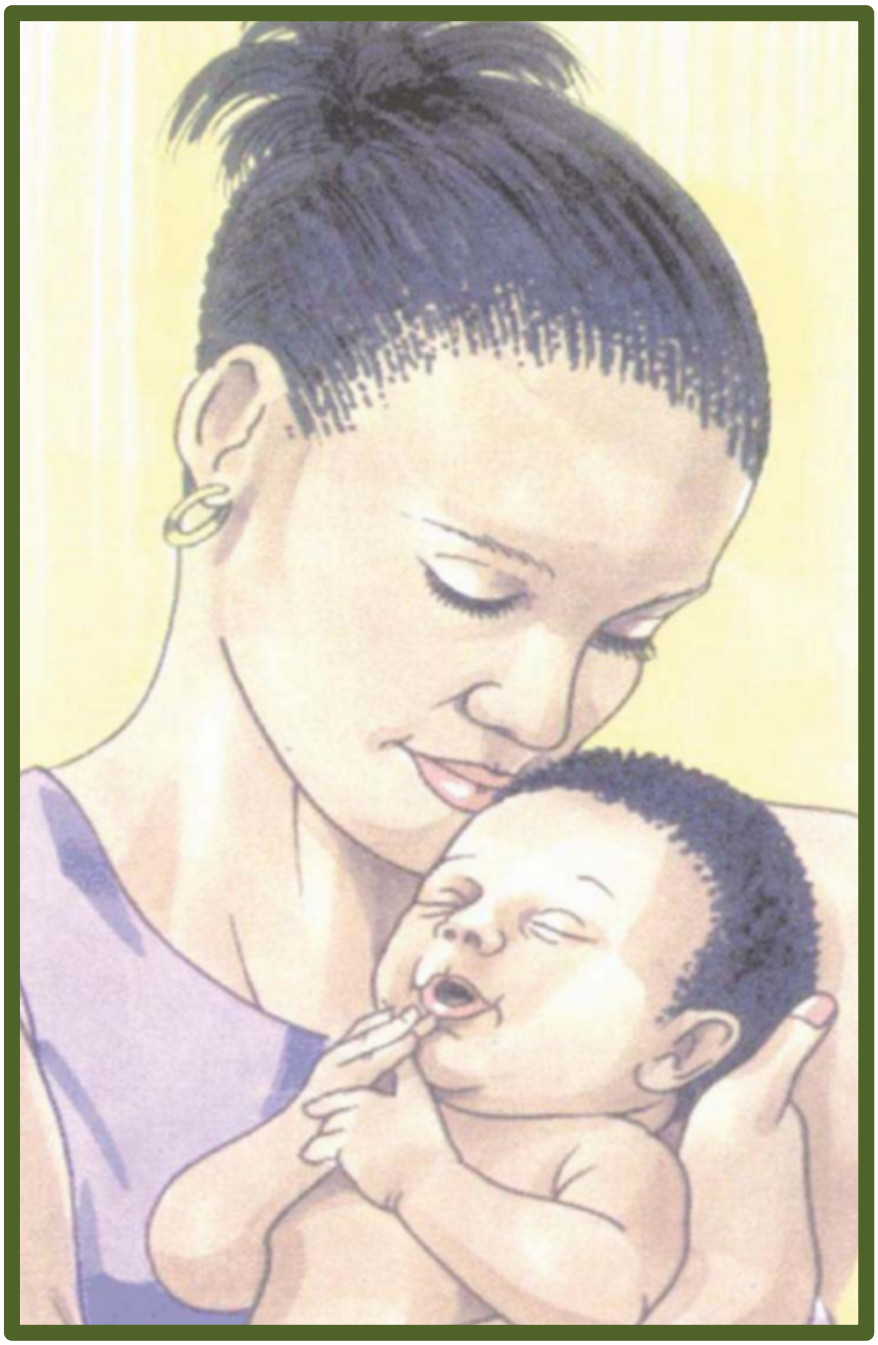
NATIONAL PERINATAL MORBIDITY AND MORTALITY COMMITTEE

(NaPeMMCo)



SAVING BABIES: ANNUAL REPORT 2018

(DATA for the YEAR 2017)

Contents

LIST OF ABBREVIATIONS

ANS	Antenatal Corticosteroids
CHC	Community Health Centre
DCST	District Clinical Specialist Teams
DHIS	District Health Information System
DHP	District Health Plan
ENNDR	Early Neonatal Death Rate
ENND	Early Neonatal Deaths
ESMOE	Essential Steps in Managing Obstetric Emergencies
HIC	High Income Country
KMC	Kangaroo Mother Care
LBWR	Low Birth Rate Weight
LB	Live Birth
LMIC	Low- to Middle Income Country
LNNDR	Late Neonatal Death Rate
MDG	Millennium Development Goals
MNCH	Maternal Neonatal And Child Health
MNCWH	Maternal Neonatal, Child and Women's Health
NaPeMMCo	National Perinatal Mortality and Morbidity Committee
NBC	Newborn Care
NCCEMD	National Committee for the Confidential Enquiry into Maternal Deaths
NDOH	National Department of Health
NMR	Neonatal Mortality Rate
NSF	Neonatal Signal Functions
PNMR	Perinatal Mortality Rate
PPIP	Perinatal Problem Identification Program
RTC	Regional Training Centres
SB	Still Birth
SBR	Still Birth Rate
SDG	Sustainable Development Goal
TB	Total Births
U5MR	Under-5 Mortality Rate

Provinces:

EC	Eastern Cape
FS	Free State
GP	Gauteng
KZN	KwaZulu-Natal
LP	Limpopo
MP	Mpumalanga
NC	Northern Cape
NW	North West Province
WC	Western Cape

DEFINITIONS OF NEONATAL AND MATERNAL INDICATORS

ABBREVIATION	EXPLANATION	CALCULATION	INDICATOR FOR:
NMR	Neonatal Mortality Rate	total number of neonatal deaths / Total number of LIVE births x 1000	overall neonatal care HIC< 6 LMIC <12 (SDG)
ENMR	Early Neonatal Mortality Rate	total number of neonatal deaths in 1st week / Total number of LIVE births x 1000	intrapartum care, and the quality of neonatal care in the facility where baby is born
LNMR	Late Neonatal Mortality Rate	total number of neonatal deaths from day 7 to day 27/ Total number of LIVE births x 1000	neonatal care in hospital, community or at home
LBWR	Low Birth Weight Rate	total number of births <2,5kg / Total number of births X100	socio-economic status of an area
SBR	Stillbirth Rate	total number of stillbirths / Total number of births x 1000	quality of intrapartum obstetric care
PNMR	Perinatal Mortality Rate	total number of perinatal deaths (SB+END) / Total number of births x 1000	indicator of obstetric care
SB:NND	Still Births To Neonatal Deaths Ratio	no. of stillbirths for every neonatal death	perinatal environment care
PCI	Perinatal Care Index	overall PNMR / % low birth weight babies High PCI = poor care	used to compare hospitals with similar circumstances

- A viable live born baby from birth to 28 days is called a neonate
- Neonatal deaths are subdivided into:
    - early (day 0 to day 6 completed)

    - late (day 7 to day 27 completed)
- A still birth is a viable baby born dead
- Functional PPIP = facility that captures all deliveries, births and perinatal deaths, enters & identifies the causes of deaths at regular mortality and morbidity meetings, institutes management change and policies as a result of the facility data and provides feedback to the facility

Executive summary

The last NaPeMMCo triennial report was for the period 2014-2016 and this current report presents data for 2017 from the DHIS as well as PPIP with graphs showing trends since 2002. Where appropriate comparisons are also made with data from the previous triennial reports.

In addition, three chapters have been added to highlight recommendations made by NaPeMMCo in previous reports. The aim is that this annual report will find a wider readership as the triennial report is only produced every three years and recommendations may come too late to address specific problems. One example is the current outbreak of Carbapenem-Resistant Enterobacteriaceae (CRE) in the Western Cape and sporadic reports of outbreaks of resistant organisms in nurseries and NICUs in SA. In chapter III, a group of experts discuss the burden of hospital-acquired infection and infection outbreaks in neonatal facilities in SA and an example of a response to this challenge is presented in chapter IV.

NaPeMMCo recommended the implementation of nasal CPAP in a phased approach into select District Hospitals in the Interim 2010-2011 Report. While this has been very successful in many sites and has undoubtedly saved the lives of many preterm and term neonates with respiratory distress, there are other sites where significant challenges and practical obstacles have been experienced. In Chapter II, a report on some of the challenges from an outreach perspective in the Eastern Cape is presented.

It is evident from the data presented that there are no major changes since the last triennial report, therefor there are no new recommendations. Instead, especially for new readers, a complete summary of NaPeMMCo activities and recommendations since its inception is given as an appendix.

GS Gebhardt, chair

CHAPTER 1: NATIONAL PERINATAL DATA 2017

This interim report will only deal with the perinatal data from the DHIS (raw numbers) and PPIP (perinatal causes) for the calendar year January to December 2017.

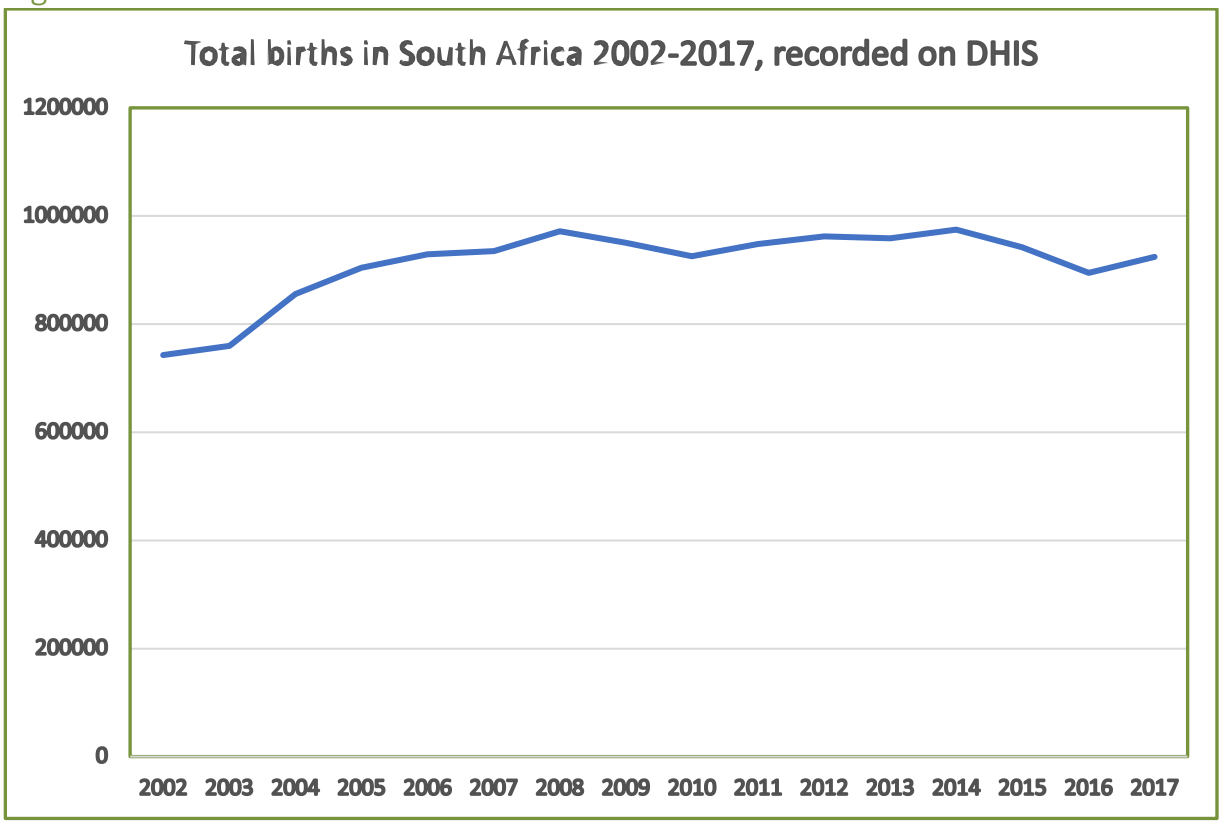
GS Gebhardt and N Rhoda

Perinatal trends 2017 (with comparisons from 2002-2017).

National data

There were 924 764 babies born during 2017 in SA, slightly more than in 2016. The total number of deliveries per year, as recorded on DHIS, is given in Table 1 (see below) and graphically presented in Figure 1.

Figure 1- Total births in SA 2002-2017



The total number of births and perinatal deaths, as recorded on DHIS since 2011 and used for calculation of rates is presented in Table 1.

Table 1: Actual number of births and perinatal deaths 2011-2017

	2011	2012	2013	2014	2015	2016	2017
Live births	926 856	941 186	937 922	954 355	922 378	876 752	905 398
Stillbirths	20 973	20 876	207 53	20 384	19 758	18 058	19 366
NND	9 325	9 665	9 278	9 780	9 562	8 961	9 094
Total births	947 829	962 062	958 675	974 739	942 136	894 810	924 764

For 2017, DHIS recorded 924 764 total births and PPIP 734 277 (80% of DHIS). This represents a 20% data gap between DHIS and PPIP. The data gap per province is given in Table 2.

Table 2: Data gap between DHIS and PPIP for Jan – Dec 2017

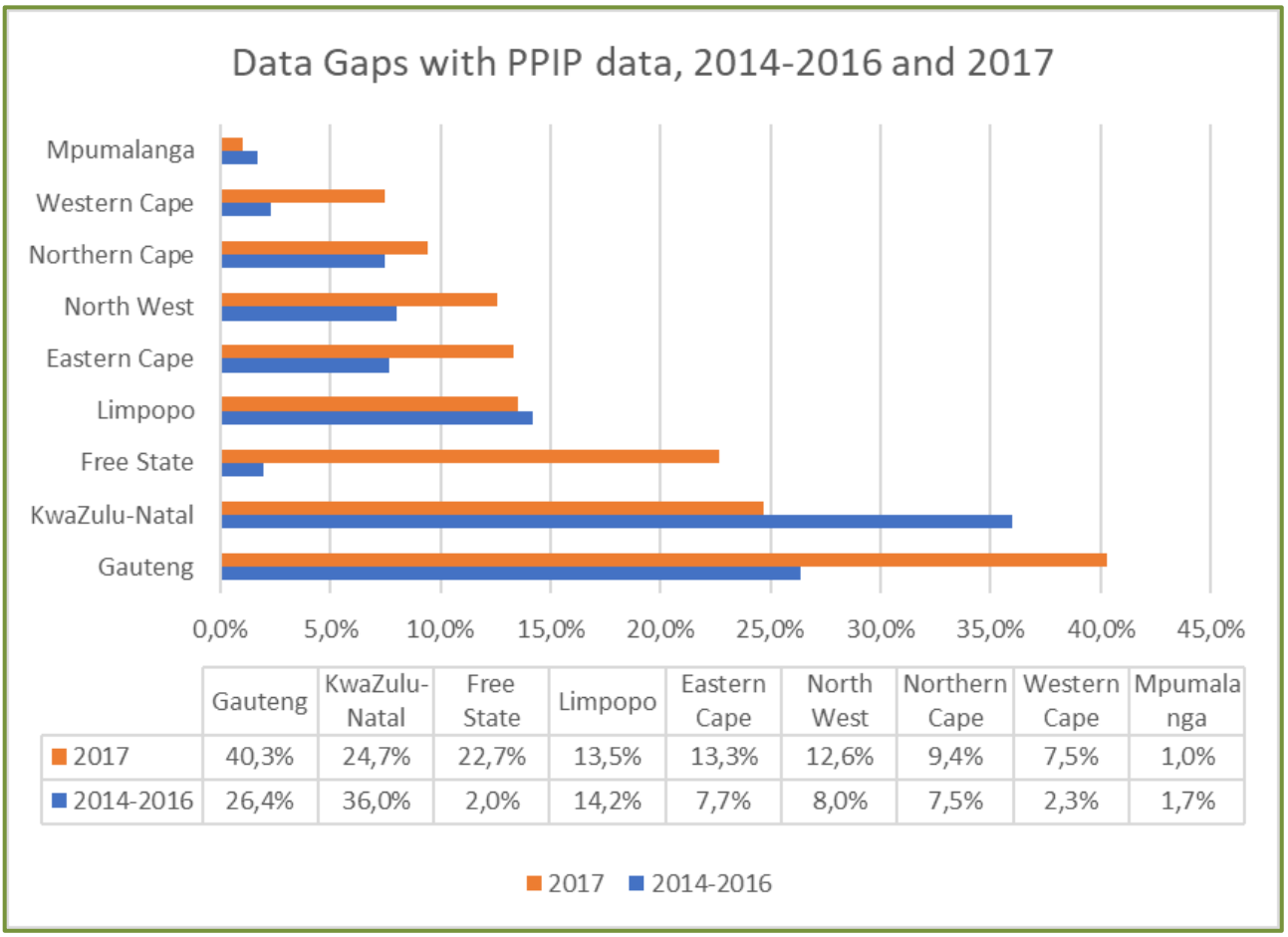
PROVINCE	DHIS	PPIP	Data gap
Eastern Cape	101902	88333	13,3%
Free State	45769	35398	22,7%
Gauteng	218149	130136	40,3%
KwaZulu-Natal	184828	139149	24,7%
Limpopo	121728	105267	13,5%
Mpumalanga	77239	76446	1,0%
North West	57228	49993	12,6%
Northern Cape	20918	18950	9,4%
Western Cape	97003	89720	7,5%
RSA	**924764**	**733332**	20,7%

The provinces with the major data gaps remain Gauteng and KZN, but where KZN has improved on their PPIP capture, Gauteng only records about 60% of their delivery data on PPIP. Any planning based on PPIP data becomes challenging in planning accurately both from a human

resource and financial perspective. It is, therefore, imperative that this data gap be addressed as a matter of urgency as this is an ongoing data gap documented since 2010.

The data gaps per province, as compared to the previous triennial report, is graphically represented in Figure 2.

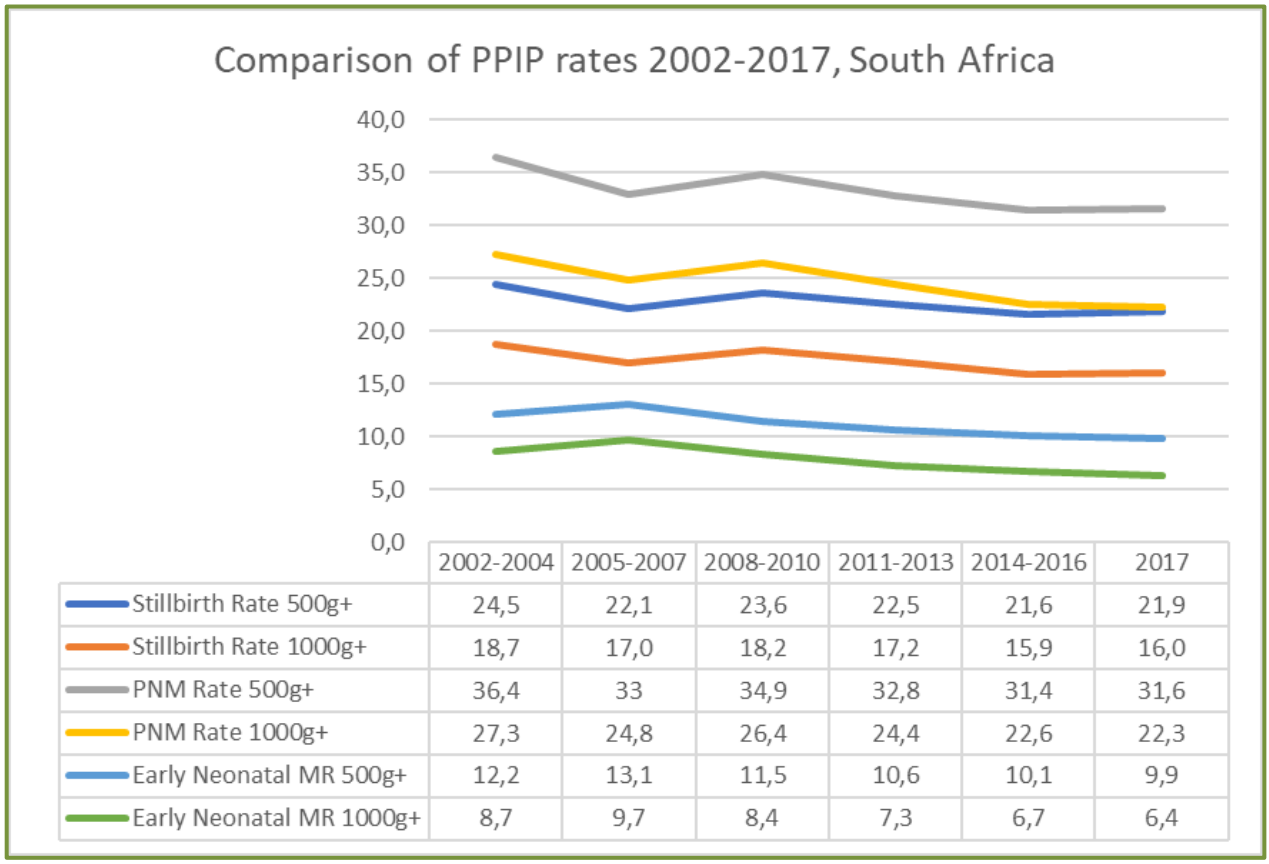
Figure 2 - Data gaps between PPIP and DHIS (between the 2 latest NaPeMMCo reports)



	Gauteng	KwaZulu-Natal	Free State	Limpopo	Eastern Cape	North West	Northern Cape	Western Cape	Mpumalanga
2017	40,3%	24,7%	22,7%	13,5%	13,3%	12,6%	9,4%	7,5%	1,0%
2014-2016	26,4%	36,0%	2,0%	14,2%	7,7%	8,0%	7,5%	2,3%	1,7%

The mortality rates for 2017 as reported on PPIP, compared to the previous triennia are given in Figure 3.

Figure 3- PPIP mortality rates 2002-2017.

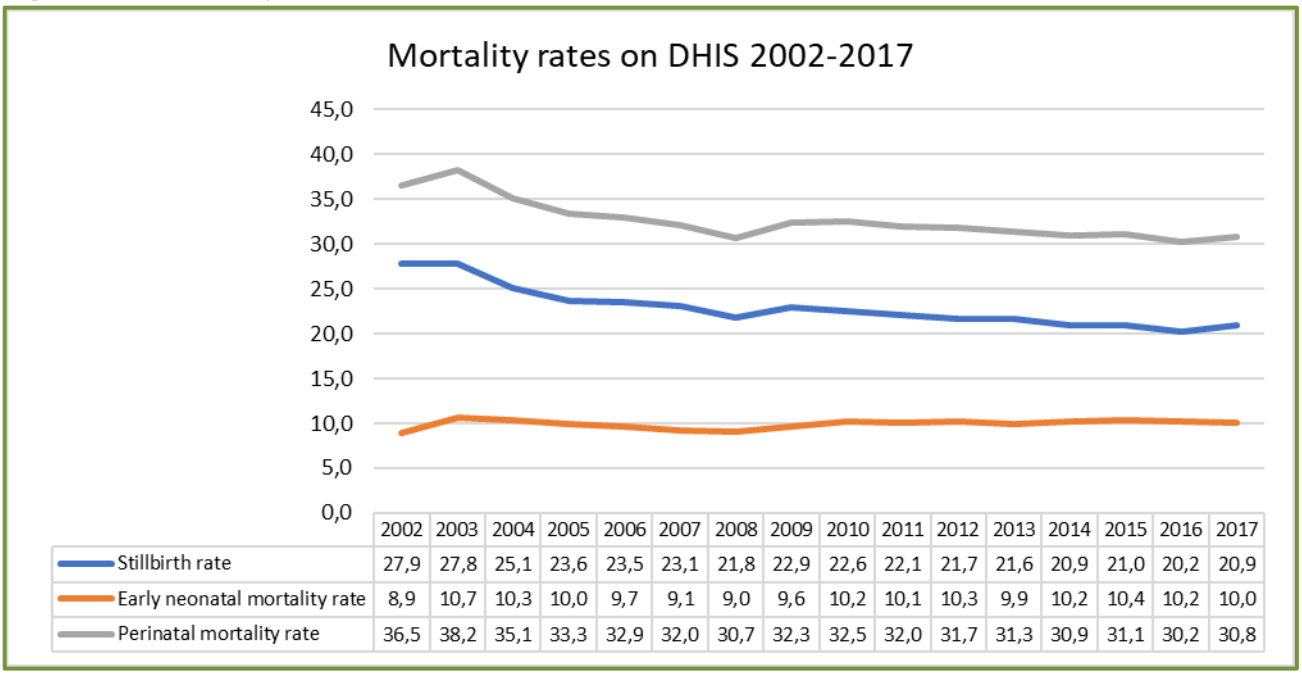


	2002-2004	2005-2007	2008-2010	2011-2013	2014-2016	2017
Stillbirth Rate 500g+	24,5	22,1	23,6	22,5	21,6	21,9
Stillbirth Rate 1000g+	18,7	17,0	18,2	17,2	15,9	16,0
PNM Rate 500g+	36,4	33	34,9	32,8	31,4	31,6
PNM Rate 1000g+	27,3	24,8	26,4	24,4	22,6	22,3
Early Neonatal MR 500g+	12,2	13,1	11,5	10,6	10,1	9,9
Early Neonatal MR 1000g+	8,7	9,7	8,4	7,3	6,7	6,4

As can be seen in Figure 3, the downward trend in rates as observed over the past 16 years seems to be sustained.

The comparable rates from DHIS are given in Figure 4. DHIS does not record birthweights, so these deaths are all from babies regarded as viable at the time of birth. There are 2022 more neonatal deaths recorded on DHIS for babies that died in the late neonatal period (not included in the calculation below which only shows the early neonatal death rate)).

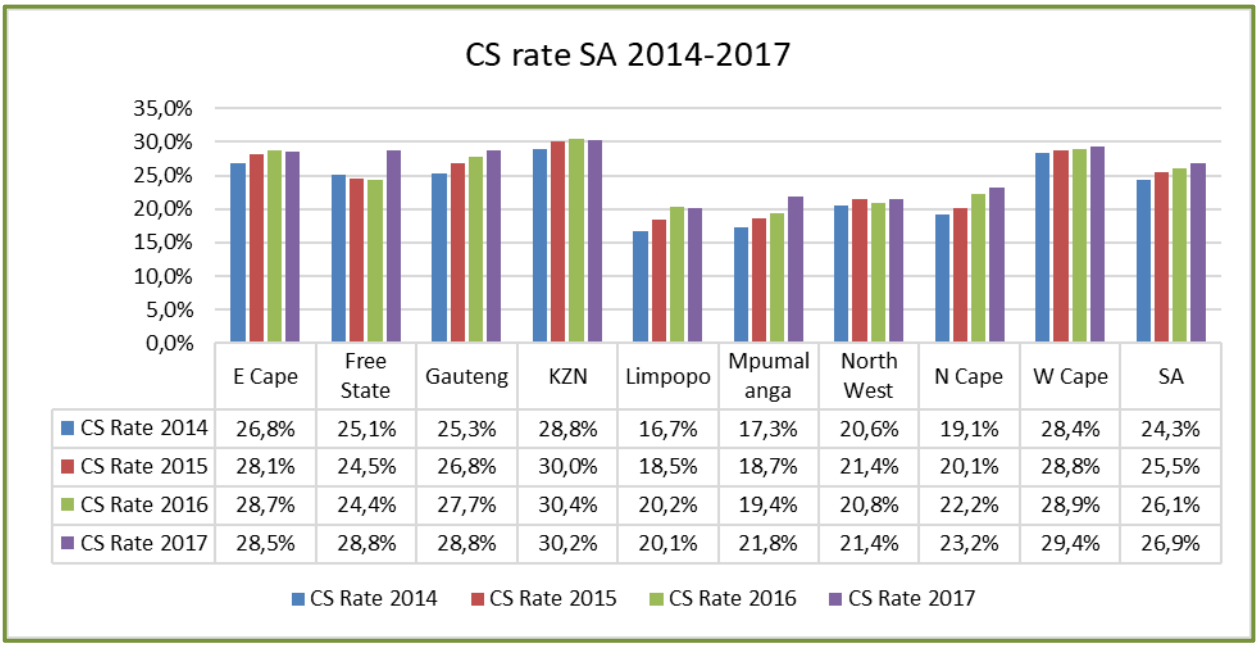
Figure 4. Mortality rates recorded on DHIS.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Stillbirth rate	27,9	27,8	25,1	23,6	23,5	23,1	21,8	22,9	22,6	22,1	21,7	21,6	20,9	21,0	20,2	20,9
Early neonatal mortality rate	8,9	10,7	10,3	10,0	9,7	9,1	9,0	9,6	10,2	10,1	10,3	9,9	10,2	10,4	10,2	10,0
Perinatal mortality rate	36,5	38,2	35,1	33,3	32,9	32,0	30,7	32,3	32,5	32,0	31,7	31,3	30,9	31,1	30,2	30,8

More babies were born by CS than ever before - as shown in Figure 4, the CS rate in almost every province increased in 2017. The overall national CS rate is now 26.9%.

Figure 5. CS rates SA 2014-2017

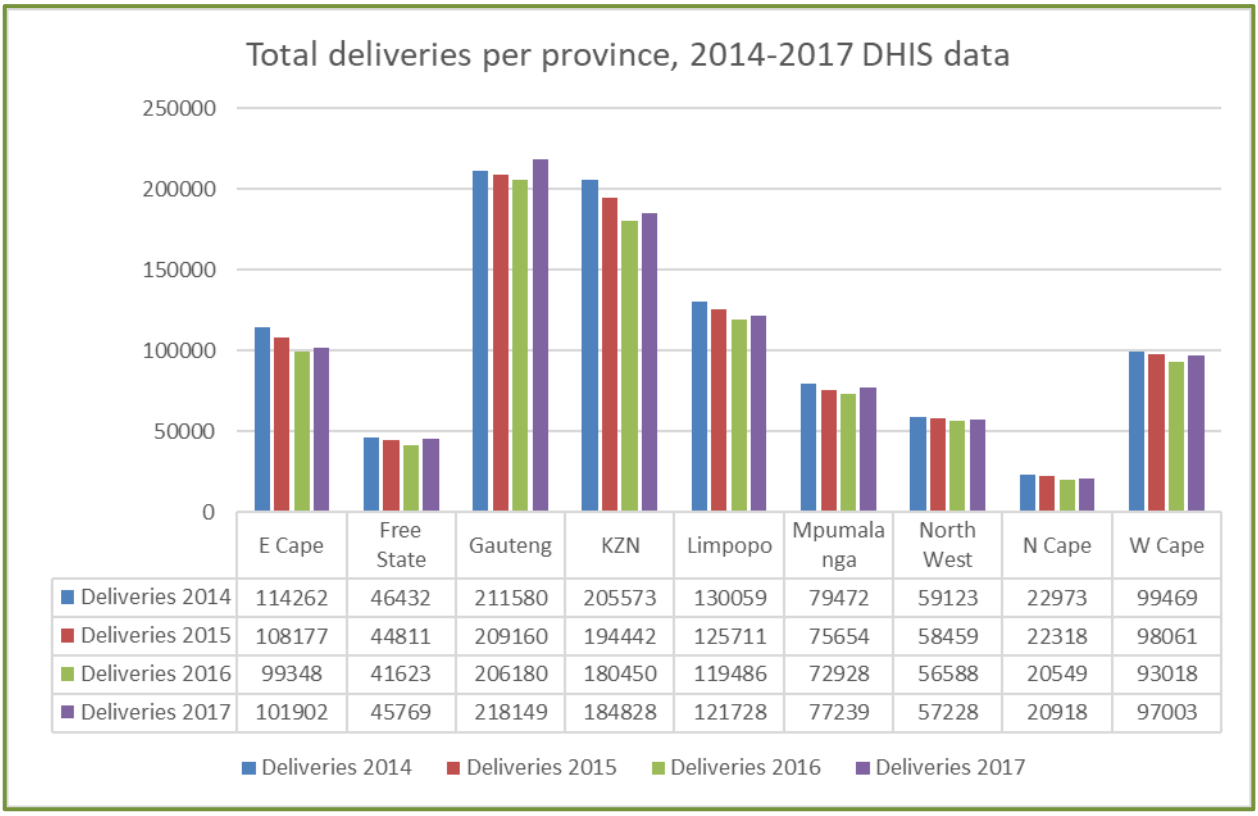


	E Cape	Free State	Gauteng	KZN	Limpopo	Mpumalanga	North West	N Cape	W Cape	SA
CS Rate 2014	26,8%	25,1%	25,3%	28,8%	16,7%	17,3%	20,6%	19,1%	28,4%	24,3%
CS Rate 2015	28,1%	24,5%	26,8%	30,0%	18,5%	18,7%	21,4%	20,1%	28,8%	25,5%
CS Rate 2016	28,7%	24,4%	27,7%	30,4%	20,2%	19,4%	20,8%	22,2%	28,9%	26,1%
CS Rate 2017	28,5%	28,8%	28,8%	30,2%	20,1%	21,8%	21,4%	23,2%	29,4%	26,9%

Provincial data - DHIS

The total deliveries per province is presented in Figure 6.

Figure 6. Total deliveries per province

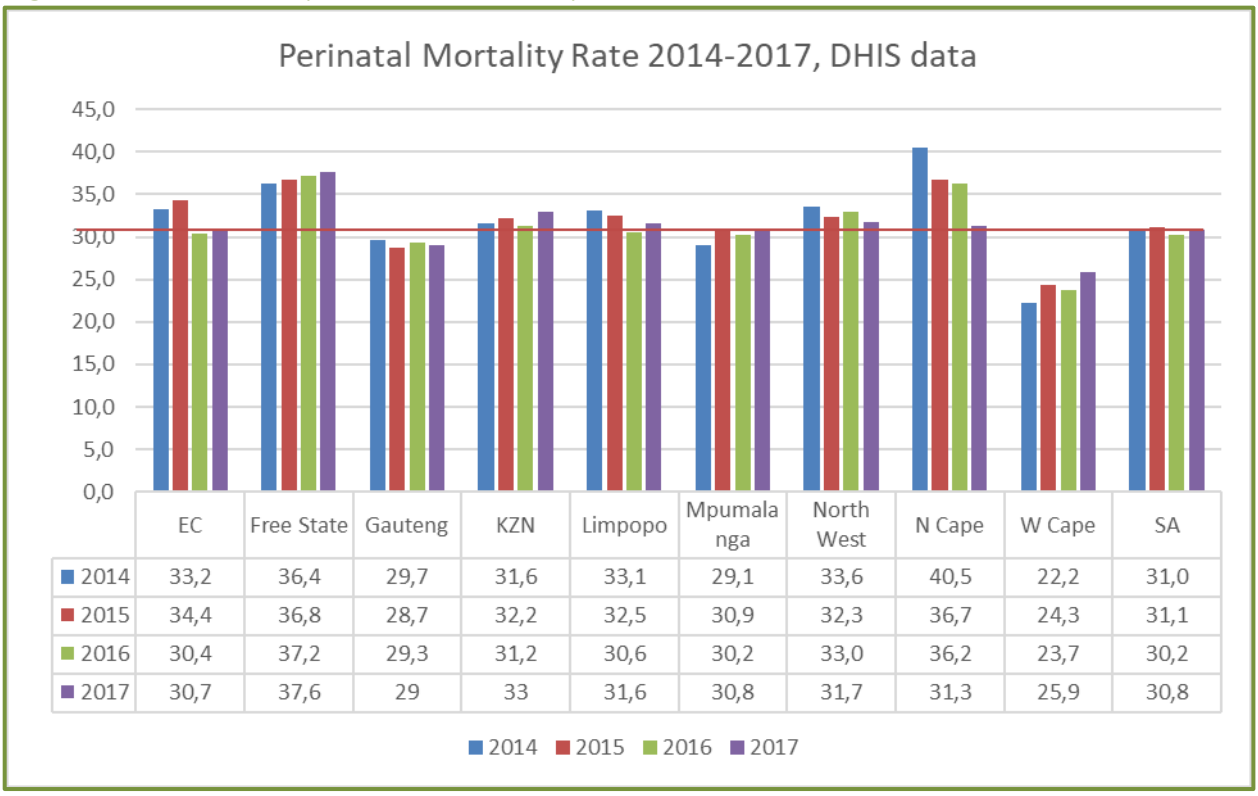


	E Cape	Free State	Gauteng	KZN	Limpopo	Mpumalanga	North West	N Cape	W Cape
Deliveries 2014	114262	46432	211580	205573	130059	79472	59123	22973	99469
Deliveries 2015	108177	44811	209160	194442	125711	75654	58459	22318	98061
Deliveries 2016	99348	41623	206180	180450	119486	72928	56588	20549	93018
Deliveries 2017	101902	45769	218149	184828	121728	77239	57228	20918	97003

The two provinces with the most deliveries recorded is Gauteng and KZN. In KZN and Limpopo, less deliveries are recorded each year. Eastern Cape deliveries plateaued in 2017 after a promising year-on-year reduction to below 100 000 per year.

The perinatal mortality rates for 2014-2017, as recorded on DHIS, is presented in Figure 7.

Figure 7. DHIS data, perinatal mortality rate 2014-2017



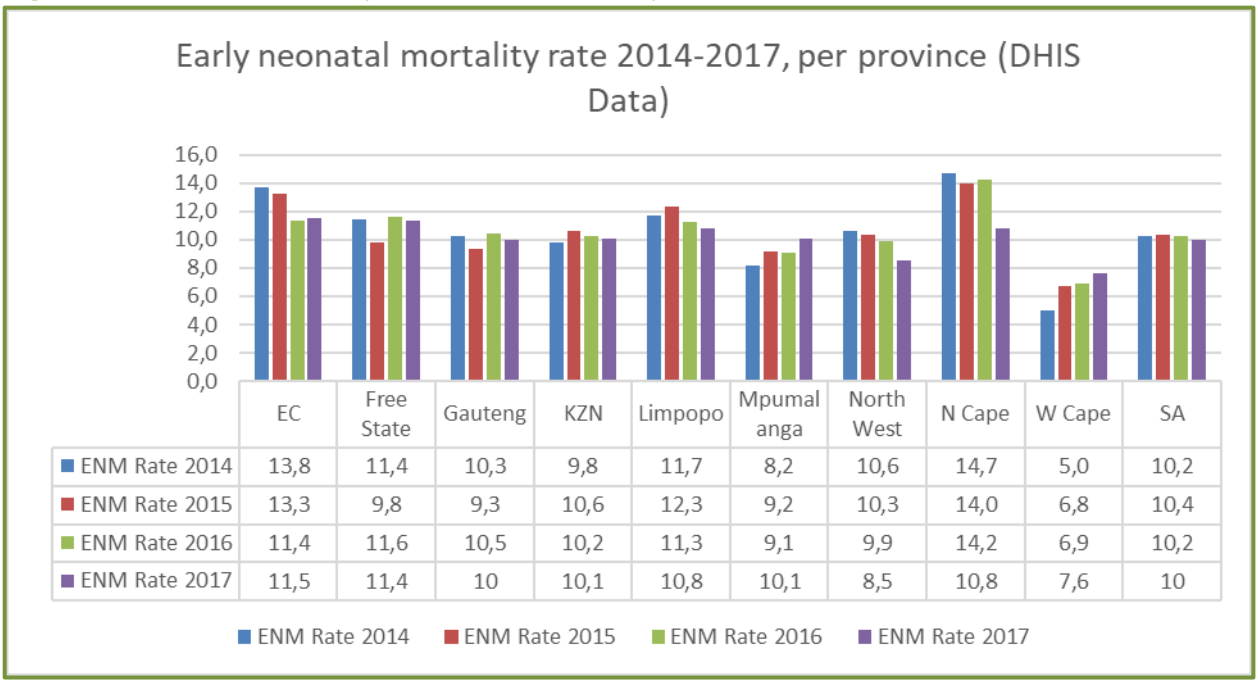
	EC	Free State	Gauteng	KZN	Limpopo	Mpumalanga	North West	N Cape	W Cape	SA
2014	33,2	36,4	29,7	31,6	33,1	29,1	33,6	40,5	22,2	31,0
2015	34,4	36,8	28,7	32,2	32,5	30,9	32,3	36,7	24,3	31,1
2016	30,4	37,2	29,3	31,2	30,6	30,2	33,0	36,2	23,7	30,2
2017	30,7	37,6	29	33	31,6	30,8	31,7	31,3	25,9	30,8

The EC DHIS derived PNMR aligns with the national average for 2017 and the reduction of approximately 2.5% for the past two years has been sustained; this has been mostly due to a reduction in the Early NMR (Fig. 8) as compared to the Stillbirth rate (Fig. 9), which remains largely unchanged.

The Free State and Western Cape shows a worrying increase in PNMR, for FS this is mostly due to an increase in stillbirths but for the WC the increase was in neonatal deaths. This trend needs to be monitored and interrogated.

The early neonatal death rate is shown in Figure 8 and the stillbirth rate in Figure 9.

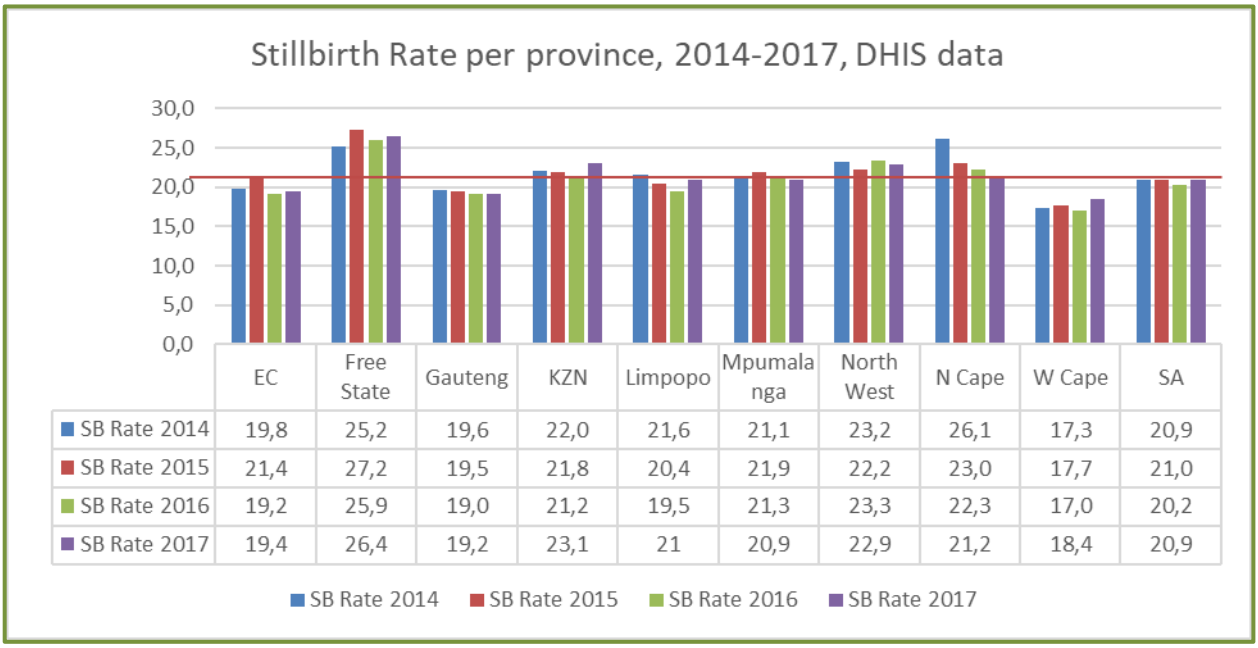
Figure 8. DHIS data, early neonatal mortality rate 2014-2017



	EC	Free State	Gauteng	KZN	Limpopo	Mpumalanga	North West	N Cape	W Cape	SA
ENM Rate 2014	13,8	11,4	10,3	9,8	11,7	8,2	10,6	14,7	5,0	10,2
ENM Rate 2015	13,3	9,8	9,3	10,6	12,3	9,2	10,3	14,0	6,8	10,4
ENM Rate 2016	11,4	11,6	10,5	10,2	11,3	9,1	9,9	14,2	6,9	10,2
ENM Rate 2017	11,5	11,4	10	10,1	10,8	10,1	8,5	10,8	7,6	10

The 2016-2017 EC ENMR would appear to be approaching national targets and certainly an improvement over the 2014-2105 period, but is the highest of all provinces, reflecting the reality of neonatal care in the first seven days of life in the province – which needs urgent and sustained attention with practical implementable site-orientated solutions.

Figure 9. Stillbirth rate per province DHIS data

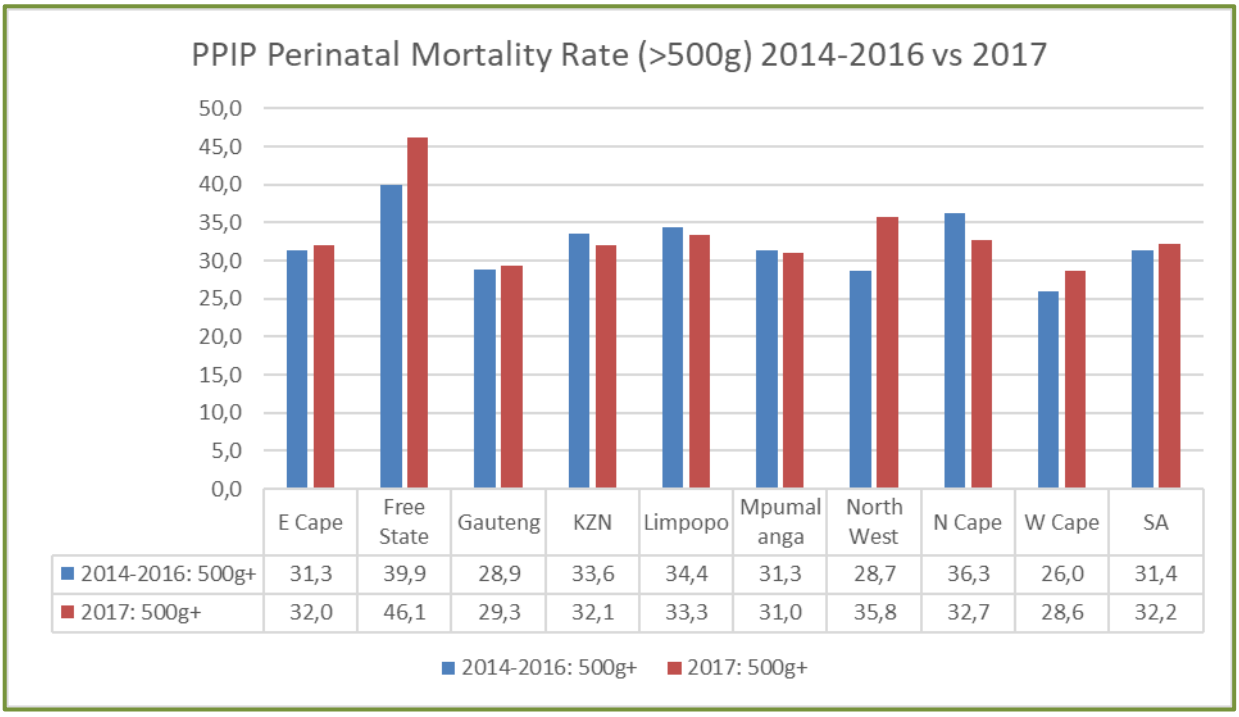


	EC	Free State	Gauteng	KZN	Limpopo	Mpumalanga	North West	N Cape	W Cape	SA
SB Rate 2014	19,8	25,2	19,6	22,0	21,6	21,1	23,2	26,1	17,3	20,9
SB Rate 2015	21,4	27,2	19,5	21,8	20,4	21,9	22,2	23,0	17,7	21,0
SB Rate 2016	19,2	25,9	19,0	21,2	19,5	21,3	23,3	22,3	17,0	20,2
SB Rate 2017	19,4	26,4	19,2	23,1	21	20,9	22,9	21,2	18,4	20,9

Provincial data – PPIP

The next data presented comes from the national PPIP database maintained at the MRC in Pretoria. In Figure 10, the PNMR for all babies >500g from PPIP is presented. This should correspond to the DHIS data, as the source for both is the labour ward register for births. There was an increase in PNMR in FS and NW in the last year as compared to the triennial data.

Figure 10- PPIP PNMR (>500g) 2014-2017

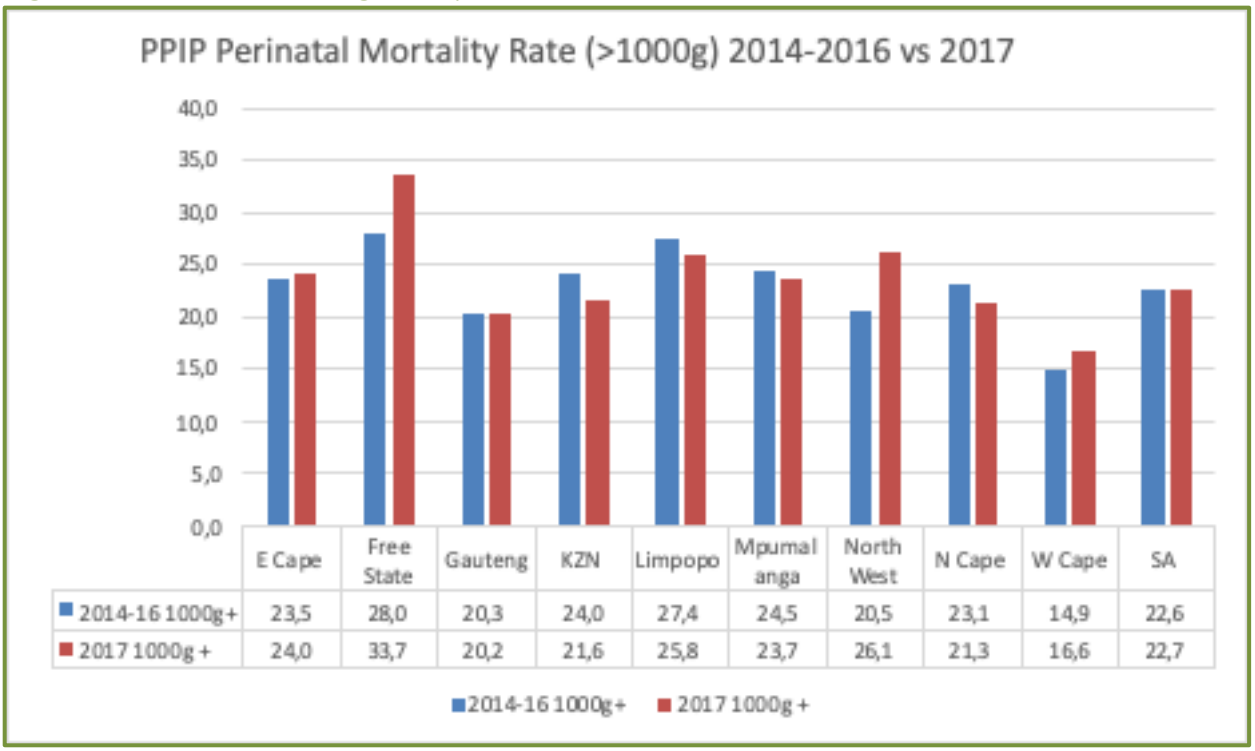


	E Cape	Free State	Gauteng	KZN	Limpopo	Mpumalanga	North West	N Cape	W Cape	SA
2014-2016: 500g+	31,3	39,9	28,9	33,6	34,4	31,3	28,7	36,3	26,0	31,4
2017: 500g+	32,0	46,1	29,3	32,1	33,3	31,0	35,8	32,7	28,6	32,2

The authenticity of the two data sources from the EC is corroborated by almost identical PNMRs.

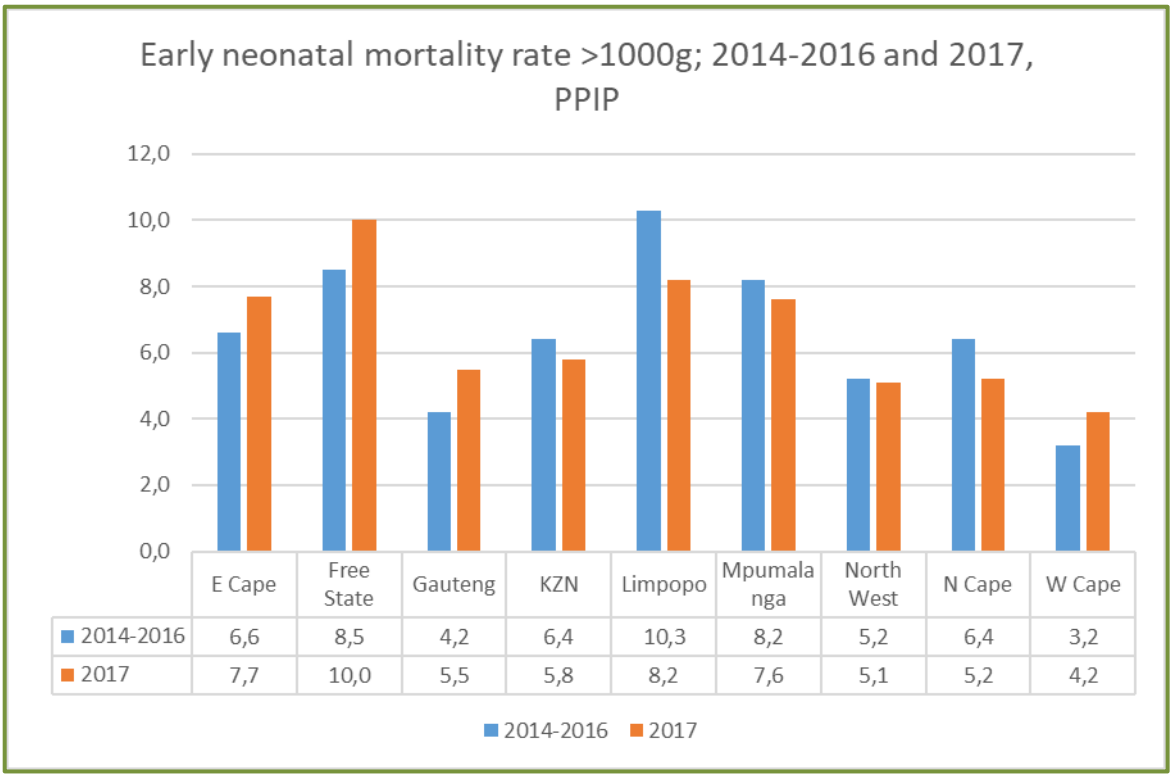
The same data, but only for babies >1000g, is presented in Figure 11.

Figure 11. PNMR >1000g as reported on PPIP



The early neonatal death rate for babies >1000g is presented in Figure 12.

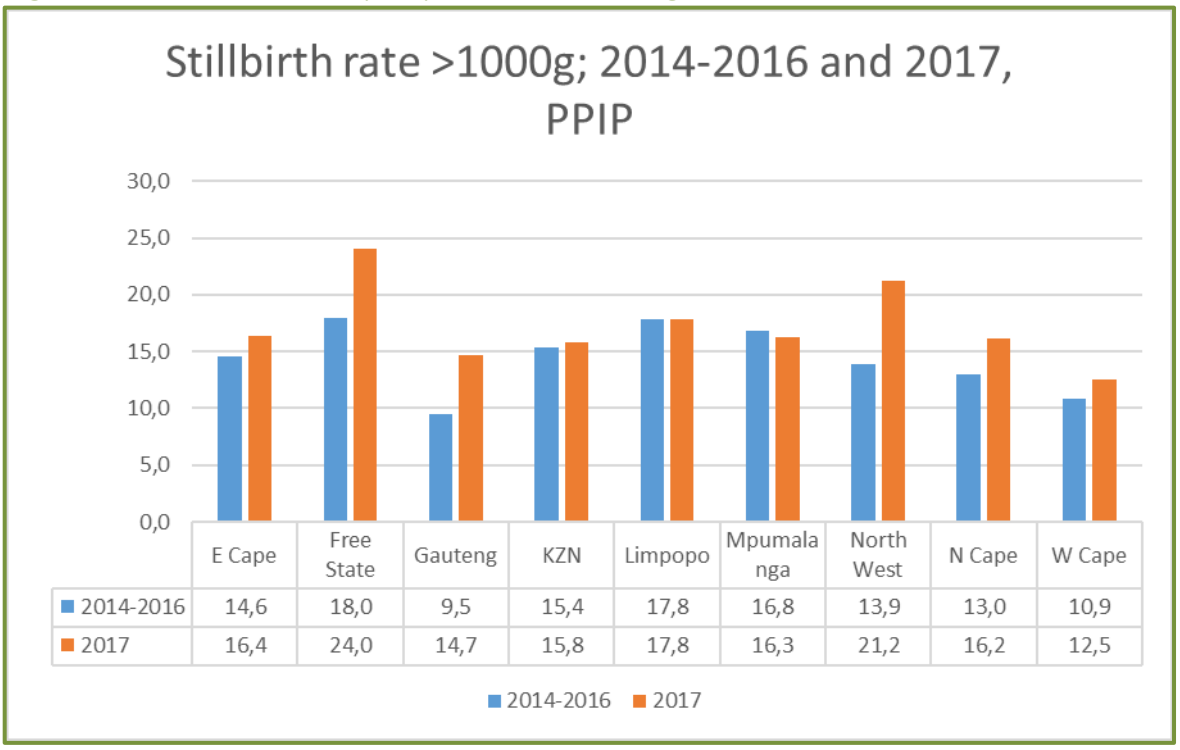
Figure 12. ENMR as recorded on PPIP >1000g



The EC was one of four provinces with an increasing ENMR in 2017. While the national ENMR (>500g) trends are decreasing, approaching 10, the PPIP ENMR data for the EC is of grave concern. The ENMR for babies >1000g has shown an increase of 1% to 7.7% for 2017. It would be wise to focus on this group of neonates in order to realign the EC with national trends. The increased trend in the FS and WC is also shown in the number of larger babies dying after birth.

The stillbirth rate per province, as recorded on PPIP, is presented in Figure 13.

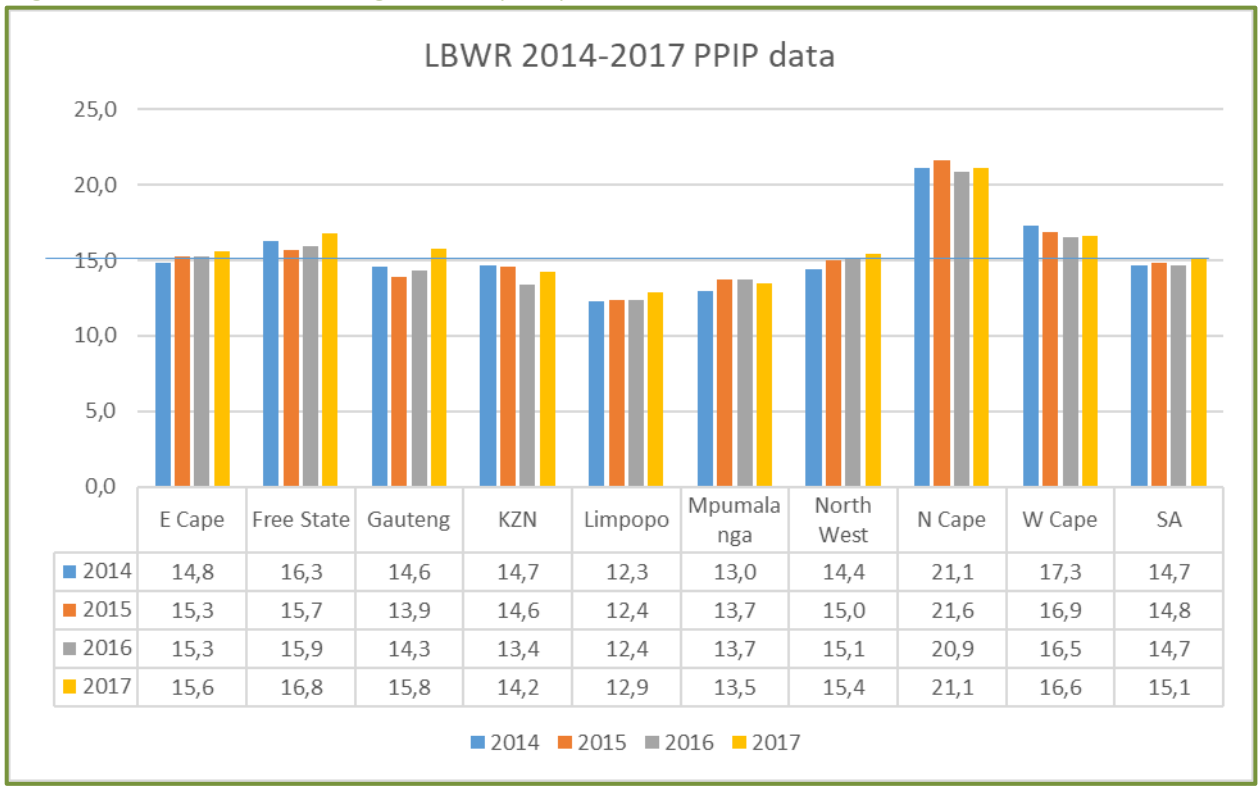
Figure 13. Stillbirth rate per province, >1000g PPIP data



	E Cape	Free State	Gauteng	KZN	Limpopo	Mpumalanga	North West	N Cape	W Cape
2014-2016	14,6	18,0	9,5	15,4	17,8	16,8	13,9	13,0	10,9
2017	16,4	24,0	14,7	15,8	17,8	16,3	21,2	16,2	12,5

The percentage of low-birth weight babies (<2500g) per province is represented in Figure 14.

Figure 14. Low Birth Weight rate per province



	E Cape	Free State	Gauteng	KZN	Limpopo	Mpumalanga	North West	N Cape	W Cape	SA
2014	14,8	16,3	14,6	14,7	12,3	13,0	14,4	21,1	17,3	14,7
2015	15,3	15,7	13,9	14,6	12,4	13,7	15,0	21,6	16,9	14,8
2016	15,3	15,9	14,3	13,4	12,4	13,7	15,1	20,9	16,5	14,7
2017	15,6	16,8	15,8	14,2	12,9	13,5	15,4	21,1	16,6	15,1

As a proxy for socio-economic status , it highlights this for NC and FS. There are other factors that drive the LBW in WC.

ANALYSIS OF THE PPIP DATA

- Of the 2737 perinatal deaths due to **intrapartum asphyxia**, 55% were perinatal deaths and 45% stillbirths. The numbers are slightly less than before (3419 in 2014, 3311 in 2015 and 2879 in 2016). What is concerning is that there were 400 babies who weighed more than 2000g and were alive at admission but died during childbirth due to intra-partum asphyxia. A further 1351 babies >2000g died shortly after birth, also due to intra-partum hypoxia sustained during birth coded as labour-related intra-partum asphyxia. Most (84%) of deaths due to intra-partum asphyxia were large babies (>2000g).

Spontaneous preterm labour

Of the 5 319 deaths due to preterm labour, 94% (5 026) weighed <2000g. This remains a signifiant cause of mortality to which there is currently no solution (prevention of preterm, delivery).

Social determinants associated with perinatal deaths.

In more than 11 200 perinatal deaths (70% of all deaths), one or more social determinants of health were identified that could have contributed to the adverse outcome. These include substance abuse (tobacco, alcohol and illegal drugs), delay in seeking medical attention or failure to attend antenatal care.

Medical personnel

The most important medical personnel modifiable factor was failure to respond or to manage hypertensive disease in pregnancy appropriately (1 110 deaths, most (78.3%) for babies >1000g).

CHAPTER II: CPAP-Related Neonatal Care Issues in District Hospitals

Thoughts on Outreach Visits to and Receiving Referrals from District Hospital Neonatal Units

Dr Kim Harper – NaPeMMCo Member – November 2018

NaPeMMCo recommended the implementation of nasal CPAP in a phased approach into select District Hospitals (DHs) in the Triennial Interim 2010-2011 Report. While this has been very successful in many sites and has undoubtedly saved the lives of many preterm and term neonates with respiratory distress, there are other sites where significant challenges and practical obstacles have been experienced. Some DHs have persevered; others have not been able to provide effective nCPAP.

Through outreach visits to DHs, a short compilation of some of the challenges that arise with the introduction of nCPAP into less well-resourced settings follows:

nCPAP

- Some nCPAP systems require both medical air and oxygen.
- Most DHs have piped oxygen but many DHs have tanked medical air only - no piped medical air. The medical air cylinders are large yet only last about twelve hours with continuous use (depending on flow settings) and backups may not be to hand.
- Tanked medical air may run out at inconvenient times, e.g. at night, or over weekends, with no easy replacement – this leaves a neonate on nCPAP in a most vulnerable position, often requiring emergency intubation and referral to a next-level hospital for nCPAP.

HENCE: AIR COMPRESSORS OR PIPED MEDICAL AIR AND OXYGEN IS ESSENTIAL TO RUN CPAP SAFELY. ALTERNATIVELY, APPROPRIATE NCPAP MACHINES THAT ARE DRIVEN BY OXYGEN ONLY SHOULD BE USED – BUT THESE DEVICES COME WITH THEIR OWN CHALLENGES.

Surfactant

- Once on nCPAP, some infants in a DH will need surfactant, e.g. 950 g neonate with Hyaline Membrane Disease who is hypoxic and severely distressed on maximum nCPAP support.
- Receiving referral hospitals may not have capacity to ventilate <1000 g infants or may be at full capacity and unable to receive the baby.

- While the Paediatrics Hospital Level Standard Treatment Guidelines and Essential Medicine List makes provision for the use of surfactant in DHs under paediatrician supervision, it may not be readily available.

HENCE: RESCUE SURFACTANT SHOULD BE AVAILABLE AT DISTRICT HOSPITALS BUT SHOULD BE AUTHORIZED BY A REFERRAL HOSPITAL PAEDIATRICIAN.

Mobile X-Rays

- It is often very difficult to obtain a mobile CXR on a neonate in DHs due to:
    - Equipment not being maintained or in poor repair.
    - No mobile machines available.
- A neonate who is nCPAP dependant cannot be moved to a main X-Ray facility.
- CXRs are extremely useful (perhaps crucial) to confirm HMD, exclude pneumonia or pneumothorax and confirm UVC positions for example. It is unreasonable to expect health care professional to care for newborns in DHs without them.

HENCE: MOBILE X-RAYS ARE NEEDED IN DHS AND MUST BE FUNCTIONAL.

IV Volumetric Controllers & Syringe Pumps

- Some DHs still using “Dial-a-flows” to manage IV fluid control for neonates as IV pumps are in short supply or IV sets are not available or of an incompatible type.
- These devices cannot give accurate low flow volumes, e.g. 4ml/hr, required for care of preterm infants. These items are not suitable for neonates.

HENCE: DHS MUST HAVE IV PUMPS WITH THE CORRECT IV SETS AVAILABLE AS STANDARD STOCK ITEMS.

Second-line Antibiotics

- What is a doctor to do for preterm neonates who have been in a DH nursery and become septic after a week or so? This is a nosocomial infection and unlikely to be sensitive to first line agents.
- Second line antibiotics, e.g. Amikacin etc., are needed at DH level as there may be Gentamicin resistant Gram negative organisms present, and once on nCPAP, it is very difficult and potentially dangerous to transfer these neonates to a next-level of care centre for second-line antibiotics (often then with significant time delays to commencement of suitable treatment due to transport delays).

- But, there is of course, the need to balance antibiotic stewardship with sepsis cover at DHs.

HENCE: CAREFUL THOUGHT NEEDS TO BE GIVEN TO THE USE OF LIFE-SAVING SECOND-LINE ANTIBIOTICS IN DHS' NEONATAL CARE UNITS.

Non-stock Items

- Too many items for neonates are not regular store item, but are considered "buy-out" disposable items which has major implications for supply chain management, with delays in acquisition and frequent stock outs of basic essential neonatal disposable items. This directly impacts on care.

HENCE: REGULARIZE NEONATAL ITEMS AS STANDARD STOCK ITEMS. NEONATES ARE NOT EXCEPTIONS.

Infection Control

- Paper towels, alcohol spray, soap and water are essential to control infection. No facility where neonates are cared for should ever be without these infection preventing items.
- Frequently, at least one item is not available – compromising neonatal safety.

HENCE: BASIC INFECTION CONTROL ITEMS ARE NON-NEGOTIABLE – THEY MUST NEVER BE ALLOWED TO BE UNAVAILABLE. ADEQUATE RESERVE ON-SITE STOCK MUST BE MAINTAINED AT ALL TIMES.

Summary:

District Hospital Neonatal Units:

- Need support from CEOs, Clinical Managers and Specialists from referring hospitals as well as a dedicated, caring team of nurses and doctors on-site who have an interest in caring for neonates.
- Experience practical problems that cause significant obstruction to good care of neonates.
- Need a "package approach" – not isolated recommendations. Very specific equipment lists and detailed implementation plans must be elucidated in practical terms when recommendations are made to implement a new modality.

- Basic stock items and infection control items are not negotiable and must ALWAYS be available.
- Second-line antibiotic policies need to be considered for use in DHs in a responsible and controlled manner.
- Surfactant as rescue therapy for patients who have failed nCPAP in a DH, should be available.

While good progress has been made with the introduction of nCPAP into DH neonatal units, attention should be given to overcome certain common basic problems that have become evident in order to maximise its full benefits.

CHAPTER III: Morbidity and Mortality Associated with Hospital Acquired Infections: Need for Enhanced Surveillance and Infection Prevention Efforts

Angela Dramowski, Nelesh Govender, Sithembiso Velaphi

Burden of hospital-acquired infection and infection outbreaks in neonatal facilities

Despite substantial decline in childhood mortality rates in South Africa[1] and globally[2], **progress in neonatal mortality reduction has been slow** (Figure 1). Severe bacterial infection remains a leading cause of neonatal morbidity and mortality affecting nearly 7 million neonates[2] and causing 750 000 deaths in low-middle income countries annually.[3] In South Africa, infections are estimated to account for **13.8% of neonatal mortality[1], however the true burden and impact of neonatal infection is likely to be far higher** for several reasons:

- a proportion of preterm neonates dying from sepsis, being labelled as having died from prematurity
- some neonatal facilities lack laboratory capacity to confirm infections
- cultures which are currently used as the gold standard to diagnose infection have low yield and sensitivity, thus there are many neonates who die from infections but with negative cultures
- there is no national laboratory surveillance of neonatal infections and outbreaks
- current death estimates often capture only a single contributor to death e.g. prematurity, thus missing cases of preterm infants who have died from sepsis
- causes of late neonatal deaths are particularly poorly documented
- hospitalization episodes (and therefore infection risk) for preterm babies are often prolonged beyond the 4-week neonatal period, and thus not included in NMR estimates
- death estimates do not reflect the burden and consequences of neonatal infection-related morbidities such as lifelong neurodevelopmental disability.

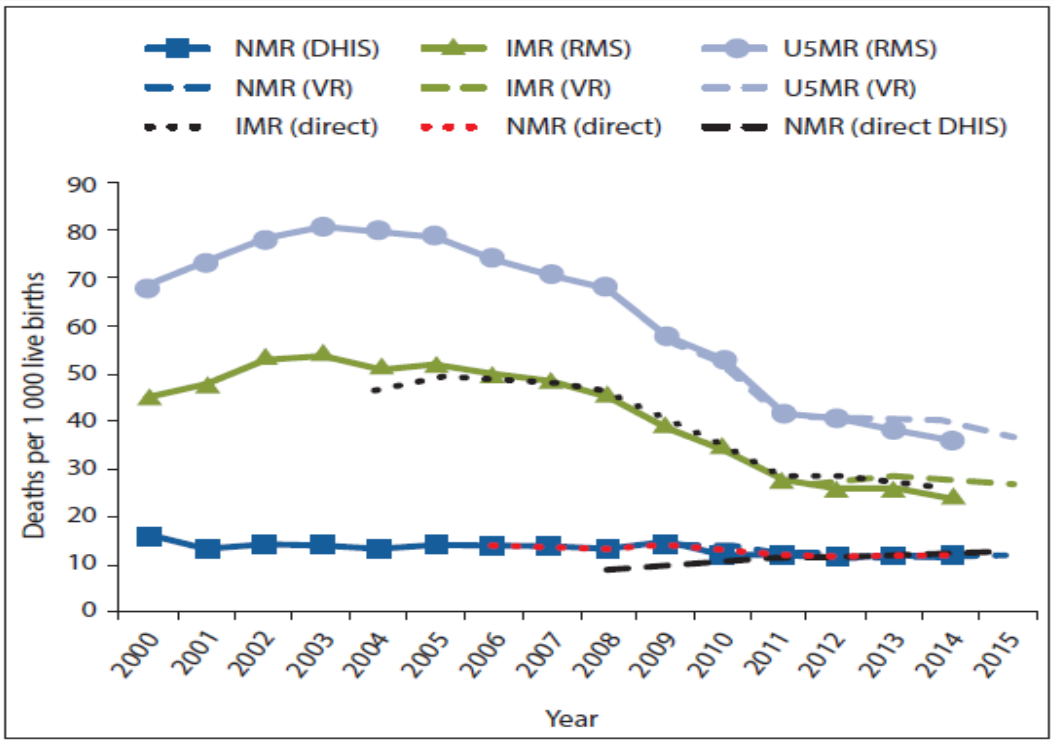


Fig. 1. SA mortality rates 2002 - 2015 (NMR = neonatal mortality rate; IMR = infant mortality rate; U5MR = under-5 mortality rate; RMS = Rapid Mortality Surveillance; VR = vital registration; DHIS = District Health Information System).

A study conducted in one of the largest neonatal unit in South Africa reported that about 70% of neonates who were assessed to have died from prematurity by clinicians, had bacteria identified in blood on post-mortem cultures, polymerase chain reaction (PCR), and on tissue immunohistopathology and PCR (unpublished data from Prof Madhi).[4] In addition, the South African Perinatal Problem Identification Programme (PPIP) cites **hospital-acquired infection as the second most prevalent avoidable factor in neonatal deaths**.[1] **Bloodstream infections** are the most common hospital-acquired infection type encountered in neonatal care, with infection rates varying from **4-14/1000 patient days,** although data is only reported from a few institutions.[5-8] Similarly data on **neonatal infection outbreaks in South Africa** is extremely limited, but outbreaks are likely to be **frequent owing to overcrowding, understaffing, sharing of equipment and poor environmental cleaning**.[9-10]

Threat of antimicrobial resistance

The worldwide rise in antimicrobial resistance (AMR) among hospital pathogens is of major concern for neonatal units. The limited South African neonatal hospital-acquired bloodstream infection reports reflect a predominance of Gram-negative pathogens with substantial AMR.[5-8] Increases in AMR rates threaten the continued effectiveness of the first-line antibiotics for neonatal sepsis: ampicillin and gentamicin. In addition, the profile of neonatal sepsis is changing, with AMR infections often encountered in the first days of life. This necessitates broad-spectrum, second-line antibiotics, and further increases risk of bacterial colonization and recurrent infections. In addition, treatment options are extremely limited for certain pathogens e.g. carbapenem-resistant *Acinetobacter baumannii* (CRAB) and *Enterobacteriaceae* (CRE), which have become leading pathogens in several neonatal units. The true burden and impact of AMR in South African neonatal units is unknown, owing to a lack of national laboratory-based neonatal infection surveillance, limited detection and reporting of neonatal outbreaks and an absence of hospital-acquired infection (HAI) surveillance programmes.

Contributors to hospital-acquired infection and antimicrobial resistance

Hospitalized neonates are a vulnerable population owing to immature immunity and frequent infectious disease exposures through contact with healthcare staff, parents, other patients, equipment, and the hospital environment. Exposure events may lead to microbial colonization only or neonatal infection with severe morbidity and mortality, as well as nosocomial outbreaks. Risk factors for hospital-acquired neonatal infections include low birth weight, prematurity, lack of breastfeeding, overcrowding and poor adherence to infection prevention practices. Another important factor is early life exposure to broad-spectrum and prolonged courses of antibiotic therapy that may permanently alter a neonate's intestinal microbiome. This is often due to challenges related to difficulties in diagnosing serious bacterial infections in neonates, owing to non-specific clinical presentation, low yield from cultures and fear of mortality associated with infections. Development of unit-specific antimicrobial treatment protocols, based on local infection and AMR data is critical to ensure both appropriate empiric antibiotic use and appropriate de-escalation or discontinuation of antibiotics in hospitalized neonates.

The incidence of hospital-acquired neonatal sepsis and –associated mortality in South African neonatal units is likely to rise in future for several reasons:

- a migration of people from other countries and increased rate of urbanization in the country is most likely to exacerbate overcrowding and relative understaffing in neonatal units
- advancements in neonatal care have led to ever smaller babies surviving with prolonged duration of admission for preterm neonates, who are up to 10-fold more likely to develop hospital-acquired infection than term infants
- persistent challenges with space and infrastructure deterioration in neonatal units
- sharing of equipment and shortages of supplies for infection prevention and control
- lack of infection prevention support, local guidelines, and staff education opportunities
- lack of expertise and difficulty in implementing and sustaining quality improvement strategies/programmes
- poor adherence to basic infection prevention and control measures
- lack of dedicated, trained neonatal unit environmental and equipment cleaning teams.

Recommendations on prevention and surveillance of hospital-acquired infection in neonatal units

a. **Infection prevention:** Infection prevention is the cornerstone of high quality, safe provision of healthcare services to vulnerable populations such as hospitalised and preterm neonates. National neonatal quality improvement strategies include the promotion of breastfeeding supported by establishment of milk banks, clean cord care, strict adherence to basic hygiene in labour wards and nurseries, availability of antibiotic therapy and appropriate case management of neonatal sepsis, meningitis and pneumonia. Although these **basic infection prevention measures are important**, specialised care and unit-**specific infection prevention protocols are needed for neonatal units**, where many unique procedures/practices occur e.g. umbilical catheter placement, surfactant administration, incubator and radiant warmer care, preparation and

storage of maternal and donor breast milk and kangaroo mother care. **Audits of infection prevention standards for neonatal units** should take into consideration these unique practices, which pose particular infection prevention challenges. ***To facilitate achieving these goals all neonatal units in Regional and Tertiary/Central hospitals must have a trained Infection Prevention and Control nurse practitioner who is fully supported/ assisted by the lead clinician and hospital management. Each district must have an IPC practitioner who overseas and supports IPC strategies in all healthcare facilities.***

b. **Antimicrobial stewardship:** There is an urgent need for all hospitals to have Antimicrobial Stewardship Programmes as one of the essential steps to prevent development of AMR. In order to develop strong and effective antimicrobial stewardship programmes, neonatal units must first be assisted to quantify and track trends in their antimicrobial use. Institutional data on pathogen profile and antimicrobial resistance patterns is needed to construct a locally appropriate treatment guideline. Improved education of prescribers, feedback of antimicrobial consumption data and strong leadership of the antimicrobial stewardship team is key to reducing inappropriate prescribing, and the negative effects of antibiotic exposure in hospitalised neonates. ***There must be an Antimicrobial Stewardship Committee established in all hospitals or districts.***

c. Infection surveillance: Epidemiologic data on all neonatal infections (early-onset vs hospital-acquired, sporadic cases vs clusters/outbreaks, bloodstream infections, meningitis and other infection types) is needed urgently from all South African neonatal units. This would assist the individual neonatal units and the national Department of Health to establish the burden of early-onset vs hospital-acquired sepsis and the profile of AMR infections. In addition, the data will identify neonatal units with relatively higher infection rates and/or frequent outbreaks for implementation of quality improvement interventions to reduce patient mortality and healthcare costs. ***All hospitals with neonatal units should***

implement surveillance and reporting of bloodstream infection rates and infection clusters as a minimum requirement.

d. Reporting and responses to outbreaks: Reported neonatal unit outbreaks in South Africa are limited, although anecdotal reports from neonatal clinicians suggest that infection clusters and outbreaks occur frequently. Outbreaks are often caused by AMR pathogens, and may be associated with high mortality rates, particularly in for Gram-negative and fungal pathogens. Data on outbreak frequency, size, mortality and source/contributing factors is extremely important to assist with quality improvement and identify units in need of infection prevention interventions. ***Clinicians (Heads of Neonatal Units/ Paediatrics) and IPC practitioners should report all outbreaks to the hospital management and the hospital management who in turn must report these outbreaks to district/ provincial IPC.***

Conclusions

The burden of hospital-acquired infection, antimicrobial resistance and infection outbreaks in South African neonatal units is likely to be higher than the currently available estimates, and may increase in future. Hospital-acquired infections and outbreaks are often preventable through provision of high-quality basic neonatal care and infection prevention practices. Co-ordinated national surveillance of neonatal infections and audits of infection prevention practices will contribute to identification of high-priority units, where intervention to reduce preventable harm to hospitalised neonates is most urgent. For other units, availability of routine data will allow benchmarking against similar healthcare facilities and a baseline for measuring the impact of quality improvement efforts to achieve safe care for hospitalized neonates.

References

1. N R Rhoda, S Velaphi, GS Gebhardt, S Kauchali, P Barron. Reducing neonatal deaths in South Africa: Progress and challenges. S Afr Med J. 2018; 108(3a):s9-s16.

2. Seale AC, Blencowe H, Manu AA, Nair H, Bahl R, Qazi SA, Zaidi AK, Berkley JA, Cousens SN, Lawn JE; pSBI Investigator Group. Estimates of possible severe bacterial infection in neonates in sub-Saharan Africa, South Asia, and Latin America for 2012: a systematic review and meta-analysis. Lancet Infect Dis. 2014; 14(8):731-41.

3. Lawn JE, Blencowe H, Oza S, You D, Lee AC, Waiswa P, Lalli M, Bhutta Z, Barros AJ, Christian P, Mathers C, Cousens SN; Lancet Every Newborn Study Group. Every Newborn: progress, priorities, and potential beyond survival. Lancet. 2014; 384(9938):189-205.

4. Madhi, S. Unravelling specific causes of neonatal mortality using minimally invasive tissue sampling: an observational study (manuscript in preparation: personal communication)

5. Dramowski A, Madide A, Bekker A. Neonatal nosocomial bloodstream infections at a referral hospital in a middle-income country: burden, pathogens, antimicrobial resistance and mortality. Paediatr Int Child Health. 2015; 35(3):265-72.

6. Crichton H, O'Connell N, Rabie H, Whitelaw AC, Dramowski A. Neonatal and paediatric bloodstream infections: Pathogens, antimicrobial resistance patterns and prescribing practice at Khayelitsha District Hospital, Cape Town, South Africa. S Afr Med J. 2018; 108(2):99-104.

7. Ballot DE, Nana T, Sriruttan C, Cooper PA. Bacterial bloodstream infections in neonates in a developing country. ISRN Pediatr. 2012;508512.

8.Spicer KB, Green J, Dhada B. Hospital-acquired infections in paediatric medical wards at a tertiary hospital in KwaZulu-Natal, South Africa. Paediatr Int Child Health. 2018;38(1):53-59.

9. Dramowski A, Aucamp M, Bekker A, Mehtar S. Infectious disease exposures and outbreaks at a South African neonatal unit with review of neonatal outbreak epidemiology in Africa. Int J Infect Dis. 2017;57:79-

85.

10. van Schalkwyk E, Iyaloo S, Naicker SD, Maphanga TG, Mpembe RS, Zulu TG, Mhlanga M, Mahlangu S, Maloba MB, Ntlemo G, Sanyane K, Mawela D, Govender NP. Large Outbreaks of Fungal and Bacterial Bloodstream Infections in a Neonatal Unit, South Africa, 2012-2016. Emerg Infect Dis. 2018;24(7):1204-1212.

CHAPTER IV: Practical example of Infection control in a Neonatal Unit

A practical example of reducing neonatal deaths due to nosocomial sepsis in a neonatal intensive care unit (NICU).

Setting: Western Cape Tertiary NICU

Dr Natasha R Rhoda – NaPeMMCo Member and Vice Chairperson

Nosocomial neonatal infection is the proverbial elephant in the room of all neonatal units globally. Resultant mortality and morbidity is costly, both financially in the short term, (treatments) and long term (neurodevelopmental delays). Neonatal infection is the third major cause of neonatal mortality in South Africa and the use of a neonatal infection dashboard was proposed as one method of attempting to reduce nosocomial sepsis in this tertiary neonatal unit.

This study was conducted in 2015 at the tertiary-level neonatal unit at Groote Schuur Hospital (GSH), Cape Town, South Africa over a 31-month period. Two time periods were examined, one before any intervention and one following the introduction of an educational intervention and use of a clinical performance dashboard. It was started in conjunction with the drive to better antibiotic stewardship, as proposed by the Vermont Oxford Network, of which the hospital is a member since 2012.

The result was that the there was a statistically significant reduction in the blood stream infections between the two time periods.

This gives evidence and credence to the fact that simple interventions CAN work, and the visualisation of the problem (clinical dashboard) serves as a constant reminder of the units infection control policy.

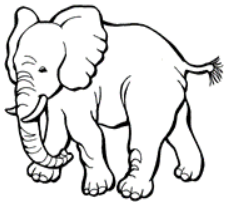
Below is a summary (designed as a pamphlet) of the intervention process which was implemented at the GSH NICU. To date, the median monthly infection is a range of 2-5/month and the mortality from sepsis has concomitantly also decreased over the last 3 years.

REDUCING NEONATAL DEATHS DUE TO NOSOCOMIAL SEPSIS

MS Raban, C Bamford, Y Joolay, MC Harrison Impact of an educational intervention and clinical performance dashboard on neonatal bloodstream infections S Afr Med J 2015;105(7):564-566. http://dx.doi.org/10.7196/SAMJnew.7764

Requirement to start the process:

1. Assign a caretaker of recording all new sepsis in the ward – usually attending doctor in NICU records all new infections and contaminated positive blood cultures
2. Training Early Onset Sepsis (EOS) vs Late Onset Sepsis (LOS)
3. Provision of a protocol for EOS/LOS
4. Daily and ongoing handwashing training adherence
5. Infection control signage in ward with red line crossing
6. Collateral – Antibiotic Stewardship ward rounds



SURVEILLANCE

DAILY:

- Empowering of staff irrespective of rank to enforce handwashing
- Minimal handling of sick neonates, nurse in a closed incubator
- Encouraging of breastmilk including use of donated breastmilk for VLBW infants
- Surveillance of infected babies
- Adherence to strict sterile techniques for collecting blood culture samples

WEEKLY:

- Clinical governance with feedback to staff of infections
- Training in taking of sterile blood cultures
- Senior consultant discussion on all sick babies

MONTHLY:

- Infection control ward rounds with Infectious Disease Consultants

QUARTERLY:

- Infection Control Hospital team with re-training of how to do adequate handwashing
- Monitoring of median of infections

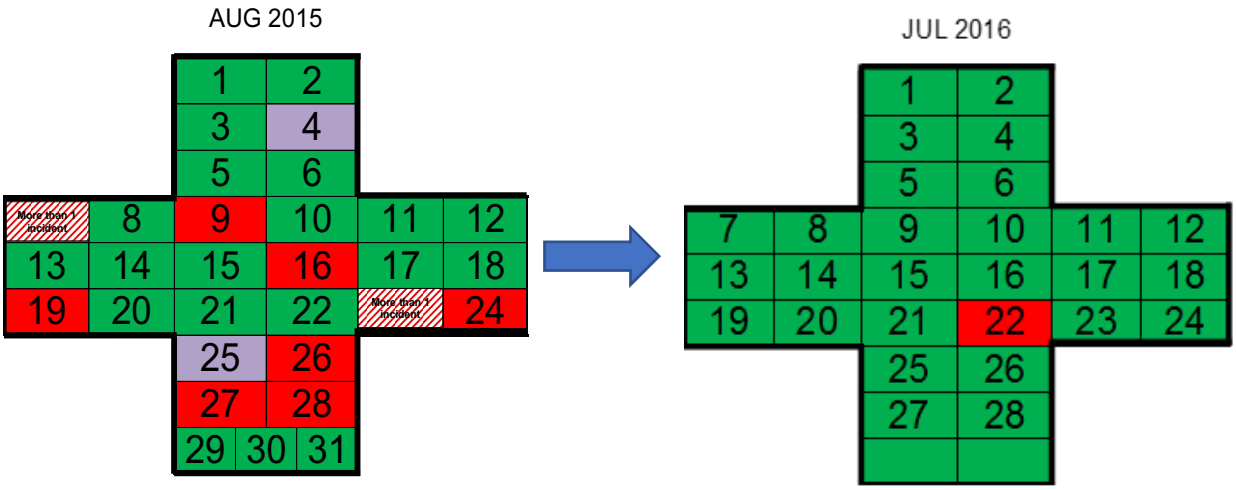
YEARLY:

- Trends in infection outbreaks

BENEFITS

- VISUAL AIDE to see how many infections happening on ward
- Immediate response to correct break in infection control
- Easily see trends in behavioural change over time

E.g.: Implemented at Groote Schuur Hospital in August 2015 – ongoing



- Infection - Late onset sepsis (LOS)
  - ✓ Median down from **10 infections / month** to **1-2 infections / month**, over a 3 year period
  - ✓ Fewer patients' with Necrotising Enterocolitis
  - ✓ Less nosocomial infections
  - ✓ Less contaminated blood cultures
- Sustainable
- Measurable
- Controllable

Successful - because one implements an infection control bundle of care

with the Welsch Cross as the face of the IC bundle.

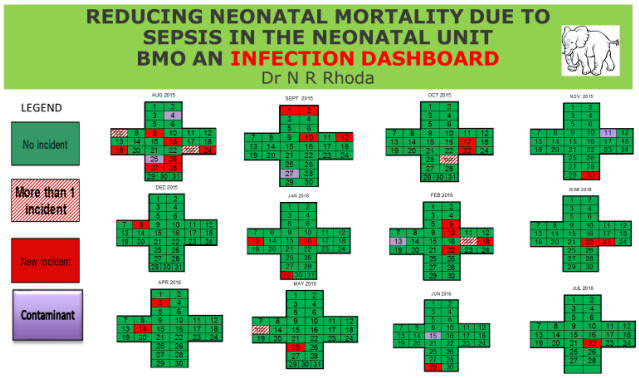
This is a practical and doable "innovation" which has proven successful in our unit and reduced nosocomial sepsis and neonatal deaths. The principle can also be applied to many other scenarios:

•Looking at the gaps in process mapping a particular cause of death (Application 1)

•Mapping causes of deaths in districts or provinces (Application 2)

•It provides easy tracking and trends in deaths

•It does not cost "extra"



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Prof. S. Velaphi (Gauteng)

Appendix I- Summary of NaPeMMCo recommendations and outcomes since 2008

N Rhoda and S Gebhardt

2008

A summary of cross-cutting recommendations were given for a 10-point plan to improve neonatal care in South Africa. Each recommendation was linked to an indicator and targets were set:

1. Clinical skills improvement
2. Staffing, equipment and facilities
3. Implementation of national maternal and neonatal guidelines
4. Training and education of undergraduates
5. Transport and referral routes
6. Normalisation of HIV infection as a chronic disease
7. Postnatal care
8. Regional clinicians appointed to establish, run and monitor and evaluate outreach programmes for maternal and neonatal health
9. Auditing, monitoring and evaluation
10. Constant health messages must be conveyed to all and understood by all

OUTCOME:

A thorough and detailed analysis was done for the first time for the neonatal population and addresses comprehensively all aspects needed to succeed in reducing NMR in accordance with MDG 4.

2010 - 1st Triennial report 2008-2010

Ten clear and detailed recommendations were made, based on the triennial data covering the following categories:

A. Improving access to appropriate healthcare

1. Regional clinicians should be appointed to establish, run and monitor and evaluate outreach programmes for maternal and neonatal health
2. Improve transport system for patients and establish referral routes
3. The government should ensure that constant health messages are conveyed to all and understood by all (Community, Patient/client and Health Care Provider)

B. Improving quality of care

4. Improve the Training of Health Care Professionals both nurses and doctors and especially in the undergraduate curricula
5. National maternal and neonatal guidelines should be followed in all healthcare facilities
6. Improve provision and delivery of postnatal care
7. Normalisation of HIV infection as any chronic disease

C. Ensure that adequate resources are available

8. Provide adequate nursing and medical staff, adequate equipment for the health needs of both mothers and babies, especially the equipment required for emergency and critical care.
9. Provide adequate number of hospital beds for the health needs of mother and babies at all levels of health care, including critical care beds.

D. Auditing and monitoring

10. Improving data collection and review of all databases DHIS, PPIP, child PIP and includes a national standardized neonatal register in labour wards and neonatal wards/ nurseries should be used by all provinces.

2012 – interim report

The five key recommendations developed by NaPeMMCo which if implemented will reduce neonatal deaths can be summarized by the acronym HHAPI:

- Improve the Health System for mothers and babies
- Improving the knowledge and skills of Health Care providers in maternal and neonatal care

- Reduce deaths due to Asphyxia
- Reduce death due to Prematurity
- Reduce deaths due to Infection

For each of these points there are specific interventions that if implemented would reduce neonatal deaths. Health care providers, health care managers, health care policy makers and the community are involved with all five points and specific actions will be required by them to ensure the interventions are implemented.

These HHAPI recommendations and their interventions was translated into key actions required by all levels of health care workers, managers, policy makers and the community to ensure their implementation. They should be integrated into the Improving Maternal and Neonatal Care Strategies. For ease of memory and for marketing the neonatal strategy to policy makers the strategy can be summarised as "In pursuit of HHAPI – NeSS" (Neonatal Survival Strategy).

OUTCOME:

HHAPI-NeSS recommendations – a strategy to align the country with common goals and targets

2013 – Interim report

Key recommendations

1. NaPeMMCo needs access to DHIS data in real time and ongoing to monitor trends
2. Putting accountability measure in place for neonatal care:
    a) Support from facility management to improve neonatal care
    b) Ownership by facility management to neonatal care incorporated into their performance agreements (SPMS)
3. Treasury approval to ring fence money for neonatal care (for all MNCH- non-negotiables)

4. The Mpumalanga process to attain the smallest data gap between PPIP and DHIS despite few resources should be recorded and duplicated throughout the country.

5. Neonatal signal functions must be completed for all birthing facilities within the country to see at what level of care they are functioning and requires the assistance from the DCST within the districts.

OUTCOME: None of the 5 recommendations became actionable

'Triennial' report 2014 (data from 2010-2013, published as a 'short report')

Key findings

1. Data for 2013 compared to years 2010-11-12
    a) The neonatal mortality rate for calendar year 2013 has stayed the same
    b) Highest neonatal death rates is in the weight category 1000g – 1999g
    c) Reduction in the data gap between DHIS and PPIP has improved since the last triennial report PPIP with good quality of care assessments for Free State, Mpumalanga, North West, and Western Cape, moderate in Limpopo and Northern Cape and poor in Eastern Cape, Gauteng and KwaZulu-Natal.
2. Causes of neonatal deaths
    a) There was no change in the top three causes asphyxia, prematurity and infections of neonatal deaths
    b) Unexplained stillbirth reminaed the largest category of macerated stillbirths across all levels of care
    c) Intrapartum birth asphyxia was the most common category in fresh stillbirths in CHCs and district hospitals. Almost 50% of these deaths were thought to be probably preventable; the common problems being with fetal monitoring, use of the partogram and the second stage of labour.
3. At district level
    a. District hospitals have the most deaths, most births and highest mortality rates and perinatal care indices.

4. At provincial level
    a. Insufficient political or clinical leadership across all levels of care for newborn care
    b. Neonatal Signal Functions is a quick way of assessing the functionality of facilities to deliver and care for babies.
    c. The issue of resources that should be available, the cost effectiveness of district hospitals and accessibility are highlighted. There is concern about maintaining skill levels for surgery and anaesthetics at low frequencies.
5. Avoidable perinatal deaths
    a. Administrative associated causes-
        i. Inadequate facilities were the most common avoidable factor in spontaneous preterm labour
        ii. Deaths due to immaturity were thought to be probably preventable if better neonatal facilities were available
    b. Patient associated
        i. In almost one in five deaths which were unexplained stillbirths the patient was reported as not responding to poor fetal movements
    c. Medical personnel associated:
        i. Health care provider issues were relatively rarely reported, but are significant in their nature.
        ii. Unprofessional behaviour was found by doctors not responding to calls and lack of training also featured
        iii. In almost a third of babies dying due to complications of hypertension, hypertension was detected but NOT acted upon.

2014 –2016 2nd Triennial report- key findings

1. Lack of leadership at all levels of care identified as a major limitation to reduce NMR.
    a) National – Establish a Neonatal Directorate within NDoH

b) Provincial – appointment of the provincial specialists

c) District – increase uptake of the Paediatric DCST

d) Appointment of a provincial data co-ordinator overseeing PPIP and child PIP (2013 recommendations)

2. Inadequate funding for improvement in neonatal care eg: replacement of faulty equipment and proposal for ring fencing money for neonatal care not effected (2012 recommendation)

3. Prioritize national roll out of 3 targeted newborn care interventions (HBB,MSSN and CPAP) in all districts

a. Reducing premature birth burden of disease will require a focussed effort to urgently upscale:

i. Antenatal steroid use (ANS)

ii. CPAP implementation at district hospitals

iii. MSSN training in districts

b. Prioritize reducing asphyxia of big babies by increase coverage of HBB to 50% by March 2015.

c. Reducing neonatal infection by:

i. Prioritising hand washing

ii. Reducing neonatal deaths in Children's wards- a vulnerable population who have:

- An in-hospital mortality rate higher than that for children;
- more likely to die within 24 hours of arrival in hospital than children;
- HIV pandemic and nosocomial sepsis are major contributors to deaths.

Simple strategies built around an understanding of the vulnerability and special needs of the neonatal population may help to improve quality of care for neonates in South African hospitals, and thereby reduce neonatal in-hospital mortality.

OUTCOMES:

- National neonatal monitoring and implementation plan for South Africa signed off in October 2014 – all provinces to provide a provincial plan.
- National circular minute no1 HIV/AIDS, TB & MCWH – admission and separation of sick newborns
- Master trainers in HBB and MSSN conducted for all provinces

2015 – Interim report

1. National Perinatal data trends in South Africa for 2014:

a. Increase in late neonatal deaths driving the increase NMR

b. Data gap between DHIS and PPIP is increasing making planning difficult with KZN and Gauteng accountable for 77% of missing data nationally.

c. PPIP is not institutionalised in all provinces and 7% fewer births were entered in 2014 compared to 2013.

d. Highest neonatal death rates remains the weight category 1000g – 1999g

2. Advocacy for non-rotation of staff in neonatal units

3. DCST has a positive impact at district level when maternal neonatal dyads are complete and specifically with their role in the ESMOE – EOST scale up pilot projects.

4. Advocacy for Assisted delivery in primary care services since the failure to perform assisted deliveries is resulting in an increased morbidity and mortality due to birth asphyxia and caesarean delivery

5. Establishment of clear guidelines

a. Protocol for antenatal steroids at district level

b. active neonatal interventions at different gestations including comfort care if clinically indicated

c. including the maternal management of imminent extreme preterm delivery

6. A support to NCCEMD to increase BANC visits to 7, as there are increased perinatal deaths with 5 ANC visits.

OUTCOMES:

- National circular (minute no 1 of 2012) issued by DDG Dr Pillay to all heads of provincial health departments, district managers, hospital CEOS and clinical managers for non-rotation of neonatal nursing staff.
- BANC visits increased from 5 to 7.
- Antenatal steroid, viability and care guidelines for preterm deliveries standardised.

2016 interim report

1. The top three primary obstetric causes of perinatal deaths were reported as unexplained macerated IUD (19%), hypertension (15%) and intrapartum asphyxia (13%).
2. The top three final causes of neonatal deaths were prematurity (48%), asphyxia (24%) and infection (12%).
3. In babies weighing >1kg, asphyxial deaths were more than premature deaths (1714 and 1202 respectively)
4. The institutional neonatal mortality rate for calendar year 2015 was 13/1000 live births and KZN, Limpopo, NC and EC all have NMR above the national rate.
5. There top three causes of neonatal deaths remain - asphyxia, prematurity and infections in babies weighing more than 1kg.

6. At district level:
    a. The quality of care continues to be improved by the presence of the DCST paediatricians and nurses.
    b. The quality of care indicators at district level has decreased over the last 3 years.
    c. Coverage of HBB and MSSN continues to be low and not monitored
7. At provincial level:
    a. No appointments of the provincial paediatricians in Eastern Cape, Northern Cape, Mpumalanga, Gauteng and North West have been made to date.
    b. Neonatal Signal Functions have not been incorporated at provincial level into the district health plans- a 2012 NaPeMMCo recommendation.

Recommendations for 2016:

1. The triennial recommendations remain and requires full implementation with special attention to strict infection control policies at all birthing units.
2. The country to focus more on prevention of Asphyxia- upstream factors

3. BANC plus to be adopted in South Africa to decrease stillbirths.
4. Therapeutic hypothermia should only be practiced under strict protocol and in a research environment and low cost cooling has not been fully evaluated with long term follow up to be recommended as a standard of care for asphyxial new-borns with neonatal encephalopathy.
5. HBB trainings within the ESMOE should continue nationally but emphasis on neonatal resuscitation drills must be incorporated in facility drills
6. The KZN Initiative for Newborn Care (KINC) model of funding has shown clear improvement in quality of care in new-borns and is recommended as a way to provide scale-up across the country.

Saving Babies Reports

A separate *Saving Babies* report was also produced by the MRC since 2000, with detailed data and recommendations, all available as downloads on www.ppip.co.za:

Saving-babies-2000

Saving-babies-2001

Saving-babies-2002

Saving-babies-2003

Saving-Babies-2003-5

Saving-babies-2006-7

Saving-Babies-2008-9

Saving-Babies-2010-12

Saving-Babies-2012

Since 2017, the NaPeMMCo report and the Saving Babies data were combined and the 2014-2016 NaPeMMCo triennial report was also the 2014-2016 Saving Babies report.