

**A comparative review of the outcomes of two
different perinatal mortality classification systems at
an Obstetric unit in Cape Town, South Africa**

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Submitted in partial fulfilment for the degree

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FACULTY OF HEALTH SCIENCES
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December 2012

DECLARATION

I, the undersigned, hereby declare that the work contained in this assignment is my original work and that I have not previously submitted it, in its entirety or in part, at any university for a degree.

Signature:

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ABSTRACT

Background

The annual burden of stillbirths is estimated to be more than 3 million deaths globally. Depending on the perinatal classification used, up to two thirds of deaths are reported as unknown. Gardosi, et al (2006) developed the ReCoDe system, which identified the relevant condition at the time of death in utero. The system aims to identify what went wrong in utero, without necessarily identifying why fetal demise occurred. With comparison to the conventional Wigglesworth classification, the authors were able to reduce the number of unexplained stillbirths from 66.2% to 15.2%.

The Perinatal Problem Identification Program (PPIP) is the nationally implemented perinatal classification system in South Africa. The PPIP database recorded approximately 660 000 births from the 1st January 2006 until 31st December 2007. This reflects approximately 40% of all births in health institutions in South Africa during this time period. There were 11742 stillbirths recorded in on the PPIP database for this two year period. Unexplained stillbirths formed 24% of the total perinatal deaths. The Saving Babies Report 2006-2007 has suggested that funding and research resources be directed to identifying the causes of deaths in this group.

Objective:

Our primary objective was to compare the outcomes of the PPIP to the ReCoDe classification system developed by Gardosi, with special attention as to reducing the number of unexplained stillbirths.

Methods:

We conducted a retrospective descriptive study on the perinatal deaths occurring at or presenting to the Department of Obstetrics and Gynaecology at Tygerberg Hospital, Cape Town, South Africa, for the time period extending from 01 January 2008 to 31 December 2008.

A weekly Perinatal Mortality Audit meeting (PNM) is held at Tygerberg Hospital. In attendance at these meetings are General obstetricians, Fetal-maternal specialists, Neonatologists, Pathologists, a Geneticist, Obstetric and Paediatric Registrars. Relevant clinical details are summarised from clinical notes and Perinatal Losses data forms. These forms are specific to Tygerberg Hospital and completed by the attending doctor at first consultation. Placental histology and post-mortem examination would have been performed in certain cases as per the departmental protocol. All perinatal deaths, both stillborn and neonatal deaths weighing more than 499g, are discussed at this forum and consensus then reached on a primary and final cause of death. This information is then entered into the PPIP database, along with any identifiable avoidable factors. The investigators separately reviewed the information available from the Perinatal Losses and the PIPP V2.2 data capture forms and then reclassified each stillbirth according to the ReCoDe hierarchical system

Results:

We studied the data sheets of 406 stillbirths of babies of whom the deaths had been previously classified according to the PPIP classification. The median maternal age was 25.65 years (range 14 – 45) while the median birth weight was 1127 grams (range 500 – 4100). The vast majority of these stillbirths occurred in singleton pregnancies and are also classified as extremely low birth weight. The three major causes of stillbirth over the study period were antepartum haemorrhage (24.4%), hypertensive disorders (22.4%) and spontaneous preterm labour (11.1%). Within the ReCoDe classification, the leading categories were in the placental group (33.2%), fetal group (21.6%) and the maternal group (20%).

The unexplained group (PPIP IUD group), from the index study constitutes 8.1% (33 of 406) of cases, while the number of unclassified stillbirths in the primary ReCoDe classification accounted for 15% (60 of 406) of the total. The main reasons for this difference is that ReCoDe does not incorporate preterm labour as a cause, and uses customised growth charts for identifying fetal growth restriction.

Conclusion:

PPIP remains the gold standard in Perinatal Audit in South Africa. We would recommend that ReCoDe be evaluated prospectively, alongside the established PPIP system, to better compare their performance outcomes. The development of customized fetal growth potential charts relevant to the local population should be explored. The Perinatal Losses data capture form should be revised to be more comprehensive and relevant.

'N vergelykendeoorsig van die uitkomst van twee verskillendeperinatalemortaliteitsklassifikasiesisteme by 'n obstetrieseenheid in Kaapstad, Suid-Afrika

OPSOMMING

Agtergrond

Die jaarlikselas van doodgeboortes word geskat op meer as 3 miljoensterfteswêreldwyd. Afhangende van die perinataleklassifikasiesisteme wat gebruik word, tot twee derdes van sterftes is aangemeld as onbekend. Gardosi, et al (2006) het die ReCoDesisteme ontwikkel, wat die betrokke toestand in die tyd van die dood in utero geïdentifiseer. Die sisteem het ten doel om te identifiseer wat verkeerd geloop het in utero, sonder om noodwendig te identifiseer waarom fetale dood plaasgevind het. In vergelyking met die konvensionele Wigglesworth klassifikasie, was die skrywers in staat om die getal van die onverklaarbare doodgeboortes van 66,2% tot 15,2% te verminder.

Die Perinatale probleemidentifikasie Program (PPIP) is die nasionaal geïmplementeerde perinatale klassifikasiesisteme in Suid-Afrika. Die PPIP databasisaangeteken ongeveer 660 000 geboortes van die 1ste Januarie 2006 tot 31 Desember 2007. Dit weerspieël ongeveer 40% van alle geboortes in die gesondheidsinstellings in Suid-Afrika gedurende hierdie tydperk. Daar was 11.742 doodgeboortes aangeteken in op die PPIP databasis vir hierdie twee jaartydperk. Onverklaarbare doodgeboortes vorm 24% van die totale perinatale sterftes. Die Saving Babies Verslag 2006-2007 het voorgestel dat befondsing en navorsing gerig word aan die identifisering van die oorsake van sterftes in hierdie groep.

Doelstelling:

Ons primêre doel was om die uitkomst van die PPIP te vergelyk met die ReCoDe klassifikasiesisteme wat deur Gardosi ontwikkel is, met spesiale aandag aan die vermindering van die aantal van onverklaarbare doodgeboortes.

Metodes:

Ons het 'n retrospektiewe beskrywendes studie uitgevoer op die perinatale sterftes wat aangemeld

het by die noodeenheid van die Departement Obstetrie en Ginekologie aan Tygerberg Hospitaal, Kaapstad, Suid-Afrika, vir die tydperk wat strek vanaf 01 Januarie 2008 tot 31 Desember 2008.

'N weeklikse Perinatale Mortaliteit Oudit vergadering (PNM) word gehou by Tygerberg Hospitaal. In die bywoning van hierdie vergaderings is Algemene Verloskundiges, Fetale-moederskant Spesialiste, Neonatoloë, Patoloë, 'n Genetikus, Obstetriesse en Pediatriese Kliënte-assistentes. Relevant kliniese inligting is uit die kliniese notas en perinatale verliese datavorms opgesom. Hierdie vorms is spesifiek na die Tygerberg-hospitaal en deur die dokter by die eerste konsultasie voltooi. Placentale histologie en post-mortem ondersoek sou voltooi gewees het in sekere gevalle soos per die departementele protokol. Alle perinatale sterftes, beïdoode gebore en neonatale sterftes wat meer as 499g, word bespreek op hierdie forum en konsensus bereik oor 'n primêre en finale oorsaak van die dood. Hierdie inligting word dan in die PPIP databasis, saam met 'n identifiseerbare voorkombare faktore. Die navorsersafsonderlik die inligting beskikbaar van die perinatale verliese en die PIPP v2.2 datavasleggingsvorms en dan herklassifiseer elkeen stilgeboorte volgens die ReCoDe hiërargiese stelsel.

Results:

Ons bestudeer die data velle van 406 doodgeboortes van babas van wie die sterftes voorheen volgens die PPIP klassifikasie geklassifiseer is. Die mediaan moeder se ouderdom was 25,65 jaar (range 14-45). Terwyl die mediaan geboortegewig was 1127 gram (reeks 500-4100). Die oorgrote meerderheid van hierdie doodgeboortes plaasgevind in Singleton swangerskappe en word ook geklassifiseer as 'n baie lae geboortegewig. Die drie grootste oorsake van doodgeboorte oor die studietydperk was antepartum bloeding (24,4%), die hipertensiewesiektes (22,4%) en 'n voortydsekraam (11,1%). Binne die ReCoDe Sistematiek, die voorste kategorieë in die placentale groep (33,2%), die fetale groep (21,6%) en die moeder groep (20%).

Die onverklaarbare groep (PIPP IUD groep), van die indeksstudie behels 8,1% (33 van 406) van gevalle, terwyl die aantal van ongeklassifiseerde doodgeboortes in die primêre ReCoDe Sistematiek verantwoordelik vir 15% (60/406) van die totaal. Die belangrikste redes vir die verskil is dat ReCoDe nie 'n voortydsekraam as 'n oorsaak, en gebruik 'n aangepasde groeikaarte vir die identifisering van fetale groei beperking.

Gevolgtrekking:

PPIP bly die gouestandaard in Perinataleoudit in Suid-Afrika.

OnssalaanbeveeldatReCoDevooruitwerkendgeëvalueer word, saam met die gevestigde PPIP stelsel, ombetertevergelykhulprestasieuitkomste. Die ontwikkeling van persoonlikefetalegroeipotensiaalkaarte met betrekking tot die plaaslikebevolkingmoetondersoek word. Die perinataleverliese data capture vormmoethersien word ommeeromvattende en relevant te wees.

ACKNOWLEDGEMENTS

I wish to acknowledge several people for their contribution to this study.

- Prof. DW Steyn for his patient supervision and mentorship.
- All the nursing staff and doctors at the Tygerberghospital labour ward for their endless effort in capturing invaluable perinatal data on a daily basis.
- My fellow registrars and co-workers, for their support and encouragement.

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1. INTRODUCTION

Obstetricians and midwives have the unique privilege of being the primary care-giver for at least two patients at every consultation. Sadly, inherent to this privilege is the daunting task of having to provide the grief-stricken parents with an acceptable explanation to an unexpected adverse pregnancy outcome.

In South Africa, large geographical areas, with limited resources and poor accessibility to health care facilities, coupled by chronic staff shortages, all contribute to the high incidence of stillbirths left unexplained. With international evidence showing a significant reduction in the number of unexplained deaths with the implementation of newer revised classifications for perinatal mortality, the question remains as to whether we as health care providers in South Africa can expect a similar improvement in reducing our unexplained intrauterine deaths.

2. LITERATURE REVIEW

Stillbirths remain an important obstetric complication globally, forming the largest component of perinatal mortality. Even so, only two global estimates for the year 2000 were published in 2006. The Saving Newborn Lives/ Save the Children USA and the Initiative for Maternal Mortality Program, at the University of Aberdeen, Scotland, reported an estimate of 2.5-4.1 million stillbirths, while the WHO estimates a figure of 3.3 million for the same year^{1,2,3}. Another 2 million stillbirths may occur but are not recorded.⁴ It is also widely accepted that there is gross underreporting of stillbirths, with the developing countries contributing up to 97% of stillbirths.^{5,6} Inconsistent definitions and unreliable reporting, especially in rural areas, make the collection of comprehensive statistics difficult.⁷

Classification of perinatal mortality is essential for clinical practice.⁸ It is one of the indices used to reflect the quality of antenatal and intrapartum obstetric care of an institution or health care system. It reveals trends in the incidence and leading causes of deaths. It assists identification of substandard factors in care while it can also improve awareness of issues regarding prevention strategies. It allows regional and international comparison, and is useful for research purposes. With significance to the parents, it helps provide answers for why their

baby died, and whether they are at an increased risk for repeat losses in subsequent pregnancies.

The development of strategic interventions to improve perinatal outcome depends on the most accurate identification of the underlying cause of death. There are presently more than 30 classification systems of stillbirth, many of which have been adapted for the needs and objectives of the specific institution.^{9,10} These systems have different methods for categorizing causes, conflicting definitions for relevant conditions as well as different levels of complexity. There is therefore no single system which is accepted universally.

Silver et al commented on possible explanations for the many classification systems.¹¹ Of the three reasons identified, firstly, many stillbirths remain unexplained in spite of rigorous investigations. Secondly, more than one condition may be implicated as cause of death in individual cases. In this regard they mention a case of infection in a fetus with trisomy 18. Lastly they highlight that certain conditions may be associated with stillbirth without having a direct influence in causing the death. Smith pointed out the continuum of certainty in pathophysiology of maternal medical conditions as a cause of stillbirth, that is, from those where there is little evidence to suggest a direct causal relation through to those where the maternal condition provides a very plausible explanation for the death of the fetus. As per his example, this may vary from a stillbirth in a woman with treated hypothyroidism and a normal birth weight, which should be regarded as unexplained, to a case of Sjogren syndrome with anti-Ro and anti-La antibodies leading to hydrops which may be regarded as a certain cause of death⁹.

To make progress in this field, a methodical approach to categorize stillbirth would be a vital step in designing prevention strategies. Efforts are underway to adopt a widely acceptable international classification system.⁹ The *Eunice Kennedy Shriver* National Institute of Child Health and Human Development held a workshop in 2007 to reconsider the pathophysiology of conditions causing stillbirth in an effort to define causes of death. The participants aimed to develop a single international system for classifying stillbirths which would not only list and define probable causes of stillbirth but also assess the degree of certainty with which the loss can be attributed to these factors.

They agreed that the criteria which should be used to classify a particular condition as a cause of stillbirth should consider various principles. These include epidemiologic data indicating

an excess of stillbirth associated with the condition, biologic plausibility that the condition causes stillbirth, that the condition is either rarely seen in association with live births or, when seen in live births, results in a significant increase in neonatal death, a dose– response relationship so that the likelihood of fetal death increases with greater exposure to the condition, evidence that the condition is associated with evidence of fetal compromise, and lastly, that the stillbirth would probably not have occurred if that condition had not been present.

The group subsequently published a new system, comprising of six broad categories of causes of death based on a complete evaluation which includes post-mortem examination, placental pathology, medical record review and maternal interview.¹² This standardized method allocates probable and possible causes of death of stillbirths based on collected information.

Gordijn and her colleagues followed a different approach.⁸ They developed a systematic multilayered approach based on information related to the moment of death, the conditions associated with death and the underlying cause of death by combining features of existing classification systems. They considered definition of the perinatal period, level of complexity, inclusion of maternal, fetal and/or placental factors and whether the approach was clinical or pathological. Assigning each system to one of three categories, the authors conclude that this multilayered approach allows in depth analysis of perinatal mortality.

Gardosi, et al developed the ReCoDe system, which identified the relevant condition at the time of death in utero.¹³ The system aims to identify what went wrong in utero, without necessarily identifying why fetal demise occurred. The system hierarchy is divided into anatomical groups, which are subdivided into pathophysiological conditions. These groups start with conditions affecting the fetus and moves outward(Appendix F). The classification system does not rely on finding an underlying cause, thereby allowing for more than one code if applicable to the case. The primary code should be the first on the list that is applicable from the information available. With comparison to the conventional Wigglesworth classification¹⁴, the authors were able to reduce the number of unexplained stillbirths from 66.2% to 15.2%. ReCoDe also identified 57.7 % of the Wigglesworth unexplained stillbirths as growth restricted.

The TULIP classification by Korteweg, et al aims to identify the underlying cause and mechanism of death by focussing on clinical details as well as pathological information.¹⁰

This classification consists of six main causes, with sub classifications, namely (1) congenital anomaly, (2) placenta, (3) prematurity, (4)infection, (5) other (fetal hydrops of unknown origin, maternal disease, trauma and out of the ordinary) and (6)unknown. The results demonstrated a total of 11% of perinatal cases being allocated to the Unknown group.

Vergani, et al compared four classification protocols on a cohort of 154 stillbirths after a consistent and comprehensive workup, aiming to identify which system would minimize the rate of unexplained causes.¹⁵ The outcome showed that ReCoDe demonstrated the lowest rate of stillbirths in the unexplained group (14.3%), compared with TULIP¹⁰ (16.2%), de Galan-Roosen¹⁶(18.2%) and Wigglesworth¹⁴ (47.4%).

Lu and McCowan performed a comparative study between ReCoDe and the Perinatal Society of Australia and New Zealand – Perinatal Death Classification system (PSANZ-PDC) in 2009.¹⁷ Their main objectives were to compare the proportion of stillbirths classified as unexplained and as a result of fetal growth restriction according to the PSANZ-PDC and ReCoDe classification systems. They found that the proportion of stillbirths classified as unexplained was less with ReCoDe compared with PSANZ-PDC (8.5%vs. 14.1%) and the proportion with the primary cause attributed to fetal growth restriction was increased with ReCoDe compared with PSANZ-PDC (23.2% vs. 8.2%).

The Perinatal Problem Identification Program is the current system used across South Africa. The national PPIP database is administered by the MRC Maternal and Infant Health Care Strategies Research Unit. It was set up on 1 October 1999 and the latest available report, the sixth report on perinatal care in South Africa analyses data submitted to the national database from the 1st January 2006 until 31st December 2007. 244 sites from throughout the country, including all levels of care (Community Health Centres - CHCs, District, Regional, Provincial Tertiary and National Central hospitals) have recorded and submitted data. Just fewer than 660,000 births have been entered for this time period, which reflects approximately 40% of all births in health institutions in South Africa during this time period.¹⁸

The Saving Babies report recorded 11742 stillbirths in the PPIP database for the two years 2006-2007. This extrapolates to roughly 8000 stillbirths occurring in health care institutions annually in South Africa.

Sixty percent of the stillbirths were macerated stillbirths and forty percent were fresh stillbirths. Unfortunately, unexplained stillbirths account for almost half of the macerated stillbirths and a third of all stillbirths. Unexplained stillbirths occur across all weight categories in more or less equal numbers. Most of these births occur in district and regional hospitals. The most common avoidable factor is related to no response to poor fetal movements.

Conclusion of the Literature Review

Internationally, a number of new classification systems have emerged and have demonstrated a reduction in the Unknown group of stillbirths. However, there is still disparity among these systems and no system has been proven to be universally accepted. Finding the ideal system is made difficult by the complex interaction between the clinical syndromes and presentations, as well as the histopathological processes that take place in the mother, fetus and placenta, all ultimately leading to fetal demise. The ReCoDe classification system has been associated the greatest reduction in the number of unexplained stillbirths, but this system still needs further evaluation within developing countries to ascertain its true benefit.

3. A DEFINITIONS AND TERMINOLOGY

The following definitions and PPIP terminology are of importance:

Stillbirth or intra-uterine death:

In uterofetal demise occurring after 21 weeks 6 days gestation or weighing more than 499g at birth; the death is indicated by the fact that the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles.

Birth weight

The first weight of the fetus or newborn obtained after birth. For live births, birth weight should preferably be measured within the first hour of life before significant postnatal weight loss has occurred. While statistical tabulations include 500g grouping for birth weight, weights should not be recorded in those groupings. The actual weight should be recorded to the degree of accuracy to which it is measured. The definition of "low", "very low", and "extremely low" birth weight do not constitute mutually exclusive categories. Below the set limits they are all-inclusive and therefore overlap (i.e. "low" includes "very low" and "extremely low", while "very low" includes "extremely low").

Low birth weight

Birth weight less than 2500g (up to and including 2499g).

Very low birth weight

Birth weight less than 1500g (up to and including 1499g).

Extremely low birth weight

Birth weight less than 1000g (up to and including 999g).

Perinatal period

The perinatal period commences at 22 completed weeks (154 days) of gestation (the time when birth weight is normally 500g), and ends seven completed days after birth.

Perinatal mortality rate

Fetal deaths and early neonatal deaths per 1000 births

Fetal death rate (Intra-uterine death rate)

Fetal deaths per 1000 births

Obstetric cause of perinatal death

The primary obstetric cause of perinatal death refers to the particular obstetric condition or pathology that initiated the chain of events eventually leading to the baby's death.

Final cause of neonatal death

The final cause of neonatal death refers to the eventual pathology that claims the baby's life.

4. AIMS

Our overall aim was to compare the outcomes of the PPIP to the ReCoDe classification system developed by Gardosi, with special attention as to reducing the number of unexplained stillbirths.

The aim of the index study was to assess

Primary Objectives

- To describe the stillbirths occurring at or presenting to Tygerberg Hospital over a 1 year period between 1 January 2008 and 31 December 2008, as classified by the Perinatal Problem Identification Program (PPIP).
- To describe the stillbirths occurring or presenting to Tygerberg Hospital over a 1 year period between 1 January 2008 and 31 December 2008, as classified by the ReCoDe system(Relevant condition at death).
- To compare and analyze the outcomes of the two classification systems mentioned above.

Secondary Objectives

- To determine the leading causes of stillbirths in Tygerberg Hospital.
- To compare these findings to the National Perinatal Problem Identification Program database
- To identify avenues to improve the current perinatal mortality system at Tygerberg Hospital

5. METHODS

We conducted a retrospective descriptive study on the perinatal deaths occurring at or presenting to the Department of Obstetrics and Gynaecology at Tygerberg Hospital, Cape Town, South Africa, for the time period extending from 01 January 2008 to 31 December 2008. Tygerberg Hospital is a secondary and tertiary referral hospital in the Western Cape, serving a low to moderate income population group

A weekly Perinatal Mortality Audit meeting (PNM) is held at Tygerberg Hospital. In attendance at these meetings are General obstetricians, Fetal-maternal specialists, Neonatologists, Pathologists, a Geneticist, Obstetric and Paediatric Registrars and medical officers and interns.

An Obstetric Registrar rotating through the Special Care Unit is responsible for reviewing and summarising perinatal mortality cases, collecting information from the patient folder as well as the Perinatal Losses data capture form (appendix A), which would have been completed in the maternity ward for all perinatal deaths. This registrar then presents each case at the PNM meeting.

Placental histology and post-mortem examination would have been performed in certain cases as per the departmental protocol (appendix D and E). Where available, these pathology reports are presented at the meeting by the attending Pathologist.

All perinatal deaths, both stillborn and neonatal deaths weighing more than 499g, are discussed at this forum and consensus then reached on a primary and final cause of death (appendix C). This information is captured onto a PPIP V2.2 capture sheet (appendix B). PPIP is a computer program designed to perform analysis on perinatal data. The classification is based on the Aberdeen classification (appendix H), which was modified in 1986 by Whitfield, et al.¹⁹ Pattinson, et al adapted the classification in 1989 to make it more relevant for use in developing countries and again in 1995, to include the concept of different tiers of avoidable factors.^{20,21}

For the index study, the investigators separately reviewed the information available from the Perinatal Losses and the PIPP V2.2 data capture forms and then reclassified each stillbirth according to the ReCoDe hierarchal system (Appendix F). The study population included all the perinatal deaths which had occurred at Tygerberg hospital during the time period extending from 01 January 2008 to 31 December 2008. We excluded all neonatal deaths from our study, as ReCoDe is only applicable to intrauterine demise. After individual analysis, a meeting was held between the two investigators to discuss all cases of disparity, and a consensus regarding the most probable cause of death was then recorded.

The data was analyzed using the SPSS software (Statistical Package for Social Science). Discrete data was compared by calculating relative risks with 95% confidence limits, as well as the χ^2 test. Fisher's exact test was used to compare ratios where the expected value in any cell of a two-by-two table is less than five. The means of normally distributed continuous data was compared by analysis of variance, while the medians of continuous data which are not distributed normally, were calculated using the non-parametric Mann Whitney u test. A p-value of < 0.05 was considered to be statistically significant, where applicable.

The study protocol was approved by the Committee for Human Research, of the University of Stellenbosch in June 2010 (Project Number: N10/06/190).

6. RESULTS

We studied the data sheets of 406 stillbirths of babies of whom the deaths had been previously classified according to the PPIP classification (Table 1). The median maternal age was 25.65 years (range 14 – 45) while the median birth weight was 1127 grams (range 500 – 4100)(Figures 1 and 2). The vast majority of these stillbirths occurred in singleton pregnancies and are also classified as extremely low birth weight. From the information available, we were unfortunately unable to determine what proportion of stillbirths that had post-mortems and placental histology performed, due to poor completion of the PIPP data capture forms in the labour ward.

	n	%
HIV positive	68	16.7
RPR positive	22	5.4
Attended antenatal care	341	84.0
Singleton pregnancies	385	94.8

Table 1: Demographic data obtained from the PPIP database.

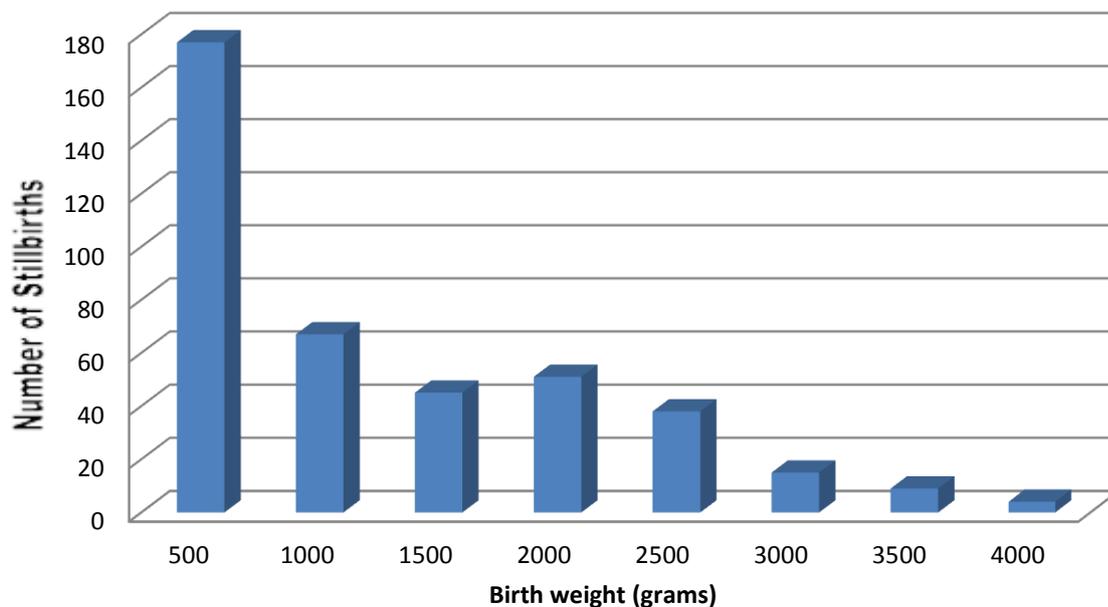


Figure 1: The distribution of birth weight of 406 stillbirths.

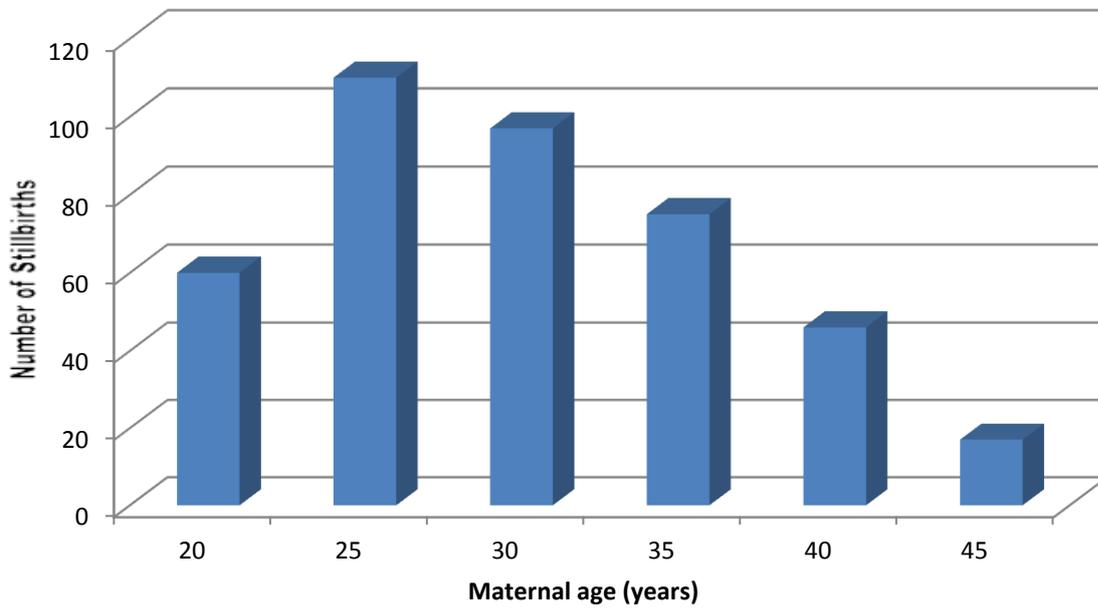


Figure 2: The distribution of maternal age

The fetal condition at time of presentation to hospital is shown in figure 3.

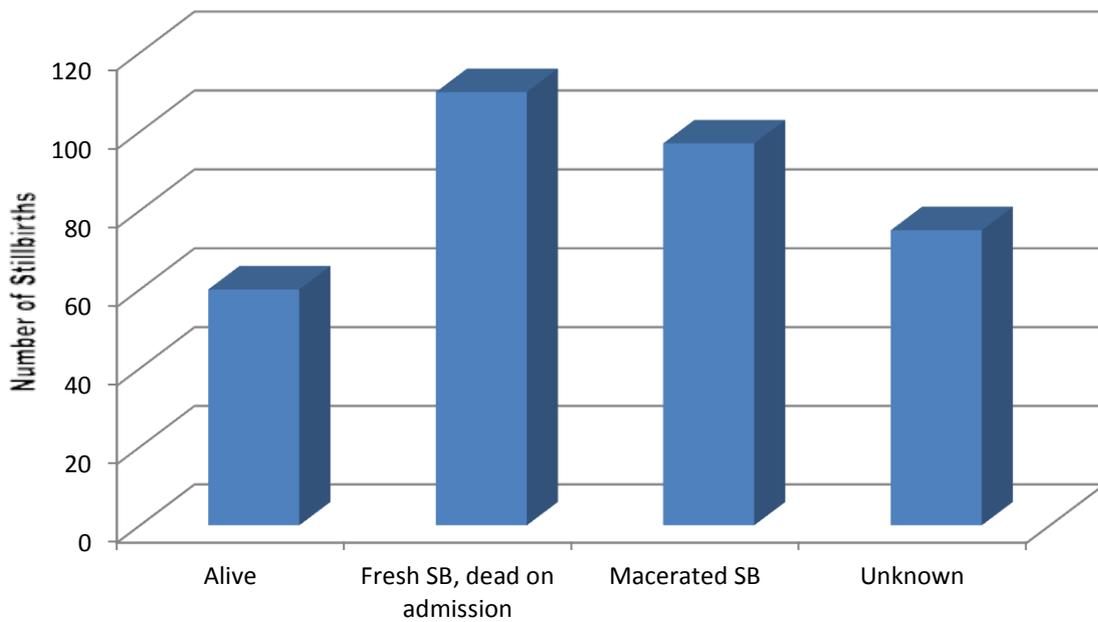


Figure 3: Admission status of fetuses that were eventually born as stillbirths (SB) according to the PPIP database.

The causes of stillbirths according to the PPIP database are summarized in Table 2. The three major causes of stillbirth over the study period were antepartum haemorrhage, hypertensive disorders and spontaneous preterm labour. The distribution of causes of stillbirth within each of the main categories is presented later.

PPIP CATEGORY	<i>n</i>	%
Spontaneous preterm labour	45	11.1
Infections	33	8.1
Antepartum haemorrhage	99	24.4
Intrauterine growth restriction	30	7.4
Hypertensive disorders	91	22.4
Fetal abnormality	34	8.4
Trauma	3	0.7
Intrapartum asphyxia	10	2.5
Maternal disease	15	3.7
Other	11	2.7
Intrauterine death	33	8.1
No obstetric cause / Not applicable	2	0.5
Total	406	100.0

Table 2: The distribution of categories of causes of stillbirth according to the PPIP classification.

The primary ReCoDe classification is presented in Table 3.

RECODE PRIMARY CATEGORY	<i>n</i>	%
Fetus	88	21.6
Cord	5	1.2
Placenta	135	33.2
Amniotic fluid	31	7.6
Uterus	0	0
Mother	81	20
Intrapartum	4	1
Trauma	2	0.5
Unclassified	60	14.7

Table 3: Primary ReCoDe Classification

The following results show the data relevant to the distribution of the ReCoDe analysis within the PPIP categories. Each group is compared to the entire number of cases, in order to allow perspective on the impact of that category, as this is vital for any intervention strategies aimed at improving the perinatal death rate.

In the group of Spontaneous Preterm Labour, forty-five women had still births according to the PPIP database. Patients in this category were significantly less likely to have had antenatal care. (Odds Ratio = 0.36, 95% confidence limits = 0.17 – 0.78)(Table 4). There were also significantly more cases of multiple pregnancies in this group (Odds Ratio = 4.57, 95% confidence limits = 1.56 – 13.07). The median birth weight was less than 1000 grams in 39 (86.7%) of the patients.

	SPTL (n = 45) <i>n (%)</i>	Rest (n = 361) <i>n (%)</i>
HIV positive	6 (13.3)	62 (17.2)
RPR positive	2 (4.4)	20 (5.5)
Attended antenatal care	31 (68.9)	310 (85.9)
Singleton pregnancies	38 (84.4)	347 (96.1)
Maternal age	26.04 ± 6.95	26.91 ± 6.68
Birth weight	700 (500 – 2360)	1300 (500 – 4100)

Table 4: Characteristics of patients within the PPIP category of Spontaneous Preterm Labour (SPTL) compared with the rest of the patients in the study.

Patients in this group were significantly more likely to have live babies at the time of presentation to hospital. (Odds Ratio = 2.07, 95% confidence limits = 1.01 – 4.19) Table 5.

	SPTL (n = 45) <i>n (%)</i>	Rest (n = 361) <i>n (%)</i>
Alive	16 (35.6)	76 (21.1)
Fresh SB, dead on admission	13 (28.9)	149 (41.3)
Macerated SB	5 (11.1)	108 (29.9)
Unknown	11 (24.4)	28 (7.8)

Table 5: Fetal condition at time of presentation to hospital in patients within the PPIP category of Spontaneous Preterm Labour compared with the rest of the patients in the study.

The primary relevant conditions at death are presented in the rows in Table 6. We identified only one relevant condition in 40 patients (mostly in the Amniotic Fluid and Unclassified Categories). In 20 of the patients in the Unclassified Category, we considered that preterm labour was the cause of death, but the RECODE classification does not allow for this as relevant condition. In the remaining five patients, two relevant conditions were identified in four patients, while three conditions were found in the remaining case. In the latter case there were two independent Cord factors (prolapse along with a constricting loop), as well as chorioamnionitis).

	<i>n</i>	Fe	Cord	Pl	AF	Ut	Mo	IP	Tr	Unc
Fe	1			1						
Cord	1				2					
Pl	2									
AF	15					1	2			
Tr	1									1
Unc	25									

Table 6: Classification of still births caused by preterm labour in the PPIP database using the ReCoDe system.

In the PPIP category Infections, there were thirty three still births recorded in the PPIP database (Table 7). There were significantly more cases where the RPR was positive in this group, while the mothers were younger. Babies in this group weighed almost 500 grams more than the rest of the cohort. The distribution of birth weights is shown in figure 4.

	INF (n = 33) <i>n (%)</i>	Rest (n = 373) <i>n (%)</i>
HIV positive	5 (15.2)	63 (16.9)
RPR positive	8 (24.2)	14 (3.8)
Attended antenatal care	26 (78.8)	315 (84.5)
Singleton pregnancies	32 (97.0)	353 (94.6)
Maternal age (Median (Range))	23.0 (16 – 36)	26.0 (14 – 45)
Birth weight (Median (Range))	1927 ± 1040	1429 ± 879

Table 7: Characteristics of patients within the PPIP category of INFECTIONS (INF) compared with the rest of the patients in the study.

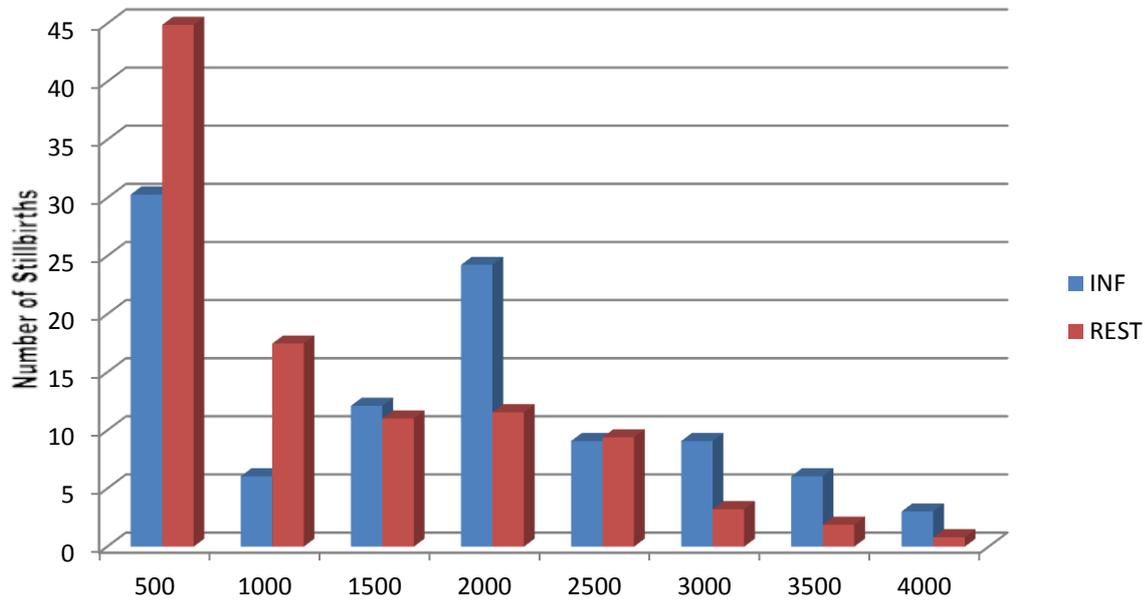


Figure 4: The distribution of the percentage in birth weight categories in the PPIP group of still births due to infection compared with the rest of the patients.

	INFECTIONS (n = 33) n (%)	Rest (n = 373) n (%)
Alive	5 (15.2)	87 (23.3)
Fresh SB, dead on admission	9 (27.3)	153 (41.0)
Macerated SB	16 (48.5)	97 (26.0)
Unknown	3 (9.1)	36 (9.7)

Table 8: Fetal condition at time of presentation to hospital in patients within the PPIP category of Infections compared with the rest of the patients in the study.

The primary relevant conditions at time of death in this group can be seen in the rows in table 9. There was only one relevant condition in 28 patients (14 cases of fetal infection and 14 cases of chorioamnionitis). Two mothers with a primary relevant condition being fetal infection had hypertensive disease. In another case with chorioamnionitis, the fetus had a lethal condition.

	N	Fe	Cord	Pl	AF	Ut	Mo	IP	Tr	Unc
Fe	18			2			2			
Pl	1				1					
AF	14									

Table 9: Classification of still births caused by Infection in the PPIP database using the ReCoDe system.

Antepartum Haemorrhage was the single most important cause of still birth in the PPIP database (n = 99; Table 10). Mothers in this category were significantly younger, while the median birth weight was significantly higher than in the rest of the cohort. (Figure 5). Fewer mothers were HIV-positive, although this difference was not statistically significant.

	APH (n = 99) <i>n</i> (%)	Rest (n = 307) <i>n</i> (%)
HIV positive	6 (6.1)	58 (18.9)
RPR positive	8 (8.1)	14.0 (4.6)
Attended antenatal care	81 (81.8)	260 (84.7)
Singleton pregnancies	95 (96.0)	290 (94.5)
Maternal age (Median (Range))	25.41 ± 6.28	27.26 ± 6.79
Birth weight (Median (Range))	1700 (520 – 3400)	940 (500 – 4100)

Table 10: Characteristics of patients within the PPIP category of Antepartum Haemorrhage (APH) compared with the rest of the patients in the study.

Patients in this group were significantly more likely to have dead babies at the time of presentation to hospital. (Odds Ratio = 3.71, 95% confidence limits = 1.71 – 8.27, Table 11). The majority of babies were born as fresh still births. (Odds Ratio = 6.88, 95% confidence limits = 4.01 – 11.86).

	APH (n = 99)	Rest (n = 307)
	n (%)	n (%)
Alive	9 (9.1)	83 (27.0)
Fresh SB, dead on admission	73 (73.7)	89 (29.0)
Macerated SB	13 (13.1)	100 (32.6)
Unknown	4 (4.1)	35 (11.4)

Table 11: Fetal condition at time of presentation to hospital in patients within the PPIP category of Antepartum Haemorrhage compared with the rest of the patients in the study.

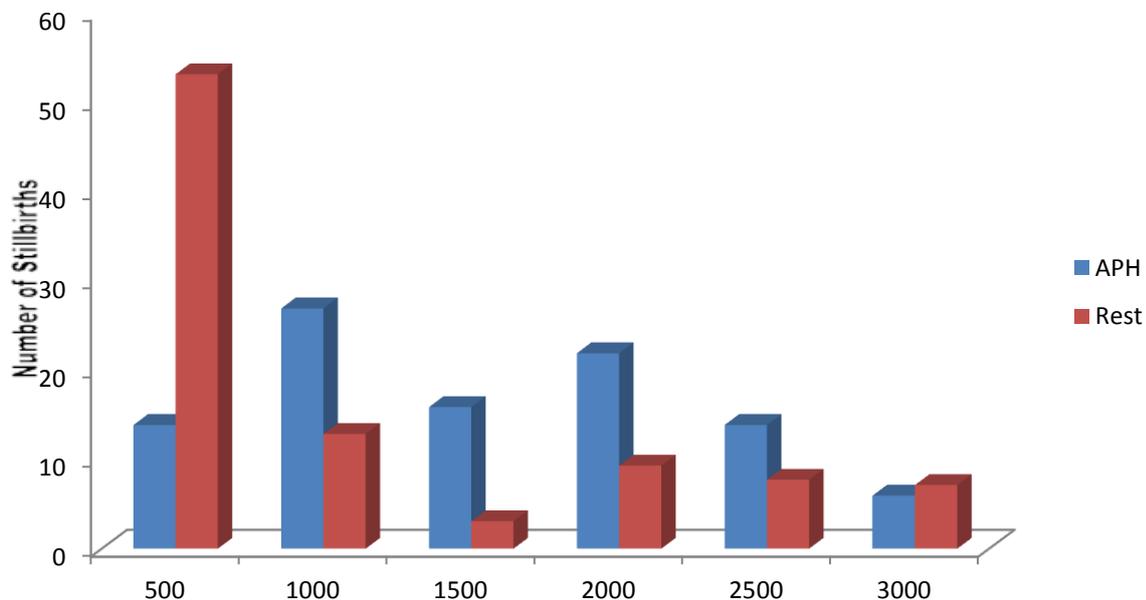


Figure 5: The distribution of birth weight categories in deaths due to APH compared with the other patients.

The primary relevant conditions at time of death in this group are depicted in the rows in table 12. Abruptio placentae was the only relevant condition found in 45 patients. There were 50 cases where two relevant conditions were identified. Of these, abruptio placentae was diagnosed in 43 mothers with hypertensive disease. There were four cases where three relevant conditions at time of death were defined. This included one mother with underlying hypertension and superimposed pre-eclampsia who was a known drug addict. The others included one mother with abruptio placentae following trauma and an uterine rupture and another with hypertension, abruptio placentae and documented placental insufficiency. In the fourth case there were severe fetal growth restriction, placental insufficiency and oligohydramnios. Placental disease was implicated in 97 patients.

	n	Fe	Cord	Pl	AF	Ut	Mo	IP	Tr	Unc
Fe	3			2	1		1			
Pl	94			1	1	1	46		2	
Mo	2						2			

Table 12: Classification of still births caused by Antepartum Haemorrhage in the PPIP database using the ReCoDe system.

There were 30 cases where the cause of death was attributed to intrauterine growth restriction. Mothers in this category were older than mothers in the rest of cohort.

	IUGR (n = 30) <i>n (%)</i>	Rest (n = 376) <i>n (%)</i>
HIV positive	7 (23.3)	61 (16.2)
RPR positive	0 (0)	22 (5.9)
Attended antenatal care	28 (93.3)	313 (83.2)
Singleton pregnancies	28 (93.3)	357 (94.9)
Maternal age	29.23 ± 7.83	26.62 ± 6.58
Birth weight	1634.13 ± 981.8	1456.90 ± 895.9

Table 13: Characteristics of patients within the PPIP category of Intrauterine Growth Restriction compared with the rest of the patients in the study.

Twenty of the 30 babies (66.7%) were born as macerated still births, compared with 24.7% amongst the rest of the patients. (Table 14).

	IUGR (n = 30)	Rest (n = 376)
	n (%)	n (%)
Alive	3 (10.0)	89 (23.7)
Fresh SB, dead on admission	5 (16.7)	157 (41.8)
Macerated SB	20 (66.7)	93 (24.7)
Unknown	2 (6.7)	37 (9.8)

Table 14: Fetal condition at time of presentation to hospital in patients within the PPIP category of Intrauterine Growth Restriction compared with the rest of the patients in the study.

We assigned only one relevant condition at death in 19 cases, and two in a further 10 cases. The relevant conditions in the remaining mother with essential hypertension were placental insufficiency and oligohydramnios (Table 15). All 12 cases in the fetal group were labelled as fetal growth restriction. It was the only relevant condition found in four cases. In another seven, placental insufficiency was also documented. One mother had pre-eclampsia. In 13 cases in the placental group, placental insufficiency was the single relevant condition. There were also a case of maternal essential hypertension and one with oligohydramnios in the placental group.

	n	Fe	Cord	Pl	AF	Ut	Mo	IP	Tr	Unc
Fe	12			7			1			
Pl	16				2		2			
Mo	1									
Unc	1									

Table 15: Classification of still births caused by Intrauterine Growth Restriction in the PPIP database using the ReCoDe system.

Ninety-one deaths were attributed to hypertensive disorders in the PPIP database. The available demographic data are summarized in Table 16. Most cases were singleton pregnancies. The birth weight was significantly lower than the rest of the patients.

	HPT (n = 91) n (%)	Rest (n = 315) n (%)
HIV positive	21 (23.1)	47 (14.9)
RPR positive	1 (1.1)	21 (6.7)
Attended antenatal care	75 (82.4)	266 (84.4)
Singleton pregnancies	90 (98.9)	295 (93.7)
Maternal age	27.78 ± 5.92	26.53 ± 6.90
Birth weight	745 (500 – 3410)	1440 (500 – 4100)

Table 16: Characteristics of patients within the PPIP category of Hypertension compared with the rest of the patients in the study.

Almost 40% of fetuses were alive at the time of admission, but within our clinical context were considered too premature to monitor the fetal heart (Table 17). There were equal numbers of fresh and macerated still births.

	HPT (n = 91) n (%)	Rest (n = 315) n (%)
Alive	35 (38.5)	57 (18.1)
Fresh SB, dead on admission	23 (25.3)	139 (44.1)
Macerated SB	23 (25.3)	90 (28.6)
Unknown	10 (11.0)	29 (9.2)

Table 17: Fetal condition at time of presentation to hospital in patients within the PPIP category of Hypertensive diseases compared with the rest of the patients in the study.

Within ReCoDe, the primary cause of the majority of deaths fell into the Mother category (Table18). There were 61 cases where only one relevant condition was identified. Two relevant conditions were identified in 21 cases, three conditions in 7 cases and four conditions in the remaining two cases.

The Mother category was relevant in all but one case. It was the only relevant condition in sixty cases. The other associated relevant conditions were fetal infection (3 cases), fetal growth restriction (8 cases), placental insufficiency (13 cases), abruptio placentae (15 cases) and amniotic fluid (6 cases).

There were more than one Mother factor in five patients. These include three with superimposed pre-eclampsia, one with diabetes mellitus and another known with abuse of metamphetamine.

The remaining case where only one relevant condition was identified, both investigators recorded the only relevant condition as chorioamnionitis without mentioning hypertension.

	n	Fe	Cord	Pl	AF	Ut	Mo	IP	Tr	Unc
Fe	11			8	1		12			
Pl	15				1		15			
AF	1						2			
Mo	64						4			

Table 18: Classification of still births caused by Hypertensive diseases in the PPIP database using the ReCoDesystem.

There were 34 cases in the PPIP database where the cause of still birth was attributed to a fetal abnormality. Patients in this group were significantly more likely to have attended antenatal care. (Table 19).

	ABN (n = 34) <i>n (%)</i>	Rest (n = 372) <i>n (%)</i>
HIV positive	3 (8.8)	65 (17.5)
RPR positive	3 (8.8)	19 (5.1)
Attended antenatal care	33 (97.1)	308 (82.8)
Singleton pregnancies	32 (94.1)	353 (94.9)
Maternal age	28.38 ± 7.44	26.67 ± 6.63
Birth weight	1285.24 ± 8.54	1486.88 ± 905.89

Table 19: Characteristics of patients within the PPIP category of Fetal Abnormality compared with the rest of the patients in the study.

Almost half of the fetuses were alive at time of presentation to hospital (Table 20).

	ABN (n = 34) <i>n (%)</i>	Rest (n = 372) <i>n (%)</i>
Alive	16 (47.1)	76 (20.4)
Fresh SB, dead on admission	8 (23.5)	154 (41.4)
Macerated SB	5 (14.7)	108 (29.0)
Unknown	5 (14.7)	34 (9.1)

Table 20: Fetal condition at time of presentation to hospital in patients within the PPIP category of Fetal Abnormality compared with the rest of the patients in the study.

The primary relevant condition at death was fetal in all cases. There were no cases where a secondary relevant factor was identified.

There were only three cases where the cause of death was attributed to Trauma in the PPIP database (Table 21). This did not differ significantly from the rest of the study group.

	TRAUMA (n = 3) <i>n (%)</i>	Rest (n = 403) <i>n (%)</i>
HIV positive	0 (0)	68 (16.9)
RPR positive	0 (0)	22 (5.5)
Attended antenatal care	2 (66.7)	339 (84.1)
Singleton pregnancies	3 (100)	382 (94.8)
Maternal age	800 (680 – 2400)	1130 (500 -41000)
Birth weight	26 (25 – 37)	25 (14 – 45)

Table 21: Characteristics of patients within the PPIP category of Trauma compared with the rest of the patients in the study.

All three babies were dead at the time of admission to hospital.

The three cases primary relevant conditions at time of death included one case assigned to the Uterus group (with a secondary classification of Mother), one to the Trauma group and one Unclassified. The first death (birth weight = 2400 grams) was associated with an uterine rupture in a diabetic mother. The second death (birth weight = 680 grams) occurred in a partially born breech presentation with entrapment of the fetal head. In the third case (birth weight = 800 gram) no relevant condition apart from preterm labour could be identified. This baby was macerated at birth.

There were ten cases in the PPIP database where the cause of death was a result of intrapartum asphyxia. The mothers in this group were approximately 1.4 years older than the rest of the mothers (Table 22).

	IPA (n = 10) <i>n (%)</i>	Rest (n = 396) <i>n (%)</i>
HIV positive	3 (30)	65 (16.4)
RPR positive	0 (0)	22 (5.6)
Attended antenatal care	10 (100)	331 (83.6)
Singleton pregnancies	9 (90)	376 (94.9)
Maternal age	28.20 ± 7.25	26.77 ± 6.70
Birth weight	2700 (580 – 4100)	1100 (500 – 4100)

Table 22: Characteristics of patients within the PPIP category of intrapartum asphyxia compared with the rest of the patients in the study.

There were no macerated still births, and half of these fetuses had a positive heartbeat on admission.

The primary relevant conditions at birth are shown in table 23. In seven cases, only one primary condition was found (four cases of intrapartum asphyxia, two cases of cord prolapse and 1 case of placental insufficiency).

Two of the remaining mothers were diabetics. The other relevant conditions were cord prolapse and intrapartum asphyxia respectively. In the last case, intrapartum asphyxia was diagnosed in a case with a fetal infection.

	N	Fe	Cord	Pl	AF	Ut	Mo	IP	Tr	Unc
Fe	1							1		
Cord	3						1			
Pl	1									
Mo	1							1		
IP	4									

Table 23: Classification of still births caused by intrapartum asphyxia in the PPIP database using the ReCoDe system.

Patients with maternal disease causing still births were significantly older than the rest of the mothers and they had significantly bigger babies at birth (Table 24).

	Maternal (n = 15) n (%)	Rest (n = 391) n (%)
HIV positive	1 (6.7)	67 (17.1)
RPR positive	0 (0)	22 (5.6)
Attended antenatal care	13 (86.7)	328 (83.9)
Singleton pregnancies	15 (100)	370 (94.6)
Maternal age	33.60 ± 6.53	26.55 ± 6.59
Birth weight	2444.67 ± 1019.23	1432.61 ± 877.71

Table 24: Characteristics of patients within the PPIP category of maternal disease compared with the rest of the patients in the study.

There were significantly more macerated still births than in the rest of the patients (Table 25).

	Maternal (n = 15) n (%)	Rest (n = 391) n (%)
Alive	1 (6.7)	91 (23.3)
Fresh SB, dead on admission	4 (26.7)	158 (40.4)
Macerated SB	9 (60.0)	104 (26.6)
Unknown	1 (6.7)	38 (9.7)

Table 25: Fetal condition at time of presentation to hospital in patients within the PPIP category of maternal disease compared with the rest of the patients in the study. (p = 0.039).

There were eight cases where only one primary relevant condition was identified (all maternal) (Table 26). Two relevant conditions were identified in a further six patients and three in the last patient. The maternal category was relevant in all cases. These included diabetes mellitus (12 patients), cardiovascular conditions (4 patients) and hypertension (3 patients).

	n	Fe	Cord	Pl	AF	Ut	Mo	IP	Tr	Unc
Pl	5						6			
Mo	10						2	1		

Table 26: Classification of still births caused by maternal disease in the PPIP database using the ReCoDe system.

There were 11 patients where the stillbirth was attributed to other causes in the PPIP database. These included three cases of twin-to-twin transfusion syndrome and two cases of Rhesus incompatibility. The other cases were non-specified "other".

	OTHER (n = 11) <i>n (%)</i>	Rest (n = 395) <i>n (%)</i>
HIV positive	2 (18.2)	66 (16.7)
RPR positive	0 (0)	0 (0)
Attended antenatal care	10 (90.9)	331 (83.8)
Singleton pregnancies	9 (81.8)	9 (2.3)
Maternal age	27.45 ± 6.31	26.79 ± 6.73
Birth weight	1619.27 ± 1089.29	1465.84 ± 897.93

Table 27: Characteristics of patients within the PPIP category of Other compared with the rest of the patients in the study.

The majority of cases presented with fresh still births where the babies were alive at presentation. (Table 28).

	OTHER (n = 11) <i>n (%)</i>	Rest (n = 395) <i>n (%)</i>
Alive	1 (9.1)	91 (23.0)
Fresh SB, dead on admission	7 (63.6)	155 (39.2)
Macerated SB	2 (18.2)	113 (28.6)
Unknown	1 (9.1)	39 (9.9)

Table 28: Fetal condition at time of presentation to hospital in patients within the PPIP category of Other compared with the rest of the patients in the study.

We identified one relevant condition in nine cases (five fetal and four unknown). The five fetal conditions included the three cases of twin-to-twin transfusion syndrome and two cases of Rhesus incompatibility. Of the remaining two cases, one was associated with fetal growth restriction, placental insufficiency and maternal drug abuse while in the other there was a fetal abnormality and iatrogenic trauma, both which were not considered to be the cause of death in the PPIP database.

The PPIP database contains 33 cases where the cause of still birth could not be determined (Table 29).

	IUD (n = 33) <i>n (%)</i>	Rest (n = 373) <i>n (%)</i>
HIV positive	9 (27.3)	59 (15.8)
RPR positive	0 (0)	22 (5.9)
Attended antenatal care	30 (90.9)	311 (83.4)
Singleton pregnancies	32 (97.0)	353 (94.6)
Maternal age	24.67 ± 6.16	26.99 ± 6.73
Birth weight	1067.94 ± 748.17	1457.79 ± 914.63

Table 29: Characteristics of patients within the PPIP category of Intrauterine Death compared with the rest of the patients in the study.

The majority of cases were macerated stillbirths or fresh stillbirths where the fetus was already dead at the time of presentation to hospital (Table 30).

	IUD (n = 33) <i>n (%)</i>	Rest (n = 373) <i>n (%)</i>
Alive	1 (3.0)	91 (24.4)
Fresh SB, dead on admission	12 (36.4)	150 (40.2)
Macerated SB	19 (57.6)	94 (25.2)
Unknown	1 (3.0)	38 (10.2)

Table 30: Fetal condition at time of presentation to hospital in patients within the PPIP category of Intrauterine Death compared with the rest of the patients in the study.

We could not identify any relevant conditions in 28 cases. In the remaining five patients we found one relevant condition in each case, one with a congenital abnormality, one with placental insufficiency, one with polyhydramnios and two associated with maternal hypertension and drug abuse.

PIIP has a category where no obstetric cause (not applicable) could be found in 2 cases. Both of these patients had attended an antenatal clinic at some point. One fetus had no heartbeat on admission and the status of the other was unknown. We found placental insufficiency as a relevant condition to be associated with both cases.

7. DISCUSSION

Perinatal audit is an essential tool to help healthcare providers, task groups and governments to identify, quantify and provide solutions to deficiencies in antenatal, intrapartum and neonatal care. It should also provide the mourning parents with an explanation for their loss and a reasonable plan for the prevention of the recurrence of such tragedy.

Since the publication of the first modern classification by Baird²² in Aberdeen in 1954, there are at least 30 different classification systems for perinatal mortality described in the literature.^{9,10} The more traditional systems, which are still in wide spread use, have been shown to result in a significant proportion of unexplained stillbirths, up to two thirds.²³ This presents an obvious hurdle to the implementation of any remedial interventions or strategies aimed at improving the standard of care, including personnel education and training.

In recent years, there have been a few attempts to reduce the number of unexplained stillbirths and new classification systems have emerged. Gardosi developed the ReCoDe system (relevant condition at death) and compared it to the conventional Wigglesworth classification.^{13,14} He was able to reduce the 66.2% of unexplained stillbirths according to the Wigglesworth classification, to only 15.2%. In 2008, Vergani et al studied the outcomes of ReCoDe¹³, the de Galan-Roosen¹⁶ and Tulip¹⁰ classifications as compared with Wigglesworth. This study showed that ReCoDe provided the lowest number of stillbirths (14.3%). Tulip followed with 16.2%, de Galan-Roosen with 18.2% and Wigglesworth 47.4%.¹⁵

Flenady, et al in 2009 assessed six systems based on their ability to retain important information, ease of use, inter-observer agreement, and the proportion of unexplained stillbirths.²⁴ The systems evaluated included the Amended Aberdeen, Extended Wigglesworth, PSANZ-PDC (Perinatal Society of Australia and New Zealand – Perinatal Death Classification), ReCoDe, Tulip and CODAC²⁵ (Cause of Death and Associated Factors). Study investigators, from 7 different countries, made up 9 teams. These teams then applied the classification systems to cohorts of stillbirths from their regions. Their outcomes depicting how each system compared to the rest, with regards to the number of unexplained stillbirths, are shown below.

Table 31: Unexplained stillbirth by classification and team (Flenady,2009)

Team	Total No cases	Wigglesworth n(%)	Aberdeen n(%)	PSANZ_PDC n(%)	ReCoDe n(%)	Tulip n(%)	CODAC n(%)
1	100	53(53)	29(29%)	38(38)	11(11)	10(10)	5(5)
2	102	60(58.8)	41(40.2)	27(26.5)	2(2)	6(5.9)	3(2.9)
3	106	22(20.8)	6(5.7)	2(1.9)	7(6.6)	3(2.8)	16(15.1)
4	101	51(50.5)	37(36.6)	33(32.7)	23(22.8)	14(13.9)	10(9.9)
5	100	57(57)	56(56)	35(35)	30(30)	27(27)	29(29)
6	100	85(85)	66(66)	31(31)	17(17)	15(15)	16(16)
7	67	24(35.8)	25(37.3)	6(9)	3(4.5)	1(1.5)	1(1.5)
8	95	35(36.8)	46(48.4)	34(35.8)	19(20)	11(11.6)	1(1.1)
9	86	43(50)	74(86)	42(48.8)	6(7)	0(0)	0(0)
	857	430(50.2)	380(44.3)	248(28.9)	118(13.8)	87(10.2)	81(9.5)

Although these new systems have been shown to reduce the number of unexplained stillbirths, no one system has been universally accepted. In addition, all these systems have been developed in high income countries and their application and relevance still need to be tested in the developing world.

Although Pattinson, et al²⁰ have shown Total Perinatal Related Wastages to be a better overall measure of the standard of perinatal care, we have elected to compare our PPIP data to ReCoDe, which was specifically designed for stillbirths, in an attempt to reduce the number of unexplained cases.

The leading causes of stillbirth over the study period were antepartum haemorrhage, hypertensive disorders and spontaneous preterm labour. This finding is a reflection of the clinical spectrum of disease presenting within the Tygerberg district. The finding is also in keeping with the 2007 National PPIP results for National Centre hospitals.¹⁸ Our study shows that the majority of stillbirths from our database our considered to be fresh (recently demised), but were already dead on admission to hospital, and most weighed less than 1000g. This probably is as result of the higher number of abruptio placentae cases, as well as the early gestation preterm labours that are referred to the institution. The Saving Babies Report of 2006-2007 attributed 25% of fresh stillborn cases to patient related avoidable factors, that

is, the pregnant women never initiated antenatal care or there was a significant delay in seeking medical attention during labour. This emphasises the importance of educating pregnant patients and reinforcing the message, at every opportunity, regarding the value of attending antenatal clinics regularly, of making adequate transport arrangements for when labour ensues and of what to do when she experiences vaginal bleeding, contractions or rupture of membranes.

The unexplained group (PPIP IUD group), from the index study constitutes 8.1% of cases. This is marginally higher than the 2007 results (7.4%) when compared to a study performed at the same institution, but much lower than previous reports (1986 - 12.4% and 1993 - 12.9%).^{26,27} This reduction in the number of unexplained stillbirths at Tygerberg hospital between 1993 and current may be linked to two major implementations. The use of umbilical artery Doppler ultrasound became routine in high risk antenatal patients soon after 1995. This has led to an overall reduction in the IUD rate and has helped to identify cases of chronic placental insufficiency.²⁸ The introduction of placental histology to the perinatal death workup, has also led to a decrease in the number of unexplained stillbirths and an increase in the number of deaths associated with intrauterine growth restriction. 848 placentas were submitted from the Tygerberg Hospital obstetric unit between 2004 and 2006. This represents about 15% of the total number of deliveries during that time period. An audit of the histological findings showed that in the pregnancies with adverse outcomes, with an explained clinical cause, acute chorioamnionitis and uteroplacental insufficiency accounted for the majority of diagnoses.²⁹

The number of unclassified stillbirths in the primary ReCoDe classification accounted for 15% (60 of 406) of the total. This is similar to the findings of Gardosi, but unexpectedly more than the same category from PPIP. A number of possible reasons could have contributed to this outcome.

Firstly, ReCoDe does not include preterm labour as a cause of intrauterine death, while preterm labour is a well established cause within the context of PPIP, and therefore across South Africa. Spontaneous preterm birth ranks second only to unexplained stillbirths as the main category of perinatal death in South Africa.¹⁸ The majority of cases allocated to the SPTL group in PPIP (55%) therefore became unexplained within the context of ReCoDe. A further 15% was allocated to the amniotic fluid group, subclassified as chorioamnionitis.

Defective deep placentation has been associated with a number of obstetrical syndromes, including preeclampsia, intrauterine growth restriction, spontaneous abortion, spontaneous preterm labour (with intact membranes) and preterm rupture of membranes. Placental histology of women with spontaneous preterm labour showed acute inflammation (acute chorioamnionitis and funisitis) to be the most common lesion. Vascular lesions were the next most common pathology found in these placentas. Maternal vascular lesions can cause uteroplacental ischemia, thereby resulting in preterm labour, fetal death, intrauterine growth restriction and maternal hypertension. The severity, timing and duration of the lesions and ischemic insult have varied influence on the clinical syndrome that results, as demonstrated with the more extensive lesions present in preeclampsia than with preterm labour. Currently the precise mechanism for the onset of contractions is unknown.^{30,31}

Secondly, Gardosi's original study resulted in the majority of previously unexplained stillbirths being classified as having fetal growth restriction as their primary relevant condition at death. Gardosi used customised birth weight for gestation centiles calculated by using the gestation related optimal weight software (GROW). This software incorporates maternal height and weight, parity and ethnic origin into the calculation of the optimal fetal weight. However, this program was developed from the population characteristics of a developed country. It is a reasonable assumption that differing socio-economic conditions, nutritional status, geographical location, ethnic mixing and population disease profile, would all have an influence on the fetus's constitutional characteristics in a developing country. Furthermore, the national PPIP database also records that 12.9% of unexplained stillbirths never booked at an antenatal facility during pregnancy and a further 7.5% booked at a late gestation.¹⁸ This imposing obstacle significantly hinders the clinician's ability to accurately determine a gestational age, and so much more an optimal weight for gestation. It has also been shown that a large proportion of the patient's that are either unbooked or late bookers, present with macerated stillbirths. Maceration further limits the ability to calculate the gestational age of the fetus and weight even with post mortem examination.³² The cohort of stillbirths from the index study had 97 cases presenting as macerated stillbirths. This finding is very different from Gardosi's study, where severe maceration was a rare event.

Another reason for the higher number of unexplained stillbirths could be related to the methods employed by the investigators in the index study, which could have resulted in the

loss of relevant clinical data. As previously mentioned, only the clinical information captured on the Perinatal Losses form and the PPIP form were used as the primary resources for ReCoDing the stillbirth cohort. This information was then reviewed independently by each investigator and consensus reached on disparate cases. This differs significantly from the methods employed by the Perinatal Mortality Audit meeting at Tygerberg hospital, where a panel of experts have access to ultrasound and Doppler reports, the geneticist's report regarding the clinical examination of the fetus and the feedback of pathology reports, to come to agreed conclusion regarding the cause of death.

In our study cohort, PPIP identified 33 deaths as being due to infections. Prins, et al found infections to be one of the leading causes of perinatal mortality in the Tygerberg hospital region, and noted that infection-related deaths, especially related to treponemal infections, were on the increase.²⁶ Our study confirmed that the number of syphilis positive patients were significantly higher in this group than the rest of the cohort. Surprisingly, there was no difference in the percentage of HIV positive patients between the Infection group and the rest of the cohort. Just less than half of these stillbirths were already macerated. Within this group ReCoDe identified 14 cases of fetal infection and 14 cases of chorioamnionitis as primary conditions. Subclinical chorioamnionitis has been linked to preterm labour and to intrauterine deaths³³, although others report that death is a rarity except when there is overwhelming established fetal sepsis.³⁴

PIPP identified Antepartum Haemorrhage as the leading cause for stillbirth in this cohort (24.4%). ReCoDe identified placental abruption alone in 45 patients, and placental abruption associated with maternal hypertension in only 43 patients. Abdella, et al observed a two fold increase in abruption associated with preeclampsia, compared to patients without preeclampsia.³⁵ They also noted a three times higher risk of fetal death when abruption placentae is associated with hypertension. Considering that most of these stillbirths were dead on admission (73.7%), therefore implying significant haemorrhage, a reasonable explanation is that a diagnosis of hypertension or preeclampsia may have been hindered by the resultant maternal shock. The underlying obstetric condition may only have become apparent days after initial resuscitation. Proposed reasons for the high number of fresh stillbirths in this group include patient related factors, specifically a delay in seeking medical attention, and factors related to delay in transport to hospital. It does however, emphasise the need to thoroughly counsel patients regarding what to do if they should have antepartum

haemorrhage, as well as to make sure that obstetric staff are adequately trained in managing a shocked patient.

The thirty cases of IUGR equated to 7.4% of the PPIP diagnoses, and a third of these fetuses were macerated. ReCoDe identified 12 cases as fetal growth restriction and a further 13 cases as placental insufficiency. Fetal abnormalities (both chromosomal and anatomic) and aberrant placental vascular development are responsible for the majority of singleton IUGR fetuses.^{36,37} Maternal risk factors include hypertension, chronic renal disease, collagen vascular disorders and thrombophilias. In our cohort, two patients had chronic hypertension, one as the only relevant condition and another in the placenta group. A single other patient had preeclampsia. The rest remained idiopathic cases of placental insufficiency resulting in fetal growth restriction. These patients should therefore be identified as high risk in subsequent pregnancies, allowing for vigilant clinical surveillance and uterine and umbilical artery Doppler screening as an intervention to prevent recurrence.³⁸

Twenty two percent of the stillbirths were directly attributed to hypertensive disease. Almost forty percent of these fetuses were alive at admission, with an extremely low mean birth weight of 745g. ReCoDe acknowledged the maternal factor in all but one of these cases. ReCoDe also gave further insight into other relevant conditions by identifying 8 cases of growth restrictions (by definition severe preeclampsia), 13 cases of placental insufficiency and 15 cases of abruption placentae within this group. This demonstrated a weakness in the PPIP system that requires the user to decide and enter a single primary cause for death, especially where a number of conditions may bear equal relevance towards future pregnancies. There was a single case of chorioamnionitis identified by ReCoDe, in the absence of hypertension. This was identified independently by both investigators and we can only speculate that additional information must have been available at the Perinatal Mortality meeting.

There was complete correlation between PPIP and ReCoDe in identifying the primary cause of death in the fetal abnormality group. 97% of these patients attended antenatal care and the diagnosis of the fetal abnormality would have been made on antenatal ultrasound. A large proportion of these cases may therefore have been elective terminations, considering as well that a half of the fetuses were alive on admission.

There were ten cases of intrapartum asphyxia, of which 3 were related to cord prolapse. The mean birth weight was 2700g and none of these fetuses were macerated. The numbers are small in this cohort, but nationally this group is considered to have the highest probably avoidable death rate, that is these normal babies that should have had the potential for a normal life.¹⁸

8. CONCLUSION

Despite our study not demonstrating the expected decrease in unexplained stillbirths, we believe that the ReCoDe system may still have a valuable role in Perinatal Audit at Tygerberg Hospital and possibly others institutions in South Africa, by offering a different perspective on perinatal deaths (what went wrong, rather than why it went wrong). PPIP remains the gold standard in Perinatal Audit in South Africa, and the improvement in perinatal mortality rates in South Africa can largely be attributed to the recommendations made by the analyses of the PPIP national database, as well all those contributing to this database and implementing the recommendations.

Our study was limited by its retrospective nature. At times during our study, we identified the Perinatal Losses data form currently used in the maternity centre at Tygerberg, as being either inadequately completed or inherently deficient of relevant data.

We would recommend that ReCoDe be evaluated prospectively, alongside the established PPIP system, to better compare their performance outcomes. The development of customized fetal growth potential charts relevant to the local population should be explored. With reference to the latest CEMACH³⁹ data form (appendix I), it is also recommended that a revision of the Perinatal Losses data capture form be considered, possibly leading to more relevant information capturing and better information retention.

9. REFERENCES

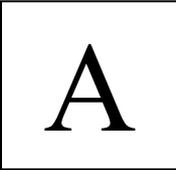
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10.APPENDICES

A - I



**DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY
PERINATAL LOSSES DATA SHEET (TBH)**

Mother Age: _____ G ___ P ___ M ___ T ___ E ___ Place of delivery: _____

Current pregnancy

Booked: YES/NO VDRL: _____ Rx 1) _____ 2) _____ 3) _____ Bl Group: _____

RVD: POS/NEG/DECLINED ARV'S: YES/NO CD4: YES/NO Count: _____

Antenatal course & Delivery _____

Postpartum _____

IUD / END Weight: _____ Apgars: 1 _____ 5 _____ 10 _____ Sex: M / F

Gestation: _____ d / US / SF / unsure

Date of birth: _____ Date of death: _____ Days old: _____

Primary cause of Death _____

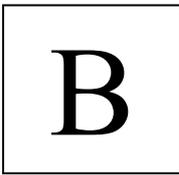
Final cause of Death _____

Advice for next pregnancy

BOOK EARLY AT MOU	NT SCAN AND GENETIC COUNSELLING	
REFER TO TBH AFTER BOOKING VISIT	DETAIL ULTRASOUND 22-24 WEEKS	
BOOK EARLY AT TBH	DOPPLER AT 24 WEEKS	
SPECIAL CARE IN NEXT PREGNANCY	IOL AT 38 WEEKS	
ADMIT AT 28 WEEKS	CERVICAL LENGTH MEASUREMENTS	
OTHER:		

Autopsy: YES / NO Results _____

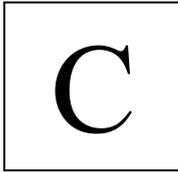
Placental Histology: YES / NO
Results _____



Perinatal Death data sheet - PPIP v2.2

Data collected at _____

Identification	<input type="text"/>		
Date of delivery	<input type="text"/>	(dd/mm/yyyy)	
Date of death	<input type="text"/>	(dd/mm/yyyy)	
Birth mass	<input type="text"/>	g	
Delivered	At this unit At home In transit At another unit Unknown (please circle)		
Maternal age	<input type="text"/>	yr	Unknown
Antenatal care	Yes No Unknown	(please circle)	
Condition at birth (please circle)	Born alive Stillborn, alive on admission Fresh stillborn, dead on admission Stillborn, admission status unknown Macerated stillborn		
Syphilis serology	Positive Negative Not done Result not available	(please circle)	
Single / multiple	Single pregnancy Multiple pregnancy	(please circle)	
Maternal HIV serology	Positive Negative Not done Result not available	(please circle)	
Received ART	Yes No Unknown	(please circle - ONLY if HIV positive)	
Primary obstetric cause of death	<input type="text"/>	Enter code. If 'Other', please describe below	
Final cause of death	<input type="text"/>	Enter code. If 'Other', please describe below	
Avoidable factors	<input type="text"/>	Possible Probable	
Enter code & circle grade. If 'Other', please describe to the right.	<input type="text"/>	Possible Probable	
	<input type="text"/>	Possible Probable	
	<input type="text"/>	Possible Probable	
	<input type="text"/>	Possible Probable	



- Perinatal Problem Identification v2
Obstetric cause of Perinatal Death

100	Spontaneous preterm labour
101	Ideopathic preterm labour
102	Preterm premature rupture of membranes
103	Preterm premature rupture of membranes with chorioamnionitis
104	Cervical incompetence
105	Iatrogenic preterm delivery for no real reason
106	Preterm labour with chorioamnionitis with intact membranes
200	Infections
201	Syphilis
202	Amniotic fluid infection
203	Other
204	Beta-haemolytic streptococcal infection
205	Malaria
206	AIDS/HIV related
300	Antepartum haemorrhage
301	Abruptio placentae
302	Abruptio placentae with hypertension
303	Placenta praevia
304	Antepartum haemorrhage of unknown origin
400	Intrauterine growth retardation
401	Idiopathic intrauterine growth retardation
402	Postmaturity
500	Hypertensive disorders
501	Chronic hypertension
502	Proteinuric hypertension
503	Eclampsia
600	Fetal abnormality
601	Fetal chromosomal abnormality
602	Neural tube defects
603	Non-specific fetal abnormality - FLK
604	Non-immune hydropsfetalis
605	Cardiovascular system
606	Renal system
607	Multiple systems
608	Hydrocephalus
700	Trauma
701	Traumatic breech delivery

702	Precipitous labour
703	Domestic violence
704	Motor vehicle accident
705	Ruptured uterus
706	Traumatic assisted delivery
800	Intrapartum asphyxia
801	Labour related intrapartum asphyxia
802	Meconium aspiration
803	Cord prolapse
804	Cord around the neck
900	Maternal disease
901	Maternal diabetes mellitus
902	Maternal heart disease
903	Other
1000	Other
1001	Rhesus isoimmunisation
1002	Twin-to-twin transfusion
1099	Other
1100	Intrauterine death
1101	Unexplained intrauterine death - fresh
1102	Unexplained intrauterine death - macerated
1103	Unexplained IUD due to lack of notes
1200	No obstetric cause / Not applicable

D

INDICATIONS FOR PLACENTAL HISTOLOGY

Placental histology must be requested in all the following cases of singleton and multiple pregnancies.

1. All unexplained stillbirths 34+ weeks or ≥ 2.0 kg. This excludes cases of abruptio placentae, cord prolapse and syphilis. In cases of uncertainty, the placenta must be kept with the body for Prof de Jong's opinion.
2. Indications of asphyxia in a viable baby. This group consists of all neonates who required resuscitation, unless clearly due to abruptio placentae or cord prolapse.
3. Second or higher order midtrimester loss.
4. Idiopathic preterm labour (gestational age < 34 weeks or birth weight < 1800 g).
5. Suspected subclinical chorioamnionitis.
6. Cases of severe intrauterine growth restriction ***without*** antenatal work-up (Doppler and ultrasound).
7. Multiple pregnancies:
 - a. All applicable indications that would be relevant in singleton pregnancies.
 - b. All multiple pregnancies with uncertain chorionicity at time of birth.
8. Congenital abnormalities without prior diagnosis (unless otherwise requested by Prof de Jong or DrGeerts).
9. Cases of severe pre-eclampsia if requested by Special Care Unit.
10. A mom where TB treatment was initiated within the last 3 months before delivery.

HOW TO ARRANGE FOR PLACENTAL HISTOLOGY

Submit placenta in 10% buffered formalin in plastic container sufficiently large so not to distort placenta.

Provide essential clinical information if available and/or relevant:

- Gestational age
- Live baby or stillbirth
- Retroviral, syphilis serology
- Recurrent loss
- Maternal disease

If autopsy is also requested, place placenta in formalin and send to mortuary with baby.

E

INDICATIONS FOR PERINATAL POSTMORTEM EXAMINATION

1. All cases of fresh stillbirths of uncertain cause.¹
2. Neonatal deaths of uncertain cause occurring in labour ward or in theatre.
3. All cases of perinatal deaths, including congenital abnormalities, when requested by Prof de Jong or DrGeerts.²

HOW TO ARRANGE A NEONATAL POSTMORTEM EXAMINATION

1. Consent for autopsy from mother **or** father (preferentially mother). Either of them must sign for determining cause of death and retaining any tissue necessary for establishing this (for histopathology).
2. Consent for disposal of fetus or for hospital to cremate baby.
3. Request form for autopsy with short clinical history. Please print clinicians name so pathologist can contact relevant clinician if necessary. Please note that placenta has been sent with baby and retrieve placenta. Place placenta in formalin.
4. Death certificate, tick box for natural cause of death but do not complete certificate stating specific cause of death.
5. Phone Prof Wright 4048 bleep 988 or Lynette/ Carol 5226 with name of baby so that autopsy may be booked.

FETAL AUTOPSY

1. Always obtain 1 and 2 above from parent.
2. **DO NOT** put fetus in formalin. Place in fridge in dry packet or bucket until fetus can safely be transported to laboratory without delay in transit.
3. Make sure placenta (in formalin) is with baby.
4. Fill out standard autopsy request form.

Note that placenta has been submitted with baby.

Phone Prof Wright or Lynette/ Carol as above.

18-10-07

¹Autopsies should not be requested of macerated stillbirth unless discussed with Prof de Jong.

² Stillbirths with congenital abnormalities should be discussed with the consultant of Special Care when Prof de Jong or DrGeerts are not available

F

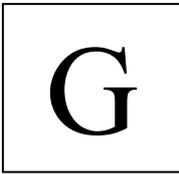
Relevant Condition of Death (ReCoDe)

Group A: Fetus	<ol style="list-style-type: none"> 1. Lethal congenital anomaly 2. Infection <ol style="list-style-type: none"> 2.1 Chronic 2.2 Acute 3. Non-immune hydrops 4. Isoimmunisation 5. Fetomaternalhaemorrhage 6. Twin-twin transfusion 7. Fetal growth restriction¹
Group B: Umbilical Cord	<ol style="list-style-type: none"> 1. Prolapse 2. Constricting loop or knot² 3. Velamentous insertion 4. Other
Group C: Placenta	<ol style="list-style-type: none"> 1. Abruption 2. Praevia 3. Vasa Praevia 4. Other "placental insufficiency"³ 5. Other
Group D: Amniotic fluid	<ol style="list-style-type: none"> 1. Chorioamnionitis 2. Oligohydramnios² 3. Polyhydramnios² 4. Other
Group E: Uterus	<ol style="list-style-type: none"> 1. Rupture 2. Uterine anomalies 3. Other
Group F: Mother	<ol style="list-style-type: none"> 1. Diabetes 2. Thyroid diseases 3. Essential hypertension 4. Hypertensive diseases in pregnancy 5. Lupus or antiphospholipid syndrome 6. Cholestasis 7. Drug misuse 8. Other
Group G: Intrapartum	<ol style="list-style-type: none"> 1. Asphyxia 2. Birth trauma
Group H: Trauma	<ol style="list-style-type: none"> 1. External 2. Iatrogenic
Group I: Unclassified	<ol style="list-style-type: none"> 1. No relevant condition identified 2. No information available

¹Defined as <10th customized weight-for-gestation percentile

²If severe enough to be considered relevant

³Histological diagnosis



EXTENDED WIGGLESWORTH CLASSIFICATION

- Category 1. Congenital defect/malformation (lethal or severe):** Only lethal or potentially lethal congenital malformation should be included here. **Serious biochemical abnormalities** such as **Tay Sach's disease** and any known single gene defects known to have a high risk of death should be included.
- Category 2 Unexplained antepartum fetal death:** Most late fetal losses should be coded here. Where a live-born baby dies due to problems during the antepartum period, code this as 'other specific causes' (category 6).
- Category 3 Death from intrapartum 'asphyxia', 'anoxia' or 'trauma':** This category covers any baby who would have survived but for some catastrophe occurring during labour. These babies will tend to be normally formed, stillborn or with poor Apgar scores, possible meconium aspiration or evidence of acidosis. Very premature infants (those less than 24 weeks gestation) may be asphyxiated at birth, but should not be entered in this category as a rule.
- Category 4 Immaturity:** This applies to live births only, who subsequently die from structural pulmonary immaturity, surfactant deficiency, intra ventricular haemorrhage, or their late consequences - including chronic lung damage.
- Category 5 Infection:** This applies where there is clear microbiological evidence of infection that could have caused death, e.g. maternal infection with Group B streptococci, rubella, parvovirus, syphilis etc; or in the case of a baby dying with overwhelming sepsis.
- Category 6 Other specific causes:** Use this if there is a specific recognisable fetal, neonatal or paediatric condition not covered under the earlier categories. Examples include:
 (1) *fetal* conditions; twin-to-twin transfusion and hydrops fetalis;
 (2) *neonatal* conditions; pulmonary haemorrhage, pulmonary hypoplasia due to prolonged loss of liquor (primary hypoplasia being classed as a malformation), persistent transitional circulation (in the absence of infection, aspiration or surfactant deficiency), blood loss unassociated with trauma (e.g. vasa praevia);
 (3) *paediatric* conditions; malignancy and acute abdominal catastrophe (such as volvulus without antecedent congenital malrotation).
- Category 7 Accident or non-intrapartum trauma:** Confirmed non-accidental injury should be coded here. If only suspected, code as a sudden infant death cause unknown (category 8)
- Category 8 Sudden infant death, cause unknown:** This will include all infants in whom the cause is unknown or unsuspected at the time of death. Modification due to postmortem information should be notified later.
- Category 9 Unclassifiable:** To be used as a last resort. Details must be given if this option is ticked.


OBSTETRIC (ABERDEEN) CLASSIFICATION

DEFINITION OF THE TERMS USED IN THE OBSTETRIC (Aberdeen) CLASSIFICATION	OBSTETRIC (Aberdeen) CLASSIFICATION
	<p>Categories at the head of the list take priority over those lower down. Only ONE answer applies – it is the lowest numbered category that adequately describes the death.</p>
<p>CONGENITAL ANOMALY. Any genetic or structural defect arising at conception or during embryogenesis incompatible with life or potentially treatable but causing death.</p>	<p>Code Category</p> <p>Congenital anomaly:- any structural or genetic defect incompatible with life or potentially treatable but causing death</p>
<p>ISOIMMUNISATION. Death ascribable to blood group incompatibility, rhesus (3) or non-rhesus (4).</p>	<p>1 Neural tube defects</p> <p>2 Other anomalies</p>
<p>ANTEPARTUM HAEMORRHAGE (APH), after 20 weeks gestation (140 days) whether revealed or not excluding antepartum haemorrhage secondary to pre-eclampsia (which is classified under pre-eclampsia). Minor degrees of haemorrhage at the start of labour (a show), and haemorrhage due to a cervical erosion or polyp should be ignored, but significant or recurrent bleeding of uncertain origin that is fairly closely followed by preterm labour should not be ignored.</p>	<p>Isoimmunisation:- death ascribable to blood group incompatibility</p> <p>3 Due to Rhesus (D) antigen</p> <p>4 Due to other antigens</p>
<p>MECHANICAL. Any death from uterine rupture and those deaths from birth trauma, or intrapartum asphyxia that are associated with problems in labour such as disproportion, malpresentation, cord prolapse, cord compression, or breech delivery in babies of 1000g or more. If there is no evidence of difficulty in labour, deaths from asphyxia or trauma should be classified as unexplained. Antepartum deaths associated with cord entanglement in the absence of strong circumstantial evidence that cord compression caused death (eg fetal death soon after external version) should also be classified as unexplained</p>	<p>Pre-eclampsia</p> <p>5 Without APH</p> <p>6 Complicated by APH</p> <p>Antepartum Haemorrhage (APH)</p> <p>7 With placenta praevia</p> <p>8 With placental abruption</p> <p>9 APH of uncertain origin</p>
<p>MATERNAL DISORDER. Include maternal trauma (such as a road traffic accident), diabetes, appendicitis, and cardiac disease etc, if severe enough to jeopardise the baby. Include significant renal disease or essential hypertension known to be present before pregnancy. Also include symptomatic and asymptomatic maternal infection when this resulted in the death of the baby.</p>	<p>Mechanical</p> <p>10 Cord prolapse or compression with vertex or face presentation</p> <p>11 Other vertex or face presentation</p> <p>12 Breech presentation</p> <p>13 Oblique or compound presentation, uterine rupture etc.</p>
<p>MISCELLANEOUS. Specific fetal and neonatal conditions only. Do not include conditions directly ascribable to prematurity or anoxia before birth, because these deaths are attributable to the relevant underlying obstetric disorder or are unexplained (see below). Include, however, specific fetal conditions (eg twin-to-twin transfusion) or neonatal conditions (eg inhalation of milk) where these are not directly ascribable to intrapartum anoxia or preterm delivery. Include, also postnatally acquired infection, except in babies of less than 1000g; here the reason for the ventilator dependency or low birthweight is the codeable factor.</p>	<p>Maternal disorder</p> <p>14 Maternal hypertensive disease</p> <p>15 Other maternal disease</p> <p>16 Maternal infection</p>
<p>UNEXPLAINED. Deaths with no obstetric explanation, including unexplained antepartum stillbirths, deaths resulting from unexplained preterm delivery (including hyaline membrane disease, intraventricular haemorrhage, etc) and cases of intrapartum anoxia or trauma if the baby weighed less than 1000g at birth or delivery without any obvious associated mechanical problem. Cases should be subclassified into those babies weighing 2500g or more (20) and those of less than 2500g (21) at birth.</p>	<p>Miscellaneous</p> <p>17 Neonatal infection</p> <p>18 Other neonatal disease</p> <p>19 Specific fetal conditions</p>
<p>UNCLASSIFIABLE. Cases where little or nothing is known about pregnancy or delivery and that cannot be fitted into any of the above categories. Use this category as sparingly as possible.</p>	<p>Unexplained</p> <p>20 Equal or greater than 2.5kg</p> <p>21 Less than 2.5kg</p> <p>22 Unclassifiable</p>

For Office use only: PDN CODE FOR CASE 0 9

SURNAME _____

PLACE OF DEATH _____

DATE OF DELIVERY / / 

Confidential Enquiry into Maternal and Child Health

Improving the health of mothers, babies and children

PERINATAL DEATH NOTIFICATION FORM 2009

CHOOSE Type of Case (TICK)

STILLBIRTH: A baby delivered without life **after** 23rd weeks of pregnancy i.e. no signs of life at birth and where no heartbeat was ever detected.

If the birth occurred unattended and there was no lung aeration seen at Post Mortem (PM) and no other circumstantial evidence of life at birth, it should be assumed that the baby was stillborn.

In all cases where there is evidence that the fetus has died prior to the 24th week of pregnancy, the death **should not** be notified as a stillbirth. Where there is any doubt about the gestational age at which the fetus died, the default position would be to notify as a stillbirth.

OR

EARLY NEONATAL DEATH: Death, following live birth at ANY GESTATION, of a baby before the age of 7 completed days.

OR

LATE NEONATAL DEATH: Death of a baby occurring from the 7th day of life and before the age of 28 completed days.

Brief Instructions and Guidance

1. Fill in the form using the information available in the maternity case notes and discharge summary.
2. Guidance for completing Sections 9 & 10 on Cause of Death is found on the folder enclosing this form.
3. There are no "not known" codes as all the information should be contained in the notes. ***If you do not know the answer to a question please indicate this in Section 12.***
4. Please complete all dates in the format DD/MM/YY, and all times using the 24hr clock e.g. 17:45.
5. Please **DO NOT** wait for the PM details to complete and return this form.

For Office Use Only:

PDN CODE FOR CASE 0 9 **SECTION 1. WOMAN'S DETAILS**

- 1.1 NHS number:
- 1.2 Surname: _____ First name: _____
- 1.3 Hospital number:
- 1.4 Usual residential address at time of delivery/birth: _____

- 1.5 Postcode:
- 1.6 Woman's date of birth: // or estimated age
- 1.7 Ethnic group:
- White: British Irish Any other White background, specify _____
- Mixed: White & Black Caribbean White & Black African White & Asian Any other mixed
- Asian or Asian British: Indian Pakistani Bangladeshi Any other Asian
- Black or Black British: Caribbean African Any other Black background
- Other ethnic groups: Chinese Any other, specify _____
- Not stated:
- 1.8 Was the woman in paid employment at booking? YES NO
If yes, what is her occupation? (Transcribe exactly what is in notes) _____
- 1.9 Was the woman's partner in paid employment at booking? YES NO NOT KNOWN
If yes, what is the partner's occupation? (Transcribe exactly what is in notes) _____
- 1.10 Height at booking (cm): .
- 1.11 Weight at booking (kg): .
If weight is unavailable, was there evidence that the woman was too heavy for hospital scales? YES NO
- 1.12 Body Mass Index at booking (BMI):
- 1.13 Smoking status: Never Gave up prior to pregnancy Gave up in pregnancy Current
- 1.14 Was this woman known to abuse alcohol? YES NO
- 1.15 Was this woman known to be a substance user? YES NO

SECTION 2. PREVIOUS PREGNANCIES

- 2.1 Did the woman have any previous pregnancies? If yes, complete questions 2.2-2.4 YES NO
- 2.2 No. of completed pregnancies ≥ 24 weeks (all live & stillbirths):
- 2.3 No. of pregnancies < 24 weeks:
- 2.4 Were there any previous pregnancy problems? If yes, tick all that apply below YES NO
- Three or more miscarriages Pre-term birth or mid trimester loss Stillbirth
- Neonatal death Baby with congenital anomaly Infant requiring intensive care
- Previous caesarean section Placenta praevia Placental abruption
- Pre-eclampsia (hypertension & proteinuria) Post-partum haemorrhage requiring transfusion
- Other, specify _____

For Office Use Only: PDN CODE FOR CASE 9 **SECTION 3. PREVIOUS MEDICAL HISTORY****3.1 Were there any pre-existing medical problems? If yes, tick all that apply below** YES NO

- | | |
|---|--|
| <input type="checkbox"/> Cardiac disease (congenital or acquired) | <input type="checkbox"/> Epilepsy |
| <input type="checkbox"/> Endocrine disorders e.g. hypo or hyperthyroidism | <input type="checkbox"/> Renal disease |
| <input type="checkbox"/> Haematological disorders e.g. sickle cell disease | <input type="checkbox"/> Psychiatric disorders |
| <input type="checkbox"/> Inflammatory disorders e.g. inflammatory bowel disease | <input type="checkbox"/> Drug or substance abuse |
| <input type="checkbox"/> Diabetes | <input type="checkbox"/> Other, specify _____ |

SECTION 4. THIS PREGNANCY**4.1 Final Estimated Date of Delivery (EDD):**

Use best estimate (ultrasound scan or date of last menstrual period) based on a 40 week gestation. Or the final date agreed in the notes.

4.2 Was this a multiple pregnancy at the onset of pregnancy? YES NO**4.3 Date of first booking appointment:** NOT BOOKED**4.4 Intended place of delivery at booking:** UNDECIDED Name of unit/place _____

Please specify the type of unit

 Obstetric unit Alongside midwifery unit Freestanding midwifery unit Home Other**4.5 What was the intended type of delivery care at booking?** Obstetric led care Midwifery led care**SECTION 5. DELIVERY****5.1 Onset of labour:** Spontaneous Induced Never in labour**5.2 Intended place of delivery at onset of labour:**

Name of unit/place _____

Please specify type of unit

 Obstetric unit Alongside midwifery unit Freestanding midwifery unit Home Other**5.3 What was the intended type of delivery at onset of labour?** Obstetric led care Midwifery led care**5.4 Actual place of delivery:**

Name of unit/place _____

Please specify type of unit

 Obstetric unit Alongside midwifery unit Freestanding midwifery unit Home Other**5.5 What was the type of care at delivery?** Obstetric led care Midwifery led care**5.6 Date & time of delivery/birth:** Date: Time: **5.7 What was the presentation at delivery?** Vertex Breech Compound (includes transverse and shoulder presentations) Brow Face**5.8 What was the FINAL mode of delivery?** Spontaneous vaginal Ventouse Lift-out forceps Mid cavity forceps Rotational forceps Assisted breech Breech extraction Pre-labour caesarean section Caesarean section after onset of labour**CAESAREAN SECTIONS ONLY (non-Caesarean Sections go to Section 6)****5.9 Was a caesarean section planned prior to labour?** YES NO**5.10 What was the type of caesarean section?**

<input type="checkbox"/> Elective - At a time to suit woman or maternity team	<input type="checkbox"/> Scheduled - Needing early delivery but no maternal or fetal compromise
<input type="checkbox"/> Urgent - Maternal or fetal compromise which is not immediately life threatening	<input type="checkbox"/> Emergency - Immediate threat to life of woman or fetus

For Office Use Only: PDN CODE FOR CASE 0 9

SECTION 6. ALL BABY OUTCOMES

6.1 Baby's surname: _____ First name: _____

6.2 Baby's NHS number:

6.3 Sex of fetus/baby: Male Female Indeterminate

6.4 Number of fetuses/babies this delivery: (all identifiable including papyraceous)

6.5 Birth order of this fetus/baby: (0= singleton)

6.6 Birth weight (kg): .

6.7 Gestation at delivery: weeks + days

6.8 Was this a termination of pregnancy? YES NO

6.9 Was the death due to an intrapartum related event?
If yes, complete questions 6.10-6.12 YES NO

6.10 Was a local Hospital/Trust review of this case undertaken? YES NO

6.11 If no, please state why not:

6.12 If yes, what method was used?
 Root cause analysis Hospital/Trust review Clinical governance review
 Other, please specify _____

SECTION 7. STILLBIRTHS (if not stillbirth go to section 8)

7.1 What gestation was death confirmed?
(confirmed by ultrasound, pathological report or when baby born dead)
If known, what date was death confirmed? weeks + days
DD/MM/YY

7.2 Was the baby alive at onset of care in labour?
 YES NO NEVER IN LABOUR UNATTENDED NOT KNOWN

SECTION 8. NEONATAL DEATHS (if not neonatal go to section 9)

8.1 Was spontaneous respiratory activity absent or ineffective at 5mins? YES NO
If a baby is receiving any artificial ventilation at 5 mins assumption is absent/ineffective activity, a 0 Apgar score indicates absent activity.

8.2 Was the heart rate persistently <100? (i.e. heart rate never rose above 100 before death)
 Persistently <100 Rose above 100

8.3 Was the baby admitted to a neonatal unit? (includes SCBU and ICU) YES NO

8.4 Place of death:
Name of unit/place _____
This is where the baby actually died, e.g. 'name of unit', 'at home', 'in transit'. This includes babies who are brought to hospital, but are either declared dead on arrival or show no subsequent signs of life, despite attempted resuscitation.

8.5 Date & time of death: Date: DD/MM/YY Time: HH:MM

8.6 Was the baby transferred to another unit after birth? YES NO

8.7 Please briefly describe the obstetric and neonatal factors contributing to and associated with the death:

For Office Use Only: PDN CODE FOR CASE 0 9 **SECTION 9. ASSOCIATED FACTORS & CAUSE OF DEATH - STILLBIRTH and NEONATES**

9.1 Which condition, indicated in 9.2 as being present, was the MAIN condition causing or associated with the death? (NB 'non-MAIN' conditions are best described as the 'Other clinically relevant maternal or fetal conditions/factors that were associated with but not necessarily causing the death'). Please list the MAIN condition:

9.2 Please TICK ALL the maternal or fetal conditions that arose during pregnancy or were associated with death - PLEASE REFER TO SEPARATE CAUSE OF DEATH GUIDANCE ON THE ENCLOSING FOLDER.

9.2.1 MAJOR CONGENITAL ANOMALY:

- Central nervous system Cardiovascular system Respiratory system Gastro-intestinal system
 Musculo-skeletal anomalies Multiple anomalies Chromosomal disorders Metabolic diseases
 Urinary tract Other, specify _____

9.2.2 HYPERTENSIVE DISORDERS OF PREGNANCY:

- Pregnancy induced hypertension Pre-eclampsia toxemia HELLP syndrome Eclampsia

9.2.3 ANTEPARTUM or INTRAPARTUM HAEMORRHAGE:

- Praevia Abruptio Cause uncertain

9.2.4 MECHANICAL:

- Cord compression:** Prolapse cord Cord around neck Other cord entanglement or knot
Uterine rupture: Before labour During labour
Mal-presentation: Breech Face Compound
 Other, please specify _____

9.2.5 MATERNAL DISORDER:

- Pre-existing hypertensive disease Diabetes Endocrine diseases Thrombophilias
 Cholestasis Drug misuse Uterine anomalies
 Other, please specify _____

9.2.6 INFECTION:

- Maternal infection:** Bacterial Syphilis Viral diseases
 Protozoal Other, specify _____
 Specify organism if known _____
Ascending infection: Chorioamnionitis Other, specify _____

9.2.7 SPECIFIC FETAL CONDITIONS:

- Twin-twin transfusion Feto-maternal haemorrhage Non-immune hydrops Iso-immunisation
 Other, specify _____

9.2.8 SPECIFIC PLACENTAL CONDITIONS:

- Placental infarction Massive perivillous fibrin deposition Vasa praevia Velamentous insertion
 Other, specify _____

9.2.9 INTRA-UTERINE GROWTH RESTRICTION: **9.2.10 ASSOCIATED OBSTETRIC FACTORS:**

- Birth trauma:** Intracranial haemorrhage Birth injury to scalp Other, specify _____
Intrapartum asphyxia:
Other: Polyhydramnios Oligohydramnios Premature rupture of membranes
 Spontaneous premature labour Other, specify _____

9.2.11 NO ANTECEDENT OR ASSOCIATED OBSTETRIC FACTORS: **9.2.12 UNCLASSIFIED: (Use this category as sparingly as possible)**

For Office Use Only: PDN CODE FOR CASE 09**SECTION 10. CAUSE OF DEATH - NEONATES ONLY (Stillbirths go to Section 11)**

10.1 Which condition, indicated in 10.2 as being present, was the MAIN condition causing or associated with the death? (NB 'non-MAIN' conditions are best described as the 'Other clinically relevant conditions/factors that were associated with but not necessarily causing the death'). Please list the MAIN condition:

10.2 Please TICK ALL the neonatal conditions causing and associated with death - PLEASE REFER TO SEPARATE CAUSE OF DEATH GUIDANCE ON THE ENCLOSING FOLDER

10.2.1 MAJOR CONGENITAL ANOMALY:

- Central nervous system Cardiovascular system Respiratory system Gastro-intestinal system
 Musculo-skeletal anomalies Multiple anomalies Chromosomal disorders Metabolic disease
 Urinary tract Other, specify _____

10.2.2 EXTREME PREMATURITY (only less than 21st weeks):

10.2.3 RESPIRATORY DISORDERS:

- Severe pulmonary immaturity Surfactant deficiency lung disease Pulmonary hypoplasia Meconium aspiration syndrome
 Primary persistent pulmonary hypertension Chronic lung disease/Bronchopulmonary dysplasia (BPD)
 Other (includes pulmonary haemorrhage), specify _____

10.2.4 GASTRO-INTESTINAL DISEASE:

- Necrotising enterocolitis (NEC) Other, specify _____

10.2.5 NEUROLOGICAL DISORDER:

- Hypoxic-ischaemic encephalopathy (HIE) Intraventricular/Periventricular haemorrhage
 Other, specify _____

10.2.6 INFECTION:

- Generalised (sepsis) Pneumonia Meningitis Other, specify _____

10.2.7 INJURY/TRAUMA (postnatal):

Specify _____

10.2.8 OTHER SPECIFIC CAUSES:

- Malignancies/Tumours Specific conditions _____

10.2.9 SUDDEN UNEXPECTED DEATHS:

- SIDS Infant deaths - cause unascertained

10.2.10 UNCLASSIFIED (Use this category as sparingly as possible):

SECTION 11. POST MORTEM (Please do not wait for post mortem results before sending in this form)

11.1 Was a Post Mortem offered? YES NO

11.2 Was consent given for a Post Mortem? YES, FULL YES, LIMITED NO CONSENT

11.2.1 If PM was limited what was consent given for?

- MRI X-Ray Other, specify _____

11.3 Was the placenta sent for histology? YES NO

11.4 Was this a Coroners' Case? YES NO

For Office Use Only: PDN CODE FOR CASE 9

SECTION 12. ANY OTHER RELEVANT DETAILS

SECTION 13. DETAILS OF PERSON WHO COMPLETED THE FORM *(personal information is not passed to central office)*

Name: _____

Positions: _____

Addresses: _____

Tel number/email address: _____

Date of notification: / /

SECTION 14. REGIONAL OFFICE USE ONLY

Please code the causes of death that were given and the clinically derived single main cause of death
(Refer to the coding sheet)

14.1 Cause of Death: Associated Maternal & Fetal Factors and Cause of Death - STILLBIRTH & NEONATES (section 9)

14.1.1 *Single Main Cause* _____

14.1.2 *Other Cause(s) (no more than 3):* _____

14.2 Cause of Death: Associated Neonatal Factors & Cause of Death - NEONATES ONLY (section 10)

14.2.1 *Single Main Cause* _____

14.2.2 *Other Cause(s) (no more than 3):* _____

14.3 Maternal death: YES NO

14.4 Was a copy of the Post Mortem report received? YES NO

If yes, was it a limited Post Mortem? MRI SCAN X-RAY OTHER LIMITED NO

If yes, was it a Coroners' Post Mortem? YES NO

14.5 Was a copy of the placental histology report received? YES NO

14.6 Was cause of death coding completed using a Placental Histology or Post Mortem?
 PLACENTAL HISTOLOGY POST MORTEM NO