Saving Babies

2012 – 2013

Ninth report on perinatal care in South Africa

Compiled by

Robert Pattinson and Natasha Rhoda for the PPIP group

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

Hardcopies and copies on CD-ROM are available from:
The MRC Unit for Maternal and Infant Health Care Strategies
Klinikala Building, Kalafong Hospital
Private Bag 667
PRETORIA, 0001
Tel/Fax: (012) 373-0825
E-mail: matinfru@up.ac.za

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Contents

Foreword

This ninth Saving Babies report is meant to serve as a document of record and is available on the PPIP website (www.ppip.co.za). The report has many tables and graphs giving information in different birth weight categories. The triennial National Perinatal Morbidity and Mortality Committee (NaPeMMCo) report will give a discussion and recommendations on perinatal care. The Saving Babies chapter in the NaPeMMCo report is a summary of this current report.

However, this report is novel in that it has calculated the average deliveries **per site** per level of care and not just the levels of care. This has been done to begin the discussion on staffing norms and what constitutes a safe maternity unit. This also helps health care managers look at the numbers of births in different birth weight categories which help examine the cost effectiveness of certain interventions such as nasal CPAP; i.e. how many babies need to be born between 1-2kg to justify the introduction of nasal CPAP so that enough cases are delivered so that the staff maintains its skills in the use of the equipment.

1st October 2014

Robert Pattinson MD, FRCOG, FCOG (SA)
Director: SA MRC Maternal and Infant Health Care Strategies unit,
Professor: Department of Obstetrics and Gynaecology, University of Pretoria
Chief Specialist: Kalafong Tertiary Hospital

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
U-SB	Unexplained stillbirth
Unk.	Unknown

Section 1

1.1 Introduction

During the period 1st January 2012 to 31st December 2013, 1,412,355 births and 32,662 stillbirths and 14,576 early neonatal deaths were recorded on the national Perinatal Problem Identification Programme (PPIP) database from 588 PPIP sites. This represents 75.6% of all births in institutions using the District Health Information System (DHIS) for the denominator (July 2014). Table 1 gives the comparison of births recorded on the DHIS and in PPIP. Four provinces have very complete PPIP data in relation to the DHIS, but three provinces the penetration of PPIP is a long way from complete.

Table 1. Comparison of births in the DHIS and PPIP (2012-2013)

	EC	FS	Gau	KZN	Lim	Mpu	NW	NC	WC	SA
500 - 999g	1415	1344	3848	2739	1778	1437	1263	711	3207	17742
1,000 - 1,499g	2429	1912	5228	3547	2949	2451	1926	912	3779	25133
1,500 - 1,999g	4381	3229	8801	5805	5449	4151	3218	1763	6912	43709
2,000 - 2,499g	12637	7635	25460	16193	15818	12618	9931	4409	18453	123154
2,500g+	121509	75443	247319	176376	181835	135809	93009	30128	149198	1210626
PPIP Total	142371	89563	290656	204660	207829	156466	109347	37923	181549	1420364
DHIS Total	234841	94139	415840	381262	254249	153206	115828	43093	185821	1878279
Difference	92470	4576	125184	176602	46420	-3260	6481	5170	4272	457915
% missing from PPIP	39.4	4.9	30.1	46.3	18.3	-2.1	5.6	12.0	2.3	24.4

Table 2 gives the official classification of hospitals from the Government Gazette of August 2011.

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 – 229,933 births (16.2% of PPIP database), District Hospitals - 654,115 births (46.3% of PPIP database), Regional Hospitals - 389334 births (27.4% of PPIP database), Provincial Tertiary Hospitals – 69,470 births (4.9% of PPIP database), and National Central hospitals – 72,503 births (5.1% of PPIP database) were well represented. All 52 districts were

represented. Late neonatal deaths were under reported and are excluded from this report. The mortality rates are very similar to those described in the 2011-2012 report.

1.2 Perinatal care indicators

Table 3. Perinatal mortality rates from PPIP database 2012-2013

500g+	CHC	DH	RH	PT	NC	SA (PPIP)
Born alive	228006	640872	374675	66744	69396	1379693
Survive	227653	633682	368752	65379	67400	1362866
Early neonatal death	326	6731	4856	1117	1546	14576
Total deaths	2253	19974	16515	3843	4653	47238
Late neonatal death	27	459	1067	248	450	2251
Stillborn	1927	13243	11659	2726	3107	32662
total	229933	654115	386334	69470	72503	1412355
1000g+	**CHC**	**DH**	**RH**	**PT**	**NC**	**SA (PPIP)**
Born alive	227557	638262	371294	65700	67264	1370077
Survive	227288	632756	367476	64850	66041	1358411
Early neonatal death	242	5123	3060	669	907	10001
Total deaths	1670	15781	11649	2620	2835	34555
Late neonatal death	27	383	758	181	316	1665
Stillborn	1428	10658	8589	1951	1928	24554
Total 1000g+	228985	648920	379883	67651	69192	1394631
PNMR	9.8	30.5	42.7	55.3	64.2	33.4
PNMR 1000g+	7.3	24.3	30.7	38.7	41.0	24.8
SBR	8.4	20.2	30.2	39.2	42.9	23.1
SBR 1000g+	6.2	16.4	22.6	28.8	27.9	17.6
ENNDR	1.4	10.5	13.0	16.7	22.3	10.6
ENNDR 1000g+	1.1	8.0	8.2	10.2	13.5	7.3

Table 4. Perinatal care indicators per level of care 2010-2011

	Community Health Centre	District Hospital	Regional Hospital	Provincial Tertiary	National Central
PNMR	9.57	33.43	39.50	51.04	63.30
PNMR 1000g+	6.88	27.17	28.35	36.16	41.19
SBR	8.11	22.03	27.57	33.26	42.87
SBR 1000g+	5.89	18.18	20.39	24.70	28.49
ENNDR	1.47	11.21	12.26	18.39	21.34
ENNDR 1000g+	0.99	9.16	8.12	11.75	13.07

Table 5 gives the PPIP perinatal care indices per level of care and figures 1-4 illustrate these indicators. District hospitals have the highest mortality rates between 1000g-2000g.

Table 5. PPIP perinatal care indices per level of care

	SA	CHC	DH	RH	PT	NC
Perinatal Mortality Rate (/1,000)						
All deliveries	33.4	9.8	30.5	42.7	55.3	64.2
All 1,000g+	24.8	7.3	24.3	30.7	38.7	41.0
500 - 999g	715.6	615.0	807.1	754.3	672.3	549.1
1,000 - 1,499g	347.6	253.4	463.1	337.0	276.5	225.7
1,500 - 1,999g	153.1	107.0	185.3	143.2	150.1	116.7
2,000 - 2,499g	47.6	19.5	49.9	53.7	58.2	50.2
2,500g+	11.1	3.3	11.6	13.8	15.9	16.4
Early Neonatal Mortality Rate (/1,000)						
All deliveries	10.6	1.4	10.5	13.0	16.7	22.3
All 1,000g+	7.3	1.1	8.0	8.2	10.2	13.5
500 - 999g	475.8	187.1	616.1	531.2	429.1	299.7
1,000 - 1,499g	153.1	43.0	238.1	147.1	106.3	92.1
1,500 - 1,999g	41.0	10.2	57.5	35.2	37.3	32.0
2,000 - 2,499g	11.0	2.7	12.2	12.1	12.1	13.2
2,500g+	3.5	0.6	4.2	3.5	4.2	6.3
Stillbirth Rate (/1,000)						
All deliveries	23.1	8.4	20.2	30.2	39.2	42.9
All 1,000g+	17.6	6.2	16.4	22.6	28.8	27.9
500 - 999g	457.5	526.4	497.6	475.9	426.1	356.1
1,000 - 1,499g	229.7	219.8	295.3	222.7	190.4	147.1
1,500 - 1,999g	116.9	97.8	135.6	112.0	117.1	87.5
2,000 - 2,499g	37.0	16.8	38.1	42.1	46.7	37.5
2,500g+	7.7	2.7	7.4	10.3	11.7	10.2
Stillbirth / Neonatal Death Ratio	1.9 : 1	5.5 : 1	1.8 : 1	2.0 : 1	2.0 : 1	1.6 : 1
Perinatal Care Index						
All deliveries	2.3	1.0	2.5	2.4	2.4	2.1
All 1,000g+	1.8	0.8	2.1	1.9	1.8	1.5

Figure 1. Comparison PNMR and level of care

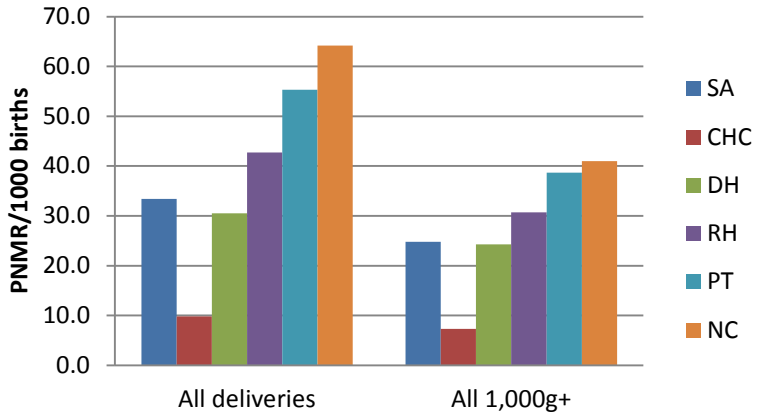


Figure 2. Comparison SBR and level of care

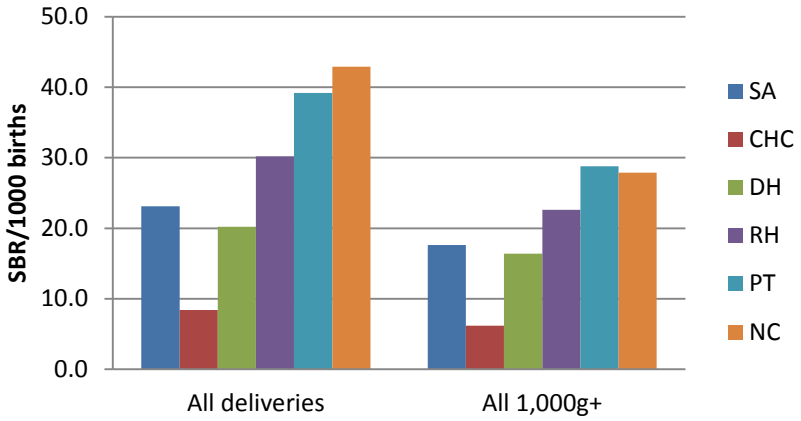


Figure 3. Comparison ENNDR and level of care

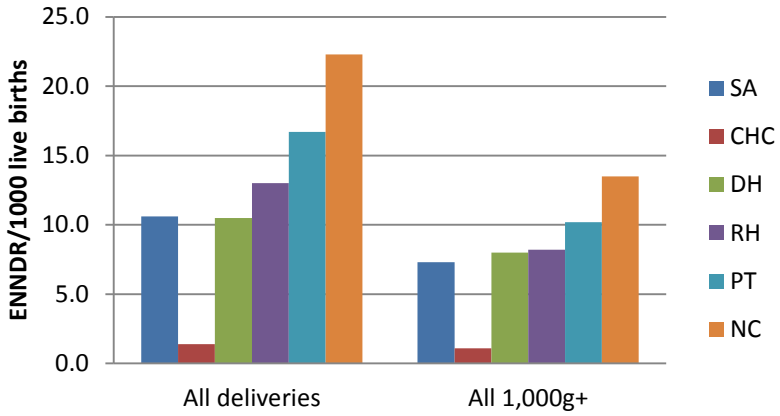
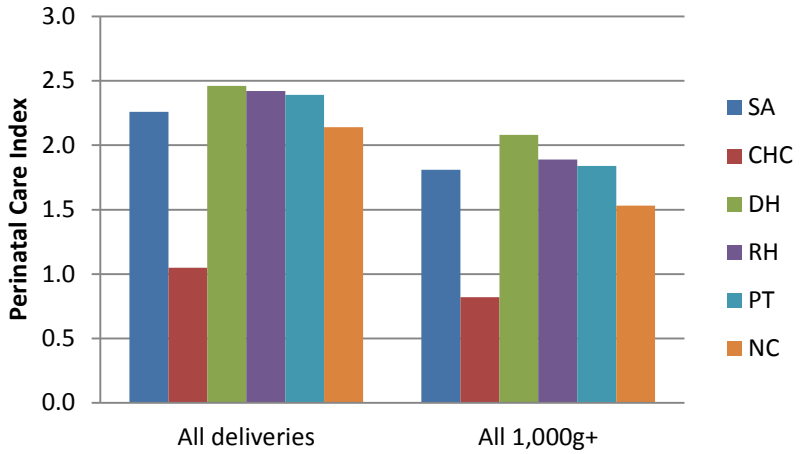


Figure 4. Comparison of PCI and level of care



The Perinatal Care Index (PCI) is highest in the district hospitals indicating a poorer quality of care.

1.3 Number of births and perinatal deaths per level of care and average per institution

The number of births per birth weight category and level of care were calculated using the number of births recorded per level of care in the DHIS for 2012-2013 and annualised. This is shown in Table 6

Table 6. Estimated number of deliveries per year in birth weight categories and level of care

All births	CHC	DH	RH	PT	NC
500 - 999g	748	3108	4087	2027	2660
1,000 - 1,499g	1122	4663	5529	2962	3239
1,500 - 1,999g	2431	9325	9616	4365	4338
2,000 - 2,499g	13091	31084	23318	8652	7172
2,500g+	169616	340373	197842	59861	40427
Total	187007	388554	240392	77867	57835
Perinatal deaths					
500 - 999g	460	2509	3083	1362	1461
1,000 - 1,499g	284	2159	1863	819	731
1,500 - 1,999g	260	1728	1377	655	506
2,000 - 2,499g	255	1551	1252	504	360
2,500g+	560	3948	2730	952	663
Total	1819	11896	10305	4292	3721
Stillbirths					
500 - 999g	394	1547	1945	864	947
1,000 - 1,499g	247	1377	1231	564	476
1,500 - 1,999g	238	1265	1077	511	380
2,000 - 2,499g	220	1184	982	404	269
2,500g+	458	2519	2038	700	412
Total	1556	7891	7273	3043	2485
Live births					
500 - 999g	742	3046	3963	1947	2546
1,000 - 1,499g	1113	4568	5362	2846	3100
1,500 - 1,999g	2411	9137	9325	4194	4152
2,000 - 2,499g	12981	30455	22614	8312	6864
2,500g+	168194	333482	191872	57512	38695
Total	185440	380688	233137	74811	55357
ENND per year					
500 - 999g	139	1876	2105	835	763
1,000 - 1,499g	48	1088	789	302	286
1,500 - 1,999g	25	525	328	156	133
2,000 - 2,499g	35	372	274	101	91
2,500g+	101	1401	672	242	244
Total	347	5262	4168	1637	1516

Most of the deaths occur in the district hospitals as do most births. This is illustrated in figure 5. Figure 6 illustrates the estimated number of early neonatal deaths per weight category and level of care. Most deaths again occur in the district hospitals. The Government Gazette of 2011 listed 188 district hospitals, 42 regional hospitals, 12 provincial tertiary hospitals and 10 national central hospitals. Table 7 gives the estimated average number of births and early neonatal deaths **per institution**. This is illustrated in figures 7 and 8.

Figure 5. Distribution of births, stillbirths and early neonatal deaths per level of care

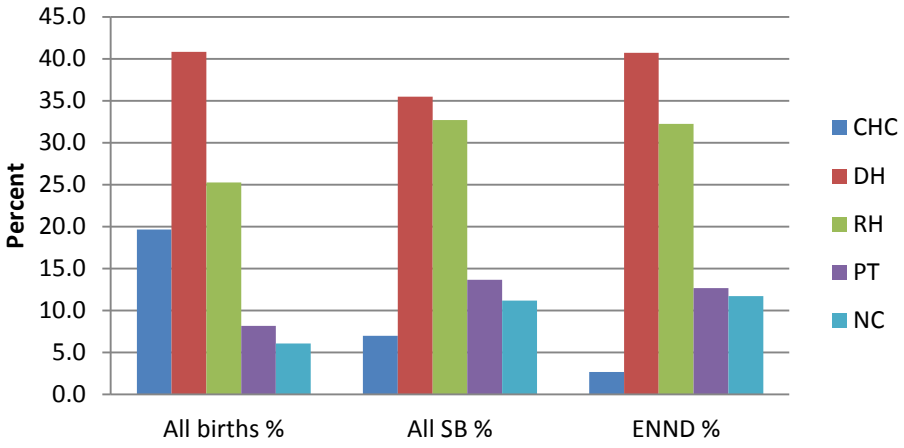


Figure 6. Estimated number of early neonatal deaths per level of care and birthweight category

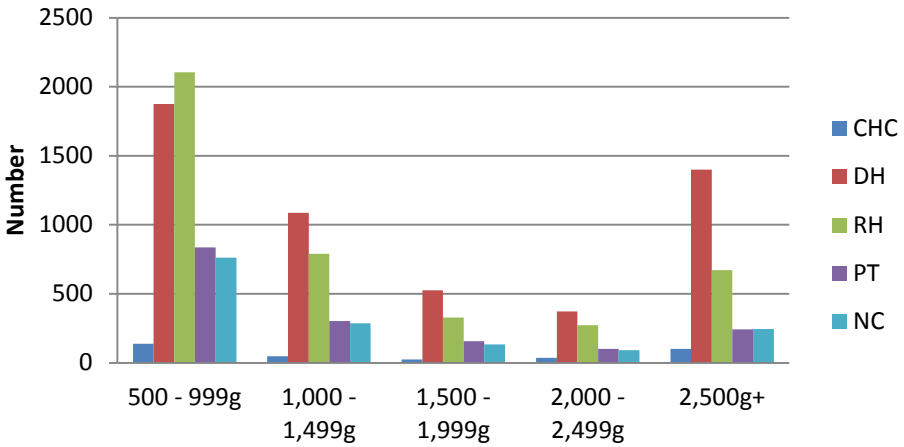


Table 7. Average number of births and live births and stillbirths and early neonatal deaths per hospital per birth weight category

	DH	RH	PT	NC
South Africa hospitals per Level of Care	188	42	12	10
Average births per year per hospital				
500 - 999g	17	97	169	266
1,000 - 1,499g	25	132	247	324
1,500 - 1,999g	50	229	364	434
2,000 - 2,499g	165	555	721	717
2,500g+	1810	4711	4988	4043
Total	2067	5724	6489	5784
Average Stillbirths per hospital per year				
500 - 999g	8	46	72	95
1,000 - 1,499g	7	29	47	48
1,500 - 1,999g	7	26	43	38
2,000 - 2,499g	6	23	34	27
2,500g+	13	49	58	41
Total	42	173	254	248
Average live births per hospital per year				
500 - 999g	16	94	162	255
1,000 - 1,499g	24	128	237	310
1,500 - 1,999g	49	222	349	415
2,000 - 2,499g	162	538	693	686
2,500g+	1774	4568	4793	3869
Total	2025	5551	6234	5536
Average ENNDs per hospital per year				
500 - 999g	10	50	70	76
1,000 - 1,499g	6	19	25	29
1,500 - 1,999g	3	8	13	13
2,000 - 2,499g	2	7	8	9
2,500g+	7	16	20	24
Total	28	99	136	152

Figure 7. Average live births per hospital type per year

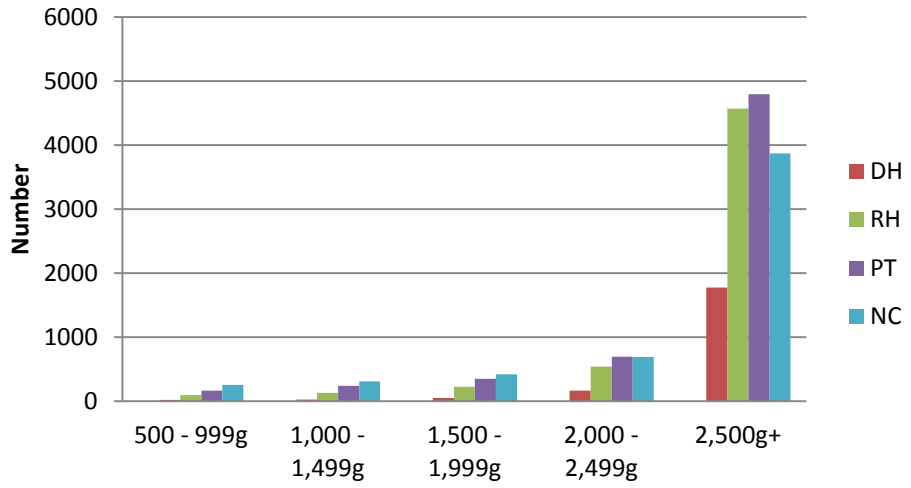
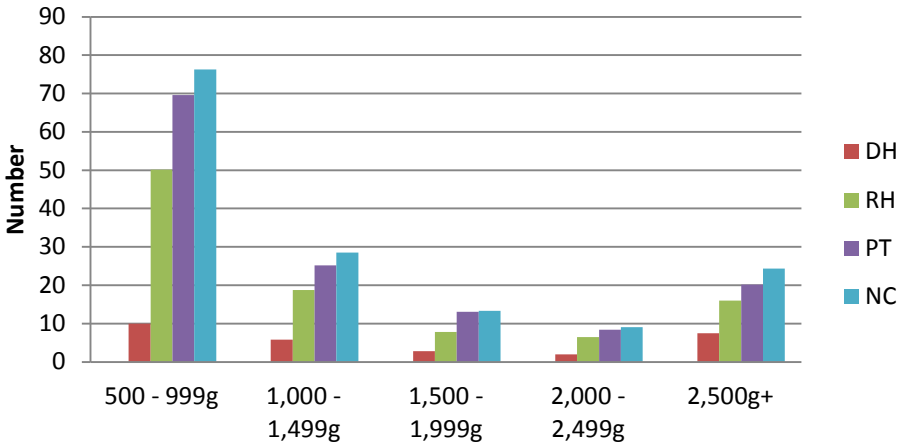


Figure 8. Average number of ENNDs per hospital type per year



In summary, most deaths occur in district hospital as do most births. The mortality rates in the district hospitals are the highest, **BUT** one district hospital on average will deliver a live born baby between 1000g and 1999g once every 5 days, and 12% (one in eight will be an early neonatal death). That is for the average district hospital delivering 2000 babies per year. If the hospital delivery 500 births per year, then they will deliver a live born between 1000g and 1999g every 20 days and two will die. This analysis raises the question of what resources should be available in each institution and how many deliveries per year will make the intervention cost-effective, while at the same time keeping health care accessible to the population.

The "CSIR Guidelines for the Provision of Social Facilities in South African Settlements" (First Edition: CSIR August 2012) is a guideline document which "seeks to provide a quantitative and rational framework for the provision of key social facilities for various levels of settlements to support the planning process and provide support to the social facility investment plans". The norms given in this guideline are a Level 3 hospital for 2.4 million population, a regional hospital per 1.77 million population (level 2); a district hospital per 300000-900000population with an access distance of 30km (Level 1); a community health centre for every 60000-140000 population with 90% access distance of 5km and a primary health care clinic for every 40000 population with an access distance of 5km. Using these figures and the population estimates of Stats SA mid-year estimated for 2013 (Statistical release P0302) it suggests South Africa should have:

- 22 tertiary hospitals – Level 3 (we have 22)
- 30 regional hospitals – Level 2 (we have 42)
- Between 59 and 177 district hospitals – Level 1 (we have 188)

It appears we have too many facilities for the population of the country. It is difficult to staff facilities and if there are too many, it means that the health care providers are spread more thinly on the ground and the quality of care will inevitably suffer.

1.4 Primary obstetric cause of death

Table 8 gives the mortality rates per primary obstetric cause and time of death for the levels of care. Some sites only complete the monthly statistic form of PPIP and do not complete the analysis of each death. A correction was made per level of care to factor these missing cases in.

Table 8. Mortality rates per primary obstetric cause and time of deaths for the levels of care

	CHC	DH	RH	PT	NC
500g+ MSB					
Antepartum haemorrhage	0.13	0.56	2.63	3.26	2.75
Fetal abnormality	0.04	0.21	0.41	0.78	1.33
Hypertensive disorders	0.30	2.73	4.20	6.45	4.98
Infections	0.27	0.55	0.62	0.63	0.87
Intrapartum asphyxia	0.18	0.58	0.74	0.73	0.48
Unexplained Stillbirth	2.80	7.14	8.26	10.49	5.19
Intrauterine growth retardation	0.13	0.30	0.83	0.09	1.25
Maternal disease	0.08	0.38	0.56	0.90	1.27
Miscellaneous	0.03	0.13	0.25	0.40	0.76
No obstetric cause / Not applicable	0.02	0.07	0.18	0.11	0.07
Spontaneous preterm labour	0.48	0.89	1.07	1.50	1.54
Trauma	0.03	0.07	0.05	0.05	0.03
Total	4.49	13.62	19.80	25.39	20.51
500g+ FSB					
Antepartum haemorrhage	0.18	1.00	3.10	4.10	7.36
Fetal abnormality	0.10	0.17	0.33	0.65	2.38
Hypertensive disorders	0.14	0.29	1.57	2.97	4.82
Infections	0.16	0.11	0.23	0.17	0.38
Intrapartum asphyxia	1.16	1.85	1.62	2.07	1.37
Unexplained Stillbirth	1.10	0.54	1.43	1.80	1.68
Intrauterine growth retardation	0.03	0.04	0.16	0.06	0.31
Maternal disease	0.02	0.04	0.11	0.11	0.49
Miscellaneous	0.06	0.06	0.03	0.14	0.39
No obstetric cause / Not applicable	0.02	0.03	0.10	0.00	0.14
Spontaneous preterm labour	0.91	0.94	1.64	1.69	2.90
Trauma	0.02	0.02	0.05	0.06	0.10
Total	3.89	5.10	10.38	13.84	22.33

Table 8. Mortality rates per primary obstetric cause and time of deaths for the levels of care (cont.)

	CHC	DH	RH	PT	NC
500g+ SBR					
Antepartum haemorrhage	0.30	1.56	5.73	7.36	10.11
Fetal abnormality	0.14	0.39	0.74	1.42	3.71
Hypertensive disorders	0.44	3.03	5.77	9.43	9.80
Infections	0.43	0.66	0.86	0.81	1.25
Intrapartum asphyxia	1.34	2.43	2.36	2.80	1.85
Unexplained Stillbirth	3.91	7.69	9.69	12.29	6.86
Intrauterine growth retardation	0.16	0.34	0.99	0.16	1.56
Maternal disease	0.10	0.42	0.67	1.01	1.76
Miscellaneous	0.09	0.19	0.28	0.54	1.16
No obstetric cause / Not applicable	0.03	0.10	0.28	0.11	0.21
Spontaneous preterm labour	1.39	1.83	2.71	3.20	4.44
Trauma	0.04	0.09	0.10	0.11	0.13
Total	8.38	18.71	30.18	39.23	42.84
500g+ ENND					
Antepartum haemorrhage	0.04	0.37	0.60	1.00	1.00
Fetal abnormality	0.10	0.57	0.78	1.36	1.93
Hypertensive disorders	0.02	0.33	1.31	2.50	3.93
Infections	0.09	0.49	0.52	0.47	0.33
Intrapartum asphyxia	0.37	3.25	2.72	3.17	2.96
Unexplained Stillbirth	0.02	0.04	0.03	0.02	0.03
Intrauterine growth retardation	0.03	0.12	0.11	0.15	0.19
Maternal disease	0.00	0.11	0.19	0.16	0.30
Miscellaneous	0.07	0.15	0.10	0.20	3.20
No obstetric cause / Not applicable	0.14	0.33	0.38	1.00	0.82
Spontaneous preterm labour	0.54	4.70	6.21	6.66	7.58
Trauma	0.02	0.02	0.02	0.04	0.00
Total	1.43	10.48	12.96	16.73	22.29
500g+ PNMR					
Antepartum haemorrhage	0.34	1.92	6.30	8.31	11.07
Fetal abnormality	0.24	0.95	1.50	2.73	5.55
Hypertensive disorders	0.46	3.36	7.05	11.83	13.56
Infections	0.52	1.14	1.36	1.26	1.57
Intrapartum asphyxia	1.71	5.62	5.00	5.85	4.68
Unexplained Stillbirth	3.92	7.72	9.71	12.32	6.89
Intrauterine growth retardation	0.19	0.46	1.10	0.30	1.75
Maternal disease	0.10	0.53	0.85	1.17	2.05
Miscellaneous	0.16	0.33	0.38	0.73	4.22
No obstetric cause / Not applicable	0.17	0.42	0.65	1.07	1.00
Spontaneous preterm labour	1.93	6.44	8.73	9.60	11.70
Trauma	0.06	0.11	0.11	0.15	0.13
Total	9.80	29.00	42.75	55.31	64.17

The top three conditions are shown in pink, orange and yellow for each level of care. In the lower levels of care the major causes are unexplained stillbirths, spontaneous preterm labour and intrapartum asphyxia; whereas in the higher levels of care complications of hypertension, antepartum haemorrhage and spontaneous preterm labour have higher mortality rates.

The mortality rates shown in Table 6 and 8 were used to calculate the numbers of deaths per year, per level of care using facility births data from the DHIS and the numbers are is shown in Tables 9 and 11.

Table 9. Number of deaths per condition, per level of care. (Extrapolated from DHIS births data and PPIP mortality rates per condition - estimate per annum the number of deaths).

500g+ PND per year per LOC	CHC	DH	RH	PT	NC	Total
Antepartum haemorrhage	63	748	1516	648	640	3615
Fetal abnormality	46	369	360	213	321	1309
Hypertensive disorders	85	1304	1694	922	784	4790
Infections	97	443	328	98	91	1056
Intrapartum asphyxia	320	2183	1201	456	271	4430
Unexplained Stillbirth	734	3000	2335	960	399	7427
Intrauterine growth retardation	36	180	265	24	101	605
Maternal disease	19	205	205	91	118	637
Miscellaneous	30	129	92	57	244	552
No obstetric cause / Not applicable	32	164	157	83	58	493
Spontaneous preterm labour	360	2502	2098	748	677	6385
Trauma	12	43	27	11	7	101
Total	1832	11268	10277	4311	3711	31399
500g+ SBR						
Antepartum haemorrhage	57	605	1377	573	585	3196
Fetal abnormality	27	150	178	111	214	681
Hypertensive disorders	83	1177	1388	735	567	3949
Infections	81	255	206	63	73	677
Intrapartum asphyxia	251	945	568	218	107	2088
Unexplained Stillbirth	731	2987	2329	958	397	7402
Intrauterine growth retardation	30	133	239	12	90	505
Maternal disease	19	162	161	79	102	522
Miscellaneous	17	72	68	42	67	266
No obstetric cause / Not applicable	6	39	68	9	12	134
Spontaneous preterm labour	259	712	651	249	257	2128
Trauma	8	35	23	9	7	82
Total	1567	7271	7255	3058	2478	21628
500g+ ENND						
Antepartum haemorrhage	7	143	139	75	55	418
Fetal abnormality	19	219	182	102	107	628
Hypertensive disorders	3	127	306	187	218	841
Infections	16	188	122	35	18	379
Intrapartum asphyxia	69	1236	633	238	164	2340
Unexplained Stillbirth	3	13	6	2	2	26
Intrauterine growth retardation	6	47	26	11	11	100
Maternal disease	0	43	44	12	17	116
Miscellaneous	13	56	24	15	177	285
No obstetric cause / Not applicable	25	125	89	75	46	359
Spontaneous preterm labour	101	1787	1447	499	420	4254
Trauma	4	8	4	3	0	19
Total	265	3991	3022	1253	1234	9764
Estimated per Annum						
All deaths	1832	11262	10277	4311	3711	31393
All births 500g+ per year	187007	388554	240392	77945	57835	961372
PNMR	9.80	28.98	42.75	55.31	64.17	32.65

Figure 5. Comparison of number of PNDs per disease category per level of care (500g+)

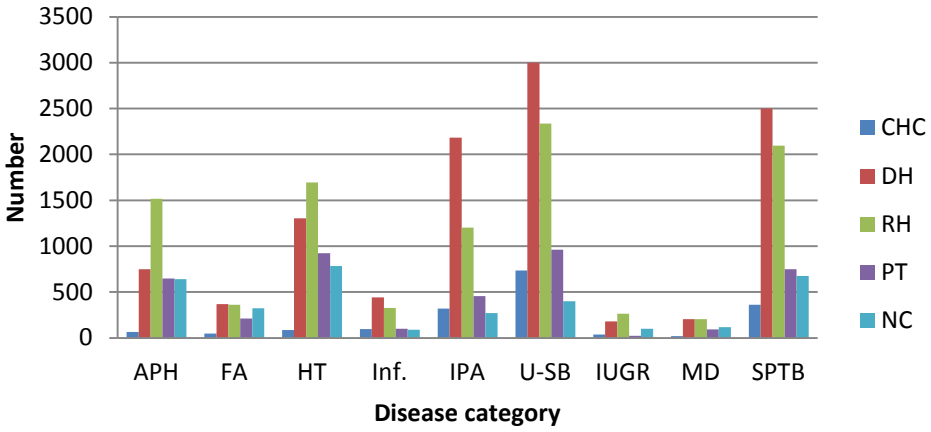


Figure 6. Comparison of the number of stillbirths per disease category and level of care (500g+)

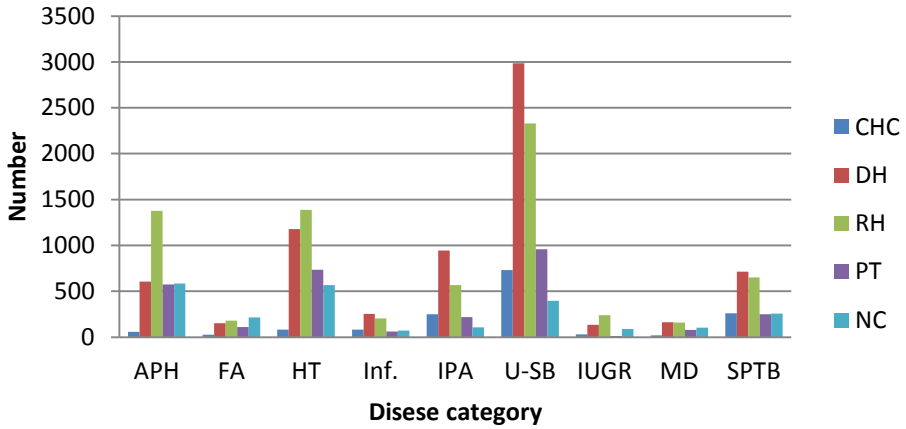
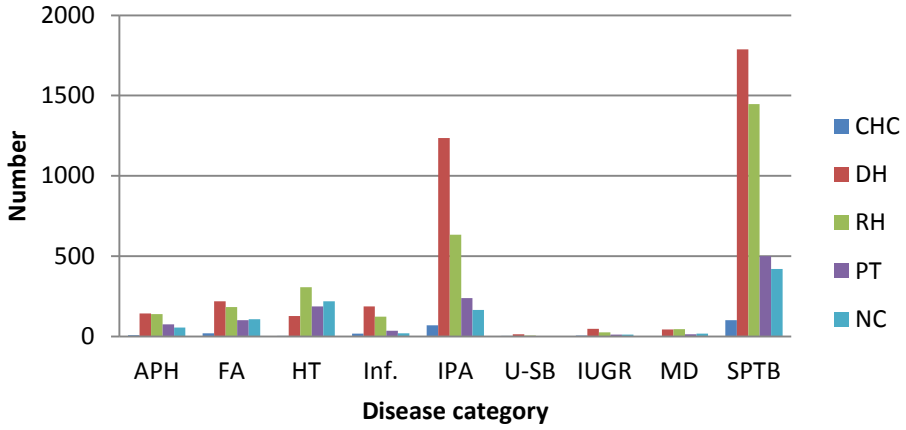


Figure 7. Comparison of the number of ENNDs per disease category per level of care (500g+)



Tables 10 and 11 give the same information for babies 1000g+.

Table 10. Mortality rates per primary obstetric cause and time of deaths for the levels of care

	CHC	DH	RH	PT	NC
1000g+ MSB					
Antepartum haemorrhage	0.08	0.47	2.27	2.72	2.38
Fetal abnormality	0.04	0.18	0.34	0.62	0.90
Hypertensive disorders	0.21	2.19	2.85	4.13	2.97
Infections	0.21	0.46	0.51	0.55	0.65
Intrapartum asphyxia	0.17	0.56	0.68	0.66	0.47
Unexplained Stillbirth	2.15	5.88	6.49	8.27	4.04
Intrauterine growth retardation	0.08	0.24	0.66	0.08	0.80
Maternal disease	0.05	0.36	0.52	0.79	1.05
Miscellaneous	0.03	0.11	0.19	0.28	0.64
No obstetric cause / Not applicable	0.01	0.05	0.16	0.08	0.06
Spontaneous preterm labour	0.23	0.51	0.58	0.66	0.38
Trauma	0.02	0.05	0.04	0.05	0.01
Total	3.27	11.07	15.28	18.89	14.36
1000g+ FSB					
Antepartum haemorrhage	0.12	0.88	2.60	3.59	6.25
Fetal abnormality	0.11	0.15	0.27	2.09	1.26
Hypertensive disorders	0.10	0.26	0.87	1.72	1.52
Infections	0.13	0.09	0.16	1.15	0.21
Intrapartum asphyxia	1.17	1.84	1.60	0.52	1.38
Unexplained Stillbirth	0.82	0.43	1.01	0.50	1.29
Intrauterine growth retardation	0.03	0.04	0.13	0.11	0.18
Maternal disease	0.01	0.02	0.09	0.10	0.33
Miscellaneous	0.04	0.04	0.02	0.06	0.25
No obstetric cause / Not applicable	0.02	0.02	0.08	0.06	0.13
Spontaneous preterm labour	0.40	0.35	0.47	0.05	0.62
Trauma	0.02	0.01	0.03	0.00	0.09
Total	2.97	4.14	7.33	9.95	13.50
1000g+ SBR					
Antepartum haemorrhage	0.21	1.35	4.87	6.31	8.63
Fetal abnormality	0.14	0.33	0.60	2.70	2.16
Hypertensive disorders	0.31	2.45	3.72	5.84	4.49
Infections	0.33	0.55	0.67	1.70	0.86
Intrapartum asphyxia	1.35	2.41	2.28	1.18	1.85
Unexplained Stillbirth	2.97	6.31	7.50	8.77	5.32
Intrauterine growth retardation	0.11	0.28	0.79	0.19	0.98
Maternal disease	0.06	0.39	0.61	0.89	1.38
Miscellaneous	0.07	0.15	0.22	0.34	0.89
No obstetric cause / Not applicable	0.02	0.07	0.24	0.15	0.19
Spontaneous preterm labour	0.62	0.86	1.05	0.71	1.01
Trauma	0.03	0.07	0.07	0.05	0.10
Total	6.24	15.21	22.62	28.84	27.85
1000g+ ENND					
Antepartum haemorrhage	0.03	0.26	0.41	0.52	0.62
Fetal abnormality	0.10	0.57	0.73	1.17	1.84
Hypertensive disorders	0.01	0.28	0.65	1.22	1.64
Infections	0.07	0.44	0.44	0.40	0.27
Intrapartum asphyxia	0.36	3.23	2.72	2.91	2.91
Unexplained Stillbirth	0.01	0.03	0.02	0.02	0.03
Intrauterine growth retardation	0.03	0.12	0.09	0.13	0.11
Maternal disease	0.00	0.09	0.12	0.07	0.27
Miscellaneous	0.06	0.13	0.09	0.14	2.11
No obstetric cause / Not applicable	0.13	0.31	0.35	0.90	0.80
Spontaneous preterm labour	0.22	2.54	2.60	2.67	2.87
Trauma	0.02	0.01	0.02	0.04	0.00
Total	1.06	8.02	8.24	10.18	13.48

Table 10. Mortality rates per primary obstetric cause and time of deaths for the levels of care

	CHC	DH	RH	PT	NC
1000g+ PNMR					
Antepartum haemorrhage	0.24	1.61	5.27	6.81	9.24
Fetal abnormality	0.24	0.89	1.32	3.84	3.94
Hypertensive disorders	0.33	2.73	4.35	7.03	6.09
Infections	0.41	0.98	1.10	2.09	1.12
Intrapartum asphyxia	1.71	5.58	4.94	4.00	4.68
Unexplained Stillbirth	2.99	6.34	7.52	8.80	5.35
Intrauterine growth retardation	0.14	0.39	0.88	0.32	1.08
Maternal disease	0.06	0.48	0.73	0.96	1.64
Miscellaneous	0.13	0.27	0.30	0.48	2.94
No obstetric cause / Not applicable	0.16	0.38	0.58	1.02	0.97
Spontaneous preterm labour	0.84	3.37	3.60	3.31	3.79
Trauma	0.05	0.08	0.08	0.08	0.10
Total	7.29	23.10	30.67	38.73	40.96

Table 11. Number of deaths per condition, per level of care. (Extrapolated from DHIS births data and PPIP mortality rates per condition - estimate per annum the number of deaths).

	CHC	DH	RH	PT	NC	Total
1000g+ number per year						
Antepartum haemorrhage	44	623	1255	523	517	2963
Fetal abnormality	46	343	313	295	221	1218
Hypertensive disorders	61	1056	1037	539	341	3034
Infections	76	379	262	160	63	941
Intrapartum asphyxia	319	2160	1177	307	262	4226
Unexplained Stillbirth	558	2453	1792	675	300	5777
Intrauterine growth retardation	26	151	209	25	60	471
Maternal disease	11	184	173	74	92	534
Miscellaneous	24	105	71	37	165	401
No obstetric cause / Not applicable	29	147	139	78	55	448
Spontaneous preterm labour	157	1302	857	254	212	2783
Trauma	10	32	20	6	6	74
Total	1361	8937	7306	2971	2294	22869
PNMR 1000g+	**7.29**	**23.10**	**30.67**	**38.73**	**40.96**	**24.22**
1000g+ SBR						
Antepartum haemorrhage	38	523	1160	484	484	2689
Fetal abnormality	27	128	144	207	121	627
Hypertensive disorders	58	948	885	448	252	2591
Infections	62	212	161	130	48	614
Intrapartum asphyxia	251	931	543	91	103	1920
Unexplained Stillbirth	555	2442	1787	673	298	5755
Intrauterine growth retardation	21	107	188	15	55	385
Maternal disease	11	149	146	68	77	451
Miscellaneous	12	57	51	26	50	196
No obstetric cause / Not applicable	4	27	56	11	11	110
Spontaneous preterm labour	116	333	251	55	56	812
Trauma	6	27	16	4	6	58
Total	1164	5883	5387	2212	1560	16207
SBR 1000g+	**6.24**	**15.21**	**22.62**	**28.84**	**27.85**	**17.16**
1000g+ ENND						
Antepartum haemorrhage	6	100	94	38	33	270
Fetal abnormality	18	213	167	85	97	581
Hypertensive disorders	3	107	149	89	87	435
Infections	14	166	100	29	14	323
Intrapartum asphyxia	67	1219	624	212	154	2276
Unexplained Stillbirth	3	11	5	2	2	22
Intrauterine growth retardation	6	44	21	9	6	86
Maternal disease	0	35	27	5	14	82
Miscellaneous	11	48	19	10	111	200
No obstetric cause / Not applicable	25	119	81	66	42	333
Spontaneous preterm labour	41	961	597	195	152	1944
Trauma	4	5	4	3	0	16
Total	196	3027	1890	743	712	6568
ENNDR 1000g+	**1.06**	**8.02**	**8.24**	**10.18**	**13.48**	**7.16**

Figue 8. Comparison of number of PNDs, per disease category, per level of care (1000g+)

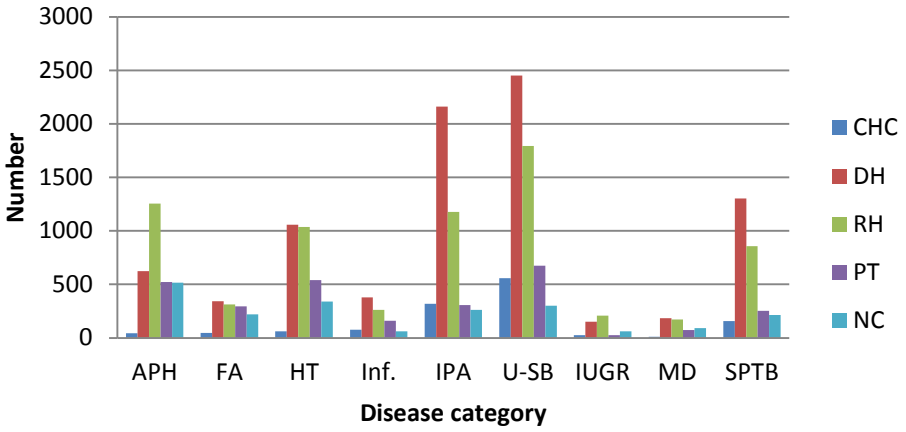


Figure 9. Comparison of number of stillbirths per disease category and level of care (1000g+)

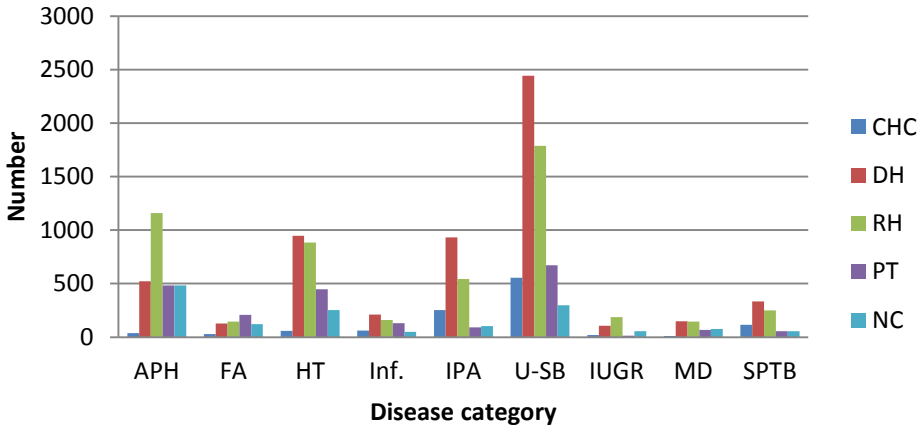
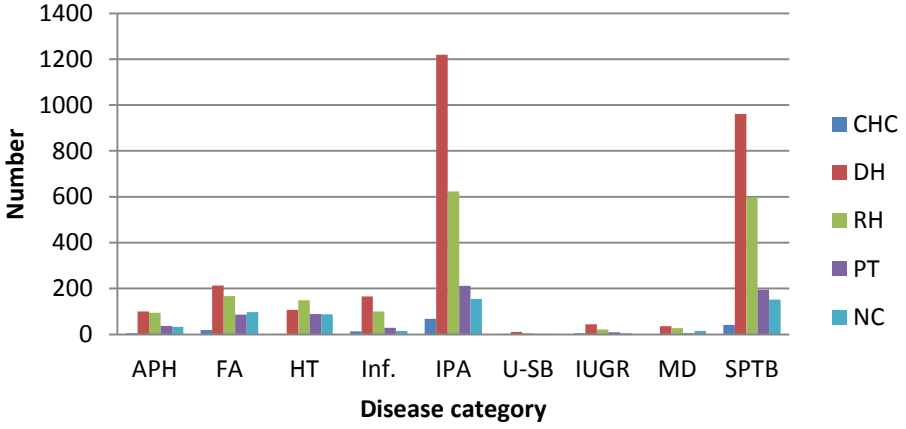


Figure 10. Comparison of ENNDs per disease category and level of care (1000g+)



1.5 Final causes early neonatal death (ENND)

Tables 12 and 13 give the early neonatal death rate per final cause of deaths and tables 14 and 15 give the estimated number of deaths per final cause of death and level of care per year.

Table 12. Final causes of early neonatal deaths expressed per 1000 live births for the levels of care (500g+ and 1000g+)

	CHC	DH	RH	PT	NC	SA
ENNDR 500g+						
Congenital abnormalities	0.09	0.69	0.96	1.81	2.90	0.83
Hypoxia	0.48	3.63	3.34	4.35	4.35	3.11
Immaturity related	0.51	4.94	6.85	7.47	11.20	5.17
Infection	0.14	0.43	1.03	2.00	2.62	0.73
Miscellaneous	0.11	0.48	0.54	0.68	0.64	0.46
Trauma	0.02	0.07	0.08	0.15	0.03	0.07
Unknown cause of death	0.07	0.22	0.16	0.27	0.54	0.20
Total	1.43	10.47	12.96	16.74	22.28	10.56
ENNDR 1000g+						
Congenital abnormalities	0.09	0.67	0.90	1.56	2.78	0.78
Hypoxia	0.46	3.59	3.30	3.96	4.24	3.04
Immaturity related	0.19	2.59	2.56	2.23	3.45	2.21
Infection	0.13	0.40	0.82	1.49	2.03	0.60
Miscellaneous	0.11	0.47	0.45	0.57	0.55	0.41
Trauma	0.01	0.07	0.07	0.13	0.02	0.06
Unknown cause of death	0.06	0.21	0.14	0.25	0.43	0.18
Total	1.06	8.00	8.24	10.18	13.48	7.29

Table 13. Final causes of early neonatal deaths expressed per number of death per level of care per annum (500g+ and 1000g+)

Estimated numbers using DHIS birth data	CHC	DH	RH	PT	NC	SA
ENND number 500g+						
Congenital abnormalities	17	262	225	135	161	800
Hypoxia	90	1383	779	325	241	2818
Immaturity related	94	1881	1597	559	620	4751
Infection	26	165	240	150	145	726
Miscellaneous	21	184	127	51	36	419
Trauma	4	28	18	11	2	63
Unknown cause of death	13	84	37	21	30	185
Total	265	3987	3022	1253	1233	9760
ENND number 1000g+						
Congenital abnormalities	17	254	206	114	147	738
Hypoxia	86	1355	757	289	224	2711
Immaturity related	36	979	587	162	182	1946
Infection	24	152	188	109	107	580
Miscellaneous	20	177	103	42	29	371
Trauma	3	27	16	9	1	56
Unknown cause of death	11	79	32	18	22	162
Total	196	3023	1889	743	712	6563

Figure 11. Comparison of numbers of ENNDs per final cause of death and level of care (500g+)

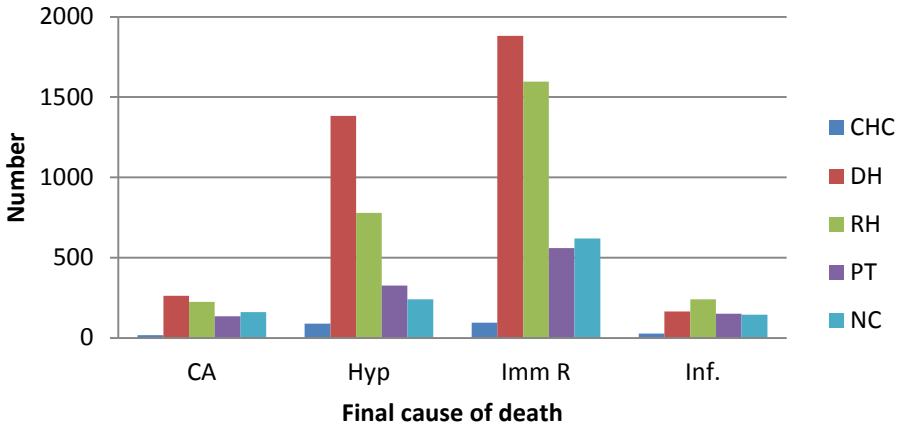
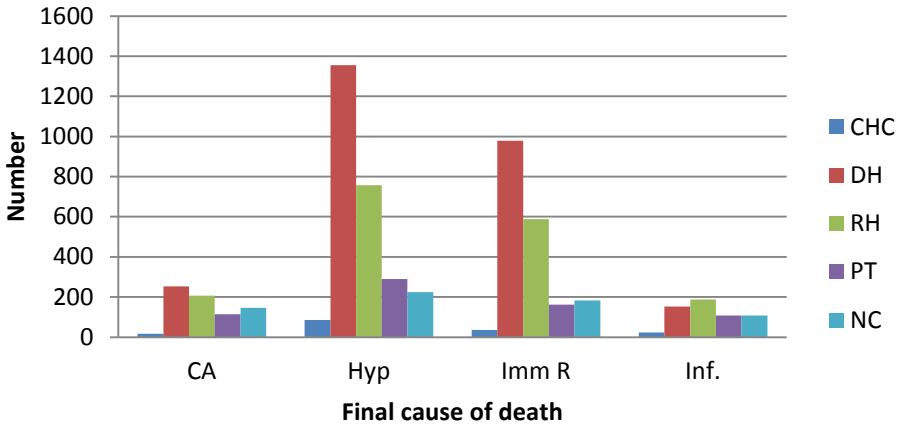


Figure 12. Comparison of number of ENNDs per final cause of death and level of care (1000g+)



1.6 Distribution of primary obstetric causes and timing of perinatal deaths

Figure 13. Distribution of timing and primary obstetric causes of perinatal deaths (500g+)

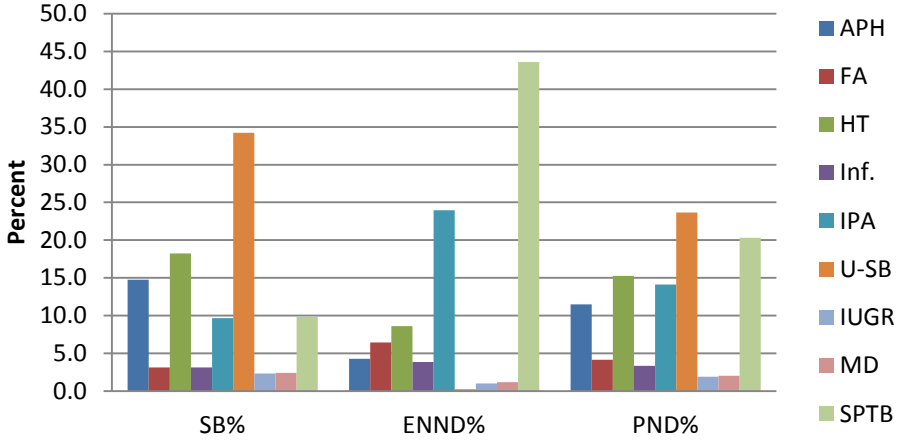
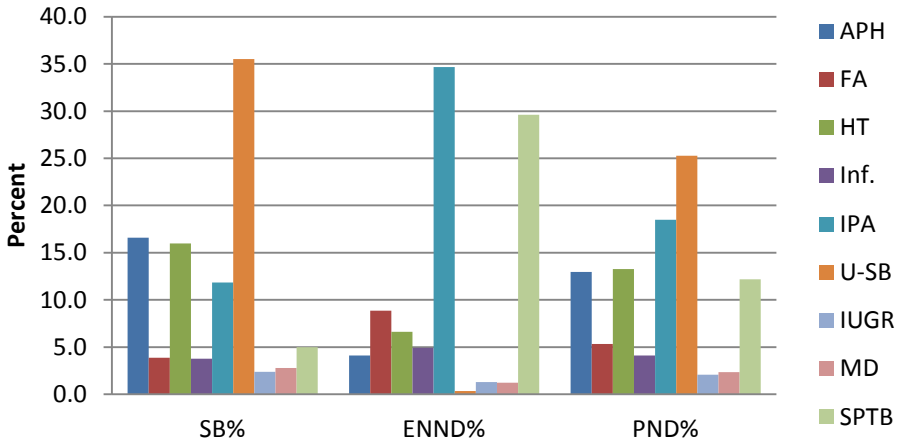


Figure 14. Distribution of primary obstetric causes and timing of perinatal deaths (1000g+)



There are 5 main primary obstetric categories of perinatal deaths (Unexplained stillbirth, intrapartum asphyxia, spontaneous preterm birth, hypertension and antepartum haemorrhage). Unexplained stillbirth is most common irrespective of whether 500g+ or 1000g+ is used for comparison. Spontaneous preterm birth and intrapartum asphyxia interchange the second and third places depending on the birth weight selected. Antepartum haemorrhage and hypertension are the next two categories. All other categories are minor compared with these 5 groups.

The importance of the unexplained stillbirth category has been ignored mostly because there is no apparent immediate intervention. It is estimated that the major causes of the unexplained stillbirths are undiagnosed intrauterine growth restriction and post-maturity, congenital infections and congenital abnormalities. PPIP v3 now includes gestation age as one of its data items; this now enables the estimation of growth of the perinatal deaths. When growth charts were applied to the unexplained stillbirth group a third of them are below the 10th centile for the growth charts of

Theron. This means of the unexplained stillbirths close to 2500 stillbirths over 500g and 1900 stillbirths over 2500g are potentially growth restricted. The condition of the mother is recorded at the time of birth and the vast majority of these mothers are reported as normal, i.e. no maternal condition was identified. The only way these babies could be detected would be if the fetus was identified as growing poorly or at risk in another way. To detect poor fetal growth symphysis fundus measurements are used, but these have a very poor ability to detect growth restricted babies. Another method would be to provide routine ultrasound scanning for all pregnant women. The public health system does not have the resources to implement this now. An option not tested at this stage is the use of continuous wave Doppler ultrasound for screening for growth restricted foetuses in the whole population. This has not been done before, and must be a high research priority. The CSIR along with the SA MRC has developed an *Umbiflow* apparatus that provides continuous wave Doppler ultrasound and can be linked to a normal laptop computer. This might bridge the device gap and allow for effective screening for growth restricted foetuses without the need for growth scans used in ultrasound.

1.7 Route of delivery

The route of delivery per level of care is shown in tables 14 and 15.

Table 14. Distribution of route of delivery and level of care for 2012-2013 (PPIP data)

	CHC	DH	RH	PT	NC	SA
Normal vaginal delivery	216892	482966	228295	39295	25382	992830
Ventouse delivery	169	3357	1594	254	451	5825
Forceps delivery	75	1219	624	89	143	2150
Vaginal breech delivery	1177	6021	3137	853	596	11784
Caesarean section	88	123281	125930	21958	24129	295386
Other (Destructive etc)	0	5	0	6	0	11
Delivery method unknown	11532	37261	26754	7015	21799	104361
Total	**229933**	**654110**	**386334**	**69470**	**72500**	**1412347**

Table 14. Distribution in percent of route of delivery and level of care for 2012-2013 (PPIP data)

Known route of delivery per level of care (%)	**CHC**	**DH**	**RH**	**PT**	**NC**	**SA**
Normal vaginal delivery	99.3	78.3	63.5	62.9	50.1	75.9
Ventouse delivery	0.1	0.5	0.4	0.4	0.9	0.4
Forceps delivery	0.0	0.2	0.2	0.1	0.3	0.2
Vaginal breech delivery	0.5	1.0	0.9	1.4	1.2	0.9
Caesarean section	0.0	20.0	35.0	35.2	47.6	22.6
Other (Destructive etc)	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0
Distribution of known route of delivery within level of care (%)						
Normal vaginal delivery	21.8	48.6	23.0	4.0	2.6	100.0
Ventouse delivery	2.9	57.6	27.4	4.4	7.7	100.0
Forceps delivery	3.5	56.7	29.0	4.1	6.7	100.0
Vaginal breech delivery	10.0	51.1	26.6	7.2	5.1	100.0
Caesarean section	0.0	41.7	42.6	7.4	8.2	100.0
Other (Destructive etc)	0.0	45.5	0.0	54.5	0.0	100.0
Total	16.7	47.2	27.5	4.8	3.9	100.0

Most caesarean sections are performed in district and regional hospitals. There are 42 regional hospitals which give an average number of caesarean section per hospital at approximately 4 per

day. There are 188 district hospitals and they are performing 1 caesarean section per day. This is for average district hospital conducting 2000 births per year. If the hospital is only conducting 500 births per year, then the number of caesarean sections is likely to be 1 or less per week. Can the skilled be maintained of the doctors give anaesthetic and doing the surgery at such a level?

1.8 Avoidable factors, missed opportunities and sub-standard care

Table 14 gives an overview of the number and distribution of cases per level of care where avoidable factors, missed opportunities and substandard care probably resulted in the death of the baby.

Table 14. Comparison of avoidable factors that probably resulted in the death of the infant (as assessed by their maternity unit) by level of care

Description	CHC		DH		RH		PT		NC	
	N	% of deaths	N	% of deaths	N	% of deaths	N	% of deaths	N	% of deaths
Total deaths	1828		18938		12123		4230		4931	
Administrative problems	80	4.4	1547	8.2	1034	8.5	345	8.2	159	3.2
Health care provider associated	221	12.1	4645	24.5	2670	22.0	932	22.0	476	9.7
Patient and family associated	630	34.5	5976	31.6	2938	24.2	1198	28.3	767	15.6
Insufficient notes to comment on avoidable factors	33	1.8	232	1.2	185	1.5	62	1.5	198	4

Table 15. Avoidable factors that probably impacted on the death of an infant (as assessed by their maternity unit) for each major disease category for babies over 500g

Birth Asphyxia (500g+)	Number	% of deaths
Deaths due to asphyxia	6082	
HEALTH CARE PROVIDER ASSOCIATED	2990	49.2
PATIENT AND FAMILY ASSOCIATED	1136	18.7
ADMINISTRATIVE PROBLEMS	960	15.8
Fetal distress not detected intrapartum; fetus monitored	510	8.4
Delay in seeking medical attention during labour	420	6.9
Fetal distress not detected intrapartum; fetus not monitored	282	4.6
Delay in referring patient for secondary/tertiary treatment	273	4.5
Delay in medical personnel calling for expert assistance	201	3.3
Management of 2nd stage: prolonged with no intervention	188	3.1
Booked late in pregnancy	184	3.0
Inappropriate response to poor fetal movements	177	2.9
Anaesthetic delay	151	2.5
Medical personnel underestimated fetal size	145	2.4

Table 15. Avoidable factors that probably impacted on the death of an infant (as assessed by their maternity unit) for each major disease category for babies over 500g (cont.)

Spontaneous preterm birth (500g+)	Number	% of deaths
Deaths due to spontaneous preterm birth	9273	
PATIENT AND FAMILY ASSOCIATED	2826	30.5
HEALTH CARE PROVIDER ASSOCIATED	1503	16.2
ADMINISTRATIVE PROBLEMS	970	10.5
Delay in seeking medical attention during labour	977	10.5
Never initiated antenatal care	815	8.8
Inadequate facilities/equipment in neonatal unit/nursery	407	4.4
Booked late in pregnancy	284	3.1
Inappropriate response to poor fetal movements	190	2.0
Neonatal care: management plan inadequate	182	2.0
Nosocomial infection	161	1.7
No accessible neonatal ICU bed with ventilator	123	1.3
Delay in referring patient for secondary/tertiary treatment	116	1.3
Neonatal care: inadequate monitoring	115	1.2
Antenatal steroids not given	112	1.2
Neonatal resuscitation inadequate	107	1.2
Antepartum Haemorrhage	**Number**	**% of deaths**
Deaths due to antepartum haemorrhage	4354	
PATIENT AND FAMILY ASSOCIATED	1129	25.9
HEALTH CARE PROVIDER ASSOCIATED	691	15.9
ADMINISTRATIVE PROBLEMS	232	5.3
Never initiated antenatal care	233	5.4
Inappropriate response to antepartum haemorrhage	203	4.7
Inappropriate response to poor fetal movements	173	4
Booked late in pregnancy	160	3.7
Delay in seeking medical attention during labour	153	3.5
Delay in referring patient for secondary/tertiary treatment	121	2.8
No response to maternal hypertension	107	2.5
Infrequent visits to antenatal clinic	61	1.4
Other medical personnel associated factors	49	1.1
Other patient associated factors	43	1
Incorrect management of antepartum haemorrhage	43	1
Hypertension	**Number**	**% of deaths**
Deaths due to complications of hypertension	6053	
HEALTH CARE PROVIDER ASSOCIATED	1759	29.1
PATIENT AND FAMILY ASSOCIATED	1630	26.9
ADMINISTRATIVE PROBLEMS	372	6.1
Inappropriate response to poor fetal movements	627	10.4
No response to maternal hypertension	507	8.4
Delay in referring patient for secondary/tertiary treatment	337	5.6
Booked late in pregnancy	293	4.8
Never initiated antenatal care	271	4.5
Failed to return on the prescribed date	101	1.7
Infrequent visits to antenatal clinic	92	1.5
Delay in seeking medical attention during labour	90	1.5
Declines admission/treatment for personal/social reasons	62	1
No dedicated high risk clinic at referral hospital	61	1

Table 15. Avoidable factors that probably impacted on the death of an infant (as assessed by their maternity unit) for each major disease category for babies over 500g (cont.)

Unexplained stillbirths	**Number**	**% of deaths**
Deaths due to unexplained stillbirths	9567	
PATIENT AND FAMILY ASSOCIATED	3312	34.6
HEALTH CARE PROVIDER ASSOCIATED	682	7.1
ADMINISTRATIVE PROBLEMS	162	1.7
Inappropriate response to poor fetal movements	1782	18.6
Never initiated antenatal care	454	4.7
Booked late in pregnancy	419	4.4
Delay in seeking medical attention during labour	289	3.0
Inadequate / No advice given to mother	101	1.1
Infrequent visits to antenatal clinic	91	1.0
Other patient associated factors	88	0.9
Other medical personnel associated factors	83	0.9
Failed to return on the prescribed date	65	0.7
Physical examination of patient at clinic incomplete	58	0.6
Delay in referring patient for secondary/tertiary treatment	53	0.6
No response to history of poor fetal movement	52	0.5
Immaturity related	**Number**	**% of deaths**
Neonatal deaths due to immaturity related	9273	
PATIENT AND FAMILY ASSOCIATED	2826	30.5
HEALTH CARE PROVIDER ASSOCIATED	1503	16.2
ADMINISTRATIVE PROBLEMS	970	10.5
Delay in seeking medical attention during labour	977	10.5
Never initiated antenatal care	815	8.8
Inadequate facilities/equipment in neonatal unit/nursery	407	4.4
Booked late in pregnancy	284	3.1
Inappropriate response to poor fetal movements	190	2.0
Neonatal care: management plan inadequate	182	2.0
Nosocomial infection	161	1.7
No accessible neonatal ICU bed with ventilator	123	1.3
Delay in referring patient for secondary/tertiary treatment	116	1.3
Neonatal care: inadequate monitoring	115	1.2
Antenatal steroids not given	112	1.2
Neonatal resuscitation inadequate	107	1.2
Hypoxia	**Number**	**% of deaths**
Deaths due to hypoxia	1507	
PATIENT AND FAMILY ASSOCIATED	449	29.8
HEALTH CARE PROVIDER ASSOCIATED	219	14.5
ADMINISTRATIVE PROBLEMS	119	7.9
Never initiated antenatal care	105	7
Inappropriate response to poor fetal movements	93	6.2
Booked late in pregnancy	65	4.3
Delay in seeking medical attention during labour	40	2.7
No response to positive syphilis serology test	26	1.7
Infrequent visits to antenatal clinic	21	1.4
Delay in seeking help when baby ill	19	1.3
Inadequate facilities/equipment in neonatal unit/nursery	18	1.2
Failed to return on the prescribed date	16	1.1
Delay in referring patient for secondary/tertiary treatment	15	1

In approximately 5% of perinatal deaths there was a direct human resources issue. This is probably higher as other avoidable factors, missed opportunities and sub-standard care also include some human resource factor, for example delay in referring a patient. Further the assessments of the

death are performed at the site where the death occurred, so the reporting of this factor is mostly likely to be under-reported.

Table 16. Direct human resources issues

Health care provider issues	All grades	Probable	% deaths
Personnel not sufficiently trained to manage patient	371	198	0.7%
Personnel too junior to manage patient	179	87	0.4%
Insufficient doctors available	258	159	0.6%
Insufficient nurses available	404	264	1.0%
Delay in doctor responding to call	341	208	0.7%
Doctor not respond to call	114	84	0.2%
Delay in calling for expert advice	712	386	2.7%
Delay in referring patient[*]	*1829*	*1058*	*4.3%*
Anaesthetic delay[*]	*217*	*194*	*0.5%*

[*] - Other issues also play a role in these factors

1.9 Summary of findings

1. PPIP gives good quality of care assessments in Free State, Mpumalanga, North Wes, and Western Cape; moderate in Limpopo and Northern Cape and poor in Eastern Cape, Gauteng and KwaZulu-Natal.
2. Sample size good, all levels of care well represented
3. Comparisons with 2010-2011 show similar values
4. The mortality rates per birth weight category are higher than expected for district hospitals in the 1000g-1999g categories, especially in early neonatal deaths
5. Perinatal care index highest in district hospitals
6. Unexplained stillbirth is the largest category of macerated stillbirths across all levels of care
7. Intrapartum birth asphyxia is the most common category in fresh stillbirths in CHCs and district hospitals
8. Most deaths occur in district hospitals, as well as most births. Mortality rates were the highest in district hospitals. **BUT** on average one district hospital will deliver a live born baby between 1000g and 1999g once every 5 days, and 12% (one in eight will be an early neonatal death). That is for the average district hospital delivering 2000 babies per year. If the hospital delivers 500 live babies per year, then they will deliver a live born between 1000g and 1999g every 20 days and two will die per year. The issue of resources that should be available, the cost effectiveness of district hospitals and accessibility are highlighted.
9. Most caesarean sections are performed in district and regional hospitals with the regional hospitals averaging 4 per day with the district hospitals averaging 1 per day (for an average of 2000 births per year). If the hospital does less than 500 deliveries per year, it will likely do less than 1 caesarean section per week. There is concern about maintaining skill levels for the surgery and anaesthetic at such frequencies.
10. Almost half of the deaths due to intrapartum asphyxia were thought to be probably preventable; the common problems being with fetal monitoring, use of the partogram and the second stage of labour.
11. Inadequate facilities were the most common avoidable factor in spontaneous preterm labour
12. In almost a third of babies dying due to complications of hypertension, hypertension was detected but NOT acted upon.
13. In almost one in five deaths which were unexplained stillbirths the patient was reported as not responding to poor fetal movements
14. Deaths due to immaturity were thought to be probably preventable if better facilities were available to the neonates
15. Health care provider issues were relatively rarely reported, but are significant in their nature. Unprofessional behaviour was found by doctors not responding to calls and lack of training also featured.

1.10 Recommendations

NaPeMMCO made its recommendations in 2011 for the 2008-2010 triennium. The recommendations are summarised as **HHAPINESS**.

- **H**ealth system improvement
- **H**ealth care provider training
- Reduced deaths due to **A**sphyxia
- Reduce deaths due to **P**rematurity
- Reduce deaths due to **I**nfection

This is incorporated in the **Ne**onatal **S**urvival **S**trategy

These recommendations still hold to day. However, to help achieve **HHAPINESS** some basic building blocks of the health system need to be in place. These are:

- Knowledgeable and skilled health care providers
- Appropriately resourced health care facilities (including equipment and human resources)
- Rapid inter-facility emergency transport system

These three key functions must be available to all pregnant women (including the less informed and most disadvantaged people). To achieve this attention should be paid to the **How** and **Who**. This can be summarised as the **5Cs**

How	Who
Care: Commitment to quality	- DCSTs to improve clinical governance, clinical supervision, response to local audit findings, and leadership functions - HCP to make themselves available for training and to participate in drills - Managers to ensure emergency drills performed regularly
Coverage	- District managers to ensure all effective interventions are implemented in maternity, especially for the poorest section of the population - EMS to ensure transport home to institution and between institutions
CPAP	- CEOs and district managers rationalise resources to ensure skills and facilities available 24/7 - HCP have skills institute nasal CPAP
Contraception	- All HCP to motivate people to prevent unwanted pregnancies - Managers to ensure various modalities are always available - WBOTs to identify women requiring contraception, and refer
Community involvement	- Health facility management to engage with community health committees - WBOTs convey the essential maternity and baby care messages to all pregnant and postnatal women

HCP – Health Care Professional; DCSTs – District Clinical Specialist Teams; CEOs – Chief Executive Officers; WBOTs – Ward Based Outreach Teams; CS - Caesarean Section

Monitoring and evaluation

The effect of implementation of these recommendations can be **monitored and evaluated** by assessing the emergency obstetric care signal functions. This can be linked with the neonatal emergency care signal functions as some of the major neonatal emergency care signal functions occur in the antenatal period. This will promote the integration of maternal and neonatal services. Table 1 shows the obstetric and neonatal signal functions.

Table 1. Obstetric and neonatal signal functions.[i]

Dimensions of Facility Care	Obstetric	Neonatal
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
	Infection prevention measures (hand-washing, gloves)	Immediate and exclusive breastfeeding
	Active management of third stage of labour (AMTSL)	Infection prevention including hygienic cord care
	HIV and TB Screening and treatment	PMTCT if HIV-positive mother
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 if baby unable to breastfeed
	Removal of retained products of conception	Injectable antibiotics for neonatal sepsis
	ARVs for mother	
C. Comprehensive emergency care (functions in addition to Basic)		
	Surgery (e.g., C-section) including anaesthesia	Intravenous fluids
	Blood transfusion	Safe administration of oxygen

The signal functions are measures of life saving services, thus giving Magnesium Sulphate is a measure of being able to manage severe hypertension and eclampsia; ability to give oxytocin is a measure of being able to manage obstetric haemorrhage etc.

[1]Adapted from 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

Section 2

2.1 Mortality indices for provinces and districts for babies 500g+ (from PPIP 2012-2013)

Provinces Districts	All birth weights 500g+	Stillbirths 500g+	ENND 500g+	Total Deaths 500g+	Live births 500g+	500g+ PNMR	500g+ SBR	500g+ ENNDR
. - Eastern Cape	**142371**	**3259**	**1797**	**5056**	**139112**	**35.51**	**22.89**	**12.92**
.. + Alfred Nzo	11143	181	113	294	10962	26.38	16.24	10.31
.. + Amathole	40142	1047	512	1559	39095	38.84	26.08	13.10
.. + Cacadu	12888	285	121	406	12603	31.50	22.11	9.60
.. + Chris Hani	33442	638	361	999	32804	29.87	19.08	11.00
.. + Joe Gqabi	306	11	6	17	295	55.56	35.95	20.34
.. + NM Metro	15103	220	51	271	14883	17.94	14.57	3.43
.. + OR Tambo	24570	809	577	1386	23761	56.41	32.93	24.28
.. + Ukhahlamba	4777	68	56	124	4709	25.96	14.23	11.89
. - Free State	**89563**	**2556**	**1157**	**3713**	**87007**	**41.46**	**28.54**	**13.30**
.. + Fezile Dabe	16233	438	219	657	15795	40.47	26.98	13.87
.. + Lejweleputswa	22688	612	328	940	22076	41.43	26.97	14.86
.. + Mangaung	24468	778	320	1098	23690	44.87	31.80	13.51
.. + T Mofutsanyane	23947	679	265	944	23268	39.42	28.35	11.39
.. + Xhariep	2227	49	25	74	2178	33.23	22.00	11.48
. - Gauteng	**290656**	**6320**	**2594**	**8914**	**284336**	**30.67**	**21.74**	**9.12**
.. + Ekurhuleni	113121	2463	1164	3627	110658	32.06	21.77	10.52
.. + Jhb Metro	45540	941	542	1483	44599	32.56	20.66	12.15
.. + Sedibeng	29922	627	205	832	29295	27.81	20.95	7.00
.. + Tshwane	69425	1147	501	1648	68278	23.74	16.52	7.34
.. + West Rand	32648	1142	182	1324	31506	40.55	34.98	5.78
. - KwaZulu Natal	**204660**	**5364**	**2411**	**7775**	**199296**	**37.99**	**26.21**	**12.10**
.. + Amajuba	1159	12	7	19	1147	16.39	10.35	6.10
.. + eThekwini	45546	1460	543	2003	44086	43.98	32.06	12.32
.. + iLembe	1507	40	13	53	1467	35.17	26.54	8.86
.. + Sisonke	17690	324	236	560	17366	31.66	18.32	13.59
.. + Ugu	20515	473	195	668	20042	32.56	23.06	9.73
.. + uMgungundlovu	19141	578	260	838	18563	43.78	30.20	14.01
.. + Umkhanyakude	15090	295	138	433	14795	28.69	19.55	9.33
.. + Umzinyathi	15379	267	186	453	15112	29.46	17.36	12.31
.. + Uthukela	19726	543	299	842	19183	42.68	27.53	15.59
.. + Uthungulu	35846	1119	417	1536	34727	42.85	31.22	12.01
.. + Zululand	13061	253	117	370	12808	28.33	19.37	9.13
. - Limpopo	**207829**	**4594**	**2530**	**7124**	**203235**	**34.28**	**22.10**	**12.45**
.. + Capricorn	49160	1300	651	1951	47860	39.69	26.44	13.60
.. + Mopani	39077	979	613	1592	38098	40.74	25.05	16.09
.. + Sekhukhune	41968	890	450	1340	41078	31.93	21.21	10.95
.. + Vhembe	56746	974	547	1521	55772	26.80	17.16	9.81
.. + Waterberg	20878	451	269	720	20427	34.49	21.60	13.17
. - Mpumalanga	**156466**	**3526**	**1574**	**5100**	**152940**	**32.59**	**22.54**	**10.29**
.. + Ehlanzeni	77617	1531	830	2361	76086	30.42	19.73	10.91
.. + Gert Sibande	36669	898	351	1249	35771	34.06	24.49	9.81
.. + Nkangala	42180	1097	393	1490	41083	35.32	26.01	9.57
. - North West	**109347**	**2533**	**958**	**3491**	**106814**	**31.93**	**23.16**	**8.97**
.. + Bojanala	36698	872	302	1174	35826	31.99	23.76	8.43
.. + Dr K Kaunda	23356	593	227	820	22763	35.11	25.39	9.97
.. + NM Molema	30325	690	304	994	29635	32.78	22.75	10.26
.. + Ruth Segomotsi	18968	378	125	503	18590	26.52	19.93	6.72

Provinces Districts	All birth weights 500g+	Stillbirths 500g+	ENND 500g+	Total Deaths 500g+	Live births 500g+	500g+ PNMR	500g+ SBR	500g+ ENNDR
. - Northern Cape	**37923**	**998**	**460**	**1458**	**36925**	**38.45**	**26.32**	**12.46**
.. + Frances Baard	12564	384	180	564	12180	44.89	30.56	14.78
.. + JT Gaetsewe	10058	281	112	393	9777	39.07	27.94	11.46
.. + Namakwa	2521	47	25	72	2474	28.56	18.64	10.11
.. + Pixley ka Semme	5946	93	66	159	5853	26.74	15.64	11.28
.. + Siyanda	6834	193	77	270	6641	39.51	28.24	11.59
. - Western Cape	**181549**	**3708**	**1244**	**4952**	**177841**	**27.28**	**20.42**	**7.00**
.. + CT Metro	121578	2585	738	3323	118993	27.33	21.26	6.20
.. + Cape Winelands	15624	287	98	385	15337	24.64	18.37	6.39
.. + Central Karoo	2326	61	25	86	2265	36.97	26.23	11.04
.. + Eden	17097	353	144	497	16744	29.07	20.65	8.60
.. + Overberg	15241	271	167	438	14970	28.74	17.78	11.16
.. + West Coast	9683	151	72	223	9532	23.03	15.59	7.55

2.2 Mortality indices for provinces and districts for babies 1000g+ (from PPIP data 2012-2013)*

Provinces Districts	All births 1000g+	SB 1000g+	ENND 1000+	All deaths 1000g+	Live births 1000g+	PNMR 1000g+	SBR 1000g+	ENND 1000g+
. - Eastern Cape	**140956**	**2608**	**1341**	**3949**	**138348**	**28.02**	**18.50**	**9.69**
.. + Alfred Nzo	11100	165	96	261	10935	23.51	14.86	8.78
.. + Amathole	39599	820	337	1157	38779	29.22	20.71	8.69
.. + Cacadu	12711	193	75	268	12518	21.08	15.18	5.99
.. + Chris Hani	33241	557	287	844	32684	25.39	16.76	8.78
.. + Joe Gqabi District	302	8	6	14	294	46.36	26.49	20.41
.. + NM Metro	14970	147	33	180	14823	12.02	9.82	2.23
.. + OR Tambo	24273	657	457	1114	23616	45.89	27.07	19.35
.. + Ukhahlamba	4760	61	50	111	4699	23.32	12.82	10.64
. - Free State	**88219**	**1877**	**840**	**2717**	**86342**	**30.80**	**21.28**	**9.73**
.. + Fezile Dabe	16060	340	179	519	15720	32.32	21.17	11.39
.. + Lejweleputswa	22355	433	235	668	21922	29.88	19.37	10.72
.. + Mangaung	23893	508	209	717	23385	30.01	21.26	8.94
.. + T Mofutsanyane	23711	561	198	759	23150	32.01	23.66	8.55
.. + Xhariep	2200	35	19	54	2165	24.55	15.91	8.78
. - Gauteng	**286808**	**4734**	**1651**	**6385**	**282074**	**22.26**	**16.51**	**5.85**
.. + Ekurhuleni	111729	1761	751	2512	109968	22.48	15.76	6.83
.. + Jhb Metro	44855	611	304	915	44244	20.40	13.62	6.87
.. + Sedibeng	29672	479	151	630	29193	21.23	16.14	5.17
.. + Tshwane	68048	779	316	1095	67269	16.09	11.45	4.70
.. + West Rand	32504	1104	129	1233	31400	37.93	33.97	4.11
. - KwaZulu Natal	**201921**	**3977**	**1643**	**5620**	**197944**	**27.83**	**19.70**	**8.30**
.. + Amajuba	1154	11	5	16	1143	13.86	9.53	4.37
.. + eThekwini	44777	1024	307	1331	43753	29.73	22.87	7.02
.. + iLembe	1487	28	8	36	1459	24.21	18.83	5.48
.. + Sisonke	17567	267	193	460	17300	26.19	15.20	11.16
.. + Ugu	20278	361	134	495	19917	24.41	17.80	6.73
.. + uMgungundlovu	18723	385	163	548	18338	29.27	20.56	8.89
.. + Umkhanyakude	14974	215	109	324	14759	21.64	14.36	7.39
.. + Umzinyathi	15308	235	155	390	15073	25.48	15.35	10.28
.. + Uthukela	19456	406	210	616	19050	31.66	20.87	11.02
.. + Uthungulu	35256	842	277	1119	34414	31.74	23.88	8.05
.. + Zululand	12941	203	82	285	12738	22.02	15.69	6.44
. - Limpopo	**206051**	**3842**	**1915**	**5757**	**202209**	**27.94**	**18.65**	**9.47**
.. + Capricorn	48463	1012	449	1461	47451	30.15	20.88	9.46
.. + Mopani	38723	818	461	1279	37905	33.03	21.12	12.16
.. + Sekhukhune	41724	795	378	1173	40929	28.11	19.05	9.24
.. + Vhembe	56438	849	425	1274	55589	22.57	15.04	7.65
.. + Waterberg	20703	368	202	570	20335	27.53	17.78	9.93
. - Mpumalanga	**155029**	**2851**	**1159**	**4010**	**152178**	**25.87**	**18.39**	**7.62**
.. + Ehlanzeni	76999	1268	609	1877	75731	24.38	16.47	8.04
.. + Gert Sibande	36398	744	276	1020	35654	28.02	20.44	7.74
.. + Nkangala	41632	839	274	1113	40793	26.73	20.15	6.72
. - North West	**108084**	**1963**	**700**	**2663**	**106121**	**24.64**	**18.16**	**6.60**
.. + Bojanala	36324	676	217	893	35648	24.58	18.61	6.09
.. + Dr K Kaunda	22957	403	144	547	22554	23.83	17.55	6.38
.. + NM Molema	29961	562	233	795	29399	26.53	18.76	7.93
.. + Ruth Segomotsi	18842	322	106	428	18520	22.72	17.09	5.72

Provinces Districts	All births 1000g+	SB 1000g+	ENND 1000+	All deaths 1000g+	Live births 1000g+	PNMR 1000g+	SBR 1000g+	ENND 1000g+
. - Northern Cape	**37212**	**701**	**272**	**973**	**36511**	**26.15**	**18.84**	**7.45**
.. + Frances Baard	12196	237	78	315	11959	25.83	19.43	6.52
.. + JT Gaetsewe	9978	232	96	328	9746	32.87	23.25	9.85
.. + Namakwa	2483	28	14	42	2455	16.92	11.28	5.70
.. + Pixley ka Semme	5861	72	39	111	5789	18.94	12.28	6.74
.. + Siyanda	6694	132	45	177	6562	26.44	19.72	6.86
. - Western Cape	**178342**	**2191**	**605**	**2796**	**176151**	**15.68**	**12.29**	**3.43**
.. + Cape Town Metro	119358	1543	378	1921	117815	16.09	12.93	3.21
.. + Cape Winelands	15426	171	45	216	15255	14.00	11.09	2.95
.. + Central Karoo	2275	32	13	45	2243	19.78	14.07	5.80
.. + Eden	16743	206	63	269	16537	16.07	12.30	3.81
.. + Overberg	14989	159	67	226	14830	15.08	10.61	4.52
.. + West Coast	9551	80	39	119	9471	12.46	8.38	4.12

* - Eastern Cape, Gauteng and KwaZulu-Natal have more than 25% of births not registered on PPIP and the data for them must be treated with caution.

2.3 Mortality ranked per district for PNMR, SBR and ENNDR (babies 1000g+)

Districts	Ranked PNMR 1000g+	SBR 1000g+	ENND 1000g+	Districts	PNMR 1000g+	Ranked SBR 1000g+	ENNDR 1000g+	District	PNMR 1000g+	SBR 1000g+	Ranked ENNDR 1000g+
.. + Joe Gqabi District	46.36	26.49	20.41	.. + West Rand	37.93	33.97	4.11	.. + Joe Gqabi District	46.36	26.49	20.41
.. + OR Tambo	45.89	27.07	19.35	.. + OR Tambo	45.89	27.07	19.35	.. + OR Tambo	45.89	27.07	19.35
.. + West Rand	37.93	33.97	4.11	.. + Joe Gqabi District	46.36	26.49	20.41	.. + Mopani	33.03	21.12	12.16
.. + Mopani	33.03	21.12	12.16	.. + Uthungulu	31.74	23.88	8.05	.. + Fezile Dabe	32.32	21.17	11.39
.. + JT Gaetsewe	32.87	23.25	9.85	.. + T Mofutsanyane	32.01	23.66	8.55	.. + Sisonke	26.19	15.20	11.16
.. + Fezile Dabe	32.32	21.17	11.39	.. + JT Gaetsewe	32.87	23.25	9.85	.. + Uthukela	31.66	20.87	11.02
.. + T Mofutsanyane	32.01	23.66	8.55	.. + eThekwini	29.73	22.87	7.02	.. + Lejweleputswa	29.88	19.37	10.72
.. + Uthungulu	31.74	23.88	8.05	. - Free State	30.80	21.28	9.73	.. + Ukhahlamba	23.32	12.82	10.64
.. + Uthukela	31.66	20.87	11.02	.. + Mangaung	30.01	21.26	8.94	.. + Umzinyathi	25.48	15.35	10.28
. - Free State	30.80	21.28	9.73	.. + Fezile Dabe	32.32	21.17	11.39	.. + Waterberg	27.53	17.78	9.93
.. + Capricorn	30.15	20.88	9.46	.. + Mopani	33.03	21.12	12.16	.. + JT Gaetsewe	32.87	23.25	9.85
.. + Mangaung	30.01	21.26	8.94	.. + Capricorn	30.15	20.88	9.46	. - Free State	30.80	21.28	9.73
.. + Lejweleputswa	29.88	19.37	10.72	.. + Uthukela	31.66	20.87	11.02	. - Eastern Cape	28.02	18.50	9.69
.. + eThekwini	29.73	22.87	7.02	.. + Amathole	29.22	20.71	8.69	. - Limpopo	27.94	18.65	9.47
.. + uMgungundlovu	29.27	20.56	8.89	.. + uMgungundlovu	29.27	20.56	8.89	.. + Capricorn	30.15	20.88	9.46
.. + Amathole	29.22	20.71	8.69	.. + Gert Sibande	28.02	20.44	7.74	.. + Sekhukhune	28.11	19.05	9.24
.. + Sekhukhune	28.11	19.05	9.24	.. + Nkangala	26.73	20.15	6.72	.. + Mangaung	30.01	21.26	8.94
.. + Gert Sibande	28.02	20.44	7.74	.. + Siyanda	26.44	19.72	6.86	.. + uMgungundlovu	29.27	20.56	8.89
. - Eastern Cape	28.02	18.50	9.69	. - KwaZulu Natal	27.83	19.70	8.30	.. + Chris Hani	25.39	16.76	8.78
. - Limpopo	27.94	18.65	9.47	.. + Frances Baard	25.83	19.43	6.52	.. + Alfred Nzo	23.51	14.86	8.78
. - KwaZulu Natal	27.83	19.70	8.30	.. + Lejweleputswa	29.88	19.37	10.72	.. + Xhariep	24.55	15.91	8.78
.. + Waterberg	27.53	17.78	9.93	.. + Sekhukhune	28.11	19.05	9.24	.. + Amathole	29.22	20.71	8.69
.. + Nkangala	26.73	20.15	6.72	. - Northern Cape	26.15	18.84	7.45	.. + T Mofutsanyane	32.01	23.66	8.55
.. + Ngaka Modiri Molema	26.53	18.76	7.93	.. + iLembe	24.21	18.83	5.48	. - KwaZulu Natal	27.83	19.70	8.30
.. + Siyanda	26.44	19.72	6.86	.. + NM Molema	26.53	18.76	7.93	.. + Uthungulu	31.74	23.88	8.05
.. + Sisonke	26.19	15.20	11.16	. - Limpopo	27.94	18.65	9.47	.. + Ehlanzeni	24.38	16.47	8.04
. - Northern Cape	26.15	18.84	7.45	.. + Bojanala	24.58	18.61	6.09	.. + Ngaka Modiri Molema	26.53	18.76	7.93
. - Mpumalanga	25.87	18.39	7.62	. - Eastern Cape	28.02	18.50	9.69	.. + Gert Sibande	28.02	20.44	7.74
.. + Frances Baard	25.83	19.43	6.52	. - Mpumalanga	25.87	18.39	7.62	.. + Vhembe	22.57	15.04	7.65
.. + Umzinyathi	25.48	15.35	10.28	. - North West	24.64	18.16	6.60	. - Mpumalanga	25.87	18.39	7.62
.. + Chris Hani	25.39	16.76	8.78	.. + Ugu	24.41	17.80	6.73	. - Northern Cape	26.15	18.84	7.45
. - North West	24.64	18.16	6.60	.. + Waterberg	27.53	17.78	9.93	.. + Umkhanyakude	21.64	14.36	7.39
.. + Bojanala	24.58	18.61	6.09	.. + Dr K Kaunda	23.83	17.55	6.38	.. + eThekwini	29.73	22.87	7.02
.. + Xhariep	24.55	15.91	8.78	.. + Ruth Segomotsi	22.72	17.09	5.72	.. + Jhb Metro	20.40	13.62	6.87
.. + Ugu	24.41	17.80	6.73	.. + Chris Hani	25.39	16.76	8.78	.. + Siyanda	26.44	19.72	6.86

.. + Ehlanzeni	24.38	16.47	8.04	. - Gauteng	22.26	16.51	5.85	.. + Ekurhuleni	22.48	15.76	6.83
.. + iLembe	24.21	18.83	5.48	.. + Ehlanzeni	24.38	16.47	8.04	.. + Pixley ka Semme	18.94	12.28	6.74
.. + Dr K Kaunda	23.83	17.55	6.38	.. + Sedibeng	21.23	16.14	5.17	.. + Ugu	24.41	17.80	6.73
.. + Alfred Nzo	23.51	14.86	8.78	.. + Xhariep	24.55	15.91	8.78	.. + Nkangala	26.73	20.15	6.72
.. + Ukhahlamba	23.32	12.82	10.64	.. + Ekurhuleni	22.48	15.76	6.83	. - North West	24.64	18.16	6.60
.. + Ruth Segomotsi	22.72	17.09	5.72	.. + Zululand	22.02	15.69	6.44	.. + Frances Baard	25.83	19.43	6.52
.. + Vhembe	22.57	15.04	7.65	.. + Umzinyathi	25.48	15.35	10.28	.. + Zululand	22.02	15.69	6.44
.. + Ekurhuleni	22.48	15.76	6.83	.. + Sisonke	26.19	15.20	11.16	.. + Dr K Kaunda	23.83	17.55	6.38
. - Gauteng	22.26	16.51	5.85	.. + Cacadu	21.08	15.18	5.99	.. + Bojanala	24.58	18.61	6.09
.. + Zululand	22.02	15.69	6.44	.. + Vhembe	22.57	15.04	7.65	.. + Cacadu	21.08	15.18	5.99
.. + Umkhanyakude	21.64	14.36	7.39	.. + Alfred Nzo	23.51	14.86	8.78	. - Gauteng	22.26	16.51	5.85
.. + Sedibeng	21.23	16.14	5.17	.. + Umkhanyakude	21.64	14.36	7.39	.. + Central Karoo	19.78	14.07	5.80
.. + Cacadu	21.08	15.18	5.99	.. + Central Karoo	19.78	14.07	5.80	.. + Ruth Segomotsi	22.72	17.09	5.72
.. + Jhb Metro	20.40	13.62	6.87	.. + Jhb Metro	20.40	13.62	6.87	.. + Namakwa	16.92	11.28	5.70
.. + Central Karoo	19.78	14.07	5.80	.. + Cape Town Metro	16.09	12.93	3.21	.. + iLembe	24.21	18.83	5.48
.. + Pixley ka Semme	18.94	12.28	6.74	.. + Ukhahlamba	23.32	12.82	10.64	.. + Sedibeng	21.23	16.14	5.17
.. + Namakwa	16.92	11.28	5.70	.. + Eden	16.07	12.30	3.81	.. + Tshwane	16.09	11.45	4.70
.. + Cape Town Metro	16.09	12.93	3.21	. - Western Cape	15.68	12.29	3.43	.. + Overberg	15.08	10.61	4.52
.. + Tshwane	16.09	11.45	4.70	.. + Pixley ka Semme	18.94	12.28	6.74	.. + Amajuba	13.86	9.53	4.37
.. + Eden	16.07	12.30	3.81	.. + Tshwane	16.09	11.45	4.70	.. + West Coast	12.46	8.38	4.12
. - Western Cape	15.68	12.29	3.43	.. + Namakwa	16.92	11.28	5.70	.. + West Rand	37.93	33.97	4.11
.. + Overberg	15.08	10.61	4.52	.. + Cape Winelands	14.00	11.09	2.95	.. + Eden	16.07	12.30	3.81
.. + Cape Winelands	14.00	11.09	2.95	.. + Overberg	15.08	10.61	4.52	. - Western Cape	15.68	12.29	3.43
.. + Amajuba	13.86	9.53	4.37	.. + N Mandela Metro	12.02	9.82	2.23	.. + Cape Town Metro	16.09	12.93	3.21
.. + West Coast	12.46	8.38	4.12	.. + Amajuba	13.86	9.53	4.37	.. + Cape Winelands	14.00	11.09	2.95
.. + Nelson Mandela Metro	12.02	9.82	2.23	.. + West Coast	12.46	8.38	4.12	.. + Nelson Mandela Metro	12.02	9.82	2.23

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