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**Data collection and management in medico-legal death investigation in South Africa:**

**An exploratory study**

Dissertation submitted in partial fulfilment of the requirements for the MSc degree in Medical Criminalistics,  
Faculty of Health Sciences, University of Pretoria

2023

**Candidate:**

Ms IO da Silva

u17016224

Faculty of Health Sciences

Department of Forensic Medicine

University of Pretoria

u1701622@tuks.co.za

**Supervisor:**

Professor G Saayman

Professor

Faculty of Health Sciences

Department of Forensic Medicine

University of Pretoria

gert.saayman@up.ac.za

**Co-supervisor:**

Dr S Rossouw

Acting Head of Department

Faculty of Health Sciences


Department of Forensic Medicine

University of Pretoria

servaas.rossouw@up.ac.za

## Declaration

I, the undersigned, hereby declare that the dissertation submitted to the University of Pretoria for the degree MSc (Medical Criminalistics) and the work contained therein, is my own original work and has not previously, in its entirety or in part, been submitted to any university for a degree. Where previously published work has been used, acknowledgement to the author(s) is provided in a reference list at the end of each chapter in the dissertation.

Signed:  on this day of 02/02/2023 2023

## **Acknowledgements**

I would like to thank the following people, without whom I would not have been able to complete this research, and without whom I would not have made it through this master's degree.

To my supervisor, Professor Gert Saayman, for your guidance and helping hand throughout the process of this research, from the conceptualisation of the study to the final product, and for reminding me to take a step back when I could not see the wood for the trees. To my co-supervisor, Dr Servaas Rossouw, for all your guidance and advice when I needed it. A big thank you to both of my supervisors for giving me the space to develop as an independent researcher while still being there to offer guidance and support when I faced challenges.

A special thank you to the University of Pretoria for the UP Postgraduate Master's Bursary and the National Research Foundation for the award of the NRF Scarce Skills Masters Bursary, without whose financial support this study would not have been possible.

I am also grateful to my friends and family that helped and supported me through this research endeavour. A huge thanks to those that helped and assisted me by taking the time to read my writing and offer feedback and advice, and to those that lent an ear and a shoulder to cry on when I needed it, without you I would not have made it through this degree.

## **Abstract**

Mortality data are a cornerstone of public health initiatives and interventions and has been used to implement preventative strategies to reduce the burden of diseases and injuries in society. A subset of mortality data is non-natural mortality data, which can be used to reduce the burden of violence and injuries in a country. However, the benefits of such data cannot be fully utilised if there are not appropriate data collection, management, and dissemination protocols in place.

South Africa is a country with a high level of violence and non-natural deaths; however, current sources of non-natural mortality data have received criticisms in scientific publication for not being accurate. Initiatives to address this problem, most notably the National Injury Mortality Surveillance System, have been undertaken since the 90's, by making use of state mortuaries as a source of non-natural mortality data. While these initiatives were able to introduce a new era of epidemiological study in the country, they were not sustainable in the long-term. These initiatives collected and disseminated data from state mortuaries in South Africa, but they did not work to implement standardised data collection and management protocols or a database that could collect and store data from the various state mortuaries.

In the United States of America, Australia, and New Zealand data collection and dissemination databases have been implemented, the National Vital Statistics System in the United States of America, and the National Coronial Information System in Australia and New Zealand. These initiatives show that it is possible to successfully implement a data collection and dissemination system for non-natural mortality data in countries that have varying medico-legal death investigation systems in different jurisdictions, and therefore that it should be possible to implement such a system in a country like South Africa where there is only one medico-legal death investigation system.

The aim of this study was to establish what data elements are and should be collected as part of a medico-legal death investigation service in South Africa and how the data can be routinely and systematically captured and utilised to be of benefit to society.

Specifically, this research focused on the current data elements as well as data flow, collection, and management at a single urban mortuary in South Africa.

The study endeavoured to identify the data elements that are and could be collected for medico-legal death investigation in South Africa, assess the current storage, archiving, and management of data in medico-legal death investigation, identify the legal and ethical considerations pertaining to medico-legal death investigation, and to identify technical software that can be used to capture and manage medico-legal death investigation data.

To determine this, a three-part study was undertaken, a scoping review of available literature relating to data collection, capture, and management in medico-legal death investigation, as well as any related fields such as informatics and public health, a retrospective descriptive analysis of data from a single urban mortuary in South Africa for a period from 2017 to 2019, generating a three-year profile of cases at a typical urban mortuary in South Africa, and a fieldwork component to outline the flow of data and identify the key elements and categories of data that are routinely collected for non-natural deaths in South Africa.

Findings from this research showed that there is significant benefit in routinely collecting and disseminating non-natural death data from state mortuaries in South Africa. It also found that data collection and management practices from fields outside of medico-legal death investigation, specifically public health, can be adapted to suit the needs of medico-legal death investigation data. Significant findings from the retrospective review include the increasing proportion of suicides for the three-year period, as well as accidental deaths being the most common manner of death, road traffic fatalities being the most common external cause of death, and homicide numbers overtaking accidental deaths for the months of October to December. The fieldwork component of the study contextualised the current flow of data in medico-legal death investigation in South Africa and identified common data elements that are collected. This research found that commonly collected data elements for medico-legal death investigation are important for the generation of statistics related to non-natural deaths, but the lack of a routinised systematised data collection and management platform impacts the quality of data.

Overall, the results of this research suggest that the implementation of routinised and systematised data collection practices within the field of medico-legal death investigation would benefit the quality of non-natural mortality data in South Africa, however, what data elements and who owns the data needs to be agreed on before implementation can go forward. While this study utilised a single urban mortuary as a pilot for the exploratory study, it is suggested that further study into the current data practices in other mortuaries be conducted, to identify problems and opportunities that may be unique to different areas. It also is recommended that further in-depth study is undertaken into the observations that the retrospective analysis found, and that accurate and relevant denominators for specific areas be utilised so that future studies can be used as epidemiologic information.

**Key words:** medico-legal death investigation, medico-legal death investigation data, medico-legal data, South Africa, non-natural mortality data, data element

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## **List of abbreviations**

**AARTO** – Administrative Adjudication of Road Traffic Offences

**BIM** – Business Information System

**CAS**- Case Administration System

**CIMAC** – Crime Information Management and Analysis Centre

**DHA** – Department of Home Affairs

**DR** – Death Registration

**FMP** – Forensic Medical Practitioner

**FO** – Forensic Officer

**FPS** – Forensic Pathology Service

**ICD-10** –International Classification of Diseases 10<sup>th</sup> Revision 2016 edition

**ICD-11** – International Classification of Diseases 11<sup>th</sup> Revision 2019 edition

**IRIS** – Integrated Resource Information Systems

**LIMS** – Laboratory Information Management System

**MoU** – Memorandum of Understanding

**NaTIS** – National Road Traffic Information System

**NCDMS** – National Crash Data Management System

**NCIS** – National Coronial Information System

**NDoH** – National Department of Health

**NIMSS** – National Mortality Surveillance System

**PC** – Personal Computer

**PIMSS** – Provincial Injury Mortality Surveillance System

**PMLL** – Pretoria Medico-Legal Laboratory

**REDCap** – Research Electronic Data Capture

**RTMC** – Road Traffic Management Corporation

**SAMRC** – South African Medical Research Council

**SAPS** – South African Police Service

**Stats SA** – Statistics South Africa

**UN** – United Nations

**UP** – University of Pretoria

**USA** – United State of America

**USB** - Universal Serial Bus

**VBA** – Visual Basic for Application

**vCJD** – variant Creutzfeldt–Jakob disease

**WHO** – World Health Organisation

\*For the purposes of this report “state mortuaries” refer to “Forensic Pathology Service Medico-Legal Laboratories” after 2006, and “SAPS Government Mortuaries” prior to 2006\*

## Chapter 1: Introduction

### 1.1. Background

Injury and disease data are cornerstones of public health initiatives, and when used correctly, can benefit public health within a community.<sup>1</sup> A subset of this data is mortality data, which has been recognised as being important for informing health resource allocations.<sup>2</sup> However, the timely dissemination of mortality data is fundamental, as disease and injury control and prevention relies on stakeholders having access to relevant and accurate data.<sup>3</sup>

Within the field of public health *surveillance* can be defined as “the ongoing, systematic collection, analysis, interpretation, and dissemination of health information”.<sup>4,5</sup> The surveillance of deaths is an important component of the public health approach to violence and injury prevention.<sup>6</sup> There are a multiplicity of global agencies that report on global mortality data.<sup>7,8</sup> The World Health Organisation (WHO) collects mortality data from various countries, from civil registry systems, and regularly reports and publishes this data and for 2019 more than 55 million deaths were reported by the agency.<sup>7</sup> However, other agencies that provide reports on mortality data, such as the United Nations (UN), have reported different values for global mortality, reporting 58 million deaths for 2019.<sup>8</sup> This difference of 3 million deaths between these two global reporting agencies illustrates the importance of utilising accurate data for statistics and that there are significant differences in data sets that authoritative agencies utilise.<sup>7,8</sup> This discrepancy in mortality data reported by global agencies likely occurs as a result of poor data collection and reporting protocols on an individual country-by-country basis, which is why it is important to develop and implement standardised and routinised data collection practices according to defined parameters, so that discrepancies in mortality data can be addressed.

A subset of mortality data is non-natural mortality data.<sup>2</sup> While the definition of what a non-natural death is varies from country to country, it is generally accepted that it includes fatalities due to violence, injuries, accidents, poisonings, and sudden unexpected or unexplained deaths.<sup>9-11</sup> In addition, certain countries include deaths due to medical interventions.<sup>10,11</sup> While some countries such as the United States of America

(USA) have high mortality burdens due to lifestyle diseases, where the most common cause of death are diseases of the heart, or low homicide numbers such as in Australia, with only 416 homicides occurring in 2018, South Africa has high levels of violence, and so non-natural death data are crucial for informing policy and planning in the country.<sup>12–</sup>

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A subset of non-natural deaths are deaths due to injuries.<sup>2</sup> For 2019 the WHO reported that 4.4 million injury-related deaths occurred.<sup>7,15</sup> Injuries, both intentional and unintentional, made up almost 8% of deaths.<sup>7,15</sup> Of these 4.4 million deaths, 71.6% were due to unintentional injuries and 28.4% were due to intentional or violence related injuries.<sup>7,15</sup> Deaths due to unintentional injury accounted for 5.7% of total deaths and deaths due to intentional injuries accounted for 2.3% of total deaths.<sup>7</sup> Injury surveillance has been recognised as a mechanism that can be used to define injury problems and priorities, identify risk factors for injury deaths, and can be used to design, implement, and evaluate injury fatality prevention interventions.<sup>3</sup> It has been shown that injury surveillance systems were important precursors for programmes to reduce the burden of injury-related deaths.<sup>3,16</sup> In developed countries, such as the USA and Australia, government organisations play a pivotal role in the organisation and management of mortality surveillance systems.<sup>3,17,18</sup>

In the USA, the Centres for Disease Control (CDC) operates the National Vital Statistics System (NVSS) and it is the oldest and most successful example of intergovernmental data-sharing in public health.<sup>14,16</sup> The National Centre for Health Statistics (NCHS) collects and disseminates data on births and deaths in the USA, this data is provided through contracts between the NCHS and vital registration systems in various jurisdictions throughout the USA.<sup>14,16</sup> The NVSS analyses over 2 million records each year, to provide timely and accurate information on cause of death data.<sup>13,17,19</sup> The data are readily accessible via the NVSS website, and is logically and clearly presented.<sup>17</sup> It provides information on various facets of death, such as the leading causes of death, life expectancy, maternal mortality, drug overdose information, and visualisations of the data.<sup>17</sup> The NVSS reported that 2.8 million deaths occurred in 2019, with the majority of the top ten causes of death being due to diseases, however, the third most common

cause of death were deaths due to accidental injury, which made up 6.1% of deaths.<sup>13</sup> Intentional self-harm made up 1.7% of deaths for 2019.<sup>13</sup> The USA is a country with a high disease-related mortality burden, however, it can be seen that injury-related deaths also comprise a large number of deaths in the country. The NVSS is an example of how, even in a country with different medico-legal frameworks in various jurisdictions, efficient data collection, management, and dissemination can be successfully achieved.

In Australia and New Zealand, the National Coronial Information System (NCIS) is used to collect mortality data from coroners and contains information on every death reported to a coroner in Australia and New Zealand.<sup>18,20,21</sup> Prior to the inception of the NCIS there was no systematic national data storage system for Australia's various coronial jurisdictions and it has served as a valuable tool to facilitate public health knowledge.<sup>18,20,21</sup> The NCIS collects demographic, circumstantial and contextual information on every reported death in New Zealand and Australia, as well as the legal, medical, and scientific reports relating to the deaths, with the Australian Bureau of Statistics and the New Zealand Ministry of Health providing supplementary data relating to the deaths.<sup>18,20,21</sup> It is managed by the Victorian Department of Justice and Regulation and governed by a board of management which comprises of coronial, public health, and jurisdictional representatives from Australian States and Territories and New Zealand, and funding is provided from various agencies, including Australian Justice Departments, the New Zealand Ministry of Justice, the Commonwealth Department of Health, and the Australian Institute of Criminology.<sup>18,20,21</sup> Using data from the NCIS it was found that for 2019 the number of victims of homicide in Australia was 416, an increase of 10% from the previous year and also the first national increase in 4 years.<sup>14</sup> The NCIS is an excellent example of how data sharing and integration from various states, international, and governmental entities can be achieved.

In the majority of developing countries, there are no sophisticated mortality surveillance systems in place, and the initial support to set up these systems comes from external agencies, rather than governmental ones.<sup>3</sup> In certain African countries, the WHO has supported injury surveillance activities, such as in Mozambique and Ethiopia.<sup>22,23</sup> In Uganda, a trauma registry system has been pioneered and includes data on the

prevention of injuries and trauma as well as clinical data.<sup>24</sup> While it may be more difficult to implement mortality surveillance systems in developing countries, and these successful initiatives show that it is possible to do so.

In South Africa, the agency officially tasked with collecting and publishing data on mortality is Statistics South Africa (Stats SA), which makes use of data on deaths collected through the South African civil registration system, maintained by the Department of Home Affairs (DHA).<sup>12</sup> Stats SA reported that for 2018 there were 454 014 deaths, and that 54 163 of those deaths were due to non-natural causes, making up 11.9% of the total deaths.<sup>24</sup> It appears therefore, that South Africa has a higher proportion of deaths that are due to non-natural causes, than the global proportion based on data from the WHO.<sup>7,12</sup> However, there is reason to believe that the Stats SA reports on mortality may not be accurate. Death notification forms from the DHA are used as a data source for mortality in South Africa by Stats SA, but various studies have highlighted the poor quality of death notification in the country, including non-natural deaths.<sup>25–29</sup> Identified problems included ill-defined deaths, misclassification of the immediate cause of death, notification using a mechanism of death without stating the underlying cause (specifically for injury deaths), errors in cause of death certification, lack of content validity, and the use of ill-defined and non-specific codes, all of which signify considerable shortcomings with cause-of-death data in South Africa.<sup>25,27–30</sup> For non-natural deaths in particular, it was found that the specific external cause and manner of death were rarely recorded on death notification forms in some countries.<sup>25</sup>

The misclassification of deaths can still be seen in the most recent publication by Stats SA, in which 68.3% of non-natural deaths were recorded as having the cause of death being *Other external causes of accidental injury*, and of those deaths almost half of them were attributed to *Accidental exposure to other and unspecified factors*.<sup>12</sup> The large number of non-natural deaths not having a specific cause of death listed means that it is not possible to observe trends in manners of death or specific causes of death when using data from the DHA's national population register.

Because of the high levels of violence in South Africa, data pertaining to non-natural deaths are crucial for informing policy and planning in the country.<sup>12</sup> Analysing mortality



trends is an important starting point to gain a better understanding of the risk factors that may predispose many non-natural deaths.<sup>3</sup> However, despite the importance of mortality statistics, there are few recent studies in scientific literature that describe non-natural deaths in South Africa as a whole.<sup>6</sup> Studies that focus on certain causes or manners of death, such as suicides or road traffic fatalities, have been published, however, publications on the overall profile of cases that present to state mortuaries – outside of the Western Cape - are limited.<sup>31–35</sup>

While other data sources are available, such as crime statistics from the South African Police Services (SAPS) or road traffic accident data from the Road Traffic Management Corporation (RTMC), these data sources also suffer from limitations. Crime and murder statistics are based on case case-files that are reported to and captured by the Crime Information Management and Analysis Centre (CIMAC).<sup>36,37</sup> SAPS and Stats SA have signed a Memorandum of Understanding to ensure that the statistics generated from crime case-files at SAPS by the CIMAC are in line with international best practice.<sup>37</sup> This was done in order to ensure that the quality of crime data collected and utilised by SAPS and Stats SA is accurate and valid. SAPS also acknowledges that the crime statistics that are generated are important, as the statistics are used to inform policy development and planning within the criminal justice system, and thus the data needs to be accurate.<sup>37</sup>

However, this does not mean that these alternate data sources do not have shortcomings. It is important to note that the statistics recorded and reported by the CIMAC are not based on body counts but on crime case-files, and are therefore vulnerable to under reporting.<sup>36–39</sup> While case case-files contain information on victims, such as demographic details, SAPS statistics do not report on details regarding victims or the circumstances of their deaths, but rather on overall numbers.<sup>38,39</sup> The data that the CIMAC analyses and reports on is related to all crimes and incidents that SAPS investigates and does not have specific data related only to mortality.<sup>36,38,39</sup> There is also an incongruity between what SAPS reports and what Stats SA reports, especially when it comes to mortality statistics.<sup>12,40</sup> Stats SA reported that in 2018 there were 7590 deaths due to assault, whilst SAPS reported that 21 022 murders occurred,

more than double what Stats SA reported.<sup>12,40</sup> Differences in classification, different data sources, and different reporting periods (SAPS uses financial years for reporting while Stats SA uses calendar years) are potential reasons for these incongruencies.<sup>12,40</sup> The standardisation of collecting and reporting such data, as well as integration of the various data sources, would help to address these incongruencies.

The mortality rate due to road traffic injuries in South Africa is almost double the global average mortality rate for road traffic fatalities.<sup>41</sup> The high number of road traffic fatalities in the country is not well understood – in part probably due to the lack of a reliable non-natural mortality surveillance system, and therefore, a lack of reliable non-natural mortality data in South Africa.<sup>3</sup> The RTMC exists in terms of Section 3 of the Road Traffic Management Corporation Act 20 of 1999 and publishes reports on fatal crashes in South Africa using data from the National Traffic Information System (NaTIS), Administrative Adjudication of Road Traffic Offences (AARTO) speed infringement data, and the RTMC's own fatal crash data from the National Crash Data Management System (NCDMS).<sup>42</sup> The NaTIS records, manages, and enforces the requirements of the National Road Traffic Act 93 of 1996 and records information on motor vehicle crashes.<sup>3,43</sup> However, even when using data from various sources, the RTMC's fatal crash data still has limitations, the data only makes use of fatal crash data relating to road vehicles, and does not include railway fatalities, and so does not accurately represent transport related fatalities as a whole.<sup>42</sup> A report published by the RTMC found that 12 921 deaths due to fatal crashes occurred in 2018, which included motor vehicle and pedestrian vehicle fatalities.<sup>44</sup> In comparison, for the same period, Stats SA reported that 6165 deaths were due to transport accidents, which again highlights the incongruencies between mortality data that Stats SA and other governmental agencies report.<sup>12</sup>

For the 2018 mortality statistics release, Stats SA reported that the data utilised had a 96% completeness level, however, this does not accurately reflect the quality of the data, especially with regards to the misclassification of causes of injury and non-natural death, and the validity of the data.<sup>12,27</sup> Comparing non-natural mortality statistics from Stats SA to those published by other agencies, it can be seen that there are

discrepancies.<sup>12,40,44</sup> When looking at road traffic fatality and homicide data from the RTMC and SAPS, it can be extrapolated that 33 943 of the total non-natural deaths in 2018 were due to fatal crashes or murder.<sup>40,44</sup> If these statistics were similar to what Stats SA reported, then 38.8% of non-natural deaths in 2018 would have been due to homicide and 23.9% would have been due to transport accidents, these causes of death comprising of 62.7% of non-natural deaths.<sup>12,40,44</sup> However, this is not the case, Stats SA reported that only 14% of deaths were due to assault and 11.4% of deaths were due to transport accidents, together comprising only 25.4% of reported non-natural deaths by Stats SA.<sup>12</sup> This large discrepancy between what Stats SA and other agencies publish on non-natural mortality data further illustrates that the statistics that Stats SA publishes may not be an accurate source of non-natural mortality data. These discrepancies indicate the importance of validating and integrating different data sources.

Certain external causes of death, such as falls, poisonings, deaths due to medical intervention, and fires, are not specifically tracked by governmental agencies in South Africa.<sup>3</sup> It is difficult to track trends of non-natural mortality due to the lack of accurate and timely data on such deaths.<sup>28</sup> The implementation of routine data collection and management at state mortuaries together with a centralised, national forensic data management system in South Africa would be a way to address this problem. In South Africa, all deaths that are suspected to be due to non-natural causes, which include deaths possibly due to medical intervention, have to undergo medico-legal death investigation, as contemplated in the Inquests Act, among other legislatures.<sup>10,45-49</sup> State mortuaries are therefore perhaps the ideal place for the collection and monitoring of non-natural deaths in South Africa. There are a finite number of state mortuaries in South Africa, which must all abide the same legislative framework and protocols for admitting deaths, which should make it relatively easy to track deaths at each mortuary and on a national level.<sup>46</sup>

Medico-legal death investigation data in South Africa are largely the product of interrogation by medical professionals for the purpose of aiding justice; therefore, these data are likely to be more accurate and reliable than death certificate data, and it

includes data pertaining to the circumstance and manner of death, as well as scene data.<sup>50</sup> Medico-legal death investigation in South Africa is such that the data generated during the course of investigation is collected in a systematic and routine manner, as it is intended to serve legal processes.<sup>46</sup> Because of this, it can be expected that the quality of data will be better than other sources of non-natural mortality data currently in use. Studies that compared mortuary data to Stats SA data found that more deaths were reported using mortuary data than from Stats SA, and that the problem of miscoding injury deaths to *other external causes of accidental injury* was alleviated by utilising mortality data. This shows that underreporting and miscoding of injury deaths, especially homicide and transport injuries, can be alleviated by making use of data from state mortuaries.<sup>27</sup>

While there have been initiatives to implement an injury mortality surveillance system based on state mortuary data in South Africa, these initiatives have suffered from a lack of support and compliance by state mortuaries, and have not proved to be sustainable long-term.<sup>3,51</sup> The National Injury Mortality Surveillance System (NIMSS) was piloted in 1998 and aimed to collect data from medico-legal death investigation in South Africa.<sup>6</sup> However, it suffered from a lack of funding, incompleteness, and lack of compliance from mortuaries.<sup>51</sup> While the advent of the NIMSS was useful and provided information that helped usher in a new wave of epidemiological study in South Africa, it did not work to implement a national routinised and systematised database that could be used at each individual state mortuary. The South African Medical Research Council (SAMRC), the research agency that coordinated the system, and the National Department of Health (NDoH) had disputes regarding ownership, intellectual property, publication, and authorship related to the data and findings from the data.<sup>3</sup> However, because a formal resolution regarding the access and use of the data generated at state mortuaries could not be reached, the long-term viability of the NIMSS was threatened. The last reports that are available utilising data from the NIMSS were published by the SAMRC in 2013 and contained data from 2011.<sup>52</sup>

In the Western Cape, the computerised Provincial Injury Mortality Surveillance System (PIMSS), which was developed from the NIMSS, is still in use at state mortuaries within

the province, despite the NIMSS being discontinued, and is used as a source of non-natural mortality data by various research and governmental entities.<sup>3,32,51,53</sup> The deficiencies that plagued the NIMSS, such as non-compliance and lack of funding, have been averted with the advent of the PIMSS in part because data collection at state mortuaries in the Western Cape is completely integrated into the operational process of the mortuaries.<sup>3</sup>

Data generated during medico-legal death investigation are an important source of descriptive epidemiologic information relating to non-natural deaths.<sup>3</sup> There is a need for systemic, routinised collection and management of data generated at state mortuaries in South Africa. However, the analysis of this data is also needed, and it should be subjected to independent scientific interrogation, to draw accurate inferences from the data.<sup>3</sup> It is also needed to understand the limitations of the data and to affect ongoing improvements to the database system.<sup>3</sup> If countries with various jurisdictions and different medico-legal death investigation systems, such as Australia, New Zealand and the USA, can implement data collection and storage systems for non-natural mortality data, a country like South Africa which has a more cohesive medico-legal death investigation system should be able to implement such a system as well.<sup>17-19,50</sup>

## **1.2. Study Rationale**

Database development consists of many interlocking elements and steps that flow together to lead to the development of a functional database.<sup>54,55</sup> One of these elements is systems analysis, which is used to determine the need for an information system and to establish the limits of such a system.<sup>54</sup> To effectively analyse a system, one has to know how the system itself functions, what the data elements or components are, where the data are generated within the system, where the data are housed in the system, and how the data are managed and utilised. Only if a comprehensive analysis is performed with respect to these elements can the limitations of the current (non-natural death) data collection and management be addressed.

This study was intended to address the latter perspective in the context of medico-legal death investigation in South Africa. Therefore, this is an exploratory study using a single urban mortuary as a pilot venue to evaluate the data collection and management

system within the field of medico-legal death investigation in South Africa. This exploratory pilot study focused on the Pretoria Forensic Pathology Service Medico-Legal Laboratory (PMLL).

Medico-legal death investigation essentially includes two broad functions, namely, to facilitate justice on an individual case-by-case level, and on a broader level, to assist public health.<sup>50</sup> One of the main functions of medico-legal death investigation in South Africa, the function to assist public health information, is currently not being adequately served. This is in part due to the lack of a standardised or structured data collection, capture, and management system within the field of medico-legal death investigation.

In 2006, after much deliberation, the government of South Africa made the decision to transfer the management of the state medico-legal mortuaries from the domain of SAPS to the national and provincial departments of health, under the auspices of the Forensic Pathology Service (FPS).<sup>6,56</sup> While there were certainly improvements in service delivery and infrastructure many problems persist.<sup>50</sup> These include the lack of fast and efficient toxicology services, proper vocational training of those employed within the service, lack of recent infrastructural development, and a notable lack of sustainable implementation of provincial or national data-monitoring systems in state mortuaries.<sup>26,</sup>

46, 47

The purpose of this study is not to develop a database, but to explore what data are collected, how it is collected, and what data should be collected during the course of medico-legal death investigation. An understanding of the data flow in medico-legal death investigation, as well as the current data collection and management infrastructure, is crucial to identify data elements that are and should be collected and stored in such a system.

### **1.3. Aim**

The overall aim of this study was to establish what data elements are collected as part of a medico-legal death investigation service in South Africa and how the data can be routinely and systematically captured and utilised to benefit society.

## **1.4. Objectives**

The objectives of this study were as follows:

*Objective 1:* To identify the data elements that are and could be collected for medico-legal death investigation in South Africa.

*Objective 2:* To assess the current storage, archiving, and management of data in medico-legal death investigation in South Africa.

*Objective 3:* To identify the legal and ethical considerations pertaining to medico-legal death investigation data in South Africa.

*Objective 4:* To identify technical software that can be used to capture and manage medico-legal death investigation data.

## **1.5. Methodology**

This was a mixed-methods study that used both quantitative and qualitative data to achieve the aims and objectives of this study.

This study was conducted in three parts:

1. A scoping review of available literature relating to data collection, capture, and management in medico-legal death investigation, as well as any related fields, such as informatics and public health.
2. A retrospective descriptive analysis, of data in the current database used by the Department of Forensic Medicine at the University of Pretoria, generating three-year profile of cases at a typical urban state mortuary in South Africa.
3. Fieldwork to establish the key elements or categories of data that are routinely collected for non-natural deaths in South Africa.

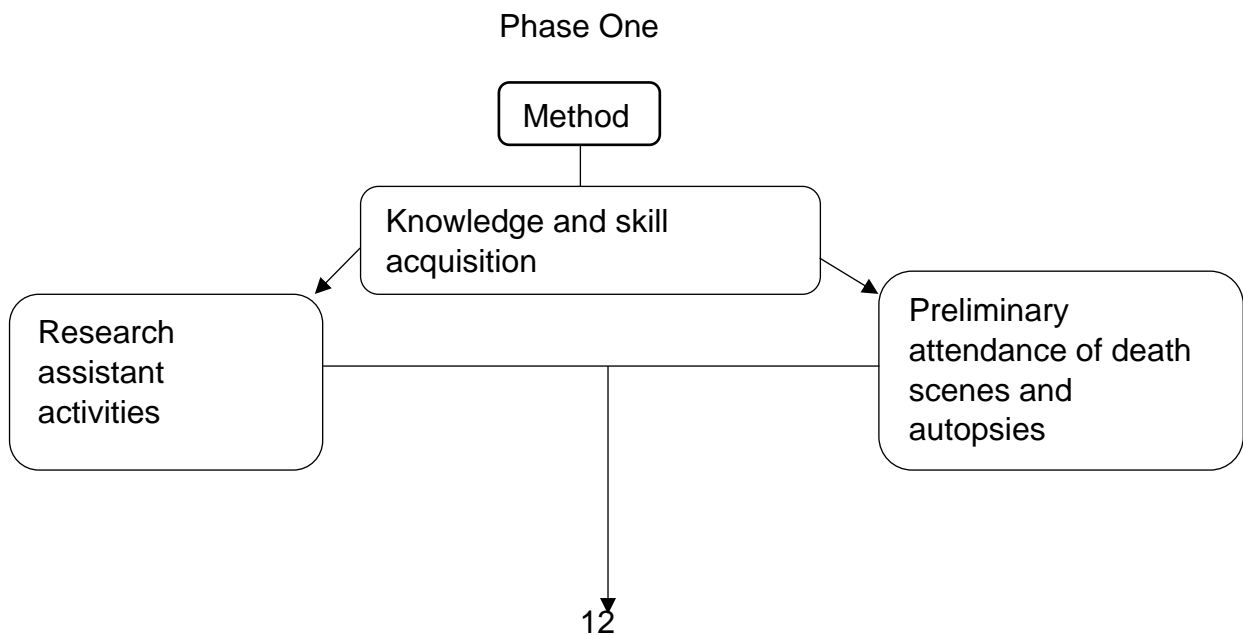
The main source of qualitative data was secondary data collected for the scoping review, whereas the main sources of quantitative data were the collection and evaluation of primary data from cases presenting to the PMLL from 2017 to 2019. The fieldwork component of the study gathered both quantitative and qualitative data from the working environment of medico-legal death investigation. This study used textual

analysis, which included both content analysis and textual interpretation, and collected and observed data generated in the field.

The use of a mixed-methods research design allowed for a diversity of primary sources and secondary data used in the study. This allowed for flexibility in the structure of the study and detection of unanticipated factors, opinions, and findings that arose during the study period. The study components were simultaneously conducted using a triangulation method.

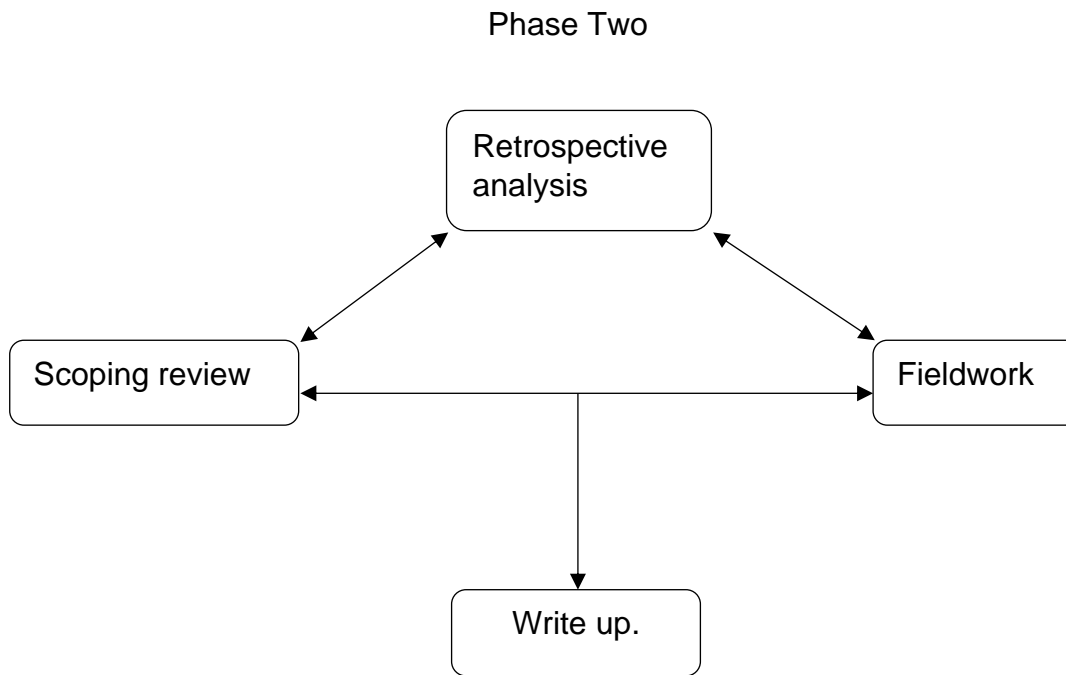
Phase One of the study involved knowledge and skill acquisition to prepare the researcher for the research stages in phases two and three, and was completed before the commencement of Phase Two, during the protocol writing stages of the study. Phase Two involved the bulk of the research activities and did not commence prior to receiving ethical clearance from the Faculty of Health Sciences Research Ethics Committee. In Phase Two, the scoping review, retrospective analysis, and fieldwork were undertaken simultaneously. The third phase involved synthesis of the results from the three sections of this study.

The detailed methodology for each section of the study can be found in Chapter Four for the scoping review, Chapter Five for the retrospective analysis, and Chapter Six for the fieldwork component of the study. The sequential order in which the study was performed is presented in Figure 1.1.





**Figure 1.1: Phases of the research methodology, Phase One**



**Figure 1.2: Phases of the research methodology, Phase Two**

## 1.6. Ethical considerations

This study was undertaken in accordance with the provisions for an MSc in Medical Criminalistics at the University of Pretoria. This included the conceptualisation and presentation of a research protocol, which was submitted to the University of Pretoria's Faculty of Health Science's MSc Committee, the approval of which can be found in Appendix A. After approval by the MSc Committee, the protocol was submitted to the University of Pretoria's Health Sciences Research Ethics Committee, the approval of which can be found in Appendix B.

Permission was obtained from the PMLL facility manager (Appendix C) for access to post-mortem case-files to evaluate data capture and flow at the PMLL. Autopsy and death scenes were attended under the supervision of the attending Forensic Medical Practitioner (FMP) with the consent of the presiding SAPS officer in the case of death scenes.

Permission from the UP Department of Forensic Medicine was granted for access to the Excel spreadsheet system for the retrospective analysis of this study. No names or Death Registration (DR) numbers were disclosed in the study, and all identifying information regarding the deceased was anonymised. The information stored in the Excel spreadsheet was housed on a password-protected Personal Computer (PC) that was accessible by the primary researcher for the duration of the study. All data used in this study were kept on a password-protected Universal Serial Bus (USB) drive and Google Drive, to which only the primary researcher had access.

## **1.7. Dissertation Layout**

### **Chapter 1: Introduction**

Chapter One outlines the background and rationale of the study and provides a description of the core research problem and its significance. It outlines the aim and objectives of the study, as well as how they were reached. It provides a description of the study area and the general methodology of the study and describes the layout of the dissertation.

### **Chapter 2: Literature review**

Chapter Two presents a comprehensive literature review of the current literature, structured in the form of a narrative review. It outlines the problems faced in South Africa with regard to medico-legal data acquisition and past initiatives to collect and manage this data.

### **Chapter 3: Scoping review**

Chapter Three outlines the scoping review component of this study and outlines the methodology and results of the scoping review. This study identified four main fields related to data within the medico-legal death investigation field. These fields include public health, information, legislative and ethical components, and mortality surveillance systems. Information and expertise from these fields can be used to guide the development of a database for medico-legal data. Input from experts from these fields

would benefit the process of developing a database for medico-legal death investigation.

#### **Chapter 4: Retrospective review article**

Chapter Four presents the results of a retrospective descriptive review of cases admitted to the PMLL from 2017 to 2019. The data used were stored in an Excel spreadsheet held by the Department of Forensic Medicine at the University of Pretoria. The data kept in the spreadsheet is a research endeavour that the Department undertook and is comprised of data that each individual FMP is responsible for collecting and are independent of the PMLL. This component is presented in the form of a research article. The retrospective review is a snapshot of cases at a single mortuary in South Africa, which shows the utility of medico-legal data and is not indicative of all state mortuaries in South Africa.

#### **Chapter 5: Fieldwork article**

Chapter Five is an article based on the fieldwork component of the study. This component sought to outline the requirements and data elements of a standardised data collection system for state mortuaries. It did not aim to develop a database for such uses but to provide a comprehensive body of literature that outlines relevant information and the data elements that should be collected, which should be taken into consideration if such a database is established. It outlined the current data flow and process of a typical urban state mortuary in South Africa and identified the data elements and data subsets generated during the course of medico-legal death investigation.

#### **Chapter 6: General discussion and conclusion**

Chapter Six presents a general discussion and conclusions of the study, by reviewing the key findings of the three components of the study. A broad, holistic overview of the value of medico-legal death investigation data is presented and the three components are brought together by reviewing and revising the context of each section and juxtaposing them against one another. The strengths and limitations of the components as well as for the overall study are also addressed. It also suggests possible

recommendations and identifies further research opportunities based on the findings from the study components.

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## Chapter 2: Literature review

Mortality statistics are a valuable data source that can be used to assess the health status of a population.<sup>1</sup> In the realm of public health, mortality statistics are used as a cornerstone in formulating health policies to reduce and prevent premature mortality, and to improve the overall health of a community. However, without an adequate database infrastructure to capture data relating to mortality, the benefits of mortality statistics cannot be fully utilised.<sup>2</sup> The data that are generated during medico-legal death investigation is an important source of mortality statistics but is currently not being collected or utilised in a manner that contributes substantially to such public health benefits.

Medico-legal death investigations in South Africa are carried out on all suspected non-natural deaths, prescribed by the Inquests Act 58 of 1959.<sup>3</sup> As stipulated in Regulations Regarding the Rendering of Forensic Pathology Service, non-natural deaths are defined as:

- “(a) any death due to physical or chemical influence, direct or indirect, and/or related complications;
- (b) any death, including those deaths which would normally be considered to be a death due to natural causes, which in the opinion of the medical practitioner has been the result of an act of commission or omission which may be criminal in nature;
- (c) any death as contemplated in section 56 of the Health Professions Act, Act 56 of 1974 (“The death of a person undergoing, or as a result of, a procedure of a therapeutic, diagnostic or palliative nature, or of which any aspect of such a procedure has been a contributory cause shall not be deemed to be a death from natural causes as contemplated in the Inquests Act, 1959 (Act 58 of 1959), or the Births and Deaths Registration Act, 1992 (Act 51 of 1992)”); and
- (d) where the death is sudden and unexpected, or unexplained, or where the cause of death is not apparent”<sup>4</sup>

Medico-legal death investigation in South Africa includes two main functions: to facilitate the administration of justice in cases of non-natural deaths, and to improve public health functions. The judicial function serves on a case-by-case basis, while the public health function serves on a broader level, looking at data from overall cases rather than individual cases. While the judicial function of medico-legal death investigation is being adequately filled, the public health function falls short. Data from medico-legal investigations of death tell a story of the health of a community and the nation as a whole, this data can be used for a variety of initiatives, such as identifying new causes of injury, tracking known health threats, and evaluating the effectiveness of response efforts.<sup>5</sup> However, without adequate data collection and management practices, these benefits cannot be fulfilled, and so public health uses, and benefits are lost. Mortality data compiled on a national level has been the cornerstone of public health surveillance for decades, however, this functionality is lost in this modern day and age in which data are not being adequately collected, managed and compiled.<sup>5</sup> The uses and functionality of data have been increasing in the modern era as the trend towards evidence-based and data-driven solutions grows, however, the importance of complete, timely, and accurate representation of mortality data cannot be emphasised enough.<sup>5</sup> There is currently no coordinated or sustained national initiative to capture and share data that are generated in respect of cases admitted to medico-legal mortuaries in South Africa.<sup>6</sup> This lack of a structured system for data practices impacts policy development, strategic planning, resource allocation, statutory reform, and the implementation of preventative strategies based on epidemiological profiles of non-natural deaths.<sup>6</sup>

In this chapter, the epidemiology of non-natural deaths using data that are readily available to the public, both globally and in South Africa, is discussed in Section 2.1. Section 2.2 provides a brief overview of medico-legal death investigation in South Africa. The manner in which non-natural death statistics are recorded in South Africa is outlined in Section 2.3. Section 2.4 discusses the challenges related to data collection in South Africa. Previous initiatives to record and publish non-natural death statistics in South Africa are outlined in section 2.5

## **2.1. Overview of non-natural death statistics**

Deaths due to non-natural causes, including injury and violence, are a major public health concern. To understand the burden of injury and violence, one needs to know the epidemiological profile of deaths due to these causes.

### **2.1.1. Global non-natural death statistics**

The World Health Organisation (WHO) reported that 4.4 million injury-related deaths occurred worldwide in 2019.<sup>7,8</sup> Injuries, both intentional and unintentional, made up almost 8% of all global deaths.<sup>7,8</sup> Of these 4.4 million deaths, 71.6% were due to unintentional injuries and 28.4% were due to intentional or violence related injuries.<sup>7,8</sup> Deaths due to unintentional injury accounted for 5.7% of the total deaths and deaths due to intentional injuries accounted for 2.3% of deaths.<sup>8</sup> A large portion of non-natural deaths were due to unintentional injuries rather than intentional or violence-related injuries, suggesting that the global burden of injuries is mainly due to unintentional or accidental injuries.

The highest injury mortality was due to road traffic fatalities, followed by self-harm, falls, and interpersonal violence.<sup>8</sup> Road traffic fatalities made up 2.3% of all global deaths, 29.1% of all global injuries, and 40.6% of unintentional injuries.<sup>8</sup> Self harm made up 1.3% of all global deaths, 15.9% of all global injuries, and 56.2% of intentional injuries.<sup>8</sup> Globally more than half of intentional injuries were due to self-harm. Falls comprised 1.2% of all global deaths, 15.5% of all global injuries, and 21.7% of unintentional injuries.<sup>8</sup> Interpersonal violence made up 0.9% of all deaths, 10.8% of all injuries, and 38% of intentional injuries.<sup>8</sup> An estimated 1.28 million people died from road traffic fatalities in 2019, suggesting that a large burden of injury mortality was due to road traffic accidents.<sup>8</sup>

More males died from injuries than females, with males comprising 68.1% of all deaths due to injuries.<sup>8</sup> Males comprised 66.2% of unintentional injury deaths, while females made up 33.8% of all unintentional injuries.<sup>8</sup> When it comes to intentional injuries 73.1% of all intentional injury deaths were males, while 26.9% of intentional injury deaths were females.<sup>8</sup> Deaths due to road injury, self-harm, and interpersonal violence were the

most prevalent causes of death for males, while deaths due to road injury, falls, and self-harm were the most prevalent causes of death for females.<sup>8</sup> Males made up a larger proportion of injury deaths than females, however, road traffic fatalities were the most common cause of injury death for both sexes.

The overall age range with the majority of non-natural deaths for males was the 30 to 49 years age group, while for females the age range with the most non-natural deaths was the 70 years and greater age group.<sup>8</sup> For males deaths due to both intentional and unintentional injuries has the highest prevalence in the 30 to 49 age group, while for females deaths due to unintentional injuries has the highest prevalence in the age group of 70 years and greater, however, the most prevalent age group for death due to intentional injuries was the 30 to 49 years of age group.<sup>8</sup>

While the WHO's mortality reports have been used as a source of global mortality data for many studies, it is important to note that there are discrepancies between what the WHO and other reporting agencies publish on mortality data. The United Nations (UN) reported that 58 million deaths occurred worldwide in 2019, while the WHO reported that 55 million deaths occurred for the same period.<sup>8,9</sup> This discrepancy of 3 million deaths is an example of how utilising different data sources can result in discrepancies in reported data. The WHO utilises data from countries civil registries as data sources for global mortality reports, and so problems that may be present in civil registry systems in certain countries will affect the quality of data that the WHO utilises in reports.<sup>8</sup>

### **2.1.2. Non-natural death statistics in South Africa**

Statistics South Africa (Stats SA) is the main body statutory body in South Africa that consistently produces reports with mortality data that include statistics related to non-natural causes of death.<sup>10</sup> For 2018 Stats SA reported that 454 014 deaths occurred, and of those deaths 54 161 were due to non-natural causes.<sup>11</sup> In South Africa, non-natural deaths accounted for 11.9% of all causes of death in 2018.<sup>11</sup> The number of non-natural deaths in South Africa has decreased from 1997 to 2018, with 17% of all deaths in South Africa being due to non-natural causes in 1997 and 11.9% in 2018.<sup>11</sup> However, when looking at more recent mortality data, there has been an increase in the

percentage of non-natural deaths. From 2009 to 2018 there was an increasing trend of non-natural deaths, with 8.7% of total deaths in 2009 being due to non-natural causes and 11.9% in 2018.<sup>11</sup>

Almost 70% (68.3%) of non-natural deaths were coded as being due to *other external causes of accidental injury or event of undetermined intent*, this category made up more than 8% of all total deaths.<sup>11</sup> This miscoding non-natural deaths on death certificates, thereby meaning the death will be coded as being due to other external causes of accidental injury, is a problem with the Stats SA mortality data that many publications have addressed and cited as a reason for the low quality of Stats SA data.<sup>12-16</sup> The second most common cause of non-natural death was due to assault (14% of non-natural deaths and 7.1% of total deaths), and the third most common cause of death was transport related fatalities (11.4% of non-natural deaths and 1.4% of total deaths).<sup>11</sup> Less than 1% of non-natural deaths were due to intentional self-harm and less than 0.5% of deaths were due to a sequelae of external causes of morbidity and mortality.<sup>11</sup> For the City of Tshwane 2454 deaths were associated with external causes of morbidity and mortality for the year 2018.<sup>11</sup> Non-natural deaths made up 9.3% of all total deaths in the City of Tshwane for 2018.<sup>11</sup>

Males were shown to consistently have a higher proportion of deaths due to non-natural causes than compared to females in South Africa.<sup>11</sup> For males the most prevalent causes of death were *other external causes of accidental injury* (68.5%), *assault* (15.9%), and *transport accidents* (10.9%).<sup>11</sup> For females the most prevalent causes of death were *other external causes of accidental injury* (67%), *transport accidents* (13.6%), and *assault* (7.7%).<sup>11</sup> In all instances, except for transport accidents, the percentage of deaths due to a certain cause were higher in males than in females.<sup>11</sup>

These findings are skewed because of the nature of the classification of *other external causes of accidental injury*. While *other external causes of accidental injury* constitute the largest group of non-natural deaths recorded by Stats SA, it is actually a grouping of many other causes of injury into one larger group. *Other external causes of accidental injury* are a singular classification that is made up of 13 smaller subgroups, with the largest subgroup being accidental exposure to other and unspecified factors.

**Table 2.1: Distribution of deaths due to other external causes of accidental injury, Stats SA 2018**

Cause of death (based on ICD-10)	Number	Percentage
Accidental exposure to other and unspecified factors (X58-X59)	18 075	48,9
Exposure to inanimate mechanical forces (W20-W49)	7 502	20,3
Other accidental threats to breathing (W75-W84)	5 465	14,8
Exposure to smoke. Fire and flames (X00-X09)	2 662	7,2
Accidental drowning and submersions (W65-W74)	1 444	3,9
Accidental poisoning by and exposure to noxious substance(X40-X4	805	2,2
Exposure to electric current, radiation and extreme ambient air	443	1,2
Exposure to forces of nature (30-X39)	278	0,8
Falls (W00-W19)	197	0,5
Contact with venomous animals and plants (X20-X29)	47	0,1
Exposure to animate mechanical forces (W50-W64)	46	0,1
Contact with heat and hot substances (X10-X19)	16	0,0
Overexertion, travel and privation (X50-X59)	11	0,0
<b>Total</b>	<b>36 997</b>	<b>100</b>

For both males and females, the age group most affected by non-natural death was the age group of 15 to 29 years.<sup>11</sup> However, 58.4% of all male deaths in that age group were due to non-natural causes, while only 20% of all female deaths were due to non-natural causes.<sup>11</sup> This shows a clear pattern of discrepancy between male and female deaths due to non-natural causes. However, this age group is large and spans over 14 years. These results would be more accurate and show a more representative spread if they were divided into age groups by four or five years, such in the overall death rates section of the Stats SA mortality reports and other mortality publications. Of note is the exclusion of Chapter 19 deaths (Injury, poisoning & certain consequence of external causes) in the Stats SA reports, further adding to inaccurate data.<sup>1,7,11,17</sup>

## **2.2. Medico-legal death investigation in South Africa**

In 2006 the government of South Africa made the executive decision to transfer the management of the state medico-legal mortuaries from the responsibility of SAPS to the national and provincial departments of health, under the auspices of the Forensic Pathology Service (FPS).<sup>18</sup> The reasons outlined for this change were cited as being that the service was fragmented and uncoordinated, and to ensure that there was



separation and autonomy of the FPS from SAPS.<sup>18</sup> Another reason for the transfer was to ensure that a more comprehensive FPS could be rendered.<sup>18</sup>

However, in 2022 there are still problems that this transfer has not been able to rectify. There are many deficiencies within the current FPS, one of which this study focuses on: the notable lack of an appropriate provincial or nationwide data monitoring system in state mortuaries. This needs to be rectified, as the FPS is mandated by law to collect, review, and analyse data related to medico-legal death investigation, as well as to keep statistics on trends in non-natural deaths.<sup>19,20</sup> These statistics should be used to provide information and advice to governmental agencies and departments to help prevention strategies for non-natural causes of death.<sup>19,20</sup> These mandates are currently not being appropriately met and thus the inadequate data cannot be utilised to its full capacity.

South Africa has a well-developed infrastructure for medico-legal death investigation and support that is underscored by an appropriate legislative platform. The FPS is mandated by law to investigate all instances of non-natural deaths, as stipulated in Section 3 of the Inquests Act 58 of 1959, as well as Section 17 of the Birth and Deaths registration Act 51 of 1992, Section 56 of the Health Professions Act 56 of 1974, and the Criminal Procedures Act 51 of 1997, and chapter 4 the National Health Act 61 of 2003.<sup>3,20,21</sup> These mandates are laid out in one body of legislation which is the Regulations Regarding the Rendering of Forensic Pathology Services.<sup>3,20,21</sup>

From the scene of death to the possible legal and court procedures connected to the death, every step is recorded in the South African medico-legal death investigation system through the use of various administrative forms that capture data. Data from the scene of the death, autopsy to related investigations should be captured.<sup>4</sup> Data that are generated at the scene of the death, autopsy, ancillary investigations, and subsequent relevant legal proceedings are all sources of mortality data that can benefit public health interventions and reform, but only if they are adequately captured and utilised.

All decedents suspected of having died of non-natural causes are assigned a SAPS Case Administration System (CAS) number and an FPS Death Registration (DR) number. These identifying numbers remain with the body during the subsequent SAPS investigation, post-mortem investigation, and ancillary investigations. These unique

identifying numbers are used to keep track of bodies in state mortuaries as well as during police investigations. State mortuaries also take note of key data elements relating to the deceased, such as age, sex, race, cause of death, area in which the body was found, and police station to which the body was reported. After an autopsy, in accordance with Section 17 of the Births and Deaths Registration Act 51 of 1992, all deaths due to other than natural causes are recorded on a prescribed certificate after the corpse is no longer needed for examination.<sup>21</sup> This certificate is known as a death notification certificate, and the data on these certificates falls under the custody of the Department of Home Affairs (DHA), after submission to the DHA by the funeral undertakers.<sup>21</sup>

### **2.3. How are mortality statistics recorded in South Africa?**

Registration and statistics systems are used to document vital events, such as births and deaths, as they occur in a country's population.<sup>22</sup> This information comes from civil registration systems which are formal recordings of such occurrences. In South Africa, these systems are handled by the DHA. Civil registration systems are important as they generate comprehensive vital statistics that can be used to inform policy making.<sup>23</sup> These systems not only have important public health implications, but also social, political, and economic benefits.<sup>23</sup> General vital statistics can be used to compare mortality discrepancies to developed countries.<sup>23</sup>

In South Africa all non-natural deaths need to be issued a death notification form, DHA 1663, after autopsy once the forensic medical practitioner is satisfied that the corpse is no longer needed for examination, as contemplated in the Births and Deaths Registration Act 51 of 1992.<sup>21</sup> In the event of a death, a death notification form is submitted to the Department, which then issues a burial order and an abbreviated death certificate to the family of the deceased.<sup>10</sup> For deaths of individuals who have a South African ID number or whose birth has been registered, the National Population Register is updated as part of the registration process.<sup>10</sup>

The custodian of all documents and records pertaining to deaths registered in South Africa is the Director General of Home Affairs.<sup>21</sup> The details that are obtained from death certificates are included in the population register, an electronic civil registration

system.<sup>21,24</sup> The Department of Home Affairs is mandated to provide a complete and accurate death register.<sup>21</sup> South Africa is one of the few African countries that produces vital statistics from a civil registration system.<sup>24</sup>

While Stats SA aims to continually produce mortality statistics, this endeavour only is made possible by the availability of registered administrative death records from civil registration.<sup>11</sup> Stats SA produces information on mortality and causes of death from the civil registration system as mandated by the Statistics Act 6 of 1999.<sup>11,25</sup> This mandate includes ensuring compiling of reliable information of causes of mortality through the application of appropriate quality criteria, standards, classifications and procedures for vital statistics.<sup>11,25</sup>

In the most recent publication of mortality and morbidity by Stats SA for causes of death for 2018, an assessment of the 2018 South African Statistics from civil registration was included in the report.<sup>11</sup> The accuracy of the death registration was measured at 95%.<sup>11</sup> This high value means that the data from civil registration can be regarded as complete in terms of the relevance and comparability of mortality and cause of death statistical indicators<sup>11</sup>. However, some data points still contained missing information in the civil registration system. The proportion of missing information was also noted in the report. In 2018 0.4% of deaths had information missing on the sex of the deceased, but place or institution of death (26,2%), method used to ascertain cause of death (53,7%) had a high incidence of missing information.<sup>11</sup>

The proportion of deaths that occurred in healthcare facilities was 45,6% for 2018.<sup>11</sup> This percentage is a proxy for the percentage of deaths that have causes that are more likely to be detailed enough for the underlying cause of death to be determined.<sup>11,23</sup> Although less than 50% of total deaths occurred in healthcare facilities all deaths in South Africa are mandated to be certified by a medical practitioner, with the exception of stillbirths.<sup>11,21</sup> The proportion of deaths assigned to symptoms and signs of disease not elsewhere classified was 13.5% for 2018. This is a shortfall of 3,5% from the recommended 10% threshold as outlined by Mahapatra et al.<sup>11,23</sup>

The relevance of the statistics was measured at 100% by looking at routine tabulations by age and sex, and the comparability was measured at 100% for stability of key

definitions over time, uniformity of definitions across areas, and consistency of cause specific mortality proportions over consecutive years.<sup>11</sup> The timeliness was also evaluated, with the processing time being 36 months and the mean time from end of reference period to publication being 40 months.<sup>11</sup> The accessibility of the data was also evaluated, with the data are released in two formats, the metadata being published on the web and a compact disc, with copies being available on request.<sup>11</sup> The availability of user service was that Stats SA is reachable by email, telephone or fax.<sup>11</sup> However, an assessment of the quality of data pertaining to non-natural deaths only was not done by Stats SA, and so the quality of non-natural death data alone is not known in South Africa.<sup>10</sup>

Other national sources of mortality and injury data SAPS and the Road Traffic Management Corporation (RTMC) records.<sup>26</sup> Data from the SAPS regarding homicides are the only available source of national homicide data, while the RTMC utilises SAPS accident report forms.<sup>26,27</sup> The South African Medical Research Council (SAMRC) endeavours to report on mortality data, in the form of Rapid Mortality Surveillance reports. However, the data source utilised by the SAMRC is the National Population Register from the DHA; therefore, the data source is the same as that used by Stats SA.

#### **2.4. Challenges in data collection in South Africa**

South Africa, like many other countries, has introduced a civil registration system that does generate some vital statistics, but the usefulness of these statistics are severely limited due to problems within the system.<sup>23</sup> South Africa is a region that is marred by mortality data absences and deficiencies, and these deficiencies have been scrutinised and attempts to rectify them have been made.<sup>16</sup> Assessments carried out by the WHO based on 1996 data rated South Africa as a country with a low quality of mortality data, and found that death registration had a completeness of less than 70% with more than 20% of all deaths having ill-defined cause-of-death codes.<sup>16</sup> Although death registration has been in practice in South Africa since 1867, and the national statistical office was established in 1914, partial coverage has been a problem due to inconsistencies in civil registration practices for different population groups and geographical areas.<sup>16</sup> These inconsistencies resulted in the underutilisation of vital statistics for the majority of the

20<sup>th</sup> century in South Africa.<sup>16</sup> The quality of mortality statistics in South Africa has been reported as steadily increasing since the 20<sup>th</sup> century, and while there have been some improvement in the challenges to data collection, there are still deficiencies in acquiring and publishing mortality data.<sup>10,11,16</sup>

While Stats SA is mandated to annually produce a report on mortality statistics, the reality is that due to Stats SA experiencing extreme staff shortages for several years, there has been substantial delays in reporting.<sup>10,11</sup> Initially this delay in reporting was two years, however, the delay has now been extended to three years, meaning the timeliness and relevance of the data are affected.<sup>10</sup> The most recently published report on mortality data by Stats SA was published in July of 2021, however, the report was only for death data from 2018.<sup>10</sup> This can also be seen in the assessment of the death registration data by Stats SA themselves, and is noted as a weakness of their reports.<sup>11</sup> The timeliness of their reports was evaluated as being 36 months for processing time and time from end of reference period to publication as being 40 months.<sup>11</sup> This time period of over three years to process and publish hinders the access to accurate and timely mortality data. It also affects the relevance and utility of the information that is published.<sup>11</sup>

There is also reason to believe that the statistics that Stats SA reports on mortality may not be accurate. Death notification forms from the DHA are used as a data source for mortality in South Africa by Stats SA, however, studies have highlighted the poor quality of death notification in the country, especially regarding non-natural deaths.<sup>10,12-15</sup> Identified problems included ill-defined deaths, misclassification of the immediate cause of death, certification using a mechanism of death without stating the underlying cause, errors in cause of death certification, lack of content validity, and the use of ill-defined and non-specific codes, all of which signify considerable shortcomings with cause-of-death data in South Africa.<sup>10,12,14-16</sup> For non-natural deaths, it was found that the specific external cause and manner of death was rarely recorded on death notification forms.<sup>12</sup> These problems are all reasons why mortality statistics published by Stats SA may not be an accurate reflection of non-natural mortality, and why publications and reports that make use of DHA death registration data may also not be accurate. This

misclassification of deaths can still be seen in the most recent publication by Stats SA, in which 68.3% of non-natural deaths were recorded as having the cause of death being *Other external causes of accidental injury*, and of those deaths almost half of them were attributed to *Accidental exposure to other and unspecified factors*.<sup>11</sup> In addition, this report states that Chapter 19 deaths (Injury, poisoning and certain other consequences of external causes) are not included.<sup>11</sup> Other deficits that are commonly noted in publications regarding South Africa's mortality statistics are a lack of timely data, under-reporting, misclassifications of death, and ill-defined causes of death.<sup>13,28,29</sup>

Another problem that continually arises with regard to mortality data in South Africa is the assignment of causes of death as *unknown* or deaths *assigned to symptoms and signs not elsewhere classified*.<sup>10,11</sup> Inaccurate reporting of causes of death leads to an incomplete picture of national mortality. In the most recent report of *Mortality and causes of death in South Africa: Findings from death notification* by Stats SA, the proportion of deaths *assigned to symptoms and signs of disease not elsewhere classified* was 13.5% for 2018.<sup>11</sup> This is a shortfall of 3,5% from the recommended 10% maximum threshold as outlined by Mahapatra et al and improvements are needed in the reduction of ill-defined causes of death.<sup>11,23</sup>

## **2.5. Initiatives to record non-natural deaths in South Africa**

Focused initiatives have been introduced in South Africa to improve civil registration and vital statistics, particularly those related to mortality statistics. These initiatives came about after two WHO comparative assessments rated the quality of South Africa's mortality data as low.<sup>16</sup> As a result of South Africa's suboptimal vital registration data, various National Burden of Disease studies have addressed and outlined data deficiencies – and sought to establish alternative or additional data collection methods to complement the civil vital registration system channelled through DHA and Stats SA.<sup>14,16,30–32</sup>

Efforts to address the lack of injury mortality data in South Africa included attempts to implement injury mortality surveillance systems in Cape Town, which later expanded to other cities and provinces in 2000, as the National Injury Mortality Surveillance System (NIMSS).<sup>26,33</sup> The NIMSS was an initiative started by the SAMRC in 1998 and involved

the active collation and centralisation of routinely kept data of all non-natural deaths entering the forensic medico-legal system at participating mortuaries.<sup>30</sup> It was established to address the absence of systematic and rigorous information systems regarding non-natural deaths in South Africa.<sup>34</sup> It aimed to address this gap by providing basic information on deaths due to non-natural causes to the MRC-UNISA Crime Violence and Injury Lead Programme (MRC-UNISA CVI) for further statistics analyses.<sup>34</sup>

It involved voluntary participation of some of the larger state forensic mortuaries and the data collection and compilation was designed in accordance to particular shortcomings in the national registration system regarding non-natural deaths.<sup>30</sup> From 2001 to 2008 the NIMSS had full coverage in a number of large cities.<sup>30</sup> The aim of the NIMSS was to ultimately establish a permanent system to record all non-natural deaths that occur annually in South Africa to provide information on the incidence, causes and consequences of non-natural deaths, to prioritise injury and violence prevention action directed at high-risk groups and socio-environmental factors, to identify new injury trends and emerging problem areas, monitor seasonal and longitudinal changes in the non-natural fatality profiles, and to evaluate direct and indirect violence and injury prevention and control measures.<sup>35</sup>

The NIMSS recorded 21 items of information for every deceased individual that entered the forensic medico-legal system at participating facilities.<sup>34</sup> The utility of the information collected by the NIMSS lies in the fact that it provided pointers to improving the prevention and control of injuries in South Africa and in its ability to evaluate the impact of direct and indirect interventions that was expected to reduce some of the major causes of fatal injury.<sup>35</sup> Many studies have used the NIMSS data as a basis for extrapolation to national estimates, however, the data set was always more reflective of urban rather than rural fatalities in South Africa.<sup>35</sup> The dataset was routinely biased towards large urban areas and rarely included rural state mortuaries.<sup>34</sup>

In addition to not being able to provide full coverage for all deaths at state mortuaries in South Africa, the NIMSS was not able to come to a workable conclusion regarding the negotiations for access to post-mortem folders at mortuaries and the follow-up of

missing information.<sup>26</sup> These deficiencies of the NIMSS were due to logistical reasons and lack of funding.<sup>26,35</sup> The last available publications from the NIMSS are provincial reports available on the SAMRC website, which are for the years 2010 and 2011.<sup>36,37</sup> Due to these problems, and the fact that the NIMSS is no longer publishing reports, it has proved to be an unsustainable endeavour to capture and publish data relating to non-natural deaths in South Africa.

While the NIMSS is no longer a functional surveillance system to capture data pertaining to non-natural deaths on a national scale, in the Western Cape there is a Provincial Injury Mortality Surveillance System (PIMSS).<sup>38</sup> The PIMSS makes use of post-mortem reports, police crime incident reports, and chemical pathology laboratory results as sources of data relating to non-natural deaths that report to state mortuaries in the Western Cape.<sup>38</sup> Following on from the earlier initiatives of the NIMSS, the current system of the PIMSS is a robust and simple tool that provides data that is congruent with, yet avoids the rigid confines of the International Classification of Diseases 10<sup>th</sup> Edition 2016 (ICD 10) coding system.<sup>38</sup> However, there is very little readily available information relating to the process of consultation between participating research agencies to refine the data collection instrument, manual and automated data collection procedures, and the systems initialisation within provincial governments relating to the PIMSS.<sup>38</sup> There are also no initiatives to try and bring this type of PIMSS to other provinces in South Africa or regular publications by the Western Cape government regarding the information stored in the PIMSS. While the Western Cape Government has endeavoured to produce mortality data, the information came from the various FPS Business Information Systems (BIM), case files and data from the DHA, rather than the PIMSS.<sup>39</sup>

Many problems have plagued initiatives to routinely publish non-natural mortality data in South Africa, such as lack of participation and compliance by state mortuaries, lack of funding, staff shortages, longer publication times for reports, and lack of sustained publication efforts.<sup>10,11,26,34–37</sup> A notable problem with all of these initiatives is that they made use of current data sources at state Forensic Pathology Service mortuaries and attempted to consolidate them into usable information. This is a time-consuming



endeavour that could have been avoided through the establishment of a standardised data system in each state mortuary. Problems such as staffing, and funding limitations might have been avoided if these endeavours started with the implementation of standardised databases at state mortuaries and would have increased the likelihood of the project being more sustainable.

Standardised data practices and data systems would mean that the consolidation of data on a national scale where the analysis of data could be much more integrated and, therefore, would rectify many of the problems faced by previous initiatives to capture and publish mortality data. Looking at many of these previous initiatives to publish non-natural mortality data it can be seen that if there were standardised data practices in place across state mortuaries in South Africa, non-natural mortality data and statistics would be more readily available for analysis and publication; thus, the public health functionality of medico-legal death investigation would be properly served.

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## Chapter 3: Scoping review

### 3.1. Introduction

The discipline of medico-legal death investigation involves the legal investigation of non-natural deaths. The wealth of data generated through the course of medico-legal death investigation has many benefits; however, due to the lack of structured collection of data and the management thereof within medico-legal death investigation in South Africa, the potential benefits of this data are not realised.

Medico-legal death investigation, which includes the medico-legal autopsy and related ancillary investigations, is mandated by the Inquests Act, the Birth and Deaths registration Act, the Health Professions Act, and the Criminal Procedures Act of South Africa.<sup>1-3</sup> As part of the inquest procedure a qualified medical professional, usually a forensic medical practitioner, conducts out an autopsy on individuals in which the cause of death is suspected to be due to non-natural causes.<sup>3</sup>

According to Statistics South Africa (Stats SA) there has been an average of 54 721 non-natural deaths per year from 1997 to 2018, with 54 161 deaths occurring in 2018.<sup>4,5</sup> These deaths comprised 13% of all deaths in South Africa as of 2018.<sup>4,5</sup> Stats SA reported that approximately 34 000 autopsies (in perinatal deaths), and 78 000 post-mortem examinations (in deaths occurring one week after birth), were performed in South Africa during 2018 to ascertain the cause of death of decedents. However, it was not specified what the proportion of these methods of ascertainment were used for non-natural deaths.<sup>4</sup> Autopsies made up 7.6% of the methods to ascertain the cause of death and post-mortem examinations 17.3% during this period, for all deaths reported.<sup>4</sup> However, the statistics relating to non-natural deaths that are routinely collected and disseminated by Stats SA suffer from miscoding and miscounting.<sup>4-7</sup>

Improving the current reporting system of medico-legal death investigation is an essential aspect to improve the FPS reporting systems as a whole and also has important public health implications.<sup>8</sup> Currently, research utilising data generated during the course of medico-legal death investigation is limited due to the inadequacies of data collection and management in the field. Research is laborious and time-consuming as

data pertaining to medicolegal death investigation is mainly stored in paper format at the many state mortuaries in South Africa.<sup>8</sup> The introduction of a mandatory, standardised, and systematised data collection and management system within Forensic Pathology Services would allow for data to be entered into a computerised database that pools data from various state mortuaries in South Africa would facilitate further analysis and utilisation of the data.<sup>8</sup> This would reduce the time needed to collect data for research activities and could be used by academic institutions and government agencies for public health functions such as epidemiologic studies, health, and disease surveillance, and to institute preventative strategies.<sup>8</sup> Improving and streamlining the data collection and management platform pertaining to medico-legal death investigation is paramount to introducing a system that can support research and public health projects.<sup>8</sup>

The results section is presented as a narrative report and summarises the findings of the scoping review. The discussion section outlines how the scoping review was able to answer the research question and how the objectives of this section were met.

The objectives of this scoping review were to explore what the main data elements of a standardised data collection system for medico-legal data would be to identify legal and ethical considerations pertaining to medico-legal death investigation data in South Africa and to identify what technical equipment can be used to capture and manage medico-legal death investigation data. These objectives were met through the contextual analysis of studies published in peer-reviewed journals and through the analysis of relevant legislation.

A scoping review was selected as the method to fulfil these objectives, as it was determined by the researchers to be the best method for collating information regarding data practices in the field of medico-legal death investigation. It is a non-empirical study, in which the analysis unit is based on already existing data.

### **3.2. Methodology**

The methodological approach used in this chapter was a scoping review. A scoping review was conducted to gather evidence from the literature on data capturing, management, and retrieval with regard to the field of medico-legal death investigation. It



also gathered evidence on legal and ethical considerations pertaining to data in the medico-legal field, in a South African context. While scoping reviews are still an emerging methodology with no universal definition, there is a general consensus as to the core elements of a scoping review.<sup>8-13</sup>

The methodology for this scoping review was guided by the framework for a scoping review outlined by Arksey and O'Malley.<sup>10</sup> Arksey and O'Malley defined the purpose of scoping studies as aiming to rapidly map “the key concepts underpinning a research area and the main sources and types of evidence available”.<sup>9,10</sup> Scoping studies are concerned with contextualising knowledge in terms of identifying the current state of understanding, to identify what is known and unknown regarding the topic in question and then setting this knowledge in the context of policy and practice.<sup>9,13</sup> A scoping review differs from a systematic review in that broader topics are addressed, rather than focusing on a narrowly defined research question as in systematic reviews.<sup>10</sup>

Scoping reviews do not include a quality appraisal of the evidence, but rather contain existing literature without weighing the evidence.<sup>10</sup> Quality appraisal of the studies was not conducted, as this review aimed to explore the general scope of research that has been conducted.<sup>14</sup> The purpose of a scoping review is to examine the extent, range and nature of a research activity in a particular area under study.<sup>10</sup> Clarifying and linking the purpose of the scoping review to the research question and objectives allows for the increased efficiency and quality of further research synthesis.<sup>9</sup>

The scoping review examined the literature on data capturing, management, and retrieval for the past 25 years globally and locally, as well as legislature that is relevant to medico-legal death investigation and data practice in South Africa. The scoping review used document content analysis to answer the research question posed by the study. Document content analysis is defined as “a systematic procedure for reviewing or evaluating documents – both printed and electronic (computer-based and internet-transmitted) material” for the purpose of this study.<sup>14</sup>

As this scoping review followed the methodological framework outlined by Arksey and O'Malley, the following research steps were conducted:

- “(i) identifying the research question,  
(ii) identifying relevant studies,  
(iii) study selection,  
(iv) charting the data,  
(v) collating, summarising, and reporting results.”<sup>10</sup>

### **3.2.1. Research question**

The main research question for this scoping review was based on the overall aim of the study:

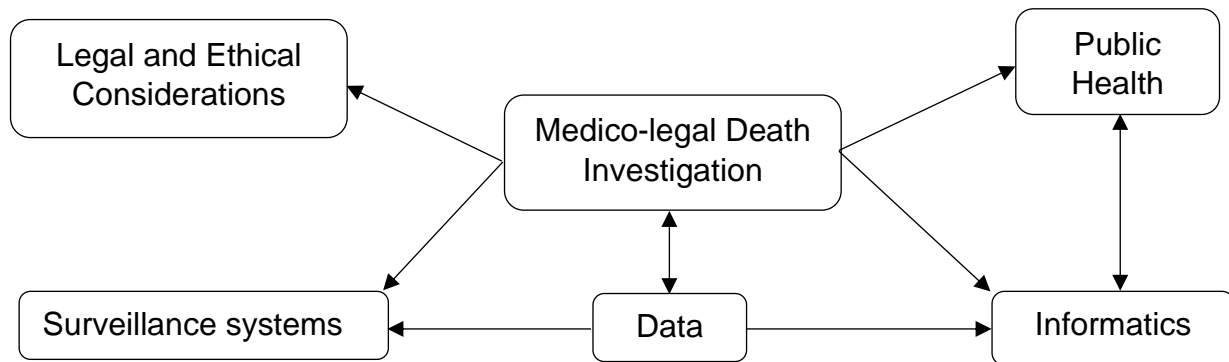
- What are the requirements and main data elements that should be collected for a standardised data collection system for medico-legal death investigation data in South Africa?

The sub-questions for the scoping review were shaped by the objectives that the scoping review aimed to fulfil, these were:

- What would the main elements of a standardised data collection system for medico-legal death investigation data in South Africa be?
- What are the legal and ethical considerations pertaining to medico-legal death investigation data in South Africa?
- What technical equipment can be used to capture and manage medico-legal death investigation data?

### **3.2.2. Broad identification of literature**

Four main themes were identified, *public health impact of medicolegal data*, *informatics*, *legal and ethical considerations*, and *mortality surveillance systems*. These initial sub themes were used to establish the keywords that were used to search for relevant literature for the scoping review. The interplay of these four themes in the medico-legal concept were used to guide and conceptualise the search strategy. The conceptualisation of the search strategy is shown in Figure 3.1.



**Figure 3.1: Conceptualisation of search strategy**

Published and grey literature were searched for using the University of Pretoria's (UP) electronic library database, as well as making use of the electronic databases Scopus, to ensure that as much relevant literature as possible was accessed. Secondary documents that came up in the search on Scopus were not included in the results, due to complications accessing these documents as they were not indexed in the Scopus or UP databases. The UP database was used as the primary document database, while Scopus was used as a secondary database to augment the findings from the primary database.

The search was limited to articles published in the English language. The results were reviewed by the primary author and included in the scoping review in agreement with the primary author and supervisors of the project. All studies included in the scoping review were exported to a single library using Mendeley software. Repeated studies or literature were identified and removed from the library. The results from each electronic search were recorded according to the relevant themes and keywords used for the search. In cases in which the keyword search yielded over 100 results the first ten pages of results were perused for relevant studies due to time and resource constraints that the study faced. When the primary database did not yield any search results, the secondary database was used. The initial search results are presented in Table 3.1.

**Table 3.1: Initial search results**

Theme	Number of results	Number of perused results	Number of relevant studies
Public health	9742	795	55
Informatics	52 613	246	35
Ethical considerations	475	313	13
Mortality surveillance systems	25 438	234	31

### 3.2.3. Study selection

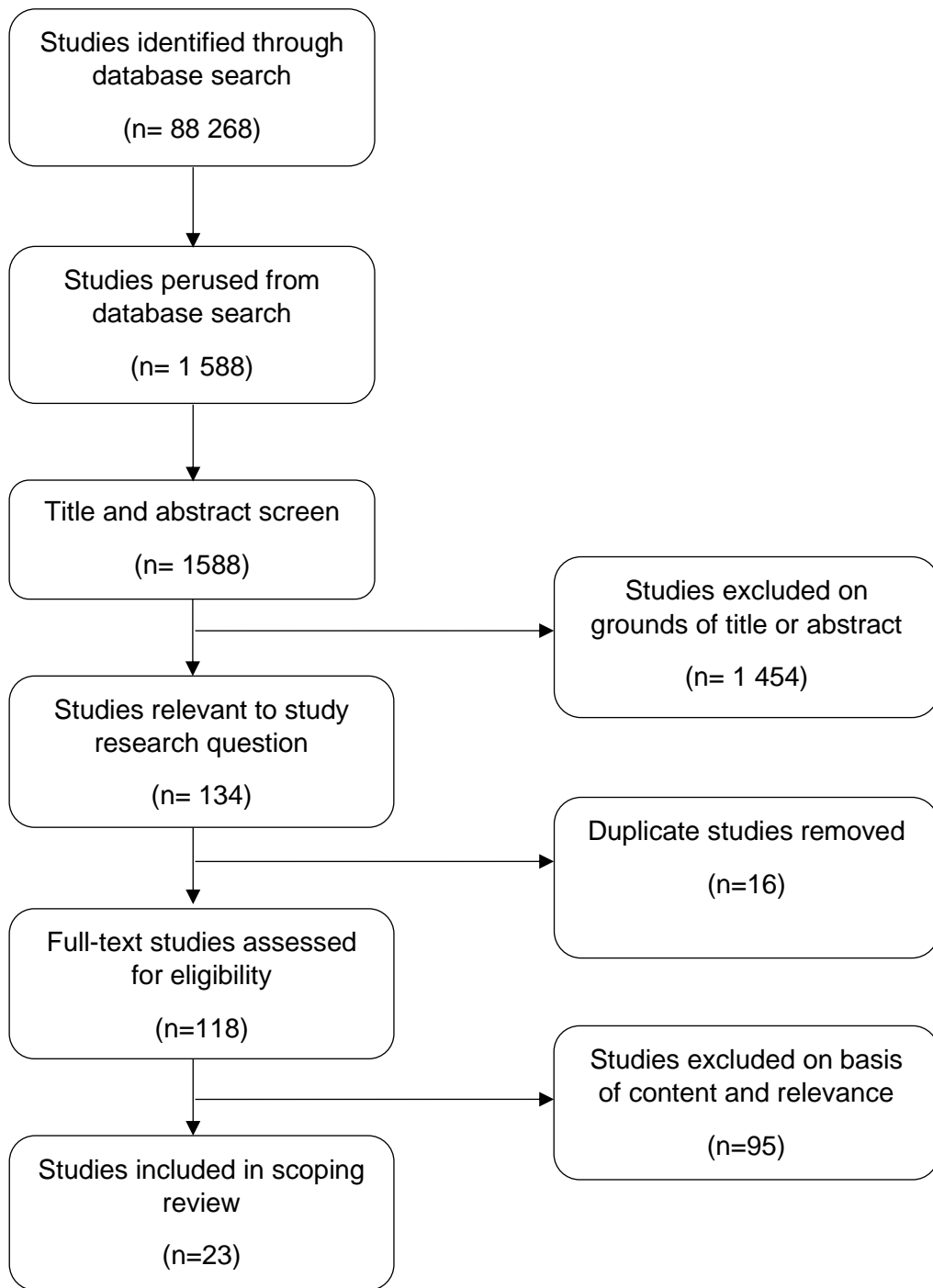
Title and abstract screening were guided by the initially identified sub themes and keywords. Further inclusion criteria were established to ensure that the content of the identified literature was relevant to the research question and aim of the study. Each article was assessed to ensure that it met inclusion criteria.

The inclusion criteria were as follows:

- Articles of data capturing of non-natural deaths
- Articles on best practice methods for data collection, capture and/or management
- Articles on data capturing for autopsies and post-mortems
- Articles relating to informatics
- Articles on ethics and ethical considerations
- Articles on data-capturing pertaining to medico-legal death investigation
- Articles relating to public health
- Articles pertaining to medico-legal death investigation
- Articles conducted locally or internationally
- Legislation relating to the FPS in South Africa
- Legislation relating to data in South Africa
- Legislation relating to statistics in South Africa
- Accessible on electronic database
- Published within the last 25 years

Studies that did not meet any of the inclusion criteria were excluded from the scoping review.

The research questions, identified themes, and aims and objectives of the study were used to establish keywords to search for relevant literature for the scoping review. Keywords related to databases, data capture, collection, and management were also included. The keywords used to search for studies relevant to the theme and study research question, as well as the Boolean operators used for each search, can be found in Appendix C. For the legal and ethical perspectives section, only legislation relating to data, forensic pathology services, and statistics published by the government of South Africa were perused. The search strategy for scholarly articles related to this study is outlined below. The search strategy did not include statistics regarding legislature that was included in the scoping review. The search strategy and study selection are outlined in Figure 3.2.



**Figure 3.2: Search strategy for scoping review**

### **3.2.4. Charting data**

All studies meeting the inclusion criteria were entered into Mendeley, an open-source reference-management software. Basic data regarding the selected studies were captured in a data-charting form (Appendix E). This table provides basic information regarding the selected studies included in the scoping review. This information included the title of the article, authors, journal of publication, year of publication, and keywords. Information regarding the relevant legislation included in the scoping review was recorded and can be found in Appendix F.

### **3.2.5. Collating, summarising, and reporting results**

The results of the scoping review are presented as a narrative report in this chapter. The results were divided into separate sections based on the identified sub themes and used to search for relevant literature. The narrative report summarises the extracted data relating to the public health impact of medicolegal data, the role of informatics in data collection, capture, and management, the legal and ethical considerations surrounding medico-legal data, mortality surveillance systems, and the technical equipment used for them.

## **3.3. Results**

From a total 88 268 search yields, 1588 articles were retrieved and perused from the UP Library electronic database. Of these 1588 studies 134 were determined to be valuable in answering the research questions. After excluding duplicate studies, 118 were subjected to content analysis. Of these 118 articles, 23 met the inclusion criteria and were included in the scoping review. Included data that was summarised included the title, journal published in, year published, and abstract, this information can be found in Appendix E.

### **3.3.1. Characteristics of included studies**

Articles ranged in publication dates from 2001 to 2021 and described a broad number of topics, such as public health, informatics, ethics, and mortality surveillance systems. Most studies were published between 2011 and 2015 (n = 12), with 2015 being the year

in which most studies were published (n = 6). Only one study was published in 2007, 2013, 2014, 2017, and 2020.

The range of literature included in the scoping review was very broad because the research being undertaken has not been outlined in a single body of literature before, and a broad variety of fields are applicable to it.

The majority of publications were from the United States of America (n=12). Australia, Ethiopia, and the United Kingdom each had one publication. In one case, the country of origin was not specified. Three publications were from multiple countries and four were from South Africa. The majority of studies included in the scoping review were quantitative (n=9). A statistical breakdown of the characteristics of the included studies can be found in Appendix G.

The results are in the form of a narrative report divided by themes that informed the search strategy. These themes are public health, informatics, legal and ethical perspectives, and mortality surveillance systems. The studies that form the basis of the scoping review are presented in how they relate to the overall research question and field of medico-legal death investigation, which was decided at the discretion of the researchers.

### **3.3.2. Public health**

Public health is defined as an allied health and medical speciality that aims to improve and promote a population's health and welfare, and to reduce or prevent morbidity and mortality.<sup>15-18</sup> The word *forensic* is derived from the Latin word *forensis* which means *public* or *forum*, not *crime* or *science*, as many people incorrectly believe.<sup>19</sup> While medico-legal death investigation does serve a judicial function, it is important to note the public health function that it also serves. Mortality statistics have been cited as an integral part of monitoring for public health, resource allocation, and the development of public health policy.<sup>20</sup> The Centres for Disease Control (CDC) defines medico-legal death investigation system as a component of the public health system, which not only supports public health but also public safety.<sup>21-23</sup> Therefore, the public health



implications and benefits of medico-legal data cannot be understated. Various studies identified data sharing and analysis as important aspects of public health strategies.<sup>24</sup>

Currently, the quality of data generated by medico-legal death investigation systems limits effective public health responses.<sup>25</sup> To understand the importance of collecting medico-legal data and defining the specific data elements that should be collected, the importance of such data needs to be understood. Medico-legal death investigation serves as a public health service that is poorly delivered in South Africa due to the lack of a routinised data collection system. Incomplete and inaccurate statistics increase the burden of non-natural deaths and do not provide policy makers with the necessary information for targeted prevention measures.<sup>25</sup>

Due to the nature of medico-legal death investigation, including the fact that investigations are initiated immediately after notice of death, data collected for medico-legal death investigation is noted as being ideal for the timely monitoring and study of reportable deaths.<sup>26</sup> The importance of medico-legal data goes beyond statistics, and should be used for public health action and surveillance.<sup>27</sup> This data can be used for epidemiological and public health research that would not otherwise be feasible.<sup>27</sup> Forensic pathology plays an important role in protecting public health, in that the information generated during the course of medico-legal death investigation provides a powerful tool for epidemiologic research.<sup>17</sup> Medico-legal death investigation explores deaths that are sudden, violent, and unexplained, such as homicides, suicides, road traffic fatalities, and unusual occurrences of infectious diseases, with an overlap between deaths that are of medico-legal significance and public health significance.<sup>17</sup>

The successful adaptation of public health principles and rationales to the medico-legal death investigation system have previously been implemented.<sup>22,28</sup> These successful initiatives indicate that due to the public health function of medico-legal death investigation, various public health programs and principles can be modified to suit the needs of medico-legal death investigation. Some studies have outlined the value of medico-legal data for public health interventions and mentioned some of the data elements that were collected in such systems. These elements included socio-demographic characteristics, medical information, circumstances surrounding the death,

results from forensic medical and scientific tests and the outcomes of legal proceedings.<sup>26,29</sup>

It is important to disseminate medico-legal data for it to be effectively utilised.<sup>19</sup> The sharing of such data to relevant entities and interested parties, is what makes medico-legal data relevant.<sup>19</sup> These tie into the public health principles of surveillance and epidemiologic research.<sup>19</sup>

Data from medico-legal death investigation was cited as being a valuable data source for preventative medicine, an important facet of public health.<sup>29</sup> A significant point that was revealed was that the utility of medico-legal databases are more accurate than death certificates or even police reports.<sup>29</sup> The absence of discussion regarding the limitations and strengths of medico-legal data for public health was raised by certain studies, which aimed to systemically review published literature regarding the public health utility of medicolegal data.<sup>29</sup>

A systematic review of the National Coronial Information System (NCIS) used by coroners in both Australia and New Zealand revealed that frequently reported strength of the NCIS were comprehensive coverage, a high level of detail, reliability, utility, and a high level of data quality and timeliness.<sup>29</sup> With regards to the utility of the NCIS it was described as a useful tool for both death investigation and research on public health and safety.<sup>29</sup> The NCIS was cited as being a valuable tool for both researchers and injury prevention policy makers to identify hazards, as well as to inform the development of prevention strategies and to assess the effectiveness of such strategies.<sup>29</sup> However, a lack of availability of data specifically in open or ongoing cases was reported.<sup>29</sup>

This lack of accessibility results in public health research and interventions relying on cases that are already closed.<sup>29</sup> Inaccuracies due to coding errors were also identified, as well as a lack of completeness relating to historical and proximate circumstances of deaths.<sup>29</sup> Inadequacies pertaining to missing information resulted in undermined case identification was undermined, which leads to under-reporting and the inability to monitor mortality trends.<sup>26</sup> Secondly that detailed analysis of mechanisms of injury and identification of contributing factors will also not be possible.<sup>29</sup>

The introduction of a medico-legal database has the benefit of providing more in-depth data regarding mortality statistics than traditional means of mortality reporting such as national vital statistics systems or voluntary reporting form local agencies.<sup>29</sup> However, the design of such a database without the sole purpose of research or specific research question in to guide it will lead to variability in the content and detail of information that is available from the database.<sup>29</sup>

### **3.3.3. Informatics**

The need for informatics development has been recognised within all public health systems, and within the realm of public health informatics is defined as the systematic application of information and computer science to public health practice and research.<sup>18</sup> A study by Kukafka et al identified that the majority of studies involving the term *public health informatics* revolved around the detection and surveillance of outbreaks, and that there have been positive benefits of integrating the fields of public health and informatics.<sup>18</sup> Given that medico-legal death investigation serves a public health role, it would be beneficial to apply public health informatics practices to the field of medico-legal death investigation.

The role of informatics in forensic pathology, and thus medico-legal death investigation, is a discipline with few publications relevant to the field. When it comes to the forensic autopsy there are three phases of the autopsy.<sup>30</sup> These three phases are defined as preanalytical, analytical, and post analytical phases, each of which generates different subsets of data that should be routinely collected.<sup>30</sup>

The production of timely post-mortem reports is another aspect that is not addressed by statutory bodies. The importance of structuring autopsy reports to facilitate searching, analysing and research of this invaluable data is a priority in informatics.<sup>30</sup> The importance of adapting autopsy reports to the changing demands of medicine by incorporating informatics and new technologies is of crucial importance.<sup>30</sup> Clinical and medical informatics were regularly identified as subspecialties of medicine that are related to forensic pathology.<sup>31,32</sup> It can therefore be speculated that systems in these related disciplines could be adapted to suit the changing requirements of forensic pathology.

Existing medico-legal death investigation systems have various shortcomings.<sup>31</sup> A lack of standards is an essential problem that is routinely identified in the literature.

Limitations relating to forensic pathology include the lack of data standards for death investigation systems, rudimentary electronic information systems, and inadequate of communication between different systems.<sup>31</sup>

In 2015 O'Malley described forensic informatics as the study of information science relevant to forensic science tasks and the study of information science to support forensic tasks.<sup>32</sup> It has been compared to the discipline of medical informatics and is also considered to include the study of how to design a system that delivers the appropriate forensic information to the appropriate person, and is considered to be linked to workflow discussions and standards.<sup>32</sup> This concept of forensic informatics was described in the context of intelligence lead policing and its application to improving police efforts, and did not mention its implications to forensic pathology or medico-legal death investigation.<sup>32</sup> The article did, however, outline how a forensic information system was devised in Australia through the use of Entity Relationship Modelling which provided a basis for the visualisation of abstract and structured forensic entity relationships.<sup>32</sup>

This approach proved to be useful to the development of a forensic information system and should be considered a key tool in the development of a mortuary information system for medico-legal death investigation.<sup>32</sup> It outlined the benefit of using agile methodology rather than traditional development practices.<sup>32</sup> This forensic informatics structure was identified as greatly enhancing police investigations and decreased backlogs and turnaround times for investigations and improved forensic procedures and practices.<sup>32</sup> The benefits outlined by this article can be achieved in the medico-legal setting by the implementation of a similar mortuary information system.

#### **3.3.4. Legal and ethical considerations**

In South African legislation, data have been defined as “electronic representations of any form”.<sup>33</sup> This definition comes from the Electronic Communications and Transactions Act 25 of 2002. This act governs the admissibility of electronic evidence;

however, it does not contain information regarding the storage of information with regard to medico-legal death investigation.

In South Africa the Inquests Act 58 of 1959 governs the mandate to perform medico-legal post-mortem investigations.<sup>1</sup> Deaths that are due to non-natural or unknown causes are required by law to have medico-legal autopsies performed to ascertain the cause of death.<sup>1</sup>

In terms of research and publication of medico-legal data, the National Health Act of 2003 stipulates that “No person shall publish to another person any fact whereby the identity of the recipient of any tissue removed from another person before, or after the death of the said person may possibly be established” unless prior consent by the deceased or next of kin of the deceased was given, but this relates specifically to donations and not anonymised surveillance data.<sup>34,35</sup> However, due to the stipulations of the Inquests act, in which familial consent is not required, the use of information from medico-legal death investigation for research purposes is unclear and has not been clearly defined in legislation.<sup>1</sup>

An important stipulation to take note of in this regulation is the stipulation that publication of information in which the identity of the recipient of removed tissue may be established is prohibited.<sup>35</sup> In the case of medico-legal death investigation, all information regarding decedents is anonymised, as all decedents undergoing a medico-legal post-mortem investigation are assigned a DR number. This practice limits the risk of identifying the decedent of any tissue used in a publication. However, the use of data regarding the death of the decedent for research and publication has not been outlined in any body of legislation.

A Memorandum of Understanding (MoU) between the South African Police Service (SAPS) and the National Department of Health (NDoH) was signed, which outlines the responsibilities of the SAPS and FPS with regards to the undertaking of medico-legal death investigation.<sup>36</sup> The MoU was signed with the objective of ensuring the full cooperation between the SAPS and the NDOH in the management of all stages of medico-legal death investigation to promote the development of a just society, to outline and regulate the roles and responsibilities of the SAPS and DOH at all stages of

medico-legal death investigation, and to ensure that all documentation and reports provided to the FPS are complete.<sup>36</sup> The MoU states that the FPS is responsible for the collecting, reviewing, and analysing of related data, and providing information and advice to health and other government authorities or departments.<sup>36</sup> However, the MoU does not stipulate protocols for data collection and management, or who owns the data generated during the course of medico-legal death investigation.

The Regulations Regarding the Rendering of Forensic Pathology Services stipulates that the FPS is responsible for collecting, reviewing, and analysing related data, however, details on how this should be done or who is responsible for it are not outlined in any legislation.<sup>3,34</sup>

The National Code of Guidelines for Forensic Pathology Practice In South Africa, a guideline that was put forth by the National Forensic Pathology Services Committee, outlines one of the aims of the FPS as being to establish adequate data collection and processing.<sup>3</sup> It also states that all designated facilities should be equipped to maintain a database with relevant records.<sup>3</sup> However, the wording of the guidelines is vague and does not outline what exactly can be considered *relevant records*. Additionally, the Code of Guidelines is not a statutory document and therefore is not legally enforceable.<sup>3</sup>

Section 440, titled 'Keeping Statistics' states: "The relevant statistics data collection sheet, FPS 011 already containing the details of the case is completed by a designated person / or entered into the database directly by a designated person.<sup>3</sup> The FPS 011 form is described as " A Statistics data collection sheet with details of case", however, it does not outline the specific information that the FPS 011 should include, and at many mortuaries the FPS 011 is not in use.<sup>3</sup> The guidelines do not outline what information should specifically be included in the datasheet or what the parameters for a database should be. The lack of a statutory outline of data elements and collection standards has a negative effect on the utility of data generated in state mortuaries.

With regards to statistics generated at state mortuaries, section 20, titled *Accounting and reporting requirements* in the Regulations to the National Health Act states that "The Provincial Head of Department must submit annual returns of statistics and reports related to the Service to the National Director General in a format determined by the

National Director from time to time".<sup>3</sup> The Regulations do not directly state which statistics must be submitted and the format is left to the discretion of the director general.<sup>3</sup>

The quality of current mortality data from medico-legal death investigation systems has been cited as a limiting factor in its benefits to public health interventions.<sup>25</sup>

The balance between protecting individual patient confidentiality and enabling effective public health intelligence to guide public health interventions is important when analysing any kind of epidemiological surveillance.

Literature regarding ethical considerations related to the collection and management of medico-legal data is scarce and not routinely published. As ethical considerations also need to be taken into consideration, the legislature of the country in which the data will be collected will vary from country to country, depending on the relevant legislation pertaining to medico-legal death investigation. In South Africa, publication of research related to medico-legal death investigation is permitted, as long as the decedent is not identifiable from the publication.<sup>34,35</sup> The issue of familial consent for collection of such data is circumvented due to the nature of medico-legal death investigation, in which all decedents are anonymised by assigning a Death Register (DR) number.<sup>1,3,35</sup>

While the recording and reporting of medico-legal statistics is mandated in the legislature, there are no Regulations or guidelines defining what statistics or data should be recorded or how it should be managed and disseminated.<sup>3</sup> These inadequacies relating to medico-legal data has led to a shortfall in routine data collection and management within medico-legal death investigation and the FPS of South Africa.

### **3.3.5. Mortality surveillance systems**

A study by Mikkelsen et al evaluated the quality of cause of death data from six high-income countries and found that while the countries included in the study all had highly developed mortality information systems that produced cause of death data in alignment with international standards, there were deficiencies in their statistics that could have significant policy implications.<sup>37</sup> These deficiencies were found to mainly be due to a lack of standardised instructions for medical certifiers on how to complete death

certificates.<sup>37</sup> The utilisation of death certificate data can negatively affect mortality statistics, and a way to address this issue would be to utilise data from state mortuaries, specifically for non-natural mortality data. Forensic Pathology Service mortuaries are a legislated point of contact for non-natural deaths in South Africa, and data regarding these deaths are meticulously captured.

A study by Croom et al examined the process of medical record acquisition at medico-legal death investigation offices in depth, and found that there were many inefficiencies in the medical record acquisition process, which negatively affects public health and safety research and resource waste.<sup>38</sup> Identified resources that are wasted included investigators time, paper and the performance of unnecessary autopsies, all of which are likely to occur in South Africa as well.<sup>38</sup> Recommendations included the standardisation of death certificates and death codes, mandatory training of record providers and future studies to spur policy development and implementation, all of which should be taken into account when looking at medico-legal death investigation in South Africa.<sup>38</sup>

Medico-legal death investigation systems have been found to have the potential to play an important role in disease surveillance, however, in order to adequately fulfil the public health function, these systems should not be entirely separate from the government of the country in which the system exists.<sup>39</sup> This issue of an independent death investigation system failing to provide its public health functionality was highlighted in a paper by McGowan et al in which variant Creutzfeldt–Jakob disease (vCJD) had the potential to emerge as a second-wave infection resulting from human-to-human transmission and a study was proposed to investigate the prevalence of the abnormal prions in the UK population by making use of a post-mortem tissue archive, but the study was found to be unfeasible as coroners did not wish to participate in such a government implemented study, citing that the study would adversely affect the independence of the coronial service.<sup>39</sup> In South Africa this is not an issue that would be relevant to establishing a database for medico-legal death investigation data, as Forensic Pathology Service (FPS) is a governmental entity that resides in the stewardship of the NDoH, but is run by the provincial Departments of Health. A more



recent example of the utility and benefit of medico-legal death investigation systems aiding public health with regards to emerging diseases is the COVID-19 pandemic, in which many findings of the disease came from forensic medical practitioner's (FMP's) findings.<sup>40-42</sup>

A study into utilising mortuaries as a source of injury data by Grills et al found that there are many challenges to the establishment of an international guideline for mortuary data surveillance, however, making use of the CDC's "attributes of a successful surveillance system" may be a way to characterise potential barriers anticipated in constructing a guideline.<sup>43</sup> These attributes are:

"- Usefulness and acceptability

- Simplicity and accessibility
- Specificity
- Timeliness
- Data quality and sensitivity
- Representativeness
- Flexibility
- Stability"<sup>43</sup>

In order to build an effective system all possible obstacles would need to be systematically assessed and strategies to overcome these challenges need to be employed.<sup>43</sup> The study found that the most significant challenges of such a system would be representativeness and the securing of government support, and that strategies to overcome these barriers would need to be further developed over the course of a pilot study. In order for a robust system to be developed, preparatory work, engagement with stakeholders, and the pilot implementation of the system could be used to contribute to a robust system which will begin to build reliable fatal injury data information to inform injury prevention.<sup>43</sup> This study sought to produce a guideline for low and middle income countries, however, it was primarily focused on injury fatality data, rather than overall non-natural death data.

South Africa has a well-established national vital registration system; however, the cause of death statistics suffers from the under-registration of deaths and the misclassification of the causes of death.<sup>20</sup> The registration system has also been cited as failing to provide timely mortality statistics that can be utilised at district level.<sup>20</sup> An initiative to capture and publish non-natural mortality data in South Africa was undertaken in 1998 and has served as the basis for many other similar initiatives.<sup>28</sup> The study adapted the rationale for public health surveillance, which included:

- i. The ongoing and systematic collection of data
- ii. The consolidation and analysis of collected data
- iii. The dissemination of information through narrative epidemiological reports to public health practitioners
- iv. Follow up to see if data has been applied to prevention and control”<sup>28</sup>

This pilot study outlined the different data elements collected and divided into five clusters.<sup>28</sup> These clusters were case and personnel identifiers, victim demographic details, cause of death, circumstance and manner of death, ancillary investigations, and information relating to deaths due to intentional violence.<sup>28</sup> In total 23 data elements were identified and collected.<sup>28</sup> EpiInfo 6 was used to collect this information, as it is a readily available and easy to use application. This data was collected from participating mortuaries on a three-month basis and was integrated and analysed by specialist researchers in Johannesburg and Cape Town, while geographic information was analysed by the Council for Scientific and Industrial Research (CSIR) in Pretoria.<sup>28</sup> The study was able to produce epidemiological profiles of non-natural deaths from participating mortuaries, but it encountered some challenges. These challenges included variance of data accuracy across different mortuaries, lack of timeliness for data elements relating to laboratory reports, organisational issues such as a lack of equipment, personnel resistance, and funding issues.<sup>28</sup> The set-up costs at the time of the study were estimated to be around R26 000 per mortuary, which would amount to approximately R93 700 in 2022.<sup>28,44</sup>

One study utilised an Excel Macro in Visual Basic for Application (VBA) to procure data from tables in Word documents based on autopsy and toxicology reports.<sup>45</sup> However,

this endeavour was only possible due to the uniformity and consistency of the reports and so in instances where only paper copies exist or variations in terminology and format exist, extra work would need to be done before the Macros could be implemented.<sup>45</sup>

Research Electronic Data Capture (REDCap), a web-based system, has been identified as a software system that could potentially be used for the collection and management of medico-legal data.<sup>46</sup> REDCap allows researchers to design relevant databases and collaborate with institutional partners in different countries. It allows for the collection, storage and management of information that is collected and stored in the database.<sup>46</sup> As it allows for the researcher to design a database tailor-made, it can be customised to suit the needs of medico-legal data capture and management. Readily available, and free, open-source software can be adapted to suit the needs of medico-legal data acquisition and has been used in previous endeavours to capture and publish medico-legal data in South Africa.<sup>28</sup>

The use and satisfaction of Laboratory Information Management Systems (LIMS) in forensic pathology and death investigation offices was assessed by one study.<sup>47</sup> The study found that the majority of death investigation offices used their own home-grown systems which consisted of software such as Microsoft Access, Excel, or FoxPro, or made use of Standard Query Language (SQL) servers, such as Microsoft, Redmond, or Wash.<sup>47</sup> In some cases, the offices made use of vendor-purchased database systems with CME/VertiQ being the most common vendor-purchased forensic LIMS System in use. In the table below, the various software that was identified as being used in death investigation systems identified in the study have been outlined, some of which can be seen in table 3.2 below.<sup>47</sup> The study found that user satisfaction for purchased vendor Forensic LIMS was greater than that of systems that were developed in-house.<sup>47</sup>

**Table 3.2: Software for Forensic LIMS**

Software used for in-house forensic LIMS	Vendor Forensic LIMS
Microsoft Access	CME
Microsoft Excel	VertiQ
SQL Server	Justice Trac
.Net	Case Manager/ Quincey
Oracle	MDI Log
Filemaker	Coroner/ME
ColdFusion	Lablynx
FoxPro	Themis
	Veripac
	Tiburon
	VAST

Regarding studies where mortality surveillance systems were the main focus of the article, few actually identified data collection and management protocols used for the mortality surveillance systems. However, studies that did mention what software and applications were used either made use of purchased statistical and coding packages, such as Stata and *Integrated Resource Information Systems (IRIS)* or mentioned that they made use of in-house developed software using readily available packages such as Microsoft Access or Excel.<sup>43,47-51</sup> The lack of readily available and accessible software and data collection and management protocols for mortuary information management is a factor that needs to be addressed.

### **3.4. Discussion**

This study sought to consolidate literature relating to medico-legal death investigation and data into a comprehensive body of literature. It also sought to explore data elements related to medico-legal death investigation, identify legal and ethical considerations pertaining to it, and identify technical equipment that can be used to house data generated during the course of medico-legal death investigation. The results

show that there are various fields related to medico-legal death investigation and that practices in these fields can be applied to it.

The public health value of mortality statistics, specifically non-natural statistics, has been illustrated in various studies. However, this public health function has not yet been adequately fulfilled. The effectiveness of public health interventions using mortality data is currently limited because of the lack of routine data collection and management in the field. As medico-legal death investigation is linked to public health, public health interventions and databases can be used as a blueprint for the modelling of databases within the field. Important principles of public health, such as surveillance and epidemiologic research, can also be applied to medico-legal data. A review of a coronial system in Australia outlined the benefits of such a medico-legal system, however, the limitations were found to affect the overall quality of the data itself as well as the quality of interventions that could be conducted due to the data.

The role of informatics in medico-legal death investigation is outlined in the scoping review. The major limitation of medico-legal death investigation systems was identified as being the lack of data collection standards. The use of entity relationship modelling for the use of developing a medico-legal database was suggested as an avenue that should be further explored.

Ethical considerations relevant to the collection and storage of medico-legal data include consent to the storage and publication of information. However, due to the nature of medico-legal death investigation in South Africa, consent is not required to collect this data, and there is a mandate to store the data outlined in the legislation. While there are various pieces of legislation in South Africa related to medico-legal death investigation, there are no concrete guidelines on how data should be collected, stored, and disseminated.

Various types of software that can be used to capture data generated during medico-legal death investigation have been identified from the literature. However, the most common software system used was Excel spreadsheets. Although Excel is readily available and easy to use, it limits the utility of the data, as it cannot be integrated over

various mortuaries. Software that can address these issues is usually purchased and can potentially incur very high costs when implemented at different locations.

From the literature it can be seen that other countries have recognised the utility of medico-legal death investigation data and have implemented systems that can effectively collect and disseminate this data.<sup>15,17,19–24,26,29,31,37,45</sup> However, it would not be feasible to simply try to incorporate databases for medico-legal service data that other countries have implemented. Every country that has implemented a medico-legal surveillance system has a medico-legal death investigation system as well as legislation and provisions unique to that country, and the databases were designed with this in mind. Given that South Africa has an idiosyncratic medico-legal death investigation system that functions as a hybrid system, it will need a system and data collection and management protocols that align with this system.

#### **3.4.1. Limitations of the scoping review**

The limited selection and coverage of available sources related to the research question was a significant limitation of this scoping review. As there is no primary literature addressing the research question, the researcher had to make use of their own knowledge and expertise in the field of investigation and propose that findings from similar studies could be applied to the field of interest or how findings from previous studies relate to the field of study. The paucity of relevant literature on the subject influenced the scoping review's interpretation of the literature by the researcher as well as any potential bias that the researcher may have had.

Another limitation is that, while the scoping review provided new insights and tied existing knowledge into one synthesised document, it was limited in that it did not yield new knowledge and could not validate existing empirical insights. To test new insights generated by this scoping review an empirical study is recommended to test new insights generated.

As the majority of the studies included in this scoping review originated from the USA, the synthesised knowledge lacks information from the perspective of a resource-constrained environment, such as South Africa. None of the publications included in the

scoping review laid out specific data elements or fields that should be collected for medico-legal death investigations. As there are no international or national guidelines in the studies for relevant data elements to be included in a comprehensive database, it would be up to the discretion of the database developers to make the decision on what to include.

### **3.5. Conclusions**

This scoping review summarises various studies related to medico-legal death investigation in the context of public health, informatics, legal and ethical considerations, and mortality surveillance systems. The importance of the public health functionality of mortality statistics has been emphasised in various publications, as well as the different technical software applications that can be used to store mortality data. There are various technical equipment and software that can be used to house data generated during the course of medico-legal death investigation, ranging from general software such as Microsoft Excel to more complex and tailor-made databases such as VertiQ. Different technical software has advantages and disadvantages, as well as cost implications. In South Africa, there are many legislative frameworks that govern the execution of medico-legal death investigation; however, this does not extend to mandates around the collection, management, and dissemination of the data generated during medico-legal death investigation. Ethical considerations surrounding mortality data were not explored in the literature used for this scoping review, so this is an aspect of medico-legal data that should be further studied and expanded upon in future research.

The findings from the scoping review have shown that that in recent years there has been an uptake in understanding the importance of data that is generated during the course of medico-legal death investigation, and thus systems have been implemented to adequately capture and manage this data, such as the NCIS in Australia and New Zealand.<sup>29,38</sup> However, this has not been seen in South Africa and initiatives to collect data from medico-legal mortuaries did not implement data collection and management protocols in the Country.<sup>7</sup> Other countries have been looking at the data and how to put it to good effect, however, in South Africa there has not even been an agency that has

taken ownership of this kind of data at a national level. While there are legal issues related to this kind of data, they have been addressed in relevant legislation.

More studies are urgently needed to identify and develop the manner and process of data collection of medico-legal data in South Africa and to determine the ultimate management of the data and the mandate by a centralised agency to take ownership of the data. Additionally, a bespoke system will need to be developed and implemented for medico-legal data in South Africa.



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The previous chapter comprised of a scoping review, which was undertaken to address objective one - to identify what data elements should be collected for medico-legal death investigation in South Africa, three - to identify legal and ethical considerations pertaining to medico-legal death investigation data in South Africa, and four - to identify what technical software can be used to capture and manage medico-legal death investigation data. It summarised the legal and ethical considerations relevant to data generated during medico-legal death investigation, and also identified technical equipment that can be used to collect and manage this data. The next chapter comprises of a retrospective analysis of data that is generated at a typical urban state mortuary in South Africa. The retrospective analysis was undertaken to reach objective one - to identify what data element are and could be collected for medico-legal death investigation in South Africa - and two - to assesses the current infrastructure for data that is in use for data generated during medico-legal death investigation in South Africa – of the study This retrospective analysis is presented in the form of a research article, which forms the first part of a two-part research submission. This manuscript has been written with the intention to be submitted to the SA Crime Quarterly Journal with the title *Data collection and management in medico-legal death investigation in Pretoria, South Africa: A retrospective analysis of non-natural deaths (2017 to 2019)*. Currently only the candidate is listed as an author on this manuscript, however, it will undergo further editing and writing by the supervisors of this dissertation and authorship will be determined according to contributions made to the final version of the submitted article in accordance with the authorship guidelines of *SA Crime Quarterly*.

## **Chapter 4: Retrospective analysis**

### **Data collection and management in medico-legal death investigation in Pretoria, South Africa: A retrospective analysis of non-natural deaths (2017 to 2019)**

#### **Authors:**

IO da Silva<sup>1</sup>

#### **Abstract**

Non-natural mortality statistics are a valuable source of data that is not routinely collected or disseminated from state mortuaries in South Africa. While there have been various initiatives to capture and publish this data from state mortuaries, none have proven to be sustainable long-term. To illustrate the benefits of an integrated data system, it is necessary to understand the benefits and limitations of the current systems in use within this field. The objectives of this study were to provide an overall profile of cases presenting to the Pretoria Medico-legal Laboratory over a three-year period and to explore and identify the main data elements that are collected within the field of medico-legal death investigation at a typical urban state forensic mortuary in South Africa. This was a retrospective trend study that used post-mortem investigation data. The overall trends for cases that underwent autopsies at a typical urban mortuary in South Africa were descriptively analysed. The findings from this retrospective analysis were used to identify the data elements and limitations of the current database in use at this state mortuary. In total, 5913 cases were included in the study. Commonly collected data elements for medico-legal death investigation is important for the generation of statistics related to non-natural deaths, but the lack of a routinised systematised data collection and management platform impacts the quality of data collected. However, practical issues associated with implementing such a platform at all FPS mortuaries in South Africa, such as a lack of infrastructure, available budget and compliance issues also affect the ability to implement such a system.

## Introduction

Non-natural mortality statistics are a valuable data source. In the realm of public health, mortality statistics are used as a cornerstone in formulating health policies to reduce and prevent premature mortality and improve the overall health of a community. However, without adequate databases to capture data relating to mortality, the benefits of mortality statistics are not realised.<sup>7</sup> The generation of mortality statistics from non-natural mortality data is important, as in many cases, they are the only source of quality mortality data pertaining to non-natural deaths and medico-legal autopsies that are available on a national level.<sup>11</sup> Mortality data has the potential to support decentralised population health administration; however, the utility of the data depends on the quality of the data.<sup>11</sup> Evaluating data contained in a mortality surveillance system, and the system itself is crucial to ensure that the quality of non-natural mortality data is of a high enough standard to benefit public health and other sectors. In South Africa, mortality data is not currently being collected at all state forensic mortuary facilities in a prescribed, standardised manner.

While there have been various attempts to routinely publish data from state mortuaries, none of these have been sustainable in the long run, and none succeeded in implementing a database that could be used on a national level.<sup>2-6</sup> In 2001, the National Injury Mortality Surveillance System (NIMSS) was piloted.<sup>5</sup> It attempted to consolidate and publish data on non-natural deaths from state mortuaries.<sup>5</sup> However, it proved to be unsustainable endeavour.<sup>2</sup> The NIMSS did not represent data from all mortuaries, as it did not have permission to collect and publish data from various state mortuaries in South Africa.<sup>2</sup> The last publication from the NIMSS project was for data from 2011, and state mortuary data have not been collected and published on a national level since.<sup>9</sup> The South African Medical Research Council (SAMRC) and Statistics South Africa (Stats SA) endeavour to provide information on mortality data, however, these publications do not solely focus on non-natural deaths and do not provide in depth information that publications of data from mortuaries have the potential to provide.<sup>10,11</sup> The lack of a standardised data management system in the field of medico-legal death investigation means that data generated by state mortuaries in South Africa cannot be



utilised to its full potential. While there is a legal mandate to keep statistics relating to medico-legal death investigations, there is little outlined on how such statistics should be kept or whether these statistics should be published.<sup>8</sup> There is no reason this data cannot be collected and disseminated from all state mortuaries in South Africa. There is a defined number of medico-legal mortuaries in South Africa, which all function within a homogenous legal and operational framework.<sup>8</sup>

The flow of data within medico-legal death investigation follows a logical order and is captured at every step of the process via various administrative forms.<sup>8</sup> At the scene of death data regarding the scene of death, time of death, time found, and the circumstances surrounding the death were captured. Findings from the autopsy performed on the decedent, as well as demographic details, were also captured. This data from the PMLL were assimilated for the management of the decedent at state mortuaries as well as for ancillary and legal investigations. This data were also consolidated onto a single statistical sheet.

This study aimed to define and investigate data elements in the field of medico-legal death investigation. This study used the Pretoria Medico-Legal Laboratory (PMLL) as a pilot venue. The PMLL is a large urban mortuary that receives approximately 2000 cases per year and serves a greater part of the Tshwane Metropolitan area, which has a population of approximately 2.9 million residents.<sup>13,14</sup> However, the precise geographic area and population that the PMLL serves has not been defined, an issue that would need to be rectified should epidemiological analysis need to be performed.

A random three-year sample was taken and analysed to identify key data elements. Data at the PMLL is routinely captured by Forensic Medical Practitioners (FMP), who have been collecting certain data elements related to medico-legal death investigation. FMPs complete a data collection form after admission to a case where each FMP is individually responsible for capturing these data elements. However, this data is not always accurate at the time of filling in the data capture sheet. In this study, the data was analysed in this provisional state. Data elements collected on this data sheet included demographic details, scene of death, police station to which the death was reported, cause of death, whether the decedent received hospital care, and manner of

death. Although FMPs are not mandated to determine the manner of death of a decedent – it is the magistrate who legally determines the manner of death – they offer a provisional assessment of the manner of death. These data sheets offer an abbreviated set of data pertaining to medico-legal death investigations and do not include findings from ancillary and other investigations related to the cases.

## **Methods**

This was a retrospective descriptive study of all cases of non-natural deaths in which data sheets were contemporaneously completed by FMPs at the time of autopsy at the PMLL for a three-year period - between the 1st of January 2017 and the 31st of December 2019. This retrospective descriptive analysis was based on information of all suspected non-natural deaths that underwent autopsies at the PMLL and were recorded in the University of Pretoria's Department of Forensic Medicine's in-house digital repository of cases. The data was then stored in an Excel spreadsheet. Cases recorded in the system from 2017 to 2019 were included in this retrospective review. Cases where no autopsy was performed, where the remains were identified as non-human remains, where the date on which the post-mortem investigation was performed fell outside of the study period, where external circumstance/cause of death was determined to be a non-viable product of conception, abortion, or stillbirth, and cases that were released without further review were excluded from the study population. Data on the overall number of bodies were sourced from the PMLL spreadsheet named 'Forensic Pathology Service, Gauteng - Bodies Admitted For The Period 2006-2020'. Data obtained from the digital repository included details regarding the death of decedents and demographic characteristics. Data was extracted and cleaned to simplify the analysis process. The data stored in the digital repository was based on the PMLL's statistics form.

These forms were completed by the FMP performing the autopsy at the PMLL and contains case data available to the FMP from case reports and autopsy findings. Data on these forms were entered by a research assistant into a spreadsheet in custody by the Department of Forensic Medicine at the University of Pretoria. The data source comprised three separate spreadsheets that were accessed and kept separate

throughout the analysis. The data in each spreadsheet were cleaned and edited to ensure continuity between the separate spreadsheets. The total numbers and frequencies were calculated, and the results are presented below. The data were scrutinised for various trends and profiles.

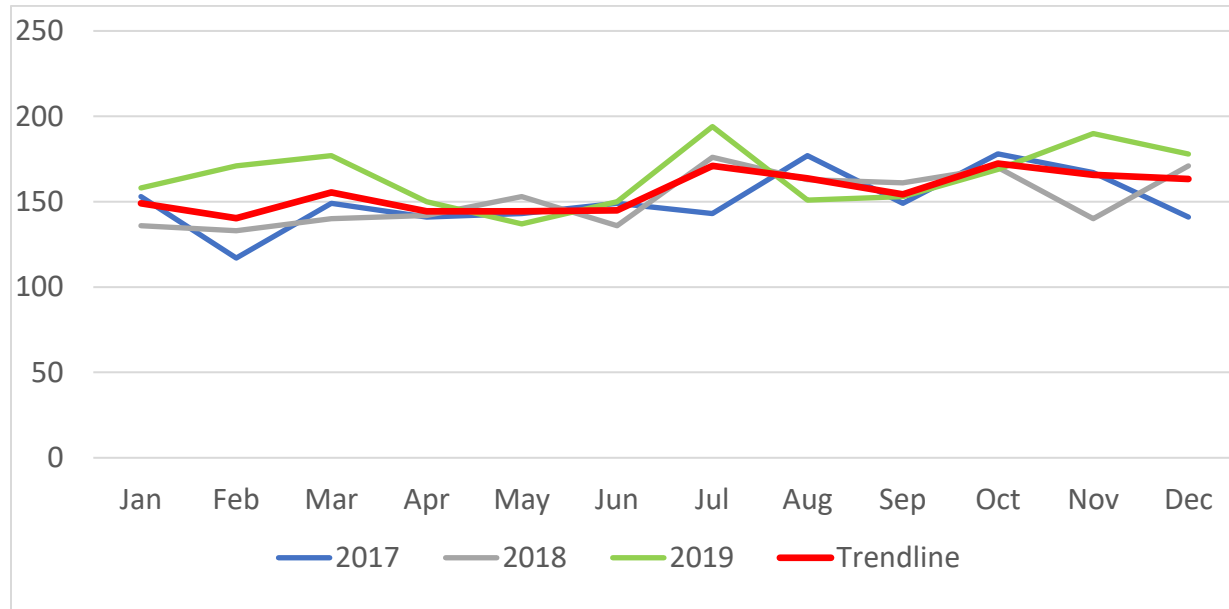
This study was approved by the Faculty of Health Sciences MSc Committee and the Research Ethics Committee prior to the commencement of the study (Research Ethics Reference Number 656/2021). This article presents the results of an original study that was conducted as part of a larger MSc study in partial fulfilment of the requirements for a master's degree in Medical Criminalistics at the University of Pretoria.

## **Results**

A total of 5951 cases were admitted to the PMLL for the three-year period (2017 to 2019). Of those cases, 5913 underwent medico-legal autopsies from the 1st of January 2017 to the 31st of December 2019 with associated data sheets that were completed and entered into the University of Pretoria's Department of Forensic Medicine's database. Cases in which the external circumstance/cause of death was determined to be a non-viable product of conception, abortion, or stillbirth, and cases that were released without further review or where the post-mortem examination date fell outside the study period were excluded from the study population (n=307). The number of cases admitted to the PMLL made up 11.14% of the total suspected non-natural deaths in the province of Gauteng, and 56.95% of cases within the Pretoria Cluster of state mortuaries for the three-year period.<sup>15</sup>

The number of cases that underwent autopsies each month were calculated and presented in the form of a line graph, as shown in Figure 1. The date on which the post-mortem examination was performed was used to determine the month under which the case fell. The highest number of post-mortem examinations occurred in August 2017 (n=177), July 2018 (n=187), and 2019 (n=194), and for the three-year period, the month with the highest total number of post-mortem examinations was October (n=172). The lowest number of post-mortem examinations occurred in February 2017 (n=117), 2018 (n=133), and May 2019 (n=137) for the three-year period. February had the lowest number of post-mortem examinations (n=140). The number of cases ranged from 117 to

194 and the average number of cases per month was 155 (17.4). There was a 0.7% increase in the number of cases that underwent post-mortem examinations from 2017 to 2018 and an 8.6 % in cases from 2018 to 2019.



**Figure 1: Number of cases per month, 2017 – 2019.**

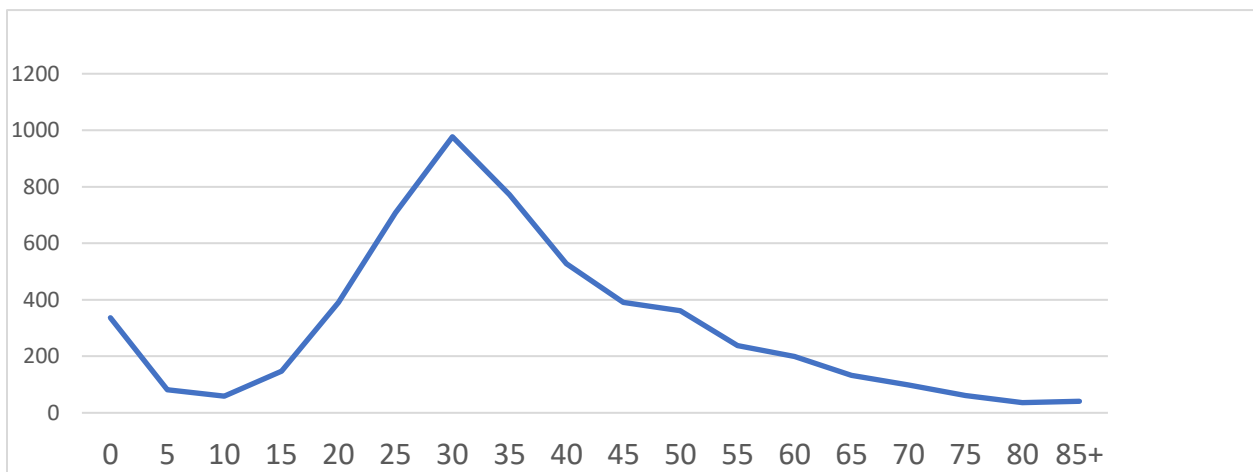
### Demographic details

The population group to which the decedent belonged was recorded by FMP at the time of autopsy on the data collection form. There were five classes of racial groups within the dataset, these were: Black, White, Asian/Indian, Coloured, and Unknown. The racial group with the highest number of decedents presenting to the PMLL during the study period was the Black racial group, with 4158 (74.2%) of all cases being Black individuals. The racial group with the lowest number of decedents presenting to the PMLL was the Asian/Indian racial group, with only 105 (1.9%) cases for the three-year period. The White racial group comprised 1159 (20.7%) cases during the study period, and the Coloured, mixed-race, racial group comprised 115 (2.1%) cases. The percentage of cases in which the racial group of the decedent was unknown was 1.2% (n=69). Males comprised the majority of the cases that underwent autopsies, with 4352 (77.6%) of the decedents who underwent autopsies being male. Females made up

1218 (21.7%) of the post-mortem examinations performed during the study period. In 0.6% (36) of cases, the sex of the decedent was not determined at the time of autopsy.

## Age

The ages were divided into 18 groups of five years each. The ages ranged from 1 day to 98 years. All ages noted as zero or in which the age was stated as unknown, foetus, stillbirth, non-viable, or the gestational age was recorded were excluded from gross tabulations of age. There was a peak incidence of non-natural deaths in the 30–35 years age group. The mean age of the decedents was 36 years (standard deviation, 17.20 years). The distribution of the age groups during the study period is shown in Figure 2. For males, the age group with the highest incidence of non-natural deaths was the 30-to-35 age group, which comprised 18.48% of the total male cases (n=832). For females, the age group with the largest proportion of non-natural deaths was the 0-to-5-year age group, which comprised 11.84% of the total female cases (n=156).



**Figure 2: Frequency of age groups, 2017 – 2019**

## Manner of death

The five manners of death, as classified on the data collection form used for this study, were accident, homicide, natural, medical treatment/procedure, suicide, and undetermined.

Accidents consisted of 34.3% (n=1922) of cases, followed by homicides in 23% (n=1292) of cases. Seven hundred and eight (13.9%) cases during the study period were suicides. Two hundred and fifty-one deaths (4.5%) were due to medical procedures, and deaths due to natural causes accounted for 7.3% (n=408) of all cases. In 17 % (n=953) of the cases, the cause of death was not determined at the time of autopsy, or the manner of death was not filled in on the data sheet.

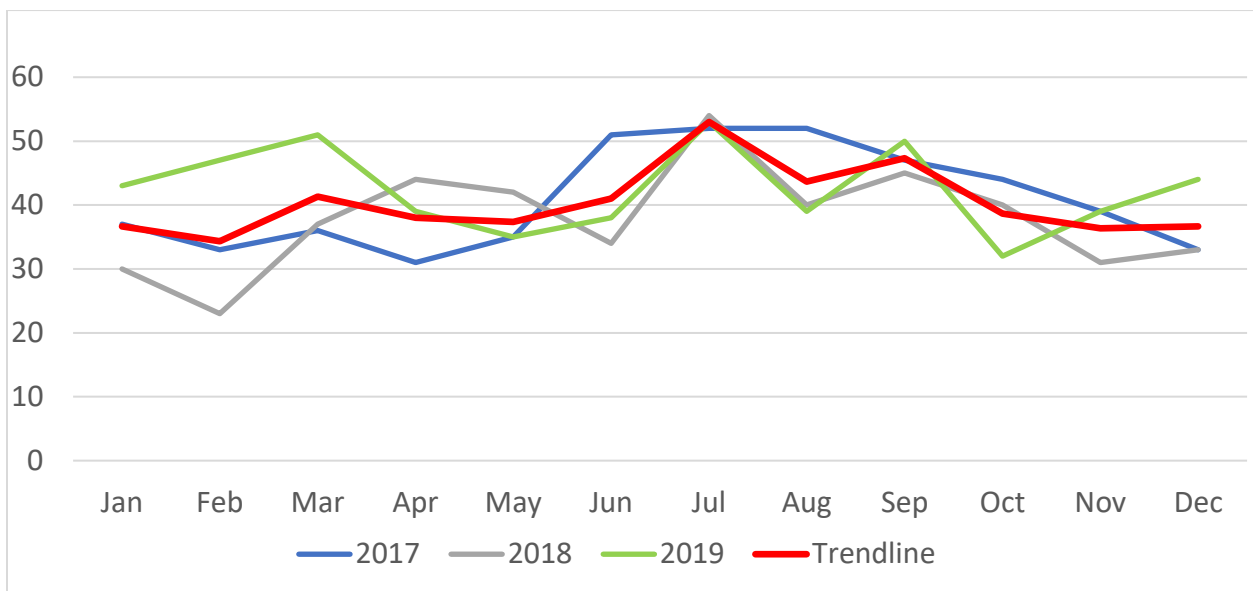
### **Cause of death**

Over thirty-three different external causes or circumstances of death were recorded in the database. The five most common causes of death were road traffic fatalities, firearm discharge, blunt object or blunt force, hanging, and sharp object. Road traffic fatalities accounted for 25.9% (n=1453) of all deaths during the study period, firearm discharges accounted for 12.5% (n=700) of all deaths, blunt object/force accounted for 6.6% (n=368) of all deaths, hanging accounted for 6.5% (n=367), and sharp object accounted for 6.3% (n=353). These top five most common causes or circumstances of death comprised 57.8% (n=3241) of the total cases during the study period, with all other causes accounting for the remaining 42.2% (n=2368) of deaths. The demographic profiles of the different causes of deaths mirrored the overall demographic profiles of deaths reported to the PMLL, with Black individuals making up the greatest proportion of deaths, followed by White individuals, and males making up the greatest proportion of deaths.

### **Road Traffic Fatalities**

Road traffic fatalities included pedestrian-vehicle fatalities, all motor vehicle fatalities, and motorcycle and bicycle fatalities. The age group with the highest incidence of road traffic fatalities was the 30 to 35 age group, accounting for 16% (n=232) of road traffic fatalities while the 80 to 85 age group only had one fatality for the three year period. In terms of population group, Black individuals accounted for the largest proportion of fatalities, with 79.3% (n=1152) of road traffic fatalities being Black individuals. This was followed by the White population group which made up 12.5% (n=181) of fatalities. Coloured individuals made up 6.5% (n=95) of fatalities, and Asian/Indian individuals made up 1.5% (n=22) of fatalities. In three cases the population group to which the

decedent belonged to was not determined at the time of autopsy. Males made up 80.7% (n=1172) of fatalities, while females made up 19.2% (279) of fatalities. In two cases the sex of the decedent was not determined at the time of autopsy. The number of road traffic fatalities per month for the three-year period was also analysed. The month with the highest number of road traffic fatalities was July for all three years, while the months with the lowest number of road traffic fatalities was April for 2017(n=31), February for 2018 (n=23), and October for 2019 (n=32), with an average of 40 cases per month, with a standard deviation of 7.6 cases. The number of road traffic fatalities per month in each year is shown in Fig. 3.



**Figure 3: Road traffic fatalities by month, 2017 – 2019**

### **Firearm fatalities by manner of death**

In total, 680 firearm fatalities were recorded during the study period. Of the total firearm fatalities, 77% (n=523) were homicidal, 22% (n=151) were suicidal, 1% (n=5) were undetermined, and less than 1% (n=1) were accidental.

### **Discussion**

These results present a snapshot of cases in a typical urban mortuary in South Africa. This was not an epidemiological study, as no denominators were incorporated. Instead, it seeks to establish numbers and identify trends. These results serve as a valuable

benchmark or reference for the area because the analysis used data that predated the COVID-19 pandemic. It was also able to identify hiatuses in the data and the collection methods.

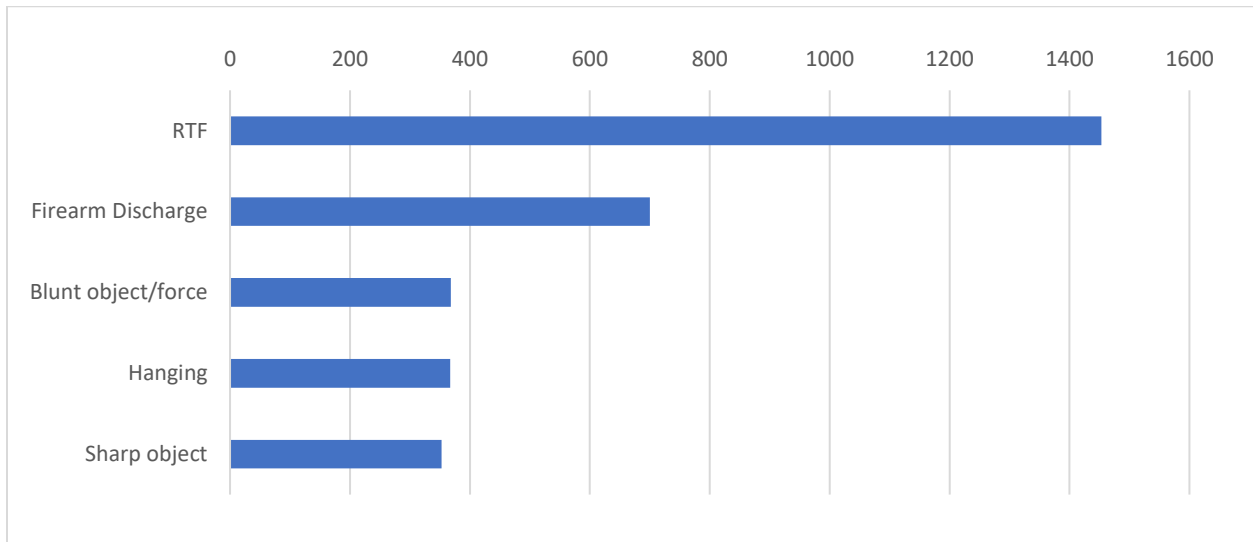
While the manner of death is determined by a magistrate, the FMP offers a presumed cause of death based on autopsy findings and the circumstances surrounding death. While the most common manner of death was determined to be accidental, the study found that the manner of death was unspecified in 17% of cases. The number of cases in which the manner of death was noted as undetermined was greater than the number of deaths attributed to suicides, natural causes, and medical treatments/procedures. This finding can be attributed to the lack of history surrounding death; however, this warrants further study. The number of suicides for the three-year period averaged 13.9% (n=780) of the total cases for the three-year period. However, when examining years individually, the proportion of suicides increased. In 2017, suicide accounted for 13.4% of the total number of cases, 13.6% in 2018, and 14.6% in 2019. This increasing trend in the proportion of suicides should be further investigated.

Another benefit of collecting and publishing these statistics is that they can be compared to statistics from other countries. In Ontario, Canada, 52% deaths that underwent inquests for the 2016/17 to 2018/2019 period were classified as natural deaths, in comparison this study found that 34.3% of non-natural deaths in Pretoria were accidental deaths.<sup>16</sup> In Ontario accidental deaths constitute 32% of deaths, this study found that 34.4% of deaths are accidental.<sup>16</sup> While the number of suicidal deaths in Ontario were higher than in Pretoria, the proportion of suicides was higher in Pretoria, 13.9% compared to 3%.<sup>16</sup> Most notably, in Ontario 1% of cases are homicidal in nature while in Pretoria 23% of non-natural deaths are homicidal in nature.<sup>16</sup>

There are over 30 data elements for the field of cause or circumstance of injury, which means that reporting the causes of death is prohibited in this article owing to the substantial number of results. The number of road traffic fatalities during the study period was more than double that of the second most common cause or circumstance of death and firearm fatalities. Firearm fatalities were double those of the third-most common cause of death. The next three most common causes and circumstances of



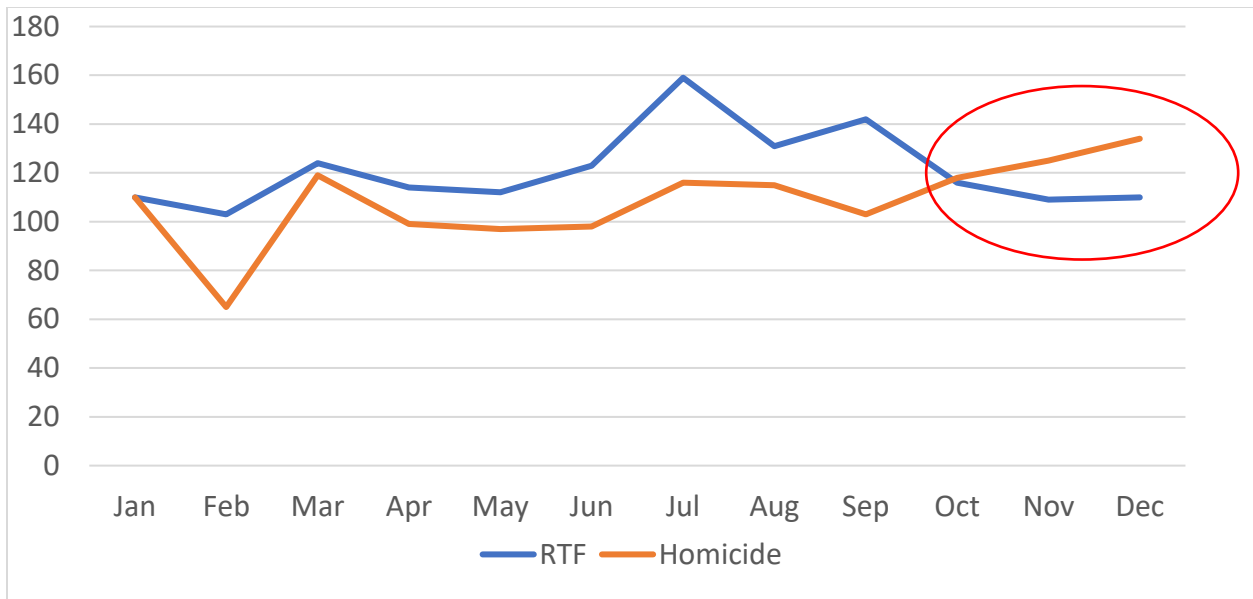
injury had the approximately same number of cases during the study period. Exact numbers can be seen in the table below.



**Figure 4: Major external causes/ circumstances of death, 2017 – 2019.**

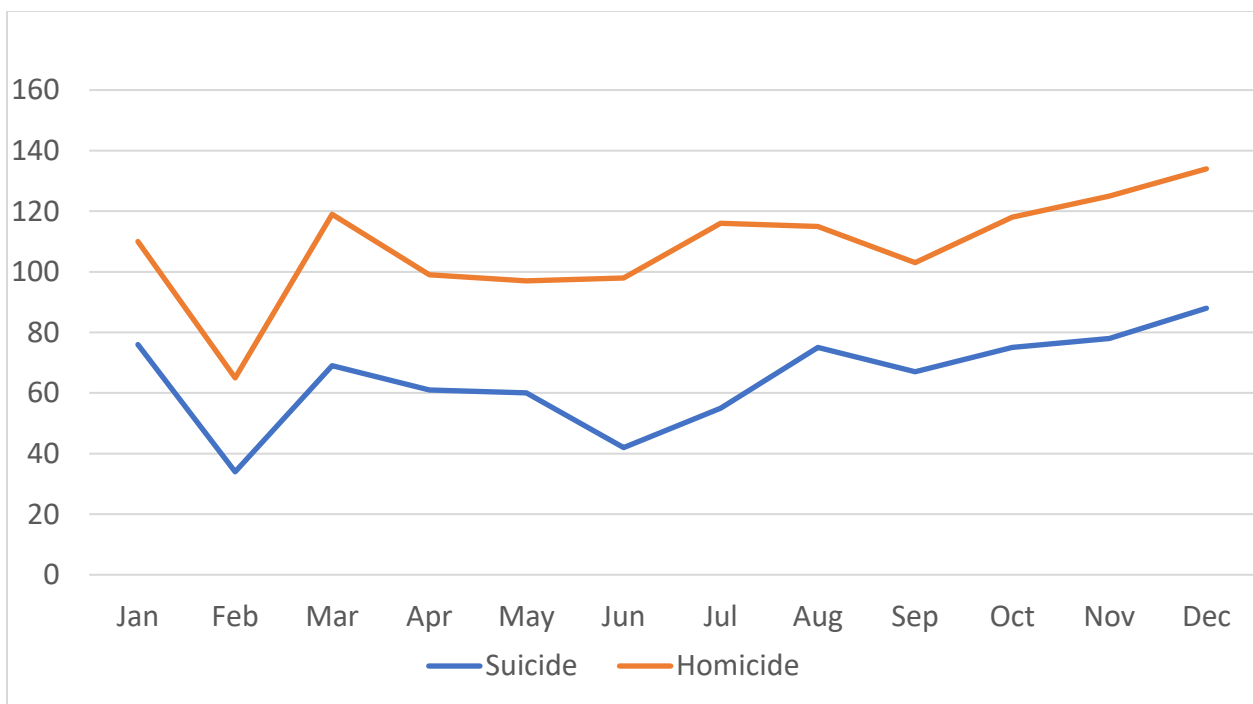
The manner of death owing to firearm injuries was also investigated. Most firearm deaths were homicidal, with few accidental deaths. There was only one firearm fatality that was determined to be accidental for the three-year period - illustrating that in the greater Tshwane area, most deaths involving firearms are violent in nature. Owing to a considerable proportion of cases having an accidental manner of death and the fact that road traffic fatalities made up over a quarter of the caseload during the study period, the number of road traffic fatalities per month was further investigated. Road traffic fatalities constituted the largest proportion of accidental deaths, with 68.8% of accidental deaths being road traffic fatalities.

The number of road traffic fatalities versus homicidal deaths was compared, and it was found that road traffic fatalities outnumbered homicidal deaths for the first ten months of the year, but from October to November, homicidal deaths outnumbered road traffic fatalities. It is unknown why this phenomenon was observed, and future studies are recommended. This phenomenon is illustrated in Figure 5.



**Figure 5: Road traffic fatalities compared to homicidal deaths, 2017 – 2019**

Homicidal and suicidal deaths were also compared, and it was found that while homicidal deaths outnumber suicidal deaths in all months of the year, the shape of the graphs of both of these manners of deaths mirror each other. The congruent nature of homicidal and suicidal deaths is also an important finding, suggesting that the factors that drive homicide in the Tshwane area also drive suicide. This can be seen in Fig. 6.



## **Figure 6: Suicidal deaths compared to homicidal deaths, 2017 – 2019**

A commonality identified in the dataset is that many data elements contain missing information. This missing data not only affected the quality of the statistics that could be generated using this database but also affected the reliability of the database. This resulted in the exclusion of data elements from the profile analysis because of the large amount of missing data that negatively affected it. Data elements such as time and date of death were not included in the final results. The database only contained information known to the FMP at the time of autopsy. Therefore, information from the ancillary and other investigations was not included in the database. The department also uses an electronic database, termed NUKLEUS, which is not integrated with the current spreadsheet system; therefore, in-depth post-mortem findings are not available in the database that was used. This limits the scope and extent of studies that can be undertaken using this database.

## **Conclusion**

This study reported the overall cases that underwent medico-legal death investigation at the PMLL over a three-year period. It has revealed information that no previous studies on mortality data from the PMLL have shown before - the trend identified regarding road traffic fatalities and homicides, the increasing number of suicidal deaths, and the congruent nature of homicides and suicides. These are important trends that have been identified that warrant further, more in depth study in the future.

While publications using data from the PMLL have been published, none of them looked at the overall cases but rather focused on specific causes of death, such as suicide or sharp force trauma.<sup>17–21</sup> This review also serves as an important benchmark for pre-Covid trends and can serve as a valuable reference for investigating the impact of the Covid-19 pandemic has had on non-natural deaths in Pretoria. It is recommended that a study of this nature be conducted at the PMLL using data from 2020 to 2022 to identify and compare trends to this study, as well as to identify the impact of Covid-19 had on case numbers admitted to the PMLL.

There is valuable data regarding the numbers, profiles, and trends of non-natural deaths in Pretoria. Data can be collected and recorded easily using a database system that is currently in use in the mortuary. However, data quality is compromised by a lack of standardisation of parameters to collect and store this information. The data may be underutilised with regard to management practices, resource allocation, health policies, and legislation. The value of this data will be amplified if standardised collection and recording procedures can be applied across multiple facilities in multiple provinces. It can be seen that although the quality of the data is not optimal, insights are still able to be gleaned from the current database. The data fields that were used in this retrospective analysis should be included in future publications.

Since data from a single urban state mortuary was used in this study, it should not be assumed that these results represent the profiles of cases that present to other state mortuaries in South Africa. These findings can be used to compare case numbers and profiles at state mortuaries that represent a similar environment in which the PMLL is situated.

This retrospective review explored the utility of the current data fields routinely collected at the PMLL. It identified that the current data elements have an important utility and should be included in any database that houses medico-legal data. However, the issues raised through the process of the retrospective analysis, such as the lack of standardised data input, the amount of missing information in certain data fields, and the lack of publication and reporting conventions, need to be addressed if a standardised database is to be successfully implemented provincially and nationally.

## Notes

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The previous chapter comprised of the first part of a two-part article submission to SA Crime Quarterly Journal. It made use of a retrospective analysis to reach objective one - to identify what data element should be collected for medico-legal death investigation in South Africa - and two - to assess the current infrastructure for data that is in use for data generated during medico-legal death investigation in South Africa – of the study. It identified trends for the three-year period and highlighted important considerations with regards to medico-legal data. The next chapter is the second part of this two-part submission. This chapter summarises the fieldwork component of the study and presents it in the form of a research article. This component was undertaken to reach objective one and two of the study. It explores the main data elements generated during medico-legal death investigation, as well as where these data elements originate from. It also assesses the current infrastructure in use. It makes use of the Pretoria Medico-Legal Laboratory as the pilot for this evaluation. This chapter will be submitted to the SA Crime Quarterly Journal with the title *Data collection and management in South Africa: A pilot evaluation*. Currently only the candidate is listed as an author on this manuscript, however, it will undergo further editing and writing by the supervisors of this dissertation and authorship will be determined according to contributions made to the final version of the submitted article in accordance with the authorship guidelines of SA Crime Quarterly.

I.



## Chapter 5: Fieldwork

### Data collection and management in medico-legal death investigation in South Africa: A pilot evaluation

IO da Silva<sup>1</sup>

u17016224@tuks.co.za

#### Abstract

Mortality data are an invaluable data source and has been a cornerstone of public health initiatives for the prevention and reduction of deaths. An important subset of mortality data is non-natural mortality data, especially in countries with a high burden of death due to injuries. South Africa is a country with a high level of violence and non-natural deaths, however, the actual number of non-natural deaths in the country is not known, due to issues with current data sources. State forensic mortuaries in South Africa are the ideal venues to collect this kind of data. This article outlines the flow of data and current data capture and management within the field of medico-legal death investigation at a single state forensic mortuary in South Africa. Commonly collected data elements were also identified and outlined.

#### Introduction

The scientific investigation of death has served society well over the centuries since its implementation as a scientific domain. It has served as a tool to teach us about the human body and disease processes and has served as a major stepping stone for the advancement of biomedical science.<sup>2</sup> However, the judicial function that the medico-legal investigation of death serves is also important.<sup>2,3</sup> Medico-legal death investigation concerns itself with deaths that may have a legal consequence.<sup>2,3</sup> It uses the application of biomedical sciences to bolster the administration of justice by judges and prosecuting agents.<sup>2,3</sup> Medico-legal death investigation has developed rapidly over the last hundred years and has become a specialised discipline within its own right.<sup>2,3</sup> Forensic pathology as a specialised postgraduate degree has only come into inception within the last 70 to

80 years, and in some countries still does not exist as a separate specialisation for medical practitioners to pursue.<sup>2,3</sup>

Huge growth has occurred in the field of medico-legal death investigation, and this is not limited to the field of forensic pathology itself but extends to the various disciplines that encompass ancillary investigations that form part of the process of death investigation.<sup>3</sup>

This exponential growth and development of medico-legal death investigation has added an enormous amount of value to not only death investigation but also society as a whole.

Many developed countries have come to realise that the value of medico-legal death investigation lies not only in the facilitation of justice on an individual case-by-case basis but that there is an added value from the collective results of death investigation. Having access to the bigger picture allows for public health and policy benefits as well.<sup>4</sup>

Developed countries such as the United States of America (USA) have realised these benefits and have routinised the collection and dissemination of such non-natural death statistics.<sup>5</sup> In the USA, the Centre for Disease Control (CDC) routinely collects and publishes data pertaining to non-natural deaths from the various mortuaries and coroners' offices through the country, through a system called the National Vital Statistics System (NVSS).<sup>5</sup>

However, in South Africa we are not reaping these added benefits of medico-legal death investigation, due to a lack of adequate data collection and management practices at our state mortuaries.<sup>6</sup> There have been many reports on the importance of standardised approaches to collect and exchange data that are generated in the field of medico-legal death investigation.<sup>7</sup> In the USA a report by the National Science and Technology Council recommended that in order to enhance the quality, timeliness and accessibility of medico-legal death investigation data agencies should work with entities to envision and adopt a 21st-century electronic data system.<sup>8,9</sup> The National Research Council of the National Academies Report, Strengthening Forensic Science in the United States, commented on the importance of the standardisation of computerisation of case records and the development of case information databases.<sup>8,9</sup>

Data related to non-natural deaths are not properly recorded and reported on in South Africa. Although generic data are collected and reported regarding causes of death, which comes from the Department of Home Affairs National Population Register and is disseminated by Statistics South Africa (Stats SA), these data are not an accurate representation of medico-legal death investigation that occurs in South Africa.<sup>10,11</sup> Information regarding medico-legal death investigation is lost due to a lack of proper management of the data. Data that are published regarding non-natural deaths have not been properly scrutinised, which has led to problems regarding different subsets of non-natural deaths in South Africa. This leaves many public health and policy benefits for this data unutilised. This deficiency is due to the fact that we are not collecting data profiles from state mortuaries in South Africa.

Globally, non-natural deaths comprise 8% of all deaths that occur annually.<sup>12</sup> However, in 2019 in South Africa, 12% of all annual deaths were due to non-natural causes.<sup>10</sup> Due to a lack of accurate and valid statistics regarding non-natural deaths, the actual percentages are not known, and discrepancies in reported numbers between Stats SA and other agencies in South Africa are often seen.<sup>10,13–15</sup> This is another reason data related to non-natural deaths in South Africa must be scrutinised, as the scope and nature of non-natural deaths are unknown due to a lack of accurate data. A large subset of deaths in South Africa are due to non-natural causes, which has major implications for the safety and wellness of the country as a whole.

Not gathering this data, as well as the paucity of published articles on this data as a whole, is why this type of study is important. Collecting this kind of data is not difficult; however, it must be entered into a database through defined portals. Each state mortuary in South Africa must follow the same portals and policies regarding data collection and management. In Gauteng, the most populous province in South Africa, there are eleven state mortuaries at which medico-legal death investigations occur.

There have been attempts to collect and publish this kind of data, such as the National Injury Mortality Surveillance System (NIMSS), these publications merely provided snapshots of the data.<sup>6,13</sup> These publications provided profiles of non-natural deaths on an ad hoc basis but did not undertake the task of implementing routinised and

systematised data collection and management within medico-legal death investigation in South Africa. What we need is data that are continuously being updated and provided to key players and stakeholders in the field, so that running commentary and comparisons can be made. The details surrounding the data, such as who owns it, how it is collected, and how it should be stored and uploaded, also need to be investigated.

## **Methods**

This study utilised information gathered from the attendance of different stages of the medico-legal death investigation process to assess the current infrastructure for data and to identify the data subsets and elements generated during medico-legal death investigation.

Fieldwork was carried out in order to collect information regarding data practices in a medico-legal death investigation setting. The fieldwork took place within the operational area of the Pretoria Medico-legal Laboratory (PMLL), as a pilot evaluation site, in order to assess the flow of data as generated in a large urban mortuary in South Africa. This fieldwork included the attendance of five death scenes and fifteen medico-legal autopsies and investigated data flow in the administrative offices of the PMLL, from January to December 2022. The insights presented in this article are the result of observational research and analysis that was undertaken during the fieldwork component.

The information obtained from the fieldwork component of this study was used to help identify what parameters should be considered when collecting and managing medico-legal data as well as to help identify any shortcomings in the current data flow of medico-legal death investigation. This article forms part of a study titled *Data collection and management in medico-legal death investigation in South Africa: An exploratory study* that was conducted in partial fulfilment of the requirements for a master's degree in Medical Criminalistics at the University of Pretoria.

## **Data flow in medico-legal death investigation in South Africa**

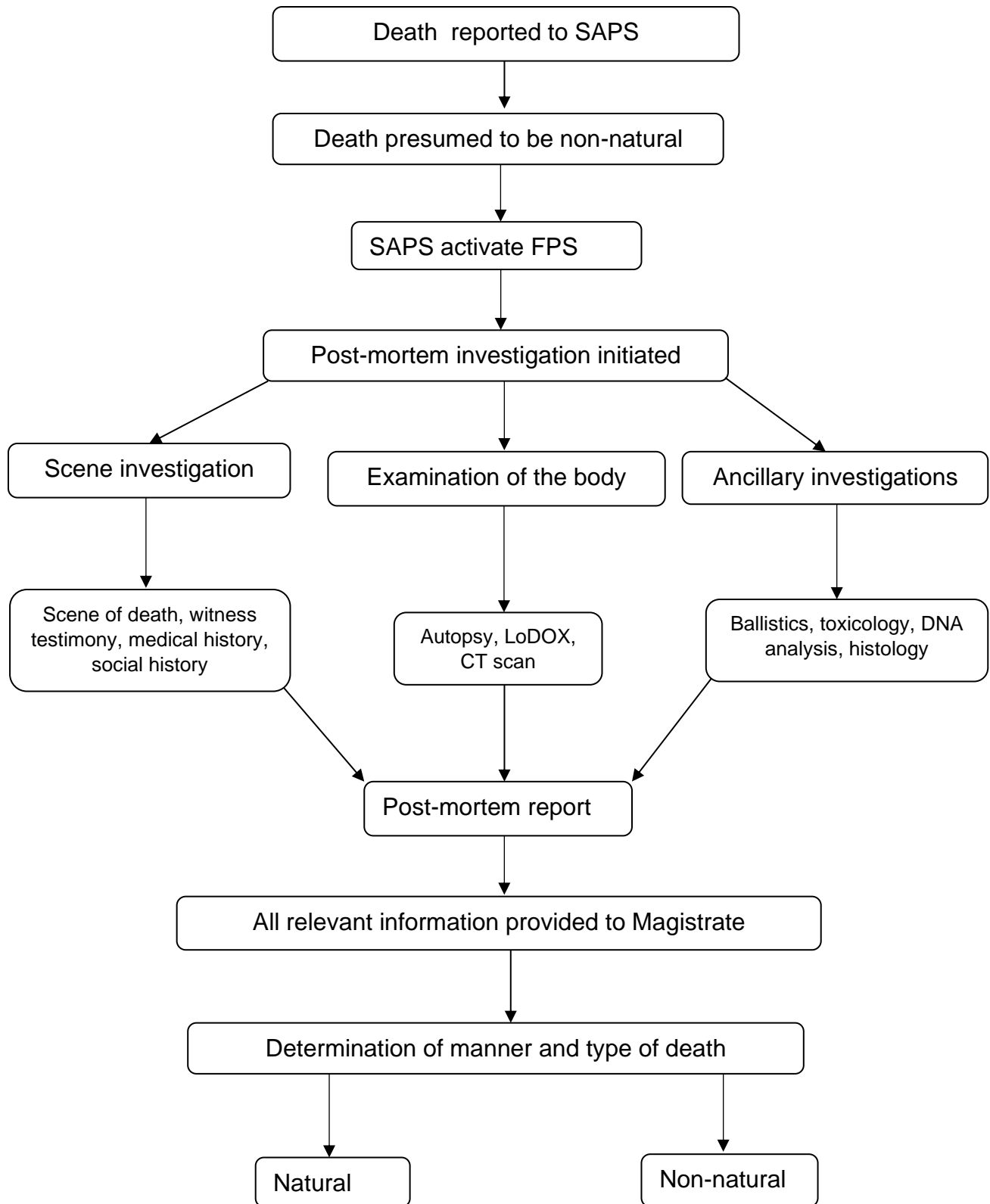
The flow of data for medico-legal death investigation starts with the reporting of a death suspected to be due to non-natural causes to the SAPS. If the death is presumed to be natural, a treating physician of the decedent will complete a DHA-1663 form, and the death will be registered with the Department of Home Affairs (DHA) and a burial order will be issued.<sup>16</sup> Natural deaths do not require medico-legal death investigation and therefore do not generate any relevant data through the forensic mortuaries.

In cases in which the cause of death is believed to be non-natural, the decedent will be brought to the mortuary for a medico-legal autopsy.<sup>16,17</sup> Forensic officers (FO), and in certain cases, Forensic Medical Practitioners (FMPs) will attend the scene of death. Data regarding the scene of death are collected, usually from the attending SAPS officer, and will be included in the post-mortem case-file. FO's collect the data from the death scenes, which are included in the post-mortem case-file that accompanies the decedent to the mortuary.<sup>16</sup>

The body will then be brought to the morgue for medico-legal autopsy, which includes the collection of samples for ancillary investigations, such as ballistics, toxicology, DNA analysis, and histology. Once the autopsy is completed, the FMP will fill in the post-mortem report and a statistics sheet. The statistics sheet that FMPs fill in is the brought to the Department of Forensic Medicine at the University of Pretoria and is inputted into an excel spreadsheet.

After collection of the body by the South African Police Service (SAPS), all information regarding the case is presented to an inquest, who determines whether the cause of death is natural or non-natural. If the death is determined to be due to non-natural causes an inquest will be opened and the magistrate will determine if another party is liable for the death and will decide to prosecute for the death or not.<sup>15,16,17</sup> The case will remain open until the relevant decision is made regarding the cause of death by the magistrate in charge of the case. If the inquest determines that an individual is responsible for the death of the decedent, criminal or civil proceedings will be undertaken to prosecute that individual. A diagram of the simplified process flow of medico-legal death investigation in South Africa is shown in Figure 1. The process of

medico-legal death investigation is very complex and involves many different aspects and players. However, that could not be adequately captured in an article of this nature, and so only a simplified version is presented. Each one of these steps in the process of medico-legal death investigation generates relevant data, that should be appropriately captured.



**Figure 1: Simplified process flow of medico-legal death investigation in South Africa**

## **Storage, archiving, and management of data**

At the PMLL the forms that make up the post-mortem case-file are kept in paper format and stored in specially designated storage facilities within the PMLL. Post-mortem case-files are stored in boxes in the storage facilities and are arranged by death register (DR) number for the specific years. The post-mortem case-file includes various forms that are filled in at different stages of medico-legal death investigation. It includes the SAPS 180 form, which is the police report that is filled out by the investigating officer, the FPS 002 which is the death scene form and is filled out by the Forensic Officer (FO) at the scene, the FPS 007 form which is the form completed by the FMP after they have completed the medico-legal autopsy, and the FPS 007a which is the sworn affidavit made by the FMP. The post-mortem case-file will also include information related to the deceased medical history if it is available. In addition to the paper formats of post-mortem case-files, DR numbers as well as basic demographic information and post-mortem investigation information are captured manually in the case incident register that resides in the reception area of the PMLL.

Statistics forms filled in by FMPs, which contains demographic as well as some case and post-mortem examination information, are captured and stored on excel spreadsheets in the Department of Forensic Medicine at the University of Pretoria, however, this is a separate research endeavour and is not linked to the Pretoria Forensic Pathology Service (FPS) facility. Monthly statistics are captured on an Excel spreadsheet by the facility manager. These statistics include the number of bodies admitted to the facility to date, the number of bodies admitted to the facility for the current month, the number of autopsies performed to date and for the current month, number of bodies admitted and released, and the number of autopsies per doctor. It also includes information related to the number of cases in which certain ancillary investigations were done, information related to autopsy reports, identification, body capacity, court appearances, categories of death, vehicle management, as well as administrative management. The numbers are totalled every quarter and at the end of the year. The facility manager submits these numbers to the Gauteng Department of



Health's head office. These numbers are compiled into a singular Excel spreadsheet that is then shared with the head of each facility on a yearly basis.

### **Data elements in medico-legal death investigation**

A data element can be defined as a single fact or piece of information.<sup>18, 19</sup> In the case of medico-legal death investigation, a data element is any piece of information generated during the medico-legal death investigation process. This research identified two main types of data elements throughout the fieldwork component of the study. The two main types of data elements are core and circumstance-specific data elements.

#### **Core data elements**

Core data elements are collected for all cases and causes of death.<sup>7</sup> These include information related to the identity of the decedent, demographic information, cause of death information, manner of death information, time and date information, location information, ancillary information, and information regarding the decedent's history. Core data elements can be further classified into subtypes of data elements, based on which step of medico-legal death investigation the data element is generated in, as shown in Table 1.

**Table 1: Core data element subtypes**

Core data element subtypes
Identification data
Demographic data
Cause of death data
Manner of death data
Time data
Date data
Location data
Medical history data
Social history data
Ancillary investigations data

Autopsy findings data

### **Circumstance specific data elements**

Circumstance-specific data elements are collected to determine the manner and cause of death. These include data that is related to the manner of death, specific autopsy investigations, decedent characteristic data, and reporting-related data.

Circumstance-specific data element subtypes, based on which step of medico-legal death investigation the data element is generated in, as well as examples of these subtypes, are shown in Table 2.

**Table 2 Circumstance specific subtypes**

Circumstance specific subtypes	Examples
Cause-specific data	Falls, Road traffic fatalities, Firearm fatalities, Mob assault
Manner-specific data	Homicide, Suicide, Accident, Undetermined
Decedent specific data	Infant, Child, Adult, Elderly
Investigation data elements	Type of autopsy
Reporting related data elements	Aviation related, notifiable diseases

### **Discussion**

The primary objectives of this study were to identify the data elements that are and could be collected for medico-legal death investigation in South Africa and to assess the current storage, archiving, and management of data in medico-legal death investigation in South Africa.

The current process flow within medico-legal death investigation in South Africa is the lack of continuity and data flow among the different components of death investigation. While a Memorandum of Understanding exists between the SAPS and the NDoH, the sharing of data and investigation findings are not integrated.<sup>20</sup> The lack of integration

between SAPS case numbers and FPS death registration (DR) numbers makes it harder to collect and assimilate data from different steps of medico-legal death investigation. A solution to this would be to follow a numbering convention that correlates to the CAS numbers used by the SAPS investigations, and this number would be used for labelling at the FPS as well as for ancillary and judicial investigations.

While data are collected at every step of the medico-legal death investigation process at the PMLL, there is a notable lack of standardisation and protocols for how this data should be collected. This can be seen particularly with regards to pre-autopsy information, in which the quality of the information varies greatly. A previous study at the PMLL, which evaluated FMPs satisfaction with pre-autopsy information, found that the quality of current pre-autopsy information received by FMPs received an information quality score of 21.14%, with only 18.5% of them being satisfied with the information provided from death scenes.<sup>21</sup> The study also reported that 55.6% of FMPS felt that crucial information was missing from pre-autopsy information.<sup>21</sup> While this study provided insight into FMPs rating of the quality of pre-autopsy information available to them, it did not assess the actual data or investigate how the data itself could be improved. The observations from this fieldwork study validate the findings from this previous study by identifying the lack of data collection protocols for pre-autopsy information at death scenes. The previous study found that the lack of appropriate training of FOs hindered their ability to collect appropriate autopsy information on behalf of the FMP.<sup>21</sup> However, if standardised data collection protocols for death scenes were to be implemented and included specific parameters for specific causes of death by making use of identified core and circumstance-specific data elements, this issue would be adequately addressed.

The current management of data at the PMLL is suboptimal, as there are various different electronic versions of the data that are generated at the mortuary that are stored in many different locations, that are not updated with relevant information or integrated with each other. This can lead to poor quality of data, as well as inaccuracy of the data sources. While important information is being captured on Excel spreadsheets, it is not being integrated with other versions which can lead to data

incongruencies if different versions of the spreadsheet exist. In addition, the large amount of paper only copies is not only a security problem, but also leads to problems with data access and data assimilation for data analysis's, as collecting the data from paper copies is time consuming. Additionally, the security of paper formats is very low, and it is easy to access the paper formats of post-mortem examination reports. The lack of a national professional body that governs FO's also compromises the data quality.

Studies undertaken that used data from the PMLL at the Department of Forensic Medicine at the University of Pretoria make use of data from post- mortem case-files generated on admission of decedents.<sup>22-26</sup> Therefore, data from ancillary investigations are not included in this data form, which means that if new findings pertaining to the case are made at a later stage, they will not be included; thus, the data would be inaccurate at later stages of the medico-legal death investigation process.

There are eleven state mortuaries that service the entire province of Gauteng and are divided into three clusters: the Johannesburg Cluster, the Germiston Cluster and the Pretoria Cluster. The Johannesburg Cluster includes the Johannesburg, Roodepoort, Diepkloof, and Carletonville Medico-legal Laboratories, the Germiston Cluster includes the Germiston, Springs, Heidelberg, and Sebokeng Medico-legal Laboratories, and the Pretoria Cluster includes the Pretoria, Ga-Rankuwa, and Bronkhorstspruit Medico-legal Laboratories. If each of these mortuaries adhered to the same data collection and management principles and policies, the sharing and publication of the generated data would be easy to manage. In theory, it is simple to implement policies to manage the data generated at these mortuaries. Each facility should have a unique identifier facility number and each case presenting to a facility should be assigned a unique case number, as describe in the National Code of Guidelines.<sup>16</sup> Each facility should have a centralised database that serves as a conduit for a centralised data repository that stores data generated from various facilities. An important caveat of an endeavour such as this is to define and refine the data collection process, both as it currently stands and how it should be improved upon, and to prescribe what data elements should be routinely collected.

In 2008 the National Forensic Pathology Services Committee (NFPSC) published the National Code of Guidelines for Forensic Pathology Practice in South Africa. While it was not a piece of legislature, and therefore is not legally enforceable, it served to try and describe, direct, and standardise the aspects of the FPS.<sup>16</sup> The Guidelines included the presentation of prescribed death investigation documentation, and while some of these forms are in use at the PMLL, such as the FPS 007, not all of them are.<sup>16</sup> The guidelines also laid out that there should be a unique identifying alphanumeric number for each case admitted to the FPS and that each facility should have a designated number and abbreviation for the province it resides in, however, at the PMLL this suggested system is not in case.<sup>16</sup> Rather it makes use of a DR number followed by the year, but does not include the suggested facility number or provincial identifier. In order for data from different mortuaries to be integrated, the number convention suggested in the guideline would need to be implemented for ease of identifying cases from different mortuaries. So, while there is a document that lays out the operational processes of death investigation in South Africa and provides guidelines on how to collect and store data, but it is not being followed at mortuaries.

The fieldwork found that different players at the PMLL are responsible for the capture of data at different stages of the medico-legal death investigation process, which are SAPS, and the FPS. Within the FPS, FOs are generally responsible for the capture of data at death scenes, while administrative staff are responsible for the capture of data related to the number of cases and the input (admission) and output (release) of bodies at the PMLL. FMPs are responsible for capturing data that are generated during the post-mortem investigation, which includes information on internal and external autopsy examinations as well as histological investigations. Data related to ancillary investigations are received by administrative staff and placed in post-mortem case-files manually. The study was not able to identify who is responsible for the data generated during medico-legal death investigation and how it should specifically be captured and stored. While the Regulations Regarding the Rendering of Forensic Pathology Services state that the Service's responsibilities include collecting, reviewing, and analysing related data there are no further stipulations on how exactly this should be done.<sup>27</sup>

The study found that there is a lack of standardisation in the data elements collected during medico-legal death investigation, and that the storage and management of this data is often inconsistent. The data are mainly stored in paper format and excel spreadsheets, which are not connected to any formal database. This makes it difficult to retrieve and analyse data, and there is a risk of data loss and inaccurate and inconsistent data.

## **Conclusion**

While the underlying legislative and administrative infrastructure for data collection in medico-legal death investigation in South Africa is well formed, the technological and data management infrastructure is not. There is a lack of government and legislative input with regards to data capture and storage beyond paper copies. The insights and observations made regarding the data management in medico-legal death investigation were based only on a singular urban state mortuary in South Africa, as this study was a pilot evaluation. While these insights are representative of the PMLL, they may not be applicable to mortuaries that do not have the staffing of or serve a demographic population similar to the PMLL or mortuaries in rural areas. It is recommended that further study and investigation is undertaken at other state mortuaries in South Africa to contextualise the data flow and management of mortuaries in different areas and to identify any problems and opportunities that may be unique to these specific areas.

It is recommended further studies of this nature are undertaken at different state mortuaries in South Africa, so that standard data collection protocols be developed and implemented to ensure that all relevant data elements are consistently collected. Additionally, the data should be digitalised and stored in a national or provincial centralised database to facilitate data retrieval and analysis.

In conclusion this study highlights the need for standardisation and improvement in the data collection and management practices of medico-legal death investigation in South Africa. A standardised data collection protocol and centralised database would enable the data generated during medico-legal death investigation to be used for research, and

to inform policy and practice regarding non-natural deaths. This would ultimately benefit society by ensuring that accurate and reliable information is available for the investigation and prevention of non-natural deaths.

## Notes

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## **Chapter 6: General Discussion and Conclusion**

This study aimed to explore the data elements that are and could be collected for a standardised data collection system for medico-legal death investigation in South Africa. This was done by making use of a three-part mixed-methods study. It consisted of a scoping review, a retrospective review, and a fieldwork component. The scoping review was presented in the form of a dissertation chapter, while the retrospective review and fieldwork components were written as manuscripts and appear in the dissertation as such.

The scoping review identified four distinct fields to gather literature on medico-legal death investigation and data related to the field. These four fields were: public health, informatics, legal and ethical perspectives, and mortality surveillance systems. The scoping review consolidated various studies related to these fields into one comprehensive body of literature. The scoping review identified legislation that governs medico-legal death investigation; however, it also identified that there is a lack of direct structured legislation regarding the collection, management, and dissemination of data generated during medico-legal death investigation in South Africa. In order for data collection and management to be standardised legislation outlining data collection protocols, as well as where the responsibility for the collection, storage and dissemination of this data lies, needs to be drafted and codified.

The scoping review also identified various technical software that have been used in mortuaries to collect and manage medico-legal data. There are many different types of software that can be used to capture and store data generated during medico-legal death investigation, however, general vendor databases are not ideal for medico-legal data generated at state mortuaries in South Africa due to the unique structure of the medico-legal death investigation system in the Country, and the laws that govern it. It is therefore recommended that a unique database that takes this into account should be designed, and relevant players in the field of medico-legal death investigation should be consulted during the inception, development, and implementation of such a database.

The retrospective analysis used data from 2017 to 2019 regarding cases admitted to the Pretoria Medico-legal Laboratory to identify trends in the data and analysed 5913 cases.

The month in which the highest number of autopsies were performed during the three-year period was July, and the month with the lowest number of autopsies was February. It is recommended that further in-depth studies be conducted to determine why these months had the highest and lowest number of cases. The study identified that there was a steep increase in the number of cases from 2018 to 2019, however, the cause of this increase was not identified and should be further investigated.

Accidental deaths constituted the largest proportion of deaths admitted to the PMLL, followed by deaths due to homicides. Deaths in which the manner of death was not determined comprised a larger proportion of cases than deaths in which the manner of death was determined to be natural, suicidal, or due to a medical procedure. The fact that a large proportion of deaths were coded as having an unknown manner of death suggests that the quality of data that FMPs receive may not be adequate at the time of autopsy, and so perhaps FMPs should be able to revise their initial presumed manner of death at a later stage, and that data should be updated, so that findings from the data can be more accurate.

Road traffic fatalities accounted for more than a quarter of the deaths during the study period, followed by firearm discharges. The majority of firearm discharges were determined to be homicidal in nature, with less than 1% of cases being accidental. This suggests that, in Pretoria at least, individuals with firearms are not accidentally causing firearm fatalities, and that most firearm fatalities are done with the intent to cause harm. The most notable finding of this retrospective analysis was the increase in suicide cases; while the proportion of cases for other causes of death remained similar over the study period, the proportion of suicides steadily increased, and further studies should be done to identify the cause of this increase.

Another significant finding was that, from January to September, accidental deaths were greater than homicidal deaths; however, from October to December, homicidal deaths outnumbered accidental deaths. This finding is notable and should be further investigated to try and identify the cause of this increase in homicidal deaths from October to December. The congruent nature of homicidal and suicidal deaths is also an important finding, as it is suggestive that the factors that drive homicide in the Tshwane

area also drive suicide or vice versa. These findings suggest that there is a link between the causes for homicides and suicides in Pretoria, however, further studies are required to determine what the causes are and how they drive homicidal and suicidal deaths.

The fieldwork component of the study documented the data flow in medico-legal death investigation, as well as assessing the current infrastructure and identifying the various data subsets generated during the course of medico-legal death investigation. The implementation of a standardised and routinised data collection and management system is and has not been successfully implemented. Despite efforts to capture and publish this data from state mortuaries, none of the initiatives have been successful in the long term.

Efforts to facilitate better management and leadership of the FPS, such as moving it from custody of the SAPS to that of the NDoH, did not rectify deficiencies with data collection. There are legislative mandates regarding the data generated by the FPS, but no routinised system has been implemented on a regional, provincial, or national scale, except in the Western Cape. The data generated at state medico-legal laboratories have valuable public health and policy implications; however, these benefits are lost due to the lack of a routinised data management system.

The absence of accurate and reliable data relating to non-natural deaths has been highlighted in publications.<sup>2</sup> While Stats SA aims to publish data related to mortality and morbidity in South Africa, problems arise with regard to reports that are published.<sup>3</sup> Due to staff constraints, the publication of statistics relating to deaths published by Stats SA is under a backlog, with the most recent data being published in 2021 reporting on death data from 2018, which is now four years out of date.<sup>3</sup> The statistical release is based on the civil registration system maintained by the Department of Home Affairs, and makes use of information from death notification DHA-1663 forms.<sup>3</sup>

While this data is important to keep track of, it does not provide reliable, accurate, and complete data on suspected non-natural deaths that present to state mortuaries. It also does not provide any information on the number of autopsies performed by FMPs in South Africa, an important caveat for policy and budgetary makers. The results published by the SAMRC are important but also outdated with respect to state

mortuaries specifically, in addition, the results are not an accurate reflection of the true data generated at state mortuaries throughout South Africa. The last NIMSS report from the SAMRC was published in 2013, which made use of data from state mortuaries.<sup>4</sup> As of 2012 the SAMRC has published data on mortality making use of data from the national population register from the DHA as its main data source.<sup>5</sup>

This study has shown that collecting and reviewing case data related to autopsies at state mortuaries can be performed with relative ease, and that the data that can be generated from existing data from in-house databases currently in use at these mortuaries reveals valuable information regarding the profiles and trends of admissions to state mortuaries and overall, regarding non-natural deaths in South Africa.

The three-year review of admissions at the PMLL highlights important trends and findings, some of which have not previously been recorded. While publications using data from the PMLL have been published, none of them looked at overall cases but rather focused on a specific cause of death, such as suicide or sharp force trauma.<sup>6-10</sup> This review also serves as an important benchmark for pre-covid trends and can serve as a valuable reference to investigate the impact of the COVID-19 pandemic on non-natural deaths admissions to the PMLL.

Due to the exploratory nature of the study, it was conducted at a single state mortuary, rather than multiple mortuaries. This limits the applicability of the results as they cannot be extrapolated to other mortuaries. The lack of up-to-date accessible denominators limited the applicability of the retrospective review, as the results could not be compared to other studies due to a lack of denominators. This also limited the scope of the study as it could not further investigate the incidence rates of the identified trends.

In conclusion, the results of this study suggest that the implementation of routine and standardised data collection, management, and storage protocols at state mortuaries in South Africa would greatly benefit the quality of non-natural mortality data. Of even greater value would be the provincial and national collection of this data, but this will require significant data management strategies and directives relation to ownership and use of such data. Implementing and adapting data collection strategies in use in other

fields, such as public health, would be beneficial to the field of medico-legal death investigation with regards to data collection and management.

Given that the scope and nature of this study has not been undertaken before, and consisted of three different components, it was not without limitations. These include the limited scope of the scoping review, the fact that only a few data elements were analysed in the retrospective analysis, and the evaluation of the data flow at only a singular state mortuary. While the study investigated data collection and management in medico-legal death investigation in South Africa, as well as comprising of a scoping review to determine other disciplines that are relevant to this field, it also identified possible opportunities for further research, which can address some of the limitations of this study. It is recommended that further retrospective analyses and evaluations of data management be undertaken and other mortuaries in South Africa, to identify trends relevant to specific areas, and to see if there are data management concerns that may be unique to certain areas.

Despite these limitations this research has provided insights into data collection and management in medico-legal death investigation in South Africa, and has exposed areas that would benefit from further research. In order for the field of medico-legal death investigation to adequately serve society, it needs to have standardised and structured data collection and management practices in place and would strongly benefit from the implementation of an integrated database system. However, in order to implement such a system, the data practices currently utilised need to be improved upon.

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## Appendices

### Appendix A: MSc Committee Approval Letter



MSc Committee  
School of Medicine  
Faculty of Health Sciences

20 April 2022

Prof G Saayman  
Department of Forensic Medicine  
Faculty of Health Sciences

Dear Prof,

**Ms IO da Silva, Student no 17016224**

Please receive the following comments with reference to the MSc Committee submission of the abovementioned student:

<b>Student name</b>	Ms IO da Silva	<b>Student number</b>	17016224
<b>Name of study leader</b>	Prof G Saayman		
<b>Department</b>	Forensic Medicine		
<b>Title of MSc</b>	Data collection and management in medico-legal death investigation in South Africa: An exploratory study		
<b>Date of first submission</b>	29 September 2021		
<b>October 2021</b>	• Thank you for submitting the revised protocol.		
<b>April 2022</b>	• Thank you for submitting the ethics approval letter.		
<b>Decision</b>	This protocol has been approved. Ethics approval has been obtained. The internal and external examiners can be nominated and submitted to the MSc Committee six months prior to submission of the dissertation. Please ensure that the CV of the examiners includes: supervision, examination and publication records		

Yours sincerely



Prof Marleen Kock  
Chair: MSc Committee

## Appendix B: Research Ethics Approval Letter



Faculty of Health Sciences

**Institution:** The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

- FWA 00002567, Approved dd 22 May 2002 and Expires 03/20/2022.
- IORG #: IORG0001762 OMB No. 0990-0279 Approved for use through February 28, 2022 and Expires: 03/04/2023.

Faculty of Health Sciences Research Ethics Committee

19 January 2022

### Approval Certificate New Application

Dear Miss IO da Silva

**Ethics Reference No.: 656/2021**

**Title: Data collection and management in medico-legal death investigation in South Africa: An exploratory study**

The **New Application** as supported by documents received between 2021-11-03 and 2022-01-19 for your research, was approved by the Faculty of Health Sciences Research Ethics Committee on 2022-01-19 as resolved by its quorate meeting.

Please note the following about your ethics approval:

- Ethics Approval is valid for 1 year and needs to be renewed annually by 2023-01-19.
- Please remember to use your protocol number (656/2021) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.

**Ethics approval is subject to the following:**

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

The candidate is recommended to read and add the following article to the protocol: Butchart A, Peden M, Matzopoulos R, Phillips R, Burrows S, Bhagwandin N, Saayman G, Cooper A. The South African National Non-Natural Mortality Surveillance System--rationale, pilot results and evaluation. S Afr Med J. 2001 May;91(5):408-17. PMID: 11455806.

We wish you the best with your research.

Yours sincerely

On behalf of the FHS REC, Dr R Sommers

MBChB, MMed (Int), MPharmMed, PhD

Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes, Second Edition 2015 (Department of Health)

Research Ethics Committee  
Room 4-00, Level 4, Tsoelike Building  
University of Pretoria, Private Bag x223  
Gazima 0031, South Africa  
Tel +27 (0)12 356 3084  
Email: deepika.behari@up.ac.za  
www.up.ac.za

Fakulteit Gesondheidswetenskappe  
Lefapha la Disaense Sa Mapheho

## Appendix C: Letter of Consent

### LETTER OF CONSENT FOR:

Data collection and management in medico-legal death investigation in South Africa: An exploratory study

#### Contact details:

Isabella da Silva, 078 605 2759, [u17016224@tuks.co.za](mailto:u17016224@tuks.co.za)

Prof Gert Saayman, 083 250 6252, [gsaayman@up.ac.za](mailto:gsaayman@up.ac.za)

Dr Servaas Rossouw, [servaas.rossouw@up.ac.za](mailto:servaas.rossouw@up.ac.za)

Department of Forensic Medicine, Pathology building, Room 4-44, Prinshof Campus, University of Pretoria, 6  
Bophelo Road, Riviera

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I, CHARLES J. CRANE, facility manager of the Pretoria Medico-legal Laboratory (PMLL), hereby give permission to IO da Silva to attend death scenes, autopsies and access data from the Pretoria Medico-legal Laboratory for use in the study 'Data collection and management in medico-legal death investigation in South Africa: An exploratory study.'

Attendance of death scenes and autopsies will be done in order to contextualise and document the flow of data in an urban mortuary in South Africa. Any data that is recorded will not disclose any personal or case specific details of the deceased.


#### NOTE:

DR numbers will only be used for recording purposes and will not be disclosed or published. A copy of the article as well as the results of the study will be made available to the PMLL.

Signed at: Pretoria

Date: 2021/11/09

Name: CHARLES CRANE

Signature: 

## Appendix D: Scoping Review Search Terms

**Table D1: Search terms for public health theme**

Public health search terms		Research question search terms
Searched with 'OR'		Searched with 'OR'
Public health	'AND'	Medico-legal death investigation Medicolegal death investigation Mortality statistics Non-natural deaths Unnatural deaths Medico-legal data Medicolegal data Medicolegal database Medico-legal database Mortality database Mortality data capture Data capture Mortality data collection Mortality data management Data management Mortality surveillance systems

**Table D2: Search terms for informatics theme**

Informatics search terms		Research question search terms
Searched with 'OR'		Searched with 'OR'
Informatics	'AND'	Forensic pathology Death investigation Forensic Public health

**Table D3: Search terms for legislature subtheme**

Legislature search terms		Research question search terms
Searched with 'OR'		Searched with 'OR'
South African Legislation	'AND'	Data Statistics Forensic pathology Non-natural Unnatural Mortality

**Table D4: Search terms for ethics subtheme**

Ethics search terms		Research question search terms
Searched with 'OR'		Searched with 'OR'
Ethics Ethical	'AND'	Medico-legal death investigation Medicolegal death investigation Mortality data Non-natural deaths Unnatural deaths Medicolegal data Medico-legal data

**Table D5: Search terms for mortality surveillance system theme**

Mortality surveillance systems		Research question search terms
Searched with 'OR'		Searched with 'OR'
Mortality surveillance system Surveillance system	'AND'	Database Data capture Data collection Data elements Data management Software

## Appendix E: Data Collection Form for Articles in Scoping Review

**Table E: Data collection form for articles in scoping review**

Type	Country	Authors	Title	Journal	Year	Keywords
1 Pilot study, mixed methods	South Africa	Butchart A, Peden M, Matzopoulos R	The South African non-natural mortality surveillance system - Rationale, pilot results and evaluation	South African Medical Journal	2001	None provided
2 Review, qualitative	United States of America	Kass NE	An ethics framework for public health	American journal of public health	2001	None provided
3 Review, mixed methods	South Africa	Bradshaw D, Groenewald P, Bourne DE	Making COD statistics useful for public health at local level in the city of Cape Town	Bulletin of the World Health Organisation	2006	Mortality/statistics; Data collection/methods; Death certificates; Cause of death; South Africa
4 Review, qualitative	United States of America	Hanzlick R	Medical examiners, coroners, and public health: a review and update	Archives of pathology and laboratory medicine	2006	None provided
5 Editorial, qualitative	Not specified	Kukafka R, Yasnoff WA	Public health informatics	Journal of biomedical informatics	2007	None provided
6 Development of guideline, qualitative	Australia, Switzerland	Grills NJ, Ozanne-Smith J, Bartolomeus K	The mortuary as a source of injury data: Progress towards a mortuary data guideline for fatal injury surveillance	International journal of injury control and safety promotion	2011	Mortuary data; Guideline, Surveillance, Forensic medicine, Injury prevention
7 Case study,	United Kingdom	McGowan CR, Viens AM	Death investigation systems and disease surveillance	Epidemiology and infection	2010	None provided

	qualitative					11	
8	Survey, mixed methods	United States of America	Drake SA, Nolte KB	Essential medicolegal death investigation services: standardization of a survey instrument based on the essential public health services	Journal of forensic sciences	2011	None provided
9	Survey, quantitative	United States of America	Drake SA, Cron SG, Giardo A, Tevino V, Nolte KB	Comparative analysis of the public health role of two types of death investigation systems in Texas: application of essential services	Journal of forensic sciences	2011	None provided
10	Retrospective review, quantitative	South Africa	Groenwald P, Naledi T, Daniels J	Strengthening local-level cause of death surveillance: A case study of Western Cape Province, South African	The Lancet	2013	None provided
11	Validation study, mixed methods	United Kingdom; South Africa	Dillon DG, Pirie F, Rice S	Open-source electronic data capture system offered increased accuracy and cost-effectiveness compared with paper methods in Africa	Journal of Clinical Epidemiology	2014	Sub-Saharan Africa; Data capture; Electronic questionnaire; Open source; Epidemiology; Survey
12	Evaluation, quantitative	United States of America	Cain MD, Robertson CA, Park SL, Davis GG	Computer extraction of data from autopsy and toxicology reports	Academic Forensic Pathology	2015	None given
13	Review, mixed methods	South Africa	Groenwald P, Azevedo V, Daniels J	The importance of identified cause-of-death information being available for public health surveillance, actions and research	South African Medical Journal	2015	None given
14	Review, qualitative	United States of America	Hanzlick R	The "value-added" forensic autopsy: public health, other uses, and relevance to forensic pathology's future	Academic Forensic Pathology	2015	Forensic pathology, Autopsy, Uses of autopsy
15	Review, qualitative	United States of America	Levy B	The need for informatics to support forensic pathology and death investigation	Journal of pathology informatics	2015	Clinical informatics, Death investigation, Forensic pathology, Public health, Public safety

16	Review, qualitative	United States of America	Levy B	Informatics and autopsy pathology	Surgical pathology clinics	2015	Autopsy, Pathology Forensic Informatics Synoptic Virtopsy Images
17	Review, qualitative	Australia	O'Malley T	Forensic informatics enabling forensic intelligence	Australian journal of forensic science	2015	Forensic register; Forensics; Informatics; Intelligence; Mobile data; Police
18	Evaluation, mixed methods	United States of America	Cherico-Hsiao S, Bankosi A, Singal P	Sharing overdose data across state agencies to inform public health strategies: A case study	Public health reports	2016	None provided
19	Survey, mixed methods	United States of America	Croom NA, Melinek J	Dissecting and streamlining the medical record acquisition process in death investigation systems	Academic Forensic Pathology	2016	None provided
20	Commentary, qualitative	United States of America	Warner M, Brown PA	Public Health Impact: how medicolegal death investigation data help the living	Academic Forensic Pathology	2017	None provided
21	Evaluation, quantitative	Australia, Canada, Denmark, Germany, Japan, Switzerland	Mikkelsen L, Iburg KM, Adair T	Assessing the quality of cause of death data in six high-income countries: Australia, Canada, Denmark, Germany, Japan, and Switzerland	International journal of public health	2020	Causes of death. Medical certification Data quality Garbage codes Assessment of data
22	Cross-sectional study, quantitative	Ethiopia	Ngusie HS, Shferaw AM, Bogale AD, Ahmed Mh	Health data management practice and associated factors among health professionals working at public health facilities in resource limited settings	Advances in medical education and practice	2021	Health data management practice, Health professionals, Ethiopia
23	Review, qualitative	United States of America	Joos O, Mrkic S, Sferrazza L	Legal framework: a starting point for strengthening medicolegal death investigation systems and improving cause and manner of death statistics in civil registration and vital statistics systems	Academic Forensic Pathology	2021	Forensic pathology, Legal framework, Mortality statistics, Medicolegal, Civil registration, Vital statistics



## Appendix F: Data Collection Form for Relevant Legislation

**Table F: Data collection form for relevant legislation**

<b>Legislation</b>	<b>Year</b>	<b>Section from legislation</b>
Inquests Act 58	1959	Section 2; Section 3; Section 4
Births and Deaths Registration Act 51	1992	Section 15; Section 17; Section 18
Criminal Procedure Act 51	1977	Section 49
Electronic Communications and Transaction Act 25	2002	Chapter 1
Health Professions Act 56	1974	Section 56
National Health Act 61	2003	All
National Code of Guidelines for Forensic Pathology Practice in South Africa	2003	Chapter 2; Chapter 12;
Protection of Personal Information Act 4	2013	Chapter 1
Regulations Regarding the general control of human bodies, tissue, blood, blood products and gametes	2012	Section 24
Regulations Regarding the Rendering of Forensic Pathology Services	2018	All sections
Memorandum of Understanding between the South African Police Service and the National Department of Health	2018	All sections

## Appendix G: Statistics of General Characteristics of Studies Included in Scoping Review

**Table G: General characteristics of studies**

Criteria	Number	Percentage (%)
<b>Publication year</b>		
2000-2005	2	8.7
2006-2010	3	13.0
2011-2015	12	52.2
2016-2020	4	17.4
2021-2022	2	8.7
<b>Publication type</b>		
Case study	1	4.3
Commentary	1	4.3
Cross sectional study	1	4.3
Development of guidelines	1	4.3
Editorial	1	4.3
Evaluation	4	17.4
Pilot study	1	4.3
Retrospective review	1	4.3
Review	9	39.1
Survey	3	13.0
Validation study	1	4.3
<b>Study type</b>		
Mixed methods	7	30.4
Qualitative	7	30.4
Quantitative	9	39.1
<b>Country</b>		
Australia	1	4.3
Ethiopia	1	4.3
Multiple countries	3	13.0
Not stated	1	4.3
South Africa	4	17.4
United Kingdom	1	4.3
United States of America	12	52.2