FACTORS INFLUENCING KNOWLEDGE OF DOCTORS ON MEDICAL CERTIFICATION OF CAUSE OF DEATH IN LIMPOPO PROVINCE

by

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DEDICATION

To my family who gave me time to work on the project and supported me unreservedly throughout my studies. I am forever indebted to you.

And to my late grandmother, who always emphasised the importance and power of education from my tender age. May her soul rest in peace on her centenary year.

Lastly, to my uncle, Oom Jerry, who believed in me, encouraged and supported me throughout my life, I am who I am today because of you.

DECLARATION

I, **MATOME ABEL LEKOLOANA** declare that this research report is my own work. It is being submitted for the degree of Master of Public Health Medicine in the University of Limpopo. It has not been submitted before for any degree or examination at this or any other institution.

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Signature of Candidate Date

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ABSTRACT

Introduction

The quality of mortality data in South Africa has been questioned because of the high percentage of deaths reported to be due to ill-defined causes. We sought to assess the level of knowledge of doctors on the International Classification of Diseases (ICD) rules for medical certification of cause of death and determine the factors influencing that knowledge.

Methods

A cross-sectional study was conducted across 12 hospitals in Limpopo Province among the five districts stratified by level of care. Doctors completed self-administered questionnaire, which included the baseline characteristics and questions that tested their theoretical knowledge of the ICD rules of death certification. The outcome, an adequate level of knowledge was set at a score of ≥ 60%. A chi square test was used to determine the factors associated with the outcome. Ethical approval was obtained from Turfloop Research Ethics Committee, University of Limpopo.

Results

Of the 301 doctors who participated, 50.5% were female, 64% were junior doctors and 13% were specialists. Up to 49% of doctors worked in the two tertiary hospitals. Only 18% of the doctors have ever attended a Continuing Professional Development (CPD) on the topic. The mean overall score on knowledge of medical certification for all the doctors was 59.80% (±11.95) with 53% obtaining at least 60% on the questionnaire. Doctors lacked knowledge on identifying unnatural deaths and discerning the underlying cause of death. Factors associated with the adequate knowledge included years of clinical experience ($p=0.01$), previous training ($p<0.001$), awareness of guidelines ($p=0.04$), comfort level ($p=0.01$) and rank ($p=0.02$).

Conclusion

The study highlighted the need for training of all doctors in the province and identified the knowledge gaps. Interactive capacity-building workshops have been shown to improve knowledge of doctors on medical certification of cause of death in other studies. To improve the quality of mortality data in Limpopo Province, such workshops must be conducted in all hospitals.

Key words: death notification, medical certification, cause of death

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DEFINITION OF CONCEPTS

Cause of death: Any condition or injury that results in or contributes to death, and the circumstances of the accident or violence that produced any such injuries. It must be classifiable according to the International Classification of Diseases (ICD) (Lehohla 2012:80, WHO 2013:203).

Civil registration: the continuous, permanent, compulsory and universal recording of the occurrence and characteristics of vital events (live births, deaths, fetal deaths, marriages and divorces) and other civil status events pertaining to the population as provided by decree, law or regulation, in accordance with the legal requirements of each country. It establishes and provides legal documentation of such events. These records are also the best source of vital statistics (WHO 2013:204).

Coding rules: Coding rules contained in the applicable revision of the ICD, published by the World Health Organization, allow systematic selection of an underlying cause of death from all entities reported on the death certificate. These coding rules improve the usefulness and comparability of mortality statistics among countries by giving preference to certain categories and by consolidating conditions (Pieterse, Groenewald, Burger, Kirk and Bradshaw 2009a: 35).

Contributory cause: Any cause of death that is neither the immediate, intervening, originating antecedent nor underlying, is a contributory cause of death (i.e. conditions that should be reported on Part 2) (Lehohla 2012:80).

Death certificates: Official records of individual deaths issued by Department of Home Affairs (DHA), containing information on the cause of death and any other required demographic information, certified by a physician or reported by other legally appointed official. In South Africa, death certificates only indicate if the cause of death was due to natural or unnatural causes, without mention of the medical condition or injury that caused or resulted in death (Lehohla 2012:80).

Death certification (also known as medical certification of the cause of death) is part of the death notification process that involves the certification of the event and nature of death on the Death Notification Form (DNF) by a medical

practitioner who completes form DHA-1663 B according to ICD certification standards (WHO 2013:204). See Annexure C.

Death notification is a process that begins with the reporting of a death (on a death report form DHA 1680) or medical certification of cause of death (on death certification form DHA 1663 A and B), involves the informant (usually a relative), the undertaker, and culminates in the registering of the death on the National Population Register (if deceased has SA Identity Document) and the issuing of an abridged death certificate by the DHA. The death notification process is summarised in Annexure B (Lehohla 2012:4).

Death notification form is a permanent record of the fact of death that allows the Department of Home Affairs to issue a death certificate. It provides important personal information about the decedent (DHA-1663 A) and the circumstances and cause of death (DHA-1663 B) that allows the DHA to issue an abridged death certificate and a burial order. The DHA-1663 B is sent to Statistics South Africa for compilation of mortality statistics (Lehohla 2012:2).

External causes of death: Deaths due to accidents and violence including environmental events, circumstances and conditions as the cause of injury, poisoning, and other adverse effects. Broad categories include accidents, suicides, medical misadventures or abnormal reactions, homicide, legal intervention, and injury from war operations. Such cases are referred to a forensic pathologist for a post-mortem examination and completion of DHA-1663 (Lehohla 2012:81).

Garbage codes

Global Burden of Disease (GBD) experts coined this term for ICD codes for mortality data which do not signify an underlying cause of death. This includes ill-defined signs and symptoms, intermediate causes of death (e.g. septicaemia), mechanisms of death (e.g. cardiac arrest) or partially specified causes (e.g. cancer with unknown site) (Lehohla 2012:81).

ICD-10 code: A single ICD alphanumeric string, representing a single disease or injury or a group of related conditions. This classification system is maintained by

WHO for coding diseases, signs, symptoms and other factors causing morbidity and mortality. It is used worldwide for morbidity and mortality statistics and designed to promote international comparability in the collection, processing, classification and presentation of statistics (WHO 2013:207; Lehohla 2012:81).

Ill-defined cause of death – a collection of vague diagnoses that should not be used as the underlying cause of death, and consisting of symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (WHO 2013:207)

Immediate cause of death: Any disease or condition entered on line (a) in Part 1 of the death certificate directly leading to death and consequent to diseases entered on lower lines of Part 1. Also known as the terminal, direct or final cause of death (Lehohla 2012:82).

Mechanism of death: The physiological disturbance in the body at the time of death, e.g. metabolic acidosis, hypokalaemia, acute cardiac failure (Lehohla 2012:83).

Underlying cause of death: The disease or injury that initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence that produced the fatal injury. Also called the primary medical cause of death. It is used as the basis for the tabulation of mortality statistics (WHO 2013, Lehohla 2012:84).

Vital statistics: Data collected from continuous or periodic recording or registration of all ´vital events´, such as births, deaths, marriages and divorces. It represents a summary measure of the frequency of occurrence and relevant characteristics of specified and defined vital events derived from civil registration, enumeration and other sources of vital events data (Lehohla 2012:85).

LIST OF ABBREVIATIONS

AIDS: Acquired Immunodeficiency Syndrome

BI-1663: Notification/Register of Death/ Stillbirth (Old death notification form)

CME: Continuing Medical Education

CPD: Continuing Professional Development

DHA: Department of Home Affairs

DHA-1663: Notice of Death/Stillbirth (Current death notification form)

DHA-1680: Death Report Form

DOH: Department of Health

FPD: Foundation for Professional Development

HIV: Human Immunodeficiency Virus

ICD: International Classification of Diseases

ID: Identity Document

NDOH: National Department of Health

NDHA: National Department of Home Affairs

RVD: Retroviral Disease

SA: South Africa

SAG: South African Government

Stats SA: Statistics South Africa

TB: Tuberculosis

UN: United Nations

WHO: World Health Organization

CHAPTER 1: INTRODUCTION

1.1 Introduction

Civil registration with high coverage, accurate medical certification of cause of death and subsequent coding of the cause of death remains the 'gold standard' source of continuous mortality data (Setel, Macfarlane, Szreter, Mikkelsen, Jha, Stout and Abou 2007:2; Stats SA 2014:4). In South Africa (SA), statistics from civil registrations are the only national source of information on causes of death (Stats SA 2014:1). The births and deaths registration Act No 51 of 1992, administered by the Department of Home Affairs (DHA), compels any person who was present at the time of death, or becomes aware of the death or is charged with the burial thereof to give notice of death as soon as is practicable (SAG 1992:10; Stats SA 2014:3). This has resulted in a high coverage of especially adult (15 years and older) death registration estimated at 94% in 2011 (Stats SA 2014:6). However, there have been reported challenges with coverage in the rural areas and among young children (Setel et al 2007:3; Nolijana, Groenewald, Bradshaw and Reagon 2009).

The United Nations (UN) defines civil registration as the continuous, permanent, compulsory and universal recording of the occurrence and characteristics of vital events (livebirths, deaths, foetal deaths, marriages and divorces) and other civil status events pertaining to the population as provided by decree, law or regulation, in accordance with the legal requirements of each country (UN 1998:2). As a system, it relies on the continued collaboration between civil society, Statistics South Africa (Stats SA), DHA and Department of Health (DOH) to produce comprehensive quality cause of death data and other administrative information (Stats SA 2014:1). Civil registration systems are a cornerstone of any health information system and the statistics they produce are essential for understanding public health status in countries and how it is changing (Mahapatra, Shibuya, Lopez, Coullare, Notzon, Rao and Szreter 2007:1).

Worldwide, causes of death statistics are compiled in accordance with the World Health Organization (WHO) regulations that require that member nations classify and code causes of death using the most recent revision of the International Classification of Diseases (ICD) (Pieterse, Groenewald, Burger, Kirk, and Bradshaw 2009a:7). The ICD is regularly updated (almost every 10 years) in a quest to improve cause of death statistics. The current version which is the tenth version, ICD–10, is due for review, with the ICD 11 expected to be available for use by countries in 2018 (Boerma, Harrison, Jakob, Mathers, Schmider and Weber 2016:1). Besides providing for the classification and coding of diseases and injuries, including a wide variety of signs, symptoms and other abnormal findings, the ICD also provides a framework for certifying the cause of death and for the compilation of internationally standardised, and therefore comparable, mortality statistics (Pieterse et al 2009a:7; Stats SA 2014:4). The framework includes a set of rules for disease classification and a notion of the underlying cause of disease, a condition that initiated a chain of events leading to the death and against which prevention efforts are directed (Pieterse et al 2009a:8; Stats SA 2014:4)

Medical certification of the cause of death as part of the death notification process involves the certification of the event and nature of death on the standardised death notification form (DNF) usually by a medical practitioner (Pieterse et al 2009a:2; Lehohla 2012:4). Once the notification of death has been checked for completeness and accepted by the DHA, a death is registered, an abridged death certificate and a burial order are issued (See Annexure B for the death notification process). The DHA-1663 B of the DNF is then forwarded to Stats SA to collate, code and classify the data, perform analysis and produce reports on deaths occurring in SA in accordance with the ICD framework (Pieterse et al 2009a:2; Lehohla 2012:5).

The study focused on the cause-of-death section of the death notification form (DHA-1663 B) as it contains the most statistically useful information on the causes of death (See Annexure A). The section is divided into two parts: **Part I** is for reporting a chain of events leading directly to death, with the **immediate cause** of death (the final disease, injury or complication directly causing death)

on line (a) and the **underlying cause** of death (the disease, injury that initiated the chain of events that led directly and inevitably to death) on the lowest used line. If only one line is used, only line (a) should be completed. The listing must be sequential with the condition mentioned below being capable of causing the one above it. The estimates of time-intervals between presumed disease onset and date of death can be recorded if precise intervals are not known. **Part II** is for reporting all other significant diseases, conditions, or injuries that contributed to death but which did not result in the underlying cause of death given in **Part I** (Pieterse et al 2009a:10; Lehohla 2012:26-29).

Cause of death statistics are commonly used to describe levels, trends and differentials in mortality, track changes in burden of disease in different groups, guide priorities for intervention programmes, contribute to biomedical and socio-medical research, identify areas requiring epidemiological research, monitor impact of health programmes and to allocate and distribute resources within the health sector (Lehohla 2012:2; WHO 2013:65). Reliable information on the mortality patterns of populations becomes important for health policy and planning and for evaluation in all sectors of development (Mahaptra et al 2007:6; Setel et al 2007:3; WHO 2013:65). At a more local level, death certificate may be required to settle the deceased's estate, obtain insurance or other pension benefits and to authorise the burial or cremation of the deceased (Pieterse et al 2009a:2). For mortality statistics to satisfy its critical functions, it becomes important that DNFs be filled out completely, accurately and promptly (Brooks and Reed 2015:74).

The quality of the causes of death data depends heavily on the completeness and quality in which the DNF was completed and on the accuracy of coding (Aung, Rao and Walker 2010:143; Joubert, Rao, Bradshaw, Vos and Lopez 2013:8). But given the number of role players involved in the information value-chain (civil society, DOH, DHA and Stats SA), data quality can be compromised by a number of issues at various levels. Some of the issues include coverage (incomplete registration of deaths), late registrations, partially completed DNFs (missing data), ill-defined causes of deaths with no underlying cause, improbable

classifications for age or sex and under-reporting of certain causes, e.g. HIV/AIDS (Mahapatra et al 2007:2; Stats SA 2014:5).

1.2 Research problem

1. 2.1 Source of the research problem

The accuracy and thus usefulness of cause of death statistics depend on the quality of information provided primarily by doctors on the DNF. This in turn depends on their knowledge of the ICD classification rules and training on the completion of the DNF (Aung et al 2010:143). Despite the availability of instructions on how to properly complete the DNF, many physicians still report causes of death improperly (Aung et al 2010:144; Lu, Anderson and Kawachi 2010:1069).

The proportion of deaths assigned codes for symptoms, signs and ill-defined conditions can be used as one indicator of the quality of death certification and coding (Mathers, Fat, Inoue, Rao and Lopez 2005:172; WHO 2013:74). From a policy or prevention perspective, these codes do not represent useful underlying causes of death and are often referred to as ‘garbage codes’ (WHO 2013:74). The overuse of garbage codes compromise local utility and international comparability of cause of death information (Mathers et al 2005:172). The percentage of deaths due to ill-defined underlying causes should be kept at a minimum, not more than 10% for those aged 65 years and older, and at < 5% for deaths in those younger than 65 years, since they are of no public health value (Joubert et al 2013:3; WHO 2013:74).

However, Stats SA reported that for causes of death in 2011, a total of 24.4% of causes of death were attributed to ill-defined underlying cause of death, slightly up from the previous year. And that the proportion that relates only to symptoms, signs and abnormal clinical and laboratory findings was the second most reported cause of death in 2011 (Stats SA 2014:9). So the situation regarding garbage codes shows no sign of improvement and valuable mortality data is being lost.

This raises the question of whether doctors have adequate knowledge on the ICD rules for medical certification of cause of death, and what are the factors that contribute to the deteriorating quality of medical certification of cause of death.

1. 2. 2 Statement of the problem

The quality of mortality data in South Africa has been shown to be poor given the high percentage of deaths assigned to ill-defined causes of death. Most of the studies audited the DNFs to assess the compliance of the certifying doctors with the ICD rules. However, in South Africa, once the DNFs reach Stats SA, the forms are no longer readily accessible. Some studies administered questionnaires with case scenarios to the certifying doctors to assess their knowledge since the DNFs are completed by them. The study sought to assess the level of knowledge of doctors on the ICD rules for the medical certification of cause of death using a questionnaire and then determine factors associated with adequate knowledge.

1.3 Research questions

1.3.1 What is the level of knowledge of doctors in Limpopo Province on the ICD rules for medical certification of cause of death?

1.3.2 What factors influence the level of knowledge of doctors on medical certification of cause of death?

1.4 Purpose of the study

1.4.1 Aim

To investigate factors influencing the level of knowledge of doctors on the medical certification of cause of death in Limpopo Province.

1.4.2 Objectives

- To describe the baseline characteristics of the doctors in Limpopo Province

- To determine the level of knowledge of doctors on medical certification of cause of death
- To determine factors associated with adequate knowledge on medical certification of cause of death

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Roughly 30% of the world's population currently live in countries which claim complete (more than 90%) registration of vital events although assessments may not be comprehensive. Europe, North America and Oceania seem to have well developed civil registration systems, whereas Africa, Asia and to a lesser extent Latin America do not (Mahapatra et al 2007:3). South Africa is one of only three African countries (along with small islands of The Seychelles and Mauritius) in which births and deaths registration is high, but the quality of the mortality data from vital statistics is compromised by the high proportion of cause of death data still attributed to ill-defined causes (Setel et al 2007:5).

Joubert et al (2013:7) evaluated the quality of South Africa's national mortality statistics from civil registration and rated the statistics satisfactory for coverage and completeness of death registration, temporal consistency, age/sex classification, timeliness, and sub-national availability but content validity (cause attribution) was deemed unsatisfactory due to a high proportion (more than 20%) of ill-defined/non-specific codes. This was based on a report by Stats SA (2014:9) indicating a high proportion of symptoms, signs and ill-defined causes at 24.4% for 2011. Some of the factors that contribute to poor quality of cause of death data include lack of training on medical certification of causes of death, physician inexperience, lack of interest in death certification due to lack of appreciation of the importance of mortality data and competing knowledge interests, poor knowledge of the legal obligations of accurate completion and the presence of comorbidities, especially in the elderly (Devis and Rooney 1999:25; Lu, Shau, Shih, Lee, Chou and Lin 2000:234 ; Lu et al 2010:1075; Brooks and Reed 2015:74). Most of these factors form part of training or instructions on medical certification of death.

2.2 Challenges with mortality data

Misclassification of underlying cause of death, either due to overstating (e.g. in cardiovascular causes) (Lakkireddy, Gowda, Murray, Basarakodu and Vacek 2004:495) or under-reporting (e.g. of HIV infection as the underlying cause of death) (Groenewald, Nannan, Bourne, Laubscher and Bradshaw 2005:196; Nolijana et al 2009;649; Burger, Groenewald, Rossouw and Bradshaw 2015:28) or even just incorrect causal sequencing with improbable attributions (e.g. hypertension purported to cause diabetes, (Lu et al 2010:1074), for cause-specific mortality have been widely reported. This just highlights the methodological variation and diverse findings of studies assessing the quality of mortality data. Lack of knowledge of the ICD rules (mechanisms of death vs underlying cause of death) and other social, professional and cultural issues such as concerns about the lack of confidentiality of the information on the death notification form and the implications for the family when claiming for life insurance and other policy benefits have been cited as reasons for the reluctance of doctors to write certain diagnoses (e.g. HIV) on the death notification form (Groenewald et al 2005:196; Nolijana et al 2009:650; Lu et al 2010:1075, Burger et al 2015:29). This in turn compromises the accuracy of mortality data and limits its utility for planning, assessing epidemiological trends and allocating resources.

Deficiencies in the knowledge of the ICD rules for the medical certification of cause of death have been widely reported and inevitably lead to errors which compromise the quality and validity of the mortality statistics (Lakkireddy et al 2004:492; Aung et al 2010:143; Lu et al 2010:1069; Haque, Shamim, Siddiqui, Irfan and Khan 2013:3; Mahdavi, Sedghi, Sadoghi and Azar 2015:374). The implication of the above is that the national mortality data becomes unreliable and cannot fulfil its critical epidemiological and health planning functions (Haque et al 2013:3, Brooks and Reed 2015:74). A comprehensive set of rules for ICD classification and coding are explained elsewhere (Pieterse et al 2009a:7; Lehohla 2012:2; WHO 2013:26; Brooks and Reed 2015:78). Despite the fact that doctors are expected to complete DNFs,

training on ICD rules is not prioritised during undergraduate, pre-service (induction) and in-service (CPD meetings) training.

2.3 Variations in the practice of death certification

In most developed countries, medical certification of cause of death is done by a medical practitioner, but in developing countries, a significant proportion of deaths may occur without medical attention and may be registered without a medical opinion (Mathers et al 2005:172). In South Africa, the Birth and Deaths Registration Act No, 51 of 1992, requires that all deaths be certified by a medical practitioner using a prescribed DNF, known as DHA-1663 form. But in instances where death occurs in remote areas where there are no medical practitioners within a reasonable distance to certify the death, the chief or tribal leader, member of the police service, or funeral undertaker are allowed to report the death and describe the circumstances that led to the death by completing a DHA-1680, death reporting form, which is then sent to the nearest DHA offices (Lehohla 2012:4; StatsSA 2014:3). Professional nurses are also allowed to complete the DHA-1663, especially for perinatal deaths or when a doctor is not available (Pieterse et al 2009a:2). Home deaths may represent underlying issues of access to healthcare services, and a lack of proper medical certification of such deaths may distort the true picture of mortality patterns. These deaths are usually certified by doctors in the private sector who may or may not have seen the deceased prior to their death. The ICD rules prescribe that, to complete the DNF, the certifying doctor must have seen the deceased before death or at least examined them to exclude external causes (Lehohla 2012:4).

However in hospital settings, where most deaths occur, medical certification of cause of death is the primary responsibility of medical practitioners (Aung et al 2010:143). It is therefore expected that doctors have a clear understanding of the ICD rules and principles in order to provide accurate data that can be easily coded to produce high quality mortality statistics that are fit for purpose. In terms of the Inquest Act of 1959, all unnatural deaths (from external causes and not from a

natural disease) are subject to a medico-legal investigation which usually includes performance of a post-mortem examination by forensic pathology services to determine the cause and mechanism of death while the courts are tasked with determining intent (homicide, suicide, accident etc.) (SAG 1959; Joubert et al 2013:2).

2.4 Public health implications of improper death certification

According to Stats SA, the percentage of total deaths assigned to symptoms, signs and ill-defined conditions for Limpopo Province was the highest in the country at 17.9% and way above the national average (12.8%) during the period 1997 – 2007 (Joubert et al 2013:7). Of concern is that, Stats SA (2014:10) reports no improvement, instead the national average increased to 13.6%. With regards to the misclassification of HIV disease, Limpopo Province was one of only two Provinces where HIV disease did not appear in the ten leading underlying causes of death (the other being North West Province). Other provinces showed great variability with the highest rank being only 4th in the Northern Cape and the lowest 10th in the Free State (Stats SA 2014:89-98). Burger et al (2015:28) reported that HIV reporting on the DNF has been affected by concerns of lack of confidentiality and fears about implications for the certifier and for the next of kin when they claim for life insurance or other benefits. But the Births and Death registration Act provides for a self-sealing page of the last page of the death notification form to address confidentiality issues since it prescribes completion of the death notification form with utmost accuracy (Burger et al 2015:30; Lehohla 2012:5). But the introduction of this self-sealing DHA-1663 B form for confidentiality reasons was only recently introduced in Limpopo Province (in particular, for Mankweng hospital it was introduced in May 2016). The introduction was unfortunately not accompanied by the training on the significance of this development, therefore it remains to be seen as to whether it will result in any changes in behaviour of the certifiers.

In Limpopo Province, the top three leading underlying causes of death are Tuberculosis, influenza and pneumonia, and intestinal infectious diseases, conditions usually associated with HIV disease (Stats SA 2014:98). This is questionable since HIV disease does not even form part of the top ten causes of death. On the other hand, the category of "*disorders involving the immune mechanism*", a different disease entity from HIV disease, appeared in the top ten leading underlying causes in Limpopo and four other provinces, albeit ranked a lowly 9th position (Stats SA 2014:98). Certifiers tend to use medical jargon to describe HIV disease such as immunosuppression (ISS), retroviral disease (RVD) etc., furthermore, informal abbreviations may be used creating coding difficulties. South Africa continues to be home to the largest number of people living with HIV estimated at 6.4 million in 2012, and the world's third highest TB burden with a co-infection rate in the order of 60% (NDOH 2014:9). So, HIV disease is expected to feature high up the mortality list of most provinces as one of the leading underlying cause of death.

Although no studies were found that specifically assessed the validity of the medical certification of the cause of death in Limpopo Province, the mortality data is incongruent with regards to HIV and its associated (opportunistic) conditions. The high mortality from opportunistic infections when HIV infection does not feature in the top ten causes of death may point to a systematic underreporting alluded to above. And the high percentage of deaths assigned to symptoms, signs and ill-defined conditions casts doubt on the accuracy and reliability of the Limpopo mortality data thus rendering the data unfit for monitoring epidemiological trends and informing policy.

This information is derived from the death notification forms completed primarily by doctors and depends heavily on the knowledge of the ICD rules for disease classification and training on the completion of the DNF. Studies have reported inadequate performance of doctors on the medical certification of cause of death, judged by the quality of the completion of death notification forms, as the primary reason for inaccurate data (Aung et al 2010:144).

2.5 Situational analysis on medical certification of death across the world

Studies around the world have sought to assess the quality of population-based mortality statistics in various countries to determine the usefulness of the reports (Mahapatra et al 2007:1; Lu et al 2001:232; Joubert et al 2013:2). But due to differing approaches in the evaluations and some methodological flaws, comparability is a challenge and often no definite conclusions can be reached. Researchers are advised to offer explicit descriptions of methods and criteria as that will afford readers an opportunity to assess the generalisability of the conclusions to their own setting. However, a comprehensive framework to assess vital statistics from civil registration systems has been suggested (Mahapatra et al 2007:2).

Some of the approaches used include comparison of the recorded causes of death based on clinical grounds with autopsy findings (Mieno, Tanaka, Arai, Kawahara, Kuchiba, Ishikawa and Sawabe 2010:192), auditing death notification forms to check for errors (Cambridge and Cina 2010:232, Nolijana et al 2009:648), assessing awareness of certifiers and coders of the ICD rules using questionnaires (Mahdavi et al 2015:373), comparing reported causes of death with information from the medical records for hospital deaths (Carter, Hufanga, Rao, Akauola, Lopez, Rampatige and Taylor 2012:2; Haque et al 2013:2), sending a questionnaire with a case scenario to doctors to assess responses with regards compliance with ICD 10 rules (Lakkireddy et al 2004:493; Pieterse et al 2009b:643) and assessing the level of under-reporting of HIV using either ASSA models, the rate of opportunistic infections or medical records to check if HIV recorded in the medical records also appeared in the death notification form (Nolijana et al 2009:648; Groenewald et al 2005:194). Some researchers conducted quasi-experimental studies with training as an educational intervention (Myers and Farquhar 1998:1320; Pieterse et al 2009b:643). The varied methodologies represent lack of consensus on assessment methodology, with researchers' choice largely based on availability of data, feasibility, level of expertise and personal preferences.

The most popular approach found during literature search was the cross-sectional determination of error rate on the DNF audited against the ICD rules. At least five studies were identified and most were concerned with major errors (that could have an impact on the coding of the underlying cause of death) which ranged from 11% to over 60% (Cambridge and Cina 2010:233; Haque et al 2013:3; Lu et al 2001:234 ; Myers and Farquhar 1998:1321; Nolijana et al 2009:650). But when minor errors were included, the error rate went up to more than 90% in some studies (Haque et al 2013:3; Nolijana et al 2009:650). Cambridge and Cina (2010:235) remarked that the high proportion of errors, ranging from 30% to 80% in studies across the world were probably due to lack of training, paucity of continuing medical education in this area and a lack of appreciation of the need for accuracy of mortality data. Training has been regarded as a common challenge and it has been shown to improve knowledge on death certification in most intervention studies.

In a study that closely resembles the current study, an anonymous questionnaire was sent to randomly selected internal medicine residents via standard mail. Participants were requested to complete the model death notification form that included a case scenario with death as the final outcome. The structured questionnaire contained questions on respondents' sex, level of residency training, comfort level, awareness of guidelines, perceived need for supervision and a desire for further training regarding death certification. A score of 60% was considered acceptable or a pass out of possible total of 30 points. Only 12% (590/4800) of residents responded of which 76% (448) were directly responsible for death certification in their hospitals, 76% had not received formal training, 61% were not comfortable with their abilities, 73% were not aware of the certification guidelines, 81% requested further training while 61% felt supervision was needed. Overall, 77% of respondents had suboptimal performance (Lakkireddy et al 2004:495). The poor response may reflect lack of interest in the subject and may unfortunately introduce some form of selective bias as responders and non-responders may differ in a systematic way.

Level of residency training correlated with experience in death certificate completion ($p = 0.001$). Senior residents were more comfortable with their abilities

(p= 0.001) and reported greater awareness of the guidelines (p = 0.004). In a univariate analysis, optimal performance was related significantly to respondents' level of residency, previous experience, comfort with ability, past formal training, awareness of guidelines and perceived need for supervision. Only 38% were able to identify the correct primary cause of death (Lakkireddy et al 2004:495). The poor response rate (12%) and the inclusion of only internal medicine residents limits generalisability of results to all doctors, and the lack of emphasis on the underlying cause of death in favour of the primary cause is not in line with the ICD rules. But the analysis was well done and revealed some interesting and useful findings.

Mahdavi et al (2014:374) reported a low (overall score of 34%) level of awareness of the general rules of medical certification of cause of death among participants in a cross-sectional study based on questionnaires. Professional experience of more than 5 years demonstrated higher levels of awareness. Just like in the Lakkireddy study, 80% of participants expressed a further need for training on cause of death certification. Challenges identified in this study were the complexity of the case, lack of training on cause of death certification and poor understanding of the DNF. Perhaps using the same questionnaire for the different category of workers (coders, health information officers and clinicians) may have compromised the results. Although they are all involved in the death notification process, they have different responsibilities, different training needs and obviously different background knowledge. There was no justification of why the scores were calculated the way they were.

Although the methodology for the various studies are different, and often generalisability might be an issue, the studies had a common thread among them, to assess the quality and validity of information in the death notification form. This information is dependent on the doctors' knowledge of the ICD rules of disease classification and skills in the completion of the death notification form (Aung et al 2010:149). The very low standard to which most medical certification of cause of death are completed locally (Stats SA 2014:10) and around the world, has been documented and there is no evidence of recent improvement (Furness, Fletcher, Shepherd, Bell, Shale and Griffin 2016:11).

Almost all the studies cited lack of training for the doctors on cause of death certification as a factor. Aung et al (2010:143) remarked that the fundamental issue leading to poor quality statistics is the inadequacy of information on causes of death recorded on the DNF. And efforts to improve the quality of cause of death information include improvements in death notification forms, training programmes for medical student and physicians on completion of DNFs, provision of self-learning educational material (internet-based), implementation of death query systems with feedback to physicians, periodic auditing of death notification forms and where feasible, increase autopsy rates. But countries should choose interventions that are feasible within their available resources without compromising the quality of mortality data. Interactive workshops were shown to be the most effective in improving the knowledge of doctors.

Interestingly, the death notification form in Finland has been adapted to include a summary of the case history by the certifying doctor and is meant to assist the nosologist (coder) with the correct sequencing and coding of the underlying cause of death. A review of death certificates for validation by an expert panel resulted in a decrease of 75.2% of the category of symptoms, signs and ill-defined causes and a 77.3% increase of endocrine causes. The authors concluded that the death certification practices and cause of death validation procedure seemed to serve the coding of causes of death appropriately to improve the quality of mortality statistics (Lahti and Penttila 2000:15-28). A summary of the case-history is a good innovation even though it might be seen as additional work for the certifiers. But if implemented correctly accompanied by proper training, it has great potential to improve mortality data as it forces certifiers to apply their mind to the process and will definitely assist coders.

Furthermore, in May 2015, Scotland introduced a system meant to improve the accuracy of medical certification of cause of death which involves a review of about 10% of DNFs by a medical reviewer. During the review, if forms contain un-codable information, the certifying doctor can be contacted to clarify and for only a few forms, medical records may be requested to provide further information. Following the audit, a new form may need to be completed by the certifier to accurately capture the causes of death. The system plans to identify

problems and make improvements at the same time (Scotland 2015:2). On the other hand, the Department of Health in the United Kingdom is looking to introduce reforms to its death certification process that will see all death notification forms being scrutinised by an independent medical examiner (Furness et al 2016:6). This will provide some form of feedback and support to the certifiers, while improving the accuracy of medical cause of death information. The auditing of roughly 10% of DNFs seems more feasible in resource limited settings like South Africa.

2.6 Conclusion

Information on the DNFs determines the quality of mortality statistics. Several interventions such as improvements of the DNF format, provision of self-learning educational material including online resources, query systems on selected DNFs, periodic DNF audits with feedback to certifiers and some countries even sought to increase autopsy rates, have been implemented in various settings in a quest to improve the quality of mortality statistics (Aung et al 2010:143). But in terms of educational interventions, interactive workshops were found to be the most effective form of education in improving the quality of cause of death certification (Pieterse et al 2009b:643; Aung et al 2010:148). It was further noted that if cause of death certification training was introduced in the undergraduate curriculum, it should preferably be in the later years of study, when it becomes more relevant, should be reinforced during induction at the beginning of internship with periodic refresher courses for medical officers. Inclusion of death certification questions at post-graduate assessments and in most continuing medical education (CME) programmes have also been suggested (Aung 2010:149).

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Study design

This was a cross-sectional study with an analysis of factors associated with the level of knowledge of doctors on medical certification of cause of death.

3.2 Study setting

Limpopo Province is one of the 9 provinces in South Africa. It is the northern most province sharing local borders with North West, Gauteng and Mpumalanga provinces and international borders with Botswana to the north-west, Zimbabwe to the north and Mozambique to the east. The province is divided into five districts (Capricorn, Mopani, Sekhukhune, Vhembe and Waterberg). There are 40 hospitals in the province ranging from district level hospitals (5 – 7 per district), regional level hospitals (one per district except in Capricorn district), provincial tertiary and academic hospitals (two, both located in Capricorn district) and four specialised hospitals (psychiatric (3) and drug –resistant TB (1)).

3.3 Sampling

3.3.1 Study population

All doctors working in public sector hospitals in Limpopo Province.

3.3.2 Sampling method

A stratified cluster sampling technique was used in this study. The stratification was by level of care (district, regional and tertiary). All doctors in a cluster (hospital) available at the time of data collection were included in the study. Due to the topography of the province and time constraints, coupled with the need to include the entire province, the following selections were made. For district level

of care, only one of the five districts was chosen to represent that level. All hospitals in that district were selected to participate. For this study, Capricorn district was chosen to represent that level. For the regional (secondary) level of care, each of the regional hospitals was chosen to participate and represent the district it serves. For the tertiary level of care, the only two tertiary hospitals in the province were both included.

The above selection resulted in 12 (out of a total of 40) hospitals included in the study. All doctors in the hospitals listed in Table 3.1 were eligible for inclusion in the study.

Table 3.1 Hospitals that participated in the study by level of care

District hospitals (Capricorn district)	Regional hospitals (District represented)	Tertiary hospitals
Botlokwa	Mokopane (Waterberg)	Pietersburg
Helen Franz	Letaba (Mopani)	Mankweng
Lebowakgomo	St Ritas (Sekhukhune)	
Seshego	Tshilidzini Vhembe)	
WF Knobel		
Zebediela		

3.3.3 Sample size

The expected level of knowledge on medical certification of causes of death would be low given that StatsSA reports misclassification of causes of death to be high. Therefore factors influencing knowledge of doctors on medical certification of cause of death would be high and would therefore require a large sample size. Based on the findings of StatsSA, the expected error rate was assumed to be approximately 60%.

The sample size calculation was based on an approximate population of medical doctors in all public hospitals in Limpopo Province of 700, a desired confidence level of 95%, a desired confidence interval of ± 5% and the expected error rate of 60%. Using Epi-info version 7 the minimum sample size required was

estimated to be 150. However as cluster sampling was employed in the study, allowance for a design effect of 2.0 increased the required sample size to 220. In addition, an anticipated non-response rate of 10% and a need to increase the power of the study resulted in a minimum required sample size of 300 doctors.

A response rate of 100% was achieved, a breakdown of the doctors by hospital and level of care is provided in Figure 4.1.

3.4 Data collection

Following ethical clearance by TREC, permission was sought at the provincial Limpopo Department of Health to conduct the study. After the province had given permission to conduct the study in the province, they referred the researcher to the District Executive Managers (DEMs) in the respective districts who also had to give permission to access their hospitals. The DEMs gave their approvals and referred the researcher to the Chief Executive Officers (CEOs) in each of the 12 hospitals. Once the CEOs had given permission or approval, an arrangement was made with the Clinical Managers to arrange for a suitable date for data collection. To improve the response rate given the number of hospitals that had to be visited and the distance involved, data collection was coupled with a presentation on medical certification of cause of death. On the day of data collection, doctors were told about the research project as per information on Annexure F, asked to participate and given a questionnaire (Annexure G) to complete. After 15 to 20 minutes, all the doctors returned the questionnaires and a 40 minute presentation on ICD rules was given. The presentation covered case scenarios and Stats SA reports, essentially all the themes in the questionnaire. The entire process, data collection and presentation was allocated one hour but the lively discussions always extended the time, sometimes by up to 30 more minutes. Data was collected between 25 October 2017 and 08 January 2018. No data collection was done in December 2017.

3.4.1 The data collection tool

A self-administered close-ended questionnaire on medical certification of cause of death was completed by doctors. The questionnaire was adapted from the study material, guidelines on death certification and questions from two training courses on death certification (See Annexure G). The themes and most of the questions were derived from: (1) Death Certificate Short-Course (E-learning) offered by the Foundation For Professional Development: (available online at www.foundation.co.za/onlinecourses) and (2) Cause of Death certification: A guide for completing the Notice of Death/Stillbirth (DHA-1663), published by Stats SA in 2012. The questionnaire contained questions on respondents' personal characteristics (see 6.3.4). It also had true/false/don't know questions to assess the level of knowledge of doctors on various aspects of death notification in South Africa, but specifically on the ICD rules governing medical certification of cause of death. The level of knowledge of doctors was assessed under the themes or knowledge areas indicted in Table 6.1 below.

TABLE 3.2The knowledge areas used to assess the level of knowledge

Knowledge area	Abbreviation	No. of questions
1.Rules of completion	Rules	7
2.Death notification for natural cause of death	CoDNat	5
3.Identifying unnatural causes of death	Unnat	12
4.Knowledge on underlying cause of death	UCoD	9
5.Identifying immediate causes of death	Immed	5
6.Differentiating between immediate and underlying cause of death	Imm_UCoD	11
7.The purpose or uses of death notification	Purp	10
8.The process followed for unnatural deaths	Unnat	10
9.The ethical issues around the death notification form	Ethic	10
Total	Overall	79

Each knowledge area was marked, and allocated a score which was converted into a percentage. An overall score was calculated as an average of all the questions. All the questions were deemed to have the same weighting. Sixty

percent (60%) was regarded as an acceptable level of knowledge as used in another study (Lakkireddy et al 2004). A mark was allocated if the answer corresponded with the pre-determined answer. The marking of the questionnaire was based on pre-determined answers (memorandum) to ensure uniform assessment of all questionnaires. See Annexure D for a summary of the ICD completion rules.

Case scenarios:

To assess if the knowledge of doctors corresponded with practice, two short case scenarios were attached to the questionnaire with death as an outcome (See Annexure H). Doctors were requested to complete the mock DHA-1663 B form based on the information provided. The case scenarios were included to allow participants to apply the knowledge of ICD completion rules. The judging criteria for each case scenario, previously used by Pieterse et al 2009, was:

1. Correct and logical sequencing of causes of death (in line a to d),
2. Selection of the correct underlying cause of death,
3. Estimation of the time interval from disease onset to death and
4. The use of abbreviations

The application of the knowledge in case scenarios was also meant to control for potential guessing in the questionnaire. The CPD approach presented a win-win situation for both the researcher and the participants since at the end, the researcher walked away with completed questionnaires while the doctors were given a highly informative presentation that left them enlightened.

3.4.2 Inclusion criteria

The study included all doctors working for the Limpopo Department of Health stationed in all participating hospitals and were available at the time of data collection.

3.4.3 Exclusion Criteria

Doctors working in disciplines where death notification forms are not completed regularly were excluded: Ophthalmology, Radiology, Dermatology and Psychiatry. Also, doctors in participating hospitals who were not available on the

day of data collection were excluded. Lastly, doctors working solely in the private sector did not form part of the study.

3.4.4 Predictor (independent) variables

Variables are defined as the qualities, properties or characteristics of persons, things or situations that change or vary, i.e. they tend to take on more than one possible value. Independent variables influence other variables thus causing a change (Brink, van der Walt and van Rensburg 2014). In this study, the following independent variables were collected and assessed to check if they influenced the outcome (level of knowledge):

- Age
- Rank
- Years of work experience
- Workstation (Name of facility & clinical discipline)
- Previous training in death certification
- Awareness of guidelines on death certification
- The level of comfort in completing the death notification form
- Expressed need for (further) training

3.4.5 Outcome (dependent) variable

The dependent variable reflects the effect of or response to the independent variable. It is the variable that changes as the independent variable is introduced, removed or varied (Brink et al 2014). For this study, the dependent variable is the overall score of at least 60% from the medical certification of cause of death questionnaire, representing the level of knowledge.

3.5 Data analysis

Descriptive statistics were used to summarise the baseline characteristics of the doctors participating in the study using means (and standard deviation) and median (and range) for continuous variables, and proportions for categorical variables. The primary outcome variable is a score of at least 60% from the

questionnaire. The Student T-test (unpaired) was used to assess the differences in the means while a chi-square test was used to assess associations between categorical variables (proportions). The cross-sectional study design limited further analysis. The level of significance was set at $p < 0.05$. Data was captured and collated using Microsoft excel and analysed using STATA version 14.

3.6 Validity and Reliability

The validity of a data collection instrument (questionnaire), called instrument validity, seeks to ascertain whether an instrument accurately measures what it is supposed to measure, in the context in which it is applied (Brink et al 2014). The questionnaire on medical certification of cause of death has been developed directly from the course content (ICD rules and guidelines on medical certification of death) and all the questions were derived from medical certification courses mentioned under data collection tool (section 5.3.1). Face validity, a subjective determination that the questionnaire is adequate for obtaining the desired information (Brink et al 2014) or makes sense to those knowledgeable about the subject (Erhlich and Joubert 2014), was done with the Mankweng hospital internal medicine team during the pilot study. It was thus considered to measure knowledge of doctors on the subject. Reliability refers to the degree to which an instrument produces reproducible results, after repeated testing (Ehrlich and Joubert 2014). The questionnaire was developed using the standardised ICD rules, and was self-administered, since the ICD rules are universal, the questionnaire was re-checked against the ICD rules for conformance. Also, the questionnaire was marked using a set of pre-determined (model) answers. As such, assessment of each questionnaire was against a uniform standard. The questionnaire also satisfied other ideal properties of an instrument, such as being relevant to the population to which it is used, practically feasible to use and comprehensive in scope. To increase the validity of this study, triangulation was used. Triangulation refers to the use of multiple methods or perspectives to collect and interpret data about some phenomenon and therefore converge on an accurate representation of reality (Brink et al 2014). In this study, while the

questionnaire was used to assess the level of knowledge of doctors, the case scenarios sought to assess application of that knowledge to check for concurrence.

3.7 Bias

Bias is an influence that produces an error or distortion, which can affect the quality of evidence in studies, it produces results or conclusions that differ from the truth in a systematic (one-sided) way (Brink et al 2014:208, Erhlich and Joubert 2014:166). Biased study results are generally attributable to selection of participants into a study (selection bias), collection of data (information bias) or the association of risk factors in the study population (confounding) (Erhlich and Joubert 2014:166). Because of the need to generalise the results of this study to the entire community of Limpopo doctors employed in the public sector, representation was sought at all levels of care (district, regional and tertiary). But due to limited time and the topography of the province, hospitals from one district (Capricorn) were chosen to represent all district hospitals in the province, all the regional and tertiary hospitals were included. The district hospitals were assumed to be more similar across districts than they are different. To minimise selection bias and deal with the potentially low numbers and low response rate, all the doctors in the above-mentioned hospitals were eligible for inclusion in the study. To boost the response rate, data collection was coupled with a continuing medical education (CME) session on the same topic. To minimise information bias, a standardised self-administered questionnaire was used which was marked using pre-determined answers. Although all doctors were eligible for inclusion, the target was doctors who regularly certify deaths, so doctors who were excluded were deemed to be unlikely to affect the outcome of the study and therefore not bias the results. The use of different methods (questionnaire and case scenarios) to collect data, was meant to neutralise any information bias introduced by either method.

3.8 Ethical considerations

Ethical clearance was obtained from the Turfloop Research Ethics Committee (TREC) of the University of Limpopo (TREC/253/2017: PG). Permission to conduct the study was granted by the Limpopo Department of Health Research Committee. Further permissions were requested from the DEMs in all the five districts and once granted, subsequent permissions were sought and granted by respective CEOs in all participating hospitals except Pietersburg hospital. The Pietersburg Mankweng Research Ethics Committee granted the approval on behalf of the CEO of Pietersburg hospital (PMREC – 31/10/3/2017). The CPD and data collection sessions were then arranged with the clinical managers in all district and regional hospitals and head of clinical units in the tertiary hospitals. The study questionnaire was only in English. The questionnaire was anonymous and the principles of autonomy, privacy and confidentiality were observed throughout the study. Participants were briefed about the research project and encouraged to participate.

CHAPTER 4: RESULTS

4.1 Introduction

In this chapter, the results are presented according to the objectives of the study. The objectives of the study were (1) to describe the baseline characteristics of the doctors, (2) to determine the level of knowledge of the doctors and then (3) to determine the factors associated with the level of knowledge on medical certification of death.

4.2 Demographic characteristics of the respondents

A total of 301 doctors participated in the study. The median age of the doctors was 29 years (range 23 to 78 years) and 51% were females. Sixty four percent (64%) of the doctors were below the age of 34 years. Fifty eight percent (58%) of the doctors had ≤ 5 years of clinical experience. Fifty two percent (52%) of the doctors were previously trained, majority at undergraduate level, with only 18% reporting ever attending a CME on the topic. Eighty percent (80%) of the doctors were not aware of the guidelines. See Table 4.1.

With regard to comfort level, 75% of doctors had moderate comfort, followed by 16% with low and 9% with high level of comfort in completing a DNF. Up to 86% of doctors expressed a need for further training in medical certification of cause of death.

Table 4.1: Demographic characteristics of the doctors

Variable	Frequency (N = 301)	Percentage (%)
Gender		
Males	149	49.5
Female	152	50.5
Age group		
< 25	17	06
25 – 34	174	58
35 – 44	49	16
45 – 54	35	12
≥ 55	26	08
Years of clinical experience¥		
< 2	76	25
2 – 5	98	33
> 5 – 10	46	15
> 10	81	27
Previously training		
Yes	156	52
No	145	48
Awareness of guidelines		
Yes	49	16
No	240	80
Comfort level		
Low	47	16
Moderate	221	75
High	28	9

¥ Years of clinical experience since qualified as a doctor

Out of a total 301 doctors who participated in the study, 49% were from tertiary hospitals, followed by 27% from regional and 24% from district hospitals. Eighteen percent (18%) of the doctors were from the department of family medicine, followed by 16% of doctors from each of the departments of internal medicine and paediatrics. Five percent (5%) of the doctors were from Emergency medicine and 2% from Forensic pathology departments (Table 4.2).

Table 4.2: Distribution of doctors per level of care, discipline and rank

Variable	Frequency (N=301)	Percentage (%)
Level of care		
District	73	24
Regional	82	27
Tertiary	146	49
Discipline		
Family Medicine	55	18
Internal Medicine	47	16
Paediatrics	47	16
General & Cardiothoracic Surgery	39	13
Obstetrics & Gynaecology	36	12
Orthopaedics	28	09
Anaesthesia	27	09
Emergency	16	05
Forensic Pathology	06	02
Rank		
Medical intern¥	82	27
MO Gr1† /Community Service	111	37
MO Gr 2/3*	43	14
Registrars	11	04
Clinical Managers	14	05
Specialists	40	13

¥ Medical internship is a 24 month programme where newly qualified doctors rotate though various clinical disciplines and work under supervision

† Medical officer grade 1 begins after completion of a one year community service programme until an officer is translated to a higher grade following compliance with the Performance Management and Development System (PMDS) policies

* Medical officer grade 2 or 3 represent the senior doctors who have progressed through the ranks by complying with the PMDS policies

Thirty seven percent (37%) of the participants were Medical Officer Grade1/ Community Service and 27% were medical interns. Five per cent (5%) of the doctors were clinical managers, 4% were registrars and 13% were specialists.

4.3 Level of knowledge of doctors on medical certification of cause of death

The mean overall score for all the doctors was 59.80% (±11.95). The level of knowledge of the doctors is shown in Figure 4.1. Overall, 53% of respondents had adequate knowledge on the medical certification of cause of death. The doctors who obtained ≥ 60% (adequate knowledge) had a mean score of 68.8% (±7.3, 95% CI 67.8 to 69.8). The doctors who obtained less than 60% (inadequate knowledge) had a mean score of 49.4% (±6.7, 95% CI 48.2 to 50.6). The difference between the mean scores of the two groups was statistically significant (p<0.001).

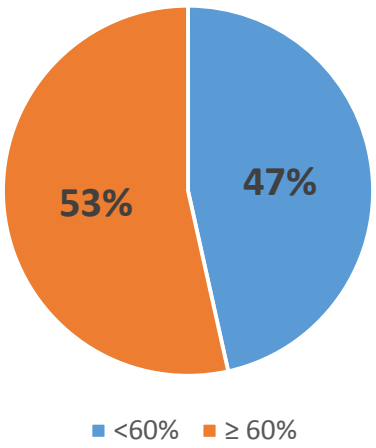


Figure 4.1: The proportion of doctors by adequacy of level of knowledge

Assessing specific knowledge areas, only 26% of the doctors had adequate knowledge on identifying unnatural deaths, 33% of the doctors had adequate knowledge on underlying causes of death and 37% of the doctors were unable to differentiate between immediate and underlying causes of death. (See Figure 4.2). Refer to Table 3.2 for the abbreviations of knowledge areas.

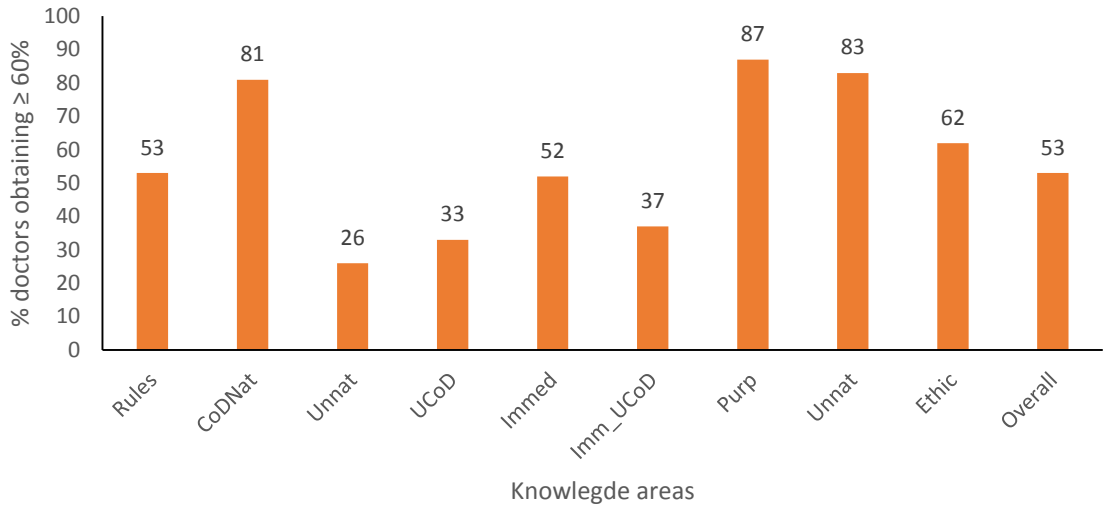


Figure 4.2. Proportion of knowledgeable doctors per knowledge area

When performance was assessed per clinical discipline, the proportion of doctors with adequate knowledge on medical certification of death was lower among doctors in the departments of obstetrics and gynaecology, and paediatrics (42% and 47% respectively). Forensic pathology department had the highest percentage of doctors showing adequate knowledge (83%).

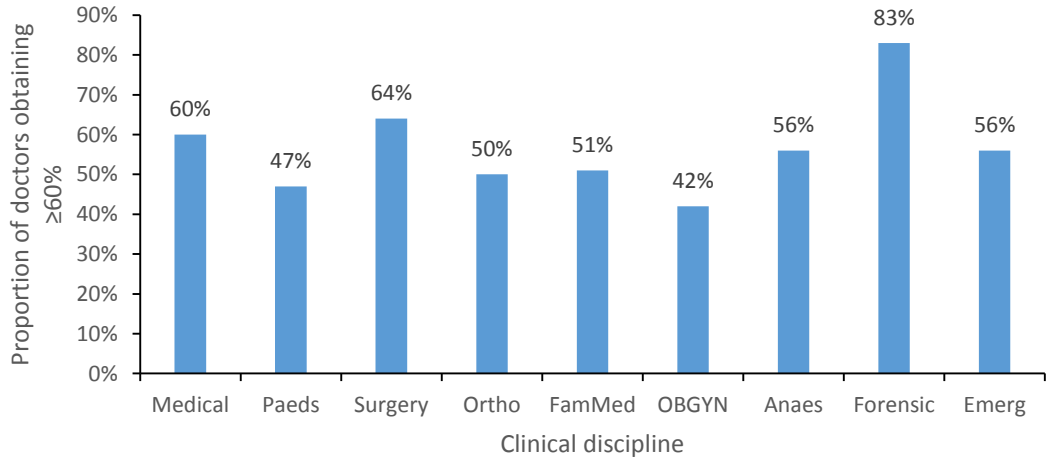


Figure 4.3. Proportion of doctors with adequate knowledge by clinical discipline

Across all clinical disciplines, there was poor performance in identification of unnatural deaths, underlying causes of death and differentiating between immediate and underlying causes of death except in the forensic pathology

department. (Figure 4.4). Refer to Table 3.2 for abbreviations of knowledge areas.

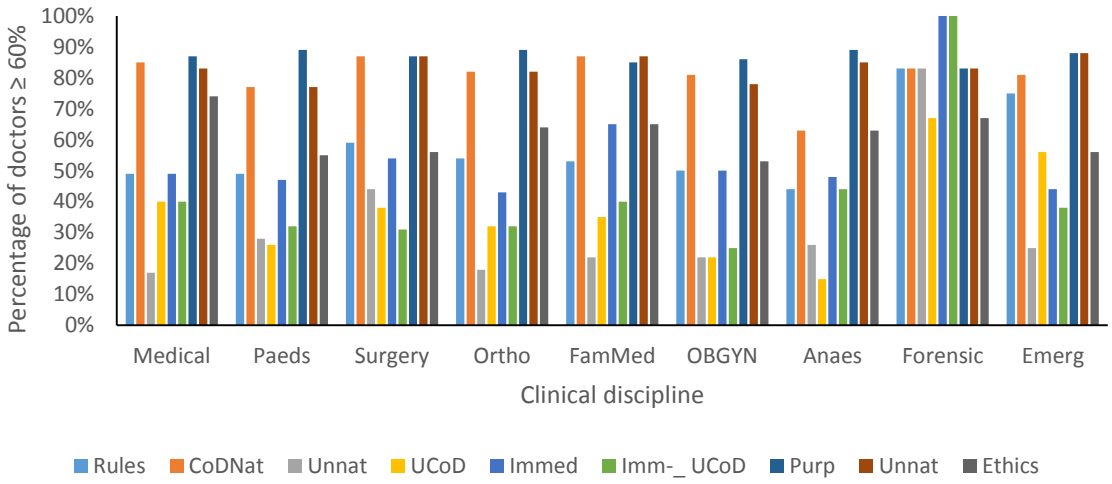


Figure 4.4. Performance of doctors for each knowledge area across clinical disciplines

Medical interns consistently performed poorly compared with other rank groups while registrars, clinical managers and medical specialists tended to perform relatively better. (Refer to Table 3.2 for abbreviations of knowledge areas).

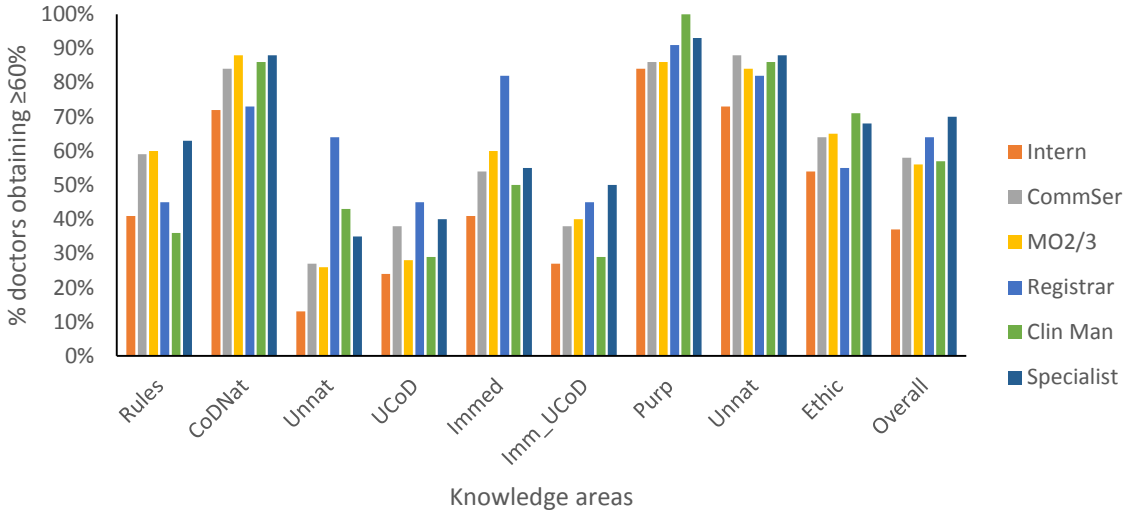


Figure 4.5. Performance of doctors for each knowledge area by rank

Case scenarios

Two short case scenarios were provided for doctors to complete a mock DHA-1663 (Annexure H). Out of the 301 doctors who participated in the study, only 221 doctors responded to the first scenario. A total of 137 (62%) were able to record the correct and logical sequence of events leading up to the death. But only 19 (9%) doctors were able to correctly identify the underlying cause of death. Only half (111) of the doctors estimated the time interval from illness due to a particular medical condition to death. Fifty three (53) doctors (24%) used abbreviations.

Two hundred and two (202) doctors responded to the second case scenario. Only 81 (40%) of the doctors responding to the question recorded the correct and logical sequence of events that led to the death. Sixty five (65) doctors (32%) correctly identified the underlying cause of death. Eighty nine (89) doctors (44%) estimated the time interval and 137 (68%) used abbreviations.

4.4 Factors associated with knowledge of doctors on medical certification of cause of death

As shown in Table 4.3, males were more knowledgeable than females, however, the result was not statistically significant (55% versus 52%, p=0.595). A significantly higher proportion of doctors with adequate knowledge had more than 10 years' working experience compared to those with inadequate knowledge (60% versus 40%, p=0.010). Knowledge increased with age but the result was not statistically significant (p=0.071).

A significantly higher proportion of doctors who were trained were knowledgeable compared to those not trained (63% versus 43%, p<0.001). Of the 156 doctors who were trained, two thirds were trained at undergraduate level with only one third reporting ever attending a CPD meeting on medical certification of cause of death. Overall, only 18% of doctors had ever attended a CPD meeting on medical certification of cause of death. Meanwhile, 86% of doctors expressed a need to attend such a CPD meeting. Similarly, doctors who were aware of the guidelines were more knowledgeable than doctors who were not aware of the guidelines

(67% versus 51%, p=0.040). A higher proportion of doctors with high comfort level (79%) were knowledgeable, compared to doctors with moderate (57%) and low (26%) level of comfort in completing the medical certification of cause of death (p<0.001).

Gender (p=0.595), age group (p=0.071), clinical discipline (p=0.788), level of care (p=0.400), and district (p=0.336) were all not associated with doctors obtaining an adequate score of at least 60% on the questionnaire.

Table 4.3. Demographic factors influencing the knowledge of doctors

Variable	N (%)	Knowledge level		p-value
		≥ 60	< 60	
Gender				
Male	149 (49.5)	82 (55)	67 (45)	0.595
Female	152 (50.5)	79 (52)	73 (48)	
Age group (years)				
< 25	17 (6)	03 (18)	14 (82)	0.071
25 – 34	174 (58)	93 (53)	81 (47)	
35 – 44	49 (16)	31 (63)	18 (37)	
45 – 54	35 (12)	19 (54)	16 (46)	
≥ 55	26 (9)	16 (62)	10 (38)	
Years of clinical experience				
< 2	76 (25)	29 (38)	47 (62)	0.010
2 – 5	98 (33)	56 (57)	42 (43)	
> 5 – 10	46 (15)	27 (59)	19 (41)	
> 10	81 (27)	49 (60)	32 (40)	
Previous training				
Yes	156 (52)	99(63)	57(37)	<0.001
No	145 (48)	62(43)	83(57)	
Awareness of guidelines				
Yes	49 (16)	33 (67)	16 (33)	0.040
No	240 (80)	123 (51)	117 (49)	
Comfort level				
Low	47 (16)	12 (26)	35 (74)	<0.001
Moderate	221 (75)	126 (57)	95 (43)	
High	28 (9)	22 (79)	6 (21)	

As expected, a significantly higher proportion of medical interns were less knowledgeable compared to all other categories of doctors (p=0.002, Table 4.4).

Similarly, few doctors from obstetrics and gynaecology (42%) and paediatrics (47%) were knowledgeable compared with other disciplines, however, the result was not statistically significant (p=0.788). Level of care (p=0.400) and district (p>0.336) were not significantly associated with doctors' knowledge.

Forensic medicine had the highest proportion of doctors with adequate knowledge but they were under-represented, only 6 doctors responded. Tertiary level had a higher proportion of doctors with adequate knowledge (58%) compared to district hospitals (53%) and regional hospitals (46%). But the difference was not statistically significant. Only Capricorn district had more than 50% of doctors with adequate knowledge, however, performance by district was not statistically significant.

Factors associated with adequate level of knowledge as determined by chi square test were years of clinical experience (p= 0.010), previous training on the topic (p<0.001), awareness of guidelines (p= 0.040), comfort level (p< 0.001) and rank (p= 0.002).

Table 4.4 Workplace factors influencing the level of knowledge

Variable	N (%)	Knowledge level		p-value
		≥ 60 (%)	< 60 (%)	
Rank				
Medical interns	82 (27)	30 (36)	52 (64)	0.002
Medical Officer Gr1/ Community Service	111 (37)	64 (58)	47 (42)	
Medical Officer Gr 2/3	43 (14)	24 (56)	19 (44)	
Registrars	11 (4)	07 (64)	04 (36)	
Clinical Managers	14 (5)	08 (57)	06 (43)	
Specialists	40 (13)	28 (70)	12 (30)	
Discipline				
Medical	47 (16)	28 (60)	19 (40)	0.788
Paediatrics	47 (16)	22 (47)	25 (53)	
Surgery	39 (13)	25 (64)	14 (36)	
Orthopaedics	28 (9)	14 (50)	14 (50)	
Fam Medicine	55 (18)	28 (51)	27 (49)	
Obstetrics & Gynaecology	36 (12)	15 (42)	21 (58)	
Anaesthesia	27 (9)	15 (56)	12 (44)	
Forensic	06 (2)	5 (83)	1 (17)	
Emergency	16 (5)	9 (56)	7 (44)	
Level of care				
District	73 (24)	39 (53)	34 (47)	0.400
Regional	82 (27)	38 (46)	44 (54)	
Tertiary	146 (49)	84 (58)	62 (42)	
District				
Capricorn	218 (72)	122 (56)	96 (44)	0.336
Mopani	15 (5)	06 (40)	09 (60)	
Sekhukhune	14 (5)	06 (43)	08 (57)	
Waterberg	20 (7)	10 (50)	10 (50)	
Vhembe	34 (11)	17 (50)	17 (50)	

Due to the cross-sectional study design, further analysis (i.e. logistic regression) was not done as causality cannot be assigned in such studies.

CHAPTER 5: DISCUSSION

5.1 Summary and interpretation of the results

There is a growing interest across the world on the quality and validity of national mortality data to determine the usefulness of such reports, and South Africa is no exception (Mahapatra et al 2007:1; Lu et al 2001:232; Joubert et al 2013:2). Joubert et al (2013) used a comprehensive framework to assess the national mortality reports and although satisfactory in many ways, content validity (cause-attribution) scored unsatisfactorily due to the high proportion of deaths due to ill-defined or non-specific causes or codes. While audits of the completed DNF against clinical records or autopsy reports or to check for errors have been used to assess content validity, the varied methodology used seems to suggest challenges with an objective measure. Nonetheless, inadequate performance of doctors in the medical certification of death has been reported as the principal reason for inaccurate data (Aung et al 2010). We assessed the theoretical and practical aspects of medical certification of cause of death against various characteristics of doctors working in the public hospitals in Limpopo Province. The questionnaire tested the knowledge of doctors on the theoretical aspects of death certification while the case scenarios addressed the practical aspects.

5.2 The baseline and workplace characteristics of the doctors

The distribution of doctors by level of care in this study reflected the general distribution of doctors in the province with almost half of all doctors employed in the two tertiary hospitals. This is expected given the size of the tertiary hospitals, each with just over 500 usable bed capacity, a variety of clinical disciplines that need to be serviced and the fact that these are training institutions. The distribution by discipline is influenced by the allocation of medical interns and junior doctors who tend to rotate through clinical disciplines for exposure. This cadre of young (median age 29 years range, 23 to 78) and junior doctors is important in this study since it represents almost two thirds (64%) of the participants. This observation is important since it talks to supervisory capacity in the province. Only 54 (18%) participants reported ever attending a CPD meeting

on medical certification. This is slightly lower than the rates reported by Lakkireddy et al (2004) (24%) and Mahdavi et al (2015) (24.6%), and represents a lack of training and scarcity of CPD meetings on this topic, perhaps owing to a lack of appreciation of the importance of the topic or a general lack of trainers on the topic (Cambridge and Cina 2010).

Similar to the participants in Lakkireddy et al (2004), 80% of participants were not aware of the medical certification guidelines with over 80% requesting further training in both studies. The need for training was also indicated by 79% of participants in Mahdavi et al (2015). The training needs were evident in all the studies despite the different profiles of participants (registrars for Lakkireddy et al (2004) and doctors, coders and health information staff in Mahdavi et al (2015). Medical certification of cause of death, as a topic, needs to be prioritised in CME meetings.

5.3 The level of knowledge of participating doctors

The mean overall questionnaire score of 59.80% for all the doctors was reasonable given that an acceptable score was 60%. But given the importance of the topic and the need to produce internationally comparable statistics, perhaps a higher score may be considered in the future. Adequate performance (≥60%) was achieved by 53% of the doctors in contrast to 77% who had suboptimal performance in Lakkireddy et al (2004), perhaps owing to the different tools used in both studies and the profile of doctors. A very low proportion of doctors performed adequately on questions on identification of unnatural deaths (27%), the concept of underlying cause of death (33%) and differentiating between the immediate and underlying cause of death (37%). The sub-optimal performance was not observed among doctors in forensic pathology as death certification forms part of their core curriculum and therefore are exposed to training and regular reinforcements as they deal with the topic routinely. In fact, majority of the doctors who reported ever attending a CME meeting on medical certification of cause of death in Limpopo Province were trained by the forensic pathology team in Pietersburg hospital. The poor performance on the themes above was a clear indication of the lack of training on medical certification of

cause of death. The implication of the inability to identify unnatural deaths is that such deaths are not being referred to forensic pathology services as required by law (Inquest Act) and thus unnatural deaths occurring in the wards may be under-estimated. The lack of understanding of the concept of the underlying cause of death, was confirmed by case scenarios. Only 32% of doctors were able to identify the correct underlying cause of death. This has tragic consequences for compilation of mortality data simply because mortality data is compiled on the basis of a correctly identified and coded underlying cause of death. This likely reflects a lack of understanding of the concept and most likely its importance because of lack of training. These themes need to be thoroughly clarified when designing workshops or preparing presentations on the topic.

5.4 Performance by clinical discipline

Looking at clinical disciplines, paediatrics and obstetrics & gynaecology had fewer proportion of doctors achieving adequate score (47% and 42% respectively). This may relate either to the frequency of completing the DNF or the perceived importance (or lack thereof) of the topic. However this may hold true for obstetrics where majority of maternal deaths are largely unnatural deaths and therefore referred to forensic pathology services for a post-mortem. But maternal deaths from medical causes such as non-pregnancy related infections (e.g. HIV) need to be accurately captured as prevention efforts are likely to be successful when directed at the actual underlying causes. Forensic pathology had the highest proportion of doctors having adequate knowledge. Although represented by only six doctors, which can bias the results, training on death certification forms part of their core curriculum and routine work. Also, the performance of this discipline was not diluted by inexperienced medical interns or junior doctors. It is important to note that death certification training in Pietersburg hospital is conducted by forensic pathology department. But given that only a few (54) doctors were trained, perhaps the multidisciplinary nature of the CPD meeting lends itself to poor attendance or maybe such meetings are just few and far in between. The other clinical disciplines which showed adequate knowledge were internal medicine and surgery with at least 60% of doctors

obtaining at least a 60% score. But unlike forensic pathology, these disciplines, like the rest, had inadequate performance on identifying unnatural deaths, the underlying cause of death and differentiating between immediate and unnatural causes of death.

5.5 Performance by rank

Medical interns tended to perform poorly compared to other ranks across all knowledge areas, most likely due to lack of training and inexperience. This was exaggerated in the “difficult knowledge areas” with only 13% and 24% of medical interns showing adequate knowledge in identifying unnatural deaths and underlying cause of death respectively. In contrast, and expectedly, a higher proportion of medical specialists (70%) had adequate knowledge. This is a concern since it is common practice that DNFs are completed by the most junior doctor in the unit and not by specialists. It also raises questions about the training and supervision of the medical interns regarding medical certification as the results suggest that the certification skills are not being adequately imparted to juniors. Perhaps just like the most senior doctor takes full responsibility for the clinical management of a patient, they should do the same for medical certification of cause of death. Completion of a DNF must be done in consultation with the senior doctors and perhaps be discussed routinely during morbidity and mortality meetings following the same ICD rules. The latter may also improve local morbidity and mortality data.

5.6 Identifying the correct underlying cause of death

The underlying cause of death is arguably the most important in that it is generally what is coded as the cause of death in compilation of mortality statistics and must be aetiologically specific (Brooks and Reed 2015). The inability to select the correct underlying cause of death, the disease or injury that initiated a sequence of events leading directly to the death, has serious implications for mortality data. A correct selection of the underlying cause of death allows the condition to appear in the top 10 leading causes of death and even form part of the burden of disease profile for the population. Such conditions are naturally prioritised for control and

most importantly, massive resources are allocated to programmes that seek to address them. From a public health perspective, the most effective strategy is to prevent the underlying cause of death (Brooks and Reed 2015), such that if prevention efforts are effective all the complications and sequelae that usually follow are eliminated before they start. For instance, by effectively preventing HIV infection, the health system will not have to deal with all the opportunistic infections arising out of immunosuppression from HIV. But as reported in other studies (Nolijana et al 2009:648; Groenewald et al 2005:194), participants in our study were reluctant to write Human Immunodeficiency virus (HIV) infection on the DNF. Less than a third (32%) of doctors actually indicated HIV infection as the underlying cause of death in one of the case scenarios. As reported in other studies, Nolijana et al 2009, doctors preferred to write terms like Retroviral disease and immunosuppression even when there were no confidentiality concerns in the context of our study. But this was interpreted to reflect current ingrained practice.

The Stats SA mortality reports have a column for “certain disorders involving the immune mechanism” and another for “viral diseases not elsewhere specified”. In 2011, both these conditions appeared in the top 10 leading causes of death in Limpopo Province, but HIV infection was not part of the top ten leading underlying causes of death (Burger et al 2015). This was attributed to under-reporting since opportunistic infections (pneumonias, tuberculosis and intestinal infectious diseases) all appeared in the top 10 list. To emphasize this point, tuberculosis as well as pneumonia and influenza have consistently been the number 1 and 2 leading underlying cause of death (respectively) according to Stats SA reports since 2001, the year in which the condition “certain disorder involving the immune mechanism” broke into the top ten leading cause of death, replacing HIV (Stats SA 2005, Stats SA 2016).

Concerns raised by medical practitioners during nation-wide capacity building workshops by a national task team (discussed later) regarding the under-reporting of HIV on DNF include concerns about patient confidentiality, the impact on life insurance and other policy claims and the mistaken belief that reporting

HIV on the DNF was not allowed (Burger et al 2015). But all these concerns are no longer valid because the 2014 amendment of the Births and Deaths Registration Act provides for the self-sealing mechanism of the DNF after completion which can only be opened by Stats SA (Burger 2015), safe-guarding the confidentiality of the form and obviating the need for envelopes. Insurance companies do not require a DNF for a claim, to process a claim they require an abridged death certificate, which indicate only “natural or unnatural death” and is issued by DHA. Furthermore, apparently the South African government has since 2005 outlawed an exclusion clause for insurance pay out only on the basis of HIV. But the insurance fine print may have other conditions such as waiting period or non-disclosure as a reason for non-payment (Burger et al 2015). The self-sealing mechanism implies that once the doctor completes the DNF and seals it, it can only be opened by Stats SA staff for coding and compilation of mortality statistics.

5.7 Correct sequencing in Part I of the DNF

Another aspect of the case scenarios that doctors struggled with was reporting of the causal chain of events leading to death in Part 1 of the DNF. The conditions must be listed sequentially from the immediate or most recent condition that led to death on line a, through the intermediate causes in line b and c, to the underlying cause of death in line d or the lower most entry (Brooke and Reed 2015). The correct sequencing was recorded by 40% to 60% of doctors for the case scenarios. Similar to the rate (36% to 54%) recorded by Pieterse et al (2009) among medical interns at an academic tertiary hospital. Considering that according to the rules, the condition below must be able to give rise to the one above it, the only explanation why qualified doctors could not get it right is lack of training. The sequence is meant to provide an accurate, logical and chronological account of the conditions that led to death (Brooke and Reed 2015) and can assist coders to correctly identify the underlying cause if the certifier was unable to.

5.8 Summary

Gender, age, clinical discipline, level of care and district were not found to be associated with adequate knowledge of the ICD rules of medical certification of cause of death on chi square test. The implication for this is that training must be extended to all the doctors in all hospitals across the province. A chi square test found the following factors to be significantly associated with achieving an overall score of at least 60%, years of clinical experience ($p=0.010$), previous training ($p<0.001$), awareness of guidelines ($p=0.04$), level of comfort with DNF completion ($p<0.001$) and rank ($p=0.002$). Despite the difference in the profile of doctors and the tools for assessing knowledge, the same factors were associated with optimal performance in a study by Lakkireddy et al (2004). These findings underscore the importance of relevant training and the value of clinical experience.

In response to inadequacies of national mortality data, a task team comprised of staff representing Stats SA, the National Department of Health (NDOH), the burden of disease unit in the Medical Research Council (MRC) and the National Department of Home Affairs (NDHA) was formed in 2010/11 to build capacity across the country. They conducted 15 (2-day long) workshops in all the 9 provinces, training 288 doctors, mostly clinical managers. The plan was to train master trainers who will then be accredited and supported with resources to provide CPD accredited workshops in their localities. Of the 100 accredited trainers, only 27 conducted some form of training (Burger et al 2015). It turned out that clinical managers may have not been the most suitable cadre to target as potential master trainers given their reluctance to conduct further trainings. Although not specified as to which province the accredited trainers were based, it appeared that none of the trainers who conducted further training were from Limpopo Province. This is because the few doctors who reported being trained in the study, cited either the 2-day “train-the trainer” workshop by the task team or one of a few CMEs done by the forensic pathology department in Pietersburg hospital. It would seem that, the choice of clinical managers as potential master trainers disadvantaged the Limpopo doctors as no further workshops ever

happened in the province. This was probably aggravated by the over-protective approach taken by the task team to preserve the quality and integrity of the training by allowing only accredited master trainers to conduct the presentations and not make the presentations widely available. Interactive workshops, with robust discussions of technicalities and practical case scenarios were found to be the most effective form of education in improving the quality of death certification (Aung et al 2010).

During data collection for this study, such workshops were conducted immediately after the doctors had completed the questionnaire to clarify issues raised in the questionnaire. The 45 minute presentation was well received across all clinical disciplines with most clinical managers and heads of clinical units requesting a follow-up presentation as a refresher and to cover doctors who were not available on the day. At the end of data collection, over 300 doctors working in public hospitals in Limpopo Province which formed part of the study had been trained.

5.9 Limitations

The biggest limitation is that not all Limpopo hospitals were included in the study due to the topography of the province and time constraints. Further, only public hospitals were included in our study. The cross-sectional study design limited the analysis, as such univariate and multivariate logistic regression could not be performed as causality cannot be assigned in such studies. The use of chi square to assess association meant that we could not assess the differences within the groups, determine the strength of the association or tease out potential confounders. The poor turn-out in some regional hospitals meant that the entire district was under-represented which could bias the results. There was also an over-representation of Capricorn district since all the tertiary hospitals are based in the district. The selection of one district to represent all district hospitals, and a regional hospital to represent the entire district though it makes logistical sense, may have introduced some selection bias. It was reassuring however that the difference between the districts was not statistically significant. The same held

true for levels of care, which meant that participants in our study were in many respects a uniform group that can comfortably be compared. Due to doctors being a limited community, random sampling within a facility could not be performed as that would have limited the sample. Instead, doctors who were available on the day of data collection were asked to participate. Although an attempt at stratifying by level of care was attempted, doctors were not stratified by other parameters such as rank, clinical discipline, years of clinical experience or age-group. An over-representation of junior doctors, though a reflection of the profile of doctors in Limpopo Province, probably complicated the analysis by clinical discipline since junior doctors tend to rotate through various clinical departments for exposure. But the fact that they are supposed to be supervised wherever they rotate, meant that irrespective of their current station, supervision must have included medical certification of cause of death. Analysis was not done by facility since not all hospitals in the province were included, and because hospitals which have mostly junior doctors who were never trained would inadvertently have had poor performance and perhaps be stigmatised. This may also introduce reporting bias. The use of a questionnaire that was adapted from different sources (FPD online course, Stats SA Medical certification guidelines), although it went through face validity against the ICD rules of medical certification of cause of death, needs to be tested elsewhere and further strengthened as a national resource. Given the uses of the national mortality data and the international standards required for compilation, the knowledge level (≥ 60%) chosen for this study was quiet low and efforts to improve this knowledge need to be prioritised. Despite these limitations, the finding of lack of training was extremely important and needs urgent attention in order to turn the situation around.

5.10 Contributions of the study

The study identified an urgent need for training of doctors across all health facilities in Limpopo Province. It went further to highlight knowledge areas that need to be thoroughly explained during the training. Training has been shown to improve the quality of medical certification of cause of death in other studies. The study makes recommendations which if implemented, will improve the quality of

mortality data and allow the province to monitor population health, make policy decision and allocate limited resources sensibly using high quality data.

5.11 Conclusion

Knowledge on the ICD rules governing the accurate completion of the DNF although fair in this study, areas of concern were identified. Few doctors had adequate knowledge on identifying unnatural deaths, an understanding of the concept of underlying cause of death and differentiating between immediate and underlying cause of death. This was confirmed by the inability of the doctors to correctly identify the underlying cause of death in case scenarios. These concepts need to be emphasized during training. Few doctors in Limpopo Province have been trained and therefore need training. Senior doctors need to take more responsibility for death certification and must impart certification skills to junior doctors. The strength of the study was in its ability to assess both the theoretical and practical aspects of medical certification of cause of death and relate that to the certifiers.

5.12 Recommendations

The Limpopo Department of Health needs to commission a province-wide training campaign targeted at all doctors in all facilities at all levels of care including doctors in the private sector as they contribute to mortality data. Once all doctors in all hospitals have been trained, newly qualified (interns) and new recruits must also undergo such training with regular reinforcements in respective facilities. Medical certification of cause of death is such an important legislative, epidemiological and policy imperative that annual CPD programmes in all hospitals must make provision for this topic. Doctors must be informed about other resources that can be used to re-inforce their knowledge, i.e. online courses or resources by FPD or WHO and the guidelines compiled by Stats SA must be available in all facilities. The inclusion of the topic at undergraduate level has been debated, with some authors questioning the relevance at that level since medical students do not actually complete the DNFs. However, there is consensus to include the topic in post-graduate studies.

Training at induction and regularly thereafter cannot be overemphasised. Perhaps after training, the most important activity would be to discuss the topic and apply its principles during morbidity and mortality meetings as part of clinical governance in all hospitals or clinical units. This may have positive spin-offs for the quality of local (facility-based) morbidity and mortality data. It will also give senior doctors an opportunity to impart knowledge and certification skills to junior doctors. This project may present an opportunity for a closer collaboration and regular engagements between Stats SA and the certifiers (represented by doctors with knowledge and interest in the topic) to address challenges affecting mortality data. Statistics South Africa may need to consider implementing some quality assurance measures aimed at random or regular audits of DNFs to assess compliance with the ICD rules and provide feedback to the certifiers.

The core curriculum for a training course or workshop has been mentioned elsewhere (Aung et al 2015, WHO 2010, Pieterse et al 2009) and must be adhered to during preparation for workshops (See Annexure I). Other provinces are advised to assess the level of knowledge among their doctors so that training can be extended where it is needed.

6. REFERENCES

Aung, E, Rao, C & Walker, S. 2010. *Teaching cause-of-death certification: lessons from international experience.* Postgrad Med J 2010; 86:143e152. (doi:10.1136/pgmj.2009.089821)

Boerma, T, Harrison, J, Jakob, R, Mathers, C, Schmider, A & Weber S. 2016. *Revising the ICD: explaining the WHO approach*. Published Online October 13, 2016 at www.thelancet.com (http://dx.doi.org/10.1016/)

Brink, H, van der Walt, C & van Rensburg, G. 2014. *Fundamentals of Research Methodology for Healthcare Professionals*. 3rd Edition. Cape Town: Juta & Company Limited. ISBN 978 0 7021 8689 9

Brooks, G, E & Reed, D, K. 2015. *Principles and Pitfalls: a Guide to Death Certification.* Clinical Medicine & Research Volume 13, Number 2: 74-82 (doi: 10.3121/cmr.2015.1276)

Burger, E, H, Groenewald, P, Rossouw, A & Bradshaw D. 2015. *Medical certification of death in South Africa – moving forward*. S Afr Med J 2015;105 (1):27-30. (DOI:10.7196/SAMJ.8578)

Cambridge, B & Cina, J, S. 2010. *The Accuracy of Death Certificate Completion in a Suburban Community*. Am J Forensic Med Pathol 2010; 31: 232–235

Carter, K, Hufanga, S, Rao, C, Akauola, S, Lopez, D, A, Rampatige, R & Taylor R. 2012. *Causes of death in Tonga: quality of certification and implications for statistics. Population Health Metrics* 2012, 10:4. Available online at http://www.pophealthmetrics.com/content/10/1/4 (doi:10.1186/1478-7954-10-4)

Department of Home Affairs, South Africa. 2009. *Notice of death/ stillbirth. DHA-1663 B* DHA. See Department of Home Affairs

Devis, T & Rooney, C. 1999. *Death certification and the epidemiologist*. Office of national statistics. Health statistics quarterly 01

Ehrlich, R & Joubert, G. 2014. *Epidemiology: A Research Manual for South Africa*. 3rd Edition. Cape Town: Oxford University Press, Southern Africa. ISBN 9780199059713

Foundation for Professional Development. Death Certificate Short-Course (E-learning). Available online at www.foundation.co.za/onlinecourses

Furness, N, P, Fletcher, K, A, Shepherd, A, N, Bell, B, Shale, D & Griffin, K. 2016. *Reforming death certification: Introducing scrutiny by Medical Examiner. Lessons from the pilots of the reforms set out in the Coroners and Justice Act 2009.* Published May 2016 at www.gov.uk/dh

Groenewald, P, Nannan, N, Bourne, D, Laubscher, R & Bradshaw, D. 2005. *Identifying deaths from AIDS in South Africa.* AIDS 2005, 19:193–201

Haque, A, S, Shamim, K, Siddiqui, N, H, Irfan, M & Khan, J, A. 2013. *Death certificate completion skills of hospital physicians in a developing country.* BMC Health Services Research 2013 **13**: 205 (**DOI:** 10.1186/1472-6963-13-205)

Joubert, J, Rao, C, Bradshaw, D, Vos, T & Lopez, A, D. 2013. *Evaluating the Quality of National Mortality Statistics from Civil Registration in South Africa, 1997–2007*. PLoS ONE 8(5): e64592. (doi:10.1371/journal.pone.0064592)

Lahti, R, A & Penttila A. 2000. *The validity of death certificates: routine validation of death certification and its effects on mortality statistics*. Forensic Science International 115 (2001) 15 – 32

Lakkireddy, R, D, Gowda, S, M, Murray, W, C, Basarakodu, R, K & Vacek, L, J. 2004. *Death Certificate Completion: How Well Are Physicians Trained and Are*

Cardiovascular Causes Overstated? AmJ Med. 2004; 117: 492– 498**.** **(**doi:10.1016/j.amjmed.2004.04.018)

Lehohla P. 2012. *Cause of Death Certification: A guide for completing the Notice of Death/Stillbirth (DHA-1663).* Statistics South Africa, Training manual

Lu, T, H, Shau, W, Y, Shih, T, P, Lee, M, C, Chou, M, C & Lin, C, K. 2000. *Factors associated with errors in death certificate completion: A national study in Taiwan.* Journal of Clinical Epidemiology 54 (2001) 232–238

Lu, T, H, Anderson, N, R & Kawachi, I. 2010. *Trends in Frequency of Reporting Improper Diabetes-related Cause-of-Death Statements on Death Certificates, 1985–2005: An algorithm to Identify Incorrect Causal Sequences.* Am J Epidemiol 2010; 171: 1069–1078

Mahapatra, P, Shibuya, K, Lopez, D, A, Coullare, F, Notzon, C, F, Rao, C & Szreter, S, S. 2007*. Civil registration systems and vital statistics: successes and missed opportunities*. Published online October 29, 2007 at www.thelanctet.com (DOI: 10.1016/S0140-6736(07)61308-7)

Mahdavi, A, Sedghi, S, Sadoghi, F & Azar, F, E, F. 2014. *Assessing the Awareness of Agents Involved in Issuance of Death Certificates About Death Registration Rules in Iran*. Global Journal of Health Science; Vol. 7, No. 5; 2015 (doi:10.5539/gjhs.v7n5p371)

Mathers, D, C, Fat, D, M, Inoue, M, Rao, C & Lopez, D, A. 2005. *Counting the dead and what they died from: an assessment of the global status of cause of death data*. Bulletin of the World Health Organization 2005, 83 (3)

Mieno, M, N, Tanaka, N, Arai, T, Kawahara, T, Kuchiba, A, Ishikawa, S & Sawabe M. 2015. *Accuracy of Death Certificates and Assessment of Factors for*

Misclassification of Underlying Cause of Death. J Epidemiol 2016; 26(4):191-198 (doi:10.2188/jea.JE20150010)

Myers, A, K & Farquhar, R, E, D. 1998. *Improving the accuracy of death certification*. CMAJ 1998; 158: 1317-23

Nojilana, B, Groenewald, P, Bradshaw, D & Reagon, G. 2009. *Quality of cause of death certification at an academic hospital in Cape Town, South Africa*. S Afr Med J 2009; 99: 648-652.

National Department of Health, South Africa. 2014. *Strategic Plan 2014/15 – 2018/19* ISBN 978-0-621-42474-4 NDOH. See National Department of Health

Pieterse, D, Groenewald, P, Burger, E, Kirk, G & Bradshaw D. 2009a. *Cause of Death Certification: A Guide for completing the Death Notification Form (DNF) – BI-1663.* Cape Town: South African Medical Research Council (SA MRC)

Pieterse, D, Groenewald, P, Bradshaw, D, Burger, H, E, Rohde, J & Reagon G. 2009b. *Death certificates: Let's get it right!* S Afr Med J 2009, 99: 643-644

Scotland Healthcare Improvement. 2015. *Death Certification in Scotland: Questions and Answers*. Published May 2015 at http://www.healthcareimprovementscotland.org/our_work/governance_and_assurance/death_certification.aspx

Setel, W, P, Macfarlane, B, S, Szreter, S, Mikkelsen, L, Jha, P, Stout, S & Abou Z, C. 2007. *A scandal of invisibility: making everyone count by counting everyone*. Published online October 29, 2007 at www.thelancet.com (DOI: 10.1016/S0140-6736(07)61307-5)

South African Government. 1992. *Births and Registration Act 51 of 1992.* Government Gazette volume 323 No 13953 Accessed at www.gov.za/files/a51_1992.pdf SAG. See South African Government

South African Government. 1959. Inquest Act No 58, as amended. Available at https://www.gov.za/documents/inquests-act-3-jul-1959-0000

Statistics South Africa. 2005. Mortality and causes of death in South Africa, 1997–2003: Findings from death notification. Available at http://www.statssa.gov.za

Statistic South Africa. 2012. Cause of Death certification: A guide for completing the Notice of Death/Stillbirth (DHA-1663). Available at http://www.statssa.gov.za

Statistics South Africa. 2014. *Mortality and causes of death in South Africa, 2011: Findings from death notification*. Statistical release. Available at www.statssa.gov.za Stats SA. See Statistics South Africa

Statistics South Africa. 2016. *Mortality and causes of death in South Africa, 2014: Findings from death notification*. Statistical release. Available at www.statssa.gov.za

United Nations. 1998. *Handbook on Civil Registration and Vital Statistics Systems: Computerization*. Department of Economic and Social Affairs· Statistics Division UN. See United Nations

World Health Organisation. 2010. *International statistical classification of diseases and related health problems: Instruction manual - 10th revision.* 2010 edition volume 2 WHO. See World Health Organization

World Health Organisation. 2013. *Strengthening civil registration and vital statistics for births, deaths and causes of death: Resource kit*. WHO Library Cataloguing-in-Publication Data. ISBN 978-92-4-150459-1

7. ANNEXURES

7.1 Annexure A: Timeframes

ACTIVITY	TIME FRAME
TREC (Ethical) approval	31 August2017
Provincial permission obtained	14 October 2017
District permissions	16 October to 17 November 2017
CEO permissions	20 October to 24 November 2017
Data collection	01 November 2017 to 08 January 2018
Data capturing	06 November 2017 to 12 January 2018
Data analysis	15 January to 15 February 2018
Report writing	15 February to 15 March 2018
First draft of research report	19 March 2018
Review by supervisors	19 March to 02 April 2018
Corrections	02 April to 13 April 2018
Corrected report	20 April 2018
Review by HOD	23 April to 21 May 2018
Final report	28 May 2018

7.2 Annexure B: Death notification process in South Africa

<table>
<tr><th>CERTIFYING DOCTOR</th><th>UNDERTAKER</th><th>DEPARTMENT OF HOME AFFAIRS</th><th>STATISTICS SOUTH AFRICA</th></tr>
<tr><td>1. Doctor examines body, verifies death and identity of deceased</td><td rowspan="3">6. Undertaker completes section E and takes his/ her thumbprint and the fingerprints of the informant and deceased (unless it was an unnatural death when a forensic pathologist takes thumbprints</td><td>8. & 9 Checks DHA 1663 for accuracy, completeness and supporting documents</td><td>14. Organise forms and code socio-economic and geographic information</td></tr>
<tr><td>2. Doctor completes section A, B or C and G of DHA-1663</td><td rowspan="2">10. Register death on National Population Register if deceased has South African Identity Document (ID) number</td><td rowspan="2">15. Code multiple cause of death information to International Classification of Diseases (ICD)</td></tr>
<tr><td rowspan="3">3. & 4. Doctor seals page 1 of 1, DHA 1663B and attaches the rest of DHA-1663A and hands to informant or undertaker</td></tr>
<tr><td rowspan="4">7. Undertaker or informant submits documents to Department of Home Affairs</td><td rowspan="3">11. Print and issue abridged death certificate</td><td>16. Capture information</td></tr>
<tr><td rowspan="2">17. identify underlying cause of death</td></tr>
<tr><td>INFORMANT</td></tr>
<tr><td>5. Informant completes section D of DHA-1663 and provides left thumb print</td><td>12. & 13. Send DHA-1663 via regional DHA office to national DHA office for batching and collection by Stats SA</td><td>18. Compile national statistics</td></tr>
</table>

(Lehohla 2012: 6)

7.3 Annexure C: DHA-1663

NOTICE OF DEATH / STILL BIRTH

DHA-1663 G

Page 1 of 1

Confirmation for Medical and Health use Only

(After completion seal to ensure confidentiality)

To be completed in full and submitted at the Department of Home Affairs' office by the informant or authorised party. The form to be completed in black ink with **BLOCK LETTERS**. Please mark with ☑ the CORRECT box, where required.
All fields are COMPULSORY. Incomplete applications and applications that are not legible may be considered invalid.

File no _____ Date _____

G. MEDICAL CERTIFICATE OF CAUSE OF DEATH

Instructions: Section G is to be filled out by Medical Practitioner /Professional Nurse / Forensic Pathologist, who has determined the cause of death

PARTICULARS OF DECEASED

67. Identity No. (Passport No. if foreigner)

68. Gender 68.1 Male 68.2 Female 68.3 Indeterminable

69. Surname

70. Forenames

71. Population Group 71.1 African 71.2 White 71.3 Indian/Asian 71.4 Coloured 71.5 Other (specify) _____

72. Place of Death 72.1 Hospital/Inpatient 72.2 ER/Outpatient 72.3 DOA 72.4 Nursing Home 72.5 At Home 72.6 Other (specify)

73. Name of Health Facility/Practice

74. Facility Contact Telephone No. incl. Area Code

75. Patient File No.

76. Contact Person at Facility: Surname

Forenames

Rank/Rank

G.1 FOR DEATHS OCCURRING AFTER ONE WEEK OF BIRTH

Instructions: Section G.1 is to be completed for all deaths that occurred after one week of birth

77. CAUSES OF DEATH

For office use only

ICD-10

Part 1 Enter the diseases, injuries or complications that caused the death. Do not enter the mode of dying, such as cardiac or respiratory arrest, shock or heart failure. List only one cause on each line

Approximate interval between onset and death (Days / Months / Years)

IMMEDIATE CAUSE (final disease or condition resulting in death) a) _____

Due to (or as a consequence of)

Sequentially list conditions, if any, leading to immediate cause. b) _____

Due to (or as a consequence of)

Enter UNDERLYING CAUSE last (Disease or injury that initiated events resulting in death) c) _____

Due to (or as a consequence of)

d) _____

Part 2 Other significant conditions contributing to death but not resulting in underlying cause given in Part 1 _____

78. If a female, was she pregnant at the time of death or up to 42 days prior to death? (☑) 78.1 Yes 78.2 No

79. Method used to ascertain the cause of death (tick all that apply):

79.1 Autopsy 79.2 Post mortem examination 79.3 Opinion of attending medical practitioner 79.4 Opinion of attending medical practitioner on duty

79.5 Opinion of registered professional nurse 79.6 Interview of family member 79.7 Other (specify) _____

G.2 FOR STILL BIRTHS AND DEATHS OCCURRING WITHIN ONE WEEK OF BIRTH (PERINATAL DEATHS)

Instructions: Section G.2 is to be completed for all still births and deaths that occurred within one week of birth (perinatal deaths)

Mother

80. Identity Number

81. Date Of Birth Y Y Y Y M M D D

82. Age of last birthday/ DoB unknown

83. Number of previous pregnancies resulting in:

83.1 Live births 83.2 Still births 83.3 Abortions

84. Outcome of last previous pregnancy (tick one):

84.1 Live birth 84.2 Still birth 84.3 Abortion

85. Date of last previous delivery Y Y Y Y M M D D

86. First day of last menstrual period Y Y Y Y M M D D

Or, if unknown, estimated duration of pregnancy (in completed weeks)

87. Method of delivery: 87.1 Spontaneous 87.2 Forceps delivery 87.3 Forceps and rotation 87.4 Vacuum extractor 87.5 Caesarean section 87.6 Other (specify) _____

88. Antenatal care two or more visits: 88.1 Yes 88.2 No 88.3 Unknown

Child

89. Type of death: 89.1 Still birth 89.2 Live birth

90. Birth weight (in grams)

91. This birth was: 91.1 Single birth 91.2 First twin 91.3 Second twin 91.4 Other multiple

92. If still born, heartbeat ceased:

92.1 Before labour

92.2 During labour but before delivery

92.3 Before delivery but not known whether before or during labour

93. If death occurred within 24 hours after birth, number of hours alive

94. Attendant at birth:

94.1 Physician

94.2 Trained midwife

94.3 Other trained person (specify) _____

94.4 Other (specify) _____

95. CAUSES OF DEATH

a. Main disease or conditions in foetus or infant _____

b. Other diseases or conditions in foetus or infant _____

c. Main maternal disease or condition affecting foetus or infant _____

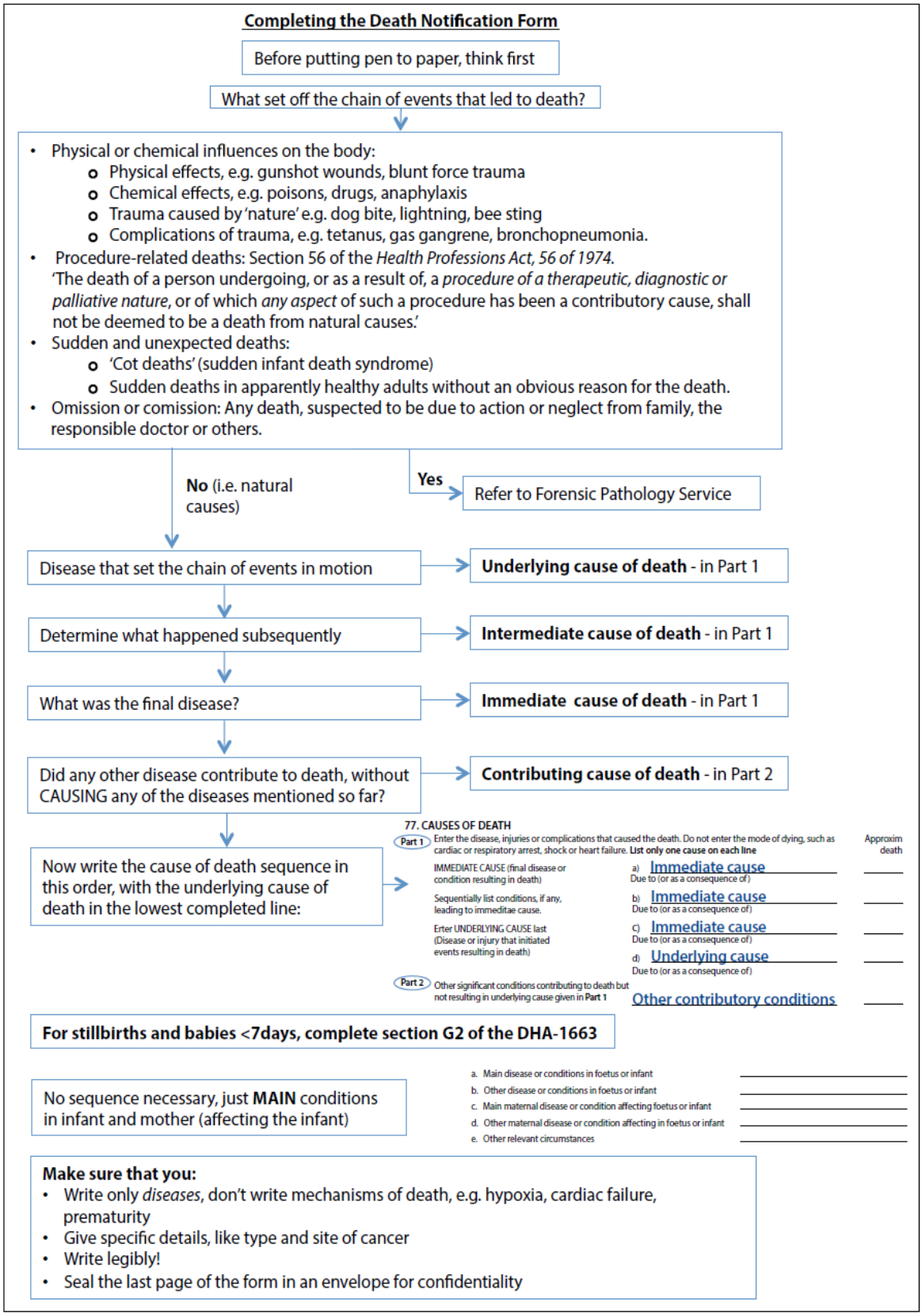
d. Other maternal diseases or conditions affecting foetus or infant _____

e. Other relevant circumstances _____

96. Autopsy Information (☑)

96.1 Certified causes of death has been confirmed by autopsy 96.2 Autopsy information may be available later 96.3 Autopsy not performed

7.4 Annexure D: Completing the Death Notification Form



Burger et al. 2015. S Afr Med J; 105(1)

7.5 Annexure E: Consent form

CONSENT FORM

Statement concerning participation in a Research Project.

Name of Study:

Factors influencing knowledge of doctors on medical certification of cause of death in Limpopo Province

I have been told about the aims and objectives of the proposed study and was provided the opportunity to ask questions and given adequate time to rethink the issue. The aim and objectives of the study are sufficiently clear to me. I have not been pressurized to participate in any way.

I understand that participation in this Study is completely voluntary and that I may withdraw from it at any time and without supplying reasons. This will have no influence on my employment condition and I appreciate that the study is trying to assist the Limpopo Department of Health to achieve its goal of assisting the community of Limpopo Province to attain a long and heathy life through better planning.

I know that this Study has been approved by Limpopo Department of Health Research Committee. I am fully aware that the results of this Study will be used for scientific purposes and may be published. I agree to this, provided my privacy is guaranteed.

I hereby give consent to participate in this Study.

Signature of participant……..Place……

Date…… Witness……

Statement by the Researcher

- I provided verbal information regarding this Study.
- I agree to answer any future questions concerning the Study as best as I am able.
- I will adhere to the approved protocol.

Name of Researcher…….....Signature…….

Date……Place…….

7.6 Annexure F: Participant information reference

Title of the study

Factors influencing knowledge of doctors on medical certification of cause of death in Limpopo Province

Aim of the study

To investigate factors influencing the level of knowledge of doctors on the medical certification of cause of death in Limpopo Province. The study will use an anonymous questionnaire to collect the demographic characteristics of participants and the score obtained for the questions will be used as a marker of the level of knowledge of participants.

The study is meant to identify the knowledge gaps in the medical certification of cause of death and the category (-ies) of doctors most affected. The idea is to assist doctors employed by the Department of Health to complete the death notification form as accurately as possible. This will allow StatsSA to produce quality mortality statistics that can confidently be used for planning and allocation of resources

The research will make us understand what the problems are and to make evidence-based recommendations on interventions.

No personal identifiers are required and the identity of all participants will be protected at all times. Participants are strongly encouraged to participate in the study but are free to withdraw at any time.

7.7 Annexure G: Questionnaire on medical certification of cause of death

THE MEDICAL CERTIFICATION OF CAUSE OF DEATH (MCCoD) QUESTIONNAIRE FOR DOCTORS						
Age group	**< 25**	**25 – 34**	**35 – 44**	**45 – 54**	**≥ 55**	
Actual age						
Gender	**M**	**F**				
Hospital			**Clinical Discipline**			
Regular Workstation (if no clinical discipline/ ward)						
Years of experience as a Doctor: since qualified	**< 2**	**2 – 5**	**> 5 – 10**	**> 10**		
Rank:	**Intern**	**Medical Officer 1/ Community Service**	**Medical Officer 2or3**	**Registrar**	**Clinical Manager**	**Specialist**	**Other**
Years of experience working in your current position or rank: Years:				**Months:**		
Previous training on cause of death certification:	**No**	**Yes**				
Training organised by	**Year**					
Training on cause of death certification at undergraduate level:	**Yes**	**No**	**Can't Remember**			
If not trained in South Africa, country of study						
Awareness of on-line death certification course: Yes No	**Ever took it: Yes No**					
Online course offered by:						
Aware of the guidelines on cause of death certification	**Yes**	**No**				
Guidelines published or prepared by:						
Ever attended a CPD session on cause of death certification? Yes No When: MM/YYYY						
CPD Organised by:						
Would you attend a CPD meeting on medical certification on cause of death? Yes	**No**					
Level of comfort with medical certification of cause of death: Low	**Moderate**	**High**				
Do you feel the need for (further) training in medical certification of cause of death Yes	**No**					

1. When completing the death notification form the following is/are <u>allowed</u>: True (T) or False(F) or Don't Know(DK)	T	F	DK
A. Commonly used abbreviations (e.g. RVD, MI, ISS, HPT etc.) since they are known to all doctors			
B. Mechanisms of death (renal-, respiratory-, cardiac-, liver- failure) alone, without the underlying cause			
C. A probable(provisional) diagnosis even if the condition has not been definitely diagnosed			
D. A complete list of all conditions present at the time of death in no particular order			
E. All the conditions present at the time of death but were not in the causal sequence			
F. Two or more conditions in any line (a, b, c or d) of Part 1 of the death notification form			
G. Two or more conditions in Part 2 (contributory causes) of the Death notification form			
2. For natural causes of death the following <u>must</u> be included: T or F or DK	T	F	DK
A. The manner of death (circumstances surrounding the death)			
B. The underlying cause of death (what initiated the chain of events leading up to the death)			
C. The complications or diseases leading up to the death			
D. Conditions contributing but not linked directly to the underlying cause of death			
E. The estimated interval between the onset of disease or complication and death			
3. The medical practitioner must complete a death notification for: T or F or DK	T	F	DK
A. Dead on arrival in the emergency department with no signs of injury			

B. For any patient that dies while still under investigation, even without a definite diagnosis			
C. Following a fatal adverse drug reaction (anaphylactic reaction or Steven-Johnson Syndrome)			
D. If death followed an insertion of intercostal drainage for spontaneous pneumothorax			
E. If a death occurs following an insertion of a central venous pressure (CVP) line			
F. Organophosphate poisoning (accidental)			
G. Organophosphate poisoning (intentional)			
H. Drug overdose (intentional)			
I. Drug overdose (accidental)			
J. Aspiration pneumonia in a patient with status epilepticus			
K. An epileptic who sustained burns and dies from sepsis and dehydration			
L. Fell from a bed during an epileptic fit and suffered head injury with intracranial haemorrhage			
4. Mark the following statements as True or False: The underlying cause of death is:	T	F	DK
A. Complication directly causing the disease or death			
B. The disease that initiated a cascade of events leading directly to death			
C. The physiologic/ biochemical derangement that complicates the primary cause of death			
D. Important from a prevention point of view			
E. The circumstances of the violence or accident that produced the fatal injury			
F. For death due to opportunistic diseases/infections, the underlying cause of death is AIDS			
G. For death due to opportunistic diseases/infections, the underlying cause of death is HIV infection			
H. There can only be one underlying cause of death for any given death			
I. The underlying cause of death must be capable of giving rise to all the conditions above it			
5. In the absence of an underlying cause of death, the following should not be used as causes of death: True or False	T	F	DK
A. Cardiac arrest			
B. Delirium			
C. Respiratory failure			
D. Pneumonia			
E. Senility (Old age)			
F. Renal failure			
6. The following are good examples of underlying cause of death: True or False	T	F	DK
A. Pulmonary thrombo-embolism			
B. Bronchopneumonia			
C. Haemorrhagic shock			
D. AIDS			
E. Cardiac failure			
F. HIV			
G. Hypertension			
H. Specific Cancer			
I. Pulmonary oedema			
J. Ischaemic heart disease			
K. Immunosuppression			
7. The purpose of death notification may include the following: True or False	T	F	DK
A. Monitoring the population's health profile			

B. Designing and evaluating public health interventions			
C. Recognising priorities for medical research and health services			
D. Follow up of patients' diseases			
E. Planning health services			
F. Allocation of resources (human, finances, infrastructure)			
G. Assessing the effectiveness of the health services or interventions			
H. Guide policy development			
I. Settle the deceased's estate			
J. Facilitate a claim for insurance or pension benefits			
8. About unnatural deaths: True or False	T	F	DK
A. They include all cases where an external influence acted on the body			
B. They include all sudden and unexpected			
C. They include death during or as a result of a medical procedure			
D. They include acts of negligence from health care providers or relatives			
E. Must be reported to the police for investigation			
F. Includes all cases of injuries and falls including lightning strike			
G. Includes all cases of poisoning and overdose			
H. Includes cases of death as a result of anaphylactic reaction			
I. Must undergo a post mortem by a forensic pathology practitioner			
J. Includes cases where a clinician suspects foul-play, even if they cannot prove it			
9. With regards to confidentiality and completion of the death notification: True or False	T	F	DK
A. HIV/ AIDS cannot be included as the underlying cause of death as it violates the deceased's confidentiality			
B. The medical practitioner uses his/her discretion as to whether he/ she wants to write HIV/AIDS as the underlying cause of death because patients die from opportunistic infections anyway			
C. The medical practitioner cannot write HIV/AIDS because the insurance will not pay out			
D. In order to ensure confidentiality, part B of the death notification (DHA 1663) form (the last page) should be placed in a sealed envelope to be sent to the Department of Home Affairs			
E. It is not necessary to include HIV/AIDS as the cause of death as patients die of opportunistic infections			
F. The term immunosuppression can be used to mean HIV for statistical and ethical reasons			
G. It is up to the relatives whether they want HIV/AIDS included in the cause of death certification			
H. The relatives have no right to know the what the deceased died of			
I. The final death certificate from the Department of Home Affairs contains all the conditions that contributed to or caused the death			
J. The term Retroviral disease can be used to refer to HIV disease to maintain confidentiality			

7.8 Annexure H: Case scenarios

Using the short case scenarios below, doctors were asked to complete the attached DNF. Although the doctors were not told in advance, the cases were judged on:

1. The correct sequencing in line a through d
2. The correct selection of the underlying cause
3. The estimation of time interval
4. The use of abbreviations

Case Scenario 1: (Adults)

An 80 year old female stumbled and fell over while vacuuming at home and sustained a fracture of the neck of the left femur. She is on chronic treatment for Hypertension and Diabetes Mellitus. She had an operation for insertion of an intramedullary nail the following day. Four weeks later her condition deteriorated, she developed hypostatic pneumonia and died two days later

Case Scenario 1: (Paediatrics)

A 10-month-old child is brought in by his mother because of a fever, which has been present for approximately 3 days. On examination the child is found to be malnourished, being small for his age, and with neck stiffness. A lumbar puncture led to the diagnosis of H. Influenza meningitis, and IV treatment was started. After one day in hospital, the child became tachypnoeic, with bilateral crepitations in the lungs. He died a few hours later.

Case Scenario 2: (Adults)

A 40 year old male on antiretroviral treatment for 2 months and Tuberculosis (PTB) treatment for 4 month who seemed to be improving on treatment suddenly presents to hospital with severe shortness of breath. He was then admitted with a provisional diagnosis of Pneumocystis jerovecii pneumonia (PCP), did not respond to treatment and died 2 weeks later.

Case Scenario 2: (Paediatrics)

After normal term delivery a male infant died at 10 days from septicaemia after infection of umbilical cord stump due to poor hygiene. The MCS of stump swab cultured *Staph. Aureus*. The child also had purulent conjunctivitis. Although the child's HIV status is unknown (PCR results pending), the mother is on ART.

Mock DHA-1663 B form that was completed by the doctors based on the scenarios

Part 1. **Enter the disease, injuries or complications that caused the death**		**Approximate interval between onset and death (days, months, years)**	**For office use only**
Immediate cause of death	a) _____ Due to (or as a consequence of)		
	b) _____ Due to(or as a consequence of)		
Underlying cause (disease or injury that initiated events leading to death)	c) _____ Due to(or as a consequence of)		
	_____ d)		
Part 2. Other significant conditions contributing to death but not resulting in the cause given in Part 1 above			

EXPECTED ANSWERS

Case scenario 1: Adult

Immediate causes:

a) Hypostatic pneumonia
b) Prolonged immobilisation
c) Fractured neck of femur (operated)
d) Fell

Contributing factors: Hypertension, Diabetes Mellitus

Case Scenario 1: (Paediatrics)

Immediate causes

a) Severe Bronchopneumonia
b) *Haemophilus influenza* meningitis
c) Malnutrition

Case Scenario 2: (Adults)

Immediate causes

a) *Pneumocystis jerovecii* pneumonia
b) Immunosuppression
c) HIV infection

Contributing cause: Pulmonary Tuberculosis

Case Scenario 2: (Paediatrics)

Immediate causes

a) *Staphylococcus aureus* septicaemia
b) Omphalitis (Umbilical stump infection)
c) Poor hygiene

Contributing cause: Purulent conjunctivitis, HIV exposed

7.9 Annexure I: Minimum requirements for content when training on death certification

Theme or knowledge area /cluster	Content
1. Legislative framework	➢ Births and Deaths Registration Act ➢ Inquest Act ➢ Statistics Act ➢ Data quality Policy of Stats SA
2. Death notification process	➢ Different settings where death occurs and processes followed ➢ Indicate issues around DHA-1663 (DNF) and DHA-1680 (Death Reporting form) ➢ Highlight the route taken by the DHA-1663 form from completion to Stats SA ➢ How mortality data is compiled (from DNF completed by doctors)
3. Uses and value of data	➢ Uses for family ➢ Uses for DOH & DHA ➢ Uses for Stats SA
4. Natural vs unnatural deaths	➢ What is a natural death ➢ What constitute an unnatural death ➢ How to decide "it's advisable to consult forensic if unsure" ➢ Procedures followed for unnatural deaths ➢ When and how to refer to forensic
5. Rules for certifying deaths	➢ ICD rules for completion of DNF ➢ Clarify mechanisms, immediate and intermediate causes from diseases ➢ Concept of " garbage codes" ➢ Concept of "Underlying course of death" ➢ Cover issues on external causes, natural deaths, perinatal deaths, cancers ➢ Cover issues around "Best medical opinion"
6. Give practical examples from training courses: Stats SA training manual	➢ Consider your audience, may need to be discipline-specific ➢ Advice to avoid mechanisms, just disease entities ➢ Emphasise that the underlying cause must be aetiologically specific ➢ Scrutinise mortality data to make a point that there is a problem
7. Legal and ethical issues	➢ Confidentiality ➢ Accuracy of data ➢ Professional ethics ➢ Legal requirements and offences

Adapted from Aung et al 2010 & Stats SA guidelines on medical certification 2012

7.10 Annexure J: Distribution of participating doctors by facility (N=301)

TERTIARY HOSPITALS (145)					
	Pietersburg(84)		**Mankweng(61)**		
		⇩			
REGIONAL HOSPITALS (83)					
	Tshilidzini (34)	**Letaba (15)**	**St Ritas (14)**	**Mokopane (20)**	
		⇩			
DISTRICT HOSPITALS (73)					
Seshego (18)	**WF Knobel (8)**	**Helena Franz (8)**	**Lebowakgomo (21)**	**Botlokwa (9)**	**Zebediela (9)**

7.11 Annexure K: Turfloop Research Ethics Committee Clearance Certificate

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 4029, Fax: (015) 268 2306, Email: Abdul.Maluleke@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE CLEARANCE CERTIFICATE

MEETING: 31 August 2017

PROJECT NUMBER: TREC/253/2017: PG

PROJECT:

Title: Factors influencing the knowledge of Doctors on the medical certificate of cause of death in Limpopo Province, RSA

Researchers: MA Lekoloana
Supervisor: Dr NM Muvhango
Co-Supervisor: N/A
School: Medicine
Degree: Master of Medicine in Public Health Medicine

PROF TAB MASHEGO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:
i) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee.**
ii) **The budget for the research will be considered separately from the protocol.**
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

Finding solutions for Africa

7.12 Annexure L: Permission to conduct the study in Limpopo Province

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH

Enquiries: Stols M.L (015 293 6169) Ref:4/2/2

Lekoloana MA
P.O. Box 828
Bendorpark
0713

Greetings,

RE: Factors Influencing the knowledge of Doctors on the medical certificate of cause of death in Limpopo Province, South Africa

The above matter refers.

1. Permission to conduct the above mentioned study is hereby granted.
2. Kindly be informed that:-
   - Research must be loaded on the NHRD site (http://nhrd.hst.org.za) by the researcher.
   - Further arrangement should be made with the targeted institutions, after consultation with the District Executive Manager.
   - In the course of your study there should be no action that disrupts the services.
   - After completion of the study, it is mandatory that the findings should be submitted to the Department to serve as a resource.
   - The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
   - The above approval is valid for a 3 year period.
   - If the proposal has been amended, a new approval should be sought from the Department of Health.
   - Kindly note, that the Department can withdraw the approval at any time.

Your cooperation will be highly appreciated.

Head of Department

Date 12/10/2017

18 College Street, Polokwane, 0700, Private Bag x9302, POLOLKWANE, 0700
Tel: (015) 293 6000, Fax: (015) 293 6211/20 Website: http/www.limpopo.gov.za

7.13 Annexure M: Pietersburg Mankweng Research Ethics Committee Approval

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH AND SOCIAL DEVELOPMENT

Enquiries: Mr MA Poopedi
Manager: Clinical Research
University of Limpopo - School of Medicine
ananiaspoopedi@gmail.com

Ref: PMREC – 31/10/3/2017
Date: 31 October 2017

To: Dr MA Lekoloana (Principal Investigator)
Public Health Medicine
Pietersburg Hospital

Protocol Title:
Factors influencing knowledge of doctors on medical doctors on medical certification of cause of death in Limpopo province

Candidate: Dr MA Lekoloana
Approval Status: Approved

Kind regards

Dr FLM Hyera
Chair of Research: Polokwane/Mankweng Complex
Head: Public Health Medicine
University of Limpopo - School of Medicine

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