

Saving Babies 2010-2011: Eighth report on perinatal care in South Africa

Compiled by

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The report can be viewed on www.ppip.co.za

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ISBN: 978-0-620-55687-3

Quoting the report:

Saving babies 2010-2011: Eighth report on perinatal care in South Africa. RC Pattinson, Tshepesa Press, Pretoria, 2013

Chapters

Authors of Chapter. Chapter title. In Saving babies 2010-2011: Eighth report on perinatal care in South Africa. RC Pattinson. Tshepesa Press, Pretoria, 2013, pp

Acknowledgements

We would like to thank the following, without whom the publication of this document would have been impossible:

- All the PPIP users: *“All that is necessary for the triumph of evil is that good men do nothing”*. Edmund Burke, Irish orator, philosopher, & politician (1729 - 1797). The PPIP users, sometimes under extremely difficult conditions, continue to support the programme and directly contribute to saving babies’ lives. They certainly are not *“doing nothing”*. This group of dedicated people is conducting more than half of the births in the public service of South Africa. There is a whole army of dedicated people working to improve the services for women and their babies!
- Mrs Roz Prinsloo who has coordinated PPIP, organised the multiple workshops all national meetings since the first in 2000 and compiled the book.
- Dr Jennifer Makin for doing the statistical analysis on the districts
- The Department of Obstetrics and Gynaecology at the University of Pretoria for allowing the editor time to compile the report
- The Maternal, Child and Women’s Health and Nutrition Cluster of the National Department of Health for their continued support, work and enthusiasm
- The Provincial MCWH units for their continued support and work
- The Medical Research Council of South Africa for funding this project

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Preface

This eighth Saving Babies report deals with the years 2010-2011. It is unique because for the first time PPIP is sufficiently widespread to be able to give the report in districts and provinces. This data is presented at the end of the report. Care should be taken not to over interpret the data presented; there are still major gaps with 27% of all births are not being recorded on PPIP). However almost all hospitals are using the programme and various indicators can be calculated per district. We hope this data will be of value to the new District Clinical Specialist Teams introduced by the Minister of Health. This report does not deal with the data in any depth because of its inadequacies, but it is hoped that the 2012-2013 report will be much more robust and more lessons can be extracted from the data, especially with the help of the district clinical specialists' inputs.

This report also presents the avoidable factors in the three delays model (more internationally favoured) and compares this model with the current system used by PPIP. The health system failures are identified by both systems, the advantage of PPIP is that it is action orientated as it gives the level (community/individual, health care manager and health care provider) that should be targeted when developing strategies for improving the health system.

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Abbreviations

APH	Antepartum haemorrhage
CA	Congenital abnormalities
CHC	Community Health Centres
CS	Caesarean section
DH	District Hospitals
DHIS	District Health Information System
ENND	Early neonatal death
ENNDR	Early neonatal death rate
FA	Fetal abnormalities
FSB	Fresh Still Birth
HT	Hypertension
Imm.	Immaturity
iMMR	Institutional Maternal Mortality Ratio
Inf.	Infections
IPA+T	Intrapartum asphyxia and birth trauma
IUGR	Unexplained intrauterine growth restriction
LBWR	Low birth weight rate
MD	Pre-existing medical conditions
NC	National Central Hospital
NOC	No obstetric cause
PCI	Perinatal Care Index
PND	Perinatal death
PNMR	Perinatal mortality rate
PPIP	Perinatal Problem Identification Programme
PT	Provincial Tertiary Hospital
RH	Regional Hospitals
SB	Stillbirth
SBR	Stillbirth rate
SPTB	Spontaneous preterm birth
T	Birth Trauma
Unexp. SB	Unexplained stillbirth
Unk.	Unknown

Introduction

During the period 1st January 2010 to 31st December 2011, 1,324,320 births and 32,178 stillbirths and 14,587 early neonatal deaths were recorded on the national Perinatal Problem Identification Programme (PPIP) database from 588 PPIP sites. This represents 73.1% of all births in institutions using the District Health Information System (DHIS) for the denominator (July 2012). Table 1 give the comparison of births recorded on the DHIS and in PPIP. Table 2 gives the official classification of hospitals from the Government Gazette of August 2011.

Table 1. Comparison of births in the DHIS and PPIP

Source	2010	2011	Total
DHIS	884152	936512	1820664
PPIP	665943	664926	1330869
PPIP as a % of DHIS	75.3	71.0	73.1

Table 2. Distribution of hospitals in South Africa (2011)

Province	District Hospital	Regional Hospital	Provincial Tertiary	National Central	Total Hospitals
Eastern Cape	38	1	3	1	43
Free State	15	5	0	1	21
Gauteng	10	9	0	4	23
KwaZulu-Natal	37	11	2	2	52
Limpopo	29	4	2	0	35
Mpumalanga	18	3	2	0	23
North West	12	3	2	0	17
Northern Cape	8	1	1	0	10
Western Cape	21	5	0	2	28
South Africa	188	42	12	10	252
PPIP SA	179	38	12	9	238

Note

1. Data for hospital classification was obtained from the Government Regulation Gazette No 34521 of 12 August 2011
2. Only hospitals conducting births included, specialised TB and orthopaedic hospitals excluded.

Table 3 gives the distribution of the PPIP sites according to level of care. All levels of care (Community Health Centres – CHCs – 209,096 births (15.8% of PPIP database), District Hospitals - 548,976 births (41.4% of PPIP database), Regional Hospitals - 350,838 births (26.5% of PPIP database), Provincial Tertiary Hospitals – 99,257 births (7.5% of PPIP database), and National Central hospitals – 116,399 births (8.8% of PPIP database) were well represented. All 52 districts were represented. Late neonatal deaths were under reported are excluded from this interim report. No comparisons with previous years will be made due to the reclassification of some hospitals in to different levels of care. However, the mortality rates are very similar to those described in the 2008-2009 report.

Table 3. Distribution of PPIP sites per level of care in South Africa

Province	District Hospital	Regional Hospital	Provincial Tertiary	National Central	Total PPIP Hospitals	Total PPIP sites	Reclassified DHs and CHCs & Clinics
Eastern Cape	36	1	3	1	41	77	36
Free State	13	4	0	1	18	33	15
Gauteng	10	9	0	4	23	59	36
KwaZulu-Natal	36	8	2	1	47	68	21
Limpopo	29	4	2	0	35	161	126
Mpumalanga	18	3	2	0	23	72	49
North West	12	3	2	0	17	41	24
Northern Cape	7	1	1	0	9	26	17
Western Cape	18	5	0	2	25	51	26
PPIP South Africa	179	38	12	9	238	588	350

DH – District Hospital; CHC – Community Health Centre

PPIP is now a truly national programme with 94% of the hospitals contributing data to PPIP. The completeness and accuracy of data must now be improved upon. The comprehensive Saving Babies report will analyse the data per district.

Perinatal care indicators per level of care

The numbers of births and deaths per level of care are given in tables 5 for babies 500g+ and for babies 1000g+.

Table 4. Number of births and perinatal deaths per level of care (2010-2011)

500g+	CHC	DH	RH	PT	NC	Total
Total births	209096	548976	350838	99257	116399	1324566
Liveborn	207400	536883	341165	95956	111409	1292813
Survivor	207067	530229	336075	93746	108414	1275531
ENND	305	6257	4184	1765	2378	14889
SB	1696	12093	9673	3813	4990	32265
Perinatal deaths	2001	18350	13857	5578	7368	47154
1000g+						
Total births	207017	544480	345277	96871	112216	1305861
Liveborn	206791	534580	338236	94478	109019	1283104
Survivor	207067	529358	334816	93024	107144	1271409
ENND	205	4895	2747	1110	1425	10382
SB	1219	9900	7041	2749	3197	24106
Perinatal deaths	1424	14795	9788	3859	4622	34488

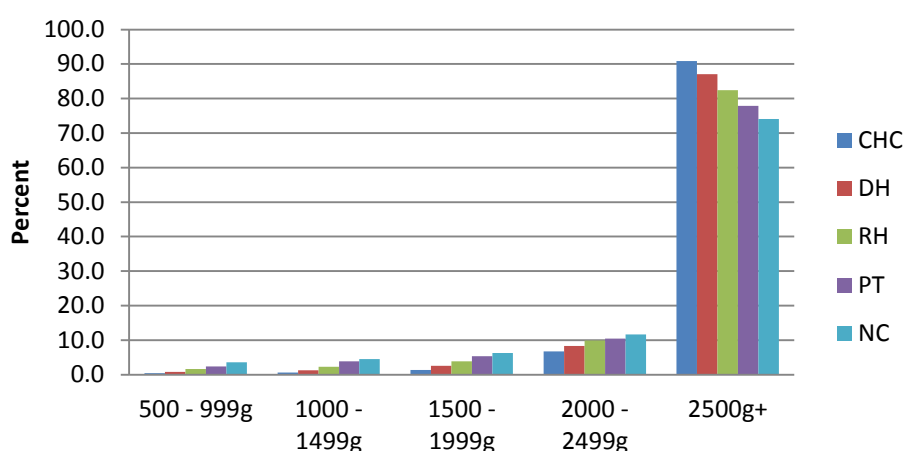
The perinatal care indicators are given in Table 5. As expected the low birth weight rate increases as the level of care increases. However, the perinatal care index (an independent measure of the quality of care) is highest in the district hospitals.

Table 5. Perinatal care indicators per level of care

	Community Health Centre	District Hospital	Regional Hospital	Provincial Tertiary	National Central
500g+					
ENNDR	1.47	11.21	12.26	18.39	21.34
LNDR	0.14	0.74	2.66	4.64	5.54
SBR	8.11	22.03	27.57	33.26	42.87
PNMR	9.57	33.43	39.50	51.04	63.30
NNDR	1.61	12.39	14.92	23.03	26.88
SB: ENND Ratio	5.6	1.9	2.3	2.2	2.1
LBW (500g+)	9.1	12.9	17.6	22.1	25.9
PCI (500g+)	1.05	2.59	2.25	2.31	2.44
1000g+					
ENNDR	0.99	9.16	8.12	11.75	13.07
LNDR	0.10	0.61	1.99	3.64	4.13
SBR	5.89	18.18	20.39	24.70	28.49
PNMR	6.88	27.17	28.35	36.16	41.19
NNDR	1.09	9.77	10.11	15.39	17.20
SB:ENND Ratio	5.9	2.0	2.6	2.5	2.2
LBW (1000g+)	8.7	12.2	16.2	20.2	23.2
PCI (1000g+)	0.79	2.23	1.75	1.79	1.78

Figure 1 illustrates clearly the distribution of births per level of care. As expected more low-birth weight babies are delivered at higher the levels of care.

Figure 1. Distribution of births in weight categories per level of care



Tables 6, 7 and 8 give the perinatal mortality rate (PNMR), and stillbirth rate (SBR) and early neonatal death rate (ENNDR) per birth weight category and level of care. Figure 2 illustrates the early neonatal death rate (ENND) in birth weight categories per level of care.

Table 6. Perinatal Mortality Rate (PNMR) per level of care and birth weight category

PNMR	CHC	DH	RH	PT	NC
500g-999g	670.93	790.70	731.70	720.45	656.47
1000g-1499g	249.41	462.68	338.80	295.15	288.94
1500g-1999g	88.17	192.07	146.05	145.70	130.94
2000g-2499g	20.05	53.75	48.62	64.68	58.06
2500g+	3.02	13.43	11.93	16.63	15.97
Total	9.57	33.43	39.50	56.20	63.30

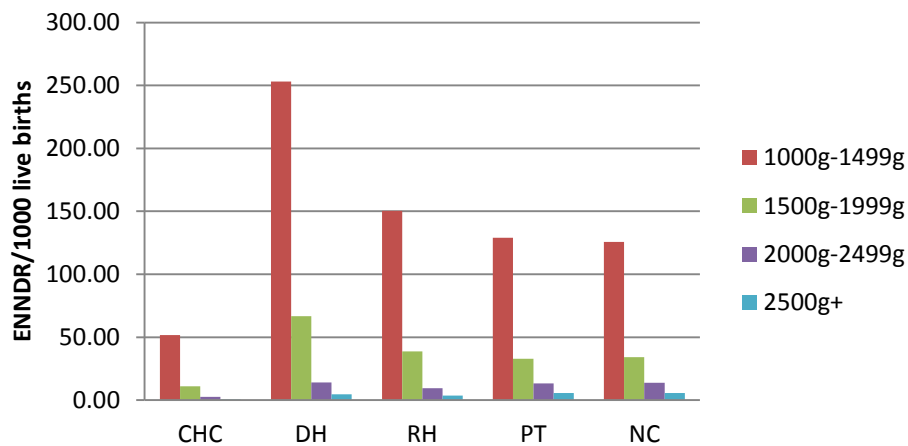
Table 7. Stillbirth Rate (SBR) per level of care and birth weight category

SBR	CHC	DH	RH	PT	NC
500g-999g	554.65	487.77	473.30	445.93	428.64
1000g-1499g	208.50	280.63	221.83	190.83	186.63
1500g-1999g	78.03	134.44	111.75	116.56	100.16
2000g-2499g	17.49	40.26	39.60	51.97	44.95
2500g+	2.55	8.83	8.32	11.13	10.29
Total	8.11	22.03	27.57	38.42	42.87

Table 8. Early Neonatal Death Rate (ENNDR) per level of care and birth weight category

ENNDR	CHC	DH	RH	PT	NC
500g-999g	261.10	591.40	490.61	495.46	398.74
1000g-1499g	51.69	253.07	150.32	128.93	125.80
1500g-1999g	11.01	66.58	38.62	32.99	34.20
2000g-2499g	2.61	14.07	9.40	13.40	13.73
2500g+	0.46	4.64	3.64	5.56	5.74
Total	1.47	11.65	12.26	18.49	21.34

Figure 2. ENNDR per birth weight category and level of care



The ENNDR in district hospitals is considerably higher than in other levels of care for babies between 1000g and 2000g.

Table 9 gives the route of delivery. The caesarean section rate for South Africa was 20.8%. This obviously differs widely per level of care. A very disturbing finding is the low proportion of assisted deliveries. This suggests that some caesarean sections are being performed when a safe assisted delivery could have been done, putting the mother at unnecessary serious risk.

Table 9. Route of delivery and level of care

Route (%)	CHC	DH	RH	PT	NC	SA
Caesarean section	0.1	17.6	28.9	34.7	36.1	20.8
Ventouse	0	0.5	0.7	0.4	0.8	0.5
Forceps	0	0.1	0.3	0.2	0.2	0.2

Primary obstetric cause of death

The primary obstetric cause of deaths (perinatal deaths, stillbirths and early neonatal deaths) per level of care is given in Table 10 for babies 500g or more and in Table 11 for babies 1000g or more.

Table 10. The primary obstetric causes of death per level of care for babies 500g or more

excl. LNND	CHC	DH	RH	PT	NC
Perinatal deaths					
Unexplained intrauterine death	3.18	9.09	9.39	13.74	9.02
Spontaneous preterm labour	2.35	7.27	8.16	9.81	13.88
Intrapartum asphyxia	1.21	6.51	4.43	5.11	6.03
Trauma	0.25	0.60	0.44	0.65	0.62
Hypertensive disorders	0.39	3.46	5.96	11.77	13.55
Antepartum haemorrhage	0.57	2.30	4.98	8.00	9.12
Fetal abnormality	0.19	1.09	1.19	2.41	4.23
Infections	0.75	1.25	1.68	1.24	1.75
Intrauterine growth retardation	0.28	0.38	0.91	0.54	1.07
Maternal disease	0.15	0.64	1.04	0.89	1.50
Other	0.07	0.31	0.72	0.64	2.04
No obstetric cause / Not applicable	0.19	0.53	0.60	1.41	0.50
Total	9.57	33.43	39.50	56.20	63.30
Stillbirths					
Unexplained intrauterine death	3.17	9.05	9.36	13.51	8.99
Spontaneous preterm labour	1.67	2.08	2.37	2.73	5.71
Intrapartum asphyxia	0.98	3.03	2.11	2.12	2.37
Trauma	0.21	0.41	0.32	0.56	0.50
Hypertensive disorders	0.39	3.16	4.88	8.64	10.10
Antepartum haemorrhage	0.50	1.85	4.36	7.27	8.25
Fetal abnormality	0.11	0.50	0.58	1.05	2.70
Infections	0.62	0.74	1.10	0.71	1.27
Intrauterine growth retardation	0.25	0.30	0.78	0.40	0.93
Maternal disease	0.13	0.54	0.93	0.77	1.31
Other	0.05	0.18	0.55	0.40	0.68
No obstetric cause / Not applicable	0.03	0.18	0.22	0.27	0.06
Total	8.11	22.03	27.57	38.42	42.87
Early neonatal deaths					
Spontaneous preterm labour	0.69	5.30	5.95	7.32	8.54
Intrapartum asphyxia	0.23	3.56	2.39	3.10	3.82
Trauma	0.04	0.19	0.11	0.09	0.13
Hypertensive disorders	0.00	0.30	1.12	3.24	3.60
Antepartum haemorrhage	0.06	0.46	0.65	0.75	0.91
Fetal abnormality	0.08	0.60	0.63	1.41	1.60
Infections	0.12	0.52	0.59	0.55	0.50
Intrauterine growth retardation	0.03	0.08	0.13	0.15	0.14
Maternal disease	0.02	0.11	0.11	0.13	0.20
Other	0.02	0.12	0.18	0.25	1.42
No obstetric cause / Not applicable	0.16	0.36	0.39	1.18	0.46
Total	1.47	11.65	12.26	18.39	21.34

Table 11. The primary obstetric causes of death per level of care for babies 1000g or more

(exclud. LNND)	CHC	DH	RH	PT	NC
Perinatal deaths					
Unexplained intrauterine death	2.47	7.44	7.37	10.62	6.96
Spontaneous preterm labour	0.95	4.05	3.32	3.97	5.07
Intrapartum asphyxia	1.22	6.49	4.38	5.02	5.96
Trauma	0.22	0.58	0.39	0.56	0.56
Hypertensive disorders	0.29	2.85	3.88	6.72	6.99
Antepartum haemorrhage	0.42	2.00	3.93	6.78	7.81
Fetal abnormality	0.17	1.01	1.07	2.20	3.14
Infections	0.55	1.10	1.29	1.02	1.33
Intrauterine growth retardation	0.23	0.33	0.75	0.40	0.60
Maternal disease	0.12	0.58	0.94	0.77	1.11
Other	0.06	0.24	0.54	0.48	1.19
No obstetric cause / Not applicable	0.18	0.50	0.49	1.30	0.48
Total	6.88	27.17	28.35	39.84	41.19
Stillbirths					
Unexplained intrauterine death	2.46	7.42	7.35	10.40	6.94
Spontaneous preterm labour	0.66	1.03	0.76	0.95	1.55
Intrapartum asphyxia	0.99	3.00	2.02	2.03	2.36
Trauma	0.18	0.39	0.28	0.51	0.45
Hypertensive disorders	0.29	2.60	3.19	5.28	5.44
Antepartum haemorrhage	0.39	1.63	3.52	6.29	7.19
Fetal abnormality	0.09	0.45	0.48	0.87	1.68
Infections	0.46	0.63	0.77	0.58	0.96
Intrauterine growth retardation	0.21	0.26	0.63	0.27	0.54
Maternal disease	0.10	0.48	0.85	0.66	1.00
Other	0.04	0.14	0.40	0.33	0.35
No obstetric cause / Not applicable	0.02	0.16	0.14	0.21	0.03
Total	5.89	18.18	20.39	28.38	28.49
Early Neonatal deaths					
Spontaneous preterm labour	0.29	3.08	2.62	3.10	3.62
Intrapartum asphyxia	0.24	3.55	2.40	3.07	3.71
Trauma	0.04	0.19	0.11	0.05	0.12
Hypertensive disorders	0.00	0.25	0.71	1.48	1.60
Antepartum haemorrhage	0.04	0.38	0.42	0.51	0.63
Fetal abnormality	0.08	0.57	0.61	1.37	1.50
Infections	0.09	0.48	0.53	0.46	0.38
Intrauterine growth retardation	0.03	0.08	0.12	0.13	0.06
Maternal disease	0.02	0.10	0.09	0.11	0.11
Other	0.02	0.10	0.14	0.15	0.87
No obstetric cause / Not applicable	0.16	0.35	0.36	1.11	0.47
Total	0.99	9.16	8.12	11.75	13.07

Spontaneous preterm birth is the most common cause of perinatal death in babies 500g or more, but intrapartum asphyxia is the most common in babies 1000g or more. As the level of care increases, the mortality rates in babies for mothers that had hypertension of antepartum haemorrhage increases. This is expected as these cases are referred to higher levels of care. Unexplained intrauterine deaths still remains the largest category of underlying causes of death.

The distribution of all perinatal deaths, stillbirths and early neonatal deaths for babies 1000g or more within the level of care are illustrated in Figures 3-5. As in previous reports the pattern of disease varies with the level of care. However, spontaneous preterm birth and intrapartum asphyxia are still the most common causes of perinatal death, if the unexplained intrauterine deaths are excluded.

Figure 3. Distribution of all primary obstetric causes of death per level of care

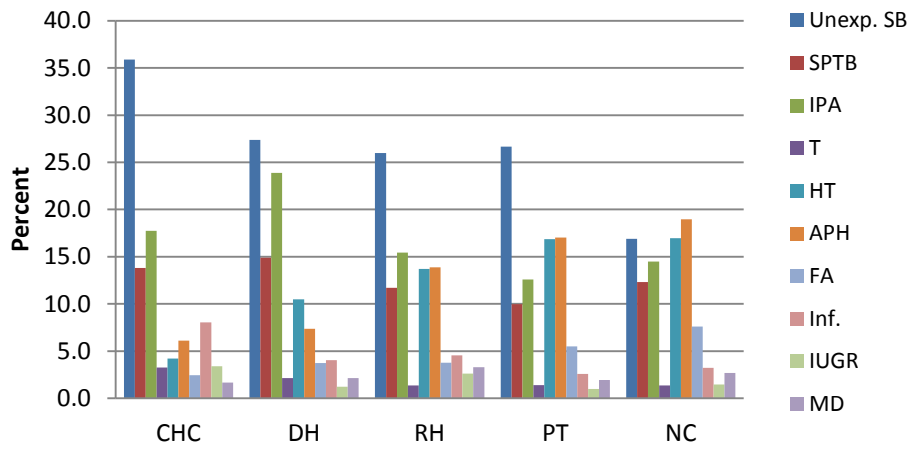


Figure 4. Distribution of primary obstetric casues of stillbirths and level of care

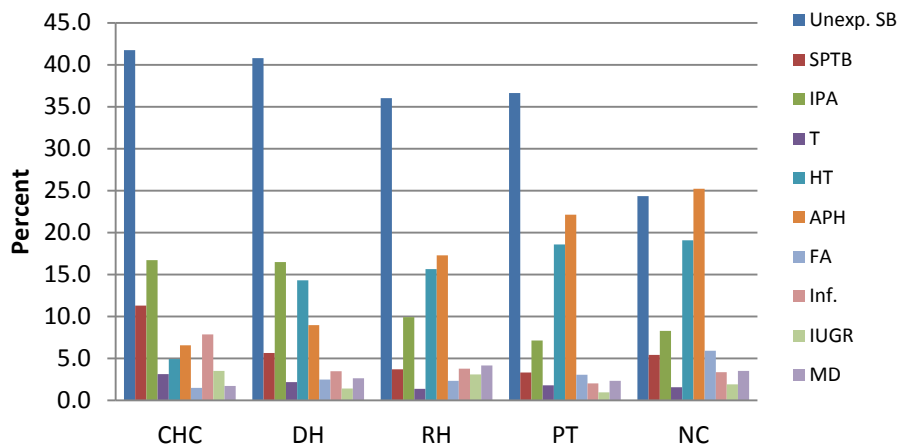
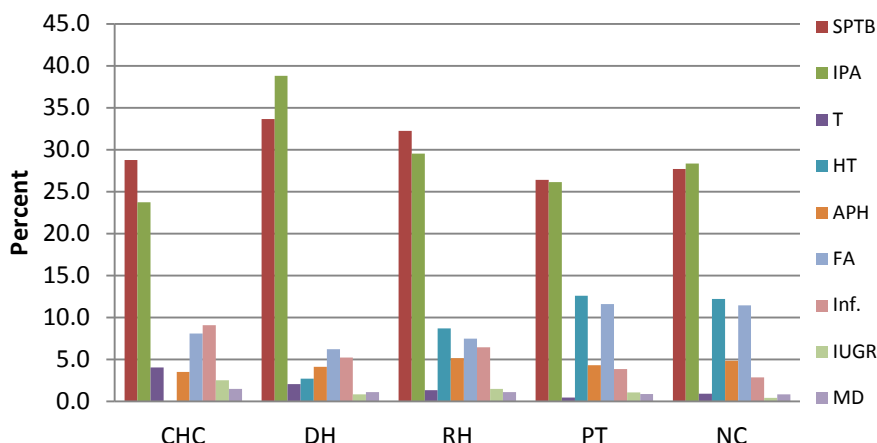


Figure 5. Distribution of the primary obstetric causes of early neonatal deaths and level of care



Distribution of primary obstetric causes in relation to the timing of perinatal death

Figure 6 illustrates the distribution of the primary obstetric causes in relation to macerate and fresh stillbirth and early neonatal deaths for babies 1000g or more. This is an approximation of antenatal, intrapartum and early neonatal deaths. The vast majority of the macerated stillbirths were unexplained intrauterine deaths followed by complications of hypertension in pregnancy. The fresh stillbirths were mainly due to intrapartum asphyxia and birth trauma and antepartum haemorrhage. The early neonatal deaths were due mostly to intrapartum asphyxia and birth trauma and spontaneous preterm birth. The pattern is the same for babies of 500g or more, except that spontaneous preterm birth is more frequent than intrapartum asphyxia and birth trauma.

Figure 6. Distribution of primary obstetric causes of antenatal, intrapartum and early neonatal deaths for infants 1000g+

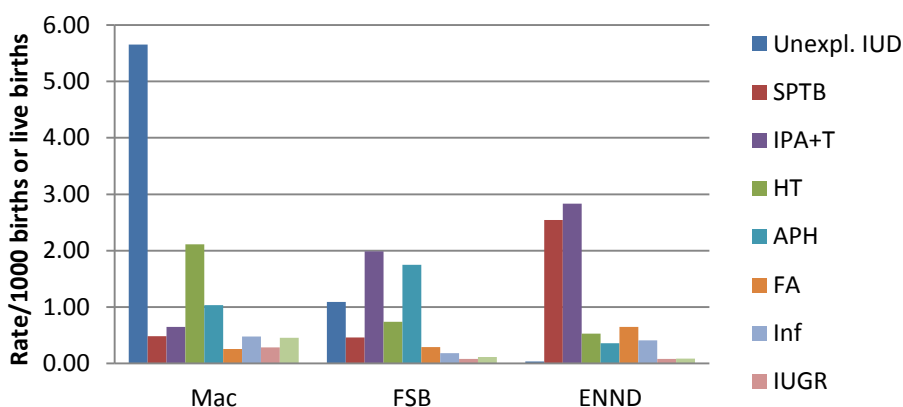
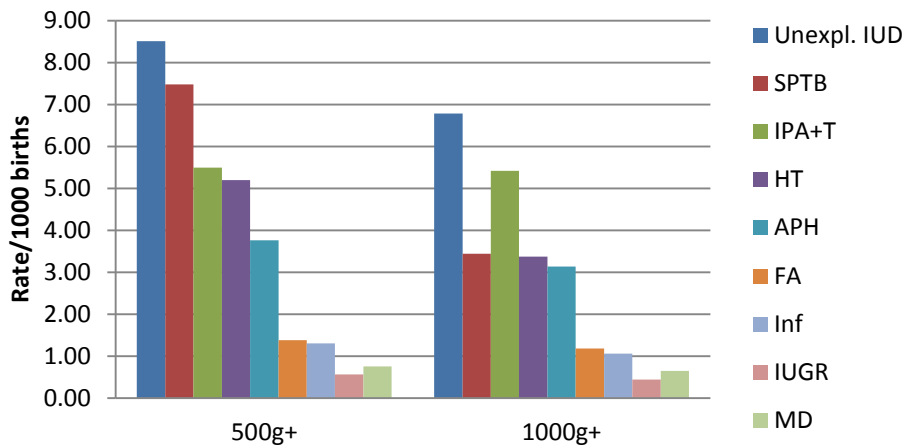


Figure 7 illustrates the different patterns of the primary obstetric causes of perinatal death for babies 500g and above and 1000g and above. There are five major categories of primary obstetric causes of deaths; unexplained intrauterine deaths, spontaneous preterm birth, intrapartum asphyxia and birth trauma, complications of hypertension and antepartum haemorrhage. Other causes such

as fetal abnormalities, infection and intrauterine growth restriction are under reported and would, if full information such as history of antenatal course, autopsy and histology of the placentas were available, have much higher mortality rates. However it is clear there are three main problems, spontaneous preterm birth, intrapartum asphyxia and placental bed diseases (hypertension and antepartum haemorrhage). There should be a strategy to reduce each of these categories of death.

Figure 7. Distribution of primary obstetric causes of death for babies 500g+ and 1000g+



Final neonatal causes of death

Table 12 and figures 8 and 9 give the final neonatal causes of death per level of care. Immaturity related and hypoxia are by far the most common final causes of death. Immaturity related is more common in the 500g or more group but hypoxia is more common in the 1000g and above group.

Table 12. The final causes of early neonatal death for babies per level of care (expressed as ENNDR/1000 live births)

	CHC	DH	RH	PT	NC
500g+					
Immaturity related	0.72	5.52	6.26	8.84	10.74
Hypoxia	0.32	4.01	3.21	4.02	5.68
Infection	0.13	0.61	1.26	2.34	2.15
Congenital abnormalities	0.10	0.73	0.88	1.84	2.15
Trauma	0.00	0.05	0.04	0.05	0.09
Other	0.06	0.45	0.41	0.92	0.33
Unknown cause of death	0.14	0.27	0.20	0.38	0.22
Total	1.47	11.64	12.26	18.39	21.34
1000g+					
Immaturity related	0.27	3.16	2.41	3.05	3.47
Hypoxia	0.32	3.97	3.18	3.94	5.36
Infection	0.12	0.57	1.07	1.89	1.65
Congenital abnormalities	0.10	0.70	0.86	1.74	2.00
Trauma	0.01	0.05	0.03	0.04	0.09
Other	0.06	0.44	0.39	0.76	0.31
Unknown cause of death	0.13	0.25	0.18	0.33	0.19
Total	0.99	9.14	8.12	11.75	13.07

Figure 8. Distribution of the final causes of neonatal death per level of care for babies 500g+

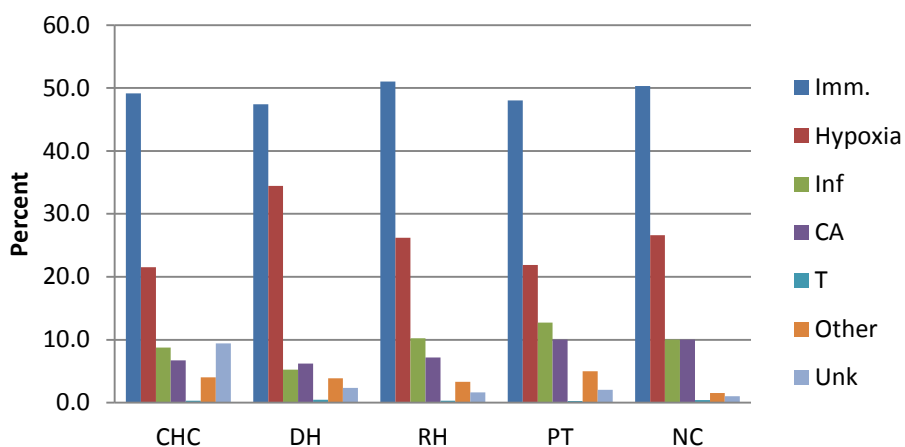
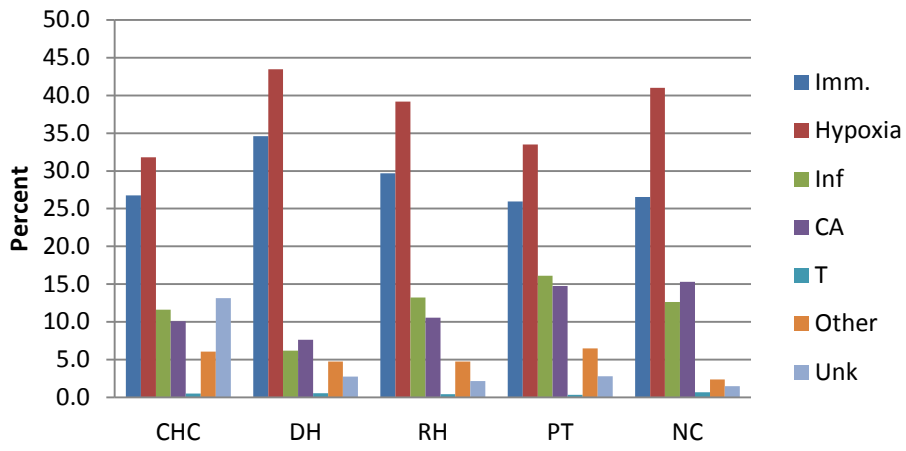


Figure 9. Distribution of the final causes of neonatal death per level of care for neonates 1000g+



Avoidable factors, missed opportunity and sub-standard care

The philosophy of PPIP was to assist in reducing perinatal deaths by using audit. Recording the medical conditions that led to a perinatal death then would be insufficient without trying to identify remedial health system failures. Thus examining the case and trying and identify avoidable factors within the health system has been integral to the concept of PPIP.

At the end of an evaluation of the perinatal care of a woman and her baby the assessors are asked to identify avoidable factors that possibly or probably contributed to the death of the baby. These factors are recorded on the PPIP software. Since 1995 PPIP has classified the avoidable factors missed opportunities and sub-standard care into three categories; those related to the woman, her family and community; administrative problems like lack of staff, transport problems or lack of facilities (e.g. lack of ventilators and caesarean section theatres); and health care provider problems mostly to do with not following the standard protocols.

The relationship between these three categories and saving lives can be illustrated by the diagram below. To save lives, the effective interventions must be available, i.e. there must be adequate coverage of the effective intervention, but also the intervention must be applied with the appropriate skills and resources, i.e. quality of care. Coverage is dependent on their individuals knowing when to use the facilities and having facilities accessible to them. Quality of care depends on their being adequate resources at the facilities and staff with the right skills mix and knowledge to manage the patient and the health care providers have their own responsibilities to ensure they have the appropriate knowledge and skills and deal with their patients with empathy. Hence, the **community/individuals** need health knowledge and everyone has to know where the health care facilities are and use them appropriately; **the Enablers – Health care managers or health administrators** must ensure the facilities are accessible, there is transport between facilities, that the facilities are adequately equipped and have the staff with the right skills; finally **the Doer – health care provider** must ensure they have adequate knowledge and skills to perform their work and should have empathy with the patients. These three groupings Community/Individual, Enabler (Health managers), and Doer (health care provider) coincide with the classification used in PPIP of Patient/Family, administrative and health care provider avoidable factors respectively.

While many women who develop complications have one or more detectable risk factors, the majority of women who share these risk factors do not have serious problems¹. Moreover, in absolute numbers, complications during pregnancy and labour may occur even in the best conditions, most importantly a **large proportion of serious complications occur among women with no recognizable risk factors at all**.^{2,3} For these reason attempts have been redirected from primary prevention of maternal deaths (i.e. improving socioeconomic conditions) to secondary prevention (i.e. preventing death once the complication has occurred). Any system of detecting avoidable

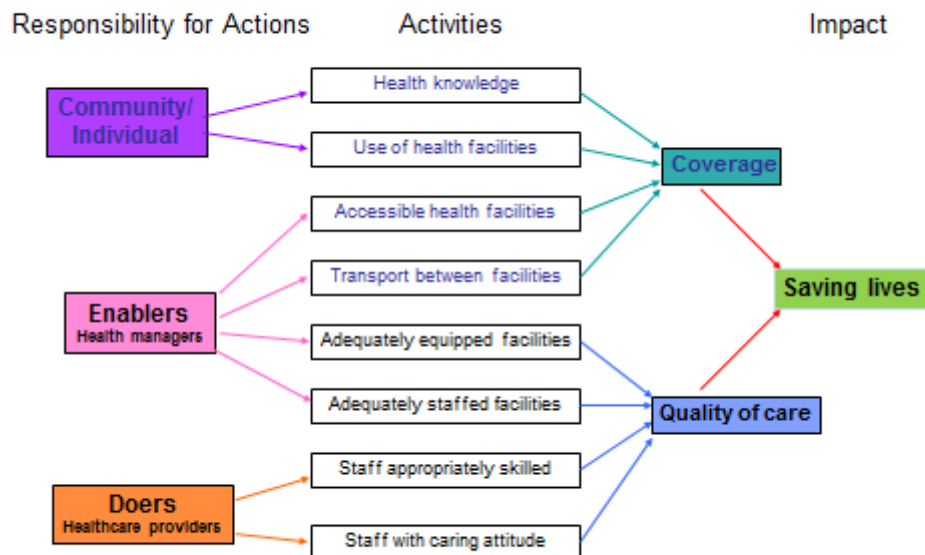
¹ Rooks JP, Weatherby NL, Ernst EK, Stapleton S, Rosen D, Rosenfield A. Outcomes of care in birth centers. The National Birth Center Study. *N Engl J Med*. 1989;321(26):1804-11

² Rosenfield A, Maine D. Maternal mortality--a neglected tragedy. Where is the M in MCH? *Lancet*. 1985;2(8446):83-5

³ Birthplace in England Collaborative Group. Perinatal and maternal outcomes by planned place of birth for healthy women with low risk pregnancies: the Birthplace in England national prospective cohort study. *BMJ* 2011;343:d7400 doi: 10.1136/bmj.d7400 (Published 24 November 2011)

factors within the health service must keep this in mind and ensure a remedy for the avoidable factor is available.

Figure 10. Prerequisites for saving lives



Parallel to PPIP creating this avoidable factor classification, Thaddeus and Maine⁴ recognized that getting timely and adequate treatment for obstetric care are major factors in determining **maternal deaths**. They proposed three delays model to understand the gaps in access to adequate management of obstetric emergencies: **phase I – delay in deciding to seek care by the individual and/or family – User factors; phase II – delay in reaching an adequate health care facility – service accessibility; and phase III – delay in receiving adequate care at the facility – quality of medical care**. This was developed to try and help identify where appropriate interventions could be made as studies found no association between obstetric emergency complications and recognized demographic characteristics, behavioural risk factors or antenatal complications.⁵

Recognising that most women who develop life threatening complications do not have risk factors, the quicker the conditions is identified, stabilised and managed, the greater the chances of survival. When dealing with maternal mortality, deaths can definitely be avoided by timely and adequate treatment¹. A similar statement can be made about preventing perinatal deaths. Indeed, in obstetric care, time is a major factor. The average interval from onset of a major obstetric complication to maternal death ranges from 2–5.7 hours for postpartum haemorrhage compared with 3.4–6 days for infections.^{6,7}

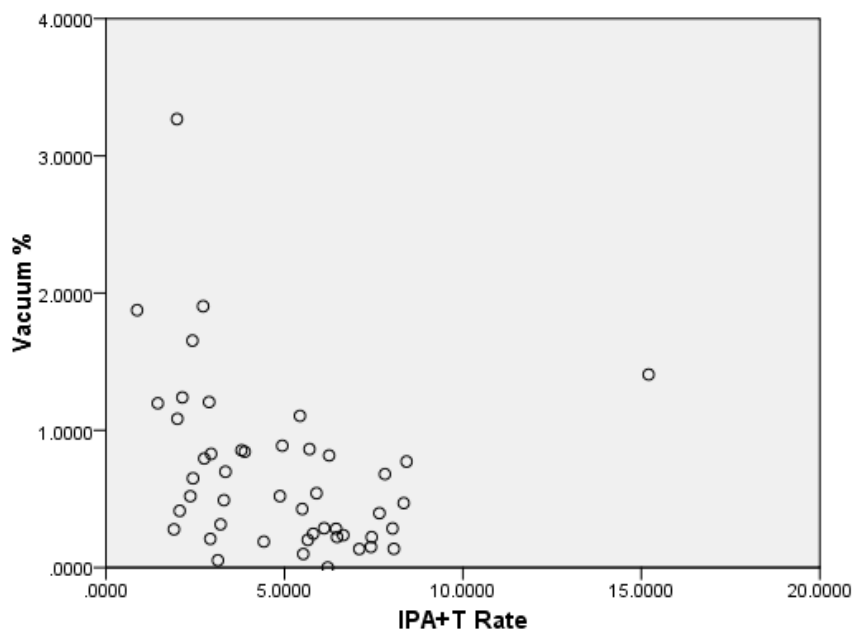
⁴ Thaddeus S, Maine D. Too far to walk: maternal mortality in context. Soc Sci Med. 1994;38(8):1091-110

⁵ Rooks JP, Weatherby NL, Ernst EK, Stapleton S, Rosen D, Rosenfield A. Outcomes of care in birth centers. The National Birth Center Study. N Engl J Med. 1989;321(26):1804-11

⁶ Ganatra BR, Coyaji KJ, Rao VN. Too far, too little, too late: a community-based case-control study of maternal mortality in rural west Maharashtra, India. Bull World Health Organ. 1998;76(6):591-8

An example of delay resulting in perinatal deaths is found in the negative correlation between ventouse delivery and the intrapartum asphyxia and birth trauma death rate in the districts in South Africa. In the Birthplace in England Collaborative Groups study on perinatal outcomes of low risk pregnancies⁸ 7.3% and 6.2% of women had ventouse and forceps delivery respectively. The Perinatal Mortality Rate (PNMR) in this populations was less than 1/1000 births. In South Africa, our PNMR for babies 1000g or more was about 25.6/1000 births for 2010-2011. Intrapartum asphyxia and birth trauma was the major underlying cause of perinatal death with a rate of 4.87/1000 births. Our assisted delivery rate for ventouse delivery was 0.52% and for forceps delivery was 0.15% (see later in report). Our caesarean section rate was 21%. The intrapartum asphyxia and birth trauma death rates/ the ventouse rate correlation was a significant negative correlation of $r=-0.307$, $p=0.036$. This is illustrated in figure 11 below. Each dot represents a district.

Figure 11. Correlation between intrapartum asphyxia and birth trauma rate (IPA+T) and vacuum delivery rate



A negative correlation means that the less ventouses performed the more deaths due to intrapartum asphyxia and birth trauma there was. Our assisted delivery rate of less than one percent is too low and is probably due to the loss of skill in performing assisted delivery. The relatively high caesarean section rate indicates that instead of performing an assisted delivery a caesarean section is being performed and the babies (and sometime mothers) end up dying due to delays. As survey of the ability to perform assisted delivery was conducted in 12 districts (54 CHCs, 63 district hospitals, 13 regional hospitals and 4 provincial tertiary hospitals). It is important to view table 13 with this information in mind. Even at the tertiary level there is a lack of ability to perform

⁷ Maine D. Safe Motherhood Programs: Options and Issues. New York: Center for Population and Family Health, Columbia University; 1991

⁸ Birthplace in England Collaborative Group. Perinatal and maternal outcomes by planned place of birth for healthy women with low risk pregnancies: the Birthplace in England national prospective cohort study. *BMJ* 2011;343:d7400 doi: 10.1136/bmj.d7400 (Published 24 November 2011)

assisted delivery. Assisted delivery as a key activity to reduce perinatal deaths by reducing delay is an important function for CHCs. All advanced midwives should be able to perform at least a ventouse delivery. The fact that these skills are almost totally absent in the CHCs speaks for itself.

Table 13. Ability to perform assisted vaginal delivery

	Total	CHC	DH	RH	PT
Ventouse (by doctor or midwife)	Available	3	36	10	3
	%	5.6	57.1	76.9	75.0
Forceps (by doctor or midwife)	Available	3	38	9	2
	%	5.6	60.3	69.2	50.0
Ventouse by midwife	Available	2	12	3	1
	%	3.7	19.0	23.1	25.0
Forceps by midwife	Available	1	9	2	1
	%	1.9	14.3	15.4	25.0

The three delays model has been generally accepted. In this report we compare the three delay model with the PPIP model of patient, health care manager and health care provider model of identifying health system failures. To achieve this all the avoidable factors, missed opportunities and sub-standard listed in PPIP were recoded into the three delays model.

Table 14 gives the results of this comparison. Table 15 lists all the avoidable factors (possible and probable) described in the PPIP data for all deaths 1000g or more between 2010 and 2011. There is essentially very good agreement except in delay 3 (quality of care) where PPIP ascribes certain action resulting to poor quality of care to the administration (health care managers).

Table 14. Summary agreement/disagreement three delays model and PPIP classification

Colour	Agreement/disagreement	Number
	Agreement Delay 1 and PPIP patient orientated factors	15
	Agreement Delay 2 and PPIP administration factors	4
	Disagreement Delay 2 and PPIP administration factors – PPIP classified as health care provider factors	2
	Disagreement Delay 3 and PPIP administration factors – PPIP classified as administration factors	15
	Agreement Delay 3 and PPIP health care provider factors	39

Table 15. Comparison of three delays model and the PPIP model of avoidable factors

3 Delays	PPIP	Description	Number	% of total
1	1	Inappropriate response to poor fetal movements	5689	19.2
1	1	Delay in seeking medical attention during labour	3165	10.7
1	1	Never initiated antenatal care	3034	10.2
1	1	Booked late in pregnancy	2914	9.8
1	1	Infrequent visits to antenatal clinic	844	2.8
1	1	Failed to return on prescribed date	433	1.5
1	1	Inappropriate response to antepartum haemorrhage	390	1.3
1	1	Inappropriate response to rupture of membranes	331	1.1
1	1	Declines admission/treatment for personal/social reasons	205	0.7
1	1	Smoking	204	0.7
1	1	Alcohol abuse	117	0.4
1	1	Delay in seeking help when baby ill	100	0.3
1	1	Attempted termination of pregnancy	93	0.3
1	1	Partner/Family declines admission/treatment	20	0.1
2	2	Lack of transport - Home to institution	599	2
2	2	Lack of transport - Institution to institution	378	1.3
2	2	No accessible neonatal ICU bed with ventilator	369	1.2
2	2	Lack of adequate neonatal transport	86	0.3
2	3	Delay in referring patient for secondary/tertiary treatment	1210	4.1
2	3	GP did not give card/letter about antenatal care	40	0.1
3	2	Inadequate facilities/equipment in neonatal unit/nursery	896	3
3	2	Personnel not sufficiently trained to manage the patient	281	0.9
3	2	Insufficient nurses on duty to manage the patient adequately	276	0.9
3	2	Inadequate theatre facilities	221	0.7
3	2	Result of syphilis screening not returned to hospital/clinic	190	0.6
3	2	Insufficient doctors available to manage the patient	177	0.6
3	2	Anaesthetic delay	157	0.5
3	2	No syphilis screening performed at hospital / clinic	136	0.5
3	2	Personnel too junior to manage the patient	135	0.5
3	2	Inadequate resuscitation equipment	126	0.4
3	2	No dedicated high risk ANC at referral hospital	60	0.2
3	2	No on-site syphilis testing available	41	0.1
3	2	Insufficient blood / blood products available	36	0.1
3	2	No Motherhood card issued	17	0.1
3	2	Staff rotation too rapid	4	0
3	3	Fetal distress not detected intrapartum; fetus monitored	1014	3.4
3	3	No response to maternal hypertension	860	2.9
3	3	Fetal distress not detected intrapartum; fetus not monitored	547	1.8
3	3	Delay in medical personnel calling for expert assistance	467	1.6
3	3	Medical personnel underestimated fetal size	441	1.5
3	3	Neonatal care: management plan inadequate	375	1.3
3	3	Management of 2nd stage: prolonged with no intervention	372	1.3
3	3	Inadequate / No advice given to mother	343	1.2
3	3	No response to poor uterine fundal growth	262	0.9
3	3	Delay in doctor responding to call	229	0.8
3	3	Neonatal care: inadequate monitoring	225	0.8
3	3	Fetal distress not detected antenatally; fetus monitored	219	0.7
3	3	Neonatal resuscitation inadequate	210	0.7
3	3	Poor progress in labour, but partogram not used correctly	209	0.7
3	3	Poor progress in labour - partogram interpreted incorrectly	186	0.6
3	3	Multiple pregnancy not diagnosed antenatally	170	0.6
3	3	No response to history of stillbirths, abruptio etc.	169	0.6
3	3	Breech presentation not diagnosed until late in labour	166	0.6
3	3	Physical examination of patient at clinic incomplete	161	0.5
3	3	Baby managed incorrectly at Hospital/Clinic	151	0.5
3	3	No response to history of poor fetal movement	145	0.5
3	3	No response to maternal glycosuria	133	0.4
3	3	Fetal distress not detected antepartum; fetus not monitored	129	0.4
3	3	Antenatal steroids not given	127	0.4
3	3	Poor progress in labour, but partogram not used	121	0.4
3	3	Multiple pregnancy not diagnosed intrapartum	119	0.4
3	3	Nosocomial infection	119	0.4
3	3	No response to apparent postterm pregnancy	118	0.4
3	3	Medical personnel overestimated fetal size	109	0.4
3	3	Incorrect management of antepartum haemorrhage	97	0.3
3	3	Doctor did not respond to call	81	0.3
3	3	Incorrect management of cord prolapse	64	0.2
3	3	Incorrect management of premature labour	63	0.2
3	3	No response to positive syphilis serology test	61	0.2
3	3	Management of 2nd stage: inappropriate use of vacuum	60	0.2
3	3	No antenatal response to abnormal fetal lie	51	0.2
3	3	Iatrogenic delivery for no real reason	33	0.1
3	3	Management of 2nd stage: inappropriate use of forceps	30	0.1
3	3	Baby sent home inappropriately	22	0.1

Table 16 gives a the top 5 of the “probably” avoidable factors, i.e. avoidable factors, missed opportunities or substandard care that if avoided the baby would have survived. The “probable” avoidable factors are given in the three groups and this are expressed as a percentage of the perinatal deaths (either all of for the specific category of perinatal death) for babies 1000g or more.

Table 16. Summary of “probable” avoidable factors in all perinatal deaths (1000g+)

Description	Number	% of deaths
Patient associated	8502	28.7
Inappropriate response to poor fetal movements	2765	9.3
Delay in seeking medical attention during labour	1466	4.9
Booked late in pregnancy	1432	4.8
Never initiated antenatal care	1209	4.1
Infrequent visits to antenatal clinic	362	1.2
Administrative problems	2354	7.9
Inadequate facilities/equipment in neonatal unit/nursery	615	2.1
Lack of transport - Home to institution	239	0.8
No accessible neonatal ICU bed with ventilator	207	0.7
Lack of transport - Institution to institution	176	0.6
Personnel not sufficiently trained to manage the patient	147	0.5
Health care provider	6130	20.7
Delay in referring patient for secondary/tertiary treatment	677	2.3
Fetal distress not detected intrapartum; fetus monitored	657	2.2
No response to maternal hypertension	512	1.7
Fetal distress not detected intrapartum; fetus not monitored	370	1.2
Delay in medical personnel calling for expert assistance	274	0.9

Table 17 gives the same probable avoidable factors but classified according to the three levels model.

Table 17. Top 5 probable avoidable factors using the three delays model

3 delays	Description	Number	% of total
User factors			
1	Inappropriate response to poor fetal movements	2765	9.3
1	Delay in seeking medical attention during labour	1466	4.9
1	Booked late in pregnancy	1432	4.8
1	Never initiated antenatal care	1209	4.1
1	Infrequent visits to antenatal clinic	362	1.2
Service accessibility			
2	Delay in referring patient for secondary/tertiary treatment	677	2.3
2	Lack of transport - Home to institution	239	0.8
2	No accessible neonatal ICU bed with ventilator	207	0.7
2	Lack of transport - Institution to institution	176	0.6
2	Lack of adequate neonatal transport	50	0.2
2	GP did not give card/letter about antenatal care	23	0.1
Quality of Care			
3	Fetal distress not detected intrapartum; fetus monitored	657	2.2
3	Inadequate facilities/equipment in neonatal unit/nursery	615	2.1
3	No response to maternal hypertension	512	1.7
3	Fetal distress not detected intrapartum; fetus not monitored	370	1.2
3	Delay in medical personnel calling for expert assistance	274	0.9
3	Neonatal care: management plan inadequate	237	0.8

As expected the results are very similar. In terms of targeting specific role players the system used by PPIP is more explicit and will be used further.

Avoidable factors, missed opportunities and sub-standard care per disease category using PPIP classification

Tables 18 to 25 give the “probable” avoidable factors for the major conditions causing perinatal and neonatal deaths.

Table 18. “Probable” avoidable factors in perinatal deaths due to intrapartum asphyxia

Description	Number	% of deaths
Health care provider	2464	43.9
Fetal distress not detected intrapartum; fetus monitored	519	9.2
Fetal distress not detected intrapartum; fetus not monitored	281	5
Management of 2nd stage: prolonged with no intervention	194	3.5
Delay in referring patient for secondary/tertiary treatment	172	3.1
Delay in medical personnel calling for expert assistance	156	2.8
Patient associated	1053	18.8
Delay in seeking medical attention during labour	350	6.2
Booked late in pregnancy	240	4.3
Inappropriate response to poor fetal movements	165	2.9
Never initiated antenatal care	103	1.8
Infrequent visits to antenatal clinic	50	0.9
Administrative problems	785	14
Inadequate facilities/equipment in neonatal unit/nursery	135	2.4
Anaesthetic delay	101	1.8
Lack of transport - Institution to institution	77	1.4
Lack of transport - Home to institution	73	1.3
Inadequate theatre facilities	58	1

Table 19. “Probable” avoidable factors in perinatal deaths due to birth trauma

Description	Number	% of deaths
Health care provider	188	35.8
Breech presentation not diagnosed until late in labour	31	5.9
Medical personnel underestimated fetal size	18	3.4
Delay in referring patient for secondary/tertiary treatment	15	2.9
Delay in doctor responding to call	12	2.3
Delay in medical personnel calling for expert assistance	11	2.1
Patient associated	120	22.9
Delay in seeking medical attention during labour	49	9.3
Never initiated antenatal care	21	4
Booked late in pregnancy	10	1.9
Assault	5	1
Failed to return on prescribed date	4	0.8
Administrative problems	65	12.4
Personnel not sufficiently trained to manage the patient	12	2.3
Lack of transport - Home to institution	9	1.7
Anaesthetic delay	8	1.5
Inadequate theatre facilities	7	1.3
Inadequate facilities/equipment in neonatal unit/nursery	4	0.8

Table 20. “Probable” avoidable factors in perinatal deaths due to Spontaneous preterm birth

Description	Number	% of deaths
Patient associated	1203	30.5
Delay in seeking medical attention during labour	448	11.4
Never initiated antenatal care	281	7.1
Booked late in pregnancy	149	3.8
Inappropriate response to poor fetal movements	94	2.4
Infrequent visits to antenatal clinic	58	1.5
Administrative problems	657	16.7
Inadequate facilities/equipment in neonatal unit/nursery	370	9.4
No accessible neonatal ICU bed with ventilator	86	2.2
Lack of transport - Home to institution	50	1.3
Inadequate resuscitation equipment	30	0.8
Lack of adequate neonatal transport	21	0.5
Health care provider	630	16
Neonatal care: management plan inadequate	91	2.3
Delay in referring patient for secondary/tertiary treatment	79	2
Antenatal steroids not given	56	1.4
Neonatal care: inadequate monitoring	46	1.2
Multiple pregnancy not diagnosed antenatally	32	0.8

Table 21. “Probable” avoidable factors in perinatal deaths due to hypertension

Description	Number	% of deaths
Patient associated	1321	35.1
Inappropriate response to poor fetal movements	517	13.8
Booked late in pregnancy	337	9
Never initiated antenatal care	151	4
Delay in seeking medical attention during labour	86	2.3
Infrequent visits to antenatal clinic	59	1.6
Health care provider	1063	28.3
No response to maternal hypertension	351	9.3
Delay in referring patient for secondary/tertiary treatment	185	4.9
Fetal distress not detected antenatally; fetus monitored	44	1.2
Fetal distress not detected intrapartum; fetus monitored	44	1.2
Inadequate / No advice given to mother	43	1.1
Administrative problems	220	5.9
Inadequate facilities/equipment in neonatal unit/nursery	33	0.9
No accessible neonatal ICU bed with ventilator	23	0.6
Insufficient nurses on duty to manage the patient adequately	20	0.5
Personnel not sufficiently trained to manage the patient	19	0.5
Lack of transport - Institution to institution	17	0.5

Table 22. “Probable” avoidable factors in perinatal deaths due to antepartum haemorrhage

Description	Number	% of deaths
Patient associated	929	26.6
Inappropriate response to antepartum haemorrhage	179	5.1
Never initiated antenatal care	168	4.8
Booked late in pregnancy	166	4.7
Inappropriate response to poor fetal movements	134	3.8
Delay in seeking medical attention during labour	129	3.7
Health care provider	472	13.5
No response to maternal hypertension	110	3.1
Delay in referring patient for secondary/tertiary treatment	71	2
Incorrect management of antepartum haemorrhage	46	1.3
Fetal distress not detected intrapartum; fetus monitored	23	0.7
No response to history of stillbirths, abruptio etc.	19	0.5
Administrative problems	227	6.5
Inadequate facilities/equipment in neonatal unit/nursery	36	1
Lack of transport - Home to institution	36	1
Lack of transport - Institution to institution	26	0.7
Inadequate theatre facilities	24	0.7
Personnel not sufficiently trained to manage the patient	16	0.5

Table 23. “Probable” avoidable factors in unexplained intrauterine deaths

Description	Number	% of deaths
Patient associated	2798	37.2
Inappropriate response to poor fetal movements	1588	21.1
Booked late in pregnancy	358	4.8
Never initiated antenatal care	323	4.3
Delay in seeking medical attention during labour	262	3.5
Infrequent visits to antenatal clinic	83	1.1
Health care provider	504	6.7
Inadequate / No advice given to mother	77	1
Delay in referring patient for secondary/tertiary treatment	54	0.7
No response to poor uterine fundal growth	32	0.4
No response to history of poor fetal movement	30	0.4
Physical examination of patient at clinic incomplete	25	0.3
Insufficient notes to comment on avoidable factors	119	1.6
File missing	49	0.7
Insufficient notes	39	0.5
Antenatal card lost	9	0.1
Administrative problems	118	1.6
Lack of transport - Home to institution	27	0.4
Result of syphilis screening not returned to hospital/clinic	16	0.2
Lack of transport - Institution to institution	10	0.1
No syphilis screening performed at hospital / clinic	9	0.1
Insufficient nurses on duty to manage the patient adequately	6	0.1

Table 24. “Probable” avoidable factors in early neonatal deaths due to hypoxia

Description	Number	% of deaths
Health care provider	1644	43.9
Fetal distress not detected intrapartum; fetus monitored	325	8.7
Fetal distress not detected intrapartum; fetus not monitored	150	4
Management of 2nd stage: prolonged with no intervention	131	3.5
Delay in referring patient for secondary/tertiary treatment	125	3.3
Delay in medical personnel calling for expert assistance	105	2.8
Administrative problems	645	17.2
Inadequate facilities/equipment in neonatal unit/nursery	153	4.1
Anaesthetic delay	75	2
No accessible neonatal ICU bed with ventilator	62	1.7
Lack of transport - Institution to institution	52	1.4
Lack of transport - Home to institution	46	1.2
Patient associated	567	15.1
Delay in seeking medical attention during labour	186	5
Booked late in pregnancy	161	4.3
Never initiated antenatal care	68	1.8
Infrequent visits to antenatal clinic	40	1.1
Inappropriate response to rupture of membranes	15	0.4

Table 25. “Probable” avoidable factors in early neonatal deaths due to immaturity

Description	Number	% of deaths
Patient associated	876	30.6
Delay in seeking medical attention during labour	364	12.7
Never initiated antenatal care	211	7.4
Booked late in pregnancy	119	4.2
Infrequent visits to antenatal clinic	46	1.6
Inappropriate response to rupture of membranes	31	1.1
Administrative problems	632	22.1
Inadequate facilities/equipment in neonatal unit/nursery	389	13.6
No accessible neonatal ICU bed with ventilator	82	2.9
Lack of transport - Home to institution	34	1.2
Inadequate resuscitation equipment	26	0.9
Lack of transport - Institution to institution	19	0.7
Health care provider	552	19.3
Neonatal care: management plan inadequate	96	3.4
Delay in referring patient for secondary/tertiary treatment	79	2.8
Antenatal steroids not given	57	2
Neonatal care: inadequate monitoring	46	1.6
Neonatal resuscitation inadequate	28	1

Priority setting

In setting priorities for intervention the areas where there will be most impact should be prioritised provided there are cost effective interventions to reduce these deaths. Figures 12 and 13 give the numbers of deaths per primary obstetric and final neonatal cause of death per birth weight category. The numbers are from the PPIP database for 2010 and 2011.

Figure 12. Distribution of primary obstetric causes of death per birth weight category

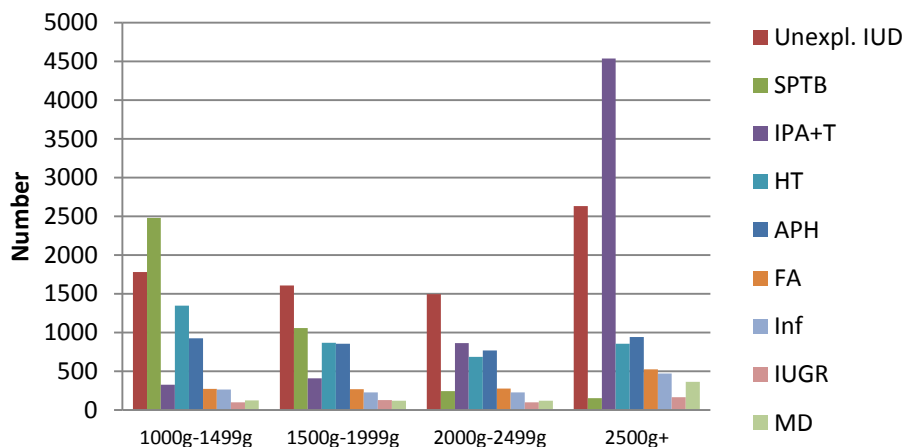
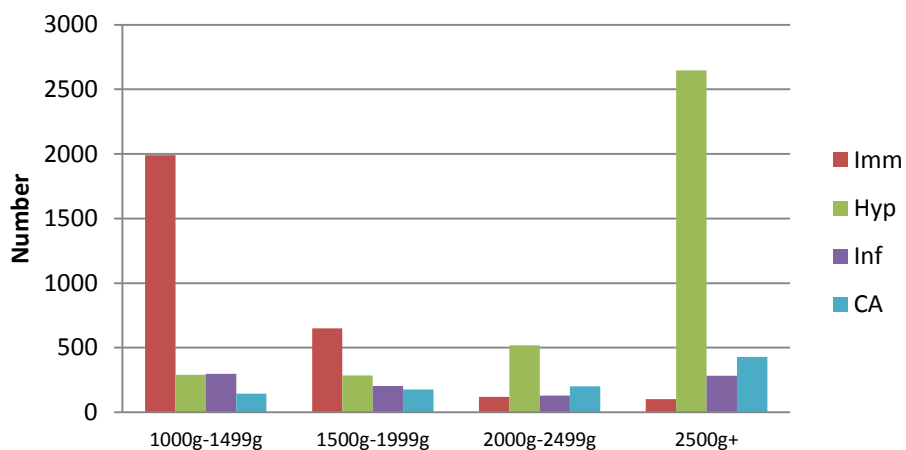


Figure 13. Distribution of final neonatal causes of death per birth weight category



Preventing intrapartum asphyxia and birth trauma and spontaneous preterm birth are clearly the two biggest priorities.

Summary

The pattern of disease per level of care is similar to the 2008-2009 report.

1. The top primary obstetric causes of perinatal deaths remain:
 - a. Labour related complications (namely intrapartum asphyxia and birth trauma)
 - b. Spontaneous preterm birth
 - c. Placenta/placental bed disease (namely pre-eclampsia/eclampsia and abruptio placenta)
2. Unexplained intrauterine death category formed largest number of deaths in the database. The majority of these were macerated stillbirths and dead on admission to the health institution. Funding and research resources must be directed to identifying the causes of deaths in this group. The quality of antenatal care will need to improve especially in the primary level of care.
3. The majority of births occur in CHCs or district hospitals, as do the majority of perinatal deaths. The major causes of perinatal death were due to intrapartum asphyxia and birth trauma and immature neonates born due to spontaneous preterm labour. The perinatal mortality rates (PNMR) were highest in district hospitals for both conditions.
4. Immaturity related and hypoxia are the two most common final neonatal causes of early neonatal deaths. The mortality rates are highest in the district hospitals for these two conditions.
5. The quality of care is poorest in the district hospitals.

Key indicators for provinces and districts

For the first time the Perinatal Problem Identification Programme can be realistically analysed per province and district. The PPIP database contains information 588 PPIP sites. This represents 73.1% of all births in institutions using the District Health Information System (DHIS) for the denominator (July 2012). Ninety-four percent of all the hospitals contribute data to PPIP. PPIP is now a truly national programme; however the completeness and accuracy of data must now be improved upon.

This report gives an analysis of key perinatal indicators and mortality rates for the province and districts. Where the data was judged inadequate it is excluded. Two provinces (Mpumalanga and Western Cape) have complete data including all the CHC and clinic births; two provinces (Limpopo, and North West) have almost complete data; three provinces have mostly complete and useable data (Eastern Cape, Gauteng, and Northern Cape); KwaZulu-Natal has patchy data and the Free State has very incomplete data. The Free State will have almost complete data for 2012-2013 as most sites are now collecting the data and a coordinator has been appointed to coordinate the process.

Table 26 gives the key indicators and mortality rates.

Table 26. Indicators and definitions

Indicator	Definition
PNMR	= SBR + ENND / Total births x 1000 (expressed per 1000 births)
SBR	= Stillbirths/Total Births x 1000 (expressed per 1000 births)
ENNDR	= ENND/Total live births (expressed per 1000 live births)
LBWR	= Number babies born less 2,5kg/total births x 100 (expressed as a percent)
PCI	= PNMR/LBWR (indicator of quality of care)
SB:ENND ratio	= SB/ENND
PNMR 2.5kg+	= SB+ENND 2.5kg+/total births 2.5 kg+
ENNDR 2.5kg+	= ENND 2.5kg+/All live births 2.5kg+ (quality of intrapartum care)
ENNDR 1.0-1.49kg	= ENND 1.0-1.49kg/ live births 1.0-1.49kg (quality of neonatal care)
FSB 2.5kg+ rate	= FSB 2.5kg+/Total births 2.5kg+
FSB+ENND 2.5kg+ rate	= FSB+ENND 2.5kg+/Total births 2.5kg+
Disease specific rates	
IPA+T rate	= Deaths due to IPA+T /Total births (expressed per 1000 births)
SPB rate	= Deaths due to SPB/Total births (expressed per 1000 births)
HT rate	= Deaths due to HT/Total births (expressed per 1000 births)
APH rate	= Deaths due to APH/Total births (expressed per 1000 births)
Unexpl.SB rate	= Deaths due to Unexplained SB/Total births (expressed per 1000 births)
Hypoxia rate	= Deaths due to hypoxia/Total live births (expressed per 1000 live births)
Immaturity rate	= Deaths due to immaturity/Total live births (expressed per 1000 live births)
Other	
CS rate	= Number CS/Total births
Vacuum rate	= Number vacuum del./total births
Forceps rate	= Number forceps del./total births
Assisted Delivery rate	= Vacuum + forceps del./total births
Operative del.	= CS + assisted del./total births

The Perinatal Care Index (PCI) has been correlated with the quality of perinatal care by comparison with COHSASA and a very good correlation was found (See appendix 1). The LBWR reflects the socioeconomic status of an area; it cannot be altered by a health institution hence is a very good independent variable and works well as a denominator. The higher the LBWR in a community, the higher the perinatal mortality as low birth weight babies have greater mortality rates. Thus a district

serving a poor community might have a high PNMR but still be providing a good quality of care if the LBWR is high. The use of the LBWR (which is high in low socio-economic conditions) as the denominator in the PCI the effect of the socio-economic conditions on the PNMR is controlled and the quality of care can be assessed. The FSB 2.5kg+ rate reflects the quality of intrapartum care. The FSB+ENND 2.5kg+ rate reflects the quality of intrapartum care and early neonatal resuscitation. Easier indicators to obtain that also reflect the quality of intrapartum care and neonatal resuscitation are the PNMR 2.5kg+ and the ENNDR 2.5kg+. The ENNDR 1.0-1.49kg reflects the quality of neonatal care. The disease specific death rates reflect the quality of intrapartum care, antenatal care, and neonatal care.

In PPIP a monthly data sheet is entered per site that includes the number of deaths per birth weight category and for each death a perinatal death form is completed. In analysing the data the number of stillbirths recorded per month per site is mostly more than the number of perinatal death forms completed. The opposite is true for neonatal deaths, where there are more perinatal death forms than cases reported per month. For this reason a correction has been applied to the data. To calculate the key indicators the number of SBR recorded per site per month was used and for the ENNDR the number of cases for which there was a perinatal death form was used. (This was the case in all but two districts Ekurhuleni and Nelson Mandela Metro, and these two districts were excluded from the relevant calculations). This might mean a slightly higher PNMR as some ENNDs may have been recorded as SB in the monthly register and these babies are then counted twice. However, we believe it is better to err on the side of caution and give higher rates than to underestimate the size of the problem. All calculation made in this analysis is for babies with a birth weight of 1000g or more.

Below are tables of the core indicators per province and per district. The institutional Maternal Mortality Rate (iMMR) has been included in all the tables. Information is available for the iMMR for 2010-2011 for the provinces; however it is not yet available for the districts. The district iMMR is taken from the Saving Mothers 2008-2010 report.

Table 27. Numbers of births and deaths per province and district 2010-2011

Province	District	Total births 1.0kg+	Total LB 1.0kg+	Births 1.0- 2.49kg	Total births 2.5kg+	LB 1.0- 1.49kg	LB 2.5kg+	SB 1.0kg+	ENND 1.0kg+	ENND 1.0- 1.49kg	SB 2.5kg+	ENND 2.5kg+	PND 2.5kg+	FSB 2.5kg+	FSB+ENND 2.5kg+
Eastern Cape		129077	126431	20015	109062	2077	109153	2646	1434	438	1044	574	1618	381	955
	Alfred Nzo	13973	13725	1077	12896	79	12773	248	191	25	123	114	237	75	189
	Amathole	33150	32417	5218	27932	627	28769	733	260	91	228	109	337	95	204
	Cacadu	12091	11929	2260	9831	154	9777	162	71	23	54	23	77	30	53
	Chris Hani	11039	10860	1481	9558	97	9481	179	72	21	77	31	108	27	58
	NM Metro	27614	27195	4694	22920	529	22796	419	145	47	124	65	189		
	OR Tambo	25452	24649	4576	20876	545	20558	803	646	222	388	249	637	165	414
	Ukahlamba	5758	5656	709	5049	46	4999	102	49	9	50	23	73	14	37
Free State		33878	32837	6907	26971	1002	26658	1041	423	162	426	152	578	128	280
	Fezile Dabe														
	Lejweleputswa	15256	14824	2766	12490	403	12093	432	210	75	152	80	232	60	140
	Mangaung	10796	10382	2934	7862	503	7763	414	155	64	99	50	149	53	103
	T Mofutsanya Xhariep														
Gauteng		308470	303442	44552	263918	4933	262161	5028	1232	391	1736	480	2216	378	858
	Ekurhuleni	91831	90214	13403	78428	1453	77793	1617	141	38	635	62	697		
	Jhb Metro	96986	95643	13571	83415	1636	82987	1343	441	161	428	170	598	201	371
	Sedibeng	29609	28926	4387	25222	294	25036	683	99	19	186	38	224	58	96
	Tshwane	76460	75249	11423	65037	1343	64614	1211	532	169	423	201	624	165	366
	West Rand	13584	13410	1768	11816	207	11731	174	19	4	64	9	73	16	25

Province	District	Total births 1.0kg+	Total LB 1.0kg+	Births 1.0- 2.49kg	Total births 2.5kg+	LB 1.0- 1.49kg	LB 2.5kg+	SB 1.0kg+	ENND 1.0kg+	ENND 1.0- 1.49kg	SB 2.5kg+	ENND 2.5kg+	PND 2.5kg+	FSB 2.5kg+	FSB+ENND 2.5kg+
KwaZulu-Natal		214203	210406	26281	187922	2602	186659	3797	1618	462	1357	710	2067	465	1175
	Amajuba	12720	12508	1199	11521	115	11444	212	32	10	77	7	84	37	44
	eThekweni	52525	51662	6389	46136	615	45859	863	223	73	277	88	365	66	154
	iLembe	12556	12271	1395	11161	146	11051	285	135	36	110	60	170	47	107
	Sisonke	17053	16783	2050	15003	145	14876	270	178	51	127	81	208	59	140
	Ugu	19735	19422	2545	17190	209	17089	313	113	37	101	41	142	30	71
	uMgungundlovu	16767	16443	2447	14320	313	14219	324	144	43	101	62	163	18	80
	uMkhanyakude	9987	9840	1058	8929	67	8874	147	45	13	55	25	80	25	50
	Umzinyathi	17337	17098	1869	15468	129	15383	239	125	33	85	53	138	28	81
	Uthukela	12824	12549	1665	11159	147	11094	275	170	39	107	84	191	32	116
	Uthungulu	25094	24515	4151	20943	561	20800	579	259	81	195	111	306	66	177
	Zululand	17605	17315	1513	16092	155	15970	290	194	46	122	98	220	57	155
Limpopo		197473	193392	22570	174903	2104	173081	4081	1886	566	1822	792	2614	624	1416
	Capricorn	46869	45848	6181	40688	745	40323	1021	606	174	365	281	646	183	464
	Mopani	29888	28928	3496	26392	282	25800	960	381	122	592	142	734	117	259
	Sehukhune	47879	47014	4890	42989	401	42628	865	357	96	361	149	510	136	285
	Vhembe	51626	50799	5258	46368	427	46038	827	358	105	330	149	479	125	274
	Waterberg	21211	20803	2745	18466	249	18292	408	184	69	174	71	245	63	134
Mpumalanga		145308	142370	18339	126969	1651	125775	2938	1250	349	1191	552	1743	544	1096
	Ehlanzeni	73066	71692	8917	64149	757	63584	1374	612	172	562	280	842	236	516
	Gert Sibande	34757	34043	4534	30223	369	29931	714	352	104	292	139	431	143	282
	Nkangala	37485	36635	4888	32597	525	32260	850	286	73	337	133	470	165	298
North West		97099	95153	13811	83288	1452	82537	1946	790	253	751	335	1086	334	669
	Bojanala	31479	30865	3712	27767	401	27497	614	232	86	270	90	360	126	216
	Dr K Kaunda	23434	22956	4116	19318	500	19185	478	160	59	133	57	190	48	105
	N M Molema	26784	26255	3691	23093	374	22870	529	268	75	223	121	344	97	218
	Ruth Segomotsi	15402	15077	2292	13110	177	12985	325	130	33	125	67	192	63	130

Province	District	Total births 1.0kg+	Total LB 1.0kg+	Births 1.0- 2.49kg	Total births 2.5kg+	LB 1.0- 1.49kg	LB 2.5kg+	SB 1.0kg+	ENND 1.0kg+	ENND 1.0- 1.49kg	SB 2.5kg+	ENND 2.5kg+	PND 2.5kg+	FSB 2.5kg+	FSB+ENND 2.5kg+
Northern Cape		32952	32113	7607	25345	969	25094	839	270	112	251	86	337	87	173
	Francis Baard	15315	14858	4011	11304	645	11178	457	114	37	126	47	173	32	79
	JT Gaetsewe	5406	5248	910	4496	67	4438	158	36	9	58	16	74	24	40
	Namakwa	2107	2069	352	1755	25	1746	38	27	13	9	7	16	4	11
	P ka Semme	3967	3882	1033	2934	106	2903	85	57	36	31	7	38	18	25
	Siyanda	6157	6056	1301	4856	126	4829	101	36	17	27	9	36	9	18
Western Cape		165247	163051	27527	137720	3074	137122	2196	547	174	598	219	817	341	560
	Cape Town Metro	115468	113858	18063	97405	2235	96973	1610	366	108	432	155	587	251	406
	Cape Winelands	11975	11827	2104	9871	144	9834	148	37	10	37	13	50	17	30
	Central Karoo	2293	2258	576	1717	47	1706	35	19	15	11	1	12	7	8
	Eden	13788	13632	2701	11087	269	11044	156	39	14	43	17	60	30	47
	Overberg	14704	14524	2910	11794	296	11739	180	65	20	55	26	81	26	52
	West Coast	7019	6952	1173	5846	83	5826	67	21	7	20	7	27	10	17
South Africa		1323707	1299195	187609	1136098	19864	1128240	24512	9368	2907	9176.00	3900	13076	3282	7182

Table 28. Key indicators and provinces 2010-2011

Province	cPNMR	SBR (M)	ENNDR (Ca)	LBWR	cPCI	SB:NND Ratio	cPNMR 2.5kg+	ENNDR 1.0-1.49kg	FSB 2.5kg+	ENNDR 2.5kg+	FSB+ENND 2.5kg+ rate	CS rate	Vacuum rate	Forceps rate	iMMR 2010-2011
Eastern Cape	31.61	20.50	11.34	15.51	2.08	1.75	13.82	210.88	4.70	5.63	11.09	26.55	0.89	0.14	188.75
Free State	43.21	30.73	12.88	20.39	2.12	2.46	21.43	161.68	4.75	5.70	10.38	34.45	0.29	0.71	251.65
Gauteng	22.10	16.30	4.06	14.44	1.53	2.81	9.11	122.24	2.39	2.55	4.63	19.94	0.38	0.09	141.31
KwaZulu-Natal	25.28	17.73	7.69	12.27	2.06	2.35	11.00	177.56	2.47	3.80	6.25	27.02	0.44	0.11	194.35
Limpopo	30.22	20.67	9.75	11.43	2.64	2.16	14.95	269.01	3.57	4.58	8.10	15.69	0.29	0.03	165.61
Mpumalanga	28.82	20.22	8.78	12.62	2.28	2.35	13.73	211.39	4.28	4.39	8.63	15.91	0.23	0.11	207.03
North West	28.18	20.04	8.30	14.22	1.98	2.46	13.04	174.24	4.01	4.06	8.03	16.48	0.44	0.13	198.11
Northern Cape	33.66	25.46	8.41	23.09	1.46	3.11	13.30	115.58	3.43	3.43	6.83	24.50	0.32	0.78	218.92
Western Cape	16.60	13.29	3.35	16.66	1.00	4.01	5.93	56.60	2.48	1.60	4.07	20.77	1.23	0.25	75.87
South Africa	25.59	18.52	7.21	14.17	1.81	2.62	11.51	144.89	2.89	3.46	6.37	21	0.52	0.15	182.23

Table 29. Disease specific rates and provinces 2010-2011

Province	IPA+T Rate	SPTB rate	HT rate	APH rate	Unexp. SB rate	Hypoxia rate	Immaturity rate	FSB+ENND 2.5+ rate	iMMR 2010-2011
Eastern Cape	6.10	3.87	4.08	3.64	4.08	4.66	2.86	11.09	188.75
Free State	6.11	5.79	6.88	4.90	9.12	4.69	4.78	10.38	251.65
Gauteng	3.18	2.40	2.00	2.08	5.94	1.94	1.36	4.63	141.31
KwaZulu-Natal	4.29	3.04	2.36	2.68	6.33	3.14	2.15	6.25	194.35
Limpopo	6.80	3.93	3.44	1.92	6.88	4.02	3.14	8.10	165.61
Mpumalanga	6.94	3.21	4.87	2.80	8.13	4.09	3.34	8.63	207.03
North West	5.35	4.11	3.52	2.62	7.31	3.19	2.68	8.03	198.11
Northern Cape	4.16	4.95	1.24	3.67	6.28	2.15	3.27	6.83	218.92
Western Cape	2.04	1.22	1.56	4.03	2.44	1.13	0.72	4.07	75.87
South Africa	4.87	3.16	3.05	2.89	6.09	3.11	2.34	6.37	182.23

Table 30. Key indicators and districts 2010-2011

Province	District	PNMR	SBR	ENNDR	LBWR	PCI	SB:NND Ratio	PNMR 2.5+	ENNDR 1.1.5	FSB 2.5+	ENNDR 2.5+	FSB+ENND 2.5+ rate	CS rate	Vacuum rate	Forceps rate	DHIS - Ins. MMR
EC	Alfred Nzo	31.42	17.75	13.92	7.71	4.08	1.30	18.38	316.46	5.82	8.93	14.66	17.40	0.89	0.13	272.77
EC	Amathole	29.95	22.11	8.02	15.74	1.90	2.82	12.07	145.14	3.40	3.79	7.30	32.53	0.86	0.12	220.56
EC	Cacadu	19.27	13.40	5.95	18.69	1.03	2.28	7.83	149.35	3.05	2.35	5.39	18.12	0.84	0.33	211.98
EC	Chris Hanu	22.74	16.22	6.63	13.42	1.69	2.49	11.30	216.49	2.82	3.27	6.07	12.60	1.11	0.02	162.91
EC	NM Metro	20.42	15.17	5.33	17.00	1.20	2.89	8.25	88.85	-	2.85		29.35	0.41	0.21	155.84
EC	OR Tambo	56.93	31.55	26.21	17.98	3.17	1.24	30.51	407.34	7.90	12.11	19.83	33.68	1.41	0.02	101.90
EC	Ukahlamba	26.22	17.71	8.66	12.31	2.13	2.08	14.46	195.65	2.77	4.60	7.33	13.88	0.82	0.28	59.38
FS	Free State	43.21	30.73	12.88	20.39	2.12	2.46	21.43	161.68	4.75	5.70	10.38	34.45	0.29	0.71	289.07
Gau	Ekuhuleni	25.21	17.61	7.74	14.60	1.73	2.32	11.30	172.06	-	3.23		19.89	0.01	0.17	192.28
Gau	Jhb Metro	18.39	13.85	4.61	13.99	1.31	3.05	7.17	98.41	2.41	2.05	4.45	18.00	0.52	0.05	156.30
Gau	Sedibeng	26.41	23.07	3.42	14.82	1.78	6.90	8.88	64.63	2.30	1.52	3.81	16.91	0.31	0.16	136.01
Gau	Tshwane	22.80	15.84	7.07	14.94	1.53	2.28	9.59	125.84	2.54	3.11	5.63	23.40	0.19	0.21	133.70
Gau	West Rand	14.21	12.81	1.42	13.02	1.09	9.16	6.18	19.32	1.35	0.77	2.12	21.28	3.27	0.12	125.40
KZN	Amajuba	19.18	16.67	2.56	9.43	2.04	6.63	7.29	86.96	3.21	0.61	3.82	15.67	0.79	0.03	299.45
KZN	eThekweni	20.68	16.43	4.32	12.16	1.70	3.87	7.91	118.70	1.43	1.92	3.34	29.33	0.28	0.02	266.62
KZN	iLembe	33.45	22.70	11.00	11.11	3.01	2.11	15.23	246.58	4.21	5.43	9.59	22.79	0.00	0.09	229.20
KZN	Sisonke	26.27	15.83	10.61	12.02	2.19	1.52	13.86	351.72	3.93	5.45	9.33	22.97	0.13	0.03	221.58
KZN	Ugu	21.59	15.86	5.82	12.90	1.67	2.77	8.26	177.03	1.75	2.40	4.13	33.22	1.21	0.09	217.25
KZN	uMgungundlovu	27.91	19.32	8.76	14.59	1.91	2.25	11.38	137.38	1.26	4.36	5.59	36.21	0.21	0.36	180.91
KZN	uMkhanyakude	19.22	14.72	4.57	10.59	1.81	3.27	8.96	194.03	2.80	2.82	5.60	17.46	0.49	0.00	150.11
KZN	Umkhanyathi	21.00	13.79	7.31	10.78	1.95	1.91	8.92	255.81	1.81	3.45	5.24	20.41	0.70	0.15	139.85
KZN	Uthukela	34.70	21.44	13.55	12.98	2.67	1.62	17.12	265.31	2.87	7.57	10.40	21.79	0.77	0.05	113.59
KZN	Uthungulu	33.39	23.07	10.56	16.54	2.02	2.24	14.61	144.39	3.15	5.34	8.45	39.40	0.43	0.38	91.30
KZN	Zululand	27.49	16.47	11.20	8.59	3.20	1.49	13.67	296.77	3.54	6.14	9.63	17.69	0.14	0.01	40.73
Lim	Capricorn	34.71	21.78	13.22	13.19	2.63	1.68	15.88	233.56	4.50	6.97	11.40	16.19	0.47	0.04	275.86
Lim	Mopani	44.87	32.12	13.17	11.70	3.84	2.52	27.81	432.62	4.43	5.50	9.81	19.70	0.28	0.01	191.85
Lim	Sehukhune	25.52	18.07	7.59	10.21	2.50	2.42	11.86	239.40	3.16	3.50	6.63	14.48	0.25	0.00	175.85
Lim	Vhembe	22.95	16.02	7.05	10.18	2.25	2.31	10.33	245.90	2.70	3.24	5.91	13.53	0.20	0.01	147.89
Lim	Waterberg	27.91	19.24	8.84	12.94	2.16	2.22	13.27	277.11	3.41	3.88	7.26	16.90	0.24	0.18	71.84

Province	District	PNMR	SBR	ENNDR	LBWR	PCI	SB:NND Ratio	PNMR 2.5+	ENNDR 1.1.5	FSB 2.5+	ENNDR 2.5+	FSB+ENND 2.5+ rate	CS rate	Vacuum rate	Forceps rate	DHIS - Ins. MMR
Mpu	Ehlanzeni	27.18	18.80	8.54	12.20	2.23	2.25	13.13	227.21	3.68	4.40	8.04	15.62	0.28	0.04	223.82
Mpu	Gert Sibande	30.67	20.54	10.34	13.04	2.35	2.03	14.26	281.84	4.73	4.64	9.33	18.06	0.15	0.33	174.15
Mpu	Nkangala	30.31	22.68	7.81	13.04	2.32	2.97	14.42	139.05	5.06	4.12	9.14	14.49	0.22	0.06	172.32
NW	Bojanala	26.88	19.51	7.52	11.79	2.28	2.65	12.97	214.46	4.54	3.27	7.78	13.69	0.10	0.01	325.92
NW	Dr K Kaunda	27.23	20.40	6.97	17.56	1.55	2.99	9.84	118.00	2.48	2.97	5.44	22.80	0.83	0.50	276.50
NW	NM Molema	29.76	19.75	10.21	13.78	2.16	1.97	14.90	200.53	4.20	5.29	9.44	16.36	0.54	0.02	60.77
NW	Ruth Segomotsi	29.54	21.10	8.62	14.88	1.99	2.50	14.65	186.44	4.81	5.16	9.92	12.76	0.40	0.00	260.22
																206.75
NC	Francis Baard	37.28	29.84	7.67	26.19	1.42	4.01	15.30	57.36	2.83	4.20	6.99	34.02	0.05	0.48	
NC	JT Gaetsewe	35.89	29.23	6.86	16.83	2.13	4.39	16.46	134.33	5.34	3.61	8.90	11.04	0.22	0.00	310.79
NC	Namakwa	30.85	18.04	13.05	16.71	1.85	1.41	9.12	520.00	2.28	4.01	6.27	22.40	0.85	7.36	184.16
NC	Pixley ka Semme	35.80	21.43	14.68	26.04	1.37	1.49	12.95	339.62	6.13	2.41	8.52	14.34	0.68	0.33	196.25
NC	Siyanda	22.25	16.40	5.94	21.13	1.05	2.81	7.41	134.92	1.85	1.86	3.71	19.91	0.65	0.28	149.46
WC	Cape Town Metro	17.11	13.94	3.21	15.64	1.09	4.40	6.03	48.32	2.58	1.60	4.17	21.50	1.08	0.24	184.62
WC	Cape Winelands	15.45	12.36	3.13	17.57	0.88	4.00	5.07	69.44	1.72	1.32	3.04	18.23	1.65	0.15	109.02
WC	Central Karoo	23.55	15.26	8.41	25.12	0.94	1.84	6.99	319.15	4.08	0.59	4.66	18.80	1.88	0.61	95.01
WC	Eden	14.14	11.31	2.86	19.59	0.72	4.00	5.41	52.04	2.71	1.54	4.24	21.21	1.20	0.18	53.74
WC	Overberg	16.66	12.24	4.48	19.79	0.84	2.77	6.87	67.57	2.20	2.21	4.41	21.78	1.90	0.18	53.65
WC	West Coast	12.54	9.55	3.02	16.71	0.75	3.19	4.62	84.34	1.71	1.20	2.91	10.90	1.24	0.77	51.56

Table 31. Disease specific mortality rates and districts 2010-2011

Province	District	IPA+T Rate	SPTB rate	HT rate	APH rate	Unexp. SB rate	Hypoxia rate	Immaturity rate	FSB+ENND 2.5+ rate	DHIS - Ins. MMR
EC	Alfred Nzo	4.94	2.15	1.72	4.51	6.01	6.27	1.97	14.66	272.77
EC	Amathole	5.70	2.90	4.98	4.65	6.33	3.27	2.13	7.30	220.56
EC	Cacadu	3.89	4.71	1.65	1.41	4.47	1.68	1.93	5.39	211.98
EC	Chris Hani	5.44	3.44	2.26	1.18	5.53	2.85	2.39	6.07	162.91
EC	Nelson Mandela Metro									155.84
EC	OR Tambo	15.21	10.18	10.88	8.57	3.93	13.31	8.07	19.83	101.90
EC	Ukahlamba	6.25	3.47	2.61	0.87	3.13	3.18	3.18	7.33	59.38
FS	Free State	6.11	5.79	6.88	4.90	9.12	4.69	4.78	10.38	289.07
Gau	Ekurhuleni									192.28
Gau	Jhb Metro	2.36	1.54	2.54	2.28	6.95	1.76	1.15	4.45	156.30
Gau	Sedibeng	3.21	1.22	1.05	2.06	5.74	1.38	1.45	3.81	136.01
Gau	Tshwane	4.42	4.21	1.96	2.08	4.87	2.67	1.75	5.63	133.70
Gau	West Rand	1.99	0.96	0.52	0.66	5.23	0.30	0.37	2.12	125.40
KZN	Amajuba	2.75	1.49	2.04	2.36	8.10	0.96	0.82	3.82	299.45
KZN	eThekweni	1.90	1.79	1.39	2.89	5.94	1.70	1.26	3.34	266.62
KZN	iLembe	6.21	5.58	8.60	1.83	6.21	4.48	3.02	9.59	229.20
KZN	Sisonke	7.10	4.87	1.76	1.99	4.46	4.05	3.58	9.33	221.58
KZN	Ugu	2.89	2.58	1.52	1.98	6.28	2.42	1.75	4.13	217.25
KZN	uMgungundlovu	2.92	2.74	0.83	1.37	9.96	2.74	1.76	5.59	180.91
KZN	uMkhanyakude	3.30	2.90	1.30	2.50	3.10	2.34	1.32	5.60	150.11
KZN	Umzinyathi	3.35	3.00	0.46	0.46	4.33	3.10	2.46	5.24	139.85
KZN	Uthukela	8.42	4.44	3.12	2.57	10.92	6.14	4.38	10.40	113.59
KZN	Uthungulu	5.50	3.11	4.90	7.21	6.38	3.71	2.69	8.45	91.30
KZN	Zululand	8.07	4.15	2.27	1.48	5.11	5.89	2.37	9.63	40.73
Lim	Capricorn	8.34	4.35	5.04	3.07	8.19	5.43	3.53	11.40	275.86
Lim	Mopani	8.03	5.19	4.25	2.51	6.99	4.63	4.81	9.81	191.85
Lim	Sehukhune	5.81	3.11	3.84	1.52	6.68	3.42	2.45	6.63	175.85
Lim	Vhembe	5.66	3.53	1.51	0.85	5.37	3.11	2.50	5.91	147.89
Lim	Waterberg	6.65	4.10	2.55	2.03	7.97	3.65	3.12	7.26	71.84

Province	District	IPA+T Rate	SPTB rate	HT rate	APH rate	Unexp. SB rate	Hypoxia rate	Immaturity rate	FSB+ENND 2.5+ rate	DHIS - Ins. MMR
Mpu	Ehlanzeni	6.45	3.24	5.06	2.44	7.32	3.83	3.23	8.04	223.82
Mpu	Gert Sibande	7.42	3.77	4.66	3.31	8.06	4.46	4.44	9.33	174.15
Mpu	Nkangala	7.44	2.61	4.70	3.04	9.76	4.26	2.54	9.14	172.32
NC	Francis Baard	3.13	2.87	1.57	4.51	5.42	2.15	1.68	6.99	325.92
NC	JT Gaetsewe	6.47	5.18	1.66	1.48	4.81	2.48	2.67	8.90	276.50
NC	Namakwa	3.80	10.92	0.95	3.80	7.12	0.97	8.22	6.27	60.77
NC	Pixley ka Semme	7.81	12.10	0.50	3.78	8.82	3.09	9.02	8.52	260.22
NC	Siyanda	2.44	3.25	0.65	3.41	7.80	1.65	2.31	3.71	206.75
NW	Bojanala	5.53	4.42	3.72	2.16	7.47	3.14	2.33	7.78	310.79
NW	Dr K Kaunda	2.94	2.60	3.12	2.73	7.64	1.66	2.18	5.44	184.16
NW	Ngaka Modiri Molema	5.90	4.82	4.85	3.14	5.04	3.88	3.66	9.44	196.25
NW	Ruth Segomotsi	7.66	4.54	1.43	2.47	10.45	4.44	2.45	9.92	149.46
WC	Cape Town Metro	2.00	0.99	1.80	4.43	2.51	1.16	0.57	4.17	184.62
WC	Cape Winelands	2.42	1.25	1.42	3.67	1.75	1.27	0.68	3.04	109.02
WC	Central Karoo	0.87	9.16	0.00	2.18	7.85	0.00	7.53	4.66	95.01
WC	Eden	1.45	1.38	1.09	2.32	2.90	0.59	0.66	4.24	53.74
WC	Overberg	2.72	1.43	0.95	4.22	1.56	1.58	0.83	4.41	53.65
WC	West Coast	2.14	1.71	0.43	1.57	1.71	1.01	1.01	2.91	51.56

Table 32 lists the correlations between the various indicators.

Table 32. Correlation coefficients between perinatal care indicators

Comparison	Correlation Coefficient	P	Number
iMMR (10-11)/PCI	0.558	0.118	9 (Provinces)
iMMR (10-11)/FSB 2.5+ rate	0.677	0.045	9 (Provinces)
PCI/FSB+ENNDR 2.5kg+ rate	0.723	0.028	9 (Provinces)
PCI/FSB 2.5+ rate	0.554	0.121	9 (Provinces)
PCI/iMMR (08-10)	0.318	0.029	46 (Districts)
PCI/FSB 2.5+ rate	0.576	0.000	44 (Districts)
PCI/FSB+ENNDR 2.5kg+ rate	0.781	0.000	46 (Districts)
PCI/ENND 2.5kg+ rate	0.796	0.000	46 (Districts)
PCI/ENND 1.0-1.49kg rate	0.627	0.000	46 (Districts)
PCI/ENNDR	0.677	0.000	46 (Districts)
FSB 2.5kg+/ENNDR 1.0-1.49kg	0.511	0.000	45 (Districts)
iMMR (08-10)/PNMR	0.607	0.000	46 (Districts)
iMMR (08-10)/SBR	0.652	0.000	46 (Districts)
iMMR (08-10)/ENNDR	0.422	0.000	46 (Districts)
iMMR FSB 2.5+ rate	0.272	0.074	44 (Districts)
FSB+ENND 2.5kg+ rate/CS rate	0.074	0.626	46 (Districts)
FSB+ENND 2.5kg+ rate/vacuum *	-0.276	0.063*	46 (Districts)
FSB+ENND 2.5kg+ rate/forceps	-0.072	0.636	46 (Districts)
FSB+ENND 2.5kg+ rate/assisted delivery	-0.194	0.196	46 (Districts)
FSB+ENND 2.5kg+ rate/operational delivery	0.039	0.799	46 (Districts)
FSB 2.5kg+ rate/CS rate	-0.123	0.422	45 (Districts)
FSB 2.5kg+ rate/vacuum rate	-0.234	0.122	45 (Districts)
FSB 2.5kg+ rate/forceps rate	-0.140	0.359	45 (Districts)
ENNDR 2.5kg+/CS rate	0.134	0.368	46 (Districts)
PNMR/CS rate	0.081	0.588	46 (Districts)
iMMR (08-10)/IPA+T rate	0.49	0.747	46 (Districts)
iMMR (08-10)/SBTB rate	0.015	0.920	46 (Districts)
iMMR (08-10)/HT rate	0.176	0.242	46 (Districts)
iMMR (08-10)/APH rate	0.072	0.635	46 (Districts)
iMMR (08-10)/Unexplained SB rate	0.343	0.020	46 (Districts)
iMMR (08-10)/Hypoxia rate	0.050	0.742	46 (Districts)
iMMR (08-10)/Immaturity rate	-0.027	0.859	46 (Districts)
IPA+T rate/CS	-0.48	0.749	46 (Districts)
IPA+T rate/vacuum	-0.307	0.036	46 (Districts)
IPA+T rate/forceps	-0.124	0.406	46 (Districts)
IPA+T rate/assisted delivery	-0.253	0.086	46 (Districts)
Hypoxia/CS	0.150	0.315	46 (Districts)
Hypoxia/vacuum	-0.243	0.100	46 (Districts)

- There is good positive correlation between the iMMR and perinatal mortality, stillbirth and neonatal mortality rates. This is not surprising

- The PCI is positively correlated with the iMMR, and intrapartum quality of care and neonatal care indicators. This is also not surprising.
- There was a surprising correlation between the unexplained stillbirth rate and the iMMR. A high unexplained stillbirth rate is associated with poor antenatal care and this is may also be reflected in a high iMMR.
- The negative correlation between the intrapartum asphyxia and trauma rate with the vacuum rate might indicate that not using the vacuum and performing a CS instead leads to unnecessary delays and more deaths.

Specific indicators need to be selected and tracked over time to see how and institution is performing. Further each institution should be assessed in terms of its functionality with respect to the signal functions for obstetric and neonatal care given in Appendix 2.

Conclusion

This eighth Saving Babies report for 2010 and 2011 has attempted to identify emerging challenges in perinatal care. Particular attention has been paid to health system failures by an extensive analysis of the avoidable factors and also using the “three delay model”.

There has been no dramatic change in disease profile from 2008-2009. Direct comparison of rates has not been possible due to the reclassifying of the level of care of a number of hospitals.

There is no reason to change the recommendations made by the National Perinatal Morbidity and Mortality Committee in their previous reports at this stage.

Finally the presentation of the PPIP data in districts will allow the provincial specialists and district clinical specialists to target certain areas or aspects. A good basis from which to start is assessing each facility in terms of the signal obstetric and neonatal functions as outlined in Appendix 2.

Appendix 1

Validation of perinatal care indicators

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Introduction

Very few of the perinatal care indicators have been validated by independent means of assessing quality of care.

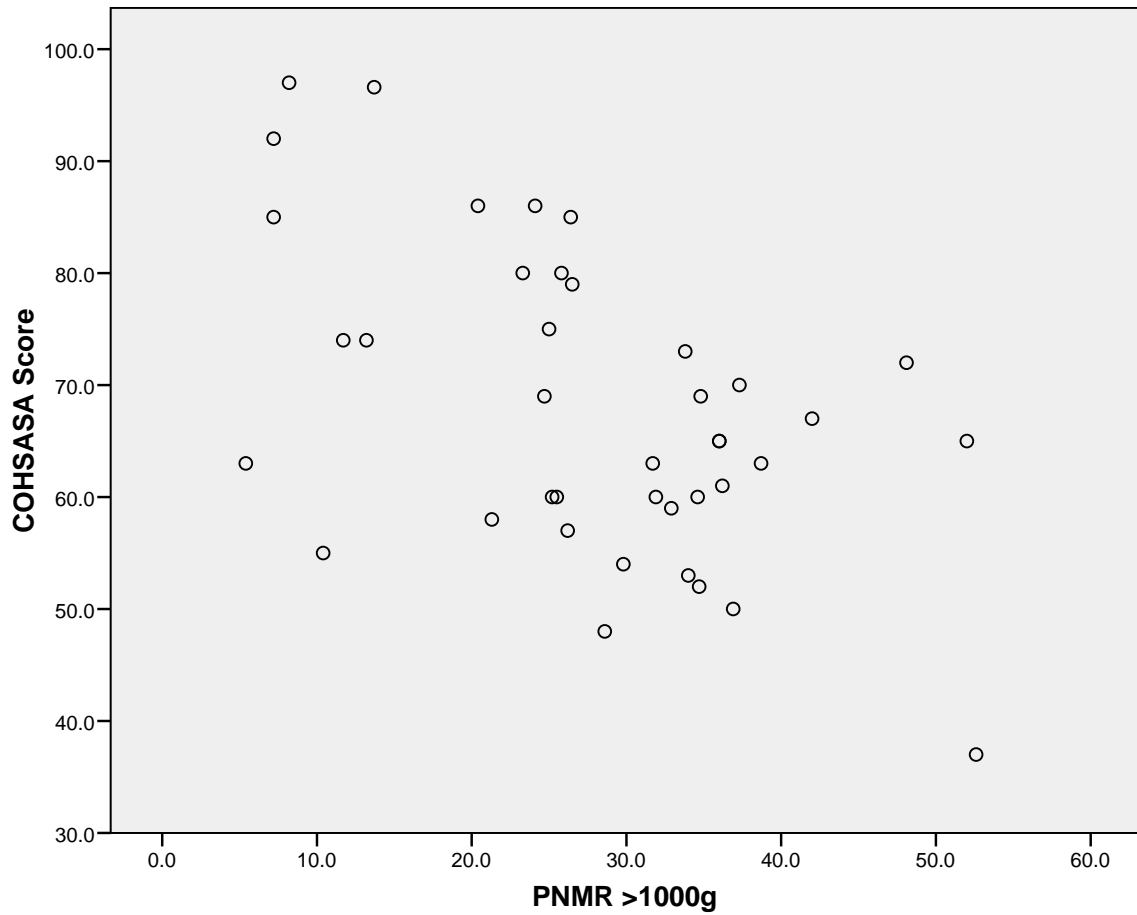
Objective and Methods

To validate perinatal care indicators by an independent means of assessing the quality of care

The Council for Health Service Accreditation of Southern Africa (COHSASA) is a non-governmental organisation that scores hospitals on their quality of care for accreditation purposes and is recognised by the International Society for Quality in Health Care. The Perinatal Problem Identification Programme (PIIP) is an audit system aimed at improving the quality of care. Health institutions audit every perinatal death and enter each death and the monthly births in weight categories in the programme. The programme calculates various perinatal care indices to measure the quality of care over time. Approximately 150 hospitals have been accredited by COHSASA in South Africa and PIIP is used by 180 hospitals in 2008. There was an overlap of 70 hospitals. The COHSASA score for overall performance of the hospital and that of the maternity section was compared with the PIIP perinatal care indicators, namely perinatal mortality rate (PNMR); neonatal deaths (NNDR) between 1-2 kg; the perinatal care index (PNMR/Low birth weight rate); and the fresh stillbirths and early neonatal deaths >2500g/births rate (a proposed measure of the quality of intrapartum care) were correlated. The 70 hospitals were divided into those that did not receive referrals from outside their sub-district and those that received referrals from outside their sub-districts.

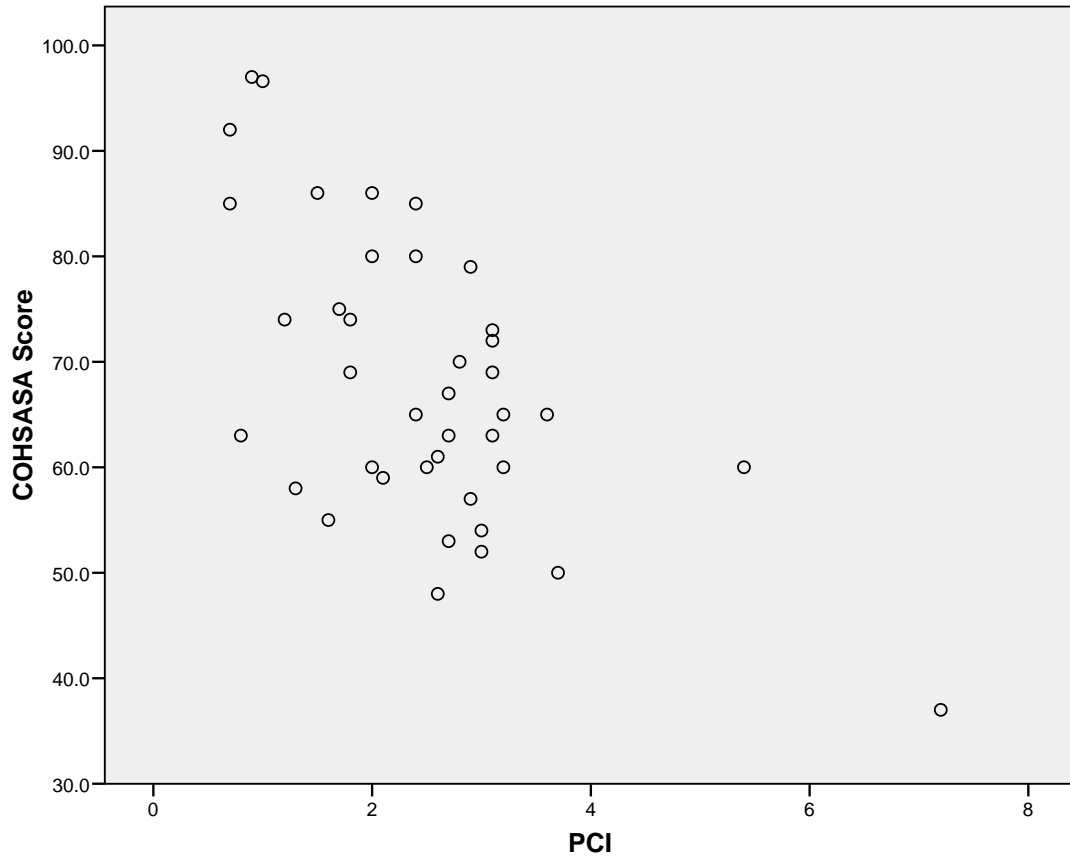
Results

For the hospitals that did not receive referrals from outside their sub-districts, there was a negative significant correlation between the COHSASA scores overall and PNMR ($r = -0.527$, $p < 0.000$), NNDR (1-2kg) ($r = -0.421$, $p = 0.01$) perinatal care index ($r = 0.610$, $p = 0.000$) but not with the intrapartum care indicator. This was true also for the COHSASA maternity scores. There was no correlation with the hospitals receiving referrals from outside their sub-districts.



Correlations

		PNMR >1000g	COHSASA Score
PNMR >1000g	Pearson Correlation	1	.231
	Sig. (2-tailed)		.313
	N	21	21
COHSASA Score	Pearson Correlation	.231	1
	Sig. (2-tailed)	.313	
	N	21	21



Correlations

		COHSASA Score	PCI
COHSASA Score	Pearson Correlation	1	-.610**
	Sig. (2-tailed)		.000
	N	40	40
PCI	Pearson Correlation	-.610**	1
	Sig. (2-tailed)	.000	
	N	40	40

** . Correlation is significant at the 0.01 level (2-tailed).

Comments

1. Significant correlations between COHSASA score and COHSASA maternity score and PNMR (1000g+) of PPIP sites 0 and 1. The correlation is negative with the higher the COHSASA scores the lower the PNMRs in the PPIP sites.
2. No association with PPIP sites 2 and 3. This can be explained by the mixture of cases these sites get. A case mismanaged elsewhere and delivered at a PPIP site 2 or 3 which

results in a death would appear as a bad statistic in the PPIP site but does not reflect on the care at the PPIP site 2 or 3.

3. There is a significant correlation with the NNDR (1-2kg) at PPIP sites 0 and 1.
4. There was surprising no correlation between FSB&ENND (2500+)/1000 births and COHSASA scores. This indicator was supposed to be an indicator of intrapartum care.
5. There was the best correlation between the Perinatal Care Index (PCI) and the COHSASA scores. The PCI has been used by PPIP users as a measure of quality of care to compare between similar PPIP sites. This index has now for the first time been validated! (PCI is the PNMR/LBWR).Conclusion

Appendix 2

Table 1. Proposed obstetric and newborn signal functions.⁹

Dimensions of Facility Care	Obstetric	Newborn
General requirements for health facility	Service availability 24/7	
	Skilled providers in sufficient numbers	
	Referral service to higher-level care, communication tools	
	Reliable electricity and water supply, heating in cold climates, clean toilets	
A. Routine care (for all mothers and babies)		
	Monitoring and management of labour using partograph	Thermal protection ^a
	Infection prevention measures (hand-washing, gloves)	Immediate and exclusive breastfeeding
	Active management of third stage of labour (AMTSL) ^b	Infection prevention including hygienic cord care ^c
B. Basic emergency care (for mothers and babies with complications)		
	Parenteral magnesium sulphate for (pre-) eclampsia	Antibiotics for preterm or prolonged PROM to prevent infection
	Assisted vaginal delivery	Corticosteroids in preterm labour
	Parenteral antibiotics for maternal infection	Resuscitation with bag and mask of non-breathing baby
	Parenteral oxytocic drugs for haemorrhage	KMC for premature/very small babies
	Manual removal of placenta for retained placenta	Alternative feeding ^d if baby unable to breastfeed
	Removal of retained products of conception	Injectable antibiotics for neonatal sepsis
		(PMTCT if HIV-positive mother) ^e
C. Comprehensive emergency care (functions in addition to Basic)		
	Surgery (e.g., C-section) including anaesthesia	Intravenous fluids
	Blood transfusion	Safe administration of oxygen

Existing EmONC functions (from UN handbook) in italics.

^aThermal protection: drying baby immediately after birth, skin-to-skin with mother, wrapping, no bath in first 6 hours.

^bAMTSL: oxytocin injection in thigh within 1 minute of delivery of baby, controlled cord traction, uterine massage after delivery of the placenta.

^cHygienic cord care: cutting with sterile blade, application of 4% chlorhexidine on tip of the cord and stump and no application of harmful substances (or clean and dry care in settings with low neonatal mortality and infection risk).

^dBreastmilk expression and cup/spoon feeding.

^ePMTCT: in brackets as not strictly a “newborn” function, but included for continuum of care; situational depending on HIV prevalence.

KMC, kangaroo mother care; PMTCT, prevention of mother to child transmission; PROM, premature rupture of membranes; 24/7, 24 hours a day 7 days a week. doi:10.1371/journal.pmed.1001340.t001

⁹ Gabrysch S, Civitelli G, Edmond KM, Mathai M, Ali M, et al. (2012) New Signal Functions to Measure the Ability of Health Facilities to Provide Routine and Emergency Newborn Care. PLoS Med 9(11): e1001340. doi:10.1371/journal.pmed.1001340