

Tracking progress on the health status and service delivery outcomes for neonates and children in the Metro West geographic service area of the Cape Metropole, 2010 - 2015

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Background. Monitoring the health status of populations of children is one of the building blocks of the health system. The provision of an indicator dashboard with disaggregated data that are collected over time can be used to gauge the performance of the health system, guide the allocation of resources and prioritise health interventions within districts.

Objectives. To determine neonatal and child mortality, morbidity and health service outcomes over a 6-year period in the Metro West geographic service area (GSA) of the Cape Town metropole.

Methods. A dashboard with key indicators was developed using existing data.

Results. From 2010 to 2015, there was a decrease in the perinatal mortality rate from 31.7 to 24.8 per 1 000 deliveries, and the early neonatal and neonatal mortality rates from 7.8 and 8.6 to 7.0 and 8.2 per 1 000 live births, respectively. The main obstetric causes of early neonatal deaths were antepartum haemorrhage (22 - 24%) and unexplained intrauterine death (13 - 16%); the main neonatal causes were immaturity (17 - 34%), congenital abnormalities (23 - 29%) and hypoxia (23 - 26%). Under-five mortality decreased in 2013 from 25 to 22 per 1 000 live births, with the main causes being neonatal conditions (32%), pneumonia (25%), congenital abnormalities (9%), injuries (8%) and diarrhoea (8%). Fifty percent of child deaths were out of hospital, with pneumonia and diarrhoea accounting for more than half of these. There was an improvement in health service coverage rates in 2015: immunisation <1 year old (99%); measles second dose (85%), pneumococcal third dose (100%) and rotavirus second dose (100%); maternal antiretroviral coverage (90%); HIV testing in mothers (93%); HIV DNA polymerase chain reaction testing in babies (97%); and a decrease in HIV transmission (2%). Exclusive breastfeeding coverage rates at 14 weeks, and vitamin A supplementation at 12 - 59 months, were only 30% and 44%, respectively, across the GSA.

Conclusion. There was a decrease in perinatal, early neonatal, infant and under-five mortality in Metro West over the 6 years. Further reductions in under-five mortality will require focusing on interventions to reduce neonatal and out-of-hospital deaths across the service delivery platform. Home visits to at-risk mothers and infants by community health workers could prevent out-of-hospital deaths and improve exclusive breastfeeding and vitamin A coverage. This will require increasing the number of community health workers and broadening their scope of practice.

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Health Care 2030 outlines the vision, values and principles of the provincial Western Cape Department of Health (DoH) for restructuring the healthcare system.^[1] The most important principles are patient-centred care, improvements in the quality of care, an increase in life expectancy and a reduction in maternal and child mortality. The aim is to apply this approach within populations and through health- and community-based services within subdistricts and districts, or geographic service areas (GSAs). The approach promotes integration and co-ordination of health services and the ownership of the population's healthcare by their health institutions. Metro West represents one of five GSAs in the province. Oversight of the GSA is by both district and hospital managers supported by service co-ordinating working groups.^[2]

A child health service co-ordinating working group (SCWG) was constituted in Metro West 6 years ago. The terms of reference of the group include identifying the current neonatal and child health status, supporting the implementation of interventions that

are consistent with Health Care 2030 and monitoring the impact of these interventions within the GSA. A previous situational analysis^[2] and a review of provincial and national reports^[3] provided the basis for developing a framework of key health indicators that could be used to monitor neonatal and child mortality, morbidity and health service-related outcomes in the GSA. The development of monitoring tools that track the health outcomes of populations over time provides a gauge of the performance of the health system, and can guide resource allocation, improve accountability and inform future health interventions. A dashboard of core indicators to monitor progress forms a key part of a health information system, which the World Health Organization identifies as one of the six building blocks of the health system.^[4,5] The tracking and updating of health indicators in maternal and child health is a task that has been assigned to the district paediatricians in the province, and provides a means for them to identify areas within the health system that need to be improved on.

The aim of this study was to determine progress using a dashboard of the key child health indicators that assess mortality, morbidity and coverage of the main child health services in the Metro West GSA. This involved analysing and linking the different data systems that are currently used. It is envisaged that this information could be used in district health planning, and in the implementation of the key neonatal and child health interventions to reduce morbidity and mortality.

Methods

The study was carried out in the Metro West GSA of the Cape Town Metro district, which includes the Klipfontein, Mitchells Plain, Southern and Western subdistricts. In 2015, the populations aged <18 years and <5 years were estimated to be 421 100 and 152 620, respectively.^[6] The largest number of children live in Mitchells Plain, followed by those in the Southern, Klipfontein and Western subdistricts. The health services in the GSA include two level 3 hospitals: Red Cross War Memorial Children's Hospital (RCWMCH) and Groote Schuur Hospital (GSH), which also each have a level 2 function; there are two level 2 hospitals (New Somerset Hospital (NSH) and Mowbray Maternity Hospital (MMH)), and four level 1 hospitals (False Bay (FBH), Mitchells Plain (MPH), Victoria (VH) and Wesfleur (WFH) Hospitals). RCWMCH is one of the two major paediatric centres in the Cape Metropole, with a level 2 responsibility for child healthcare in two of the subdistricts, and tertiary care for the entire province. NSH and VH are responsible for healthcare in the other subdistricts. Primary care facilities include the following: clinics run by the City of Cape Town (CoCT) municipality; and six 24-hour community health centres, community day centres and five 24-hour maternity obstetric units (MOUs) run by the Western Cape DoH's Metro District Health Services (MDHS).

The present study was a retrospective review of the health status and services of neonates and children in the Metro West GSA from 1 January 2010 to 31 December 2015. A dashboard was developed of indicators that could be used to track child health and service outcomes in the GSA (Table 1). The indicators were derived from previous reports^[2,3] and in consultation with representatives from the provincial Information Management Directorate. The indicators were derived by linking the different data systems that are used by the CoCT and the provincial health authorities. The main health facility-based audit systems include the Perinatal Problem Identification Programme (PIIP) and the Child Healthcare Problem Identification Programme (Child PIP). PIIP audits deliveries, births and deaths within the birthing units at hospitals and MOUs, and Child PIP audits child deaths in hospitals. Child PIP and PIIP do not audit deaths occurring outside the health facilities. Some late neonatal deaths are captured by Child PIP following hospital admission. These audit systems have been adopted by all health facilities in the GSA, with the exception of False Bay Hospital, which has not implemented Child PIP, and where few deaths are reported. The Local Mortality Surveillance System (LMSS) combines death notification and forensic pathology information on deaths both in and out of hospital. Service coverage data were obtained from Clinicom (Siemens, Germany), including hospital admissions, the Patient Record and Health Management Information System (PREHMIS, CoCT, SA) of the CoCT clinics and the Primary Health Care Information System (PHCIS) of the MDHS health facilities. Data from PREHMIS and PHCIS and other manually collected data are aggregated and imported as monthly totals in a provincial computer application called Sinjani (Western Cape DoH, SA).

The PIIP data were analysed for the birthing units within the four subdistricts, including the hospitals (WFH, NSH, MMH, MPH, FBH) and the five MOUs (Gugulethu, Hanover Park, Vanguard, Mitchells Plain and Retreat). The main information captured included the perinatal, early neonatal and neonatal mortality rates

(PNMR, ENMR and NMR), the main causes of death and the avoidable factors. As these rates are much higher at GSH, where preterm and sick neonates are referred, the data for GSH were not included in the subdistrict information, but separately and in the total annual count for the GSA. The Child PIP data were analysed for information on child deaths in terms of the residential subdistrict, the cause of death and the in-hospital mortality rates (IHMRs). The LMSS provided information on the demographic characteristics, the number of infant and under-five deaths and causes of death within the different subdistricts for 2010 - 2013. In February 2014, there was an amendment to the South African Births and Deaths Registration Act No. 51 of 1992, changing the format of the death notification form, for confidentiality purposes, resulting in the cause-of-death information no longer being obtainable through Home Affairs.^[7] Subsequently, for 2014 and 2015 there were no cause-of-death data, but the number of child deaths was determined from the in-hospital deaths captured by Child PIP, and the number of out-of-hospital deaths provided by the Forensic Pathology Service (FPS). Information was obtained from Sinjani and Clinicom to determine the various child health indicators: disease incidence rates on diarrhoea, pneumonia and severe acute malnutrition; immunisation coverage; vitamin A coverage; exclusive breastfeeding rates; and indicators relating to the prevention of mother-to-child transmission (PMTCT) of HIV.

The denominators used for the purpose of this study included the following: the numbers of births at the various birthing facilities where the PPIP programme was implemented were used to calculate the PNMR, the ENMR and the NMR; based on the Statistics South Africa (StatsSA) data^[6] and adjusted for subdistrict populations from the SA Medical Research Council burden of disease study,^[8] the births were used to calculate infant and under-five mortality for the subdistricts and Metro West; and the population estimates from Statistics South Africa (Stats SA) were used to calculate the service-related health indicators.^[6]

Ethical approval for the study was obtained from the Human Research Ethics Committee of the University of Cape Town (ref. no. 288/2013), and it was registered on the National Health Research Database (ref. no. WC_2017RP20_958). As the review was based on secondary data sources and did not involve primary research, no consent was required from participants.

A data file was created in Excel 2013 (Microsoft, USA). Analyses were undertaken in Excel to determine summary statistics, including disease incidence rates and percentages relating to coverage. The data trends over the 6-year period were analysed.

Results

Perinatal, early neonatal and neonatal mortality

The total deliveries, live births, stillbirths, early and late neonatal deaths and the perinatal, early neonatal and neonatal mortality rates for the subdistricts in Metro West from 2010 to 2015 are outlined in Table 2. Over the 6-year period, there was a decrease in the PNMR from 31.7 to 24.8 per 1 000 deliveries, and in ENMR and NMR from 7.7 and 8.6 to 7.0 and 8.2 per 1 000 live births, respectively. The reduction in these rates largely resulted from a decrease in the proportion of stillbirths and early neonatal deaths in all the subdistricts.

The PNMR and ENMR declined progressively based on the weight categories of neonates. These mortality rates fell almost three times lower with each increase in weight category, from 1 000 - 1 500 g to 2 000 - 2 500 g (Figs 1 and 2).

The main obstetric causes of death in babies weighing >1 000 g are outlined in Fig. 3. Antepartum haemorrhage and unexplained intrauterine death were the main causes of death over the 6-year period. Hypoxia, congenital abnormalities, immaturity and infections were the main causes of early neonatal deaths (Fig. 4).

Table 1. Neonatal and child health indicators in dashboard

Indicator	Calculation: numerator/denominator	Data source*	Coverage
PNMR	Stillbirths + deaths 0 - 7 days per 1 000 deliveries	PPIP	Inpatients
ENMR	Deaths 0 - 7 days per 1 000 live births in facility	PPIP	Inpatients
NMR	Deaths 0 - 28 days per 1 000 live births in facility	PPIP and Child PIP	Inpatients
IMR	Deaths <1 yr per 1 000 live births	LMSS/Stats SA [†]	Subdistrict
U5MR	Deaths <5 yr per 1 000 live births	LMSS/Stats SA [†]	Subdistrict
Child deaths in first yr of life, %	Deaths <1 yr/deaths <5 yr × 100	LMSS/Sinjani	Subdistrict
IHMR <5 yr, %	Deaths <5 yr/admissions <5 yr × 100	Child PIP	Inpatients
Diarrhoeal disease (% IHMR)	Diarrhoeal hospital deaths/diarrhoea admissions × 100	Child PIP/Clinicom	Inpatients
Pneumonia (% IHMR)	Pneumonia hospital deaths/ pneumonia admissions × 100	Child PIP/Clinicom	Inpatients
SAM (% case fatality rate)	SAM deaths <5 yr/SAM admissions <5 yr × 100	Child PIP/Clinicom	Inpatients
Diarrhoea incidence per 1 000 under-fives	Children <5 yr with diarrhoea and dehydration per 1 000 under-five population	Sinjani/StatsSA	PHC
Diarrhoea % hospital admissions	Children with diarrhoea admitted/total admissions × 100	Child PIP/Clinicom	Inpatients
Pneumonia incidence per 1 000 under-fives	Children <5 yr with pneumonia per 1 000 population <5 yr	Sinjani/StatsSA	PHC
Pneumonia % hospital admissions	Children with pneumonia admitted/ Total number of child admissions × 100	Child PIP/Clinicom	Inpatients
PMTCT: HIV transmission rate 6 wk	Babies PCR test result positive/babies who had PCR test × 100	Sinjani/ StatsSA	PHC
PMTCT: NVP uptake in infants	Babies on NVP/babies on PMTCT programme × 100	Sinjani/ StatsSA	PHC
PMTCT: HAART coverage of mother	HIV-positive mothers on HAART/mothers who tested HIV positive × 100	Sinjani/StatsSA	PHC
PMTCT: HIV testing rate	Accepted antenatal HIV testing/receiving antenatal care × 100	Sinjani/StatsSA	PHC
Immunisation coverage under 1 yr	<1 yr immunised fully/population <1 yr × 100	Sinjani/StatsSA	PHC
Pneumococcal vaccine 3rd dose coverage	Receiving 3rd dose PCV/population <1 yr × 100	Sinjani/StatsSA	PHC
Rotavirus 2nd dose coverage	Number receiving 2nd dose RV/population under 1 yr × 100	Sinjani/StatsSA	PHC
Measles 1st dose under 1 yr coverage	Number receiving 1st dose measles/population under 1 yr × 100	Sinjani/StatsSA	PHC
Measles 2nd dose coverage	Number receiving 2nd dose measles/population at 18 mo × 100	Sinjani/StatsSA	PHC
Infant exclusively breastfed at 3rd dose hep B	Infant exclusively breastfed at 3rd dose hep B/infants receiving hep B 3rd dose × 100	Sinjani/StatsSA	PHC
Vitamin A supplementation coverage of children 1 - 5 yr	Children 12 - 59 mo given vitamin A/population 12 - 59 mo	Sinjani/StatsSA	PHC

PNMR = perinatal mortality rate; PPIP = Perinatal Problem Identification Programme; ENMR = early neonatal mortality rate; NMR = neonatal mortality rate; Child PIP = Child Health Problem Identification Programme; IMR = infant mortality rate; LMSS = Local Mortality Surveillance System; Stats SA = Statistics South Africa; U5MR = under-five mortality rate; IHMR = in-hospital mortality rate; SAM = severe acute malnutrition; PMTCT = prevention of mother-to-child transmission; PCR = polymerase chain reaction; NVP = nevirapine; HAART = highly active antiretroviral therapy; hep B = hepatitis B.

*Includes data sources for numerator and denominator; [†]Statistics SA data adjusted for subdistrict population and geographic service area.

Infant and child mortality

The infant mortality rate (IMR) in Metro West decreased from 21 to 18 per 1 000 live births between 2010 and 2013 (Fig. 5). The relative decreases in IMR were 15% and 5% in Mitchells Plain and Southern subdistricts, respectively; this is in contrast with relative increases in Western and Klipfontein of 40% and 10%, respectively. The under-five mortality rate (U5MR) decreased in Metro West from 25 to 21 per 1 000 live births in 2010 v. 2011 and increased slightly to 22 per 1 000 live births in 2013. In 2015, using the data from Child PIP and the FPS, the U5MR was estimated to be 22 per 1 000 live births. At a subdistrict level, the largest decreases in under-five mortality were in Mitchells Plain and Southern, from 32 to 19 and 23 to 15 per 1 000 live births between 2010 and 2013. There was a slight decrease in the U5MR in Klipfontein, and an increase in Western from 21 to 27 per 1 000 live births.

Causes of under-five mortality

Neonatal conditions (preterm birth complications, birth asphyxia and perinatal injuries) and pneumonia were the most common causes of under-five mortality in Metro West between 2010 and 2013 (Fig. 6). Diarrhoea was the third most common cause of death in 2010, but there was a noticeable drop in diarrhoeal deaths. Diarrhoeal disease was the fifth most common cause of under-five mortality in 2014. The other important causes of under-five deaths were injuries (includes fires or hot substances, hanging or strangulation, interpersonal violence, road traffic accidents, drowning and poisoning) and congenital birth defects (cardiac, gastrointestinal, neural tube and other).

Child PIP, Clinicom and the LMSS were used to determine hospital admissions and deaths for all children and for those with diarrhoea and pneumonia. Using these data sources, we could determine child deaths that occurred within hospitals in the GSA, and those that

Table 2. Perinatal, early neonatal and neonatal mortality rates by subdistrict in Metro West GSA, 2010 - 2015*

Subdistrict	Deliveries	Live births	Stillbirths	ENNDs	LNNDs	PNMR	ENMR	NMR
2010								
Klipfontein	4 503	4 447	56	21	1	17.1	4.7	4.9
Mitchells Plain	3 669	3 626	43	12	5	15.0	3.3	4.7
Southern	13 172	12 975	199	77	10	21.0	5.9	6.7
Western	9 981	9 802	179	66	4	24.5	6.7	7.1
GSH	5 691	5 280	411	104	11	90.5	19.7	21.8
Metro West	37 016	36 130	888	280	31	31.6	7.7	8.6
2011								
Klipfontein	4 378	4 332	46	22	4	16.4	5.1	6.0
Mitchells Plain	3 555	3 516	39	9	3	14.3	2.6	3.4
Southern	13 771	13 596	175	75	14	19.2	5.5	6.5
Western	9 754	9 605	149	59	3	21.6	6.1	6.5
GSH	5 590	5 229	361	61	5	75.5	11.7	12.6
Metro West	37 048	36 278	770	226	29	26.9	6.2	7.0
2012								
Klipfontein	4 000	3 956	44	16	2	15.5	4.0	4.6
Mitchells Plain	3 280	3 234	46	12	0	17.7	3.7	3.7
Southern	13 503	13 347	156	58	12	16.7	4.3	5.2
Western	9 961	9 833	128	54	5	18.8	5.5	6.0
GSH	4 012	3 688	324	100	11	105.6	27.1	30.1
Metro West	34 756	34 058	698	240	30	27.0	7.0	7.9
2013								
Klipfontein	3 541	3 485	56	15	1	20.5	4.1	4.6
Mitchells Plain	3 029	2 992	37	10	4	14.6	3.1	4.7
Southern	13 498	13 347	148	66	16	15.7	4.8	6.1
Western	10 140	9 985	155	64	4	21.7	6.5	6.8
GSH	3 196	2 871	325	82	11	127.3	28.6	32.4
Metro West	33 404	32 680	721	237	36	28.6	7.2	8.4
2014								
Klipfontein	3 597	3 555	42	15	2	16.4	4.7	4.8
Mitchells Plain	2 892	2 873	19	12	0	10.7	4.2	4.2
Southern	12 942	12 777	165	64	11	18.5	5.0	5.9
Western	9 420	9 297	123	35	1	16.9	3.8	3.9
GSH	2 989	2 693	296	68	26	122	25.2	34.9
Metro West	31 840	31 195	645	194	40	26.4	6.2	7.5
2015								
Klipfontein	3 259	3 228	31	15	2	14.1	4.6	5.3
Mitchells Plain	5 909	5 853	55	15	1	11.8	2.6	2.7
Southern	12 567	12 446	121	79	20	15.9	6.3	8.0
Western	10 411	10 276	135	68	4	19.5	6.6	7.0
GSH	3 061	2 773	288	66	13	115.6	23.8	28.5
Metro West	35 207	34 576	630	243	40	24.8	7.0	8.2

GSA = geographic service area; ENNDs = early neonatal deaths; LNNDs = late neonatal deaths; PNMR = perinatal mortality rate; ENMR = early neonatal mortality rate; NMR = neonatal mortality rate.

*Source: Perinatal Problem Identification Programme (including numerator and denominator), Metro West GSA, 2010 - 2015.

occurred outside the hospital or at home. As outlined in Table 3, more than 50% of the child deaths occurred outside the hospital or at home. Of the pneumonia and diarrhoeal deaths, more than 80% occurred outside the hospital or at home. There was a reduction of 45% in the in-hospital deaths, with a decline in the IHMR from 1.1% to 0.6% between 2010 and 2015. The decline in IHMR over this period was associated with a decline in the in-hospital diarrhoea- and the HIV-related deaths. The data show fluctuations but little change in the IHMR for pneumonia. In terms of the out-of-hospital deaths, there was a decline in the diarrhoeal but not in the

pneumonia deaths. With respect to severe acute malnutrition, there were 236 admissions and 7 deaths in 2015, with an in-hospital case fatality rate of 3%.

Indicators on child health services

Indicators relating to low birth weight (LBW), immunisation and PMTCT status are outlined in Table 4. There was a slight decrease in the LBW rate in Metro West between 2010 and 2015, from 17.1% to 14.6%; the LBW rate decreased in two of the subdistricts (Mitchells Plain and Western), but not in Klipfontein and Southern. The

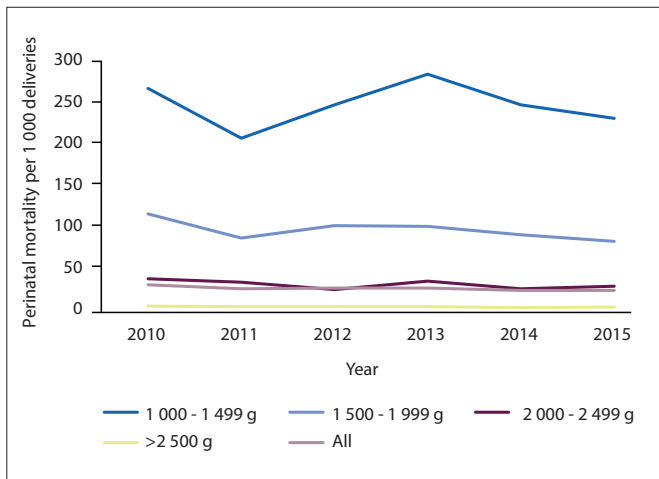


Fig. 1. Perinatal mortality rates by weight category for neonates born in Metro West geographic service area, 2010 - 2015; Perinatal Problem Identification Programme data.

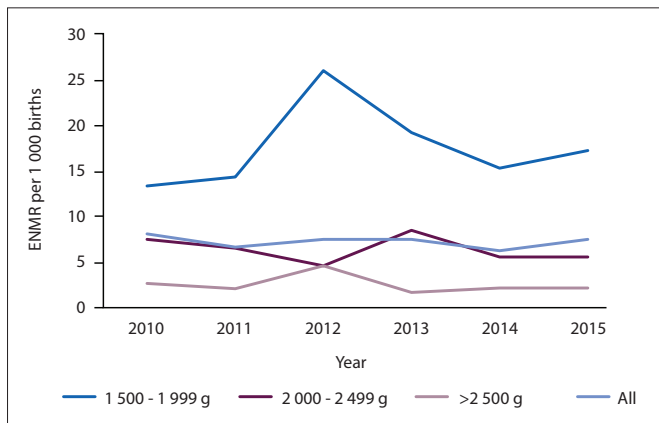


Fig. 2. Early neonatal mortality rates by weight category for neonates born in Metro West geographic service area, 2010 - 2015; Perinatal Problem Identification Programme data. (ENMR = early neonatal mortality rate.)

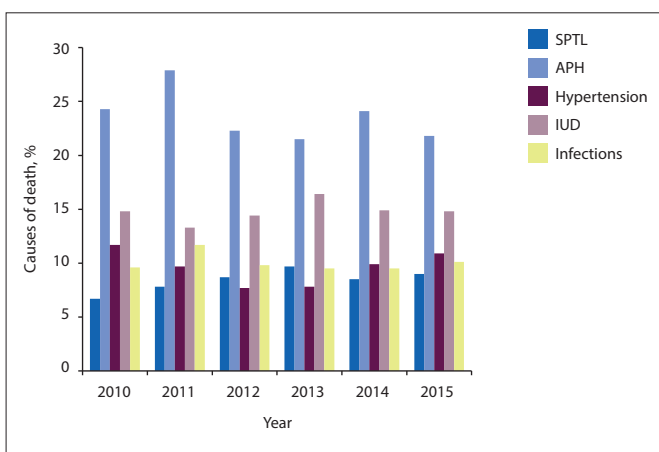


Fig. 3. Obstetric causes of death for neonates >1000 g in Metro West geographic service area, 2010 - 2015; Perinatal Problem Identification Programme data. (SPTL = spontaneous preterm labour; APH = antepartum haemorrhage; IUD = intrauterine death.)

rate for exclusive breastfeeding in 2015 was 30%, and ranged from 25% to 44% across the GSA. Vitamin A supplementation coverage improved in some subdistricts but not others over the 6-year period. There was an overall improvement in the immunisation

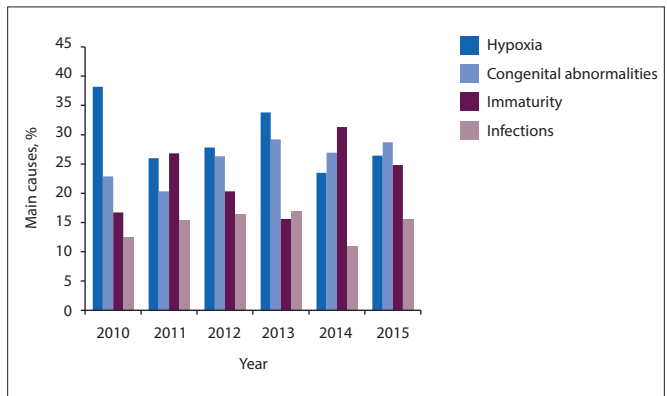


Fig. 4. Main causes of neonatal deaths in Metro West geographic service area, 2010 - 2015; Perinatal Problem Identification Programme data.

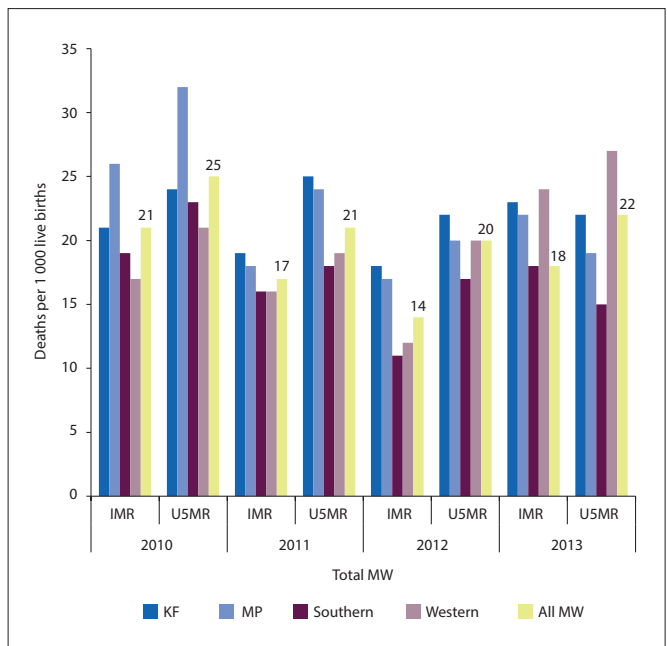


Fig. 5. Infant and under-five mortality by subdistrict, 2010 - 2013; Local Mortality Surveillance System data. (IMR = infant mortality rate; U5MR = under-five mortality rate; KF = Klipfontein; MP = Mitchells Plain; MW = Metro West.)

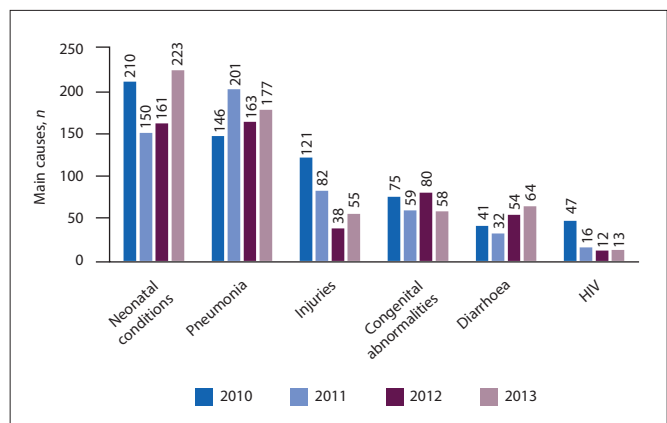


Fig. 6. Main causes of death in children <5 years old in Metro West, 2010 - 2013.

coverage indicators for the GSA. Coverage for the second dose of measles immunisation improved from 66% to 85%, while there were considerable improvements in the pneumococcal (PCV)

Table 3. Admissions and deaths from diarrhoea, pneumonia and all causes in children under five years old in Metro West GSA, 2010 - 2015*

Year	Diarrhoea						Pneumonia						All					
	Deaths, n (%)			IHMR, %			Deaths, n (%)			IHMR, %			Deaths, n (%)			IHMR, % [‡]		
	In-hospital	Out-of-hospital	Total	In-hospital	Out-of-hospital	Total	In-hospital	Out-of-hospital	Total	In-hospital	Out-of-hospital	Total	In-hospital	Out-of-hospital	Total			
2010	12 (10)	109 (90)	121	0.4	2.870	28 (19)	123 (81)	151	1.0	24 984	441 (51)	418 (49)	859	1.1				
2011	5 (6)	77 (94)	82	0.1	4 188	19 (10)	182 (90)	201	0.5	27 639	347 (49)	361 (51)	708	0.8				
2012	2 (9)	36 (91)	38	0.2	4 355	15 (9)	137 (91)	152	0.3	26 988	353 (51)	337 (49)	690	0.7				
2013	7 (13)	48 (87)	55	0.1	4 675	12 (7)	159 (93)	171	0.3	30 627	367 (48)	398 (52)	765	0.6				
2014	0	-	0	0.1	4 024	25	-	25	0.6	30 667	343 (50)	340 (50) [§]	683	0.6				
2015	3	-	3	0.1	4 047	15	-	15	0.4	30 475	359 (49)	376 (51) [§]	735	0.6				

Blank cell = data not available; IHMR = in-hospital mortality rate. *Source: Clinicom, Child PIP and LMSS; †includes all child hospital deaths in Metro West geographic service area; ‡based on all hospital deaths in Metro West geographic service area (except early and late neonatal deaths) captured in Perinatal Problem Identification Programme; §estimated out-of-hospital deaths based on data from the Forensic Pathology Services.

third dose and rotavirus (RV) second dose immunisations. Southern had the greatest improvement in immunisation coverage <1 year old, from 62% to 100%.

In terms of PMTCT between 2010 and 2015, the HIV transmission rate at 6 weeks decreased in almost all the subdistricts to ≤2%; the uptake of nevirapine in infants remained high, at 98%; highly active antiretroviral therapy (HAART) coverage in mothers increased from 67% to 90%; and HIV testing antenatally, and polymerase chain reaction testing in infants, increased to 93% and 97%, respectively (Table 4).

Priority child health conditions: Diarrhoea, pneumonia and injuries

From 2010 to 2015, the incidence of pneumonia increased in all the subdistricts in the GSA, from 54 to 115 per 1 000 under-five children. This contrasts with the incidence of diarrhoea, which remained nearly constant, with a slight increase from 13 to 20 per 1 000 children under 5 years old.

Discussion

The PNMR and ENMR of 24.8 per 1 000 deliveries and 7 per 1 000 live births for Metro West are lower than the rates reported nationally.^[9] While there has been a marginal decrease in the ENMR, the PNMR has shown a greater decrease, resulting from a drop in the stillbirth rate by almost a third over the 6-year period. Numerous factors have contributed to these decreases. These include monthly perinatal audit meetings at birthing units to address the avoidable factors and implement recommendations in line with the National Perinatal Mortality and Morbidity Committee,^[3,9,10] ongoing training in medical and obstetric emergencies and neonatal resuscitation, implementation of maternal and neonatal facility-based guidelines, increased PMTCT coverage and improvements in access to care through a more efficient interfacility emergency transport system (Dr L Jacobs, personal communication, 12 September 2018).

Further reductions in the PNMR, ENMR and NMR will require a greater focus on interventions to reduce stillbirths, prematurity and intrauterine growth restriction. The LBW rate remains high, and these neonates are at a higher risk of mortality.^[11] This situation requires strengthening antenatal interventions, including promoting early booking, adequate maternal nutrition,^[12] avoidance of substance abuse, regular antenatal attendance; monitoring for hypertension and infections and early care seeking.

The ongoing training days and rollout of programmes such as the Management of Sick and Small Newborn package to MOUs and district hospitals could address the patient- and medical personnel-related factors contributing to neonatal deaths.^[13] Reducing the neonatal deaths that account for about a third of under-five deaths is critical in making further gains in child survival in the GSA.

The U5MR for the 6-year period is lower than the national rate of 39 per 1 000 live births.^[14] Over this period there was a marginal decrease in the U5MR, which appears to be plateauing. The relative increase in the infant and U5MRs reported in Klipfontein and Western in 2013 could have resulted from an overestimation of the actual mortality rates for these subdistricts, as there was under-registration of births, which similarly affected these indicators in the province over this period.^[15]

Contributing to the decrease in under-five mortality between 2010 and 2015 in the GSA was the decrease in in-hospital child deaths from diarrhoea and HIV. The reduction in diarrhoeal admissions and deaths could be attributed to increased coverage of the rotavirus vaccine, improved management of children with diarrhoea at the primary level of care and an increase in beds and part-time staff at district and regional hospitals during the diarrhoeal season. The decrease in HIV-related deaths could be attributed to improved PMTCT coverage and access to antiretroviral treatment for HIV-infected children. While there has been a reduction in in-hospital deaths, the high number of out-of-hospital deaths limits further reductions in the U5MR in the GSA.

The findings of the present study are consistent with those of previous research^[16] that showed that more than half of the under-five deaths occurred out of hospital, with pneumonia and diarrhoea accounting for most of the natural deaths. A recent review of child deaths at two mortuaries in Cape Town and Durban showed that most of the out-of-hospital under-five deaths (40%) were due to pneumonia. Many of these deaths included preterm infants who died unexpectedly outside the neonatal period shortly after being discharged from hospital. The caregivers of these children lived in poor social circumstances with limited support. The authors of that review recommended a multi-pronged approach involving community-based services that could target high-risk mothers requiring support and interventions to prevent these deaths.^[17]

The high number of out-of-hospital child deaths and the slow decline in the U5MR provides a strong motivation for the implementation of interventions on pneumonia and diarrhoea by community

Table 4. Indicators of child health services by subdistrict and total GSA, 2010 and 2015, as % coverage

Indicator	Klipfontein		Mitchells Plain		Southern		Western		Metro West GSA	
	2010	2015	2010	2015	2010	2015	2010	2015	2010	2015
	Low birth weight rate	9.7	11.9	11	5.9	12.3	14.7	15.8	12.2	17.1
Exclusive breastfeeding at 3rd hep B immunisation*	-	27	-	44	-	25	-	26	-	30
Vitamin A coverage 12 - 59 months	18	48	21	51	16	35	25	42	20	44
SAM in-hospital CFR	3	0	1	0	0	0.7	2	0.0	1	0.3
Immunisation coverage <1 year	100	87	83	90	62	100	89	100	83	99
Measles 1st dose coverage	100	100	83	100	68	100	91	100	85	100
Measles 2nd dose coverage	75	74	75	84	54	90	63	88	66	85
PCV 3rd dose coverage	70	89	66	94	50	100	52	100	59	100
RV 2nd dose coverage	57	94	51	100	54	100	56	100	54	100
HIV transmission rate at 6 weeks	3	1	3	0	3	2	4	2	3	2
NVP uptake infant	100	98	99	100	99	99	97	97	99	98
HAART/ARV coverage in pregnant mother	67	84	57	86	83	90	62	95	67	90
HIV testing rate in mother antenatally	-	91	-	94	-	95	-	92	-	93
HIV-exposed children whose PCR was done	-	97	-	98	-	98	-	97	-	97

Percentages >100 reported as 100%.

GSA = geographic service area; hep B = hepatitis B; SAM = severe acute malnutrition; CFR = case fatality rate; PCV = polymerase chain reaction; RV = rotavirus; NVP = nevirapine; HAART = highly active antiretroviral therapy; ARV = antiretroviral; - = data not available.

*At 14 weeks.

health workers (CHWs) who operate within ward-based outreach teams. These interventions have been incorporated into the integrated community case management (iCCM)^[18] strategy of the World Health Organization and the United Nations Children's Fund, and would require an increase in the number of CHWs trained and supervised in iCCM. As outlined by Doherty *et al.*^[19] attention needs to be given to increasing the number of CHWs, improving the CHW-to-population ratio and broadening their scope of practice, so that these interventions can achieve their necessary goal.

One area where CHWs could make an impact is in vitamin A supplementation. Coverage doubled over the 6-year period in the GSA, but remains low, at just over 40%. Although the guidelines have been revised to allow CHWs to administer vitamin A, this can only be done under the supervision of a professional nurse.^[20] Changing this practice to allow CHWs to routinely provide vitamin A during outreach visits would improve coverage and potentially reduce the all-cause under-five mortality within the GSA.^[21]

Exclusive breastfeeding coverage during the first 6 months of life is low in Metro West. However, data were missing for certain health facilities, which may have contributed to these low figures. The reasons for this are not clear, as most of the birthing facilities within the GSA are Mother-Baby Friendly Initiative-accredited, and clinic staff are trained through the integrated management of childhood illness strategy and the integrated nutrition programme to promote and support breastfeeding. There is good evidence to show that educational interventions can increase the exclusive breastfeeding coverage rates, and that a combination of individual and group sessions is more effective than either alone.^[12] Scaling up the coverage of exclusive breastfeeding will improve child survival and reduce the number of stunted children.^[12] The promotion of and support for breastfeeding requires identifying the barriers to exclusive breastfeeding, its promotion using community- and facility-based platforms, the establishment of breastfeeding support groups within communities and the implementation of the postnatal care policy at MOUs and clinics.

The strengths of the present study relate to the linking of the different mortality audit systems that were used to report on all child deaths, and determine the various mortality indicators and the causes of death. Analysis of the PREHMIS and Clinicom data

provided valuable information on the service coverage rates. The linking of these data systems has resulted in the development of an indicator dashboard for the subdistricts in Metro West. Making this information available to service providers and managers could be used to inform policies and interventions to reduce mortality and morbidity and improve service delivery for neonates and children in the GSA. Further work is needed to develop a provincial system that will link these different data systems and ensure that this information is routinely provided. There is a need to determine the HIV and nutritional status of all the children whose deaths are captured by the different mortality audit systems.

The limitations of the study relate to it reporting only on children in the public health sector, which is utilised by about 75% of the population in the Western Cape. The data on service delivery outcomes therefore exclude about a quarter of the province's children, who access private healthcare.^[22] The service coverage estimations used Stats SA data that included projected population estimates by age, gender and subdistrict for the GSA, which could have affected the accuracy of these calculations. Furthermore, the quality of routine data is affected by the fact that there are multiple data collectors, and this influences completeness and accuracy.

The LMSS included child deaths among those accessing private healthcare for the period 2010 - 2013. Linking the FPS to Child PIP and PPIP ensured that out-of-hospital deaths were reported on for 2014 and 2015. We did not include the 2016 and 2017 data, as we did not have access to the FPS data for these years.

Conclusion

Progress has been made in reducing perinatal, early neonatal, infant and under-five mortality in Metro West. Achieving further reductions in these rates will require that health workers across the service delivery platform focus on interventions to reduce deaths from neonatal conditions and out-of-hospital deaths, especially resulting from pneumonia. This requires the prevention of stillbirths, and preterm and intrauterine growth-restricted births, at the different levels. Increasing the coverage of exclusive breastfeeding and vitamin A supplementation could contribute to averting child deaths in the GSA. CHWs have a key role to play in improving the coverage of these interventions and preventing out-of-hospital deaths, through

regular home visitation of at-risk infants. At GSA governance level, consideration should be given to increasing the CHW-to-population ratio and broadening the scope of practice of CHWs.

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