Addis Ababa University

College of Health Sciences

School of Medicine

Department of Pediatrics and Child Health

Quality assessment of facility based medical certification of cause of death in the Department of Pediatrics and Child Health at Tikur Anbessa Specialized Hospital between July-August 2021

Addis Ababa, Ethiopia

ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICINE

DEPARTMENT OF PEDIATRICS AND CHILD HEALTH

Quality assessment of facility based medical certification of cause of death in the Department of Pediatrics and Child Health at Tikur Anbessa Specialized Hospital between July-August 2021 Addis Ababa, Ethiopia: A cross-sectional study

Investigator

Hiyaw Abebe, MD

Pediatric and Child Health Resident

Advisors

Hayat Ahmed, MD

Consultant Pediatrician and Fellow Pediatric Cardiologist

Wubegzier Mekonnen, PhD

Associate Professor of Public Health, School of Public Health

A thesis paper submitted to Tikur Anbessa Specialized Hospital, Pediatrics and child health Department Postgraduate program in partial fulfillment of the requirement for the specialty in pediatrics and child health.

November 2021, Addis Ababa Ethiopia

Acknowledgment

I would like to extend my sincere thanks to Addis Ababa University, College of Health Sciences, School of Medicine, Department of Pediatrics and Child Health for giving me this opportunity to conduct a research on a subject of my interest. I would also like to express my heartfelt gratitude to my advisors for their continuous support and Dr. Abraham Tesfaye, PhD Microbiology, MSc Public Health for helping with the analysis. My special appreciation goes to the staff the department of Pediatrics and child health.

Table Of contents

List Of Tables

List of figures

List of Acronyms

ACME- Automatic Classification of Medical Entities

ARRA- Agency for Refugee & Returnee Affairs

CHS- College of Health Sciences

COD- Cause of death

CRVS- Civil Registration and Vital Statistics

DPCH- Department of Public and Community health

FDRE- Federal Democratic Republic of Ethiopia

HMIS- Health Management Information System

ICD 10- International Classification of Diseases

ICU- Intensive Care Unit

IIVRS- International Institute for Vital Registration and Statistics

IRB- Institutional review board

MCCOD- Medical Certificate of Cause of Death

NCHS- National Center for Health Statistics

SPSS- Statistical Package for the Social Sciences

TASH- Tikur Anbessa Specialized Hospital

UNESCO- The United Nations Educational, Scientific and Cultural Organization

UNICEF- United Nations International Children's Emergency Fund

UNSC- United Nations Security Council

UNSD- United Nations Statistics Division

WHO- World Health Organization

Abstract

Background

As one of the vital events of interest death must always be certified by a person authorized by law to issue a document, stating the causes of death. In order to ensure the universal application of this principle World Health Organization has recommended an international form of medical cause of death certification that is adopted by most countries of the world. A good quality death certificate should fulfill the criteria put forth including a correct documentation of causes of death, with the correct sequence and time intervals. In Ethiopia, however, the internationally recommended death certificate guidelines have not been utilized until now.

Objective

The purpose of the study is to assess quality of facility based medical certification of cause of death in the Department of Pediatrics and Child Health at Tikur Anbessa Specialized Hospital.

Methods

A hospital based cross-sectional study was conducted with retrospective data collection by reviewing medical death certificates of deceased patients who were admitted at the Department of Pediatrics and Child health before their death. A structured pretested questionnaire with details of the deceased, WHO formatted death certificate and Rapid Assessment Tool were used. Medical death certificates were reviewed by the primary investigator. Errors were identified by the rapid assessment tool and classified as Major and Minor errors. Disparities in the magnitude of errors as compared to age, sex, duration of stay, time of death; qualification of certifier and place of death were assessed.

Result

From the 423 reviewed medical death certificates that were reviewed, 100% of them had errors. The commonest major error was a missing time interval between diseases. The commonest minor error was use of abbreviations. Duration of stay of less than 24 hours and certification by a second year resident were associated with a higher chance of error. Death in the Pediatric Intensive Care Unit and Hemato-oncology wards was associated with a lesser incidence of errors.

Conclusion

As observed by the percentage of medical death certification errors, this study confirms that there is a high magnitude of error among all of the issued medical death certificates. There is a collectively similar quantity of poor quality certificates regardless of the attributes of the deceased, as well as determinant factors of certifiers. It also demonstrates some of the factors associated with higher or lower proportions of errors. In addition, it has also picked the magnitude of ill-defined Underlying Cause of Death. These are all crucial inputs into hospital and national data.

Introduction

Background

Death is defined as the permanent loss of all signs of life at any time after live birth, excluding fetal deaths. (1) As one of the vital events of interest death must always be certified by a person authorized by law to issue a document, stating the causes of death. World Health Organization (WHO) defines causes of death as '*all those diseases, morbid conditions or injuries which either resulted in or contributed to death and the circumstances of the accident or violence which produced any such injuries'* (2)

From a public health stand point, the most important step in disease prevention is breaking chain of events by preventing underlying cause of death resulting in death. (2) This is why underlying cause of death is defined as the basis for mortality statistics and is the main focus of a death certificate. In order to ensure the universal application of this principle WHO has recommended an international form of medical cause of death certification that is adopted by most countries of the world as a Medical Certificate of Cause of Death (MCCOD)

When death occurs in a health facility it is the dual obligation of the institution to act as an informant of the event and to provide a MCCOD by a physician, after which the certificate undergoes, registration by a national Civil registration and Vital Statistics (CRVS). The MCCOD is a permanent legal document providing a final confirmation of death. It contains details of the deceased, causes of death and their time interval.

An accurate death certificate is essential and serves numerous purposes. (3) It provides valuable information for family members regarding the cause and mode of death by influencing legal proceedings. It also has far reaching effects on hospital data, health surveillance, public health research, budgeting and health policy. In addition, it reflects the wellbeing of inhabitants of a community and guides the distribution of resources.

A good quality death certificate should fulfill the criteria put forth by the WHO including a correct documentation of causes of death, with the correct sequence and time intervals. (4)

To further strengthen the comprehensive and comparable tool for identifying diseases and causes of death, WHO developed an International Statistical Classification of Diseases (ICD-10). Its

purpose is to translate diagnoses into alphanumeric codes for easy data collection into Civil registration and Vital Statistics (CRVS) (2)

The correctness and completeness of a death certificate is essential, but despite the availability of guidance numerous studies have revealed that errors in certification are common, making certificates of poor quality. (3, 5) Globally, compulsory use of the WHO MCCOD, ICD-10 coding and physician trainings were some of the interventions taken to improve certificate quality.

The magnitude of errors in death certificates are universal and affect all geographical regions. Errors in certification were further compounded with errors in the ICD coding indicating that National, Continental and Global vital Statistics are affected by death certification quality.

On a national level, Ethiopia adopted a widespread rule monitoring the official and functioning outline of vital events registration, which was correspondingly made obligatory by the FDRE Proclamation No.760/2012. (6) Vital events registration was inaugurated across the country as of 06 August 2016, and was reinforced by the FDRE Proclamation No. 1049/2017. (7) However, the internationally recommended death certificate or ICD guidelines have not been utilized until now.

Statement of the Problem

In Ethiopia, there is a lack of cause of death data owing mostly to the relatively new CRVS that is in its infancy. Universally accepted Medical Certificates of Cause of Death are not used to document deaths occurring in facilities, which affects the hospital and national data by creating a lack of uniformity. In addition, the ICD-10 system that is used to translate diagnoses into the CRVS is not implemented, causing a hurdle towards the completion and quality of cause of death data. Another obstacle hindering the accuracy and completeness of death certificates is the lack of interventions that have to be taken, such as physician training and use of electronic records.

In every country, death certificate with causes of death is obtained from the health sector, among other sources.

The civil registration extrapolates mortality data from numerous sources, among these are outreach programs to hospitals and routine linkages from hospital notifications. The data will then be compiled in the CRVS systems and provide assistance toward improved health data. This in turn will be used in the process of policy making, progress measurement through mortality data and the creation of a platform for global planning

Thus, in our setup, we can comprehend that data extrapolated from the health system is a major input into the completeness of mortality data and that this element reflects that the facility based death certification and reporting system is defective. In addition, improving the facility based medical death certification is one of the most significant and necessary steps en route for the improvement of our vital statistics registration.

Rationale of the study

Mortality data is one of the main vital events used for public health analyses and other research studies. It is extremely essential to have timely a public health information as well as high quality vital statistics data (8)

A medical death certificate delivered through the Ethiopian health sector is a primary source of input into the CRVS system. Facility based death certificates have a direct impact on the completeness and quality of vital registration. Physicians are the chief death certifiers in the health system and they have the legal responsibility of providing a good quality of diagnosis with a complete, specific, timely and readable death certificate.

Evidence extrapolated from death certificates is used to quantity the comparative contributions of different disease entities toward mortality. (9) Statistical data on deaths by underlying cause is significant for monitoring the health of a population, scheming and assessing public health interventions, distinguishing priorities for health services and evaluating the impact of those services. Medical death certification data are also broadly used in investigation into the health effects of exposure to risk factors through day to day life.

This area of investigation is an insufficiently evaluated topic in the world with a limited number of studies. There is also far less availability of data in Africa, and no studies have been conducted regarding medical certification of cause of death in our country until now. Thus, this study aims to provide fundamental information on the quality of facility based death certification. ()

The outcome of this study will be a valuable input for improvement of hospital based data and the national statistics at large. It will also help guide the methods through which improvements could be made toward a better national health statistics.

The outcome of the envisioned study will be a valuable input for the quality improvement of hospital based certification and permanent institutional records. In addition, it will guide the organization in choosing among the types of guidance and intervention necessary for better quality of data. This in turn will assist the advancement of the CRVS of our country that is still in its early stages.

Literature review

A valid cause of death data with good quality is essential to identify public health challenges, to assist in health service planning and to evaluate interventions as well as health policies. (10) As a step towards quality improvement of cause of death, WHO has recommended the use of a standardized certificate for COD. In addition, an ICD-10 classification list for compiling COD data on a yearly basis was applied. These two interventions were implemented to improve quality of data and to eliminate errors. However, death certificate errors are common across all regions of the continent and their magnitude is enormous. (5, 10)

The following study done in Australia proves the above statement as a meta-analysis showed a great burden of inaccurate death certificates.

It was a systematic review and meta-analysis done by the Melbourne School of Population and Global Health, University of Melbourne. (5) It was aimed to assess the effectiveness of training interventions in improving quality of medical certification of cause of death as compared to medical school trainings. A screening gave a number of 616 studies, out of which 21 were selected for synthesis and four underwent meta-analysis.

The study populations were physicians from Canada, USA, India, South Africa, Spain, Bahrain and England. In seven interventions, the study populations consisted of medical students from UK, Spain, USA, Fiji and Spain.

The pre-intervention proportions of all error categories selected for meta-analyses were 51%, except for the category of 'absence of time intervals', which was 37- 93%.

This meta-analysis displays the high magnitude of errors on facility based medical certificates, despite the standard guidance and interventions. Furthermore, the study population included individuals from all over the world, showing the universality of the burden of poor quality MCCOD.

As an only example of measure of errors in Africa, there was a Cross-sectional descriptive study done at an academic hospital in Cape Town, during 2004. (11) It was a done through a retrospective review of death notification forms of deaths due to natural causes. Medical death certificates were reviewed based on errors and ability to code causes of death according to ICD-10. Out of 983 death certificates that were evaluated, almost every one of them had a minor error, out of which 32.2% had major errors. Errors increased with patient age and decreased with neoplasms. In addition, there was underreporting of deaths due to HIV/AIDS by 53.1%.

The error rate of this study was almost 100% and they were adequately grave to affect identification of underlying cause of death in about one third of the certificates. As compared to the meta-analysis done in Australia, this study displayed greater percentage errors.

In general, there is paucity of data in Africa regarding quality of medical death certificates and it is the continent with the least coverage of death registration at international level. This might have been reflected on the poor quality of death certificates. (12) As a sub-Saharan country, Ethiopia has an undocumented death registration as of February, 2021. (12) In addition, no studies have been done regarding the quality of medical death certification.

The above literatures outlined the quality of data and amount of errors in the global, continental and national setup. After measuring the magnitude of the problem, quality of death certificates can be assessed by using multiple methods. One is by identifying errors and classification into major and minor. Errors can then be compared and evaluated according to associated factors affecting their occurrence, such as seniority of physician. The following study examined multiple aspects of factors associated with errors.

This study was done in Peru, where physicians certify almost all deaths as a legal requirement; however, the quality of cause of death data is poor. (13) To address this, two interventions were implemented to improve cause of death data. These interventions were introduction of an online death certification system and a training program for physicians on standard death certification practices. The study following these interventions aimed to assess the effectiveness of the two interventions and compared the quality medical death certificates among three groups: Pre-intervention paper death certificates, death certificates after the online registration and online registration after training.

It comprised of a random sample of 300 pre-intervention death certificates, 900 death interventions that were part of the online intervention and 900 certificates that were part of both interventions. (13)The study used the Assessing the quality of death certification tool from the University of Melbourne. It evaluated the frequency of common errors in death certificates for each category of age, sex, doctor's seniority and specialty, level of health facility and general cause of death. Bivariate and multivariate analyses were conducted to assess the effectiveness of the three intervention groups. Bivariate relationships were analyzed using chi-square and t-tests. The covariates in the model were study group status (pre-intervention, online intervention, online

and training intervention), age group of the deceased, sex, doctor's experience, doctor's specialization, level of health facility, and cause of death

The average error percentage declined by 38% owing to the online intervention and by an additional 26% due to the physician training intervention. Following the interventions, the main improvements were reductions in the absence of a time interval (66% of certificates), improper order of causes of death (22%), and ill-defined conditions (13%). Errors also showed increasing pattern with increased age of patients but decreased with higher level of Physician's Specialty and level of health facility. This relationship outlines the effect that different factors impose on the quality of death certificates.

Different methodologies may be used to assess the quality of data, as described above, the study done in Peru used a random sampling technique and comparison of pre and post intervention based on the nature of errors and associated factors. (13)Physicians were unaware that they were being evaluated before and after the interventions and then a rapid assessment tool was used to categorize and analyze errors.

A different methodology was used in a study that took place in Tehran, Iran. It was done with the objective of evaluating the validity of cause of death. A cohort of 15,005 people was established in1999. (14) A total of 231 deaths occurred and were investigated by a panel of medical specialists who determined underlying cause of death. Another physician will issue a certificate without training. The COD completed by the physician was then compared with the UCOD determined by the panel of specialists. The result of this study indicated that if the death certificate is issued by a general practitioner, there is 2.3 times chance of being misclassified compared with when it is issued by a specialist. In addition, if the deceased is more than 60 years, the chance of misclassification would be 2.5 times compared with when the deceased is less than 60 years. This study is unique in that it uses a cohort to collect the attributes of the deceased.

In summary, there have been a variety of literatures done regarding quality of cause of death certificates among countries of the world. These countries are grouped among those with a relatively good death registration system and well-built medical certification of cause of death. On the contrary, Ethiopia has an undocumented death registration data and an unfledged MCCOD system. No studies or interventions have been done regarding this area of interest in

Ethiopia. Thus, quality assessment of MCCOD will help identify the scale of errors and their associated factor. In addition, it will help guide the manner of interventions that should be taken.

Objectives

General Objective

- To assess the quality of facility based medical certification of cause of death in the Department of Pediatrics and Child Health at Tikur Anbessa Specialized Hospital.

Specific Objectives

- To measure the magnitude of death certificates' correct reporting of underlying, contributory and immediate causes of death.
- To describe documentation errors on issued death certificates.
- To identify the determinants of documentation errors in certification of cause of death.

Materials and methods

Study Area and Setting

This study was conducted at Tikur Anbessa Specialized Hospital which has 900 patient beds. The Department of Pediatrics and Child Health consisted of the Emergency ward, Pediatric Intensive Care Unit, Neonatal Intensive Care Unit and Inpatient Wards with 227 patient beds. Its source of referral is from nearby health centers and hospitals with an average of 700 pediatric patients managed every month. In total, an average of 40 pediatric deaths occurs every month. Admitted patients are attended by physicians of different levels of training including around 40 Interns, 47 first year residents, 34 second year residents and 24 third year residents during the period of this study, all of whom might complete a medical certification of cause of death. There are 9 subspecialty areas with 12 subspecialists and 13 subspecialty trainees.

Study Design

The study was a hospital based cross-sectional study assessing death certificates that were issued to neonatal and child deaths between July 2020 and July 2021. It was conducted with retrospective data collection during July-August, 2021.

Study Population

The study population for the study was neonatal and child deaths happening in the department of Pediatrics and Child Health. And the source population was all children admitted to the department.

Sample size determination

The sample size of this study was calculated by taking an assumption of medical death certificates with errors being 50% to obtain a confidence level of 95% and a margin of error of 5%, a total of 384 charts will be taken. Taking an additional 10% contingency means at least 423 charts will be reviewed.

Sampling Technique

Randomly selected 423 deaths from the HMIS (Health Management Information System) logbooks that were recorded during July 2020-July 2021 were included in this study.

Inclusion Criteria

- All deaths in the study period that occurred in TASH and for which death certificates and medical records were available were included.

Study Variables

- Independent Variables- Age, sex, time of death, place of death, qualification of doctor who issued the death certificate, Training on certification of COD, Mode of certification(Paper or Online), time of death, place of death and cause of death (immediate, contributory and underlying causes),
- Dependent Variables- Quality of death certificates as assessed by the Rapid Assessment Tool.

Operational Definitions

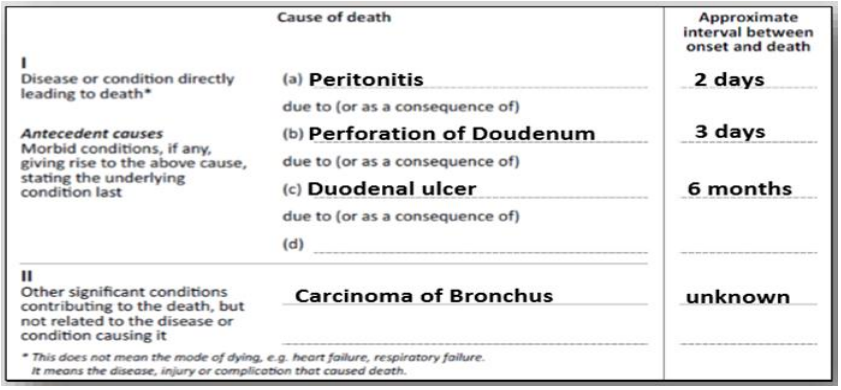
- Death certification- *either a legal document issued by a medical practitioner which states when a person died, or a document issued by a government civil registration office, that declares the date, location and cause of a person's death, as entered in an official register of deaths.* (14)
- Cause of death- *the disease or injury which initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury, in accordance with the rules of the ICD.* (15)
- Immediate cause of death- *all those diseases, morbid conditions or injuries which either resulted in or contributed to death and the circumstances of the accident or violence which produced any such injuries.*(16)
- Underlying cause of death- *the disease which has initiated the series of illnesses leading directly to death, or the circumstances connected with an accident or an act of violence which caused the injury or poisoning leading to death.*(17)
- Contributory / Intermediate Cause of Death- the condition which leads from the underlying cause of death to the immediate cause of death. (17)
- Major Error- *Multiple causes per line, Absence of disease time interval, Incorrect sequence of events leading to death, Ill-defined or poorly specified condition entered as the UCOD*(13)

- Minor Error- *Presence of blank spaces within the sequence of events, Abbreviations used in certifying the death, Additional errors on the certificate (Neoplasms, Trauma)(*13)
- Ill- Defined Underlying COD- unusable and vague causes, such as septicaemia/sepsis, Heart failure, Pneumonia- unspecified, Senility, Depression, Essential primary hypertension, Cardiac arrest.

Data Collection

- A structured questionnaire designed by compiling three forms including the important attributes of the deceased, the WHO recommended International Form of Medical Certificate of Cause of Death and the Rapid Assessment Tool was used.
- The questionnaire has eight main parts including socio demographic data of the deceased, Duration of stay, time and place of death, qualification of certifier, international form of MCCOD and Rapid Assessment Checklist.
- The first parts of the questionnaire were filled directly from the charts. The death certificate of the hospital was copied onto the prepared standard death certificate made as per the WHO recommended form.

WHO recommended International Form of Medical Certificate of Cause of Death for the certification of death.



	Cause of death	Approximate interval between onset and death
I Disease or condition directly leading to death*	(a) **Peritonitis**	**2 days**
	due to (or as a consequence of)	
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b) **Perforation of Doudenum**	**3 days**
	due to (or as a consequence of)	
	(c) **Duodenal ulcer**	**6 months**
	due to (or as a consequence of)	
	(d)	
II Other significant conditions contributing to the death, but not related to the disease or condition causing it	**Carcinoma of Bronchus**	**unknown**

* This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury or complication that caused death.

For ease of access, it was modified into a form containing its details as stated below.

Part 1

A. Immediate Cause of death _____
B. Contributory/Intermediate Cause of death_____
C. Underlying cause of death_____

Part 2

D. Other significant conditions contributing to the death_____

Part 3

E. Time interval from onset to death_____

- The Rapid Assessment Tool which was adopted from the University of Melbourne was then used as a checklist to measure errors.

The form contains a set of questions for checking errors, as stated below.

Error type	Yes	No
1. Multiple causes of death recorded in any of the lines of part 1		
2. Missing time interval from onset to death in any of the lines		
3. Abbreviations used in the entries in any of the lines		
4. Illegible hand writing in any of the lines		
5. Incorrect or clinically improbably chain of events leading to death in part 1		
6. Impossible underlying cause entered in the lowest used line of part 1*		
7. (a) Was the death due to an accident, violence, poisoning or other external cause?		
7. (b) For deaths due to external causes, i.e. accident/violence/ poisoning, were the circumstances missing? (details of the accident or violence including intent and activity [e.g. pedestrian knocked down by a car, assaulted with a knife] and place of occurrence)		
8. (a) Was the death due to a neoplasm?		
8. (b) For deaths due to neoplasms, additional details were missing (site, morphology, behavior)		

Based on their effect on coding, errors were categorized into 'Major' and 'Minor', as follows

Category	Type of error	Yes	No
Major	More than 1 COD in any line of Part I		
	Time interval not determined		
	Clinically improbable sequence of COD		
	Ill-defined or impossible UCOD		
Minor	Blank Spaces in between sequences of events leading to death		

	Use of Abbreviations		
	If Neoplasm- No site specified, benign/malignant		
	If injury- Site and intent not documented		
	Non- Illegible hand writing		

- After the the checklist has been completed by checking on the 'error' category, percentage of certificates charts with errors was calculated. Errors were also be categorised and percentage of 'Minor' and 'major' criteria were calculated.
- Association of errors and variables were also evaluated.

Data Quality Assurance

Pretest of the questionnaire was done on a sample of five medical death certificates. The findings of the pretest were used to carry out adjustments on the standard questionnaire.

For the sake of uniformity of data quality and completeness, data collection was done by the primary investigator.

Data Analysis and Interpretation

Data cleaning was done by checking certificates for completeness. Data entry was done by the primary investigator. Analysis was done using the Statistical Package for Social Sciences (SPSS). Descriptive and analytical statistics were used. Statistically significant association was taken for p values of <0.05

Ethical Considerations

Ethical clearance was obtained from the DPCH Research and publications committee and the Institutional Review Board (IRB) of the CHS. Deceased Participant confidentiality was assured. All participants included in the study were kept anonymous during subsequent analysis.

Dissemination of Results

The outcome of this research will be presented on the research defense day and a formal report will be submitted to the DPCH. The study result will also be published on scientific journals.

Results

Socio demographic Characteristics

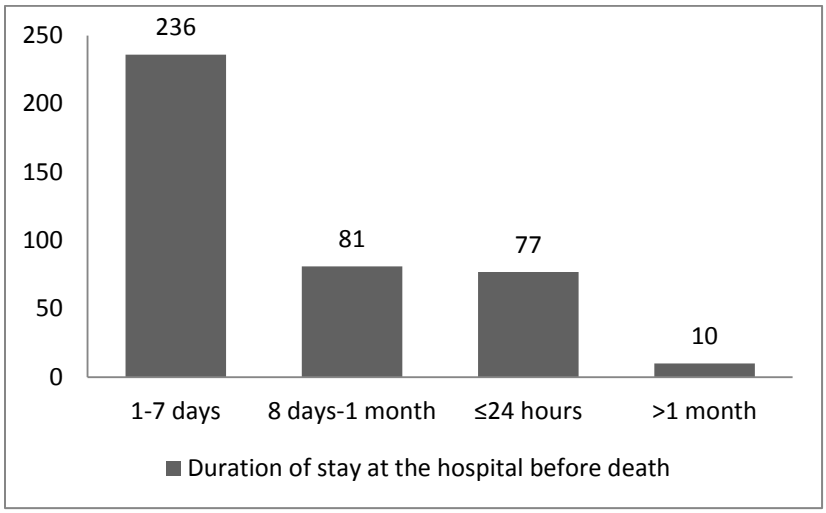
There were 423 issued medical death certificates that were reviewed during the study period, out of which 229(54.1%) were males and the majority of the deceased patients were neonates, which counted 175(41.4%). (Table 1)

Table 1- Socio demographic characteristics of diseased pediatric patients for whom medical death certificates were issued during July 2020-July 2021 in TASH.

Variable		Frequency	Percentage (%)
Sex	Male	229	54.1
	Female	194	45.9
	Total	423	100
Age	Neonates	175	41.4
	1- 12 months	93	22.0
	13months-5 years	81	19.1
	5years 1month-10 years	55	13.0
	>10 years	19	4.5
	Total	423	100

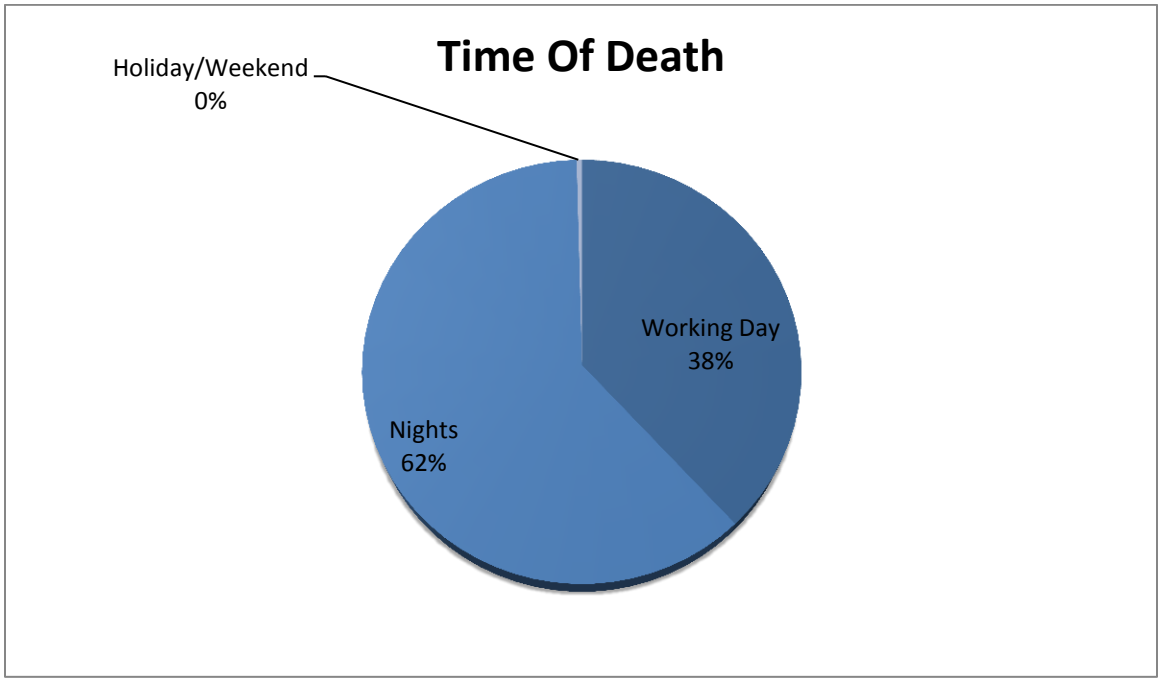
The majority of the deceased patients stayed for a duration of 1-7 days 236(55.8%) and the smallest percentage stayed for more than one month (Figure 1). There were 19(4.5%) certificates with an undocumented duration of stay.

Figure 1- Duration of stay at the hospital before death



The time of death was documented for 394(93.2%) of the patients among whom 215 (50.8%) deaths happened at night. (Figure 2)

Figure 2 Time of Death



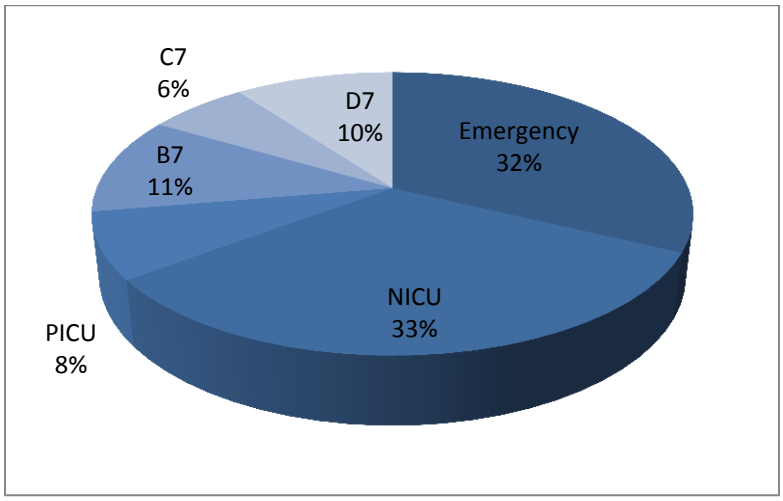
Majority of the certificates were certified by second year pediatric residents 239 (56.5%) with only 2 deaths certified interns. (Table 2) There were 15(3.5%) certificates with undocumented death certifier.

Table 2 Qualification of Death Certifiers

Qualification	Number	Percentage
Intern	2	0.5
First Year Resident	147	34.8
Second Year Resident	239	56.5
Third Year Resident	20	4.7
Total	408	96.5

There were 138(32.6%) deaths that took place at the neonatal ICU with a comparable number 136(32.2%) occurring at the emergency.(Figure 3)

Figure 3- Place of Death



All the issued death certificates had errors and the most common error was a missing duration of time interval between sequences leading up to death, 419% (99.1%) (Figure 4, Tables 3 and 4)

Figure 4- Documentation Errors on issued death certificates

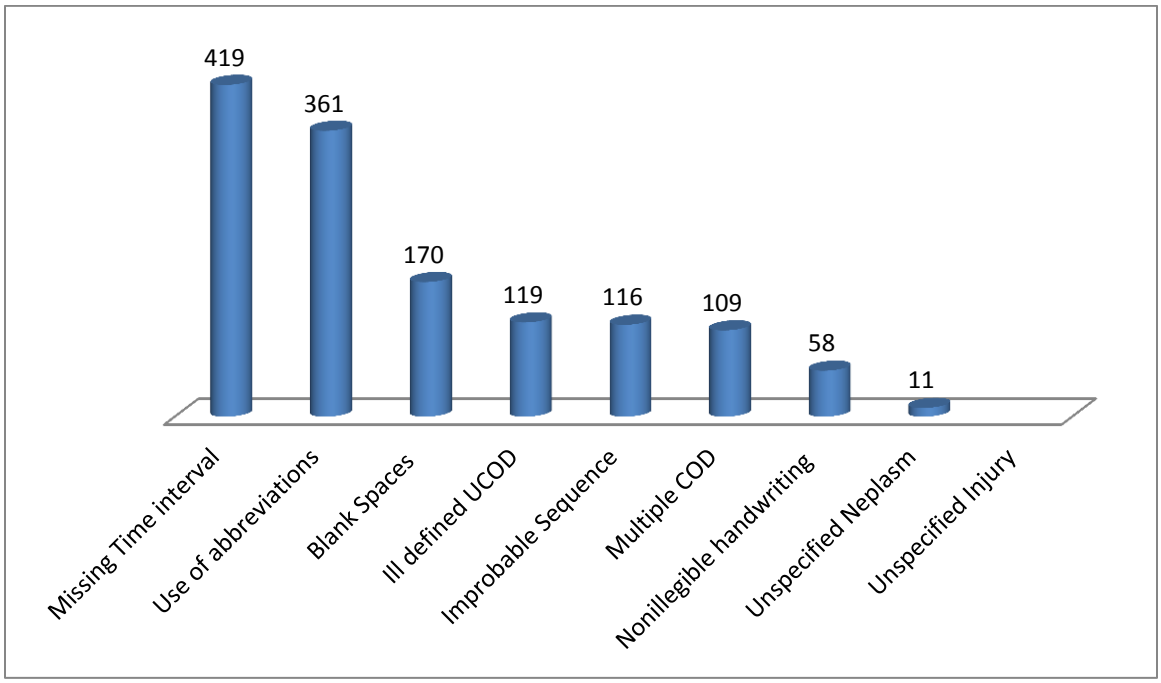


Table 3- Medical Death certificates with major errors

Number of Major Errors	Certificates with Errors	Percent
1	205	48.5
2	116	27.4
3	81	19.1
4	21	5.0
Total	423	100.0

Table 4- Medical Death certificates with Minor errors

Number of Minor Errors	Certificates with Errors	Percent
0	8	1.9
1	263	62.2
2	128	30.3
3	23	5.5
4	1	0.2
Total	423	100

In addition all the death certificates were certified by paper and none of the certifiers took any form of training on certification of cause of death.

The determinants of documentation errors in certification of underline cause of death

The 'gold standard' for cause of death statistics is complete civil registration where each death has an underlying cause assigned by a physician and is coded according to International Classification of Diseases (ICD) rules.(5) Thus, ill-defined cause of death was taken as the main dependent variable and certificates with an ill-defined UCOD were evaluated for their relationship with it. A question of "Is there an ill-defined UCOD" was dichotomized into 'yes' and 'no' on the contingency table displayed below. Ill-defined UOD also was one of the major errors.

There were six independent variables, all of which were determinant factors of the documentation errors that were studied. These were included in a bivariate analysis and later on in the multivariate analysis. Pearson's chi-square test was then used to determine whether there is a statistically significant relationship among the listed variables.

As listed below (Table 5), there was no significant relationship between the presence of an ill-defined UCOD with the age and sex of the deceased.

There was a statistically significant relationship of P-value 0.042 and CI (1.020,3.011)95% between a bivariate analysis of an ill-defined UCOD and duration of stay. As compared with patients who stayed 1-7 days, those who only stayed for 24 hours had 1.8 times more probability

of being certified as dying from an ill-defined UCOD. However, there was no significant relationship of the two variables with multivariate analysis.

There was also a significant relationship between UCOD and Qualification of the death certifier with a P-value of 0.003 (95% CI of 1.322, 4.004). This correlation showed that as compared to first year Residents, Second year residents were 2.3 times more likely to ill define an UCOD under the adjusted odd's ratio.

The place of death of patients within the hospital seemed to have a significant relationship with the quality of medical death certificates. Deceased patients that passed away at the Pediatric ICU had a 75% less chance of having an ill-defined UCOD, evidenced by a P-value of 0.034 and CI (0.070, 0.902). Correspondingly, deceased patients that passed away while at the hematoconcology ward had 89% less chance of having an ill-defined UCOD. These findings were consistent under the bivariate as well as multivariate analyses.

Table 5- Determinant factors of documentation errors in certification of underline cause of death

Explanatory Variables		**Ill defined UCOD**		**COR (95% CI)**	***p* value**	**AOR (95% CI)**	***P*** value
		Yes (%)	**No(%)**				
Sex	Male	63(52.9)	166(54.6)	1.00		1.00	
	Female	56(47.1)	138(45.4)	1.069(0.699,1.635)	0.757	0.985(0.617,1.573)	0.951
Age	≤30 days	42(35.3)	133(43.8)	0.902(0.492,1.653)	0.739	2.146(0.798,5.773)	0.130
	31 days- 12 months	35(29.4)	58(19.1)	1.724(0.899,3.178)	0.101	1.637(0.749,3.576)	0.216
	13months-5 years	21(17.6)	60(19.7)	1.00		1.00	
	5year 1 month-10	19(16)	36(11.8)	1.507(0.715,3.178)	0.280	1.975(0.75	0.1

	years					5,5.168)	65
	>10 years	2(1.7)	17(5.6)	0.336(0.071,1.579)	0.167	0.225 (0.025,1.963)	0.177
Duration of stay at the hospital before death	≤24 hours	30(25.2)	47(15.5)	1.752(1.020,3.011)	**0.042**	0.453(0.754,2.652)	0.279
	1-7 days	63(53)	173(56.9)	1.00		1.00	
	8 days-1month	19(15.9)	62(20.4)	0.841(0.466,1.517)	0.566	0.384(0.558,2.185)	0.775
	>1 month	3(2.5)	7(2.3)	0.83(0.295,4.691)	0.817	2.034(0.380,10.862)	0.406
Time of death	Working day	44(37)	89(29.3)	1.00		1.00	
	Nights	57(48)	158(52)	0.729(0.455,1.169)	0.19	0.618(0.358,1.066)	0.084
	Holiday/ Weekend	12(10)	34(11.2)	0.713(0.336,1.512)	0.379	0.541(0.231,1.268)	0.158
Qualification of death certifier	Intern	1(0.8)	1(0.3)	3.323(0.202,54.555)	0.4	0.556(0.139,2.220)	0.406
	First Year Resident	34(28.6)	113(37.2)	1.00		1.00	
	Second Year Resident	77(64.7)	162(53.3)	1.579(0.987,2.526)	0.056	2.301(1.322,4.004)	**0.003**
	Third Year Resident	3(2.5)	17(5.6)	0.586(0.162,2.121)	0.416	0.895(0.214,3.727)	0.879
Place of death	Emergency	57(47.9)	79(26)	1			
	NICU	27(22.6)	111(36.5)	0.337(0.196,0.579)	**0.00**	0.170 (0.065,0.444)	**0.000**

	PICU	4(3.4)	28(9.2)	0.197(0.065,0.595)	**0.004**	0.252(0.070,0.902)	**0.034**
	B7(≤5year)	17(14.3)	30(10)	0.785(0.395,1.558)	0.49	0.548(0.231,1.569)	0.172
	C7(>5year)	9(7.6)	18(5.9)	0.692(0.290,1.653)	0.408	0.510(0.165,0.446)	0.240
	D7(Hematoncology)	5(4.2)	38(12.5)	0.182(0.067,0.492)	**0.001**	0.116(0.030,0.998)	**0.002**

Discussion

This study aimed to assess the quality of medical death certificates by measuring their magnitude in the correct reporting of causes of death. It also aimed to describe the encountered errors and their determinant factors.

A thorough assessment of issued medical death certificates was carried out and revealed that majority of the deceased were neonates and most stayed for 1-7 days. Half of the deaths occurred at night and half were certified by second year residents. Most of the deaths occurred at the emergency and NICU.

The most striking finding is that 100% of the evaluated certificates had errors. The most common error was missing time interval followed by use of abbreviations. Since having a well-defined UCOD is the governing quality of issued medical certificates, it was taken as the main dependent variable and measure of certificate quality.

The deceased that stayed for less than 24 hours had 1.7 more odds of having an ill-defined UCOD. In addition, the odds of ill defining an UCOD was 2.3 times more in Second year resident as compared to First year residents.

Certificates that were issued at the Pediatric ICU and Hematoncology wards had 75 and 89% less odds of having an ill-defined UCOD respectively, as compared to the Emergency ward. The relatively lower number of patients among two of the wards mentioned above might be the reason for the lesser extent of errors.

These findings clearly depict the magnitude of substandard medical death certificates and described the most commonly committed errors. This in-depth evaluation also defined the determinant factors for having these certificates with errors.

A handful of studies were carried out regarding the assessment of quality of medical death certificates, however none of them studied exclusively pediatric patients. In addition, most were carried out after some forms of interventions and trainings were done. Moreover, majority of the studies used an online certifying system with in and out of hospital death assessments. (3, 11, 19, 20)

Comparable studies had similar findings with majority of certificates having errors. A research that was done in a South African academic hospital revealed that most certificates had minor errors. (11) This study evaluated 983 death certificates out of which, 967 had at least one minor error. A peculiar feature of this study was the increasing percentage of errors with increasing age, unlike the decreasing magnitude of errors with increasing age in our study. This can be attributed to the fact that the South African study was done on adults and increasing age corresponded with increased comorbidities that posed a difficulty for certifiers.

Another study including 4914 deaths was carried out in Bangladesh. (19) It indicated that 95.6% of medical death certificates had a missing time interval and use of abbreviations was the second most common error with 50.7%. This was similar to our study regarding the degree and nature of errors. Neonates and children were included in this study which might be the reason that there is a similar finding of increasing certificate quality with age.

A cross sectional record based study was undertaken in Mumbai. (20) A total of 410 certificates were reviewed and 100% of them had errors. Parallel to our study, missing time interval was the most commonly seen error.

A difference in the length of duration of stay had an effect on the quality of the medical death certificates in our study but it was not seen in the other studies. On the contrary, according to the following study done in New York place of death has an effect on the quality of certificates (3). This study showed a higher percentage of errors in deaths that occurred in a hospital as compared to those that occurred in a private residence. However, this may not be similar to our finding since we compared in hospital deaths separated by wards and not in and out of hospital deaths.

The above study that was done in New York evaluated 601 death certificates of in and out of hospital deaths. It revealed 63% of the certificates had errors. (3) The certificates were completed by physicians and non-physicians, which had a comparable percentage of errors. This exhibited that there was no relationship between quality of certificates and qualification of certifiers. Unlike our study which indicated that there was a higher odds of ill-defining a COD among second year residents as compared to first year residents.

Since all the physicians in our setup did not receive training on death certification, its association with certificate quality could not be assessed. However, there is ample evidence proving that training impacts data quality for the better. A study comprising 300 Pre-intervention and 1800 post-intervention was carried out in Peru. (13) The intervention involved a physician training and usage of an online system. There was a 38% decline in average error score owing to the online intervention and a 26% decline owing to the training intervention. The main improvements were observed in missing time interval, which is the leading cause of error in our study.

Consistent with the above study, a systematic review and meta-analysis on the Effectiveness of training was prepared. (5) It included 21 articles that were selected for synthesis of findings and four underwent meta-analysis. The pre-intervention magnitude of all error categories were 51 %, while it ranged from37-93% for missing time interval. There were improvements in error rates ranging from 6-20%.

This systematic review also states that the use of online certifying methods improved by making the certificates uniform, by avoiding handwriting errors and by reminding the certifier for missing lines. However, an electronic certification will not eliminate other causes of error such as improbable causes of death and ill-defined neoplasms or injuries.

Tikur Anbessa Hospital only practices paper based certification of death. For this reason, our study had a finding of a 100% paper based certification. Thus, current study lacks strength in assessing the effect of an online method might have on quality of certificates. In addition, the medical death certificate is not in the universally recommended WHO format.

Nevertheless, the study done in Peru and the above meta-analysis in cooperation demonstrate the benefit of a computerized certification along with a proper training.

Limitations

Despite some of its qualities, this study was a single center research with no interventions to assess pre and post intervention quality.

A substantial amount of the medical charts of the deceased were poorly kept in wards and inappropriate place which increased the number of lost and damaged charts. There were also some inconsistencies between HMIS books and the actual charts as some of the numbers recorded as deaths were actually alive patients. There were also poor documentation and attachment of copies of the certificates. The above factors made the data retrieval difficult.

Conclusion

As observed by the percentage of medical death certification errors, this study confirms that there is a high magnitude of errors among all of the issued medical death certificates. There is a collectively similar quantity of poor quality certificates regardless of the attributes of the deceased, as well as determinant factors of certifiers. It also demonstrates some of the factors associated with higher or lower proportions of errors. In addition, it has also picked the magnitude of ill-defined UCOD which will be a crucial input into hospital and national data.

Recommendation

Introducing a structured and standardized WHO recommended death certificate could be made to replace the existing death certificate in use at our department. A follow up study after providing training on death certification could be planned to evaluate the impact of training in decreasing the number of errors. Certifying of deaths by the same physician that treated the patient may also be beneficial. Follow-up studies that include multiple centers with post intervention evaluation of certificates may be beneficial in the future.

References

1. Unstats.un.org. 2021 [cited 30 May 2021]. Available from: https://unstats.un.org/unsd/demographic/standmeth/principles/M19Rev3en.pdf
2. WHO. International Statistical Classification of Diseases and Related Health Problems. 10th Revision. Vol. 2. Geneva: World Health Organization; 1993.
3. McGivern L, Shulman L, Carney JK, Shapiro S, Bundock E. Death Certification Errors and the Effect on Mortality Statistics. Public Health Rep. 2017;132(6):669-75.
4. Apai-crvs.org | Africa Program for Accelerated Improvement Civil Registration and Vital Statistics [Internet]. Apai-crvs.org. 2021 [cited 30 May 2021]. Available from: http://apai-crvs.org/
5. Gamage USH, Mahesh PKB, Schnall J, Mikkelsen L, Hart JD, Chowdhury H, et al. Effectiveness of training interventions to improve quality of medical certification of cause of death: systematic review and meta-analysis. BMC Med. 2020;18(1):384.
6. CRVS - Birth, Marriage and Death Registration in Ethiopia - UNICEF DATA [Internet]. UNICEF DATA. 2021 [cited 28 May 2021]. Available from: https://data.unicef.org/crvs/ethiopia/
7. Vital events registration kicks off in Ethiopia [Internet]. Ethiopia. 2021 [cited 28 May 2021]. Available from: https://ethiopia.un.org/en/14847-vital-events-registration-kicks-ethiopia
8. CDC - NCHS - National Center for Health Statistics [Internet]. Cdc.gov. 2021 [cited 28 May 2021]. Available from: https://www.cdc.gov/nchs/
9. Completing a medical certificate of cause of death (MCCD). GOV.UK. 2021 [cited 28 May 2021]. Available from: https://www.gov.uk/government/publications/guidance-notes-for-completing-a-medical-certificate-of-cause-of-death
10. Zhao J, Tu EJ, Law CK. The incomparability of cause of death statistics under "one country, two systems": Shanghai versus Hong Kong. Popul Health Metr. 2017;15(1):37.
11. Nojilana B, Groenewald P, Bradshaw D, Reagon G. Quality of cause of death certification at an academic hospital in Cape Town, South Africa. S Afr Med J. 2009;99(9):648-52.
12. Division, U., 2021. UNSD — Demographic and Social Statistics, April 2021 https://unstats.un.org/unsd/demographic-social/crvs/#coverage

13. Miki J, Rampatige R, Richards N, Adair T, Cortez-Escalante J, Vargas-Herrera J. Saving lives through certifying deaths: assessing the impact of two interventions to improve cause of death data in Perú. BMC Public Health. 2018;18(1):1329.
14. Khalili D, Mosavi-Jarrahi A, Eskandari F, Mousavi-Jarrahi Y, Hadaegh F, Mohagheghi M, et al. Evaluation of cause of deaths' validity using outcome measures from a prospective, population based cohort study in Tehran, Iran. PLoS One. 2012;7(2):e31427.
15. Death certificate - Wikipedia [Internet]. En.wikipedia.org. 2021 [cited 28 May 2021]. Available from: https://en.wikipedia.org/wiki/Death_certificate
16. WHO | World Health Organization [Internet]. Who.int. 2021 [cited 28 May 2021]. Available from: https://www.who.int/violence_injury_prevention/surveillance/databases/mortality/en/
17. World Health Assembly 2. Twentieth World Health Assembly, Geneva, 8-26 May 1967: part I: resolutions and decisions: annexes [Internet]. Apps.who.int. 2021 [cited 28 May 2021]. Available from: https://apps.who.int/iris/handle/10665/85800
18. Underlying cause of death | Concepts | Statistics Finland [Internet]. Stat.fi. 2021 [cited 28 May 2021]. Available from: https://www.stat.fi/meta/kas/peruskuolemansy_en.html
19. Hazard RH, Chowdhury HR, Adair T, Ansar A, Quaiyum Rahman AM, Alam S, et al. The quality of medical death certification of cause of death in hospitals in rural Bangladesh: impact of introducing the International Form of Medical Certificate of Cause of Death. BMC Health Serv Res [Internet]. 2017 2017/10//; 17(1):[688 p.].
20. Wani D, Uplap P, Sankhe L. Assessment of medical certificate of cause of death at a tertiary care centre in Mumbai, India. Indian Journal of Forensic and Community Medicine. 2019;6:70-4.

Annex

Study Questionnaire **Date- _____**

Title of Research- Quality assessment of facility based medical certification of cause of death in the Department of Pediatrics and Child Health at Tikur Anbessa Specialized Hospital

Part I- Identification

Serial Number_____

Medical Record Number _____

Part II- Socio-demographic Data

Age 1. <Neonate _____

2. 1month- 1 year _____
3. 1-5 years _____
4. 5-10 years _____
5. >10 years _____

Sex 1. M_____

2. F_____

Part III- Duration of stay at the hospital before death

1. <24 hours _____
2. 1-7 days _____
3. 7days- 1 week_____
4. 1week-1month_____
5. >1 month_____

Part IV- Time of death

1. Working day_____
2. Nights_____
3. Holiday/ Weekend_____

Part V- Qualification of death certifier

1. Intern_____
2. R1_____
3. R2_____
4. R3_____

Part VI- Qualification of treating physician

1. Intern_____
2. R1_____
3. R2_____
4. R3_____

Part VII- Training on Certification of COD

1. Yes_____
2. No _____

Part VIII- Mode of COD certification

1. Paper_____
2. Online _____

Part IX- Place of Death

1. Emergency_____
2. NICU_____
3. PICU_____
4. Wards _____

Part X- WHO recommended International Form of Medical Certificate of Cause of Death for the certification of death.

Part 1

A. Immediate Cause of death _____
B. Contributory/Intermediate Cause of death_____
C. Underlying cause of death_____

Part 2

D. Other significant conditions contributing to the death_____

Part 3

E. Time interval from onset to death_____

Part XI- Rapid Assessment tool

Category	Type of error	Yes	No
Major	More than COD in any of part 1		
	No Time interval between diagnoses		
	Clinically improbable sequence of COD		
	Ill-defined UCOD		
Minor	Blank Spaces in between sequences of events		
	Use of Abbreviations		
	Neoplasm- No site specified, benign/malignant		
	Injury- Site and intent not documented		
	Non- Illegible hand writing		