EXPLORING THE MEDICO-LEGAL DEATH SCENE INVESTIGATION OF SUDDEN UNEXPECTED DEATH OF INFANTS AT SALT RIVER MORTUARY, CAPE TOWN SOUTH AFRICA

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Declaration

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Abstract

A death scene investigation (DSI) forms an integral part of the inquiry into death, particularly for sudden unexpected death of infants (SUDI). Global guidelines exist for DSI, however, it is unclear how many countries adhere to them, and to what extent they are followed. Therefore, a systematic literature review was undertaken to assess the scope of SUDI DSI performed internationally. It was found that national protocols have been established in some countries, and have shown value in guiding medico-legal examinations. Further, South Africa did not routinely perform DSI for SUDI cases, nor was there a protocol. This was largely attributed to the burden of SUDI cases as well as the lack of resources. Therefore, this study aimed to suggest realistic and feasible ways to improve DSI for local SUDI cases. This research study consisted of three phases: 1) A two-year review of medico-legal case files from SUDI cases investigated at Salt River Mortuary; 2) The prospective observation of DSI for ten SUDI cases, using a semi-structured checklist; and 3) he distribution and analysis of a survey regarding SUDI DSI to all registered, qualified forensic pathologists in South Africa. The results showed that the SUDI death scenes were assessed in 59.2% of cases at Salt River Mortuary, with inconsistent levels of documentation or photography. Death scenes were never investigated in cases where the infant was pronounced dead on arrival at a medical facility. In both scene observations (n=10) and retrospective analysis (n=454) only one case incorporated a re-enactment, but the majority of infants were moved prior to DSI. The findings support the need for a standardised approach to DSI, coupled with specialised training for staff. Based on the available resources, this should focus on the establishment of guidelines pertaining to photography, handling medicine and scene reconstruction, as well as accurate use of relevant documentation.

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Above all I give thanks to the Lord for the blessings he has bestowed on me.

Abbreviations

CDC	Centers for Disease Control and Prevention
CESDI	Confidential Enquiry into Sudden Death in Infancy
COD	Cause Of Death
DSI	Death Scene Investigation
FPO	Forensic Pathology Officer
FPS	Forensic Pathology Services
GPS	Global Positioning System
MDT	Mobile Data Terminal
OAD	Office Autopsy Database
OCME	Office of the Chief Medical Examiner
PM	Post-Mortem Examination
SA	South Africa
SIDS	Sudden Infant Death Syndrome
SRM	Salt River Mortuary
SUDI	Sudden Unexpected Death of Infants
SUIDRF	Sudden Unexpected Infant Death Reporting Form
UCT	University of Cape Town
UK	United Kingdom
US	United States
USA	United States of America

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Preface

This minor dissertation was written as a partial requirement for the Master in Philosophy (MPhil) degree in Biomedical Forensic Science, in the Division of Forensic Medicine and Toxicology, Department of Pathology at the University of Cape Town.

This document is therefore written in a two chapter format in accordance with the MPhil Biomedical Forensic Science guidelines:

Chapter 1: Systematic literature review - Global trends in the extent of death scene investigation performed for sudden and unexpected death of infants (SUDI) cases.

Chapter 2: Research study - A mixed-methods investigation of local death scene investigation practices for SUDI cases.

Chapter 1: Systematic literature review

Global trends in the extent of death scene investigation performed for sudden and unexpected death of infant (SUDI) cases

1.1 Introduction

Sudden unexpected death of infants (SUDI) is the rapid and unexpected death of an infant aged less than one year (Moon, Horne & Hauck, 2007). Sudden infant death syndrome (SIDS), is a subset of SUDI, usually occurring during sleep, and remaining unexplained following the completion of a full autopsy, death scene investigation (DSI) and review of clinical history (Krous et al., 2004). SIDS is thus a diagnosis by exclusion whereby cause of death (COD) remains undetermined after all avenues of investigation have been exhausted (du Toit-Prinsloo et al., 2011, Krous et al., 2004). If the COD remains undetermined after the performance of a medico-legal investigation but the criteria in the definition were not met in full (*e.g.* only a partial autopsy was performed), then SIDS should not be diagnosed (Hanzlick, Iyasu & Rowley, 1996).

DSI is needed to identify risk factors and distinguish natural from unnatural death (Bajanowski et al., 2007) or to accurately diagnose asphyxia. For example, when infants die due to carbon monoxide poisoning, suffocation, occult trauma or hyperthermia this COD may not be revealed at post-mortem examination (PM) if adequate information is not provided from the scene of death (Bass, Kravath & Glass, 1986). Additionally the recording of crucial information from the death scene has been used to inform ancillary investigations and has been a useful adjunct to determining an accurate COD (Dempers et al., 2016).

Centers for Disease Control and Prevention (CDC) have developed global guidelines for SUDI DSI, which appear to be commonly referred to in literature, however, these cannot always be implemented in countries of low socio-economic grounding without modification prior to implementation. National and regional protocols for the investigation of SUDI cases seem to have been established in some countries (du Toit-Prinsloo et al., 2011, Howatson, 2006), however, there is a paucity of literature detailing the nature and extent of such protocols, specifically pertaining to the death scene. Additionally, this topic has not been systematically searched to bring the details of these protocols to light. A systematic review based

on the extent of DSI performed for SUDI cases in various countries is thus needed to address this gap. It is also unclear as to how many countries have implemented a protocol and whether this is routinely performed. Therefore, the aim of this systematic literature review was to investigate the scope of DSI in different countries.

1.2 Objectives

The aim of this literature review was achieved through the following objectives:

- Determine which countries routinely utilise a documented DSI protocol for SUDI cases
- Determine what standardised DSI protocols currently exist
- Assess what aspects are included in a DSI of SUDI cases in various countries
- Compare data between developed and developing countries

1.3 Methods

1.3.1 Searching

A search strategy was employed that encompassed the searching of databases; namely PubMed, Scopus, Cochrane and meta-database, Web of Science™. Three discipline specific journals (Forensic Science International, International Journal of Legal Medicine and Journal of Forensic Sciences) were also searched to ensure data collection was saturated. Key words and phrases were used to search the databases and journals (Appendix A) and evaluation of the relevance of each article was performed using inclusion and exclusion criteria.

1.3.2 Inclusion and exclusion criteria

The articles generated from the original database search were read in full to determine inclusion or exclusion, while subsequent articles were evaluated by using the title, abstract and, if needed, scanning the article. Articles were only selected if in adherence to specific criteria:

The article must have mentioned the performance of a DSI for which the population group was infants or SUDI or SIDS. Studies investigating aspects associated with the death, such as inanimate objects within the death scene, were excluded (e.g. rocking cradles and pillow types). Only peer-reviewed original journal articles and case reports were included. Exclusion of articles occurred when the article was not available in English, if the DSI was performed only for the purpose of their study or if the data used in the study was obtained from data collection in a study that has already been included. All articles meeting these criteria, published before the 30th April 2018 were included.

1.3.3 "Hand-searching"

"Hand-searching" was performed by applying the inclusion and exclusion criteria mentioned in section 1.3.2 above to each reference in the reference list of the articles included from the previous round of searching. This was performed to evaluate each reference, until no new articles were retrieved. It was necessary in this literature review to perform hand-searching four times.

1.3.4 Data collection and analysis

When analysing the included articles, data was collected in order to perform subsequent analysis. This data was separated into three main categories. The first category, namely **protocol information**, encompassed articles which (i) stated the need for a DSI protocol (ii) alluded to a DSI protocol (and the name thereof), (iii) utilised a specific DSI protocol or (iv) utilised self-created forms. While all included articles performed a DSI, the articles which fell into this category performed standardised DSI protocols which were either nationally implemented or internationally recommended. The latter referred to the

CDC protocol, which is currently the only internationally available protocol (Hanzlick, Iyasu & Rowley, 1996).

The second category, **data recording**, encompassed extracting information from articles which made use of photographs, scene re-enactment with or without a doll and witness accounts or interviews as forms of data recording.

Lastly, the category of **DSI elements** encompassed documenting the infants sleep surface, sleeping position, bedding/wrapping, clothing, house/room conditions, room temperature, presence of stains, occurrence of co-sleeping and the occurrence of adult smoking, alcohol use, drug use or periodic/episodic fainting. The documentation of sleep surface included any article which mentioned bed-type, mattress or sleep surface, while co-sleeping included any article mentioning either co-sleeping or bed-sharing.

The country and/or location of the study population, the year of publication and the type of article (i.e. research article or case report) was also documented. The country was then placed into the category of 'developed' or 'developing' based on the categories stipulated by the United Nations, when taking into consideration economic status and standard of living (Surbhi, 2015). All data was collected in a Microsoft Excel 2013 spreadsheet and descriptive statistics were performed using the built in statistical package.

1.4 Results

1.4.1 Summary of the literature search and included articles

The articles returned from the database search and subsequent hand-searching, as well as the articles selected according to the inclusion criteria, are represented in Table 1.1. Due to the systematic nature of the research, redundant articles were identified. These were all included in the initial article count for the 'Articles returned' but were only included once for further analysis. Overall, 74 relevant articles met the inclusion criteria and were thus included for analysis.

Table 1-1: Summary of articles generated using the search strategy and the total number used in the analysis of the literature.

A total of 140 articles were returned from the database and journal searches, 37 were found from hand-searching and 74 articles met the inclusion criteria and were included for analysis.

Source	Date accessed	Articles returned	Relevant articles	Articles found via "hand searching"	Total number of articles
PubMed	5th April 2018	94	36	26 + 4 = 30	66
Web of Science™	3rd May 2018	13	-	-	-
Scopus	5th April 2018	21	1	4 + 2 + 1 = 7	8
Cochrane	5th April 2018	0	-	-	-
Forensic Science International	5th April 2018	4	-	-	-
International Journal of Legal Medicine	5th April 2018	3	-	-	-
Journal of Forensic Sciences	5th April 2018	5	-	-	-
Total number of articles used in the literature analysis =					**74**

To provide more information on the search strategy, Figure 1.1 shows information on the five searches that were performed. After the initial search of the databases, four subsequent searches were performed until the literature was exhausted.

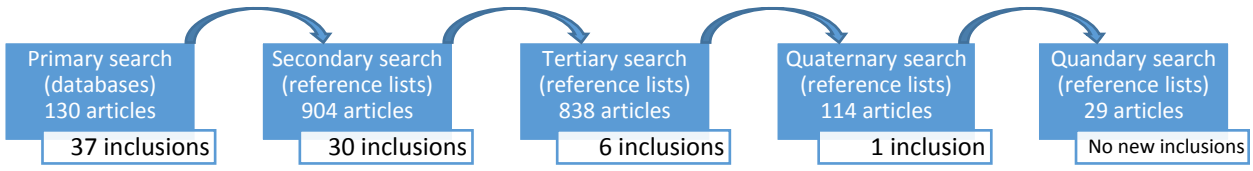

Figure 1-1: Flow diagram depicting the stages of the literature review search and the inclusions per stage.

From the performance of the primary search, thirty-seven articles were included in the systematic review. Subsequently the secondary, tertiary, quaternary and quandary searches yielded thirty, six, one and zero new articles to be added to the systematic review, respectively.

The included articles were published over a period of 70 years, with the oldest article being published in 1947. More articles have been published in recent years, causing a skewed distribution to the left (Figure 1.2), with the increase starting after 1990. The year in which the most articles were published was 2005 (n=6, 8%), with an average of 1.0423 articles being published per year over the 70 year period.

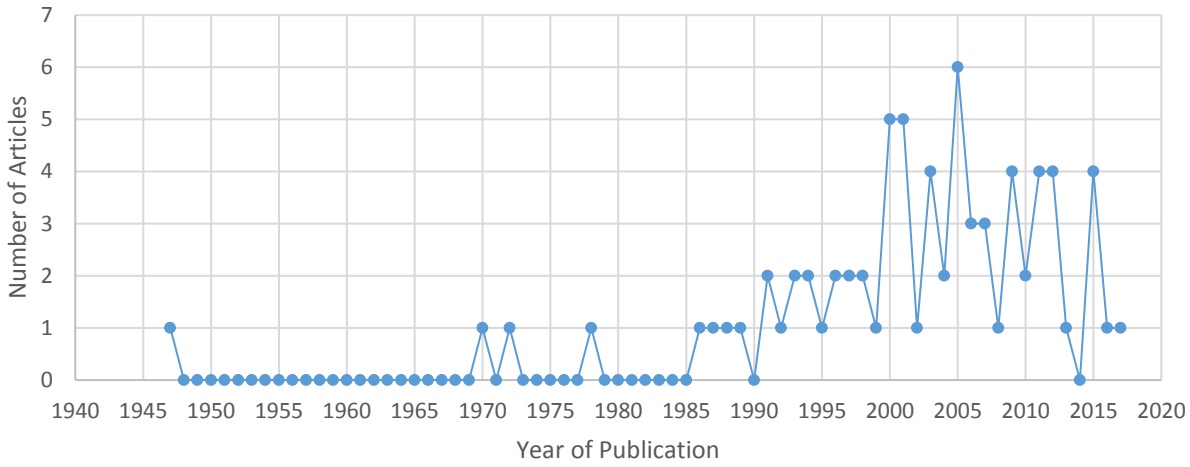

Figure 1-2: Number of included articles published per year.

The earliest published article included in this study was from 1947, with the subsequent 73 articles arising over a 70 year period till 2017. The graph shows that the data is skewed to the left indicating a greater number of published articles on the topic arising in more recent years.

1.4.2 DSI protocols

There were 74 studies in which DSI was performed; yet only 20 of these studies indicated that a dedicated and standardised DSI protocol was utilised, whereas 54 studies performed DSI without referring to a specific protocol (Figure 1.3 & Appendix B). Of the 20 studies which specified that a *standardised* DSI protocol was used, eight provided the names and/or guidelines of the DSI; three used self-created forms; while the remainder did not specify what standardised DSI protocol was used. Of these latter articles, four mentioned that a standardised protocol for SUDI investigation was performed, which included a DSI, but no further information was given about the DSI component. Overall, 16 articles motivated for the need to perform DSI, based on the results of their respective studies and case reports.

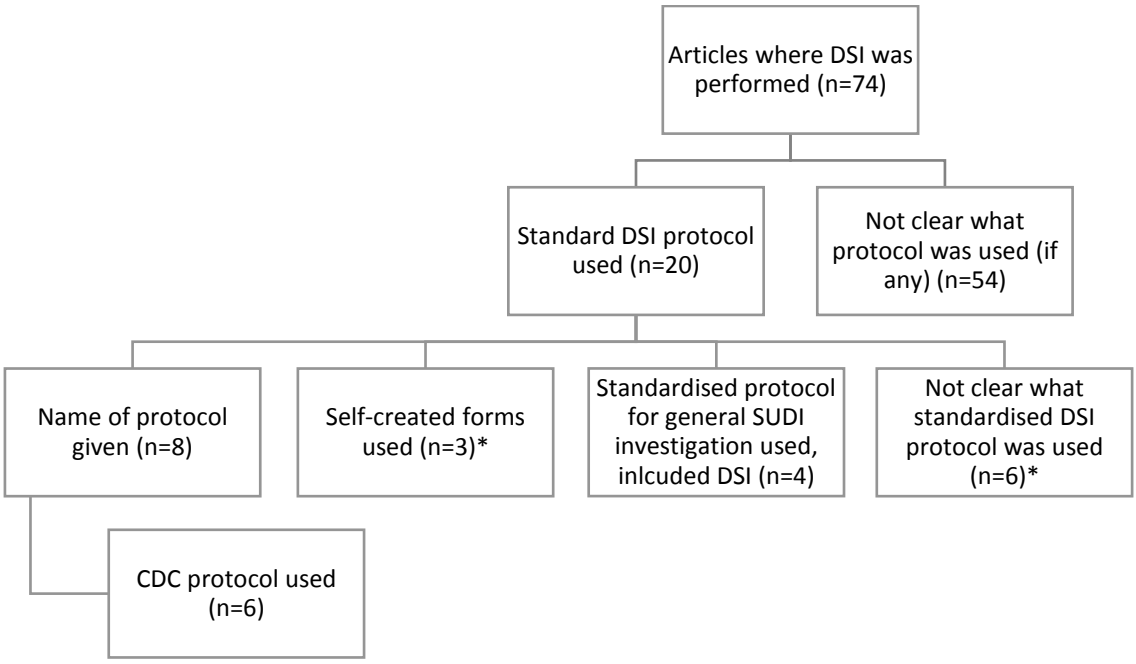

Figure 1-3: Flow diagram depicting the number of studies in the various categories performing DSI.

Seventy-four was the number of included articles. These were then further categorised into articles in which a standard DSI protocol and the remainder being articles in which it was not clear what protocol was used (if any). These categories were then further broken down to display the articles which names their protocols, articles which used self-created forms and articles in which it was unclear which standardised DSI protocol was used.
** indicates that there was an overlap of an unreferenced self-created form from a single study, that fell into both these categories.*

1.4.3 Elements included in a DSI

Upon assessing the documented DSI protocols, three common data gathering methods emerged to record information from the death scene, which, for the purposes of this study, were categorised as (i) digital recording via photography and videography, (ii) re-enactments with and without a doll and (iii) personal communication in the form of interviews and witness statements. Some investigations included all three components, whereas others included only one or two aspects (Figure 1.4 & Appendix C).

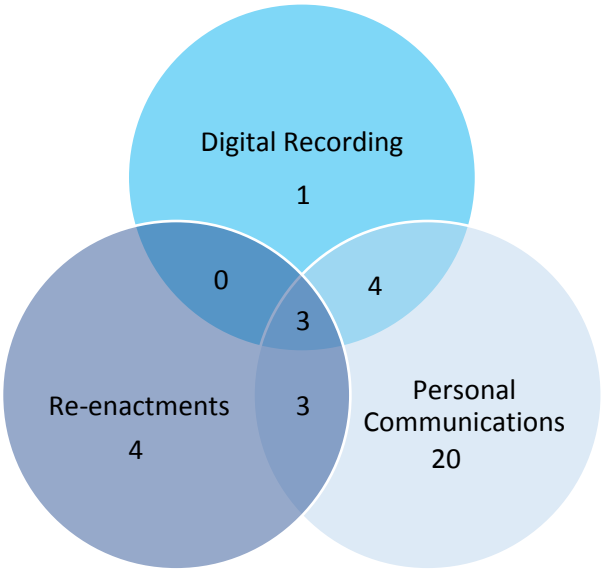

Figure 1-4: Venn diagram representing the three common data gathering methods utilised

Data gathering methods used for recording information from the scene and where these studies use more than one data gathering method.

Protocols which utilised digital recording encompassed photography (n=8, 11%) and video recording (n=1, 1.3%) of the scene, with one study which utilised both. The category of re-enactments encompassed scene recreation, with (n=7, 9.4%) and without (n=3, 4%) a doll. Lastly, personal communications encompassed the performance of witness accounts (n=9, 12%) and the performance of interviews or the interview in the form of a narrative account (n=28, 37.8%). In this latter category seven studies overlapped with doing both witness accounts and interview.

When performing a DSI, there were various elements that were included in the investigation. The inclusion of these elements in the DSI process varied between studies (Figure 1.5). In some studies the elements were well documented and in other studies they were either not mentioned or only discussed in relation to one case study example, which may not have been representative of routine practice.

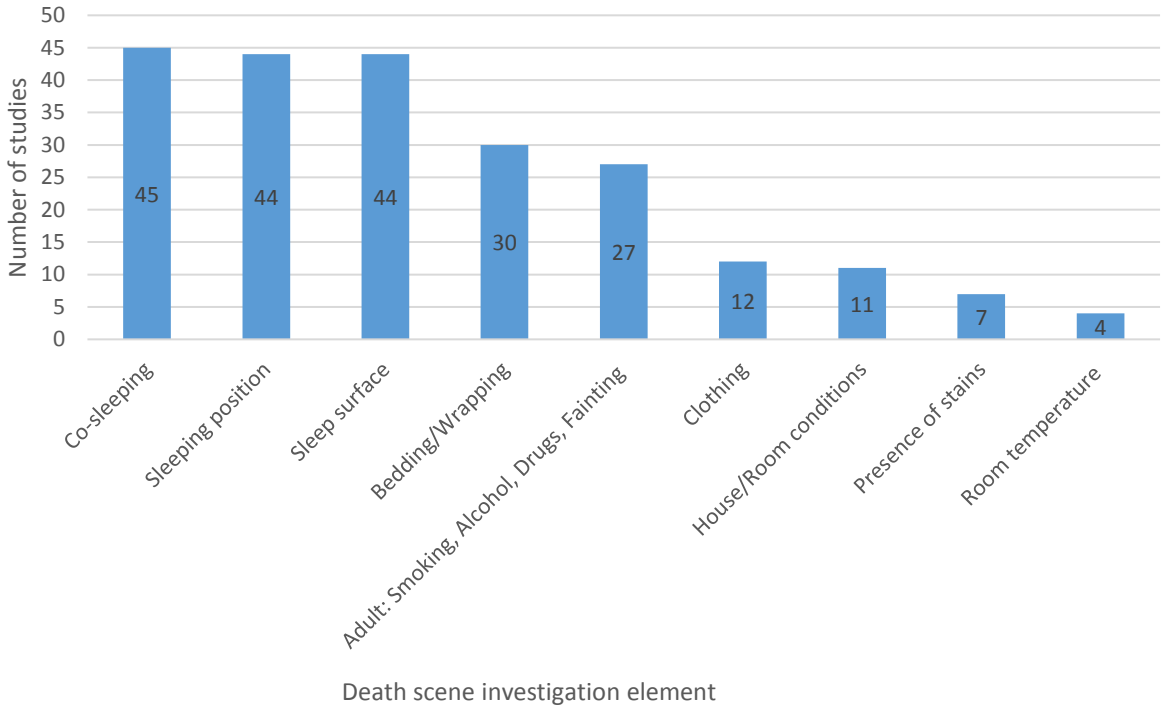

Figure 1-5: The elements included in death scene investigation.

Elements from the death scene investigation documented to have been performed in the various studies included in the literature review.

Sleep surface, co-sleeping and sleeping position were documented most frequently. Other commonly checked elements on scene was the bedding/wrapping of the infant and whether it was noted or checked if the adult responsible for the infant drank alcohol (or was intoxicated at the time), smoked cigarettes, did any sort of drugs or whether they were prone to fainting. The other scene elements were listed less frequently (Figure 1.5). There were 44 articles that documented the sleeping position of the infant as part of the DSI, in some studies it was not specified what information on sleeping position was documented, while in other studies information on how the infant was put down to sleep, how the infant was found or both was documented (Figure 1.6). In some studies it was not clear what aspects/elements were used and incorporated into the DSI and the elements mentioned are not exhaustive, some studies may have used other methods.

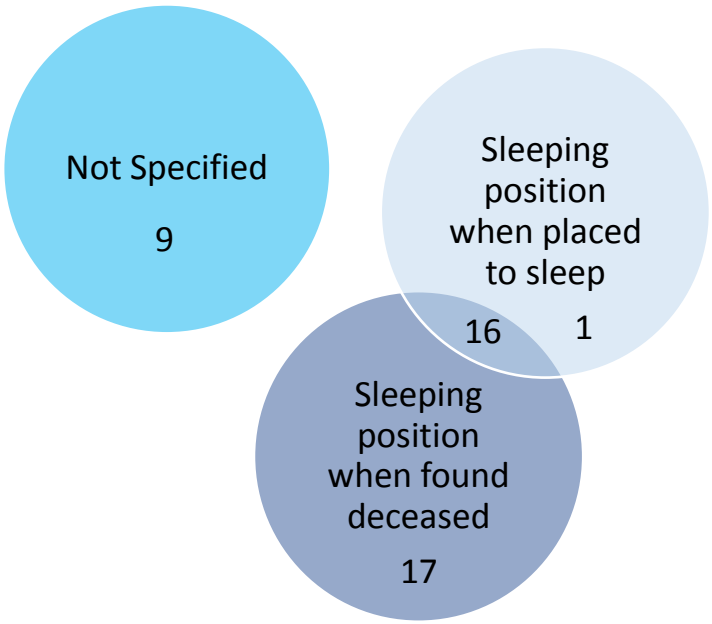

Figure 1-6: Sleeping position broken into the various aspects in which it was reported.

Some studies documented the position of the infant when placed to sleep and others documented the sleeping position when the infant was found dead following the sleeping period, some studies documented both. In a couple of studies it was stated that sleeping position was documented but which sleeping position was not specified.

1.4.4 Differences between developed and developing countries

Of the 74 included studies, 69 arose from developed countries, four from developing countries, and one was from a collaborative project between a developed and developing country (Figure 1.7). The most commonly referenced developed countries which made use of DSI protocols were the United States of America (USA) (n=37, 50%) and Australia (n=12, 16%), and one article encompassed both of these countries (Byard et al., 2001). Of the four studies performed in developing countries, three originated from South Africa (SA), two in the form of case reports and the third as a retrospective study. The fourth study originated from Columbia (Luke, 1978). Unfortunately, statistical differences in DSI between developed and developing countries could not be performed, due to the small number of articles from developing countries (<5), which was further compounded by the variability of article type within this group.

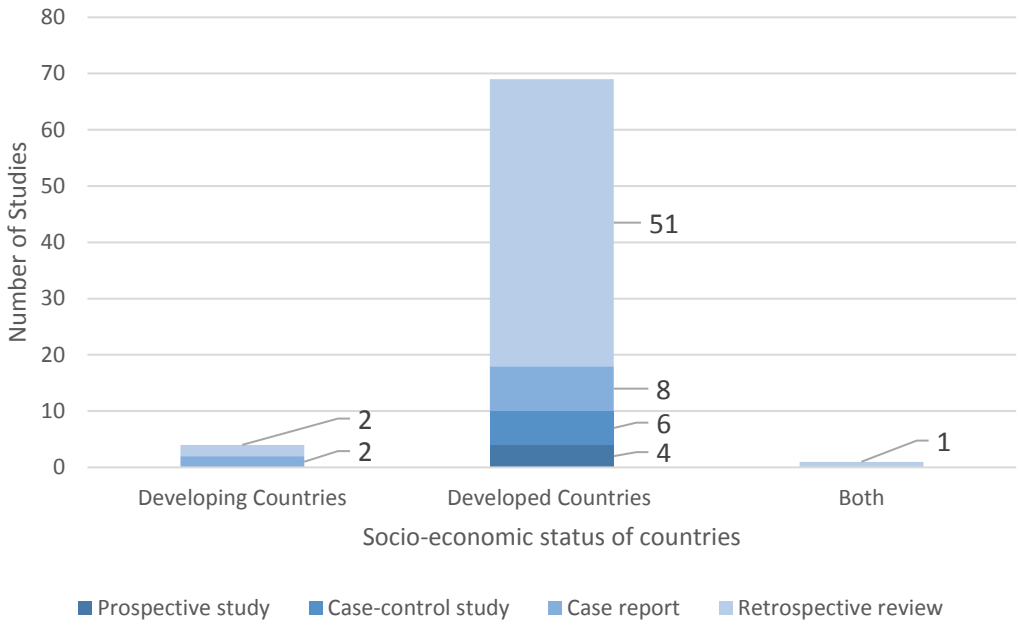

Figure 1-7: Studies originating from developed versus developing countries.

Bar graph representing the seventy-four included studies, whether these originated from developed or developing countries and the type of studies originating from these countries. One study encompassed both developed and developing countries in its research.

1.5 Discussion

After the literature search, 74 relevant articles were identified from four literature databases and three discipline specific journals. The data obtained from the literature was used to assess what aspects were included in a DSI of SUDI cases in various countries, to determine what standardised DSI protocols currently exist; which countries routinely utilise a documented DSI protocol for SUDI cases; and compare data between developed and developing countries.

Several key studies were identified in this review as being influential on subsequent studies from the same country/region as well as on routine practice (Findeisen et al., 2004, L'hoir et al., 1998, Mitchell et al., 1991, Wennergren et al., 1997). For example, the outcomes from the original 'confidential enquiry into sudden death in infancy' (CESDI) study (1993-1996) (Fleming et al., 2000) formed the basis of many follow up studies in England as well as shaped the scope of DSI currently utilised in the United Kingdom (UK) (Fleming et al., 2000, James, Klenka & Manning, 2003). This also appeared to be the case in Denmark,

which formed part of the Nordic epidemiological SIDS study (Wennergren et al., 1997), whereby numerous studies have referred to their standardised DSI protocol which has now been incorporated into routine practice (Winkel et al., 2011).

1.5.1 DSI protocols currently in use

DSI was performed in various areas around the world, however, established DSI protocols were still scarce. Only 20 studies indicated the use of a standardised DSI protocol, and of these only eight named the protocol utilised. The most commonly referred to protocol was that provided by the CDC (Atlanta, GA, USA) which was referred to in five studies by the USA as well as in one SA case report. The CDC established guidelines for the DSI of sudden unexpected infant deaths (Hanzlick, Iyasu & Rowley, 1996), and put forth a Sudden Unexpected Death Reporting Form (SUIDRF) (Centers for Disease Control and Prevention, 2006). The SUIRF is a structured document containing all questions deemed relevant by the CDC to form part of a SUDI death investigation. The form encompasses sections to gather data during the incident scene investigation as well as all subsequent witness interviews to establish medical and dietary history. This is a useful single document format that, if filled in correctly, provides adequate information for the pathologist to make informed decisions about the investigation.

The remaining two studies of the eight which named the protocol, made use of protocols that differed slightly from the CDC guidelines. A study performed in 2007 in Turkey performed a DSI protocol utilising guidelines suggested by Koehler et al. 2001, due to both studies focussing on simultaneous SIDS (SSIDS) in twins (Balci et al., 2007, Koehler et al., 2001). These guidelines highlighted the need to obtain the same data as the SUIDRF, however, due to them being guidelines (and not a set checklist) it cannot be determined as to whether the same depth of information was gathered. A DSI checklist was developed by the Missouri Child Fatality, referred to as the Death Scene Investigative Checklist for Child Fatalities; this was used as a protocol in a study performed in St Louis in the USA (Ewigman, Kivlahan & Land, 1993, Kemp et al., 2000). This differed from the two previously mentioned protocols as it focussed only on the physical findings on the scene as opposed to subsequent investigations (e.g. witness interviews). However, the physical findings assessed were similar to those assessed in the 'incident scene investigation' section of the CDC SUIDRF form. There were six other studies that mentioned the use of a standardised protocol for SUDI DSI without the mention of which protocol was utilised.

Some geographical areas made use of standardised death investigation protocols which encompassed a scene component; this was seen in four studies (Gianelli Castiglione, Greenwald & Stephens, 1993, Rambaud & Guilleminault, 2004, Senter et al., 2011, Zapata Vazquez et al., 2015). An example of this is the death investigation protocol used in New York, which was developed by the Office of the Chief Medical Examiner (OCME) in 2000 and included self-created forms for DSI (Senter et al., 2011). The DSI protocols used as part of the death investigation process were mostly unreferenced, with the exception of the Kennedy report which was used in England as a multiagency approach to the deaths of all infants and children (Kennedy, 2004, Zapata Vazquez et al., 2015).

Arizona and Texas in the USA and Adelaide, Australia, utilised their own self-created DSI forms, the latter drew strongly on the CDC guidelines (Bowen & Marshall, 2004, Byard, Carmichael & Beal, 1994, Perrizo & Pustilnik, 2006). There were six studies in the literature that performed DSI without specifying the use of a protocol but did allude to the existence of protocols.

Majority of the studies (73%) did not mention the name of the protocol used. The potential reasons for this may be that there was no protocol, or if there was, it may have not been used routinely. Alternatively, it may have been an oversight not mentioning the DSI protocol used, or not critical to the research study being conducted. The protocol may also have been unpublished or the institution in charge of DSI in that area may wish to keep protocols strictly in-house.

1.5.2 Methods used to gather data in a DSI

The data gathering method utilised on scene influences the detail and extent of data collected. When more scene data is gathered, it allows for more accurate diagnoses and assists with monitoring trends (Erck Lambert et al., 2016). Therefore in ideal circumstances, all possible data gathering methods should be utilised to ensure that no detail is missed, which could influence a decision or outcome in the case.

An interview was often performed as a form of data gathering, with most conducted as parental interviews, while witness accounts usually came from the caregiver or the person who found the infant. In other cases the interview took the format of a narrative account (Blair et al., 2009, Erck Lambert et al.,

2016). Performing an interview without specifying which information was being asked, made it challenging to discern the information needed for this study from these articles. It was often unclear whether the interview questions related to the scene specifically or rather to background familial information. In a case-control study performed in Chicago, an interview was performed encompassing questions which addressed issues which were not included in the DSI (Hauck et al., 2003). Byard *et al*. (2008) was the only study to mention that the interview performed was standardised using a proforma based on international guidelines.

Although studies noted the performance of various aspects of DSI, this does not indicate routine performance. Landi *et al*. (2005) documented that in New York both family interviews and home visits after death occurred, however, the results of that study showed that these were not routinely performed and that family interviews at the facility occurred more frequently than scene visits (Landi et al., 2005). Another study mentioned the performance of only a retrospective interview to gain information regarding the death of the infant, with no physical presence of forensic investigators on the scene (Smialek, 1986). This may be beneficial in scenarios where the scene is unable to be visited, but may lead to bias or misinterpretation of the information given by the parents, which could be more detrimental than helpful in an investigation.

Some countries or even locations within a specific country vary in their ability to conduct a SUDI DSI according to a set protocol due to multiple reasons. It is possible that the scenes have been altered prior to the DSI, either intentionally, or accidentally as part of the grieving process of the family. Further, the scene could be in a transient location or contacting family members could be problematic due to them not owning a phone or not wanting to be contacted in fear of having to “re-live” the death. Other reasons may not be due to the scene itself, but rather due to lack of training, resources, effort and/or time from respective authorities responsible for DSI (Byard & Jensen, 2007, Landi et al., 2005).

Scene investigations which incorporate the use of scene re-enactments can capture information such as risk factors and scene circumstances, which is further enhanced by the use of dolls and photography (Pasquale-Styles, Tackitt & Schmidt, 2007, Sauber-Schatz, Sappenfield & Shapiro-Mendoza, 2015). This information could be highly beneficial in assisting the pathologist to determine the COD (Sauber-Schatz, Sappenfield & Shapiro-Mendoza, 2015).

When a reconstruction takes place, the person who found the infant is asked how the infant was positioned when it was found. In the case of a doll re-enactment, the doll is usually placed on the actual bedding that the infant was found, which too is positioned to reconstruct the scene (Kemp et al., 1993). Re-enactment with a doll by the person who found the infant can indicate that although the infant was initially placed in a position in which its airways were unobstructed, this position may have changed leading to an occlusion (Byard & Beal, 1997). A doll or mannequin is helpful for reconstructing and clarifying the scene with regards to the placement of the victim in relation to beds, bedding, co-sharers and objects (Kemp et al., 2000, Pasquale-Styles, Tackitt & Schmidt, 2007). Pasquale-Styles *et al.* (2007), found that doll re-enactment revealed potential risk factors unidentified during the initial death report in 44% of cases (92 cases). Therefore doll re-enactment can help with a better evaluation of the relationship of variables in the infant's environment and can be used to corroborate verbal testimony and visual findings (such as lividity) (Pasquale-Styles, Tackitt & Schmidt, 2007).

Although three studies made use of all three broad categories of data collection strategies (Figure 1.4), there was only one study which made use of all available data collection strategies. However, this study was performed over seven states in the USA and therefore these data collection strategies were not performed uniformly and/or routinely in each location (Erck Lambert et al., 2016). Only a single study in the literature referred to the use of video to record the scene (Byard & Jensen, 2008), which could prove highly beneficial in placing the photographs into context and picking up on things that were potentially missed by the photographs. However, the lack of documentation regarding these data gathering methods in other studies is not indicative that they were not performed. Therefore the numbers documented in the results of this study may be an underrepresentation of true practices.

1.5.3 Elements included in a DSI

While the performance of a DSI was often referred to in included articles, many did not specify the components which made up the DSI and which details of the scene were accessed. In some of these articles, a case study was later explained which brought some of these details to light, but these may not have been representative of all the DSI elements assessed. As such, it was challenging in these scenarios to comprehensively assess the elements included in the routine DSI practices. Despite this limitation, the elements in DSI stated in the articles were documented for the purposes of this literature review and

showed that most elements assessed on scenes revolved around the infants sleeping environment (Figure 1.5). This is perhaps influenced by the definition of SIDS (which usually occurs during sleep) and it is therefore elements associated with the sleep environment that are in need of assessment (Krous et al., 2004).

1.5.3.1 Sleeping position

The sleeping position of the infant at the time of death is of great importance when investigating SUDI, and is a modifiable risk factor (Mitchell et al., 1991, Mitchell et al., 1992). The relationship between SUDI and prone sleeping has been proposed by several hypotheses (Dwyer et al., 1991, Fleming et al., 1996), however none have yet been proven (American Academy of Pediatrics Task Force on Infant Positioning and SIDS, 1992, Galland, Taylor & Bolton, 2002). These hypotheses suggest that the main reasons for which prone sleeping position may be detrimental to infants, are the increased risk of the obstruction of the upper airways and the increased risk for hyperthermia if the infant is well covered or/and well clothed in bed (Mitchell et al., 1991, Nelson, Taylor & Weatherall, 1989).

Another influence could be the combination of the weight of the infant and gravity which could lead to the infant becoming wedged or making it more difficult for the infant to move or turn (Ackerman & Gilbert-Barness, 1997, Gilbert-Barness et al., 1991, Ramanathan et al., 1988). This is especially hazardous when associated with an unideal sleep surface, leading to accidental asphyxiation. Sleep surface was also a common element looked at in literature (Figure 1.5).

1.5.3.2 Overheating and overlaying

Bedding is a risk factor for SIDS; it not only increases the risk of smothering of the infant but also the potential for overheating (Bajanowski & Vennemann, 2012). Different bedding types display differing resistance to air flow, leading to the inability to maintain oxygen levels if the infant becomes trapped below (Ackerman & Gilbert-Barness, 1997). Bedding could become wet due to sweating from overheating, regurgitated milk or mucus from the nostrils, among other reasons, which can limit the air flow through this material or even lead to it become compressed against the nose and the mouth of the infant causing

suffocation (Ackerman & Gilbert-Barness, 1997). It is for these reasons that stains should commonly be checked for at a death scene, however this was noted very rarely in the literature (Figure 1.5). Clothing is an aspect of the death scene that was commonly not recorded (Figure 1.5), but essentially can amount to the same outcomes as with bedding, such as difficulty moving, external airway obstruction or overheating (Bajanowski & Vennemann, 2012, Byard & Jensen, 2007, Gilbert-Barness et al., 1991).

Hyperthermic death can also result from a warm room temperature, especially in households that make use of heaters (Bajanowski & Vennemann, 2012, Bass, 1989). This was assessed in 5.4% of studies (Figure 1.5). Hyperthermia is difficult to diagnose, as there are no specific associated autopsy findings. Assessing room temperature (immediately upon arrival) and excessive clothing at the scene may be the only hint to potential hyperthermic death (Bass, 1989). If temperature is not checked, it is recommended that the parents be asked about this as, without this information, lethal hyperthermia in an infant may go unrecognised (Bass, Kravath & Glass, 1986). Co-sleeping, greatly documented in the literature as an element of the DSI, could also result in hyperthermic death due to the parent's body acting as a heat source (Mitchell et al., 1992).

Overlaying is a recurring concern in the literature, and this occurs during episodes of co-sleeping. In this study, co-sleeping was documented to be included in DSI in 60.8% of studies (Figure 1.5). Overlaying can be defined as accidental death due to smothering which is caused by a larger individual laying/sleeping on top of an infant (Collins, 2001). Bass et al. (1986) found that in the DSI of 26 cases that had been presumptively labelled as SIDS, one case was attributed to overlaying as the definite COD. This COD was also considered probable in five other cases (Bass, Kravath & Glass, 1986).

1.5.3.3 Maternal behaviour and housing

Maternal behaviour has an impact on SIDS, particularly in situations where she does drugs, smokes cigarettes, drinks alcohol or is prone to episodes of fainting. The documentation of this behaviour was seen in 36.4% of the included studies (Figure 1.5) but should form part of routine DSI practice as such behaviour results in the infant being put in harm's way. An association between maternal smoking and SUDI has been found, whereby infants who live in homes in which the mother smokes, have an increased chance of dying (Haglund & Cnattingius, 1990, Mitchell et al., 1991, Mitchell et al., 1992, Schoendorf &

Kiely, 1992). Experiments have indicated that the active or passive exposure of an infant to cigarette smoke, containing nicotine and tobacco, is a mode of contamination of the infant's airways related to an increased occurrence and severity of infections (Hofhuis, de Jongste & Merkus, 2003, Zhang & Wang, 2013). Exposure has also been shown to alter arousal responses in hypoxic conditions (Adgent, 2006).

The passive inhalation of 'Crack' smoke in poorly ventilated rooms was also shown to have led to the death of 16 apparently healthy infants (Mirchandani et al., 1991). A room needs to be well ventilated, as it is essential for adequate oxygenation. A study in New York noticed that five of thirteen deceased infants were found in a poorly ventilated room (Bass, 1989).

Housing and room conditions encompass whether room sharing takes place, the number of people in the house, the number of siblings of the deceased individual living in the house under the same conditions, home heating systems, window condensation and sleeping arrangements in the household. This was an under-documented element in the DSI taking place in the literature, with only 14.9% of studies documenting that they recorded this data on the death scene (Figure 1.5).

The proximity of objects to the infant in the sleep environment was also under-documented. Inappropriate objects, such as small toys, pacifiers, toy animals or balls in the crib, represent potentially unsafe situations (Li, L. et al., 2005). A frequent diagnosis made after DSI is of asphyxiation by common household objects (Bass, Kravath & Glass, 1986). These objects may become lodged in the infant's airways, and this is a potential risk factor which should be assessed more frequently (Li, L. et al., 2005).

Overall, when assessing DSI and the elements included, it can be noticed that all factors are inter-linked. Therefore all factors need to be investigated to determine the true risk factors present. Many elements may mask other elements if not fully assessed and this could lead to incorrect information regarding the risk factors of SUDI.

1.5.4 Differences seen, in data generated in a DSI, between developed and developing countries

Out of the 74 included studies, only four (5.4%) were from developing countries (Figure 1.7). It was therefore challenging to statistically compare the DSI elements of developing countries to those included in developed countries, due to the small sample size. Further, the nature of these articles were case-reports and retrospective reviews of SUDI cases, which did not describe the details of the DSI performed in detail. Particularly in case reports, the elements that were recorded may not have been representative of routine practice. For example, the only scene information documented in the Columbian study pertained to sleeping arrangements (Luke, 1978). Additionally, it was not clear if this was routinely documented by other agencies in the District of Columbia.

Based on the literature and the extent of the DSI documented from developing countries, it could be said that not only is DSI performed less frequently in developing countries but also to a lesser extent. None of the studies from developing countries documented the use of photography or witness statements as data gathering methods on the scene itself and none of them documented that they checked the following elements on the scene: caregivers' behaviour (drinking, smoking or taking drugs), what clothing the infant was wearing at the time of death, the house/room conditions or whether the presence of stains was checked for. Therefore crucial information could be missed in these circumstances.

For example the paucity of DSI performance can be seen in a retrospective review originating from SA, where it was documented that DSI only took place in 0.5% of cases (du Toit-Prinsloo et al., 2013). The reason given for this paucity was the lack of a standardised, nationally accepted investigation protocol for infant death in SA (du Toit-Prinsloo et al., 2013). This can be seen when comparing the three studies arising from SA (developing country) where only one study included a death scene re-enactment and an interview (Dempers et al., 2011), indicative of developing countries performing DSI to a lesser extent.

None of the developing countries had a standardised DSI practice. Each study from the developing countries appeared to have used different data gathering methods and to have checked for the more relevant elements within their respective countries. However, this was similar to developed countries, as only one multi-locational study documented that all elements and all available data gathering methods were utilised, which doesn't indicate full use in any single location. However, it must also be noted that the lack of literature from developing countries may not necessarily indicate that DSI does not take place; it could just be undocumented.

1.5.5 Limitations

There were several limitations encountered during this literature review, particularly during the data collection phase. First, when a DSI, or even an interview, occurred it was difficult to distinguish whether this was performed as a routine procedure or for the purpose of the study only. Further, it must also be taken into consideration that if a country has specified that it has a standardised DSI protocol, the studies did not always depict that this protocol was used for all cases or that all aspects of the protocol were completed. Some studies have documented this in a highly specific manner, mentioning that six out of 103 cases had a documented scene visit and nine out of 103 used the standardised self-created DSI form (Perrizo & Pustilnik, 2006); while other studies simply stated that standardised guidelines have been developed but they were not uniformly adopted and sometimes major information is not filled in (Sauber-Schatz, Sappenfield & Shapiro-Mendoza, 2015). This could lead to important information being missed and could hinder the investigation or the forensic pathologists' ability to accurately assign COD (Sauber-Schatz, Sappenfield & Shapiro-Mendoza, 2015). As such, the results represented here may be an over-estimation of routine practice for DSI in that region.

Another limitation was that there were marked variations in the interpretation and use of terminology. Often the definitions of the terminology used were not defined in the respective articles, which may have led to misinterpretation in this study. For example, the terms "bed-sharing" and "co-sleeping", were commonly used interchangeably; but co-sleeping sometimes referred to any type of sleep surface being shared (e.g. a couch); or to the sharing of a room without sharing a sleeping surface (McGarvey et al., 2006). Another example was the use of the phrase "circumstances of death" without being detailed. It is left to interpretation as to whether this included details of the death scene or purely aspects such as socioeconomic status of the family, prematurity, mother's habits during pregnancy etc. The confusion surrounding the term "circumstances" occurred only when looking at studies from America, therefore this could also be due to different language usage between countries. Lastly, the definition of words such as "place" and "location" could be referring to an area as specific as the placement of the infant within a room, or could be referring to a more broad location such as the home, or even the town in which the death occurred. The definitions of terms related to the DSI need to be defined and used consistently to study trends between countries.

1.6 Conclusion

The aim of this systematic literature review was to investigate the scope of DSI in different countries. This was tested by searching four databases and three discipline specific journals using keywords and phrases, inclusion and exclusion criteria and hand-searching. Followed by the determination of what standardised DSI protocols currently exist, which countries routinely utilised documented DSI protocols for SUDI cases, assess what aspects are included in a DSI of SUDI cases in various countries and to compare the data that arose from developed and developing countries. This was needed in order to determine the nature and extent of protocols used nationally for DSI and to determine how many countries have a routinely implemented protocol.

It was found that there was little uniformity in the DSI process for SUDI cases utilised internationally. Majority of the studies did not mention the use of a protocol when talking about the performance of a DSI and of the studies that did, few mentioned which protocol was used. The most frequently used protocol was the CDC international guidelines. Where protocols have been established, value has been added to the post-mortem investigation. Therefore, if a DSI was performed solely for the purpose of a study and it was of great importance for the diagnosis of COD, then this motivates that DSI should be implemented routinely for other SUDI cases. However, this may be limited to the resources available, or other case-specific reasons.

The elements assessed in the DSI processes, as well as the data recording techniques, varied greatly. The elements that were centred on the sleep environment were more frequently assessed; however, all factors are interlinked and all should be investigated together to determine the true risk factors present. The extent of literature published differed greatly between developed and developing countries, where none of the developing countries had a standardised DSI protocol or routinely performed a DSI.

Due to the lack of specific autopsy findings when related to asphyxia (Ackerman & Gilbert-Barness, 1997), DSI can provide valuable hints towards the events leading to the infant death and towards the COD (Bajanowski & Vennemann, 2012). Information from the DSI can also give an indication of the kind of PM that should be performed (Bass, Kravath & Glass, 1986). As such, DSI should be encouraged in SUDI

investigation, and protocols should be established nationally in this regard, with the scope of analyses corresponding to the needs and resources of the country.

Chapter 2: Research Study

A mixed-methods investigation of local death scene investigation practices for SUDI cases

2.1 Introduction

SIDS is a diagnosis by exclusion, whereby the COD remains undetermined after complete investigations have been carried out (du Toit-Prinsloo et al., 2011), including the performance of a DSI (Krous et al., 2004). National and regional protocols for the investigation of SUDI have been established in many countries (Howatson, 2006) , and global CDC guidelines exist for SUDI DSI (Centers For Disease Control and Prevention (CDC), 1996). However, SA lacks a uniform national protocol to investigate SUDI (du Toit-Prinsloo et al., 2013).

The lack of a protocol has led to classifications of COD such as 'consistent with SIDS' or 'unascertained', particularly when no COD was found. However, because the investigation may not have been complete, the case could not be classified as 'SIDS' (Erck Lambert et al., 2016, Shapiro-Mendoza et al., 2017). In some cases, this was because a complete autopsy not being performed, and in other cases, because a DSI not being performed (Dempers et al., 2016). While there are guidelines to deal with cases which fall short of the SIDS definition (Randall et al., 2009), these were also not consistently used. However, when dealing with protocol implementation in low- and middle-income counties, such as SA, resource constraints may restrict the extent of an investigation (du Toit-Prinsloo et al., 2011).

When managing SUDI cases, DSI is a major component to be integrated into the protocol (Krous, 2010). DSI (along with the autopsy) provides indispensable information into potential reasons for COD (Matthews, MacDorman & Thoma, 2015). Bass *et al.* (1986) conducted a study that entailed the performance of DSI in 26 cases with the presumptive diagnosis of SIDS, and found 18 out of 26 cases which were previously assumed to be SIDS, had definable causes, and that these causes could only be determined through thorough DSI (Bass, Kravath & Glass, 1986). Another study performed in the Eastern

Metropole, Cape Town in 2016 demonstrated that complete investigations (including full autopsies and DSI) helped in identifying a COD for approximately 40% of the cases in the study (Dempers et al., 2016).

DSI assists in identifying risk factors and to distinguish natural from unnatural death (Bajanowski et al., 2007). Differentiating between SIDS and asphyxia at PM can be challenging as there are no universally accepted markers to differentiate between the two, and both are usually unwitnessed. Diagnosis of asphyxia relies on scene evidence which demonstrates suffocation or strangulation by persons or objects in the sleeping environment (Dempers et al., 2016).

Some protocols have suggested scene re-enactment with a doll, which helps to pin-point hazards in the sleep environment and identify potential contributory aspects to airway obstruction (Corey et al., 2007, Shapiro-Mendoza et al., 2017). As discussed in Chapter 1, the recording of this crucial scene information can be used to inform ancillary investigations or be a useful adjunct to determining an accurate COD. In turn, this will assist in providing more accurate information regarding the causes and risk factors of SUDI, help target interventions across the country, and identify important issues for further research (Dempers et al., 2016).

2.1.1 Rationale

SUDI is a burden in SA; however, due to limited resources, not all SUDI cases have DSIs and not all cases are afforded all ancillary investigations. These are performed on a case-by-case basis, depending on case context, caseload, resources and forensic pathologist availability. This approach may be understandable, but is certainly not ideal. The absence of death scene information limits the richness of detail available for COD determination and limits the ability to accurately diagnose SIDS. Globally there is a lack of published research in the field of SUDI DSI as determined by the systematic literature review (Chapter 1).

SUDI DSI in SA is largely neglected by forensic pathology officers (FPOs) (du Toit-Prinsloo et al., 2013). However, DSI is important and of value to families, the provincial and national Forensic Pathology Services (FPS), health practitioners and communities, and to gather accurate mortality data by assisting with a greater understanding of SIDS cause and pathogenesis. With a greater understanding, more accurate and adequate feedback can be generated for parents; this will lead to greater community education regarding

factors that contribute to infant death and lead to improvements in infant care practices. Thorough DSI by trained personnel may also result in fewer questions regarding the environment being asked to grieving caregivers at time of PM, but more importantly, may lead to the formulation of more relevant questions for the SA community (Dempers et al., 2016).

Relative to developed countries, SA has little data published on the investigation of DSI in SUDI cases (du Toit-Prinsloo et al., 2011, du Toit-Prinsloo et al., 2013). The literature review (chapter 1) documents only three studies in SA where DSI for SUDI was used and/or assessed; none of these were performed at Salt River Mortuary (SRM), Cape Town. It is therefore unclear how SRM fares against the global and national landscape of DSI for SUDI. Further, while guidelines exist globally for SUDI DSI, they are not used routinely in SA, mainly due to financial and resource constraints (Chapter 1) (du Toit-Prinsloo et al., 2011). Therefore, DSI in SA needs to be explored to a greater extent and improved within its financial means.

2.1.2 Aim

The aim of this study was to investigate the current DSI processes of SUDI cases in South Africa, with a focus on SRM (Cape Town), and suggest realistic and feasible ways to improve this investigation in a local and national context.

2.1.3 Objectives

- Perform a retrospective review of SUDI cases admitted to SRM from 2016 - 2017 to determine the scope of DSI
- Observe approximately ten DSI of SUDI cases at SRM, and follow the cases through until the post-mortem examination is complete
- Gather information about SUDI investigation from other mortuaries from registered forensic pathologists in SA

2.2 Methods and Materials

2.2.1 Approval and ethical considerations

This study received approval by the University of Cape Town (UCT), Human Research Ethics Committee (HREC REF: 218/2018) (Appendix J). FPS approval to access the Office Autopsy Database (OAD) (HREC REF: R036/2014) was granted by the Head of Division of Forensic Medicine and Toxicology at UCT. The Director of FPS, Department of Health, Western Cape Government gave permission for the project to be performed (Appendix K).

2.2.2 Study setting and design

In SA, the management of medico-legal mortuaries is a provincial competency, with multiple mortuaries per province. The admission of cases to medico-legal facilities in SA is based on the National Health Act 61 of 2003 (No. R636). In the Western Cape, there are sixteen mortuaries, which are graded according the number of autopsies per annum. SRM is one of two M6-graded academic facilities within the Western Cape (Western Cape Department of Health, n.d.), processing on average 3500 – 4000 cases per year (Martin, LJ., 2018, oral communication, 25 November 2018). This facility services the West Metropole of the City of Cape Town, including the Western, Southern, Klipfontein and Mitchells Plain Health districts (Western Cape Department of Health, n.d.), as was the focal study setting for this project.

In order to meet the aim and objectives, the project was divided into three phases, each using different research methods. Each of these methods will be described in detail below. Overall, data collection was performed retrospectively using medico-legal case files, and prospectively by attending SUDI death scenes. The purpose of the scene attendance was two-fold; firstly, it was a quality measure to assess if scene documentation was contemporaneous and if it reflected the results from the larger retrospective study; and secondly, to pinpoint parts of the process which could be improved and to assess if it would be feasible. Lastly, a survey was conducted on forensic pathologists to describe variation in COD classification of SUDI cases around South Africa. This survey was based on a similar survey conducted in the USA (Shapiro-Mendoza et al., 2017).

2.2.3 Phase 1 – Retrospective review

In order to gather information regarding the scope and consistency of SUDI DSI cases at SRM, a two year retrospective review was carried out for the period 1 January 2016 to 31 December 2017. The OAD was used to identify relevant cases and these were verified through a linked study by the supervisor. Cases were included if the infant was less than or equal to 365 days of age at the time of death, therefore SUDI cases determined to be due to natural causes after investigation were still included. Stillbirths and abandoned newborns less than one day old were excluded. Relevant documentation within the available archived medico-legal case files was then used to extract pertinent data about the death scene (Table 2.1).

Table 2-1: Relevant documents within the case files utilised for data extraction and the data they contain.

Document	**Data contained in document**
Contemporaneous Note (Lab 27): Salt River Forensic Pathology Laboratory	Completed by the forensic pathologist at PM, contains basic information surrounding the death and the contemporaneous notes recorded at PM, leading to the diagnosis of the COD.
FPS002 form (Scene Script)	Completed by the FPO at the scene. Contains case details, timeline related to case and observations made by the FPO at the scene.
FPS006(b) form	Used by the FPO in cases of sudden and unexpected death of infants to record medical, maternal, social and scene information.

As is the nature of a retrospective study making use of case files, a limitation was missing documentation/incomplete case files. Due to the absence of documentation some variables were unknown in certain cases.

2.2.4 Phase 2 – Prospective observation

In order to gather prospective information regarding the scope and consistency of the current SUDI DSI practices associated with SRM and to observe how the information conveyed from the scene influences autopsy practices, observation was done of ten SUDI cases, from DSI until completion of the PM. To this

end, the researcher accompanied the FPOs at SRM to ten SUDI death scenes and made detailed observations. Convenience sampling was used to ensure enough scenes were attended and fell within the project's time span. SUDI death scenes were attended from the 21st July 2018 to 24th September 2018.

Forensic pathologists and FPOs were informed of the study upfront, and given the opportunity to opt out if they did not wish to participate. While informing them of the study may have introduced bias (e.g. processes may performed better whilst being observed), it was ethically important to not intentionally deceive any personnel about participating in research. No personal information was gathered with regards to the infants, families or personnel involved in the process.

When SUDI cases were called into SRM, the researcher was informed by a phone call from the FPO team leader and then met the FPOs at SRM prior to dispatching to the scene. There was an inherent delay between notification of SRM and dispatching of FPOs to the scene due to the official death declaration process. As such, this research did not delay turnaround times on service delivery. The researcher used a semi-structured checklist (Appendix D) to make observations about what was done on the scene. This checklist was created based on aspects generally performed at SUDI death scenes, according to international literature and the retrospective phase of this project.

The researcher was then called back to SRM for each subsequent step in the investigation including the identification process, the interview with the family and the PM. Observation and notetaking was done contemporaneously using Appendix D in order to observe how the information gathered on scene and the identification process influenced the PM. These attendances were purely observational and no interventions took place.

2.2.5 Phase 3 – Prospective survey distribution

In order to gather deeper information about SUDI investigation from forensic pathologists in SA, a Google Forms survey was distributed from the 14th September to 15th October of 2018 (Appendix E). The survey was created based on previous literature (Shapiro-Mendoza et al., 2017). The responses from the published survey in the USA generated an increased understanding of the process used by the certifiers of death in order to interpret cases and investigative findings (Shapiro-Mendoza et al., 2017).

As such, all registered, qualified forensic pathologist (n=65) in SA were asked to complete a questionnaire to obtain a nationally representative sample and gain relevant information to make the study reliable and applicable to others in SA. A qualified forensic pathologist is registered with the Health Professions Council of South Africa.

The survey distributed consisted of questions regarding demographic information, hypothetical case scenarios, reporting practises and knowledge/opinions on SUDI. Limited demographic information was included; such as job title/position of the individual, years of practice and amount of experience with regards to SUDI cases. Hypothetical case scenarios from the previous survey (Shapiro-Mendoza et al., 2017) were revised using data gathered from phase 1 and 2, to make the survey locally relevant. The survey was piloted and reviewed by two local forensic pathology registrars to assess the questions and remove ambiguities. A final statement was made on the survey that if the participants were willing to answer follow-up questions, they may email their name and contact details to the researcher, but this was entirely optional.

2.2.6 Data management

2.2.6.1 Privacy

Participation was voluntary and all data collection was anonymised using unique study identifiers to ensure no available link between the data and the forensic case numbers or survey responses and forensic pathologists. Additionally, confidentiality was upheld as no names, addresses, identification numbers or any unnecessary personal information was collected or recorded. If contact details were provided from forensic pathologists, their answers remained strictly confidential.

2.2.6.2 Excel

All data collected from the retrospective and prospective aspects were recorded in a Microsoft Excel® (Microsoft, Redmond, Washington, USA) spreadsheet. The observational data collected at each scene,

identification and PM was transcribed into a database, as well as the retrospective variables collected relating to death scene information and the post-mortem.

2.2.6.3 Google forms

Data management of the survey was performed by the Google Forms software, which generated graphical outputs by using descriptive statistics on the results obtained.

2.2.7 Data analysis and statistics

Microsoft Excel® 2013 (Microsoft, Redmond, Washington, US) and GraphPad Prism Version 6.1 were used to perform descriptive statistics and for visual representation of the data. The data was quantitative and categorical as far as possible, with some observations being qualitative in nature. Frequencies and percentages were used to calculate the categorical variables distribution. Yate's continuity corrected Chi-square tests were performed, with and additional Fisher's Exact test performed if the number of observations was less than five. For results with significant P-values generated from the Fisher's exact test and not with Yate's continuity corrected chi-squared test, a conservative approach was taken and the value was accepted as not significant. A single three-way chi-square test was performed, the results of which were corrected using a Bonferroni adjustment. A summary of the tests performed is presented in Table 2-2.

Table 2-2: Summary of statistical tests performed between variables

Table representing the variables of interest, the statistical test performed on these variables and the output result.

Statistical comparison between:			Statistical Test	Output Result
Variable 1	**Variable 2**			
Columns containing data on whether variables were assessed or not	Ancillary tests performed	/	Yates continuity corrected Chi-square test Fisher's Exact test if number of observations <5	P – value
Completeness of section A, B and C	Time of day	/	Yates continuity corrected Chi-square test Fisher's Exact test if number of observations <5	P – value
Completeness of all sections	Extent of PM performed	COD formulated	Yates continuity corrected Chi-square test Fisher's Exact test if number of observations <5	P – value Bonferroni adjustments
Scene type / Location	Completeness of section A, B and C	/	Yates continuity corrected Chi-square test Fisher's Exact test if number of observations <5	P – value

2.3 Results

2.3.1 Retrospective records review

2.3.1.1 Scene investigation

The retrospective study of the OAD between 1st January 2016 and 31st December 2017 showed that there were 6922 cases in total for which post-mortems were conducted, of which 454 (6.5%) were SUDI cases. Case files from each of the SUDI cases were retrieved and data pertaining to the death scene was documented. At SRM, DSI was performed with the aid of the FPS006(b) (SUDI questionnaire) document.

This document consists of seven sections (A-G), of which the first three should be completed on scene and the remaining four completed as part of the identification process that takes place at the facility, typically a few days later. After retrospective review, it was found that there was not one case in which there was completion of the entire document and for each case, each section was filled out to differing degrees (Figure 2.1). Section B ("Person(s) at/called to the scene and relationship") and C ("Household environment") were only completed in 1.3% (n=6) and 7.5% (n=34) of documents respectively over the years of 2016 and 2017, while section F ("About the mother") and G ("Household environment") were completed in 67.8% (n=308) and 69.4% (n=315) SUDI cases respectively.

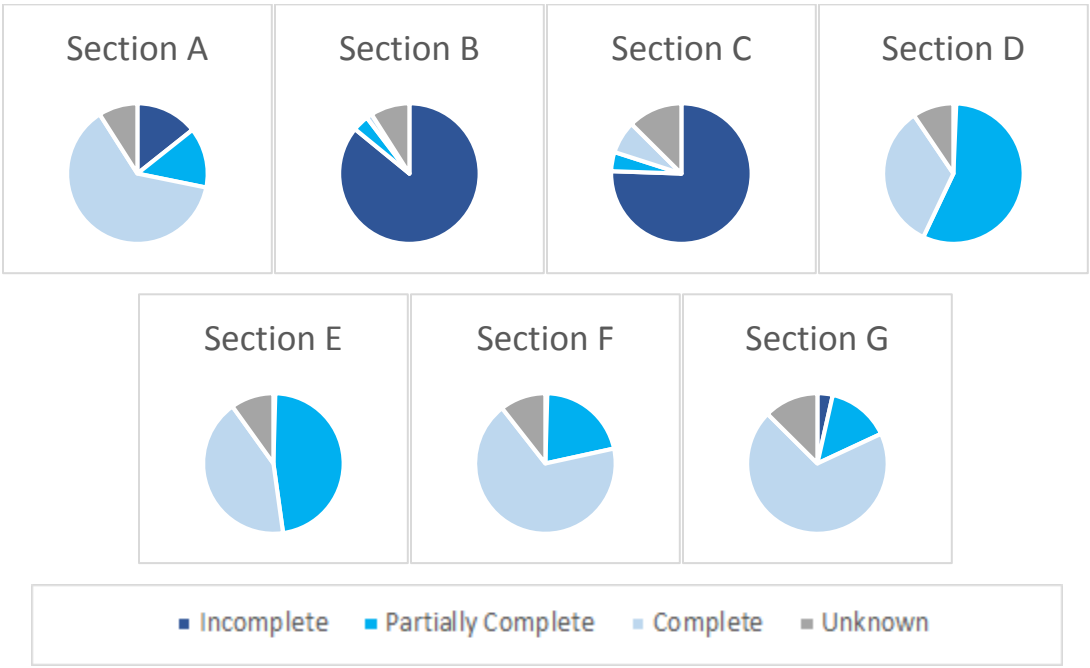

Figure 2-1: Completion of the sections of the FPS006(b) document over 2016 and 2017.

Multiple pie graphs, each representing a section of the FPS006(b) document and the extent to which these sections were incomplete, partially complete or complete over the year of 2016 and 2017 for all SUDI cases admitted to SRM. The graphs also indicate the number of times it was unknown whether the section was complete, incomplete or partially complete due to missing documentation; these are labelled unknown (Appendix G). Section A is entitled "Who gives the history/information in this case", Section B as "Person(s) at/called to the scene and relationship", Section C as "Household environment", Section D as "Circumstances of death/details about events before death", Section E as "About the baby", Section F as "About the mother" and Section G as "Household environment".

The retrospective review gave insight into which elements were assessed or documented on SUDI death scenes (Figure 2.2). The elements recorded on the scene itself were recorded in section C of the FPS006(b)

document (“Household Environment”). Section A (“Who gives history/ information in this case”) and Section B (“Person(s) at/called to the scene and relationship”) were also designed to be completed on scene. Scene elements falling into Section C were undocumented 75.6% (n=343) of the cases, partially completed in 4.4% (n=20) of the cases and 12.6% (n=57) of the cases data being missing completely due to lost/missing documentation. Therefore, in only 7.5% of cases during the two year period, was contemporaneous scene information passed on to the subsequent stages of the investigation process.

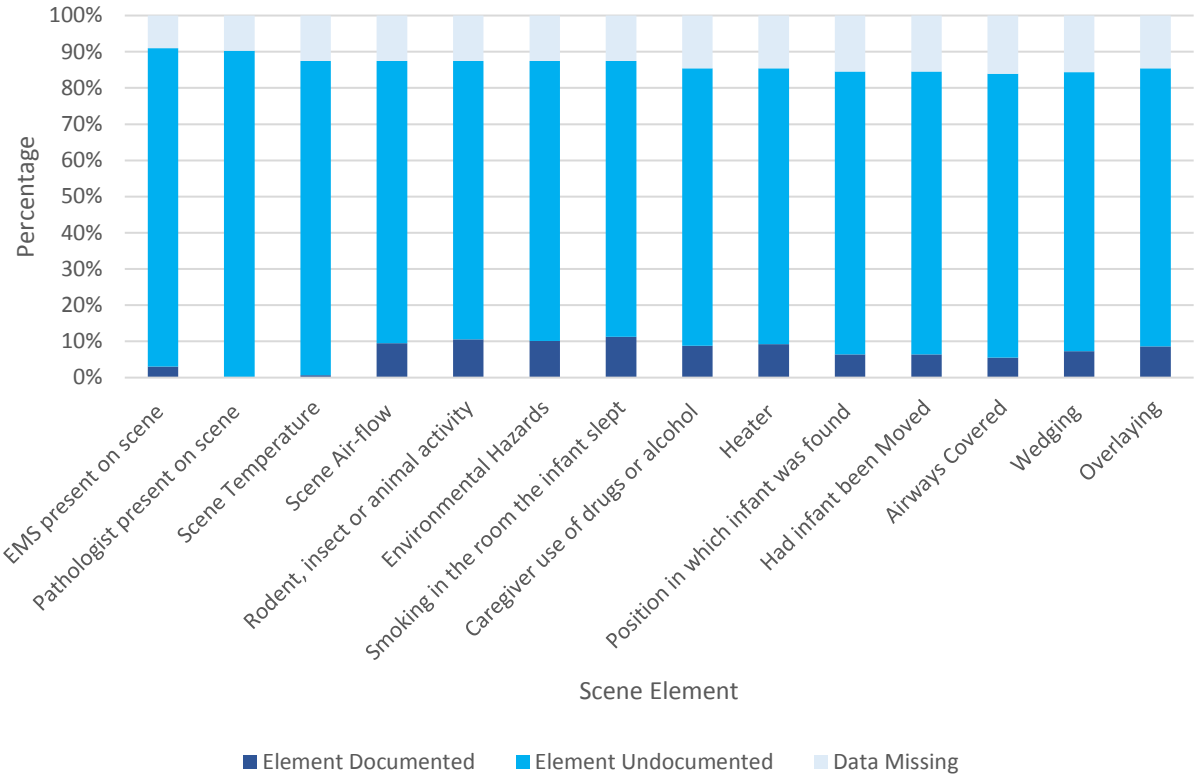

Figure 2-2: Elements assessed on scene at a SUDI death scene over 2016 and 2017.

A graph showing the elements that were looked at on SUDI death scenes over 2016 and 2017 as guided by the findings of the retrospective review. The graph indicates the percentage of times for which these elements were documented, undocumented or the data regarding these elements was missing. This data was gathered from section B and C of the FPS006(b) document, which is to be completed on scene (Appendix G).

Chi-square tests showed that the time at which the scene was attended, as well as whether it was as part of day or night shift, had no significant contribution to the completeness of the scene sections of the document.

Infants that were admitted over the two year period were collected and investigated by the FPOs at various scene types/locations (Figure 2.3). Majority of cases arose from medical centres (n=177, 38.9%), followed by informal housing (n=128, 28.2%). Eleven cases originated from unknown locations as data regarding the location was missing. When cases originated from medical centres, ambulances and fire stations, the primary scene was never returned to and investigated. Therefore no data on the conditions of the actual death scene were available for these scenarios. Scene type had a significant influence on the completeness of Section B of the FPS006(b) document (p = 0.0157), but not Sections A and C.

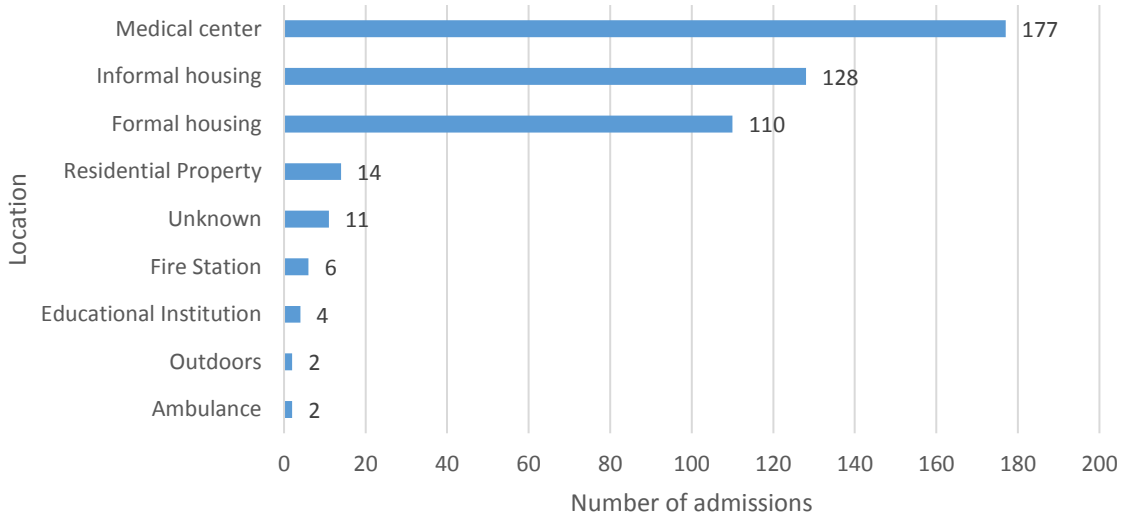

Figure 2-3: SUDI admission locations/scene types.

Graph depicting the scene types or the locations of the infants prior to admission as a SUDI case at SRM. Eleven of the cases had missing data and it was therefore that the scene type associated with these cases is unknown (Appendix G).

Photographs are required for each case, regardless of the scene type. For each case it is required that a facial photograph is taken, along with a photograph of the Global Positioning System (GPS), Mobile Data Terminal (MDT) and the body tags of the deceased. A facial photograph was present in 88.1% of cases, a GPS photograph in 54.6% of cases, a MDT photograph in 46.3% (n=400) of cases and body tag photographs in 34.4% (n=156) of cases.

The number and quality of photographs taken of the scene however, varied greatly, with some having none, while others had up to 42 photographs taken (Figure 2.4). These photographs varied in quality with

114 of the total amount of photos being blurred, while others were dark or had incorrect focus. However, the majority of the photographs were of average to good quality. Whether they accurately captured the scene or not could not be assessed, since the researcher had not been to these scenes. This research question was investigated prospectively by observation in phase 2.

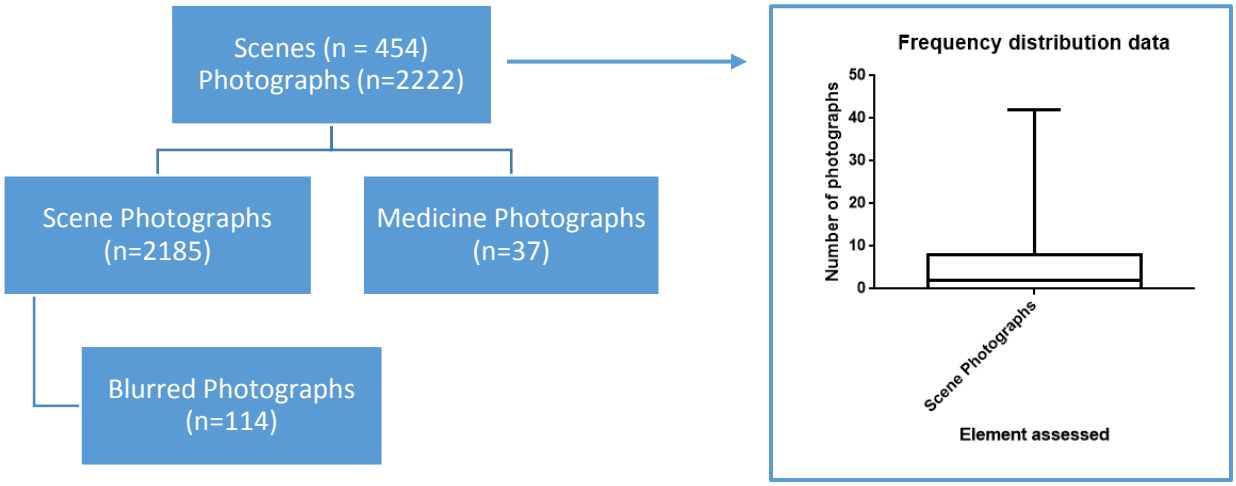

Figure 2-4: Photographs taken on scene.

Number of photographs taken (n=2222) over the total number of scenes (n=454) for the two year retrospective study. Flow diagram showing how many of these photographs were of medication found on the scene (n=37, 1.7%) or of the scene itself (n=2185, 98.3%) and how many of the scene photographs were blurred (n=114, 5.2%). The insert on the right shows a box and whisker diagram of the scene photographs. The minimum and 25% percentile being zero. The median of the data was 3, the 75% percentile was 8 and the maximum value was 33.

2.3.1.2 Identification

Once the DSI has been completed the deceased is transported to the mortuary. Usually a few days later, relatives of the deceased will come to the facility to officially confirm the identity of the infant via a viewing. The viewing is followed by the completion of the remainder of the FPS006(b) document (Sections D - G), which asks questions about the scene retrospectively (Section G) as well as household information. Figure 2.5 represents the extensiveness of the data obtained from Section D of the document, entitled "Circumstances of death/ details about events before death." On average, 7.5% of the data was missing and unavailable. However, 82% of questions asked were answered. The performance of toxicology as an

ancillary investigation at autopsy showed a significant association with the recording of face position and chest sleeping, having p-values of <0.0001 and 0.0156 respectively.

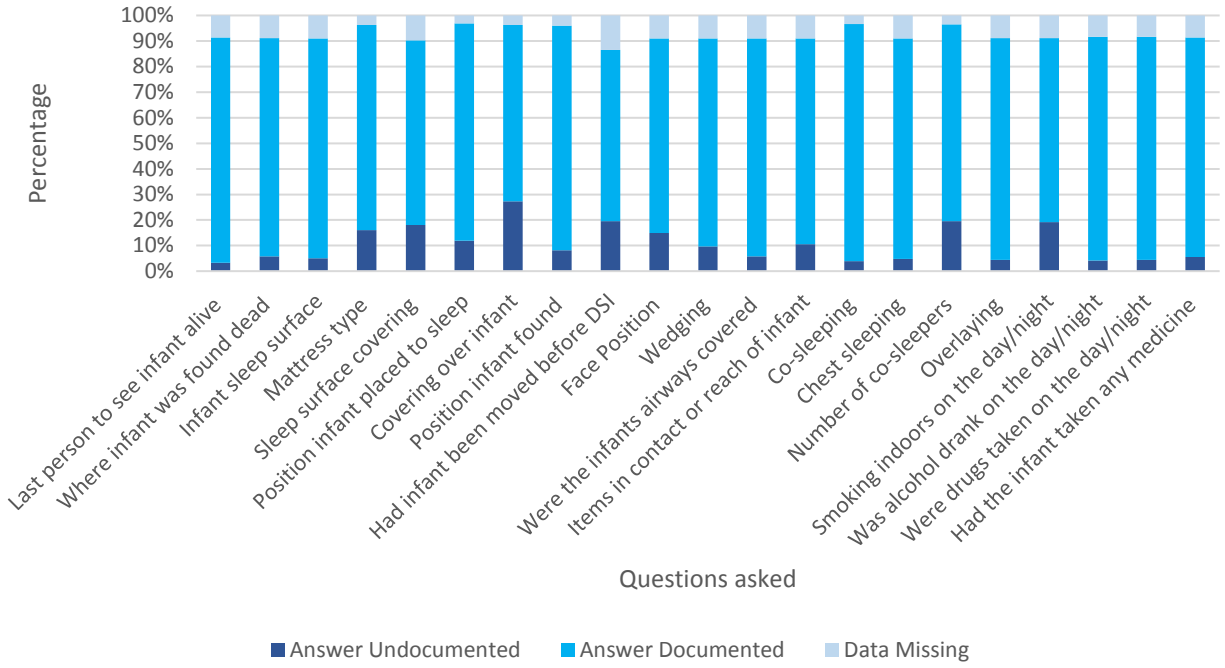

Figure 2-5: Questions asked at identification related to the circumstances of death/details about events before death

A graph showing the questions that were asked during the identification process over 2016 & 2017 and whether answers were documented or not. Data guided by the findings of the retrospective review. The graph indicates the percentage of times for which these questions had answers, had no answers or the data regarding these answers was missing (Appendix G). This data was gathered from section D of the FPS006(b) document, which is completed at identification.

Section G which is filled in at identification, consists of duplicate questions of Section C, the latter which should be filled in on the scene. These questions are directed to the family about the scene (retrospectively), and can be used to corroborate contemporaneous notes taken on scene, or to probe deeper understanding of the scene. Section G was the section which was the most complete overall (Figure 2.6). Section G, entitled "Household environment", duplicated the questions of Section C, "Household environment", up until mid-2017 where a revised FPS006(b) document was implemented which removed some duplication.

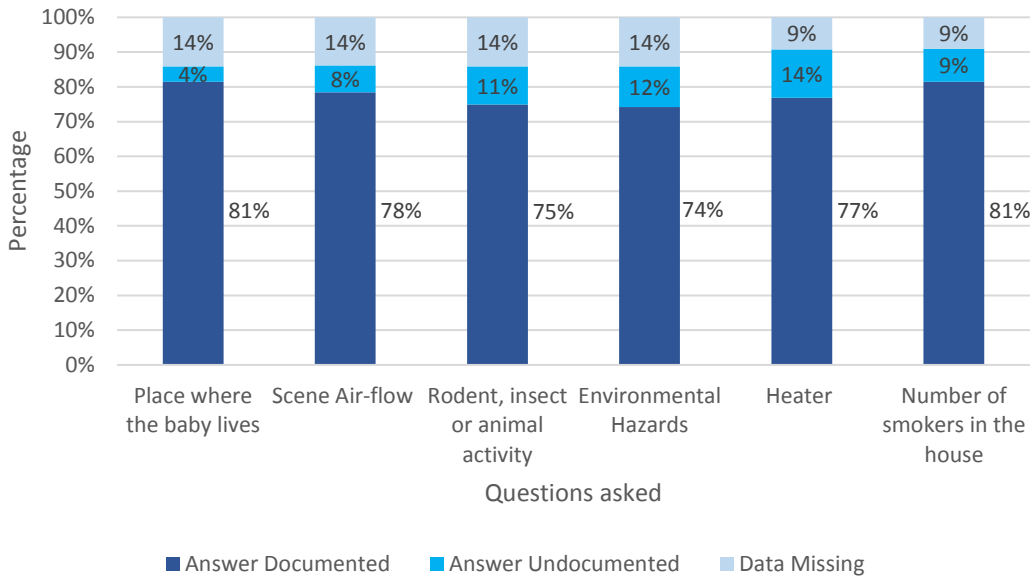

Figure 2-6: Questions asked at identification regarding the household environment.

A graph showing the questions that were asked during the identification process, regarding the household environment, over 2016 & 2017, and whether answers were documented or not. Data guided by the findings of the retrospective review in section G of the FPS006(b) document. The graph indicates the percentage of times the answers to these questions were documented, undocumented or the data regarding these answers was missing (Appendix G).

2.3.1.3 Post-Mortem examination (PM)

PM is the final step in the investigation, performed to establish the COD. The extent of PM performed is at the discretion of the forensic pathologist (Figure 2.7). At SRM a Lodox eXemplar full-body X-ray (Lodox Systems (Pty) Ltd. South Africa, 2000) is taken before the performance of each PM; this was seen in 98% of cases (n=445). Additional samples may be obtained and sent in for subsequent ancillary testing if deemed necessary by the forensic pathologist (Figure 2.9). The PM extent varies, with an external examination being the only non-invasive method, where the infant remains unopened and ancillary tests are usually not performed. In this study, an external examination was performed in 288 (63.4%) cases. During the performance of a partial autopsy (n=47, 10.4%), the infant is only opened in certain regions, most commonly the chest region to assess the heart and lungs. In a full autopsy (n=106, 23.3%), a complete internal autopsy is performed with the dissection of all organ blocks. Ancillary tests may be performed for both partial and full autopsies at the discretion of the forensic pathologist.

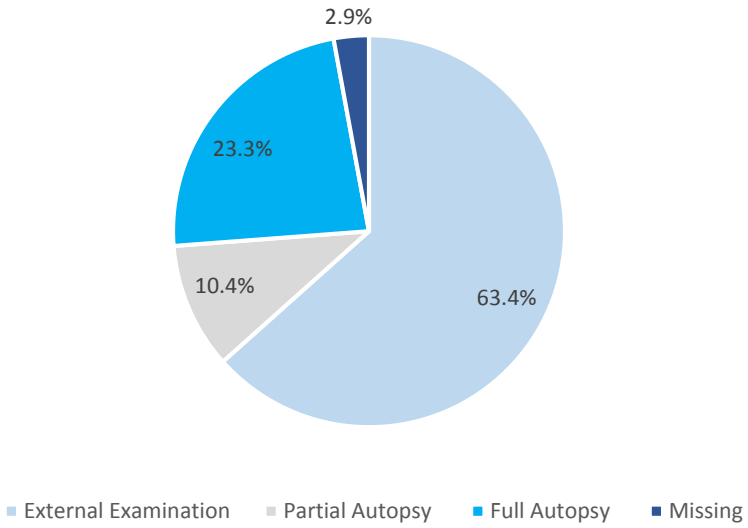

Figure 2-7: Extent of PM performed for each SUDI case.

A display of the percentage performance of each extent of PM in 2016 & 2017. External examination (n=288, 63.4%), being non-invasive, was performed most frequently. This was then followed by the performance of a full autopsy (n=106, 23.3%) and then a partial autopsy (n=47, 10.4%). The chart also represents the 2.9% of cases for which data on the extent of PM was unknown (Appendix G).

Upon completion of the PM a COD is stated by the forensic pathologist (Figure 2.8). In just over half of the cases a definitive COD was stated (n=267, 58.8%), however, the remaining 41.2% of cases had less definitive outcomes. A large number of cases were said to be "associated with" or "consistent with" a certain COD (n=146, 32.2%) and some cases were said to still be "under investigation" (n=31, 6.8%) which is usually pending ancillary test results. Unnatural deaths (n=3, 0.7%) and cases where documentation stating COD were missing (n=2, 0.4%) were the minority, this implies that the majority of cases admitted as SUDI were due to natural causes. Cases in which the COD remained "undetermined" (n=5) represented 1.1% of the total number of cases. The final COD of "undetermined" should only be used in cases in which all ancillary investigations have been performed and unremarkable results were obtained. Of the five "undetermined" cases only one (0.2%) had all ancillary investigations performed (Histology, toxicology and microbial analyses), three (0.6%) had a subset of the ancillary investigations and one (0.2%) had no ancillary investigations.

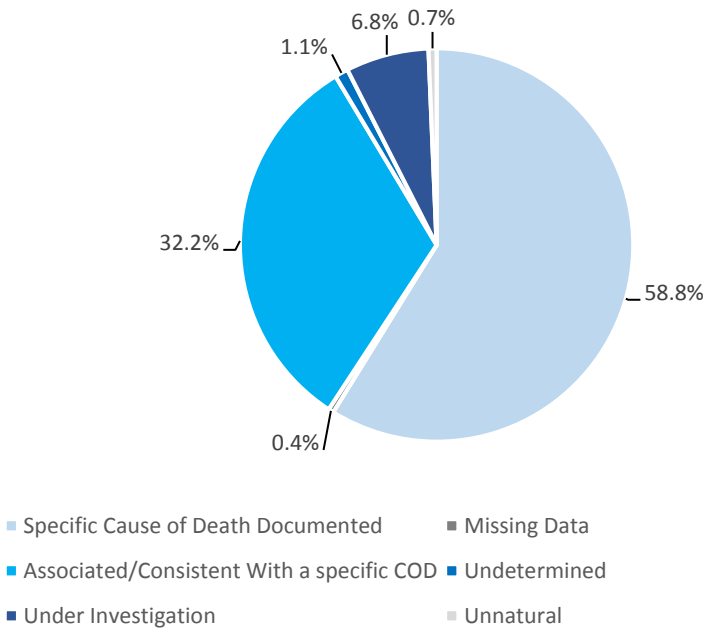

Figure 2-8: COD documented.

The COD categories documented over 2016 & 2017. A definitive COD was stated in 58.8% (n=267) of cases. Associated with or consistent with a certain COD was stated in 32.2% (n=146) of cases. With the remainder of cases COD stated as follows: under investigation in 6.8% of cases (n=31), unnatural deaths in 0.7% of cases (n=3), and undetermined in 1.1% of cases (n=5). Data regarding the COD was missing in 0.4% of the cases (n=2) (Appendix G).

The ancillary tests performed included toxicology, microbial analyses (microbiology and virology) and histology (Figure 2.9). In majority of the cases, no ancillary tests were performed. However, when performed, histology was most frequent (n=94, 20.7%), followed by microbial testing (n=74, 16.3%) and lastly toxicology (n=48, 10.6%).

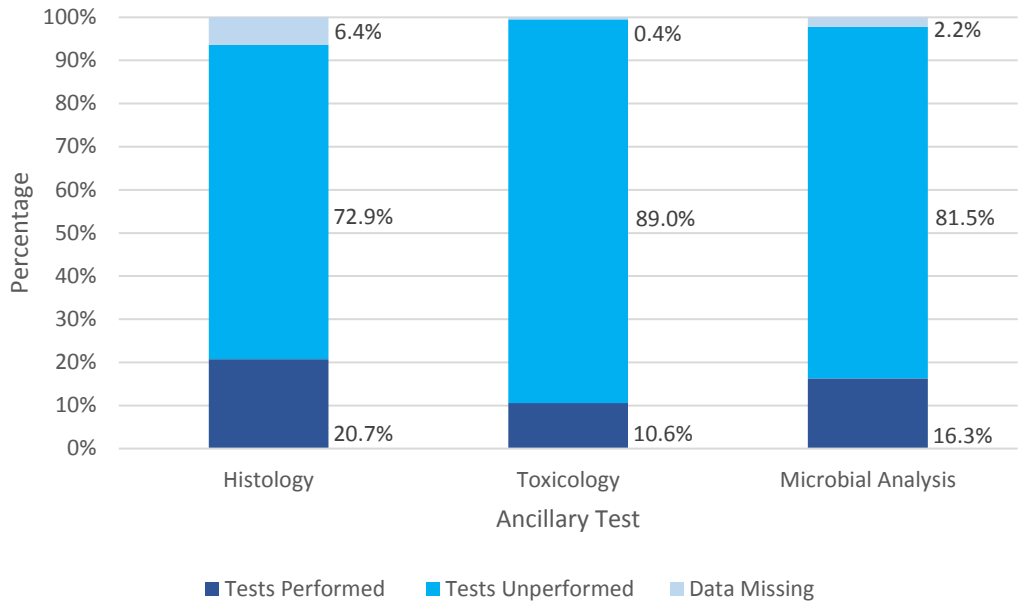

Figure 2-9: Performance of ancillary tests per SUDI case.

A display of the percentage of times each ancillary test was performed for the SUDI cases over 2016 & 2017. Histology was performed the most frequently (n=94, 72.9%), followed by microbial testing (n=74, 16.3%) and lastly toxicology (n=48, 10.6%). The chart also represents the percentage cases for which data on the performance of ancillary tests was unknown (Appendix G).

2.3.1.4 Overall investigation process

A three-way chi-squared test was performed to assess the impact that the completeness of the various sections of the FPS006(b) document, the extent of PM performed and the COD documented had on each other. It was shown that section D of the FPS006(b) document had a significant impact on the extent of PM (p-value=0.0096) and that the extent of PM had a significant impact on the COD documented (p-value = <0.0001). These remained significant after Bonferroni corrections for multiple testing.

2.3.2 Prospective observations

2.3.2.1 Scene investigation

The researcher accompanied the FPOs to ten SUDI death scenes. The scenes were attended over the period of 21st July 2018 - 24th September 2018, with 52 SUDI cases falling into these dates. Of these cases, 23 (44%) were admitted from a medical centre and in no cases was the primary scene revisited. The remaining 29 SUDI cases were from homes, where scene visits by the FPOs occurred. Of these 29 cases, the researcher was contacted in only ten cases, and all were observed. The average amount of time spent on scene by the FPOs was 25 minutes (Figure 2.10), with the range being 13 to 35 minutes.

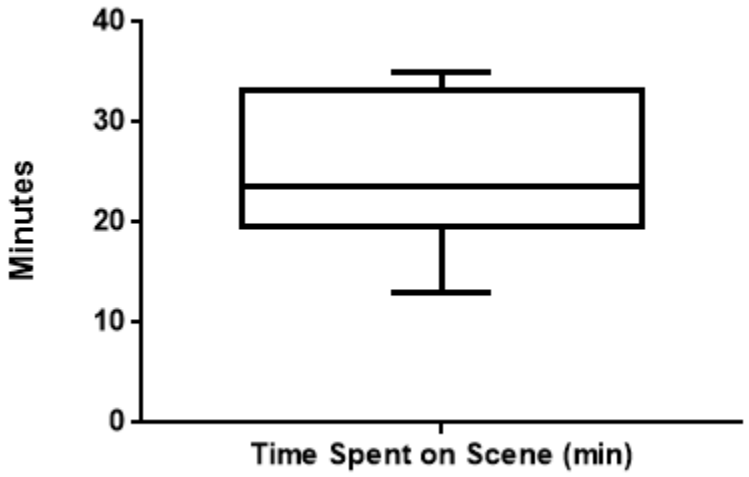

Figure 2-10: Time spent on scene.

A box and whisker diagram displaying the time spent on scene in minutes. The minimum time being 13 minutes and 25% percentile being 19.5 minutes. The median of the data was 23.5 minutes, the 75% percentile was 33.25 minutes and the maximum time was 35 minutes.

In all ten scenes, the infant had been moved prior to the FPOs arrival. In six cases the FPS006(b) form was present on scene, and in all cases photographs were taken. None of the scenes had forensic pathologist attendance nor the performance of a re-enactment (Figure 2.11). As a result of the infant being moved, there were various scene findings that could not be accurately documented, or documented at all. These findings include the position in which the infant was found, the description of the airway, wedging, co-sleeping, overlaying and whether the infant was tightly wrapped or swaddled.

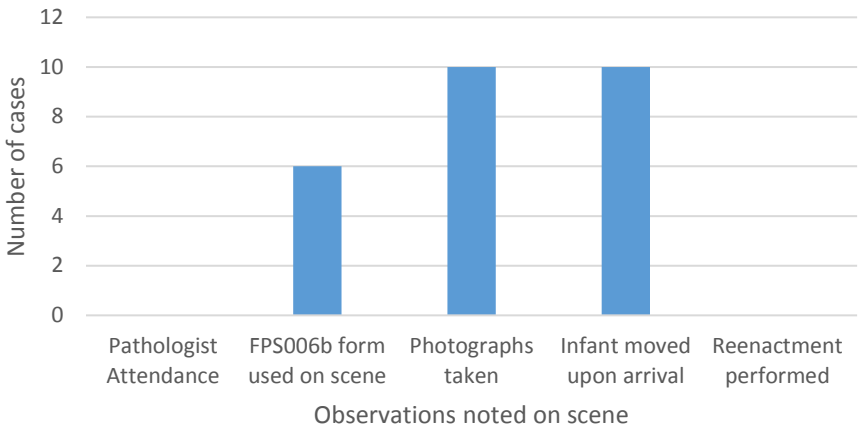

Figure 2-11: Observations made on scene and the number of cases in which these occurred.

Observations made by the researcher on the accompanied scenes. In all ten scenes photographs were taken and the infant had been moved by the time the FPOs arrived. In six cases the FPS006(b) form was present on scene. None of the scenes had forensic pathologist attendance or the performance of a re-enactment.

The number of photographs varied between scenes, with between seven and 28 photographs taken (Figure 2.12). These photographs varied in quality with two (1.3%) of the total amount of photos being blurred and two (1.3%) being overexposed or having incorrect focus. However, majority of the photographs were of good quality, informative, accurate and comprehensive. All ten cases had GPS, MDT, facial and body tag photographs.

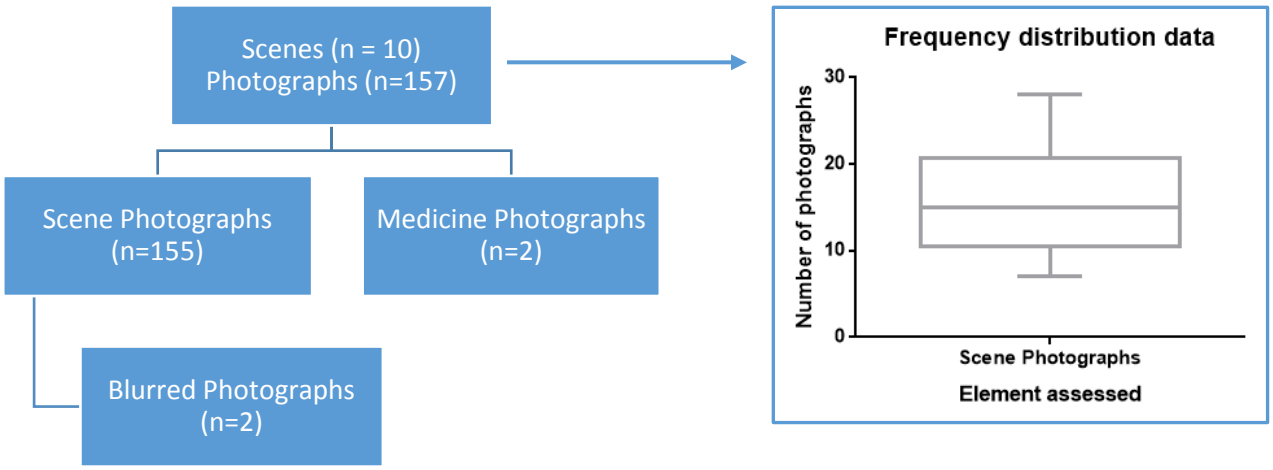

Figure 2-12: Photographs taken on scene.

Number of photographs taken (n=157) over the total number of scenes (n=10) for the prospectively attended scenes. Flow diagram showing how many of these photographs were of medication found on the scene (n=2, 1.3%) or of the scene itself (n=155, 98.7%) and how many of the scene photographs were blurred (n=2, 1.3%). The insert on the right shows a box and whisker diagram of the scene photographs. The minimum value being seven and 25% percentile being 10.5. The median of the data was fifteen, the 75% percentile was 20.75 and the maximum value was 28.

2.3.2.2 Identification

The documentation to be completed at identification includes the remaining sections of the FPS006(b) document (section D, E, F and G). When the document appears at identification, the scene aspect of the document (section A, B and C) should be complete. It was seen that this document was not followed through from scene to identification effectively for the ten observed cases (Figure 2.13).

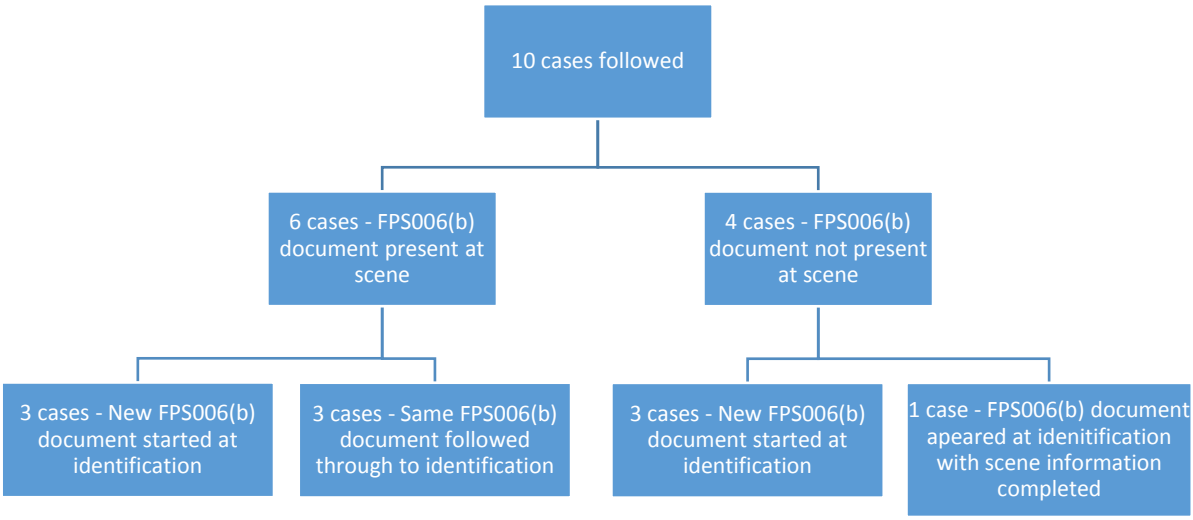

Figure 2-13: Filling in of FPS006(b) documentation for observed cases.

A flow diagram representing the filling in of the FPS006(b) documentation for the ten observed cases. In three of the ten cases the FPS006(b) document with a completed scene section (section A, B and C) was not followed through to identification and a new FPS006(b) document was started for the recording of section D – G. In three of the ten cases the FPS006(b) document with a completed scene section (section A, B and C) was followed through to identification for section D – G to be completed. In three of the ten cases a FPS006(b) document was only started at identification as it had not been present on scene. In the final cases a FPS006(b) document with a completed scene section (section A, B and C) appeared at identification, however, no FPS006(b) document had been present on scene for that case.

Additionally sections D – G were not fully completed in any of the ten cases followed. It was also noticed that in some cases pages of the FPS006(b) form were missing; therefore those pages remained incomplete following identification. Even though one FPO noticed odd flow of questions during the interview, no action was taken to obtain the full version of the questionnaire.

2.3.2.3 Post-mortem examination (PM)

Prior to PM, the FPS006(b) document was received by the forensic pathologist in nine of the ten cases. The extent of PM did not seem to vary greatly between the cases as for eight of the ten, full autopsies were performed and for the remaining two, partial autopsies took place. For the single case where no

FPS006(b) form was received by the forensic pathologist, a partial autopsy was done. Ancillary tests were performed in eight of the ten cases, which included the two partial autopsies (Figure 2.13). COD was definitive in five cases; 'Associated/Consistent with' a diagnoses in three cases and "under investigation" in the remaining two cases (Figure 2.14).

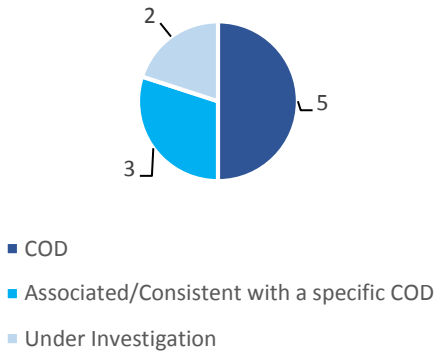

Figure 2-14: COD documented.

The cause of death categories assigned for the observed SUDI cases. A definitive COD was stated in five cases. Associated with or consistent with a certain COD was stated in three cases and under investigation was stated in two cases.

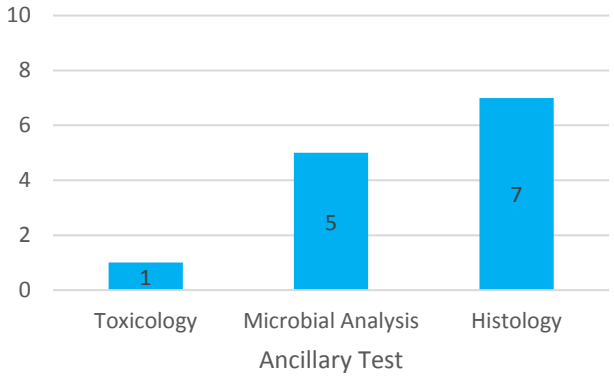

Figure 2-15: Performance of ancillary tests.

A display of the times each ancillary test was performed for the observed SUDI cases. Histology was performed the most frequently (n=7, 70%), followed by microbial testing (n=5, 50%) and lastly toxicology (n=1, 10%).

2.3.3 National survey of registered forensic pathologists in South Africa

The survey was distributed to all 65 registered, qualified forensic pathologists in South Africa. In total, 15 (23.08%) responses were received, including three who declined participation. Thus 12 (18.46%) responses were used in analysis. The data obtained originated from five of the nine provinces (Figure 2.16), with majority arising from the Western Cape (n=6, 50%).

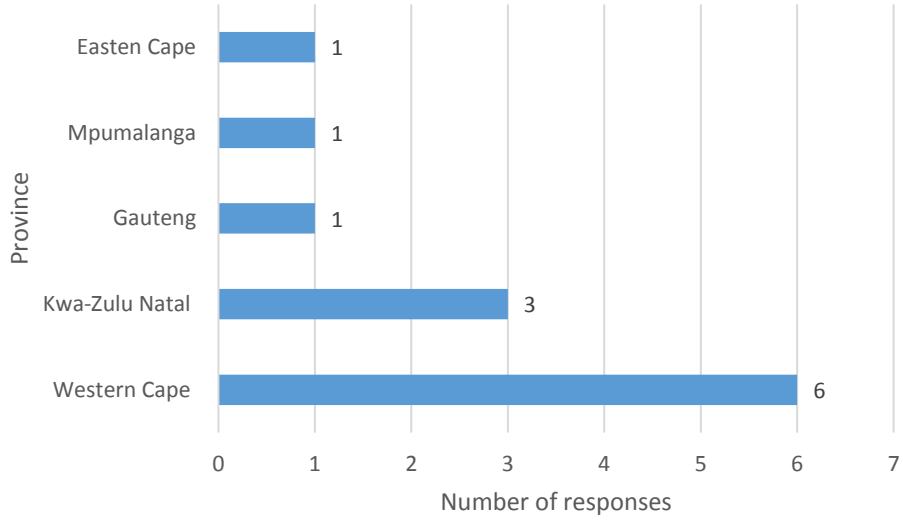

Figure 2-16: Provinces from which responses arose.

In total 12 eligible responses were obtained and these arose from forensic pathologists situated across five provinces.

In the knowledge questions, the definition of SIDS was asked. The responses showed that 16.7% (n=2) of the participants, did not include the need to perform a DSI in their definition of SIDS. It was also found that 41.7% (n=5) of participants did not consider SIDS as a COD, with the reason being that the required investigations were not available. However, 'undetermined' was used as a COD, following negative ancillary investigations, by 75% (n=9) participants.

When asked what evidence is needed for overlay, wedging or suffocation to be diagnosed, the responses were greatly weighted on scene findings rather than PM findings. Very few forensic pathologists stated that they document overlay, wedging or suffocation only when "no other fit COD" was present (4 participants for each).

The hypothetical case scenarios included a question on formulating the COD according to certain information presented, this was followed by a question stating; "Under ideal circumstances, what else would you want to know in order to determine the cause of death for this case?" (Appendix E). The most commonly recorded answer was the need for a more detailed DSI to be performed (Figure 2.18).

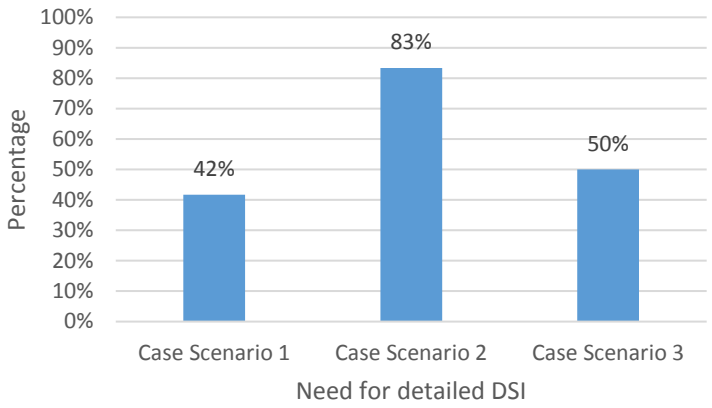

Figure 2-17: Percentage of forensic pathologists that expressed the need for a detailed DSI in each case scenario.

For each of the three case scenarios presented in the national survey sent out to the FPs, a high percentage of them expressed the need for more detailed DSI information to assist with their COD determination. In case scenario 1 41.7%, in case scenario 2 83.3% and in scenario 3 50%, made mention of this need.

It was found that when asked whether the mortuary the forensic pathologists were positioned at made use of a standardised protocol, 16.7% (n=2) of participants stated that a protocol was used routinely, 50% (n=6) stated use on a case-by-case basis and 33.3% (n=4) stated that one was never used. The participants that responded stating the routine use of a protocol, indicated in a follow-up question that these protocols didn't include a DSI. Four participants did however mention the use of a protocol on a case-by-case basis that incorporated DSI.

It was reported that 83.3% (n=10) of the participants, as well as the FPOs in their mortuaries, were not required to complete training specific to infant DSI and 75% of the participants stated that no training exists or is available. However, when asked how the forensic pathologists could get more involved in SUDI investigation they stated that they could give training and teaching to the FPOs. Other suggestions regarding increased involvement by forensic pathologists in SUDI DSI including the writing of standard operating procedures, interviewing and completing the questionnaires with the families themselves and attending more scenes.

It was stated by 91.7% (n=11) of the participants that DSI is a very important and an invaluable contribution to SUDI investigations and 100% (n=12) stated the need for a dedicated death scene investigator role, as seen in the USA, in order to better handle the DSI of our SUDI cases.

2.4 Discussion and Recommendations

2.4.1 Scene investigation

DSI is the first step in the process of investigating the cause and manner of death, and therefore it should be handled with accuracy and consistency (Tabor & Ragan, 2015). However, there is often minimal investigation into assessing the circumstances surrounding the death (Bass, Kravath & Glass, 1986). In SA DSI of infant cases has been neglected, with a previous study showing its performance in only 0.5% of cases (du Toit-Prinsloo et al., 2013). FPOs associated with SRM attend each scene for DSI and transportation of the deceased to the mortuary; this occurred in the cases in which the primary scene was attended (Figure 2.3). However, when the FPOs were called to a medical centre, fire station or ambulance, the primary scene was never returned to for investigation. The absence of DSI in cases admitted from such locations is problematic, as often the events leading to death occurred at home. Although the infants may have been declared dead at a different location, the home was often the primary environment where the baby spent its time and where it was found unresponsive by family. As such, it is strongly motivated that in cases where the deceased is collected from one of the prior mentioned facilities, the primary scene should be revisited by the FPO and a DSI should take place.

The DSI performed by the FPOs at SRM included various elements (Figure 2.2). Often the documentation of all relevant elements was problematic, due to the infant being moved prior to the FPOs arrival – this was noted in all ten scenes attended by the researcher (Figure 2.11). These scenarios bring to question, whether the scene should be documented as observed by the FPO, regardless of the infant having been moved, or whether they should ask the family to recall and re-enact the scene prior to the movement of the infant. Further, it is unclear whether data recorded in the DSI documentation was how the FPO perceived it or how the family reported it; e.g. how the FPO found the infant or how the infant was found dead by the family. Whichever way these scenarios are handled should be standardised. Scene re-enactment was only performed in a single SUDI case, resulting from the retrospective analysis (Figure 2.11). However, this would be highly beneficial to the large number of cases where the infant has been moved and it is recommended that it be implemented at SRM and in SA. This was also recommended by 83.3% of the participants that took the survey.

The housing options in SA and within the service area of SRM, fall into a highly variable range; from exceptionally informal to very upmarket housing. However, the FPS006(b) utilises two categories: “formal housing” and “informal housing”. The lack of standard definitions and descriptions for these limited categories may lead to inaccuracies in documentation and cause imprecise acceptance of the housing conditions which constitute a risk factor for SUDI. To address this gap, the FPS006(b) should include an appended glossary providing definitions and descriptions for the categories that must be assigned.

At all scenes scene temperature should be recorded, as temperature could lead to hyper-/hypo-thermia. This statement was backed up by the survey. This was not recorded at any scene, retrospective or prospectively. This lack of documentation was not unexpected as this was also only documented in four of 74 studies in the global systematic literature in Chapter 1. Recording of environmental aspects presents challenges and there are limitations associated with recording aspects such as the scene temperature, as this can fluctuate and the scene is usually visited much later once the temperature has altered. However, an estimated measurement might be better than no measurement at all. In a local context it is recommended that an attempt should be made to document the weather conditions at the scene location and/or at the estimated time of death. With this being said, the presence of heaters and the ventilation of the house need to be established on every scene.

Documentation of the use of a heater, or any other heat source, is frequently unrecorded in SA. This may be due to this being undocumented, being packed away or not being owned by the family. The global CDC guidelines suggest checking for various cooling/heating sources, yet many of these may not be locally relevant, such as “electric baseboard heat”. However, checking for adequate ventilation is relevant locally. The term “ventilation” needs to be properly defined or be described at each scene. For example, in an informal housing context, the gaps between corrugated iron walls and roofs should be documented. This setup was frequently seen during prospective scene visits.

Evidence of drugs, smoking and/or alcohol in the household, and the use thereof, is essential to document. This is supported by responses from the survey where “inebriation of adults” would prompt further investigation into possible wedging, overlay or suffocation. Substances lead to the altered behaviour of the adult which can result in an unsafe environment for the infant. Further, from scene visits, it became apparent that the approach to finding medication, cigarettes and/or alcohol was inconsistent. In some cases, medication was ignored, while in other cases, it was noted, photographed and/or collected. Since

the FPOs are not trained in handling and knowledge of medication, it cannot be expected that they would know what to do in every situation. Guidelines for the collection and documentation of all medication and illicit drugs have been set-out by the CDC (Ernst et al., 2007). Additionally it is mentioned in the Merseyside Joint Agency Protocol (Johnson, Sumner & Rebello, 2012) and "A guide to investigating child deaths" document by the Association of Chief Police Officers (Association of Chief Police Officers, 2014) that all items that may have been administered to the infant (including medication), should be retained. Perhaps local training and guidance pertaining to common medications should be given, and contact made with the forensic pathologist and/or toxicologist on call if the FPO is unsure. A recommendation is that a standardised process should be implemented in which all medicine pertaining to the infant should be collected (if not previously done by the South African Police Service). While, medicine pertaining to the mother should be documented and photographed as, depending on the type of medicine, this may be transferred to the infant via breastmilk. Documentation by note taking and photography should be standard for all prescribed medication while collection thereof should be by the South African Police Service.

Upon observation, no standardised approach, by the FPOs, to "medical history taking" and what is required when medicine is present on scene was evident. The survey also brought up that medical history taking needs to be improved. In some cases only the 'Road to Health' document was consulted to document history, in others the history was only asked from the caregiver and in some cases both were done. Regardless of the method used, a standardised process of history taking is recommended to avoid the current inconsistencies. Since the Road to Health clinic card document is brought to identification, the efforts of the FPO should be geared towards asking the family for medical information. However, since FPOs are not medical practitioners, proper medical history taking ought to be done by the forensic pathologist themselves, or FPOs should receive proper training on this process. A recommendation could be the incorporation of questions regarding medical history into section C (scene investigation section) of the FPS006b document and stating in writing on the form that the questions should be asked of the family and not checked in the Road to Health clinic card.

There was a good correlation between what was seen at the prospective observations of the DSI and what was found from the retrospective review. The survey responses mirrored the researcher's thoughts with regards to feasible and realistic improvements on scene. Overall, on scenes that the FPS006(b) document was present, the DSI appeared to be well conducted. Compassion and respect was shown by the FPOs

towards the family on scene. One group of FPOs went as far as to create and implement an information sheet given to the family on scene that gives the CAS number (police reference number) and WC number (FPS reference number) of the case, the address of SRM and the documentation that needs to be brought by the family when they attend identification. This should be implemented in all cases to help family members at these grieving times.

2.4.2 Documentation

The primary document used in a SUDI death investigation by SRM is the FPS006(b). This document forms a proxy for the CDC SUIDRF and is adapted to include appropriate aspects in a SA/Cape Town setting. It is a well thought-out document that encompasses the majority of the questions needed in these investigations. The proper completion of the documentation, however, was problematic.

The retrospective review found that the relevant documentation was only completed in the minority of cases. This finding was backed up by the prospective observation (Figure 2.13). Majority of the questions remained unanswered after the scene and identification processes (Figure 2.2, 2.5 and 2.6), and in some cases, full sections remained incomplete (Figure 2.1 and Figure 2.13). It is therefore unknown whether certain assessments were performed on scene, or if the question was asked, due to the incomplete documentation. This had no significant association to the time of day or time of year at which the document was completed.

It was often observed that during the family interview within the identification process, if an answer was 'no' to a question, it was merely left unmarked. The consequence of not filling in the answer suggests that the question was not even asked in the first place, as it cannot be assumed that if an answer is left blank it implies 'no'. Answers were also left unanswered when there was no corresponding option available to circle. For example, the question "Was the following in the room where the baby slept to heat the room?" had answers to select: (i) electric heater, (ii) "Galley", (iii) fire or (iv) other; with no available option for "none". This question often was unanswered, but it cannot be assumed that none of the heating appliances were present.

Language barriers increased the number of unanswered questions, therefore it is recommended that the identification process is undertaken by a FPO that can speak the native language of the family. Above this, English is not the first language of a number of FPOs, therefore definitions are needed for words that appear on the documentation that are not well known. This includes words such as antenatal and KMC, where it was observed that these terms could often not be described by the FPO to the family. Training in this regard is needed. Some questions are also hard to interpret and need to be better defined. An example of this is the question "How many other people slept on the same bed as the baby at the time the baby died?", which does not specify if this include the baby and/or mother (particularly if it had previously been stated that the mother and infant co-slept). These questions should therefore be restated to clarify ambiguity. There should also be a feedback loop whereby FPOs can bring these questions and ambiguities to the attention of the FPS authorities, such that revised forms can be issued.

In July 2017 an updated/revised FPS006(b) was slowly introduced. This document sought to rectify some issues that were experienced with the older document. For example, the older document contained a set of four questions that only had a single checkbox for 'yes/no' in section C (Figure 2.18). However, in doing so, the question of whether the infant had been "moved" was removed from section C (scene investigation section) and from section D (retrospectively at identification). This is necessary information to be gathered, as discussed in "2.4.1 Scene Investigation". The older FPS006(b) document also had identical sections C and G ("household environment"); so that section C could be completed on scene contemporaneously and section G could be answered at identification to see that the answers corresponded (Figure 2.19 and 2.20). This also ensured that if something was missed on scene this could be expressed at identification. It is understandable that due to training on these documents being inconsistent/irregular over the last five years , only one of these sections were being filled in so as not to repeat things unnecessarily. The duplicated questions were therefore removed in the new document and instead Section G has questions that follow on from the observations documented in Section C. However, this has not rectified the issue, as in majority of cases Section C is not completed (Figure 2.1) and since these questions no longer appear in section G, they remain unasked and unanswered.

In what position was the baby found lying?		
Has the baby been moved?		
Were there any covers/ clothing etc over the baby's head?		
Was the baby squashed/wedged between anything (object)?	Yes	No

Figure 2-18: Segment of section C of the original FPS006(b) document.

Prior to July 2017 when the updated/revised FPS006(b) document began to be implemented, this section appeared in the document. These questions form part of section C of the document. This was rectified in the updated FPS006(b) document to have individual spaces for answers to be recorded.

Section G **Household environment**				
1. Place where the baby lives	House		Shack	Other
2. Number of bedrooms?				
3. Is the room in which the baby was found well ventilated?			Yes	No
4. Odour(s) present in the room the baby slept in?			Yes	No
5. Peeling paint in the room the baby slept in?			Yes	No
6. Fungal growth (mould) in the room the baby slept in?			Yes	No
7. Are there pets in the house?			Yes	No
If yes, type and number:				
8. Was the following in the room where the baby slept to heat the room?	Electric heater	"Galley"	Fire	Other
Describe other –				
9. Number of adults in the dwelling?				
10. Number of babyren in the dwelling?				
11. Total number of people in the dwelling?				
12. Estimated monthly income?				
13. Number of smokers in the dwelling?				
14. Are there mentally retarded/ challenged people in the dwelling?			Yes	No

Figure 2-19: Section G of the original FPS006(b) document.

Prior to July 2017 when the updated/revised FPS006(b) document began to be implemented, this section appeared in the document. This section contains questions that are duplicated from section C of the document (Appendix H), this was done to see that answers corresponded and to ensure that if something was missed on scene it could be expressed at identification.

Section G Household environment				
8. Was the following in the room where the baby slept to heat the room?	Electric heater	"Galley"	Fire	Other
Describe other –				
9. Number of adults in the dwelling?				
10. Number of children in the dwelling?				
11. Total number of people in the dwelling?				
12. Estimated monthly income?				
13. Number of smokers in the dwelling?				

Figure 2-20: Section G of the updated/revised FPS006(b) document.

This section was altered to remove duplication of questions found in section C of the document, which is completed contemporaneously on scene. Therefore this section can no longer be used to see that the answers in section C and G corresponded and to ensure that if something was missed on scene it could be expressed at identification. Additionally, in majority of cases, Section C is not completed (Figure 2.1) and since questions are no longer duplicated, they remain unasked and unanswered. Section C can be found in Appendix I.

There are questions present on the FPS006(b) that are frequently unanswered, including "Estimated monthly income?", "Age of the mother?" and "What schooling level did she (the mother) achieve?". During observations, one of the male FPOs expressed his discomfort to the researcher, indicating that he felt it was not his place to ask a grieving and vulnerable woman these sensitive questions. He intentionally skipped more intimate questions such as HIV status and whether contraception was taken. Therefore it is suggested that specially trained FPOs handle these sensitive cases. Another solution could also be to fill in the interview electronically, whereby all questions are compulsory and skipping questions is not an option. However, this would require resources and training, and may be considered a long-term project.

There were discrepancies noticed in what was documented on scene by the FPOs and what the researcher documented in the Observation and Note taking sheet (Appendix D). A specific example of this is a case in which the researcher documented a frothy/foamy substance at the nose of the infant and the FPO documented this substance at the mouth. The photos later revealed that the foam was indeed at the nose of the infant, therefore more care needs to be taken when filling in documentation on scene.

Based on the above findings and that the survey feedback mentioned very little about documentation issues, it is suggested that the forensic pathologists in the Western Cape that make use of the FPS006b document may not be aware of the documentation issues and instead solely believe that the FPOs are not

asking all necessary questions. Regular, standardised and consistent training therefore needs to be carried out to ensure accurate form completion and explain why all questions on the form are necessary to the investigation.

2.4.3 Investigation process

The process starts at the death scene with the DSI. DSI is performed by the FPOs and the death scene is rarely attended by the forensic pathologist; this was not seen for any cases analysed retrospectively or prospectively. The forensic pathologists are generally not called to SUDI death scenes, however if they are, they may not always be available to attend, due to a variety of reasons, including high caseloads in SA. They may be at another scene, performing a PM, doing histology or testifying in court. In an academic setting, such as at SRM, responsibilities also include teaching and research. However, in order to gather the routine relevant information needed from the scene, DSI need not be conducted by a forensic pathologist; rather, trained FPOs should be able to follow a relevant protocol and collect appropriate information to assist the investigation (Erck Lambert et al., 2016). Although local guidelines for death investigation do exist, a standard operating procedure catered specifically for SUDI DSI needs to be created and implemented, due to the different and sensitive nature of these cases.

On scene the use of the FPS006(b) document does not solely constitute a standard operating procedure for how DSI should be conducted. Although this documentation guides the investigation, this does not include information on how to conduct the DSI and should therefore form part of a standard operating procedure. The time spent on scene, as part of the observational study, varied greatly between the teams of FPOs (Figure 2.10). A set time for which the FPOs should be on scene would not be beneficial, however, on scenes where more time was spent, the DSI appeared to be performed more thoroughly and with more respect towards the families. On these scenes, following the DSI performance, the family was allowed time to pray or sing with the baby and say their goodbyes, while on other scenes the baby was immediately removed. Additionally, when there is less of a rush, more time can be spent gathering information from the family regarding the surroundings that are being seen to allow less assumption based solely on photography. Therefore a semi-structured framework could be drawn up to assist time-management on scene; this will also remind the FPO's to set time aside for the families to pay their respects.

The accurate use of the FPS006(b) document is also not regulated and monitored. In one observed case, the forensic pathologist never received the FPS006(b) document prior to PM due to this going missing, and in another case, the document was not completed on scene but upon arrival at identification, the scene section of the document had been completed. On three scenes the FPS006(b) was present and completed on scene, however, at identification, a new document was utilised and it is unknown where the scene section of this document is (Figure 2.13). This paperwork needs to be used optimally and followed through accurately. At SRM there are multiple electronic tablets that are used as MDTs, with a software program installed allowing the tracking of each part of the process; icons can be pressed following the completion of each aspect and it logs the completion time. For example when departing SRM, the "depart" icon is selected and the time is logged, the corresponding icons are then selected upon arrival at scene, departure from scene and arrival back at SRM. Perhaps this technology can be used to solve the continuity and completion issues with documentation. These mobile tablets are already in possession by FPS and a suggestion would be to make the FPS006(b) document an electronic form that needs to be completed to move to the next stage of the investigation. For example all questions in Section C on scene will need to be completed before the completion of the scene can be logged. This would not only lead to completed documentation but also assist the following through of the documentation, as all data will be stored electronically limiting the ability for it to be misplaced.

Transportation should be monitored more strictly, as on two separate observed scenes monitored, the FPS vehicle made stops on route that were unrelated to the investigation while transporting the deceased back to SRM. One of these stops was the FPOs house, and another was the shop. Perhaps the route travelled by the vehicles could be monitored by GPS, or the route information could be linked to the above suggested electronic data gathering system, to ensure no unnecessary stops are made, influencing the time between body collection and placement in the fridge. Time is necessary to consider for cases in which microbiology may be relevant as the mortuary vehicles are un-refrigerated and post-mortem translocation and contamination of microorganisms leads to false positives in microbial testing, which can be avoided by prompt refrigeration of the body after death (Morris, Harrison & Partridge, 2007).

There are differing extents of PM performed: external examination, partial autopsy and full autopsy, all of which are usually preceded by a full body Lodox (Lodox Systems (Pty) Ltd. South Africa, 2000). The extent of PM for the retrospective review can be seen in Figure 2.7. This showed that majority of SUDI

cases undergo external examination, followed by full autopsy and then partial. This was not seen prospectively, where 80% of cases underwent a full autopsy and the remainder a partial autopsy. The difference seen between the retrospective and prospective findings was attributed to the increased number of registrars at SRM, who are required to perform full autopsies, and a linked study on SUDI cases which was ongoing at the time of scene observation. This study required the collection of various samples for microbiology testing, and thus full autopsies were done more than what was recorded in the retrospective review. These sorts of projects are not uncommon at SRM, which is linked with an academic institution where research projects are often conducted.

In the retrospective review, the extent of PM was significantly influenced by the completion of section D of the FPS006(b) document ("Circumstances of death / details about events before death"). This may be due to the data falling into this section, pertaining to the surroundings of the death, having a great influence on the pathologists thoughts on what may have been the COD and therefore the extent of the PM (Figure 2.7). The extent of PM also had a significant influence on the COD determination documented.

The COD from the forensic pathologists varied, from documenting a specific COD to the COD remaining "undetermined" after PM (Figure 2.8). With categories such as "under investigation" or "associated/consistent with a specific COD" being less specific outcomes following PM. It was seen both retrospectively and prospectively that an established COD is most frequent (Figure 2.8 and 2.14), however, it is important to understand what is influencing the cases that have lesser defined outcomes and to know whether the scene findings have any influences on this. This study found no significant association between the findings documented on the FPS006(b) document from the scene and the specificity of the outcome at PM. It was also seen that there was no significant association between the findings documented on the FPS006(b) document from the scene and the ancillary tests that are performed at autopsy. This was in contrast to the survey findings, where forensic pathologists indicated that scene findings do contribute greatly to the decision of determining some of these CODs. This includes suffocation, wedging and overlay.

When a COD is classified as 'under investigation', this is usually due to ancillary test results being unknown. The retrospective case file review showed ancillary testing being performed infrequently (Figure 2.9). This could be attributed to the fact that there are high case-loads and that the forensic pathologists are not legally mandated to investigate further once the death has been deemed as due to natural causes,

therefore the limited resources are not prioritised to this regard. However, in order to determine the global relevance and enhance knowledge on SIDS, ancillary testing is needed to place the death into a category of SIDS as defined by the Krous *et al*. 2004 criteria (Krous et al., 2004). The prospective observations, showed ancillary tests being performed for eight out of ten cases (Figure 2.15); however, this may have been due to the parallel microbiology SUDI study, the increased number of registrars at SRM and the increased awareness from implementation of child death review meetings for SRM. Child death review meetings encompass multidisciplinary committees that systematically review all child deaths from birth to adolescence as a public health model of prevention of child fatality (Christian & Sege, 2010).

In the overall investigation process, there seems to be no routine or consistent practices between SUDI cases. This starts from the scene level, based on retrospective and prospective data from SRM and survey data from multiple SA mortuaries, and follows through to PM where it is at the discretion of the forensic pathologist as to the extent of PM and performance of ancillary testing. The different practices between mortuaries, however, may be attributed to the management of FPS being a provincial competency.

2.4.4 Recommendations

In addition to all recommendations already made, the survey brought to light the suggestions by forensic pathologists in SA for the improvement of SUDI DSI, with a couple specifying the need for training courses to be implemented (n=5, 42%). A single forensic pathologist suggested that alerts should be set up for pathologists for SUDI cases, which could be implemented as part of the above suggested electronic case recording system. Additionally, when answering the hypothetical case scenarios it was highly recommended that a more detailed DSI be performed (Figure 2.17).

Along with all aforementioned suggestions, in order for the current DSI practices to be improved, training needs to be implemented to guide FPOs on the best practices with the resources available. This can specifically be implemented with regards to scene photography, where a guided approach can be implemented to ensure that the photographs taken have evidential value and accurately represent the scene. A photography course can also be implemented to teach the proper use of the camera functions to ensure less photographs that are under-/over-exposed, blurry or out-of-focus. Photography was

assessed both retrospectively and prospectively (Figure 2.4 and 2.12) indicating the varied use of photography on scene. A guided approach could help the FPOs to determine the relevant aspects the forensic pathologist would like to know. Photograph re-enactment guidelines have been established by CDC, these explain a brief process that can be followed when photographing the scene (Diebold, 2007).

Regular, formal and standardised training can also be implemented for the proper and optimal use of the FPS006(b) document. If the need for this document is explained, along with the relevance of each question, it will result in a greater completion of this document. In the past, the performance of such training resulted in better completion of the documentation and improved the DSI remarkably (Martin, LJ., 2018, oral communication, 12 December 2018). Additionally, as previously suggested, the structure of the document and questions could be revised, perhaps leading to a document that incorporates aspects of both the old and new FPS006(b) documents.

As suggested by the participants in the survey, that the employment of a dedicated death scene investigator, as seen in the USA, could assist in improving the DSI of not only SUDI cases but all DSI at SRM. This person would need to have a relevant biomedical forensic science background in order to train FPOs, assist in high-profile cases and set up guidelines and protocols within the institution; this would benefit the investigative capabilities of SRM, and other mortuaries in SA, as a whole.

Implementation of short courses for FPOs could assist in the understanding of forensic evidence present on scene and how best to preserve this. This could assist with the understanding of why certain findings on the scene are important. An example would be a short course in toxicology explaining the reason why a mother's medicine should also be documented due to the ability of certain elements to be transferred to the infant via breastmilk.

ISO/IEC 17020 standards for the accreditation of forensic inspection bodies are applicable to the investigation of forensic scenes, with section "7.17 Inspection Methods and Procedures" being particularly applicable (ANAB, 2015). These standards would be good to work towards with regards to DSI practices. However, mention is made that whenever possible, any nationally and internationally recognised methodology, which have been validated and published by authoritative bodies, should be used. This recognised methodology may be unable to be utilised due to the resource constraints faced in SA.

2.4.5 Limitations

There are several limitations in this study. The initial phase is a retrospective review that comes with its own limitations such as documentation being missing or incomplete. Additionally this data does not give insight into the extent of processes that took place but merely the data generated from these processes. The prospective observation phase of this research was only performed on a very small number of cases, which could lead to bias. We cannot generalise these results and state them as representative of true occurrence. However, valuable insight was obtained and the numbers could be expanded on in future research. Additionally, due to other research projects being performed simultaneously, PM observations may not be indicative of true practices.

The cases in which the infant was collected from medical centres, ambulances or fire stations were not prospectively followed, therefore it is unknown what truly occurs on these scenes. This is a limitation as 41% of cases arise from these locations (Figure 2.3). It would be of value to follow cases in which the FPOs attend the medical centre, ambulance or fire station to assess the procedure followed in these locations.

Lastly, the survey was only answered by a small number of individuals from only five of nine provinces and therefore data may not truly be indicative of nation-wide thoughts on the DSI process (Figure 2.16).

2.5 Conclusion

SA does not routinely perform standardised DSI for SUDI cases and there is no set protocol in this regard. Therefore the aim of this research was to investigate the current DSI processes of SUDI cases at SRM and suggest realistic and feasible ways to improve this investigation. This research study consisted of three phases. Phase one entailed the review of medico-legal case files from SUDI cases investigated at Salt River Mortuary from 1 January 2016 to 31 December 2017. The second phase was prospective observation of DSI for ten SUDI cases, using a semi-structured checklist. The last phase included the distribution and analysis of a survey regarding SUDI DSI to all registered, qualified forensic pathologists in South Africa.

The results showed that the SUDI death scenes were assessed in 59.2% of cases at Salt River Mortuary, with inconsistent DSI practises. The FPS006(b) document is used, albeit rarely, as a proxy for the global guidelines generated by the CDC. However, this does not constitute a protocol, and should be used in association with a standardised and routinely implemented DSI protocol. This study has highlighted the inconsistencies throughout the death investigation process and has suggested feasible and realistic suggestions which can be implemented in SA and SRM's resource-constrained environment. These suggestions include, but are not limited to, the implementation of training programs and short courses in forensic topics, revising of documentation and the implementation of a semi-structured framework for photography, which will not only benefit and improve the DSI but also the subsequent stages in the death investigation. Suggestions that are suited directly to the improvement of the DSI include, but are not limited to, the use of a doll of scene re-enactment due to the high number of cases in which the infant is moved and the use of a semi-structured checklist for time management on scene.

It was brought to light that international guidelines, such as those set by the CDC, cannot be followed directly, however, nationally structured protocols can be developed to a standard more suitable to the SA environment. The use of this could assist the forensic pathologists in formulating the COD determination, assisting with the understanding of the death demographics and causes of death in our country and leading to closure for the families of the deceased. With death demographics and causes being known and monitored, risk factors can be identified and this can lead to the generation of effective interventions and education for the population.

Standardised DSI is highly beneficial on any death scene, especially with the vulnerable population of infants. The scene suggestions made here can assist in cases of infant death, and can also be expanded and used on other death scenes. This will ensure and promote a routine approach at SRM and in SA that could eventually be accredited via the ISO/IEC 17020 standards.

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Appendix A – Search data used in systematic literature review

Table 1: Search data used in systematic literature review.

This table documents the databases searched, the keywords and search terms used and the number of results that were obtained in these databases using the keywords and search terms.

DATABASE	KEYWORDS	SEARCH TERM	RESULTS
Date of Search: 02-03-2018			
Web of Science		(((“death-scene investigation”) OR (“Death Scene Investigation”) OR (“infant death scene investigation”)) AND ((SUDI OR “Sudden Unexpected Death of Infant*”) OR (“Sudden Unexpected Infant Death*”) OR (“Cot Death*”) OR (“Crib Death*”) OR (“Sudden Infant Death”) OR (“Sudden Infant Death Syndrome” OR sids)))	13
Date of Search: 05 – 04 – 2018			
Scopus		(((TITLE-ABS-KEY (sudi)) OR (TITLE-ABS-KEY (sudden AND unexpected AND death AND of AND infants)) OR (TITLE-ABS-KEY ("Sudden Unexpected Infant Death")) OR (TITLE-ABS-KEY ("Cot Death*")) OR (TITLE-ABS-KEY (crib AND death*)) OR (TITLE-ABS-KEY ("Sudden Infant Death" OR sid)) OR (TITLE-ABS-KEY ("Sudden Infant Death Syndrome" OR sids))) AND ((TITLE-ABS-KEY ("death-scene investigation" OR dsi)) OR (TITLE-ABS-KEY ("Death Scene Investigation" OR dsi)) OR (TITLE-ABS-KEY ("infant death scene investigation")))) AND NOT (INDEX (medline))	21
Cochrane		'Death Scene Investigation OR infant death scene investigation OR death-scene investigation in Title, Abstract, Keywords and Sudden Unexpected Death of Infants OR Sudden Unexpected Infant Death OR Cot Death* OR Sudden Infant Death OR Sudden Infant Death Syndrome OR Crib Death* in Title, Abstract, Keywords’	0

Table 1 cont.

DATABASE	KEYWORDS	SEARCH TERM	RESULTS
PubMed	Death Scene Investigation or DSI or infant death scene investigation or death-scene investigation (AND) Sudden Unexpected Death of Infants or SUDI or Sudden Unexpected Infant Death or SUID or Cot Death or Cot Deaths or Sudden Infant Death or SID or Sudden Infant Death Syndrome or SIDS or Crib Death or crib deaths	(((((((((Sudden[All Fields] AND Unexpected[All Fields] AND ("death"[MeSH Terms] OR "death"[All Fields]) AND ("infant"[MeSH Terms] OR "infant"[All Fields] OR "infants"[All Fields])) OR SUDI[All Fields]) OR ((Sudden[All Fields] AND Unexpected[All Fields] AND ("infant death"[MeSH Terms] OR ("infant"[All Fields] AND "death"[All Fields]) OR "infant death"[All Fields])) OR SUID[All Fields])) OR ("sudden infant death"[MeSH Terms] OR ("sudden"[All Fields] AND "infant"[All Fields] AND "death"[All Fields]) OR "sudden infant death"[All Fields] OR ("cot"[All Fields] AND "death"[All Fields]) OR "cot death"[All Fields])) OR ("sudden infant death"[MeSH Terms] OR ("sudden"[All Fields] AND "infant"[All Fields] AND "death"[All Fields]) OR "sudden infant death"[All Fields] OR ("cot"[All Fields] AND "deaths"[All Fields]) OR "cot deaths"[All Fields])) OR (("sudden infant death"[MeSH Terms] OR ("sudden"[All Fields] AND "infant"[All Fields] AND "death"[All Fields]) OR "sudden infant death"[All Fields]) OR SID[All Fields])) OR (("sudden infant death"[MeSH Terms] OR ("sudden"[All Fields] AND "infant"[All Fields] AND "death"[All Fields]) OR "sudden infant death"[All Fields] OR ("sudden"[All Fields] AND "infant"[All Fields] AND "death"[All Fields] AND "syndrome"[All Fields]) OR "sudden infant death syndrome"[All Fields]) OR ("sudden infant death"[MeSH Terms] OR ("sudden"[All Fields] AND "infant"[All Fields] AND "death"[All Fields]) OR "sudden infant death"[All Fields] OR "sids"[All Fields]))) OR ("sudden infant death"[MeSH Terms] OR ("sudden"[All Fields] AND "infant"[All Fields] AND "death"[All Fields]) OR "sudden infant death"[All Fields] OR ("crib"[All Fields] AND "death"[All Fields]) OR "crib death"[All Fields])) OR ("sudden infant death"[MeSH Terms] OR ("sudden"[All Fields] AND "infant"[All Fields] AND "death"[All Fields]) OR "sudden infant death"[All Fields] OR ("crib"[All Fields] AND "deaths"[All Fields]) OR "crib deaths"[All Fields])) AND (((((("death"[MeSH Terms] OR "death"[All Fields]) AND Scene[All Fields] AND Investigation[All Fields]) OR DSI[All Fields]) OR (("infant death"[MeSH Terms] OR ("infant"[All Fields] AND "death"[All Fields]) OR "infant death"[All Fields]) AND scene[All Fields] AND investigation[All Fields])) OR (death-scene[All Fields] AND investigation[All Fields]))	94

PubMed

An additional keyword search was performed in PubMed. All keywords searched included the mesh term: "sudden infant death"[MeSH Terms].

Table 2: Additional keyword search performed in PubMed database.

This table to demonstrate that all keywords searched in PubMed resulted in the same MeSH Term.

Keyword	MeSH Term
Death scene investigation OR DSI	Sudden Infant Death
Infant death scene investigation	Sudden Infant Death
Death-scene investigation OR DSI	Sudden Infant Death
Sudden unexpected death of infant* OR SUDI	-
Sudden unexpected infant death* OR SUID	-
Cot death*	Sudden Infant Death
Crib death*	Sudden Infant Death
Sudden infant death OR SID	Sudden Infant Death
Sudden infant death syndrome OR SIDS	Sudden Infant Death

Ulrich's Periodicals Database – A librarian's tool.

Ulrich's Web was used to check in which database, each journal (Forensic Science International, International Journal of Legal Medicine and Journal of Forensic Sciences) was indexed. Each journal searched has been indexed in several databases including PubMed. This was performed using the following search strategy:

Forensic Science International

("Forensic science international"[Journal]) AND ((((((((((Sudden Unexpected Death of Infants or SUDI)) OR (Sudden Unexpected Infant Death or SUID)) OR Cot Death) OR Cot Deaths) OR (Sudden Infant Death or SID)) OR (Sudden Infant Death Syndrome or SIDS)) OR crib death) OR crib deaths)) AND ((((Death Scene Investigation or DSI)) OR infant death scene investigation) OR death-scene investigation))

With 4 results - All redundant/duplicates.

International Journal of Legal Medicine

("International Journal of Legal Medicine"[Journal]) AND ((((((((((Sudden Unexpected Death of Infants or SUDI)) OR (Sudden Unexpected Infant Death or SUID)) OR Cot Death) OR Cot Deaths) OR (Sudden Infant Death or SID)) OR (Sudden Infant Death Syndrome or SIDS)) OR crib death) OR crib deaths)) AND ((((Death Scene Investigation or DSI)) OR infant death scene investigation) OR death-scene investigation))

With 3 results - All redundant/duplicates.

Journal of Forensic Sciences

("J Forensic Sci"[Journal]) AND ((((((((((Sudden Unexpected Death of Infants or SUDI)) OR (Sudden Unexpected Infant Death or SUID)) OR Cot Death) OR Cot Deaths) OR (Sudden Infant Death or SID)) OR (Sudden Infant Death Syndrome or SIDS)) OR crib death) OR crib deaths)) AND ((((Death Scene Investigation or DSI)) OR infant death scene investigation) OR death-scene investigation))

With 5 Results - All redundant/duplicates.

Appendix B – Studies that performed death scene investigation

Table 1: Studies that performed DSI.

This table documents all studies for which a DSI was performed. These are separated according to the flow diagram, Figure 1.2. From the studies it is documented as to whether the need for a DSI was stated, whether a DSI was alluded to, the name of the DSI protocol utilised (if utilised and documented), the use of a death investigation protocol which includes DSI and the use of self-created DSI forms. The studies for which no column is filled in, indicated the performance of DSI but gave no further detail regarding this. Countries marked with (*) are categorised as developing countries, the ◊ symbol indicates DSI guidelines by Koehler et al. (2001) and the ○ symbol indicates the use of the Death-Scene Investigative Checklist for Child Fatalities, developed by the Missouri Child Fatality Review Program (Ewigman, Kivlahan & Land, 1993).The studies highlighted in yellow are a repeat as they fit in both categories.

Type of Study	Name of Protocol or Form Utilised	Article	Country	Need for DSI stated	DSI protocol alluded to
Articles where DSI was performed:					
Articles in which a standardised DSI protocol was used (20):					
Articles in which name of standardised protocol was given (8):					
Case report	CDC, Atlanta, GA, USA	(Dempers et al., 2011)	South Africa*		
		(Ladham et al., 2001)	United States of America		
Prospective study		(Shields et al., 2005)	United States of America		
Retrospective review		(Erck Lambert et al., 2016)	United States of America	X	CDC, Atlanta, GA, USA (SUIDRF)
		(Paul, Simms & Mahesan, 2017)	United States of America		
		(Sauber-Schatz, Sappenfield & Shapiro-Mendoza, 2015)	United States of America	X	
Case report	◊	(Balci et al., 2007)	Turkey		
Retrospective review	○	(Kemp et al., 2000)	United States of America		
Articles in which self-created forms were used(3):					
Retrospective review		(Bowen & Marshall, 2004)	United States of America		
	IDIF Forms (1999)	(Perrizo & Pustilnik, 2006)	United States of America	X	
	NYC OCME	(Senter et al., 2011)	United States of America	X	

Table 1 cont.

Type of Study	Name of Protocol or Form Utilised	Article	Country	Need for DSI stated	DSI protocol alluded to
Articles in which it was not clear what standardised DSI protocol was used (6):					
Retrospective review		(Byard et al., 2001)	Australia & United States of America		
		(Byard & Jensen, 2008)	Australia		
		(Byard, Carmichael & Beal, 1994)	Australia	X	
		(Krous et al., 2007)	United States of America		
		(Landi et al., 2005)	United States of America & Uruguay*	X	
		(Trachtenberg et al., 2012)	United States of America		
Standardised protocol for general SUDI investigation that included DSI (4):					
Retrospective review		(Gianelli Castiglione, Greenwald & Stephens, 1993)	United States of America	X	
		(Rambaud & Guilleminault, 2004)	France		
	NYC OCME	(Senter et al., 2011)	United States of America	X	
		(Zapata Vazquez et al., 2015)	England		
Unclear if a protocol was used (if any) (54):					
Retrospective review		(Ackerman & Gilbert-Barness, 1997)	United States of America		
		(Alexander & Radisch, 2005)	United States of America		
		(Beal, S.M., 1989)	Australia		
		(Beal, S.M. & Byard, 2000)	Australia		
		(Beal, S. M., 2000)	Australia		
		(Byard & Beal, 1995)	Australia		
		(Byard & Beal, 1997)	Australia		
		(Byard, 1998)	Australia		

Table 1 cont.

Type of Study	Name of Protocol or Form Utilised	Article	Country	Need for DSI stated	DSI protocol alluded to
Retrospective review		(Byard, Beal & Bourne, 1994)	Australia		
		(Choe et al., 2012)	Korea	X	
		(Collins, 2001)	United States of America	X	
		(Copeland, 1987)	United States of America		
		(Côté, Russo & Michaud, 1999)	Canada		
		(du Toit-Prinsloo et al., 2013)	South Africa*	X	Dundee protocol (Sadler, 1998)
		(Francisco, 1970)	United States of America		
		(Garstang, Griffiths & Sidebotham, 2017)	England		
		(Gessner, Ives & Perham-Hester, 2001)	United States of America		
		(Glasgow, Thompson & Ingram, 2006)	Ireland		
		(James, Klenka & Manning, 2003)	England		
		(Jensen et al., 2012)	Australia & Denmark	X	
		(Knight, Hunsaker & Corey, 2005)	United States of America	X	CDC, Atlanta, GA, USA (SUIDRF)
		(Li, L. et al., 2005)	United States of America	X	CDC, Atlanta, GA, USA (SUIDRF)
		(Li, L. et al., 2009)	United States of America		
		(Luke, 1978)	Columbia		
		(Mirchandani et al., 1991)	United States of America		
		(Mitchell et al., 2000)	Australia		CDC, Atlanta, GA, USA (SUIDRF)
		(Mitchell et al., 2000)	Australia		CDC, Atlanta, GA, USA & (Sturner, 1995)
		(Ostfeld et al., 2010)	United States of America		
		(Ostfeld et al., 2006)	United States of America		
		(Person, Lavezzi & Wolf, 2002)	United States of America		

Table 1 cont.

Type of Study	Name of Protocol or Form Utilised	Article	Country	Need for DSI stated	DSI protocol alluded to
Retrospective review		(Rambaud & Guilleminault, 2012)	France		
		(Sadler, 1998)	Scotland		
		(Scheers, Rutherford & Kemp, 2003)	United States of America		
		(Shen et al., 2009)	United States of America	X	
		(Thogmartin, Siebert & Pellan, 2001)	United States of America		
		(Toro et al., 2015)	Hungary		
		(Werne & Garrow, 1947)	United States of America		
		(Winkel et al., 2011)	Denmark		
Prospective study		(Bergman et al., 1972)	United States of America		
		(Kemp et al., 1993)	United States of America		
		(Sidebotham et al., 2010)	England		
Case-control study		(Blair et al., 2009)	England		
		(Hauck et al., 2003)	United States of America		
		(Li, De-Kun et al., 2003)	United States of America		
		(Ponsonby et al., 1992)	Australia		
		(Tappin, Ecob & Brooke, 2005)	Scotland		
		(Taylor et al., 1996)	United States of America		
Case Reports		Byard RW, Bourne AJ, Beal SM. 1996	Australia		
		(Dempers et al., 2011)	South Africa*		
		(Gilbert-Barness et al., 1991)	United States of America		

Table 1 cont.

Type of Study	Name of Protocol or Form Utilised	Article	Country	Need for DSI stated	DSI protocol alluded to
Case Reports		(Lavezzi et al., 2015)	Italy		
		(Perrot & Nawojczyk, 1988)	United States of America	X	
		(Sakai et al., 2009)	Japan		
		(Smialek & Lambros, 1988)	United States of America		

Appendix C – Articles documenting the performance of common data gathering methods.

Table 1: Articles documenting the performance of common data gathering methods.

Articles used to construct Venn diagram (Figure 1.4) based on what data gathering methods were used for recording information from the scene.

AUTHOR	TYPE OF STUDY	AREA/COUNTRY	PHOTOGRAPHS	SCENE REENACTMENT	SCENE REENACTMENT WITH DOLL	WITNESS ACCOUNTS	INTERVIEW
(Beal, S.M., 1989)	Retrospective review	Australia					X
(Beal, S. M., 2000)	Retrospective review	Australia					X
(Beal, S.M. & Byard, 2000)	Retrospective review	Australia					X
(Bergman et al., 1972)	Retrospective review	United States of America					X
(Blair et al., 2009)	Case-control study	England					X
(Byard & Beal, 1995)	Retrospective review	Australia					X
(Byard & Beal, 1997)	Retrospective review	Australia		X	X		
(Byard, Bourne & Beal, 1996)	Case Report	Australia		X			
(Byard & Jensen, 2008)	Retrospective review	Australia	X - and video		X		X
(Byard, Carmichael & Beal, 1994)	Retrospective review	Australia					X
(Choe et al., 2012)	Retrospective review	Korea					X
(Côté, Russo & Michaud, 1999)	Retrospective review	Canada					X
(Dempers et al., 2011)	Case Report	South Africa		X			X

Table 1 cont.

AUTHOR	TYPE OF STUDY	AREA/COUNTRY	PHOTOGRAPHS	SCENE REENACTMENT	SCENE REENACTMENT WITH DOLL	WITNESS ACCOUNTS	INTERVIEW
(du Toit-Prinsloo et al., 2013)	Retrospective review	South Africa			X		
(Erck Lambert et al., 2016)	Retrospective review	United States of America	X	X	X	X	X
(Garstang, Griffiths & Sidebotham, 2017)	Retrospective review	England					X
(Gessner, Ives & Perham-Hester, 2001)	Retrospective review	United States of America					X
(Gianelli Castiglione, Greenwald & Stephens, 1993)	Retrospective review	United States of America				X	X
(Hauck et al., 2003)	Case-control study	United States of America	X				X
(Kemp et al., 1993)	Prospective Study	United States of America			X	X	X
(Kemp et al., 2000)	Retrospective review	United States of America	X		X	X	
(Ladham et al., 2001)	Case Report	United States of America	X			X	X
(Landi et al., 2005)	Retrospective review	United States of America & Uruguay	X				X
(Luke, 1978)	Retrospective review	Columbia					X
(Paul, Simms & Mahesan, 2017)	Retrospective review	United States of America		X		X	X
(Person, Lavezzi & Wolf, 2002)	Retrospective review	United States of America	X				
(Ponsonby et al., 1992)	Case-control study	Tasmania					X

Table 1 cont.

AUTHOR	TYPE OF STUDY	AREA/COUNTRY	PHOTOGRAPHS	SCENE REENACTMENT	SCENE REENACTMENT WITH DOLL	WITNESS ACCOUNTS	INTERVIEW
(Rambaud & Guilleminault, 2012)	Retrospective review	France	X			X	X
(Sauber-Schatz, Sappenfield & Shapiro-Mendoza, 2015)	Retrospective review	United States of America		X	X		
(Shen et al., 2009)	Retrospective review	United States of America & China				X	X
(Shields et al., 2005)	Prospective Study	United States of America					X
(Smialek, 1986)	Case Report	United States of America					X
(Taylor et al., 1996)	Case-control study	United States of America					X
(Werne & Garrow, 1947)	Retrospective review	United States of America					X
(Winkel et al., 2011)	Retrospective review	Denmark				X	

Appendix D – Observation and Note Taking Sheet

Observation and Note Taking Sheet

Death Scene Investigation					
Time of arrival on scene:					
Time of departure from scene:					
Did a pathologist attend the scene?	Yes		No		
Did EMS attend the scene?	Yes		No		
Photographs taken	Yes		No		
Scene recreation	Yes		No		
Scene recreation with doll	Yes		No		
Infant medical history documented:	Yes		No		
Witness interviews	Yes		No		
If yes, with who?					
Suburb of Death:					
Were the following asked, checked or documented:					
Scene Temperature	Yes		No		
Scene airflow	Yes		No		
Environmental Hazards (eg. Carbon monoxide, cleaning chemicals, electrical devices, illicit drug and cigarette smoke exposure, possible entanglements etc.)					
Was there evidence of the following:					
Smoking	Yes		No		Notes:
Drugs or alcohol	Yes		No		Notes:

Table cont.

Medicine	Yes		No		Notes:
Heater	Yes		No		Notes:
Position of the infant when placed to sleep mentioned?	Yes		No		Notes:
Position when found	Yes		No		Notes:
Was it mentioned that this is the usual sleep environment?	Yes		No		Notes:
Infant moved	Yes		No		Notes:
Description of airway documented	Yes		No		Notes:
Wedging	Yes		No		Notes:
Possibility of co-sleeping	Yes		No		Notes:
Overlaying	Yes		No		Notes:
Tightly wrapped or swaddled?	Yes		No		Notes:
Bedding under infant	Yes		No		Notes:
Bedding over infant	Yes		No		Notes:

Table cont.

Mattress Type					
Clothing documented:	Yes		No		Notes:
Temperature of infant to the touch documented:	Yes		No		Notes:
Items within reach of infant	Yes		No		Notes:
Was evidence collected at scene?	Yes		No		Notes:
Drugs/medicine collected?	Yes		No		Notes:
NOTES - What was done on scene & order things are done on scene:					
Post-Mortem Examination					
Extent of PM performed?					
Ancillary investigations performed:					
Toxicology	Yes		No		

Table cont.

Microbiology or virology	Yes		No	
Histology	Yes		No	
Blood chemistry	Yes		No	
Radiography	Yes		No	
Genetic Testing	Yes		No	
Metabolic Testing	Yes		No	
Other ancillary testing performed?	Yes		No	
If yes, what additional tests were performed?				
Cause of death formulated at PM:				
Note				
Who answered the questions?				
What emotions were there?				
NOTES – Other notes at PM:				

Appendix E - National Survey of Registered Forensic Pathologists in South Africa 2018

as part of the Masters project:

EXPLORING THE MEDICO-LEGAL DEATH SCENE INVESTIGATION OF SUDDEN UNEXPECTED DEATH OF INFANTS AT SALT RIVER MORTUARY

Tracy Bennett

BNNTRA001

Supervisor: Laura Heathfield

Co-Supervisor: Professor Lorna Martin

MPhil Biomedical Forensic Sciences

University of Cape Town

Section 1 of 9

Exploring the medico-legal death scene investigation of sudden unexpected death of infants at Salt River Mortuary.

I would like to invite you to participate in a survey pertaining to death scene investigation of SUDI cases. This survey forms part of my Masters research study that involves an investigation into realistic and feasible ways to improve the current death scene investigation of SUDI cases in a local South African setting.

The next page contains information that will explain the details of the study. Please feel free to read this information at your leisure. Should you choose to participate in the survey, click the button to continue, which appears after all the study information has been given.

I would like to emphasise that participation in this study is completely voluntary, and withdrawal of your participation at any stage of the project is allowed.

Ethical approval has been granted by the University of Cape Town, Human Research Ethics Committee (HREC REF: 218/2018).

If, at any stage, more clarification is needed or there is something that you don't quite understand please feel free to contact me:

Tracy Bennett (MPhil: Biomedical Forensic Science student)

Division of Forensic Medicine and Toxicology | University of Cape Town

Contact Number: 083 503 2308

Email address: tracy.bennett879@gmail.com

Please find "Informed Consent" document attached:

- What the research study involves
- Why you have been invited to participate
- How you will be involved in the research
- Whether there are any risks involved
- Whether there are any benefits to you taking part in this study
- How and where your answers will be stored
- How your confidentiality will be protected

By completing the survey, you are indicating the following:

I give informed consent to participate in this research study. I agree to take part in the completion of the survey which contributes towards the research project titled “Exploring the medico-legal death scene investigation of sudden unexpected death of infants in South Africa”.

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.

- I am able to ask questions and all my questions will be adequately answered.
- I understand that taking part in this study is voluntary and I have not been pressurised to take part.

□ Continue to survey

□ No Thank You

Section 2 of 9

SECTION A – Survey related questions

A1. Is determining the cause of death which is to be stated on the death certificate part of your job description?

□ Yes

□ No – You are not eligible to complete this survey. Thank you.

Section 3 of 9

SECTION B – Mortuary Characteristics

B1. What is the average size of the living population in the jurisdiction that is served by your mortuary (Select one)?

- 1 000 000 or more
- 500 000 to 999 999
- 250 000 to 499 999
- 100 000 to 249 999
- 50 000 to 99 999
- 25 000 to 49 999
- 10 000 to 24 999
- 5 000 to 9 999
- 2 500 to 4 999

- Less than 2 500
- I'm unsure

B2. How many cases on average does your mortuary investigate per year (Select one)?

- 4 000 or more
- 3 000 to 3 999
- 2 000 to 2 999
- 1 000 to 1 999
- 500 to 999
- Less than 500
- I'm unsure

B2.1. On average, what percentage of the cases investigated by your office per year are sudden unexpected infant death cases?

_____

B3. In which province is the mortuary at which you work situated?

_____

Section 4 of 9

SECTION C – Case Studies

In this section, case descriptions are provided in order for you assess and give the cause of death. The aim was to simulate real life situations in where not all information is available.

Please Note – For this survey the term "infant" addresses an individual who is less than a year in age.

C1. Scenario 1: A 3 month old male born at 38 weeks gestation with no complications. Infant placed to sleep on his side on an adult full bed with mother. Mother reports awaking at 4am and finding infant deceased. A Statscan Critical Imaging System (Lodox Systems (Pty) Ltd. South Africa, 2000) was used to perform a scan, which showed the presence of lung infiltrates and an external examination was performed which showed sunken orbits, a sunken anterior fontanelle and loss of skin turgor. It was decided that the

infant would not be opened for a full or partial autopsy. - Given this scenario what would your cause of death determination be?

_____

_____

_____

C1.1 Under ideal circumstances, what else would you want to know in order to determine the cause of death for this case? (with regards to scenario 1)

_____

_____

_____

C1.2 The family later disclosed that the mother had been sick and was highly medicated at the time of death of the infant. With this new information, what additional steps and tests would you have performed at autopsy? (with regards to scenario 1)

_____

_____

_____

C1.3 Had prescription medication (or indication thereof) been found on the scene, would you have performed the additional steps and tests mentioned in C1.2 above? (Solely based on the scene information)

□ Yes

□ No

C2. Scenario 2: Two month old female born at 36 weeks gestation weighing 2518.5 grams. The infant resided in a dwelling in an informal settlement. The infant was placed to sleep on her side on an adult queen bed, whereboth parents also sleep. A full autopsy was performed which showed petechial haemorrhages (in the lungs, heart and thymus), lung infiltrates, blood vessel congestion and pulmonary oedema. There was negative toxicology, negative histology and no findings consistent with abuse. - Given this scenario what would your cause of death determination be?

_____

_____

_____

C2.1 Under ideal circumstances, what else would you want to know in order to determine the cause of death for this case? (with regards to scenario 2)

_____

_____

_____

C3. Scenario 3: A 5 month old male infant was found dead on the couch on its left side. He was wearing a dry diaper and a thin blanket covered the body, excluding the head/face. The infant was born at full term and there were no prenatal or postnatal medical conditions. The home was well cared for. The FPO that attended the scene reported that the family had made mention of the baby being of good health prior to death. This was the parents' first child. A complete autopsy was performed which showed no abnormalities, histology showed normal organs, and toxicology tests for alcohol, drugs of abuse, and therapeutic drugs were negative. The office could not afford to have testing performed for genetic cardiac abnormalities. - Given this scenario what would your cause of death determination be?

_____

_____

_____

C3.1 Under ideal circumstances, what else would you want to know in order to determine the cause of death for this case? (with regards to scenario 3)

_____

_____

_____

Section 5 of 9

SECTION D – Opinion and Knowledge Questions

Answer these questions utilising your knowledge as a forensic pathologist.

D1. How do you define Sudden Infant Death Syndrome (SIDS)?

_____

_____

_____

D1.1. Do you consider SIDS as a cause of death?

□ Yes □ No

Why or why not?

_____

_____

_____

D2. How do you define sudden and unexpected death of infants (SUDI)?

_____

_____

_____

D2.1. Do you consider SUDI as a cause of death?

□ Yes □ No

Why or why not?

_____

_____

_____

D3. Do you consider SIDS and SUDI as terms which are able to be used interchangeably?

_____

_____

_____

D4. Do you use undetermined as a cause of death when dealing with sudden and unexpected death of infant cases?

□ Yes □ No

D4.1 Why or why not?

_____

_____

_____

D4.2. What other classifications of cause of death have you used when dealing with sudden and unexpected death of infant cases? (tick all that apply)

□ Natural death

□ Unnatural death

□ Asphyxia

□ Hypoxia

□ Suffocation

□ Wedging

□ Overlay

□ Aspiration

□ SIDS

□ Unexplained

□ Undetermined

□ Unascertained

Section 6 of 9

SECTION E – Practices

E1. Does your mortuary make use of a protocol for investigating SUDI cases?

□ Yes, routinely

□ Yes, on a case-by-case basis

□ No, never

□ I'm unsure

E1.1 If no, why not?

_____

_____

_____

E1.2 If yes, what aspects does your protocol include?

□ Scene Investigation

□ Post-mortem Examination

□ Ancillary investigations

□ Identification process

□ Questionnaire

E2. How often are the procedures below utilised in an investigation of sudden and unexpected infant death? (Check the appropriate box.)

	Always / routinely	Most of the time	Sometimes / occasionally	Never Utilised	I'm unsure
Full Autopsy					
Partial Autopsy					
External Examination					
Interviews with family members					
Interviews with witnesses					
Medical history of infant					
Dietary history of infant					
Photography and video footage					
Diagram of scene					
Infant body diagram					
Analysis of collected scene evidence					
Visit to the original death scene					
Scene recreation with the use of a doll					

E2. Table cont.

Scene recreation without the use of a doll					
X-rays					
Lodox (Statscan Critical Imaging System (Lodox Systems (Pty) Ltd. South Africa, 2000))					
Reviewing the record of the first responder					
Toxicological analysis					
Metabolic screening					
Genetic screening					
Microbiology					
Vitreous Electrolytes					
Histology					
Bacterial Cultures					
Virology					

E2. 24. If other procedures utilised in an investigation of sudden and unexpected infant death, please list:

_____

_____

_____

E3. What factors or evidence would cause you to make a cause of death determination of the following:

E3.1 Overlay? (tick all that apply)

- ❑ Bed-sharing
- ❑ Statement from bed-sharer that overlay occurred
- ❑ Lividity patterns consistent with reported overlay circumstances
- ❑ Overweight bed-sharer
- ❑ Inebriation of bed-sharer

- ❑ Petechial haemorrhages
- ❑ No other fit cause of death
- ❑ Other – please specify:

E3.2 Wedging? (tick all that apply)

- ❑ Body still in wedged position
- ❑ Lividity patterns consistent with reported wedging circumstances
- ❑ Inebriation of adults
- ❑ Petechial haemorrhages
- ❑ No other fit cause of death
- ❑ Other – please specify:

E3.3 Suffocation? (tick all that apply)

- ❑ Blanched lividity consistent with nose and mouth obstruction
- ❑ Statement that the nose and mouth of the infant were obstructed
- ❑ Infant laying on soft pillows and bedding
- ❑ Petechial haemorrhages
- ❑ Foamy or bloody fluid on object that obstructed the nose and mouth
- ❑ Blood vessel congestion
- ❑ No other fit cause of death
- ❑ Other – please specify:

E4. Are pathologists and/or officers in your office required to complete training specific to infant death scene investigation?

□ Yes

□ No - why not?

E5. Do you, as a certified forensic pathologist, attend the death scene of sudden and unexpected infant deaths?

□ Yes, routinely

□ Yes, on a case-by-case basis

□ No, never

□ I'm unsure

E5.1 If no, why not?

Section 7 of 9

SECTION F – Demographics

F1. What is your job title? (Senior consultant, consultant, clinical head…)

_____

F2. What training have you undergone in relation to infant death investigation?

_____

_____

_____

F3. How many years of experience do you have in your profession?

_____

F4. During last year (2017) approximately how many infant deaths have you investigated or consulted on?

_____

F5. Approximately how many infant deaths have you investigated or consulted on in your career?

_____

Section 8 of 9

SECTION G – Additional Comments

G1. Are there ways you believe you and your colleagues could get more involved in sudden unexpected infant death scene investigation, but currently do not do so due to lack of time and resources?

□ Yes – continue to G1.1

□ No - continue to G1.2

G1.1. Please describe ways you would get more involved if it was feasible:

_____

_____

_____

G1.2. Besides time and resources, what else could be contributing to you being unable to get more involved in SUDI death scene investigation?

_____

_____

_____

G2. What do you think the value of death scene investigation with regards to SUDI cases is?

_____

_____

_____

G3. Do you think it should be the role of the forensic pathologist or forensic pathology officer (FPO) to investigate these scenes?

- ❑ Forensic Pathologist
- ❑ FPO

G3.1 Why?

_____

_____

_____

G4. Should there be a dedicated death scene investigator role, as seen in the USA, to specifically investigate death scenes?

- ❑ Yes

- ❑ No

G4.1 Is there a reason for this answer?

_____

_____

_____

G5. What further information gathered on the death scene would assist the post-mortem examination process?

_____

_____

_____

G6. Do you have any ideas or recommendations to improve the death scene investigation of SUDI cases in South Africa?

_____

_____

_____

G7. Do you believe that training with regards to cases of sudden unexpected infant death would be beneficial to you and your colleagues?

□ Yes

□ No

G7.1 If yes, and a full day training symposium was to be hosted, are there any topics in particular that you can suggest the talks to be focussed towards?

_____

_____

_____

G8. If additional resources were offered, ideally, which resources would you say would be of the greatest assistance in sudden unexpected infant death cases?

_____

_____

_____

G9. Please use this space to make any additional comments regarding the process of sudden unexpected infant death investigation and reporting practices that may not have been covered in this survey:

_____

_____

_____

_____

_____

_____

Section 9 of 9

Thank you for your participation.

OPTIONAL: If you would like to leave your name email address for me to follow up on your responses, please leave the details here. However, this does not form part of the completion of this survey, and is entirely optional.

_____

Appendix F - Variables to be collected from the Records from the Autopsy Database (HREC: R036/2014)

SCENE INFORMATION

Was there FPS response to scene?				Yes	No
Post-mortem performed		Date:		Time:	
Call received		Date:		Time:	
Arrival on scene		Date:		Time:	
Death declaration		Date:		Time:	
Body received		Date:		Time:	
Depart from scene		Date:		Time:	
Arrive at facility		Date:		Time:	
Was a death scene recreation with or without doll documented?				Yes	No
Facial Photographs taken:				Yes	No
Number of Scene Photographs taken:					
Comments on Photographs (if necessary)					
Was a scaled sketch performed?				Yes	No
Age:	Documented?			Yes	No
Sex:	Documented?			Yes	No
Scene Address / GPS coordinates	Documented?			Yes	No
Suburb of Death					
Location / Scene of death					
Dwelling type					
Did the infant die at the hospital? Or was the infant DOA?				Yes	No
If yes…	Did the FPO go back and attend the death scene?			Yes	No
Was section A of the FPS006(b) filled in?				Complete	
				Partial	
				Blank	
Was section B of the FPS006(b) filled in?				Complete	
				Partial	

Scene Information cont.

	Blank	
Was it documented as to whether EMS was called to the scene?	Yes	No
Was there a forensic pathologist present at the scene?	Yes	No
Was section C of the FPS006(b) filled in?	Complete	
	Partial	
	Blank	
Was the scene temperature documented?	Yes	No
Was the scene's air flow documented?	Yes	No
Was evidence of rodent activity, insect activity or animal activity documented?	Yes	No
Were there any environmental hazards documented? (eg. Carbon monoxide, cleaning chemicals, electrical devices, illicit drug and cigarette smoke exposure, possible entanglements etc.)	Yes	No
Was there anyone smoking in the room where the infant slept?	Yes	No
Did the caregiver use drugs or alcohol on the night the infant died?	Yes	No
Was it documented as to whether a heater was used?	Yes	No
Was the position of the infant when found dead documented?		
Was whether the infant had been moved documented?	Yes	No
Was it documented as to whether the nose and mouth of the infant were covered by anything – eg blankets or anything else?	Yes	No
Was it documented as to whether the face and or chest of the infant was squashed/wedged between any object(s) when found?	Yes	No
Was overlaying documented? (Anyone found on top of the baby)	Yes	No
Was section D of the FPS006(b) filled in?	Complete	
	Partial	
	Blank	
Was there documentation from the scene regarding who last saw the infant alive?	Yes	No
Was the location (place) of the infant when found documented? Where was the infant found dead?	Yes	No
Sleep surface documented?		
Mattress type documented?		

Scene Information cont.

Was the mattress covered by a blanket or a sheet?	Yes	No
Was the position of the infant when put to sleep documented?		
Was it documented was to whether anything was used to cover the infant?	Yes	No
Was the position of the infant when found dead documented?		
Was whether the infant had been moved documented?	Yes	No
Was the face position of the infant documented?	Yes	No
Was it documented as to whether the face and or chest of the infant was squashed/wedged between any object(s) when found?	Yes	No
Was it documented as to whether the nose and mouth of the infant were covered by anything – eg blankets or anything else?	Yes	No
Was it documented as to whether there were other items in contact with the baby – eg pillow?	Yes	No
Was whether the infant co-slept documented?	Yes	No
Was whether the infant slept on the chest of anyone documented?	Yes	No
Was if documented how many other people slept on the same bed as the infant at the time that the infant died?	Yes	No
Was overlaying documented? (Anyone found on top of the baby)	Yes	No
Was it documented as to whether anyone in the house smoked in the house while the infant slept on the night/day of death?	Yes	No
Was it documented as to whether anyone used alcohol on the night baby died?	Yes	No
Was it documented as to whether anyone used drugs on the night/day the infant was found dead?	Yes	No
Was it documented as to whether the mother/caretaker gave the infant medicine on the night/day of death?	Yes	No
Was section E of the FPS006(b) filled in?	Complete	
	Partial	
	Blank	
Was what the infant was wearing (clothing) at time of death documented?	Yes	No
Was section F of the FPS006(b) filled in?	Complete	
	Partial	

Scene Information cont.

	Blank	
Was section G of the FPS006(b) filled in?	Complete	
	Partial	
	Blank	
Place where the infant lives?		
Was the scene temperature documented?	Yes	No
Was the scene's air flow documented?	Yes	No
Was evidence of rodent activity, insect activity or animal activity documented?	Yes	No
Were there any environmental hazards documented? (eg. Carbon monoxide, cleaning chemicals, electrical devices, illicit drug and cigarette smoke exposure, possible entanglements etc.)	Yes	No
Was it documented as to whether a heater was used?	Yes	No
Was the number of smokers in the household documented?	Yes	No

POSTMORTEM DETAILS

Was history given to Pathologist		Yes	No
Extent of post-mortem examination performed?	EE	PA	FA
Were X-ray or Lodox scans taken?		Yes	No
Histology samples collected at post-mortem		Yes	No
Toxicology samples collected at post-mortem		Yes	No
Microbial samples collected at post-mortem		Yes	No
Cause of Death			

Appendix G - Data used for the generation of figures in "2.3.1.Retrospective Records Review"

Table 1: Table of data for Figure 2.1: Completion of the sections of the FPS006(b) document over 2016 and 2017.

Table demonstrating each section of the FPS006(b) document and the extent to which these sections were incomplete, partially complete or complete over the year of 2016 and 2017 for all SUDI cases admitted to SRM. The table also has values to indicate the number of times it was unknown whether the section was complete, incomplete or partially complete due to missing documentation; these are labelled unknown.

Sections	Completeness of sections			
	Incomplete	Partially Complete	Complete	Unknown
A	14.3%	13.9%	62.8%	9.0%
B	85.9%	3.7%	1.3%	9.0%
C	75.6%	4.4%	7.5%	12.6%
D	0.7%	56.4%	33.5%	9.5%
E	0.4%	47.4%	42.3%	9.9%
F	0.4%	21.1%	67.8%	10.6%
G	3.5%	14.5%	69.4%	12.6%

Table 2: Table of data for Figure 2.2: Elements assessed on scene at a SUDI death scene over 2016 and 2017.

Table showing the elements that were looked at on SUDI death scenes over 2016 and 2017 as guided by the findings of the retrospective review. The table give the number and percentage of times for which these elements were documented, undocumented or the data regarding these elements was missing. This data was gathered from section B and C of the FPS006(b) document, which is to be completed on scene.

	Element Undocumented	Element Documented	Data Missing
EMS present on scene	399 (88%)	14 (3%)	41 (9%)
Pathologist present on scene	410 (90%)	0 (0%)	44 (10%)
Scene Temperature	394 (87%)	3 (1%)	57 (13%)
Scene Air-flow	354 (78%)	43 (9%)	57 (13%)
Rodent, insect or animal activity	349 (77%)	48 (11%)	57 (13%)
Environmental Hazards	351 (77%)	46 (10%)	57 (13%)
Smoking in the room the infant slept	346 (76%)	51 (11%)	57 (13%)
Caregiver use of drugs or alcohol	348 (77%)	40 (9%)	66 (15%)
Heater	346 (76%)	42 (9%)	66 (15%)
Position in which infant was found	355 (78%)	29 (6%)	70 (15%)
Had infant been Moved	355 (78%)	29 (6%)	70 (15%)
Airways Covered	356 (78%)	25 (6%)	73 (16%)
Wedging	350 (77%)	33 (7%)	71 (16%)
Overlaying	349 (77%)	39 (9%)	66 (15%)

Table 3: Table of data for Figure 2.3: SUDI admission locations/scene types.

Table of scene types or locations of the infants prior to admission as a SUDI case at SRM. Eleven of the cases had missing data and it was therefore that the scene type associated with these cases is unknown.

Location	Number of Cases
Ambulance	2
Outdoors	2
Educational Institution	4
Fire Station	6
Unknown	11
Residential Property	14
Formal housing	110
Informal housing	128
Medical center	177

Table 4: Table of data for Figure 2.5: Questions asked at identification related to the circumstances of death/details about events before death

A table of the questions that were asked during the identification process over 2016 & 2017 and whether answers were documented or not. Data guided by the findings of the retrospective review. The table also indicates the percentage of times for which these questions had answers, had no answers or the data regarding these answers was missing.

	Answer Documented	Answer Undocumented	Data Missing
Last person to see infant alive	400 (88%)	15 (3%)	39 (9%)
Where infant was found dead	388 (85%)	26 (6%)	40 (9%)
Infant sleep surface	390 (86%)	23 (5%)	41 (9%)
Mattress type	364 (80%)	73 (16%)	17 (4%)
Sleep surface covering	328 (72%)	82 (18%)	44 (10%)
Position infant placed to sleep	386 (85%)	54 (12%)	14 (3%)
Covering over infant	313 (69%)	124 (27%)	17 (4%)
Position infant found	399 (88%)	37 (8%)	18 (4%)
Had infant been moved before DSI	304 (67%)	89 (20%)	61 (13%)
Face Position	345 (76%)	68 (15%)	41 (9%)
Wedging	369 (81%)	44 (10%)	41 (9%)
Were the infants airways covered	387 (85%)	26 (6%)	41 (9%)
Items in contact or reach of infant	365 (80%)	48 (11%)	41 (9%)
Co-sleeping	421 (93%)	18 (4%)	15 (3%)
Chest sleeping	391 (86%)	22 (5%)	41 (9%)
Number of co-sleepers	349 (77%)	89 (20%)	16 (4%)
Overlaying	394 (87%)	20 (4%)	40 (9%)
Smoking indoors on the day/night	327 (72%)	87 (19%)	40 (9%)
Was alcohol drank on the day/night	397 (87%)	19 (4%)	38 (8%)
Were drugs taken on the day/night	396 (87%)	20 (4%)	38 (8%)
Had the infant taken any medicine	390 (86%)	25 (6%)	39 (9%)

Table 5: Table of Figure 2.6: Questions asked at identification regarding the household environment.

Table showing the questions that were asked during the identification process, regarding the household environment, over 2016 & 2017, and whether answers were documented or not. Data guided by the findings of the retrospective review. This table indicates the percentage of times the answers to these questions were documented, undocumented or the data regarding these answers was missing.

	Place where the baby lives	Scene Air-flow	Rodent, insect or animal activity	Environmental Hazards	Heater	Number of smokers in the house
Answer Documented	81%	78%	75%	74%	77%	81%
Answer Undocumented	4%	8%	11%	12%	14%	9%
Data Missing	14%	14%	14%	14%	9%	9%

Table 6: Table of Figure 2.7: Extent of PM performed for each SUDI case.

Percentage performance of each extent of PM 2016 & 2017. External examination (n=288, 63.4%), being non-invasive, was performed most frequently. This was then followed by the performance of a full autopsy (n=106, 23.3%) and then a partial autopsy (n=47, 10.4%). The chart also represents the 2.9% of cases for which data on the extent of PM was unknown.

	Extent of PM
External Examination	63.4%
Partial Autopsy	10.4%
Full Autopsy	23.3%
Missing	2.9%

Table 7: Table of Figure 2.8: COD documented.

The COD categories documented over 2016 & 2017. A definitive COD was stated in 58.8% (n=267) of cases. Associated with or consistent with a certain COD was stated in 32.2% (n=146) of cases. With the remainder of cases COD stated as follows: under investigation in 6.8% of cases (n=31), unnatural deaths in 0.7% of cases (n=3), and undetermined in 1.1% of cases (n=5). Data regarding the COD was missing in 0.4% of the cases (n=2).

	Percentage
Specific Cause of Death Documented	58.8%
Missing Data	0.4%
Associated/Consistent With a specific COD	32.2%
Undetermined	1.1%
Under Investigation	6.8%
Unnatural	0.7%

Table 8: Table of Figure 2.9: Performance of ancillary tests per SUDI case.

Table of the percentage of times each ancillary test was performed for the SUDI cases over 2016 & 2017. Histology was performed the most frequently (n=94, 72.9%), followed by microbial testing (n=74, 16.3%) and lastly toxicology (n=48, 10.6%). The chart also represents the percentage cases for which data on the performance of ancillary tests was unknown.

	Ancillary Test Performed		
	Histology	Toxicology	Microbial Analysis
Tests Performed	20.7%	10.6%	16.3%
Tests Unperformed	72.9%	89.0%	81.5%
Data Missing	6.4%	0.4%	2.2%

Appendix H - Forensic Pathology Service FPS006(b) document/ SUDI questionnaire – original version used routinely until mid-2017

FORENSIC PATHOLOGY SERVICE

SUDI (Complete If A Baby Should Suddenly And Unexpectedly Die)

FPS laboratory_____ WC _____

Name of baby _____

Part 1: Scene Questionnaire and Observations

Date: ***Time:*** ***Name of Forensic officer:***

Section A. **Who gives the history/ information in this case e.g. mother/father/granny/grandpa/other relative(give details)**	
Name:	Relationship:
Address:	Contact telephone number:
ID Number:	
Infants full name:	
Home Address:	
Age of Baby	Date of birth:
Race:	Sex:

Section B **Person(s) at/called to the scene and relationship**		
Name/relationship	Date	Time
Name/relationship	Date	Time
Name/relationship	Date	Time
Police response/name	Date	Time
Paramedic response/name	Date	Time
When was the death certified/by whom	Date	Time
If the baby was taken to hospital		
Name of hospital		

WC_____

Date of arrival:	Time of arrival:
Name of doctor seen / declared death:	
Comment: Get copies of doctors notes	
Was resuscitation done on the baby by the paramedic or the doctors at the hospital?	

Section C
Household environment:

Place where baby lives: house shack other –		
Number of bedrooms Is the room in which the baby is found well ventilated?		
Odour(s) present in the room the baby slept in?	Yes	No
Peeling paint in the room the baby slept in?	Yes	No
Fungal growth (mould) in the room the baby slept in?	Yes	No
Did people smoke cigarettes in the room the baby slept?	Yes	No
Are there pets in the house? If yes – type and number:	Yes	No
Did caregiver use alcohol or drugs on the night baby died?	Yes	No
Was there a heater or open fire or galley blik or other heating device in room where baby slept?	Yes	No
In what position was the baby found lying? Has the baby been moved? Were there any covers/ clothing etc over the baby's head? Was the baby squashed/wedged between anything (object)?	Yes	No
Was there overlaying (someone lay on top of the baby)?	Yes	No
Comments from forensic officer who attended the scene:		

WC_____

Part 2: Facility Questionnaire

Date: ***Time:*** ***Name of Forensic officer:***

Section D
Circumstances of death / details about events before death

1. When was the baby last seen alive				Date	Time
2. Who last saw the baby alive					
3. When was the baby found dead				Date	Time
4. Who found the baby dead at the scene					
5. Was the baby ill?				Yes	No
a) If yes – What was wrong and for how long?					
b) Was the baby taken to the doctor or pharmacy or clinic or traditional healer for the illness? When (date and time)?				Yes	No
c) If not, why not:					
d) Was the baby admitted to a hospital or clinic for the illness: When (date and time)?				Yes	No
e) If not, do you know why not?					
f) What medication was given (names please					
6. Where was the baby found dead	Bed	Couch	Cot	Floor	Other
Other:					
7. Did the baby sustain any injuries – eg by falling or being hit: If yes:				Yes	No
a) When did it happen?					
b) How did it happen?					
c) Where did it happen?					
d) What did the caretaker do about it?					

WC_____

8. a) On what was the baby placed to sleep	Bed with a pillow	Bed without a pillow	Couch with a pillow	Couch without pillow	Cot with pillow
	Cot without pillow	Floor with pillow	Floor without pillow	Other	
b) If placed on a bed/cot, what was the mattress type			Foam rubber	Inner spring	Other
c) Was the mattress covered with a blanket or sheet				Yes	No
d) What position was the baby placed when put to sleep?		Back	Stomach	Side	Other
Other -					
e) what was used to cover the baby: List items					
e) What position was the baby found dead?		Back	Stomach	Side	Other
Other –					
f) Has the baby been moved?				Yes	No
g) Face position when the baby was found dead			To the left	To the right	Face down
			Face up	Unknown	
h) Face and or chest squashed / wedged between any object(s) when the baby was found dead?			Yes	No	Unknown
If yes – details please –					
i) Was the nose and mouth of the baby covered by anything – eg blankets or anything else			Yes	No	Unknown
j) Were there other items in contact with the baby – eg pillow			Yes	No	Unknown
k) Did the baby use a Dummy (pacifier)?				Yes	No
l) Did the baby sleep in the same bed as the mother?				Yes	No
m) Did the baby sleep in her arms?				Yes	No
n) Did the baby sleep on her chest?				Yes	No
o) Did the baby sleep with the mother on a couch?				Yes	No
p) How many other people slept on the same bed as the baby at the time the baby died?					
q) Was anyone found on top of the baby while in the bed (Overlaying)?				Yes	No
r) Was the window where the baby slept on the day /night the baby died				Open	Closed
s) Did the mother or anyone in the house smoke while the baby slept on the night/day of death?					
t) When was the baby last fed?				Date	Time

WC_____

u) Did the mother/caregiver use alcohol before going to bed with the baby on the night/day the baby was found dead? If yes, how much?	Yes	No
v) Did the mother/caregiver use drugs before going to bed with the baby on the night/day the baby was found dead? If yes, what drugs?	Yes	No
w) Did the mother/caregiver give the baby medication on the night/day of death? If yes, name of medication:	Yes	No

Section E
About the baby

1. Where was the baby born?	Hospital	Clinic	Home	Other
Name of hospital/clinic/other				
2. How was the baby born?			Normal vaginal delivery	Caesarian section
3. How much did the baby weigh at birth?				
4. Was the baby		Premature	Full term	Post dates (Overdue)
5. If the baby was premature, how premature was it?				
6. Did the baby receive Kangaroo care (KMC)			Yes	No
7. Did the mother carry the baby on her back?			Yes	No
8. Was the baby		Breast fed	Bottle/formula fed	Both breast and bottle fed
If formula, name of the milk –				
9. Was boiling water used to make the bottle?			Yes	No
10. What other food was use to feed the baby?				
11. Does the mother have the clinic card?			Yes	No
If yes – keep the card for the pathologist. If no – ask the mother to bring it to the facility				
12. Was the baby sick before it died?			Yes	No

If yes	<24h	>24h	> 2 weeks	Never
a) Did the baby have a cold/ runny nose?				
b) was the baby coughing?				
c) did the baby have diarrhea (runny tummy)?				

WC_____

d) Was the baby unusually restless / irritable?				
e) Was the baby crying more than usual?				
f) Was there a difference /change in the appetite / feeding?				
g) Was the baby vomiting?				
h) Any fits / seizures?				
i) did the baby have a fever / showed increased sweating?				
j) Was the baby listless? (floppy)				
k) did the baby turn blue?				
13. Was the now deceased baby taken to	Hospital	clinic	doctor	Pharmacy
	Traditional healer	Other		
14. Did the baby come in contact with someone who is sick in the past two weeks?			Yes	No
If yes – who?				
15. Did the baby ever suddenly stopped breathing?		Yes	No	Unknown
16. When was the baby's last vaccination?				
18. Is the baby known to be allergic to anything?		Yes	No	Unknown
If yes, what?				
19. Did the family visit another country prior to the death of the baby?			Yes	No
If yes, give details				
20. Was the baby admitted to hospital in the past week before the death?			Yes	No
a) If yes, for how long and where:				
b) Why?				
c) Discharge date?				
d) Condition of baby after discharge:				
e) Medication after discharge from the hospital (names please)				
21. Was the baby taken to a traditional healer?			Yes	No
a)If yes, date when the baby was taken to the healer:				

b) What was given?
c) Ask for the medication to be given to the pathologist.
d) Condition of the baby after going to the healer?
21. What did the baby wear when it died? (list clothing)

Section F
About the mother

1. Is the mother	Married	Single
2. Is the mother employed?	Yes	No
3. Age of the mother?		
4. What standard of schooling did she achieve?		
5. Was she on contraception before she fell pregnant?	Yes	No
6. Did she take iron and vitamin tablets during her pregnancy?	Yes	No
7. Did she receive antenatal care?	Yes	No
8. Did the mother have diabetes in pregnancy?	Yes	No
9. Did the mother have high blood pressure in pregnancy?	Yes	No
10. Did the mother gain weight adequately in pregnancy?	Yes	No
11. Was she diagnosed with any illness during the pregnancy eg. HIV?	Yes	No
12. Was the mother on any medication during the pregnancy?	Yes	No
If yes, what medication:		
13. Were there any difficulties during the delivery?	Yes	No
If yes, what?		
14. Were there any problems with the baby after the delivery?	Yes	No
If yes, what?		

WC_____

15. Was any specific instruction given about specific health care for the baby?				Yes	No
If yes, what?					
16. Was she depressed after the pregnancy?				Yes	No
17. Did she get any treatment?				Yes	No
18. How many babies does she have?					
19. How old are they?					
20. Are they healthy?				Yes	No
21. Do any of the babies have learning disability?				Yes	No
22. Do the living baby (ies) have the same father as the deceased baby?				Yes	No
23. Does she look after the baby?				Yes	No
24. If not, who looks after the baby?					
25. Why is the mother unable to look after the baby?					
26. Did the mother smoke during the pregnancy?				Yes	No
If yes, how many per day?					
27. Did the mother drink during the pregnancy?				Yes	No
a) What did she drink?	Beer	Wine		Spirits	Other
b) how much did she drink?		Every day		Now and again	Weekends
1 glass		Every day		Now and again	Weekends
> 1 glass		Every day		Now and again	Weekends
A bottle of alcohol		Every day		Now and again	Weekends
> 1 bottle		Every day		Now and again	Weekends
28. Does she use drugs?				Yes	No
a) If yes, what drugs does she use?	Tik	Cocaine	Heroin	Mandrax	Other
b) How often does she use drugs?		Every day		Now and again	Weekends
29. Does the mother smoke after the pregnancy?				Yes	No
30. Does the mother know that smoking harms the unborn baby?				Yes	No
31. Does the husband/partner drinks?				Yes	No

WC_____

32. Does the mother drink after the pregnancy?	Yes	No
33. Do the parents of the mother drink?	Yes	No
34. Does the mother know that alcohol harms the unborn baby?	Yes	No
35. Did the mother have a previous baby that died suddenly?	Yes	No
a) If yes, how many died?		
b) At what age?		
c) Was a PM done?	Yes	No
If yes, where was it done?		
36. Did the mother have a previous stillbirth?	Yes	No

Section G
Household environment

1. Place where the baby lives	House		Shack	Other
2. Number of bedrooms?				
3. Is the room in which the baby was found well ventilated?			Yes	No
4. Odour(s) present in the room the baby slept in?			Yes	No
5. Peeling paint in the room the baby slept in?			Yes	No
6. Fungal growth (mould) in the room the baby slept in?			Yes	No
7. Are there pets in the house?			Yes	No
If yes, type and number:				
8. Was the following in the room where the baby slept to heat the room?	Electric heater	"Galley"	Fire	Other
Describe other –				
9. Number of adults in the dwelling?				
10. Number of babyren in the dwelling?				
11. Total number of people in the dwelling?				
12. Estimated monthly income?				
13. Number of smokers in the dwelling?				
14. Are there mentally retarded/ challenged people in the dwelling?			Yes	No

WC_____

COMMENTS TO PATHOLOGIST FROM THE FORENSIC OFFICER WHO ATTENDED THE SCENE AND INTERVIEWED DURING ID PROCESS:

ITEMS RETAINED AT THE SCENE OR FROM THE MOTHER DURING INTERVIEW

Date:

Signature / Thumbprint of deponent

I certify that the above statement was taken down by myself and that the deponent has acknowledged that he / she knows and understands the contents hereof.

Date _____ Time: _____

Place: _____

_____

Department of Health
Forensic Pathology Laboratory

Appendix I - Forensic Pathology Service FPS006(b) document/ SUDI questionnaire – updated/revised version phasing in from mid-2017

FPS006(b)

FORENSIC PATHOLOGY SERVICE

SUDI – [Complete If A Baby under 1 year should suddenly and unexpectedly die]

FPS laboratory_____ WC _____

Name of baby _____

Part 1: Scene Questionnaire and Observations

Date: ***Time:*** ***Name of Forensic officer:***

Section A. **Who gives the history/ information in this case e.g. mother/father/granny/grandpa/other relative(give details)**	
Name:	Relationship:
Address:	Contact telephone number:
ID Number:	
Infants full name:	
Home Address:	
Age of Baby	Date of birth:
Race:	Gender:

Section B **Person(s) at/called to the scene and relationship**		
Name/relationship	Date	Time
Name/relationship	Date	Time
Name/relationship	Date	Time
Police response/name	Date	Time
Paramedic response/name	Date	Time
When was the death certified	Date	Time

WC_____

By whom		
If the baby was taken to hospital	Yes	No
Name of hospital		
Date of arrival: Time of arrival:		
Name of doctor seen / declared death:		
Comment: Get copies of doctors notes		
Was resuscitation done on the baby by the paramedic or the doctors at the hospital?		

Section C
Household environment:

Place where baby lived at the time of death, please circle one House Shack Other		
Number of bedrooms		
Is there enough fresh air circulating in the room in which the baby is found?	Yes	No
Odour(s) present in the room the baby slept in?	Yes	No
Was there peeling paint in the room in which the baby slept? Was the peeling paint anywhere near the baby's food	Yes	No
Was the room damp and was there fungal growth (mould) in the room in which the baby slept?	Yes	No
Did people smoke cigarettes in the room the baby slept?	Yes	No
Are there pets in the house? If yes – type and number:	Yes	No
Comments from forensic officer who attended the scene:		

WC_____

Does the mother suspect foul play by any other person/family member? Yes No
If yes, please describe.

Part 2: Facility Questionnaire

Date: ***Time:*** ***Name of Forensic officer:***

Section D
Circumstances of death / details about events before death

1. When was the baby last seen alive	Date	Time
2. Who last saw the baby alive		
3. When was the baby found dead	Date	Time
4. Who found the baby dead at the scene		
5. Was the baby ill?	Yes	No
a) If yes – What was wrong and for how long?		
b) Was the baby taken to any of the following? – please circle Yes or No doctor pharmacy clinic traditional healer When (date and time)?	 Yes Yes Yes Yes	 No No No No
c) If not, why not:		
d) Was the baby admitted to a hospital or clinic for the illness: When (date and time)?	Yes	No
e) If not, do you know why not?		
f) What medication was given at the hospital/clinic (names please)		

WC_____

6. Where was the baby found dead	Bed	Couch	Cot	Floor	Other
Other:					
7. Did the baby sustain any injuries – eg by falling or being hit: If yes:				Yes	No
a) When did it happen?					
b) How did it happen?					
c) Where did it happen?					
d) What did the caretaker do about it?					
8. a) On what was the baby placed to sleep	Bed with a pillow	Bed without a pillow	Couch with a pillow	Couch without pillow	Cot with pillow
	Cot without pillow	Floor with pillow	Floor without pillow	Other	
b) If placed on a bed/cot, what was the mattress type			Foam rubber	Inner spring	Other
c) Was the mattress covered with a blanket or sheet				Yes	No
d) What position was the baby placed when put to sleep?		Back	Stomach	Side	Other
Other -					
e) what was used to cover the baby: List items Was the baby's head covered, please describe					
f) What position was the baby found dead?		Back	Stomach	Side	Other
Other –					
g) Face position when the baby was found dead			To the left	To the right	Face down
			Face up	Unknown	
h) Face and or chest squashed / wedged between any object(s) when the baby was found dead?			Yes	No	Unknown
If yes – details please –					
i) Was the nose and mouth of the baby covered by anything – eg blankets if anything else			Yes	No	Unknown
j) Were there other items in contact with the baby – eg pillow			Yes	No	Unknown
k) Did the baby regularly use a dummy ?				Yes	No

WC_____

l) Did the baby use a dummy on the day of death?	Yes	No
m) Did the baby sleep with the mother and the father or another person? If yes, where: in the same bed in her arms next to her on her chest	Yes Yes Yes Yes Yes	No No No No No
n) How many other people slept on the same bed as the baby at the time the baby died?		
o) Was anyone found on top of the baby while in the bed (Overlaying)?	Yes	No
p) Did the mother or anyone in the house smoke while the baby slept on the night/day of death?		
q) When was the baby last fed?	Date	Time
r) Did the mother/caregiver use alcohol before going to bed with the baby on the night/day the baby was found dead? If yes, how much?	Yes	No
s) Did the mother/caregiver use drugs before going to bed with the baby on the night/day the baby was found dead? If yes, what drugs?	Yes	No
t) Did the mother/caregiver give the baby medication on the night/day of death? If yes, name the medication/s:	Yes	No

Section E
About the baby

1. Where was the baby born?	Hospital	Clinic	Home	Other
Name of hospital/clinic/other				
2. How was the baby born? What was the reason for the Caesarean section			Normal vaginal delivery	Caesarian section
3. How much did the baby weigh at birth?				
4. Was the baby		Premature	Full term	Post dates (Overdue)
5. If the baby was premature, how many weeks premature was the baby?				
6. Did the premature baby receive Kangaroo care which is skin to skin contact			Yes	No
7. Was the baby		Breast fed	Bottle/formula fed	Both breast and bottle fed

WC_____

If formula, name of the milk –				
8. Was boiling water used to make the bottle?			Yes	No
9. What other food was use to feed the baby?				
10. Does the mother have the clinic card?			Yes	No
If yes – keep the card for the pathologist. If no – ask the mother to bring it to the facility				
11. Was the baby sick before it died?			Yes	No
If yes	<24h	>24h	> 2 weeks	Never
a) Did the baby have a cold/ runny nose?				
b) Was the baby coughing?				
c) Did the baby have diarrhea (runny tummy)? How many nappies were used/changed per day				
d) Was the baby unusually restless / irritable?				
e) Was the baby crying more than usual?				
f) Was there a difference /change in the appetite / feeding?				
g) Was the baby vomiting?				
h) Any fits / seizures?				
i) Did the baby have a fever / feel very hot to touch?				
j) Was the baby listless? (floppy, no energy)				
k) Did the baby turn blue?				
13. Was the now deceased baby taken to	Hospital	clinic	doctor	Pharmacy
	Traditional healer	Other		
14. Did the baby come in contact with someone who is sick in the past two weeks? What was their sickness?			Yes	No
If yes – who was the person?				
15. Did the baby ever suddenly stop breathing?		Yes	No	Unknown
16. When was the baby's last vaccination?				
18. Is the baby known to be allergic to anything?		Yes	No	Unknown
If yes, what?				

WC_____

19. Did the family visit another country prior to the death of the baby?	Yes	No
If yes, give details		
20. Was the baby admitted to hospital in the past week before the death?	Yes	No
a) If yes, for how long and where:		
b) Why?		
c) Discharge date?		
d) Condition of baby after discharge:		
e) Medication after discharge from the hospital (names please)		
21. Was the baby taken to a traditional healer?	Yes	No
a)If yes, date when the baby was taken to the healer:		
b) What was given?		
c) Ask for the medication to be given to the pathologist.		
d) Condition of the baby after going to the healer?		
21. What did the baby wear when it died? (list clothing)		

Section F
About the mother

1. Is the mother	Married	Single
2. Is the mother employed?	Yes	No
3. Age of the mother?		
4. What standard of schooling did she achieve?		
5. Was she on contraception before she fell pregnant?	Yes	No
6. Did she take iron and vitamin tablets during her pregnancy?	Yes	No
7. Did she receive antenatal care?	Yes	No
8. Did the mother have diabetes in pregnancy?	Yes	No

WC_____

9. Did the mother have high blood pressure in pregnancy?			Yes	No
10. Did the mother gain weight adequately in pregnancy?			Yes	No
11. Was she diagnosed with any illness during the pregnancy eg. HIV?			Yes	No
12. Was the mother on any medication during the pregnancy?			Yes	No
If yes, what medication:				
13. Were there any difficulties during the delivery?			Yes	No
If yes, what?				
14. Were there any problems with the baby after the delivery?			Yes	No
If yes, what?				
15. Was any specific instruction given about specific health care for the baby?			Yes	No
If yes, what?				
16. Was she depressed after the pregnancy?			Yes	No
17. Did she get any treatment?			Yes	No
18. How many surviving children does she have?				
19. How old are they?				
20. Are they healthy?			Yes	No
21. Do any of the children have learning disability?			Yes	No
22. Do the living children have the same father as the deceased baby?			Yes	No
23. Does she look after the baby?			Yes	No
24. If not, who looks after the baby?				
25. Why is the mother unable to look after the baby?				
26. Did the mother smoke during the pregnancy?			Yes	No
If yes, how many per day?				
27. Did the mother drink alcohol during the pregnancy?			Yes	No
a) What did she drink?	Beer	Wine	Spirits	Other

WC_____

b) how much did she drink?			Every day	Now and again	Weekends
1 glass			Every day	Now and again	Weekends
> 1 glass			Every day	Now and again	Weekends
A bottle of alcohol			Every day	Now and again	Weekends
> 1 bottle			Every day	Now and again	Weekends
28. Did she use drugs?				Yes	No
a) If yes, what drugs does she use?	Tik	Cocaine	Heroin	Mandrax	Other
b) How often does she use drugs?			Every day	Now and again	Weekends
29. Does the mother smoke after the pregnancy?				Yes	No
30. Does the mother know that smoking harms the unborn baby?				Yes	No
31. Does the husband/partner drinks?				Yes	No
32. Does the mother drink after the pregnancy?				Yes	No
33. Do the parents of the mother drink?				Yes	No
34. Does the mother know that alcohol harms the unborn baby?				Yes	No
35. Did the mother have a previous baby that died suddenly?				Yes	No
a) If yes, how many died?					
b) At what age?					
c) Was a PM done?				Yes	No
If yes, where was it done?					
36. Did the mother have a previous stillbirth?				Yes	No
Section G **Household environment**					
8. Was the following in the room where the baby slept to heat the room?	Electric heater	"Galley"		Fire	Other
Describe other –					
9. Number of adults in the dwelling?					
10. Number of children in the dwelling?					
11. Total number of people in the dwelling?					
12. Estimated monthly income?					
13. Number of smokers in the dwelling?					

WC_____

14. Are there mentally retarded/ challenged people in the dwelling?	Yes	No

COMMENTS TO PATHOLOGIST FROM THE FORENSIC OFFICER WHO ATTENDED THE SCENE AND INTERVIEWED DURING ID PROCESS:

ITEMS RETAINED AT THE SCENE OR FROM THE MOTHER DURING INTERVIEW

Date:

Signature / Thumbprint of deponent

I certify that the above statement was taken down by myself and that the deponent has acknowledged that he / she knows and understands the contents hereof.

Date _____ Time: _____

Place: _____

_____

Department of Health
Forensic Pathology Laboratory

Appendix J – Ethics approval letter

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room E53-46 Old Main Buildin
Groote Schuur Hospita
Observatory 792
Telephone [021] 406 633
Email: lamees.emjedl@uct.ac.z
Website: www.health.uct.ac.za/fhs/research/humanethics/form

17 July 2018

HREC REF: 218/2018

Ms Laura Heathfield
Forensic Medicine & Toxicology
Pathology
Level 5, entrance 2
Falmouth Building

Dear Ms Heathfield

PROJECT TITLE: EXPLORING THE MEDICO-LEGAL DEATH SCENE INVESTIGATION OF SUDDEN UNEXPECTED DEATH OF INFANTS (SUB-STUDY LINKED TO 445/2015) MPHIL CANDIDATE - MS T BENNETT

Thank you for your response dated 13 July 2018 to the Faculty of Health Sciences Human Research Ethics Committee.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 July 2019.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the following MPHIL Candidate, Ms T Bennett will also be involved in this study.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938
This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH

2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines.
The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

Please quote the HREC reference number in all your correspondence.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Appendix K – Permission to access data

Vonita Thompson
Director: Forensic Pathology Service
Email: Vonita.Thompson@westerncape.gov.za
tel: +27 21 918 1505

14 December 2016

Dr M Winterbach
Forensic Pathology Service
Eden Central Karoo

Dear Dr Winterbach

PERMISSION TO ACCESS DATA FOR MINOR DISSERTATION: MPHIL BIOMEDICAL FORENSIC SCIENCE UCT

Your request for access to data is herewith approved subject to obtaining the required ethics and research approvals as outlined in your request. Approval is further granted to access the casefiles via Livelink®. If you do not already have approved access, the facility manager at George FPL can facilitate such an application.

You are reminded that the research must be anonymised removing all identifiable patient information. You are further requested to provide us with an electronic copy of your final research outcome / report within 6 months of completion of the research.

The directorate Forensic Pathology Service is very aware of the critical role that research projects such as these as well as the structured child death review process can play in Health system strengthening as well as its impact on the criminal justice process.

Regards

Vonita Thompson.

Vonita Thompson
Director: Forensic Pathology Service