

## Assessment of medical certification of cause of death at a tertiary care center in rural region of western Maharashtra, India

### Evaluación de la certificación médica de la causa de muerte en un centro de atención terciaria de una región rural en Maharashtra occidental, India

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#### Abstract

The aim of this study was to evaluate the precision and compliance with international guidelines in the medical certification of cause of death at a rural tertiary care center in Western Maharashtra, India. Additionally, we aimed to identify prevalent errors and discrepancies while investigating the factors that influence the medical certification process at the center. By conducting this research, we sought to obtain comprehensive insights into the accuracy of cause of death documentation and contribute to enhancing the adherence to standardized practices in this crucial aspect of medical practice. The Medical Certificate of Cause of Death (hereafter MCCD) is an important document issued by a doctor for which the World Health Organisation has prescribed a standard format, together with the International Classification of Diseases (hereafter ICD). In it, the doctor records the time, causes and circumstances of the deceased person's death. 615 MCCD forms were available during two years from the MAEER MIT Pune's MIMER Medical College & BSTR Hospital, Talegaon Dabhade and Pune. All of them were scrutinized for the completeness of the certificate and tried to find out the cause of death in which underlying cause of death was written. Data was analyzed and expressed in the percentage form. Ethical clearance was obtained from the Institutional ethics committee (No. IEC/MIMER/2021/761). Main leading cause of death in the present study was disease of circulatory system 868 (29.35%), followed by Neoplasm (16.54%) and Certain infectious and parasitic disease (16.44%). The present study showed incompletely and inaccurately filled MCCD forms. Therefore, adequate training and proper sensitization of the doctors regarding the usefulness of MCCD data is required.

#### Resumen

El objetivo de este estudio fue evaluar la precisión y el cumplimiento de las directrices internacionales en la certificación médica de la causa de muerte en un centro rural de atención terciaria de Maharashtra occidental, India. Además, nos propusimos identificar los errores y discrepancias prevalentes e investigar los factores que influyen en el proceso de certificación médica en el centro. Con esta investigación pretendíamos obtener información exhaustiva sobre la exactitud de la documentación de la causa de muerte y contribuir a mejorar el cumplimiento de las prácticas normalizadas en este aspecto crucial de la práctica médica. El Certificado Médico de Causa de Muerte (en adelante MCCD) es un importante documento emitido por un médico para el que la Organización Mundial de la Salud ha prescrito un formato estándar, junto con la Clasificación Internacional de Enfermedades (en adelante CIE). En él, el médico anota la hora, las causas y las circunstancias de la muerte de la persona fallecida. Durante dos años se dispuso de 615 formularios MCCD del Colegio Médico MIMER y el Hospital BSTR del MAEER MIT de Pune, Talegaon Dabhade y Pune. En todos ellos se examinó si el certificado estaba completo y se intentó averiguar la causa de muerte en la que estaba escrita la causa subyacente. Los datos se analizaron y expresaron en forma de porcentaje. Se obtuvo la autorización ética del comité de ética institucional (No. IEC/MIMER/2021/761). La principal causa de muerte en el presente estudio fueron las enfermedades del sistema circulatorio 868 (29.35%), seguidas de las neoplasias (16.54%) y ciertas enfermedades infecciosas y parasitarias (16.44%). El presente estudio puso de manifiesto que los formularios MCCD se rellenaban de forma incompleta e inexacta. Por lo tanto, se requiere una formación adecuada y una correcta sensibilización de los médicos respecto a la utilidad de los datos del MCCD.



## Introduction

Mortality statistics are essential for the welfare of the community, for health planning, for the management of health programmes, and for building scientific databases for medical research. It is mandatory for every doctor to issue a cause of death certificate when a patient dies. The Medical Certification of Cause of Death (MCCD) is the document in which the doctor records the time, causes and circumstances of the death of an individual. In India, it is carried out under the Government Medical Certification Scheme under the Registration of Births and Deaths Act, 1969. [1]. The MCCD consists of two parts: the first part deals with the immediate cause (i.e. the final injury or illness that caused the death) and the underlying or antecedent cause (i.e. the illnesses, injuries or other circumstances that set-in motion the series of events leading to the immediate cause). The second part deals with the contributing cause (which is defined as any significant condition that contributes to the death but does not directly cause it) [2].

The MCCD supports the judicial system in civil cases such as insurance claims, compensation claims, etc. Causes of death are classified according to the International Statistical Classification of Diseases (ICD). It is required for uniform coding of deaths. ICD-10 is currently used for MCCD [3]. Inaccuracies and incomplete MCCD will lead to biased estimation of several epidemiological parameters. A complete and reliable MCCD is a prerequisite for a good registration system.

The aim of this study was to evaluate the precision and compliance with international guidelines in the medical certification of cause of death at a rural tertiary care center in Western Maharashtra, India. Additionally, we aimed to identify prevalent errors and discrepancies while investigating the factors that influence the medical certification process at the center. By conducting this research, we sought to obtain comprehensive insights into the accuracy of cause of death documentation and contribute to enhancing the adherence to standardized practices in this crucial aspect of medical practice.

## Methods

The descriptive observational study was conducted in a MIMER Medical College, BST Rural Hospital area of Talegaon Dabhade, Pune. MCCD forms of all deaths are routinely completed by the doctors and these forms are then sent to the medical records department. Cause of death certificates issued by the

attending physician along with history and treatment records were studied and analysed to assess the accuracy and completeness in filling up the forms as per the prescribed guidelines [4-8]. The majority (63%) were issued by the medical department. In 75 out of 615 (12.2%) forms, age was either not mentioned or was corrected. Twenty-nine (29.6%) certificates had more than two errors, the most common being no time interval and sometimes multiple causes of death. Only seven (7.1%) of the 98 certificates examined had no errors.

## Results

The audited medical certificates of cause of death issued between September 2021 to March 2022. Out of total 615 MCCD forms, 614 (99.83%) mentioned age and 609 (99.02%) mentioned sex of the deceased person. Only 526 (85.52%) forms were completely filled. The completeness for immediate cause, antecedent cause and underlying cause was 95.56%, 66.67% and 40% respectively. Main leading cause of death in the present study was disease of circulatory system 178 (28.94%), followed by Neoplasm (16.54%) and certain infectious and parasitic disease (16.44%) [9]. These results confirm the concepts of errors observed in the MCCD forms, as shown in Table 1.

**Table 1. Errors observed in MCCD forms**

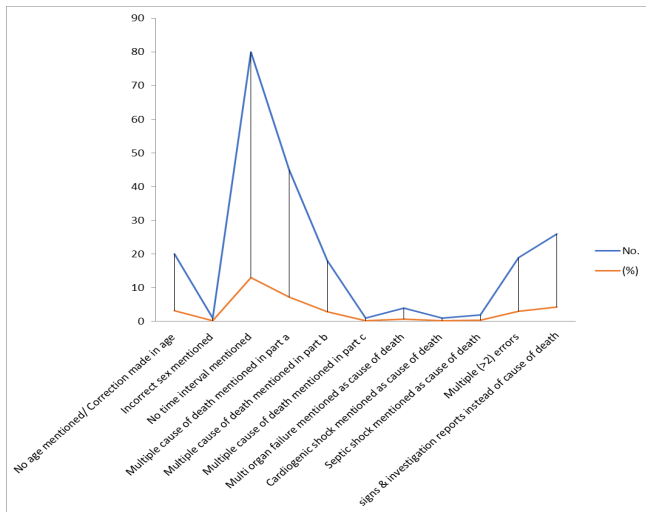
Error observed in MCCD	No. (%)
i. No age mentioned/ Correction made in age	20 (03.2)
ii. Incorrect sex mentioned	01 (0.16)
iii. No time interval mentioned	80 (13.0)
iv. Multiple cause of death mentioned in part i	45 (07.3)
v. Multiple cause of death mentioned in part ii	18 (02.9)
vi. Multiple cause of death mentioned in part iii	01 (0.16)
vii. Multi organ failure mentioned as cause of death	04 (0.65)
viii. Cardiogenic shock mentioned as cause of death	01 (0.16)
ix. Septic shock mentioned as cause of death	02 (0.32)
x. Multiple (>2) errors	19 (03.0)
xi. signs and investigation reports instead of cause of death	26 (04.2)

Furthermore, the evaluation of the Medical Certification of Cause of Death (MCCD) at the rural tertiary care center in Western Maharashtra, as depicted in figure 1, yielded valuable visualizations of the observed errors. This assessment also shed light on specific types of errors encountered during the

process.

- Notably, in 20 cases (3.2%), the age of the deceased was either omitted or required corrections. It is essential to accurately record the age as it plays a vital role in determining the cause of death and facilitating demographic analysis.

Figure 1. Errors observed in MCCD forms



- Incorrect sex mentioned: In one case (0.16%), the sex of the deceased was incorrectly documented. This error can lead to inaccurate data analysis and interpretation.
- No time interval mentioned: In 80 cases (13.0%), the time interval between the onset of illness and death was not specified. This information is vital for understanding the progression and severity of the condition leading to death.
- Multiple causes of death recorded in part *i*. In 45 cases (7.3%), multiple causes of death were recorded in part *i* of the MCCD. This can complicate the interpretation of the primary cause of death and affect accurate statistical analysis.
- Multiple causes of death recorded in part *ii*. Similarly, in 18 cases (2.9%) multiple causes of death were recorded in part *ii* of the MCCD. This can lead to confusion in determining the underlying cause of death.
- More than one cause of death was mentioned in part *iii*. In one case (0.16%) multiple causes of

death were recorded in part *iii* of the MCCD. Again, this may make it difficult to identify the primary cause of death.

- Multiple organ failure listed as cause of death In four cases (0.65%), multi-organ failure was recorded as the cause of death. Although multi-organ failure may be a consequence of an underlying disease, it is not considered a specific cause of death and should be further specified.
- Cardiogenic shock listed as cause of death: In one case (0.16%), the cause of death was attributed to cardiogenic shock. Similar to multi-organ failure, cardiogenic shock is a clinical condition resulting from an underlying disease and should not be considered as the primary cause of death.
- Septic shock listed as cause of death In two cases (0.32%), septic shock was recorded as the cause of death. Similar to the previous points, septic shock is a manifestation of an underlying infection and should be related to the specific infection causing it.
- Multiple (>2) errors: In 19 cases (3.0%), more than two errors were found in the MCCD. The overall accuracy and reliability of cause of death certification is reduced by these multiple errors.
- Signs and findings rather than causes: In 26 cases (4.2%), the MCCD included signs and examination reports instead of explicitly stating the cause of death. This lack of specificity can hinder data analysis and understanding of the primary cause of death.

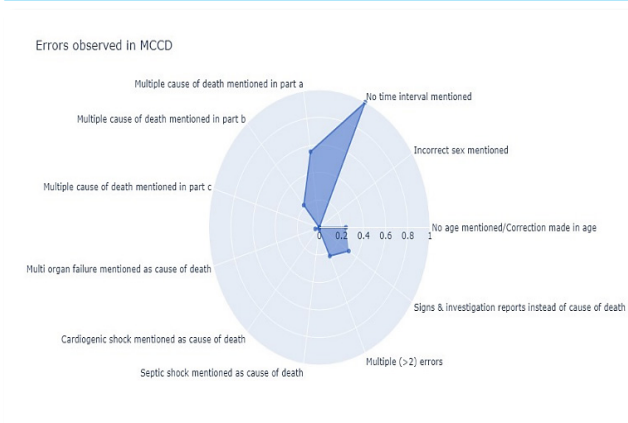
The data collected from the assessment is described by means of a bar chart, which illustrates the frequency of the different types of errors observed in the MCCD [10]. The x-axis of the graph represents the different categories of error, such as missing or corrected age, incorrect documentation of sex, missing time intervals, multiple causes of death mentioned in different parts of the certificate, mention of non-specific conditions such as multi-organ failure, cardiogenic shock and septic shock as causes of death, multiple errors within a single certificate, and documentation of signs and examination reports instead of the cause of death [11].

The y-axis represents the frequency or percentage of cases associated with each error category. Each defect category is represented on the graph as a bar, with the

height of the bar corresponding to the number or percentage of cases for that particular defect. Data labels are provided at the top of each bar, showing the specific numerical values [12]. This visual representation of the data in the form of a bar chart enhances the understanding and comparison of the prevalence of different errors in the MCCD. The research article highlights the importance of improving accuracy, compliance and standardisation in the medical certification process based on the findings and insights derived from the bar chart (see figure 2).

The Radargraph (figure 2) is a powerful visual tool which provides a complete picture of the errors detected by the MCCD. Each axis represents a specific failure type and data points along those axes indicate failure size. By comparing the positions of the data points, it is possible to quickly identify the types of errors that are more and less frequent. The filled area within the graph illustrates the overall distribution of defects across defect types. Hovering over the data points reveals tooltips showing the defect type and count values, allowing more detailed examination. The radial axis, ranging from 0 to 1, facilitates a relative understanding of the significance of the errors. With a clear title and no legend, the radar plot provides a concise yet informative visual assessment of the error distribution and severity within the MCCD dataset.

Figure 2. The visualisation of the radar chart observed in MCCD



## Discussion

The correct completion and accuracy of death certificates is essential for the collection of mortality statistics. To meet this need, doctors around the world

are trained to complete death certificates. However, despite repeated instructions, trainings / workshops to the clinicians, errors are committed in writing the correct underlying cause of death. It is used as an indicator and as a tool for monitoring public health policies. It provides useful information on the geographical distribution of deaths. In order to obtain correct mortality statistics, it is necessary to raise awareness among doctors about the correct completion of MCCD forms.

The guidelines for completing the MCCD are not only on the back of every certificate, but there are also various handbooks available for easy reference. Nevertheless, inaccuracies in death certificates are a common problem. Data on these inaccuracies in completed MCCD forms from academic institutions in India is scarce. These inaccuracies are due to the fact that medical students and doctors are not sufficiently taught the importance of writing down an authentic 'cause of death'. Instead of writing a legitimate basic cause of death, most of the practitioners attribute the cause of death to the mechanism of death, e.g. cardio-pulmonary arrest, as they are not informed about the appropriate 'cause of death'.

This happens because little attention is paid to the deceased's medical history. The filing of the MCCD is seen as a routine formality. Other factors contributing to errors include fatigue and lack of time. The Medical Certificate of Cause of Death is included in the curriculum for undergraduates, but they do not receive practical training in filing it until they are residents. Errors in death certification are a global problem, and reported rates of major errors in other institutions range from 34% to 37% [4-7].

Our study found that 85.52% of respondents had satisfactory knowledge, whereas Undavalli et al. [8] observed that 36% of the members had more than 50% of the knowledge score, which is considered as satisfactory knowledge. Analysis of the MCCD of each deceased patient during ward rounds and during the annual course of death certification will help to improve the accuracy of death certification. In the present study, it was difficult to compare inaccuracies with other studies because of the different benchmark used to construct errors. Despite the magnitude of the problem, there are few studies on educational interventions to improve the accuracy of MCCD completion in India.

The following recommendations, if implemented, will

go a long way in addressing the factors that adversely affect the accurate completion of medical certificates of cause of death. Firstly, it is strongly recommended that mandatory, frequent programmes on death certification be conducted for all residents and medical officers. The error rate will be reduced if these programmes are repeated regularly in institutions. Then the importance of completing the MCCD can be emphasised. As an educational resource for residents and attending physicians, an instructional resource should be made available to them. Other suggestions for improvement include regular audit of all MCCD by an independent body and regular updates in the form of CME programmes and death review meetings.

## Conclusion

The MCCD scheme plays a crucial role in regulating and ensuring consistency in the issuance of cause of death certificates by medical practitioners. In order to minimize errors, it is imperative to raise awareness among doctors about the value of MCCD data through effective sensitization initiatives and provide them with adequate and periodic refresher training. Additionally, the supervision of all death certificates may be necessary when deemed appropriate.

The present study reveals a significant correlation between the knowledge score and various factors such as the current department of posting, current designation, gender, religion, and work experience. A well-executed MCCD system is essential for maintaining accurate records within an institution. Consequently, the findings of this study strongly suggest the implementation of workshops, seminars, and induction training programs specifically designed for interns and junior doctors. Furthermore, regular audits should be conducted to minimize further errors in the completion of MCCDs.

## Consent for publication

The authors read and approved the final manuscript.

## Competing interest

The authors declare no conflict of interest. This document only reflects their point of views and not that of the institution to which they belong.

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