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

Akash Anand, MD1, Divya Khanna, MD1, Payal Singh, PhD1, Anuj Singh, MD1, Abhishek Pandey, MSc1, Atul Budukh, PhD2, Satyajit Pradhan, MD1

Abstract

Background: Medical certification of cause of death (MCCD) provides valuable data regarding disease burden in a community and for formulating health policy. Inaccurate MCCDs can significantly impair the precision of national health information. Objective: To evaluate the accuracy of cause of death certificates prepared at two tertiary cancer care hospitals in Northern India during the study period (May 2018 to December 2020). Method: A retrospective observational study at two tertiary cancer care hospitals in Varanasi, India, over a period of two and a half years. Medical records and cause of death certificates of all decedents were examined. Demographic characteristics, administrative details and cause of death data were collected using the WHO recommended death certificates. Accuracy of death certification was validated by electronic medical records and errors were graded. Results: A total of 778 deaths occurred in the two centres during the study period. Of these, only 30 (3.9%) certificates were error-free; 591 (75.9%) certificates had an inappropriate immediate cause of death; 231 (29.7%) certificates had incorrectly labelled modes of death as the immediate cause of death; and 585 (75.2%) certificates had an incorrect underlying cause of death. The majority of certificates were prepared by junior doctors and were significantly associated with higher certification errors. Conclusion: A high rate of errors was identified in death certification at the cancer care hospitals during the study period. Inaccurate MCCDs related to cancers can potentially influence cancer statistics and thereby affect policy making for cancer control. Implications: This study has identified the pressing need for appropriate interventions to improve quality of certification through training of doctors.

Keywords (MeSH)
death certificates, cause of death, registries, electronic health record, clinical classification, ICD-10, health policy, health information management

Introduction

A death certificate is a medico-legal document describing the time, cause and circumstances of death of an individual (Maharjan et al., 2015). The scientific assessment of medical certification of cause of death (MCCD) provides cause-specific mortalities, which serve as an important epidemiological data for vital statistics, health trends, evaluation of health programmes and for population and hospital-based studies. Inaccuracies in these data may lead to serious errors in reporting statistics (Feinstein et al., 1968; Haque et al., 2013; Swift and West et al., 2002; Villar et al., 2007). Only half of all deaths worldwide were reported in a
national death registration system with cause of death information in 2015, slightly higher compared to around a third in 2005. However, only 38% of all deaths were recorded in the World Health Organization (WHO) Mortality Database. According to Mathers et al. (2017), the proportion of these reported deaths was: 43% for high-income countries; 44% for upper-middle-income; 13% for lower-middle-income; and less than 1% for low-income countries. Only ~28% of all global deaths were reported with international classification of disease (ICD) coding and ~23% reported with meaningful underlying cause of death (UCOD) information (Mathers et al., 2017).

In India, non-communicable diseases (NCDs) account for 63% of all deaths, and cancer is one of the leading causes (9%). Cancer registries provide cancer-related statistics for a given population. Death certificates (DC) constitute an important source of information for cancer registries. Cancer-related mortality is increasing in India and accuracy of MCCDs in cancer-related deaths is the need of the hour for correctly estimating the mortality statistics and formulating national health policy (Mathur et al., 2020). Time-series data on MCCDs in India from 1991 to 2015 revealed a significant but slow increase in absolute number of medically certified cases. During these 25 years, the proportion of medically certified deaths to total registered deaths fluctuated between 12.7 and 22.0% (Office of the Registrar General & Census Commissioner, India ORGI, 2021). Errors in MCCDs are common and can occur in form of illegible handwriting, incomplete certificates, inaccurate causes and manner of death. Previous Indian studies have reported that approximately 50–60% of medical certificates of cause of death submitted to death registration authorities are incorrect (Kotabagi et al., 2004).

The current study aimed to assess the types and frequency of errors in cause of death certificates written by the certifying physicians of two high-volume tertiary cancer care hospitals in Northern India.

**Method**

**Study setting and design**

This was a retrospective observational study, conducted at two government tertiary cancer care hospitals (Mahamana Pandit Madan Mohan Malaviya Cancer Centre and Homi Bhabha Cancer Hospital; units of Tata Memorial Centre, Mumbai; Grant–in–Aid Institute, Department of Atomic Energy, Government of India) in Varanasi district of Uttar Pradesh in Northern India, where there was a high reported incidence of oral, breast and cervical cancers (Tata Memorial Centre, India, 2017). Both centres (a total of 333 inpatient beds) cater to approximately 200 million population in a large catchment area covering Eastern Uttar Pradesh, Western Bihar, Jharkhand, Chhattisgarh and Madhya Pradesh states of India. During the study period of approximately two and a half years (May 2018 to December 2020) more than 36,000 cancer patients were registered in these hospitals. These patients had either been newly diagnosed at the hospitals or had been treated in the past at other hospitals in Varanasi, Mumbai and Delhi before the establishment of the two cancer hospitals in Varanasi district. Many of the patients were candidates for palliative care.

**Process of MCCD and death registration**

Both hospitals were legally bound under the Registration of Births and Deaths Act (Government of India, 1969) to medically certify cause of death using the WHO recommended MCCD Form 4/4A (Office of the Registrar General, Government of India, 2012). The cause of death was certified by either junior doctors (graduates with a MBBS degree) or consultants (with postgraduate or super-speciality qualifications), who identified themselves as certifier on the Form (e.g. name, medical council registration number, signature and employee code). The medical record sections of the study hospitals maintained the death certification records, and ICD-10 was used for coding causes of death by a trained scientific officer. Original copies of cause of death certificates (Form 4/4A) were retained by the hospitals for death registration. The civil registration system (CRS) in India provided a decentralised registration model through which the two study hospitals could register deaths through www.crsorgi.gov.in. The certifying physician fills the MCCD (Form 4/4A) and death report (Form 2). The Birth and Death Registrar creates the death certificate (Form 6) based on the information from the Form 4/4A, Form 2, and deceased identification documents. The death certificate (Form 6) is provided to the family of the deceased (Rao and Gupta, 2020). ICD coding of causes of death was shared with the District Registrar’s Office of Births and Deaths on a monthly basis, before the 10th day of the subsequent month. The cause of death certificate (Form 4/4A) is required to provide the facts of the death for cremation and death registration, while the death certificate (Form 6) is the legal document required for proof of death (e.g. for insurance and inheritance claims). Should the certifying physician suspect foul play, the death becomes a medico-legal case and the deceased will mandatorily undergo a forensic autopsy to determine the cause and manner of death. This may also be initiated by the certifying physician through intimation to local police. However, as the study hospitals were cancer hospitals, such occurrences were rare.

**Electronic medical record (EMR)**

EMRs of all registered cancer patients included both demographic and clinical information (e.g. clinical notes of registered patients related to diagnosis, staging of cancer, type of treatment intent [curative/palliative], treatment details, follow-up status, any emergency medical conditions and other co-morbid conditions). Certificate details (both technical and medical information) were cross-checked with the abstracted information from EMRs.
Data analysis

All 778 cause of death certificates prepared at the two hospitals during the study period were included in the study and assessed retrospectively. The cause of death was reported as per the WHO guidelines (WHO, 1979) and Physician Manual for MCCD (Office of the Registrar General, Government of India, 2012). Information was collected from the certificates available at the hospitals for the following variables: (i) demographic characteristics, (e.g., age, gender and residential address of the deceased); (ii) administrative information (place of death: ward/emergency/critical care unit, date and time of death, certifying physician details and whether autopsy had been performed), with identification details of the certifier verified through their employee code information; and (iii) medical information, indicating the immediate, antecedent and underlying causes of death and other contributory factors.

According to WHO (1979, 2016), the underlying cause of death has been 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 defined as “disease or condition directly leading to death. This does not mean the mode of dying (e.g. heart failure and ashenia) but [rather] the disease, injury or complication that caused the death”. The revised ICD-10 (2016) guidelines defined the starting point as “the condition or event that started the sequence of acceptable causal relationships ending with the terminal cause of death. In a correctly completed certificate, the condition reported on the lowest used line in Part I of the MCCD is the starting point of the sequence”. In this study, both the originating cause and the originating antecedent cause were considered the starting point, and contributory conditions were defined as, “any cause of death that is neither the direct, intervening, originating antecedent nor underlying cause is a contributory cause of death” (WHO, 1979; 2016). Information was abstracted from individual MCCDs using the WHO recommended certificate, with accuracy of certificates validated and corroborated by undertaking a review of the EMR. Two independent investigators, both trained in MCCD and abstracting cancer cases from the EMR for the cancer registry (SEER Training Modules, 2021), constructed the chain of events for cause of death (immediate, underlying and other significant conditions) and then compared these details with MCCD details provided by the certifying physicians. The investigators were blinded to each other’s evaluation and final agreement was achieved through consensus. Haque’s grading scale for grading the errors in documentation was used (Haque et al., 2013) (see Table 3).

Errors were assigned a grade from 0 to V. A grade of zero 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 statistically significant.

Ethics approval

The study received ethics approval from the Institutional Ethical Committee of the Tata Memorial Centre (Mahamana Pandit Madan Mohan Malaviya Cancer Centre and Homi Bhabha Cancer Hospital) for the use of the cause of death certificates and the EMRs of the decedents. Owing to the nature of the study, individual consent of participants was not required (IEC11000028).

Results

A total of 778 deaths occurred during the study period, and all MCCD certificates were accessible from the medical records section of the hospitals. The mean age at time of death was

| Table 1. Distribution of death certificates with respect to technical errors (n = 778). |
|---------------------------------------------------------------|
| Variables                                      | Frequency | Nos (%) |
|---------------------------------------------------------------|
| Legal nominee                                         |          |        |
| Correct entry                                           | 607      | (78.0) |
| Incorrect entry                                        | 87       | (11.2) |
| Not available                                          | 84       | (10.8) |
| Residence                                              |          |        |
| Complete                                               | 579      | (74.4) |
| Incomplete                                             | 199      | (25.6) |
| Date of death                                          |          |        |
| Complete entry                                         | 772      | (99.2) |
| Incomplete entry                                       | 06       | (0.8)  |
| Time of death                                          |          |        |
| Complete entry                                         | 728      | (93.6) |
| Incomplete entry                                       | 50       | (6.4)  |
| Gender of deceased                                     |          |        |
| Male                                                    | 403      | (51.8) |
| Female                                                  | 298      | (38.3) |
| Not available/Incorrect entry                          | 77       | (9.9)  |
| Age at time of death                                   |          |        |
| Complete entry                                         | 670      | (86.2) |
| Incomplete/Wrong entry                                 | 108      | (13.8) |
| Name of the doctor mentioned                           |          |        |
| Yes                                                     | 689      | (88.6) |
| No                                                      | 89       | (11.4) |
| Signature of the doctor present                        |          |        |
| Yes                                                     | 756      | (97.2) |
| No                                                      | 22       | (2.8)  |
| Other errors (lack of seal of authority or signing date)|          |        |
| Yes                                                     | 738      | (94.8) |
| No                                                      | 40       | (5.2)  |
| Illegible writing                                      |          |        |
| Yes                                                     | 86       | (11.1) |
| No                                                      | 692      | (88.9) |
| Abbreviations/short forms usage                        |          |        |
| Yes                                                     | 95       | (12.2) |
| No                                                      | 683      | (87.8) |
46.42 ± 17.8 years and 51.8% were male (see Table 1). The frequency distribution of MCCD certificates according to the primary cancer site was: 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%). MCCD certificates mentioning an unknown primary site of cancer were confirmed from the EMRs of the deceased. During the study period, India witnessed the first COVID-19 wave in March 2020. Of the registered cancer patients, 16 succumbed to COVID-19.

Of the registered cancer patients, 16 succumbed to COVID-19. Of the registered cancer patients, 16 succumbed to COVID-19. Only 30 (3.9%) MCCD certificates had no errors. Thus, their causes of death certificates were also analysed. Only 30 (3.9%) MCCD certificates had no errors.

### Major certification errors

These included errors where the medical cause of death had been incorrectly completed (Grade IV and V errors) (Tables 2 and 3). Tables 2 and 3 show that 591 (75.9%) certificates had inappropriate immediate cause of death; 231 (29.7%) had incorrectly mentioned mode of death such as cardiopulmonary arrest as immediate or UCOD; and 585 (75.2%) certificates had an incorrect UCOD. Incorrect UCOD were noted for those certificates where the immediate cause of death had been reported as UCOD (wrong sequence of events), or where the contributory conditions were mentioned as UCOD, or the UCOD was mentioned under the contributory conditions, or an ill-defined event (e.g. cardiac arrest and heart failure) was mentioned as UCOD. Eighty certificates mentioned “brought dead” as immediate cause of death.

A total of 208 (26.7%) certificates mentioned multiple causes of death on one line; 748 (96.1%) certificates had no mention of time intervals; and a total of 42 certificates (5.3%) had a competing cause of death. These deaths were due to complications of diabetes mellitus, ischaemic heart disease, alcohol-related liver disease and chronic respiratory disease.

Regarding specificity of the neoplasm in certificates, all death certificates mentioned the site of cancer in the form of primary or metastatic site or primary site unknown, and behaviour of neoplasm was mentioned in 741 (95.2%) certificates. However, only 274 (35.2%) certificates mentioned histology of the underlying malignancy.

Except for 51 certificates, the remainder (93.4%) did not mention any contributory conditions in Part II of the certificate. The co-morbid conditions (e.g. diabetes mellitus, hypertension, chronic kidney disease, chronic obstructive pulmonary disease, chronic alcoholic liver disease, hypothyroidism, cardiovascular disease, atherosclerosis, peripheral vascular disease and chronic smoking/tobacco intake) were listed incorrectly in Part I of the certificate rather than including them in Part II. All 16 COVID-19-related MCCD 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.

### Technical or minor certification errors

Errors in demographics and administrative details (Grade I error) were seen in 68.7% certificates. These included 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%) certificates. Illegible writing was seen in 86 (11.1%) and abbreviations or short forms were seen in 95 (12.2%) certificates. However, the rate of inappropriate certification did not differ significantly with the age or gender of the deceased (Table 1). Of the 778 cause of death certificates, junior doctors certified 630 deaths (81%), while the remainder were certified by postgraduate residents and consultants. Major certification errors were found in 81.7%, 60.4%, and 63.5% of certificates completed by junior doctors, postgraduate residents, and consultants, respectively (Table 4).

### Table 2. Distribution of death certificates with respect to errors in cause of death. (n = 778).

| Variables                                      | Frequency Nos (%) |
|------------------------------------------------|-------------------|
| Brought dead as cause of death                 |                   |
| Yes                                            | 80 (10.3)         |
| No                                             | 698 (90.7)        |
| Cardiac respiratory arrest as cause of death   |                   |
| Yes                                            | 231 (29.7)        |
| No                                             | 547 (70.3)        |
| Immediate cause of death                       |                   |
| Correct entry                                  | 187 (24.0)        |
| Incorrect entry                                | 591 (76.0)        |
| Antecedent cause mentioned as immediate cause of death |           |
| Yes                                            | 170 (21.8)        |
| No                                             | 608 (78.2)        |
| Underlying cause mentioned as immediate cause of death/wrong chain of events |         |
| Yes                                            | 193 (24.8)        |
| No                                             | 585 (75.2)        |

### Table 3. Distribution of death certificates with respect to Haque’s Grading Scale (n = 778).

| Grade               | Description                                           | Frequency Nos. (%) |
|---------------------|-------------------------------------------------------|--------------------|
| Grade 0             | No errors                                             | 30 (3.9)           |
| Grade IA            | Errors incomplete/Inaccurate demographics             | 384 (49.4)         |
| Grade IB            | The signatory that 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 (75.2)         |
proportion of minor errors was 70.3%, 48.9% and 32.7%, respectively. The difference in the distribution of proportions of errors in certificates as per the qualification and experience of certifying physicians was found to be statistically significant (see Table 4).

Discussion

MCCDs provides vital information regarding public health indicators for monitoring health policies and 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 and research, and potentially lead to misleading information regarding health care. MCCDs is also an important source of information for population and hospital-based cancer registries.

In India, active cancer registration is completed by trained registry staff, who visit different locations (diagnostic laboratories, hospitals and vital statistics departments) for collection of cancer-related information. The DC notifications are followed up and those cases where only the DC is available and no other medical records are found, are assigned as DC only (DCO). It has often been observed during data collection for cancer registries of lower-income countries that the DCs are the only source of cancer statistics for the country (Mathur et al., 2020). Varying patterns of DCO percentages and mortality incidence ratios have been observed among different population-based cancer registries that are dependent on the quality of death certification. In some registries, a limited number of DCOs are obtained due to non-availability of data or poor quality of certification of cause of death. Thus, poorly prepared DCs will lead to inadequate data collection for the registries, which will affect the cancer-related statistics required for monitoring and evaluation of cancer prevention and control activities (Mathur et al., 2020).

Our study highlighted errors related to demographic information about decedents in almost half (49.4%) of the certificates, with either incomplete or incorrect entries regarding age, gender and residence of the decedent. Inaccurate age will affect age-related epidemiological parameters, such as age-adjusted incidence and mortality rates; incomplete or incorrect residential address will affect the geographical distribution of cancer and tracing of the families of the deceased for data collection. Inaccurate or incomplete gender information can affect gender-specific patterns of cancer burden and mortality. Inaccurate demographic information and incorrect legal nomination may complicate claims from the insurance organisations and pensions. One probable explanation for demographic errors is that terminally ill patients are brought to emergency care without an adequate description of their medical state or previous medical records. Technical errors were also observed in nearly one-fifth (19.4%) of the MCCDs, including incorrect or absence of name of the physician, absence of signature of the certifier, absence of the seal of the hospital, missing signing date, time of death and date of death, which made the MCCDs invalid for death registration. To register a death, the identity of the deceased, date and time of death and cause of death are mandatory and absence of any of these details will prevent registration of the death.

Illegible writing or use of abbreviations or short forms, or both, were observed in 11% and 12% of the certificates, respectively. While these two errors occurred less frequently when compared to other errors, illegibility and abbreviations of medical terms can make ICD coding difficult, and a recent systematic review reporting common errors in death certification showed that abbreviations and illegibility lead to serious coding errors (Alipour and Payandeh, 2021). However, within the context of our hospital, we categorised these issues as minor because we had a scientific officer trained in medical records who was also experienced in cancer registration and could comprehend the relevant medical terminologies and abbreviations; and for illegible handwriting, this officer had access to the certifying physician or treating unit for clarification. However, this may not be feasible in other hospitals where use of abbreviations and illegibility could adversely affect ICD coding.

Only 30 (3.9%) certificates had no errors. We observed Grade IV errors in 75.9% and Grade V errors in 75.1% of certificates. Grade IV and V errors were the major errors in death certification and will result in gross errors in mortality statistics, thus directly affecting formulation of

**Table 4.** Distribution of type of certification errors with respect to qualifications and experience of the certifying physician (n = 778).

| Type of error                        | Junior doctors | Post graduate residents | Consultants | Total |
|--------------------------------------|----------------|-------------------------|-------------|-------|
|                                      | Nos (%) N = 630| Nos (%) N = 96          | Nos (%) N = 52 | Nos (%) N = 778 |
| **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)  |

*a* Chi-square statistic is 28.747. The p-value is <0.00001.

*b* Chi-square statistic is 42.632. The p-value is <0.00001.

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national health policy. In addition, the certified cause of death is subject to legal scrutiny in cases of medico-legal deaths. Constructing the correct sequence of events also assists an improved understanding of the pathophysiological events that lead to death for a given clinical condition, as well as facilitating improved decision-making by clinicians when confronted by similar conditions in future. In our study, the majority of certificates had been prepared by junior doctors and the proportion of certification errors committed by the junior doctors was significantly higher when compared with postgraduate residents and doctors who had more clinical experience. It is possible that the higher proportion of errors by junior doctors could have resulted from them not being the treating physician, who is generally a consultant with a detailed understanding of the deceased’s medical conditions. Post this study, a remedial measure in the form of training doctors in accurate MCCD completion has been introduced by the study hospitals, and assessment of the impact of this measure is planned in future research.

Mode of death (e.g. cardio-respiratory arrest, circulatory failure and respiratory failure) should be avoided in death certificates as this provides no useful information for understanding the underlying disease process (Kotabagi et al., 2004). In our study, 231 (29.7%) certificates had labelled modes of death as the immediate cause of death. We observed that the certifiers, instead of constructing the chain of events, had written the complete diagnoses of the deceased from the medical records, along with the mode of death in the first line of Part I of the certificate. This same phenomenon has frequently been observed in other lower to middle-income countries (Curado et al., 2009; Haque et al., 2013; Hazard et al., 2017). However, within the Indian context, on most occasions these deaths were unattended, so the exact time, date and details of the terminal event were not available and, therefore, the cause of death not known. These details could be established by a clinical post-mortem examination, with the consent of relatives (Kotabagi et al., 2004).

During our study period, a total of 16 COVID-19–related deaths occurred, all of which contained major certification errors, and 11 of which had a curative intent of treatment (as noted in EMR). Although these patients succumbed due to COVID-19 complications, COVID-19 infection was noted on the certificate as the contributory condition. COVID-19–related deaths should not be incorrectly classified as cancer-related mortalities as this would contribute to misclassification of COVID-19–related mortality and also have implications for cancer–related survival data analysis, especially in cancer trials and cancer registries in which the primary end-point is death due to cancer (Felice and Moriconi, 2021; Singh, 2021).

Similarly, global findings to ours have also been reported. Adjacent countries (Pakistan, Nepal and Bangladesh) have reported a high percentage of errors in MCCD (Haque et al., 2013; Hazard et al., 2017; Maharjan et al., 2015). However, errors in death certificates are not limited to developing countries; for e.g., more than 50% of general practitioners in the United Kingdom and United States of America reported being insufficiently instructed about the process of death certification (Haque et al., 2013). While it is difficult to compare our findings with previous Indian studies due to differences in definitions and interpretations of errors, there are consistent findings among many previous studies, including our study, where the majority of MCCDs had a wrong cause of death that qualified as a major error (Bishwalata et al., 2020; Ganasva et al., 2016; Ganasva et al., 2015; Ghanshyam et al., 2018; Patel et al., 2017; Patil et al., 2019; Pokale et al., 2016; Upalp et al., 2019). Thus, evaluation of death certification through audits should become an essential practice and be conducted regularly in all hospitals, especially in lower-middle and lower-income countries where the quality and availability of death registration is poor, despite higher mortality burden as reported by the WHO (Mathers et al., 2017).

**Study limitations**

The results of this study are limited to the evaluation of cause of death certification for cancer-related deaths only, and findings may not be generalised to other establishments. The last line of Part I of the death certificate is the UCOD. During the audit, we encountered many certificates mentioning cause of death information in solely the first line of Part I of the death certificate. As a result, we could analyse errors in the cause of death using that line only. Accessing information from EMR for validation of the MCCDs is dependent on the quality and completeness of the clinical notes entered electronically, which may also have influenced the quality of the audit.

**Conclusion**

The results of our study show that the majority of cause of death certificates completed during the study period included an incorrect sequence of events that led to major certification errors, suggesting a lack of clarity and sensitisation among physicians for accurate completion of MCCDs. These errors may have stemmed from a lack of knowledge among doctors in terms of how to identify and select the underlying cause, antecedent, immediate and contributory causes of death and suggests an urgent need for appropriate interventions to improve the MCCD completion skills of physicians.

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**Authors’ contributions**

Study conception and design: AA, DK. Acquisition of data: AA, DK, AS, AP, PS. 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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Data availability
The datasets used and/or analysed during the current study will be available from the corresponding author on reasonable request.

Ethics approval
The Institutional Ethical Committee of the Tata Memorial Centres, (Mahamana Pandit Madan Mohan Malaviya Cancer Centre and Homi Bhabha Cancer Hospital) gave ethical approval for the study and to use the cause of death certificates and EMR of the decedents for the study. The ethical committee waived off the consent to participation owing to the nature of the study. (IEC11000028)

Informed consent
All authors have given written consent for publication.

ORCID iDs
Divya Khanna https://orcid.org/0000-0001-7856-8059
Abhishek Pandey https://orcid.org/0000-0002-6736-5368

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