

Medical Education

Educational intervention to improve death certification at a teaching hospital

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ABSTRACT

Background. Information recorded in the 'cause of death' section of death certificates is an important source of mortality statistics. It is used for policy decisions, development of healthcare programmes and health research. Errors in death certificates can lead to inappropriate allocation of resources. Errors are universal and have been reported previously. We planned an educational intervention aimed at resident doctors from various specialties at our teaching hospital to improve the accuracy of the 'cause of death' section in death certificates.

Methods. Three workshops, each of 90 minutes, were conducted for residents. A total of 198 death certificates (96 before and 102 after intervention) were audited. We compared the frequency of major and minor errors before and after the educational intervention.

Results. Following the educational intervention, there was a significant decrease in major errors such as unacceptable underlying cause of death (39.6% v. 24.5%, $p=0.034$), reporting of mechanism without underlying cause of death (13.5% v. 1%, $p=0.001$) and improper sequencing of events (25% v. 6%, $p=0.004$). There was no significant decrease in minor errors such as absence of time intervals, use of abbreviations and reporting a mechanism with a legitimate cause.

Conclusion. Both major and minor errors are common in death certification at teaching hospitals. Educational interventions can improve the accuracy of reporting in death certificates.

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INTRODUCTION

The Medical Certificate of Cause of Death (MCCD), commonly called the death certificate, is a document of considerable importance. It contains epidemiological data that are necessary for formulating vital statistics and guiding the allocation of resources for research and national health programmes. Because health statistics, national morbidity and mortality statistics, and data on disease prevalence in population are derived from death certificates, it is essential to ensure completion and accuracy of the 'cause of death' section in death certificates. Errors in 'cause of death' statements are common and occur as a result of errors at

a number of steps in the certification process. These errors range from illegible and incomplete certificates to inaccurate causes and manner of death. Previous studies from outside India have shown that 24%–37% of sampled death certificates contain major errors in the causes of death.^{1–4}

The standard cause of death report in India follows the recommendations of the WHO and the causes of death are classified according to the International Classification of Diseases (ICD) and the MCCD (form no. 4/4A of Registration of Births and Death Act) is as per the format presented in Volume 2 of ICD-10.⁵ The cause of death is determined by the certifying physician and is defined as (i) the disease or injury which initiated the train of events leading directly to death or (ii) the circumstances of the accident or violence which produced the fatal injury. In addition to the underlying cause of death, the 'cause of death' section provides for reporting the entire sequence of events leading to death as well as other 'significant conditions contributing to death'. Normally the condition in the lowest line of Part I is taken as the underlying cause of death and used for statistical analysis of mortality by ICD-10.

Although death certification is included in the curriculum for undergraduate medical courses, it has little practical application at the time it is taught. Few hospitals or postgraduate training programmes offer formal instruction in the process of certification of death although recording of accurate information in the death certificate is regarded as an important skill. Like most teaching hospitals in India, the majority of death certificates at our hospital are completed by residents in their first or second year of postgraduate training. Our observation of errors in completion of MCCD and improvement following an audit prompted us to develop and implement an educational intervention aimed at improving the accuracy of certification of death by residents (Pandya HV, Bose N, Phatak A. Medical audit exercise in MCCD, discharge diagnosis and discharge summary at Shree Krishna Hospital. Unpublished data presented at MEDRECON 2006, Indore, Madhya Pradesh, India). We describe the educational intervention and report the results of audit of death certificates before and after the intervention.

METHODS

Study design

The evaluation of an educational intervention comprising audit of death certificates for comparison of frequency of major and minor errors before and after the intervention aimed at 43 residents of target postgraduate disciplines at the centre.

This study was done at Shree Krishna Hospital, a 550-bed teaching hospital at the H.M. Patel Centre for Medical Care and Education, Karamsad, Gujarat. All residents of clinical departments responsible for writing death certificates in the hospital were

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invited to participate in the study. A structured educational intervention was designed and implemented as a series of workshop sessions, under the Hospital Mortality Review Programme, which reviews all in-hospital deaths and death certificate information at our centre. The sessions were conducted by one of the authors (HP), who has been coordinating the mortality review programme for the past 5 years, and has expertise in certification of death and audit. Three workshops, each of 90 minutes' duration, were conducted every month from April to June 2007.

A brief didactic presentation during the first workshop outlined the process of certification of death and the terminology used in writing the 'cause of death'. This was followed by an interactive session where situations based on actual cases were used to create mock death certificates. Residents were asked to identify errors in mock death certificates and then shown the accurate death certificates.

During the second and third workshops, residents worked in groups of 5 to complete the cause of death based on written material prepared from real cases. The completed death certificates were presented and discussed with the whole group.

All certificates of in-hospital deaths, except for patients brought dead and those requiring a post-mortem, from December 2006 through March 2007 (pre-intervention) and July through October 2007 (post-intervention) were audited for 7 types of errors (Table I). The method of audit based on 6 types of errors as described by Myers and Farquhar was used with minor modifications.⁶

Death certificates issued before and after the educational intervention were retrieved for analysis from the Medical Records Office. Two consultants (NB and RS) with expertise in certification of death audited the death certificates and reviewed clinical case records to verify the accuracy. In the event of any uncertainty regarding the type of error, HP reviewed the certificates with NB and RS.

Primary outcome measures were frequency of major and minor errors on the death certificates before and after educational intervention. SPSS (Statistical Package for Social Science) version 14 was used to analyse the data. Test for difference between proportions was applied to compare proportions before and after the intervention. A *p* value <0.05 was considered significant.

The study was approved by the Human Research Ethics Committee of H.M. Patel Centre for Medical Care and Education.

RESULTS

Attendance at the workshops was moderate with 19, 20 and 25 out of 43 postgraduates attending the first, second and third workshops, respectively. A total of 114 death certificates were excluded as these were written for either patients brought dead or hospital deaths requiring postmortem. Another 7 certificates were excluded since the cause of death was written on formats that were technically incorrect for writing the MCCD. One death certificate could not be traced among certificates written in the post-intervention period. Of the 198 death certificates analysed, 96 and 102 belonged to the pre- and post-intervention period, respectively (Table II).

During the pre-intervention period, 39.6% of certificates had an unacceptable 'underlying cause of death'. Competing causes (38.5%) and improper sequencing (25%) accounted for most of the major errors. After the educational intervention there was a statistically significant decrease in the proportion of unacceptable 'underlying cause of death', improper sequencing of events and mentioning the mechanism of death without the underlying cause of death. Minor errors were frequent both before and after the

intervention, and the most frequent errors were omission of the time interval and use of abbreviations.

DISCUSSION

While completing a death certificate the physician is required to fill up a number of items such as name, age and sex of the deceased, the cause and manner of death, and association with pregnancy, if deceased was a female. Finally, the physician must sign after verifying the certificate and print his/her name legibly. Instructions for writing the cause of death are available and some are printed on the certificate.⁷ Despite the limited data to be entered by a physician, errors in death certification have been reported universally.^{1-4,8} The cause of death statistics in India are questioned in view of the poor coverage, and poor compliance with guidelines for cause of death reporting, coding and classification.⁹ However, there are no published data on errors in death certification reported from academic centres in India.

The importance of writing an accurate 'cause of death' is not adequately emphasized and taught to medical students and practitioners. Most practitioners who are unaware of the proper 'cause of death' ascribe the cause of death to the mechanism of death, e.g. cardiorespiratory arrest instead of writing a proper

TABLE I. Definition of major and minor errors in death certificates

Type of error	Definition
<i>Major</i>	
Mechanism of death listed without an underlying cause	Mechanism or non-specific condition listed as the underlying cause of death
Improper sequencing	Sequence of events does not make sense; underlying cause of death not listed on the lowest completed line of part I
Competing causes	Two or more causally unrelated, aetiologically specific diseases listed in part I
Unacceptable cause	Wrong cause of death based on review of clinical records or any one of the above errors (either alone or in combination)
<i>Minor</i>	
Abbreviations	Abbreviations used to identify diseases
Absence of time intervals	No time intervals listed in parts I or II
Mechanism of death followed by a legitimate underlying cause of death	Use of a mechanism, but qualified by an aetiologically specific cause of death

TABLE II. Errors identified during the audit of death certificates before and after the intervention

Type of error	Before intervention <i>n</i> =96	After intervention <i>n</i> =102	<i>p</i> value
<i>Major</i>			
Unacceptable UCD	38 (39.6)	25 (24.5)	0.034*
Mechanism only without UCD	13 (13.5)	1 (1.0)	0.001*
Improper sequencing	24 (25.0)	6 (5.9)	0.0004*
Competing causes	37 (38.5)	26 (25.5)	0.069
<i>Minor</i>			
No time intervals	28 (29.2)	28 (27.5)	0.91
Use of abbreviations	21 (21.9)	34 (33.3)	0.1
Mechanism and legitimate cause	13 (13.5)	8 (7.8)	0.28

Values in parentheses indicate percentages; UCD underlying cause of death

underlying cause of death. Errors have been attributed to the inexperience of house staff and unfamiliarity with the medical history of the deceased and perceived lack of importance of death certificate. Additional factors for errors include fatigue and time constraints.⁴ The responsibility of death certification at teaching hospitals often falls in the hands of least experienced members of the team. Without proper training and feedback on the skill of writing a death certificate, faulty habits can continue.

This universal problem of inaccuracies, as has been shown by various studies, can be minimized through a simple educational intervention aimed at residents who usually complete death certificate at academic centres. Various approaches recommended to improve accuracy of death certificates include an annual course in death certification and discussion of the death certificate of each deceased patient during physician rounds. Some previous groups have implemented an educational intervention to improve the accuracy of death certification and evaluated the intervention.^{6,10-14} In spite of problems of poor compliance to guidelines on cause of death reporting, educational interventions to improve the accuracy of death certificates have not been previously reported from India. Our study design was similar to that of Myers and Farquhar; however, our educational intervention was somewhat different and was aimed at a wider target group of residents. We used interactive workshops which have been demonstrated to be a better mode of teaching as compared with printed handouts.¹¹ The intervention used by us was successful in reducing major errors. We failed to demonstrate any significant improvement in minor errors (Table II).

There has been variation in criteria used to define errors among various studies, and hence comparisons of errors with other studies are difficult. However, there seems to be an agreement that an unacceptable underlying cause of death qualifies as major error. The effect of improvement following the intervention in our study was similar to that shown by Myers and Farquhar. It was documented in spite of moderate participation by residents due to their pressing patient care commitments and many certificates were probably filled by residents who failed to attend all 3 sessions or did not attend them at all. This improvement in accuracy of death certificates can also be explained by the supplemental effect of the discussion on death certificate information during the regular monthly mortality meeting during the study period. Since these meetings were also attended by consultants, there could be an additional effect of immediate audit of death certificates filled by the residents. We did not announce our plans to audit death certificates and hence the improvement is unlikely to be due to the Hawthorne effect—a change in behaviour due to an educational intervention. This is particularly important because mortality meetings have been running at our centre since 2003 but the structured educational intervention was introduced only in 2007, which, in our opinion, brought about the improvement in MCCDs written by residents in the post-intervention period. However, we cannot rule out the possibility of a ripple effect of the educational intervention since death certification is often completed after discussion among peers in a team of residents and the

improved skills could also rub off on those who might not have participated in the intervention. We believe persistence of minor errors such as use of abbreviations, absence of time intervals and mechanism with legitimate underlying cause of death could be due to long acquired behavioural traits which can change only after frequent reinforcements over a period of time.

In conclusion, writing a death certificate is an important skill that all doctors certifying death must acquire to improve accuracy of mortality statistics in India. Our study has shown that a simple but structured educational intervention can improve the accuracy of 'cause of death' on death certificates. Death certification is included in the undergraduate medical curriculum, but we recommend that academic centres should conduct a course on death certification for all newly admitted postgraduates. However, in the absence of such studies from India, we recommend that educational interventions for improvement of death certification in various settings should be conducted and evaluated.

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