

# Evaluation of Medical Certification of Cause of Death of Tertiary Cancer Hospitals of Northern India

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## Research Article

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# **Abstract**

## **Background**

Medical Certification of Cause of Death (MCCD) can provide valuable health status data regarding disease incidence, prevalence and mortality in a community. It can guide local health policy and help in setting priorities. On the contrary, incomplete and inaccurate MCCD data can significantly impair the precision of a national health information database. In the current study, the accuracy of death certificates at two tertiary cancer care hospitals in Northern India, has been evaluated.

## **Methods**

This retrospective study has been conducted at Tata Memorial Centres namely, Mahamana Pandit Madan Mohan Malaviya Cancer Centre and Homi Bhabha Cancer Hospital, Varanasi, India on MCCD over a period of two and a half years. Medical records and death certificates of all the deceased were examined. The demographic characteristics, administrative details, co-morbidities and cause of death from death certificates were collected using an approved standardized form. The accuracy of this information was validated using the medical records. Errors in the death certificates were classified according to Haque's grading scale.<sup>1</sup>

## **Results**

778 deaths occurred during the study period between May 2018 to December 2020, and all certificates were accessed for analysis. Only 30 (4%) certificates were error-free. 591(75.9%) death certificates had an inappropriate immediate cause of death. 231(29.7%) death certificates had incorrectly labelled mode of death, such as cardiopulmonary arrest as the immediate cause of death. 585 (75.2%) death certificates had an incorrect underlying cause of death. Majority of the death certificates were prepared by the post MBBS junior residents and this was significantly associated with higher certification errors.

## **Conclusion**

A high rate of errors was identified in the death certificates completed at our hospitals. Inaccurate death certificates related to cancers can potentially influence the cancer statistics of the defined region and thereby affect policymaking for cancer prevention and control. There is a pressing need for appropriate intervention/s to resolve this important issue. In an attempt to improve the quality of certification, it is envisaged to conduct training for all consultants and residents in proper death certification.

# **Introduction**

Medical Certification of Cause of Death (MCCD) is a medico-legal document describing the time, cause and circumstances of death of an individual. The scientific assessment of MCCD provides cause-specific mortalities, which are the key indicators of health trends in the population. Hence, accurate MCCDs are an important source of epidemiological data for assessing the effectiveness of public health programs.

MCCD data is used for calculating vital statistics and inaccuracies in them may lead to errors in population based studies that rely on these statistics.<sup>1–4</sup>

In India, non-communicable diseases (NCDs) accounts for 63% of all deaths, and cancer is one of the leading causes (9%). Cancer registries provide cancer related statistics of a given population. Death certificates constitute an important source of information for cancer registries. Cancer related mortality is increasing in India and accuracy of MCCD in cancer related deaths is the need of the hour for estimating cancer related mortality statistics and formulation of national health policy.<sup>5</sup>

Regional coverage of death registration varies from nearly 100% in the European region to around 50% in the Asia-Pacific region and less than 10% in Africa.<sup>6</sup> The time series data on medical certification of cause of death of India for the 25 years from 1991 to 2015 reveals a significant but slow growth in absolute numbers of medically certified cases. During these years, the share of medically certified deaths to total registered deaths has been hovering around 12.7 – 22.0 per cent.<sup>7</sup>

Errors in MCCD are common and can occur in form of illegible and incomplete certificates to inaccurate causes and manner of death. Earlier Indian studies have reported that approximately 50–60% of medical certificates of cause of death submitted to death registering authorities are incorrect.<sup>8</sup>

The present study aims at assessing the types and frequency of errors in MCCDs written by the attending/ certifying physicians of two high volume tertiary cancer care hospitals of Northern India.

## Methods

### Study setting and design

This retrospective observational study was conducted at two government tertiary care cancer hospitals, namely Mahamana Pandit Madan Mohan Malviya Cancer Centre and Homi Bhabha Cancer Hospital (Tata Memorial Centres), in Varanasi district of state of Uttar Pradesh in Northern India. There is a high reported burden of oral, breast and cervical cancers in this region.<sup>9</sup> Both the centres (total of 333 inpatient beds) are catering to approximately 200 million population of a large catchment area covering Eastern Uttar Pradesh, Western Bihar, Jharkhand, Chhattisgarh and Madhya Pradesh states of India. In a period of approximately two and a half years (May 2018- December 2020) more than 36,000 cancer patients have been registered in these hospitals.

These registered patients have been either newly diagnosed at our hospitals or have been taking the treatment in past at other hospitals of Varanasi, Mumbai, Delhi etc. before the establishment of the two cancer hospitals in Varanasi district. Many of the patients were candidates for palliative care. The study reference period was from May 2018 to December 2020.

### Analysis of death certificates

All 778 MCCDs prepared at the two hospitals during this period were included in the study and assessed retrospectively. The cause of death were reported in accordance with the World Health Organization (WHO) guidelines.

Information collected from the MCCDs available at the hospitals, related to the following variables:

- i. Demographic characteristics, (e.age, gender, residential address of the deceased).
- ii. Administrative details included place (treating hospital unit/and time of death, individual completing the death certificate and whether autopsy had been performed or The signature and identification profile of the certifier were verified).
- iii. Medical data indicating the immediate, antecedent and underlying cause of death and other contributory factors.

As per WHO, the underlying cause of death is defined as “the disease or the injury which initiated the train of morbid events leading directly to the death or the circumstances of the accident or violence which produced the fatal injury.” Immediate cause of death is defined as, “disease or condition directly leading to death. This does not mean the mode of dying, e.g. Heart failure, Asthenia etc. but the disease, injury, or complication, which caused the death.” The antecedent cause of death is defined as, “morbid conditions, if any, giving rise to the immediate cause of death.” The contributory conditions are defined as, “all other diseases or conditions believed to have unfavourably influenced the course of the morbid process and thus contributed to the fatal outcome but which were not related to the disease or the condition directly causing death.”<sup>10</sup>

The information was abstracted from individual MCCDs using the standardized format. Accuracy of this information was validated and corroborated by undertaking a review of the relevant information from electronic medical records of the hospitals. The evaluation was done independently by two trained reviewers in the study team, blinded from each other's evaluation. Final agreement was made through consensus. Haque's grading scale<sup>1</sup> for grading the errors in documentation was used. (Table-3).

Errors were assigned a grade from 0 to V. A grade zero was assigned if no error was identified. Grade IV and V are the major errors in certification. We also assessed the technical errors such as use of abbreviations, illegible writing and lack of details of certifying physician in the certificate.

## **Statistical Analysis**

All the data was entered in MS-Excel 2007 software and analysed using Statistical Package for Social Sciences (SPSS, version 17). Descriptive analysis was performed for all the study variables. Chi-square test was applied to assess any significant difference in qualification and experience of certifying physicians and the observed errors in death certification. A 'p' value of < 0.05 was considered as statistically significant.

## **Ethical Consideration**

The study has been approved by the Institutional Ethical Committee and approval was obtained from the hospitals to use the death certificates and medical records of the deceased.

## Results

A total of 778 deaths occurred during May 2018-Decemeber 2020, the audit period, and all death certificates were accessible. The mean age at the time of death was  $46.42 \pm 17.8$  years and males made up 51.8%. (Table-1) The most important leading cancer sites for whom the death certificates were available were: haematological malignancies-153(19.7%), primary site unknown-90(11.6%), lung-75(9.7%), breast-69(8.9%), gall bladder-63(8.2%) and oral cavity-57 (7.3%). Only 30 (4%) death certificates had no errors. During the study period sixteen COVID-19 related deaths took place.

**Major certification errors:** These included errors where the medical cause of death was incorrectly filled (Grade IV and V errors) (Table-2, 3). 591(75.9%) death certificates had inappropriate immediate cause of death, 231(29.7%) death certificates had incorrectly labelled mode of death such as cardiopulmonary arrest as immediate cause of death and 585(75.2%) death certificates had incorrect underlying cause of death. Eighty certified deaths mentioned "brought dead" as the immediate cause of death. All sixteen COVID-19 related death certificates had major certification errors, where the immediate cause of death was mentioned as cancer instead of the complication related to COVID-19 infection, which was the underlying cause of death. Only 51 certificates (6.5%) mentioned the other important contributory conditions related to the cause of death.

### Technical/minor certification errors:

The demographics and administrative details (Grade I error) was seen in 68.7% certificates (Table-1). These includes wrong legal nominee in 171 (21.9%), incomplete residence of the deceased in 199 (25.5%), wrong gender in 77 (9.9%) and absence of name of certifying physician in 89 (11.4%). Illegible writing was seen in 86 (11.1%) certificates and abbreviations /short forms were seen in 95 (12.2%) certificates. The rate of inappropriate certification however did not differ significantly with the age or gender of the deceased.

Of 778 death certificates, MBBS doctors prepared 630 (81%) and rest were prepared by the postgraduate residents and consultants. The proportion of major certification errors was 81.7%, 60.4 % and 63.5 % among the MBBS junior doctors, post-graduate residents and consultants, respectively. Similarly, the proportion of minor errors was 70.3 %, 48.3% and 32.7%, respectively. The difference in the distribution of proportions of errors in death certificates as per the qualification and experience of certifying physician was found to be statistically significant. (Table-4)

## Discussion

Medical cause of death certification provides vital information regarding public health indicators for monitoring of health policies. They are an important source of information for assessing the patterns of

diseases in a given population. Lack of reliable cause of death data will impede monitoring and evaluation of health related activities, research and thereby can potentially lead to misleading information regarding health care.

MCCD are an important source of information for population and hospital based cancer registries. In India, active cancer registration is done, where trained registry staff visits different places (diagnostic laboratories, hospitals and vital statistics departments) for collection of cancer related information on a standard format. The death certificate notifications are followed-up and those cases where only death certificate is available and no other medical records are found, are assigned as death certificate only (DCO). It is often observed during data collection in cancer registries of lower income countries that the death certificates can be the only source of cancer statistics for the country. Varying patterns of DCO % and Mortality: Incidence ratio were observed among different population based cancer registries which is dependent on the quality of death certification. In some registries very few DCO is obtained due to non-availability or poor quality of certification of cause of death. Hence, poorly prepared death certificates will lead to inadequate data collection for the registries, which in turn will affect the cancer related statistics and thereby influence monitoring and evaluation of cancer prevention and control activities.<sup>5</sup>

We observed that in almost half (49.3%) of the MCCDs there were errors related to demographic information of the deceased. The MCCDs either had no/ incomplete/incorrect entry regarding age, gender and residence of the deceased. Inaccurate age will affect the age related epidemiological parameters such as age related incidence and mortality rates. Incomplete/ incorrect residential address will affect the geographical distribution of cancer and tracing of the families of the deceased for data collection. Similarly, incorrect/lack of gender information can affect gender wise patterns of cancer burden and mortality. Inaccurate demographic information and wrong legal nominee may lead to difficulty in medical reimbursements from the insurance organizations and future medico-legal claims. One possible explanation for demographic errors may also be due to several patients being brought dead or the accompanying attendant not closely related to the deceased.

We observed that nearly one-fifth (19.4%) of the MCCDs had technical errors such as incorrect/absence of name of the physician, absence of signature, seal of the hospital, signing date, time of death, date of death which makes the MCCDs invalid for medico-legal purposes. For registering a death, identity of the deceased, date and time of death and cause of death are mandatory for the death registering authorities. Absence of any of these details will not allow registration of the death.

In some of the death certificates, illegible writing and use of abbreviations/short forms were seen in 11% and 12% of the certificates, respectively. Abbreviations and short forms of disease should not be used as they are likely to lead to confusion in statistical office. Illegible writing and abbreviation of medical terms makes the understanding of MCCDs difficult for ICD coding.<sup>11</sup>

Only 30 (4 %) death certificates had no errors. We observed Grade IV errors in 75.9% and Grade V errors in 75.1% certificates. Grade IV and V errors are the major errors in death certification. Wrong

diagnosis/incorrect filing up of the certificate will result in gross errors in mortality statistics thus directly affecting formulation of national health policy. In addition, the certified cause of death is subjected to legal scrutiny in medico-legal deaths. The importance of recording the sequence correctly lies in the fact that appropriate strategies can be adopted to cut the chain at its most vulnerable point and thus prevent death.

Terminal events leading to death like circulatory failure, respiratory failure etc. as modes of dying should be avoided as they are no more than signs of death and provide no useful information for the underlying disease process.<sup>8</sup> In our study, 231(29.7%) death certificates have labelled modes of death as immediate cause of death. Most clinicians confuse the cause of death with the modes of death.<sup>12</sup> This finding is observed frequently in lower-middle income countries.<sup>1,13</sup> In the Indian context, many a times these deaths are unattended, hence, exact time, date and terminal event symptomatology is not available so the cause of death is also not known. However, the same can be established by the clinical post-mortem examination after the consent of the relatives.<sup>8</sup>

Globally, similar outcomes have been reported in the past. Adjacent countries like Pakistan, Nepal and Bangladesh have also reported a high percentage of errors in the cause of death certificates.<sup>1,14,15</sup> These errors are not just limited to the developing countries. More than 50% of general practitioners in the United Kingdom and in the US reported being insufficiently instructed about the process of death certification.<sup>1</sup> It is difficult to compare our findings with previous studies done in India due to differences in the definitions and interpretations of errors between studies. However, there is consistent finding among most of the previous studies, including ours, that the majority of the MCCDs have wrong cause of death certification, which qualify as major errors.<sup>16-23</sup> The current study included death certification for only cancer related deaths. Hence, our findings may not be generalizable to other establishments.

It was observed that majority of the death certificates are prepared by the MBBS doctors and the proportion certification errors committed by the MBBS doctors was significantly higher as compared to the post-graduate residents and doctors who have higher clinical experience. Another possible reason of higher proportion of errors by junior doctors is that the treating physician, who is generally the senior doctor and has all the details of the deceased medical conditions, may not be available at the time of death certification.

Lastly, a total of sixteen COVID-19 related death took place in the study period and all of them had major certification errors. Inaccurate COVID-19 related death certification will contribute to misleading data for COVID-related statistics.

## Conclusion

We observed that the majority of the MCCDs had mentioned wrong chain of events leading to death and often have mentioned mode of death as immediate cause of death. Hence, there is a lack of clarity amongst physicians in accurately writing the cause of death certificates. These errors in MCCDs stem

from improper knowledge among doctors on how to identify and select the underlying cause, antecedent, immediate and contributory causes of death. There is an urgent need for appropriate interventions to improve the accuracy of medical certification of cause of death completion skills of the physicians, especially during the current pandemic of COVID, where the correct medical certification of cause of death is most critical.

## Declarations

### Funding:

We declare that there is no role of any funding in the study.

### Ethical consideration and consent to participate:

The study has been approved by the Institutional Ethical Committee and approval was obtained from the hospitals to use the death certificates and medical records of the deceased. The ethical committee waived off the consent to participation owing to the nature of the study.

### Competing interests:

All authors declare that they have no competing interest.

### Consent for publication:

All authors have given consent for publication.

### Availability of data and materials:

The datasets used and/or analysed during the current study will be available from the corresponding author on reasonable request.

### Authors' contributions:

Study conception and design: AA, DK. Acquisition of data: AA, DK, AS, AP, RS. Analysis and interpretation of data: AA, DK, SP, AB, PS. Critical revision of the manuscript for important intellectual content: AA, DK, SP, AB. Manuscript concept and design: AA, DK, SP, AB. All authors read and approved the final manuscript before submission.

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## Tables

**Table 1**  
**Distribution of MCCDs with respect to technical errors.**

<b>Variables</b>	<b>Frequency</b>
	Nos (%)
	<b>N = 778</b>
<b>Legal Nominee</b>	
Correct entry	607(78.0)
Incorrect entry	87(11.9)
Not Available	84(10.7)
<b>Residence</b>	
Complete	579(74.4)
Incomplete	199(25.5)
<b>Date of Death</b>	
Incomplete Entry	06(0.77)
Complete Entry	772(99.2)
<b>Time of Death</b>	
Incomplete Entry	50(6.42)
Complete Entry	728(93.5)
<b>Gender of Deceased</b>	
Male	403(51.8)
Female	298(38.3)
Not Available/Incorrect entry	77(9.9)
<b>Age at time of death</b>	
Incomplete/Wrong Entry	108(13.8)
Complete Entry	670(86.2)
<b>Name of the doctor mentioned</b>	
Yes	689(88.5)
No	89(11.4)
<b>Signature of the doctor present</b>	
Yes	756(97.1)

<b>Variables</b>	<b>Frequency</b>
	<b>Nos (%)</b>
	<b>N = 778</b>
No	22(2.8)
<b>Other errors (lack of seal of authority or signing date)</b>	
Yes	738(94.8)
No	40(5.14)
<b>Illegible writing</b>	
Yes	86(11.1)
No	692(88.9)
<b>Abbreviations/short forms usage</b>	
Yes	95(12.2)
No	683(87.8)

Table 2  
Distribution of MCCDs with respect to errors in cause of death.

Variables	Frequency	
	Nos (%)	
	<b>N = 778</b>	
<b>Brought Dead as cause of death</b>		
Yes	80	(10.2)
No	698	(89.7)
<b>Cardiac respiratory arrest as cause of death</b>		
Yes	231	(29.7)
No	547	(70.3)
<b>Immediate cause of death</b>		
Correct Entry	187	(24.0)
Incorrect Entry	591	(76.0)
<b>Antecedent cause mentioned as Immediate cause of death</b>		
Yes	170	(21.8)
No	608	(78.1)
<b>Underlying cause mentioned as Immediate cause of death/wrong chain of events</b>		
Yes	193	(24.8)
No	585	(75.1)

Table 3

Distribution of MCCDS with respect to Haque's Grading Scale (n=778)

Grade	Description	Frequency
		Nos. (%)
Grade 0	No errors	30 (3.8)
Grade IA	Errors incomplete/Inaccurate demographics	384 (49.3)
Grade IB	Whether the signatory attended the patient could not be confirmed	151 (19.4)
Grade II and Grade III	Co-morbidities list incomplete/ not listed	727 (93.4)
Grade IV	Inappropriate immediate cause of death or only a mechanism(s) of death (or mode of dying) given	591(75.9)
Grade V	Underlying cause(s) of death was incorrectly attributed or placed in an improper sequence	585 (75.1)

Table 4

Distribution of type of certification errors with respect to qualification/experience of the certifying physician

Type of error	Qualification/experience of certifying physicians				
	Present	MBBS Doctors	Post Graduate Residents	Consultants Nos (%)	Total Nos (%)
		Nos (%)	Nos (%)		
		N=630	N=96		
Major Certification errors*	Present	515 (81.7)	58 (60.4)	33 (63.5)	606 (77.8)
	Absent	115 (18.3)	38 (39.6)	19 (36.5)	172 (22.1)
	Total	630 (80.9)	96 (12.3)	52 (6.7)	778 (100)
Minor/ Technical Certification errors**	Present	443 (70.3)	47 (48.9)	17 (32.7)	507 (65.1)
	Absent	187 (29.7)	49 (51.1)	35 (67.3)	271(34.8)
	Total	630 (80.9)	96 (12.3)	52 (6.7)	778 (100)

\* chi-square statistic is 28.747. The p-value is < 0.00001.

\*\* chi-square statistic is 42.632. The p-value is < 0.00001.