

**SUDDEN AND UNEXPECTED DEATHS
IN ADULTS: AN INVESTIGATION OF
CASES REPORTED TO TYGERBERG
FORENSIC PATHOLOGY SERVICES
FROM JANUARY 2001 – DECEMBER
2005**

by
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*Thesis presented in partial fulfilment of the requirements for the degree
Master of Medicine (Forensic Pathology) at the University of
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DECLARATION

The study described in this dissertation was carried out in the Division of Forensic Medicine, Department of Pathology, University of Stellenbosch, and covers the period 1 January 2001 to December 2005.

The work was done under the supervision of Dr EH Burger, Senior Specialist in the division of Forensic Pathology.

By submitting this dissertation electronically, I declare that the entirety of the work contained therein is my own, original work, and that I have not previously in its entirety or in part submitted it for obtaining any qualification. Acknowledgement has been made in the text where use was made of the work of others.

October 2010

***“To make people count,
we first need to be able to count people”***

JW Lee, Director-General of the WHO (July 2003 – May 2006) in his 2003 address to the WHO.

ABSTRACT

Background - The workload of the forensic pathologist and Forensic Pathology Services staff is increased by the referral of potentially unnecessary natural cases to the Forensic Pathology Services. The primary aims of the medico-legal autopsy are limited to establishing a cause of death in presumed unnatural cases, and to exclude criminality or negligence.

Objective – To determine the final outcomes of forensic post-mortem examinations in “sudden and unexpected” adult deaths over a 5 year period.

Methods - An observational, retrospective, descriptive study was conducted. “Sudden and unexpected” adult deaths referred to Tygerberg Forensic Pathology Services between 1 January 2001 and 31 December 2005 were reviewed. Data was collected from the autopsy reports, contemporaneous notes and hospital records.

Findings – A total of 816 adult cases of sudden and unexpected death were referred to Tygerberg Forensic Pathology Services over the 5 year period studied. Complete autopsies had been performed in 74% (601/816) of cases. The presumed manner of death was natural in 79 % of cases, and an increase in the number of natural cases autopsied per year was noted over the 5-year study period. Diseases of the cardiovascular, respiratory and central nervous systems were responsible for the majority of natural deaths. Infectious diseases were responsible for most deaths in the youngest age group studied (18-29 years). Acute alcohol poisoning was responsible for the deaths of 35 (6%) cases, with an average blood alcohol concentration of 0.38g/100mL in these cases. Eight deaths were drug-/substance related. Waiting times for blood alcohol and toxicology results increased over the 5-year study period. No cause of death was found in 10.6% of cases.

Conclusions -The questionnaire and interviewing structure could possibly be improved in order to obtain better pre-autopsy information and to reduce the number of “unnecessary” medicolegal autopsies, thereby reducing the burden of cost on the Forensic Pathology Services.

OPSOMMING

Agtergrond – Die werkslading van die forensiese patoloog en ander personeel van die Forensiese Patologie Dienste word vermeerder deur die verwysing van moontlik onnodige natuurlike gevalle na die Forensiese Patologie Dienste. Die primêre doelwitte van die medies-geregtelike nadoodse ondersoek is beperk tot die bepaling van ‘n oorsaak van dood in vermoedelik onnatuurlike gevalle, en om nalatigheid of kriminele aksies uit te skakel.

Doelwit – Om die finale uitkomst van medies-geregtelike nadoodse ondersoeke in “skielike en onverwagte” volwasse sterftes oor ‘n 5-jaar tydperk te bepaal.

Metodes – ‘n Observasionele, retrospektiewe, beskrywende studie is uitgevoer. “Skielike en onverwagte” volwasse sterftes wat verwys is na Tygerberg Forensiese Patologie Dienste vanaf 1 Januarie 2001 tot 31 Desember 2005 is hersien. Inligting is versamel vanaf die nadoodse ondersoekverslae, kontemporêre notas en hospitaalnotas.

Bevindinge – Agthonderd en sestien volwasse gevalle van skielike en onverwagte sterftes is oor die 5-jaar periode verwys na Tygerberg Forensiese Patologie Dienste. Volledige lykskouings is uitgevoer in 74% (601/816) van die gevalle. Die vermoedelike wyse van die sterfte was natuurlik in 79.04% en ‘n toename in die aantal natuurlike gevalle wat lykskouings ondergaan het, is waargeneem oor die 5-jaar studie tydperk. Siektes van die kardiovaskulêre, respiratoriese en sentrale senuweestelsel was verantwoordelik vir die meerderheid natuurlike sterftes. Infektiewe toestande was verantwoordelik vir die meeste sterftes in die jongste ouderdomsgroep (18-29 jaar) wat bestudeer is. Akute alkoholvergiftiging was verantwoordelik vir die sterftes van 35 (6%) gevalle, met ‘n gemiddelde bloed-alkohol-konsentrasie van 0.38g/100mL in hierdie gevalle. Agt sterftes was dwelm-/middelverwant. Die wagtyd vir bloed-alkohol en toksikologie resultate het vermeerder oof die 5-jaar studie tydperk. Die oorsaak van dood was nie gevind in 10.6% van gevalle.

Afleidings – Die vraelys en onderhoud-struktuur kan moontlik verbeter word om sodoende beter inligting te verkry voor die uitvoering van ‘n lykskouing, en om die aantal “onnodige” medies-geregtelike nadoodse ondersoeke te verminder, en sodoende die kostedruk te verminder op die Forensiese Patologie Dienste.

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CHAPTER ONE

INTRODUCTION

1.1 General introduction

Approximately 2700 post-mortem examinations are performed at Tygerberg Forensic Pathology Services per year, with the primary aims being the establishment of the cause of death, the possible manner of death (natural vs. unnatural) and the further investigation of unnatural causes of death.

No statutory definition of an unnatural death exists, with the exception that “the death of a person undergoing, or as a result of, a procedure of a therapeutic, diagnostic or palliative nature, or of which any aspect of such a procedure has been a contributory cause, shall not be deemed to be a death from natural causes as contemplated in the Inquest Act, 1959 (Act 58 of 1959), or the Births, Marriages and Deaths Registration Act, 1992 (Act 51 of 1992)”, specified in section 56 of the Health Professions Act .

A natural death is defined by the Oxford English Dictionary¹ as the following: “happening in the course of nature, as the result of age or disease, as opposed to one brought about by accident, violence, poison, etc.”

By collective forensic and legal opinion, a cause of death is historically considered to be unnatural if at least one of the following factors is involved; and these factors usually serve as indication for the performance of forensic post-mortem examinations under section 3(2) of the Inquests Act (Act 58 of 1959):²

- ❖ External factors: The application of force on the body through physical, chemical or mechanical factors.
- ❖ Procedure-related deaths. (*vide supra*)
- ❖ Sudden and unexpected deaths.
- ❖ Acts of omission or commission: Death due to an act or failure to act – usually, but not exclusively, in the realm of medical care-givers.

Approximately 250-380 cases of “sudden and unexpected” or “unknown” deaths (adult and paediatric cases) are annually reported to Tygerberg Forensic Pathology Services, of which approximately two thirds of the cases are adult cases.

Currently no formal statistics exist on the outcomes of forensic post-mortem examinations performed on adult cases reported and referred to the Tygerberg Forensic Pathology Services as “sudden and unexpected deaths”. No record of any similar studies conducted elsewhere in South-Africa could be found on extensive Internet database searches.

The investigation and critical evaluation of these cases will therefore provide invaluable information with regards to:

- Causes of sudden and unexpected death, which may be useful in the planning of medical services on community level.³
- The resource utilization involved in the performance of post-mortem examinations in cases of “sudden and unexpected death” in adults, thereby determining the burden of cost on the Forensic Pathology Services (FPS) in the performance of forensic post-mortem examinations in adult cases of sudden and unexpected death.
- Revising and improving the current health questionnaire and interview conducted by the forensic officers employed by the Forensic Pathology Services (FPS).
- Development of standardized protocols for the performance of forensic post-mortem examinations in cases of sudden and unexpected death in adults, with emphasis on the most common causes of sudden and unexpected death.

1.2 Aim and objectives of the study

The aim of this study was:

- To determine the final outcomes (causes of death) of forensic post-mortem examinations in adult cases of “sudden and unexpected death”, over a 5 year period, between 1 January 2001 to 31 December 2005.

Specific objectives of this study were:

- To determine the demographics of the cases reported as cases of “sudden and unexpected death”, including age, sex and geographical area.
- To assess the correlation between the information from informants on symptoms and medical information and the identified cause of death.
- To review the use of specialized tests and estimate the average cost burden on Forensic Pathology Services in the performance of post-mortem examinations in cases of “sudden and unexpected death”.
- To recommend adjustments and improvements to the current information gathering methods used by the FPS that could reduce the proportion of unnecessary medico-legal autopsies.

CHAPTER TWO

METHODS

2.1 Definitions:

Various definitions of “**sudden and unexpected death**” exist. At this facility, the definitions are used interchangeably. Various definitions according to different sources include:

- ❖ The World Health Organization definition of sudden death is “death within 24 hours from the onset of symptoms”⁴.
- ❖ “Unexpected death following so rapidly from the onset of symptoms that the cause of death could not be certified with confidence by a medical practitioner familiar with the patient”⁵.
- ❖ “Witnessed non-traumatic death occurring instantaneously or within 1 hour after the onset of acute symptoms or signs. If the event was not witnessed, sudden death is defined as the interval between the time the subject was last seen and the time the body was found within 6 hours.”⁶
- ❖ “An event resulting in death or terminal life support within 1 hour of the inciting event.”^{6,7}

An “**adult**” is defined as any person 18 years and older.

“Cause of death”:^{2,8}

The cause of death is defined as the disease, condition or injury that leads directly or indirectly, immediately or subsequently to death.

The *primary medical cause of death* is the disease or injury which initiated the chain of morbid events leading directly to death.

The *terminal cause of death* is usually a complication which occurs as a result of the primary medical cause of death, for example a person with an open head injury (primary medical cause) may develop meningitis (terminal cause).

“Mechanism of death”:²

The physiological derangement or biochemical disturbance produced by the cause of death, for example hypovolaemic shock due to a stab wound.

“Manner of death”:²

The manner of death refers to the circumstances surrounding the death, and may be natural, accidental, homicidal, suicidal, iatrogenic or undetermined.

“Verbal autopsy”:⁹

A verbal autopsy is an interview administered to caregivers or family members after a death occurs with the aim of determining the cause of death.

2.2 Study design:

This study was an **observational, retrospective, descriptive study**. Cases from 1 January 2001 to 31 December 2005 were reviewed and no comparison group was used.

2.3 Study population:

The study population included all adult cases reported to, and referred to Tygerberg Forensic Pathology Services as cases of “sudden and unexpected” or “unknown” deaths from January 2001 to December 2005. Cases were retrieved from a register of all cases referred to Tygerberg FPS. The responsibility of keeping this register up to date is that of the administrative staff employed by Tygerberg FPS. Cases in which the final post-mortem results were not available yet were excluded from the study (total of 10 cases).

Table 2.1 gives an overview of the subcouncils served by Tygerberg FPS, with a breakdown of the different suburbs in each subcouncil.

Table 2.1 – Subcouncils and suburbs served by Tygerberg FPS

Subcouncil	Suburbs in the subcouncil
Adelaide Tambo	Belhar, Delft, The Hague
Belville	Belville, Ravensmead
Bergdal	Brackenfell, La Rochelle, Stellenberg
Central	Airport Industria, Bishop Lavis, Bonteheuwel
Charlotte Maxeke	Harare, Khayelitsha
De Grendel	Bothasig, Edgemoed, Goodwood, Panorama, Platteklouf
Koeberg	Aurora, Durbanville, Stellenryk, Uitsig
Lizo Nkonki	Bluedowns, Eersterivier, Mfuleni
Oostenberg	Blackheath, Kuilsriver
Other Suburbs - Cape Town	Including: Mitchell’s Plain, Athlone
Outside Cape Town	Including: Piketberg, Paarl, Stellenbosch
Tygerberg	Boston, De Tijger, Oosterzee, Parow

2.4 Data analysis:

Copies of post-mortem reports, contemporaneous notes, collateral information and hospital records are filed in storage in the Division of Forensic Medicine, Tygerberg. These documentation was retrieved and studied and the data was collected and entered, using Epidata 3.1¹⁰ and Microsoft Excel. Data analysis was performed by the author, with statistical assistance provided by Prof M Kidd of the Biostatistics Unit at the Faculty of Health Sciences. The Chi-square test was used to determine whether significant differences existed between the expected and observed frequencies in different categories. A p-value was considered to be statistically significant if less than 0.05.

Information obtained from the review of the post-mortem reports, contemporaneous notes, collateral information and hospital records, included: age, sex, race, suburb in which deceased stayed, symptoms present prior to death, medical history, medication taken, information on the informant, place of death, cause of death, manner of death, performance of special dissection techniques and special investigations.

2.5 Ethical and legal considerations:

Information used in this study was anonymised. Study numbers were assigned to individual cases, and the information is stored on a password-protected computer in the Division of Forensic Medicine, Department of Pathology, Health Science Faculty, University of Stellenbosch.

Ethics approval was obtained from the Health Research Ethics Committee (HREC) of the Health Science Faculty, University of Stellenbosch (Ethics reference no: **N09/09/256**), and the PGWC research committee.

Waiver of informed consent was granted by the HREC, because of the anonymisation of the data, the difficulty in retrospectively reaching next-of-kin in the forensic pathology setting, the potential value that the findings may add to forensic practice, and the low risk involved in the use of the data.

CHAPTER THREE

DESCRIPTION OF POST-MORTEM CASES

3.1 Post-mortem examinations at Tygerberg Forensic Pathology Services.

The Tygerberg Forensic Pathology Services (FPS) medico-legal laboratory is situated on the hospital grounds, next to Tygerberg Hospital. Tygerberg Hospital is situated in Parow, a suburb of Cape Town, and provides a range of primary to tertiary medical services to the surrounding community of the northern suburban areas of the greater Cape Town area.

A total of 13 536 post-mortem examinations were performed at Tygerberg FPS between 1 January 2001 and 31 December 2005. The number of post-mortem examinations over the 5-year period has remained relatively stable, with an average of 2707 cases per year, but the number of sudden and unexpected deaths has steadily increased. (*Refer table 3.1*)

Table 3.1 – Number of post-mortem examinations per year

Year	Number of post-mortem examinations	Number and percentage of “sudden and unexpected deaths”	
2001	2747	87	3.2%
2002	2898	147	5.1%
2003	2625	179	6.8%
2004	2559	204	8.0%
2005	2707	204	7.5%

During this 5-year period a total of 826 adult cases were reported to Tygerberg Forensic Pathology Services as being “sudden and unexpected” deaths. Cases in which the final post-mortem results were not available yet were excluded from the study (total of 10 cases). Therefore the total study population consisted of 816 cases.

Autopsies were performed in 601 (74.4%) of the 816 cases, and the remainder of the cases (215) were handled as “view and grant” cases, where the cause of death could be determined after reviewing the case history and the performance of an external examination alone, by a medical practitioner.

3.2 Sex distribution of cases.

Figure 3.1 – Sex distribution of sudden unexpected deaths

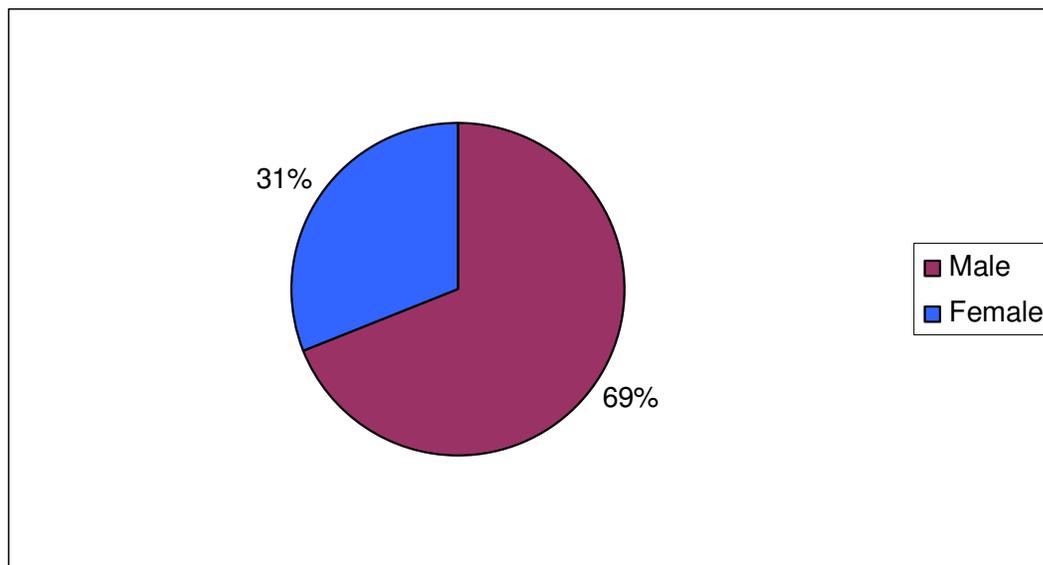
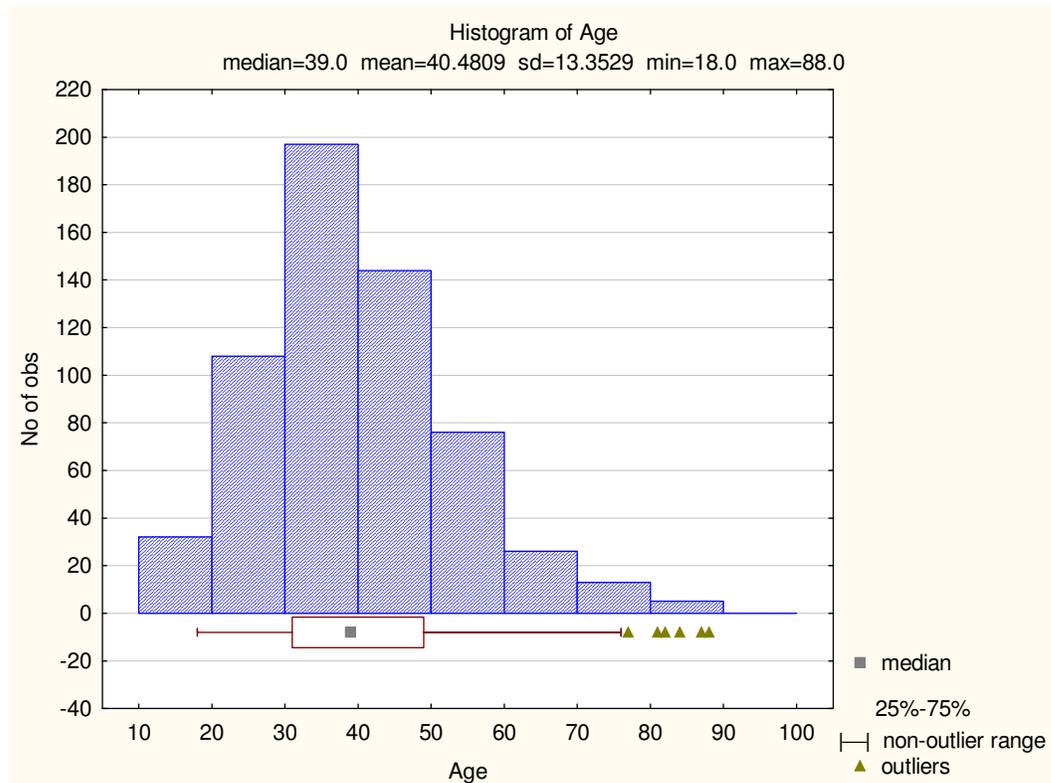


Figure 3.1 refers. Males comprised 69% (561 cases) and females 31% (255 cases) of cases in this study, with a male:female ratio of 2.2:1

3.3 Age distribution of cases.

The mean age of the total study population was 42.6 years (age range 18-89). The median age was 41 years, and the mode was 35 years. The mean age of the cases in which autopsies had been performed was 40.5 years and the median age 39 (Refer figure 3. 2).

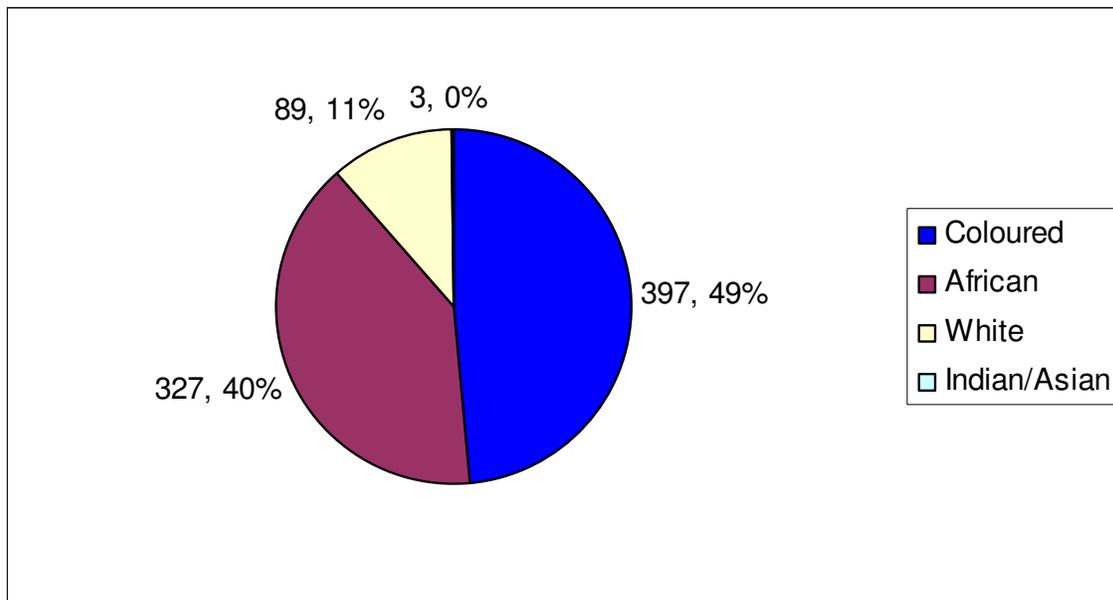
Figure 3.2 – Age distribution of cases in which autopsies had been performed



3.4 Racial distribution of cases.

Figure 3.3 refers. Coloured persons constituted the majority of cases (49%). The ethnic distribution of the cases involved in this study, approximates the ethnic distribution of the total population in the subcouncils, according to the 2001 population census by the City of Cape Town¹¹, which is as follows: Coloured 40%, African 34%, White 24% and Indian/Asian 1%.

Figure 3.3 – Racial distribution of number of cases



3.5 Distribution according to City of Cape Town subcouncils.

The distribution of cases and the causes of death per subcouncil of the City of Cape Town municipality¹¹ were compared to identify possible differences. Suburbs where death allegedly took place were distributed to subcouncils, according to the municipal borders as indicated in Table 2.1. Tables 3.2 and 3.3 show the distribution of cases according to the various subcouncils, and per 100,000 population, for easier comparison. Clear differences between the various subcouncils are noted, with the largest number of cases per 100,000 population of sudden death originating from Charlotte Maxeke subcouncil, and the least from Koeberg.

Table 3.2 – Distribution of cases per subcouncil

Subcouncil	Autopsy performed (n = 601)	Autopsy not performed (n = 215)	Total (n = 816)	Subcouncil cases as percentage of Total number of cases (n = 816)
Adelaide Tambo	38	10	48	5.9%
Belville	75	34	109	13.4%
Bergdal	73	32	105	12.9%
Central	42	20	62	7.6%
Charlotte Maxeke	145	44	189	23.2%
De Grendel	20	6	26	3.2%
Koeberg	10	11	21	2.6%
Lizo Nkonki	40	9	49	6.0%
Oostenberg	39	14	53	6.5%
Other Suburbs - Cape Town	15	6	21	2.6%
Outside Cape Town	15	2	17	2.1%
Tygerberg	49	16	65	8.0%
Unknown	40	11	51	6.3%
Total	601	215	816	100%

Table 3.3 – Distribution of cases per subcouncils per 100,000 population

Subcouncil	Population	Number of sudden and unexpected deaths	Sudden and unexpected deaths per 100,000 population
Adelaide Tambo	88,547	48	54.19
Belville	56,692	109	192.30
Bergdal	113,451	105	92.57
Central	72,268	62	85.81
Charlotte Maxeke	88,993	189	212.36
De Grendel	71,204	26	36.56
Koeberg	88,461	21	23.71
Lizo Nkonki	81,079	49	60.39
Oostenberg	67,736	53	78.30
Tygerberg	80,883	65	80.41

3.6 Distribution of cases according to person performing the autopsy.

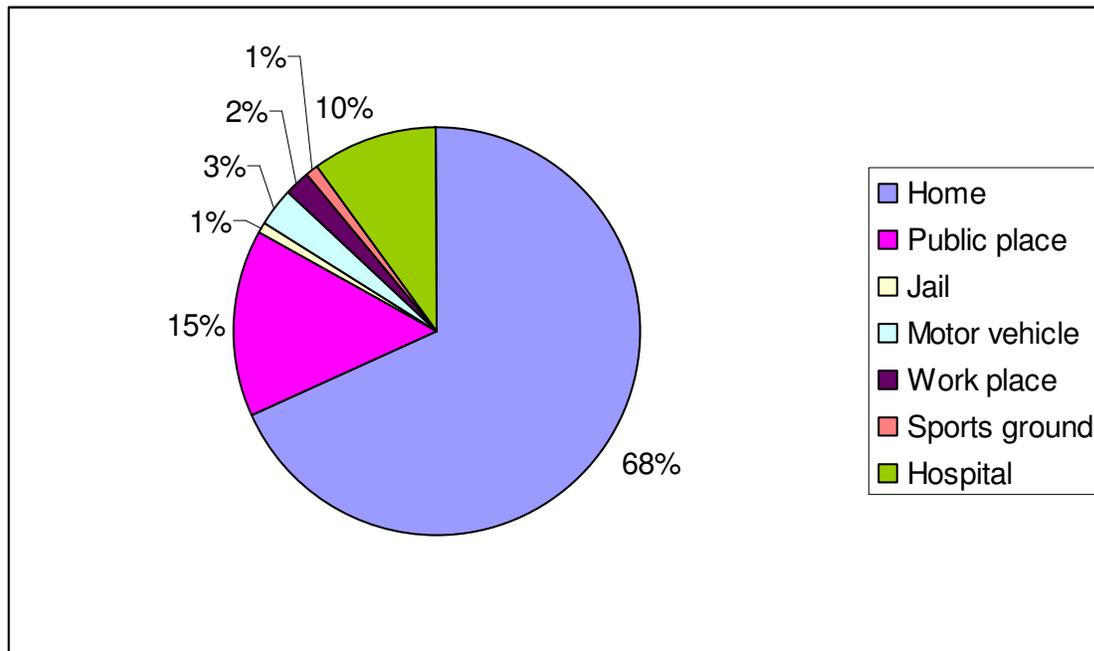
Post-mortem examinations (including “view and grant” cases) were performed by medical officers or registrars in 63.6% (519/816) of cases and by consultant specialists in the remaining 36.7% (297/816) cases.

Autopsies were performed by registrars or medical officers in 78.6% (408/519) of cases handled by them, and in 65.0% (193/297) of cases handled by consultants. This shows that consultants were more likely than registrars to sign out a case as “natural” without the performance of an autopsy ($p = 0.002$).

3.7 Place of death

Death took place at home in the majority (68%) of cases. Figure 3.4 shows the distribution of the place of death.

Figure 3.4 – Distribution of place of death



CHAPTER FOUR

INFORMANT

4.1 Status and address of informant

An informant is the person supplying collateral information in each case. Information (documented on the forensic questionnaire) was received in 83% (678/816) of all cases, and in 81% (489/601) of the cases in which autopsies had been performed.

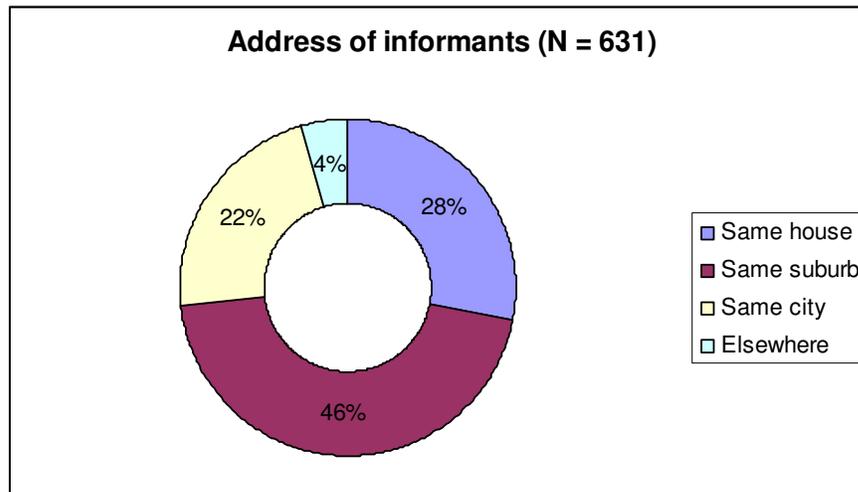
The relationship of the informant to the deceased person, as well as the address of the informant, was recorded. The address of the informant was available in 631/678 cases. Information was most often supplied by a spouse, child or close relative (55%), who stayed in the same house or suburb (74%). A breakdown of the results is given in Table 4.1 and figure 4.1.

Table 4.1 – Informants

Informant	Spouse	Child	Close relative*	Friend	Distant relative[†]	Doctor	Prison guard	No one
Total study population (n = 816)	145	61	247	57	121	42	5	138
% of total cases	18%	7%	30%	7%	15%	5%	1%	17%
Autopsy cases (n = 601)	102	31	191	36	88	36	5	112
% of autopsy cases	17%	5%	31%	6%	15%	6%	1%	19%

*A close relative was defined as being a parent, grandparent or sibling of the deceased.

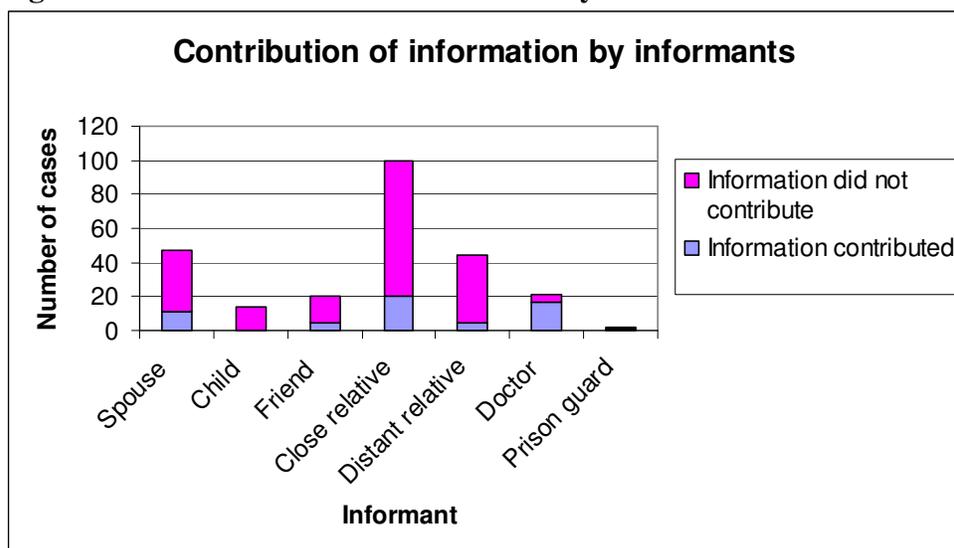
[†]A distant relative was defined as being a cousin, step-sibling or step-parent of the deceased.

Figure 4.1 – Address of informants

4.2 Reliability of informant

A breakdown of the contribution of information by various informants is shown in figure 4.2.

After reviewing the history received from the informant and the complete autopsy report in each case, we tried to establish whether the supplied information contributed to the formulation of a cause of death (i.e. whether history and cause of death correlated). This comparison was only done in cases where full autopsies had been performed. Supplied information was found to be most appropriate and therefore contributed to the formulation of a cause of death when supplied by a doctor ($p = 0.001$, when comparing groups).

Figure 4.2 – Contribution of information by various informants

CHAPTER 5

SYMPTOMS AND MEDICAL HISTORY PRIOR TO DEATH

5.1 Most common symptoms and medical history reported

A questionnaire is completed by a forensic officer during an interview with the deceased's family or friends. (See Appendix I) The aim of the interview and questionnaire is to obtain important medical or social information which may assist the pathologist in the completion of a post-mortem examination.

Information received in all 816 cases was reviewed and the findings were as follows:

Symptoms prior to death were reported in 377/816 (46.2%) cases in the total study group, and in 268 (45%) of the 601 cases in which autopsies were performed. A known medical history was reported in 283/816 (34.7%) case in the total study group and in 172 (29%) of cases that were autopsied. The symptoms and medical history were correlated with the cause of death in only the cases where autopsies were performed.

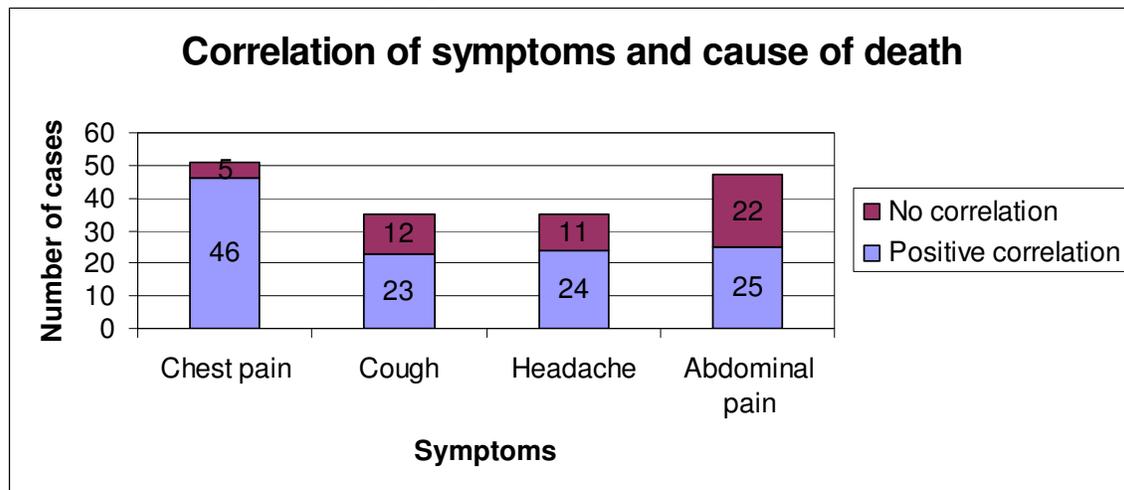
The most common symptoms reported were chest pain (51 cases) and abdominal pain (46 cases). The most common known medical disease reported was hypertension (73 cases) and tuberculosis (37 cases).

5.2 Correlation of symptoms and cause of death

Chest pain was the symptom which was in keeping most often (90.2%) with expected symptoms of the eventual cause of death (46/51 cases). The eventual causes of death in cases where chest pain was reported to be present prior to death were ischaemic heart disease, ruptured aorta aneurysm and pulmonary thrombo-embolism.

The symptoms "cough, headache and abdominal pain" could fit in with expected symptoms of the eventual cause of death in 65.7%, 68.6% and 53.2% respectively; however these symptoms were also misleading in numerous cases. See figure 5.1.

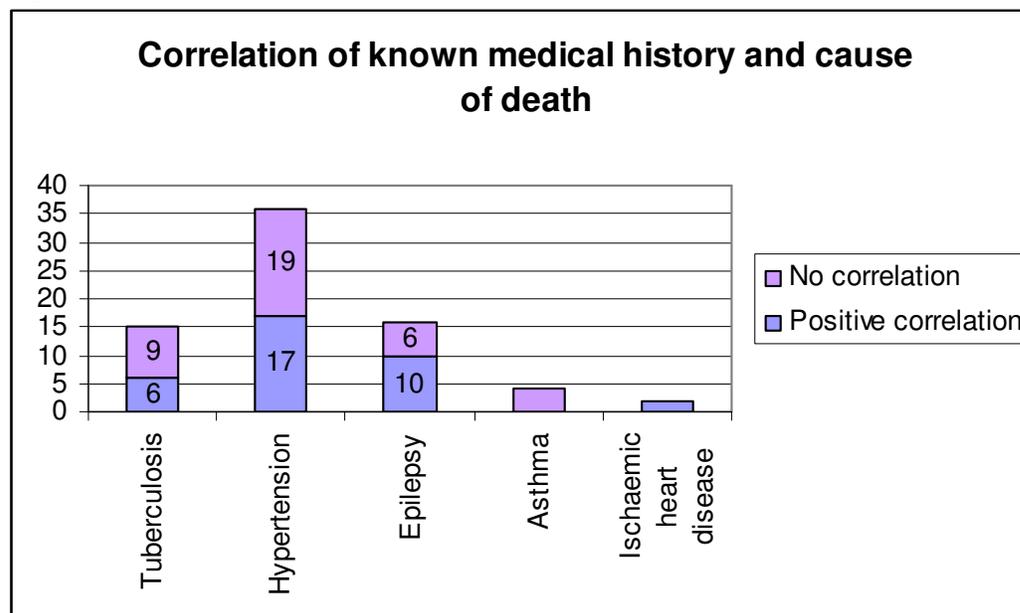
Figure 5.1 – Correlation of symptoms and cause of death



5.3 Correlation of medical history with cause of death

Correlation between a known medical history prior to death, and the cause of death determined after the performance of an autopsy was evaluated. A history of “ischaemic heart disease” correlated 100% with the cause of death determined at autopsy (2/2 cases). A history of asthma showed no correlation with the eventual determined cause of death. Epilepsy, tuberculosis and hypertension showed ambiguous results. (See Figure 5.2)

Figure 5.2 – Correlation of medical history and cause of death



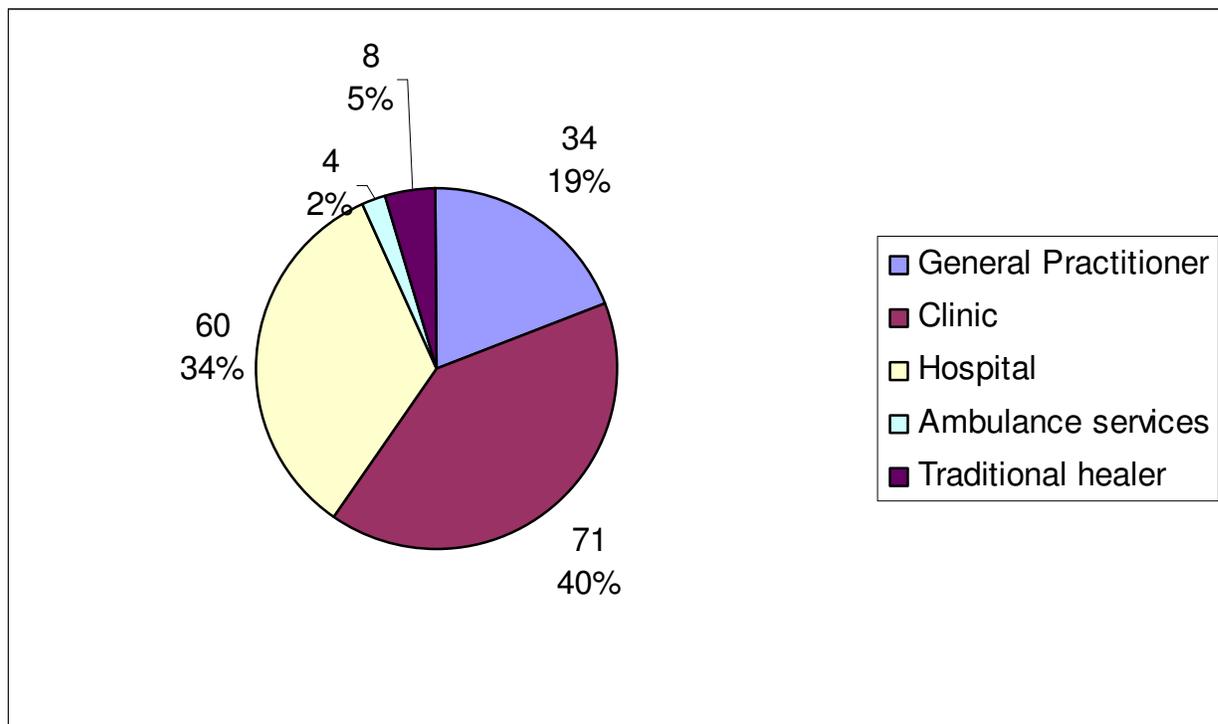
CHAPTER 6

MEDICAL HELP SOUGHT PRIOR TO DEATH

6.1 Distribution of places where medical help was sought prior to death

Medical help was sought in 22% of cases (177/816 in the total study group), mostly at a local clinic. The distribution of places where medical help was sought is shown in figure 6.1.

Figure 6.1 – Distribution of places where medical help was sought prior to death (number of cases, percentage)



6.2 Differences in subcouncils

Comparisons with regards to whether medical attention was received prior to death, known medical history, whether the deceased was on any medication and when the deceased was last seen by a doctor, were made between the various subcouncils.

Table 6.1 indicates the number of cases per subcouncil where a health care facility was attended prior to death.

Figure 6.2 shows the differences in when a health care facility was last attended prior to death between the various subcouncils.

It was evident that statistically significant differences ($p < 0.05$) existed between these variables in the various subcouncils (See Figures 6.3 – 6.6).

The Charlotte Maxeke subcouncil (Khayelitsha, Harare) was the subcouncil in which:

- Decedents attended health care facilities prior to death least often;
- A medical history was known in only a small number of cases;
- Only a small number of decedents were on medication prior to death; and
- Most decedents were seen years ago by a health care practitioner.

Table 6.1 – Health care facility attended prior to death by population in studied subcouncil

Subcouncil	Number (and percentage) of cases where a health care facility was attended prior to death, per subcouncil	Total number of sudden and unexpected adult cases in subcouncil
Adelaide Tambo	13 (27%)	48
Belville	15 (14%)	109
Bergdal	18 (17%)	105
Central	11 (18%)	62
Charlotte Maxeke	50 (26%)	189
De Grendel	5 (19%)	26
Koeberg	7 (33%)	21
Lizo Nkonki	6 (12%)	49
Oostenberg	7 (13%)	53
Other suburbs Cape Town	4 (19%)	21
Outside Cape Town	11 (65%)	17
Tygerberg	12 (18%)	65
Unknown	17 (33%)	51
Total	176 (22%)	816

Figure 6.2 – Last time a health care facility was attended prior to death by population in studied subcouncil

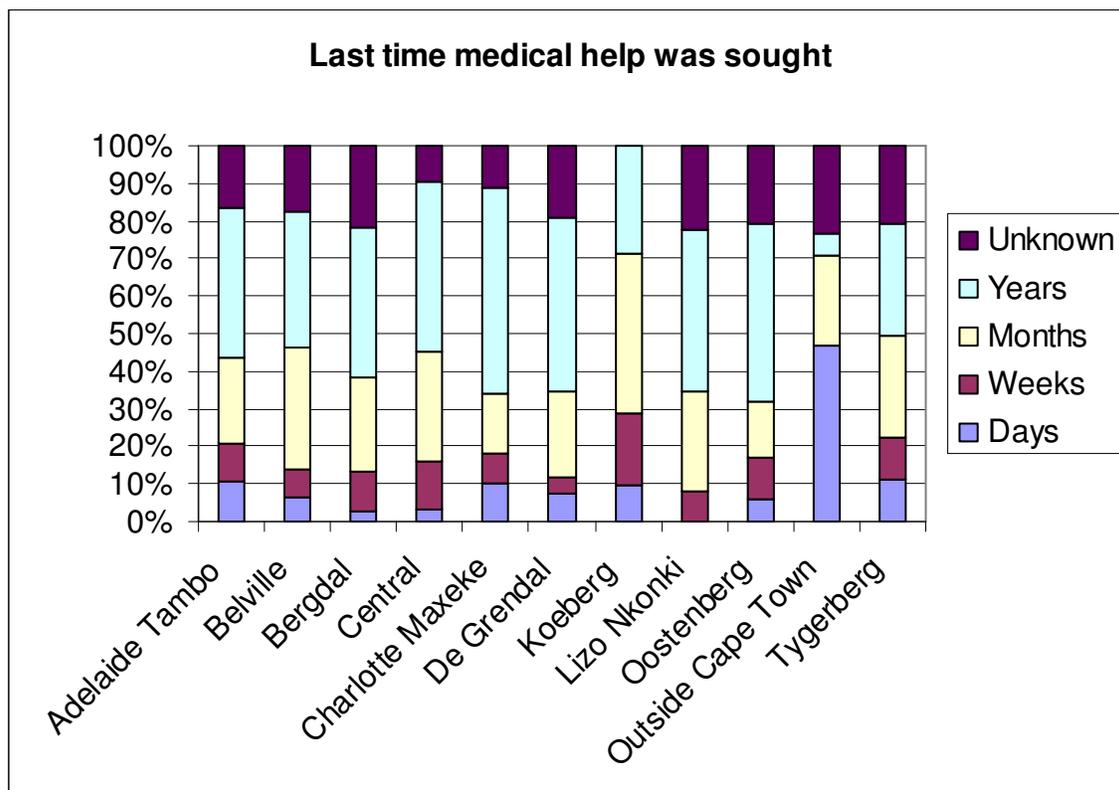


Figure 6.3 – Categorized histogram: comparing whether medical attention was received prior to death between subcouncils.

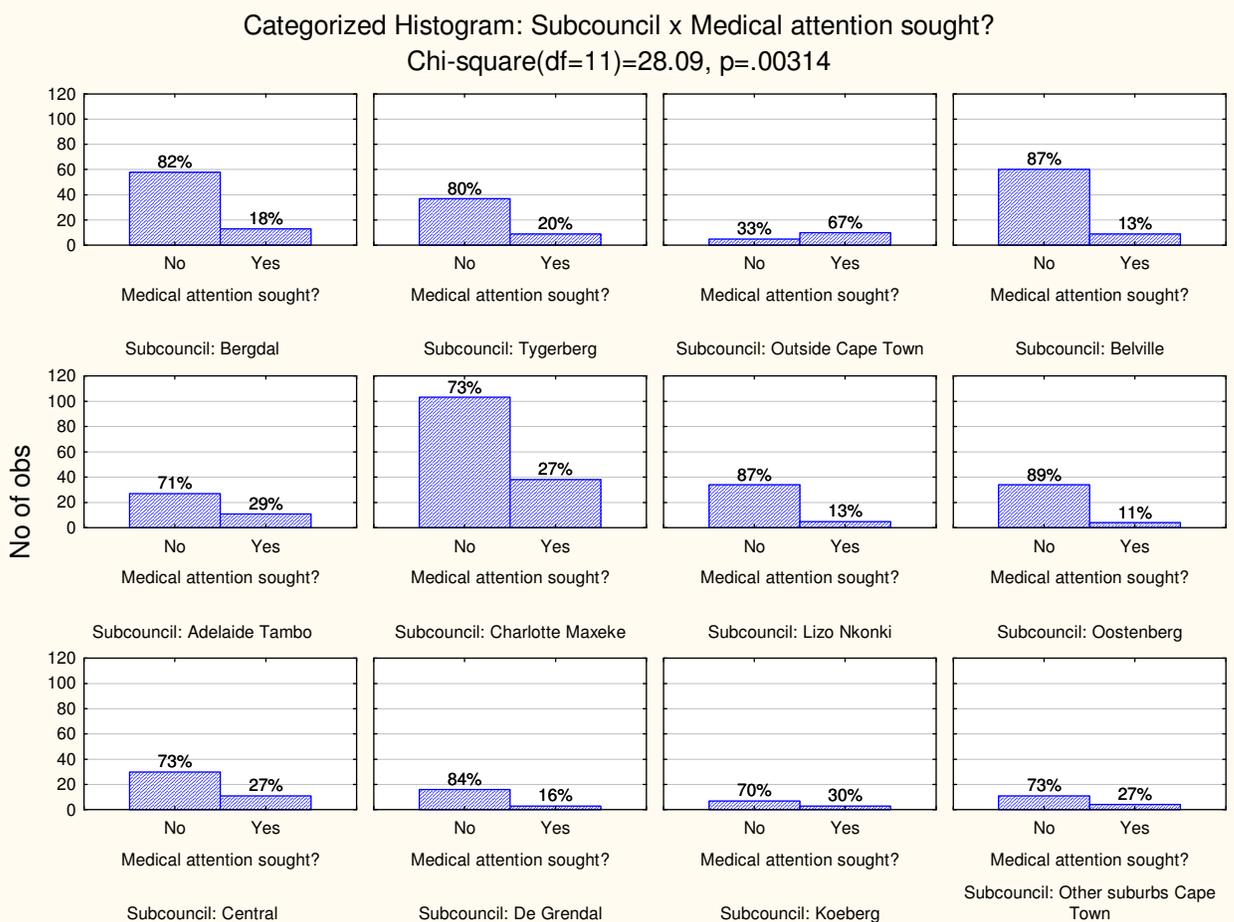


Figure 6.4 – Categorized histogram: comparing whether a medical history was known between subcouncils.

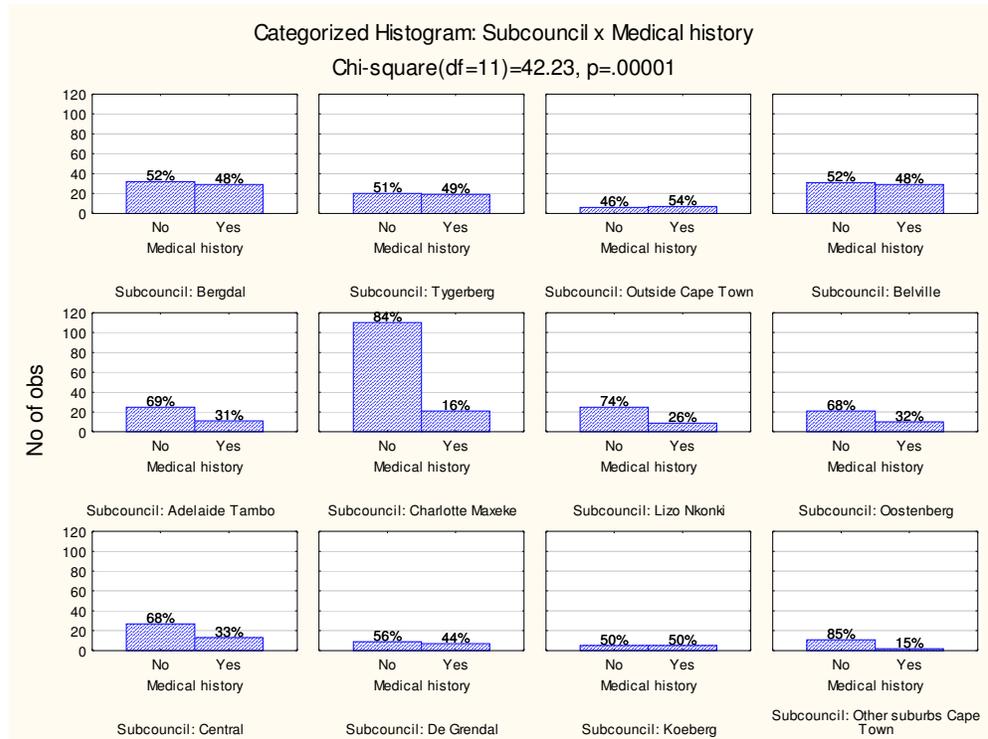


Figure 6.5 – Categorized histogram: comparing whether the deceased was on any medication prior to death between subcouncils.

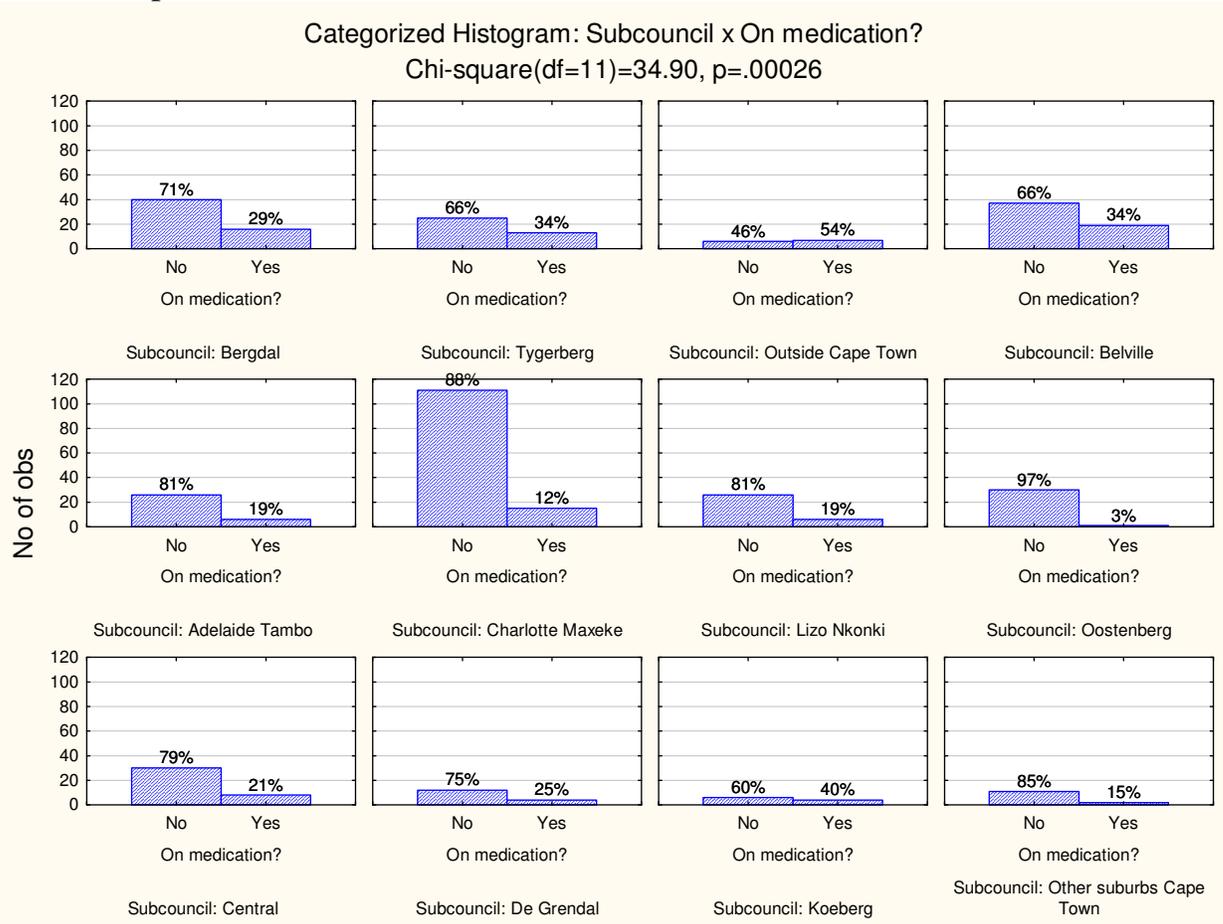
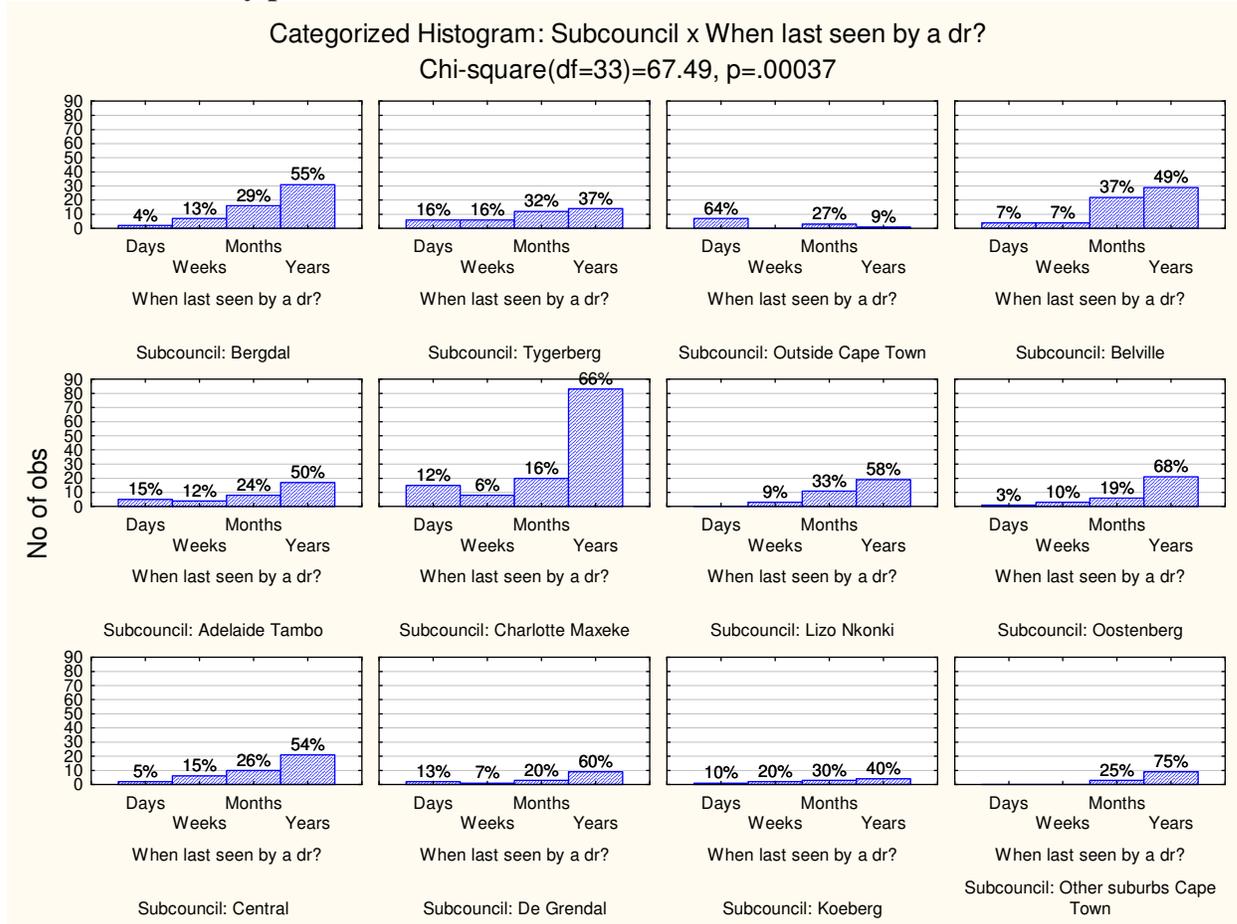


Figure 6.6 – Categorized histogram: comparing when the deceased last attended a health care facility prior to death between subcouncils.



CHAPTER SEVEN

CAUSE OF DEATH

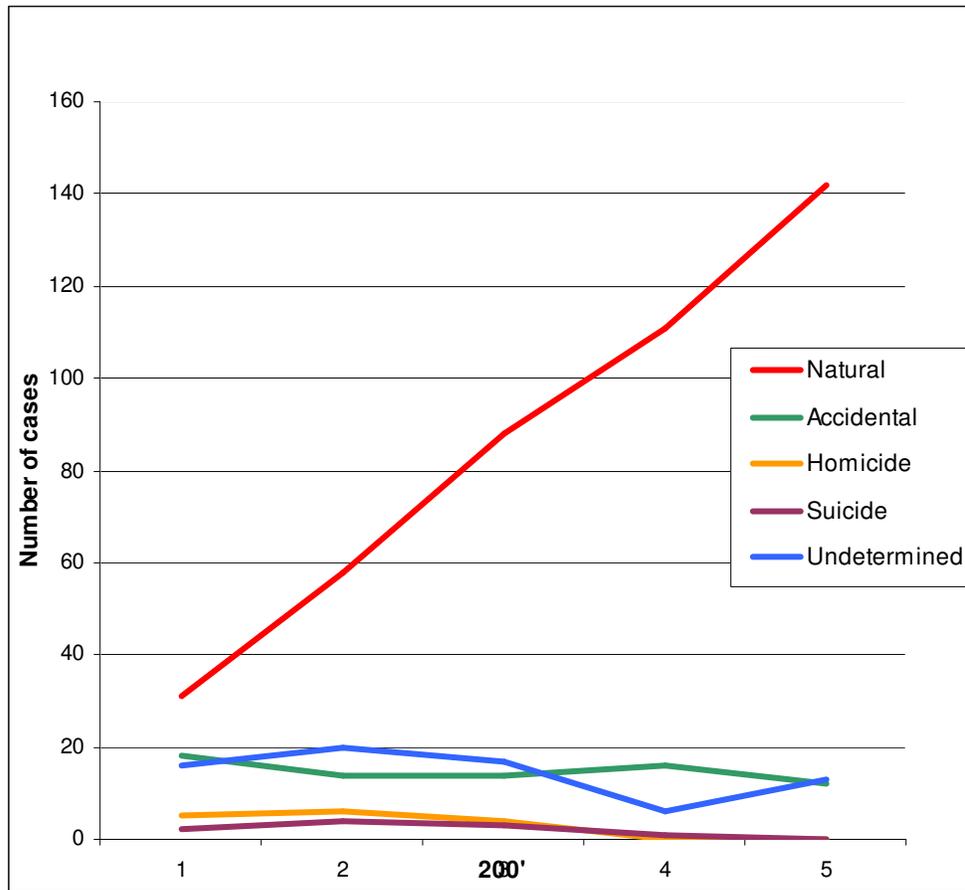
7.1 Presumed manner of death

The manner of death is not determined by the forensic pathologist in South Africa, but by the South African Court System, although the forensic pathologist has an important role in distinguishing between natural and unnatural deaths. The presumed manner of death was natural in 79% (645/816) of the total study population versus 71.5% (430/601) in the cases where full autopsies have been performed. Table 7.1 shows the distribution of the presumed manner of death in the total number of cases (n = 816), as well as the cases in which full autopsies were performed. Figure 7.1 demonstrates the increase in natural causes of death in cases where autopsies had been performed over the 5-year study period. A total of 171 cases were classified as being “other than natural”, with a breakdown of these cases as follows: 74 accidental causes of death, 15 homicidal causes of death, 10 suicidal causes of death and 72 had an undetermined manner of death (not necessarily undetermined cause of death).

Table 7.1 – Distribution of presumed manner of death

Manner of Death	Autopsy cases (n = 601)	%	View and grant cases (n = 215)	%	Total number of cases (n = 816)	%
Natural	430	71.6%	215	100.0%	645	79.0%
Accidental	74	12.3%	0	0%	74	9.1%
Homicide	15	2.5%	0	0%	15	1.8%
Suicide	10	1.7%	0	0%	10	1.2%
Undetermined	72	12.0%	0	0%	72	8.8%

Figure 7.1 - Distribution of presumed manner of death over a 5 year period



7.2 Systemic classification of causes of death in natural causes of death where autopsies were performed

Overall, ischaemic heart disease was the most common cause of death, with 106/601 cases (17% of total cases), followed by pneumonia 45/601, pulmonary tuberculosis 37/601 and pulmonary thrombo-embolism 21/601. The systems most commonly involved in natural deaths were the cardiovascular, respiratory and central nervous systems.

The most common cardiovascular causes of death were ischaemic heart disease (75%), infectious cardiac diseases, including pericarditis, myocarditis and infective endocarditis (9%), and ruptured aorta aneurysm (8%).

In the group of respiratory causes of death, pneumonia (37%) was found most commonly, followed by pulmonary tuberculosis (30%) and pulmonary thrombo-embolism (13%).

The most frequently found central nervous system causes of death were infectious diseases (30%), ruptured saccular aneurysm (12%), intracerebral haemorrhage (12%) and epilepsy (12%).

The gastro-intestinal and genitor-urinary systems accounted for only a few causes of death, with the most frequently found gastro-intestinal causes of death being peptic ulcer disease (5/24) and pancreatitis (5/24).

Table 7.2 shows a breakdown of the systems involved, with the 3 most common causes of death in each system.

Table 7.2 - Principal causes of death distributed per system

System (Total number of cases per system)	Most common causes of death	Number of cases (% per system)
Cardiovascular (n = 140)	Ischaemic heart disease*	106 (75%)
	Infectious heart diseases [†]	12 (9%)
	Ruptured aorta aneurysm	8 (6%)
Respiratory (n = 122)	Pneumonia	45 (37%)
	Pulmonary tuberculosis	37 (13%)
	Pulmonary thrombo-embolism	21 (17%)
Central Nervous System (n =61)	Infectious diseases [‡]	18 (30%)
	Spontaneous intracerebral haemorrhage	12 (20%)
	Ruptured saccular aneurysm	12 (20%)
	Epilepsy	12 (20%)
Gastrointestinal (n = 24)	Peptic ulcer disease	5 (21%)
	Pancreatitis	5 (21%)
	Liver disease [§]	4 (17%)
Genito-urinary (n =10)	Kidney disease [¶]	4 (40%)
	Pregnancy-related causes**	3 (30%)
	Malignancy	2 (20%)

*Includes acute myocardial ischaemia, acute myocardial infarction, chronic myocardial ischaemia, coronary artery disease.

[†]Includes infectious pericarditis, myocarditis and endocarditis.

[‡]Includes meningitis and brain abscess.

[§]Includes fatty disease of the liver, liver cirrhosis, portal hypertension due to liver disease, undetermined liver disease.

[¶]Includes pyelonephritis, glomerulonephritis.

**Includes ruptured ectopic pregnancy, chorioiditis.

7.3 Age distribution of natural causes of death

Infectious diseases (pneumonia, meningitis) were the most common causes of death in the youngest age group (18-29 years). In all the other age group categories, ischaemic heart disease dominated as the most prevalent natural cause of death. Pulmonary tuberculosis was present in all age categories.

Table 7.3 shows a breakdown of the natural causes of death per age group.

Table 7.3 – Most prevalent natural causes of death per age group

Age group (total number of cases per age group)	Most prevalent natural causes of death*	Number of cases (% of total per age group)
18-29 years (n = 88)	Pneumonia Meningitis Ischaemic heart disease Infectious cardiovascular diseases Pulmonary tuberculosis	12 (13.6%) 11 (12.5%) 6 (6.8%) 6 (6.8%) 4 (4.5%)
30-39 years (n = 115)	Ischaemic heart disease Pulmonary tuberculosis Pulmonary thrombo-embolism Pneumonia Ruptured saccular aneurysm Epilepsy Meningitis	30 (26%) 17 (15%) 10 (8.7%) 7 (6%) 4 (3.5%) 4 (3.5%) 4 (3.5%)
40-49 years (n = 100)	Ischaemic heart disease Pulmonary tuberculosis Spontaneous intracerebral haemorrhage Epilepsy Meningitis	28 (28%) 11 (11%) 6 (6%) 5 (6%) 5 (6%)
50-59 years (n = 68)	Ischaemic heart disease Pneumonia Pulmonary thrombo-embolism	26 (38%) 6 (8.8%) 4 (6%)
60-69 years (n = 22)	Ischaemic heart disease Pulmonary thrombo-embolism	4 (18%) 2 (9%)
Older than 70 years (n = 18)	Ischaemic heart disease Pulmonary tuberculosis	7 (39%) 2 (11%)

*In the age groups of 18-59 years, only diseases where 4 or more people were affected are mentioned.

7.4 Sex distribution

Figure 7.2 – Most prevalent natural causes of death in females

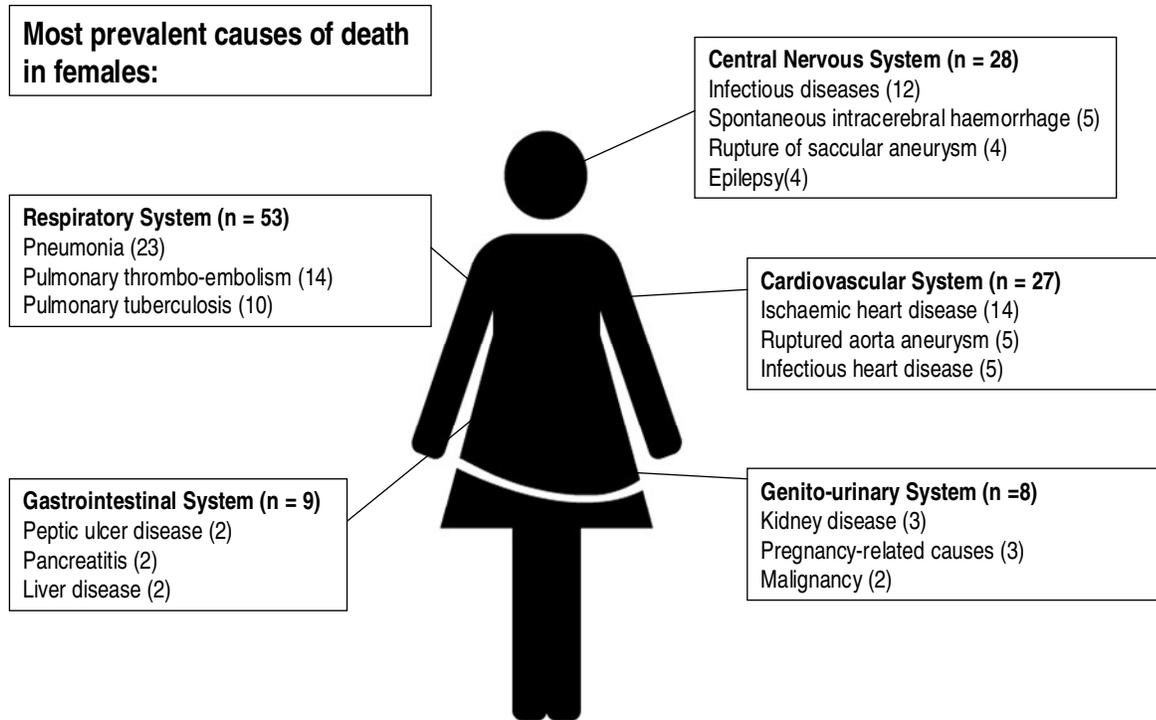
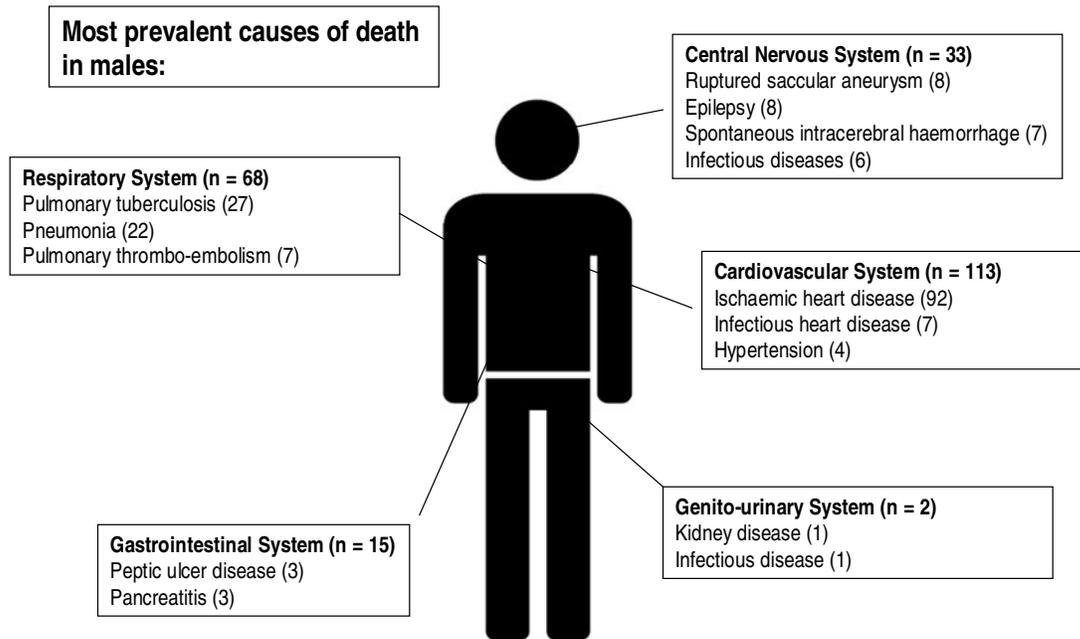


Figure 7.3 – Most prevalent natural causes of death in males

CHAPTER 8

SPECIAL DISSECTION TECHNIQUES AND INVESTIGATIONS

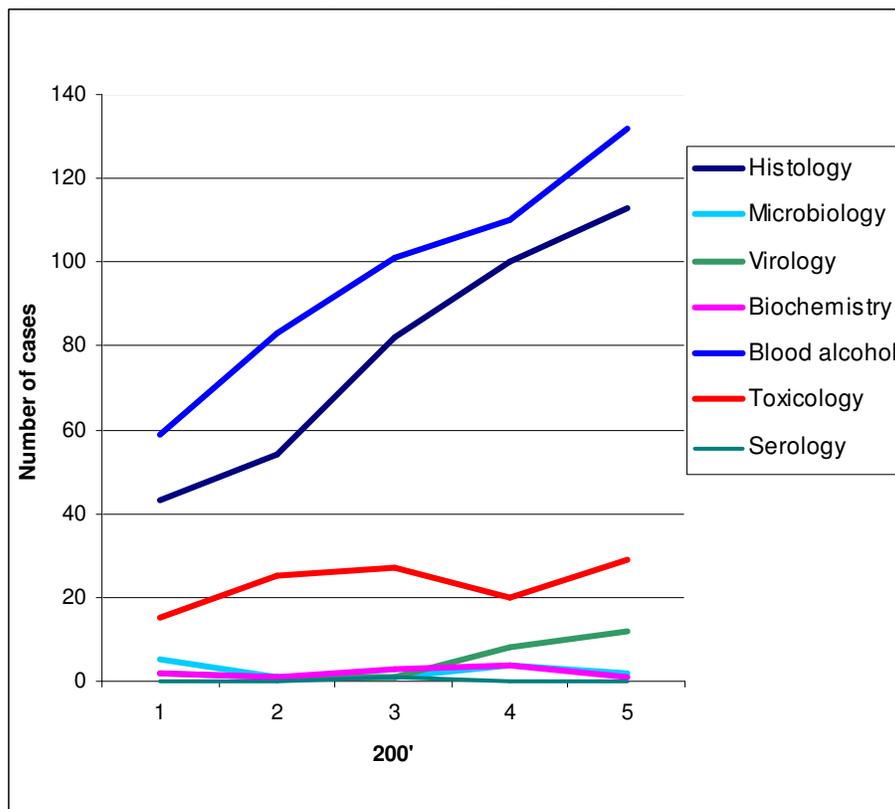
8.1 Special dissection techniques

Special dissection techniques were employed in 18.1% (109/601) of cases where autopsies were performed. The most common special dissections performed were layer-wise neck dissection (56 cases), formalin fixation of the brain with formal neuropathological evaluation (53 cases), formalin fixation of the heart with formal heart dissection (12 cases) and removal of the spinal cord (3 cases).

8.2 Special laboratory investigations performed

Special investigations were performed or requested in 90.5% (544/601) cases. Figure 8.1 shows the trends of different special investigations performed over the 5-year study period from 2001 to 2005.

Figure 8.1 – Trends of special investigations performed from 2001-2005



A steady increase in the number of histological examinations and alcohol concentration determination is evident, in keeping with the increase in adult cases of “sudden and unexpected” deaths over the 5-year study period. Toxicological analysis, microbiology, serology and biochemistry have remained stable. The number of virological examinations shows an increase: During 2004 and 2005, more tests for Human Immunodeficiency Virus (HIV) have been performed. Microbiological cultures were only requested in 13 cases.

Toxicology:

Toxicological analyses were requested in 116 cases. Results of these analyses were available within 3 months in 27% of cases, within 3 to 6 months in 29% of cases, 6 to 9 months in 18% of cases, 9 to 12 months in 12% of cases, 1 to 2 years in 8% of cases, and only after 2 years in 6% of cases. Eight cases were determined to be drug- or substance-caused. The yearly trend is seen in Figure 8.1, showing a dramatic increase in the waiting times for toxicology results.

Table 8.2 shows the drugs and substances involved in these eight cases.

Table 8.1 – Availability of toxicology results

Time taken for results to be released	< 3 months	3-6 months	6-9 months	9-12 months	1-2 years	> 2 years
No of cases (n = 116)	31	34	21	14	9	7
Percentage (%)	27	29	18	12	8	6

Figure 8.2 – Distribution of waiting times for toxicology results over the 5-year study period

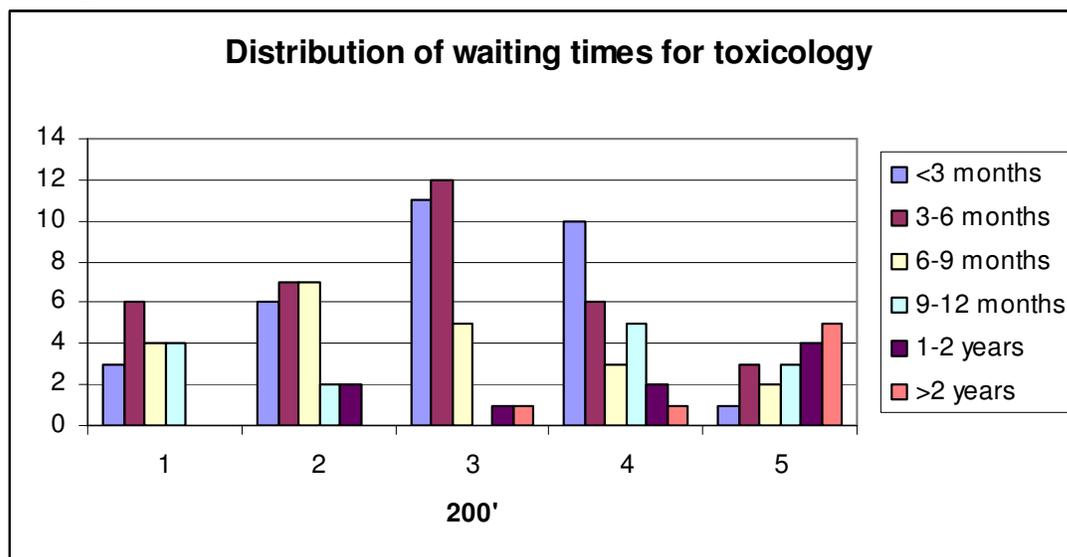


Table 8.2 – Drugs and substances involved in drug-caused deaths

Drug or substance involved	Number of cases
Imipramine*	1
Amitriptyline [†]	2
Orphenadrine [‡]	2
Morphine [§]	1
Amitriptyline, carbamazepine, clomipramine [¶]	1
MDMA (“Ecstasy”) ** (4-Methylenedioxymethamphetamine)	1

*Tricyclic antidepressant.

[†]Tricyclic antidepressant.

[‡]Anticholinergic anti-Parkinson agent; used in treatment of Parkinson’s disease, senile and pre-senile depression and neuroleptic syndrome.

[§]Opioid; Metabolite of heroin; or primary drug used for pain relief.

[¶]Tricyclic antidepressant, anticonvulsant, tricyclic antidepressant

**Central nervous system stimulant, drug of abuse

8.3 Blood alcohol concentration

The diagnosis of death “consistent with -”, or “due to acute alcohol poisoning”, was made in 35 out of 601 cases (6%), with an average blood alcohol concentration level of 0.38g/100mL (range of 0.25-0.62g/100mL) in these cases.

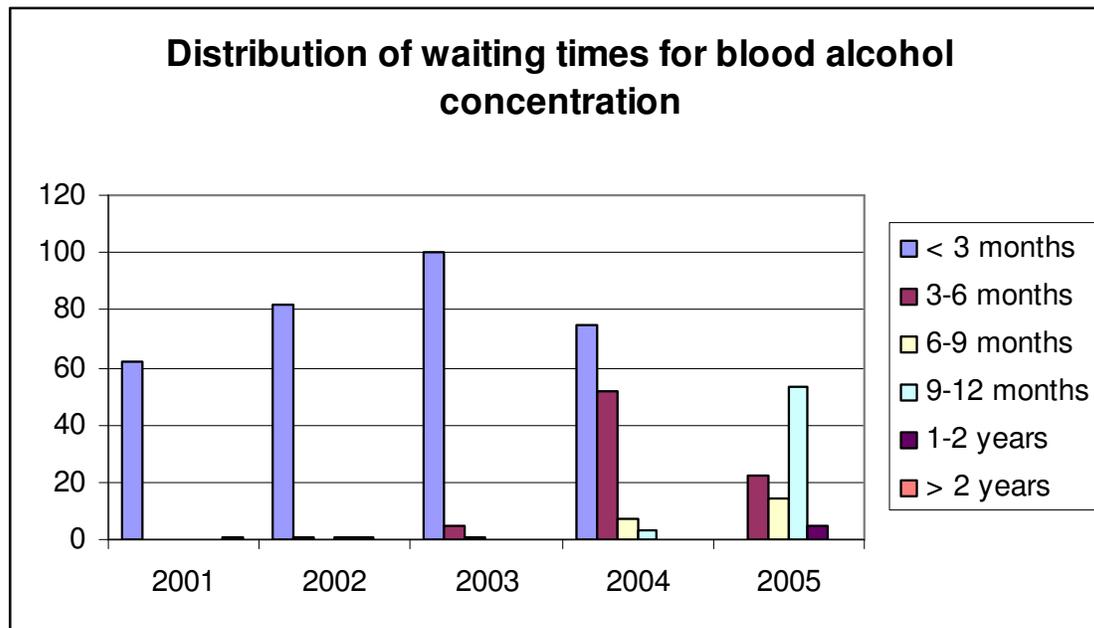
Blood alcohol concentration determination was requested in 485/601 cases (80.7%) in which autopsies had been performed. Results were available within 3 months after the performance of autopsies in 65.8% of cases; however in some cases results were only

available after 1 year. Figure 8.3 shows that the waiting times for blood alcohol concentration increased over the 5-year study period.

Table 8.3 – Availability of blood alcohol concentration results

Time taken for results to be released	< 3 months	3-6 months	6-9 months	9-12 months	1-2 years	> 2 years
No of cases (n = 485)	319	80	22	57	6	1
Percentage (%)	65.8	16.5	4.5	11.8	1.2	0.2

Figure 8.3 – Distribution of waiting times for blood alcohol concentration over the 5-year study period



8.4 Cost of special investigations

Current (2010) costs for the performance of the various special investigations have been obtained, to estimate the burden of cost in the performance of autopsies in cases of sudden and unexpected deaths in adults.

Table 8.4 – Costs of special investigations (2010 prices)

Special investigation	Cost (ZAR)
Histology (15 blocks) (excluding special stains and immunohistochemistry)	1600.00
Microbiology – bacteriological culture	56.70
Virology – HIV Elisa	126.80
Biochemistry – glucose	32.60
Biochemistry – urea and creatinine	81.20
Serology – Total IgE	115.00
Serology – Mast cell tryptase	660.00

Histology was performed in 392 cases over the 5-year period, which means that at the current cost, this investigation alone would have cost the provincial government at least R627,200 over the 5-year period, or an average of approximately R125,440 per year.

CHAPTER 9

UNDETERMINED CASES

9.1 Autopsies in cases where cause of death was undetermined with post-mortem examination alone.

The percentage of cases signed out as being “undetermined with post-mortem examination alone” was 10.6% (64/601). (Please note that this number reflects the number of cases which had an undetermined *cause* of death, and differs from the number of cases with an undetermined *manner* of death, referred to on page 34.)

Special dissection techniques were employed in 13/64 unascertained autopsies (20.3%) and laboratory investigations were performed or requested in 58/64 unascertained autopsies (90.6%).

Two of the autopsies where the causes of death were recorded as “undetermined with post-mortem examination alone”, were performed by medical officers, 43 of the autopsies by registrars and 19 of the autopsies by consultants.

If one compares the number of autopsies recorded as “undetermined with post-mortem examination alone” to the total amount of autopsies performed by the various designated persons, the results were as follows: (Unascertained cases/Total number of autopsies performed)

- Medical officers: 2/9 (22%).
- Registrars: 43/399 (10.8%)
- Consultants: 19/193 (9.8%)

The difference in the number of autopsies performed and those deaths determined to be “undetermined with post-mortem examination alone” between registrars and consultants was not statistically significant.

9.2 Usefulness of police docket reports in determining the cause of death.

Police docket reports on cases which were undetermined by post-mortem examination alone, which had already been received and finalized by the department at the time of the study, were also reviewed. It was found that a cause of death could be offered in 9/23 cases (39%) of the cases, that were initially recorded as being “undetermined with post-mortem examination alone”. Police docket reports are discussed in more detail in chapter 10.

CHAPTER 10

DISCUSSION

The workload of the forensic pathologist and Forensic Pathology Services staff is increased by the referral of unnecessary natural cases to the Forensic Pathology Services.

The autopsy is considered the “gold standard” for diagnosing a cause of death, and is an invaluable teaching tool for the recognition of pathological processes and diseases. However, the primary concern of the medico-legal autopsy is limited to establishing a cause of death and to exclude criminality or negligence.

The performance of autopsies has many practical implications: time, money and resource allocation, as well as distress to relatives and friends of the deceased due to the administrative delay and completion of the autopsy, and the hampering of religious practices¹². In a resource limited country like South Africa, an effort should be made to limit the number of unnecessary autopsies performed as far as possible. This is often impeded by the poor quality and limited amount of information available prior to and at autopsy.

The presumed manner of death in the majority of the “sudden and unexpected death” cases referred to Tygerberg Forensic Pathology Services over the 5-year period from 2001-2005, was natural. The number of presumed natural causes of death has increased dramatically over the 5-year study period. It could be argued that many of the autopsies performed were unnecessary and necessitated by the lack of useful pre-autopsy information.

Various studies have looked at the reliability of presumptive diagnoses of causes of death, made by reviewing medical history, collateral information and the performance of an external examination. It has been found that the pre-autopsy and post-autopsy proximate causes of death were in agreement in the 65.3% of cases¹² in a study by Biggs et al, 91% of cases in a study by Gill and Scordi-Bello¹³, and 72% of cases in a study by Nashelsky and Lawrence¹⁴.

However, if the sole purpose of the investigation is to determine whether a cause of death is natural or unnatural, it could be argued that a full postmortem examination, with the performance of expensive special investigations, may not be strictly necessary, especially in the current climate of financial uncertainty¹².

Place of death:

Death occurred at home in the majority of cases (68%). The distribution of the place of death in this study is very similar to results by De la Grandmaison et al in a study on a medico-legal series of cases of sudden adult death over a 5 year period in France, in 2002^{15,16}. In their series, they found that death took place at home in 51% of cases and a

public place in 22% of cases, followed by death in a motor vehicle (9%), jail (8%), sports ground (4%), work place (3%) and private place (3%).

Cases where death took place in hospital were in most cases not signed out by the attending medical practitioners, because of a “dead on arrival” situation with no prior knowledge of the patient, or the cause of death was unknown and unexpected in a young adult.

Pre-autopsy information:

The history of the deceased person is essential in forensic pathology, as it is in clinical medicine. However, controversy exists in the forensic community, around the extent to which the history should influence the pathologist in coming to a decision as to the cause of death⁴. If no history is available, it may be easy to miss subtle pathology that may have been evident at autopsy if it was expected. It could also cause failure to perform or request special investigations, which may prove to be important at a later stage.

Information is especially essential in cases of “sudden and unexpected” deaths, to ascertain whether the death was indeed, “sudden and unexpected”. A sustained effort should be taken to reach family members, the general practitioner and to possibly get hold of clinical notes.

Chest pain was the symptom which could fit in most often with expected symptoms of the eventual cause of death. This suggests that chest pain is a sensitive indicator of a natural disease process, but is not specific for a specific disease or diagnosis. This may influence the absolute and correct completion of the death notification form and have associated statistical implications, but it may help the forensic pathologist to distinguish between an unnatural and natural cause of death. In this study, all of the final causes of death associated with chest pain (ischaemic heart disease, ruptured aorta aneurysm and pulmonary thrombo-embolism) were natural causes, except when pulmonary thrombo-embolism was a complication of injury or trauma.

Unfortunately, in this study only a limited number of cases were available for correlation between the symptoms and medical history, and the cause of death. With regards to distinguishing specific disease symptoms, multiple validation studies have shown that the verbal autopsy has different sensitivities and specificities when comparing different diagnoses. For example, in one study by the WHO, acute diarrhea has a sensitivity of 57% and specificity of 97%¹⁷. Further studies need to be undertaken to establish which symptoms and diseases are commonly found in our setting, and may be indicative of natural causes of death. A history of ischaemic heart disease was obtained in only two cases, whereas ischaemic heart disease was found to be the most common overall cause of death!

Medical assistance was sought in 22% of cases (177/816 in the total study group). In some cases, medical assistance was sought in the same week that death occurred, and then death took place at home, possibly indicating that an incorrect diagnosis had been made, or that treatment had failed. Generally, these cases should not have been subjected

to forensic autopsies, as a life-threatening condition was most likely present in the days prior to death. In a number of cases decedents died on the way to hospital, or before medical help could be sought. These cases fit better with the definition and description of sudden and unexpected death.

Sampson et al reviewed information given to pathologists over a 1-year period, to assess the quality of pre-autopsy information, and found that in a relatively small number of reports the quality of information could be classified as satisfactory¹⁸. This correlates with the findings of our study. Key areas of essential information to be obtained prior to autopsy identified by Sampson et al, (thus the information is “satisfactory”) includes: “name, age, date of death or when found dead, where the body was found, occupation, position of the body when found, and relevant medical history”.

According to Sampson et al, various factors could explain the high frequency of suboptimal information received, including:

- Relatives may be too distressed to talk.
- The deceased may have been unidentified when found.
- General practitioner could not be identified.
- Police officer sought information which may not have been relevant to the pathologist’s requirements.

More reasons could be added in the local South African environment, including:

- Language barriers.
- Lack of medical training of forensic officers, who are the main interviewers of relatives or friends of the deceased.
- Poor access to transport for family members to attend an interview at the facility.

Recommendations on how to possibly improve the quantity and quality of information received will be discussed in chapter 11.

Cause and presumed manner of death:

The most common organ systems involved in cases of natural deaths were the cardiovascular, respiratory and central nervous systems, with the most common overall cause of death ischaemic heart disease. These findings are similar to studies performed in France¹⁶ and Jamaica¹⁹.

Infectious diseases of the central nervous system as a cause of death (18/61 cases, 30% of central nervous system causes) were more common in the setting studied than in other studies. In a study by Black and Graham on sudden unexplained death in adults due to intracranial pathology²⁰, the principal intracranial causes of death were epilepsy (60%), intracerebral haemorrhage (7%), and spontaneous subarachnoid haemorrhage by ruptured saccular aneurysm (19%), with meningitis only accounting for 1% of cases.

In this study, infectious diseases were the most common causes of death in the youngest age group (18-29 years). Routine testing for HIV-infection is not performed at the

Forensic Pathology Services and the impact of associated HIV-infection on the underlying causes of death in these cases are unknown.

Pulmonary tuberculosis was present in all age categories, as could be expected in a suburban area of the Western Cape, which has a high incidence of tuberculosis. In fact, the Western Cape Province had the highest notification rate of smear-positive Tuberculosis cases in South Africa in 2002²¹. The notification rate for new smear-positive Tuberculosis cases in Cape Town was 266/100,000 in 2002²². Even though the prevalence of tuberculosis is high in the Western Cape, the high number of cases found in this study was not anticipated, as tuberculosis is a chronic disease with a range of symptoms and signs. The fact that so many tuberculosis deaths are reported to the Forensic Pathology Services may be explained by a lack of knowledge about the deceased's medical history, rather than the "suddenness" of the death. Also, some cases end up at FPS because the deceased has seldom been to a medical facility, and did not have a "regular" medical attendant who was willing to sign the death notification form.

A total of 171 cases were classified as being "other than natural", with 74 accidental, 15 homicidal, and 10 suicidal causes of death, and 72 cases undetermined with post-mortem examination alone. These diagnoses could have been missed if no autopsies had been performed, as many findings are only discovered on internal examination or with the help of special investigations, and it may have obvious legal consequences. This confirms that there is a rightful place for the performance of forensic autopsies in true cases of sudden and unexpected deaths.

Laboratory investigations:

An increase in the performance of histological examinations and alcohol concentration determinations was noted, but this was directly related to the increase in "sudden and unexpected deaths" in this time period. Tissue for histology is often taken in these cases to confirm or diagnose a specific natural disease process, while alcohol concentration is routinely requested in all adult deaths at Tygerberg FPS.

Controversy exists in the forensic pathology field as to whether it is beneficial and cost-effective to do routine histological examinations in forensic autopsies²³. However, it is recommended that histology and other special investigations be performed after the performance of an autopsy where the cause of death is not clear after macroscopic evaluation of the body and organs²⁴. According to Cohle and Sampson²⁵, a minimum of 10 sections of myocardium (including left and right ventricles, and interventricular septum) should be taken to exclude focal cardiovascular pathology, eg myocarditis or sarcoidosis. In our study, consultants were less likely to retain tissue for histological evaluation, being more knowledgeable and experienced in recognizing certain pathological conditions macroscopically.

The Practice guideline for Forensic Pathology²⁴, prepared by the Forensic Pathology Committee of the College of American Pathologists, recommends that comprehensive

drug screens should be carried out where it is indicated in the history, or where no significant anatomic findings were present.

An unexpected finding was the number of cases where death was due to acute alcohol poisoning. Possible mechanisms of death in acute alcohol poisoning may include direct depressive effects on the respiratory centre in the brainstem, or through secondary events such as aspiration of vomitus². The 5th and 95th percentile values for blood-ethanol concentration in acute alcohol poisoning deaths, in a Swedish study by Jones and Holmgren²⁶, were 0.22 and 0.50g/100mL, respectively.

The diagnosis of death “consistent with”, or “due to” acute alcohol poisoning was made in 35 out of 601 cases (6%), in our study, with an average blood alcohol concentration level in these cases of 0.38g/100mL. (Range of 0.25-0.62g/100mL) This contrasts strongly with the study on a medico-legal series of sudden adult death cases over a 5-year study period by De la Grandmaison in France, where alcohol was “detected” in only two cases out of 77 cases¹⁶. The exact values of the blood alcohol concentration in the two cases in De la Grandmaison’s study were not supplied.

Apart from the 35 cases where the cause of death was attributed to acute alcohol poisoning, another 3 cases were discovered where very high (fatal) blood alcohol concentrations were present. These cases had been signed out prior to the availability of blood alcohol concentration results, with the causes of death indicated as various natural causes. This demonstrates the importance of waiting for the results of all relevant tests, before finally determining the cause of death and finalizing the autopsy report.

One major perceived problem in the Forensic Pathology Services is that too much time is spent waiting for results of the blood or eye fluid alcohol concentration determination, as well as toxicology results.

In this study, it was found that 65.8% of blood alcohol concentration results were available within 3 months after the performance of autopsies; however in some cases results were only available after 1 year.

Results of the toxicological analyses were only available after 9 months in 27% of cases. The current (2010) turnaround time for toxicology results is more in the order of 24-36 months, as recently stressed in the public media, with some results still outstanding after 4 – 5 years^{27, 28}. The relatively quick turnaround time of the majority of blood alcohol concentration results and toxicological analyses in this study may be explained by a research project on drug and alcohol screening at autopsy, which was performed at the Forensic Chemistry Laboratory in Woodstock during 2003-2004. Specimens were collected and tested under the researcher’s supervision, and results were available to pathologists within a short period of time.

The time spent waiting for results delays the completion of the autopsy report, as well as the police investigation, and this delay in obtaining results has a very negative impact on service delivery and job satisfaction. Currently, due to financial constraints, toxicology tests are only requested in very select cases at mortuaries in South Africa.

Microbiological cultures were only requested in 13 cases. No consensus exists in the Forensic Pathology community regarding the use of microbiology in post-mortem examinations. However; it can be regarded as a reliable tool for postmortem quality control of antemortem diagnostic and therapeutic procedures, and can serve as an additional indicator of nosocomial infections within a specific hospital environment²⁹. Many causes of death in this study were infection-related, and those diagnoses could possibly have been supported by postmortem bacteriological cultures.

Negative autopsies:

The percentage of cases signed out as being “undetermined with post-mortem examination alone” in this study, was slightly higher than reported international results, at 10.6% (64/601). The UK National Confidential Enquiry into Patient Outcome and Death study looked at the quality of the Coroner’s autopsies, and reported that 2.6% of cases (44/1691) were recorded as “unascertained” or undetermined with post-mortem examination alone⁴. According to a national survey of sudden, unexpected cardiac or unexplained deaths in England in 2003, no cause of death was found in 4.1% of deaths under 65 years old³⁰. Milroy³¹ states that the number of unascertained autopsy cases will depend on the “thoroughness of the autopsy and the interpretation that the pathologist will give to borderline significant pathology”.

The number of special dissection techniques employed in cases of unascertained death (13/64 cases or 20.3%) in this setting may be too low. The cardiovascular and central nervous systems are respectively the 1st and 3rd most common organ systems involved in cases of sudden and unexpected death in this study. It is possible that obscure causes of death may be missed with “fresh” examination of the heart and brain, without proper fixation and evaluation in consultation with specialists in the various fields.

The number of unascertained cases per designated person performing the autopsy did not vary much between registrars (10.7%) and consultants (9.8%). This could be explained by the fact that the registrars are being supervised by consultants, and policy in the division is that specialists should be consulted by registrars in cases where the cause of death is not clear.

The South African Police Service (SAPS) uses police dockets to manage all information on a case which is being investigated. The documents in the docket may include witness statements, post-mortem reports, photographs, medical notes, etc. When the cause of death is unascertainable by autopsy alone, the investigating officer from the SAPS should try to collect more information regarding the circumstances of the death, or on the personal and medical history of the deceased person. All of the available information on a specific case is then returned to the forensic pathologist in the form of the case docket, for review of the evidence and possible determination of the cause of death.

Police docket reports on cases which were undetermined by post-mortem examination alone, which had already been received and finalized by the department at the time of the

study, were also reviewed and it was found that a cause of death could be offered in 39% of the cases, initially recorded as being “undetermined with post-mortem examination alone”.

This shows that it is worthwhile to receive docket, which often contain more significant and comprehensive collateral information, and allow the pathologist to come to a more certain conclusion regarding the cause of death. On the other hand, if this information was available at the start of the autopsy, the lengthy procedure may have been avoided.

CHAPTER 11

RECOMMENDATIONS

The following recommendations are made to possibly improve the quality of service provided by Forensic Pathology Services, and to aid the pathologist in the performance of postmortem examinations in cases of “sudden and unexpected” deaths in adults:

- Improvement of the interview.
- Improvement of the questionnaire.
- Feedback to families.

Interview

The importance of the registration of causes of death is recognized worldwide, as the lack of reliable data continues to limit efforts to build a solid evidence base for health policy, planning, monitoring and evaluation³¹. Ways to gather and register information on mortality statistics include the performance of autopsies, completion of death notification forms and the performance of verbal autopsies.

Ascertaining whether the deceased had a known medical history is one of the key elements when taking a history from relatives. Specific common conditions (i.e. hypertension, diabetes mellitus, ischaemic heart disease, epilepsy, asthma, tuberculosis) are listed in the current questionnaire and any other additional information or diseases not specifically asked for should be recorded. However, it is apparent that the information received at our facility prior to autopsy is often scanty, misleading and not informative enough.

The following suggestions may improve the quality of the information received during an interview conducted by the FPS interviewers, and may increase the value of the interview to achieve almost the same status as a “verbal autopsy”:

- Basic medical training of forensic officers with specific reference to relevant symptoms and diseases, which should include discussion of symptoms and their description in local languages⁹.
- Availability of translators to overcome language barriers.
- The appointment of forensic nurses, to improve the services.
 - In a study by Jane Ruddy, on the “forensic pathologist’s perception of the nurses’ role in the coroner’s enquiry”³², the following roles for a nurse in forensic pathology services were identified:
 - Keeping records;
 - Communicator;
 - Supporter;
 - Evidence giver;
 - Certifying death.
- Allowing time for forensic pathologists to interview family members, friends and attending medical practitioners themselves if indicated.

- The opportunity to re-interview informants post-autopsy. At this time the pathologist could ask whether symptoms related to the autopsy findings may indeed have been present, which were thought not to be relevant at the time of the interview. This will not assist in reducing the number of “unnecessary” autopsies, but may help to reduce the number of “unascertained” autopsies. Minimal findings of uncertain significance may have been present, which could possibly be clarified and contextualized with adequate and relevant history, and a cause of death could possibly be offered.

Questionnaire

The use of a questionnaire, such as the International Standard Verbal Autopsy Questionnaire (Appendix II), may lead to the uncovering of more specific and appropriate information pre-autopsy. This will lead to a reduction in the number of full autopsies performed, without influencing the quality of the information collected.

If one considers the most common causes of death in cases of “sudden and unexpected” death in adults in this study, and look at the current questionnaire used (Refer Appendix I), some shortcomings of the current questionnaire are evident, especially if one compares it to the International Standard Verbal Autopsy questionnaire used by the WHO. For example, the most common cause of death in this study was “ischaemic heart disease”. Currently, no questions regarding important risk factors for the development or symptoms of ischaemic heart disease are asked. Questions relevant to the following risk factors for ischaemic heart disease should be added to the questionnaire: family history of ischaemic heart disease, high cholesterol, smoking history and sedentary lifestyle³³.

Further discussion with target groups about the possible use of a shortened and modified version of the International Standard Verbal Autopsy Questionnaire, suited to local needs, and possibly available in local languages should be planned and implemented.

Feedback system

It has been stressed in various papers^{10, 30, 34} that feedback regarding the cause of death should be given to families, especially where the cause of death could have an impact on the health of the surviving family members. This is especially important in inheritable conditions (eg. channelopathies, cardiomyopathies), but it is just as important in infectious diseases (eg pulmonary tuberculosis) to ensure the protection of the surviving family members and close contacts.

Presently, no formal feedback sessions are arranged with family members, partly because of time constraints on the side of the forensic pathologist, and the onus rests on the family members to contact the pathologist or investigating officer regarding the outcomes of the autopsy. Many relatives probably never know, or even have a basic understanding of what the final cause of death was. In most of the autopsies of unnatural causes, the lack of feedback is due to the fact that the cases are *sub judice* and results may not be made available. However, where the cause of death was found to be natural, there is no reason not to explain to the family what the cause of death had been.

Where possible, feedback should at least be given in cases where the results of the autopsy could have a negative effect on the health of the surviving family members or close contacts.

CONCLUSIONS

In this study of sudden and unexpected deaths in adults at Tygerberg Forensic Pathology Services, it was found that the majority of cases had a presumed natural manner and cause of death. Ischaemic heart disease was the most common cause of death and chest pain prior to death was a prominent finding. Infectious diseases accounted for most deaths in the youngest age group studied. Intracranial infections as a cause of sudden death accounted for more deaths in our setting compared to studies in other countries. “Sudden and unexpected” adult deaths were reported much more frequently in Charlotte Maxeke subcouncil than in others. An increase in the waiting times for toxicology and blood alcohol concentration results were noted. A high number of deaths were due to acute alcohol poisoning. Improvement of the questionnaire and interview of the relatives may help to decrease the number of unnecessary autopsies, thereby reducing the burden of cost on Forensic Pathology Services.

REFERENCES:

1. Oxford Dictionary of English. London: Oxford press. 2005.
2. Dada MA, McQuoid-Mason DJ. Introduction to medico-legal practice. Durban: Butterworths; 2001.
3. O'Sullivan JP. The coroner's necropsy in sudden death: an under-used source of epidemiological information. *J Clin Pathol.* 1996;49: 737-740.
4. Saukko P, Knight B. Knight's forensic pathology. 3rd ed. London: Hodder Arnold; 2004.
5. Mason JK. Forensic Medicine for lawyers. 3rd ed. London: Butterworths, 1995.
6. Shen WK, Edwards WD, Hammill SC, Bailey KR, Ballard DJ, Gersh BJ. Sudden unexpected nontraumatic death in 54 young adults: a 30-year population based study. *Am J Card.* 1995;76:148-152.
7. Eckart RE, Scoville SL, Campbell CL, Shry EA, Stajduhar KC, Potter RN, Pearse LA, Virmani R. Sudden death in young adults: a 25-year review of autopsies in military recruits. *Ann Intern Med.* 2004;141:829-834.
8. Schwar TG, Olivier JA, Loubser JD. The forensic ABC in medical practice – a practical guide. Pretoria: HAUM Educational publishers. 1988.
9. Setel PW, Rao C, Hemed Y, Whiting, DR, Yang G, Chandramohan D, Alberti KGMM, Lopez AD. Core verbal autopsy procedures with comparative validation results from two countries. *PLoS Med* 3(8): e268.
10. Lauritsen JM & Bruus M. EpiData (version 3). A comprehensive tool for validated entry and documentation of data. The EpiData Association, Odense Denmark, 2003-2004.
11. Cape Town Statistics from Census 2001. www.capetown.gov.za/statistics.
12. Biggs MJP, Brown LJR, Ruddy GN. Can cause of death be predicted from the pre-necropsy information provided in coroners' cases? *J Clin Pathol.* 2008;64:124-126.
13. Gill JR, Scordi-Bello IA. Natural, unexpected deaths: reliability of a presumptive diagnosis. *J Forensic Sci.* 2010;55:77-81.
14. Nashelsky MB, Lawrence CH. Accuracy of cause of death determination without forensic autopsy examination. *Am J Forensic Med Pathol.* 2003;24:313-319.
15. Lorin de la Grandmaison G. Is there progress in the autopsy diagnosis of sudden unexpected death in adults? *Forensic Sci Int.* 2000;116:138-144.
16. De la Grandmaison G, Durigon M. Sudden adult death: a medico-legal series of 77 cases between 1995 and 2000. *Med Sci Law.* 2002;42:225-232.
17. Anker M et al. A standard verbal autopsy method for investigation causes of death in infants and children, WHO/CDS/CSR/IRS/99.4
18. Sampson H, Johnson A, Carter N, Ruddy G. Information before coronial necropsy: how much should be available? *J Clin Pathol.* 1999;52:856-859.
19. Escoffery CT, Shirley SE. Causes of sudden natural death in Jamaica: a medicolegal (coroner's) autopsy study from the University Hospital of the West Indies. *Forensic Sci Int.* 2002;129:116-21.
20. Black M, Graham DI. Sudden unexplained death in adults caused by intracranial pathology. *J Clin Pathol.* 2002; 55: 44-50.
21. National Tuberculosis Control Program South Africa. Mobilizing against tuberculosis. South African Plan for TB Control for 2002 to 2005. Pretoria: The Program; 2002.
22. City of Cape Town/Metropole region TB control program. A partnership between the provincial administration of the Western Cape Metropole Region and City Health. Progress report 1997-2002. Cape Town: The Program; 2002.
23. Molina DK, Wood LE, Frost RE. Is routine histopathologic examination beneficial in all medicolegal autopsies? *Am J Forensic Med Pathol.* 2007;28:1-3.
24. Randall BB, Fierro MF, Froede RC. Practice guideline for Forensic Pathology. *Arch Pathol Lab Med.* 998;122:1056-1064.
25. Cohle SD, Sampson BA. The negative autopsy: Sudden cardiac death or other? *Cardiovasc Pathol.* 2001;10:271-274.
26. Jones AW, Holmgren P. Comparison of blood-ethanol concentration in deaths attributable to acute alcohol poisoning and chronic alcoholism. *J For Sci.* 2003;48:874-9.
27. Masondo S. Forensic Labs in a shambles. *The Times.* 5 February 2010.

28. Dolley C. Dire staff shortages at forensic labs stifle justice. Cape Times. 8 February 2010.
29. Tsokos M, Puschel K. Postmortem bacteriology in forensic pathology: diagnostic value and interpretation. *Leg Med.*2001;3:15-22.
30. Bowker TJ, Wood DA, Davies MJ et al. Sudden, unexpected cardiac or unexplained death in England: a national survey. *Q J Med.* 2003;96:266-279.
31. Milroy CM. The autopsy in cases of unascertained sudden death. *Curr Diag Pathol.*2007;13:401-409.
32. Ruddy JE. Her Majesty's coroners and Home Office forensic pathology perception of the nurses' role in the coroner's enquiry. *Int J Nurs Stud.* 2000;37:351-9.
33. Davidson's principles and practice of Medicine. 18th edition. London: Churchill Livingstone. 1999.
34. Lee A, Ackerman MJ. Sudden unexplained death: evaluation of those left behind. *Lancet.* 2003;362:1429-1431.

Appendix I

**DEPARTMENT OF HEALTH
FORENSIC PATHOLOGY SERVICES
TYGERBERG**



**ANNEXURE A
WC.....**

SUDDEN AND UNEXPECTED DEATHS IN ADULTS AND BABIES

I,state under
oath/affirm

(full names)

I am an adult male/female, residing at
.....

I am theof the deceased
.....

(relationship)

(name of deceased)

who wasyears old.

OnI was interviewed by
.....

regarding the circumstances of the death of the above-mentioned deceased and I
answered the following questions:

A. GENERAL MEDICAL HISTORY:

Did the deceased suffer from any of the following conditions, if so, for how long, did they receive treatment, did they take the treatment, which Doctor or Clinic/Hospital did they attend for the problem:

TB	
Diabetes	
Hypertension	
Epilepsy	
Asthma	
Cancer	
Any psychiatric condition	
Any other	
Was he/she ill before death?	
If so, for how long did he/she complain and what was the nature of the complaint?	
Was medicine taken for any sickness before death?	
If so, which medicine was ingested and where was it obtained?	
Any other relevant history	

B. Questions that must be put to next-of-kin regarding sudden and unexpected deaths or where the next-of-kin cannot supply a death certificate (BI-1663):

Was someone present during the time of death? If so, whom, relationship and age	
When last was the deceased at a Doctor, Clinic or Hospital?	
Name of Doctor, Clinic or Hospital	
Why did he/she attend the Doctor for the last time?	
Did the deceased recently consult a traditional healer?	
Did the deceased recently take any traditional medicine?	
Was the deceased allergic to anything?	
Was the deceased ever operated on? If so, when and for what?	
Where did the deceased work and what was the nature of the work	
Did the deceased work with dangerous gasses or chemicals?	
Was the deceased ever involved in an accident? If so, what type of accident?	
Did he/she retain any side-effects, e.g. epilepsy, paralysis, defect?	
Was the deceased ever badly assaulted?	
Was the deceased ever under the influence of drugs or alcohol?	
Do you think someone is responsible for the death?	
Do you suspect suicide?	
Is there anything else that you think the pathologist should know?	
Was the deceased in financial or emotional trouble or under stress/pressure?	

COMPLETE 2 OR 3 IF	
2. SOMEONE WAS PRESENT DURING THE DEATH:	
Describe fully exactly what actions the deceased was doing just before his/her death, e.g. sitting, walking, coughing, sleeping, grabbing chest, etc.	
Before death, did the person – vomit, cough up blood, have bowel movements?	
What happened when death approached? Describe fully (fits, shortness of breath, foaming at the mouth, became blue in the face, collapsed, etc.)	
Did someone attempt first aid? (e.g. Heimlich procedure)	
What exactly was done?	
3. PERSON WAS FOUND DEAD:	
When was the deceased last seen alive?	
In what position was the deceased found?	
Were there signs of vomiting, coughing up blood, bowel action before death?	
Did he/she stay alone or did someone else stay with the deceased?	

If the deceased stayed alone, was the room/residence locked?	
Was the room/residence locked from the inside?	
How was the body discovered, e.g. family, friends	
Did someone begin searching for the deceased?	
Was the deceased in trouble or under stress/pressure?	
Did the deceased write anyone a letter/note before death?	
4. COMPLETE IF A BABY SHOULD SUDDENLY DIE	
Is the mother married, divorced or single?	
Has the family already had a baby that died suddenly?	
Has the mother had any miscarriages?	
Was the pregnancy normal?	
How many other children has the mother had?	
Did the baby sleep with the mother?	
If not, where did the baby sleep?	

Did the baby sleep with other person in the same bed?	
If yes, how many?	
How was the baby covered?	
In what position do you normally put the baby to sleep?	Back/side/stomach
On what type of mattress did the baby sleep?	Foam/rubber/inner spring/none
In what position was the baby found?	Back/side/stomach
Was a pillow used for the baby?	
Did the baby vomit?	
Did the baby suffer from diarrhea?	
Did the baby have a temperature?	
Did the baby breast-feed or was he/she bottle-fed?	
Did the baby cry more than normal?	
Did the baby suffer from any illness?	
Is there any baby/child sickness in the area?	
Where was the baby born? (Name of hospital/clinic/home)	
Was the baby ill the day before?	
Was a traditional healer consulted?	
Was traditional medicine given, by mouth or enema?	
Was the baby recently taken to clinic or hospital for vaccination (if yes, when and where?)	
Possibly unnatural causes	
Possibly natural causes	
Deceased was examined and the following was observed:	

Death certificate issued / not issued:

Cause of death given as:

DATE: _____

SIGNATURE

PRINT NAME

1. I know and understand the contents of this declaration.
2. I have no objection to taking the prescribed oath.
3. I consider the prescribed oath binding on my conscience.

PLACE

.....

SIGNATURE/THUMB PRINT OF

DEPONENT

DATE

I certify that the deponent has acknowledged that he/she understands the contents of this declaration which was sworn to before medico-legal post-mortem examination and that the deponent's signature was placed thereon in my presence at

.....on

.....

.....

COMMISSIONER OF OATHS

FULL NAMES:

.....

.

DESIGNATION (RANK)

.....

BUSINESS ADDRESS

.....

EXAMINATION OF CADAVER BY POLICE OFFICER WHO TOOK STATEMENT
(MENTION INJURIES, WOUNDS, DIFFERENTIALS, DEFORMITIES AND ANYTHING
OF IMPORTANCE)

NAME IN PRINT

SIGNATURE

Appendix II

INTERNATIONAL STANDARD VERBAL AUTOPSY QUESTIONNAIRE 3 DEATH OF A PERSON AGED 15 YEARS AND ABOVE

ID/CONTROL/REFERENCE NUMBER

--	--	--	--	--	--

SECTION 1.1 INTERVIEWER VISITS				
	1	2	3	FINAL VISIT
DATE	_____	_____	_____	DAY <table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle;"></table>
INTERVIEWER'S NAME	_____	_____	_____	MONTH <table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle;"></table> YEAR <table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle; text-align: center;">2</table> <table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle; text-align: center;">0</table>
RESULT*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	INT. NUMBER <table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle;"></table> RESULT <table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle;"></table>
NEXT VISIT: DATE	_____	_____		TOTAL NUMBER OF VISITS <table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle;"></table>
1 COMPLETED 2 NOT AT HOME 3 POSTPONED 4 REFUSED 5 PARTLY COMPLETED 6 NO APPROPRIATE RESPONDENT FOUND 7 OTHER _____ <div style="text-align: right; font-size: small;">(SPECIFY)</div>				
NAME _____	SUPERVISOR	NAME _____	FIELD EDITOR	OFFICE EDITOR <table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle;"></table>
DATE _____	<table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle;"></table>	DATE _____	<table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle;"></table>	KEYED BY <table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle;"></table>
PLACE NAME _____		ADDRESS/DIRECTIONS TO HOUSEHOLD _____		
_____		_____		
_____		_____		
SECTION 1.2 ADDITIONAL DEMOGRAPHIC INFORMATION (FOR USE IN SAMPLE VITAL REGISTRATION OR DEMOGRAPHIC SURVEILLANCE SITE)				
REGION/PROVINCE _____	REGION/PROVINCE. <table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle;"></table>			
FIELD SITE _____	FIELD SITE <table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle;"></table>			
HOUSEHOLD NUMBER _____	HOUSEHOLD NUMBER <table border="1" style="display: inline-table; width: 20px; height: 15px; vertical-align: middle;"></table>			
NAME OF REFERENCE PERSON _____	RESIDENT IN ENUMERATION AREA 1			
RESIDENTIAL STATUS OF THE DECEASED _____	BODY BROUGHT HOME FOR BURIAL 2			
	HOME-COMING SICK 3			
SAMPLE INFORMED CONSENT STATEMENT				
<p>Hello. My name is _____ and I am working with [AGENCY].</p> <p>We are collecting information on the causes of death in the community. We would very much appreciate your participation in this effort. We want to ask you about the circumstances leading to the death of the deceased. Whatever information you provide will be kept strictly confidential. No information identifying you or the deceased will ever be released to anyone outside of this information-collection activity.</p> <p>Participation in this survey is voluntary and you can choose not to answer any individual question or all of the questions. You may also stop the interview completely at any time without any consequences at all. However, we hope that you will participate in this survey since the results will help the government improve services for people.</p> <p>At this time, do you want to ask me anything about the purpose or content of this interview?</p> <p>May I begin the interview now?</p> <p>Signature of interviewer: _____ Date: _____</p>				
RESPONDENT AGREES TO BE INTERVIEWED ... 1 RESPONDENT DOES NOT AGREE TO BE INTERVIEWED ... 2 → END <div style="text-align: center; margin-top: 5px;">↓</div>				

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
SECTION 4. RESPONDENT'S ACCOUNT OF ILLNESS/EVENTS LEADING TO DEATH			
401	Could you tell me about the illness/events that led to her/his death? _____ _____ _____ _____ _____ _____		
402	CAUSE OF DEATH 1 ACCORDING TO RESPONDENT		
403	CAUSE OF DEATH 2 ACCORDING TO RESPONDENT		
SECTION 5. HISTORY OF PREVIOUSLY KNOWN MEDICAL CONDITIONS			
501	I would like to ask you some questions concerning previously known medical conditions the deceased had; injuries and accidents that the deceased suffered; and signs and symptoms that the deceased had/showed when s/he was ill. Some of these questions may not appear to be directly related to his/her death. Please bear with me and answer all the questions. They will help us to get a clear picture of all possible symptoms that the deceased had. Please tell me if the deceased suffered from any of the following illnesses:		
502	High blood pressure?	YES 1 NO 2 DONT KNOW 8	
503	Diabetes?	YES 1 NO 2 DONT KNOW 8	
504	Asthma?	YES 1 NO 2 DONT KNOW 8	
505	Epilepsy?	YES 1 NO 2 DONT KNOW 8	
506	Malnutrition?	YES 1 NO 2 DONT KNOW 8	
507	Cancer?	YES 1 NO 2 DONT KNOW 8	→ 509 → 509
508	Can you specify the type or site of cancer?	TYPE/SITE _____	
509	Tuberculosis?	YES 1 NO 2 DONT KNOW 8	
510	HI/AIDS?	YES 1 NO 2 DONT KNOW 8	
511	Did s/he suffer from any other medically diagnosed illness?	YES 1 NO 2 DONT KNOW 8	→ 601 → 601
512	Can you specify the illness?	ILLNESS _____	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP																																												
SECTION 7. SYMPTOMS AND SIGNS ASSOCIATED WITH ILLNESS OF WOMEN																																															
701	Did she have an ulcer or swelling in the breast?	YES 1 NO 2 DONT KNOW 8	→ 703 → 703																																												
702	For how long did she have an ulcer or swelling in the breast?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DONT KNOW 9 9 8																																													
703	Did she have excessive vaginal bleeding during menstrual periods?	YES 1 NO 2 DONT KNOW 8	→ 705 → 705																																												
704	For how long did s/he have the excessive vaginal bleeding during menstrual periods?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DONT KNOW 9 9 8																																													
705	Did she have vaginal bleeding in between menstrual periods?	YES 1 NO 2 DONT KNOW 8	→ 707 → 707																																												
706	For how long did she have vaginal bleeding in between menstrual periods?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DONT KNOW 9 9 8																																													
707	Did she have abnormal vaginal discharge?	YES 1 NO 2 DONT KNOW 8	→ 801 → 801																																												
708	For how long did she have abnormal vaginal discharge?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DONT KNOW 9 9 8																																													
SECTION 8. SYMPTOMS AND SIGNS ASSOCIATED WITH PREGNANCY																																															
801	Was she pregnant at the time of death?	YES 1 NO 2 DONT KNOW 8	→ 806 → 806																																												
802	How long was she pregnant?	WEEKS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DONT KNOW 9 9 8																																													
803	How many pregnancies had she had, including this one?	PREGNANCIES <input type="text"/> <input type="text"/> DONT KNOW 9 8																																													
804	During the last 3 months of pregnancy, did she suffer from any of the following illnesses:	<table border="0"> <thead> <tr> <th></th> <th>YES</th> <th>NO</th> <th>DK</th> </tr> </thead> <tbody> <tr> <td>1 Vaginal bleeding?</td> <td>1</td> <td>2</td> <td>8</td> </tr> <tr> <td>2 Smelly vaginal discharge?</td> <td>1</td> <td>2</td> <td>8</td> </tr> <tr> <td>3 Puffy face?</td> <td>1</td> <td>2</td> <td>8</td> </tr> <tr> <td>4 Headache?</td> <td>1</td> <td>2</td> <td>8</td> </tr> <tr> <td>5 Blurred vision?</td> <td>1</td> <td>2</td> <td>8</td> </tr> <tr> <td>6 Convulsion?</td> <td>1</td> <td>2</td> <td>8</td> </tr> <tr> <td>7 Febrile illness?</td> <td>1</td> <td>2</td> <td>8</td> </tr> <tr> <td>8 Severe abdominal pain that was not labor pain?</td> <td>1</td> <td>2</td> <td>8</td> </tr> <tr> <td>9 Pallor and shortness of breath (both present)?</td> <td>1</td> <td>2</td> <td>8</td> </tr> <tr> <td>10 Did she suffer from any other illness?</td> <td>1</td> <td>2</td> <td>8</td> </tr> </tbody> </table>		YES	NO	DK	1 Vaginal bleeding?	1	2	8	2 Smelly vaginal discharge?	1	2	8	3 Puffy face?	1	2	8	4 Headache?	1	2	8	5 Blurred vision?	1	2	8	6 Convulsion?	1	2	8	7 Febrile illness?	1	2	8	8 Severe abdominal pain that was not labor pain?	1	2	8	9 Pallor and shortness of breath (both present)?	1	2	8	10 Did she suffer from any other illness?	1	2	8	
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NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
805	Did she die during labor, but undelivered?	YES 1 NO 2 DONTKNOW 8	
806	Did she give birth recently?	YES 1 NO 2 DONTKNOW 8	→ 818 → 818
807	How many days after giving birth did she die?	DAYS <input type="text"/> <input type="text"/> DONTKNOW 9 8	
808	Was there excessive bleeding on the day labor started?	YES 1 NO 2 DONTKNOW 8	
809	Was there excessive bleeding during labor before delivering the baby?	YES 1 NO 2 DONTKNOW 8	
810	Was there excessive bleeding after delivering the baby?	YES 1 NO 2 DONTKNOW 8	
811	Did she have difficulty in delivering the placenta?	YES 1 NO 2 DONTKNOW 8	
812	Was she in labor for unusually long (more than 24 hours)?	YES 1 NO 2 DONTKNOW 8	
813	Was it a normal vaginal delivery?	YES 1 NO 2 DONTKNOW 8	→ 815 → 815
814	What type of delivery was it?	FORCEPS/VACUUM 1 CAESAREAN SECTION 2 OTHER 6 (SPECIFY) DONTKNOW 8	
815	Did she have foul smelling vaginal discharge?	YES 1 NO 2 DONTKNOW 8	
816	Where did she give birth?	HOSPITAL 1 OTHER HEALTH FACILITY 2 HOME 3 OTHER 6 (SPECIFY) DONTKNOW 8	
817	Who conducted the delivery?	DOCTOR 1 NURSE/MIDWIFE 2 TRADITIONAL BIRTH ATTENDANT 3 RELATIVE 4 MOTHER BY HERSELF 5 OTHER 6 (SPECIFY) DONTKNOW 8	
818	Did she experience an abortion recently?	YES 1 NO 2 DONTKNOW 8	→ 901 → 901
819	Did she die during the abortion?	YES 1 NO 2 DONTKNOW 8	→ 821 → 821
820	How many days before death did she have the abortion?	DAYS <input type="text"/> <input type="text"/> DONTKNOW 9 8	
821	How many months pregnant was she when she had the abortion?	MONTHS <input type="text"/> <input type="text"/> DONTKNOW 9 8	
822	Did she have heavy bleeding after the abortion?	YES 1 NO 2 DONTKNOW 8	
823	Did the abortion occur by itself, spontaneously?	YES 1 NO 2 DONTKNOW 8	→ 901 → 901
824	Did she take medicine or treatment to induce?	YES 1 NO 2 DONTKNOW 8	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
SECTION 9. SIGNS AND SYMPTOMS NOTED DURING THE FINAL ILLNESS			
901	For how long was s/he ill before s/he died?	DAYS 1 <input type="text"/> MONTHS 2 <input type="text"/> DONT KNOW 9 9 8	
902	Did s/he have a fever?	YES 1 NO 2 DONT KNOW 8	→ 907 → 907
903	For how long did s/he have a fever?	DAYS 1 <input type="text"/> MONTHS 2 <input type="text"/> DONT KNOW 9 9 8	
904	Was the fever continuous or on and off?	CONTINUOUS 1 ON AND OFF 2 DONT KNOW 8	
905	Did s/he have fever only at night?	YES 1 NO 2 DONT KNOW 8	
906	Did s/he have chills/rigor?	YES 1 NO 2 DONT KNOW 8	
907	Did s/he have a cough?	YES 1 NO 2 DONT KNOW 8	→ 913 → 913
908	For how long did s/he have a cough?	DAYS 1 <input type="text"/> MONTHS 2 <input type="text"/> DONT KNOW 9 9 8	
909	Was the cough severe?	YES 1 NO 2 DONT KNOW 8	
910	Was the cough productive with sputum?	YES 1 NO 2 DONT KNOW 8	
911	Did s/he cough out blood?	YES 1 NO 2 DONT KNOW 8	
912	Did s/he have night sweats?	YES 1 NO 2 DONT KNOW 8	
913	Did s/he have breathlessness?	YES 1 NO 2 DONT KNOW 8	→ 918 → 918
914	For how long did s/he have breathlessness?	DAYS 1 <input type="text"/> MONTHS 2 <input type="text"/> DONT KNOW 9 9 8	
915	Was s/he unable to carry out daily routines due to breathlessness?	YES 1 NO 2 DONT KNOW 8	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP								
916	Was s/he breathless while lying flat?	YES 1 NO 2 DON'T KNOW 8									
917	Did s/he have wheezing?	YES 1 NO 2 DON'T KNOW 8									
918	Did s/he have chest pain?	YES 1 NO 2 DON'T KNOW 8	→ 928 → 928								
919	For how long did s/he have chest pain?	DAYS 1 <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table> MONTHS 2 <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table> DON'T KNOW 9 9 8									
920	Did chest pain start suddenly or gradually?	SUDDENLY 1 GRADUALLY 2 DON'T KNOW 8									
921	When s/he had severe chest pain, how long did it last?	LESS THAN HALF AN HOUR 1 HALF AN HOUR TO 24 HOURS 2 LONGER THAN 24 HOURS 3 DON'T KNOW 8									
922	Was the chest pain located below the breastbone (sternum)?	YES 1 NO 2 DON'T KNOW 8									
923	Was the chest pain located over the heart and did it spread to the left arm?	YES 1 NO 2 DON'T KNOW 8									
924	Was the chest pain located over the ribs (sides)?	YES 1 NO 2 DON'T KNOW 8									
925	Was the chest pain continuous or on and off?	CONTINUOUS 1 ON AND OFF 2 DON'T KNOW 8									
926	Did the chest pain get worse while coughing?	YES 1 NO 2 DON'T KNOW 8									
927	Did s/he have palpitations?	YES 1 NO 2 DON'T KNOW 8									
928	Did s/he have diarrhoea?	YES 1 NO 2 DON'T KNOW 8	→ 933 → 933								
929	For how long did s/he have diarrhoea?	DAYS 1 <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table> MONTHS 2 <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table> DON'T KNOW 9 9 8									
930	Was the diarrhoea continuous or on and off?	CONTINUOUS 1 ON AND OFF 2 DON'T KNOW 8									
931	At any time during the final illness was there blood in the stool?	YES 1 NO 2 DON'T KNOW 8									
932	When the diarrhoea was most severe, how many times did s/he pass stools in a day?	NUMBER <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table> DON'T KNOW 9 8									

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
933	Did s/he vomit?	YES 1 NO 2 DONT KNOW 8	→ 937 → 937
934	For how long did s/he vomit?	DAYS 1 MONTHS 2 DONT KNOW 9 9 8	
935	Did the vomit look like a coffee-colored fluid or bright red/blood red or some other?	COFFEE-COLORED FLUID 1 BRIGHT RED/BLOOD RED 2 OTHER 6 (SPECIFY) DONT KNOW 8	
936	When the vomiting was most severe, how many times did s/he vomit in a day?	NUMBER DONT KNOW 9 8	
937	CHECK QUESTION 302 FOR SEX OF THE DECEASED: FEMALE <input type="checkbox"/> ↓ MALE <input type="checkbox"/>		939
938	CHECK QUESTIONS 801, 805, 819 TO SEE IF SHE DIED DURING PREGNANCY, LABOR, ABORTION OR POSTPARTUM: NO <input type="checkbox"/> ↓ YES <input type="checkbox"/>		948
939	Did s/he have abdominal pain?	YES 1 NO 2 DONT KNOW 8	→ 941 → 941
940	For how long did s/he have abdominal pain?	DAYS 1 MONTHS 2 DONT KNOW 9 9 8	
941	Did s/he have abdominal distension?	YES 1 NO 2 DONT KNOW 8	→ 945 → 945
942	For how long did s/he have abdominal distension?	DAYS 1 MONTHS 2 DONT KNOW 9 9 8	
943	Did the distension develop rapidly within days or gradually over months?	RAPIDLY WITHIN DAYS 1 GRADUALLY OVER MONTHS 2 DONT KNOW 8	
944	Was there a period of a day or longer during which s/he did not pass any stool?	YES 1 NO 2 DONT KNOW 8	
945	Did s/he have any mass in the abdomen?	YES 1 NO 2 DONT KNOW 8	→ 948 → 948
946	For how long did s/he have the mass in the abdomen?	DAYS 1 MONTHS 2 DONT KNOW 9 9 8	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
947	Where in the abdomen was the mass located?	RIGHT UPPER ABDOMEN 1 LEFT UPPER ABDOMEN 2 LOWER ABDOMEN 3 ALL OVER ABDOMEN 4 DON'T KNOW 8	
948	Did s/he have difficulty or pain while swallowing solids?	YES 1 NO 2 DON'T KNOW 8	→ 950 → 950
949	For how long did s/he have difficulty or pain while swallowing solids?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DON'T KNOW 9 9 8	
950	Did s/he have difficulty or pain while swallowing liquids?	YES 1 NO 2 DON'T KNOW 8	→ 952 → 952
951	For how long did s/he have difficulty or pain while swallowing liquids?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DON'T KNOW 9 9 8	
952	Did s/he have headache?	YES 1 NO 2 DON'T KNOW 8	→ 955 → 955
953	For how long did s/he the have headache?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DON'T KNOW 9 9 8	
954	Was the headache severe?	YES 1 NO 2 DON'T KNOW 8	
955	Did s/he have a stiff or painful neck?	YES 1 NO 2 DON'T KNOW 8	→ 957 → 957
956	For how long did s/he have a stiff or painful neck?	DAYS <input type="text"/> <input type="text"/> DON'T KNOW 9 8	
957	Did s/he have mental confusion?	YES 1 NO 2 DON'T KNOW 8	→ 960 → 960
958	For how long did s/he have mental confusion?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DON'T KNOW 9 9 8	
959	Did the mental confusion start suddenly, quickly within a single day, or slowly over many days?	SUDDENLY 1 WITHIN A DAY (FAST) 2 SLOWLY (MANY DAYS) 3 DON'T KNOW 8	
960	Did s/he become unconscious?	YES 1 NO 2 DON'T KNOW 8	→ 963 → 963
961	For how long was s/he unconscious?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DON'T KNOW 9 9 8	
962	Did the unconsciousness start suddenly, quickly within a single day, or slowly over many days?	SUDDENLY 1 WITHIN A DAY (FAST) 2 SLOWLY (MANY DAYS) 3 DON'T KNOW 8	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
963	Did s/he have convulsions?	YES 1 NO 2 DONT KNOW 8	→ 965 → 965
964	For how long did s/he have convulsions?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DONT KNOW 9 9 8	
965	Was s/he unable to open the mouth?	YES 1 NO 2 DONT KNOW 8	→ 967 → 967
966	For how long was s/he unable to open the mouth?	DAYS <input type="text"/> <input type="text"/> DONT KNOW 9 8	
967	Did s/he have stiffness of the whole body?	YES 1 NO 2 DONT KNOW 8	→ 969 → 969
968	For how long did s/he have stiffness of the whole body?	DAYS <input type="text"/> <input type="text"/> DONT KNOW 9 8	
969	Did s/he have paralysis of one side of the body?	YES 1 NO 2 DONT KNOW 8	→ 972 → 972
970	For how long did s/he have paralysis of one side of the body?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DONT KNOW 9 9 8	
971	Did the paralysis of one side of the body start suddenly, quickly within a single day, or slowly over many days?	SUDDENLY 1 WITHIN A DAY (FAST) 2 SLOWLY (MANY DAYS) 3 DONT KNOW 8	
972	Did s/he have paralysis of the lower limbs?	YES 1 NO 2 DONT KNOW 8	→ 975 → 975
973	How long did s/he have paralysis of the lower limbs?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DONT KNOW 9 9 8	
974	Did the paralysis of the lower limbs start suddenly, quickly within a single day, or slowly over many days?	SUDDENLY 1 WITHIN A DAY (FAST) 2 SLOWLY (MANY DAYS) 3 DONT KNOW 8	
975	Was there any change in color of urine?	YES 1 NO 2 DONT KNOW 8	→ 977 → 977
976	For how long did s/he have the change in color of urine?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DONT KNOW 9 9 8	
977	During the final illness did s/he ever pass blood in the urine?	YES 1 NO 2 DONT KNOW 8	→ 979 → 979
978	For how long did s/he pass blood in the urine?	DAYS 1 <input type="text"/> <input type="text"/> MONTHS 2 <input type="text"/> <input type="text"/> DONT KNOW 9 9 8	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP																								
979	Was there any change in the amount of urine s/he passed daily?	YES 1 NO 2 DON'T KNOW 8	→ 982 → 982																								
980	For how long did s/he have the change in the amount of urine passed daily?	DAYS 1 <input type="text"/> MONTHS 2 <input type="text"/> DON'T KNOW 9 9 8																									
981	Did s/he pass too much urine, too little urine, or no urine at all?	TOO MUCH 1 TOO LITTLE 2 NO URINE AT ALL 3 DON'T KNOW 8																									
982	During the illness that led to death, did s/he have any skin rash?	YES 1 NO 2 DON'T KNOW 8	→ 986 → 986																								
983	For how long did s/he have the skin rash?	DAYS <input type="text"/> DON'T KNOW 9 8																									
984	Was the rash on: 1 The face? 2 The trunk? 3 The arms and legs? 4 Any other place?	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">YES</th> <th style="text-align: center;">NO</th> <th style="text-align: center;">DK</th> </tr> </thead> <tbody> <tr> <td>FACE</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">8</td> </tr> <tr> <td>TRUNK</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">8</td> </tr> <tr> <td>ARMS AND LEGS</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">8</td> </tr> <tr> <td>OTHER PLACE</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">8</td> </tr> <tr> <td>SPECIFY: _____ ↓</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		YES	NO	DK	FACE	1	2	8	TRUNK	1	2	8	ARMS AND LEGS	1	2	8	OTHER PLACE	1	2	8	SPECIFY: _____ ↓				
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985	What did the rash look like?	MEASLES RASH 1 RASH WITH CLEAR FLUID 2 RASH WITH PUS 3 DON'T KNOW 8																									
986	Did s/he have red eyes?	YES 1 NO 2 DON'T KNOW 8																									
987	Did s/he have bleeding from the nose, mouth, or anus?	YES 1 NO 2 DON'T KNOW 8																									
988	Did s/he ever have shingles/herpes zoster?	YES 1 NO 2 DON'T KNOW 8																									
989	Did s/he have weight loss?	YES 1 NO 2 DON'T KNOW 8	→ 990 → 990																								
989.1	For how long did s/he have weight loss?	DAYS 1 <input type="text"/> MONTHS 2 <input type="text"/> DON'T KNOW 9 9 8																									
989.2	Did s/he look very thin and wasted?	YES 1 NO 2 DON'T KNOW 8																									
990	Did s/he have mouth sores or white patches in the mouth or on the tongue?	YES 1 NO 2 DON'T KNOW 8	→ 991 → 991																								
990.1	For how long did s/he have mouth sores or white patches in the mouth or on the tongue?	DAYS <input type="text"/> DON'T KNOW 9 8																									
991	Did s/he have any swelling?	YES 1 NO 2 DON'T KNOW 8	→ 992 → 992																								

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991.1	For how long did s/he have the swelling?	DAYS 1 <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td></tr><tr><td> </td><td> </td></tr></table> MONTHS 2 <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td></tr><tr><td> </td><td> </td></tr></table> DONT KNOW 9 9 8																													
991.2	Was the swelling on: 1 The face? 2 The joints? 3 The ankles? 4 The whole body? 5 Any other place?	<table style="width: 100%;"><thead><tr><th></th><th>YES</th><th>NO</th><th>DK</th></tr></thead><tbody><tr><td>FACE</td><td>1</td><td>2</td><td>8</td></tr><tr><td>JOINTS</td><td>1</td><td>2</td><td>8</td></tr><tr><td>ANKLES</td><td>1</td><td>2</td><td>8</td></tr><tr><td>WHOLE BODY</td><td>1</td><td>2</td><td>8</td></tr><tr><td>OTHER PLACE</td><td>1</td><td>2</td><td>8</td></tr><tr><td>SPECIFY: _____ ↓</td><td></td><td></td><td></td></tr></tbody></table>		YES	NO	DK	FACE	1	2	8	JOINTS	1	2	8	ANKLES	1	2	8	WHOLE BODY	1	2	8	OTHER PLACE	1	2	8	SPECIFY: _____ ↓				
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992	Did s/he have any lumps?	YES 1 NO 2 → 993 DONT KNOW 8 → 993																													
992.1	For how long did s/he have the lumps?	DAYS 1 <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td></tr><tr><td> </td><td> </td></tr></table> MONTHS 2 <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td></tr><tr><td> </td><td> </td></tr></table> DONT KNOW 9 9 8																													
992.2	Were the lumps on: 1 The neck? 2 The armpit? 3 The groin? 4 Any other place?	<table style="width: 100%;"><thead><tr><th></th><th>YES</th><th>NO</th><th>DK</th></tr></thead><tbody><tr><td>NECK</td><td>1</td><td>2</td><td>8</td></tr><tr><td>ARMPIT</td><td>1</td><td>2</td><td>8</td></tr><tr><td>GROIN</td><td>1</td><td>2</td><td>8</td></tr><tr><td>OTHER PLACE</td><td>1</td><td>2</td><td>8</td></tr><tr><td>SPECIFY: _____ ↓</td><td></td><td></td><td></td></tr></tbody></table>		YES	NO	DK	NECK	1	2	8	ARMPIT	1	2	8	GROIN	1	2	8	OTHER PLACE	1	2	8	SPECIFY: _____ ↓								
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993	Did s/he have yellow discoloration of the eyes?	YES 1 NO 2 → 994 DONT KNOW 8 → 994																													
993.1	For how long did s/he have yellow discoloration of the eyes?	DAYS 1 <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td></tr><tr><td> </td><td> </td></tr></table> MONTHS 2 <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td></tr><tr><td> </td><td> </td></tr></table> DONT KNOW 9 9 8																													
994	Did s/he look pale (thinning/lack of blood) or have pale palms, eyes or nail beds?	YES 1 NO 2 → 995 DONT KNOW 8 → 995																													
994.1	For how long did s/he look pale or have pale palms, eyes or nail beds?	DAYS <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td></tr><tr><td> </td><td> </td></tr></table> DONT KNOW 9 8																													
995	Did s/he have an ulcer, abscess, or sore anywhere on the body?	YES 1 NO 2 → 1001 DONT KNOW 8 → 1001																													
995.1	For how long did s/he have the ulcer, abscess, or sore?	DAYS <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td></tr><tr><td> </td><td> </td></tr></table> DONT KNOW 9 8																													
995.2	What was the location of the ulcer, abscess, or sore?	_____ _____ (SPECIFY)																													

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
SECTION 11. RISK FACTORS			
1101	Did s/he drink alcohol?	YES 1 NO 2 DONT KNOW 8	→ 1106 → 1106
1102	How long had s/he been drinking? RECORD '00' IF LESS THAN ONE YEAR	YEARS <input type="text"/> <input type="text"/> DONT KNOW 9 8	
1103	How often did s/he drink alcohol?	DAILY 1 FREQUENTLY (WEEKLY) 2 ONCE IN A WHILE 3 DONT KNOW 8	
1104	Did she stop drinking?	YES 1 NO 2 DONT KNOW 8	→ 1106 → 1106
1105	How long before death did s/he stop drinking? RECORD '00' IF LESS THAN ONE MONTH	MONTHS <input type="text"/> <input type="text"/> DONT KNOW 9 8	
1106	Did s/he smoke tobacco (cigarette, cigar, pipe etc.)?	YES 1 NO 2 DONT KNOW 8	→ 1201 → 1201
1107	How long had s/he been smoking? RECORD '00' IF LESS THAN ONE YEAR	YEARS <input type="text"/> <input type="text"/> DONT KNOW 9 8	
1108	How often did s/he smoke?	DAILY 1 FREQUENTLY (WEEKLY) 2 ONCE IN A WHILE 3 DONT KNOW 8	→ 1201 → 1201 → 1201
1109	How many cigarettes did s/he smoke daily?	NUMBER OF CIGARETTES <input type="text"/> <input type="text"/> DONT KNOW 9 8	
1110	Did s/he stop smoking before death?	YES 1 NO 2 DONT KNOW 8	→ 1201 → 1201
1111	How long before death did s/he stop smoking? RECORD '00' IF LESS THAN ONE MONTH	MONTHS <input type="text"/> <input type="text"/> DONT KNOW 9 8	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
SECTION 12. DATA ABSTRACTED FROM DEATH CERTIFICATE			
1201	Do you have a death certificate for the deceased?	YES 1 NO 2 DON'T KNOW 8	→ 1301 → 1301
1202	Can I see the death certificate? COPY DAY, MONTH AND YEAR OF DEATH FROM THE DEATH CERTIFICATE.	DAY MONTH YEAR <input type="text"/> <input type="text"/>	
1203	COPY DAY, MONTH AND YEAR OF ISSUE OF DEATH CERTIFICATE.	DAY MONTH YEAR <input type="text"/> <input type="text"/>	
1204	RECORD THE CAUSE OF DEATH FROM THE FIRST (TOP) LINE OF THE DEATH CERTIFICATE: _____		
1205	RECORD THE CAUSE OF DEATH FROM THE SECOND LINE OF THE DEATH CERTIFICATE (IF ANY): _____		
1206	RECORD THE CAUSE OF DEATH FROM THE THIRD LINE OF THE DEATH CERTIFICATE (IF ANY): _____		
1207	RECORD THE CAUSE OF DEATH FROM THE FOURTH LINE OF THE DEATH CERTIFICATE (IF ANY): _____		

SECTION 13. DATA ABSTRACTED FROM OTHER HEALTH RECORDS										
1301	OTHER HEALTH RECORDS AVAILABLE?	YES 1 NO 2 → 1311								
1302	FOR EACH TYPE OF HEALTH RECORD SUMMARIZE DETAILS FOR LAST 2 VISITS (IF MORE THAN 2) AND RECORD DATE OF ISSUE									
1303	BURIAL PERMIT (CAUSE OF DEATH) _____ _____									
1304	POSTMORTEM RESULTS (CAUSE OF DEATH) _____ _____									
1305	MCH/ANC CARD (RELEVANT INFORMATION) _____ _____									
1306	HOSPITAL PRESCRIPTION (RELEVANT INFORMATION) _____ _____									
1307	TREATMENT CARDS (RELEVANT INFORMATION) _____ _____									
1308	HOSPITAL DISCHARGE (RELEVANT INFORMATION) _____ _____									
1309	LABORATORY RESULTS (RELEVANT INFORMATION) _____ _____									
1310	OTHER HOSPITAL DOCUMENTS SPECIFY: _____ _____ _____									
1311	RECORD THE TIME AT THE END OF INTERVIEW	HOURS <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td></tr><tr><td> </td><td> </td></tr></table> MINUTES <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td></tr><tr><td> </td><td> </td></tr></table>								

INTERVIEWER'S OBSERVATIONS
TO BE FILLED IN AFTER COMPLETING INTERVIEW

COMMENTS ON SPECIFIC QUESTIONS:

ANY OTHER COMMENTS:

SUPERVISOR'S OBSERVATIONS

NAME OF THE SUPERVISOR: _____ DATE: _____