCD) – component of the Civil Registration system is a source of mortality statistics in India, but is limited by the quality of cause of death information available.
- Common errors observed : illegible handwriting, use of abbreviations for medical terms, modes of dying (eg cardiorespiratory failure) as underlying cause of death.
- In India, the Civil Registration System has enabled electronic record system for death registration, and needs to strengthen MCCD reporting through electronic systems.

Strengthening cause of death information through NCDIR e-Mor

- Online software e-Mor (NCDIR electronic Mortality) to record accurate cause of death information
- All deaths must be recorded and certified with cause of death by a medical doctor in the Medical Certification of Cause of Death (MCCD) Form 4 / 4A
- Interested hospitals, nursing homes register with ICMR-NCDIR to use the free software to record MCCD
- Use of this software does not replace the system of death reporting and death registration existent
- Build death auditing system in hospitals

The screenshot displays the NCDIR e-Mor website interface. At the top, the ICMR and NCDIR logos are visible alongside the text 'National Centre for Disease Informatics and Research' and 'Indian Council of Medical Research'. A navigation bar includes 'Home', 'About', 'Training', and 'Contact Us'. The main content area features a diagram titled 'Sources of mortality data in India' which shows the 'Office of the Registrar General, India' receiving data from the 'Civil Registration System' (leading to 'MCCD' and 'Death Report') and the 'Sample Registration System' (leading to 'Verbal Autopsy (VA)'). 'Other Surveys' are also shown as data sources, including 'National Family Health Survey', 'District Level Household Survey', 'Annual Health Survey', and 'Cross sectional studies'. To the right, a section titled 'Strengthening cause of death statistics in India' lists five key messages. Below this, there is an 'About MCCD' section with a definition and a 'Cause of death - All what you want to know!' link. On the far right, a 'Registered User Login' form is present with fields for 'User Id' and 'Password', and a 'Login' button.

Sources of mortality data in India

Strengthening cause of death statistics in India

- All deaths must be recorded and certified with cause of death by a medical doctor
- Record underlying cause of death in the Medical Certification of Cause of Death (MCCD) Form 4 / 4A
- Build death auditing system in hospitals
- Interested hospitals, nursing homes can register with ICMR-NCDIR to use the free online software e-Mor (NCDIR electronic mortality) to record accurate cause of death information to strengthen Form 4/4A
- Use of this software does not replace the system of death reporting and death registration existent in each state

About MCCD

Medical Certificate of Cause of Death (MCCD) is the certificate issued by the attending medical practitioner who had treated the person during admission in a medical institution or in the last illness (prior to death) while taking treatment from a physician outside of a medical institution.

Cause of death - All what you want to know !
The cause of death is defined as "all those diseases, morbid conditions/abnormalities, injuries which either resulted in or contributed to death and the circumstances of the accident or violence which produced any such injuries". [Read More...](#)

Registered User Login

User Id

Password

Background

- Ministry of Health and Family Welfare (MoH&FW) , Government of India notified EHR Standards.
- To accelerate and promote adoption of the EHR standard, Ministry of Health & Family Welfare (MoH&FW) has formed National Resource Centre for EHR Standards (NRCeS)at C-DAC, Pune.
- Also function as National Release Centre(NRC) for SNOMED CT.
- NRCeS provides the knowledge base for EHR Standards and associated resources and facilitates acceptance of and adherence to EHR standards.
- ICMR-NCDIR is a licensee.

Tools and Technologies

C-DAC's SNOMED CT Toolkit (CSNOtk)

□ The salient features of the CSNOtk include:

- Easy to use Object Oriented API for search, suggest, lookup and explore
- SNOMED CT to ICD-10 Mapping API
- Facility for import and search from the reference sets
- Easy to use embed jQuery based custom controls
- Apache Lucene engine based full-text search
- Ready to use SNOMED CT web service
- Automates database and Lucene index creation from the SNOMED CT release files
- Feature rich SNOMED CT browser
- The CSNOtk is available from C-DAC at www.cdac.in (email: sdkenq@cdac.in) under Apache License v2.0 as free and open source software.

CSNOtk Components

CSNOLib

- CSNOLib is set of API components written in JAVA.
- Includes tool to create a relational database (default MySQL) and populate with SCT concepts from release files.
- Can be integrated in any JAVA application.

CSNOServ

- Ready to call Representational State Transfer (REST) API layer exposed as Web Service
- Deployable over web / application server.



CSNOCtrl – JQuery based control

Used to retrieve the SNOMED CT Terms

- Used with any existing textbox on web- form in JAVA / .NET/ PHP based application.
- Easy integration of SNOMED CT to ICD-10 mapping.

There are 19 hierarchies in SNOMED CT

I	Body structure (body structure)
II	Clinical finding (finding)
III	Environment or geographical location (environment / location)
IV	Event (event)
V	Observable entity (observable entity)
VI	Organism (organism)
VII	Pharmaceutical / biologic product (product)
VIII	Physical force (physical force)
IX	Physical object (physical object)
X	Procedure (procedure)

XI	Qualifier value (qualifier value)
XII	Record artifact (record artifact)
XIII	Situation with explicit context (situation)
XIV	SNOMED CT Model Component (metadata)
XV	Social context (social concept)
XVI	Special concept (special concept)
XVII	Specimen (specimen)
XVIII	Staging and scales (staging scale)
XIX	Substance (substance)

Hierarchies used in e-Mor application

- DISORDER
- PROCEDURE
- EVENT
- FINDING
- SITUATION WITH EXPLICIT CONTEXT
- ORGANISM
- PHYSICAL FORCE
- QUALIFIER VALUE

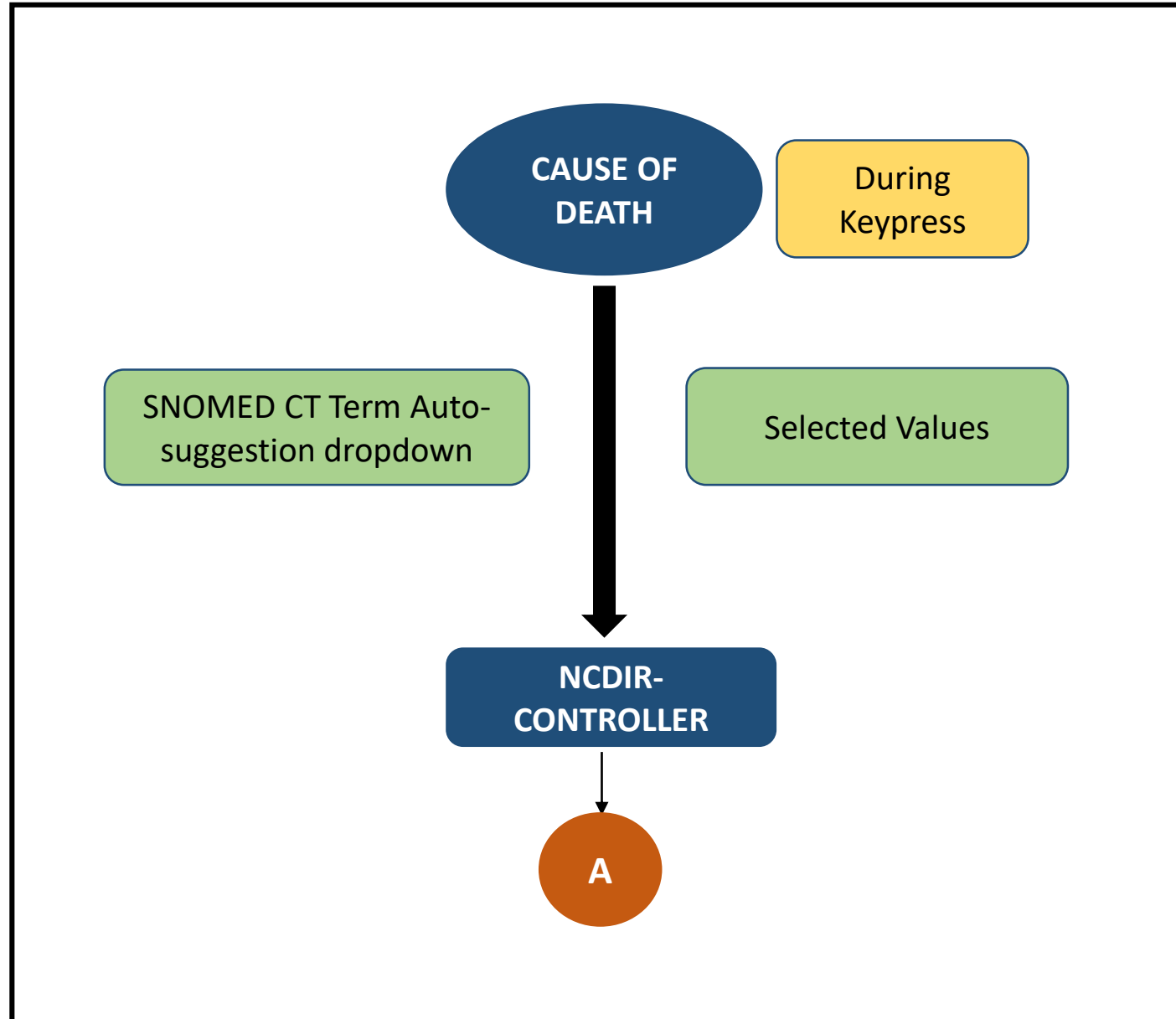
SNOMED CT to ICD -10 Map tool

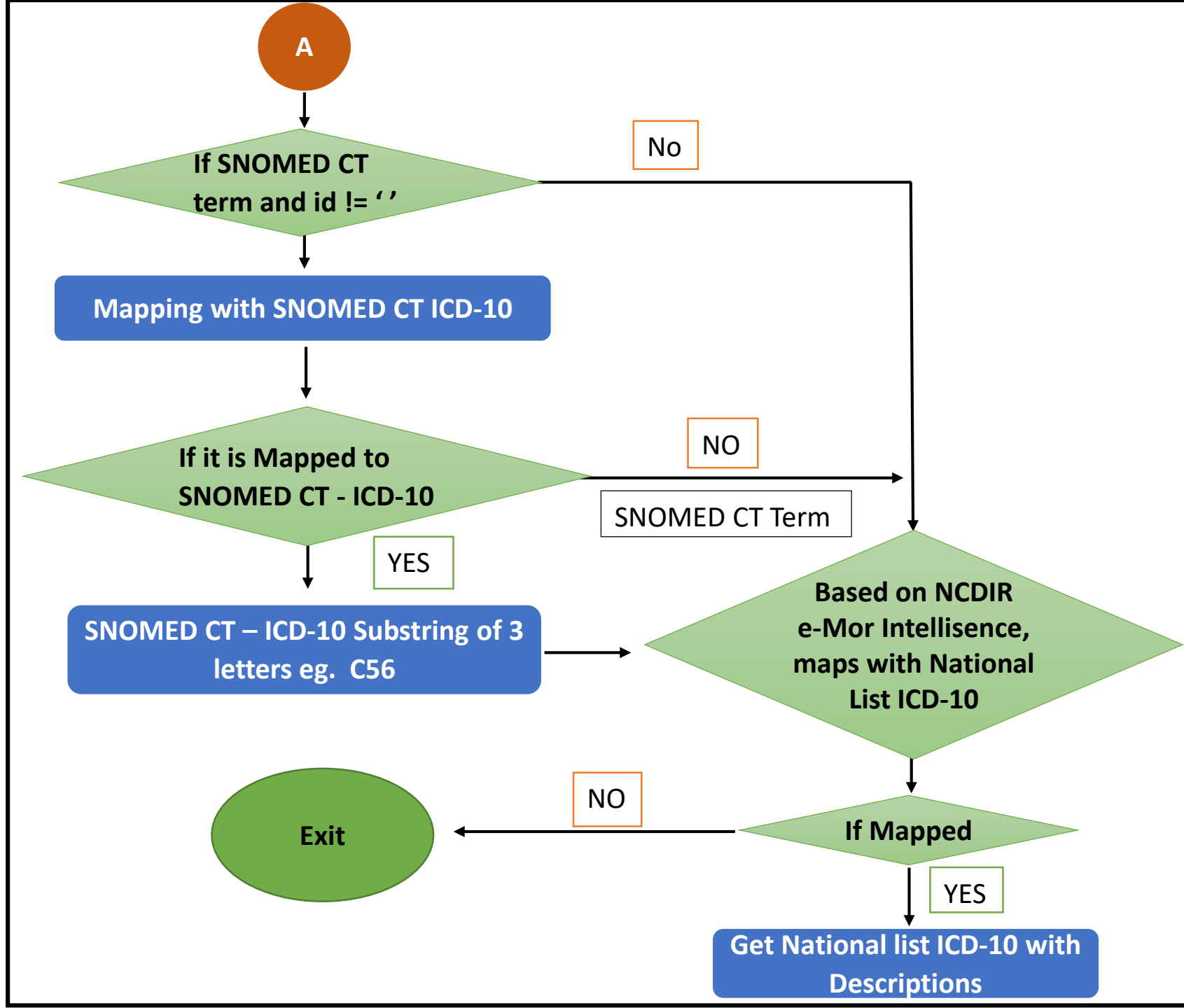
- SNOMED CT (Systematized Nomenclature of Medicine - Clinical Terms) with its map to ICD-10 allows for standardized clinical terms as input and translated to standardized ICD-10 codes used for statistical reporting.
- ICD Classification systems are in practice globally for reporting statistics on causes of death.
- SNOMED CT to ICD-10 evaluated for completeness –ongoing exercise.
- ICD-10 codes appear with SNOMED CT descriptions.

Changes to be done

- ICD-10 descriptions should be recorded.
- Medical terms to ICD-10 codes should be complete.
- ICD-10 codes should be synchronized to national reporting and statistical systems.

Work flow – Mapping SNOMED CT descriptions to ICD -10





Technology used to Map SNOMED CT (Version July 2019 v1.0) descriptions to National list of ICD- 10, India

Language	: Java 8 (jdk 1.8)
Framework	: Spring Framework
Database	: MySQL 5.7
Server	: Apache Tomcat 9.0
Frontend	: HTML 5, JSP, Bootstrap 3.3.7, Css , JQuery, Ajax

- As and when the cause of death is entered, SNOMED CT terms will appear as suggestions (using Web service REST API) which allows the user to select the cause of death description.
- The selected description will be checked for the exact ICD-10 mapping in the SNOMED CT database using the respective SNOMED CT term and Concept ID.
- If the mapped ICD-10 is found then the respective ICD-10 code is mapped with the National List of ICD-10 to retrieve the ICD-10 description which will be displayed in the ICD-10 description textbox.
- If the mapped ICD-10 is not found, then the ICD-10 description is retrieved from the National List of ICD-10 using the search and intelligence technique developed by NCDIR.

NCDIR e-Mor Software



National Centre for Disease Informatics and Research
(Indian Council of Medical Research)
NCDIR e-Mortality Software (NCDIR e-Mor)



- Home
- Register Death
- Export
- Quality Check
- Reports
- Manuals
- Blank Form
- User

NAME OF CLINIC / NURSING HOME / HOSPITAL / INSTITUTE : 200001 National Centre for Disease Informatics and Research

User Name : 200001_1

Death Serial No : 2000012

HOSPITAL INFORMATION

Name of Unit / Department *

Name of Treating Doctor /
Surgeon / Physician

Hospital Registration Number *

Date of Admission to Hospital

DECEASED INFORMATION

Date of Death *

Time of Death *

 : a.m. ▼

Full name of patient (at least one name is compulsory) *

Mr./Shri. ▼

Title

First Name

Middle Name

Last Name

Age *

Years Months Days Hours

Sex*

- Male Female Others

Religion

 ▼

Occupation

 ▼

Aadhar (Unique Identification) Number

NAME OF CLINIC / NURSING HOME / HOSPITAL / INSTITUTE : 200001 National Centre for Disease Informatics and Research

User Name : 200001_1

Death Serial No : 2000011

HOSPITAL INFORMATION

Name of Unit / Department * SURGICAL ONCOLOGY Name of Treating Doctor / Surgeon / Physician ABCDE
Hospital Registration Number * 12345 Date of Admission to Hospital 01/10/2019

DECEASED INFORMATION

Date of Death * 03/10/2019 Time of Death * 07 : 45 p.m.

Full name of patient (at least one name is compulsory) *

Mr./Shri. ABCD X Y
Title First Name Middle Name Last Name

Age * 65 Sex * Male Female Others
Years Months Days Hours

Religion 7.Parsi
Occupation 7.Craft And Related Trades Workers
Aadhar (Unique Identification) Number 1212121212

Permanent address of the deceased *

Urban

HNo. / Building Name

123 A

Road / Street Name

WEST STREET

Area / Locality / PO

SOUTHERN LOCALITY

Ward / Corporation / Div

City / Town*

BENGALURU

District*

BENGALURU

State*

KARNATAKA ▼

Rural

House No.

Village / Gram Panchayat *

Taluk / Tehsil (Sub Dist)*

PHC / Sub-Centre

Pin Code*

560001

Local Address of the deceased at the time of death

Please select box if the address is same as permanent address

Urban

HNo. / Building Name

123 A

Road / Street Name

WEST STREET

Area / Locality / PO

SOUTHERN LOCALITY

Ward / Corporation / Div

City / Town*

BENGALURU

District*

BENGALURU

State*

KARNATAKA ▼

Rural

House No.

Village / Gram Panchayat *

Taluk / Tehsil (Sub Dist)*

PHC / Sub-Centre

Pin Code*

560001

FAMILY / INFORMANT INFORMATION

	Title	First Name	Middle Name	Last Name	Aadhar Number	Informant
Father	Mr./Shri. ▼	AAAAA	BBBBB	CCCCC	123456123456	<input checked="" type="radio"/>
Mother	Mrs./Shrimati ▼				Should be 12-Digit	<input type="radio"/>
Husband / Wife	Mr./Shri. ▼				Should be 12-Digit	<input type="radio"/>
Informant	Mr./Shri. ▼					<input type="radio"/>

INFORMANT'S ADDRESS

Please select box if the address is same as permanent address

<input checked="" type="radio"/> Urban	<input type="radio"/> Rural		
HNo. / Building Name	123 A	House No.	
Road / Street Name	WEST STREET	Village / Gram Panchayat	
Area / Locality / PO	SOUTHERN LOCALITY	Taluk / Tehsil (Sub Dist)	
Ward / Corporation / Div		PHC / Sub-Centre	
City / Town	BENGALURU		
District	BENGALURU	Pin Code	560001
State	KARNATAKA ▼		

DEATH INFORMATION

Place of Death

This Hospital

House

Others, specify

Type of medical attention received just before death

Admitted in same hospital

Medical attention other than Institution

No medical attention

Unknown

What was the mode of dying?

4.Respiratory Failure/Arrest ▼

--Select Mode of Dying--

1.Cardiac Arrest/Heart Attack

2.Cardio Respiratory Failure

3.Cardio Respiratory Arrest

4.Respiratory Failure/Arrest

5.Shock

6.Heart Failure

7.Coma/Brain Failure

8.Multi Organ/System Failure

9.Others, specify

This is mode of dying.
Continue to complete MCCD
OR
Save draft and generate
Certificate of death for disposal of body.

OK

CAUSE OF DEATH

(1) What is the disease or condition directly leading to death of the person ? *

(Avoid causes listed as mode of dying, complete the underlying cause of death sequence)

Approximate interval between onset and death

Years Months Days Hours Minutes

Immediate Cause

ICD-10 DESCRIPTION

- CARDIAC AR
- Cardiac arrest**
- Cardiac arrhythmia
- 1b Induced cardiac arrest
- Neonatal cardiac arrest
- 1c Cardiac arrest team call
- History of cardiac arrest
- Bradycardic cardiac arrest
- Cardiac arrest due to trauma
- Cardiac arrest during surgery

SNOMED CT Terms

1b

1c

CAUSE OF DEATH

(1) What is the disease or condition directly leading to death of the person ? *

(Avoid causes listed as mode of dying, complete the underlying cause of death sequence)

Approximate interval between onset and death

Years Months Days Hours Minutes

Immediate Cause

This is a Mode of dying, Continue to Enter the Immediate cause of Death.

1a

(due to or as a consequence of)

Antecedent Cause

1b

(due to or as a consequence of)

1c

OK

CAUSE OF DEATH

(1) What is the disease or condition directly leading to death of the person ? *

(Avoid causes listed as mode of dying, complete the underlying cause of death sequence)

Approximate interval between onset and death

1a Immediate Cause
MYOCARDIAL INFARCTION
(due to or as a consequence of)

ICD-10 DESCRIPTION

Years Months Days Hours Minutes

1b Antecedent Cause
ISCHEMIC HEART DISEASE

I25 Chronic ischaemic heart disease
Please click on box to select ICD description
I25 Chronic ischaemic heart disease
Other Specify

15
Years Months Days Hours Minutes

National List of ICD-10 Codes

SNOMED CT Terms

(2) Did t

ditions contributing to death but not resulting in the underlying cause given above ? *

Approximate interval between onset and death

Years Months Days Hours Minutes

- Coronary artery disease
- Cerebrovascular disease
- Diabetes Mellitus
- Cancer
- Other, Specify
- Other, Specify
- None

(2) Did the person suffer from other significant conditions contributing to death but not resulting in the underlying cause given above ? *

Approximate interval between onset and death

Coronary Heart Disease

Cerebrovascular Disease

Diabetes Mellitus

Cancer

Other, Specify

HYPERTENSION

Other, Specify

None

Years Months Days Hours Minutes

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--	--	--	--	--

--	--	--	--	--

--	--	--	--	--

25				
----	--	--	--	--

If cancer is an underlying or contributing condition, then explain below

Primary Site of Tumour-Topography
(include sub-site if any)

Primary Histology-Morphology

Secondary Site of Tumour

Morphology of Metastasis

MANNER OF DEATH *

Natural Accident Suicide Homicide Pending investigation

How did the injury occur?

Death Related to Pregnancy

No During Pregnancy During Delivery Within 6 weeks after the end of Pregnancy

HABITS

If used to habitually

Smoke

No Yes

Years

Chew tobacco

No Yes

Years

Chew arecanut in any form(including pan masala)

No Yes

Years

Drink alcohol

No Yes

Years

DOCTOR INFORMATION

Name of the Doctor certifying death *

QWERTY

Registration Number

987654

Designation

SENIOR SURGEON

Hospital

National Centre for Disease Informatics and Res

Name of person completing form

ASDF

Date of completing form

10/10/2019



Name of Data Entry Operator

ZXCV

Date of entry

11/10/2019



* Required

 Submit

 Modify

 Delete

 Reset

 Generate Certificate of Death



 Generate MCCD/Form 4



 Generate Death Report/Form 2



 Download e-Mor Record



National Centre for Disease Informatics and Research

Certificate of Death for Disposal of Body

Death Serial Number 2000011

Date of Death 03/10/2019 Time 07 : 45 p.m.

Full name of the deceased Mr./Shri. ABCD X Y

Hospital Number 12345

Name of the Father Mr./Shri. AAAAA BBBBB CCCCC

Name of the Mother _____

Name of the Husband/Wife _____

Place of Death This Hospital

Age 65 Years.

Sex Male

Marital Status _____

Occupation Craft And Related Trades Workers

Religion Parsi

Nationality Indian

Permanent residential address* 123 a WEST sTREET SOUTHERN LOCALITY BENGALURU
BENGALURU,17-560001

Whether medically certified? No

Date of Admission 01/10/2019

Kind of medical attention received,if any Admitted in same hospital

Informant's

1)Name NATIONAL CENTRE FOR DISEASE INFORMATICS AND RESEARCH

2)Address _____

Date: 11/10/2019

Signature of Doctor

FORM NO. 4
(See RULE 7)
MEDICAL CERTIFICATE OF CAUSE OF DEATH
(Hospital In-Patients. Not to be used for still births)
To be sent to Registrar along with Form No.2(Death Report)

Name of the Hospital National Centre for Disease Informatics and Research

I hereby certify that the person whose particulars are given below died in the hospital in Ward No Surgical Oncology on 03/10/2019 at 07 : 45 p.m.

NAME OF DECEASED <u>Mr./Shri.. ABCD X Y</u>		Age at Death				For use of Statistical Office	
Sex	If 1 year or more, age in years	If less than 1 year, age in month	If less than one month, age in days	If less than one day, age in hours			
1. Male	65						
2. Female							
CAUSE OF DEATH					Interval between onset and death approx		
I Immediate cause State the disease, injury or complication which caused death, not the mode of dying such as heart failure, asthenia, etc Antecedent cause Morbid conditions, if any, giving rise to the above cause stating underlying conditions last.		a) MYOCARDIAL INFARCTION ----- due to (or as a consequences of) b) ISCHEMIC HEART DISEASE ----- due to (or as a consequences of) c) ----- ----- ----- ----- -----			6Hours ----- 15Years ----- 25 YEARS ----- ----- ----- -----		----- I25 Chronic ischaemic heart disease ----- ----- -----
II Other significant conditions contributing to the death but not related to the disease or condition causing it		HYPERTENSION ----- ----- ----- -----			----- ----- ----- -----		

Manner of Death

1. Natural 2. Accident 3. Suicide 4. Homicide 5. Pending Investigation

How did the injury occur?

If deceased was a female, did the death occur while pregnant/at the time of delivery/within 6 weeks after pregnancy? 1. Yes 2. No

If yes, was there a delivery? 1. Yes 2. No

Doctor's Name: Dr. QWERTY

Signature of the Medical Attendant certifying the cause of death

Medical Registration Number: 987654

Date of verification: 10/10/2019

Hospital Name: National Centre for Disease Informatics and Research

(To be detached and handed over to the relative of the deceased)

Certified that Mr./Shri.. ABCD X Y S/D/W of R/O 123 A WEST STREET SOUTHERN LOCALITY BENGALURU, BENGALURU, 17, 560001 was admitted to this hospital on 01/10/2019 and expired on 03/10/2019

Doctor / Medical Supdt: QWERTY

Hospital Name: National Centre for Disease Informatics and Research

Legal Information

This Part to be added to death register

To be filled by the informant

1. **Date of Death:** 03/10/2019
(Enter the exact day,month and year the death took place eg,1-1-2000)
2. **Name of the deceased:** Mr./Shri. ABCD X Y
UID No of deceased (if any): 121212121212
3. **Sex of the deceased:** Male
(Enter "male","female","others" do not use abbreviation)
4. **Name of mother:**
UID No of mother (if any):
5. **Name of father:** Mr./Shri. AAAAA BBBB CCCCC
UID No of father (if any): 123456123456
6. **Name of husband/wife:**
UID for husband / wife (if any):
7. **Age of the deceased:** 65 Years.
(If the deceased was over 1 year of age,give age in completed years.If the deceased was below 1 year of age,give age in months,and below 1 month give age in completed number of days,and if below one day,in hours)
8. **Address of the deceased at the time of death:**
123 A WEST STREET SOUTHERN LOCALITY BENGALURU
BENGALURU,17,560001
9. **Permanent address of the deceased**
123 A WEST STREET SOUTHERN LOCALITY BENGALURU
BENGALURU,17 - 560001
10. **Place of death:**
(Tick the appropriate entry 1,2 or 3 below and give the name of the Hospital/Institution or the address of the house where the death took place.If other place,give location)
1. Hospital/Institution Name:
National Centre for Disease Informatics and Research
2. House Address:
3. Other Place :
11. **Informant's Name:** National Centre for Disease Informatics and Research
Address:
- (After completing all columns 1 to 22,informant will put date and signature here:)

Date: Signature of the informant

DEATH REPORT

Statistical Information

This Part to be detached and sent for statistical processing

To be filled by the informant

12. **Town or Village of Residence of the deceased:**
(Place where the deceased actually lived.this can be different from the place where the death occurred.The house address is not required to be entered)
- a) **Name of Town/Village:** BENGALURU
- b) **Is it a town or village:** (Tick the appropriate entry below)
 1.Town 2.Village
- c) **Name of District:** BENGALURU
- d) **Name of State:** 17
13. **Religion:**
1.Hindu 2.Muslim 3.Christian
 4.Any other religion: Parsi
14. **Occupation of the deceased:** Craft And Related Trades
Workers
15. **Type of medical attention received before death**
(Tick the appropriate entry below)
 1.Institutional 2.Medical attention other than Institution
 3.No medical attention

To be filled by the informant

16. **Was the cause of death medically certified ?**
 1.Yes 2.No
17. **Name of the disease or Actual cause of death (For all deaths irrespective of whether medically certified or not)**
ISCHEMIC HEART DISEASE
18. **In case this is a female death,did the death occur while pregnant, at the time of delivery or within 6 weeks after the end of pregnancy:**
1.Yes 2.No
19. **If used to habitually smoke for how many years?**
40
20. **If used to habitually chew tobacco in any form-for how many years?**
21. **If used to habitually chew arecanut in any form-for how many years?**
22. **If used to habitually drink alcohol for how many years?**

To be filled by the Registrar

Registration No: Registration Date:
Registration Unit:
Town/village:
District:
Remarks: (If any):

Name and Signature of the Registrar

To be filled by the Registrar

Name Code
District:
Tahsil:
Town/Village:
Registration Unit:

Registration No: Registration Date:
Date of Death: Sex:1.Male 2.Female 3.Others
Age:
Place of Death
1.Hospital/Institution 2.House 3.Other Place

Name and Signature of the Registrar



National Centre for Disease Informatics and Research

Indian Council of Medical Research

NCDIR e-Mortality Record(NCDIR e-Mor)

Clinic/Nursing Home/Hospital/Institute Name : National Centre for Disease Informatics and Research

User Name : 200001_1

Death SI Number : 2000011

Hospital Information

Name of Unit / Department : Surgical Oncology Name of Treating Doctor/Surgeon/Physician : abcdE
Hospital Registration Number : 12345 Date of Admission to Hospital : 01/10/2019

Deceased Information

Date of Death : 03/10/2019 Time of Death : 07 : 45 AM
Full Name of patient : Mr./Shri. ABCD X Y Sex : Male
Age : 65 Years
Religion : Parsi
Occupation : Craft And Related Trades Workers
Aadhar Number : 121212121212

Permanent Address of the deceased

Urban

HNo./Building Name : 123 a
Road/Street Name : WEST sTREET
Area/Locality/PO : SOUTHERN LOCALITY
Ward/corporation/Div :
city/town : BENGALURU
District : BENGALURU
Pincode : 560001
State : 17

Address Of The Deceased At The Time Of Death

Urban

HNo./Building Name : 123 a
Road/Street Name : WEST sTREET
Area/Locality/PO : SOUTHERN LOCALITY
Ward/corporation/Div :
city/town : BENGALURU
District : BENGALURU
Pincode : 560001
State : 17

FAMILY/INFORMANT INFORMATION

Father : Mr./Shri. AAAAA BBBB CCCCC Aadhar No : 123456123456
Mother : Aadhar No :
Husband / Wife : Aadhar No :
Informant : Aadhar No :

Conclusion

Example of implementation excellence:

1. Use of SNOMED CT appropriate for the health care setting
2. SNOMED CT to ICD-10 Map enriched
3. Standardized input and out put recording of clinical terms and disease codes

FUTURE

ICD-11 implementation , future improvisation