ORIGINAL ARTICLE

Assessment of Accuracy of Death Certification in Teaching Hospital in A Developing Country

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ABSTRACT
Introduction: Death certification is largely random and fragmented in most developing countries.
Objective: This study is done to evaluate errors in medical & non-medical part and to determine causes of errors of cause of death.
Material and Method: Two hundred and twenty death certificates were randomly selected that have been issued from November 2013 to April 2014 for the deceased who were admitted in Services Hospital, Lahore. A predetermined error grading scale was used to assess the accuracy and completeness of selected death certificates. Causes of errors were analyzed and confirmed after detailed scrutiny of the medical section of death certificates. Data was statistically analyzed using SPSS version 20.
Results: Four percent of death certificates were incompletely written.7% had no errors. The most frequent errors included Grade I errors involving patients' demographics seen in 93% death certificates of which occupation was incorrect in 79.6% certificates. Grade IV and Grade V errors regarding cause/s of death were seen in 184(84%) and 128 (58%) certificates. Speculated causes of the errors of cause of death (99%) were lack of training and diagnostic incompetency.
Conclusion: Errors in the completion of the death certificates are very common. Training for the doctors on induction to improve accuracy of death certificate is recommended during internship and at postgraduate level.

Key words: Death certificate, Errors, Cause of death.

INTRODUCTION
Death certification is of significant medico-legal importance. It has a history dating back to the 12th century. It is a legal obligation for the doctor attending the deceased during his terminal illness to complete the death certificate in accordance with the WHO guidelines[1].

Information comprising of demographics, date, time and place of death, co-morbidities and cause of death is mentioned in every death certificate. Death certificates can be a useful tool for the proof of legal death, deterrence of crime, monitoring of the health status of populations and implementation of appropriate interventions for disease prevention[2,3].

Despite the World Health Organization guidelines for the statistical analysis of mortality, death registration is fragmented and largely random in most developing countries [4,5]. This is mainly due to errors related to the cause of death given in death certificates, even in countries that encourage autopsies[4]. In Pakistan, however, the problem is graver due to discouragement of autopsies except when there is suspicion of foul play. Correct certification of the cause of death is possible only if the doctor has a clear understanding of the: 1) difference between "cause" and "mechanism" of death, and 2) meaning of the terminologies "immediate cause of death" and "underlying cause of death", both of them included in the standard format of the medical section of a death certificate[2]. The underlying cause of death is "the disease, physical injury or intoxication that initiated the train of morbid events resulting in death;"[6]. Conversely, a mechanism of death is "a train of changes in body physiology or biochemistry, which is incompatible with life produced by a cause of death"[6].

Despite the fact that most doctors routinely complete death certificates according to WHO guidelines, a critical analysis of the information contained in death certificates shows that they are full of errors mainly related to the cause of death[7]. Literature has shown that the error rates in death certificate completion are about 25% to 78% in hospital-based studies[8-11] and 16% to 56% in

population-based studies[12,13]. Since morbidity and mortality statistical studies are mainly based on the analysis of these certificates[14,15], inaccuracies in their completion may lead to biased estimation of several epidemiological parameters[13,16]. This drawback has been recognized in United States, Great Britain, Canada, and many other countries[5,7].

The etiology of these errors include obscure ante mortem diagnosis, omissions in medical and non medical part of certificate, coding errors, unavailability of medical records, unawareness of certification process and its importance, complexity of sorting out temporal sequence that led to death when multiple diseases are involved and lack of formal training[17].

A vast majority of previous studies have analyzed solely the errors related to the cause of death[15]. However, only a few studies have documented all possible errors[17,18], identified the common ones and classified them into minor and major errors. Studies have also shown that accuracy can be improved with training workshops, quality assurance programs with feedback, and encouraging more autopsies[2,13,16,18].

OBJECTIVE:

The aim of the study was

- To assess the completeness of data-reporting in death certificates
- To determine the accuracy of death certificates
- To identify the types and frequency of errors in medical and non medical part of death certificates.
- To explore etiological relevance of errors of cause of death statement.
- To highlight the importance of educational interventions to improve the death certificates writing skills of the physicians in order to minimize errors.

MATERIAL AND METHODS

Study Sample:

This retrospective study was conducted to examine and analyze the completeness and accuracy of death certificates in a teaching hospital. 220 death certificates were randomly selected that have been issued over a six month period (November 2013 to April 2014) for the deceased who were admitted in Services Hospital, Lahore.

Inclusion Criteria

The inclusion criteria were patients of all age groups, with complete medical records, who died after admission to the hospital.

Exclusion Criteria

The exclusion criteria were patients with no medical records, who died from iatrogenic or traumatic causes, before admission to the hospital.

Variables and Measurements

The death certificate used to report the cause of death is in accordance with World Health Organization (WHO) guidelines. The following information was obtained from the death certificates:

(i) Demographic data (e.g. name, age, sex, marital status, occupation, residential address, date of death) of the deceased patients.
(ii) Administrative details, including date of admission, place and time of death, name, designation and signature of doctor completing the death certificate, and whether autopsy had been performed or not.
(iii) Medical data indicating the immediate, antecedent, underlying cause of death and co morbidities.

Assessment Method

The information obtained from the death certificates was collected using an approved standardized form. Completeness and accuracy of this information was then evaluated by a thorough review of the medical records by the authors.

A predetermined error grading scale was used to assess the accuracy and completeness of selected death certificates. Grade 0 to V was assigned to errors as shown in Table 1. Causes of errors were speculated after detailed scrutiny of the medical section of death certificates.

Statistical analysis

Data was statistically analyzed using SPSS version 20.

RESULTS

Out of 220 Death certificates, 212 (96%) were completely filled. Only 8(4%) had omissions either in the medical or in non-medical part (Table2).

Table 1: Grading scale used to assess death certificate errors

GRADES	TYPE OF ERRORS
Grade 0	No errors
Grade I	Incomplete /inaccurate demographics
Grade II	Incomplete /inaccurate information related to doctor completing certificate
Grade III	Incomplete/ inaccurate Co-morbidities list
Grade IV	Incorrect immediate cause of death
Grade V	Incorrect or improper sequence of underlying cause(s) of death

Table 2: Frequency of Errors against Complete & Incomplete Death Certificates

Death certificate	Correct Cause of Death No (%)	Incorrect Cause of Death No (%)	Total No (%)
Completely written	36(16)	176(84)	212 (96)
Incompletely written	0	8(100)	8(4)
Total	36(16)	184 (84)	220 (100)

Table 3: Completeness and Accuracy of non-medical section of death certificates

Non- medical section	Completely written (%) n=220	Errors (%) n=256
Medical record no.	220(100)	0
Identity	220(100)	13 (4.7)
Age	220(100)	0(0)
Sex	220(100)	0(0)
Occupation	220(100)	204(79.6)
Residential address	220(100)	31 (12)
Date & time of Death	220(100)	0(0)
Name of doctor handing over dead body	220(100)	4(1.5)
Name and relation of person receiving dead body	220(100)	4 (1.5)
Legible signature & name of certifying Doctor	220(100)	0(0)

Table 4: Completeness of Medical section of Death Certificates

Variables	Number	Percentage
Immediate cause	220	100
Time interval between immediate cause and death	220	100
Antecedent cause	220	100
Underlying cause	220	100
Co-morbidities	212	96.3

Cause of death statement was excluded while evaluating non-medical section of the death certificates.10 areas were selected where error/s could be found. In this section, all variables were filled out completely in death certificates (100%). Total number of errors in non-medical part was greater than the total number of certificates i.e. 256. Occupation was not written correctly in majority, thus comprising 4/5th of errors (79.6%). Second commonest error was inaccuracy in residential address 31(12%) followed by inaccurate identity of the deceased 13(4.7%). Least common were errors in mentioning the name of doctor handing over dead body and the person receiving it that were same (4, 1.5% each) .Date & time of death was written correctly in all certificates i.e. 100% accuracy. Other variables i.e. medical record no., age, sex, signature and name of the certifying doctor showed 100% accuracy as well (Table 3).

Co-morbidities were filled out completely in 212 certificates (96.3%).Completeness of all other variables in medical section of death certificates was 100 % (Table 4).

According to the grading scale, 7% death certificates had no errors. The most frequent errors in the data included Grade I errors involving

patients' demographics seen in 93% death certificates. Grade IV and Grade V errors regarding cause/s of death were seen in 184(84%) and 128 (58%) certificates.(Table 5)

Majority of the certificates 44 (20%) belonged to 41-50 years age group followed by 61- 70 years 39 (17.7%). Out of 220 death certificates, cause of death was accurately written in 36 certificates; majority of them belonging to the old age group 51-70 years 22 (61%). On the other hand, age group 41-50 years showed the maximum number of death certificates with incorrect cause of death 41(22.2%) followed by 61- 70 years 30 (16.3%) and 21-30 years 29 (15.7%) respectively as shown in table 6.

Table 5: Distribution of death certificates according to grading of errors

Grade	Number of death certificates (n=220)	Percentage
Grade 0	16	7
Grade I	204	93
Grade II	4	2
Grade III	52	24
Grade IV	184	84
Grade V	128	58

Table 6: Frequency of Age group & Cause of Death

Age group	Number (n=220)	Correct cause of death (n=36)	Incorrect cause of death (n=184)
0-10 yrs	13 (5.9)	0	13 (7)
11-20 yrs	20 (9)	3 (8.3)	17 (9.2)
21-30 yrs	33 (15)	4 (1)	29 (15.7)
31-40 yrs	20 (9)	4 (1)	16(8.6)
41-50 yrs	44 (20)	3 (8.3)	41 (22.2)
51-60 yrs	27 (12.2)	13 (36)	14 (7.6)
61- 70 yrs	39 (17.7)	9(25)	30 (16.3)
71-80 yrs	20 (9)	0	20 (10.8)
81-90 yrs	4(1.8)	0	4 (2.1)

Table 7: Frequency of Speculated Causes of Error of Cause of Death

Speculated cause of errors	No. of Errors (n=261)	Percentage
Obscure ante-mortem Diagnosis	62	24
Complicated format of death certificate	3	1
Lack of formal training	189	72
Ambiguity of temporal sequence of causes of death	7	3

Every death certificate revealed possibility of multiple causes behind errors. Therefore, speculated causes behind errors of cause of death were more in number than total number of death certificates i.e. 261. Out of them, lack of formal training was the commonest 189(72%). Second commonest cause was obscure ante-mortem diagnoses 62 (24%). Complicated format of death certificate was responsible for 1% errors while ambiguity of temporal sequence of causes of death caused 3% of errors.(Table 7)

DISCUSSION

Analysis of the information recorded on death certificates is one of the oldest and most extensive tools for public health monitoring as various epidemiological parameters are derived from evaluation of death certificates. Therefore, completion and accuracy of death certificates is of immense importance. Doctors at both undergraduate and postgraduate level are being trained in death certification or disease coding procedures globally to minimize errors[18]. This study was done to assess death certificates with reference to errors found in medical and non-medical section and to evaluate causes of these errors.

Our study revealed that 4% certificates were incompletely written. However, other studies reported much higher frequency of incomplete death certificates. Raje[19] reported 21% certificates

being incomplete. El-Nour et al[20] found 98.2% certificates incompletely filled in a study conducted in pediatric hospitals of Khartoun state of Sudan during 2004. During 1993, Hanzlick reported 63% certificates with either omission or error in cause of death[21]. Our study found lower frequency of incompletely written death certificates may be because they were obtained from a teaching hospital where electronic medical record system is in vogue thereby decreasing the likelihood of incomplete certificates.

7% certificates had no errors in our study while Haque at al[22] and Raje[19] found only 2% error free death certificates in their respective studies. However, Jordan and Bass reported that 68.1% death certificates were written correctly in contrast to our study[9]. According to our study, 83% certificates were completely written, but showed inaccuracies. This is in accordance with studies by Raje[19] and Haque et al[22] who found that 79% and 62% of death certificates had errors respectively.

The non medical part of all death certificates was filled out completely in our study. Sibai et al[5] also reported that the information on the death certificates was almost complete in respect to all demographic characteristics of the deceased except for occupation and month of birth thus partially agreeing with our findings. Moreover, Shah[23] and El-Nour et al[20] quoted that the variables related to identification information were filled out in 95-100% and 92.8% of the certificates respectively, thus in accordance with our results. In our study, 93% of the death certificates had errors pertaining to inaccurate demographics which is in agreement with Haque et al[22] who found such errors in 92% certificates. The most common error in non- medical part of death certificate was inaccurate occupation (79.6%) followed by errors of residence (12%) and identity (5%). One of the studies in USA also found errors pertaining to residence in death certificates[24]. The reason for complete non-medical part of death certificate in our study is that biodata is obtained from the identity card, which has to be presented at the time of admission to the hospital. The increased number of errors of occupation may be because of the reason that it is not mentioned on the identity card and it is difficult to assign a single occupation if the deceased had multiple employments either simultaneously or over a lifetime. This has a serious negative impact on the occupational health research and the analysis of mortality data in relation to the socioeconomic status, particularly as educational status is not mentioned on the certificate. Therefore, it is necessary to highlight with sound reasoning the importance of the mentioning correct occupation in death certificates during training of doctors.

All variables in the medical section were completely filled except co-morbid conditions which showed completion in 96% certificates. Completeness of variables such as immediate cause, antecedent cause, underlying cause and co-morbid conditions were 99.8%, 97.7%, 98.4% and 95.2% respectively in study by Shah[23] thus agreeing with our findings. On the contrary, Sibai et al[5] reported that immediate, antecedent and underlying cause of death was mentioned in 40.7%, 25.9% and 11.1% of death certificates respectively.

Incorrect cause of death was given in 84% death certificates. This is comparable with studies by other authors. Raje[19] found inaccurate cause of death in 99% death certificates while Haque et al[22] and Sibai et al[5] reported similar errors in 62% and 58.5% certificates respectively. Also, Hanzlick[21] examined 1267 deaths in a one year study and found 47% of such errors. There are many plausible explanations for this. This may be due to conversion from paper to electronic certificates, clerical omissions or because they are recorded by busy, harried junior doctors with little or no formal training in death certification or disease coding procedures. The best certifier should be the treating doctor of the deceased who maintained his medical record[25]. However, this duty continues to be assigned to the house officers or residents[2,11] who mostly give the underlying cause of death, the antecedent cause(s) and the direct cause of death without reviewing the medical records. According to the study of Lu et al[11], in most death certificates, the certifying physician copied the admission or discharge diagnoses directly to the cause-of-death section on the death certificate. These error issues are not limited to the developing countries. More than 50% of general practitioners in the United Kingdom and in the USA reported lack of formal training regarding the completion of death certificates[11]; many said that their first contact with a death certificate occurred when their patient died[26].

Direct comparison of our study with previous studies is difficult due to differences in the definitions and classification of errors. However, inaccurate cause of death and a lack of an acceptable underlying cause of death are accepted

as major errors by all these studies including ours. It is very common for physicians to confuse underlying cause of death with mechanisms of death. Due to their lack of etiologic specificity, mechanisms of death should not appear on death certificates. In our study, 63.6% cases were labeled with mechanism of death rather than cause of death. Similar findings have been reported in the past across the globe. Raje[19] found that mechanism of death was listed as cause of death in 60% certificates while Haque at al[22] quoted that 62% certificates had such errors. In 1993 Jordan and Bass[9] revealed such errors in 31.9% of a sample of death certificates completed at a tertiary care teaching hospital in Canada. El-Nour et al[20] found 45% of the death certificates contained similar errors while a national study in Greece[27] and Taiwan[11] revealed 34.5% and 7% of such errors respectively.

All death certificates of pediatric age group had errors in cause of death. Other age groups did not show any significant variation regarding inappropriate cause of death. This can be explained by the duration of illness that leads to death. Many a times, the infants & children succumb to death before a complete ante-mortem diagnosis is made[28]. However, certification of accurate cause of death is more likely after a long, well-characterized illness with precise diagnosis, thereby decreasing the chances of incorrect disease statistics[26].

Obscure ante-mortem diagnoses, ambiguity of temporal sequence of causes of death indicate diagnostic incompetency which account for 27% of errors related to cause of death in our study. Overall, lack of formal training (72%) and diagnostic incompetency (27%) are responsible for almost all errors of cause of death (99%). Other studies also found similar causes of errors. The doctors from 9 different departments were interviewed to study their knowledge and practice of filling up of death certificates in study by Shah[23]. He reported that only 16.6% of the doctors knew correct definition of all the three causes of death. Villar showed that 56.8% of the doctors listed mechanism of death as the immediate or the underlying cause of death in certificates and a simple educational intervention can increase the accuracy rate by more than three-fold[2]. Complicated format of death certificates caused only 1% errors, indicating that it does not have significant role in causing errors. El- Nour et al[20] agreed to our finding and reported that 90% of doctors had no issue regarding the format of death certificate.

CONCLUSION AND RECOMMENDATION

Errors in the completion of death certificates are very common especially pertaining to cause of death. Training for doctors to improve accuracy of death certificate is required at undergraduate and postgraduate levels.

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