Saving Mothers

2020-2022

Eighth Comprehensive Triennial report into Maternal deaths in South Africa, 2020-2022; includes data for COVID-19 pandemic

health
Department:
Health
REPUBLIC OF SOUTH AFRICA

2030 NDP

30 YEARS OF FREEDOM
South Africa 1994 - 2024

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Ms Bontle Mamabolo (South African Medical Research Council's Maternal and Infant Health Care Strategies Unit) processed and analysed the MAMMAs data for the NCCEMD.
Acknowledgements for the assistance of the previous editor, Professor R Pattinson and previous NCCEMD committee chaired by Professor J Moodley until August 2020.

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ABBREVIATIONS

AR	Anaesthetic related
ART	Antiretroviral Therapy
BBA	Born before arrival
BLDACD	Deaths associated with Bleeding at or after Caesarean delivery
BMI	Body mass index
BP	Blood pressure
CD	Caesarean delivery
CEO	Chief Executive Officer
CFR	Case Fatality rate
CHC	Community Health Centre
CHW	Community health worker
CLEVER	Clinical care; Labour ward management; Eliminate barriers; Verify care; EOST; Respectful care
Clinic	Primary health care clinic
DCST	District Clinical Specialist Teams
DDPCP	Death During Pregnancy, Childbirth and the Puerperium
DH	District hospital
DHIS	District health information system
EC	Eastern Cape province
EOST	Emergency obstetric simulation training
ESMOE	Essential Steps in Managing Obstetric Emergencies
FDC	Fixed dose combination
FRANC	First referral for antenatal care
FS	Free State province
GP	Gauteng Province
HIV	Human immunodeficiency virus
HPD	Hypertensive disorders in pregnancy
HOI	Head of Institution
iMMR	In Facility Maternal Mortality Ratio
IUCD	Intrauterine contraceptive device
KZN	KwaZulu-Natal province
LARC	Long acting reversible contraception
LP	Limpopo province
MaMMAS	Maternal Morbidity and Mortality Audit Sytem
MD	Maternal death
M&S	Medical and Surgical conditions
MP	Mpumalanga province
MVA	Manual vacuum aspiration
NaPeMMCo	National Perinatal Morbidity and Mortality Committee

NC	Northern Cape province
NCCEMD	National Committee for Confidential Enquiries into Maternal Deaths
NCH	National central hospital
NPRI	Non-pregnancy related infections
NW	North West province
OH	Obstetric haemorrhage
MBU	On-site Midwife Birthing Unit
PHC	Primary health care
PMTCT	Prevention of Mother-to-Child Transmission
PPE	Personal Protective Equipment
PPH	Postpartum haemorrhage
PRS	Pregnancy related sepsis
RH	Regional Hospital
TB	Tuberculosis
TH	Tertiary hospital
TOP	Termination of pregnancy
TXA	Tranexamic acid
VTP	Vertical Transmission Prevention
WBOT	Ward based outreach teams
WC	Western Cape province

FOREWORD

The death of a woman during pregnancy, childbirth, or the puerperium still remains one of the greatest possible tragedies. The right to life is everyone's constitutional right, and women also deserve it. Everyone has the right to have access to healthcare services, including reproductive healthcare. All women must feel safe when faced with the need to seek care everywhere within our health system, and it's everyone's moral obligation to ensure that safety.

In South Africa, a system of national confidential enquiries into maternal deaths exists to review maternal deaths. This team consists of highly committed healthcare professionals who dedicated their time to the confidential assessments of individual maternal deaths in all nine provinces of South Africa. This confidential enquiry identifies challenges in the health system and makes recommendations for improvement. The recommendations are produced in the form of annual and triennial reports, which highlight shortcomings in the healthcare system, avoidable factors in individual clinical care, and whether the death could have been prevented or not.

The NCCEMD works as a ministerial team which reports to the Honourable Minister of Health, Dr J Phaahla, his Honourable Deputy Minister, Dr S Dhlomo with support from the NDOH MCWH team.

It is quite a mammoth task to bring such triennial and annual reports to fruition, and it involves tremendous effort, energy, and meticulous attention to detail. Professor S Fawcus (editor) of the Saving Mothers' Reports and Ms B Mamabolo (SAMRC-UP) deserve special mention and South Africa's gratitude for these thoughtful documents and the contributions that they have made to decrease maternal and newborn deaths in South Africa.

We would also like to thank the chapter heads who have provided Abstracts for their chapters in Section 7. Furthermore, we would also like to thank provincial assessors (named in section 8 of the report) who assessed all the maternal deaths in their provinces and thus generated the data for the MaMMAS database from which these reports are generated. Without you, these reports would not have happened.

South Africa was just celebrating the fruits of implementation of these recommendations from the latest triennial report (Saving Mothers' Report 2017–2019), which demonstrated that the assessment of individual maternal deaths and the lessons learned leading to recommendations, do result in good news. For the first time since the initial report in 1998, the institutional maternal mortality ratio had dropped to less than 100 per 100,000 live births in 2019. This was certainly an achievement for South Africa, one of the few countries in the world that has such an assessment system of individual deaths and implements the recommendations. However, the unexpected happened. The COVID-19 pandemic came when we least expected it; South African women were not spared, and its aftermath is still evident. We also lost a significant number of healthcare workers. It had both direct and indirect effects on our health system, as highlighted in this triennial report, where maternal deaths increased by 30% in 2020 and 47% in 2021, during the COVID-19 pandemic, compared to 2019 but decreased to pre-pandemic level in 2022 to just above a 100 maternal deaths per 100,000 live births level. The pandemic set back progress towards achieving the SDG goal of MMR 70 maternal deaths per 100,000 live births by 2030, but now we're back on track, and hopefully great lessons are learned for the future.

In November 2023, the Executive summary of the 2020-2022 Saving Mothers report was published. The Comprehensive report presented here includes more detailed data, detailed recommendations with allocation of responsibilities, abstracts of the Primary Obstetric cause chapters and Provincial reports.

Of note, the detailed chapters of each Primary Obstetric Cause will be published mid-year in an expanded Comprehensive report.

Let us continue to grow South Africa together in our journey to save lives. Together, we can!

Dr Sylvia N Cebekhulu: NCCEMD Acting Chairperson

SYNOPSIS/KEY FINDINGS ON MATERNAL DEATHS IN SOUTH AFRICA 2020-2022, AND SUMMARY OF KEY RECOMMENDATIONS

Maternal deaths and Maternal Mortality rates.

There were 1234, 1507, and 1062 maternal deaths in 2020, 2021 and 2022 respectively giving a corrected triennial total of 3803, which is greater than 3347 deaths reported in the previous triennium (2017-2019). There were 3,019165 live births, reported by public health facilities via DHIS in 2020-2022, giving a corrected iMMR of 126 MDs per 100,000 live births compared to 113.8 in the previous triennium.

It is notable that during 2020 and 2021, the iMMR was 30% and 47% respectively higher than for the pre-pandemic year 2019 when it was 98.8. However, the iMMR declined to 109.7 in 2022, which is less than the iMMR in the previous triennium. This shows that the steep decline from 2010 was reversed in 2020 and 2021 but stabilised in 2022.

The increase in iMMR in 2020 and 2021, occurred in all provinces in South Africa.

Primary obstetric causes of maternal deaths

Non-Pregnancy Related Infections (NPRI) were the major causal grouping in all three years as in previous triennia but showed a very large increase in 2020 and 2021, where it accounted for 322 (27.1% all MDs) in 2020 and 561 (37.7% of MDs) in 2021. In 2022 it accounted for 180 deaths (18.6% MDs) which is lower than in previous triennia. For the whole triennium it was the leading cause accounting for 29.1% of all MDs.

COVID-19 pneumonia and complications constituted the majority of these NPRI deaths accounting for 124 (38.5% of NPRI deaths) in 2020, and 369 (66.6% of NPRI deaths and 25% of all MDs) in 2021. In 2022, there were only 12 deaths directly due to COVID-19.

Obstetric haemorrhage (OH) deaths increased to become the second most common cause, accounting for deaths in 599 women (16.4% of total MDs).

Hypertensive disorders (HDP) were the third most common cause, accounting for 539 MDs (14.7%)
Medical and surgical (M&S) disorders were the fourth cause accounting for 513 MDs (14% of total MDs)
Early pregnancy deaths from miscarriage and ectopic accounted for 269 deaths (7.3%) and thus Early Pregnancy complications combined are the fifth most common cause.

There were 39 Anaesthetic deaths in 2022 which is twice the number in previous years, and although not a major cause, almost all of these deaths were preventable.

In terms of comparisons with the previous triennium, the iMMR for NPRI increased from 27.1 MDs per 100,000 live births in 2017-2019 to 35.2 in 2020 to 2022. However, the iMMR for Obstetric Haemorrhage and Medical and Surgical disorders remained similar between the two triennia (OH iMMR 19.1 in 2017-2019 and 19.8 in 2020-2022; M&S iMMR 16.9 in 2017-2019 and 17 in 2020-2022). In contrast, the iMMR for Hypertension declined from 20.2 to 17.9, and for Early Pregnancy complications from 11.4 in 2017-2019 to 8.9 in 2020-2022.

Location of maternal deaths

In the 2020-2022 triennium, the majority of deaths (90.1%) occurred at public hospitals with a larger number (6.1%) in private hospitals than in previous years, especially during 2021. This shows that the COVID-19 pandemic affected all classes of society.

Caesarean delivery rates and fatality rates

The Caesarean Delivery (CD) rate for all deliveries in 2020 and 2021 was 28%, the same as in 2019, but in 2022 it was 31.1%. The CD Case Fatality Rate increased to 145.7 CD associated deaths per 100,000 CDs in 2020 and 203.6 in 2021, compared to 112.5 in 2019. This could reflect the fact that many sick women with COVID-19 in the third trimester had CD for severe respiratory compromise, and it may not have been a direct effect of the CD. In 2022, the CD CFR had declined to 118.4, similar to 2019.
There were 198 deaths from bleeding associated with CD, giving a BLDACD CFR for the triennium of 22.3, similar to 2017-2019 when it was 23.6.

Preventability of maternal deaths

Deaths were assessed to be possibly or probably preventable by the health system for 58% of women who died in 2020, 56% in 2021, and 59% in 2022; the most common causes of preventable deaths being OH, and HPD deaths, with lesser numbers in the NPRI group. In the 2020-2022 triennium, 57.4% of deaths were potentially preventable compared to 62.4% in the previous triennium. This decrease was probably due to the large numbers of deaths from COVID-19 in 2020-2022, most of which were assessed as being unavoidable. There was a notable increase in the proportion of probably preventable anesthetic deaths in 2022, and this will be further elucidated in the chapter on anaesthetic deaths. Of note, the proportion of deaths with Administrative preventable factors increased in 2020 (57.1%) and 2021 (52.6) compared to 48.1% in the previous triennium.

Conclusion

The NCCEMD process was impacted by the COVID-19 pandemic because of increased workload and sickness of Health Care Workers.

Maternal deaths increased by 30% in 2020 and 47% in 2021 compared to 2019, during the severe years of the COVID-19 pandemic, but the IMMR decreased to pre-pandemic levels in 2022.
This trend was seen in all provinces.
COVID-19 pneumonia /NPRI deaths were the major contributor to the steep increase in 2020 and 2021.
Deaths from Obstetric Haemorrhage increased in 2020 and 2021, reflecting collateral impact of the COVID-19 pandemic on functioning of the health system.
Of concern, anaesthetic deaths were twice as high in 2022 compared to 2020 and 2021.
Hypertensive deaths and deaths from Medical and Surgical disorders were the third and fourth most common causes, followed by Early Pregnancy complications. The decline in Hypertension and Early pregnancy deaths in the current triennium is encouraging, but the possibility of under-reporting of maternal deaths during the pandemic must also be considered.
The pandemic reversed progress towards achieving the SDG goal of a MMR 70 by 2030, but progress is now back on track, with KZN, WC and Limpopo province closest to achieving this goal.

Key Recommendations

This is a summary of Crucial recommendations arising from both the 2017-2019 and the 2020-2022 triennial reports.

All maternity sites must conduct morbidity and mortality review meetings, where:

- Minutes are kept,
- Actions are assigned to individuals.
- There is follow-up to check that the actions have been performed and there is accountability.

Maternal and neonatal health services must be prioritised irrespective of existing parallel programmes by:

- Political commitment by NDOH and provinces in line with the International Maternal and Neonatal Health Conference (IMNHC) declaration. (The DOH, SA signed the IMNHC Commitment to achieve the SDG of an MMR of 70 maternal deaths per 100,000 live births by 2030; and to promote respectful, dignified, and safe care for women in maternity services in South Africa).
- MECs must ensure that the non-negotiable essential functions for MNH are in place and function properly. This includes ensuring that all equipment, medicines and other consumables required to implement the maternal and newborn package of care are in place in all health facilities/service points, and to feedback to the Ministry of Health quarterly.
- Financial Investment - funding for MNH services must be directed towards addressing the leading causes of maternal and neonatal mortality and should be ring fenced.

Provincial health system interventions and oversight to ensure:

- The NCCEMD process functions effectively as mandated by DOH in each province, and data is submitted accurately and timeously.
- Integration of HIV care, COVID-19 care, Contraception, Safe Surgery and Mental Health services into maternity and neonatal health services.

- Regular monitoring and evaluation of progress towards implementing NCCEMD recommendations and progress towards the SDG.
- Strengthen lines of communications at all levels of care. Support is required for frontline healthcare workers from the province down to the lowest levels of care. HODs and MECs to visit institutions and engage with clinicians and patients on their daily challenges.
- Ensure functional communication channels exist for consultation with and referral to higher levels of care (inter-facility). Promote easy access to maternity care by the community.
- Establish On-site Midwife run Birthing Units (OMBUs) at all large district, regional and tertiary hospitals which currently conduct large numbers of births of low-risk women. This will allow healthcare workers to focus on those women with risk factors.

General Clinical management interventions:

Focus to be on the top five leading cause of maternal deaths, five **Hs** by:

- Institutionalising Covid-19 pandemic lessons about maintaining MNH and SRH services during humanitarian or service delivery crises.
- Contraceptive services need to be expanded to include postpartum LARCs (esp. IUCD insertion), and Contraceptive availability at all facilities caring for women and at high-risk medical clinics must be ensured.
- Antenatal care restructured to ensure every problem case is reviewed on-site prior to referral by the most experienced midwife, and all antenatal clients to be assessed at least once between 28-34 weeks gestation by an experienced antenatal care provider (midwife or doctor).
- Clinical examination skills during antenatal, intrapartum and postpartum care must be emphasised with ongoing training.
- Prior to discharge from a ward and facility, specific criteria must be checked and documented, with appropriate action taken for abnormal findings, and to ensure women are not discharged in unstable condition.

Specific interventions for 5Hs:

- **H**IV - Implement the updated PMTCT protocol now named Vertical Transmission Prevention (VTP) for better HIV management and TB detection (viral load suppression and escalation for second line agents when needed).
- Ensure CD4 results are reviewed, and high-risk women treated appropriately to prevent and treat HIV associated infections
- **H**aemorrhage -Establish a Safe Labour minimum standards criteria and evaluation programme like the Safe Caesarean Delivery (surgery and anaesthesia) programme.
  Continue implementation of pre-existing initiatives e.g., NASG, Massive blood transfusion protocol, safe CD audits; and evaluate their impacts.
  Implementation of new approach for early detection and management of PPH in all maternity sites: EMOTIVE drape and care bundle for PPH.
- **H**ypertension - Guideline dissemination with training.
  Early pregnancy counselling service and access to safe MTOP when indicated
  Community awareness for earlier initiation of antenatal care.
- **H**eart (medical and surgical disorders) - Medical Obstetric clinics to be established at regional and tertiary hospitals for women with medical disorders requiring multi-disciplinary care.
  Screening questions and Clinical examination skills during antenatal care. Screening for mental health issues and identifying women at risk of suicide.
- first **H**alf of pregnancy complications – Develop strategies to improve management of early pregnancy complications (miscarriage, TOP and ectopic pregnancy).
  Pregnancy testing to be available at all health facilities and in the community
  Early recognition and Diagnosis of pregnancy complications, and prompt referral to higher levels of care when indicated.
  Outreach to primary care gynaecology services in CHCs for training and clinical support
  Early pregnancy counselling service and improved access to safe TOP; all health facilities must either provide a safe TOP service or have a clear referral policy to a facility that provides safe TOP.

Training and policies

- ESMOE board to be constituted, ESMOE modules updated and programme to restart.
- ESMOE Training (including anaesthetic ESMOE) to be compulsory for all new staff and two-yearly updates for existing staff.
- EOST drills/exercises must occur monthly in maternity facilities. This is especially so at primary care and district hospital level as the rarity of conditions makes doing emergency drills essential to maintain skills.
- Each hospital and CHC should have at least one on-site trainer able to run the relevant ESMOE modules and drills.
- Adherence to new SA Maternity Care Guideline.

1. INTRODUCTION

The eighth triennial Saving Mothers Comprehensive Report (for 2020-2022) presents an overview of maternal mortality, with underlying causes, trends, associated factors and preventability compared to previous triennia. It is important to note that this report covers the COVID-19 pandemic period which was declared a public health emergency in South Africa in March 2020, and which was ended in May 2023. The pandemic contributed to the general excess mortality observed in 2020 and 2021, but less in 2022 when the variant was less virulent and vaccination had been introduced. Furthermore, the COVID-19 pandemic had a major impact on maternal health outcomes and utilisation of maternal and reproductive health services (1).

The pandemic also adversely affected the assessment process and data analysis process of the NCCEMD since many provincial assessors were heavily involved in managing the COVID-19 pandemic in their places of work.
In 2020 there was a change of the NCCEMD national committee, and very sadly just as the new committee was moving forward, it experienced the untimely death of the new chairperson Prof. Eddie Mhlanga in 2022; may his soul rest in peace.

The NCCEMD would also like to acknowledge the work of the previous Chairperson, Prof. J Moodley, and previous Saving Mothers editor, Prof RC Pattinson, and the previous committee. The MRC unit headed by Prof Pattinson, continued to collate the MAMMAs data for the Saving Mothers report and the NCCEMD is very grateful for Ms Bontle Mamabolo and previously Ms Cathy Bezuidenhout for their substantial contribution. Prof. Pattinson is acknowledged for his important and helpful contributions to this report.

The work of the NCCEMD continues to be supported by the National Department of Health's MCWH directorate which was headed by Dr Manala Makua during the 2020-2022 triennium.

Previous triennial reports focused on the triennium as a whole (2,3,4); this report maintains the same format but also shows details of the individual years which make up the triennium because of marked differences between the years 2020, 2021 and 2022.

This Comprehensive triennial report for 2020-2022 provides a detailed analysis of the Saving Mothers data, abstracts of individual chapters on each of the primary obstetric causes of death, provincial reports and detailed recommendations. The full chapters on each primary cause require a secondary review by chapter heads, which is in progress. They will be published later in 2024.

2. METHODS

The method used to compile this report is the same as used for all previous reports (2,3,4), and the database was closed in May 2023. All Deaths during Pregnancy, Childbirth and the Puerperium (DDPCP) were notified to the provincial MCWH office, assessed by independent assessors, and data entered anonymously into the secure password protected national MaMMAS database used by the NCCEMD. Maternal death (MD) numbers were calculated by subtracting coincidental deaths from DDPCP.

Collection of maternal death data for the Saving Mothers triennial report was severely hindered due to human resource and other challenges in maintaining the NCCEMD process during the COVID-19 pandemic. Many

provincial assessors were heavily involved in managing the COVID-19 pandemic in their places of work.

The classification of Maternal deaths used in South Africa is based on the WHO ICD 10 adaptation for maternal deaths (5).

Maternal deaths are classified by Primary Obstetric causes, for example Obstetric Haemorrhage (OH), Non pregnancy related infections (NPRI) etc. These are then subdivided into Causal Subcategories e.g. for OH: uterine atony, bleeding at Caesarean delivery (CD) etc; and for NPRI: TB, pneumonia etc. The classification can be found in NCCEMD documents (6).

Since SARS-CoV-2 or COVID-19 was a novel infection in 2020 with specific characteristics and high mortality, it needed to be incorporated into the classification in order to be identifiable. It was thus decided by the NCCEMD to code it as follows: NPRI /Other (specify COVID-19 complication). A death during pregnancy due to COVID-19 complications was thus categorised as an indirect maternal death.

There were also women who died from other primary causes such as Hypertension, but whose condition was possibly exacerbated by concurrent COVID-19 infection. In such cases, the NCCEMD decided that COVID-19 infection should be included as a final or contributory cause as: Other (specify COVID-19).

3. VALIDITY OF THE DATA AND CORRECTIONS

Table 1 gives the live births from the DHIS, and maternal deaths submitted to the NCCEMD and entered on the Maternal Morbidity and Mortality Audit System (MaMMAS) in 2020. It is important to note that all Deaths During Pregnancy, Childbirth, and the Puerperium (DDPCP), previously known as pregnancy related deaths, were reported. DDPCP include any woman who died during pregnancy or the puerperium and includes coincidental deaths such as those due to motor vehicle accidents, natural disasters, and assault. The definition of a maternal death excludes these coincidental deaths.

Table 1 also compares the number of maternal deaths (MDs) submitted to the NCCEMD and entered into the MaMMAS database with the numbers reported by the District Health Information system (DHIS) signed off in May 2023. In previous reports, MaMMAS has identified more maternal deaths than DHIS. This is because MaMMAS includes deaths which happen outside health facilities and deaths at private hospitals, whereas DHIS only includes public facility deaths. In 2020 to 2022, this pattern of more deaths reported to MaMMAS than to DHIS occurred for all provinces except Gauteng (GP) and Eastern Cape (EC) in 2020; GP in 2021; and GP, Limpopo (Lim) and KwaZulu-Natal (KZN) in 2022, where MaMMAS reported fewer. A correction was made for the provinces suspected of under-reporting, and involved correcting the numbers of maternal deaths upwards to match the DHIS numbers (shown in bold in Table One)

Table 1: All pregnancy related deaths reported to MaMMAS and to DHIS

2020-2022	DHIS MD	MaMMAS deaths (DDPCP)	Coincidental*	MaMMAS MD**	Corrected MDs***
2020	1121	1228	31	1197	**1234**
2021	1413	1513	24	1489	**1507**
2022	1035	993	24	969	**1062**
	3569	**3734**	**79**	**3655**	**3803**

*Coincidental deaths = Total coincidental deaths per year, per province
**MaMMAS MD = DDPCP minus coincidental deaths
*** Details of correction per province shown in Appendix one

Details of this data and corrections made for each year of the triennium and province are shown in Appendix one (section 9.1)
The corrections were applied for maternal death and iMMR calculations shown in Section 4.1. Data was not corrected for the analysis of Causes of death, Associated factors and Preventability shown in Sections 4.2 to 4.6.

4. RESULTS

4.1 Maternal deaths and iMMR for 2020-2022 and previous years/triennia

There were 1234, 1507, and 1062 maternal deaths (MDs) in 2020, 2021 and 2022 respectively giving a corrected triennial total of 3803, which is greater than 3347 deaths reported in the previous triennium (2017-2019). There were 3,019165 live births, reported by public health facilities via DHIS in 2020-2022, giving a corrected iMMR of 126 MDs per 100,000 live births compared to 113.8 in the previous triennium.

Table 2 shows the number of corrected maternal deaths per province per year 2017-2022, which covers the pre-COVID-19 years (2017-2019), the peak COVID-19 Years (2020-2021), and the year (2022) when the COVID-19 impact was becoming less. Numbers of Live births pre province is shown in Appendix 9.1.

Table 2: Number Maternal Deaths per province 2017-2022 (with corrections ©)

	c2017	c2018	c2019	c2020	c2021	c2022
Eastern Cape	138	131	118	c160	153	133
Free State	67	92	77	89	114	55
Gauteng	257	267	249	c271	c341	c266
KwaZulu-Natal	239	202	179	250	276	c189
Limpopo	174	152	166	166	196	c143
Mpumalanga	117	112	70	95	167	113
North West	82	95	78	81	116	70
Northern Cape	28	25	32	23	43	26
Western Cape	73	74	56	99	101	67
South Africa	**1175**	**1150**	**1022**	**1234**	**1507**	**1062**

Table 3 shows the in-facility maternal mortality ratio (iMMR) per province per year, and for the whole triennium.

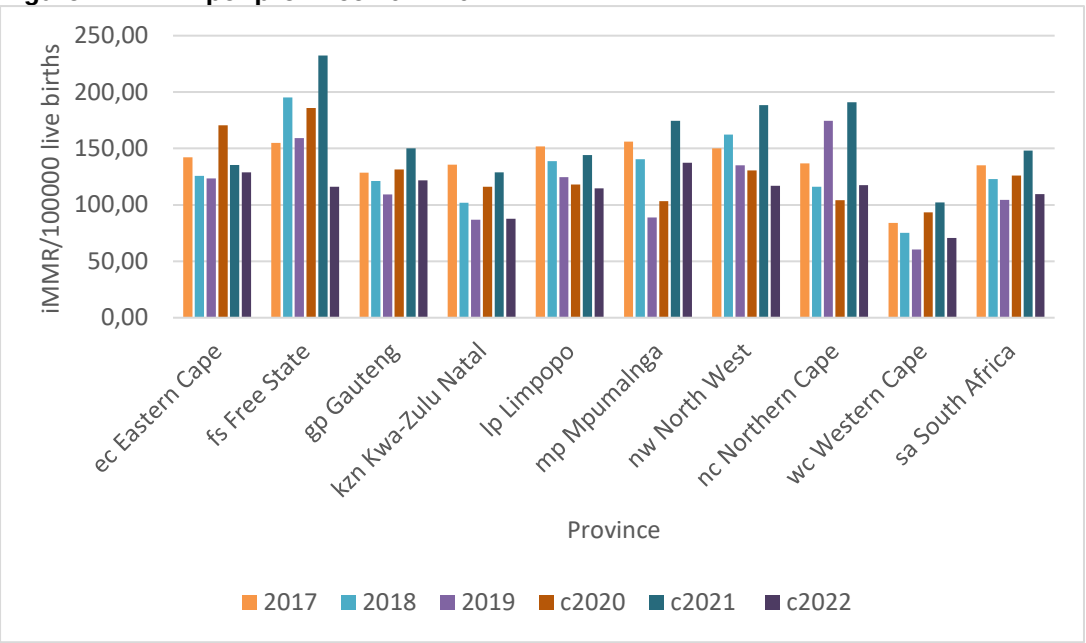
Table 3: iMMR per year 2020-2022 (with corrections©)

Corrected	2020 ©	2021 ©	2022 ©	2020-2022©
Eastern Cape	146.7	138.0	128.9	138.0
Free State	183.7	232.3	116.2	180.9
© Gauteng	112.8	150.1	121.7	128.0
© KwaZulu-Natal	116.4	128.8	87.8	111.0
© Limpopo	118.1	144.2	114.7	125.9
Mpumalanga	103.2	174.5	137.4	138.9
North West	130.6	188.5	116.8	145.5
Northern Cape	104.3	190.9	117.4	137.9
Western Cape	93.3	102.3	70.8	89.2
South Africa	**119.2**	**148.4**	**109.7**	**126.0**

It is notable that during 2020 and 2021, the iMMR was 30% and 47% respectively higher than for the pre-pandemic year 2019 when it was 98.8. However, the iMMR declined to 109.6 in 2022, which is closer to the iMMR in the previous triennium (Figure 1). This shows that the steep decline from 2010 was reversed in 2020

and 2021 but stabilised in 2022.

Figure 1: iMMR per province 2017-2022



The downward trend in iMMR per province in 2017-2019, increase in 2020 and 2021, and stabilisation in 2022 are shown in Figure one. Free state had the highest iMMR in this triennium (2020-2022) with Limpopo iMMR having declined considerably so now it is the province with the third lowest iMMR.
The iMMR per district 2020-2022 is shown in Appendix 2.

Yearly trends in maternal deaths and iMMR

Figure 2 shows the national number of maternal deaths recorded per year since the inception of the SA Confidential Enquiry into maternal deaths, and Figure 3 the trend in iMMR from 2005 to 2022. Following the encouraging and steep decline from 2010, with an iMMR less than 100 in 2019, there was an increase in 2020 to 119.2 and even greater in 2021 to 148.4. The upturn correlated with the onset of the COVID-19 pandemic which started its impact in April 2020. In 2022 the iMMR came down to 109.7, similar to pre-pandemic levels. It is still far from the SDG goal of 70,000 live births by 2030.

Figure 3 shows the trend in iMMR from 2005 and shows a significant upsurge in 2020 compared to previous years. The iMMR increased by 30%. This is less than the 38% described in the SAHR chapter (1), which describes data for financial year 2020/2021, from April 2020 and thus did not cover the first quarter of the year before the onset of the pandemic.

Figure 2: Number of maternal deaths in SA from 1998-2022 (corrected ©)

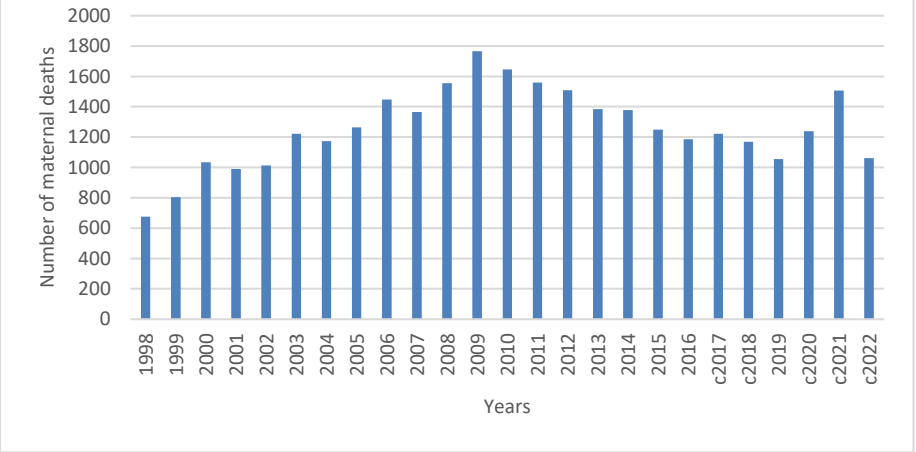


Figure 3: iMMR in SA per year 2005-2022 (corrected ©)

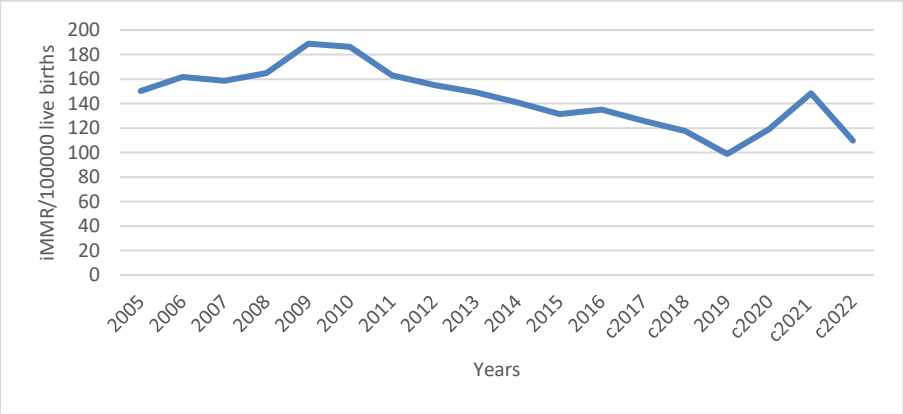
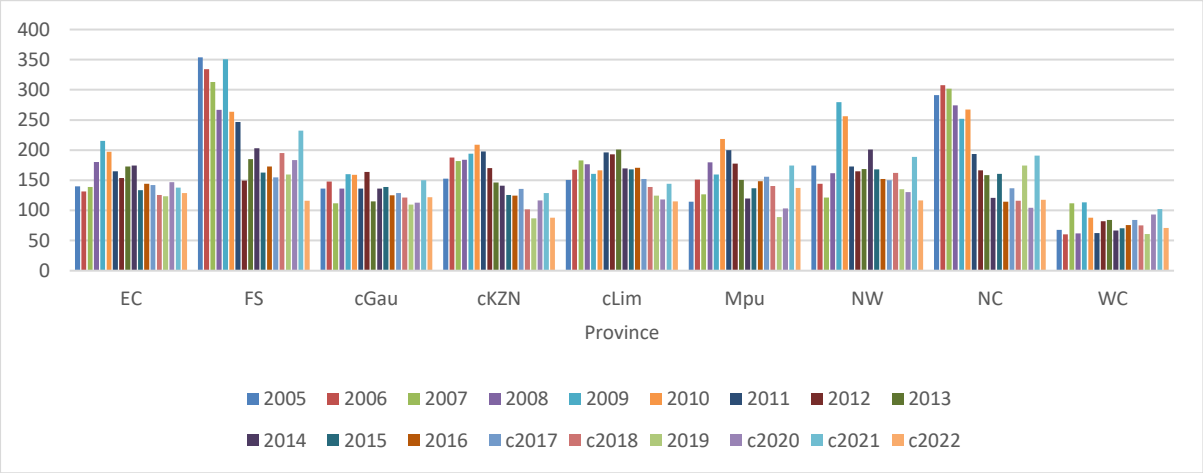


Figure 4 shows trends in iMMR for each province from 2005 to 2022 enabling annual comparisons to be made. Of note W. Cape (WC) has achieved an iMMR of less than 100 except in the COVID-19 years, and KZN achieved an iMMR of less than 100 in 2019 and 2022, despite being a very populous rural province. All provinces have shown downward trends since 2010-2012, except for 2020 and 2021.Limpopo province has also shown remarkable progress.

Figure 4: iMMR per province 2005-2022



Triennial trends in maternal deaths and iMMR

Triennial comparisons are more reliable than annual comparisons because they deal with larger numbers. Figure 5 show a steady decline in iMMR per triennium from 2011 but an increase in the recent triennium. The 2020 to 2022 iMMR is heavily influenced by the high iMMR in 2020 and 2021.

Figure 5: Trends in iMMR per triennia in South Africa 2011-2022

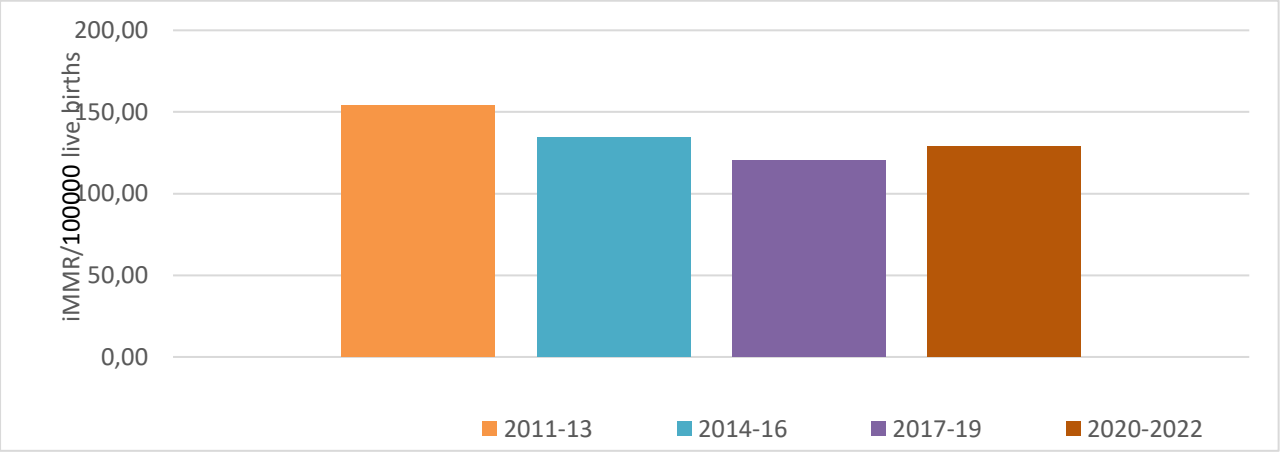


Table 4 and Figure 6a show triennial trends in iMMR per province from 2011.
All provinces showed a downward trend till 2017-2019 and excepting Limpopo which declined further in 2020-2022, they all showed an increased iMMR in the 2020-2022 triennium.

Table 4: iMMR per province for four triennia from 2011-2022

	2011-13	2014-16	2017-19	2020-22c
Eastern Cape	159.5	148.5	121.4	138.0
Free State	186.3	174.6	157.4	180.9
Gauteng	135.2	128.8	109.5	128.0
Kwa-Zulu Natal	168.6	127.1	103.1	111.0
Limpopo	191.1	165.2	134.1	125.9
Mpumalanga	172.9	132.2	123.0	138.9
North West	166.4	172.2	141.6	145.5
Northern Cape	152.2	121.4	122.3	137.9
wc Western Cape	71.0	68.3	65.2	89.2
sa South Africa	**154.1**	**134.3**	**113.8**	**126.0**

Figure 6a: iMMR per province for 4 triennia 2011-2022 (corrected)

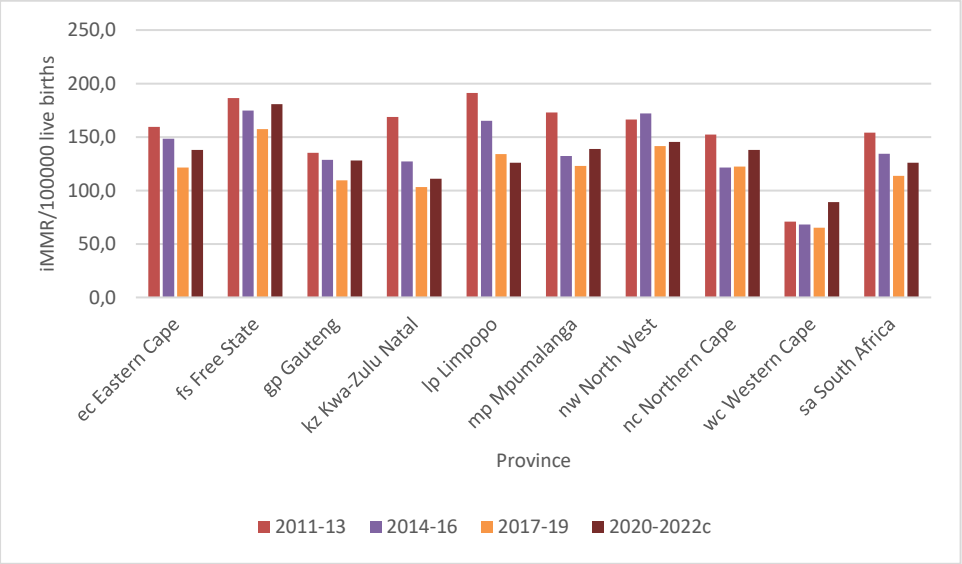
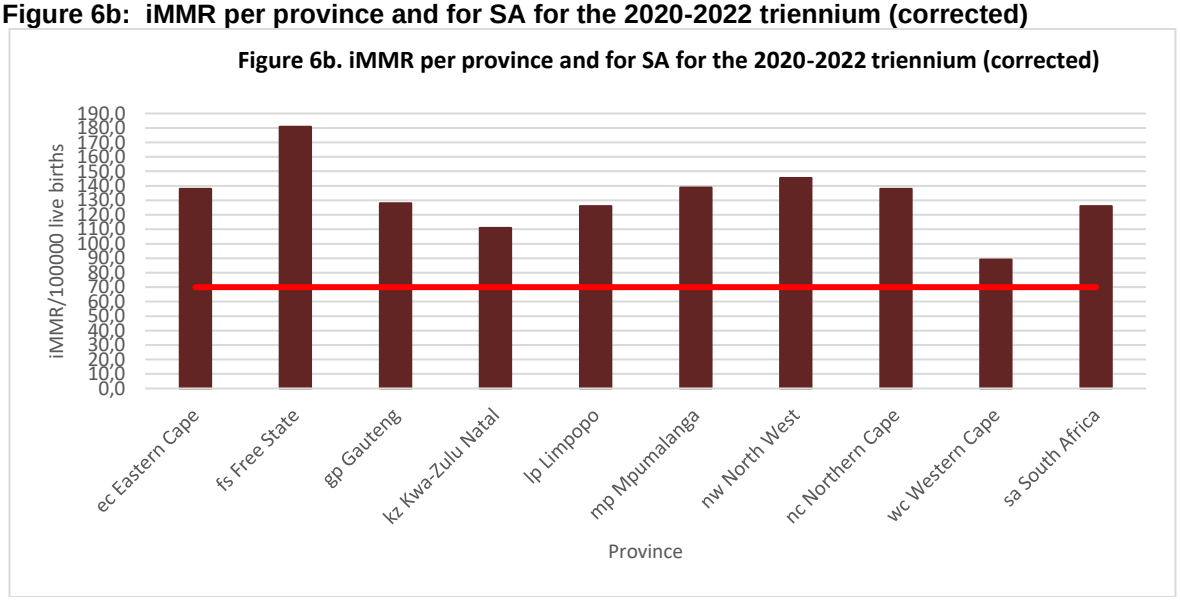


Figure 6b shows iMMR in the 2020-2022 triennium in relation to the SDG target of 70 by 2030. No province has yet reached the target, but Western Cape, Kwazulu-Natal and Limpopo appear to be closest in terms of trajectory.

Figure 6b: iMMR per province and for SA for the 2020-2022 triennium (corrected)



Maternal deaths per district and district iMMRs are shown in Appendix 9.2.

4.2 Primary Obstetric causes of Maternal Death (uncorrected data)

The Primary Obstetric Cause of death is shown in Table 5 for each year and the whole 2020-2022 triennium. Postmortems were performed for 26% of maternal deaths.

Table 5: Primary Obstetric Causes of Maternal deaths for 2020, 2021 and 2022, and triennium (uncorrected)

Primary obstetric problem	Number MDs (%) 2020 N= 1197	Number MDs (%) (2021) N=1489	Number MDs (%) (2022) N=969	Number MDs (%) (2020-2022) N=3655
Medical and surgical disorders	**183 (15.3)**	**190 (12.8)**	**(140 (14.4)**	**513 (14.0)**
Non-pregnancy-related infections*	**322** (27)**	**561 (37.7)***	**180(18.6)****	**1063 (29.1)**
Ectopic pregnancy	36 (3)	33 (2.2)	34 (3.5)	103 (2.8)
Miscarriage	49 (4.1)	54 (3.6)	63 (6.5)	166 (4.5)
Pregnancy-related sepsis	63 (5.3)	68 (4.6)	56 (5.8)	187 (5.1)
Obstetric haemorrhage	**200 (16.7)**	**237 (15.9)**	**162 (16.7)**	**599 (16.4)**
Hypertensive disorders of pregnancy	**185 (15.5)**	**188 (12.6)**	**166 (17.1)**	**539 (14.7)**
Anaesthetic complications	21 (1.8)	17 (1.1)	39 (4.0)	77 (2.1)
Adverse drug reactions	13 (1.1)	6 (0.4)	7 (0.7)	26 (0.7)
Embolism	33 (2.8)	43 (2.9)	40 (4.1)	116 (3.1)
Acute collapse - cause unknown	15 (1.3)	36 (2.4)	21 (2.2)	72 (2)
Miscellaneous	4 (0.3)	3 (0.2)	8 (0.8)	15 (0.4)
Unknown	73 (6.1)	53 (3.6)	53 (5.5)	179 (4.9)

**Includes COVIC-19 deaths **Includes 124 COVID-19 deaths in 2020*
****Includes 369 deaths in 2021 **** Includes 12 COVID-19 deaths in 2022*

Non-Pregnancy Related Infections (NPRI) was the major causal grouping in all three years as in previous triennia but showed a very large increase in 2020 and 2021, where it accounted for 322 (27.1% all MDs) in 2020 and 561 (37.7% of MDs) in 2021. In 2022 it accounted for 180 deaths (18.6% MDs) which is lower than previous triennia. For the whole triennium it was the leading cause accounting for 29.1% of all MDs

COVID-19 pneumonia and complications constituted the majority of these NPRI deaths in 2020 and 2021, accounting for 124 (38.5% of NPRI deaths) in 2020, and 369 (66.6% of NPRI deaths and 25% of all MDs) in 2021. In 2022, there were only 12 deaths directly due to COVID-19.

Obstetric haemorrhage (OH) deaths increased to become the second most common cause, accounting for deaths in 599 women (16.4% of total MDs).

Hypertensive disorders (HDP) were the third most common causes, accounting for 539 MDs (14.7% of total) Medical and surgical (M&S) disorders were the fourth cause accounting for 513 MDs (14% of total MDs)

Early pregnancy deaths from miscarriage and ectopic accounted for 269 deaths (7.3%) and thus Early Pregnancy complications combined are the fifth most common cause.

There were 39 Anaesthetic deaths in 2022 which is twice the number in previous years, and although not a major cause, almost all of these deaths are preventable.

4.3 COVID-19 deaths

Table 6 shows the number of COVID-19 deaths per province for each year and the triennium. The total deaths specified in MAMMAs as due to COVID-19 was 505 and the majority occurred in 2021. Gauteng, KwaZulu-

Natal, Western Cape, and Eastern Cape were particularly affected.

Table 6: COVID-19 deaths per province for each year and the whole triennnium, 2020-2022

Province	EC	FS	GAU	KZN	LIM	MPU	NW	NC	WC	TOTAL
NPRI/ COVID-19 2020	30	1	12	40	1	7	4	2	27	124
NPRI/ COVID-19 2021	32	17	78	89	43	33	20	14	43	369
NPRI/ COVID-19 2022	3	1	3	4	0	1	0	0	0	12
NPRI/ COVID-19 2020-2022	65	19	93	133	44	41	24	16	70	505

Causal subcategories for each Primary Obstetric Cause as well as Final and contributory cause for each condition can be found in Appendices 9.3 and 9.4 and will be described in more detail by Chapter heads in the Comprehensive report.

4.4. Trends in Primary causes of deaths and provincial comparisons

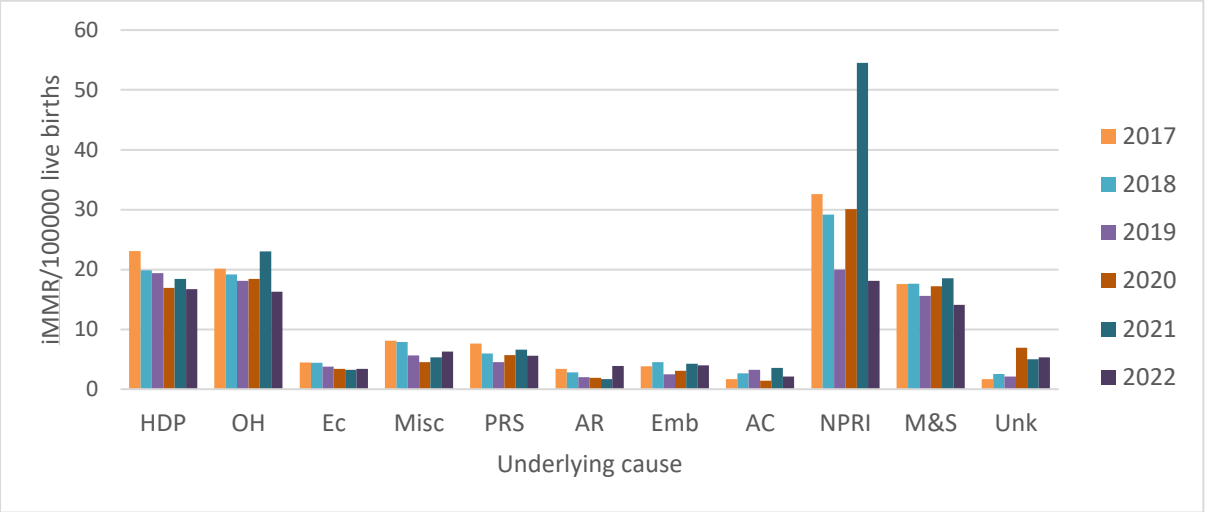
Table 7 presents the iMMR for each primary obstetric cause per year and for the whole triennium.

Table 7: iMMR for Primary Obstetric Cause per year 2020-2022 (uncorrected)

	2020	2021	2022	2020-2022
Hypertensive disorders of pregnancy	17.87	18.51	17.15	17.9
Obstetric haemorrhage	19.32	23.33	16.73	19.8
Ectopic pregnancy	3.48	3.25	3.51	3.4
Miscarriage	4.73	5.32	6.51	5.5
Pregnancy-related sepsis	6.09	6.9	5.78	6.2
Anaesthetic complications	2.03	1.69	4.03	2.6
Embolism	3.19	4.23	4.13	3.8
Acute collapse - cause unknown	1.45	3.54	2.17	2.4
Non-pregnancy-related infections	31	55.23	18.59	35.2
Medical and surgical disorders	17.68	18.7	14.46	17
Unknown	7.05	5.22	5.47	5.9
iMMR for all maternal deaths	**115.62**	**146.59**	**100.09**	**121**

Figure 7 compares iMMR per year starting from 2017 so that pre-pandemic iMMRs can be compared with the pandemic years (2020 and 2021) for primary obstetric cause.

Figure 7: iMMR per Primary Obstetric Cause of maternal death 2017-2022



In terms of comparisons with the previous triennium and triennia, the iMMR for NPRI increased from 27.1 MDs per 100,000 live births in 2017-2019 to 35.2 in 2020-2022. However the iMMR for Obstetric Haemorrhage and Medical and Surgical disorders remained similar between the two triennia (OH iMMR 19.1 in 2017-2019 and 19.8 in 2020-2022; M&S iMMR 16.9 in 2017-2019 and 17 in 2020-2022). In contrast, the iMMR for Hypertension declined from 20.2 to 17.9, and for Early Pregnancy complications from 11.4 in 2017-2019 to 8.9 in 2020-2022.

Figure 8: Comparison iMMR of 8 triennia per primary obstetric cause 1999-2022)-uncorrected

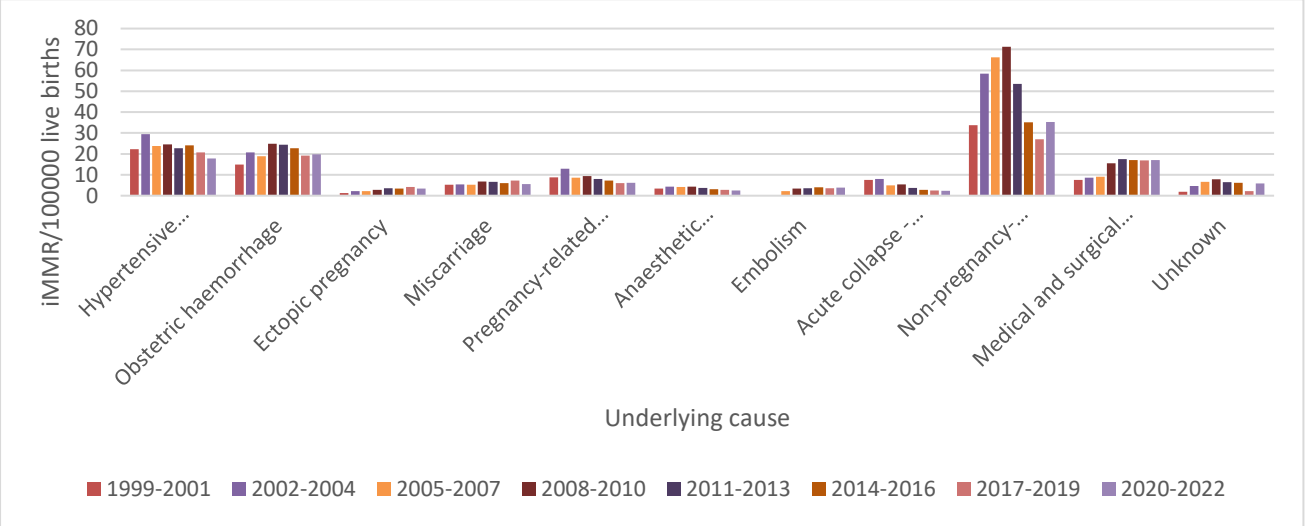


Table 8 shows the iMMR per province for primary obstetric cause with a ranking of priority causes.

For all provinces except Free State, NPRI was the most common cause, but the ranking of causes thereafter varied between provinces. The highest iMMR for OH occurred in Free State, Mpumulanga and North West. The highest iMMR for HDP occurred in Free State (where it was the most common primary obstetric cause) and Northern Cape. In the W Cape M&S was the second most common cause. KZN had the lowest iMMR from HDP, and Western Cape the lowest from OH.

Table 8: Maternal mortality ratio per underlying cause and province for the 2020-2022 triennium and the ranking of the four most common underlying causes

	EC	FS	GP	KZN	LP	MP	NW	NC	WC	SA
*M&S	17.64	28.30	17.20	17.23	15.71	15.92	19.07	14.99	11.69	16.99
*NPRI	47.97	34.52	27.26	39.89	26.68	35.92	40.33	38.97	36.74	35.21
Ec	2.48	6.21	3.79	3.10	4.49	2.59	3.27	5.99	1.67	3.41
Miscarriage	5.88	2.76	7.14	4.81	5.24	7.04	9.26	4.50	1.00	5.50
PRS	6.50	10.35	5.83	4.81	7.98	8.52	4.90	5.99	4.01	6.19
*OH	17.02	31.06	19.97	14.74	22.69	30.36	28.34	20.98	9.35	19.84
*HDP	20.73	35.90	17.49	9.78	21.69	20.00	25.07	26.98	10.69	17.85
AR	3.40	3.45	1.02	1.86	4.74	5.18	2.72	1.50	1.00	2.55
ADR	0.62	1.38	1.02	0.78	1.99	0.74	0.00	0.00	0.00	0.86
Emb	6.19	5.52	2.33	2.95	4.24	4.81	2.18	5.99	5.01	3.84
AC	1.86	0.00	3.94	2.02	0.75	1.85	3.81	1.50	3.34	2.38
Miscellaneous	0.31	1.38	0.00	0.47	0.50	0.74	0.00	1.50	1.34	0.50
Unknown	0.93	17.26	8.02	6.52	2.99	5.18	6.54	8.99	3.34	5.93

Key

*	Top four most common underlying causes
	Most common
	2nd most common
	3rd most common
	4th most common

4.5. Associated factors for women who died: Age, HIV status, Anaemia, Caesarean delivery.

Age

The age distribution amongst all live births was sourced from STATS SA (7), thus enabling age related maternal mortality to be calculated. Figure 9 shows that MMR increases with maternal age. Figure 10 shows that this trend was most marked for NPRI, probably due to higher age related COVID-19 mortality, and Obstetric haemorrhage. The previous U- shaped curve for Hypertension shown in the previous triennium was not observed in this triennium This could reflect better care of HPD for young teenagers related to the new HPD protocol published in 2019 (8).

Figure 9: iMMR per age category for the 2020-2022 triennium

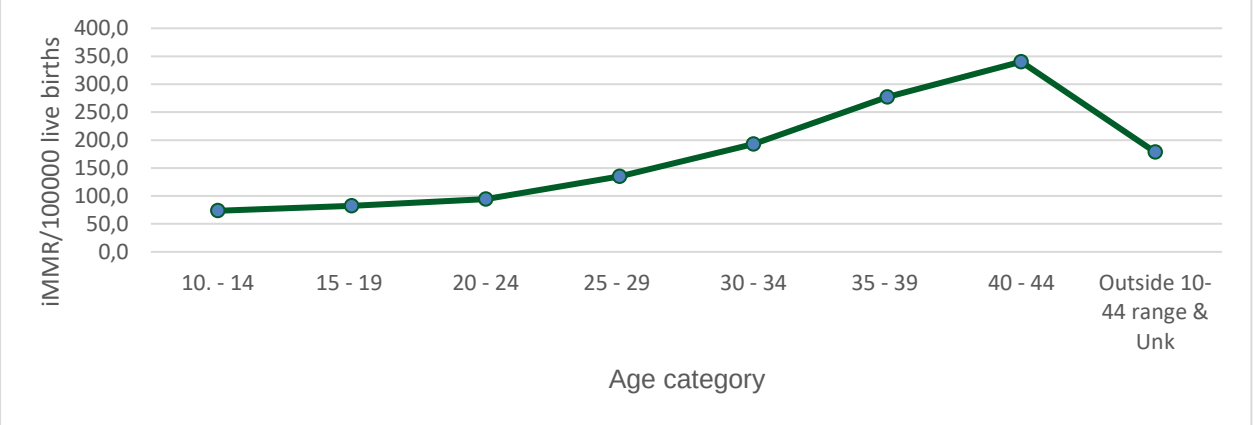
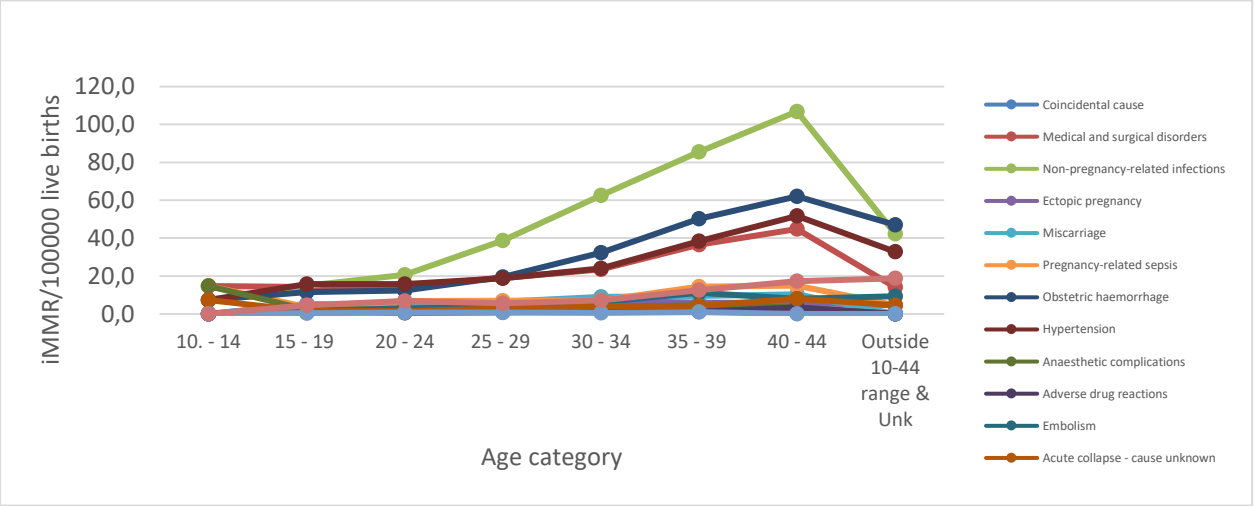


Figure 10. iMMR per age category per underlying cause for the 2020-2022 triennium



HIV status

Table 9 shows that HIV negative women exceeded HIV positive for maternal deaths in this triennium, unlike in previous triennia. This reflects improved testing, and treatment of HIV positive pregnant women and women in general. However, it remains a concern that HIV status was unknown for 13.4% of deaths, and that 14.4% of HIV positive women were not on antiretroviral treatment.

Table 9: Details of HIV testing and treatment

HIV Status	N	%
Positive	1475	39.5
Negative	1759	47.1
Declined test	1	0
Unknown	499	13.4
HIV Treatment	**Known Positive**	**% of known HIV positive**
None	213	14.4
TLD	300	20.3
TEE	531	36.0
Not specified	431	29.2

Anaemia

Anaemia defined as haemoglobin less than 10 gms/dl in pregnancy before the events that led to the death, occurred in 29.6% of maternal deaths and was over 35% for NPRI, and Medical and surgical disorders (Table 10). However, the high percentage of anaemia in women dying from ectopic and miscarriage is probably due to the only HB result available having been measured after the onset of the emergency event.

Table 10: Numbers maternal deaths with anaemia and underlying cause of death

Primary obstetric problems	No Anaemia	Anaemia	% Anaemia	Unknown
Medical and surgical disorders	268	145	35.1	100
Non-pregnancy-related infections	562	303	35.0	198
Ectopic pregnancy	26	47	64.4	30
Miscarriage	41	58	58.6	67

Primary obstetric problems	No Anaemia	Anaemia	% Anaemia	Unknown
Pregnancy-related sepsis	102	35	25.5	50
Obstetric haemorrhage	385	114	22.8	100
Hypertension	366	64	14.9	109
Anaesthetic complications	64	10	13.5	3
Adverse drug reactions	14	7	33.3	5
Embolism	70	23	24.7	23
Acute collapse - cause unknown	45	13	22.4	14
Miscellaneous	12	2	14.3	1
- No primary cause found	13	7	35.0	6
- Lack of information	26	11	29.7	16
Maternal death	**1994**	**839**	**29.6**	**722**
- Death at home or outside health services	53	12	18.5	35
Coincidental cause	20	8	28.6	51
DDPCP	**2067**	**859**	**29.4**	**808**

Caesarean delivery

The national CD rate for 2020 to 2022 was 28.8% which is similar to the previous triennium (28.1%). The Case Fatality rate was 155.9 per 100,000 CD which has increased from 2019 (132.4 for 2017-2019 triennia and 112.5 in 2019). The CD Case Fatality Rate increased to 145.7 CD associated deaths per 100,000 CDs in 2020 and 203.6 in 2021, compared to 112.5 in 2019 (Table 11). This could reflect the fact that many sick women with COVID-19 in the third trimester had CD for severe respiratory compromise, and it may not have been a direct effect of the CD. In 2022, the CD CFR had declined to 118.4, similar to 2019.

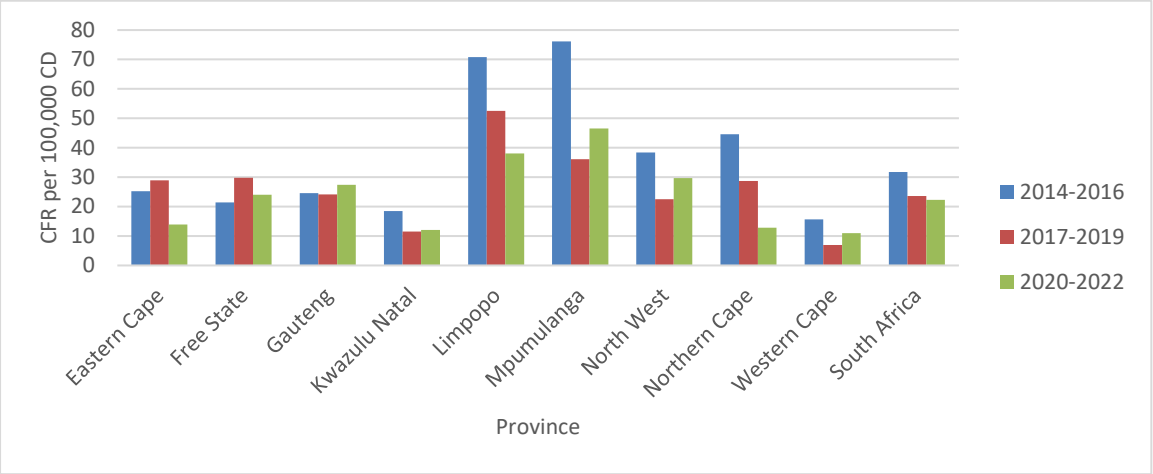
This increase in CD CFR could reflect deterioration of quality of care relating to CD or could be due to the higher CD rates in women with severe COVID-19 pneumonia.

Table 11: Caesarean delivery and maternal deaths 2020-2022 ***(*CD CFR = Number CD deaths per 100,000 CDs)***

PROVINCE (2020)	Deliveries 2020	CD	CD rate (%)	MD with CD	CDCFR*
Eastern Cape	330739	100672	30.4	122	121.2
Free State	149849	45894	30.6	108	235.3
Gauteng	703334	207695	29.5	336	161.8
KwaZulu-Natal	662648	232152	35.0	257	10.7
Limpopo	409067	94513	23.1	190	201.0
Mpumalanga	273822	58057	21.2	143	246.3
North West	187657	43800	23.3	88	00.9
Northern Cape	68412	15586	22.8	33	211.7
Western Cape	306012	91123	29.8	109	119.6
South Africa	**3091540**	**889497**	**28.8**	**1387**	**155.9**

There were 198 deaths from bleeding associated with caesarean delivery (BLDACD), giving a BLDACD CFR for the triennium of 22.3, similar to 2017-2019 when it was 23.6. Of note in 2020-2022, is the wide discrepancy in BLDACD CFR between provinces with the highest rates in Mpumulanga (46.5 BLDACD deaths per 100,000 CDs) and Limpopo (38.1), with the lowest rates in Western Cape (10.0) and KwaZulu-Natal (12.1). However, Figure 11 shows some very encouraging trends in Limpopo and Northern Cape where BLDACD CFR is one a downward trend.

Figure 11: Bleeding associated with CD CFR per triennia and province from 2014-2022



4.6 Health system factors: Location and Level of Care, Antenatal care, Emergency Referrals

In the 2020-2022 triennium, the majority of deaths (90.1%) occurred at public hospitals with a larger number (6.9%) in private hospitals than in previous years, especially during 2021. This shows that the COVID-19 pandemic affected all classes of society (Tables 12 and 13)

Table 12: Location of DDPCP 2020-2022

	Facility* N (%)	**In transit** N (%)	**Home/Outside** N (%)	**Total** N (%)
2020	1093 (92.4%)	15 (1.3%)	75 (6.3%)	1183 (100%)
2021	1411 (94.3%)	14 (0.9%)	72 (4.8%)	1497 (100%)
2022	932 (93.9%)	11 (1.1%)	50 (5%)	993 (100%)
2020-2022	3436 (93.6 %)	40 (1.1%)	197 (5.4%)	3673 (100%)

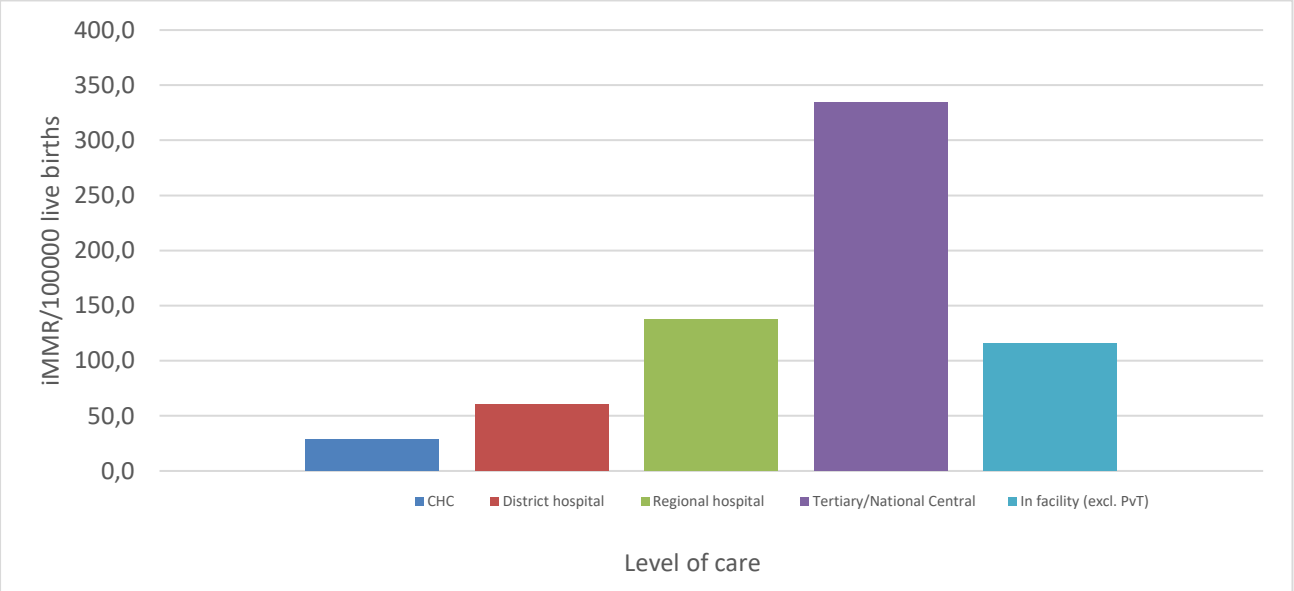
*2020. Included 80 deaths in private hospitals.
*2021. Included 128 deaths in private hospitals.
*2022. Included 36 deaths in private hospitals.
In 2020-2022 triennium, deaths in private hospitals were 244 compared to 115 in 2017-2019.

Table 13: Number maternal deaths per underlying category and level of care 2020-2022 (uncorrected)
In facility deaths include In-transit and in facility deaths

Primary obstetric problem	**CHC**	**District hospital**	**Regional hospital**	**Tertiary/ National Central**	**Private hospital**	**In facility**
Coincidental cause	4	15	15	25	3	62
Medical and surgical disorders	8	81	160	221	27	497
Non-pregnancy-related infections	14	194	333	380	124	1045
Ectopic pregnancy	7	33	28	30	1	99
Miscarriage	7	35	47	72	3	164
Pregnancy-related sepsis	2	22	64	84	10	182
Obstetric haemorrhage	21	167	186	174	36	584
Hypertension	19	92	172	220	20	523
Anaesthetic complications	0	34	26	15	2	77

Primary obstetric problem	CHC	District hospital	Regional hospital	Tertiary/ National Central	Private hospital	In facility
Adverse drug reactions	2	4	9	10	1	26
Embolism	4	38	35	20	12	109
Acute collapse - cause unknown	7	25	13	19	1	65
Miscellaneous	0	2	6	7	0	15
Unknown	11	20	26	24	4	85
Total	**106 (3.0%)**	**762 (21.6%)**	**1120 (31.7%)**	**1301 (36.8%)**	**244 (6.9%)**	**3533 (100%)**

Figure 12: iMMR per level of care for the 2020-2022 triennium



The finding of an increased iMMR at higher levels of care is due to high-risk women or women with new obstetric complications being referred to higher levels of care and suggests that the referral system is working correctly; although the condition in which women arrive at TH/NC could reflect substandard care by the lower level that refers, or transport delays. Section E will look at preventable factors for each level of care.

Booking status

Table 14 shows Antenatal care was received by 75% of maternal deaths, but only 57,3% booked before 20 weeks. Lowest attendance rates were in women dying from miscarriage or ectopic pregnancy, who would not have been expected to seek antenatal care.

Table 14: Antenatal care details amongst maternal deaths

Primary obstetric problems	No ANC	Unknown	Received ANC	Total ANC known	% known to have received ANC	<20 weeks	% <20weeks
Medical and surgical disorders	121	51	341	462	73.8	205	60.1
Non-pregnancy-related infections	232	97	734	966	76.0	432	58.9
Ectopic pregnancy	64	12	27	91	29.7	20	74.1
Miscarriage	119	19	28	147	19.0	23	82.1
Pregnancy-related sepsis	30	30	127	157	80.9	63	49.6
Obstetric haemorrhage	71	22	506	577	87.7	260	51.4
Hypertension	113	21	405	518	78.2	236	58.3
Anaesthetic complications	6	0	71	77	92.2	45	63.4
Adverse drug reactions	6	3	17	23	73.9	11	64.7
Embolism	16	12	88	104	84.6	53	60.2
Acute collapse - cause unknown	16	2	54	70	77.1	27	50.0
Miscellaneous	3	1	11	14	78.6	9	81.8
- No primary cause found	5	2	19	24	79.2	10	52.6
- Lack of information	10	5	38	48	79.2	22	57.9
Maternal death	**812**	**277**	**2466**	**3278**	**75.2**	**1416**	**57.4**
- Death at home or outside health services	15	12	73	88	83.0	41	56.2
Coincidental cause	27	32	20	47	42.6	10	50.0
DDPCP	**854**	**321**	**2559**	**3413**	**75.0**	**1467**	**57.3**

Emergency Referrals

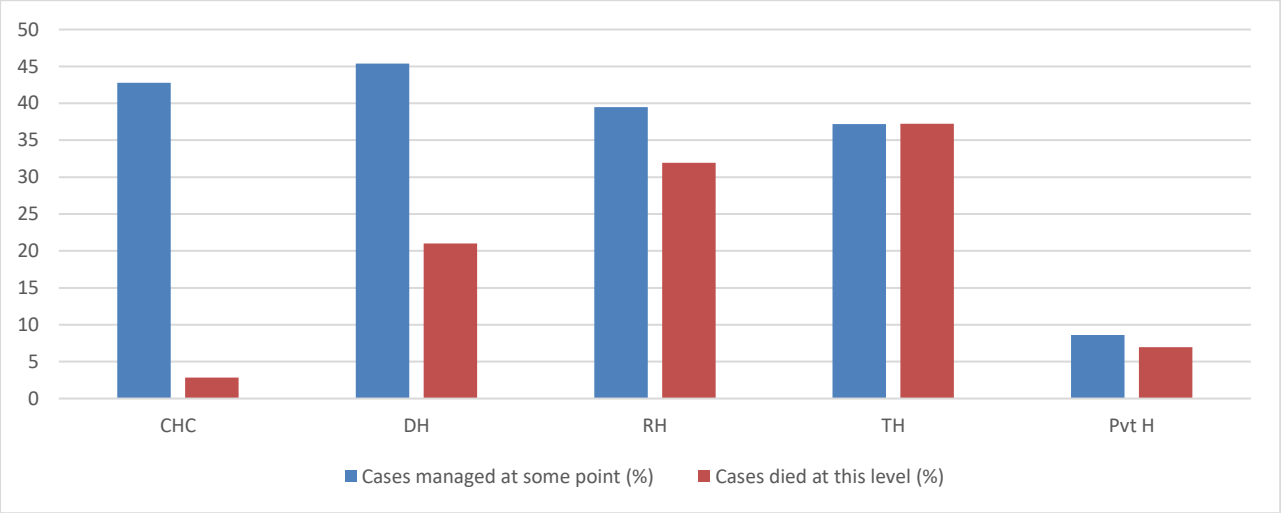
There were 1912 (52.3%) maternal deaths who required an emergency inter-institution referral before they died (Table 15). The majority of referrals were from CHCs and DHs. Figure 13 shows the relationship between the number of DDPCP managed at some point at each level of care and the number dying at that level.

Table 15: Details of Emergency Referrals for maternal deaths.

Primary obstetric problems	No Referral	CHC	DH	RH	TH/NCH	PvT
Medical and surgical disorders	231	85	121	53	14	9
Non-pregnancy-related infections	517	199	227	62	12	46
Ectopic pregnancy	60	21	13	4	0	5
Miscarriage	83	28	43	8	1	3
Pregnancy-related sepsis	75	36	52	18	1	5
Obstetric haemorrhage	336	98	138	19	1	7
Hypertension	221	118	143	38	11	8
Anaesthetic complications	46	12	18	0	0	1

Primary obstetric problems	No Referral	CHC	DH	RH	TH/NCH	PvT
Adverse drug reactions	12	4	6	3	0	1
Embolism	69	27	17	0	0	3
Acute collapse - cause unknown	46	16	9	0	0	1
Miscellaneous	6	2	6	1	0	0
- No primary cause found	11	7	7	1	0	
- Lack of information	30	7	10	3	0	3
Maternal death	**1743**	**660**	**810**	**210**	**40**	**92**
- Death at home or outside health services	96	2	2			
Coincidental cause	53	5	15	4	0	2
DDPCP	**1892**	**667**	**827**	**214**	**40**	**94**

Figure 13: Comparison of percentage DDPCP managed at some point of those that died at that level



4.7 Preventable factors

Overall preventability and comparison with previous triennia

Table 16: Preventability of DDPCP 2020-2022 compared with 2017-2019 within the health system*

	2020 (DDPCP = 1183)	2021 (DDPCP= 1497)	2022 (DDPCP= 993)	2020-2022 (DDPCP= 3673)	2017-2019 DDPCP= 3289)
	N (%)	N (%)	N (%)	N (%)	N (%)
No suboptimal care identified	401 (33.9%)	528 (35.3%)	320 (32.2%)	**1249 (34%)**	924 (28.1%)
Suboptimal care, no impact on outcome	96 (8.1%)	132 (8.8%)	87 (8.8%)	**315 (8.6%)**	312 (9.5%)
Suboptimal care, possible impact on outcome	408 (34.5%)	538 (35.9%)	333 (33.5%)	**1279 (34.8%)**	1021 (31.0%)

	2020 (DDPCP = 1183)	2021 (DDPCP= 1497)	2022 (DDPCP= 993)	2020-2022 (DDPCP= 3673)	2017-2019 DDPCP= 3289)
	N (%)	N (%)	N (%)	N (%)	N (%)
Suboptimal care, probable impact on outcome	278 (23.5%)	299 (20%)	253 (25.5%	**830 (22.6%)**	1032 (31.4%)

**% potentially preventable 58% in 2020; 56% in 2021; 59% in 2022; and 57.4% in 2020-2022 compared to 62.4% in previous triennium.*

Deaths were assessed to be possibly or probably preventable by the health system (excluding patient/community related factors) for 58% of women who died in 2020, 56% in 2021, and 59% in 2022, the most common causes of preventable deaths being OH, and HPD deaths, with lesser numbers in the NPRI group (Table 16 and Figure 14). In the 2020-2022 triennium, 57.4% of deaths were potentially preventable compared to 62.4% in the previous triennium. This decrease was probably due to the large numbers of deaths from COVID-19 in 2020-2022, most of which were assessed as being unavoidable. The largest percentage of preventable deaths was found in OH, HYP and Anaesthetic deaths. The notable increase in the number of anesthetic deaths in 2022, shown in Table 5 will be further examined in relation to preventable factors in the chapter on anaesthetic deaths in the expanded comprehensive report.

Figure 14: Impact of suboptimal care per underlying cause for 2020-2022 triennium

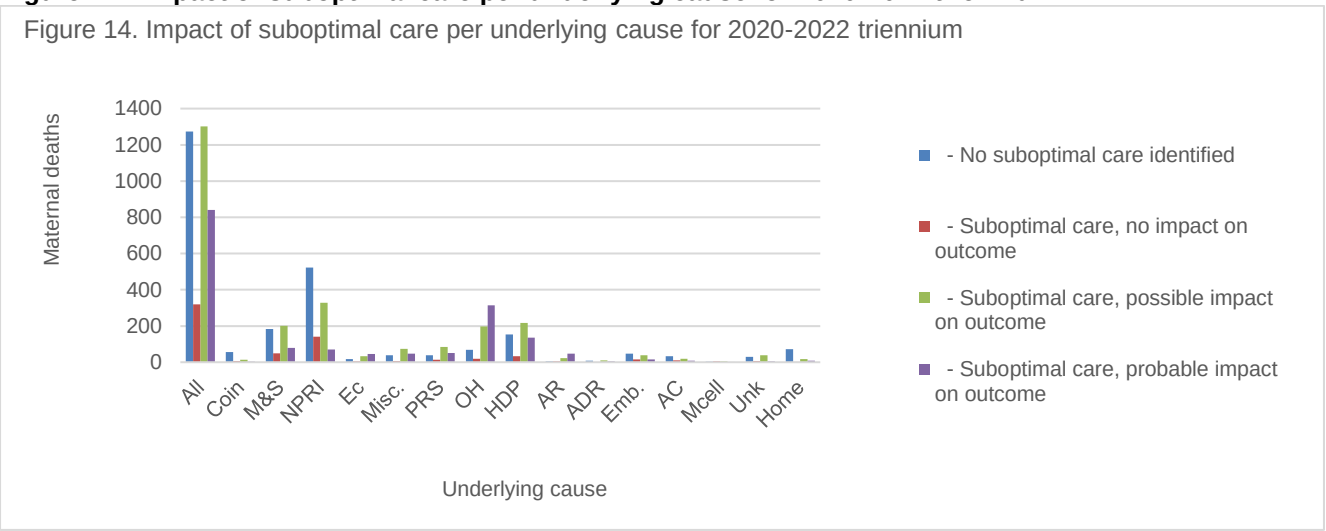


Table 17 shows that the most frequent patient/community related preventable factors were lack antenatal care and delay accessing care. These both decreased slightly in the 2020-2022 triennium compared to the previous one, indicating that women continued to seek care for their pregnancies, despite the COVID-19 pandemic.

Table 17: Patient/Community related Preventable factors 2020-2022 and comparison with previous triennium

2020-2022	Number 2020-22	%	% 2017-2019
Lack of information	400		
Assessable cases	3334		
No avoidable factor detected	1623	48.7	46.8
No antenatal care	609	16.3	19.9
Infrequent antenatal care	152	4.1	6.8
Delay in accessing medical help	1057	28.3	29.7

2020-2022	Number 2020-22	%	% 2017-2019
Declined medication/surgery/advice	277	7.4	8.6
Family problem	78	2.1	1.8
Community problem	31	0.8	0.6
Unsafe abortion	44	1.2	1.6
Other	259	6.9	1.7
Total	**3734**		

Overall, there was a small increase in the proportion of deaths with administrative avoidable factors (Table 18). However, comparing years, the proportion of deaths with Administrative avoidable factors increased in 2020 (57.1%) and 2021 (52.6) compared to 48.1% in the previous triennium. The most frequently cited avoidable factors in this category were appropriate skill not available on site/standby, lack of healthcare facilities (eg ICUs) and delay attending to patient due to overburdened services. This probably reflects the effects of the COVID-19 pandemic on functioning of the health system. The Human Resource categories cannot be properly compared between triennia due to changes in categories as shown in the footnote beneath the table. The category “appropriate skill not available not available onsite / on standby” refers to facilities where there is no one on duty with the skill designated for that level of care; for example, a primary care delivery unit without a registered midwife or a regional hospital without an obstetric specialist. This would be due to unfilled posts in most instances, but some cases were cited where the person with the appropriate level of skill was on duty, but not contactable or available to help.

Table 18: Administrative related preventable factors

Description	Number 2020-22	%	%2017-19
Lack of information	330		
Assessable cases	3404		
No avoidable factors	1702	50	51.6
Avoidable factors detected	**1702**	**50**	48.4
Transport problem: Home to institution	57	1.5	1,9
Transport problem: Institution to institution	234	6.3	6,2
Lack of accessibility: Barriers to entry	47	1.3	1,2
Lack of accessibility: Other	50	1.3	0,7
Delay in attending to patient (Overburdened service)	**265**	**7.1**	6,4
Delay in attending to patient (Reason unknown)	185	5	
Lack of healthcare facilities: ICU	**328**	**8.8**	8,3
Lack of healthcare facilities: Blood/blood products	82	2.2	3,1
Lack of healthcare facilities: Other	119	3.2	2,9
Inadequate numbers of staff on duty*	**271**	**7.3**	

Description	Number 2020-22	%	%2017-19
Appropriate skill not available on site / on standby*	**363**	**9.7**	
Communication problems: Technical	70	1.9	1,6
Communication problems: Interpersonal	63	1.7	3
Other	359	9.6	9,1
Total	**3734**		

*new categories in 2020-2022
compared to 2017-2019 categories: Lack appr trained staff Drs-20.5%, Nurses- 13.7%

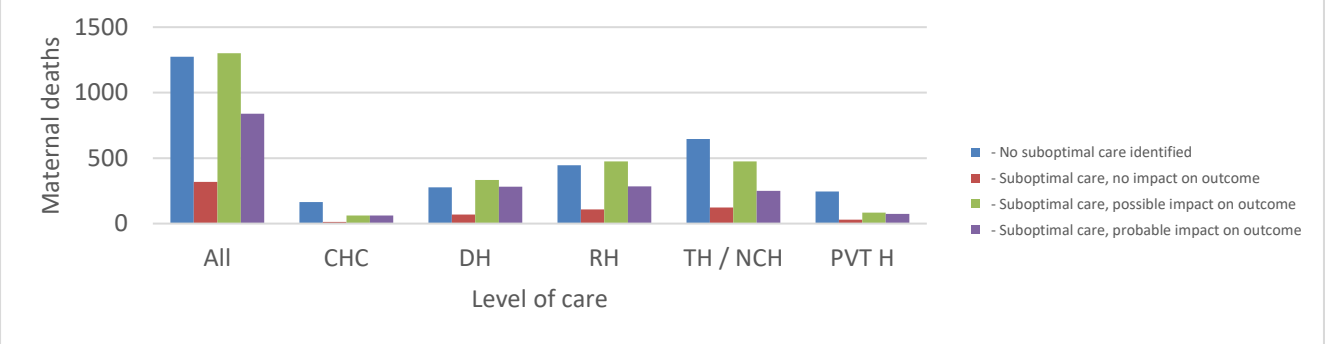
Medical care preventable factors are shown in Table 19. These were most common for district hospitals which had decreased slightly from the previous triennium. Preventable factors in private hospitals decreased. Poor problem recognition and sub-standard care remain the most frequent problems, similar to previous triennia.

Table 19: Medical care related preventable factors

Proportion of deaths managed at each level with preventable factors (%)	CHC	DH	RH	TH/NC	Private
Any Preventable factors	42.1 *(39.3 in prev triennium)*	65.3 *(69.4 in prev triennium)*	57.3 *(59 in prev triennium)*	42.5 *(40.2 in prev triennium)*	45.9 *62.9 in prev triennium)*
Initial assessment	19.9	20.7	14	8.7	14.2
Problem with recognition / diagnosis	18.9	32.8	23.2	14.7	22.6
Delay in referring the patient	10.5	20	7.2	1.1	2.6
Managed at inappropriate level	4.3	15.3	5.2	0.8	0.6
Incorrect management (Wrong diagnosis)	3.1	9.5	7	3.5	5.8
Sub-standard management (Correct diagnosis)	10.9	25.2	29.1	22.5	17.7
Not monitored / Infrequently monitored	1.9	9.3	8.4	3.9	1.9
Prolonged abnormal monitoring with no action taken	2.9	10.8	11.2	6	6.1

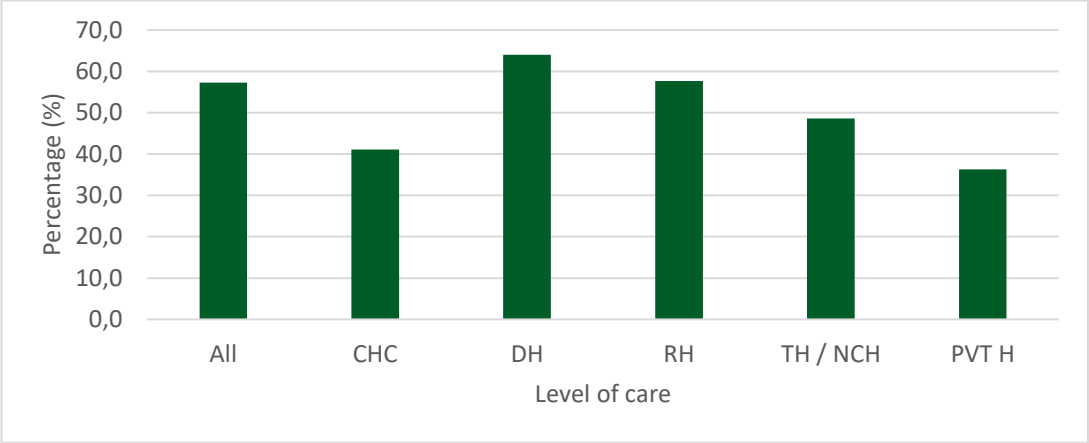
Preventability per level of care in the health system

Figure 15: Impact of suboptimal care for each level of care for 2020-2022 triennium



The highest proportion of potentially preventable deaths occurred at district hospitals, the first referral level for primary care facilities, often staffed by junior doctors and often far away from specialist care at higher level hospitals (figure 16).

Figure 16: Percentage of potentially preventable deaths (%), out of all deaths for each level of care



5. DISCUSSION AND CONCLUSION

Discussion

Notification, submission, and assessment of maternal death cases for the Saving Mothers report was severely hindered after the onset of the COVID-19 pandemic. This meant that the data may not be as accurate as in previous years.

An important finding of this report is the 30% and 47% increase in iMMR in 2020 and 2021 respectively compared to 2019, after correcting for under-reporting. This is similar to findings in other countries (9).
Of note, the return in 2022 to pre pandemic levels suggests a resilient health system.

Assessment of the collateral impact of COVID-19 needs further interrogation of the data by chapter heads, although it is likely that the increase in OH deaths and deaths with administrative avoidable factors, reflects a decline in quality of maternity care during the worst years of the pandemic, because preventing maternal deaths requires a fully functional health system. The increase in anaesthetic deaths needs to be investigated, especially given the concern in SA over several case reports of maternal deaths from inadvertent intrathecal tranexamic acid (TXA) injection.

In 2022, KZN and WC have iMMRs less than 100 per 100,000LBs and are closer to achieving the Sustainable Development Goal (SDG) of 70 maternal deaths per 100,000 live births by 2030. Limpopo province has made remarkable progress in reducing its iMMR, possible due to the Limpopo Obstetric Response Team (LORT) launched in early 2020.

Conclusion

- The NCCEMD process was impacted by the COVID-19 pandemic because of increased workload and sickness of Healthcare Workers.
- Maternal deaths increased by 30% in 2020 and 47% in 2021 compared to 2019, during the severe years of the COVID-19 pandemic, but the IMMR decreased to pre-pandemic levels in 2022.
- This trend was seen in all provinces.
- COVID-19 pneumonia /NPRI deaths were the major contributor to the steep increase in 2020 and 2021.
- Deaths from Obstetric Haemorrhage increased in 2020 and 2021, reflecting collateral impact of the COVID-19 pandemic on functioning of the health system.
- Of concern, anaesthetic deaths were twice as high in 2022 compared to 2020 and 2021.
- Hypertensive deaths and Deaths from Medical and Surgical disorders were the third and fourth most common causes, followed by Early Pregnancy complications. The decline in Hypertension and Early

pregnancy deaths in the current triennium is encouraging, but the possibility of under-reporting of maternal deaths during the pandemic must also be considered.

- The pandemic reversed progress towards achieving SDG goal of MMR 70 by 2030, but progress is now back on track.

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6. DETAILED RECOMMENDATIONS

The impact of previous findings of the NCCEMD in raising awareness of critical issues and recommending interventions is noted: HIV/TB deaths in pregnant women; nevirapine toxicity when this was initially part of the first-line ART regimen for pregnant women; deaths from bleeding associated with caesarean delivery; hypertension deaths in teenagers etc. In addition, guidelines on PPH, Caesarean Delivery and hypertensive disorders of pregnancy have been produced.

Renewed energy is required to implement new recommendations arising from the findings in this report and previous ones that have not yet been fully implemented, in part due to the COVID-19 pandemic.
The Framework for Recommendations developed in the previous triennial report are in Appendix 9.5.

Detailed Recommendations arising from both the 2017-2019 and the 2020-2022 triennial reports are as follows:

RECOMMENDATION	RESPONSIBILITY	REFERENCES/TOOLS
1. Every maternity site must participate in regular maternal and perinatal morbidity and mortality review meetings, which are mandatory and at which:		
• Minutes are kept • Actions are assigned to named individuals with reporting timelines. • There is follow-up to hold these individuals to account.	CEO, Head of institution (HOI), District manager etc	SA Maternity Care Guidelines 2016 (awaiting update)
2. Maternal and neonatal health services must be prioritised at national and provincial level, and must be maintained despite other parallel programmes or pandemics by:		
• Political commitment by NDOH and provinces in line with the International Maternal and Newborn Health Conference declaration (Cape Town May 2023); which specified a Commitment to SDG of achieving MMR of 70 MDs or less per 100,000 Live births by 2030; and the promotion of dignified, respectful care for women in maternity services.	Minister of Health, Provincial MECs, Provincial HODs	IMNHC declaration, Cape Town, May 2023. Sustainable Development Goals 2030
• MECs and HODs of provinces ensuring that the non-negotiable essential functions and requisite resources for MNH are in place and function properly. This means ensuring adequate human resources, infrastructure, equipment, medicines, and other consumables required to implement the maternal and newborn package of care in all health facilities/service points and managers must feedback on this to the National Ministry of Health quarterly.	Provincial MEC and HOD	WHO Basic Emergency Obstetric Care (BEMOC) and Comprehensive Emergency Obstetric Care (CEMOC) signal functions
• Financial investment in terms of increased funding for MNH services including for adequate staffing numbers in maternity wards to allow the quality care that will reduce deaths from the 5 leading causes of maternal death. Such funds must be ring-fenced. This includes funds to ensure specialist midwives are available for all designated labour wards at primary care level (PHC, CHC, MOUs, OMBU).	Provincial MEC, HOD, CFO	
3. Provincial health system interventions and oversight to ensure:		
• NCCEMD process functions in each province and data submitted accurately and timeously to NCCEMD. Provinces to ensure budgets are available for assessors' meetings.	Provincial HOD, CFO	NCCEMD Guidelines
• Integration of services, for example, HIV care, COVID-19 care, contraception, mental health, safe surgery etc must be integrated with financial support into maternity care services	Provincial HODs, CFO, Provincial MCWH managers	NDOH 2022 COVID-19 Clinical and Operational Guideline for Mothers, Newborns and Children

RECOMMENDATION	RESPONSIBILITY	REFERENCES/TOOLS
		SA Maternity Care guidelines 2016 (updated version to appear 2024)
• Regular monitoring and evaluation of and reporting on progress towards implementing NCCEMD recommendations and progress towards the SDG by clinical managers and health service leadership.	Provincial MECs and HODs, reporting to NDOH	SDG 2030 NCCEMD 2020-2022 recommendations
• Strengthening of lines of communication between levels of care so that HODs and MECs can support front line health workers and hear their challenges. This will involve visits to facilities by MECs and HODs.	Provincial MECs and HODs	
• Functional communication channels must exist for consultation about and referral of patients to higher levels of care, and this is supported by agreed upon referral patterns and referral criteria. This includes ensuring equitable access to ICU level of care. Each province must have a clinical outreach policy, which specifies that clinicians at health facilities must, as part of their job description, provide outreach to the facilities within their catchment area.	Provincial HODs, CEOs and HOIs, District Managers.	
• Ensure that generalist doctors working at District hospitals are competent to perform safe caesarean section, laparotomy for ectopic and provide general and regional anaesthesia; and that these skills are part of their core competencies.	Provincial HODs, CEOs and HOIs, District Managers. Training institutions	WHO Comprehensive Emergency Obstetric Care (CEMOC) signal functions. Minimum s Standards for Safe CD in. South Africa (Saving Mothers 2015 interim report)
• Adequate, reliable, appropriate and accessible emergency transport with appropriate emergency personnel to transport critical patients, both from home to facility and between facilities, as well as reliable and accessible planned patient transport between different levels of care for stable pregnant women.	Provincial MECs and HODs Provincial EMS manager	EMS scope of practice document SA Maternity care guidelines and Referral criteria
• Establishment of On-site Midwife-run Birthing Units (OMBUs) at all large district, regional and tertiary hospitals that conduct large numbers of births for low-risk women.	Provincial MECs and HODs, CEOs/HOIs	Saving Mothers Sixth triennial report 2014-2016
4. Clinical management interventions: Focus to be on the top 5 leading causes of maternal death, 5 Hs: (NB**:** These apply to all causes but with more emphasis on leading causes**)**		
• Institutionalise Covid-19 pandemic lessons about maintaining MNH and SRH services during humanitarian crises. Ensure availability of high care beds in all labour wards in district and regional hospitals where women with obstetric complications can be more frequently	District managers/CEO/HOI Provincial MECs /HODs, Provincial MCWH managers	NDOH COVID-19 Clinical and Operational Guideline for Mothers, Newborns and Children 2022

RECOMMENDATION	RESPONSIBILITY	REFERENCES/TOOLS
monitored, as well as high care and ICU beds in all tertiary hospitals.		
• Contraception services need to be expanded to include postpartum LARCs (esp. IUCD and implant insertion); & ensuring contraceptive availability at all facilities and within all services caring for women (e.g., ART clinics and high-risk medical clinics).	National and Provincial MCWH/SRH, District managers, CEOs/HOIs	National Contraceptive Clinical Guidelines (2019)
• Contraception must be more accessible to teenagers, especially at high school level and tertiary institutions. Establish adolescent friendly family planning and maternity services. Strengthen collaboration with educational and training institutions to ensure easy access for contraceptive provision to teenagers	MECs, Provincial HODs, Provincial MCWH/SRH, District managers, Heads medical and nursing training institutions School health	National Contraceptive Clinical Guidelines (2019)
• Antenatal care must ensure every pregnant woman is reviewed by a the most experienced midwife or maternity doctor at least once between 28-34 weeks GA.	District Managers	BANC, SA maternity care guidelines
• Strengthen collaboration with training institutions and ESMOE national board to emphasise clinical examination skills during antenatal, intrapartum and postpartum care	ESMOE national board Heads medical, nursing and clinical associate training institutions	
• Prior to discharge from a ward and facility, specific criteria must be checked and documented (women with abnormal findings like tachycardia, pyrexia etc should not be discharged).	Medical and nursing managers, clinical and operational managers	MCR discharge checklist
• Provinces to adopt the new standardised national maternity case record and perioperative case record and ensure budget for its printing and distribution is ring-fenced	National and provincial MCWH, Provincial HOD, CFO	National MCR template for printing
5. Specific interventions for 5Hs:		
HIV • Implement the updated National VTP guidelines for better HIV management, viral load suppression and TB detection. • Ensure CD4 counts are checked to identify high-risk pregnant women for prevention and treatment of HIV associated infections.	Provincial MCWH, District managers, CEOs/HOIs	NDOH Guideline for Vertical Transmission Prevention of Communicable Infections
Haemorrhage • Establish minimum standards for safe and respectful care during labour that can be audited Incorporate the E Motive approach (uses an accurate blood collection method and a care bundle for reducing severe PPH after vaginal delivery) into ESMOE, SA Maternity care guidelines and all PPH training. Maintain focus on Safe CD programme,	NCCEMD, Na PeMMCo Provincial MCWH, CFO, CEOS/HOIs, District managers, National ESMOE board Provincial MCWH, EMS managers, Medical,	SA Maternity care Guideline, ESMOE (include E Motive approach)

RECOMMENDATION	RESPONSIBILITY	REFERENCES/TOOLS
blood availability, NASG and ensure they are evaluated	Nursing and EMS training institutions	
• Renew focus on Safe Anaesthesia which is one component of the Safe CD programme. ESMOE programme to include updated anaesthetic module Every hospital, including district hospitals, should have a designated lead anaesthetic doctor, responsible for maintaining safe standards of anaesthetic care. District hospitals should be supported and mentored by outreach anaesthetists from the regional or tertiary hospitals.	CEOs, HOIs, District Managers, National ESMOE board, SA society of anaesthesiologists	ESMOE anaesthetic module
• Recommend that TXA is stored outside the operating room and is not placed on the anaesthetic trolley in theatre to mitigate against inadvertent intrathecal injection.	Operating Theatre operational manager	ACE NCCEMD newsletter alert November 2022 (DOH)
Hypertension • Guideline dissemination with training. • Advocacy with community structures to ensure earlier initiation of antenatal care Ensure sufficient numbers of functioning BP measurement devices (preferably pregnancy appropriate) are available and serviced.	Provincial MCWH, District managers, CEOs/HOIs, Operational managers	SA Hypertension in pregnancy guidelines. SA Maternity care guidelines
Heart (medical and surgical disorders) • Community engagement to encourage initiation of antenatal care as soon as pregnancy is suspected	MECs, HODs, Provincial MCWH, District managers	
• Screening for medical problems using clinical history taking and examination skills during antenatal care. Unexplained tachycardia should always be investigated	Medical/Clinical/Operational managers. Medical, and Nursing training institutions	
• Establish Medical Obstetric clinics at regional and tertiary level, where obstetric and internal medicine specialists/subspecialists conduct joint clinics for pregnant women with complex medical problems	CEO	
• Screening for mental health issues during antenatal care and identifying women at risk of suicide as specified in the new Maternity Case record	Operational managers	Maternity Case record mental health screening tool
First Half of pregnancy • Establish linkages between primary healthcare facilities and facilities where women with early pregnancy complications are managed so that guidelines and training on detection and management of Ectopic pregnancy and miscarriage can be introduced. Introduce outreach to primary care gynae in CHCs.	CEOs/HOIs	SA Maternity care Guidelines. Saving Mothers 2017-2019 technical report Obstetrics and Gynaecology Forum 2020, vol 30, no 4
• Health workers in casualty departments to participate in training on the	CEOs/HOIs of district and regional/tertiary hospitals	ESMOE module on early pregnancy complications

RECOMMENDATION	RESPONSIBILITY	REFERENCES/TOOLS
assessment, diagnosis and management of women with ruptured ectopic pregnancy and women with complications of miscarriage (ESMOE module)	District manager, operational managers	
• Every district hospital must have a lead anaesthetic doctor whose role is to achieve and maintain safe standards of anaesthetic care at the hospital, with support from regional specialists and this must include ability to provide anaesthetic for ruptured ectopic pregnancy	District managers/ CEOs/HOIs	
• Ensure pregnancy testing available at all primary care facilities, MOUs, and CHWs in the community.	District managers, operational managers	
• Early pregnancy counselling service and access to safe TOP for women who request it. All health facilities with a 24-hour birthing service and on-site doctors must manage women with safe (low-risk) miscarriages and provide / offer access to a Safe TOP service	District managers, operational managers	
6. Training and policies		
• Integrated national maternal and neonatal care guidelines must be electronically accessible to all maternity healthcare workers	NDOH MCWH	
• National Essential Medicines List guidelines for Primary healthcare and hospital level must be electronically accessible to all maternity healthcare workers	NDOH pharmaceutical services	
• ESMOE (including anaesthetic module) must be the standard programme used for in-service training of maternity healthcare workers and all the ESMOE training materials must be accessible via the Knowledge Hub	NDOH MCWH and ESMOE board	Knowledge hub and ESMOE training materials
• A national ESMOE board must be constituted to oversee and update the content of the programme and guide the scale-up of ESMOE training	NDOH MCWH	
• Each hospital and designated primary care level birthing unit (MOU or OMBU) should have at least one on-site trainer able to run the relevant ESMOE modules and drills.	Provincial MCWH, District managers, CEOs/HOIs	
• Need to ensure ESMOE training for all new staff and two-yearly updates for existing staff.	District managers, CEOs/HOIs	
• EOST drills/exercises must occur monthly in maternity facilities. This is especially so at primary care and district hospital level as the rarity of conditions makes doing emergency drills essential to maintain skills.	District managers, CEOs/HOIs	

7. ABSTRACTS FOR PRIMARY CAUSE OF DEATH CHAPTERS

7.1 Non-Pregnancy Related Infections *Dr Salome Komane*

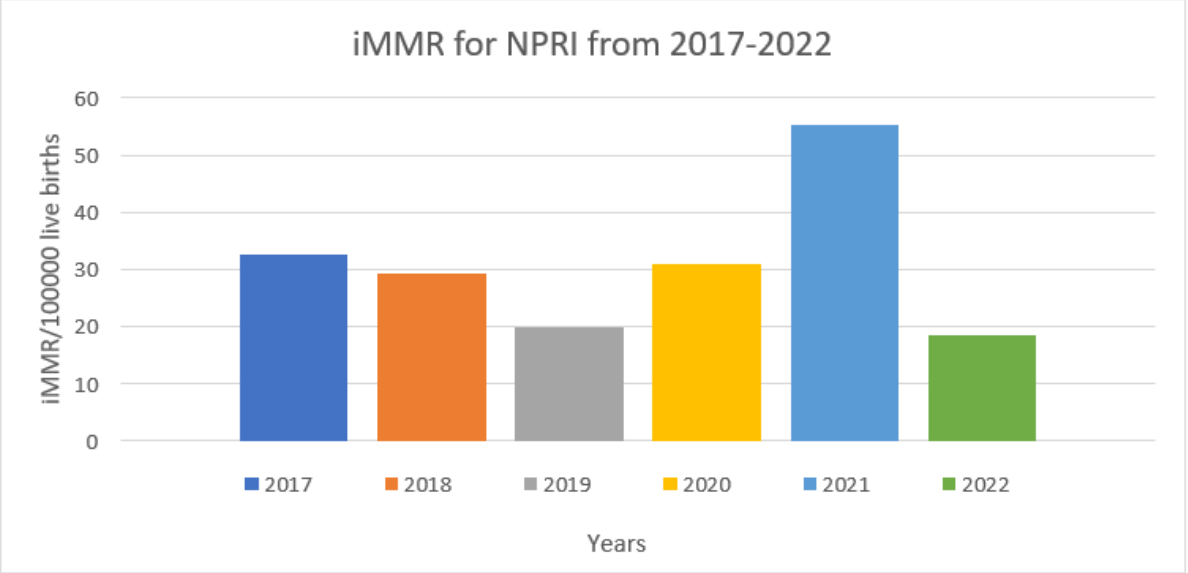
Abstract

Deaths due to Non-Pregnancy Related Infections remain the leading cause of maternal mortality for the triennium 2020-2022. However, there had been a steady reduction in numbers of NPRI maternal deaths from 2011 to 2019. With the advent of the COVID-19 pandemic in 2020, the number of maternal deaths increased substantially in South Africa as it did in several countries affected by the pandemic.

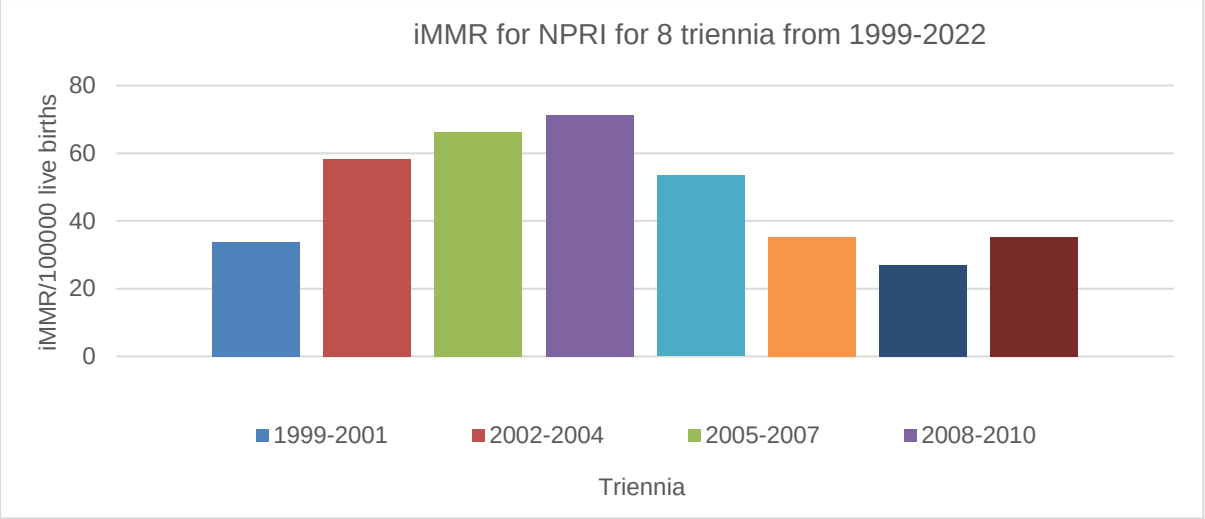
Summary of the Findings of Maternal deaths in the triennium 2020 – 2022

The Non-Pregnancy Related Infections (NPRI) category of maternal deaths constitute deaths from tuberculosis (TB), pneumonias, meningitis, malaria and gastroenteritis from a variety of infectious causes including HIV and COVID-19. The latter was a new infection, and it was agreed by NCCEMD that it be classified as NPRI/Other with COVID-19 specified.

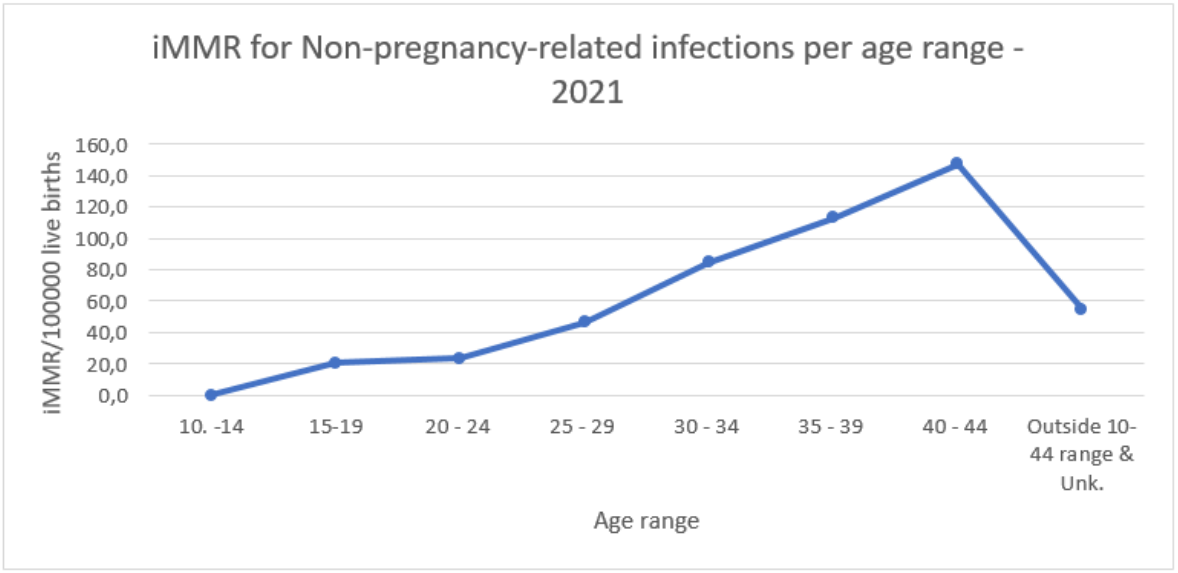
There were 1063 deaths reported in the NPRI category of maternal deaths in 2020-2022 compared to 770 deaths in 2017-2019. This is a substantial increase of 38% compared to the previous triennium (2017-2019).
All provinces reported an increased number of deaths from NPRI with the highest numbers occurring in KwaZulu-Natal (n=257) followed by Gauteng (n=187), Eastern Cape (n=155) and Western Cape (n=110).



The distribution of the institutional maternal mortality ratios (iMMR) per underlying cause from 2011-2019 shows a significant decrease of NPRI over the years from 53.4 in 2011-2013 to 35.17 in 2014-2016, 27.07 in 2017 - 2019 and then a significant increase to 35.2 maternal deaths per 100,000 live births in 2020-2022 triennium.



The highest iMMR occurred at tertiary hospitals with 110.1 maternal deaths per 100,000 live births followed by national central hospitals (79.2), regional hospitals (40.8) and district hospitals (15.4). In this triennium there were more deaths at higher level institutions compared to previous trienniums and this is the effect of the COVID-19 pandemic. The distribution of maternal deaths per age showed that deaths due to NPRI were highest in the age groups 25-44 years at (n=484: 86.2%) in the year 2021, the year for which denominator data was sourced from STATs SA.



There were 627 women who were HIV infected among the 1063 women who died in the NPRI category of maternal deaths. Thus, HIV was an underlying factor in 35.2 per cent of overall maternal mortality in South Africa. In the NPRI category 58.98% deaths were HIV positive, 3.5% were negative and in 6.0% the HIV status was unknown. There were 516 (81.8%) on ART, and 18.2 per cent were not on treatment.

The major cause of death in the NPRI category was 'other' (550 deaths), of which 517 were specified as **directly** due to COVID-19 complications, mostly COVID-19 pneumonia. Of the 550 NPRI/other deaths, 208 were in fact HIV positive with 191 of these on ARVs, but as noted above, 517 deaths were **directly** attributed to COVID-19 complications. Of the 517 COVID-19 deaths, there were 132 deaths in 2020, 373 in 2021 and 12 in 2022. The highest iMMR in the NPRI category was the 'other' category at 15.5 maternal deaths per 100,000 live births, TB was second at 6.0, PCP pneumonia was third at 3.7 and other pneumonias were fourth at 3.1. These figures have changed as compared to that of the previous triennial report (2017-2019) where TB was the major cause of death.

Patient oriented problems were identified in 52.3% of the deaths and this was a 30% decrease from 2017-2019, indicating that patients continued to seek care despite the pandemic. Administrative problems were identified in

38.1% of deaths which is similar to 39.7% in 2017-2019.
Most of the deaths were referred from primary care and managed at district hospitals (n=445), regional hospitals (n=405), tertiary and above (n=381) and private (n= 152). 37.7% of the NPRI deaths assessed as potentially preventable compared with 75.2% from the previous triennium suggesting that the majority of COVID-19 deaths were not thought to have been preventable. Resuscitation problems were identified to be substandard in 15.9% of deaths, a huge reduction of 32.5% from the previous triennium.

Overall Comment

Of concern is that majority of the 1063 deaths occurred in 2020 and 2021 (883 deaths) during the height of the COVID-19 pandemic in South Africa. During these two years, COVID-19 complications accounted for 505 (57.2%) of NPRI deaths. This finding warrants a preparedness of a country for pandemics. A review of folders should assist in finding the reasons as to whether these deaths were due to lack of resources especially intensive care units (ICU) and lack of strict monitoring of infected mothers, or those who were known HIV positive interrupted treatment and presented early in pregnancy in a critical condition and died. It is likely that COVID-19 not only directly caused maternal deaths but may have contributed to increases in other direct causes of maternal deaths such as Obstetric haemorrhage because of its impact on functioning of the health system.

Recommendations

1. Primary prevention of HIV, especially among women of childbearing age.
2. Preventing unintended pregnancies by promotion of contraception especially the long acting reversible contraception (LARC) methods.
3. Ensure safe conception among women living with HIV.
4. HIV testing to identify all women who are HIV positive, including those who seroconvert during pregnancy.
5. Provide antiretroviral therapy (ART) on the same day that her HIV positive status becomes known, to optimise maternal health and to prevent mother to child transmission of HIV as per the New PMTCT (VTP) guideline 2020 and guidelines for maternity care in South Africa.
6. Monitor the maternal viral load to ensure that all HIV positive pregnant and breastfeeding women are virologically suppressed on ART.
7. Mandatory screening for TB and other infections at all subsequent antenatal visits.
8. All women eligible for TB preventative therapy (TPT) and prophylaxis of opportunistic infections (CPT) must be initiated as per guidelines without delays.
9. HIV positive pregnant women who are acute or chronically unwell need thorough investigation of TB and other opportunistic infections with involvement of internal medicine and infectious specialists early.
10. Training of healthcare providers on the new HIV, TB and ART guidelines.
11. Ensure continuous monitoring of HIV positive women during the post-partum and breastfeeding period for 24months and longer if indicated and link them to Community Healthcare Workers (CHW) for continuum of care.

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7.2 Medical and Surgical disorders (Dr Sibongile Mandondo, Dr Mustapha Makinde and Prof. Priya Soma-Pillay)

Five hundred and thirteen mothers demised due to medical and surgical disorders (M&S) during the 2020-2022 triennium. Although sixty-two more women died during the 2020-2022 triennium compared to the previous triennium, the iMMR of 16.9 has remained constant for the last thee triennia.

Medical and surgical disorders remain the fourth most common cause of maternal death in South Africa from the 2005 -2007 triennium till the present triennium (2020-2022). The most common causes of death in this category are deaths due to cardiac disease (n=157), respiratory disease (n= 60), neoplasm (n=43), central nervous system (n= 38), gastrointestinal tract diseases (n=33) and suicide (n=26). Cardiac diseases account for a third (31%) of the medical and surgical disorders deaths, with cardiomyopathy (n=101) being the most common cause among the cardiac disease (n=157) category.

Seventeen percent (n=89) of deaths occurred at district level or lower. This percentage is slightly lower than the 20% (n=87) of deaths reported in the 2017 -2019 triennium thus reflecting an improvement in the referral system. There has also been a significant decrease in the number of deaths that occurred at district and CHC level in 2022 (n=20) compared to the numbers during the COVID-19 pandemic (2020, n=34; 2021, n=35). This probably reflects the overburdening of the health system during the pandemic thus requiring healthcare workers at district level to care for tertiary level patients.

National Central hospitals experienced the highest M&S related mortality with iMMR at 58.9 maternal deaths per 100,000 live births, tertiary hospitals at 55.3 and regional hospitals at 19.9. In National Central hospitals, neoplasm was responsible for the highest cause with iMMR of 10.1 followed by cardiomyopathy at 8.9 and rheumatic heart disease at 5.7. In tertiary hospitals, the highest cause iMMR was due to cardiomyopathy at 12.1 followed by GIT and respiratory disorders both at 5.6.

Twenty-one deaths (n=21) occurred in private institutions compared to twenty-four (n=24) in the 2017- 2019 triennium. Seventeen private patients were delivered by CD and 4 by vaginal birth. Deaths due to cardiac and respiratory conditions made up 45.8 % vs 62.5% in 2017-2019 of medical and surgical deaths in private institutions.

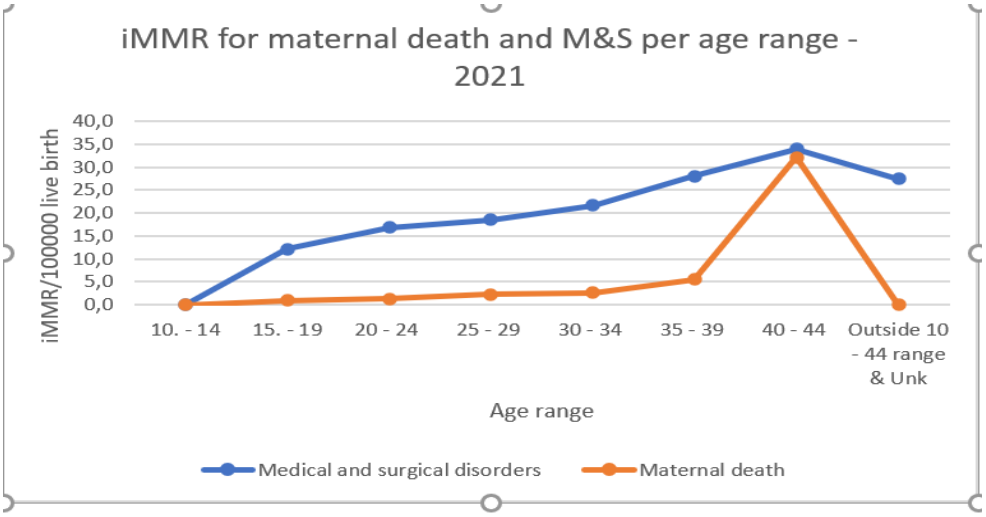
The highest number of deaths occurred in Gauteng (n=118), followed by KZN (n=111), Limpopo (n=63), Eastern Cape (n=57) and Free State (n=41). The National iMMR was 17.0 deaths per 100,000 live births, and the provinces with the highest iMMR from M & S was the Free State (28.3), followed by North West (19.1), Eastern Cape (17.6), with Gauteng and KZN both at 17.2. Western Cape had the lowest iMMR at 11.7.

The iMMR for suicide was more than double the national average in the Eastern Cape and Mpumalanga. Similarly, cancer deaths were increased in Mpumalanga, Gauteng and KwaZulu-Natal. Screening programmes for cancer and mental health should be strengthened in these provinces.

In the 2020-2022 triennium, out of 513 deaths, the final causes of maternal deaths were Respiratory failure (n=178), Metabolic failure (n=111), Renal failure (n=90), Circulatory failure (n=89) and Cerebral complications (n=85).

Women in the general population who become pregnant after the age of 40 have a 7-times increased risk of dying compared to women under the age of 35. However, for women with underlying medical or surgical disorders this risk remains high (3 times the general population) from the age of 15 and remains increased for the entire reproductive period. (Figure 1.) The highest iMMR (34 deaths per 100,000 live births) was recorded for women in the 40-44 year age category, followed by women in the 35-39 year age group at 28.1. Cardiac disease and neoplasm were responsible for the majority of deaths in both age groups.

Figure 1: Maternal mortality rates in different age ranges, for M&S maternal deaths compared to all maternal deaths in 2021.



There was great improvement in deaths among teenagers due to medical and surgical conditions. There were two deaths in young girls in the age category 10-14 years with an iMMR of 14.7, compared to this category causing an iMMR of 25.1 in the 2017-2019 triennium. The iMMR in the 15-19 year age group was 12.1, compared to 15.6 in 2017-2019. This may be due to improved access to antenatal attendance with implementation of learner pregnancy policy and comprehensive sexual reproductive health policy implementation and screening in schools. Suicide is the leading cause of death in 15-19 age group with iMMR of 2.8 followed by cardiac at 2.7 and neoplasm at 1.9.

Six out of nine women who died as a result of suicide in 2021 were under the age of 24.
The increased risk of dying for women with medical disease highlights the importance of pre-conceptual counselling, contraception and general health awareness for women in the reproductive age categories.

Most deaths occurred among primigravid women (n=149, 29%) while less deaths occurred in higher order parity indicating that most women do not access medical services prior to pregnancy hence prenatal diagnosis and optimisation of their medical and surgical conditions were missed.

The majority of patients were HIV negative (n=283), with a total of 165 patients being HIV positive. Ninety percent of HIV positive patients were on ARVs. This highlights the need to integrate contraception counselling into ART management and ensure health workers in the chronic stream of PHC clinics are competent at insertion of long acting reversible contraception.

The caesarean delivery rate for women who died in this category was 51.6% (n=147). Most of the Caesarean sections were conducted at Regional hospitals (n=43) followed by Tertiary hospitals (n=42) and National Central hospitals (n=40). The high caesarean delivery rate may be attributed to the high-risk underlying disease condition. This may explain why a higher percentage of these mothers were delivered in regional and tertiary institutions as compared to those delivered in the district hospitals (n=16).

Maternal death assessors believed that medical care was suboptimal in 329 (64.1%) of M&S deaths, and that for 54.6% the maternal deaths were potentially preventable. Patient oriented avoidable factors were present in 267 (52%) of deaths and administrative factors in 217 (42.3%) deaths. These Patient factors included: delay in accessing medical help by patients (27.3%), no antenatal care (17.5%) and declined medication/surgery advice (9.9%). Out of the maternal deaths in which resuscitation was attempted, avoidable factors were identified in 217 (42.3%) of those cases.

Important administrative avoidable factors identified in the public sector were lack of appropriate skill onsite or on standby to deal with medical problems (6.8%), inadequate number of staff on duty (5.7%), delays in initiating critical care as a result of an overburdened service (5.7%), lack of healthcare facilities (5.2%) and transport problems from institution to institution (3,9 %).

Medical care avoidable factors at CHC level occurred in 43.2% of M&S deaths, district hospitals were highest at 61.4%, regional hospitals at 53.5%, tertiary hospitals at 46% and private hospitals at 53.6%.

Medical care avoidable factors were assessed by level of care in public sector. Problems with initial assessment were highest in CHC at 26.2%. Poor problem recognition/ diagnosis at District hospitals was high at 32.8 % compared with other levels, followed by delay in referring the patient at 24% and management at inappropriate level at 18.5%.

Regional hospitals' medical avoidable factors were initial assessment at 24% vs 21.1 % for tertiary hospitals. Prolonged abnormal monitoring with no action taken was higher in regional hospitals at 10.7 % vs 6.5 % at tertiary level and above.
Substandard management with correct diagnosis was higher in tertiary level and above at 18.5 % vs 17.3% in regional hospitals.

Fifty-three percent of deaths in private institutions were assessed as avoidable. The leading medical factor was problems with recognition/diagnosis at 35.3 % followed by substandard management with correct diagnosis and initial assessment problem both at 14.7 %.

Maternal death Case report: M&S / Cardiomyopathy with Pulmonary Oedema

Summary

14yrs, primigravida. Booked before 20 weeks with normal booking bloods. She had moderate anaemia with HB of 8.6, normal BP and a pulse of 95 at the first antenatal visit. The anaemia was not treated. At subsequent visits, she had persistent tachycardia with heart rate ranging from 110 to 125 beats per minute, which was not investigated. She was treated at one antenatal visit for urinary infection.

She presented at term to a district hospital with lower abdominal pains. Haemoglobin was not checked and her pulse was 118. She was not in labour, was advised take ferrous Sulphate 200mg twice a day and discharged home. The tachycardia was not investigated and a general cardio- respiratory examination was not done.

She presented three days later complaining of shortness of breath since the evening of discharge. On admission, she had a tachycardia of 120 and respiratory rate of 34breaths per minute. Oxygen Saturation was not done. A CTG was commenced by the nurse, during which the patient developed severe shortness of breath and started coughing blood-stained fluid and frothing. The CTG showed fetal tachycardia. The CTG was stopped, she was put in the semi-fowlers position, oxygen was given by face mask, and a urinary catheter inserted. She was given a stat dose of lasix and the doctor called; he arrived immediately.
A clinical diagnosis of pulmonary oedema with cardiomyopathy was made, the cardiac apex was displaced was displaced and she had severe anaemia. Treatment was given as per protocol with repeated doses of IVI lasix and isorbide dinitrate 5mg sublingual with no improvement. Other doctors were called to assist. CPAP was initiated but she continued frothing and was intubated and ventilated. There was no blood gas machine. The patient had a cardiac arrest one hour after starting treatment. CPR was commenced but the baby was not delivered peri-mortem.
Patient died within 2 hours of admission.
Postmortem Confirmed pulmonary oedema with cardiomyopathy.

Assessment

Primary Obstetric Cause: Cardiomyopathy. *Final cause*: Pulmonary oedema. *Contributory condition*: Anaemia
Avoidable factors: Patient and administrative – nil
Medical care: Poor problem recognition/Initial assessment; Substandard care; Prolonged abnormal observations with no action.
Suggestions for prevention: Patients with tachycardia must be referred to hospital for investigation during ANC. When patients present in labour, a proper history needs to be taken and all antenatal problem identified instead of focusing on labour complaints only, and a systemic examination should be conducted using the Big 5, forgotten 4, core 1 approach. Plotting of vital signs on the antenatal early warning chart will prompt escalation of care. Respiratory rate should be a routine vital sign measured in labour ward. Maternal resuscitation drills must be conducted. DHs must have skills for peri- mortem caesarean section. Transitional high care beds with CPAP need to be available in district hospitals. Mother must be stabilised before fetal monitoring is commenced.

Recommendations

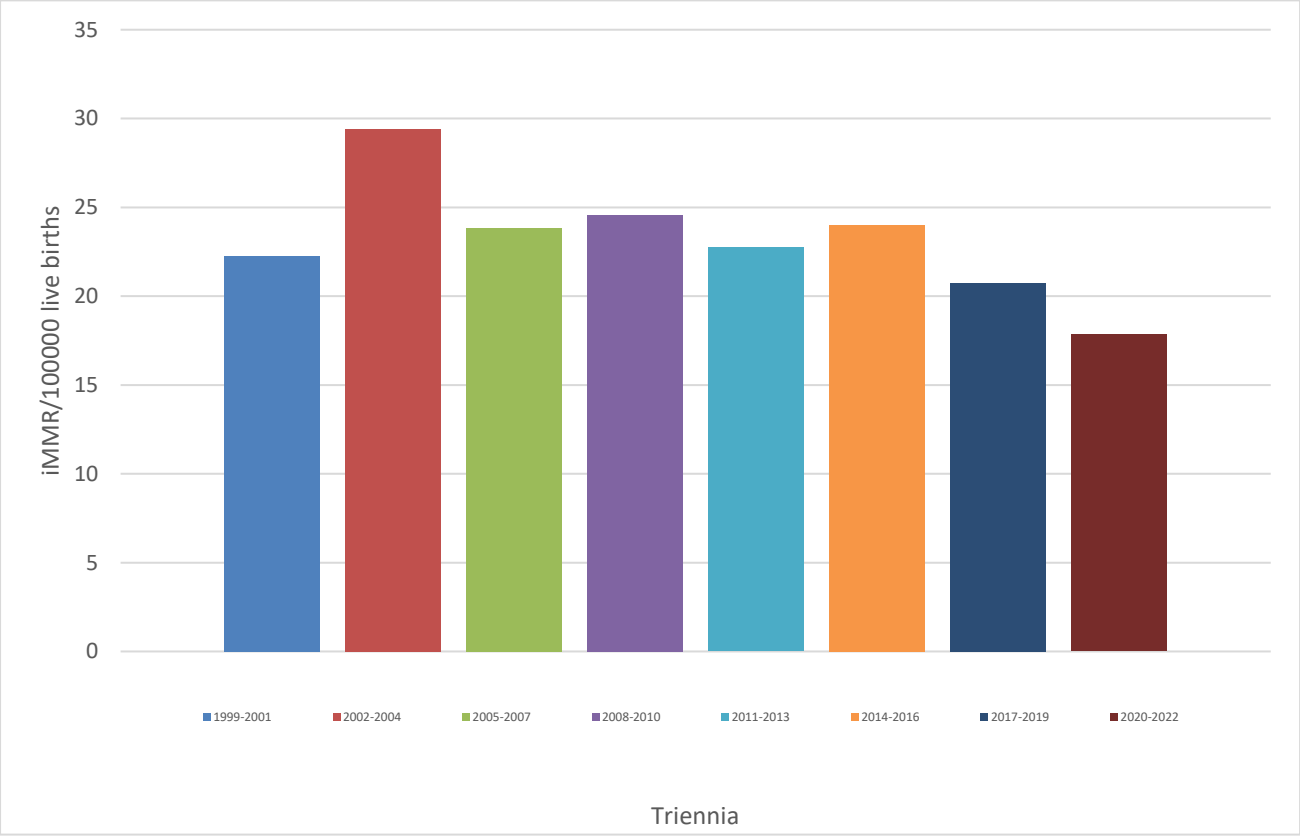
1. Sexual and reproductive health awareness and education should begin at schools. Young women should have easy access to contraception including emergency contraception in clinics. Contraceptive services should be made available after-hours for scholars. The role of technology and tele-health like B-WISE app should be marketed to youth to enhance access to contraceptive care. Adolescent Youth Friendly Services should be established at clinics where feasible.
2. Routine vital signs among pregnant patients should include respiratory rate in addition to blood pressure, pulse and urinanalysis to triage patients appropriately. The antenatal early warning chart that is provided in the maternity case records should be used for inpatients, and abnormal vital signs responded to with escalation of care.
3. Obstetric High care units in regional and tertiary hospitals should be adequately staffed to improve quality of care. Patients admitted in High Care should have a high care discharge summary provided to guide follow up at lower levels. This summary should include near miss interventions, the delivery plan or postnatal review plan.
4. Near miss audits should be institutionalised and an interdisciplinary morbidity meeting involving anaesthetists and physicians should be encouraged.
5. All healthcare workers providing chronic care and NIMART care should be trained on sexual and reproductive healthcare including LARC and should be familiar with the World Health Organisation's medical eligibility criteria for contraceptive use.
6. Specialised care for medical diseases in pregnancy should be ring-fenced in regional and tertiary hospitals through a joint clinic involving physicians and obstetricians.
7. Referral systems and outreach and in-reach programmes should remain functional and district hospitals should have a transitional high-care area to stabilise and manage women awaiting transfer to regional hospitals and tertiary hospitals.
8. Basic ICU care including emergency medical/cardiac modules should become part of the ESMOE course. All registrars in O&G should have a compulsory rotation in ICU.
9. Women presenting with shortness of breath and/or maternal tachycardia must be investigated and managed with multidisciplinary approach involving physicians and obstetricians.
10. Women should be screened for mental health conditions at the first ante-natal visit and offered the contact details for online counselling services. Teenagers are the most vulnerable group and need referral and linkages. Support groups at local clinics or community need to be established.
11. Gender based violence should be suspected in patients with recurrent admissions and negative findings on investigation after referral to other disciplines. Protocol to manage GBV and patients who screen positive for mental health need to be included in all BANC plus training.

7.3 Hypertensive disorders of Pregnancy (Dr Makgobane Ramogale-Zungu and Prof Jagidesa Moodley)

Key Data Points

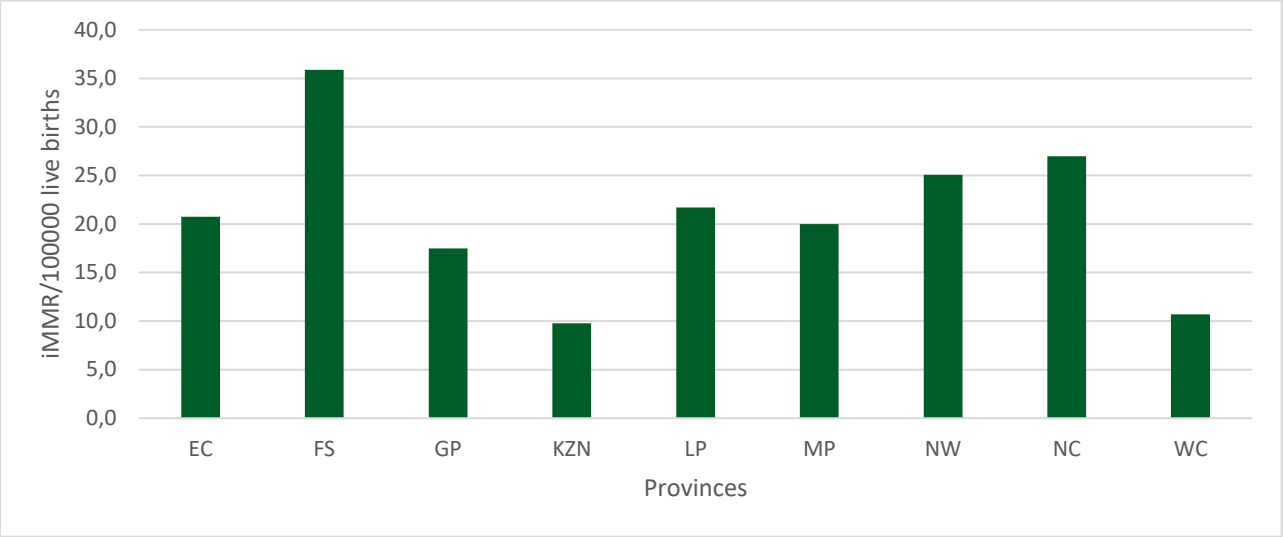
- There were 539 maternal deaths due to Hypertensive Disorders in Pregnancy (HDP) in the current triennium, 2020-2022 (14.7% of total maternal deaths). This was 51 deaths less than the 590 deaths recorded in the previous triennium 2017-2019.

Figure1: iMMR from hypersensitive disorders of pregnancy for 8 triennia from 1999-2022



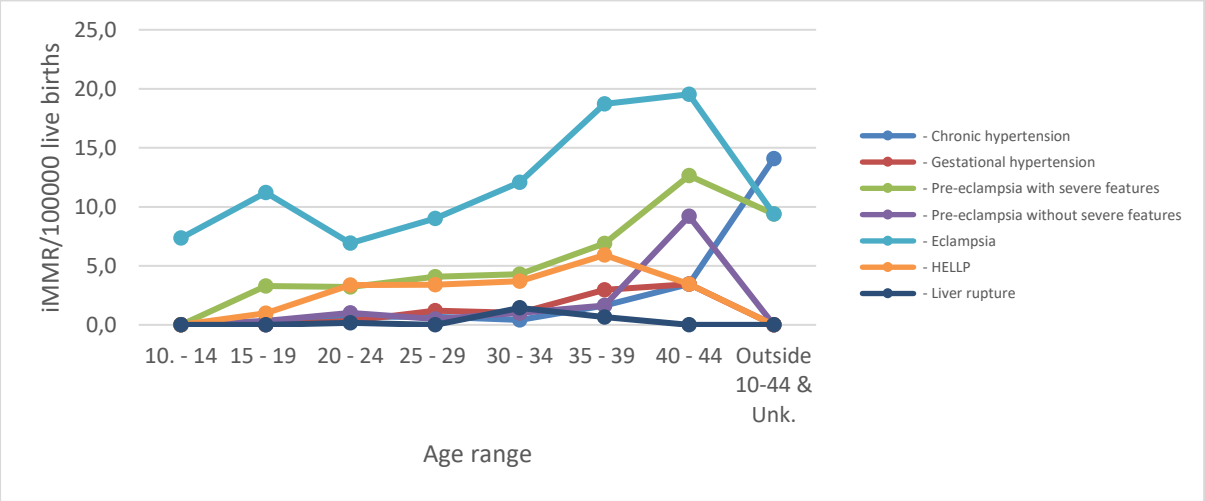
- The number of deaths due to HDP in the current triennium in individual provinces ranged from 18 in the Northern Cape (NC) to 120 in Gauteng (GP).
- Eclampsia (n=264) accounted for the majority of deaths. The numbers of deaths in the other categories of HDP were Pre-eclampsia with severe features (n=108); HELLP (n=82); Pre-eclampsia without severe features (n=28); gestational hypertension (n=-6) chronic hypertension (n=21) and liver rupture (n=10).
- The institutional Maternal Mortality Ratio (IMMR) for HPD was 17.85 deaths per 100,000 live births. There were 3,019,165 live births in the public sector in the 3-year period. Two provinces, Free State (35.9 per 100,000 live births) and NW (27) had the highest IMMRs (Figure 2).

Figure 2: iMMR for Hypertension per province for the 2020-2022 triennium



- Most deaths due to HDP occurred in Regional Hospitals (n=172), followed by tertiary hospitals (n= 147). National central hospitals had 73 deaths, District Hospitals had 92 deaths, and Community Health Centers had 19 deaths. There were 16, 53, and 1 deaths due to pre-eclampsia with severe features, eclampsia and HELLP respectively in District Hospitals. Nine deaths due to eclampsia occurred in CHCs.
- There were 20 maternal deaths due to HDP reported by Private Health Facilities (10 were due to eclampsia).
- There was an increase and later a decline in iMMRs over the three years of the triennium, being 17.9 in the year 2020; 18.5 in 2021 and 17.2 in 2022.
- Final Causes of deaths due to HDP:
  - Cerebral complications accounted for 57.3% of all deaths due to HDP (eg. intracranial hemorrhage =164); cerebral edema = 32 and brain death following a hypoxic event = 66, etc)
  - Cardiac failure/pulmonary edema (31.4%)
  - Acute kidney injury (20%), DIC (10.4%) and liver failure (9.5%) were other major final causes of death.
- HIV Status and HDP Deaths: Of 539 deaths, the HIV "status" was unknown in 73 cases. Of those tested, 74.6% were HIV negative and 26% were HIV positive.
- The iMMR per hypertension subcategories per age range is shown in Figure 3.

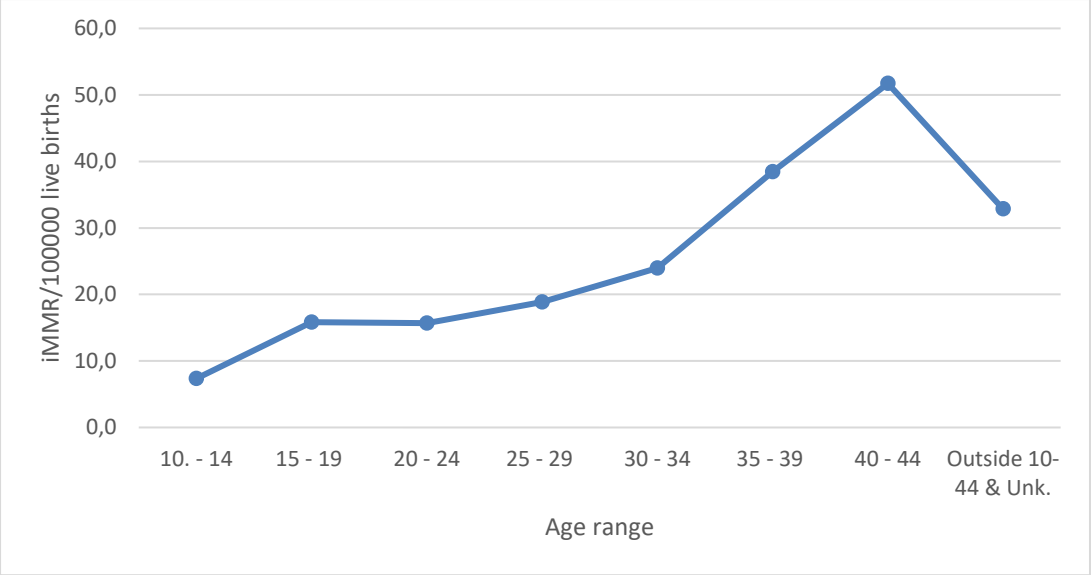
Figure 3: iMMR for hypertension subcategories per age range – 2020-2022 trennium



- Maternal Age and HDP deaths: Of 539 deaths, 1 was less than 15 years, 48 were 15-19, and 93 were age 20 -24 years.

- The IMMR for those between the age of 10 and 14 years was 7.4 and 15.8 deaths per 100,000 live births for those aged 19 to 24 years (Figure 4). It increased with age, unlike in the 2017-2019 triennium where iMMR was as high in the <15 yr group as in the >35 yr age group. This shift is encouraging and could be explained by less teenage pregnancies or better care of teenagers by the health system, or the predominance of older women dying due to COVID-19 and skewing the age breakdowns.

Figure 4: iMMR for Hypertension per age range – 2020-2022 Triennium



- Parity and HDP: a substantial proportion of deaths occurred in primigravidae (n=169), accounting for 31% of all HDP deaths. In addition, 88 (33%) of the 264 women who died of eclampsia who died were primigravidae.
- Approximately 51.2% of all HDP deaths had an avoidable factor.

Summary

Mortality Rates associated with HDP remain substantial, despite a slight decline in the iMMR.

The Major causes of death remain the same viz cerebral complications, pulmonary edema, acute kidney injury and disseminated intravascular coagulation. Respiratory failure deaths were also seen which were slightly higher than kidney injury in this triennium.

Primigravidae, especially those less than19 years, remain at high risk of death due to eclampsia, but this has improved since the previous triennium.

Maternal death Case study: Eclampsia (Hypertensive disorder)

Summary of patient

33yrs old P1, m1, G3 booked at local clinic at 15wks
Patient had pré hypertension and tachycardia at 2 initial visits.
BP - 139/81, p- 110; and BP- 135/84 P- 120. No action taken and no referral. She was given a date for review in 2 months time.

On a routine 3rd antenatal visit, BP-187/107 and 181/128 with généraliséd body swelling. Patient was 32 wks according to sonar.
She was referred to district hospital. No magnesium sulphate or antihypertensives were given
District hospital:

On arrival at district hospital, patient had symptoms of imminent eclampsia, she was loaded with MgSO4 and given antihypertensives (Methyldopa 1g and 10mg Nifedipine). The case was discussed with a regional/tertiary institution and patient was accepted. While awaiting transfer to a tertiary institution, she developed tonic clinic seizures. Patient fell and IV line came out. It had to be re-inserted. Patient had a second seizure and was unresponsive following the seizure. CPR was commenced. Wrong doses of adrenaline given (0.5mg). CPR stopped for more than 2 minutes to attempt intubation. Intubated on the 3rd attempt (difficult intubation). Patient certified dead after an hour of resuscitation.

Sonar was done after patient s death and fetal heart was present, Perimortem CS was done and baby was extracted with apgar 2/10 and weight 1.6kg with a large retroplacental clôt.

Assessment:

Primary Obstetric cause of death: Eclampsia
Avoidable factors:

a. Patient - nil
b. Administrative - nil
c. Medical care

- Poor problem recognition, assessment and management of Hypertension at CHC
- Referral to inappropriate level
- Prolonged abnormal observations with no action
- Resuscitation problems

Lessons to learn and suggestions for prevention:

1. Need for clear referral criteria/ adherence to referral protocol.
2. Training of management of severe Pre-eclampsia at local clinic prior to transfer to hospital.
3. Training on Maternal resuscitation module

Preliminary recommendations

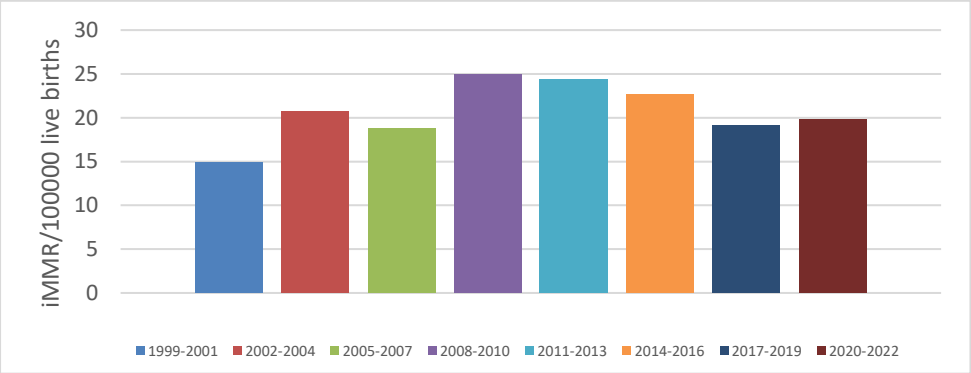
More detailed recommendations will follow after all the files have been reviewed by authors.

1. **Contraception**: messages about reproductive health for both males and females must be strengthened at all educational facilities – schools, colleges, universities. All health professionals must ensure that women over the age of 35 years especially those over 45 years must be offered appropriate contraceptive methods in the antenatal period.
2. **Communities**: young women (adolescents and women less than 24 years) and their families must be informed of the warning signs of Pre-Eclampsia.
3. **Introduction of low dose aspirin for women at risk of pre-eclampsia**
4. **Post Natal Observations and hospital discharge.** Patients with Pre-Eclampsia with severe features must be examined diligently prior to hospital discharge and ensure that both the Blood Pressure and pulse rate are normal. Patients with HDP must continue their anti-hypertensive agents following hospital discharge and be seen again within 5-7 days at the site of delivery. In addition all women with HPD with severe features must have laboratory investigations and a complete cardiovascular examination (preferably ECG and x-ray chest) if they have had early onset Pre-Eclampsia or chronic hypertension to exclude cardiomyopathy.
5. **Borderline / pre-hypertension /stage 1 hypertension**. Slight elevations of BP should be asked to return for a BP check within 3 days or referred to a High Risk clinic.

7.4 Obstetric Haemorrhage (Prof. S Fawcus and Dr Su-Ritha Wessels)

Maternal deaths from Obstetric Haemorrhage (OH) increased slightly in the 2020-2022 triennium and accounted for 599 maternal deaths (16.4% of total maternal deaths) compared to 544 (15.7%) in 2017-2019. OH was the second most common cause of maternal death with an iMMR of 19.8 deaths per 100,000 live births compared to 19.1 in 2017-2019. Thus, the promising reduction in OH MMR seen in the last triennium was not sustained (Figure 1).

Figure 1: iMMR for OH for eight triennia



The increase in OH deaths was largely seen in 2020 (200 deaths) and 2021 (237 deaths) and not in 2022 (162 deaths). The higher number of OH deaths in 2020 and 2021 probably reflect an indirect effect of the COVID-19 pandemic which had its greatest impact in these two years; and adversely affected the functioning of the health system due to staff shortages, reallocation of duties, overburdened ICUs and emergency transport services.

There was considerable provincial variation with the triennial iMMR due to OH being highest in Free State (iMMR 31.1), Mpumulanga (iMMR 28.6) and North West (iMMR 28.3); and lowest in KwaZulu Natal (iMMR 14.7) and Western Cape (iMMR 9.4).

Associated features for OH deaths were maternal age over 35 yrs (36.1%), prolonged labour (14.7%), anaemia (22.8%), HIV positive (33.2%), induced labour (14%), previous Caesarean Delivery (CD, 33.9%), and CD in the index pregnancy (49.4%).

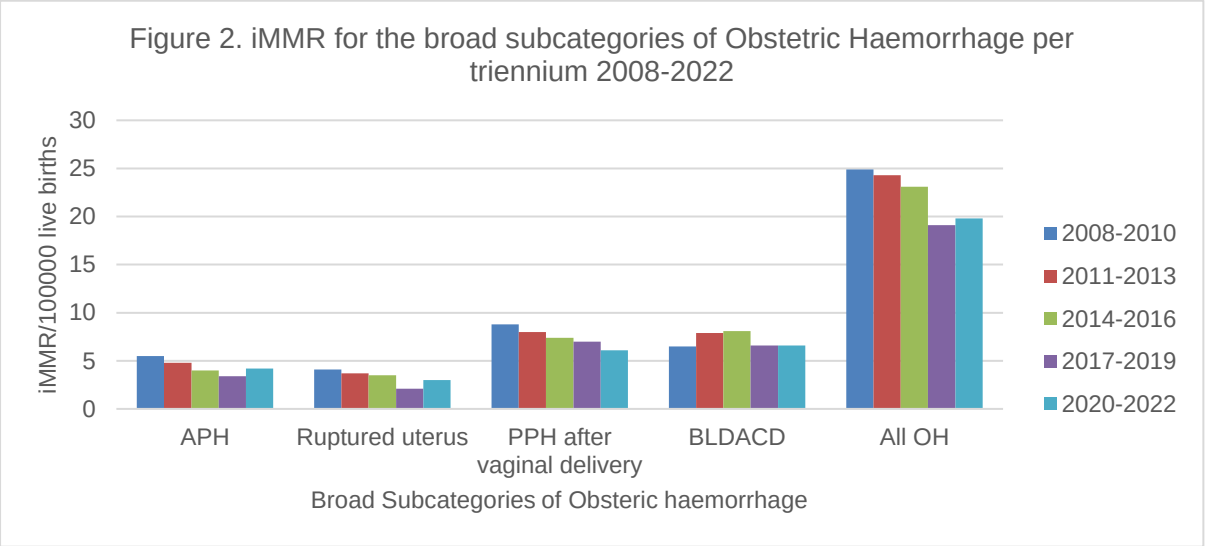
The major causal subcategory groupings of OH death are shown in Figure 2 and were:

1. Bleeding associated with Caesarean delivery (BLDACD, 33.1%, iMMR 6.6 per 100,00 live births), mostly detected after CD.
2. Postpartum haemorrhage (PPH) following vaginal delivery (30.7%, iMMR, 6.1 per 100,00 live births), mostly from uterine atony, retained placenta and unspecified PPH.
3. Antepartum haemorrhage (21.2%, iMMR 4.2) mostly from abruptio placentae
4. Ruptured uterus (15.0%, iMMR 3) equally from a scarred and unscarred uterus.

   OH from BLDACD and PPH after vaginal delivery remain the two largest causal subcategories. Compared to 2017-2019, the iMMR from PPH after vaginal delivery and BLDACD have decreased slightly but iMMR for APH and ruptured uterus have increased slightly.

   Reviewing the last 5 triennia from 2008-2022, there has been a sequential decrease in iMMR for APH, and Ruptured uterus which was not sustained in 2020-2022. PPH after vaginal delivery has shown gradual decline, and BLDACD MMR increased in 2011-2013 and 2014-2016 before declining in 2017-2019 and 2020-2022.

Figure 2: iMMR for the broad subcategories of Obstetric Haemorrhage per triennium 2008-2022



During 2020-2022, 889,497 caesarean deliveries (CDs) were performed, giving a national CD rate of 28.8% (ranging from 21.2% in Mpumulanga to 35% in KwaZulu-Natal. The case fatality rate (CFR) from BLDACD in 2020-2022 was 22.3 BLDACD deaths per 100,000 CDs, which is similar to 2017-2019 (23.6), thus it remained lower than in the 2014-2016 and 2011-2013 triennia. Of note in 2020-2022, is the wide discrepancy in BLDACD CFR between provinces with the highest rates in Mpumulanga (46.5 BLDACD deaths per 100,000 CDs) and Limpopo (38.1), with the lowest rates in W.Cape (10.0) and KwaZulu-Natal (12.1).

Antenatal care was received by 87.7% of women who died from OH.
The majority of OH deaths (88%) occurred at public hospitals; 27.9% at district hospitals (DH), 31.1% at regional hospitals (RH) and 29% at tertiary hospitals (TH/NC). There were 21 deaths at CHCs, 36 in private hospitals, 15 outside a health facility and 13 in transit to or between facilities The corresponding OH iMMR for level of care was 5.7 maternal deaths per 100,00 LBs in CHCs, 13.2 in DHs, 22.8 in RHs and 44.7 in TH/NCs. These level of care statistics refer to where the women died, not where they delivered, as many women were referred from district level due to bleeding after vaginal delivery or CD. There were 56.1% of the OH deaths who had been referred, mostly from CHCs (16.3%) and District hospitals (23%) demonstrating the importance of availability of emergency transport and optimising care before and during referral.

Assessors judged the majority (85.5%) of the OH deaths to be possibly or probably avoidable, slightly less than 89.5% in the previous triennium; and 52.4% were thought to be probably avoidable. Patient related avoidable factors, mostly delay in seeking care, were present for 35.4% of women who died. Administrative avoidable factors occurred for 69.8%, highlighting major problems in health facility management and training. This included lack of blood (8.5%), delays in inter-institution transport (11.4%), delays initiating clinical care due to overburdened services (12.2%), lack of staff (13.4%) and a lack of staff with appropriate skill (18.5%). Health worker/medical related avoidable factors occurred for 41% of assessable deaths at CHC level, 83.2% at DH, 74.4% at RH, 61% at TH/NC and 80% at private hospitals. At CHC and DH, problems were identified with initial assessment and problem recognition. For example, many women were discharged from labour ward to postnatal ward with abnormal vital signs and unrecognised PPH. At all three levels of hospital, substandard care was the most frequent problem. Emergency hysterectomy was performed in 27.4% of all OH deaths (19.4% of deaths from bleeding associated with CD and 10.2% of women dying from PPH after vaginal delivery).

Review of patient files is required to better identify details of avoidable factors.

Maternal death case report: PPH after vaginal delivery

Summary

34yrs, para 2, previous CS x1. Booked, HIV positive with suppressed viral load, No anaemia.
VBAC at district hospital (DH). Normal labour progress with vaginal delivery of live baby and placenta
Blood loss 1000mls detected at 30 mins. Diagnosis: Uterine atony vs Cervical tears?
Treated with 20 units oxytocin infusion, Syntometrine im, Tranexamic acid iv, iv fluids, Voluven, 3 units blood, 2

units fresh dried plasm (FDP).
Considered taking to Operating Theatre for exploration and possible laparotomy, but the second doctor unconfident to perform General Anaesthetic.
Decided to refer to regional hospital (4 hours' drive away), patient accepted. The ambulance collected her after 90 minutes.
Died in ambulance on route and returned to DH.
Postmortem excluded uterine rupture, trauma or retained products, but showed uterine atony with uterus full of blood.

Assessment

Primary Obstetric Cause: PPH after vaginal delivery/ uterine atony. *Final cause*: hypovolaemic shock. *Contributory*: Coagulopathy (DIC)
Avoidable factors: Patient: Nil. Administrative: Ambulance delay; Lack of appropriate skill on site at DH. No NASGs.

Medical care: Poor problem recognition/late detection PPH; Substandard care, Patient should have been taken to OT, Patient needed NASG for transfer.

Suggestions for prevention. E MOTIVE approach for early detection PPH and early escalation of care for refractory PPH. Doctors at DHs must have skills for postpartum laparotomy and general anaesthesia and be supported by regional hospital. NASG to be available at DHs.

Key recommendations

- Protect maternity services in future pandemics.
- Implement E Motive nationally.
- Focus on preventing and treating anemia in pregnancy as well as in childhood and adolescence, addressing heavy menstrual bleeding in women, screening and treatment of chronic infections, and adequate nutrition. This requires advocacy.
- No woman should be discharged from labour ward to the postnatal area if Systolic BP is <100 and/or Pulse is =>110 and/or ongoing bleeding.
- Resume implementation of ESMOE/EOST training, Safe CD audit, use of NASG and Massive Obstetric Haemorrhage Transfusion Protocol.
- Implement E Motive approach and updated PPH algorithms in new SA Maternity Care guidelines.
- Direct Telephonic / IT links for 24-hour specialist support to district hospital doctors.
- Inequities in outcomes between provinces require attention to staffing levels and clinical governance.
- Develop training package for CHWs and WBOTs, to sensitise communities to problem of PPH.
- Work with Ambulance services to ensure appropriate prioritisation of bleeding patients and availability of urgent paramedic assisted ambulances.

7.5 Early Pregnancy deaths *Dr N. Moran*

Note: A comparison of the DHIS data and the data on maternal deaths (including cause of death) entered into the MaMMAS programme during this triennium has suggested that in some Provinces there was a modest under-reporting of maternal deaths into the MaMMAS programme. This has been corrected for in terms of the total numbers of maternal deaths and the overall MMRs reported in this 2020-22 Saving mothers report. However, no correction has been made for the unreported causes of death. This means that the numbers of deaths listed in this report per cause will be a modest underestimate. The extent of the correction suggests that approximately 4% of data on causes of death is missing. This should be taken into account when interpreting trends in numbers and rates per causes of death when compared to the previous triennium. Any decreasing trend is likely to be slightly exaggerated, and any increasing trend is likely to be a slight underestimate.

Summary of Findings

There were 269 early pregnancy deaths in 2020-2022, a 17% decrease compared to 2017-2019. One hundred and three (103) were caused by ectopic pregnancy (13% decrease), and 166 by complications of miscarriage (19% decrease). This reverses the increasing trend that was noted with concern in the 2017-19 report. Forty-five percent (45%) of ectopic pregnancy deaths and 28% of miscarriage deaths were clearly avoidable within the health system during the 2020-2022 triennium. The equivalent figures for the 2017-19 triennium were 57% for ectopic deaths and 34% for miscarriage deaths, suggesting some improvement in the quality of care for these early pregnancy complications. This suggests that the recommendations made in the last Saving Mothers report (2017-19) for reducing early pregnancy deaths have been implemented at least to some extent. Nonetheless at least 93 women died unnecessarily due to the poor quality of care rendered to women with complications of early pregnancy across all levels of care. The recommendations in the current report therefore remain similar to those in previous Saving Mothers reports. Ongoing efforts are required to implement these recommendations.

Ectopic pregnancy

Deaths from ectopic pregnancy occurred with similar frequency at district hospitals (32%), tertiary/central (29%) and regional (27%) hospitals. Twelve cases (12%) were classified as extrauterine pregnancy beyond 20 weeks' gestation. Although only 61% of women who died from ectopic pregnancy had known HIV status, of those who were tested, 68% were HIV infected. The final cause of death was hypovolaemic shock in 66%. The most frequent patient behaviour-related avoidable factors were delay in accessing medical help and lack of antenatal care. The most frequent administrative avoidable factors were unavailability of appropriate skill on-site and delay in attending to the patient due to an overburdened service. With regard to management by healthcare providers, there were avoidable factors in 86% of cases at district hospital, 65% of cases at regional hospital level and at Primary healthcare level, and 59% of cases at tertiary level. The most frequent healthcare provider-related avoidable factors were inadequate initial assessment and failure to make the diagnosis, and therefore incorrect management, substandard care despite making the right diagnosis, and substandard resuscitation of hypovolaemic shock. In 23% of cases, there was no resuscitation attempted. Anaesthesia was only administered in 38% of cases, clearly indicating missed opportunities for surgical intervention.

Miscarriage

Deaths from miscarriage occurred most frequently at tertiary/central hospitals (43%) followed by regional (28%), and district (21%) hospitals. Of the subcategories of miscarriage, 64% were classified as septic miscarriage, 19% as deaths from haemorrhage (non-traumatic), 4% as deaths from uterine trauma, and 7% were classified as gestational trophoblastic disease. Nine cases (5%) followed a legal termination of pregnancy, which raises some concern about the standards of safety at some legal TOP sites. HIV status was only obtained from 60% of women who died from miscarriage. Of those who were tested, 55% were HIV infected. The final cause of death was septic shock in 56% and hypovolaemic shock in 31%. The most frequent patient behaviour-related avoidable factors were delay in accessing medical help, no antenatal care, and unsafe abortion. The latter was documented in 16% of miscarriage deaths where avoidable factors were assessable, a reduction from the 25% in 2017-2019. The most frequent administrative avoidable factors were unavailability of appropriate skill on-site, delay in attending to the patient due to an overburdened service and lack of access to an intensive care unit. With regard to management by healthcare providers, there were avoidable factors in 74% of cases at district hospital level, 65% of cases at regional hospital and 58% of cases at tertiary/central level. The most frequent healthcare provider-related avoidable factors were inadequate initial assessment and failure to make the diagnosis, substandard care despite making the right diagnosis, and substandard resuscitation of circulatory

shock, whether due to sepsis or hypovolaemia. In 16% of cases, there was no resuscitation attempted. At district hospital level specifically, delay in referral or failure to refer was an additional prominent avoidable factor. Anaesthesia was only administered in 45% of cases, suggesting missed opportunities for surgical intervention.

Maternal death Case studies: Early pregnancy loss

a. Ectopic pregnancy

A 30 year-old Gravida 3 Para 2 was brought by ambulance to a regional hospital emergency (casualty) department at 21h00 having collapsed at a party. She complained of vomiting, abdominal pain and difficulty in breathing. She was noted to be very pale. She was seen by the senior doctor on duty in the emergency department who made the following assessment: "P1 triage category (i.e. highest priority indicating that the patient's life is in immediate danger); unrecordable blood pressure (BP), cold peripheries, anaemia, missed last menstrual period, ?ectopic pregnancy. BP improved with fluid resus." The doctor made a decision to not admit the patient, but instead to divert the ambulance to another unspecified hospital, because of many other P1 patients in the "resus area", and because there were already two ectopic pregnancy patients waiting for theatre. She arrived an hour later at 22h05 at the emergency department of another regional hospital. On arrival her BP was 58/31. Her haemoglobin level was 5,2 g/dl. She arrested a few minutes after arrival. Cardiopulmonary resuscitation, including intubation and ventilation, was initially successful at achieving a return of cardiac output. An adrenalin infusion was started, as was a unit of emergency blood. An ultrasound scan showed "+++ free fluid" in the abdomen. A urinary catheter was inserted, but no urine drained as she was in circulatory shock. The gynae doctor was called but refused to take over management of the patient until pregnancy was confirmed by a pregnancy test. This caused a delay in management as a blood sample had to be sent to the laboratory for βhCG level, which confirmed a pregnancy. A laparotomy was then planned but transfer to the operating theatre was delayed because the anaesthetist wanted cross-matched blood to be available first. On arrival in theatre at 01h00, three hours after admission, the anaesthetist assessed the patient to be dead already.
Recommendations relevant to this vignette (refer to "Key recommendations" section below): 1,3,4,5,9,10

b. Miscarriage

A 27 year-old gravida 3 para 2 was brought by her boyfriend at 01h17 to a tertiary hospital casualty department feeling dizzy and weak, with a history of heavy per vaginal bleeding for several days after she had attended a private doctor and received medication for terminating the pregnancy. She was a known HIV positive woman who had stopped taking her antiretroviral therapy.

On arrival her blood pressure (BP) was 81/49, her pulse rate 135 beats per minute, but she was fully conscious. She was attended to by the casualty doctor at 01h50, who noted that she was very pale. There was no abdominal tenderness and the uterus was not palpable abdominally. On vaginal examination the cervix was open and there were malodorous products of conception palpable in the cervical os. A diagnosis of haemorrhagic shock due to incomplete miscarriage was made. A peripheral intravenous line was put up and a urinary catheter inserted. The haemoglobin level was 3,5g/dl and the platelet count was 206. A plan was made to call the gynae team, and to cross match two units of blood for transfusion. At 02h19, a nursing note states that she is still bleeding in clots, and that her general condition is stable.

At 03h30, the gynae doctor attended to the patient and noted that on speculum examination, the cervix was pink, not necrotic with no pus draining from it. BP was now 59/39. The doctor discussed the patient with his consultant who thought the patient was in septic shock. The consultant ordered that the patient be taken to theatre for hysterectomy, be started on inotropes and that an ICU bed be booked. The first unit of blood transfusion was started at 04h00. Up to this time, no drugs were administered or mechanical methods attempted specifically to stop the bleeding. At 05h00, she arrested while waiting to go to theatre. Cardiopulmonary resuscitation was initially successful at achieving a return of cardiac output, and she underwent hysterectomy the same morning. No pus was found in the abdomen, pelvis or uterus. She arrested again at the end of the procedure, while she was still in theatre. This time resuscitation was unsuccessful.

Recommendations relevant to this vignette (refer to "Key recommendations" section below): 1,2,3,4,5,6,7,8,10

Key recommendations

1. Family planning and contraception services (including emergency contraception) must be promoted in all communities and must be made more accessible to those who would benefit from them, including

teenagers. Contraception services must be integrated into care services for HIV and other chronic diseases.

2. Fighting the HIV/AIDS epidemic must remain a priority, with multiple strategies including integration of HIV/AIDS screening and care, including care for ART treatment failure, into maternal and women's care services.
3. Communities must be educated about booking early for antenatal care, recognising and acting on danger signs in early pregnancy, and how to access safe TOP.
4. There must be regular training of doctors and nurses in the recognition and emergency resuscitative management of circulatory shock in the context of early pregnancy. This should include regular "fire drills" on the management of shock.
5. Casualty departments must have clear policies ensuring that shocked gynaecological patients are given equal priority and attention by casualty staff compared to any other category of shocked patient.
6. There must be regular training of doctors and nurses on the recognition and management of different types of miscarriage, including indications and technique for evacuation of the uterus, and criteria for referral to specialist level.
7. All hospitals which manage early pregnancy complications must have a facility separate from the main theatre complex for performing evacuation of the uterus by manual vacuum aspiration (MVA) without general anaesthesia.
8. All health facilities must either provide termination of pregnancy (TOP) services or have a clear referral facility for TOP, based on an agreed district referral pattern, to ensure that all women have access to free and safe TOP. Medical TOP must be available at but not restricted to dedicated TOP clinics.
9. There must be regular training of doctors and nurses on the recognition of ectopic pregnancy and its management, particularly the need for immediate surgery if the patient is shocked.
10. Facility managers must ensure that all doctors and nurses are aware of their professional and ethical responsibilities when on-duty and must hold them accountable when these responsibilities are neglected.

7.6 Pregnancy related sepsis following viable pregnancy (Dr S. Cebekhulu)

Summary of findings

The previous reports including Saving Mothers reports consistently use the term "pregnancy-related sepsis" (PRS) to include the deaths that are caused by infections in the genital tract or in tissues involved in the birth process in viable pregnancies. In an attempt to standardise maternal sepsis definition; the WHO defines maternal sepsis as the "life-threatening organ dysfunction resulting from infection during pregnancy, childbirth, post-abortion or postpartum". However, for consistency, NCCEMD has continued with its previous classification whereby deaths from non-pregnancy related infections (NPRI) and septic miscarriage (although part of the WHO new definition) are counted as separate primary causes and described in separate abstracts elsewhere in this report. Between 2020 and 2022, 172 women died from PRS. This is similar to 2017-2019 and it was the second lowest number when comparing triennia. The number of deaths decreased every triennium since 2008-2010 (258), 2011-2013 (226), 2014-2016 (205), 2017-2019 (170) and 2020-2022 (172) (figure 1). These trends correspond with trends in the institutional maternal mortality rate (iMMR per 100,000 live births) over the last five trienniums. The steady decline in the iMMR that was observed over the three years of the last triennium (2017-2019), with the lowest at 4.11 in 2019, was not observed during this triennium mainly because of the COVID-19 pandemic. However, there was a promising decline for the year 2022(5.8), to almost the same level as pre-pandemic (2019) (figure 2)

Figure 1: Triennial maternal mortality trends

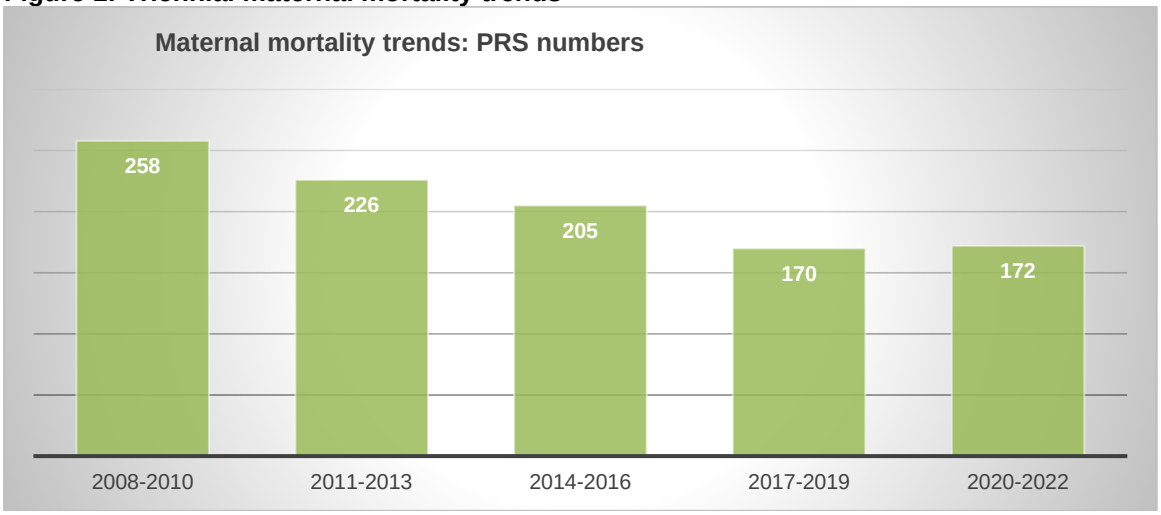
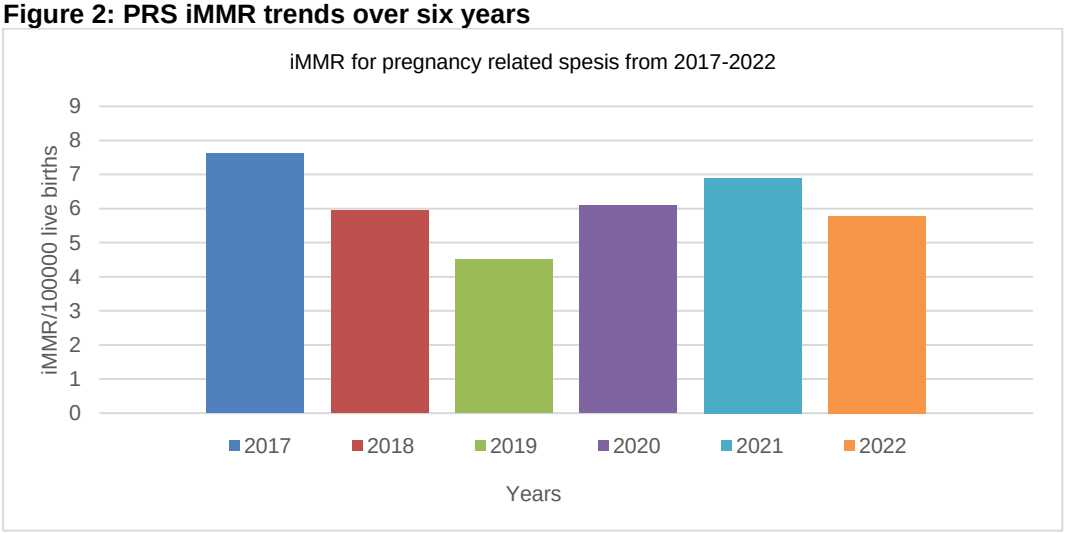


Figure 2: PRS iMMR trends over six years



Of these 172 deaths, 71 women had sepsis after vaginal delivery, 71 after caesarean section, 17 suffered bowel trauma during caesarean section and 13 deaths were caused by chorioamnionitis. The proportion of deaths after caesarean section fluctuates from 43.8 percent (2011-2013) to 49.3 percent (2014-2016) 47.2 percent (2017-2019) and 41.3 percent for this triennium (2020-2022). The recent increase in the deaths from bowel injury at caesarean section may indicate a trend of increasing numbers of difficult repeat caesarean sections and this warrants a detailed further analysis.

For at least 12 percent of the women their HIV status was unknown (two per cent more, compared to ten per cent in 2017-2019) and an increasing percentage of more than 90 percent were on ART treatment compared to 75.6 percent in 2017-2019, 75.2 percent in 2014-2016, 49 per cent in 2011-2013 and only 20 per cent in 2008-2010.

Almost all the deaths (98.5 percent) occurred in hospital, mainly in regional and tertiary facilities. Free State still has the highest iMMR due to PRS at 10.4 which has increased from 9.29. North West improved from a high of 8.03 down to 4.9. whilst Mpumalanga increased to 8.5 (2020-2022) after having had a decrease of iMMR from 12.8 to 4.48 then 4.21 in the previous three triennia respectively.

While the rate of PRS deaths has shown a slow but steady decline in recent years, the high proportion of avoidable deaths is still of great concern. More than seventy percent of these deaths were potentially preventable with more than forty percent of suboptimal care being health systems' related factors like overburdened services, and non-availability of appropriate skill (lack of appropriately trained doctors and nurses

in more than seventy percent of deaths). On the patient side, delay in accessing care is the most important contributor (50 percent, which has declined from 64.2 per cent in 2017-2019). The severity of PRS is often underestimated by the healthcare providers and its management is inadequate. Avoidable factors associated with the healthcare providers were present in 55.1 per cent of cases in district hospitals, 73 percent of cases in regional hospitals, 60.2% in tertiary hospitals and 66.7 percent in private hospitals. For the latter, this had increased from 55.6 percent. Lastly, the majority (greater than ninety percent) of women with PRS died during the postpartum period.

Maternal deaths case report: Pregnancy related sepsis after CS complicated by bowel injury

Summary

28 year old P0G2 (previous ectopic pregnancy). She booked early at antenatal clinic, BMI 30kg/m2, not anaemic, HIV negative, syphilis test negative. She attended antenatal care as prescribed and she was diagnosed with pregnancy induced hypertension (PIH) that was controlled on treatment. She was then admitted at 38 weeks gestation for elective caesarean section (CS) for breech and PIH at a district hospital. Caesarean section was done and reported by the surgeon as apparently uneventful. She was kept in hospital for monitoring and further treatment, and she had persistently worsening tachycardia in hospital since the second day post caesarean section. She was seen daily by both medical officers and nurses, assessed as stable though she reported abdominal discomfort. On the third day post CS, she was assessed as possible paralytic ileus/bowel obstruction and she was referred to a tertiary hospital. On admission, a laparotomy was planned but was delayed because she had an acute abdomen with faecal matter oozing from the surgical wound. She was subsequently operated on and admitted to the critical care unit. She never improved, got worse until it was decided on the sixth day that she be taken to theatre for re-exploratory laparotomy (no intraoperative details were provided except that a colostomy was also performed). She continued to deteriorate, another relook laparotomy was done, and she died after twenty-eight days from multi-organ (renal, respiratory, and metabolic) failure.

Key findings in case

1. Risk factors for bowel injury in this woman was previous surgery and being obese.
2. There were multiple areas of missed opportunities that could have led to better outcome for this woman (Please see below avoidable factors)

Avoidable factors
Healthcare worker related avoidable factors
i. Early recognition-Missed bowel injury at initial surgery, ii. There was inadequate patient assessment with poor monitoring (incomplete vital signs at all levels of care). iii. Delayed and Inadequate treatment following diagnosis of bowel injury at tertiary hospital
Patient related avoidable factors- None identified
Administrative avoidable factors- None identified
Key recommendations of the Surviving Sepsis campaign. 1. If hypoperfusion present: resuscitate with 30mL/kg of IV crystalloids within the first 3h 2. Reassess perfusion status frequently using dynamic clinical parameters (heart rate, blood pressure, urine output, lactate levels, passive leg raising test) 3. Initiate broad-spectrum antimicrobials within the first hour 4. Obtain routine cultures before starting antimicrobial therapy 5. Identify site of infection and perform source control as soon as feasible NB: Therefore, invariably, all patients with PRS must, within at least the 1st hour, receive the above-mentioned interventions and source control by the sixth hour [1,2].

Key recommendations for reducing PRS deaths

1. Ensure capacity and accessibility of facilities for outpatient postnatal care within six days of delivery in all districts. On discharge from the place of delivery, advise women on signs of infection, and what to do if these are noticed.
2. Strengthen systems to ensure detection and treatment of HIV infection as early as possible in pregnancy, including strategies to ensure initiation of antenatal care as early as possible in gestation (before 14 weeks).
3. Ensure that surgeons and operating theatre staff follow standard precautions before and during Caesarean sections, including asepsis, good and safe surgical technique, and routine prophylactic antibiotics. Extended doses of antibiotics must be given in women with risk factors for PRS.
4. Remind and educate clinicians about suspecting and recognising septic shock in ill postpartum women, using forums such as morbidity and mortality meetings, or formal ESMOE training or other training platforms.
5. No woman should be discharged from the hospital if any abnormal vital signs are recorded and immediate readmission is advised in women with any symptoms and signs suggestive of sepsis.
6. Proper initial triage of these patients and immediate implementation of maternal sepsis' bundles must always be done at all levels of care.
7. District hospital protocols, especially in rural areas, must emphasise recognition of septic shock and the need for early transfer of such women to higher levels of care, after the immediate implementation of sepsis' bundles as outlined in the maternity care guidelines.
8. In regional hospitals, audit the capacity of staff and facilities to manage women with septic shock, according to recommended norms and standards for staff and facilities, including intensive care units, should be followed.
9. Educate all doctors performing Caesarean sections about precautions for preventing bowel injury at repeat Caesarean section (or any previous abdominal surgery). Ensure protocols are in place for intraoperative management of bowel injuries, including general surgical help, and transfer to higher levels of care (with immediate treatment). Bowel injury should be suspected post-operatively in women with CS sepsis who fail to respond to antibiotics.
10. Ensure that all junior healthcare professionals receive full supervision from their seniors.

References

1. Cebekhulu S, Pattinson RC. Maternal deaths due to sepsis: a slow but steady decline. O&G Forum 2020; 30: 22-23
2. Cebekhulu SN, Cornelissen L, Pattinson R. Too little, too late: the recurrent theme in maternal deaths due to sepsis. O&G Forum 2018; 28: 9–12

7.7 Acute Collapse and Embolism *Professor Lawrence Chauke*

- There were 188 cases of death from acute collapse and/or embolism out of 3029165 live births.
- A total of 116 maternal deaths were due to embolism and the remaining 72, due to acute collapse of unknown cause,
- This translates into an embolism and acute collapse incident rate of 3.8 and 2.4 deaths per 100 000 livebirths respectively.
- Of the 116 cases of maternal deaths due to embolism, 102 (87, 9%) and 14(12.1) were due to pulmonary and amniotic fluid embolism respectively.
- The ages of women who died due to embolism ranged between 20 and 44 years with the majority between the ages 25 to 39, and parity 0 to 3.
- HIV status was known in 95 (81.9%) of the maternal deaths and just over half (54, 56.8%) of the mothers were HIV negative. Only 21 of the maternal deaths (19 in the embolism group and 2 in the acute collapse of unknown cause) had unknown HIV status.
- Of the 41 (43.1%) of the maternal deaths that tested HIV positive, 37 (90.2%) were on ART.
- It is important to note that over half (54, 56.8%) of the maternal deaths due to embolism occurred among HIV negative women.
- The Majority of embolism related deaths (102/116, 87.9%) occurred after caesarean section and pulmonary embolism was the leading cause of death in most of the cases.

- Of the 116-embolism related maternal deaths, the majority were cared for at DHs (38, 32.8%) RHs (35, 30.2%) and TPHs (17, 14.7%). The remaining seven received care at CHCs (4, 3.4%) and NCHs (3, 2.6%).
- The iMMR for embolism and acute collapse remained constant since 2011 at approximately 3.6 and 2.53 per 100,000 live births respectively with a decline in the iMMR for embolism noted in 2019. However, the 2020-2022 triennium saw a slight increase in the iMMR (3.8) for embolism together with a corresponding decreased in that of maternal deaths due to acute collapse of unknown cause (2.38). Whether the slight increase iMMR for embolism was related to the COVID-19 pandemic and the corresponding decrease in the maternal deaths due to acute collapse of unknown cause a reflection of improvement in the utilisation of postmortems or diagnosis of PE, remains uncertain.
- The iMMR for embolism showed a gradual increase with increasing maternal age and women between the ages of 35 and 39 seems to have been at the highest risk dying from both amniotic fluid and pulmonary embolism.
- Avoidable factors were identified in 36.1% of the 105 maternal deaths due to embolism that were assessed as follows: Patient related factors, 38 (36.2%) Administrative, 37 (35.2%) and resuscitation related factors in 43 (41%)
- In 63 cases of acute collapse of unknown cause that were assessed, avoidable factors were as follows: 24 (38.1) patients related, 26 (41.3%) administrative and 23 (36.5%) related to resuscitation.

Maternal death case study: Acute collapse due to Pulmonary Embolism

Summary

34 years G3P2 at 20 weeks, unbooked. HIV non-reactive. Presented at CHC with history of SOB. No known comorbidity. IV line inserted and patient immediately transferred to tertiary hospital. Patient arrived at tertiary hospital in severe respiratory distress. Suffered cardiac arrest while being assessed by the doctor. Resuscitation done which was temporarily successful however she suffered a second cardiac arrest few minutes late. Subsequent resuscitation attempt was unsuccessful.
Postmortem: pulmonary embolus.
Primary cause of death: Pulmonary embolus
Final cause of death: Cardiac arrest due to respiratory failure
Avoidable factors: Patient- unbooked, Administrative: Nil, Medical: Patient not intubated on time despite her clinical picture.

Suggestions for prevention: Review EMS protocol on patient intubation

Key Recommendations

The recommendations remain the same as in the previous years:
- Early mobilisation of women after cesarean section is strongly recommended and where available, pneumatic compression should be used until a woman is able to mobilise.
- Strongly consider thrombo-prophylaxis for women who are obese (BMI > 30), those who have prolonged hospital stays and those who have had caesarean delivery.
- Ensure that in cases of acute collapse – cause unknown, in which the cause of death is unexplained and in patients who died from a surgical procedure that a postmortem is requested. More importantly if a postmortem has been done, ensure that at least the gross postmortem results are obtained. This can be done by building relationships with the experts who perform postmortems in your health district.
- Regular training and drills in maternal resuscitation are strongly recommended.

7.8 Anaesthetic deaths (Dr Motselisi Mbeki)

This data is derived from the NCCEMD MaMMAS database. A review of the Anaesthesia database (DRAMA) is ongoing, and this will provide additional and more in-depth information about Anaesthetic deaths. The DRAMA database is able to show the cases for which substandard anaesthetic care was contributory to maternal deaths, especially for obstetric causes such as obstetric haemorrhage.

7.1 Total Number of Anaesthesia-Related Deaths, and iMMR

The total number of patients who had an anaesthesia-related maternal death was 77. The iMMR for anaesthesia-related maternal deaths in 2020-2022 has improved from other triennial dates and is now 2.55 (Table 1). What is concerning is that within the triennium, the iMMR has risen from 2.2 in 2020 to 4.1 in 2022.

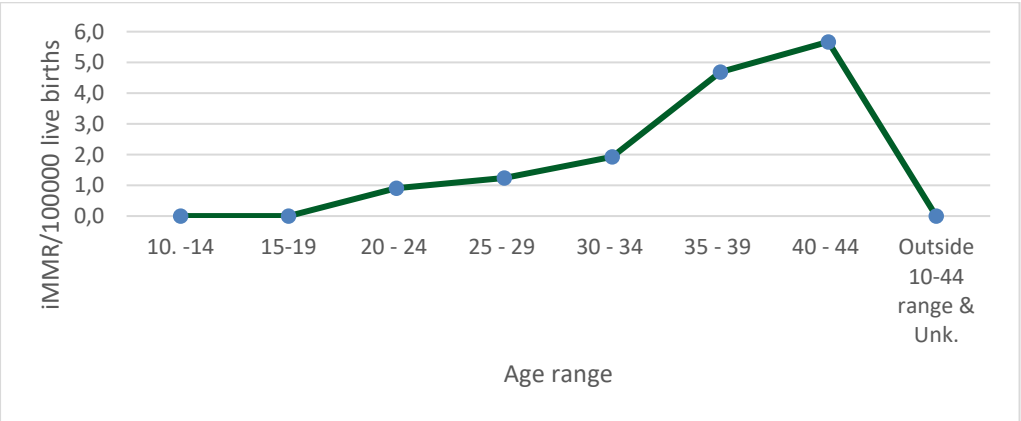
Table 1.

	1999-2001	2002-2004	2005-2007	2008-2010	2011-2013	2014-2016	2017-2019	2020-2022
Hypertensive disorders of pregnancy	22.26	29.43	23.85	24.58	22.75	24.02	20.73	17.85
Obstetric haemorrhage	14.93	20.72	18.82	24.91	24.32	22.67	19.11	19.84
Ectopic pregnancy	1.19	2.2	2.11	2.72	3.63	3.45	4.19	3.41
Miscarriage	5.27	5.34	5.21	6.73	6.58	6	7.18	5.5
Pregnancy-related sepsis	8.74	12.84	8.55	9.34	8.04	7.3	5.99	6.19
Anaesthetic complications	3.34	4.27	4.1	4.38	3.73	3.16	2.72	2.55
Embolism			2.19	3.37	3.63	4.03	3.6	3.84
Acute collapse - cause unknown	7.55	8.01	4.91	5.36	3.77	2.8	2.53	2.38
Non-pregnancy-related infections	33.72	58.4	66.28	71.29	53.47	35.17	27.05	35.21
Medical and surgical disorders	7.51	8.62	9.09	15.57	17.53	16.97	16.91	16.99
Unknown	1.93	4.64	6.67	7.82	6.44	6.14	2.14	5.93
iMMR	**106.42**	**154.48**	**151.77**	**176.22**	**153.88**	**134.33**	**113.77**	**121.06**

Most cases were done under spinal anaesthesia rather than general anaesthesia, despite evidence that spinal anaesthesia is safer than general anaesthesia in obstetrics patients.

There was also an association with an increased iMMR for patients that are of advanced maternal age and anaesthesia-related maternal deaths. The iMMR peaks in the patient age category of 40-44 with an iMMR of 5.7. (Figure 1)

Figure 1. iMMR for Anaesthetic complications per age range -2021



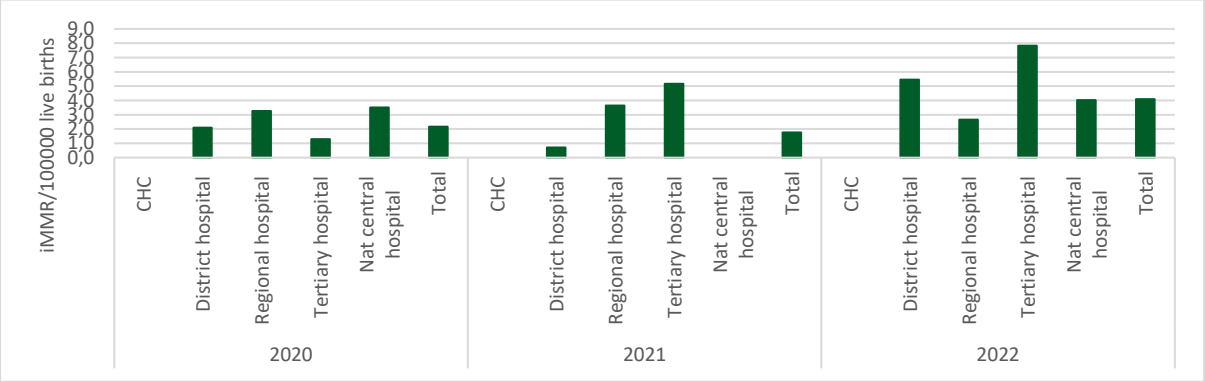
7.2 Level of care and anaesthetic mortality

A disproportionate number of the deaths are in District Hospitals (Table 2 and Figure 2).
As in previous triennia, most of the anaesthesia-related maternal deaths occurred in Caesarean Deliveries in the District Hospitals. (Table 2). However, increasingly Regional Hospitals are sites for significant anaesthesia-related maternal mortality. Twenty-nine patients died in District Hospitals versus 26 patients in regional hospitals.

Table 2. Anaesthetic deaths, mode of delivery and level of care

Primary obstetric problems	Vaginal	CD	CD CHC			CD DH	CD RH	CD TH	CD NCH	CD Pvt
Anaesthetic complications	**3**	**70**	**0**			**29**	**26**	**9**	**4**	**2**
General anaesthetic	3	15				5	5	2	2	1
Spinal anaesthetic		55				24	21	7	2	1

Figure 2. iMMR for Anaesthetic complications per level of care from 2020-2022



7.3 Final Causes of Death and Avoidability

For the 77 anaesthetic deaths, there were numerous final causes of death:

- Respiratory Failure – 41 (53%)
- Cerebral events – 21 (27.2%). The majority are due to hypoxic events.
- Cardiac Failure – 15 (19.5%)
- Other – 15 (19.5%)

These warrant further analysis when the DRAMA database is interrogated. The categories of causes of death may change after this review.

Potentially 86% of maternal deaths were avoidable.

7.4 Recommendations

District hospitals continue to contribute to a disproportionately high number of maternal deaths. Poor training has been repeatedly implicated but inadequate supervision is likely to contribute to the higher iMMR. Strategies are needed to improve and maintain teaching and training in District hospitals, as well as introducing methods to improve onsite supervision for unexpected complications.

Regional hospitals are emerging as sites for significant anaesthesia-related maternal mortality. We wonder whether fluctuating staffing issues and difficulties with retaining medical specialists may contribute to the worsening iMMR.

Age is a factor in anaesthesia-related maternal deaths. The category most affected is the patients who are 40-44 years old. It is not yet clear whether these patients are also being anaesthetised at District hospitals, but they must be considered a high-risk group that has to be referred to regional or tertiary hospitals.

7.5 Conclusions

There was an increase in 2022 in anaesthesia-related deaths, which is a concerning trend. The provinces with more significant iMMR are Mpumalanga, Limpopo, Free State and the Eastern Cape. There is also a concern about the underreporting of anaesthesia-related deaths.
The District Hospitals continue to be sites of avoidable anaesthesia-related maternal mortality, but regional hospitals and tertiary hospitals also have significant MMR.
Although it is a few patients, age seems to be a factor in anaesthesia-related maternal mortality. Ensuring that patients of advanced maternal age are delivered in regional hospitals onwards may improve this.
A more in-depth analysis of the Anaesthetic deaths in the MAAMAs and DRAMA databases, with folder review is ongoing and will be published in the expanded Comprehensive report later in 2024.

7.6 Miscellaneous, Adverse Drug Reactions and Coincidental causes *Prof S. Fawcus*

Miscellaneous (Hyperemesis Gravidarum, HMG, and Acute Fatty Liver, AFLS).
There were 15 deaths in this category making up 0.4% of all maternal deaths, with a iMMR of 0.5 maternal deaths per 100,000 live births. They included 9 deaths from Hyperemesis Gravidarum (HMG) and 6 from Acute Fatty Liver Syndrome (AFLS)

Hyperemesis Gravidarum (HMG) There were nine deaths from Hyperemesis gravidarum, with an iMMR of 0.3 per 100,000 live births. This compares with 9 for 2017-2019. They occurred in KZN (3), Limpopo (2), Free State (2), E. Cape (1) and Mpumulanga (1) There were 2 deaths at district hospitals, 5 at Regional and 2 at Tertiary/national central.

Acute Fatty Liver (AFLS)
There were 6 deaths from AFLS with an iMMR of 0.2 per 100,000 live births. This compares with 12 in 2017 - 2019 when the iMMR was 0.39. There were 4 deaths in W Cape, 1 in Northern Cape and 1 in Mpumulanga. There were no death at a district hospital, 1 at Regional, and 5 at tertiary/national hospitals.

Since numbers are small, HMG and AFLS are analysed together in MAMMAs as Miscellaneous (n =15). Avoidable factors occurred at patient community level for 46.7%, Administrative problems for 53.3% and Resuscitation problems 40%. Assessors thought that 46.6% of cases were possibly or probably avoidable.
Numbers are too small to make Recommendations.

Adverse Drug Reactions (ADR)
There were 26 deaths in this category making up 0.7% of all maternal deaths, with a iMMR of 0.9 maternal deaths per 100,000 live births. They included 6 deaths associated with ART, 2 with TB medications, 10 with Herbal Medications and 8 with 'other' medications.

There were 2 in E.Cape (iMMR 0.6 ADR deaths per 100,000 live births); 2 in Free State (iMMR 1.4), 7 in Gauteng (iMMR 1.0), 5 in KwaZulu-Natal (iMMR 0.8) ; 8 in Limpopo (iMMR 2), and 2 in Mpumulanga (iMMR 0.7). There were no ADR deaths in North West, N.Cape or W.Cape.

All deaths were in facilities; 2 in CHCs, 4 in DHs, 9 in RHs,10 in TH/NC and one unknown.
Avoidable factors occurred at patient community level for 57.7%, Administrative problems for 57.7% and Resuscitation problems 57.7%. Assessors thought that 61.5 % of cases were possibly or probably avoidable.
Folders still need to be interrogated. Numbers are too small to make Recommendations.
There is a concern that some deaths from inadvertent intrathecal injection of TXA could be coded separately under Anaesthetic related deaths.

Co-incidental, and inconclusive causes of DDPCP

This section focuses on a group of deaths which are coincidental / fortuitous (non-maternal) and others which are termed 'unknown' and are inconclusive as to whether they were true maternal deaths or coincidental for

reasons such as: cause could not be established, or there was lack of available information.

Coincidental deaths

There were 79 of these, accounting for 2.1% of Deaths During Pregnancy, Childbirth and the Puerperium (DDPCP). This is less than the previous triennia; 115 deaths (3.3% of DDPCP in 2017-2019) and 117 deaths (3.1%) in 2014-2016.

Coincidental deaths are not maternal deaths and are excluded from calculations of maternal mortality ratios (MMRs).

Coincidental deaths accounted for 2.1% of DDPCP in E Cape, 3.4% in Free State, 2.2% in Gauteng, 1.5% in Kwazulu Natal, 1.2% in Limpopo, 1.3% in Mpumulanga, 1.8% in North West, 0% in N Cape and 5.7% in W Cape. The higher proportion in W Cape is probably due to greater availability of forensic pathology services and involvement in the Maternal Death enquiries.

The causal subcategories were:
Motor vehicle accidents (MVA) - 21 (26.6%)
Other accidents – 10 (12.7%)
Assault – 21 (26.6%).
Other – 27 (34.2%).
Assault cases have doubled compared to the previous triennium.
Postmortems were done for 49.4%

Of the 79 deaths, 21.5% occurred at home/outside a facility, 5.1% in CHCs, 19% at district hospitals, 19% at regional hospitals, 31.6% at tertiary/national central hospitals and 3.8% in private hospitals.

The proportion of deaths with possibly or probable avoidable factors was 20.3% which is lower than for maternal deaths. The largest proportion of avoidable factors (46.8%) was at patient / community level.

Given the concern about gender-based violence in South Africa (the ‘second ‘epidemic), it would be important to look further into the assault and ‘other’ subcategories, to see if these were due to femicide. In terms of MVAs, certain countries such as UK, have strict regulations about seat belt use in pregnancy. It is not known to what extent there is such an awareness in South Arica and definitely not in crowded public transport.

Unknown

This is a difficult and varied group of deaths to understand and analyse collectively. It requires further folder reviews. These deaths with unknown causes include those (a) at home and outside facilities with no clinical notes of the final event, (b) those in facilities where no cause could be identified and (c) deaths where there was lack of information. It is obviously unclear how many in this group are maternal deaths and how many could be coincidental. There were 179 deaths in this group, accounting for 4.8% of DDPCP.

If they are reviewed as maternal deaths they accounted for 4.9% with an MMR of 5.9, more than 2.1 in 2017-2019 but similar to 6.14 in 2014-2016.

They accounted for 5.3% of DDPCP in E. Cape, 7.1% in Free State, 3.2% in Gauteng, 7.1% in KwaZulu-Natal, 2.5% in Limpopo, 3% in Mpumulanga, 3.4% in North West, 9.1% in Northern Cape and 5.9% in W Cape.In terms of subcategories:

94 (52.5%) were deaths at home or outside.
Of the 85 deaths that occurred in facilities, 70 (83%) were in public hospitals and 4 (4.7%) in private hospitals.
In terms of avoidability, this is difficult to assess where cause of death is unknown.
The inability to allocate a cause reflects a lack of post-mortems. Only 31 % had post-mortems. Insufficient PMs are being done even when medico-legally indicated such as for home/outside deaths. This reflects a national shortage of forensic pathology services.
Improving accurate classification of deaths and increasing the number and quality of postmortems would aid in reducing the proportion of these coincidental and unknown groups of deaths.

8. PROVINCIAL REPORTS AND ASSESSMENT TEAMS

8.1 Eastern Cape

Executive Summary

The Eastern Cape reported a total of 436 deaths for the 2020 - 2022 triennium with an iMMR of 138.6 maternal deaths per 100,000 live births. This reflects an increase of forty (N=40) women from 396 in the 2017-2019 triennium when the IMMR was 121.24. The leading causes of deaths were non-pregnancy related infections (COVID-19 and HIV, n=155), hypertension (n=67), medical and surgical disorders (n=57), obstetric hemorrhage (n=55) and pregnancy related sepsis (n=21). Embolism (n=20) and miscarriage (n=19) followed closely.

Most maternal deaths were in facility in public hospitals (n=390), however twelve (n=12) women died in transit, and 16 at home. Sixteen women died in private hospitals compared to three in the last triennium.

The most common indirect cause was non-pregnancy related conditions from COVID-19 complications and HIV complicated by TB. Among the direct causes of maternal deaths, the most common subcategory of deaths due to hypertension was **eclampsia**; for medical and surgical disorders it was **cardiac disease,** and for obstetric haemorrhage it was bleeding after caesarean section. Pregnancy related sepsis post caesarean section, septic miscarriage in young patients under 30 years of age and thromboembolism were a concern.

The national central hospitals based in OR Tambo experienced the highest mortality with the majority, (n=104), referred from three districts in their catchment area. Regional hospitals had 118 maternal deaths, tertiary hospitals had 78, followed by 96 at district hospitals.

In national central hospital, NPRI (n=31) was responsible for the highest cause of mortality followed by hypertension (n=22) and Medical and Surgical conditions (n=20).

OR Tambo district had the highest number of maternal deaths (n=156) followed by Buffalo City Municipality and Amathole combined (n=104), Nelson Mandela Bay Metro (n=95), and Chris Hani (n=41). All these districts have L2 and L3 hospitals.

There was slight improvement in deaths among teenagers less than 20 years from 10.8% (n=54) to 8.3% (n=36). This may be due to improved access to antenatal attendance with implementation of the learner pregnancy policy and comprehensive school health policy. Although of note, hypertension is the leading cause of death in 15-19-year age group contributing 25% (n=8) of deaths in this age group.

The highest iMMR (34) was recorded for women in the 35–39 year age category (n=95). This remains a risk group requiring to be prioritised for pregnancy prevention when family is complete.

Patient avoidable factors in the public sector were identified in 52.3% of assessed cases and administrative factors in 45.8%. Patient factors included delay in accessing medical help by patients (27.9%), no antenatal care (22.8%), declined medication/surgery or advice (10.4%), and infrequent antenatal care (7.8%). Resuscitation problems were identified in 40.5% of cases.

Important administrative avoidable factors identified included transport problem from institution to institution (9.1%), lack of ICU facilities (8.8%), lack of appropriate skill onsite or on standby to deal with medical problems (6.2%), delays in initiating critical care as a result of an overburdened service (5.8%), inadequate number of staff on duty (5.3%) and lack of healthcare facilities (3.9 %). The problem of lack of ICU beds increased from 4.6% in the last Triennium to 14.1 in 2020 and 8.6% in 2022 due to COVID-19 patients requiring critical care. Similarly, the contribution of overburdened services increased from 3.8% in 2017-2019 to 7.4% in 2020 and 7.2% in 2021.

Most of the 55 obstetric haemorrhage deaths occurred at facilities (n=45, 81.8%), with 1.4% at home/outside facility and 0.9% in transit. This means optimisation of patients in transit with the use of measures such as the non-pneumatic antishock garment (NASG), should be emphasised. In terms of the outside/ home deaths we would need to ascertain the avoidable factors e.g. look at the duration of wait for medical assistance and the availability of ambulances, availability of ALS by EMS for escorting unstable patients and availability of Aero medical for doing transfers during day. The shows that emergency medical services remain a great challenge for the province.

Medical care avoidable factors were identified as highest at district hospitals for 61.4% of cases, followed by 53.5% at regional hospitals, 46% at tertiary hospitals and 53.6% in private hospitals. Medical care factors were high in District hospitals due to problems of recognition/diagnosis (31%) compared with other levels, followed by substandard management/correct diagnosis for 23.7% of deaths, delay in patient referral for 16.7% and patients managed at inappropriate level for 13.9%. There is a high attrition of skilled doctors in many district hospitals with better retention and supervision in hospitals with family physicians and registrars like Madwaleni and Zitulele. This strategy needs to be expanded.

Regional hospitals' medical avoidable factors were problem recognition (20%), followed by initial assessment (13.8%) compared to 8.2% for tertiary hospitals and higher levels. Prolonged abnormal monitoring with no action taken was also highest in regional hospitals at 10% vs 2.4% at tertiary level and above, as was substandard monitoring at 25%. These statistics highlight the shortage of specialists.

Employment of specialists will need to be prioritised in regional hospitals to improve quality of care. Having an O&G, Anaesthetist and Paediatrician with a nursery in the same hospital improves outcomes. Arrangements to access to blood and blood products also needs to be addressed. Provision of transitional high care with blood gas analysers and transport ventilators will address the administrative challenges.

Recommendations

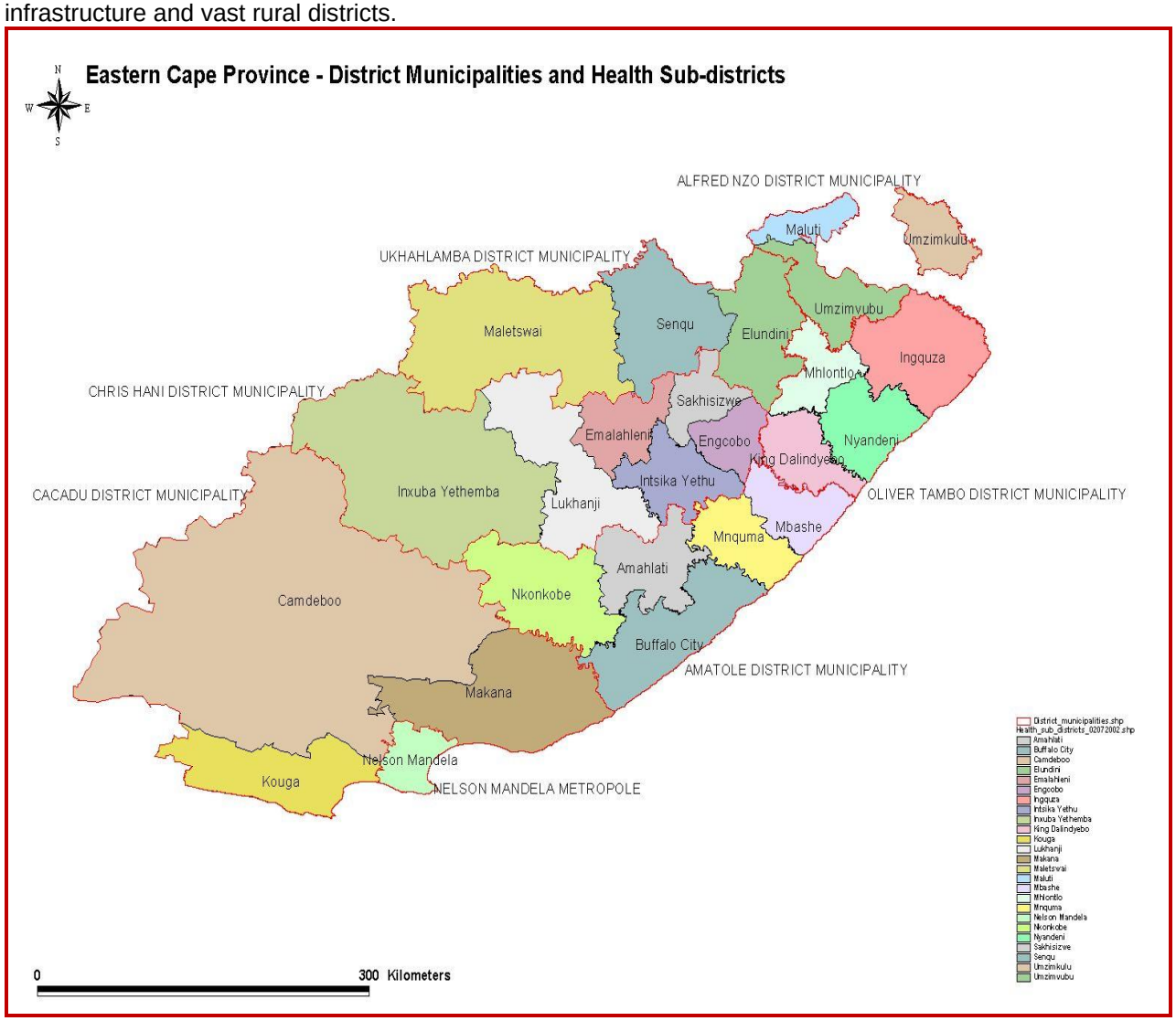
- Facility CEOs and Heads of obstetric departments must ensure that every maternal death that occurs in their facility is promptly reviewed. The review of the death must lead to a practical action plan for preventing a recurrence. Regional perinatal meetings need to be conducted, in addition to district reviews to ensure that relevant role players, HODs of O&G departments and the district clinical specialist teams monitor the implementation of the action plan, and progress presented at provincial quarterly reviews.
- HOD of ECDOH must ensure dissemination of the Sexual Reproductive Health and Rights SOP (2019) to all relevant stakeholders and ensure that the provincial learner pregnancy policy is available and signed by both HODs of Health and Education. Provision of comprehensive SRH services will need to be prioritised. Inter-sectoral collaboration and engagement in the social transformation cluster must be given priority. This will reduce morbidity and mortality related to teenage pregnancy.
- District clinical specialists must ensure that high risk antenatal care clinics are established, and the referral criteria disseminated. Referral criteria should be clear, consistent, and must be available both at the referring site and at the receiving site, and their use monitored. Facility managers must ensure that these referral criteria are followed, and clinical governance forums need to discuss referral challenges and provide solutions.
- The safe caesarean section plan, respectful maternity care plan and Emotive should be implemented in all districts. This will require an adequate number of medical specialists (O&G and anaesthetists) to be available in regional hospitals; and family physician posts need to be created and filled in priority district hospitals.
- The CPD point pilot programme at Amathole should be scaled up to all districts. Ongoing training on the recognition and management of conditions commonly causing maternal deaths must be provided for doctors and midwives and EMS personnel using compulsory fire drills. All staff must complete mandatory training as well as online training and Funda Friday to refresh skills.
- Emergency transport. Dedicated obstetric ICU ambulances need to be available in Amathole, and Alfred Nzo. In the interim a dedicated budget and a mechanism with written SOP should be available to authorise private ambulance for critical patients where state paramedics are not available. The EMS training college needs to ensure that the college has an ESMOE in transit trainer to ensure safe transfer of patients by ILS providers and combat the high number of in transit deaths. Aeromedical services need to be available.
- ALL districts need to ensure the correct version of the maternity case record is budgeted for, available and used in all facilities to mitigate medico-legal risks. Maternity Care Guidelines and BANC plus protocols must be adhered to. Early warning charts both in antenatal and postnatal care must be used and clear discharge summaries and follow up plans provided for all women being discharged.
- The Social mobilisation directorate needs to develop a communication strategy to ensure every woman attends the antenatal clinic at least 8 times, and especially every second week in the third trimester. Women at risk for pre-eclampsia must be informed about the need for receiving and taking low-dose aspirin daily during pregnancy. Messages to counter the risk of unsafe abortion and benefits of contraception including Emergency contraception posters need to be developed.
- Supply chain and pharmaceutical services directorates need to ensure all drugs, especially contraceptives, and equipment including BP machines, transport CPAP and ventilators are available.
- All State facilities must be able to either offer TOP services or refer eligible clients to a site within the

district which offers free TOP services. All sites providing TOP must be able to provide the option of medical TOP for suitable clients.

- Establish OMBU to improve quality of care in regional and tertiary hospitals.
- Strengthen community pregnancy testing, follow up and linkages using ward-based community outreach teams to improve early booking and reduce defaulter rates at ANC which were identified as key patient orientated problems.
- Strengthen the PHC mentoring strategy of allocating clinical nurse mentors per sub-district. Clinical nurse mentors should conduct In-service education on APC, SRH including insertion LARC at PHC facilities. These mentors support clinic supervisors and PHC DCSTs to provide quality care.
- Revive maternity waiting homes and repurpose some of the small hospitals to improve transport availability and costs.

Introduction

The Eastern Cape is the third most populous province in South Africa with a total population of 6,562,053 (Stats SA, Nov 2012). The province is divided into six Districts and two Metropolitan Districts. It has two medical schools: the new Nelson Mandela Medical University in Gqeberha, and Walter Sisulu University in Mthatha with two tertiary hospital complexes, in Mthatha and East London. The province also has 2 regional hospitals, 65 district hospitals, 37 community health centres and 806 clinics. All district hospitals and most CHCs conduct deliveries. The total live births for the triennium were 323133 live births (109077 in 2020, 110909 in 2021, a decreased to 103147 in 2022). There were 14% of the deliveries at CHCs, and 55% at DHs. The levels of poverty and unemployment increased during the COVID-19 pandemic. There is also underdeveloped infrastructure and vast rural districts.



The first part of this report provides an overview of the Eastern Cape maternal deaths for the period 2020–2022 with comparative data from the previous triennial period.

The second part is a detailed discussion on the main primary causes of care with comparison by age group, level of care and district distribution. Condition specific recommendations are outlined for the major primary causes of obstetric deaths. This part was written by individual assessors who each took responsibility for in depth analysis of one particular primary obstetric cause of death.

Part One. Overview of maternal deaths, iMMR, Causes of Death, Demographic and Health System factors and Avoidable factors in Eastern Cape, 2020-2022

Deaths reported and iMMR

The Eastern Cape reported in total 436 deaths for the 2020 - 2022 triennium with an iMMR of 138.6. This reflects an increase of forty (n=40) women from 396 in the 2017 to 2019 triennium when the iMMR was 121.24. However, there is a notable decrease of 69 deaths between the 2014-2016 triennium (505 deaths) as compared to the 2020-2022 triennium (436 deaths). Table 1 shows deaths reported to DHIS and to MAMAAs as well as live births per year; and a calculation of iMMR per year and for the 2020-2022 triennium.

Table 1: Maternal deaths from DHIS and MAMMAs, Live Births and iMMR, 2020-2022

Eastern Cape	Live births	MaMMAS deaths (DDCP)	MaMMAS MD	DHIS MD	MaMMAS MD (corrected)	MaMMAs iMMR	MaMMAs iMMR (corrected)	DHIS iMMR
2020	109077	168	139	160	160	127.43	146.69	146.7
2021	110909	154	153	151	153	137.95	137.95	136.1
2022	103147	134	133	132	133	128.94	128.94	128

Eastern Cape	Live births	MaMMAS MD (corrected)	MaMMAs iMMR (corrected)
2020-2022	323133	446	138.0

A correction was made in 2020 due to suspected underreporting to MaMMAS. The numbers were adjusted to be the same as DHIS reported deaths which usually are less not more than MaMMAS numbers.
Figures I and 2 show trends in numbers of MDs, and iMMR per year over time; and Figure 3 shows triennial trends.

Figure 1: Trends in number maternal deaths 1998-2022

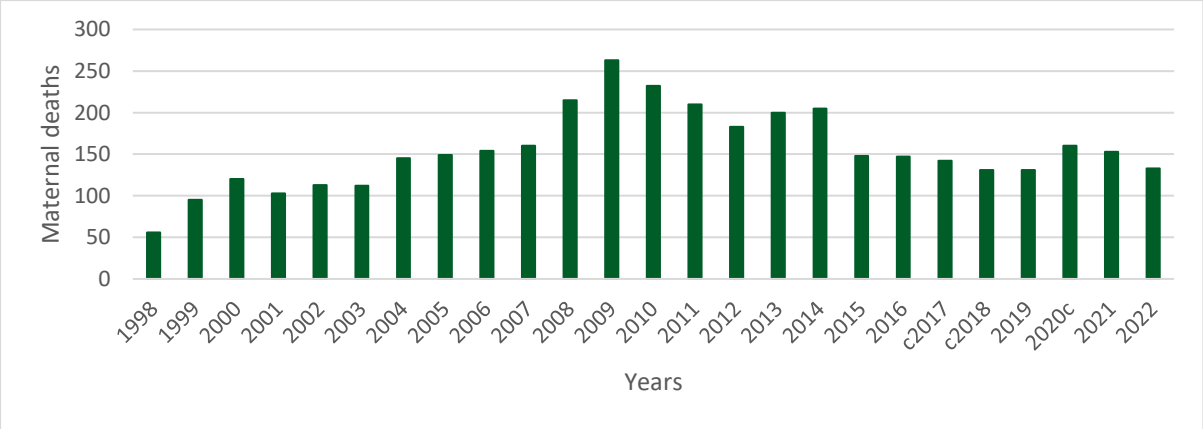


Figure 2: Trends in iMMR 2005-2020

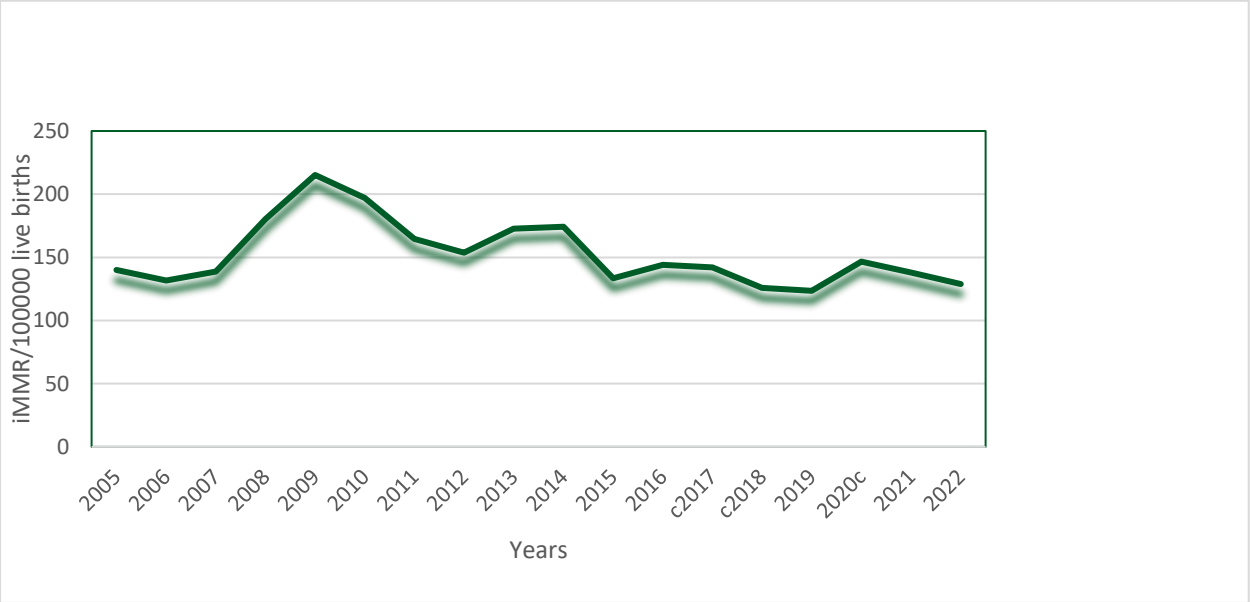
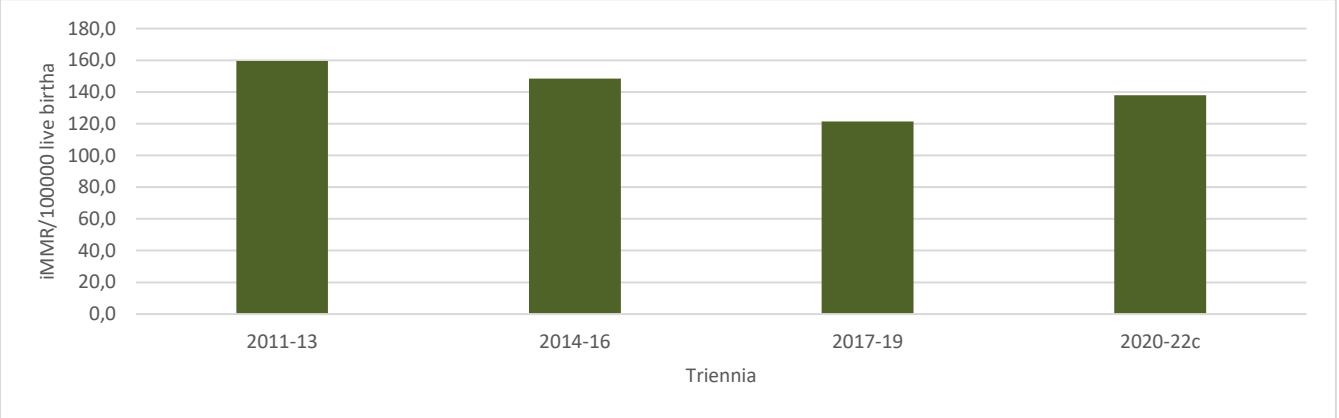


Figure 3: iMMR for Triennia 2011-2022



There has been a consistent decline during the first 3 triennia represented in Figure 3. The iMMR decreased from 160 (2011-2013) to 120 (2017-2019). However, iMMR spiked at the peak of the COVID-19 pandemic from 120 (in 2019) to 146.69 in 2020 and 137.60 in 2021. Th decreased to 128.94 in 2022 as the burden of the pandemic subsided (Table 2).

Table 2: MaMMAS Number of deaths and iMMR 2017-2022

Year	Number reported	iMMR (MDs per 100 000 live births)
2017	142	132.10
2018	134	121.94
2019	120	110.32
2020	160	146.69
2021	153	137.60
2022	133	128.94

Primary obstetric causes of maternal deaths

The leading causes of deaths were non-pregnancy related infections namely COVID-19 and HIV (n=155), hypertension (n=67), medical and surgical disorders (n=57), obstetric haemorrhage (n=55) and Pregnancy related sepsis (n=21). Embolism (n=20) and miscarriage (n=19) followed closely.

Table 3: iMMR, Number of deaths and ranking by primary cause of death 2020-2022

Eastern Cape	No. of deaths	iMMR 2020-2022 (MDs per 100,000 LBs)	Ranking
Medical and surgical disorders	57	17.6	3rd
Non-pregnancy-related infections	155	48.0	1st
Ectopic pregnancy	8	2.5	
Miscarriage	19	5.9	7th
Pregnancy-related sepsis	21	6.5	5th
Obstetric haemorrhage	55	17.0	4th
Hypertension	67	20.7	2nd
Anaesthetic complications	11	3.4	8th
Adverse drug reactions	2	0.6	
Embolism	20	6.2	6th
Acute collapse - cause unknown	6	1.9	
Miscellaneous	1	0.3	
Unknown	3	0.9	

Table 4: iMMR per Primary obstetric cause per year and for the triennium

Eastern Cape iMMR	2020	2021	2022	2020-2022
Medical and surgical disorders	11.00	20.74	21.33	17.6
Non-pregnancy-related infections	53.17	55.90	33.93	48.0
Ectopic pregnancy	1.83	2.70	2.91	2.5
Miscarriage	5.50	6.31	5.82	5.9
Pregnancy-related sepsis	3.67	6.31	9.69	6.5
Obstetric haemorrhage	19.25	14.43	17.45	17.0
Hypertension	20.17	17.13	25.21	20.7
Anaesthetic complications	4.58	1.80	3.88	3.4
Adverse drug reactions	0.92	0.90	0.00	0.6
Embolism	3.67	9.02	5.82	6.2
Acute collapse - cause unknown	1.83	2.70	0.97	1.9
Miscellaneous	0.00	0.00	0.97	0.3
Unknown	1.83	0.00	0.97	0.9
Maternal deaths	127.43	137.95	128.94	131.5
Coincidental cause	6.42	0.90	0.97	2.8
DDCP	133.85	138.85	129.91	134.3
Live births (2019)	**109077**	**110909**	**103147**	**323133**

Final causes of deaths

In the 2020-2022 triennium, out of 434 patients, the final causes were Respiratory failure (n=167), circulatory failure (n=161), cerebral complications (n=79), hematological failure (n=70), cardiac failure (n=62) immune failure (n=47).

Non-Pregnancy related Infections

Out of 434 deaths, non-pregnancy related Infections (n= 155) were the highest cause with COVID-19 contributing 47% (n = 73) of the total. The resulting iMMR was 48 per 100,00 live births. The number of deaths from NPRI increased from 58 in 2020 to 62 in 2021.

Fifty-two (71%) of the patients who died of COVID-19 were HIV negative. Most of the COVID-19 deaths (n=23) occurred in tertiary hospitals, followed by 11 deaths in district hospitals probably due to overburdened services and lack of critical care beds at the higher referral level.

HIV also contributed to deaths from NPRI. TB was the leading cause of deaths with forty-three cases making up 9.9 % of the total deaths followed by pneumonia and meningitis each with t 2.5% (n=11).

Of the NPRI deaths, forty-nine deaths (29%) occurred in regional hospitals, followed by 32 deaths (24.5 %) in tertiary hospitals and 31 deaths (20%) in national central hospitals. NPRI were responsible for 62% (n=11) in Private hospitals. There was seven MD in the 10-19-year-old age group with 40 deaths each in the age groups 30-35 and 35-39 years.

The Districts with Metros had the highest number of MDs from NPRI namely Nelson Mandela Bay Municipality, Buffalo City Municipality and Amathole, all with 46 deaths, followed by OR Tambo. In Chris Hani district, out of 44 deaths, NPRI was the leading cause of death at 25% (n=11). Among smaller districts without regional hospitals, such as Sarah Baartman, 45% of maternal deaths were due to NPRI. Tracking and linkage of patients will need to be prioritised. New ART guidelines must be rolled out and nerve centres established.

Hypertension

The second leading cause of death was hypertensive disorders with sixty-seven (n=67, 15.4%). The number of deaths due to hypertension increased from 22 (in 2020) to 26 (in 2022). The iMMR was 20.7MDs per 100,000 LBs for the triennium. Forty-two (n=42) of the patients were HIV negative. Hypertension remains extremely high as a cause of MD, at 30%, in the age group >35 years, followed by 11 percent in teenagers (< 19 years). Out of 67 deaths due to hypertension, the majority of deaths occurred in national central hospitals (n=22), followed by regional hospitals (N=23) and twelve deaths in tertiary hospitals. Patients were mostly appropriately referred however, it was identified that there were multiple missed opportunities at primary care level with the majority of deaths being preventable. Most patients died of eclampsia. A comprehensive hypertension action plan has been developed and presented at the third midwifery congress in August 2022 and a high-risk antenatal care training package rolled out in various districts.

Medical and surgical disorders (M&S)

Medical and surgical disorders (M&S) increased to third position with fifty-seven maternal deaths (N=57) making up 13.1 percent of total deaths. The numbers almost doubled from 12 to 23 (49%) in 2021, which was sustained in 2022 (n=22) deaths. Sixty-one percent (n=35) of patients who died of M & S conditions were under 30 years. Frequently abnormal vitals were not acted on at primary care level. In this triennium, the iMMR from Medical and surgical conditions was 17.6 compared to the national iMMR of 16.99. The leading causes of deaths were cardiac (n=17), suicide (n=7), respiratory problems (n=7) and CNS and neoplasm both with five.

Of the seven suicide deaths, three occurred in district hospitals, three (n=3) in national central hospitals and one in a regional hospital. Cardiac patients were appropriately referred to physicians, though no joint clinics were established. Seven cardiac deaths occurring at national central hospitals with five (n=5) in regional hospital indicating an effective referral system.

Cardiomyopathy peri-partum and post-partum seemed to be the leading cause of death. Several Patients were admitted in general wards in critical condition with advanced respiratory failure without being intubated and ventilated. Use of early warning chart and checklists in post–natal wards will reduce patients being sent home

unstable and thus requiring re-admissions. Contraception should be emphasised to prevent pregnancy in cardiac patients.

Obstetric haemorrhage

Obstetric haemorrhage was the fourth leading cause of death with fifty-five deaths making up 12.7% of the total. The IMMR was 17.1 deaths per 100,000 live births, displaying a significant improvement from the last triennium. BLDACD was the leading cause with 13 deaths though a significant improvement was noted when compared to 26 deaths in the last triennium. Forty-five percent (45%) of BLDACD occurred at tertiary hospital, with 6 deaths at the Buffalo City Municipality. This was followed by 5 deaths due to abruptio placentae with hypertension, and ruptured uterus without previous caesarean section. PPH post normal vaginal delivery (NVD) was highest in the 35-39 year age group. The majority of patients died in lower levels of care with 6 deaths outside health facilities, two at CHC and 18 at District Hospitals with transport being a significantly contributor. Non pneumatic anti shock garments have been procured and disseminated but ongoing training of ambulance personnel needs to be prioritised. Following results from the EMOTIVE trial, the accurate estimation of blood loss and bundle approach with availability of tranexamic acid in all levels of care will be escalated. The safe CS plan needs to be implemented. Lastly, HIV was not a significant risk factor as 30 out of 55 patients (54%) were HIV negative.

Anaesthesia

The number of deaths from Anaesthesia complications were eleven at 2.5% of the total, and the iMMR was 3.4 deaths per 100,000 live births. There was a slight decrease from 11 in the last triennium. Four of these deaths occurred at district hospitals, another 4 at regional hospitals and 2 at national central hospitals. The majority, 10 out of 11 deaths, were related to spinal anaesthetic with 1 being general anaesthesia. Five of the availability of specialist anaesthetists in regional hospitals, and doctors with Diplomas in Anaesthetics in district hospitals is strongly recommended, together with in-reach support and budget for accommodation.

Thirty-one percent (N=134) of the anesthetics were conducted at L2 hospitals (n=43), which increased as compared to the 24% in the last triennium. Tertiary hospitals conducted 16 % (n=22) of anesthetics and district hospitals conducted 15.4% (n=21). Five of the 11 patients were in the 30-34-year age range and 2 were teenagers.

Demographic, obstetric and health system factors for maternal deaths

The proportion of HIV positive women who died was less than in previous triennia. Out of 434 deaths, 41% (N=181) were HIV negative, 43% (N=186) were HIV positive and 15.4% (N=67) had an unknown status. Amongst the pregnancy related sepsis (PRS) deaths, 10 out of 21 deaths were HIV positive, suggesting an association. The majority of patients with PRS, 12 out of 21 patients, were delivered by caesarean section at national central hospital suggesting delays in referral from district hospitals.

Twenty-five percent (N=112) of maternal deaths were unbooked. Forty percent (n= 176) died undelivered during the antenatal period. More patients delivered via caesarean section 28.5 % (n=125) than vaginally 27.2 (n=118).

Of the 434 cases, only 48 postmortems were conducted. Seven out of twenty-one patients with embolism and two out of four patients with acute collapse had postmortems. Only four out of seven anesthetic deaths had postmortems even though this is mandatory for procedure related deaths. The lack of postmortems is due to limited access to forensic pathologists. A budget needs to be available to outsource the service to private for mandatory postmortems.

The pregnancy outcomes were liveborn in 38% (n=165), stillborn in 13.6% (n=59) and the rest were undelivered. Of concern, is the increase in patients with miscarriage from 7.2% in last triennium to 10.1%.

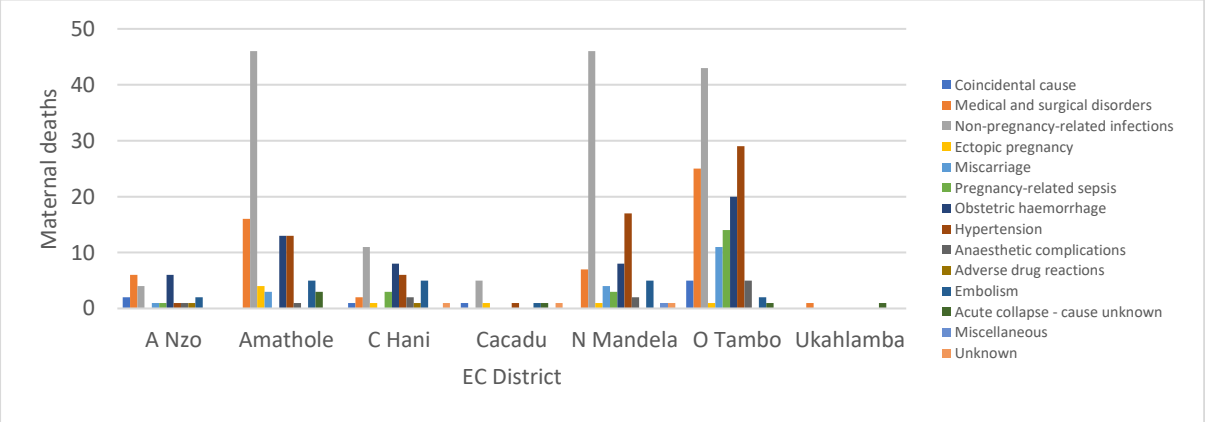
District Distribution of maternal deaths

OR Tambo district had the highest number of maternal deaths (n=156) followed by Buffalo City Municipality with Amathole combined (n=104), Nelson Mandela Bay Metro (n=95) and Chris Hani (n=41). All these districts have regional and tertiary/national central hospitals. The figure below shows district distribution by primary cause of death.

Table 5: District distribution of maternal deaths by Primary Obstetric Cause ranked

Primary obstetric problems	A Nzo	Amathole + BCM	C Hani	Cacadu	N Mandela	O Tambo	uKhahlamba	Total
Medical and surgical disorders	**6** 1ST	**16** 2ND	2	0	7	**25** 3RD	1	57
Non-pregnancy-related infections	**4** 2ND	**46** 1ST	**11** 1ST	**5** 1ST	**46** 1ST	**43** 1ST	0	155
Ectopic pregnancy	0	4	1	1	1	1	0	8
Miscarriage	1	3	0	0	4	11	0	19
Pregnancy-related sepsis	1	0	3	0	3	14	0	21
Obstetric haemorrhage	**6** 1ST	**13** 3RD	**8** 2ND	0	**8** 3RD	20	0	55
Hypertension	1	**13** 3RD	6	1	**17** 2ND	**29** 2ND	0	67
Anaesthetic complications	1	1	2	0	2	5	0	11
Embolism	2	5	**5** 3RD	1	5	2	0	20
Acute collapse - cause unknown	0	3	0	1	0	1	1	6
Total	**25**	**104**	**41**	**11**	**95**	**156**	**2**	**434**

Figure 4: District distribution of primary causes of death



Maternal Age

The highest iMMR (34) was recorded for women in the 35-39 (n=95) year age category, followed by women between 25-29 years (n=93) and the 30-34-year age group (n=91).

There is slight improvement in deaths among teenagers l (<20 years) from 10.8 % (n=54) to 8.3 % n=36). This may be due to improved access to antenatal attendance with implementation of learner pregnancy policy. Hypertension was the leading cause of death in the 15-19-year age group contributing 25% (n=8) of deaths, followed by NPRI (n=6) and medical and surgical disorders (n=4). Fifty percent of patients with thromboembolism were under 30 years. They died in regional hospitals, therefore thrombo-prophylaxis protocols need to be adhered to. The majority of patients with miscarriage, 13 out of 19, were less than 30 years old.

Maternal deaths by Level of Care

The national central hospitals based in OR Tambo experienced the highest mortality with the majority, (n=104), referred from three districts in their catchment. Regional hospital had 118, tertiary hospitals had 78, followed by 96 at district hospitals.

In national central hospital, NPRI (n=31) was responsible for the highest cause of mortality followed by hypertension (n=22) and Medical and Surgical conditions (n=20). In tertiary hospitals, the leading cause of deaths was NPRI (n=38) followed by hypertension (n=12) and obstetric haemorrhage (n=10).

In district hospitals, the highest cause was NPRI (n=27) followed by obstetric haemorrhage (n=18) and Medical and Surgical conditions (n=11). The increase in NPRI deaths at lower levels of care was due to COVID-19 patients who could not be transferred due to overburdened services and lack of ICU beds.

Table 6: Maternal deaths by Level of care

Primary obstetric problem	Outside	CHC	District hospital	Regional hospital	Tertiary hospital	Nat central hospital	Private hospital	Total
Coincidental cause	1	1	2	1	1	2	1	9
Medical and surgical disorders	2	0	11	16	8	20	0	57
Non-pregnancy-related infections	2	1	27	45	38	31	11	155
Ectopic pregnancy	0	0	2	2	3	1	0	8
Miscarriage	0	0	6	5	2	6	0	19
Pregnancy-related sepsis	0	0	4	4	2	10	1	21
Obstetric haemorrhage	6	2	18	10	10	7	2	55
Hypertension	0	1	9	23	12	22	0	67
Anaesthetic complications	0	0	4	4	0	3	0	11
Adverse drug reactions	0	0	1	1	0	0	0	2
Embolism	1	1	9	5	2	1	1	20
Acute collapse - cause unknown	2	0	1	2	0	1	0	6
Miscellaneous	0	0	1	0	0	0	0	1
Unknown	2	0	1	0	0	0	0	3
Total	**16**	**6**	**96**	**118**	**78**	**104**	**16**	**434**

Avoidable factors

Maternal death assessors believed that medical care was suboptimal in 244 (55.3%) cases and in 34.9% of cases suboptimal care was possibly/probably contributory to the maternal death. The proportion of suboptimal care was similar to the 2017-2019 triennium findings.

Table 7: Avoidability of deaths, 2020-2022

	2020 -2022	
Description	**n**	**n**
No suboptimal care	194	44.7
Suboptimal care, different management would have made no difference to the outcome	45	10.4
Suboptimal care, different management might have made a difference to the outcome	126	29.0
Suboptimal care, different management would reasonably have been expected to have made a difference to the outcome	69	15.9

Patient avoidable factors in the public sector were identified in 52.3% of assessed cases and administrative factors in 45.8%. Patient factors included delay in accessing medical help by patients (27.9%), no antenatal care (22.8%), declined medication/surgery or advice (10.4%), and infrequent antenatal care (7.8%). Resuscitation problems were identified in 40.5% of cases.

Table 8: Percentage of deaths with Avoidable factors related to administrative problems

Description	2021	2020	2020-2022	2017-2019
Lack of information	4.3	3.7	5.2	4.8
No avoidable factor	55.4	39.3	49.1	47.7
Transport Problem Home to Institution	2.9	1.5	2.5	3
Transport Problem from Institution to Institution	7.2	8.1	9.9	9.7
Lack of accessibility Barriers to entry	1.4	2.2	1.4	0.4
Lack of accessibility Other	2.2	1.5	2.3	0
Delay in attending to patient (Overburdened service)	7.2	7.4	5.8	3.8
Delay in attending to patient (reasons unknown)	3.6	1.5	2.3	0
Lack of Healthcare facilities ICU	8.6	14.1	8.8	4.6
Lack of Healthcare Facilities Blood / Blood products	2.2	5.2	2.1	3.8
Lack of Healthcare Facilities Other	2.9	5.9	3.9	3
Inadequate numbers of staff on duty	5	11.1	5.8	0
Appropriate skills not available on site on standby	5	4.4	6.2	0
Communication Problem Technical	0	3	1.4	0,6
Communication Problems Interpersonal	0.7	1.5	1.4	0.8
Other	13.7	18.5	15	13.9

Important administrative avoidable factors identified in the public sector were transport problems between institutions (9.1%), lack of ICU facilities (8.8%), lack of appropriate skill onsite or on standby to deal with medical problems (6.2%), delays in initiating critical care as a result of an overburdened service (5.8%), inadequate number of staff on duty (5.3%) and lack of healthcare facilities (3.9%), Table 8. The problem of lack of ICU beds increased from 4.6% in previous triennium to 14.1% in 2020, mostly accounted for by COVID-19 patients

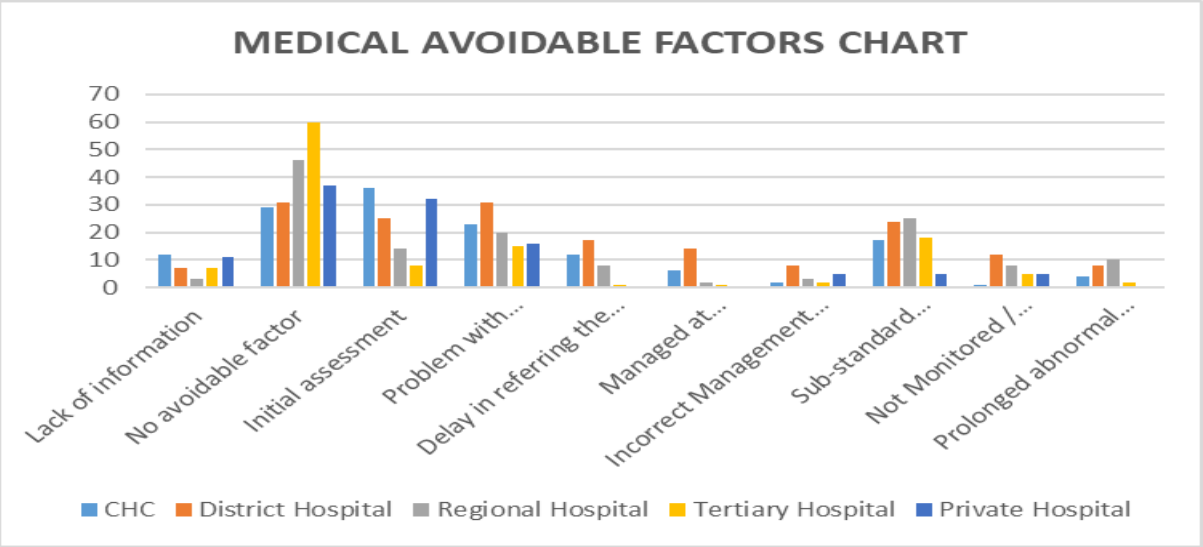
requiring critical care. The contribution of overburdened services increased from 3.8% in 2017-2019 to 7.4% in 2020 and 7.2% in 2021.

Medical care avoidable factors at CHC level were 43.2%. The highest number were at district hospitals at 61.4%, followed by 53.5% at regional hospitals, 46% at tertiary hospitals and 53.6% in private hospitals.

Medical care avoidable factors were assessed by level of care in public sector as demonstrated in Fig 5. Problems with initial assessment were highest in CHCs at 36 %. Medical problems were high in district hospitals due to problems of recognition/diagnosis (31%) compared with other levels, followed by substandard management / correct diagnosis at 23.7%, delay in patient referral at 16.7% and managed at inappropriate level at 13.9%. Regional hospitals' medical avoidable factors were problem recognition (20%), followed by initial assessment at 13.8 % vs 8.2% for tertiary hospitals and higher levels.

Decongesting tertiary hospitals with OMBUs will improve quality of care. Better use of Triage will assist in patient selection, managing at appropriate level and stabilising before referral. Triage training is needed for medical and nursing training curriculum. Inclusion of doctors and nurses in maternity, casualty and gynaecology wards n ESMOE training and Fire drills, will assist reduce health worker related gaps.

Figure 5: Medical avoidable factors by level of care



Private Hospitals

There were 16 patients who died in private hospitals compared to three in the last triennium. The majority sixty-eight % (N=11) died due to COVID-19, two due to obstetric haemorrhage and one due to pregnancy related sepsis. Fifty-three percent of deaths in private institutions were assessed as avoidable. The leading medical factors were poor initial assessment at 31%, followed by poor problem recognition at 15.8%. Substandard management with correct diagnosis, infrequent monitoring and wrong diagnosis /incorrect management were in equal proportion at 5.3%.

Part 2. Detailed analysis of main primary obstetric causes

For Part 2, provincial maternal death assessors divided themselves into groups to further assess the leading primary obstetric causes of death. Each group looked at trends for Eastern Cape from previous triennia, where data was available. Extra tables from MaMMAS for causes by age, level of care for a specific cause were analysed. Due to the demands of the COVID-19 pandemic, the Eastern Cape did not produce a 2017-2019 provincial report, meaning that 2017-2019 data on causes and subcategories of causes was not available for comparison for all Causes.

The team then came up with abstracts and recommendations for each cause and identified districts where these interventions were to be prioritised. Most assessors participated though one person was lead writer for abstracts per topic below.

A list of assessors is provided at the end as acknowledgement of the contribution of the teams to the abstracts.

Table 9: Sub-categories of causes of death 2020-2022 for Ectopic, Miscarriage and Pregnancy related sepsis

	2020-2022	
	N	%
DIRECT		
Ectopic Pregnancy	8	1.8
• Less than 20 weeks	6	1.4
• More than 20 weeks.	2	0.5
Miscarriage	19	4.4
• Septic Miscarriage	15	2.7
• Hemorrhage (non–traumatic)	3	0.7
• Uterine Trauma		
• GTD	1	0.2
• Following Legal TOP		
• Hyperemesis Gravidarum		
Pregnancy–Related Sepsis	21	4.8
• Chorioamnionitis with ruptured membranes		
• Chorioamnionitis without ruptured membranes	1	0.2
• Puerperal Sepsis after NVD	9	2.1
• Puerperal sepsis after Caesarean Section	8	1.8
• Bowel Trauma at Caesarean Section	3	0.7

Ectopic pregnancy

Six women died of ectopic pregnancy prior to 20 weeks' gestation and there were two ectopic pregnancies above 20 weeks' gestation.

Although few patients died from ectopic pregnancy, no women should die of this cause. Routine pregnancy test screening in women of child-bearing age should improve recognition. Currently none of the district hospitals do laparotomy for ectopic; this must be rectified so surgery can be performed at this level. The global surgery collaboration is in place to improve anaesthetic skills at district hospitals which is the main limitation.

Miscarriage (Ms J Pieterson and Ms Ndubaza)

There was a rise in deaths from 2.6% (N=12) to 4.4% (N=19) in this triennium. Septic miscarriages contributed 61% (N=15) to the total deaths followed by 3 haemorrhagic and 1 GTD. There were 9 cases where administrative factors were due to self–induced late illegal abortions. There is reduced reporting of these cases. Most women who died were teenagers. Community education and engagement needs to be done to improve awareness. Currently, second trimester CTOP services are only offered in regional and tertiary hospitals limiting access. An expansion of CTOP services to district hospitals for 2nd trimester TOPs would reduce deaths from this cause.

Table 10: Maternal age and early pregnancy deaths

	20=24	25-29	30-34	35-39	TOTAL
Ectopic	1	6	0	1	8
Miscarriages	6	7	2	4	19

Primary obstetric problems	district hospitals	regional hospital	tertiary hospital	nat. central hospital
Ectopic pregnancy	2	2	3	1
Miscarriages	6	5	2	6

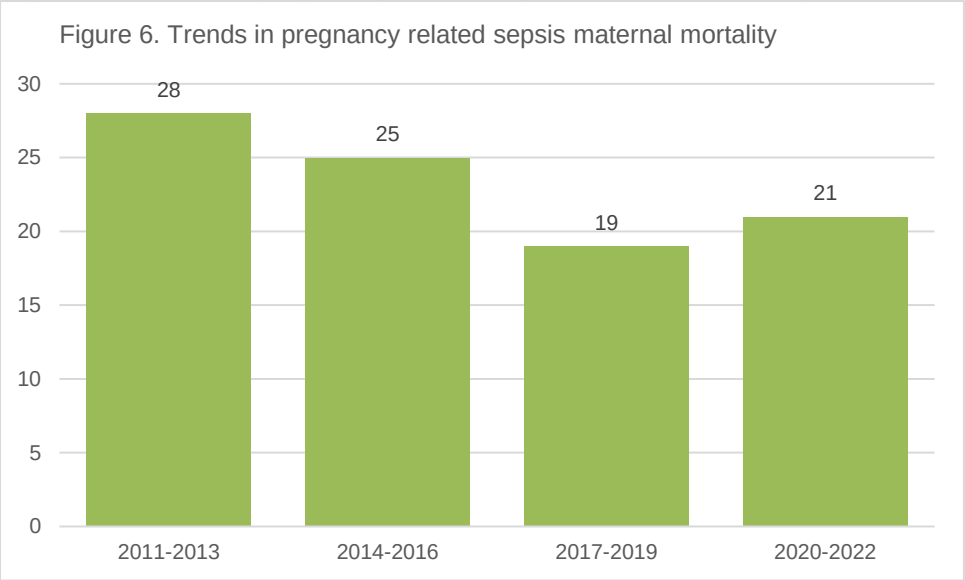
Pregnancy related sepsis (Dr B Mzileni)

Deaths due to pregnancy related sepsis have remained the 5th most common cause of maternal death for the triennium 2020-2022. There were 21 deaths reported for this category and this made up 4.5% of total maternal deaths compared to 5% (N=19) in the previous triennium.

The number of deaths had decreased every triennium since 2011-2013 from 28, to 25 in 2014-2016 and 19 in 2017-2019. This decline was not sustained in 2020-2022 as there is a slight increase in this triennium. This is supported by the institutional maternal mortality rate (maternal deaths per 100,000 live births) which showed the same trends over the last three triennia.

There is a widespread use of prophylactic antibiotics in the Caesarean section (CS). However, this may be given earlier than the recommended one hour before CS. Guidelines for antibiotic use in managing obstructed labour need to be adhered to. CS is a risk factor for PRS. Three maternal deaths were due to bowel trauma at caesarean section. Early warning charts can also assist with early detection of this contributor.

Figure 6: Trends in pregnancy related sepsis maternal mortality



The iMMR increased over three years of this triennium, from 3.67 in 2020, 6.31 in 2021 and 9.67 in 2022 giving an overall iMMR from PRS of 6.5 maternal deaths per 100,000 live births for this triennium. HIV was a risk factor as 10 out of 21 (47.6%) women were HIV positive and status was unknown in 25%. Sixty-six percent (n=13) of these women died in OR Tambo at the National Central hospital with iMMR of 14.91 due to PRS.

Of these 21 deaths, nine women had sepsis after vaginal delivery, 8 after caesarean section, three had bowel injury during caesarean section and one death was caused by chorioamnionitis with intact membranes.

There is a 50% reduction in deaths after caesarean, although it has fluctuated from 2.1 percent of all EC maternal deaths in 2011-2013, 2.4 percent in 2014-2016, 3.6% in 2017-2019 and 1.8 percent for this triennium.

There is concern that the cases of bowel trauma were not recognised at CS and not diagnosed post operatively. This also indicates lack of skill in the surgeons, as the caesarean sections were not recorded as difficult in the notes. Caesarean section audits and skill assessment of the surgeons is not routinely done according to the Safe CS plan for Eastern Cape.

The severity of pregnancy related sepsis is often underestimated by the healthcare providers and its

management is inadequate. Avoidable factors associated with the healthcare providers were present in district hospitals, regional hospitals and in private hospitals. While the rate of PRS deaths has shown a slow but steady decline in recent years, the high proportion of avoidable deaths is of concern. The majority of women with PRS died during the postpartum period. Most women who died from complications related to PRS received substandard treatment at the district, national central and tertiary levels of care despite the correct diagnosis. This suggests lack of insight into the treatment of such patients, alongside lack of appropriately trained doctors and nurses.

Key recommendations for PRS

1. Ensure capacity and accessibility of facilities for outpatient postnatal care within six days of delivery in all districts. On discharge from the place of delivery, advise women on signs of infection, and what to do if these are noticed.
2. Strengthen systems to ensure detection and treatment of HIV infection as early as possible in pregnancy, including strategies to ensure initiation of antenatal care as early as possible in gestation (before 14 weeks).
3. Ensure that surgeons and operating theatre staff follow standard precautions before and during Caesarean sections: including asepsis, safe surgical technique, and routine prophylactic antibiotics. Extended doses of antibiotics must be given in women with risk factors for PRS.
4. Remind and educate clinicians about suspecting and recognising septic shock in ill postpartum women, using forums such as morbidity and mortality meetings, formal ESMOE training or other training platforms.
5. No woman should be discharged from the hospital if any abnormal vital signs are recorded and immediate readmission is advised in women with any symptoms and signs suggestive of sepsis.
6. Proper initial triage of these patients and immediate implementation of maternal 'sepsis bundles' must always be done at all levels of care.
7. In district hospital protocols, especially in rural areas, emphasis is needed on the recognition of septic shock, as well as the need for early transfer of these women to higher levels of care, after the immediate implementation of 'sepsis bundles' as outlined in the maternity care guidelines.
8. In regional hospitals, audit the capacity of staff and facilities to manage women with septic shock. Recommended norms and standards for staff and facilities, including intensive care units, should be followed.
9. Educate all doctors performing Caesarean sections about precautions for preventing bowel injury at repeat Caesarean section. Ensure protocols are in place for intraoperative management of bowel injuries, including general surgical help, and transfer to higher levels of care.

Obstetric haemorhage (Dr CS Mpehle and Ms T Mangcotywa)

Obstetric haemorrhage was the fourth most common cause of maternal death for the triennium *2020–2022*. There were 55 deaths reported for this category and this made up 12.9% of total maternal deaths compared to 18.9% (N=71) in the last triennium. The three leading contributors in this category are:

1) Bleeding after caesarean section (N=13)
2) Ruptured uterus with previous CS (N=6)
3) Abruptio placentae with hypertension (N=5)

Ruptured uterus without previous CS (N=5) and uterine atony (N=5) all had an incidence of 1.2%. Table 11.

The use of surgical safety checklists and the assessment of facilities using the surgical safety assessments is something that needs ongoing encouragement. Six out of thirteen deaths occurred at the NCH due to late referrals from district hospitals. The use of stabilisation methods such as ability to perform haemostatic sutures such as B-lynch, and the use of the torniquet is likely a contributor in this reduction. Ongoing training on intra-operative management of bleeding is necessary.

Although bleeding after caesarean section showed the greatest reduction from the previous triennium from twenty-two (5.9%) to thirteen (3.1%), this still remains the greatest contributor of deaths due to obstetric haemorrhage. Six deaths due to bleeding after CS occurred at the tertiary hospital, 3 deaths occurred at district hospitals and 3 at regional hospitals. The importance of the appropriate use of early warning charts should be emphasised, as well as early recourse for re-laparotomy. Surgical techniques may have also been a contributor as adequate haemostasis at the caesarean section may not have occurred. The use of tranexamic acid and prophylactic B-Lynch sutures should also be encouraged when concerned about risk of post-operative bleeding.

Table 11: Sub-categories of causes of death Obstetric haemorrhage

	2020-2022	
	n	%
Obstetric Haemorrhage	55	12.9
• Abruption with hypertension	5	1.2
• Abruption without hypertension	1	0.2
• Placenta Praevia	4	0.9
• Other APH not specified	2	0.5
• Ruptured Uterus with previous C/S	6	1.4
• Ruptured Uterus without previous C/S	5	1.2
• Retained Placenta	3	0.7
• Morbidly Adherent Placenta	1	0.2
• Uterine Atony	5	1.2
• Vaginal Trauma	1	0.2
• Cervical Trauma	2	0.5
• Uterine Inversion	2	0.5
• Bleeding during C/S	1	0.2
• Bleeding after Caesarean Section	13	3.1
• Other PPH not specified	4	0.9

Most obstetric haemorrhage deaths (N=20) occurred from OR Tambo patients, followed by Amathole BCM (N=13), and 8 in both Chris Hani and Nelson Mandela. Of concern is the six out of thirteen maternal deaths in Amathole/BCM that occurred at the tertiary hospital due to bleeding after caesarean section. Alfred Nzo needs to focus on OH interventions as it is the leading cause of death in the district with 25% alongside Medical & Surgical disorders.

Out of 4 cases of younger patients (<20 years), 75% of deaths were due to abruptio placentae with hypertension. Advanced maternal age (> 35 years) was a significant contributor by 40% to deaths of obstetric haemorrhage.

Ruptured uterus with previous CS is the second most common contributor to the deaths in this triennium. These cases increased from 0.3% (N=1) in the previous triennium to 1.4% (N=6). It is necessary to understand where the gap is. Women with Previous CS should be carefully assessed when planning of a trial of labor. The facility of delivery needs to have adequate staff for close monitoring and clinical acumen for recognising impending rupture. Adherence to partogram and continuous CTG monitoring is vital. Patients awaiting theatre and those in labour should be tocolysed and appropriate measure should be taken to date the pregnancy so that elective surgeries are done at the correct time. There is an increasing trend of patients attempting self-induction and the dangers of drugs such as misoprostol and traditional medication such as “umchamo wemfene”, should form part of antenatal education, particularly in patients with a scarred uterus.

Most OH deaths occurred at facilities (N=45) 10.6%, with 1.4% home/outside facility deaths and 0.9% in transit. This means optimisation of patients in transit with the use of measures such as the non-pneumatic antishock garment (NASG), should be emphasised. In terms of the outside/ home deaths we would need to ascertain possible avoidable factors (e.g. look at the duration of wait for medical assistance such as the availability of ambulances, availability of ALS for escorting unstable patients by EMS and availability of Aero medical doing transfers during day. The above mentioned is still a challenge for the province.

Lack of transport from institution-institution was the leading administrative avoidable factor which contributed 9% to total causes.

The mode of delivery did not have an impact as 38% (N=21) of patients had a CS and 42% (N=23) delivered via NVD.

The recent result of the EMOTIVE study emphasises the accurate detection of blood loss and bundle approach for patients with PPH. The most critical element here is recognition and although the measuring devices vary, the awareness of this approach will hopefully assist in rapid and relevant intervention. This critical approach is being emphasised in the ESMOE training. This training session should be mandatory for all healthcare providers working in maternity and facilities should have regular drills.

Recommendations for obstetric haemorrhage:

1. ESMOE training including the use of the NASG should be routinely taught to obstetric units. This includes regular fire drills. The NASG should also be recommended for use by the EMS and they should have an adequate supply.
2. EMOTIVE approach with the emphasis on early recognition of PPH and the bundle approach to management should be introduced.
3. Safe CS checklists and accreditation. ESMOE training must emphasise safe surgical and anaesthetic skills, particularly for the district doctors in managing the airway.
4. Mandatory use of early warning charts and monthly facility audits of their use.
5. Link district doctors to a regional or tertiary hospital for in-reach to improve their skills and to participate in Diploma preparation to write the Diploma in Obstetrics and Anaesthetics. Funding to be secured to reimburse successful candidates.
6. SOP for post-operative monitoring of patients.
7. Institutionalising maternal near miss audits, will allow for more facility/region specific interventions.
8. Special charts for induction of labour: including risk factors, bishop score assessment and misoprostol doses to be designed and distributed provincially.

Table 12: Sub-categories of causes of death 2020-2022, hypertension, anaesthesia, embolism and acute collapse

	2020 - 2022	
	n	**%**
Hypertension	67	17
• Chronic Hypertension	1	0.2
• Proteinuric Hypertension	2	0.5
• Eclampsia	36	8.3
• HELLP	5	1.2
• Liver Rupture		
• Acute Fatty Liver		
Anaesthetic complications	11	2.5
• General Anaesthetic	1	0.2
• Spinal Anaesthetic	10	2.3
Embolism	20	3.1
• Pulmonary Embolism	18	4.1
Acute Collapse – Cause unknown	6	1.4

Hypertension (Dr GZ Mbambisa, Mrs N Gwiji and F Ngamlana)

Hypertensive disorders are the second leading cause of maternal deaths at 20, 7% (N=67). The most common cause of death in this category remains eclampsia at 8.3% (N=36). This is an improvement from 55 deaths (10.9%) in the previous triennium. The iMMR was 20.7 deaths per 100,000 live births, having dropped to 17.3 in 2021 and increased in 2022. Of the 66 that died in the facilities, most deaths occurred in the regional hospitals (n=23), 22 died in the national central hospitals, 12 died at the tertiary hospitals, 9 died at the district hospitals and one at a CHC. No hypertension deaths were reported by the private hospitals. OR Tambo district had the most deaths, 29 out of 156, followed by NMBM with 17 out of 95, both BCM and Amathole had 13 out of 104 and Chris Hani with 6 out of 41.

Hypertension was the leading cause of death contributing 25% (n= 8 between the ages of 15 – 19. The extremes of age were most affected with 10 deaths between the ages of 40 – 44 years, and 9 in the age group of 35 – 39. No deaths were reported in the youngest age group (10 – 14 years). Caesarean delivery was the most common delivery route (N=25); 13 were done at the national central hospital. Fifteen women died after vaginal delivery, these also occurred in regional and tertiary hospitals which reported 6 deaths each. Of the 67 deaths due to hypertensive disorders, 42 women were HIV negative, 16 positive and 9 had an unknown status. The number of post-mortems conducted was very low with only 6 done.

Deaths from gestational hypertension improved whilst deaths from HELLP remained the same. This could be related to appropriate referral to tertiary level as well as availability of fresh dried plasma at DH.

Poor management of pre-eclampsia remains a challenge as patients continue to be managed as outpatients despite proteinuria with borderline hypertension. Infrequent follow up of clients at high risk clinics, poor tracing of defaulters, and poor audit of records were avoidable factors. Skilling doctors and nurses and EMS personnel on ESMOE in transit is critical. However, ongoing monitoring of compliance to guidelines needs attention. Availability of contraceptives, Labetolol for control of severe hypertension, and procurement of appropriate BP machines needs attention.

Anaesthesia (Prof. B Mrara)

Primary anaesthetic deaths have increased to 11 contributing 2.5% to the total, with an iMMR of 3.4 deaths per 100,000 live births. These occurred mainly in district hospitals related to poor monitoring of patients under spinal anaesthetic, and insufficient knowledge and skills for managing complications of spinal Anaesthetic. Four patients died at DH and four at RH. Five of the deaths occurred in OR Tambo with two in NMBM and Chris Hani. Five of the 11 patients were in the 30-34-year age range and two were teenagers. Plans include expanding the anaesthetic assessors team with continued in-reach and improved retention of trained doctors. Thematic focused retraining and feedback will be improved. There were also deaths where anaesthesia was contributory to the death but not the primary cause; and for which there was substandard anesthetic care.

Substandard care themes:

1. Results not checked (coagulopathy, renal failure)
2. Failure of post operative care: PPH vigilance is needed.
3. BP monitoring intra-operatively must be adhered to, and appropriate use of vasopressors for spinal hypotension
4. High care and ICU referrals need to be arranged where applicable, with improved availability of such beds.
5. ACLS protocols need to be re-inforced with respect to adrenalin frequency, and use of furosemide
6. Blood product availability (platelets and cryoprecipitate)
7. Management of comorbid illness: TB, HIV, Poisoning, Pulmonary Embolus
8. Vigilance is needed for adverse pregnancy outcomes in patients with severe Preeclampsia post delivery.

Embolism (Prof. M Mdaka and Mrs T Matshoba)

Embolism is the sixth commonest cause of maternal death. There is an increase in deaths from 2.1% (N=16) to 4.6% (N=20). VTE prophylaxis should always be administered in patients with predisposing factors, including after emergency CS. Forty-five percent of patients died in DH, with one in CHC and outside. Only seven out of 20 patients had postmortem. There were two cases of amniotic fluid embolism.

The RCOG VTE score as well as the safe surgical checklist can assist to identify the patients at risk for embolism and their routine use and incorporation in the Maternity Case Record is recommended.

Acute collapse – cause unknown

There were six cases of acute collapse with two occurring outside facilities. Autopsy rate should be improved in both the pulmonary embolus and acute collapse.

Medical and surgical disorders (Dr S Mandondo and Dr Mbongozi)

Table 12: Sub-categories of causes of death 2020-2022 pre-existing medical and surgical disorders

	2020 - 2022	
	n	%
Pre-Existing Medical and Surgical Disorders	57	12.4
• Cardiac disease	17	4.0
• Endocrine		
• GIT	1	0.2
• CNS	5	1.2
• Respiratory	7	1.6
• Haematological	2	0.5
• Skeletal		
• Suicide	7	1.6
• Genito-urinary	1	0.25
• Neoplasm	4	0.9
• Other	13	3

Medical and surgical disorders increased to 3rd position with fifty-seven maternal deaths (N=57) making up 13.1% of the total. The numbers almost doubled from 12 to 23 (45% increase) in 2020. These numbers were sustained in 2021 and 2022 (n=22 deaths). Sixty-one percent (N=35) patients who died of M&S conditions were under 30 years mainly because abnormal vitals were ignored at PHC level. The iMMR from Medical and surgical conditions in EC was 17.6 maternal deaths per 100,000 live births, compared to the national iMMR of 16.99. The most common cause of deaths was cardiac (n=17), suicide (n=7), respiratory problems (n=7), CNS (n=5) and neoplasm (n= 4 deaths).

Of the seven suicide deaths, three occurred in DH, three at NCH and one in RH. Seven of the cardiac deaths occurred at the NCH with five in regional hospital indicating that the patients are referred appropriately.

Cardiomyopathy and other cardiac disease were the leading cause of death. Patients admitted in critical condition with advanced respiratory failure were admitted to general wards. Use of early warning chart and checklists in post-natal ward will reduce re-admissions of patients who had been sent home in unstable condition.

Recommendations: Hypertension and Pre-existing Medical and Surgical conditions

1. Routine vital signs among pregnant patients should include respiratory rate antenatally in addition to blood pressure, pulse and urine dipstix to triage patients appropriatelly in OPD. The antenatal early warning chart is provided in the maternity case records should be used for all admissions and abnormal vitals escalated and responded to.
2. All registrars in O&G should rotate in ICU, and obtsetric High care units should be adequatelly staffed to improve critical care. All patients admitted in High Care in regional and tertiary hospital should have a

high care discharge summary provided to guide follow up at lower levels. This summary should include a delivery plan or postnatal plan review plan.

3. Regional and tertiary hospitals should establish joint clinics involving obstetricians and physcians for the management of women with underlying medical disease. Management of these patients should include a delivery plan and a plan for future contraception.
4. District hospitals should have a transitional highcare area to stabilise and manage women while awaiting transfer to regional and tertiary facilites.
5. Women should be screened for mental health conditions at the first ante-natal visit using the mental health screening tool in the Maternity Case Record, and offered the contact details for online counselling services. Teenagers are vulnerable group and need refferal and linkages for ongoing support. Support group at local clinics or community at subsequent visits need to be established.
6. Gender based violence should be suspected in patients with recurrent admissions and negative findings on investigation after referral to other disciplines. Protocol to manage GBV and patient who screen positive for mental health need to be included in all BANC plus trainings.
7. ESMOE and clinical training needs to include algorithm for managing tachycardia both antenatally and post natally as well as a cardiac module as part of the ESMOE course.
8. Contraception counselling needs to be adhered to and emphasised in patients with extremes of age and access to Long Term Reversible contraception monitored in all primary healthcare clinics . Adolescent and Youth friendly services need to be established where feasible The B WISE app needs to be marketed to youth to improve knowledge about contraceptives. Anonymous tele consulting and information in this app is an effective tool .
9. Conduct Near MISS audit of patients with severe pre-eclampsia complications at tertiary so that DCST and consultant provide feedback to referring facilities during outreach
10. The Nurse mentor strategy needs to be mantained to improve skills at PHC facility level

Non–pregnancy related infections (NPRI) (Dr M. Feketshane, Mrs Nwesigye and Mrs N Magingxa*)*

COVID-19 maternal deaths 2020 -2022

2020	37	35%
2021	33	20%
2022	3	5%

Non-pregnancy related infections (NPRI) remained the leading cause of maternal deaths for the triennium 2020-2022. There were 155 deaths reported for this category and this made up 36.5% of total maternal deaths compared to 23.9% (N=90) in the last triennium. Included in this category were the 73 COVID-19 maternal deaths.

The first positive COVID-19 case in South Africa was confirmed in March 2020. The peak impact of the pandemic on maternal deaths was noted in the first two years of the triennium (2020-2021). There were 37 deaths in 2020 (35%), 33 (22%) in 2021 and a drastic drop to 3 (5%) in 2022.

Recommendations

1. Ongoing awareness and safety measures.
2. Ensure vaccination of all pregnant women in the event of future COVID-19 outbreaks.
3. During future COVID-19 outbreaks, mask wearing, social distancing and hand washing will remain the mainstay of infection prevention and control.

Table 13: Sub-categories of causes of death for non-pregnancy Related Infections

	2020-2022	
	n	**%**
Non–Pregnancy Related Infections	155	62.7
• PCP Pneumonia	4	0.9
• Other Pneumonia	11	2.5

	2020-2022	
	n	%
• TB	43	9.9
• Appendicitis		
• Endocarditis		
• UTI	1	0.2
• Cryptococcal meningitis	1	0.2
• Other meningitis	11	2.5
• Kaposi's sarcoma		
• Hepatitis		
• Gastroenteritis	3	0.7
• Wasting syndrome	2	0.5
• Complications of antiretroviral therapy		
• COVID-19	73	16.7

Recommendation NPRI (Dr P Selanto and Mrs N Ngwabeni)

1. Strengthen pregnancy screening at community, TB screening in pregnancy and Gene expert for all clients. CCMDD parcels can be used to insert messages to create demand.
2. Integration of contraceptive services into routine chronic care with promotion of LARC and monitor usage on tier.net. Communication on Emergency contraception needs to be widely disseminated.
3. Implement the New PMTCT guidelines using TLD and focus on VL suppression.
4. Pregnancy testing and linkage of antenatal client to WBOTs to follow up into the Post-natal period. Community engagement on RISKS of not booking, self- induced TOP and marketing of maternity waiting homes is needed.
5. Use nerve center approach to monitor progress.
6. All sub-districts need to continue to allocate clinical nurse mentors who will conduct In-service education on SRH including insertion LARC at PHC facilities. These mentors must have monitored by PHC supervisors and DCST.

Implementation of recommendations for the major causes of maternal death in EC requires attention to strengthening the health system, improving clinical governance and health worker training.

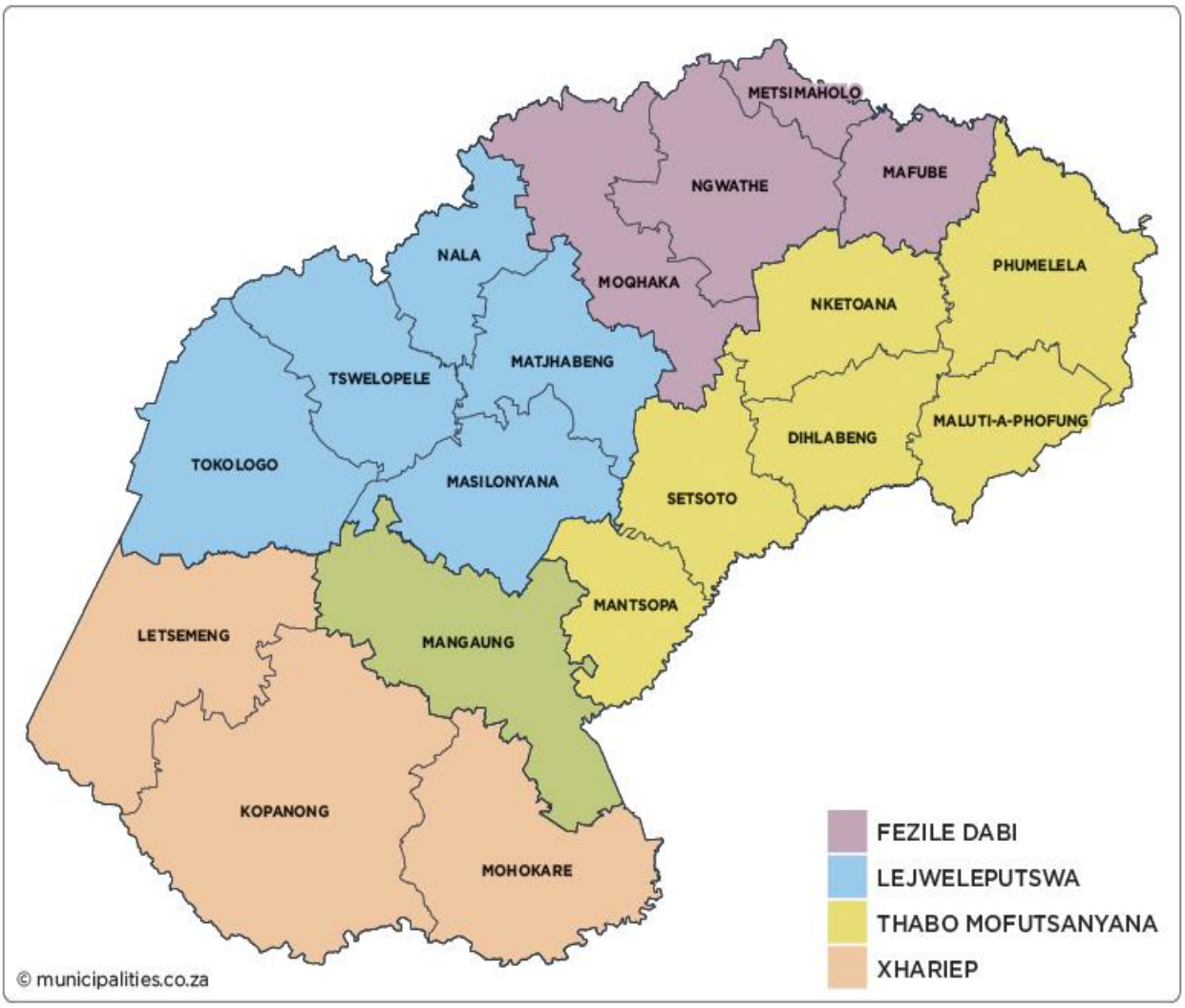
Eastern Cape Maternal Death Assessors List (2020-2022)

Name and Surname	District	Name Surname	Facility
Dr Sibongile Mandondo	Amathole	Prof. Busisiwe Mrara	NMCH
Ms Cingiswa Qwakanisa	BCM	Dr KAP Bhat	East London Complex
Dr Nonkosi Selanto	BCM	Dr Mihlali Simama	Frontier Hospital
Mrs Ntombizanele Ngwabeni	CMH	Dr Bezile Langa	Frontier Hospital
Dr Zwelidumile Mbambisa	Private r	Ms Noluthando Gwiji	O.R Tambo
Ms Fezeka Ngamlana	Chris Hani	Dr Catherine Bongi Mpehle	CMH/Frere

Name and Surname	District	Name Surname	Facility
Prof. Mana Mdaka	NMCH	Dr Yakheka Dyasi	Private
Ms Lulama Sompeta	Private	Ms Julia Pieterson	Dora Nginza Hospital
Ms Ntombizodwa Phokontsi	NMMB	Ms Yolisa Ndubaza	Dora Nginza Hospital
Dr Mfundo Feketshane	East London Complex	Ms Thozeka Mangcotywa	Nontyatyambo MOU
Ms Naomi Mwesigye	Frere Hospital	Dr Lorenzo Borreti	PE Complex
Dr Bulelwa Mzileni	Sarah Baartman	Dr Y Dyasi	Private
Ms Nomthandazo Magingxa	BCM	Dr Nopasika Pinzi	Quuens
Dr Xolani Mbongozi	NMCH	Ms N Dilinga	Dr Malizo Mpehle
Mrs Thandekile Matshoba	NMCH		

8.2 Free State

Overview of the Province



The Free State is situated at the heart of South Africa, surrounded by the Northern Cape, Eastern Cape, North West, Mpumalanga, KwaZulu-Natal, and Gauteng provinces, as well as Lesotho. It is a rural province with farmland, mountains, goldfields, and several small towns scattered throughout.

Despite being the third-largest province in South Africa in terms of land mass, the Free state has the second-smallest population and the second-lowest population density. It spans an area of 129,825 square kilometers and is home to 2.9 million people, which is about 5% of the country's population. The economy of the Free State is mainly driven by agriculture, mining, and manufacturing. The mining industry is a significant employer, with the province being the world's fifth-largest gold producer. The chemicals industry is also a major player, with Sasol, a giant synthetic fuels company, headquartered in the province.

The Free State comprises one metropolitan municipality (Mangaung Metropolitan Municipality) and four district municipalities. These are further divided into 18 local municipalities.

Executive Summary

Introduction

The Saving Mothers report presents an overview of maternal mortality, including underlying causes and trends from 2020-2022, obtained from MAMMAs and District Health Information System (DHIS). The country as part

of the global agenda is expected to reduce maternal mortality to below 70/100 000 live births by 2030. South Africa and the Free State has experienced a downward trend in maternal mortality until 2019. However Free State Province has been one of the provinces with the highest maternal mortality rate since 2017.

Methods

This report contains information about maternal deaths that occurred between 2020-2022 in the Free state Province. The data was collected from all health facilities in the province, including deaths that occurred outside of the facilities if they were reported. However, due to COVID-19 pandemic, data collection faced challenges as the healthcare facilities were overburdened.

Results

Based on the records, there were 258 maternal deaths and 9 coincidental deaths in the reporting period. Out of this, 40 deaths occurred in Fezile Dabi, 64 in Lejweleputswa, 93 in Motheo now known as Mangaung Metro, 67 in Thabo Mofutsanyana, and 3 in Xhariep District. The in-facility maternal mortality ratio (iMMR) during this period was calculated to be **178.1 per 100,000** live births. Out of the total deaths, 37 cases (14.3%) occurred during the Early Pregnancy period, 46 cases (17.8%) occurred during the Antenatal period, 13 cases (5%) occurred during Intrapartum, and the highest number of deaths 170 cases, (65.8% of the total) occurred during Postpartum period. Only one death (0.4% of the total) was anesthesia related, which suggests that either deaths due to anesthesia-related complications are rare or there is a failure to detect such cases. The data also indicate that the department must work on strategies to strengthen postnatal care.

Hypertension is the most common obstetric problem across all districts, followed by non-pregnancy-related infections, Obstetric Hemorrhage, then Medical and surgical disorders. It is concerning that there were 25 deaths where the cause of death was unknown.

Discussion

Submission and assessment of maternal death cases for the Saving Mothers report was hindered by COVID-19. This may have impacted data accuracy. During this period the province experienced an increase in out of facility deaths, which also suggests limited access to healthcare facilities during the pandemic. The joint assessment of maternal death files was not possible due to the limited movement in the province. The provincial office had to distribute the files to the assessors in respective facilities.

An important finding of this report is the increase in maternal mortality during 2020 and 2021 at the height of the pandemic and a remarkable decrease in 2022.

Conclusion

The data shows that maternal mortality in the Free State Province increased to 183.69 in 2020 and further to 232.31 per 100 000 live births in 2021, and substantially decreased to 116.19 per 100 000 live births in 2022. The maternal death rate for the 2020-2022 triennium was 178.1 per 100 000 live births.

Medical and surgical disorder were the leading causes of maternal deaths in 2020, but there was a significant decrease in 2021-2022, with an iMMR of 28.3 maternal deaths per 100,000 live births for the triennium 2020-2022.

There was an increase in deaths due to non-pregnancy-related infections in 2020 and 2021, which decreased in 2022. The iMMR for NPRI for the triennium was 34.5.

Obstetric haemorrhage and hypertension also contributed significantly to the number of deaths, with iMMRs of 31.1 and 35.9 respectively from 2020 to 2022. Most causes of death saw a decrease in 2022 compared to the previous years, which is a positive sign.

The number of live births was relatively stable over the three years, with a slight decrease in 2022.

Overall, these findings suggest that maternal health in the Free State has faced some challenges, but there are also promising signs of improvement. However, more efforts are needed to further reduce maternal mortality rates.

Detailed data on maternal deaths 2020-2022 and comparisons with previous years

Table 1: Maternal deaths, live births and iMMR for 2020-2022

Free State	Live births	MaMMAS deaths (DDCP)	MaMMAS MD	DHIS MD	MaMMAS MD (corrected)	MaMMAs iMMR	MaMMAs iMMR (corrected)	DHIS iMMR
2020	48452	93	89	70	89	183.69	183.69	144.5
2021	49073	115	114	100	114	232.31	232.31	203.8
2022	47336	59	55	50	55	116.19	116.19	105.6

2020-2022	Live births	MaMMAS MD (corrected)	MaMMAs iMMR (corrected)
fs Free State Province	144861	258	178.1

There was an increase in maternal deaths in 2020 and 2021 in the provinces like in the rest of the country. This was due to the contribution of COVID-19 pandemic with the numbers being the lowest in 2022.

In 2020, the iMMR was 183.69. In 2021, it increased to 232.31 but then significantly decreased to 116.2 per 100,000 live births in 2022. It was 178.1 for the whole triennium.

Despite this decrease in 2022, and in previous triennia, the Free State still has the highest values compared to other provinces and was the province with the highest iMMR in 2020-2022.

Figure 1: Maternal deaths in FS, 1998-2022 (corrected)

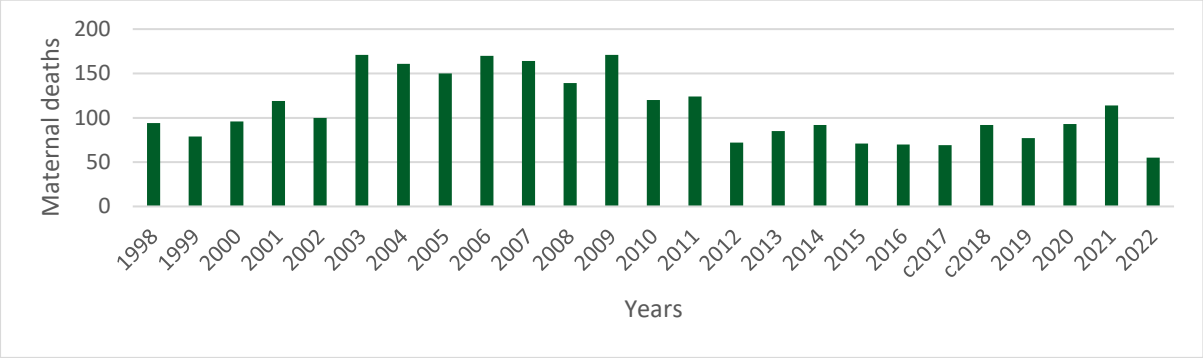
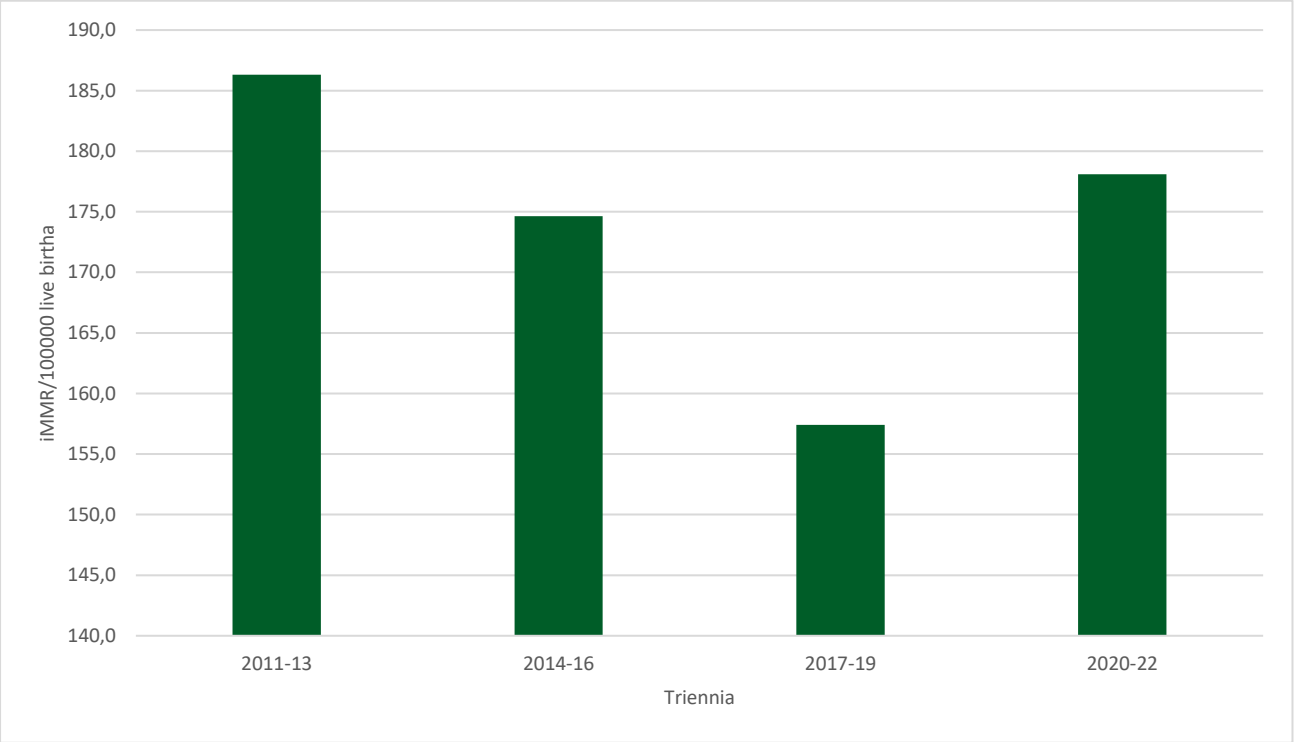
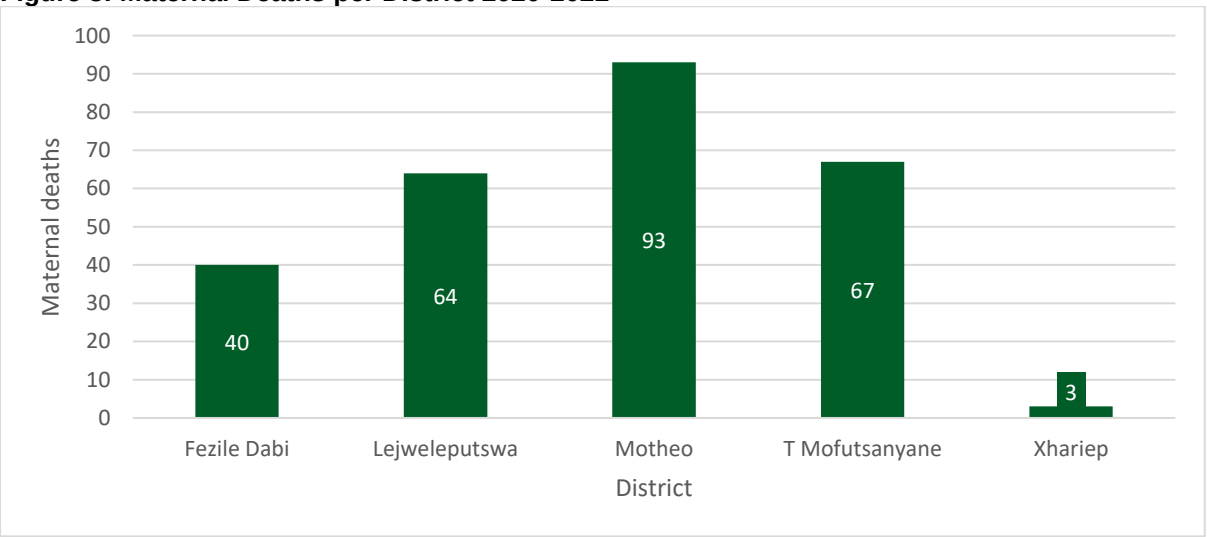


Figure 2: Free State iMMR for 4 triennia from 2011-2022



The iMMR declined from 186.3 in 2011-2013 to 157.4 per 100 000 live births in 2017-2019. However, there was an increase in the maternal mortality ratio during the period of 2020 to 2022, where it rose to 178.1.

Figure 3: Maternal Deaths per District 2020-2022



The district with the highest number of maternal deaths was Motheo (93 deaths) followed by Thabo Mofutsanyana (67 deaths) and Lejweleputswa (64 deaths). The Tertiary and Central Hospitals are in Motheo District and are referral Hospitals for all complicated cases in the province.

Table 2: Primary Obstetric Cause per year and for 2020-2022

Free State	2020	2021	2022	2020-2022
Medical and surgical disorders	22	14	5	41
Non-pregnancy-related infections	13	29	8	50
Ectopic pregnancy	1	6	2	9

Free State	2020	2021	2022	2020-2022
Miscarriage	2	1	1	4
Pregnancy-related sepsis	8	4	3	15
Obstetric haemorrhage	13	23	9	45
Hypertension	14	20	18	52
Anaesthetic complications	1	1	3	5
Adverse drug reactions	2	0	0	2
Embolism	2	5	1	8
Acute collapse - cause unknown	0	0	0	0
Miscellaneous	1	0	1	2
Unknown	10	11	4	25
Maternal deaths	89	114	55	258
Coincidental cause	4	1	4	9
DDCP	93	115	59	267
Live births (2019)	**48452**	**49073**	**47336**	**144861**

Hypertension was the most common obstetric problem across all districts, with a total of 52 deaths (20.1%) for the triennium 2020-2022, followed by non-pregnancy-related infections with 50 deaths (19.3%), Obstetric Hemorrhage at 45 deaths (17.4%), and Medical and surgical disorders at 41 deaths (15.8%). Of concern were the 25 cases (9.6%) deaths where the causes were unknown. Poor feedback from forensic pathology on postmortem results and incomplete clinical records contribute to the unknown causes of death.

Miscarriage and adverse drug reactions are the least common issues, with only four and two cases respectively. Motheo district had the highest number of hypertension cases, followed by Thabo Mofutsanyana, while Xhariep has no hypertension related deaths. A review of cases in Thabo Mofutsanyana revealed poor management of hypertension, delay in referral, delay in commencing emergency management, failure to implement protocols on the use of Magnesium Sulphate, and poor decision-making due to the utilisation of unsupervised medical interns in Thabo Mofutsanyana Hospitals.

Xhariep had the fewest cases, with only three reported. This district does not have a regional hospital or facility that offers Caesarean Section. All high-risk patients and those that need Caesarean section are transferred to Motheo.

Obstetric hemorrhage and hypertension are the two causes with relatively high iMMR throughout the three years, with iMMRs of 31.1 and 35.90 deaths per 100,000 live births respectively.

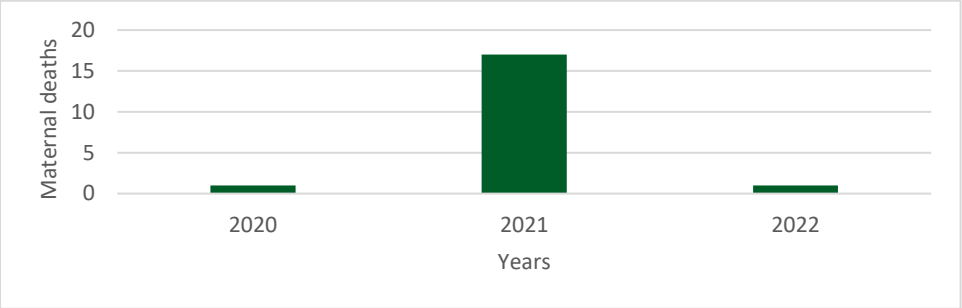
The iMMR due to medical and surgical disorders has decreased from 45.41 in 2020 to 10.56 in 2022, with an overall iMMR of 28.30 for the triennium.

The iMMR due to coincidental causes varied over the three years, with an overall iMMR of 6.21. However, the iMMR due to non-pregnancy-related infections peaked in 2021 at 59.10, which was significantly higher than the rates in 2020 and 2022. The average rate over the three years was 34.52.

The number of live births has slightly decreased from 48 4525 in 2019 to 47 336 in 2022. Despite some progress made in reducing maternal mortality rates, obstetric hemorrhage and hypertension remain significant contributors to maternal mortality. Hence, further efforts should be made to address these issues to continue the downward trend in mortality rates.

There is a category of deaths that is referred to as “Unknown” which accounts for a total of 25 deaths. Out of these 25, four deaths occurred at a medical facility and 21 occurred outside a medical facility.

Figure 4: COVID-19 Maternal Deaths



The number of COVID-19-related maternal deaths were 19, the highest number was 17 deaths in 2021. The low numbers in 2020 could be due to maternal death assessors not having a good understanding of how and where COVID-19 needs to be classified under non-pregnancy related infections.

During the early stages of the pandemic in 2020, testing capacity might have been limited, which could have led to underreporting of cases. The practices for recording and classifying COVID-19 deaths might have changed over time as our understanding of the virus improved.

If a patient had other health conditions, it might have been challenging to determine the exact causes of death, which could lead to potential misclassification.

Table 3: Location of death (DDPCP)

Primary obstetric problems	Facility	In transit	Home/Outside	Total
Coincidental cause	8	0	1	9
Medical and surgical disorders	41	0	0	41
Non-pregnancy-related infections	48	0	2	50
Ectopic pregnancy	8	1	0	9
Miscarriage	4	0	0	4
Pregnancy-related sepsis	14	0	1	15
Obstetric haemorrhage	43	2	0	45
Hypertension	47	0	5	52
Anaesthetic complications	5	0	0	5
Adverse drug reactions	2	0	0	2
Embolism	6	0	2	8
Acute collapse - cause unknown	0	0	0	0
Miscellaneous	2	0	0	2
Unknown	4	0	21	25
Total	**232**	**3**	**32**	**267**

The majority of the deaths happened within a healthcare facility, indicating that most women had access to healthcare. However, this also raises concerns about the quality of care provided. Very few deaths occurred while in transit.

Table: Primary obstetric cause of death per Level of care (DDPCP)

Primary obstetric problem	Outside	CHC	District hospital	Regional hospital	Tertiary/ Nat central hospital	Private hospital	Total
Coincidental cause	1	1	0	3	4	0	9
Medical and surgical disorders	0	0	4	12	17	8	41
Non-pregnancy-related infections	2	0	7	20	12	9	50
Ectopic pregnancy	0	0	4	4	1	0	9
Miscarriage	0	0	1	3	0	0	4
Pregnancy-related sepsis	1	0	0	6	8	0	15
Obstetric haemorrhage	0	0	12	23	7	3	45
Hypertension	5	0	3	26	15	3	52
Anaesthetic complications	0	0	1	4	0	0	5
Adverse drug reactions	0	0	0	1	1	0	2
Embolism	2	0	1	3	1	1	8
Acute collapse - cause unknown	0	0	0	0	0	0	0
Miscellaneous	0	0	0	2	0	0	2
Unknown	21	0	0	3	1	0	25
Total	**32**	**1**	**33**	**110**	**67**	**24**	**267**

The majority of deaths occurred in regional hospitals (110 out of 267). This could be due to a higher number of complicated cases being referred to these hospitals. However, it remains a concern that some of the Regional Hospitals do not have full-time obstetricians.

Hypertension was the leading cause of death in regional hospitals accounting for 26 deaths while tertiary/central hospitals accounted for 15. This indicates a need for improved management of hypertension across all levels of care.

Non-pregnancy-related infections were the second leading cause of death in regional hospitals (20) and the leading cause in private hospitals (9).

Obstetric hemorrhage was the third leading cause of death in regional hospitals (23). Improved management of obstetric hemorrhage could significantly reduce maternal mortality.
A significant number of deaths occurred outside of healthcare facilities (32), most of which were due to unknown causes (21). This highlights the need for community education and improved access to care.

Most deaths (69 out of 267) occurred in the age group 35-39. The leading causes were hypertension (17), non-pregnancy-related infections (11), and obstetric hemorrhage (16). This indicates the importance of strengthening sexual and reproductive health services in this group Table 5.

The second highest number of total deaths (68 out of 267) was in the age group of 30-34. The leading causes of deaths were non-pregnancy-related infections (17), obstetric hemorrhage (16) and hypertension (6).
Age Group 25-29 accounted for the third highest number of deaths (53 out of 267). The leading causes were non-pregnancy-related infections (10) hypertension accounted for (8).

Eighteen deaths (18 out of 267) occurred between the ages of 40-44 years and hypertension was the leading cause. The province should improve access to sterilisation.

The Free State like other provinces has a challenge of deliveries to teenagers. In the current reporting period, few deaths were reported from this age group (10-19) years.

Table 5. Primary obstetric cause of death and Maternal age (DDPCP)

Primary obstetric problem	10 - 14	15-19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	Outside 10-44 range & Unknown	Total
Coincidental cause		1	1	2	3	2	0	0	9
Medical and surgical disorders		3	7	10	14	6	1	0	41
Non-pregnancy-related infections		0	6	10	17	11	6	0	50
Ectopic pregnancy		0	1	4	1	3	0	0	9
Miscarriage		0	0	1	1	2	0	0	4
Pregnancy-related sepsis		1	3	4	4	2	1	0	15
Obstetric haemorrhage		4	3	3	16	16	3	0	45
Hypertension		4	14	8	6	17	3	0	52
Anaesthetic complications		0	1	3	0	1	0	0	5
Adverse drug reactions		0	0	1	0	1	0	0	2
Embolism		1	1	2	2	2	0	0	8
Acute collapse - cause unknown		0	0	0	0	0	0	0	0
Miscellaneous		0	1	1	0	0	0	0	2
Unknown		1	3	4	4	6	4	3	25
Total	**0**	**15**	**41**	**53**	**68**	**69**	**18**	**3**	**267**

Table 6. Primary Obstetric cause and Mode of delivery (DDPCP)

Primary obstetric problems	Vaginal	CD	CHC CD	DH CD	RH CD	TH/NCH CD	PvT CD
Coincidental cause	1	0	0	0	0	0	0
Medical and surgical disorders	10	13	0	0	4	5	4
Non-pregnancy-related infections	15	18	0	1	7	5	5
Ectopic pregnancy	7	7	0	3	4	0	0
Miscarriage	0	0	0	0	0	0	0
Pregnancy-related sepsis	7	7	0	0	2	5	0
Obstetric haemorrhage	24	16	0	3	8	3	2
Hypertension	7	32	1	3	20	9	3
Anaesthetic complications	0	5	0	1	4	0	0
Adverse drug reactions	0	1	0	0	1	0	0
Embolism	2	4	1	1	2	2	2
Acute collapse - cause unknown	0	0	0	0	0	0	0
Miscellaneous	0	0	0	0	0	0	0
Unknown	12	5	5	5	5	5	5
Total	**85**	**108**	**7**	**17**	**57**	**34**	**21**

Table 6 shows the mode of delivery for each primary obstetric cause of deaths.
In the reporting period, there were **46746** Caesarean deliveries, and out of 267 deaths, 108 were delivered through CD, which accounts for 41.8% of maternal deaths.

The primary causes of death for caesarean deliveries were hypertension (32), non-pregnancy-related infections (18), and Obstetric hemorrhage (16).

Meanwhile, vaginal delivery had the second-highest number of total deaths at 85. Obstetric hemorrhage accounted for 24 deaths followed by non-pregnancy-related infections (15 deaths), and Medical and surgical disorders (10 deaths).

Table 7. Primary Obstetric cause and HIV status (DDPCP)

Primary obstetric problems	Negative	Positive	Declined test	Unknown	Total
Coincidental cause	0	3	0	6	9
Medical and surgical disorders	19	15	0	7	41
Non-pregnancy-related infections	8	38	0	4	50
Ectopic pregnancy	2	3	0	4	9
Miscarriage	1	2	0	1	4
Pregnancy-related sepsis	8	5	0	2	15
Obstetric haemorrhage	18	23	0	4	45
Hypertension	31	17	0	4	52
Anaesthetic complications	5	0	0	0	5
Adverse drug reactions	1	1	0	0	2
Embolism	4	3	0	1	8
Acute collapse - cause unknown	0	0	0	0	0
Miscellaneous	2	0	0	0	2
Unknown	13	6	0	6	25
Total	**112**	**116**	**0**	**39**	**267**

Among the total deaths of 267 individuals, the HIV-positive group accounted for 116 deaths. Non-pregnancy-related infections (38), obstetric hemorrhage (23), and hypertension (17) were the leading causes of death among HIV-positive individuals. Similarly, the HIV-negative group had 112 deaths, with hypertension (31), obstetric hemorrhage (18), and medical and surgical disorders (19) being the leading causes of death. It was reported that no pregnant women declined the HIV status group, and the cause of death was often unknown as well, which has already been identified as a matter of concern.

This calls for continuation in health promotion by providing education to the communities to “know your Status” and ensure that the 95,95,95 strategy is implemented as all levels of care by enhancing access to care, ensuring linkage and retention in care, and a functional referral system.

Table 8. Primary Obstetric cause and Postmortems (DDPCP)

Primary obstetric problems	Postmortem	Not Done
Coincidental cause	3	6
Medical and surgical disorders	1	40
Non-pregnancy-related infections	0	50
Ectopic pregnancy	1	8
Miscarriage	0	4

Primary obstetric problems	Postmortem	Not Done
Pregnancy-related sepsis	2	13
Obstetric haemorrhage	3	42
Hypertension	7	45
Anaesthetic complications	1	4
Adverse drug reactions	1	1
Embolism	3	5
Acute collapse - cause unknown	0	0
Miscellaneous	0	2
Unknown	6	19
Total	**28**	**239**

- The total number of postmortems conducted was 28, while the number of cases where postmortem was not done was 239. In some cases, postmortem was not indicated.
- The highest number of postmortems were conducted for cases related to hypertension (7), followed by Obstetric hemorrhage (3), Embolism (3), and Coincidental cause (3).
- The highest number of cases where a postmortem was not done was related to non-pregnancy-related infections (50), followed by hypertension (45), and Obstetric hemorrhage (42).
- There were 6 cases where the cause was unknown and a postmortem was conducted, while there were 19 such cases where a postmortem was not done.

Table 9 shows the final cause of death for maternal deaths.

- Circulatory system issues were the leading final cause of death, accounting for 40.4% of the total. This category includes hypovolemic shock (25.8) and septic shock (14.6%).
- The second leading final cause was respiratory failure, which accounted for 34.5% of the deaths.
- Cardiac failure and cerebral complications were also significant causes, contributing to 16.5% and 15.4% of the deaths respectively.
- Other notable causes include renal failure (10.5%), hematological issues (13.5%), and immune system failure (9.4%).
- The final cause of death was unknown in 11.6% of the cases.

Table 9. Final cause of maternal death

Cause of death	Number	% of total
Circulatory system	108	40.4
- Hypovolaemic shock	69	25.8
- Septic shock	39	14.6
Respiratory failure	92	34.5
- Respiratory failure	92	34.5
Cardiac failure	44	16.5
- Pulmonary oedema	44	16.5
Embolism	14	5.2
- Acute collapse due to embolism	14	5.2
Renal failure	28	10.5
- Renal failure	28	10.5
Liver failure	8	3
- Liver failure	8	3
Cerebral complications	41	15.4
- Intracranial haemorrhage	17	6.4
- Cerebral oedema resulting in coning	3	1.1

Cause of death	Number	% of total
- Meningitis	5	1.9
- Brain death following hypoxic event	11	4.1
- Unspecified	5	1.9
Metabolic	18	6.7
- Maternal ketoacidosis	5	1.9
- Electrolyte imbalance	9	3.4
- Thyroid crisis	1	0.4
- Lactic acidosis	2	0.7
- Other	1	0.4
Haematological	36	13.5
- DIC	27	10.1
- Severe anaemia	9	3.4
Immune system	25	9.4
- Immune system failure	25	9.4
Unknown	31	11.6
- Home death	19	7.1
- Unknown	12	4.5
Other	19	7.1
- Other	19	7.1
Total deaths	**267**	

Table 10. Timing of Emergency and Timing of death

Timing of emergency		
- Early pregnancy	40	15.0
- Antenatal period: 20w +	76	28.5
- Intrapartum period	27	10.1
- Postpartum period	123	46.1
- Anaesthesia	1	0.4
Timing of death		
- Early pregnancy	37	13.9
- Antenatal period: 20w +	46	17.2
- Intrapartum period	13	4.9
- Postpartum period	170	63.7
- Anaesthesia	1	0.4

The timing of the emergency was mostly in the postpartum period which accounted for the highest percentage (46.1%). Similar to the timing of the emergency, the timing of the death was mostly in the postpartum period (63.7%).

The following Tables focus on the **Avoidability** of maternal deaths in Free State

Table 11. Avoidability of deaths

No suboptimal care identified	66	24.7
Suboptimal care, no impact on outcome	21	7.9
Suboptimal care, possible impact on outcome	122	45.7

Suboptimal care, probable impact on outcome	58	21.7
Total:	**267**	

Suboptimal care was identified in 201 out of 267 cases. This includes cases where suboptimal care had no impact, possible impact, or probable impact on the outcome. Approximately **75.3%** of patients received suboptimal care.

In 24.7% of the cases (66 cases), no suboptimal care was identified. This suggests that in these cases, the standard of care met or exceeded expectations, but the patient still died.

In 7.9% if the cases (21 cases), suboptimal care was identified but it did not impact the outcome. This means that while the care provided was not up to the standard, it did not adversely affect the patient's health outcome. In 45.7% of the cases (122 cases), suboptimal care was identified and it possibly impacted the outcome. This is a significant percentage and suggests that improvements in care could potentially lead to better health outcomes. In 21.7% of the cases (58 cases), suboptimal care was identified and it probably impacted the outcome. This indicates a strong likelihood that the substandard care directly contributed to the adverse health outcome.

Table 12. Classification of Avoidable Factors

	Number	% of total	% of cases at this level
PATIENT ORIENTED PROBLEMS			
- Avoidable factors identified	123	46.1	
- No avoidable factors	114	42.7	
- Lack of information	37	13.9	
ADMINISTRATIVE PROBLEMS			
- Avoidable factors identified	146	54.7	
- No avoidable factors	98	36.7	
- Lack of information	28	10.5	
RESUSCITATION PROBLEMS			
- Avoidable factors identified	173	64.8	
- No avoidable factors	72	27.0	
- Lack of information	23	8.6	
MEDICAL CARE - CHC			
- Managed at this level	145	54.3	
- Avoidable factors identified	37		25.5
- No avoidable factors	93		64.1
- Lack of information	16		11.0
MEDICAL CARE - DISTRICT HOSPITAL			
- Managed at this level	157	58.8	
- Avoidable factors identified	92		58.6
- No avoidable factors	57		36.3
- Lack of information	15		9.6
MEDICAL CARE - REGIONAL HOSPITAL			
- Managed at this level	154	57.7	
- Avoidable factors identified	95		61.7
- No avoidable factors	47		30.5
- Lack of information	18		11.7

	Number	% of total	% of cases at this level
MEDICAL CARE - TERTIARY & ABOVE			
- Managed at this level	72	27.0	
- Avoidable factors identified	34		47.2
- No avoidable factors	36		50.0
- Lack of information	2		2.8
MEDICAL CARE - PRIVATE HOSPITAL			
- Managed at this level	31	11.6	
- Avoidable factors identified	14		45.2
- No avoidable factors	14		45.2
- Lack of information	3		9.7

Patient-Oriented Avoidable factors were identified in 46.1% of cases, while no avoidable factors were found in 42.7% of cases. In 13.9% of cases, there was lack of information.

Administrative related Avoidable factors were identified in 54.7% of cases, while no avoidable factors were found in 36.7% of cases. In 10.5% of cases, there was a lack of information.

Medical care related Avoidable factors, are broken down by level of care.

Community Health Centre (CHC):
145 cases were managed at this level, which is 54.3% of the total cases.
37 cases (2535%) had avoidable factors identified.
93 cases (64.1%) had no avoidable factors.
In 16 cases (11.0), there was a lack of information.

District Hospitals:
157 cases were managed at this level, which is 58.8% of the total cases.
92 cases (58.6) had avoidable factors identified.
57 cases (36.3%) had no avoidable factors.
In 15 cases (9.6%), there was a lack of information.

Regional Hospital:
154 cases were managed at this level, which is 57.7% of the total cases.
95 cases (61.7%) had avoidable factors identified.
47 cases (30.5%) had no avoidable factors.
In 18 cases (11.7%), there was a lack of information.

Tertiary & above:
72 cases were managed at this level, which is 27.0% of the total cases.
34 cases (47.2%) had no avoidable factors identified.
36 cases (50.0) had no avoidable factors.
In 2 cases (2.8%), there was a lack of information.

Table 13. Patient Orientated Care avoidable factors

Description	Number	% of cases
Lack of information	37	13.9
No avoidable factor	114	42.7
No antenatal care	37	13.9
Infrequent antenatal care	2	0.7
Delay in accessing medical help	77	28.8
Declined medication/surgery/advice	15	5.6
Family problem	4	1.5
Community problem	1	0.4
Unsafe abortion	2	0.7
Other	14	5.2
Total cases	**267**	

No patient oriented avoidable factor was identified in 42.7% of cases. This suggest that in nearly half of the cases, the deaths occurred despite the standard patient care measures in place, indicating that these were likely due to severe medical complications or other factors outside of patient-oriented care.

There were 28.8% of cases which involved a delay in accessing medical help. This indicates that s significant number of patients experienced delays in receiving medical help, which could have been due to various reasons such as transportation issues, lack of awareness, or systemic delays in the healthcare system.

Lack of information and no antenatal care were significant factors in 13.9% of cases each.

In 5.6% of cases, patients declined recommended treatments or advice, which could have led to adverse outcomes.

Infrequent antenatal care, family problems, community problems, unsafe abortion, and other issues combined, represented 10.4% of cases. These issues form part of there pre-hospital avoidable factors even though they represent a smaller proportion of the cases but are still important areas to address.

The data suggests that while some maternal deaths were unavoidable, there is still an important need for a community focus on health promotion activities for early identification through community-based screening and testing of all child bearing women.

Table 14. Administrative related avoidable factors

Description	Number	% of cases
Lack of information	28	10.5
No avoidable factor	98	36.7
Transport problem: Home to institution	8	3
Transport problem: Institution to institution	8	3
Lack of accessibility: Barriers to entry	6	2.2
Lack of accessibility: Other	6	2.2
Delay in attending to patient (Overburdened service)	20	7.5

Description	Number	% of cases
Delay in attending to patient (Reason unknown)	5	1.9
Lack of healthcare facilities: ICU	15	5.6
Lack of healthcare facilities: Blood/blood products	7	2.6
Lack of healthcare facilities: Other	9	3.4
Inadequate numbers of staff on duty	34	12.7
Appropriate skill not available on site / on standby	43	16.1
Communication problems: Technical	3	1.1
Communication problems: Interpersonal	1	0.4
Other	26	9.7
Total cases	**267**	

According to the data, in 36.7% of cases, there were no avoidable factors, meaning that the deaths occurred despite the existing administrative measures in place. This suggests that medical complications or other factors outside of administrative control were likely the cause of these deaths.

In 16.1% of cases, the appropriate skills were not available on-site or on standby. This indicates a significant issue with the availability of skilled, knowledgeable, and competent healthcare professionals, which could have a direct impact on patient outcomes.

Inadequate numbers of staff on duty were a contributing factor in 12.7% of cases, potentially leading to delays and or substandard care.

10.5% of cases were associated with a lack of information. This could refer to a lack of patient records, communication gaps, or missing data, which could hinder effective patient management.

7.5% of cases were due to delays in attending to the patient, which could be attributed to overburdened services and subsequent delays in patient care.

11.6% of cases were due to a lack of healthcare facilities, including a shortage of ICU facilities, blood/blood products, etc. indicating infrastructure or resource limitations.

6% of cases were related to transport problems, which include issues with transport from home to institution and between institutions, indicating potential issues with emergency transport services.

4.4% of cases were due to a lack of accessibility, including barriers to early entry into healthcare system.
1.5% of cases were associated with communication problems, both technical and interpersonal communication issues, indicating potential areas for improvement in communication strategies.

Overall, the data suggests that while some maternal deaths were unavoidable, many were associated with administrative issues such as staffing, skills availability, facility limitations, and communication problems. Removing barriers to early entry into health services by creating a responsive healthcare system and addressing these issues could potentially reduce the number of maternal deaths in the Free State.

Table 15 Medical Care related avoidable factors by level of care

Description	Number	% of all cases	% of cases at level
COMMUNITY HEALTH CENTRE			
Managed at this level	145	54.3	100
Lack of information	16	6	11
No avoidable factor	93	34.8	64.1
Initial assessment	11	4.1	7.6

Description	Number	% of all cases	% of cases at level
Problem with recognition / diagnosis	17	6.4	11.7
Delay in referring the patient	9	3.4	6.2
Managed at inappropriate level	1	0.4	0.7
Incorrect management (Wrong diagnosis)	6	2.2	4.1
Sub-standard management (Correct diagnosis)	7	2.6	4.8
Not monitored / Infrequently monitored	2	0.7	1.4
Prolonged abnormal monitoring with no action taken	0	0	0
DISTRICT HOSPITAL			
Managed at this level	157	58.8	100
Lack of information	15	5.6	9.6
No avoidable factor	57	21.3	36.3
Initial assessment	28	10.5	17.8
Problem with recognition / diagnosis	48	18	30.6
Delay in referring the patient	34	12.7	21.7
Managed at inappropriate level	20	7.5	12.7
Incorrect management (Wrong diagnosis)	14	5.2	8.9
Sub-standard management (Correct diagnosis)	25	9.4	15.9
Not monitored / Infrequently monitored	9	3.4	5.7
Prolonged abnormal monitoring with no action taken	9	3.4	5.7
REGIONAL HOSPITAL			
Managed at this level	154	57.7	100
Lack of information	18	6.7	11.7
No avoidable factor	47	17.6	30.5
Initial assessment	13	4.9	8.4
Problem with recognition / diagnosis	35	13.1	22.7
Delay in referring the patient	20	7.5	13
Managed at inappropriate level	12	4.5	7.8
Incorrect management (Wrong diagnosis)	13	4.9	8.4
Sub-standard management (Correct diagnosis)	52	19.5	33.8
Not monitored / Infrequently monitored	14	5.2	9.1
Prolonged abnormal monitoring with no action taken	12	4.5	7.8
TERTIARY HOSPITAL / ABOVE			
Managed at this level	72	27	100
Lack of information	2	0.7	2.8
No avoidable factor	36	13.5	50

Description	Number	% of all cases	% of cases at level
Initial assessment	7	2.6	9.7
Problem with recognition / diagnosis	10	3.7	13.9
Delay in referring the patient	1	0.4	1.4
Managed at inappropriate level	0	0	0
Incorrect management (Wrong diagnosis)	4	1.5	5.6
Sub-standard management (Correct diagnosis)	18	6.7	25
Not monitored / Infrequently monitored	5	1.9	6.9
Prolonged abnormal monitoring with no action taken	4	1.5	5.6
PRIVATE HOSPITAL			
Managed at this level	31	11.6	100
Lack of information	3	1.1	9.7
No avoidable factor	14	5.2	45.2
Initial assessment	2	0.7	6.5
Problem with recognition / diagnosis	11	4.1	35.5
Delay in referring the patient	0	0	0
Managed at inappropriate level	0	0	0
Incorrect management (Wrong diagnosis)	4	1.5	12.9
Sub-standard management (Correct diagnosis)	5	1.9	16.1
Not monitored / Infrequently monitored	1	0.4	3.2
Prolonged abnormal monitoring with no action taken	2	0.7	6.5
Total cases	**267**		

According to the data, 54.3% of all cases were managed by community health centers, and the most common issue was ‘Problem with recognition/diagnosis’ (11.7%). Meanwhile, district hospitals managed 58.8% of all cases, and the most prevalent issue here was also a ‘Problem with recognition/diagnosis’ (30.6%).

Regional Hospitals managed 57.7% of all cases, and ‘No avoidable factor’ (30.5%) and ‘Sub-standard management/Correct diagnosis’ (33.8%) were the most common issues.

Tertiary hospitals and those above managed 27% of all cases, and half of the cases at this level had ‘No avoidable factor’, while ‘sub-standard management /Correct diagnosis) was a problem in 25% of cases.

Private Hospitals managed 11.6%of all cases, and the most common issue was ‘Problem with recognition/diagnosis’ (35.5%).

It appears that ‘Problem with recognition/diagnosis’ is the most common issue across all levels of care. This suggests that improving diagnostic accuracy and management of cases could potentially reduce maternal mortality rates.

It's also worth noting that the percentage of cases managed at each level does not necessarily reflect the quality of care at that level, as the complexity and severity of cases may vary.

The lack of information mainly was from incomplete clinical notes or files not found.

Table 16. Resuscitation related avoidable factors

Description	Number	% of cases
Lack of information	23	8.6
No avoidable factor	72	27
Airway problems	23	8.6
Breathing problems	33	12.4
Circulation problems	53	19.9
Drug problems	2	0.7
Investigation problems	4	1.5
Monitoring problems	13	4.9
Not attempted	65	24.3
Total cases	**267**	

Out of all the cases, resuscitation efforts were not assessable in 23 cases (8.6%) due to the unavailability of resuscitation information. In 72 cases (27%), despite the resuscitation efforts, the outcome could not be avoided, indicating that the situations were too critical to be reversed. In 65 cases (24%), resuscitation was not attempted, possibly due to failure to recognise the need for resuscitation or that the patient's condition was thought to be terminal.

This data suggests that while resuscitation was attempted in many cases, there were various obstacles to its success. These obstacles, such as lack of information or inherent health problems (airway, breathing, and circulation issues), highlight areas where improvements could potentially increase the success rate of resuscitation in maternal death cases. It also underscores the importance of presentative measures and early intervention to reduce the severity of complications leading to maternal deaths.

Recommendations

1. The previous recommendations from the NCCEMD Executive Summary 2017-2019 and 2020-2022 remain relevant including the following which are specific to the Free State Province. It is crucial to promptly establish a system for implementing and overseeing these recommendations. Direct engagement with Districts is necessary, to develop strategies to facilitate the execution of NCCEMD Recommendations.
2. In the realm of maternal health leadership, regional hospitals need to employ a minimum of two full-time obstetricians per hospital. Departments should not be managed by interns and community service doctors. Instead, full-time senior medical officers, who have passion and interest in gynecology and obstetrics, should be appointed.
3. Enhancements are needed in the infrastructure of all hospitals, with particular attention to Dihlabeng, Manapo, and Boitumelong Regional hospitals.
4. The health system should be fortified by improving data collection and ensuring the synchronization and accuracy of data systems including patient records.
5. Existing resources should be reallocated based on necessity. The provision of 24 hour Caesarean Section services at district hospitals, specifically at Tokollo, Albert Nzula, and Senorita Ntlabathi, is of utmost importance. This could significantly improve the health results for both mothers and their newborns.
6. It is necessary to set up outreach programmes.
7. EMS should be accessible for immediate transportation of complicated cases especially from Eastern

Free State e.g. Manapo, Phumelela and the Northern Free State hospitals to Central Hospitals.

8. Primary Health Care (PHC) in the province requires reinforcement in terms of Human Resources for Health (HRM), particularly the issue of appropriate skills mix and provision of basic essential equipment. Equitable allocation of resources should be prioritised.
9. The staff structures in all facilities must be reassessed. Norms and standards centered on Maternal health should be integrated into the Ideal Clinic and Ideal hospital Project.
10. Capacity building for all medical officers, especially for ultrasound training to prevent incorrect diagnosis of extrauterine pregnancy. There are skills deficit among medical officers. The National Department of Health (NDoH) should assist the Provincial Department of Health (DoH) by collaborating with academic Obstetrics and Gynecology and the Health Professionals Council of South Africa (HPCSA) for Exit Competency in priority programmes.
11. It is crucial to build capacity, which involves training healthcare workers on maternal healthcare and skills enhancement and creating a supportive environment for their work. The focus should be on quality care and not just quantity. ESMOE training, including the anesthesia module and ESMOE drills, is necessary.
12. Enhance the capabilities of midwives in the area of mental health. Implement mental health screenings and establish support groups for high-risk patients, as well as debriefing sessions for staff.
13. Develop province-wide protocols for dealing with organophosphate exposure during pregnancy.
14. It is important to involve EMS and pathologists to determine the accurate cause of death specifically for out-of-facility deaths. EMS training should be implemented to ensure timely reporting and avoid late reporting where someone gets buried before case investigation. Doctors should not write a notification of death without properly assessing the patient/the body.
15. Enhance collaborations with stakeholders, including General Practitioners (GPs), traditional health practitioners, and developmental supporting partners, as maternal healthcare is intricate.
16. Establish peer review evaluation teams to ensure safe Caesarean Sections and safe deliveries.
17. Keep track of the World Health Organization (WHO) Signal functions within the province.
18. At community level, establishing a connection to care is essential, and maternal health should be a central concern of an effective community healthcare programme.
19. Antenatal clients who are high risk should give birth at specified hospitals and go to high-risk postnatal clinics when necessary (Medical Obstetric Clinics).
20. Make sure that mothers and babies are given a suitable discharge plan as part of continuous care when they are discharged from any health facility. It is recommended that postnatal care should be carried out at least three times: on day three, between days 7-14, and at six weeks after birth as recommended by WHO (2).
21. The establishment of OMBU at Boitumelo, Bongani, and Pelonomi hospitals should be fast-tracked.

References

1. Municipalities of South Africa. Free State Province Overview. municipalities.co.za. Accessed [2023]. Available from: https://municipalities.co.za/
2. World Health Organization. WHO recommendations on postnatal care of the mother and newborn. World Health Organization, 2024.

Free State provincial assessors

No	Name	Position
1.	Ms M. Msasa	Advanced midwife
2.	Dr Selloane Phakisi	Advanced Midwife
3.	Dr Victor Akeke	Family physician
4.	Ms Desriee Mofokeng	Advanced Midwife
5.	Dr Kelebogile Finger- Motsepe	Medical Officer
6.	Dr Janine Lemmer-Malherbe	Specialist Anaesthetist
7.	Dr Palesa Ntaitsane	Medical Officer
8.	Ms Lulu Radebe	Advanced Midwife
9.	Ms Nanki Mpembe	Advanced Midwife
10.	Ms Sebakeng Mphirime	Advanced Midwife

No	Name	Position
11.	Ms Nokufa Nkhame	Advanced Midwife
12.	Ms Portia Ramalitse	Advanced Midwife
13.	Ms Lungile Juleka	Advanced Midwife
14.	Ms Thuliswa Sithole	Advanced Midwife
15	Ms Mpho Mofedi	Advanced Midwife
16	Ms Nelly Sebusi	Advanced Midwife
17	Dr Thando Nondabula	Obstetrician
18	Dr Matshidiso Duiker	Obstetrician
19	Mookho Kumpi	Advanced Midwife
20	Ms Emma Moloi	Advanced Midwife
21	Ms Maria Mbelekane	Advanced Midwife
22	NosimiloTowa	Advanced Midwife

8.3 Gauteng

Overview of the Province

Gauteng (Figure 1) with a population of 16 098 571 people approximately 16 million, is the smallest in land size but it is a densely populated province, followed by KwaZulu-Natal (11 million) and Western Cape (7 million). It stretches over an area of 18 178 km² or approximately 1.4% of the total surface area of South Africa, bordered by the Free State, North-West, Limpopo and Mpumalanga provinces. It is situated on the highveld and comprises of five Health Districts, ie three metropolitan municipalities and two district municipalities populated as follows: Sedibeng (966 230), West Rand (969 545), City of Ekurhuleni (4 080 699), Johannesburg (6 121 323) and Tshwane (3 860 013). Gauteng renders healthcare services to 84% of the population in the public sector and 16% in the private sector.

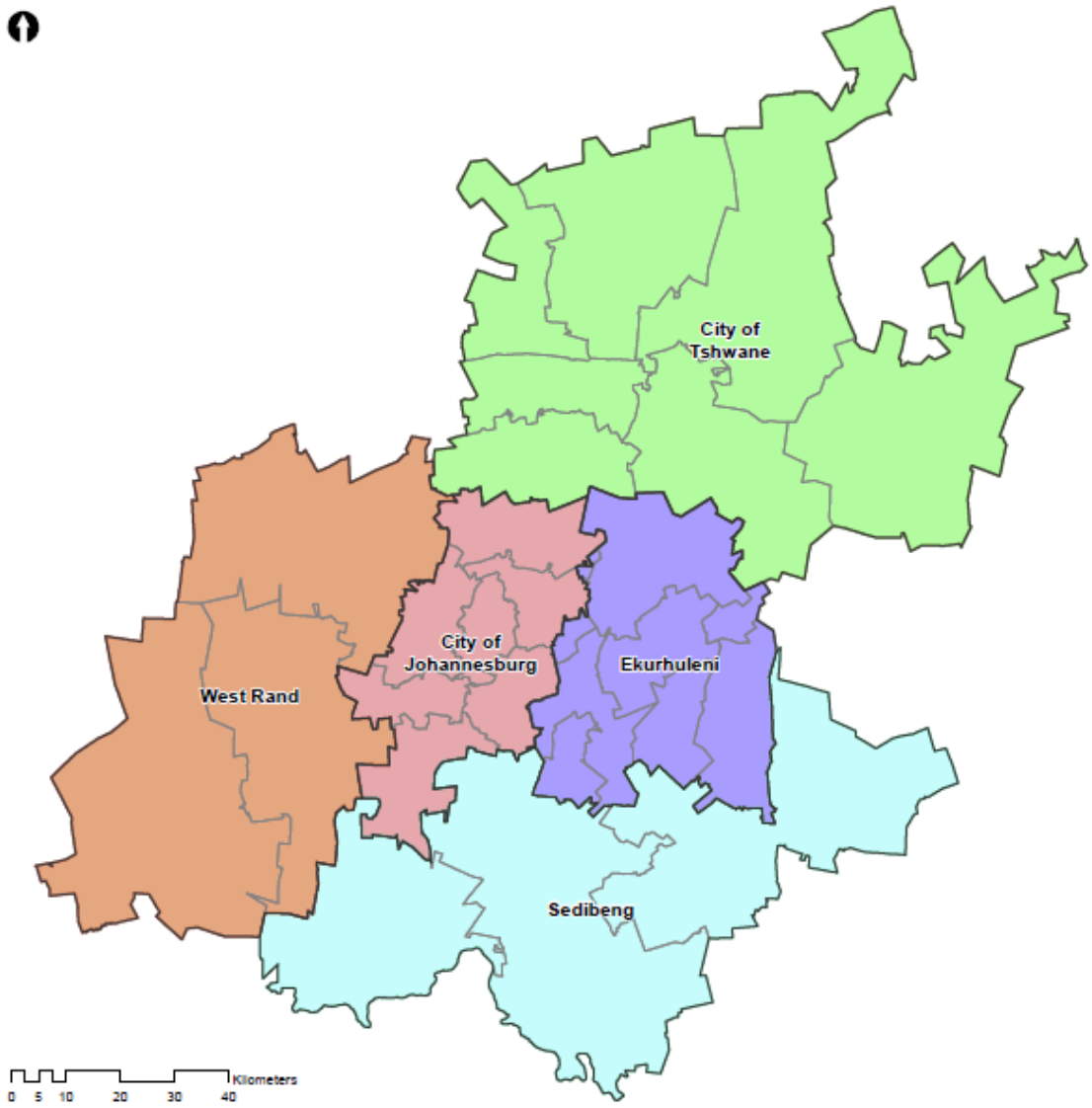


Figure 1: Map of Gauteng Province, source DHIS, 2023

Gauteng is considered the economic hub, wealthiest and highly urbanised province in the country. It is the financial hub of not only South Africa but the entire African continent. It contributes more than 35% to South Africa's Gross Domestic Product (GDP), the provincial economy grew by 7.4% in the first half of 2021 compared to the same period last year. It is home to the Johannesburg Stock Exchange, the largest stock exchange in Africa. Some of the largest companies in Africa and abroad are based in Gauteng, it also includes Pretoria, the administrative capital. It contributes heavily in the financial, manufacturing, transport, technology, and telecommunications sectors, among others. It also plays host to a large number of overseas companies

requiring a commercial base in and gateway to Africa.

Validity of data and Corrections by NCCEMD

In tables 1a and 1b, corrections are noted taking into consideration that more deaths were captured on DHIS than MAMMAs which suggest underreporting to NCCEMD, especially as the latter should include deaths outside of facilities and private deaths, which are not reported to DHIS. The correction increased the number of maternal deaths to be equivalent to those reported to DHIS, see numbers in red print. In the 2005-2027 triennium report a concern was raised about possible under reporting of maternal deaths[1]. In the 2008-2010 triennium report improved reporting was noted[2]. However, it is noted that there is misinterpretation of the definition of maternal deaths in some facilities which needs to be addressed for capturing on DHIS, eg entering of maternal deaths beyond the cutoff of 42 days postpartum.

Table 1a. Numbers of Maternal deaths (corrected)

Gauteng	Live births	MaMMAS deaths (DDCP)	MaMMAS MD	DHIS MD	MaMMAS MD (corrected)	MaMMAs iMMR	MaMMAs iMMR (corrected)	DHIS iMMR
2020	240270	260(c276)	255	271	271	106.13	112.79	112.8
2021	227182	331(c349)	323	341	341	142.18	150.10	150.1
2022	218619	216(c272)	211	266	266	96.51	121.67	121.7

Table 1b: iMMR for 32020-2022 (corrected)

2020-2022	Live births	MaMMAS MD (corrected)	MaMMAs iMMR (corrected)
gp Gauteng Province	686071	878	128.0

Numbers of Maternal deaths, iMMR and trends

Figure 1a: Trends in Gauteng maternal deaths from 1998-2022

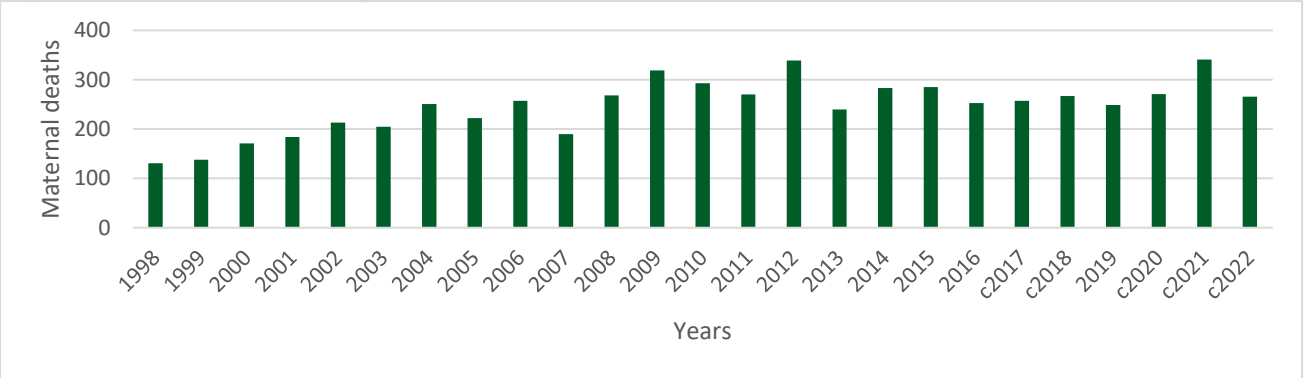
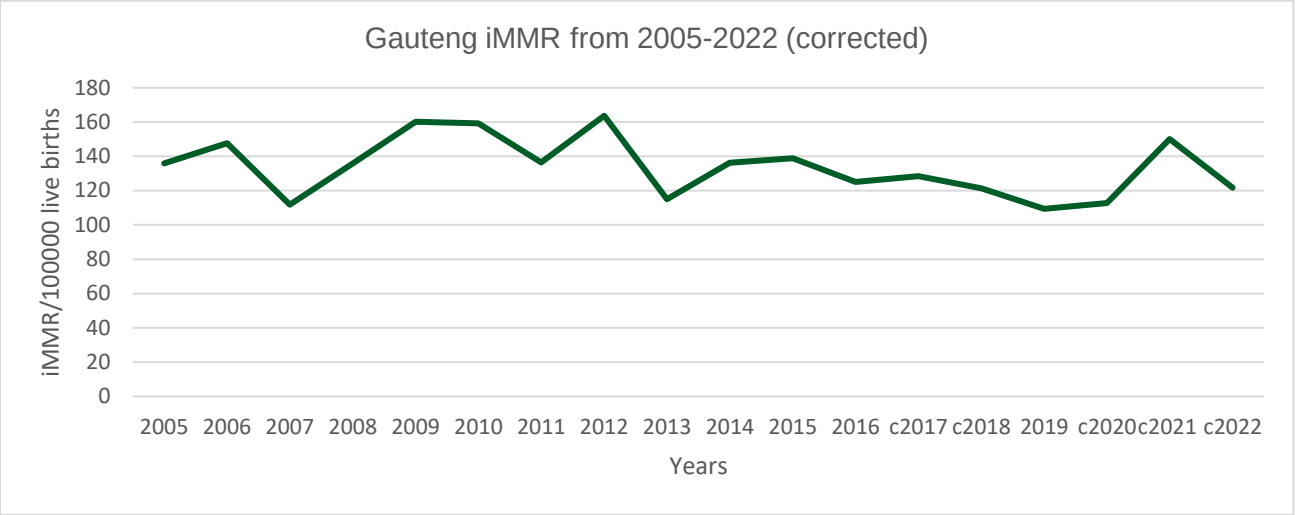


Figure 1b. Trends in Gauteng iMMR from 1998 – 2022



In Figures 1a and 1b, striking spikes in maternal deaths and iMMR are noted in 2009, 2012 and 2021 and during the 2020 – 2022 triennium. The latter increase was due to the COVID-19 pandemic which was severe in Gauteng in 2021.

Figure 2. Gauteng iMMR for 2020 – 2022 (corrected)

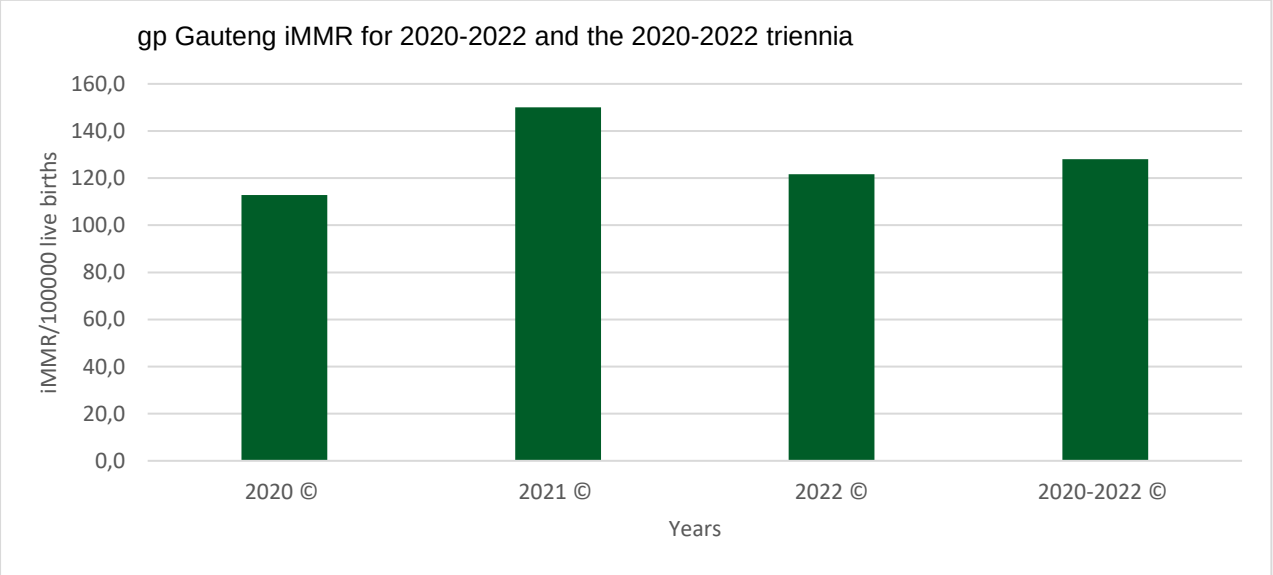
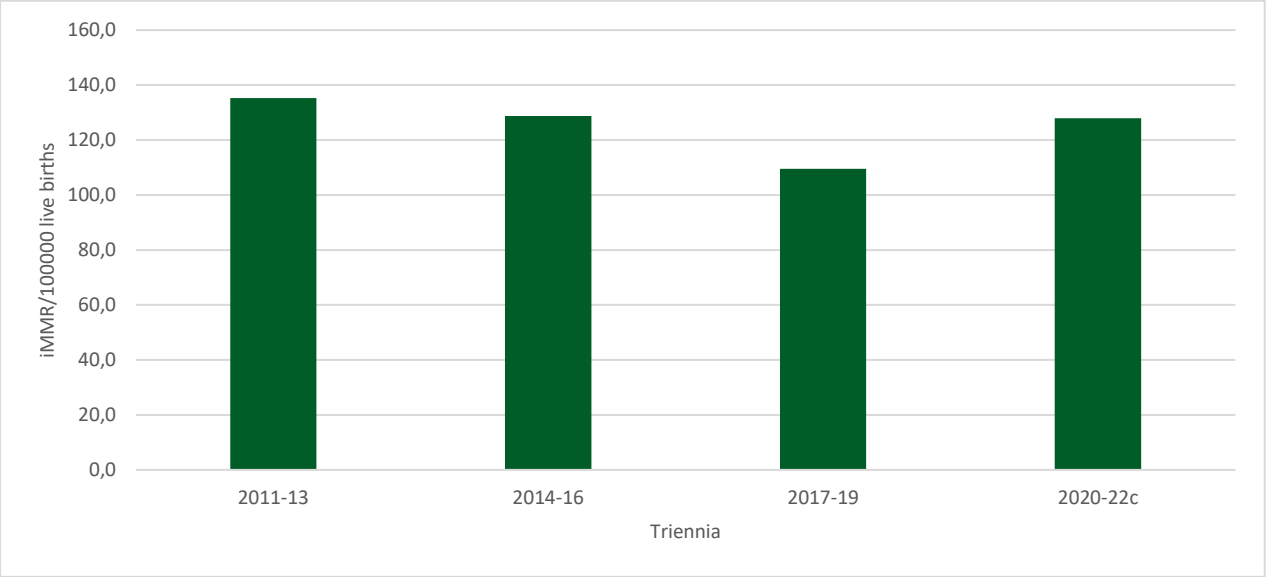


Figure 3. Comparison of iMMR over four triennia (corrected)



In the above graph comparing the four triennia, there was a significant reduction in iMMR from 2011-2013 to 2017-2019 following specific interventions in reducing maternal deaths due to non-pregnancy related infection and obstetric haemorrhage. Implementations of Saving Mothers Report recommendations contributed to the significant reduction in iMMR. A spike in maternal deaths is observed in 2020-2022 triennium due to COVID-19 pandemic and healthcare services disruption.

Causes of Maternal death, 2020-2022

The leading causes of maternal deaths were non-pregnancy relate infections (187), obstetric haemorrhage (137), hypertension (120), medical and surgical disorders (118), unknown (55) and miscarriage (49). The increase in non-pregnancy related infection was attributed to COVID-19 deaths. Tables 2 and 3.

Table 2: Primary Obstetric Causes of Maternal Deaths (uncorrected data)

Gauteng	2020	2021	2022	2020-2022
Medical and surgical disorders	37	48	33	118
Non-pregnancy-related infections	45	110	32	187
Ectopic pregnancy	9	6	11	26
Miscarriage	16	16	17	49
Pregnancy-related sepsis	15	14	11	40
Obstetric haemorrhage	50	55	32	137
Hypertension	50	38	32	120
Anaesthetic complications	2	0	5	7
Adverse drug reactions	3	1	3	7
Embolism	3	4	9	16
Acute collapse - cause unknown	5	13	9	27
Miscellaneous	0	0	0	0
Unknown	20	18	17	55
Maternal deaths	255	323	211	789
Coincidental cause	5	8	5	18
DDCP	260	331	216	807
Live births (2019)	**240270**	**227182**	**218619**	**686071**

Table 3: iMMR per causes of death per year, 2020-2022, and for the triennium

Gauteng iMMR	2020	2021	2022	2020-2022
Medical and surgical disorders	15.40	21.13	15.09	17.20
Non-pregnancy-related infections	18.73	48.42	14.64	27.26
Ectopic pregnancy	3.75	2.64	5.03	3.79
Miscarriage	6.66	7.04	7.78	7.14
Pregnancy-related sepsis	6.24	6.16	5.03	5.83
Obstetric haemorrhage	20.81	24.21	14.64	19.97
Hypertension	20.81	16.73	14.64	17.49
Anaesthetic complications	0.83	0.00	2.29	1.02
Adverse drug reactions	1.25	0.44	1.37	1.02
Embolism	1.25	1.76	4.12	2.33
Acute collapse - cause unknown	2.08	5.72	4.12	3.94
Miscellaneous	0.00	0.00	0.00	0.00
Unknown	8.32	7.92	7.78	8.02
Maternal deaths	106.13	142.18	96.51	115.00
Coincidental cause	2.08	3.52	2.29	2.62
DDCP	108.21	145.70	98.80	117.63
Live births (2019)	240270	227182	218619	686071

In Figures 4a and 4b and table 4, there is a marked increase of deaths due to non-pregnancy related infections in 2021 as compared to 2020 and a further decline to pre-COVID-19 period in 2022. A similar trend is observed for obstetric haemorrhage and medical and surgical disorders which also peaked in 2021 due to lack of access to healthcare services and overwhelmed healthcare system during the COVID-19 pandemic.

Figure 4a: iMMR per cause of death for 2020, 2021, 2022 and the whole triennium

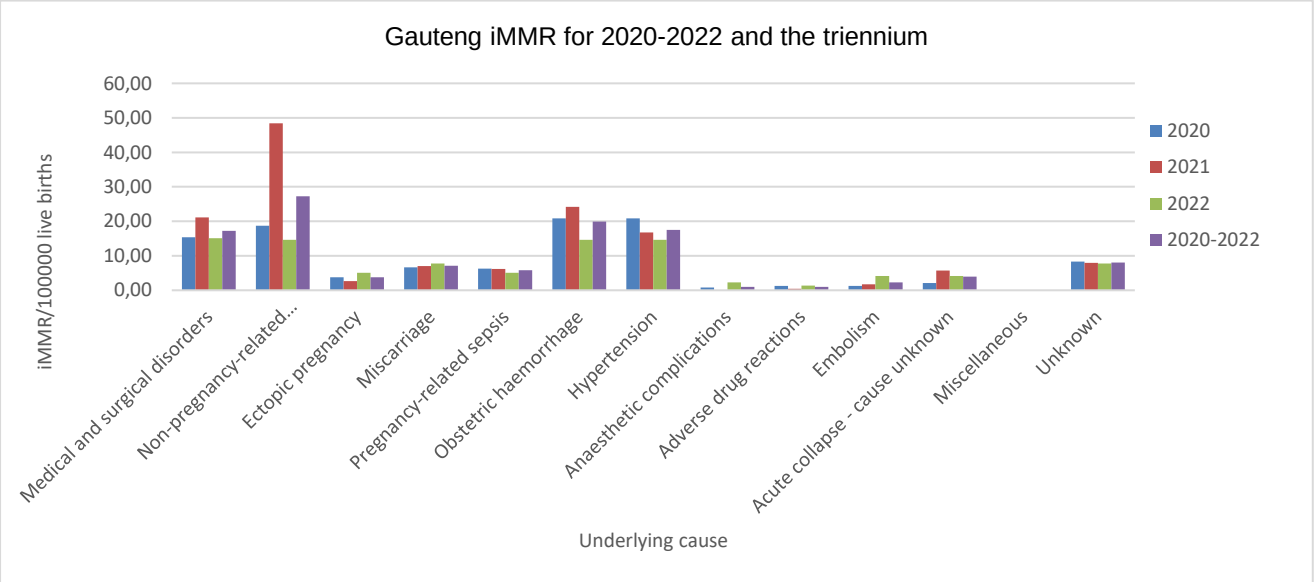
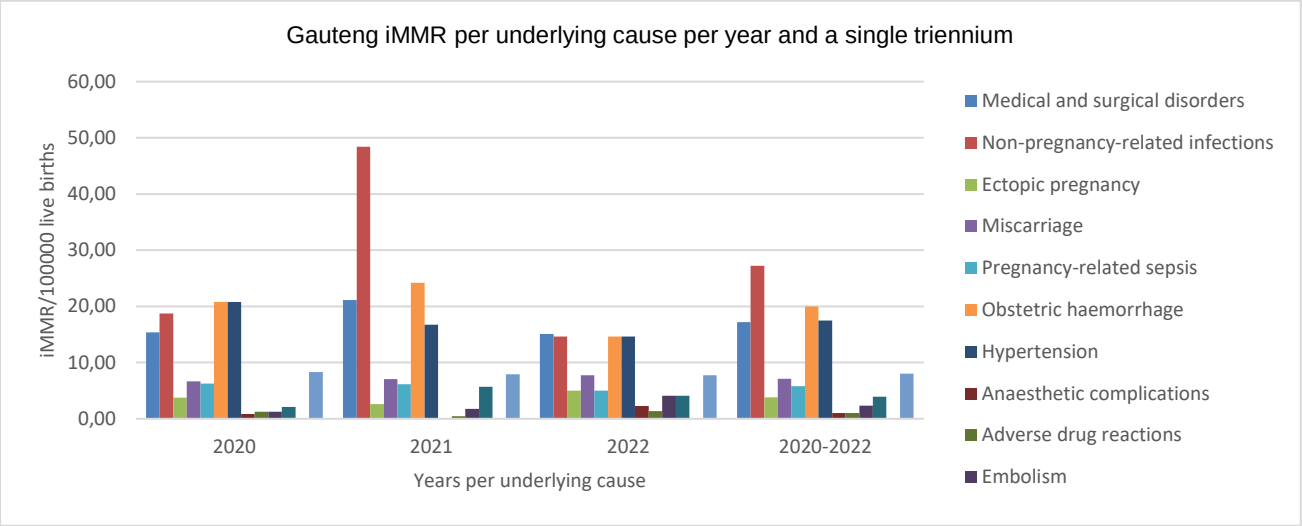


Figure 4b. Comparison of iMMR per underlying cause per year and the whole triennium



Figures 4a and b show that for the whole triennium, non-pregnancy related infections remain the leading cause of maternal deaths followed by obstetric haemorrhage and hypertension.

Table 4: Breakdown of Primary Obstetric Causes by subcategory 2020-2022

Primary obstetric problems	Gauteng
Coincidental cause	**18**
- MVA	2
- Other accidents	1
- Assault	15
- Other	
Medical and surgical disorders	**118**
- Cardiomyopathy	19
- Rheumatic heart disease	5
- Other cardiac disease	5
- Endocrine	9
- GIT	5
- CNS	9
- Respiratory	12
- Haematological	2
- Genito-urinary	1
- Suicide	4
- Substance abuse	
- Other psychiatric disease	1
- Neoplasm	15
- Auto-immune	2
- Other	29
Non-pregnancy-related infections	**187**
- PCP pneumonia	25
- Other pneumonia	21
- TB	20
- UTI	
- Appendicitis	3
- Malaria	
- Cryptococcal meningitis	1
- Other meningitis	4
- Kaposi's sarcoma	2
- Toxoplasmosis	

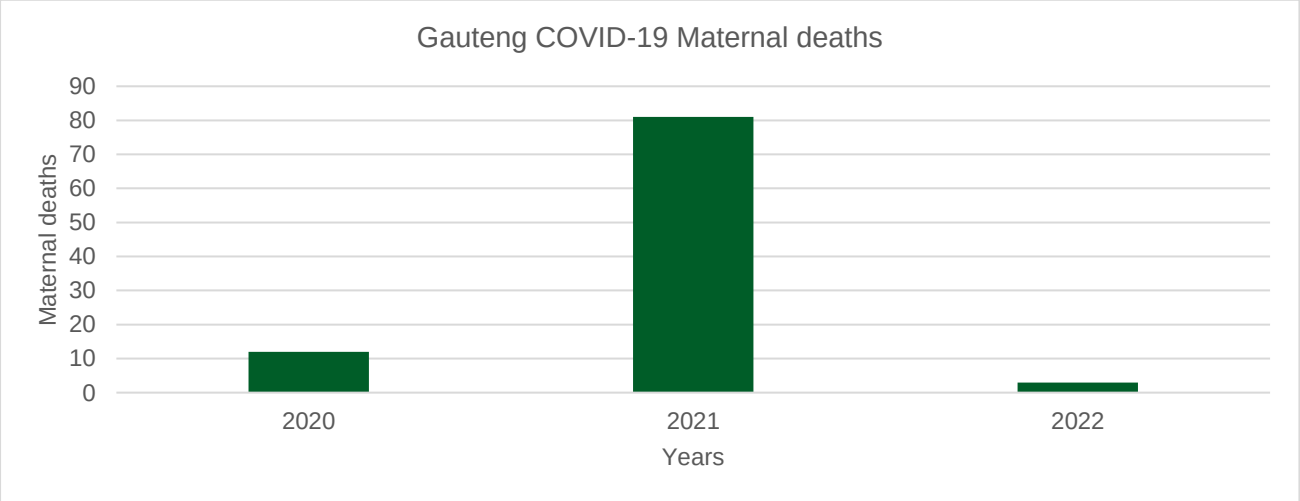
Primary obstetric problems	Gauteng
- Hepatitis	1
- Gastroenteritis	
- Wasting syndrome	4
- Other	106
Ectopic pregnancy	**26**
- Less than 20 weeks	22
- More than 20 weeks (extrauterine pregnancy)	4
Miscarriage	**49**
- Septic miscarriage	29
- Haemorrhage (non-traumatic)	8
- Uterine trauma	4
- GTD	7
- Following legal TOP	1
Pregnancy-related sepsis	**40**
- Chorioamnionitis (ruptured membranes)	3
- Chorioamnionitis (intact membranes)	1
- Puerperal sepsis after NVD	13
- Puerperal sepsis after CD	21
- Bowel trauma at CD	2
Obstetric haemorrhage	**137**
- Abruption with hypertension	12
- Abruption without hypertension	5
- Placenta praevia	6
- Other APH not specified	2
- Ruptured uterus with previous CD	9
- Ruptured uterus without previous CD	11
- Uterine atony after vaginal delivery	15
- Vaginal trauma after vaginal delivery	4
- Cervical trauma after vaginal delivery	4
- Retained placenta after NVD (morb adherent)	2
- Retained placenta after NVD (not adherent)	5
- Inverted uterus after vaginal delivery	
- Other PPH not specified after vaginal delivery	5
- Bleeding during CD (morbidly adherent placenta)	10
- Bleeding during CD (not adherent placenta)	11
- Bleeding after Caesarean delivery	36
Hypertension	**120**
- Chronic hypertension	6
- Gestational hypertension	5
- Pre-eclampsia with severe features	25
- Pre-eclampsia without severe features	6
- Eclampsia	61
- HELLP	14
- Liver rupture	3
Anaesthetic complications	**7**
- General anaesthetic	2
- Spinal anaesthetic	5
Adverse drug reactions	**7**
- ARV medication	2
- TB medication	
- Other medication	3
- Herbal medication	2
Embolism	**16**

Primary obstetric problems	Gauteng
- Pulmonary embolism	14
- Amniotic fluid embolism	2
Acute collapse - cause unknown	**27**
Miscellaneous	0
- Hyperemesis gravidarum	
- Acute fatty liver	
Unknown	**55**
- Death at home or outside health services	29
- No primary cause found	6
- Lack of information	20
Total:	**807**

Table 5: Gauteng COVID-19 maternal deaths

COVID-19 maternal deaths	Gauteng
2020	12
2021	81
2022	3
2020-2022	**96**

Figure 5: Gauteng COVID-19 maternal deaths in 2020, 2021 and 2022



In Table 4 COVID-19 contributed to most deaths from non-pregnancy related infections (classified as 'other'), and caesarean delivery contributed the most to obstetric haemorrhage category. It is noted that eclampsia remains the leading cause of death in hypertensive disorders of pregnancy. Tables 5 and Figure 5, show that there was a rise in COVID-19 related deaths in 2021 as COVID-19 infections increased.

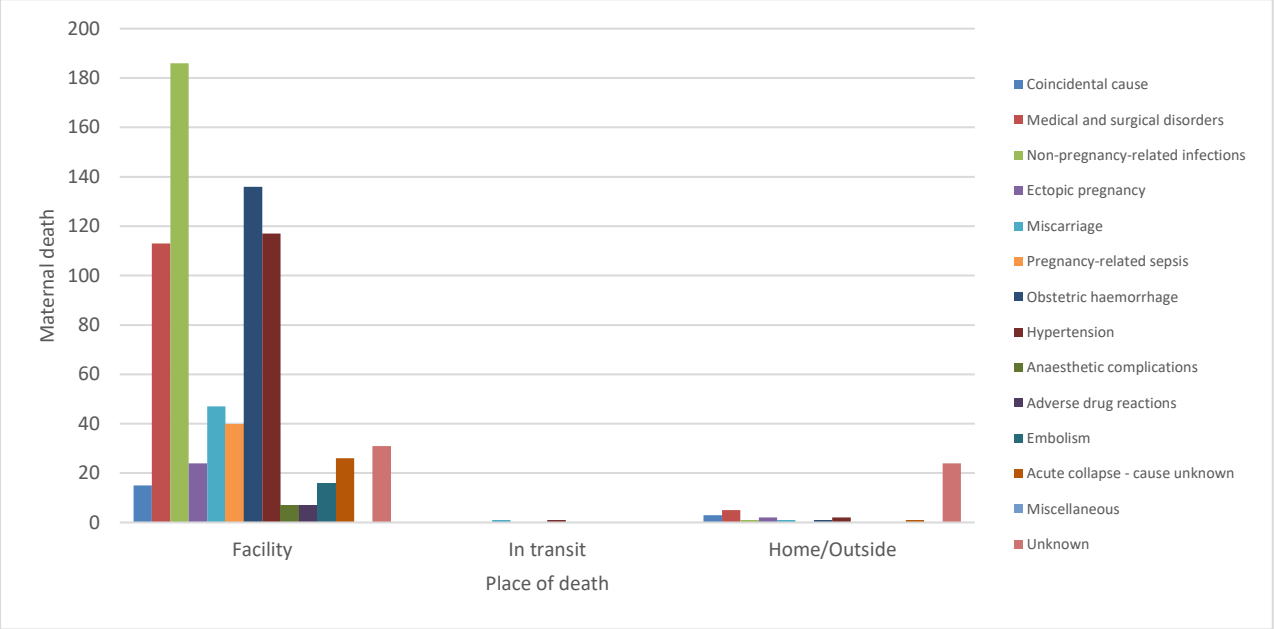
Table 6: Place of death and level of care

Primary obstetric problems	Facility	In transit	Home/Outside	Total
Coincidental cause	15	0	3	18
Medical and surgical disorders	113	0	5	118
Non-pregnancy-related infections	186	0	1	187
Ectopic pregnancy	24	0	2	26
Miscarriage	47	1	1	49
Pregnancy-related sepsis	40	0	0	40
Obstetric haemorrhage	136	0	1	137

Primary obstetric problems	Facility	In transit	Home/Outside	Total
Hypertension	117	1	2	120
Anaesthetic complications	7	0	0	7
Adverse drug reactions	7	0	0	7
Embolism	16	0	0	16
Acute collapse - cause unknown	26	0	1	27
Miscellaneous	0	0	0	0
Unknown	31	0	24	55
Total	**765**	**2**	**40**	**807**

Table 6 shows that the greatest number of deaths occurred in health facilities.

Figure 6: Number of Maternal deaths per place of death and underlying cause



In the above graph, most deaths occurred at the health facility and the main cause of death was non-pregnancy related infections related to COVID-19 pneumonia.

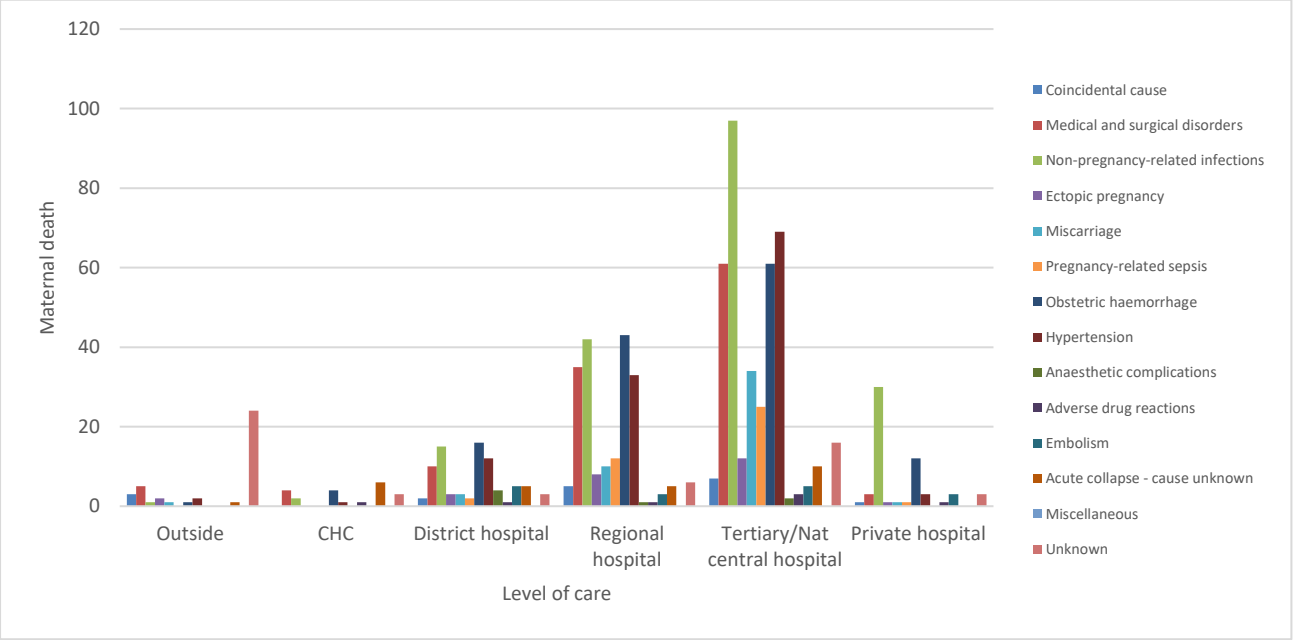
Table 7: Maternal deaths per level of care and underlying cause

Primary obstetric problem	Outside	CHC	District hospital	Regional hospital	Tertiary/Nat central hospital	Private hospital	Total
Coincidental cause	3	0	2	5	7	1	18
Medical and surgical disorders	5	4	10	35	61	3	118
Non-pregnancy-related infections	1	2	15	42	97	30	187
Ectopic pregnancy	2	0	3	8	12	1	26
Miscarriage	1	0	3	10	34	1	49
Pregnancy-related sepsis	0	0	2	12	25	1	40
Obstetric haemorrhage	1	4	16	43	61	12	137
Hypertension	2	1	12	33	69	3	120
Anaesthetic complications	0	0	4	1	2	0	7
Adverse drug reactions	0	1	1	1	3	1	7

Primary obstetric problem	Outside	CHC	District hospital	Regional hospital	Tertiary/Nat central hospital	Private hospital	Total
Embolism	0	0	5	3	5	3	16
Acute collapse - cause unknown	1	6	5	5	10	0	27
Miscellaneous	0	0	0	0	0	0	0
Unknown	24	3	3	6	16	3	55
Total	**40**	**21**	**81**	**204**	**402**	**59**	**807**

In Table 7 and Figure 7, the majority of women died from non-pregnancy related infections, mainly COVID-19 pneumonia and that the deaths occurred at the appropriate level of care.

Figure 7: Maternal deaths per level of care, per underlying cause for the 2020 – 2022 triennia



The greatest number of women died at the appropriate level of care but there was shortage of staff as the doctors and nurses became sick, some died due to COVID-19 pandemic; and the healthcare system was overwhelmed and overburdened. No staffing norms are available for Obstetrics and Gynaecology departments. There were transport challenges for mothers due to lock down as permits were needed for travelling due to COVID-19 restrictions.

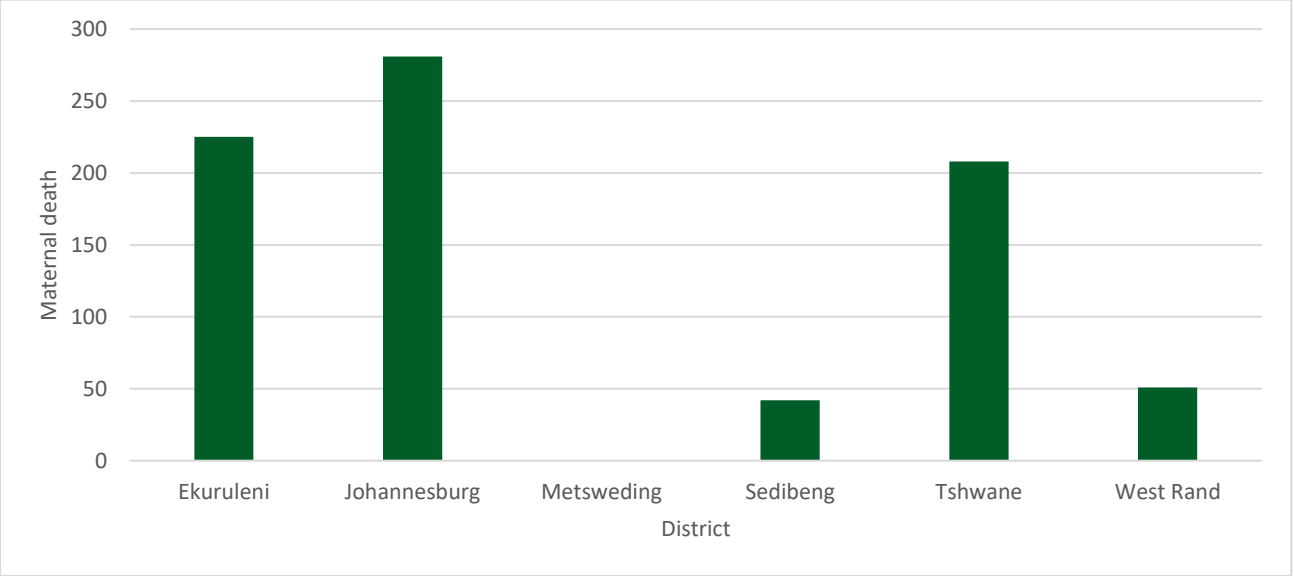
Table 8: Primary obstetric causes per Health District for 2020-2022

Primary obstetric problems	Ekurhuleni	Johannesburg	Metsweding	Sedibeng	Tshwane	West Rand	Total
Coincidental cause	6	5	0	1	4	2	18
Medical and surgical disorders	32	50	0	5	28	3	118
Non-pregnancy-related infections	44	68	0	7	59	9	187
Ectopic pregnancy	8	5	0	4	9	0	26
Miscarriage	27	14	0	0	7	1	49
Pregnancy-related sepsis	8	19	0	1	8	4	40
Obstetric haemorrhage	38	38	0	9	41	11	137
Hypertension	33	37	0	8	31	11	120
Anaesthetic complications	1	2	0	1	1	2	7

Primary obstetric problems	Ekurhuleni	Johannesburg	Metsweding	Sedibeng	Tshwane	West Rand	Total
Adverse drug reactions	1	5	0	0	0	1	7
Embolism	7	2	0	2	4	1	16
Acute collapse	8	14	0	2	1	2	27
Miscellaneous	0	0	0	0	0	0	0
Unknown	12	22	0	2	15	4	55
Total	**225**	**281**	**0**	**42**	**208**	**51**	**807**

In the above table, most deaths occurred in the three metropolitan areas, namely Ekurhuleni, Johannesburg and Tshwane Health District with Johannesburg taking the lead followed by Ekurhuleni and Tshwane. All these three Health Districts are metropolitan areas and highly populated providing quaternary level of care to the rest of the province and to the other bordering provinces. The causes of deaths are related to non-pregnancy related deaths in all three respectively.

Figure 8: Total maternal deaths per Health District for the 2020 – 2022 triennium



In the above graph, the three metropolitan areas, which are also Health District in the province, namely Johannesburg, Ekurhuleni and Tshwane have recorded the greatest number of deaths respectively. Figure 9 shows that the most frequent cause of death in these three metropoles were non-pregnancy related infections.

Figure 9: Gauteng maternal deaths per Health District and per underlying cause for the 2020 – 2022 triennium

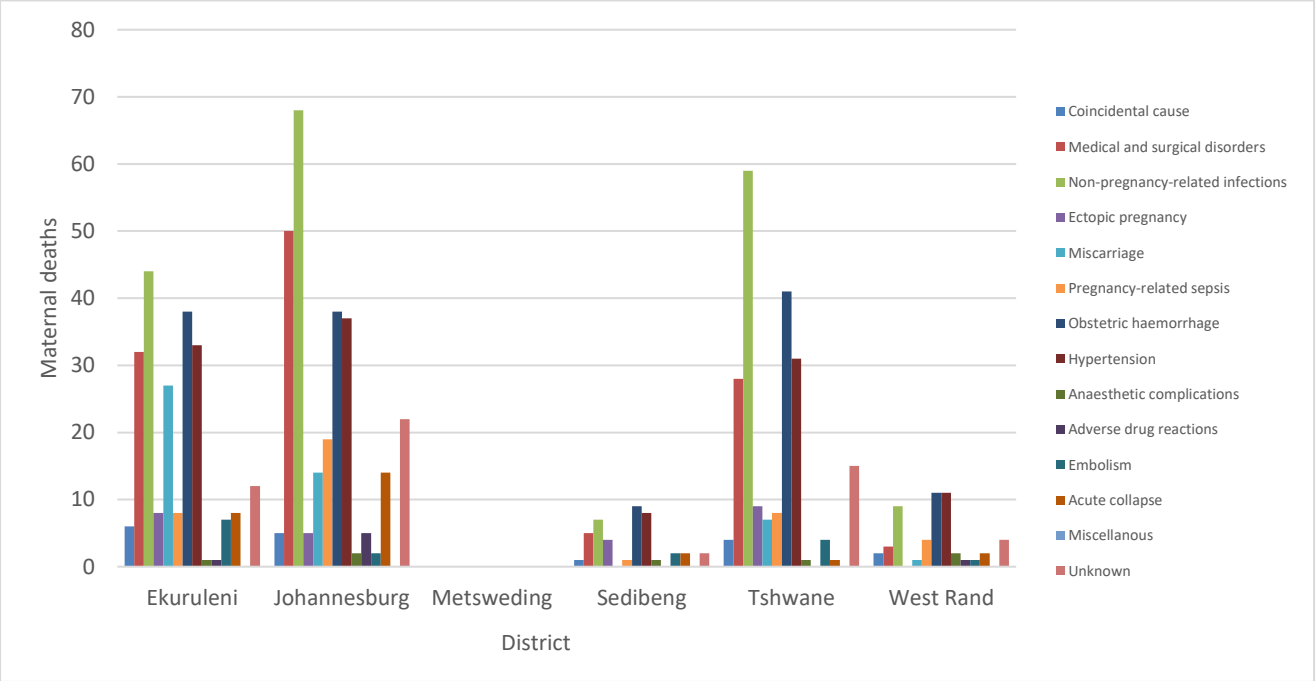


Table 9: Primary obstetric problem per maternal age

Primary obstetric problem	10 - 14	15-19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	Outside 10-44 range & unknown	Total
Coincidental cause		3	7	2	5	1	0	0	18
Medical and surgical disorders		8	14	28	27	29	11	1	118
Non-pregnancy-related infections		4	21	35	66	47	13	1	187
Ectopic pregnancy		1	0	8	8	4	4	1	26
Miscarriage		5	6	14	15	5	4	0	49
Pregnancy-related sepsis		1	7	10	5	14	3	0	40
Obstetric haemorrhage	1	4	8	33	42	39	7	3	137
Hypertension		8	14	30	30	27	9	2	120
Anaesthetic complications		1	1	2	2	1	0	0	7
Adverse drug reactions		1	0	1	1	2	2	0	7
Embolism		1	2	1	6	5	1	0	16
Acute collapse - cause unknown		1	3	8	8	4	3	0	27
Miscellaneous		0	0	0	0	0	0	0	0
Unknown		2	14	6	15	13	5	0	55
Total	**1**	**40**	**97**	**178**	**230**	**191**	**62**	**8**	**807**

In Tables 9 and Figure 10, the greatest number of women that are dying are between the ages 30 – 34 and the leading causes of deaths being non-pregnancy related, followed by obstetric hemorrhage and hypertension.

Figure 10: Gauteng maternal deaths per age and underlying cause for the 2020 – 2022 triennium

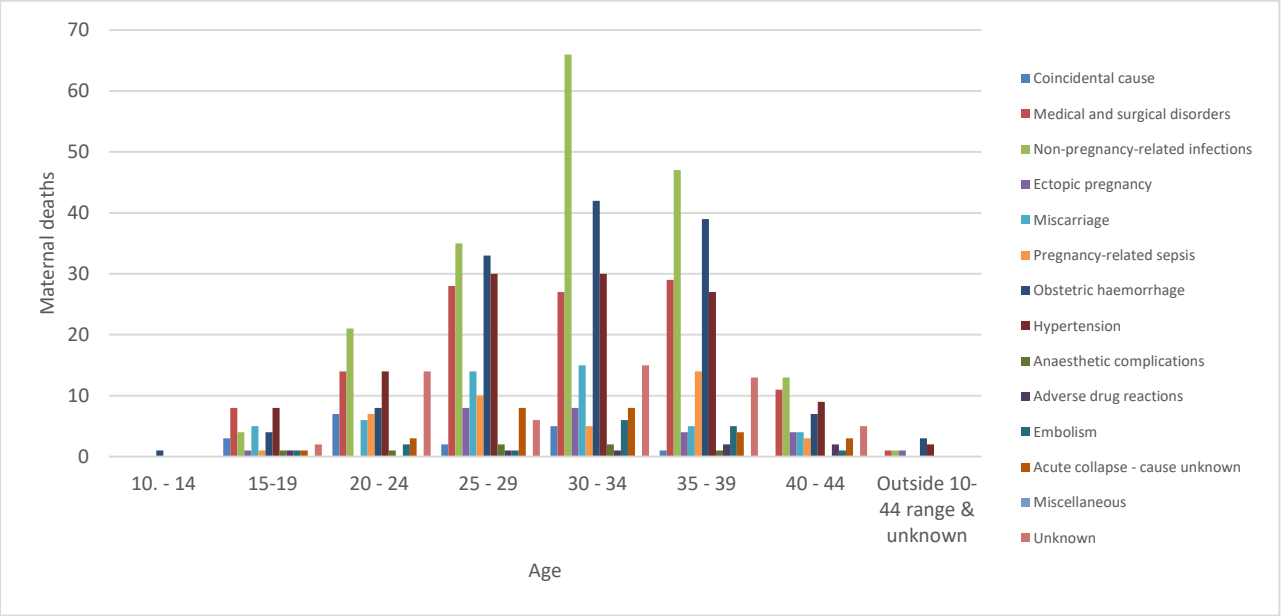


Table 10: Primary obstetric problems per delivery route

Primary obstetric problems	Vaginal	CD	CHC CD	DH CD	RH CD	TH/NCH CD	Pvt CD
Coincidental cause	1	3	0	0	0	3	0
Medical and surgical disorders	28	44	1	2	13	29	3
Non-pregnancy-related infections	34	67	1	4	11	35	20
Ectopic pregnancy	18	19	1	4	7	9	2
Miscarriage	3	2	0	0	1	1	0
Pregnancy-related sepsis	14	26	0	0	8	17	1
Obstetric haemorrhage	45	83	0	6	29	37	11
Hypertension	16	69	2	7	23	40	5
Anaesthetic complications	0	7	0	4	1	2	0
Adverse drug reactions	1	3	0	1	0	1	1
Embolism	3	7	0	1	1	3	2
Acute collapse - cause unknown	5	10	0	2	3	5	0
Miscellaneous	0	0	0	0	0	0	0
Unknown	18	12	2	2	5	4	3
Total	**186**	**352**	**7**	**33**	**102**	**186**	**48**

In the above table, the greatest number of women died post caesarean delivery.

Table 11: Primary obstetric problems per HIV status

Primary obstetric problems	Negative	Positive	Declined test	Unknown	Total
Coincidental cause	4	5	0	9	18
Medical and surgical disorders	65	37	0	16	118
Non-pregnancy-related infections	67	103	0	17	187
Ectopic pregnancy	5	11	0	10	26
Miscarriage	15	12	0	22	49

Primary obstetric problems	Negative	Positive	Declined test	Unknown	Total
Pregnancy-related sepsis	11	24	0	5	40
Obstetric haemorrhage	82	45	0	10	137
Hypertension	77	22	0	21	120
Anaesthetic complications	6	1	0	0	7
Adverse drug reactions	2	5	0	0	7
Embolism	8	4	0	4	16
Acute collapse - cause unknown	15	6	0	6	27
Miscellaneous	0	0	0	0	0
Unknown	26	14	0	15	55
Total:	**383**	**289**	**0**	**135**	**807**

In the above table, the greatest number of women that died were HIV negative.

Table 12: Primary obstetric problems per postmortem results

Primary obstetric problems	Postmortem	Not done
Coincidental cause	10	8
Medical and surgical disorders	38	80
Non-pregnancy-related infections	30	157
Ectopic pregnancy	10	16
Miscarriage	12	37
Pregnancy-related sepsis	14	26
Obstetric haemorrhage	63	74
Hypertension	43	77
Anaesthetic complications	4	3
Adverse drug reactions	2	5
Embolism	8	8
Acute collapse - cause unknown	19	8
Miscellaneous	0	0
Unknown	24	31
Total:	**277**	**530**

This table shows that most maternal deaths did not have a postmortem; this was in part due to the COVID-19 pandemic restrictions on performing them.

Table 13: Final cause of death

Cause of death	Number	% of total
Circulatory system	311	38.9
- Hypovolaemic shock	187	23.4
- Septic shock	124	15.5

Cause of death	Number	% of total
Respiratory failure	266	33.3
- Respiratory failure	266	33.3
Cardiac failure	90	11.3
- Pulmonary oedema	90	11.3
Embolism	41	5.1
- Acute collapse due to embolism	41	5.1
Renal failure	85	10.6
- Renal failure	85	10.6
Liver failure	47	5.9
- Liver failure	47	5.9
Cerebral complications	118	14.8
- Intracranial haemorrhage	51	6.4
- Cerebral oedema resulting in coning	11	1.4
- Meningitis	7	0.9
- Cerebral emboli	4	0.5
- Brain death following hypoxic event	33	4.1
- Unspecified	12	1.5
Metabolic	165	20.6
- Maternal ketoacidosis	34	4.3
- Electrolyte imbalance	33	4.1
- Thyroid crisis	5	0.6
- Lactic acidosis	83	10.4
- Other	10	1.3
Haematological	180	22.5
- DIC	103	12.9
- Severe anaemia	77	9.6
Immune system	75	9.4
- Immune system failure	75	9.4
Unknown	82	10.3
- Home death	36	4.5
- Unknown	46	5.8
Other	92	11.5
- Other	92	11.5
Total deaths	**800**	

Respiratory problems were the leading and final cause in the greatest number of maternal deaths, related to COVID-19 related infections, mainly pneumonia.

Avoidable Factors

Table 14: Patient related avoidable factors

	Number	% of total	% of cases at this level
PATIENT ORIENTED PROBLEMS			
- Avoidable factors identified	329	40.8	
- No avoidable factors	389	48.2	
- Lack of information	109	13.5	
ADMINISTRATIVE PROBLEMS			
- Avoidable factors identified	310	38.4	
- No avoidable factors	418	51.8	
- Lack of information	95	11.8	
RESUSCITATION PROBLEMS			
- Avoidable factors identified	281	34.8	
- No avoidable factors	454	56.3	
- Lack of information	78	9.7	
MEDICAL CARE - CHC			
- Managed at this level	253	31.4	
- Avoidable factors identified	55		21.7
- No avoidable factors	177		70.0
- Lack of information	23		9.1
MEDICAL CARE - DISTRICT HOSPITAL			
- Managed at this level	164	20.3	
- Avoidable factors identified	77		47.0
- No avoidable factors	71		43.3
- Lack of information	23		14.0
MEDICAL CARE - REGIONAL HOSPITAL			
- Managed at this level	256	31.7	
- Avoidable factors identified	113		44.1
- No avoidable factors	124		48.4
- Lack of information	24		9.4
MEDICAL CARE - TERTIARY & ABOVE			
- Managed at this level	402	49.8	
- Avoidable factors identified	177		44.0
- No avoidable factors	200		49.8
- Lack of information	37		9.2
MEDICAL CARE - PRIVATE HOSPITAL			
- Managed at this level	78	9.7	
- Avoidable factors identified	28		35.9
- No avoidable factors	40		51.3
- Lack of information	12		15.4
TIMING OF EMERGENCY			
- Early pregnancy	130	16.1	
- Antenatal period: 20w +	327	40.5	
- Intrapartum period	66	8.2	
- Postpartum period	284	35.2	
- Anaesthesia	21	2.6	
TIMING OF DEATH			
- Early pregnancy	101	12.5	
- Antenatal period: 20w +	150	18.6	
- Intrapartum period	25	3.1	
- Postpartum period	508	62.9	
- Anaesthesia	23	2.9	

	Number	% of total	% of cases at this level
IMPACT OF SUBOPTIMAL CARE			
- No suboptimal care identified	372	46.1	
- Suboptimal care, no impact on outcome	47	5.8	
- Suboptimal care, possible impact on outcome	232	28.7	
- Suboptimal care, probable impact on outcome	156	19.3	
Total:	**807**		

In the above table, it is demonstrated that 48% of maternal deaths were potentially preventable by the health system.
Patient related factors were present for 40.8% and administrative factors for 38.4% of maternal deaths.

Table 15. Patient /Community Orientated avoidable factors

Description	Number	% of cases
Lack of information	109	13.5
No avoidable factor	389	48.2
No antenatal care	110	13.6
Infrequent antenatal care	35	4.3
Delay in accessing medical help	185	22.9
Declined medication/surgery/advice	34	4.2
Family problem	5	0.6
Community problem	1	0.1
Unsafe abortion	12	1.5
Other	39	4.8
Total cases	**807**	

In the above table, delayed in accessing care was the most common problem, which suggests delay in the decision to seek care.

Table 16: Administrative related avoidable factors

Description	Number	% of cases
Lack of information	95	11.8
No avoidable factor	418	51.8
Transport problem: Home to institution	4	0.5
Transport problem: Institution to institution	19	2.4
Lack of accessibility: Barriers to entry	3	0.4
Lack of accessibility: Other	1	0.1
Delay in attending to patient (Overburdened service)	50	6.2
Delay in attending to patient (Reason unknown)	25	3.1
Lack of healthcare facilities: ICU	104	12.9
Lack of healthcare facilities: Blood/blood products	18	2.2
Lack of healthcare facilities: Other	23	2.9
Inadequate numbers of staff on duty	25	3.1
Appropriate skill not available on site / on standby	28	3.5

Description	Number	% of cases
Communication problems: Technical	8	1
Communication problems: Interpersonal	9	1.1
Other	60	7.4
Total cases	**807**	

In the above table, no avoidable administrative factors were found for 418 deaths, but of note 104 were related to lack of healthcare facilities.

Table 17. Medical Care related avoidable factors

Description	Number	% of all cases	% of cases at level
COMMUNITY HEALTH CENTRE			
Managed at this level	253	31.4	100
Lack of information	23	2.9	9.1
No avoidable factor	177	21.9	70
Initial assessment	23	2.9	9.1
Problem with recognition / diagnosis	23	2.9	9.1
Delay in referring the patient	11	1.4	4.3
Managed at inappropriate level	2	0.2	0.8
Incorrect management (Wrong diagnosis)	6	0.7	2.4
Sub-standard management (Correct diagnosis)	9	1.1	3.6
Not monitored / Infrequently monitored	3	0.4	1.2
Prolonged abnormal monitoring with no action taken	4	0.5	1.6
DISTRICT HOSPITAL			
Managed at this level	164	20.3	100
Lack of information	23	2.9	14
No avoidable factor	71	8.8	43.3
Initial assessment	17	2.1	10.4
Problem with recognition / diagnosis	33	4.1	20.1
Delay in referring the patient	16	2	9.8
Managed at inappropriate level	14	1.7	8.5
Incorrect management (Wrong diagnosis)	7	0.9	4.3
Sub-standard management (Correct diagnosis)	31	3.8	18.9
Not monitored / Infrequently monitored	11	1.4	6.7
Prolonged abnormal monitoring with no action taken	5	0.6	3
REGIONAL HOSPITAL			
Managed at this level	256	31.7	100
Lack of information	24	3	9.4
No avoidable factor	124	15.4	48.4
Initial assessment	23	2.9	9
Problem with recognition / diagnosis	48	5.9	18.8
Delay in referring the patient	5	0.6	2
Managed at inappropriate level	4	0.5	1.6
Incorrect management (Wrong diagnosis)	16	2	6.3
Sub-standard management (Correct diagnosis)	44	5.5	17.2
Not monitored / Infrequently monitored	21	2.6	8.2
Prolonged abnormal monitoring with no action taken	23	2.9	9
TERTIARY HOSPITAL / ABOVE			
Managed at this level	402	49.8	100
Lack of information	37	4.6	9.2
No avoidable factor	200	24.8	49.8
Initial assessment	25	3.1	6.2

Description	Number	% of all cases	% of cases at level
Problem with recognition / diagnosis	59	7.3	14.7
Delay in referring the patient	4	0.5	1
Managed at inappropriate level	1	0.1	0.2
Incorrect management (Wrong diagnosis)	16	2	4
Sub-standard management (Correct diagnosis)	95	11.8	23.6
Not monitored / Infrequently monitored	19	2.4	4.7
Prolonged abnormal monitoring with no action taken	16	2	4
PRIVATE HOSPITAL			
Managed at this level	78	9.7	100
Lack of information	12	1.5	15.4
No avoidable factor	40	5	51.3
Initial assessment	7	0.9	9
Problem with recognition / diagnosis	16	2	20.5
Delay in referring the patient	1	0.1	1.3
Managed at inappropriate level	1	0.1	1.3
Incorrect management (Wrong diagnosis)	3	0.4	3.8
Sub-standard management (Correct diagnosis)	16	2	20.5
Not monitored / Infrequently monitored	1	0.1	1.3
Prolonged abnormal monitoring with no action taken	5	0.6	6.4
Total cases	**807**		

In the above table, problem recognition and substandard care remain the most commonly cited factors at all levels of care.

Table 18. Resuscitation related avoidable factors

Description	Number	% of cases
Lack of information	78	9.7
No avoidable factor	454	56.3
Airway problems	44	5.5
Breathing problems	77	9.5
Circulation problems	93	11.5
Drug problems	4	0.5
Investigation problems	5	0.6
Monitoring problems	12	1.5
Not attempted	73	9
Total cases	**807**	

In the above table, the greatest number of maternal deaths (454) had no avoidable factors suggesting that they were admitted already in a serious medical condition. In seventy-three of these deaths resuscitation was not attempted.

Conclusion and Recommendation

The department has established a Task Team to develop the **policy on the establishment of Onsite Midwife-led Birthing Units (OMBUs)** and conducted the provincial health summit to address skills gap on management of the top two causes of maternal death, **obstetric haemorrhage** and **hypertensive disorders of pregnancy with introduction of the Maternal Quality Standards (MQS) for management of hypertension in pregnancy at the primary healthcare level**. In increasing awareness on the availability of and as a strategy in social mobilisation, the province developed a **poster on the addresses of all termination of pregnancy**

healthcare facilities. In efforts to reduce the number of low-risk deliveries at the national central hospitals a consultative workshop on the functionality of **Midwife-Obstetric Units (MOUs)** was held with **Operational Managers**. The health-soft-cross-border areas as a challenge is being addressed by the introduction of the **Health-Soft-Cross-Border Forums**.

It has been recommended that increase in access to safe termination of pregnancy will contribute reduced number of maternal deaths due to septic abortion and all **Community Health Centres (CHCs)** must be able to provide **medical abortion.** Also, strengthening the maternal death reporting system will improve the notification of maternal deaths as per the definition for the purpose of recording to the DHIS and NCCEMD. A report on hospitals' compliance with Minimum Standards for Safe Caesarean Delivery is being finalised. It is also recommended that the province must continue to implement the **16+ WHO key interventions**.

References

1. Saving Mothers: Fourth Report on Confidential Enquiries into Maternal Deaths in South Africa; 2005-2007 p259
2. Saving Mothers: Fifth Report on Confidential Enquiries into Maternal Deaths in South Africa; 2008 - 2010 p220

Gauteng provincial assessors

No.	Title	Name and surname
1	Advanced Midwife / Midwife Specialist (ADM)	Sikhonjiwe Masilela (Mr)
2	Advanced Midwife / Midwife Specialist (ADM)	Rebecca Makau (Ms)
3	Advanced Midwife / Midwife Specialist (ADM)	Mary Makgotlhoe (Ms)
4	Dr (Obstetric and Gynaecologist)	Opai Tetteh
5	Professor (Obstetric and Gynaecologist)	Shastra Bhoora
6	Dr (Obstetric and Gynaecologist)	Felicia Molokoane
7	Dr (Obstetric and Gynaecologist)	A.M Muse
8	Dr (Obstetric and Gynaecologist)	Siphiwo Gqamlana
9	Advanced Midwife / Midwife Specialist (ADM)	Mary Kgarabyae (Ms)
10	Advanced Midwife / Midwife Specialist (ADM)	Pheeha Kgorane (Ms)
11	Advanced Midwife / Midwife Specialist (ADM)	Zolisa Notyilana (Ms)
12	Professor (Obstetric and Gynaecologist)	Tshililo Mashamba
13	Dr (Obstetric and Gynaecologist)	Makgobane Ramogale-Zungu
14	Dr (Obstetric and Gynaecologist)	Daphney Focus-Amoah
15	Advanced Midwife / Midwife Specialist (ADM)	Refilwe Malatji (Ms)
16	Advanced Midwife / Midwife Specialist (ADM)	Tato Josephine Nyembe
17	Advanced Midwife / Midwife Specialist (ADM)	Bridgette Buitendacht (Ms)
18	Advanced Midwife / Midwife Specialist (ADM)	Siyabonga Mosia (Mr)
19	Advanced Midwife / Midwife Specialist (ADM)	Patricia Mashego (Ms)
20	Advanced Midwife / Midwife Specialist (ADM)	Poppy Nkambule (Ms)
21	Advanced Midwife / Midwife Specialist (ADM)	Meldah Mokone (Ms)
22	Dr (Obstetric and Gynaecologist)	B.S.S Nkosi
23	Dr (Obstetric and Gynaecologist)	Nobuhle Myamya
24	Advanced Midwife / Midwife Specialist (ADM)	Sindile Mhlongo (Ms)
25	Advanced Midwife / Midwife Specialist (ADM)	K.S Seoka (Ms)
26	Advanced Midwife / Midwife Specialist (ADM)	T Kwinda (Ms)
27	Advanced Midwife / Midwife Specialist (ADM)	Connie Mokoena (Ms)
28	Advanced Midwife / Midwife Specialist (ADM)	NV Majosi (Ms)
29	Advanced Midwife / Midwife Specialist (ADM)	HY Kabini (Ms)
30	Advanced Midwife / Midwife Specialist (ADM)	Patience Maluleke (Ms)
31	Advanced Midwife / Midwife Specialist (ADM)	Mikie Madumise (Ms)

8.4 KwaZulu-Natal

Note: this report includes information from a few maternal death assessments which were entered into the MAMMAS database after the KwaZulu-Natal database was sent to the NCCEMD for compiling the overall Saving mothers 2020-22 Report. In the overall report, a correction (estimate) was made to account for the missing 2022 cases from KwaZulu-Natal. This summary includes the data from all these missing cases and will therefore differ slightly from the figures seen in the overall report.

Maternal Mortality Data with Comments

724 maternal deaths were notified in KwaZulu-Natal in the triennium 2020-2022. This is a 14% increase compared to the previous triennium (see table 1)

Table 1. Number of maternal deaths notified, and number entered into MaMMAS per year:

	Maternal deaths notified and entered into MaMMAS
2017-2019	637 (2014-2016: 746)
2020	252
2021	280
2022	192
2020-2022	724

Coincidental deaths in pregnancy included:

- The institutional maternal mortality ratio (iMMR) for KZN which dropped from 130 per 100,000 in 2014-16 to 100 in 2017-19, rose back up to 108 per 100,000 in 2020-22. Despite this rise, the KZN iMMR was 12% below the National average iMMR (126). KZN has the second lowest iMMR of all Provinces in South Africa, the lowest being in the Western Cape
- The rise in number of maternal deaths in the 2020-22 triennium was due to the COVID-19 pandemic, which contributed 135 maternal deaths directly due to COVID-19 infection, the majority being in early 2021.
- The number of deaths in KZN in the final year of the triennium, 2022, fell to 192, which was similar to the number of maternal deaths that occurred in 2019 (185). This demonstrated a resilient maternal healthcare service which was able to recover from the COVID-19 pandemic and re-establish a downward trend in maternal mortality.
- The iMMR in KZN in 2022 was 84,5 per 100,000. It is feasible that with continuing downward trends in maternal mortality, that the SDG target of 70 will be achieved by 2030.
- 49% of maternal deaths in KZN occurred in regional hospitals, by far the most common site for maternal deaths to occur. An increasing proportion of notified deaths (10.6%) occurred outside the State health facilities (in private health facilities or outside a health facility)
- There was an increase in the number and proportion of maternal deaths which followed delivery by caesarean section (CS). There were 243 deaths at or after CS in 2020-22 (54% of all deaths excluding deaths early in pregnancy and undelivered cases), compared to 183 in 2017-19 (50%). This partly reflects the fact that many pregnant women who were in respiratory failure due to COVID-19 were intubated and taken for caesarean section, in an unsuccessful attempt to alleviate the respiratory failure. However, it also highlights the need for renewed emphasis on ensuring facilities conducting caesarean section are complying with minimum safety standards.
- There was a smaller increase in the number of deaths that occurred after vaginal delivery: 203 in 2020-22 (46%) compared to 184 in 2017-19 (50%).
- 64% of maternal deaths occurred in the post-partum period.
- The most common category of maternal death by far remains non-pregnancy-related infections (NPRI), which accounted for 36% of all deaths. Over half of these were deaths due to COVID-19 infection. NPRI deaths due to other causes (mostly due to HIV-related infections) decreased from 164 in 2017-19 to 125 in 2020-22, which demonstrated that the benefits of increased coverage of antiretroviral therapy continued despite the pandemic. Apart from COVID-19, the most common sub-category was tuberculosis (whose numbers also decreased from 61 deaths in 2017-19 to 45 in 2020-22)
- The next most common causes of death in order were medical and surgical disorders (biggest contributor: cardiac disease), obstetric haemorrhage (biggest contributor: bleeding during or after caesarean section),

hypertensive disorders of pregnancy (biggest contributor: eclampsia), and miscarriage (biggest contributor: septic miscarriage).

- Compared to the last triennium, there were significant decreases in the number of deaths due to hypertensive disorders of pregnancy, miscarriage, and anaesthetic deaths, but an increase in deaths from obstetric haemorrhage. Deaths due to medical and surgical disorders, remained similar in number as did deaths from pregnancy-related sepsis and ectopic pregnancy.
- In the last year of the triennium (2022), when COVID-19 deaths were no longer a significant contributor, the most notable trend was a continued increase in obstetric haemorrhage deaths (35 deaths), the number being only slightly lower than NPRI deaths (37 deaths) which had decreased markedly. Of the 35 haemorrhage deaths, 30 were due to PPH, an equal number following vaginal delivery, and following caesarean section (15 cases each). This highlights the need to focus on the early detection and management of PPH, as the haemorrhage deaths were the biggest contributor to avoidable deaths (see below).
- 94% of the maternal deaths had known HIV status. Of these 54.6% were HIV positive, which is a lower proportion than in 2017-19 (59.4%).
- 152 deaths (21%) were assessed as being <u>probably</u> avoidable within the healthcare system, a 31% decrease compared to 2017-19 (221 definitely avoidable deaths). It is difficult to know what to make of this apparent improvement in the quality of care, because deaths assessed as being <u>possibly</u> avoidable were far more in 2020-22 compared to 2017-19.
- The most common causes of definitely avoidable death were obstetric haemorrhage (58 deaths) followed by NPRI (19 deaths) and medical and surgical conditions (17 deaths), with the following causes also contributing significant numbers: hypertensive disorders (13), ectopic pregnancy (11), miscarriage (8), anaesthetic deaths (7), and pregnancy-related sepsis (7). A detailed breakdown of definitely avoidable deaths according to cause of death is presented in table 2 below.
- It is notable that the number of definitely avoidable deaths due to hypertensive disorders of pregnancy decreased greatly from 42 cases in 2017-19 to 13 cases in 2020-22. This is reflected in the overall decrease in hypertension deaths during this triennium and suggests a positive effect of implementation of the new national guidelines on management of hypertensive disorders which were introduced during the last triennium. There is perceived improvement at PHC level in the early detection of hypertension (including borderline hypertension) and prompt referral to high-risk clinics. There is also a perceived improvement in the management of hypertension after referral to the high-risk clinic, including recognition of severe features and decision for delivery being made at an earlier stage of the disease.
- The total numbers of anaesthetic deaths decreased from 19 in 2017-19 to 12 in 2020-22, and the probably avoidable anaesthetic deaths decreased from 16 to 7. This encouraging trend occurred despite three deaths in 2022 due to an avoidable anaesthetic drug error, whereby tranexamic acid was mistakenly injected intrathecally instead of bupivacaine at the time of administration of a spinal anaesthetic for caesarean section. These fatal drug errors led to various measures being taken to prevent future recurrence, spreading the information about the drug error and how to prevent it. The decrease in anaesthetic deaths may have been related to the introduction of a system in 2021 at all district hospitals in KZN of designating one medical officer as the “Lead Anaesthetic Doctor”, responsible, with support from the outreach anaesthetist, for ensuring a safe anaesthetic service.
- The most common patient-related avoidable factor was delay in accessing medical help, which in many cases probably indicates that the patient had a transport problem. No antenatal care or infrequent antenatal care were also common avoidable factors.
- The most common administrative avoidable factors within the healthcare system were: delay in attending to the patient due to overburdened service or other reasons, 97 cases (13.4% of maternal deaths); inter-facility transport problems, 52 cases (7.2%); lack of ICU access, 49 cases (6.8%) and inadequate staff on duty, 49 cases (6.8%)
- The most common medical personnel-related avoidable factors within the healthcare system were: failure to recognise the problem or make the diagnosis, often related to inadequate initial assessment of the patient (all levels of care except tertiary); substandard management despite correct diagnosis -ie failure to follow protocols (all levels of care including tertiary and private); delay in referring or failure to refer the patient to a higher level of care (mainly at primary or district hospital level). In many of these cases this must imply that the doctors and nurses managing the patient were incompetent or lacking in commitment to quality care
- Resuscitation was substandard in 35% of maternal deaths, including 20% of deaths where resuscitation was not even attempted.

Table 2. Clearly avoidable deaths within the healthcare system according to primary cause of death 2020-2022

Cause of death	Total number of deaths 2020-22	Number of avoidable deaths			Number (%) of deaths avoidable per cause 2020-22
		2020	2021	2022	
Obstetric haemorrhage	96	15	15	28	58(60%)
Non-pregnancy-related infections	260	6	10	3	19(7%)
Medical and surgical disorders	113	9	6	2	17(15%)
Hypertensive disorders	65	6	3	4	13(20%)
Ectopic pregnancy	20	6	2	3	11(55%)
Miscarriage	32	3	1	4	8(40%)
Anaesthetic complications	12	2	0	5	7(58%)
Pregnancy-related sepsis	31	5	1	1	7(23%)
Embolus	19	1	2	3	6(32%)
Unknown cause	43	0	1	2	3(7%)
Coincidental causes	11	1	0	0	1(9%)
Adverse drug reactions	5	1	0	0	1(20%)
Acute collapse	13	0	1	0	1(8%)
Miscellaneous	4	0	0	0	0
Total	**724**	**55**	**42**	**55**	**152(21%)**

Recommendations

- Facility CEOs and Heads of obstetric departments must be made aware of every maternal death that occurs in their facility and ensure that every case is promptly reviewed. The review of the death must lead to a practical action plan for preventing a recurrence. Relevant role players, including those involved in the management of the case, facility senior management and the district clinical specialist team should be involved in the review, and together agree on the plan. Implementation of the plan must be monitored and reviewed for example at the facility or District perinatal meetings, or by the facility patient safety incident (PSI) committee.
- Emphasis must be put on making appropriate contraception and family planning methods available to vulnerable groups to prevent unwanted or unplanned pregnancy. These groups include teenagers, over 35s, and those with chronic medical conditions including HIV infection and cardiac disease. Innovative strategies are needed to achieve this, for example taking family planning services to high schools, tertiary education institutions and workplaces, and using community care givers to improve uptake of and compliance with family planning methods. Family planning must be integrated into all levels of healthcare which encounter women of reproductive age including specialist medical clinics (eg cardiology clinics and HIV clinics). Long-acting reversible contraceptives, particularly the intra-uterine contraceptive device and the progesterone implant, must be promoted as they are highly effective contraceptive methods. All family planning providers must be trained in their insertion and removal including all doctors working at District hospitals and in specialist obstetrics and gynaecology departments. Emergency contraception must be accessible from all health facilities every day of the week, and this must be effectively communicated to the community.
- Obstetric care at regional hospitals across the province needs to be supported and improved. This will require prioritisation of the filling of specialist obstetrics and gynaecology (O+G) posts and O+G medical officer posts at regional hospitals so that a functional regional level service can be provided. This is essential for supporting the service at District level (outreach) as well as for providing quality training for medical students, interns, and registrars.
- Plans should be made to set up On-site midwife-run delivery units (OMBUs) at those hospitals whose labour wards are currently overcrowded with large numbers of low-risk women. In KZN this situation mainly applies to the regional hospitals, but plans should also be made for the busiest of the large District hospitals. This will ease the burden on the hospital labour ward and allow appropriate care to be given to

both the high-risk and low-risk women. New midwife posts need to be created for this, and priority put on filling them. This is a preferred model, compared to having multiple small midwife-run units at the community clinics referring to the regional or district hospital. Two OMBUs were successfully established during the 2020-22 triennium in KZN, and these should be supported in terms of staff recruitment to ensure their functioning can be sustained.

- Hospital CEOs must ensure that the caesarean section (CS) service in their hospital complies with South African guidelines for safe CS[1]. The minimum standards include the requirement that audits of caesarean section are conducted, which may reduce the numbers of unnecessary CS while ensuring that CS are performed timeously when indicated. A recently added minimum standard is that the drug Tranexamic acid must be stored outside the operating room in the theatre complex, to ensure that it cannot be mistakenly administered instead of spinal anaesthetic drug.
- Facility CEOs and operational managers must ensure that the Minimum standards for safe and respectful care during labour, as listed in a 2023 provincial circular (G56/23), are complied with by all designated delivery sites.
- Post-natal care in general needs to be intensified. The new national Maternity Case Record must be used in KZN from 2024, including the pre-discharge checklist and discharge summary. Pregnant women need to be linked to their community care giver who must be involved in providing post-natal care to strengthen the facility-based post-natal care.
- The scope of duties of community care givers with respect to pregnant women must include diagnosis of pregnancy (urine pregnancy tests), encouraging early antenatal booking and compliance with antenatal visits, encouraging compliance with medications and supplements, and post-natal home visits.
- Maternity waiting homes should be available at all delivery sites where pregnant women experience transport difficulties in accessing the delivery site when in labour.
- There must be a focus at all delivery sites on improving the early detection and management of post-partum haemorrhage (PPH). The EMOTIVE study was conducted in KZN amongst other sites during the 2020-22 triennium and the EMOTIVE protocol was shown to be highly effective in reducing severe PPH. Training must be conducted to introduce the EMOTIVE protocol at all delivery sites, so that it becomes standard practice.
- Facility managers must ensure that HIV care of pregnant women is integrated into maternity care, including initiation and management of ARVs, and screening for, diagnosis and management of opportunistic infections including TB. This requires all midwives and doctors managing maternity care to be trained in the latest National ARV/VTP guidelines and to be competent in all aspects of the routine care of HIV positive pregnant women, including recognising and appropriately managing ARV treatment failure.
- Every District hospital must have amongst its medical officers, a designated Lead Anaesthetic doctor who, with support from the medical manager, and the outreach anaesthetist from the referral centre, has a responsibility to ensure a safe anaesthetic service is provided at the hospital.
- District clinical specialists must ensure that clear and consistent referral patterns and referral criteria for risk factors and problems in pregnancy are available to all healthcare practitioners caring for pregnant women. These criteria must be available both at the referring site and at the receiving site. Facility managers must ensure that they are followed.
- Ongoing training on the recognition and management of conditions commonly causing avoidable maternal deaths must be provided for doctors and midwives working at all levels of care. Facility managers must ensure that regular ESMOE fire drills are conducted (at least monthly) for all relevant staff. This implies that every hospital and CHC must have amongst their staff active ESMOE master trainers, who are given the opportunity to conduct the fire drills. District Clinical specialists must support this process. The Provincial and/or District Health departments must provide ESMOE train-the trainer courses to train doctors and midwives to be ESMOE trainers, so the gap can be filled at any maternity facility without an ESMOE trainer.
- The ESMOE programme includes a module on Respectful and humane care during labour. All labour ward staff must participate in this module to promote a culture of respect for women using our maternity services as well as respect amongst the healthcare workers. Respect for women in labour includes allowing companions for women in labour which is one of the minimum standards for safe and respectful care during labour.
- All State facilities in KZN must be able to either offer TOP services or refer eligible clients to a site within the district which offers free TOP services. All sites providing TOP must be able to provide the option of medical TOP for suitable clients.
- Facility managers must ensure that all doctors and nurses are aware of their professional and ethical responsibilities when on-duty and must hold them accountable when these responsibilities are neglected.

KwaZulu-Natal Provincial assessors past and present who assessed cases from the 2020-22 triennium

No	Name	Name of Institution	Comment
1.	Prof. J Moodley	UKZN	Quality Assurance Assessor-
2.	Dr N Moran	KZN DOH Head office	O+G Specialist Member of NCCEMD
3.	R Roopchand	Mahatma Gandhi Memorial Hospital	Advanced Midwife
4.	Prof. D Bishop	uMgungundlovu DCST	Specialist Anaesthetist
5.	Dr B Hira	Mahatma Gandhi Memorial Hospital	O&G Specialist
6.	Dr TL Khumalo	UGu DCST	O&G Specialist
7.	Dr T Ibrahim	eThekwini DCST	O&G Specialist
8.	Dr M Naidoo	UKZN and Wentworth Hospital	Family Physician
9.	A Ngema	iLembe DCST	Advanced Midwife
10.	Dr N Mayat	Queen Nandi Hospital	O&G Specialist
11.	P Phungula	KZN DOH Head Office	Advanced midwife, Provincial Maternal Health Manager
12.	Dr Z Moyce	Pixley Ka Isaka Seme Memorial Hospital:	Specialist Anaesthetist
13.	S Mnqayi	DCST: King Cetshwayo DCST	Advanced Midwife
14.	J Tobo	Ugu DCST	Advanced Midwife
15.	Dr I Popov	Port Shepstone Hospital	O&G Specialist
16.	Dr CL Chellan	King Edward VIII Hospital	Specialist Anaesthetist
17.	Dr L Naidoo	iLembe DCST	O&G Specialist
18.	K Makhathini	uMgungundlovu DCST	Advanced Midwife
19.	Dr K Govender	General Justice Gizenga Mpanza Regional Hospital	O&G Specialist
20.	N Kubheka	Prince Mshiyeni Memorial Hospital	Advanced Midwife
21.	S Pillay	Osindisweni Hospital	Advanced Midwife
22	Prof TD Naidoo	Greys Hospital	O&G Specialist
23	Dr J Titus	Retired	O+G Specialist
24	L Scott	Retired	Advanced Midwife
23.	Dr U Wessels	Retired	O&G Specialist
24	Dr U Singh	Addington Hospital	Specialist anaesthetist

8.5 Limpopo

Introduction

Limpopo, South Africa's northern most province, borders onto Mozambique, Zimbabwe, and Botswana. It also borders the Mpumalanga, Gauteng, and Northwest provinces. Named after the Limpopo River, which flows along its northern border, it is a region of contrasts, from true Bushveld country to majestic mountains, primeval indigenous forests, unspoiled wilderness, and patchworks of farmland. In the eastern region lies the northern half of the magnificent Kruger National Park.

Limpopo ranks fifth in South Africa in both surface area and population, covering an area of 125 754km² and being home to a population of 6 124 446.

The capital city is Polokwane (Formerly known as Pietersburg). Other major towns include Bela-Bela (Formerly Warmbad), Lephalale (formerly Ellisras), Makhado (Formerly Louis Trichardt), Musina (Messina), Mokopane (formerly known as Potgietersrus) (Thabazimbi and Tzaneen (see the Limpopo map).

Agriculture and Mining are the primary driver of economic activity. Limpopo is rich in mineral deposits, including platinum-group metals, iron ore, chromium, high and middle-grade cooking coal, diamonds, antimony, phosphate, and copper, as well as mineral reserves such as gold, emeralds, scheelite, magnetite, vermiculite, silicon and mica. The province is a typical developing Province, exporting primary products and importing manufactured goods and services.

The climatic conditions in the province allow for double harvesting seasons, which results in it being the one of the largest producers of various agricultural products. Sunflowers, cotton, maize and peanuts are cultivated in the Bela-Bela–Modimolle area. Bananas, Avocados, litchis, pineapples, mangoes and pawpaw's, as well as a variety of nuts, are grown in the Tzaneen and Makhado areas.

The vast land caters for grazing and game farming also offers hunting and ranching.

Limpopo is divided into five district municipalities, which are further subdivided into 22 local municipalities.

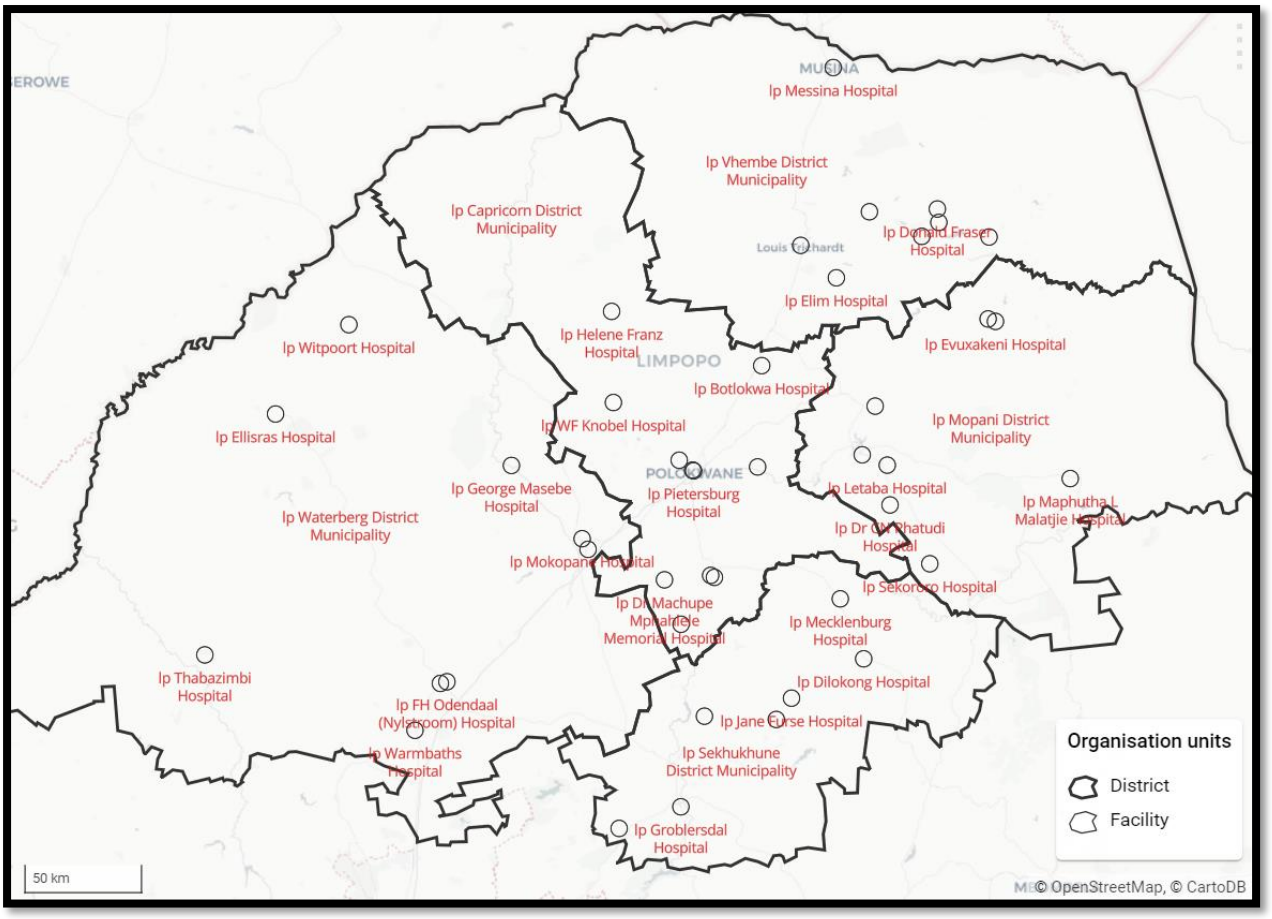
Approximately 80% of the population in Limpopo province resides in the rural part of the province which has an impact on the access to education with a subsequent negative impact on economic sector development.

The province consists of five districts with 451 clinics, 21 gateway clinics, 160 mobile 25 Community Health Centres, 30 district hospitals, 5 regional hospitals and two tertiary hospitals.

Despite the increase in the number of clinics providing a full package of Primary Health Care services the department still experience challenges in shortage of Human resource to supporting the clinics.

Maternal death notification process has improved because deaths taking place at home and in the private sector are reported, however there is a need to strengthen the flow of files.

Previous reports reflected non - pregnancy related infections as the leading cause of indirect maternal deaths. HIV and AIDS still pose a challenge to the whole country which is also seen in Limpopo province. However, there are there were many women in the 2020-2022 triennium who died from non - pregnancy related infection in the triennium due to COVID-19. Post-Partum Haemorrhage is the leading direct cause of maternal deaths followed by hypertensive diseases in pregnancy.



Maternal deaths numbers, rates and trends.

Limpopo Province reported 166, 196 and 143 maternal deaths in 2020, 2021 and 2022 respectively adding up to 505, and 486 files for the triennium were entered in the national data base. The number of maternal deaths reported over the triennium has declined slightly compared to the last triennium (2017 -2019).

Figure 1. Limpopo maternal deaths from 1998 to 2022

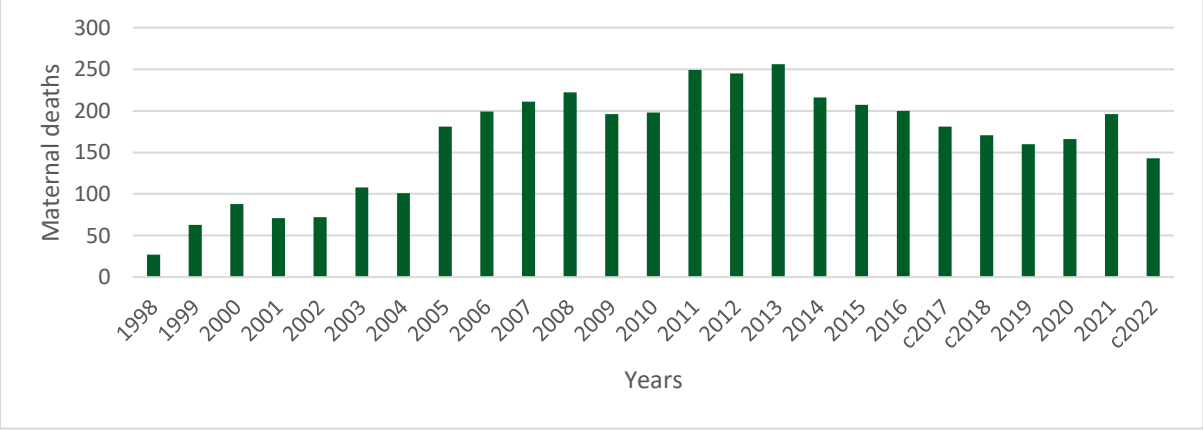


Figure 2. Trends in iMMR 2005-2022

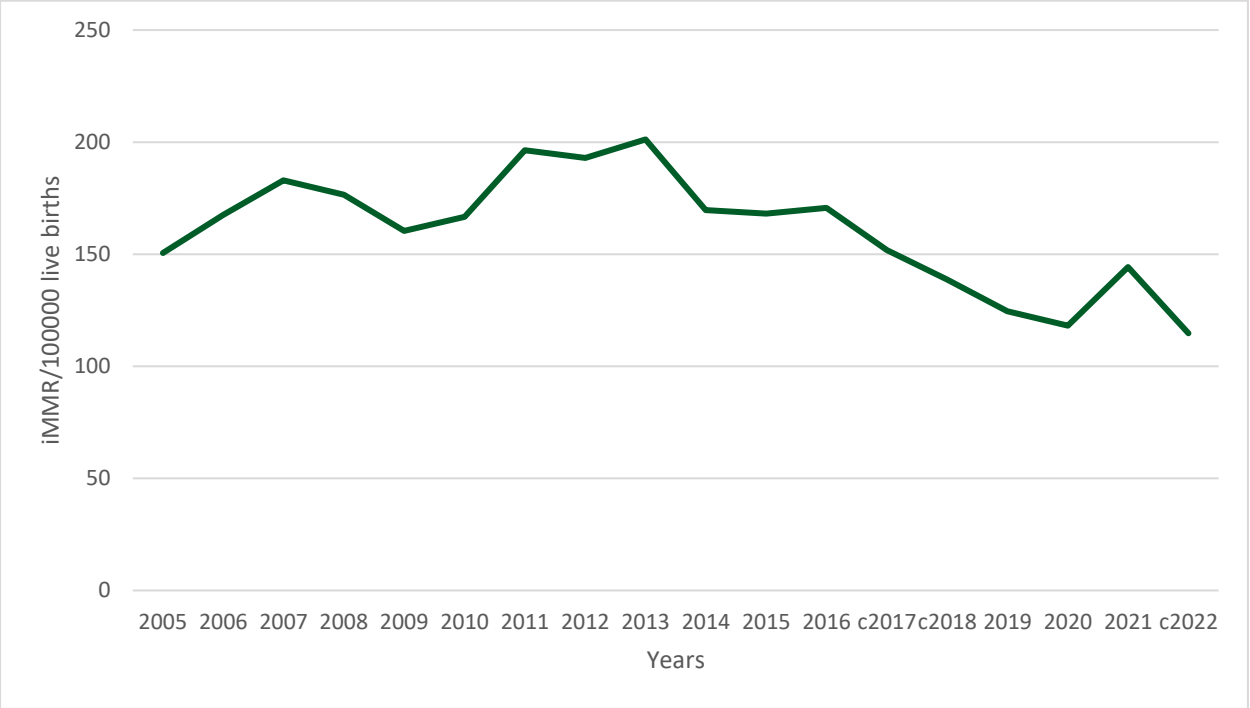


Figure 3. iMMR for 2020,2021,2022 and the whole triennium

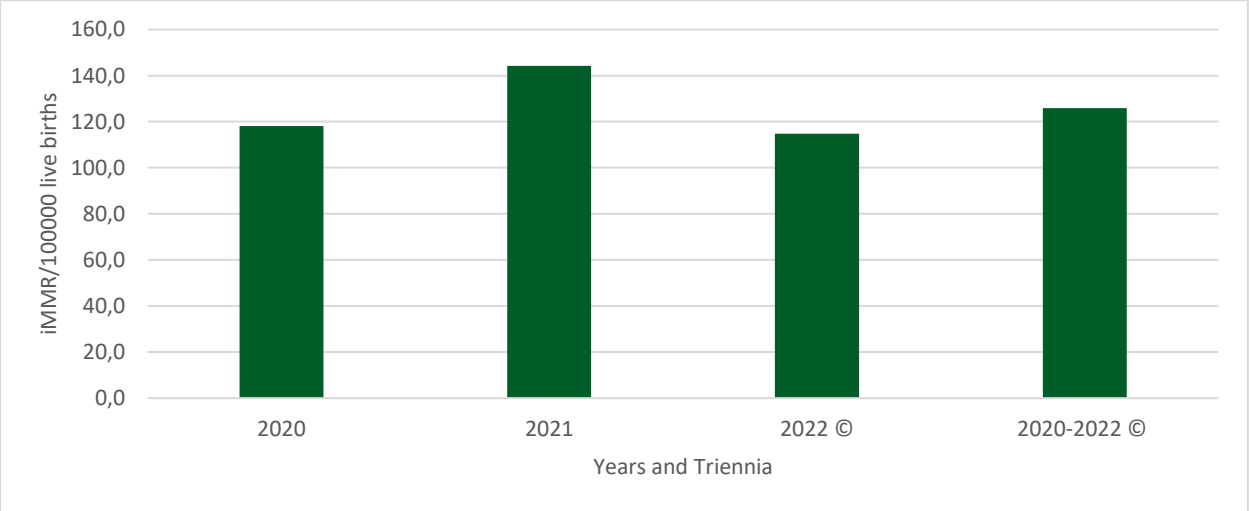
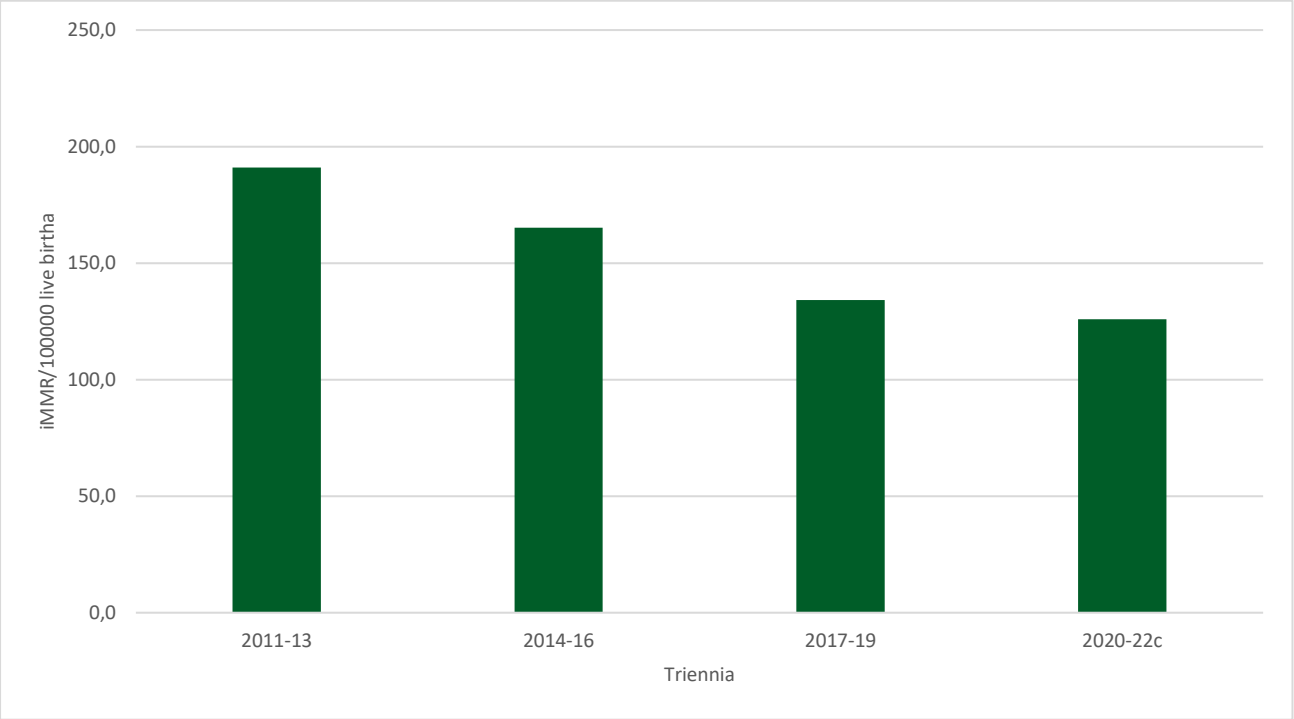
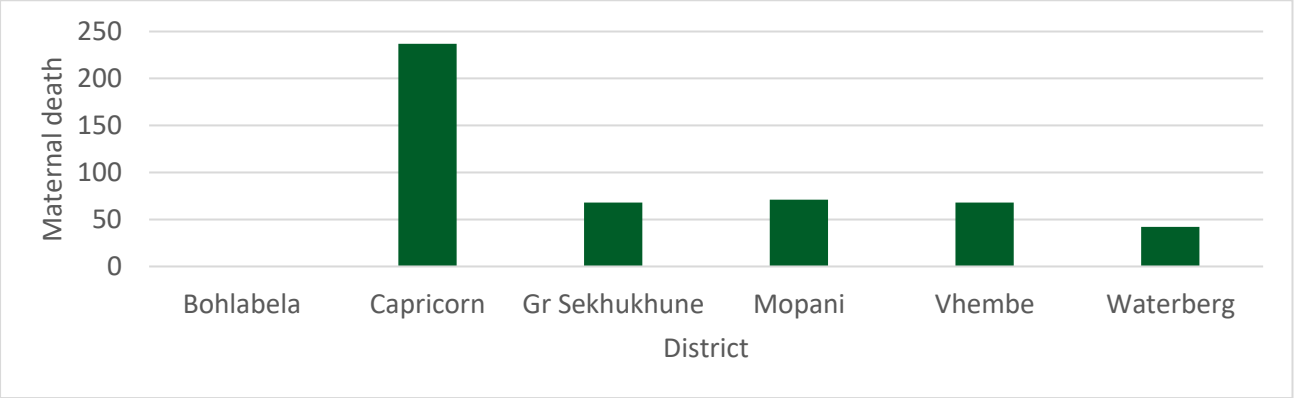


Figure 4. Trends in iMMR for four triennia



Limpopo is the only province in SA where iMMR declined in this triennium; and it now ranks third lowest iMMR after Western Cape and KwaZulu-Natal, with an iMMR of 125.9 deaths per 100,000 live births.

Figure 5. Maternal deaths per district, 2020-2022



Detailed data for the triennium will be presented as Figures and Tables, and then discussed.

Primary Obstetric Causes of Death

Figure 6. Comparison of Causes of death, 2020-2022

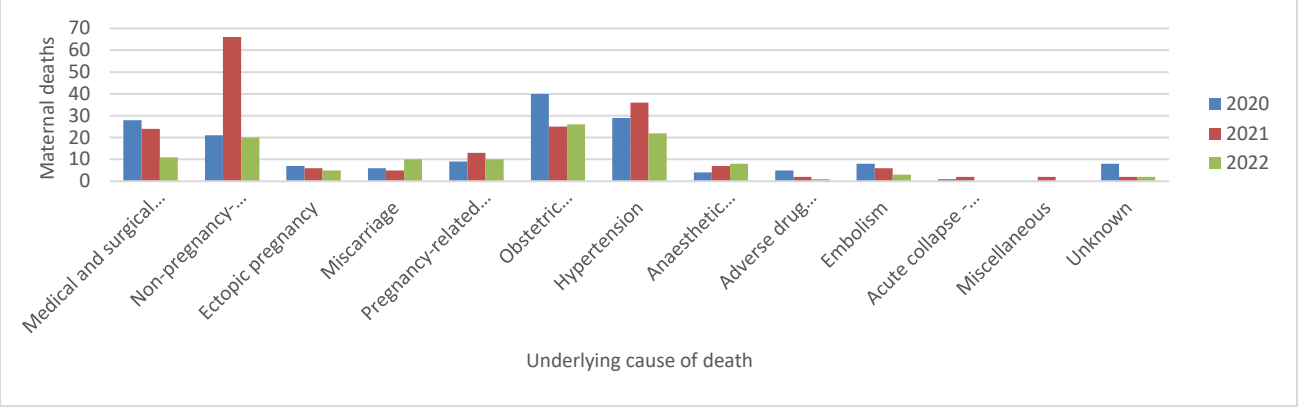


Table 1. Primary Obstetric causes, 2020-2022

Limpopo	2020	2021	2022	2020-2022
Medical and surgical disorders	28	24	11	63
Non-pregnancy-related infections	21	66	20	107
Ectopic pregnancy	7	6	5	18
Miscarriage	6	5	10	21
Pregnancy-related sepsis	9	13	10	32
Obstetric haemorrhage	40	25	26	91
Hypertension	29	36	22	87
Anaesthetic complications	4	7	8	19
Adverse drug reactions	5	2	1	8
Embolism	8	6	3	17
Acute collapse - cause unknown	1	2	0	3
Miscellaneous	0	2	0	2
Unknown	8	2	2	12
Maternal deaths	166	196	118	480
Coincidental cause	1	4	1	6
DDCP	167	200	119	486
Live births (2019)	**140542**	**135892**	**124648**	**401082**

Figure 7. Comparison of Causes of death, 2020-2022

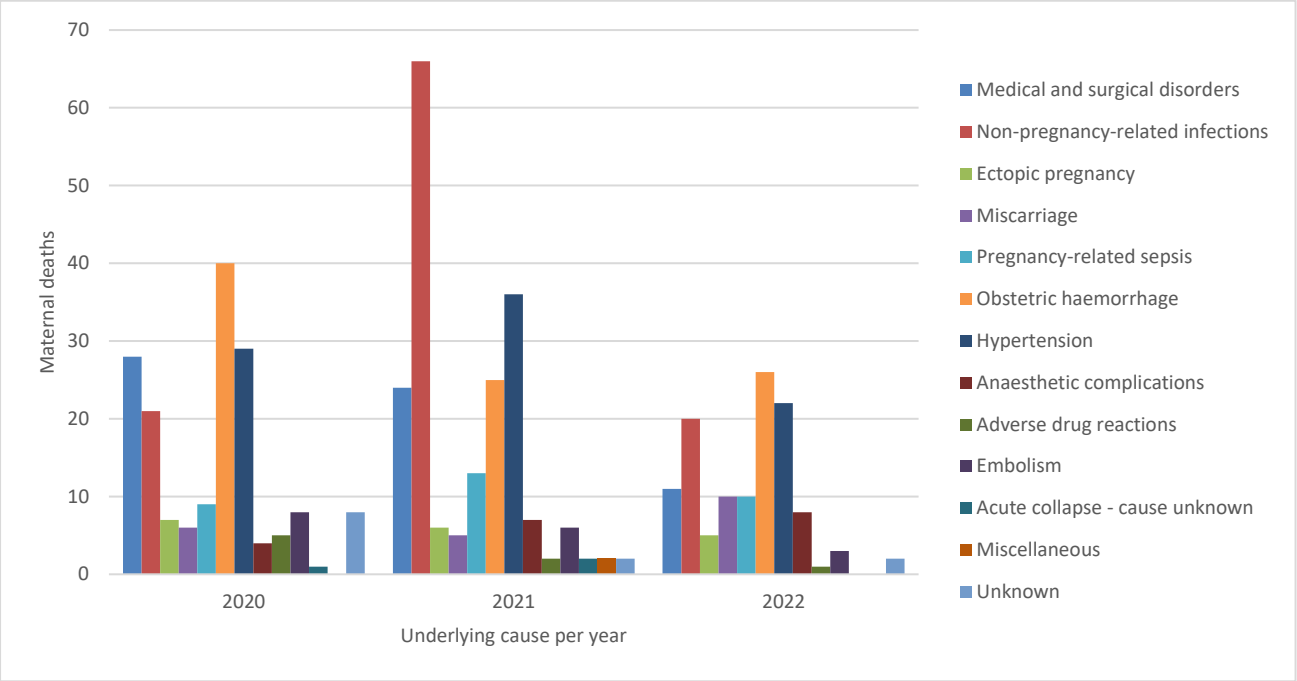


Figure 8. IMMR per Cause of death, 2020-2022

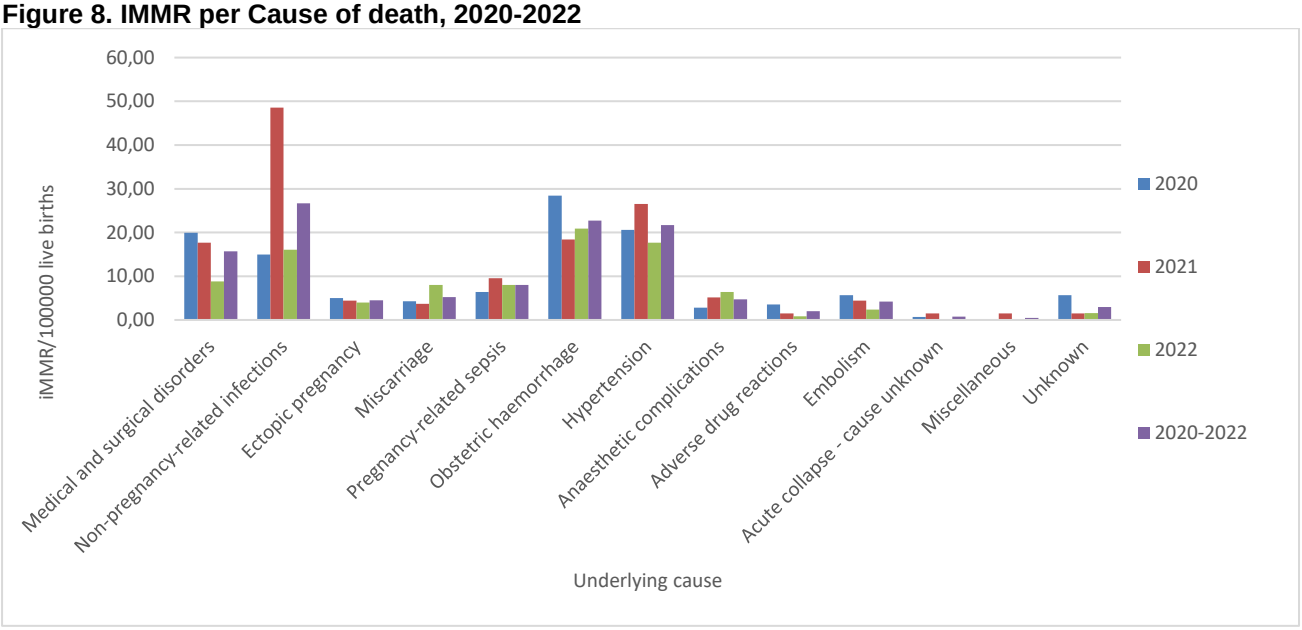


Table 2. IMMR per Cause of death, 2020-2022

Limpopo iMMR	2020	2021	2022	2020-2022
Medical and surgical disorders	19.92	17.66	8.82	15.71
Non-pregnancy-related infections	14.94	48.57	16.05	26.68
Ectopic pregnancy	4.98	4.42	4.01	4.49
Miscarriage	4.27	3.68	8.02	5.24
Pregnancy-related sepsis	6.40	9.57	8.02	7.98
Obstetric haemorrhage	28.46	18.40	20.86	22.69

Limpopo iMMR	2020	2021	2022	2020-2022
Hypertension	20.63	26.49	17.65	21.69
Anaesthetic complications	2.85	5.15	6.42	4.74
Adverse drug reactions	3.56	1.47	0.80	1.99
Embolism	5.69	4.42	2.41	4.24
Acute collapse - cause unknown	0.71	1.47	0.00	0.75
Miscellaneous	0.00	1.47	0.00	0.50
Unknown	5.69	1.47	1.60	2.99
Maternal deaths	118.11	144.23	94.67	119.68
Coincidental cause	0.71	2.94	0.80	1.50
DDCP	118.83	147.18	95.47	121.17
Live births (2019)	**140542**	**135892**	**124648**	**401082**

Figure 9. iMMR for Obstetric cause in each year of the triennium

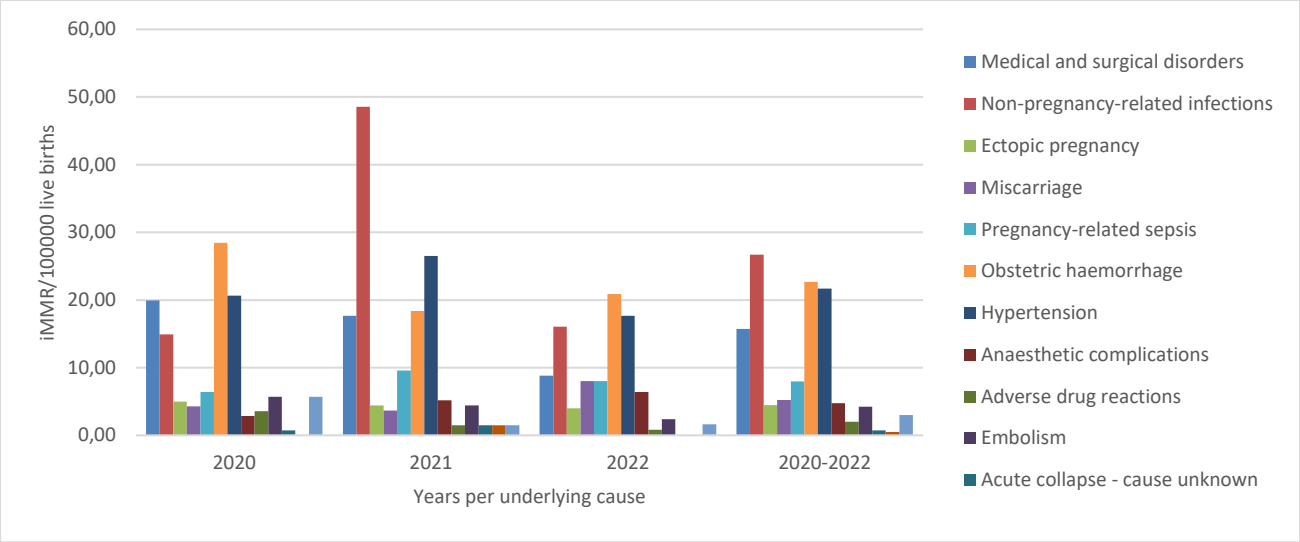


Table 3. Subcategories of Obstetric Causes of death, 2020-2022

Primary obstetric problems	Limpopo
Coincidental cause	**6**
- MVA	3
- Other accidents	1
- Assault	
- Other	2
Medical and surgical disorders	**63**
- Cardiomyopathy	18

Primary obstetric problems	Limpopo
- Rheumatic heart disease	
- Other cardiac disease	
- Endocrine	6
- GIT	6
- CNS	4
- Respiratory	7
- Haematological	5
- Genito-urinary	1
- Suicide	
- Substance abuse	
- Other psychiatric disease	
- Neoplasm	
- Auto-immune	2
- Other	14
Non-pregnancy-related infections	**107**
- PCP pneumonia	14
- Other pneumonia	5
- TB	17
- UTI	
- Appendicitis	
- Malaria	1
- Cryptococcal meningitis	9
- Other meningitis	6
- Kaposi's sarcoma	1
- Toxoplasmosis	
- Hepatitis	1
- Gastroenteritis	4
- Wasting syndrome	1
- Other	48
Ectopic pregnancy	**18**
- Less than 20 weeks	18
- More than 20 weeks (extrauterine pregnancy)	
Miscarriage	**21**
- Septic miscarriage	16
- Haemorrhage (non-traumatic)	2
- Uterine trauma	1
- GTD	
- Following legal TOP	2
Pregnancy-related sepsis	**32**

Primary obstetric problems	Limpopo
- Chorioamnionitis (ruptured membranes)	
- Chorioamnionitis (intact membranes)	1
- Puerperal sepsis after NVD	17
- Puerperal sepsis after CD	11
- Bowel trauma at CD	3
Obstetric haemorrhage	**91**
- Abruption with hypertension	1
- Abruption without hypertension	8
- Placenta praevia	1
- Other APH not specified	4
- Ruptured uterus with previous CD	5
- Ruptured uterus without previous CD	9
- Uterine atony after vaginal delivery	11
- Vaginal trauma after vaginal delivery	1
- Cervical trauma after vaginal delivery	6
- Retained placenta after NVD (morb adherent)	1
- Retained placenta after NVD (not adherent)	
- Inverted uterus after vaginal delivery	
- Other PPH not specified after vaginal delivery	8
- Bleeding during CD (morbidly adherent placenta)	2
- Bleeding during CD (not adherent placenta)	8
- Bleeding after Caesarean delivery	26
Hypertension	**87**
- Chronic hypertension	4
- Gestational hypertension	13
- Pre-eclampsia with severe features	4
- Pre-eclampsia without severe features	2
- Eclampsia	38
- HELLP	26
- Liver rupture	
Anaesthetic complications	**19**
- General anaesthetic	6
- Spinal anaesthetic	13
Adverse drug reactions	**8**
- ARV medication	4
- TB medication	
- Other medication	1
- Herbal medication	3
Embolism	**17**

Primary obstetric problems	Limpopo
- Pulmonary embolism	15
- Amniotic fluid embolism	2
Acute collapse - cause unknown	**3**
Miscellaneous	2
- Hyperemesis gravidarum	2
- Acute fatty liver	
Unknown	**12**
- Death at home or outside health services	11
- No primary cause found	
- Lack of information	1
Total:	**486**

COVID-19 deaths

COVID-19 maternal deaths	Limpopo
2020	1
2021	43
2022	0
2020-2022	**44**

Table 4. Primary Cause of Death and Location of death

Primary obstetric problems	Facility	In transit	Home/Outside
Coincidental cause	6	0	0
Medical and surgical disorders	63	0	0
Non-pregnancy-related infections	104	1	2
Ectopic pregnancy	18	0	0
Miscarriage	21	0	0
Pregnancy-related sepsis	32	0	0
Obstetric haemorrhage	89	2	0
Hypertension	83	2	2
Anaesthetic complications	19	0	0
Adverse drug reactions	8	0	0
Embolism	16	0	1
Acute collapse - cause unknown	2	0	1
Miscellaneous	2	0	0
Unknown	2	0	10
Total	**465**	**5**	**16**

Table 5. Primary Cause of Death and level of care

Primary obstetric problem	Outside	CHC	District hospital	Regional hospital	Tertiary/Nat central hospital	Private hospital	Total
Coincidental cause	0	0	3	1	2	0	6
Medical and surgical disorders	0	0	11	13	31	8	63
Non-pregnancy-related infections	2	2	27	28	38	10	107
Ectopic pregnancy	0	0	9	6	3	0	18
Miscarriage	0	0	7	4	9	1	21
Pregnancy-related sepsis	0	0	5	10	14	3	32
Obstetric haemorrhage	0	2	32	26	27	4	91
Hypertension	2	2	22	16	41	4	87
Anaesthetic complications	0	0	5	9	5	0	19
Adverse drug reactions	0	0	2	3	3	0	8
Embolism	1	0	6	3	4	3	17
Acute collapse - cause unknown	1	0	1	0	1	0	3
Miscellaneous	0	0	0	2	0	0	2
Unknown	10	0	1	1	0	0	12
Total	**16**	**6**	**131**	**122**	**178**	**33**	**486**

Table 6. Primary Obstetric Causes per district in Limpopo province, 2020-2022

Primary obstetric problems	Bohlabela	Capricorn	Gr Sekhukhune	Mopani	Vhembe	Waterberg	Total
Coincidental cause	0	3	3	0	0	0	6
Medical and surgical disorders	0	40	7	3	9	4	63
Non-pregnancy-related infections	0	55	12	16	13	11	107
Ectopic pregnancy	0	4	3	5	4	2	18
Miscarriage	0	12	3	1	3	2	21
Pregnancy-related sepsis	0	18	2	5	4	3	32
Obstetric haemorrhage	0	36	12	18	19	6	91
Hypertension	0	48	13	10	10	6	87
Anaesthetic complications	0	5	7	2	3	2	19
Adverse drug reactions	0	3	2	0	2	1	8
Embolism	0	7	1	6	1	2	17
Acute collapse - cause unknown	0	2	0	1	0	0	3
Miscellaneous	0	0	0	1	0	1	2
Unknown	0	4	3	3	0	2	12
Total	**0**	**237**	**68**	**71**	**68**	**42**	**486**

Figure 10. Maternal deaths per Primary Obstetric Cause per district 2020-2022

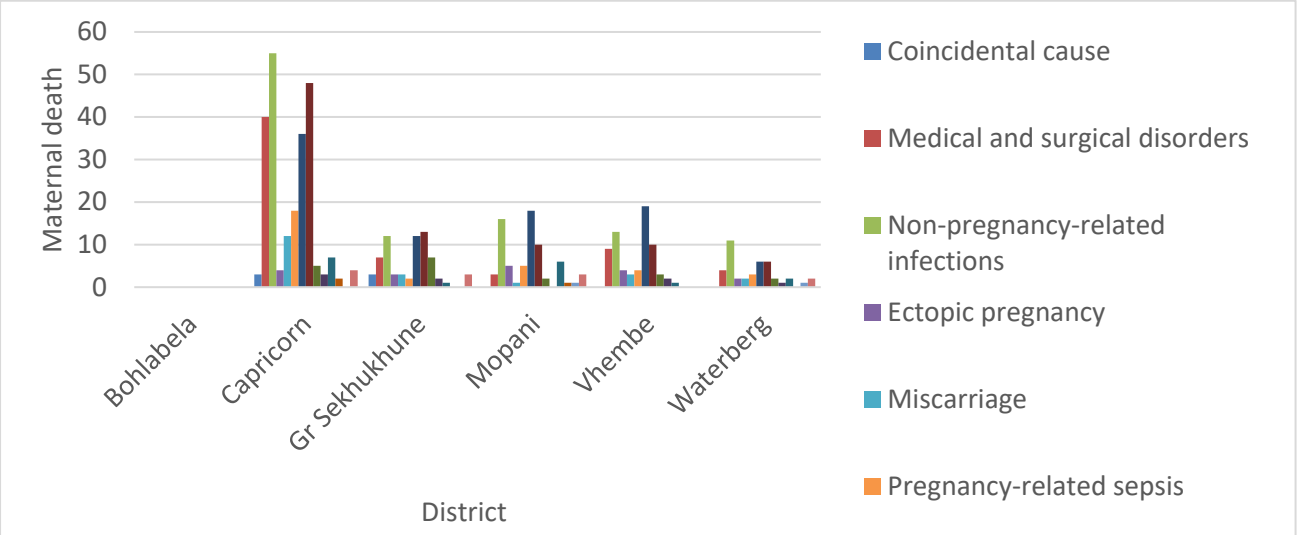


Table 7. Primary Obstetric Cause and Age

Primary obstetric problem	10- 14	15-19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	Outside 10-44 range & unknown	Total
Coincidental cause	0	2	0	2	2	0	0	0	6
Medical and surgical disorders		4	9	9	18	18	4	1	63
Non-pregnancy-related infections		8	11	20	31	25	11	1	107
Ectopic pregnancy		0	1	7	6	3	1	0	18
Miscarriage		3	3	1	7	4	3	0	21
Pregnancy-related sepsis		2	4	7	8	8	3	0	32
Obstetric haemorrhage		1	9	20	18	22	18	3	91
Hypertension		6	17	16	17	26	4	1	87
Anaesthetic complications		1	3	4	3	7	1	0	19
Adverse drug reactions		0	1	2	3	1	1	0	8
Embolism		0	2	2	4	4	4	1	17
Acute collapse - cause unknown		1	0	0	2	0	0	0	3
Miscellaneous		0	0	1	0	1	0	0	2
Unknown		1	4	3	0	1	3	0	12
Total	**0**	**29**	**64**	**94**	**119**	**120**	**53**	**7**	**486**

Table 8. Primary Obstetric Cause and Mode of Delivery

Primary obstetric problems	Vaginal	CD	CD CHC	CD DH	CD RH	TH/NCH	Pvt
Coincidental cause	2	0	0	0	0	0	0
Medical and surgical disorders	18	15	0	4	2	5	4
Non-pregnancy-related infections	34	26	1	5	5	11	8

Primary obstetric problems	Vaginal	CD	CD CHC	CD DH	CD RH	TH/NCH	Pvt
Miscarriage	1	1	0	1	0	0	0
Pregnancy-related sepsis	17	14	0	0	5	6	3
Obstetric haemorrhage	27	50	0	19	15	12	4
Hypertension	21	42	2	9	6	27	6
Anaesthetic complications	1	18	0	4	9	5	0
Adverse drug reactions	3	2	0	0	0	2	0
Embolism	7	7	0	3	1	1	2
Acute collapse - cause unknown	0	1	1	1	1	1	1
Miscellaneous	0	0	0	0	0	0	0
Unknown	3	0	0	0	0	0	0
Total:	**134**	**176**	**4**	**46**	**44**	**70**	**28**

Table 9. Final cause of Death

Cause of death	Number	% of total
Circulatory system	198	40.7
- Hypovolaemic shock	128	26.3
- Septic shock	70	14.4
Respiratory failure	122	25.1
- Respiratory failure	122	25.1
Cardiac failure	100	20.6
- Pulmonary oedema	100	20.6
Embolism	40	8.2
- Acute collapse due to embolism	40	8.2
Renal failure	70	14.4
- Renal failure	70	14.4
Liver failure	49	10.1
- Liver failure	49	10.1
Cerebral complications	69	14.2
- Intracranial haemorrhage	26	5.3
- Cerebral oedema resulting in coning	11	2.3
- Meningitis	9	1.9
- Cerebral emboli	1	0.2
- Brain death following hypoxic event	14	2.9
- Unspecified	8	1.6
Metabolic	62	12.8
- Maternal ketoacidosis	17	3.5
- Electrolyte imbalance	33	6.8
- Thyroid crisis	3	0.6
- Lactic acidosis	8	1.6
- Other	1	0.2
Haematological	100	20.6

Cause of death	Number	% of total
- DIC	72	14.8
- Severe anaemia	28	5.8
Immune system	60	12.3
- Immune system failure	60	12.3
Unknown	18	3.7
- Home death	12	2.5
- Unknown	6	1.2
Other	20	4.1
- Other	20	4.1
Total deaths:	**486**	

Avoidable factors

Table 10. Overview of Avoidable factors, 2020-2022

	Number	% of total	% of cases at this level
PATIENT ORIENTED PROBLEMS			
- Avoidable factors identified	224	46.1	
- No avoidable factors	221	45.5	
- Lack of information	43	8.8	
ADMINISTRATIVE PROBLEMS			
- Avoidable factors identified	296	60.9	
- No avoidable factors	142	29.2	
- Lack of information	50	10.3	
RESUSCITATION PROBLEMS			
- Avoidable factors identified	291	59.9	
- No avoidable factors	137	28.2	
- Lack of information	61	12.6	
MEDICAL CARE - CHC			
- Managed at this level	142	29.2	
- Avoidable factors identified	78		54.9
- No avoidable factors	56		39.4
- Lack of information	14		9.9
MEDICAL CARE - DISTRICT HOSPITAL			
- Managed at this level	245	50.4	
- Avoidable factors identified	167		68.2
- No avoidable factors	62		25.3
- Lack of information	21		8.6
MEDICAL CARE - REGIONAL HOSPITAL			
- Managed at this level	150	30.9	
- Avoidable factors identified	87		58.0
- No avoidable factors	46		30.7

	Number	% of total	% of cases at this level
- Lack of information	18		12.0
MEDICAL CARE - TERTIARY & ABOVE			
- Managed at this level	182	37.4	
- Avoidable factors identified	75		41.2
- No avoidable factors	79		43.4
- Lack of information	31		17.0
MEDICAL CARE - PRIVATE HOSPITAL			
- Managed at this level	35	7.2	
- Avoidable factors identified	16		45.7
- No avoidable factors	17		48.6
- Lack of information	2		5.7
TIMING OF EMERGENCY			
- Early pregnancy	91	18.7	
- Antenatal period: 20w +	148	30.5	
- Intrapartum period	61	12.6	
- Postpartum period	178	36.6	
- Anaesthesia	11	2.3	
TIMING OF DEATH			
- Early pregnancy	71	14.6	
- Antenatal period: 20w +	91	18.7	
- Intrapartum period	39	8.0	
- Postpartum period	274	56.4	
- Anaesthesia	11	2.3	
IMPACT OF SUBOPTIMAL CARE			
- No suboptimal care identified	130	26.7	
- Suboptimal care, no impact on outcome	44	9.1	
- Suboptimal care, possible impact on outcome	163	33.5	
- Suboptimal care, probable impact on outcome	149	30.7	
Total:	**486**		

Discussion

Limpopo reported 486 DDPCP, of these 6 were coincidental resulting in 480 maternal deaths for the triennium 2020-2022 and all files were captured on MaMMAS. In 2022, under reporting was suspected because MAMMAs numbers were less than DHIS, and the total maternal deaths for the triennium were corrected up to 505 for all provincial iMMR calculations. Reporting of maternal deaths that occurred outside facility were 8 in the 2020-2022 triennium and maternal deaths in early pregnancy were also reported (<13weeks).

Demographic data indicates that deaths between the ages 20-24 have decreased by 7% whereas for the ages 25-29 have increased by 5.4% for the triennium 2020-2022 with more maternal deaths in age groups 30-34 and 35-39 over the three-triennium compared to other age groups indicating a need to strengthen contraception services. Deaths in women with Parity 2 and 0 remain high at 25% and 22% respectively.

Most of the maternal deaths take place at tertiary hospital accounting for 37.1% of the deaths. This could be due late referrals. District hospital account for 28.1% of the deaths for the triennium 2020-2022 with a decrease of 8.1% as compared with the previous triennium indicating improvement in skills and implementation of protocols and guidelines.

The five major causes of maternal deaths in Limpopo in the triennium 2020-2022 are:

1. Non-Pregnancy related infections 107 (22.2%)
2. Obstetric haemorrhage 91 (18.9%)
3. Hypertensive disorders 87 (18.12%)
4. Pre - existing Medical and Surgical disorders 63 (13.1%)
5. Pregnancy related sepsis 32 (6.6%)

Obstetric haemorrhage remains the highest direct cause of maternal deaths at 22.2% in the triennium 2020-2022 reflecting the challenge faced by the province in respect of availability of skilled health workers leading to substandard care with the correct diagnosis which is at 24.4%. There is also inconsistence supply of medications at primary healthcare facilities. The avoidable deaths for this category were 93%.

Deaths of mothers with a positive HIV status have decreased from 43.1% in 2017- 2019 triennium to 34.2%, a decrease of 8.9%. Deaths of women with an unknown HIV status increased by 5.9% in 2020-2022 as compared to 2017 – 2019 triennium.
Shortage of skilled midwives and doctors including specialists continue to be a challenge faced by the province in the reduction of maternal deaths as evidenced by health worker related avoidable factors due to problems in medical management of cases. This lack of core of clinical competence affects the quality of management of clients.

Recommendations

COMPONENT	ACTIVITIES
HIV and AIDS and TB COVID-19	• Increase the testing rate for HIV and screening for TB among women of childbearing age for early initiation of treatment and care. • Initiate all HIV positive TB negative pregnant women on IPT. • Correct implementation of protocols and guidelines on the management of HIV positive women should be encouraged for all health professionals at all levels of care. • Consistent availability of drugs to manage HIV and AIDS and TB. • Conduct follow up on defaulters and monitor adherence to treatment. • COVID-19 vaccination for pregnant women
Obstetric Haemorrhage	• Implement E Motive approach to early detection and management of PPH after vaginal delivery. • Strengthen the Implementation of training on Essential Steps in Managing Obstetric Emergencies and Emergency Obstetric Simulation Training. (ESMOE-EOST). • Encourage correct use and interpretation of the partogram for early intervention. • Active Management of the Third Stage of Labour to be practised with each delivery by all health professionals conducting deliveries. • Improve the skills of doctors in providing safe caesarean section. • Haematinics to be consistently available at all levels of care. • Drills on management of obstetric emergencies to be conducted at all levels of care to improve the skills in the management of obstetric haemorrhage. • Post-Partum Haemorrhage box to be available at levels of care for emergency management of the patient. • Fourth stage of labour monitoring to be done for all women post-delivery to exclude Post-Partum Haemorrhage and other complications. • Post- natal care to be encouraged within 6 days and women should be examined for any complications and be treated.

COMPONENT	ACTIVITIES
	• Promote the use of maternal health standards, protocols and guidelines in the management of obstetric haemorrhage.
Hypertension	• Promote early detection of hypertension and improve early detection of women who are at risk. • Promote the use of Hypertension guidelines during training of doctors and midwives. • Consistent Availability of calcium and low dose aspirin in all facilities providing maternal healthcare services to reduce the incidence of hypertensive disorders of pregnancy. • Encourage early booking for early identification of problems and intervention especially for hypertension in pregnancy. • Early referral of patients with signs of hypertensive disorders of pregnancy. • Monitor blood pressure and test the urine at every visit and provide appropriate intervention to the client. • Eclampsia box to be available at all levels of care for emergency management of pregnant women with eclampsia.
Health worker training	• Disseminate the maternal health standards to all doctors and midwives. • Training of health professionals in Sexual Reproductive Health • Training on Basic Antenatal Care Plus including Prevention of Mother to Child Transmission of HIV. • Training of Medical Officers in Diplomas of Obstetrics and Gynaecology; and Anaesthesia • Training Essential Steps in Managing Obstetric Emergencies (ESMOE-EOST). • Conduct monthly ESMOE-EOST drills at all levels of care. • Conduct support and mentorship for trained personnel to maintain the skill. • Onsite mentoring of healthcare workers should be implemented continuously. • In reach and Outreach services should be conducted to the district hospitals by specialists at regional and tertiary hospitals
Health system strengthening	• Allocate appropriately trained staff with relevant skills and knowledge to maternal healthcare services and avoid rotation of staff. • Provide equipment and consumables at all levels of care. • Consistent supply of medicine. • Availability of blood and blood products • Improve the audit of implementation of Basic Ante Natal Care (BANC) and labour records. • Conduct audit of the antenatal and maternity case record to improve quality of care. • Cluster clinics to conduct deliveries and establish MOUs at district hospitals where the infrastructure is available. • Dedicated Emergency obstetric ambulances to be made available to facilitate inter-facility transfer. • Strengthen contraception services. • Essential equipment and surgical supplies to be consistently available at all levels of care. • Tertiary and regional hospitals to conduct in reach and outreach programmes to support doctors at district level. • Doctors visiting Primary Health Care facilities to also take care of pregnant women. • Hospitals to conduct monthly perinatal review meetings to discuss cases and implement recommendations made in the meeting.

Limpopo provincial assessors

No	Surname and initials	District	Institution	Job title
1.	Mathetha M	Capricorn	Capricorn district office	Acting Deputy director MCWH&N
2.	Lebogo SJ	Capricorn	Hellen Franz hospital	Nursing service manager
3.	Setumo LJ	Capricorn	Seshego hospital	Advanced midwife
4.	Moremi DR	Capricorn	Sovenga campus	Tutor
5.	Phalane MD	Capricorn	Pietersburg hospital	Advance midwife
6.	DR K Baloyi	Capricorn	Polokwane /Mankweng complex	O&G Specialist
7.	Khumalo J	Capricorn	Seshego hospital	Advance midwife
8.	Mohlake K	Capricorn	Pietersburg hospital	Area manager maternity
9.	Mashele LX	Provincial office	Maternal health	Deputy Director
10	DR Marumo	Sekhune	Phladelphia hospital	Medical offiger maternity
11	Malapane MF	Sekhukhune	Phladelphia hospital nursing school	Tutor
12	Ramontsho MG	Sekhukhune	District office	Deputy director MCWH
13.	Motsanani B	Waterberg	Warm baths hospital	Advanced midwife
14.	Rhvhedzani MS	Vhembe	PHC	Assistant manager
15.	Nyakana M	Mopani	Letaba hospital	Advanced midwife
16.	Machavani M	Mopani	District office	Deputy director MCWH
17.	Singo T	Vhembe	Donald Frazer hospital	Advanced midwife

8.6 Mpumalanga

Introduction

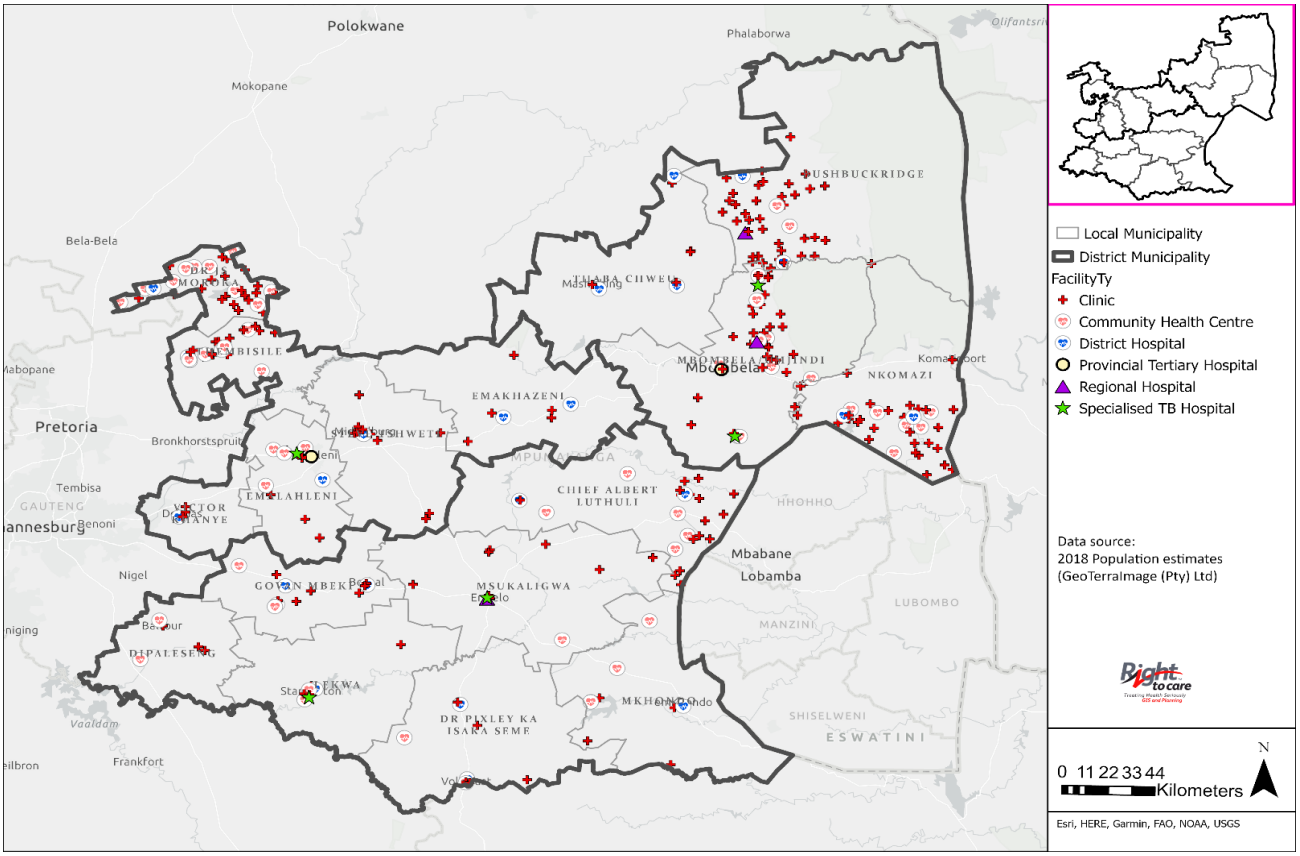
Mpumalanga Province is divided into three districts, namely Ehlanzeni, Gert Sibande and Nkangala. There are 17 sub-districts, with a recent population of about 5 143 324 (2022 Census). The province is committed to the achievement of SDG, by the year 2030. The confidential enquiry into Maternal Mortality helps in achieving these goals.

Mpumalanga province does not have a medical school; therefore, this poses a challenge in delivery of tertiary and quaternary (central hospital) services. The province has two tertiary, three regional, 23 district hospitals, 60 CHCs, and 232 clinics. None of the three districts within the province has a fully functional District Clinical Specialist Team (DCST). One of the two tertiary hospitals (Witbank hospital) also offer regional hospital services with only one full time Obstetrician and one full time anesthesiologist. Both tertiary hospitals (Rob Ferreira hospital and Witbank hospital) are not affiliated to any medical school. None of the regional hospitals has an anesthesiologist.

The COVID-19 pandemic adversely affected maternal mortality in the province, both directly and indirectly.

DHIS data on maternal mortality is collected and reported by the facility to the district MCWH coordinator. The death reports from the three districts are collated by the Assistant Director Maternal Health, and together with the District MCWYH coordinators organise the assessment of files. The assessed files are then captured into MaMMAS by the Deputy Director Maternal Health.

Service Delivery Platform/Public Health Facilities map



Source: Right To Care

Maternal deaths reported 2020-2022

Trends in maternal deaths

Mpumalanga province' maternal deaths increased from 299 in the last triennium (2017-19) to 375 in this triennium (2020-22).

Table 1: Trends in Maternal deaths 2017 to 2022

YEAR	NUMBER OF MD	% OF DEATHS IN SA
2017	117	9.94%
2018	112	9.73%
2019	70	6.85%
2020	95	7.69%
2021	167	11.08
2022	113	10.64%

Figure 1: Mpumalanga maternal deaths from 1998-2022

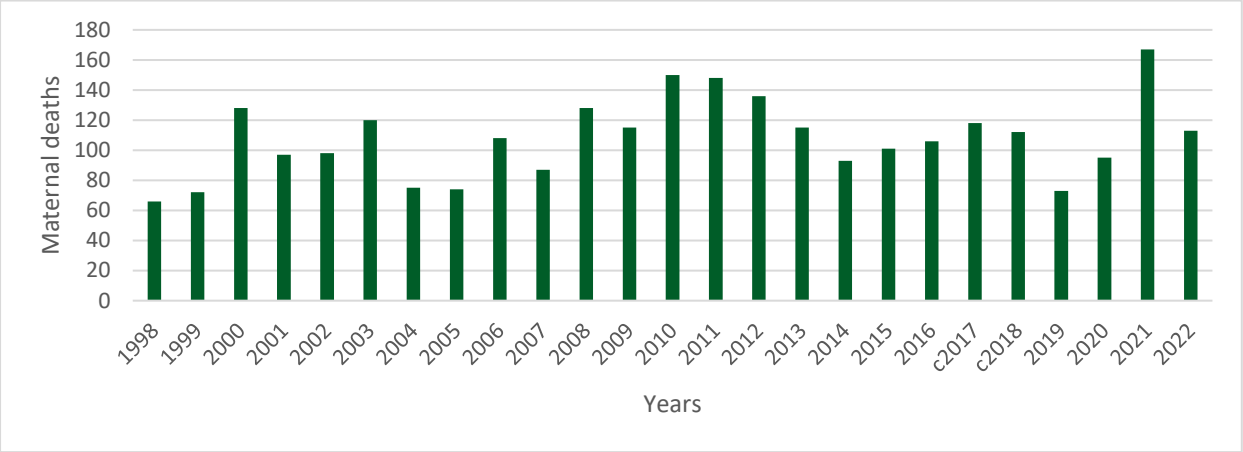
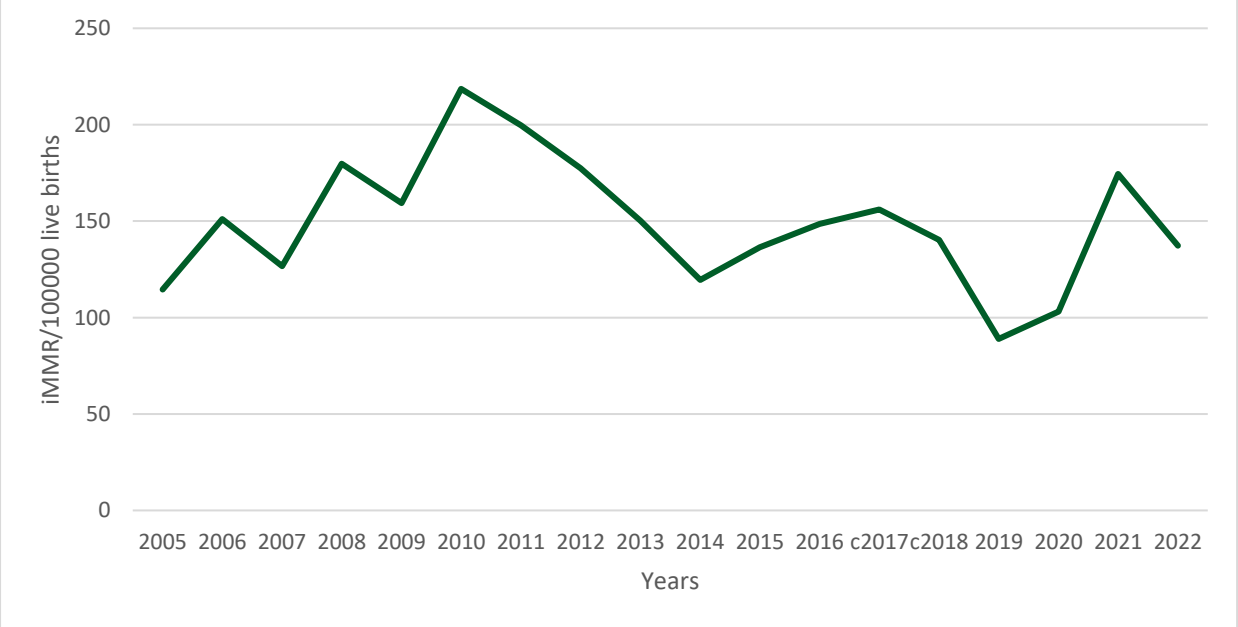


Figure 2: Mpumalanga iMMR from 2005-2022



There was a steady increase in institutional maternal mortality ratio (iMMR) from 2005-2010. This was followed by a steady decrease between 2011 to 2019 which could be attributed to antiretroviral treatment for HIV as well

as district support provided by the DCST as documented in the previous reports. Within the last triennium (2020—2022), there was a sharp increase in iMMR, in 2021 mainly due to direct and indirect effects of the COVID-19 pandemic on maternity services. This was followed by a small decline in 2022. This decline was mainly due to achievements in reduction on COVID-19 deaths, but further decline may be achieved if the indirect effect of COVID-19 pandemic on maternity services is fully reversed.

Figure 3: Mpumalanga iMMR for 2020-2022 and the 2020-2022 triennia

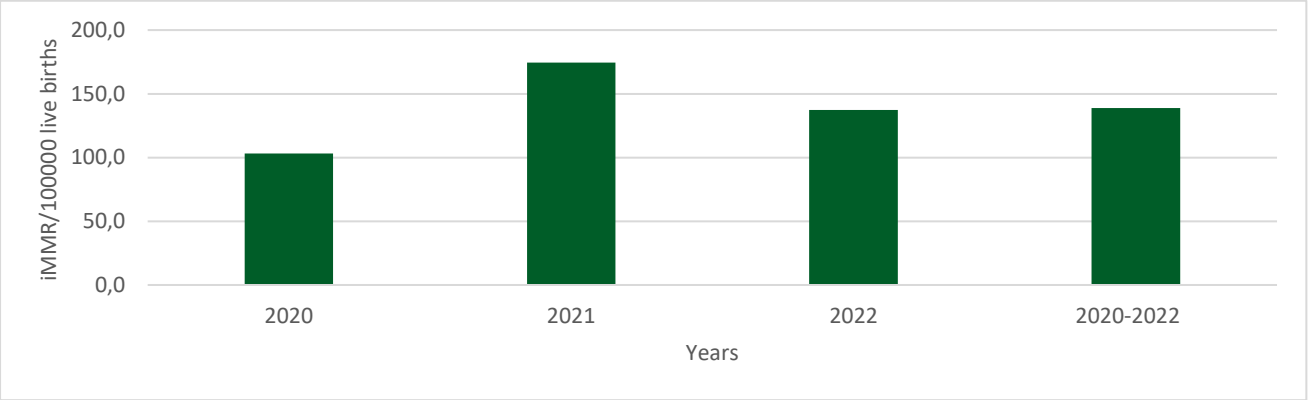


Figure 4: Mpumalanga iMMR for 4 triennia from 2011-2022

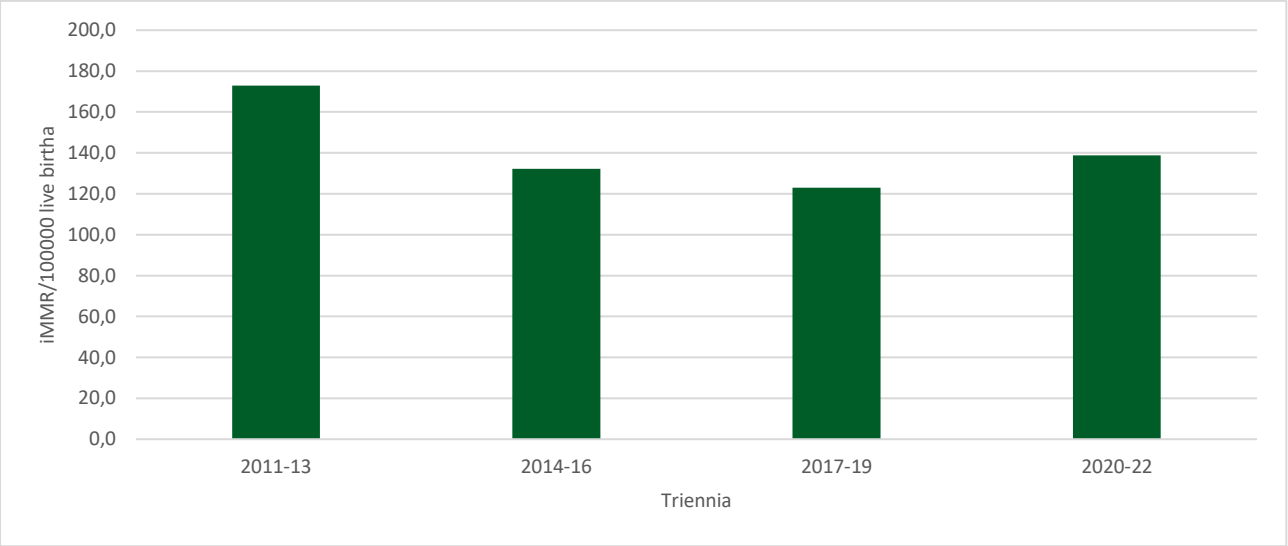


Table 2 shows the number of deaths reported to NCCEMD (MAMMAs database) and to DHIS. No corrections were required since, as expected MAMMAs numbers exceeded DHIs numbers. Live birth data was obtained from the DHIS database.

Table 2: DHIS and MaMMAS data

Mpumalanga	Live births	MaMMAS deaths (DDCP)	MaMMAS MD	DHIS MD	MaMMAS MD	MaMMAs iMMR	DHIS iMMR
2020	92094	99	95	77	95	103.16	83.6
2021	95700	168	167	142	167	174.50	148.4
2022	82270	113	113	105	113	137.35	127.6

2020-2022	Live births	MaMMAS MD	MaMMAs iMMR
Mpumalanga Province	270 064	375	138,86

Causes of maternal deaths

Figure 5: Mpumalanga Maternal deaths for 2020,2021 and 2022

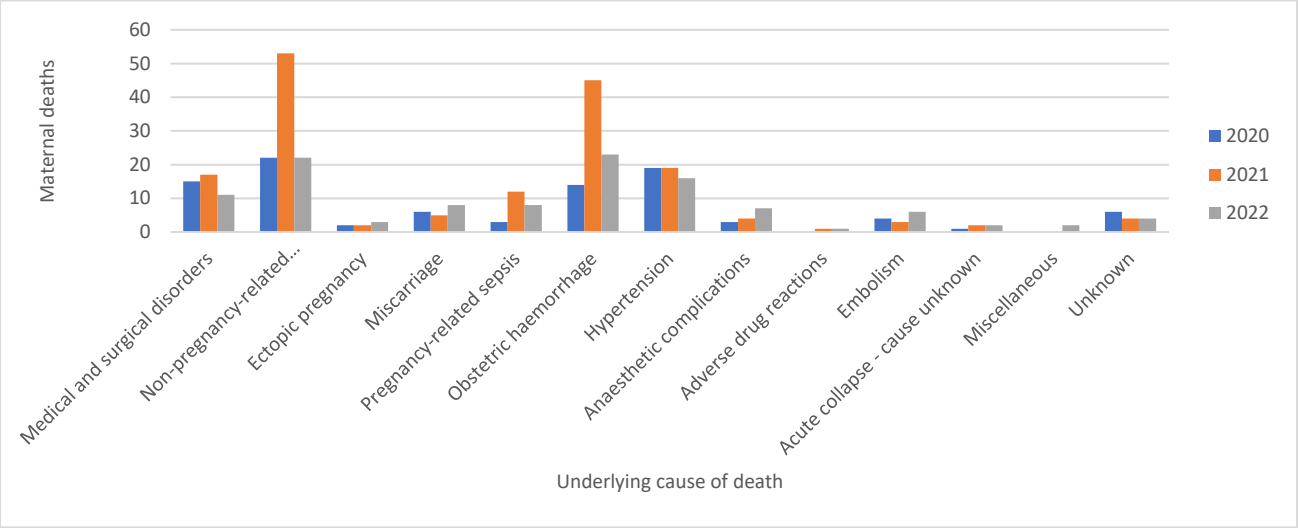


Table 3: TOP 5 Primary Obstetric Causes (numbers of maternal deaths)

Mpumalanga	2020	2021	2022	2020-2022	2020-2022 %	2017-2019 %
1. Non-pregnancy related infections	22	53	22	97	25.9% ↑	25.68%
2. Obstetric haemorrhage	14	45	23	82	21.9% ↓	26.95%
3. Hypertension	19	19	16	54	13.9% ↓	23.58%
4. Medical and surgical disorders	15	17	11	43	11.5% ↓	13.05%
5. Pregnancy-related sepsis	3	12	8	23	6.1% ↑	4.21%
Miscarriage	6	5	8	19	5.1% ↓	13.05%
Anaesthetic complications	3	4	7	14	3.7% ↑	1.26%
Embolism	4	3	6	13	3.5% ↓	4.21
Ectopic pregnancy	2	2	3	7	1.9% ↓	6.32
Acute collapse	1	2	2	5	1.3%	
Adverse drug reactions	0	1	1	2	0.5% ↓	3.37

Mpumalanga	2020	2021	2022	2020-2022	2020-2022 %	2017-2019 %
Miscellaneous	0	0	2	2	0.5%	
Unknown	6	4	4	14	3.7%	
Maternal deaths	**95**	**167**	**113**	**375**	**100%**	
Coincidental cause	4	1	0	5		
DDCP	99	168	113	380		
Live births (2019)	92094	95700	82270	270064		

- There was a notable increase in non-pregnancy related Infections in 2021, mostly accounted for by COVID-19 related deaths
- There was a sharp increase in Obstetric Haemorrhage related deaths from 14 in 2020 to 45 in 2022 and then a subsequent decrease to 23 in 2022.
- Obstetric Haemorrhage has decreased from the last triennium (26.95% to 21.09%)
- Deaths from hypertensive disease in pregnancy decreased in the last triennium (2020-2022) by 9.68% compared with previous triennium (2017-2019).
- Anaesthetic deaths have increased from 1.26% in the last triennium to 3.7% currently.

Table 4: iMMR per primary obstetric cause 2020-2022

Mpumalanga iMMR	2020	2021	2022	2020-2022
Non-pregnancy-related infections	23.89	55.38	26.74	35.92
Obstetric haemorrhage	15.20	47.02	27.96	30.36
Hypertension	20.63	19.85	19.45	20.00
Medical and surgical disorders	16.29	17.76	13.37	15.92
Pregnancy-related sepsis	3.26	12.54	9.72	8.52
Miscarriage	6.52	5.22	9.72	7.04
Anaesthetic complications	3.26	4.18	8.51	5.18
Embolism	4.34	3.13	7.29	4.81
Ectopic pregnancy	2.17	2.09	3.65	2.59
Acute collapse - cause unknown	1.09	2.09	2.43	1.85
Adverse drug reactions	0.00	1.04	1.22	0.74
Miscellaneous	0.00	0.00	2.43	0.74
Unknown	6.52	4.18	4.86	5.18
Maternal deaths	**103.16**	**174.50**	**137.35**	**138.86**
Coincidental cause	4.34	1.04	0.00	1.85
DDCP	107.50	175.55	137.35	140.71

Anaesthetic deaths are on the increase due to logistic problems and insufficient skills.

Figure 6: iMMR per primary cause per year, and for the triennium 2020-2022

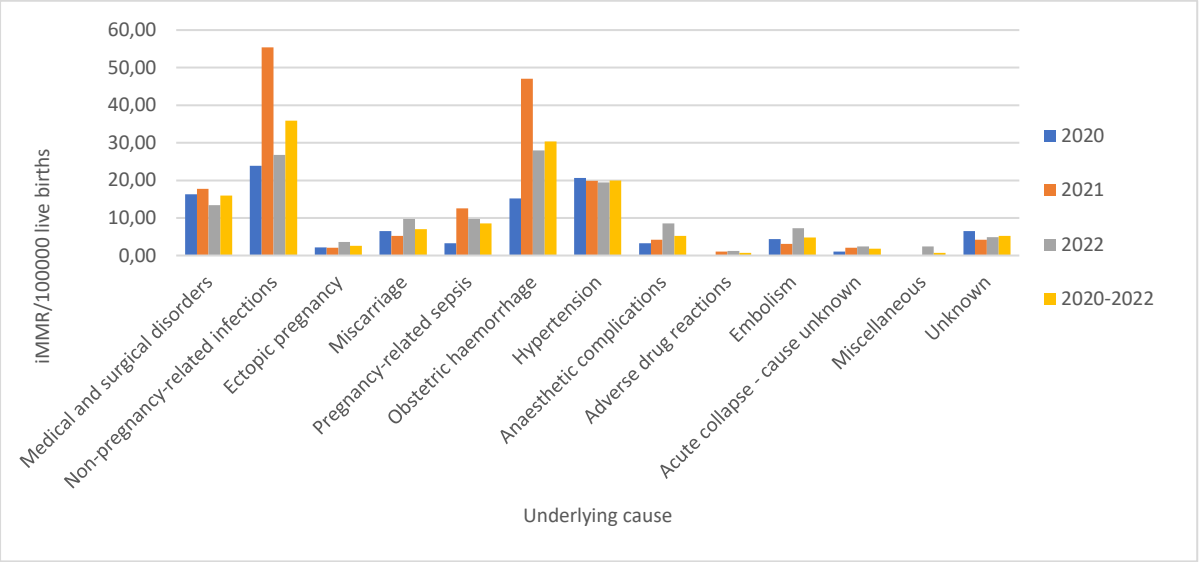


Figure 7: Pattern of iMMR per underlying cause per year and for the triennium

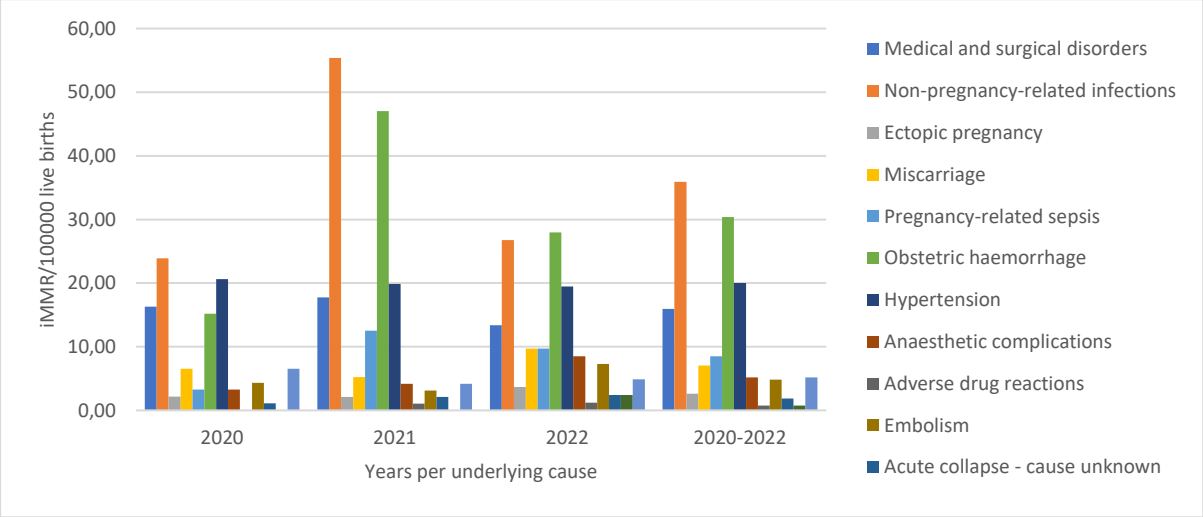


Table 5: Effect of COVID-19

COVID-19 maternal deaths	MP
2020	7
2021	33
2022	1
2020-2022	**41**

Figure 8: Mpumalanga COVID-19 Maternal deaths

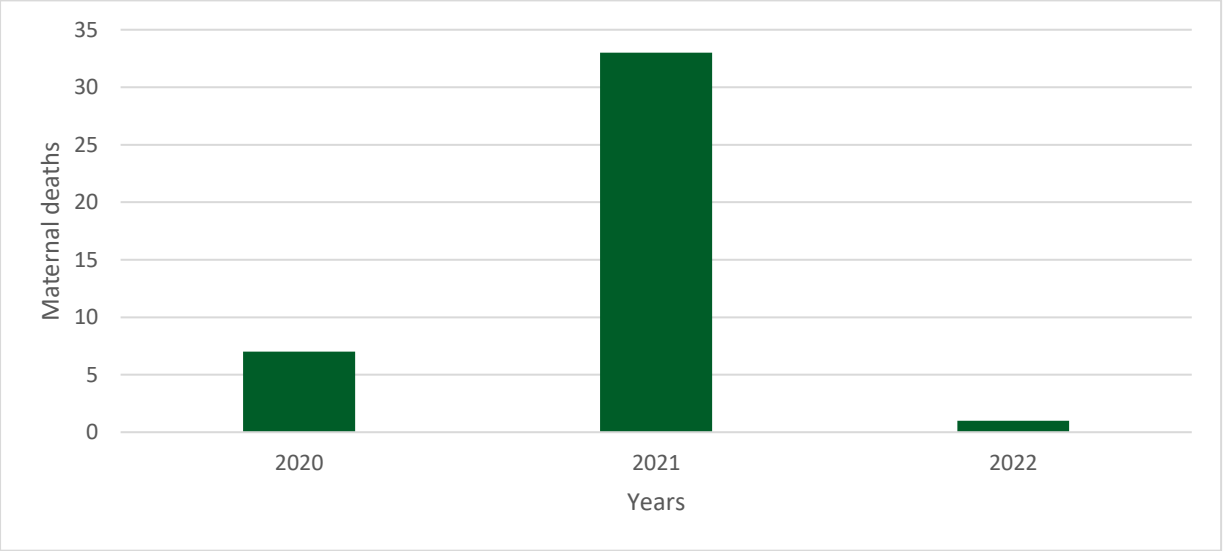


Table 6: Effect of HIV infection

Primary obstetric problems	Negative	Positive	Declined test	Unknown	Total
Non-pregnancy-related infections	33	59	0	5	97
Obstetric haemorrhage	45	31	0	6	82
Hypertension	29	16	0	9	54
Medical and surgical disorders	20	17	0	6	43
Pregnancy-related sepsis	10	10	0	3	23
Miscarriage	4	5	0	10	19
Anaesthetic complications	9	4	0	1	14
Embolism	8	4	0	1	13
Coincidental cause	0	2	0	3	5
Acute collapse - cause unknown	0	5	0	0	5
Adverse drug reactions	1	1	0	0	2
Miscellaneous	1	0	0	1	2
Unknown	7	5	0	2	14
Total	**167**	**160**	**0**	**53**	**380**

Table 7: Place of death

Primary obstetric problem	Outside	CHC	District hospital	Regional hospital	Tertiary hospital	Private hospital	Total
Non-pregnancy-related infections	3	0	32	27	23	12	97
Coincidental cause	0	0	2	2	1	0	5
Medical and surgical disorders	1	0	16	11	15	0	43
Obstetric haemorrhage	2	3	34	17	24	2	82
Hypertension	1	2	19	16	15	1	54

Primary obstetric problem	Outside	CHC	District hospital	Regional hospital	Tertiary hospital	Private hospital	Total
Pregnancy-related sepsis	0	0	4	9	10	0	23
Miscarriage	0	0	6	6	6	1	19
Anaesthetic complications	0	0	10	4	0	0	14
Embolism	1	1	8	3	0	0	13
Acute collapse - cause unknown	0	0	4	1	0	0	5
Adverse drug reactions	0	0	0	1	1	0	2
Miscellaneous	0	0	0	2	0	0	2
Unknown	9	0	2	3	0	0	14
Total	**17**	**6**	**137**	**102**	**95**	**16**	**373**

Table 8: Maternal Deaths per district

Primary obstetric problems	Ehlanzeni	Gert Sibande	Nkangala	Total
Non-pregnancy related infections	54	18	25	97
Obstetric haemorrhage	32	27	23	82
Hypertension	24	14	16	54
Medical and surgical disorders	18	9	16	43
Pregnancy-related sepsis	11	4	8	23
Miscarriage	8	4	7	19
Anaesthetic complications	6	3	5	14
Embolism	8	4	1	13
Ectopic pregnancy	3	0	4	7
Coincidental cause	2	2	1	5
Acute collapse - cause unknown	3	2	0	5
Miscellaneous	2	0	0	2
Unknown	7	4	3	14
Total	**180**	**91**	**109**	**380**

Figure 9: Mpumalanga maternal deaths per district

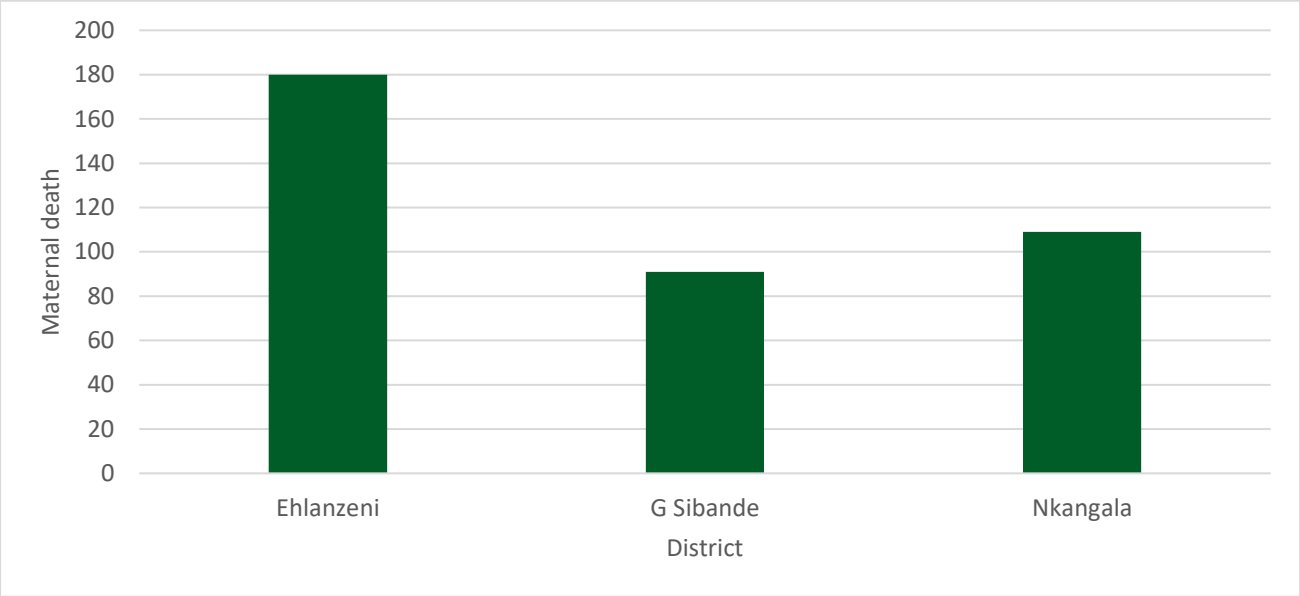


Table 9: Route of delivery

Primary obstetric problems	Vaginal	CD	CD CHC	CD DH	CD RH	CD TH/NCH	CD Pvt
Coincidental cause	0	1	0	0	1	0	0
Medical and surgical disorders	13	9	0	3	3	3	0
Non-pregnancy-related infections	33	24	1	9	7	9	2
Ectopic pregnancy	6	6	0	4	1	1	0
Miscarriage	1	0	0	0	0	0	0
Pregnancy-related sepsis	7	15	0	2	5	8	0
Obstetric haemorrhage	27	45	0	18	13	12	2
Hypertension	13	19	0	2	7	9	1
Anaesthetic complications	1	13	0	9	4	0	0
Adverse drug reactions	1	1	0	0	0	1	0
Embolism	3	4	0	3	1	0	0
Acute collapse - cause unknown	0	1	0	1	0	0	0
Miscellaneous	0	0	0	0	0	0	0
Unknown	5	5	1	4	2	1	1
Total	**110**	**143**	**2**	**55**	**44**	**44**	**6**

Table 10: Post-mortem Services

Primary obstetric problems	Post-mortem	Not done
Coincidental cause	2	3
Medical and surgical disorders	15	28
Non-pregnancy-related infections	6	91

Primary obstetric problems	Post-mortem	Not done
Ectopic pregnancy	2	5
Miscarriage	5	14
Pregnancy-related sepsis	9	14
Obstetric haemorrhage	39	43
Hypertension	13	41
Anaesthetic complications	9	5
Adverse drug reactions	0	2
Embolism	7	6
Acute collapse - cause unknown	3	2
Miscellaneous	1	1
Unknown	4	10
Total	**115**	**265**

The province depends on the Forensic service for postmortem. The post-mortems are not always performed by a pathologist, and so the quality of the post- mortems is sometimes a challenge.

Table 11: Resuscitation

Description	Number	% of cases
Lack of information	59	15.5
No avoidable factor	161	42.4
Airway problems	10	2.6
Breathing problems	17	4.5
Circulation problems	29	7.6
Drug problems	16	4.2
Investigation problems	3	0.8
Monitoring problems	14	3.7
Not attempted	100	26.3
Total cases	**380**	

Discussion

- The number of maternal deaths reported in this triennium increased by 76 from 299 (2017-2019) to 375 (2020-2022) in this triennium.
- There was a sharp increase in Obstetric Haemorrhage related deaths from 14 in 2020 to 45 in 2021. This is multi-factorial but probably related to adverse effects of the COVID-19 pandemic on maternity services, as well as inexperienced junior medical officers and community servers in the rural district hospitals who carry after hour responsibilities. In recent years, more and more community service medical officers come into our service without having even completed the required 10 caesarean sections during their internship training. There was a decrease to 23 in 2022 as the COVID-19 pandemic became contained.

- During the pandemic, district support by the DCST team was affected due to a re-focus of their skill and clinical inputs into pandemic related matters.
- The COVID-19 pandemic adversely affected maternal mortality in the province, both directly and indirectly.
- HIV infection was associated with increased deaths from non-pregnancy related infections.
- Deaths from obstetric haemorrhage are more common following caesarean section delivery.
- There was a steady increase in Anaesthetic related deaths. This might be a reflection of poor Anaesthetic skills in the district hospitals and regional hospitals coupled with inadequate Anaesthetic nursing support. The province has invested in providing the Safe Obstetric Anaesthetic course in conjunction with the University of the Free State. Improvement in Anaesthetic skills may impact positively on provision of resuscitation following cardiopulmonary arrest since resuscitation was not attempted in about 25% of maternal deaths.
- Deaths related to hypertension in pregnancy decreased in the last triennium by 9.68% (2020-2022= 13.9% and 2017-2019=23.58%).
- More deaths occurred in the district hospitals compared with the regional and tertiary institutions in all the top five causes of maternal deaths. This is probably a reflection of dysfunctional referral system and a lack of skills amongst medical officers in these facilities.
- Deaths from miscarriages decreased from 13.05% in the previous triennium to 5.1% in this triennium.

Recommendations

- To decrease deaths due to OH, the province should implement the recently developed E-Motive approach for early detection and first response for PPH, aiming to decrease OH deaths by at least 60%. Safe caesarean section delivery must be ensured especially at the district hospitals.
- To strengthen the prevention and management of hypertension during antenatal care in PHC facilities.
- HIV infection prevention and contraception services must be strengthened among women of reproductive age group.
- The availability of all basic resources should be improved.
- Availability of a medical school in Mpumalanga should be motivated and actioned.
- Improvement in Anaesthetic skills is highly recommended, and provision of Anaesthetic nurses need to be addressed.
- The province needs to sustain the good practices.

Mpumulanga Provincial assessors

Ehlanzeni District - Maternal death assessors

No	Name	Category	Health facility
1.	Dr G Goosen	DCST	Ehlanzeni District
2.	Sr D Dlamini	Sub district MCWH	BBR sub-district
3.	Dr Orie	Obstetrician	Themba Hospital
4.	Sr D Ngoma	Advanced Midwife	Themba hospital (Retired in 2022)
5.	Dr BG Ndubane	Doctor	Mapulaneng Hospital
6.	Sr J Maboi	Advanced Midwife	Mapulaneng Hospital
7.	Sr G Mnisi	Advanced Midwife	Tintswalo hospital (Retired)
8.	Dr Walzl	Doctor	Tonga Hospital (Retired)
9.	Sr K Shongwe	Advanced Midwife	Shongwe Hospital
10.	Sr Mabel Sibiya	Advanced Midwife	Matikwane Hospital
11.	Sr Z Mhlongo	Sub district MCWH	Nkomazi sub-district

Gert Sibande district - Maternal death assessors

No	Name	Category	Health facility
1.	Dr R Ndlovu	Doctor	Ermelo Hospital
2.	Sr Y Mvambo	Advanced Midwife	Ermelo Hospital
3.	Dr Okoka	Doctor	Carolina Hospital
4.	Sr V Ncongwane	Advanced Midwife	Carolina Hospital
5.	Dr AR Anyawo	Doctor	Evander Hospital
6.	Sr L Lidzadze	Advanced Midwife	Evander Hospital
7.	Dr E Shabalala	Doctor	Piet Retief hospital
8.	Sr Nomsa Sibeko	Advanced Midwife	DCST Gert Sibande (Retired)
9.	Sizakele Nxumalo	Advanced Midwife	Embhuleni Hospital
10.	Dr S Mpombwa	Doctor	Embhuleni hospital
11.	Sr BK Vilakazi	Advanced Midwife	Standerton hospital
12.	Dr S Sivuyile	Doctor	Standerton hospital
13.	Dr EB Mthethwa	Doctor	Bethal hospital
14.	Ms Kholekile Mabunda	MCWYH Coordinator	District (Retired)
15.	Mr Thando Ngwenya	MCWYH Coordinator	District Office
16.	Dr J Mahlangu	Doctor	Standerton Hospital

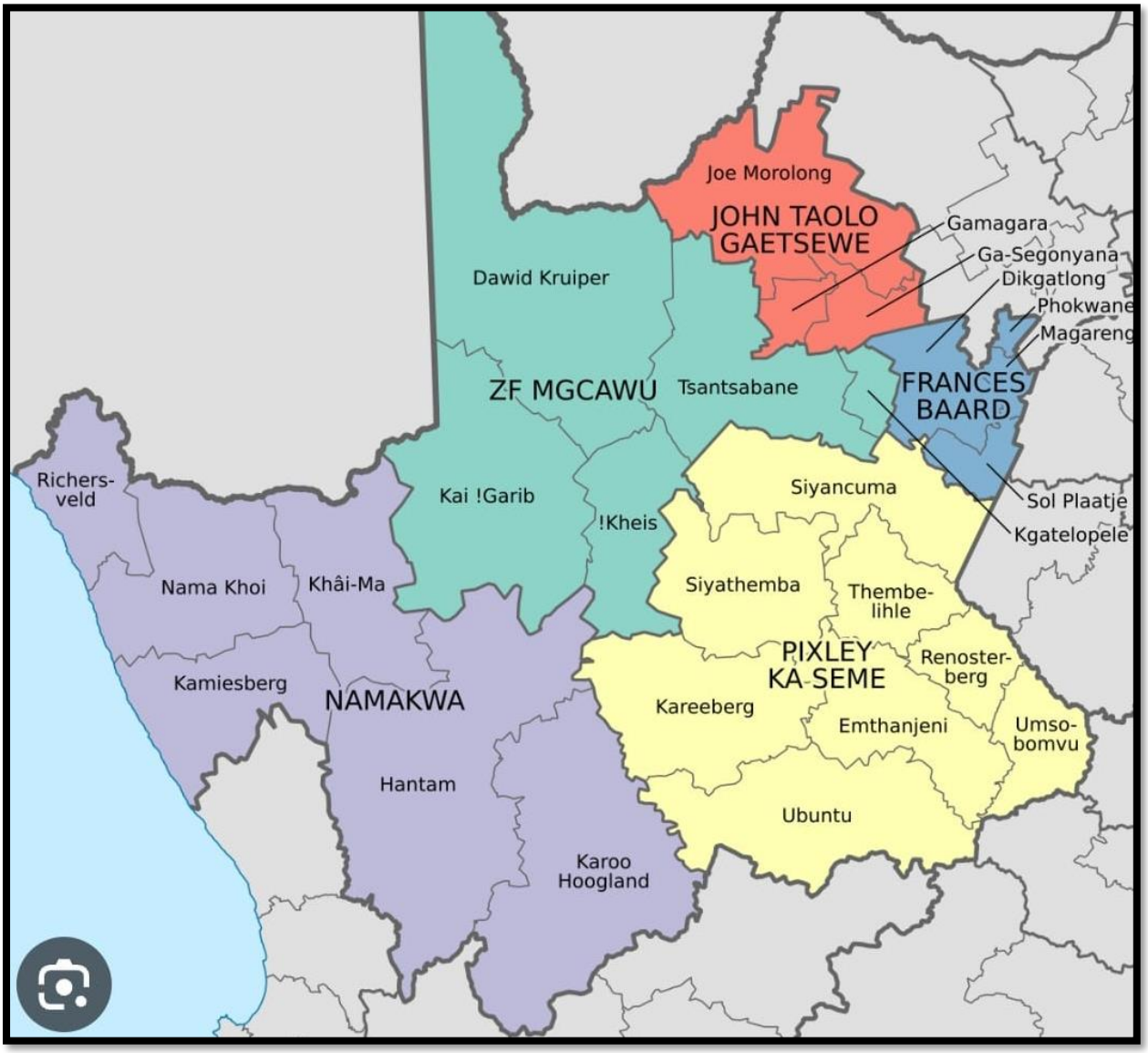
Nkangala district - Maternal death assessors

No	Name	Category	Health facility
1.	Dr S Motsweni	Doctor	Bernice Samuel Hospital
2.	Sr NM Mabena	Advanced Midwife	Bernice Samuel Hospital
3.	Dr Sibanyoni	Doctor	Kwamhlanga Hospital
4.	Sr K Mtshaisa	MCWYH co-ordinator	Thembisile Hani sub-district
5.	Sr RD Mishele	Advanced Midwife	Mmamethlake hospital
6.	Sr MV Lepaku	Advanced Midwife	Mmamethlake hospital
7.	Dr Tibamwenda	Doctor	Mmamethlake hospital
8.	Sr S Canda	Advanced Midwife	Witbank Hospital (RIP)
9.	Dr Mwamba	Doctor	Middleburg Hospital
10.	Ms A Viljoen	District MCWYH	Nkangala District

Provincial officials

No	Name	Category
1.	Ms Marie Muller	MaMMAS data capturer (Retired)
2.	Ms Annsie Mashele	MaMMAS data capturer
3.	Ms Victoria Mokoena	Deputy Manager Maternal Health, MD Assessor
4.	Dr Kekane	Anaesthetic Assessor
5.	Dr M Makhinde	Quality Assessor and NCCEMD member

8.7 Northern Cape



Introduction

Northern Cape is the largest province in the country with the smallest population of 1,36 million as reported in the (Stats SA Mid –Year Population Estimates 2020). It constitutes 2.2% of the population of South Africa and covers 372 889 square kilometres which is 30.5% of the country's land area. It is largely rural with vast distances to travel.

The province is divided into five districts namely: Frances Baard (FB), John Taolo Gaetsewe (JTG), Zwelintlanga Fatman Mgcawu (ZFM), Namakwa (NMK) and Pixley Ka Seme (PKS).

Frances Baard is the smallest district but with the highest population and Namakwa is the largest district with the smallest population and John Taolo Gaetsewe is the most rural district.

The province comprises of the following health institutions: One level three (Tertiary) hospital in FB, one regional hospital in ZFM and eleven district hospitals, 130 clinics, 46 Satellite clinics, 29 mobiles and 33 Community Health Centres.
During the 2020-2022 triennium a total of 92 maternal deaths were notified with the total of 66 723 livebirths giving an iMMR of 137.9/100 000 livebirths.

The major causes of deaths for this triennium were non-pregnancy related infections, Hypertension and Obstetric haemorrhage.

Mining and agriculture are the main source of employment thus resulting in high influx to respective areas. This impacts negatively on Antenatal care services, e.g. late booking, and unbooked cases.

The low socio -economic status, high transport costs, poor road conditions as well as lack of emergency medical transport result in the delay of patients reaching health service points timeously.

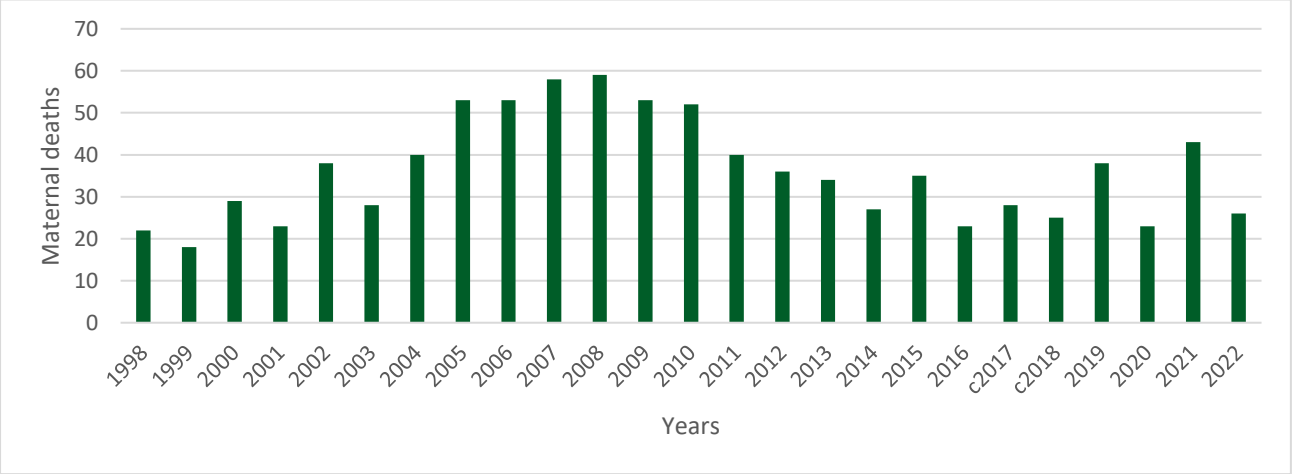
Community healthcare centres render services between 8 to 24 hours depending on staff compliment. Only six of eleven district hospitals function at capacity. Lack of essential equipment, non-functional theatres, infrastructural challenges and competent staff at level 1 hospitals are the main challenges and impact negatively on quality of care.

The Tertiary institution, Robert Mangaliso Sobukwe hospital, also renders both level 1 and level 2 care because Sol Plaatjie and Magareng sub districts do not have district hospitals. Two district hospitals in FB not fully functional. The Regional hospital (Dr Harry Surtie: ZFM) renders service for both ZF Mgcawu and Namakwa districts.

There is no Obstetrics and Gynaecology specialist for the District Clinical Specialist Teams throughout the province; this is only available at the Tertiary hospital.

Trends in maternal deaths and MMR

Figure 1. Maternal deaths 1998 to 2022



A decrease in numbers of maternal deaths was noted in 2020 possibly due to underreporting as consequence of fear with the start of the COVID-19 pandemic. In 2021 a large increase in maternal deaths was noted with 14 out of 43 deaths due to COVID-19. In 2022 no COVID-19 deaths were reported and maternal mortality decreased to pre- COVID-19 levels. During the 2020-2022 triennium a total of 92 maternal deaths were notified with a total of 66 723 livebirths giving an iMMR of 137.9/100 000 livebirths.

Figure 2. Trends in iMMR 2005 to 2022

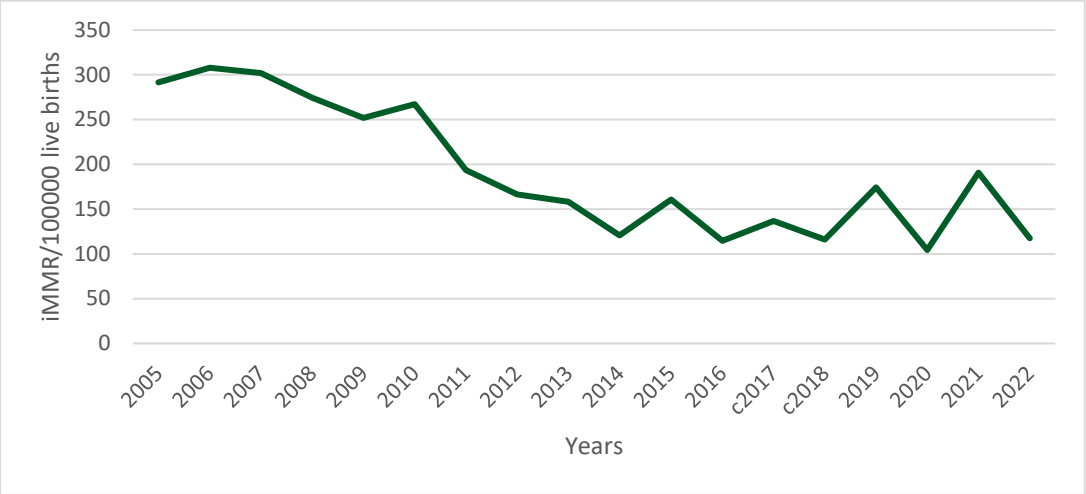
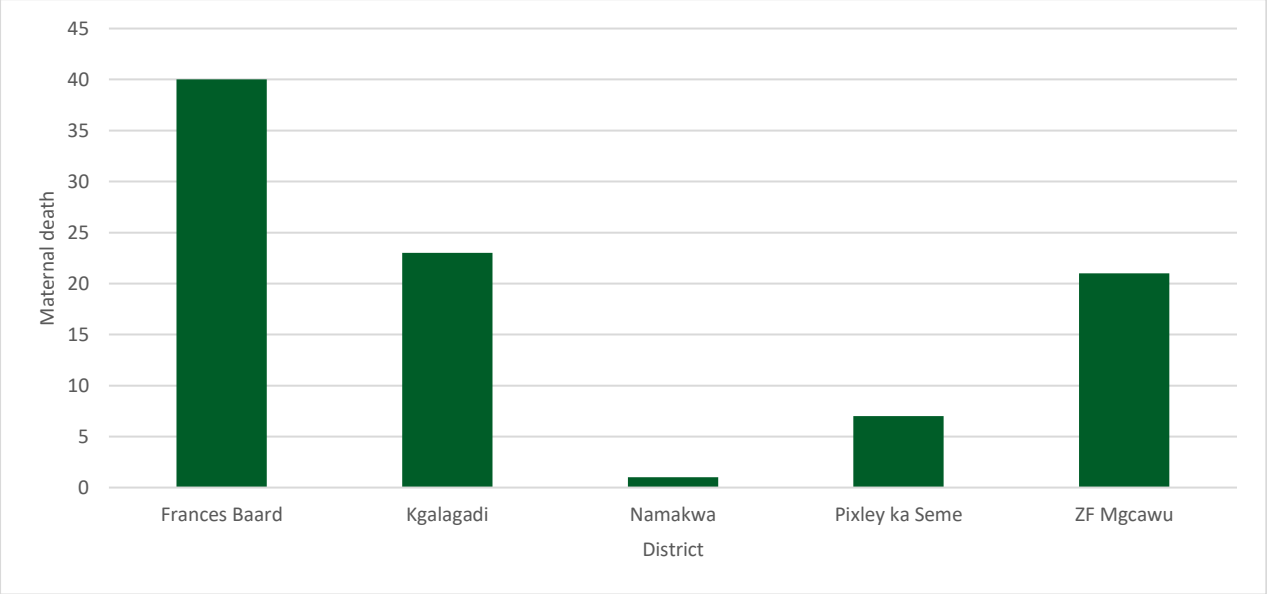


Figure 3. Maternal deaths per district, 2020-2022



Frances Baard district has the highest number of maternal deaths in the province due to all complicated cases requiring specialist care being referred to the Tertiary level. It is followed by John Taolo Gaetsewe and ZF Mgcawu district, which were less hit by COVID-19 related deaths in 2021.

CAUSES OF MATERNAL DEATH

NPRI was the leading cause of maternal deaths for the triennium. NPRI deaths due to COVID-19 were highest in 2021 with 14 COVID-19 deaths.

The number of HDP deaths was similar for 2020 and 2022. Although it might appear that there was a decrease in 2021, many of the patients who died of COVID-19 also had HDP.

OH was highest in 2021. This might have been a secondary effect of COVID-19, as more staff were mobilised to other areas and transport was also negatively affected, etc.

Table 1. Primary Obstetric Causes of Maternal death with Causal subcategories, 2020-2022

Primary Cause of death	2020	2021	2022	2020-2022
Coincidental cause	**0**	**0**	**0**	**0**
MVA	0	0	0	
Other	0	0	0	
Medical and surgical disorders	**2**	**2**	**6**	**10**
Cardiomyopathy	1	0	1	2
Haematological	0	0	1	1
Endocrine	0	1	0	1
Respiratory	0	0	3	3
GIT	0	0	0	0
CNS	0	0	0	0
Rheumatic heart disease	0	1	0	1
Other	1	0	1	2
Non-pregnancy-related infections	**5**	**20**	**1**	**26**
PCP pneumonia	1	0	0	1
Other pneumonia	2	4	0	6
TB	0	2	1	3
Other	2	14	0	16
Ectopic pregnancy	**1**	**1**	**2**	**3**
Less than 20 weeks	1	1	2	3
Miscarriage	**2**	**1**	**0**	**3**
Haemorrhage non-traumatic	1	1	0	2
Following Legal TOP	1	0	0	1
Pregnancy-related sepsis	**0**	**3**	**1**	**4**
Chorioamnionitis (Ruptured membranes)	0	0	0	0
Chorioamnionitis (intact membranes)	0	0	0	0
Bowel trauma at caesarean delivery	0	1	0	1
Puerperal sepsis after NVD	0	2	1	3
Puerperal sepsis after C/S	0	0	0	0
Obstetric haemorrhage	**4**	**7**	**3**	**14**
Abruption with hypertension	1	1	0	2
Abruption without Hypertension	0	1	1	2
Placenta Praevia	0	0	0	0
Other APH not specified	0	0	0	0
Ruptured uterus with C/S	0	0	0	0
Ruptured uterus without C/S	0	0	1	1
Retained Placenta after NVD (not adherent)	0	0	0	0
Retained Placenta after NVD (morbidly adherent)	1	1	0	2
Uterine atony after vaginal delivery	0	2	0	2
Bleeding during Caesarean delivery (morbidly adherent placenta)	0	0	0	0

Primary Cause of death	2020	2021	2022	2020-2022
Bleeding during Caesarean delivery (not adherent placenta)	0	0	0	0
Bleeding after Caesarean delivery	1	1	0	2
Other PPH not specified after vaginal delivery	0	0	0	
Cervical trauma with severe features	0	0	1	1
Vaginal trauma after vaginal delivery	0	1		1
Hypertension	**7**	**3**	**8**	**18**
Chronic Hypertension	0	0	1	1
Gestational hypertension	0	0	1	1
Pre-Eclampsia with severe features	2	1	2	5
Pre-Eclampsia without severe features	0	1	0	1
Eclampsia	4	1	1	6
HELLP	1	0	1	2
Liver rupture	0	0	2	2
Anaesthetic complications	**0**	**1**	**0**	**1**
Spinal Anaesthetic	0	1	0	1
General Anaesthesia	0	0	0	0
Adverse Drug reaction	0	0	0	0
Embolism	**0**	**3**	**1**	**4**
Pulmonary embolism	0	3	1	4
Acute collapse - cause unknown	**0**	**1**	**0**	**1**
Unknown	**2**	**1**	**3**	**6**
Death at home or outside health services	2	1	0	3
No primary cause found	0	0	0	0
Lack of Information	0	0	3	3
Miscellaneous	**0**	**0**	**1**	**1**
Acute fatty liver	0	0	1	1

Figure 4. IMMR per underlying cause per year and for the 2020-2022 triennium

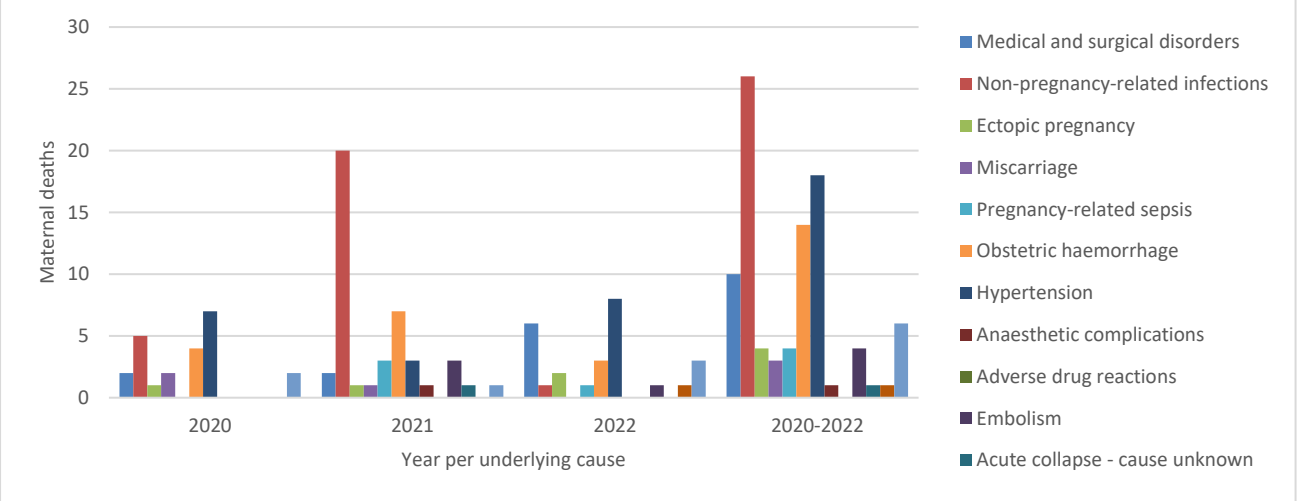


Table 2. COVID-19 Maternal deaths

COVID-19 maternal deaths	NC
2020	2
2021	14
2022	0
2020-2022	**16**

The numbers of maternal deaths due to COVID-19 was much lower than in other provinces with only 16 COVID-19 cases. This might be attributed to less dense population and not being a travel destination.

Of concern:

- None of the patients received the vaccine, although the roll out of the vaccine was towards the end of 2021.
- Unbooked cases.
- Indirect consequence of COVID-19 pandemic, increase in loss to follow up for chronic treatment.
- Other obstetric cases not managed optimally due to COVID-19.
- Overburdened service e.g. no ICU bed available, ventilators, shortage of staff.

Table 3. Maternal deaths per district per the underlying cause 2020-2022

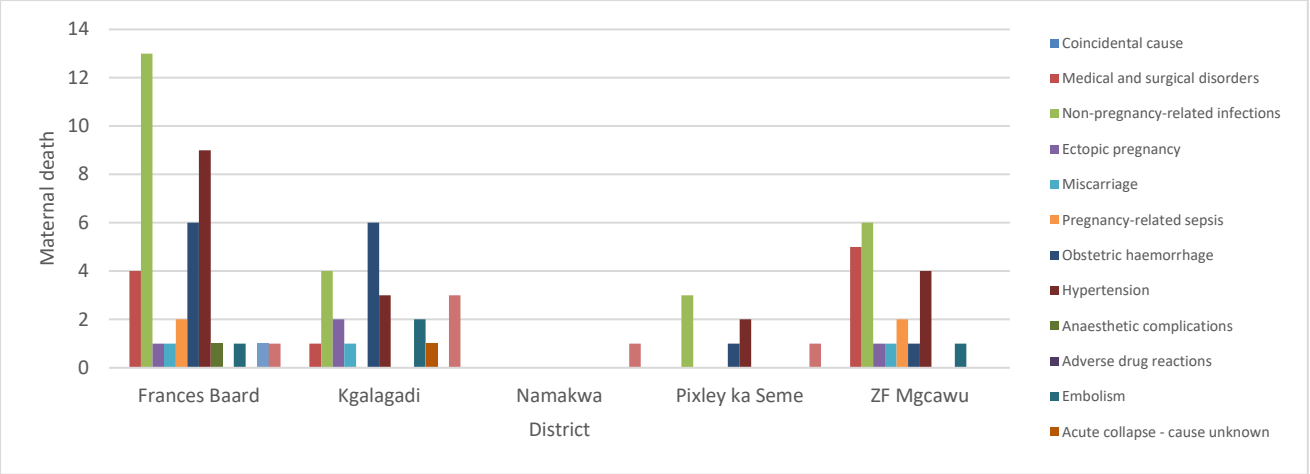
Primary obstetric problems	Frances Baard	Kgalagadi	Namakwa	Pixley ka Seme	ZF Mgcawu	Total
Coincidental cause	0	0	0	0	0	0
Medical and surgical disorders	4	1	0	0	5	10
Non-pregnancy-related infections	13	4	0	3	6	26
Ectopic pregnancy	1	2	0	0	1	4
Miscarriage	1	1	0	0	1	3
Pregnancy-related sepsis	2	0	0	0	2	4
Obstetric haemorrhage	6	6	0	1	1	14
Hypertension	9	3	0	2	4	18
Anaesthetic complications	1	0	0	0	0	1
Adverse drug reactions	0	0	0	0	0	0
Embolism	1	2	0	0	1	4
Acute collapse - cause unknown	0	1	0	0	0	1
Miscellaneous	1	0	0	0	0	1
Unknown	1	3	1	1	0	6
Total	**40**	**23**	**1**	**7**	**21**	**92**

Thirteen patients who died of NPRI were in FB. The tertiary hospital and two private hospitals are in FB and therefore explain the high number.

Nine out of 18 HDP deaths are from FB with the Tertiary hospital as the receiving institution for the district. ZF Mgcawu had four deaths where the regional hospital is situated and receives patients from the district and from Namakwa.

The six deaths due to OH in Kgalagadi (JTG) is of concern.

Figure 5. Maternal death per district per underlying cause, 2020-2022



Non-pregnancy related infections (NPRI) were the leading causes of deaths in FB district, followed by hypertensive disorders in pregnancy and by Obstetric haemorrhage.

OH was the leading cause of death in JTG (Kgalagadi), followed by NPRI, HDP and Medical and Surgical disorders. In ZF Mgcawu district NPRI deaths were most common, followed by Medical and Surgical disorders and HDP.

Table 4. Final causes of death, 2020-2022

Final cause of death	2020	2021	2022	2020-2022
Circulatory system	**6**	**13**	**7**	**26**
Hypovolaemic	2	9	5	
Septic shock	4	4	2	
Respiratory failure	**8**	**22**	**5**	**35**
Respiratory failure	8	22	5	
Cardiac failure	3	3	4	
Pulmonary oedema	3	3	4	
Embolism	**0**	**4**	**2**	**6**
Acute collapse due to embolism		4	2	
Renal failure	**2**	**6**	**9**	**17**
Renal failure	2	6	9	
Liver failure	**1**	**4**	**2**	**7**
Liver failure	1	4	2	
Cerebral complications	**8**	**6**	**3**	**17**

Final cause of death	2020	2021	2022	2020-2022
Intracranial haemorrhage	2	0		
Cerebral oedema resulting in coning	1	1	1	
Brain death following hypoxic event	4	0	0	
Unspecified	1	1	1	
Metabolic	**2**	**7**	**4**	**13**
Maternal ketoacidosis	1	3	3	
Lactic acidosis	0	2	1	
Electrolyte imbalance	1	1	0	
other	0	1	0	
Haematological	**7**	**4**	**8**	**19**
DIC	4	2	2	
Severe anaemia	3	2	6	
Immune system	**4**	**1**	**3**	**7**
Immune system failure	**4**	**1**	**3**	
Unknown	**2**	**3**	**3**	**8**
Death at home or outside health services	1	2	1	
Unknown	1	1	2	
Other	**1**	**4**	**6**	**11**

Respiratory and circulatory cause resulted in most maternal deaths due to complications of COVID-19.

Demographic, obstetric and health system data

Table 5. Age and Maternal deaths, 2020-2022

Age	2020	2021	2022	2020-2022
<20	2	5	2	9
20-24	3	4	2	9
25-29	3	12	4	19
30-34	3	9	10	22
35-39	5	11	6	22
40-44	7	2	2	11
45+	0	0	0	0
Unknown	0	0	0	0

The majority of deaths occurred amongst women aged 25 to 44 years, with most deaths occurring in the age group 30-39 years.

Family planning services and health education were negatively affected by the COVID-19 pandemic.
In the age groups < 20yrs, pregnancy could be avoided, with better Health Education and Contraception.

Table 6. Maternal age and Primary Obstetric Cause of death, 2020-2022

Primary obstetric problem	15-19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	Outside 10-44 range & unknown	Total
Coincidental cause	0	0	0	0	0	0	0	0
Medical and surgical disorders	0	3	2	1	3	1	0	10
Non-pregnancy-related infections	2	2	5	5	8	4	0	26
Ectopic pregnancy	1	0	0	1	2	0	0	4
Miscarriage	0	1	2	0	0	0	0	3
Pregnancy-related sepsis	0	1	3	0	0	0	0	4
Obstetric haemorrhage	3	1	2	3	3	2	0	14
Hypertension	1	0	3	8	2	4	0	18
Anaesthetic complications	0	0	1	0	0	0	0	1
Adverse drug reactions	0	0	0	0	0	0	0	0
Embolism	0	0	0	2	2	0	0	4
Acute collapse - cause unknown	1	0	0	0	0	0	0	1
Miscellaneous	0	1	0	0	0	0	0	1
Unknown	1	0	1	2	2	0	0	6
Total	**9**	**9**	**19**	**22**	**22**	**11**	**0**	**92**

NPRI affected all age groups with 16 COVID-19 deaths.

HDP was highest in age group 30-34 followed by 40-44. The management of HPD at primary health remains sub-optimal with conditions not identified or managed incorrectly.

OH affected all age groups with management being sub-optimal where protocols were not implemented. Medical and surgical disorders increased in the age group 25-44. Pre-existing conditions might have been missed during the ANC period.

Figure 6. Maternal age and Primary Obstetric cause of death, 2020-2022

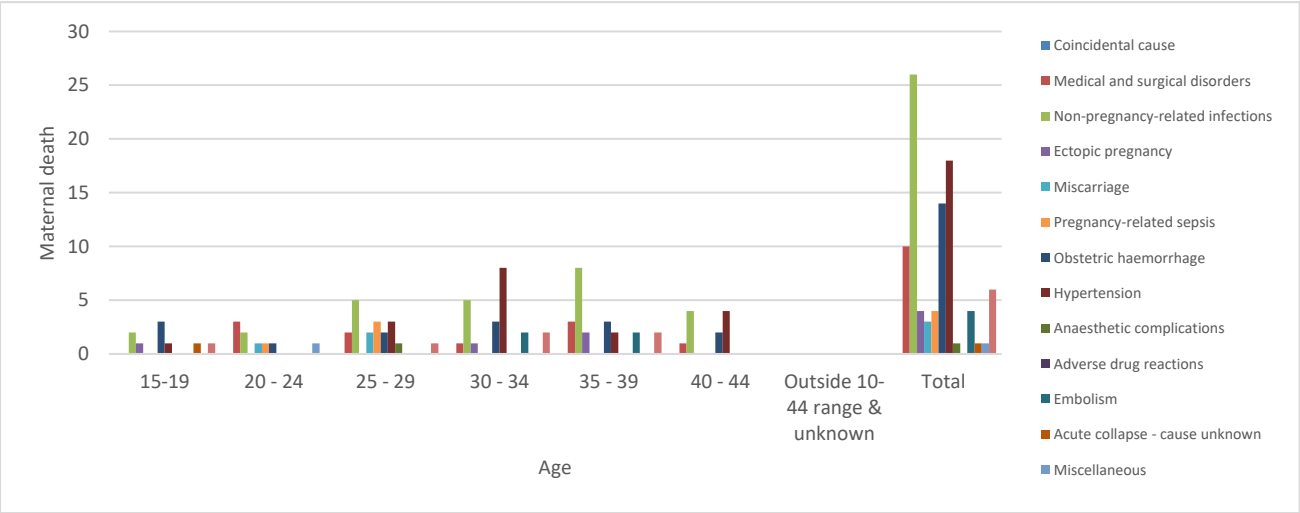


Table 7. Maternal deaths and parity, 2020-2022

Parity	2020	2021	2022	2020-2022
0	4	10	3	17
1	4	12	6	22
2	7	9	7	23
3	5	6	4	15
4	2	0	5	7
5	0	2	1	3
6+	1	1	0	2
Unknown	0	3	0	3

Most deaths are in the multipara groups and their obstetric history with possible risk factors should be known and therefore their management should have been planned accordingly. The high number of deaths in nulliparous women is of concern.

Table 8. Maternal deaths and Antenatal Care Attendance, 2020-2022

Antenatal Care Attendance	2020	2021	2022	2020-2022
Received ANC	18	29	16	63
No Antenatal Care	3	9	9	21
Unknown	2	5	1	8

Table 8 shows that most women who died had attended the ANC clinic (61.5%). There is concern about the quality of care provided. Although the reasons for not attending the ANC are mostly unknown, this still reflects on a failing system directly or indirectly.

Table 9. Maternal deaths and Gestational Age at booking, 2020-2022

Gestational Age at Booking	2020	2021	2022	2020-2022
Booked before 20 weeks	9	17	9	35
Did not book before 20 weeks	8	11	6	25
Unknown	1	1	1	3

Most women booked for ANC before 20 weeks, and this seemed not to have been affected by the effects of COVID-19 in 2021

Table 10 shows that more deaths occurred amongst women who were HIV negative, followed by those who were HIV positive and not virally suppressed. Of concern are those who were never tested for HIV and those with CD4 count of less than 350/mm^3. The majority of HIV positive women who died of NPRI had unsuppressed viral loads of above 1000 copies/Ml

Table 10. Maternal deaths and HIV Status, 2020-2022

HIV Status	2020	2021	2022	2020-2022
Positive	8	11	8	27
Negative	13	25	14	52
Unknown	2	7	4	13
Declined	0	0	0	0

Table 11. HIV status and Primary Obstetric Cause of death

Primary obstetric problems	Negative	Positive	Declined test	Unknown	Total
Coincidental cause	0	0	0	0	0
Medical and surgical disorders	5	3	0	2	10
Non-pregnancy-related infections	12	8	0	6	26
Ectopic pregnancy	1	2	0	1	4
Miscarriage	1	2	0	0	3
Pregnancy-related sepsis	1	2	0	1	4
Obstetric haemorrhage	10	3	0	1	14
Hypertension	13	3	0	2	18
Anaesthetic complications	1	0	0	0	1
Adverse drug reactions	0	0	0	0	0
Embolism	3	1	0	0	4
Acute collapse - cause unknown	1	0	0	0	1
Miscellaneous	1	0	0	0	1
Unknown	3	3	0	0	6
Total	**52**	**27**	**0**	**13**	**92**

Eight patients who died from NPRI were HIV positive, 12 were HIV negative, and for six their status was unknown.

Table 12. Maternal deaths in HIV positive women and CD 4 counts, 2020-2022

Type of Therapy	2020	2021	2022	2020-2022
500+/mm³	2	4	2	8
350-499/mm³	0	1	2	3
200-349/mm³	1	0	1	2
Less than 200/mm³	4	3	3	10
Unknown	1	3	0	4

Deaths occurred amongst women with CD4 count of less than 350/mm³. Adherence counselling to be emphasised and disclosure encouraged.

Table 13. Maternal deaths in HIV positive women and HIV Viral Load, 2020-2022

HIV VIRAL LOAD	2020	2021	2022	2020-2022
LDL and less than 50	1	4	2	7
50 - 999	1	0	0	1
≥1000	3	2	6	11
Unknown	3	5	0	8

Deaths occurred amongst women with unsuppressed viral loads and viral loads unknown. Adherence counselling needs to be emphasised, disclosure encouraged, and guidelines implemented.

Table 14. Maternal deaths in HIV positive women and antiretroviral treatment, 2020-2022

Type of Therapy	2020	2021	2022	2020-2022
None	2	3	1	6
TLD	0	3	2	5
TEE	6	5	3	14
Other ART	0	0	2	2

It is concerning that some women were not initiated on the TLD, though there is a decline on those who were never initiated on treatment.

Table 15. Maternal deaths and Pregnancy Outcome, 2020-2022

Pregnancy outcome	2020	2021	2022	2020-2022
Live-born	10	17	10	37
Stillborn	6	9	9	24
Neonatal Death	0	2	0	2
Miscarriage	2	2	1	5
Ectopic Pregnancy	1	1	1	3
Undelivered	4	9	5	18
Unknown	0	3	0	3

Most women who died (40%) had delivered live babies, followed by stillbirths and those who died undelivered.

Table 16. Maternal deaths and Route of Delivery, 2020-2022

Route of delivery	2020	2021	2022	2020-2022
Vaginal	9	12	11	32
Assisted delivery	0	2	0	2
Caesarean section	7	16	7	30
Laparotomy	0	0	1	18
Miscarriage	0	0	0	0
Undelivered	6	11	2	19
Not applicable	0	1	4	5

Similar numbers of maternal deaths had Caesarean sections as had vaginal delivery.

Table 17. Primary cause of death and route of delivery, 2020-2022

Primary obstetric problems	Vaginal	CD	CD CHC	CD DH	CD RH	CD TH/NCH	CD Pvt
Coincidental cause	0	0	0	0	0	0	0
Medical and surgical disorders	5	0	0	0	0	0	0
Non-pregnancy-related infections	6	11	0	1	1	2	7
Ectopic pregnancy	3	3	0	1	1	1	0
Miscarriage	0	0	0	0	0	0	0
Pregnancy-related sepsis	2	2	0	0	1	0	1
Obstetric haemorrhage	8	5	0	3	0	1	1
Hypertension	6	9	1	3	2	5	2
Anaesthetic complications	0	1	0	0	0	1	0
Adverse drug reactions	0	0	0	0	0	0	0
Embolism	1	2	0	0	0	1	1
Acute collapse - cause unknown	1	0	0	0	0	0	0

Primary obstetric problems	Vaginal	CD	CD CHC	CD DH	CD RH	CD TH/NCH	CD Pvt
Miscellaneous	1	0	0	0	0	0	0
Unknown	2	0	0	0	0	0	0
Total	**35**	**33**	**1**	**8**	**5**	**11**	**12**

There was a high number of caesarean sections done on patients with NPRI. The medical condition of the mother prior to delivery e.g. the intubated COVID-19 patients most probably played the biggest role.
All patients who delivered in private facilities had caesarean sections.

For the three OH deaths where CS were performed at district level, lack of skill, transport, and lack of blood products might have contributed to the deaths.

For the eight OH patients who delivered vaginally, routine observations were not done due to poor monitoring, vital signs were not interpreted correctly, and protocols were not implemented.

Unfortunately, the NASG was not used to manage OH in all patients who died despite it being available.

Table 18. Level of care where maternal deaths occurred, 2020-2022

Level of care	2020	2021	2022	2020-2022
Home/ outside facility	3	4	2	9
CHC	1	1	0	2
District	7	11	7	25
Regional	1	7	7	15
Tertiary	7	13	8	28
Private	4	7	2	13

Most deaths occurred at tertiary hospital for all three years as expected, followed by district hospitals and regional hospital for the province (Table 18). An increase in deaths in Private facilities in 2021 was noted due to COVID-19 infections. The number of deaths occurring at district level remain a concern. Contributing factors are a delay in referring patients, lack of equipped and reliable transport and lack of skilled staff at these facilities.

Table 19. Level of care from which maternal deaths were referred ,2020-2022

Level of Care from which patients were referred	2020	2021	2022	2020-2022
Community Health Centre	4	7	4	15
District Hospital	3	6	6	15
Regional Hospital	0	0	1	1
Tertiary Hospital	0	1	0	1
Private Hospital	1	4	0	5

16% of patients were referred from the Community Health Centre and 16% from district hospitals.

Table 20. Level of Care where anaesthetics were performed, 2020-2022

Level of Care	2020	2021	2022	2020-2022
Community Health Centre	0	0	0	0
District Hospital	3	0	5	8
Regional Hospital	1	3	2	6
Tertiary Hospital	3	7	5	15
Private Hospital	3	9	1	13

Most patient received anaesthesia at Tertiary Hospital followed by private facilities where most caesarean deliveries are conducted.

Table 21. Primary Obstetric Cause of Death and location of death, 2020-2022

Primary obstetric problems	Facility	In transit	Home/ Outside	Total
Coincidental cause	0	0	0	0
Medical and surgical disorders	9	0	1	10
Non-pregnancy-related infections	25	0	1	26
Ectopic pregnancy	4	0	0	4
Miscarriage	3	0	0	3
Pregnancy-related sepsis	4	0	0	4
Obstetric haemorrhage	14	0	0	14
Hypertension	15	1	2	18
Anaesthetic complications	1	0	0	1
Adverse drug reactions	0	0	0	0
Embolism	3	0	1	4
Acute collapse - cause unknown	1	0	0	1
Miscellaneous	1	0	0	1
Unknown	2	0	4	6
Total	**82**	**1**	**9**	**92**

Nine per cent of deaths died out of the facility and almost 90% died at facility level. Ideally no patients should die outside facilities.

Table 22 shows Primary obstetric cause of death at each level of care. The six patients who died from NPRI (COVID-19) at district level, could not be transferred due to overburdened services at the next level of care.

There were seven OH deaths at district hospital. Of concern is the sub-optimal care provided at that level and non- use of NASG.

HDP remains a challenge to manage, with poor implementation of guidelines, problem recognition and loss to follow-up being the main problems.

Several patients who died at Tertiary hospital were received in critical condition.

Table 22. Primary Obstetric Cause and level of care, 2020-2022

Primary obstetric problem	Outside	CHC	DH	RH	T/NC	PRIV	Total
Coincidental cause	0	0	0	0	0	0	0
Medical and surgical disorders	1	0	1	4	4	0	10
Non-pregnancy-related infections	1	1	6	4	7	7	26
Ectopic pregnancy	0	0	2	1	1	0	4
Miscarriage	0	0	1	1	1	0	3
Pregnancy-related sepsis	0	0	1	1	1	1	4
Obstetric haemorrhage	0	0	7	1	4	2	14
Hypertension	2	1	4	3	7	1	18
Anaesthetic complications	0	0	0	0	1	0	1
Adverse drug reactions	0	0	0	0	0	0	0
Embolism	1	0	1	0	1	1	4
Acute collapse - cause unknown	0	0	1	0	0	0	1
Miscellaneous	0	0	0	0	1	0	1
Unknown	4	0	1	0	0	1	6
Total	**9**	**2**	**25**	**15**	**28**	**13**	**92**

Table 23. Primary cause of death and Postmortems

Primary obstetric problems	Postmortem	Not done
Coincidental cause	0	0
Medical and surgical disorders	0	10
Non-pregnancy-related infections	0	26
Ectopic pregnancy	0	4
Miscarriage	0	3
Pregnancy-related sepsis	0	4
Obstetric haemorrhage	2	12
Hypertension	2	16
Anaesthetic complications	0	1
Adverse drug reactions	0	0
Embolism	2	2
Acute collapse - cause unknown	0	1
Miscellaneous	0	1
Unknown	0	6
Total	**6**	**86**

There were 93% of maternal deaths that did not have postmortems. It is a challenge as there is no anatomical pathologist in the province. Forensic pathology has limited resources with staff shortages and lack of transport in the province.

Avoidable factors

Table 24. Classification of Avoidable factors for maternal deaths, 2020-2022

	Number	% of total	% of cases at this level
PATIENT ORIENTED PROBLEMS			
- Avoidable factors identified	57	62.0	
- No avoidable factors	27	29.3	
- Lack of information	14	15.2	
ADMINISTRATIVE PROBLEMS			
- Avoidable factors identified	42	45.7	
- No avoidable factors	36	39.1	
- Lack of information	24	26.1	
RESUSCITATION PROBLEMS			
- Avoidable factors identified	25	27.2	
- No avoidable factors	55	59.8	
- Lack of information	14	15.2	
MEDICAL CARE - CHC			
- Managed at this level	29	31.5	
- Avoidable factors identified	16		55.2
- No avoidable factors	13		44.8
- Lack of information	3		10.3
MEDICAL CARE - DISTRICT HOSPITAL			
- Managed at this level	39	42.4	
- Avoidable factors identified	30		76.9
- No avoidable factors	9		23.1
- Lack of information	10		25.6
MEDICAL CARE - REGIONAL HOSPITAL			
- Managed at this level	16	17.4	
- Avoidable factors identified	14		87.5
- No avoidable factors	2		12.5
- Lack of information	5		31.3
MEDICAL CARE - TERTIARY & ABOVE			
- Managed at this level	29	31.5	
- Avoidable factors identified	10		34.5
- No avoidable factors	17		58.6
- Lack of information	3		10.3
MEDICAL CARE - PRIVATE HOSPITAL			
- Managed at this level	15	16.3	
- Avoidable factors identified	5		33.3
- No avoidable factors	4		26.7
- Lack of information	10		66.7
TIMING OF EMERGENCY			
- Early pregnancy	12	13.0	
- Antenatal period: 20w +	38	41.3	
- Intrapartum period	9	9.8	
- Postpartum period	33	35.9	
- Anaesthesia	0	0.0	
TIMING OF DEATH			
- Early pregnancy	12	13.0	
- Antenatal period: 20w +	13	14.1	
- Intrapartum period	0	0.0	
- Postpartum period	67	72.8	
- Anaesthesia	0	0.0	
IMPACT OF SUBOPTIMAL CARE			
- No suboptimal care identified	29	31.5	

	Number	% of total	% of cases at this level
- Suboptimal care, no impact on outcome	4	4.3	
- Suboptimal care, possible impact on outcome	36	39.1	
- Suboptimal care, probable impact on outcome	23	25.0	
Total	**92**		

Patient related avoidable factors are the largest group of avoidable factors, which might be due to lack of awareness on danger signs, delay in seeking help (43.5%) and unbooked cases (18.5%). Focus should be directed to public health awareness campaigns and strengthening the WBOT system for tracking and tracing of patients.

Administrative problems were identified in 45,7% of deaths, where emphasise and focus should be directed towards ensuring well-resourced facilities for provision of service packages, mostly at district level.

Lack of information in 26% of deaths, and poor record keeping was a major problem. Transport delays, delay in attending to the patient, inadequate number of staff on duty and appropriate skill not being available are the main factors.

Avoidable factors during **resuscitation** were identified in 27.2% of patients, ESMOE/EOST needs to be prioritised at all levels of care.

Medical care:

Avoidable factors were identified at CHC level 55.2% with initial assessment and problem recognition being the main problem.

At district level, 76.9% had medical related avoidable factors which included sub-standard management /correct diagnosis, poor problem recognition, poor initial assessment, no monitoring and infrequent monitoring, prolonged abnormal monitoring with no action and delay in referring. Thes factors occurred, despite all these facilities having doctors.

At Regional level, 87.5% of deaths had medical care avoidable factors identified. Poor Problem recognition, sub-standard management, poor initial assessment, no monitoring/infrequent monitoring and prolonged abnormal monitoring with no action were the main reasons identified.

Medical care related avoidable factors occurred in 34.5% of deaths at Tertiary hospitals, and 33,3% in Private hospitals.

Most emergencies and deaths occurred during the post-partum period. Monitoring is sub-optimal with early warning signs not recognised and no action on prolonged abnormal observations. Training of staff on BANC plus and ESMOE/EOST to be prioritised.

Only 35.1% of maternal deaths in Northern Cape had no sub-optimal care. In 39.1%, there was sub-optimal care with a possible impact on the outcome and on 25% there was sub-optimal care with a probable impact on outcome. Overall, 64.1% of deaths were potentially preventable by the health system.

This should be a priority for the province in the next triennium and KPA’s of CEO’s should include maternal health services.

Table 25. Patient orientated avoidable factors, 2020-2022

Description	2020	2021	2022	2020-2022
Avoidable factors identified	15	25	17	57
Lack of information	3	8	3	14
No avoidable factor	6	13	8	27
No antenatal care	1	7	9	17
Infrequent antenatal care	3	2	1	6
Delay in seeking help	9	19	12	41
Declined medication/surgery/advice	4	5	4	13
Family problem	0	0	0	0
Community problem	0	0	0	0
Unsafe abortion	0	1	0	1
Other	10	7	7	24

Delay in seeking medical care remains a challenge. Public awareness on the importance of early ANC booking to be emphasised. Fear to access health services due to COVID-19 might have contributed to high numbers in 2021.

Table 26. Administrative avoidable factors, 2020- 2022

Description	2020	2021	2022	2020-2022
Avoidable factors identified	9	18	15	42
Lack of information	7	10	7	24
No avoidable factor	10	19	7	36
Transport problem: Home to institution	1	1	0	2
Transport problem: Institution to institution	2	1	5	8
Lack of accessibility: Barriers to entry	0	0	0	0
Lack of accessibility: other	0	0	0	0
Delay in attending to patient (Overburdened service)	2	2	2	6
Delay in attending to patient (reason unknown)	1	1	3	5
Lack of healthcare facilities: ICU	1	3	0	4
Lack of healthcare facilities: Blood/blood products	0	0	1	1
Lack of healthcare facilities: Other	0	0	0	0
Inadequate numbers of staff on duty	3	2	3	8
Appropriately skill not available on site/on standby	2	7	0	9
Communication problems: Technical	0	0	0	0

Description	2020	2021	2022	2020-2022
Communication problem: Interpersonal	0	1	0	1
Other	2	2	9	13

Appropriately skill not available on site/on standby was highest in 2021 due to COVID-19 and limited staff available to manage Obstetric cases.

Table 27. Emergency Care avoidable factors, 2020-2022

Description	2020	2021	2022	2020-2022
Lack of information	5	7	2	14
No avoidable factor	14	27	14	55
Airway problems	0	2	0	2
Breathing problems	0	2	1	3
Circulation problems	1	1	2	4
Drug problems	2	0	1	3
Investigation problems	0	1	0	1
Monitoring problems	2	3	1	6
Resuscitation not attempted	2	5	8	15

Emphasis must be directed towards monitoring of problems at all levels of care and improving management of patients from referring facilities.

Summary of Northern Cape maternal mortality data

- There was an increase of maternal deaths due to NPRIs in 2021 as a result of the pandemic COVID-19.
- In all the three years, (2020, 2021 and 2022) NPRI was the leading cause of maternal deaths followed by Hypertension, Obstetric Haemorrhage and Medical and Surgical conditions.
- 2022 showed that deaths occurred more at tertiary Hospitals followed by regional, then district Hospitals respectively with less deaths occurring at CHCs.
- There was an increase in deaths occurring outside facilities and during the post-partum period where focus should be directed towards intrapartum care and use of the checklist before discharge.
- More deaths occurred amongst women of age 20 to 39yrs.
- Most of the women who died had tested negative for the retroviral disease but of concern was the large percentage of HIV positive women whose viral load was > 1000 copies/ml.
- Most women who died, delivered live births and stillbirths.
- Most women were referred from the Community Health Centre to District hospitals and upward to Regional and Tertiary Hospitals which is a good practice that needs to be sustained.
- Most women died during the post-partum period, WBOTs system for track and tracing needs to be improved.
- There was suboptimal care with possible/probable impact on outcome in 64.1% of the deaths.

Recommendations

Policy:

- Establishment adequately resourced facilities to manage the obstetric emergencies in the district.
- Improve inter-facility transport to prevent delay between facilities.
- Implement policy on accreditation of delivery sites and caesarean section sites.

Healthcare promotion:

- All facilities to be provided with IEC material on maternal health services covering:
- Risk factors during pregnancy and after delivery.
- Value of early booking at ANC.

- Importance of knowing HIV status and the value of VTP and ART during pregnancy.
- Value of family spacing /contraception.
- Campaigns to inform the local communities of maternity related issues.

Collaboration:
Collaboration with private sector on maternal health services

Training:
- Knowledge and skills of healthcare provider.
- Establish ESMOE maintenance training schedules.
- Emergency obstetric simulation training policy to be developed, monitored and implemented at all levels of care.
- Implement prioritisation of training in obstetric surgery and delivery services.
- Improve supervision of junior and newly appointed medical officers
- Establish multidisciplinary team approach in the management of medical diseases in pregnancy

Consultation skills:
- Clinical outreach and in-reach for training

Monitoring and evaluation:
- Interrogate data submitted by hospitals and clinics to DHIS at district level to identify areas that is problematic.
- Routine audit of files at all levels of care for compliance with protocols.

The following three key aspects of a health system are essential:
- Knowledgeable and skilled healthcare providers
- Appropriately resourced and accessible healthcare facilities (including equipment and human resources)
- Rapid inter-facility emergency transport system

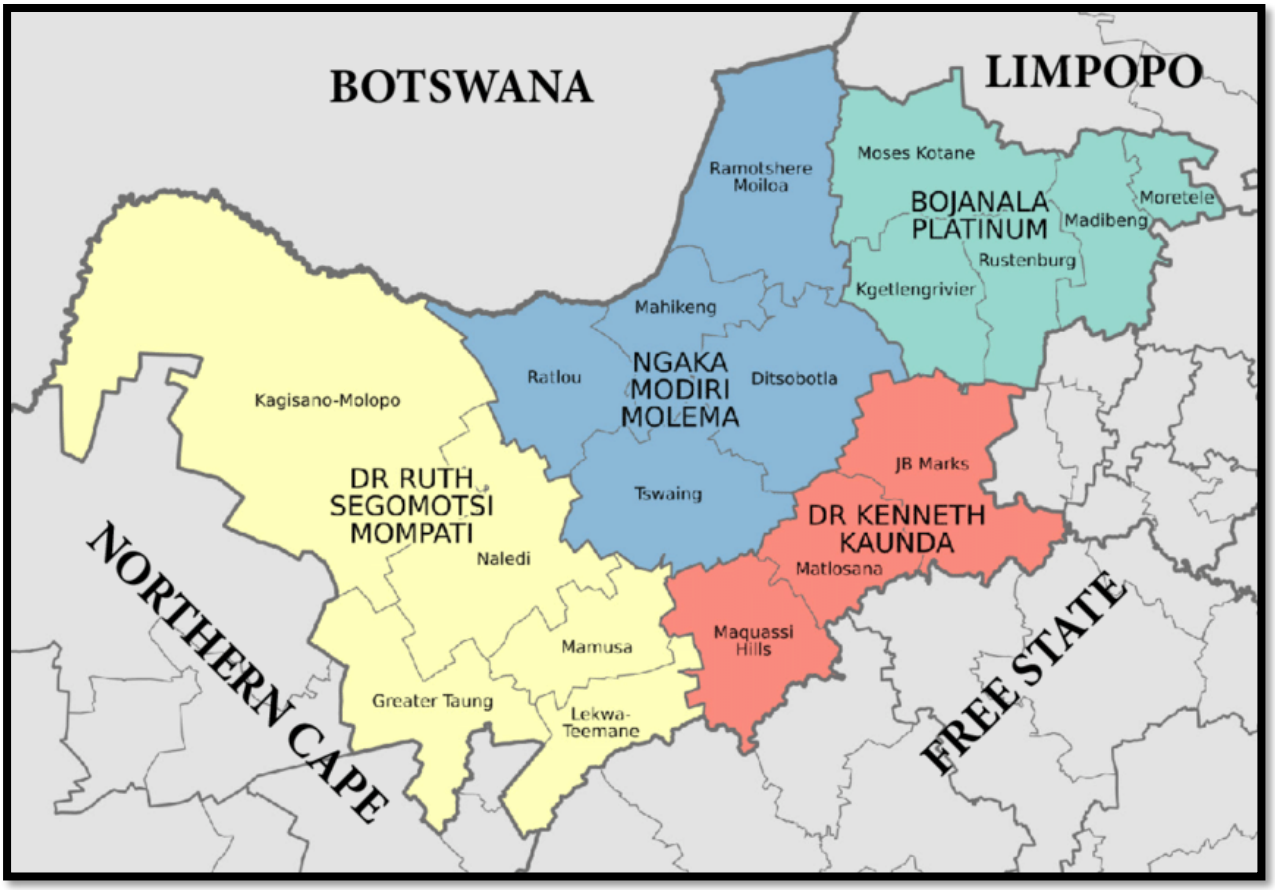
The NC province will adopt and will continue with the implementation and monitoring of the Saving mothers report national recommendations.

Northern Cape Assessors

No	Name	Position
1.	Ms MJ Diphoko	Assistant Director: Maternal health
2.	Dr LV Valdez Munoz	Consultant O&G: RMSH Provincial quality assurer
3.	Dr P Anderson	Head clinical unit medical: RMSH (Anaesthetist)
4.	Dr S Wessels	Acting Consultant: O&G: RMSH Provincial NCCEMD representative
5.	Dr G Torres	DCST: family physician: PKS
6.	Ms B Maramba	District clinical coordinator: Maternal: PKS
7.	Dr L Romero	DCST: family physician: NAM
8.	Dr S Lukuugi	DCST: family physician: ZFM
9.	Dr C Ifebuzor	DCST: family physician: JTG
10.	Dr JM Ngundu	DCST: family physician: FB
11.	Ms P Langa	Advanced midwife: RMSH
12.	Ms L Vakele	DCST: Advanced midwife: JTG
13.	Ms L Mocumi	Advanced midwife: FB
14.	Ms M Shushu	District clinical coordinator: FB
15.	Ms Seretse	Advanced midwife: JTG
16.	Ms Micaela De Wet	District clinical coordinator: Maternal: Namakwa
17.	Ms F Witbooi	Advanced midwife: DHSH
18.	Ms G Du Toit	Advance midwife: PKS
19.	Dr Lopez	DCST: Anaesthesiologist: PKS

8.8 North West

North West Map



Introduction

The North West Province has an estimated population size of 4,169,094 (DHIS 2023). The total female population is estimated at 2,052,922 of which 1,056,373 represent the number of women of reproductive age group (15-49). The largest number of the population lives mainly in rural areas of North West Province. The province is divided into four Health Districts with 11 District Hospitals, 47 Community Health Centres and 266 clinics. It also provides tertiary services at Klerksdorp/Tshepong Hospital Complex and Job Shimankane Tabane Hospital and has no medical schools. There are three Regional Hospitals namely Mahikeng Provincial, Joe Morolong Memorial and Potchefstroom. These three Regional Hospitals provide some specialised services with Obstetricians and Anaesthesiologists appointed at these Hospitals.

Deaths reported and MMR

DDPCP reported to the province in the triennium 2020-2022 were 272, of which 267 were maternal, and total deliveries in the province were 183505. Maternal Mortality Ratio (MMR) was 145.5 per 100 000. In 2020 MMR was 130.59 per 100 00 live births, in 2021 MMR was 188.53 per 100 000 live births and in 2022 MMR was 116.76 per 100 000 live births. This reflects a drastic increase in maternal mortality in 2021 during the COVID-19 pandemic and a decrease thereof in 2022.

The indicators below were calculated using the information from the 267 maternal death files which were captured into MaMMAS programme from 2020 to 2022.

Table 1. MaMMAs, DHIS and iMMR data 2020-2022

North West	Live births	MaMMAS deaths (DDCP)	MaMMAS MD	DHIS MD	MaMMAS MD	MaMMAs iMMR	MaMMAs iMMR	DHIS iMMR
2020	62026	83	81	72	81	130.59	130.59	116.1
2021	61528	117	116	97	116	188.53	188.53	157.7
2022	59951	72	70	65	70	116.76	116.76	108.4

2020-2022	Live births	MaMMAS MD	MaMMAs iMMR
North West Province	183505	267	145.5

There was a decrease in the total number of live births, and this is because of the decline in total deliveries in general in the province possibly due to intensive marketing of LARC for couple year protection rate to reduce unwanted pregnancy in the province. Figure one shows that the MMR increased to 188,53 in 2021 due to COVID-19 pandemic and decreased to 116.76 in 2022 as there was no COVID-19 case reported in that year.

Figure 1. iMMR for 2020,2021,2022 and the triennium

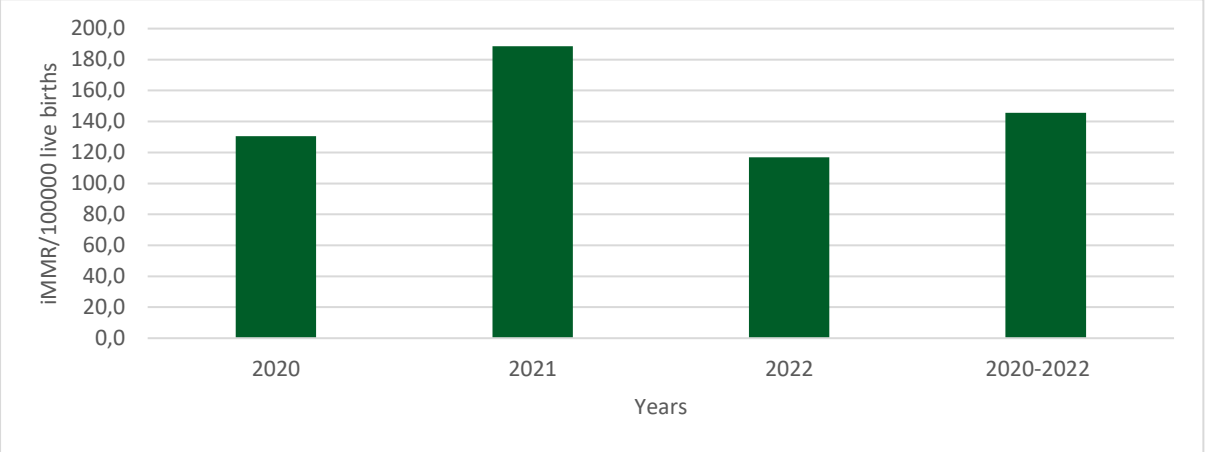
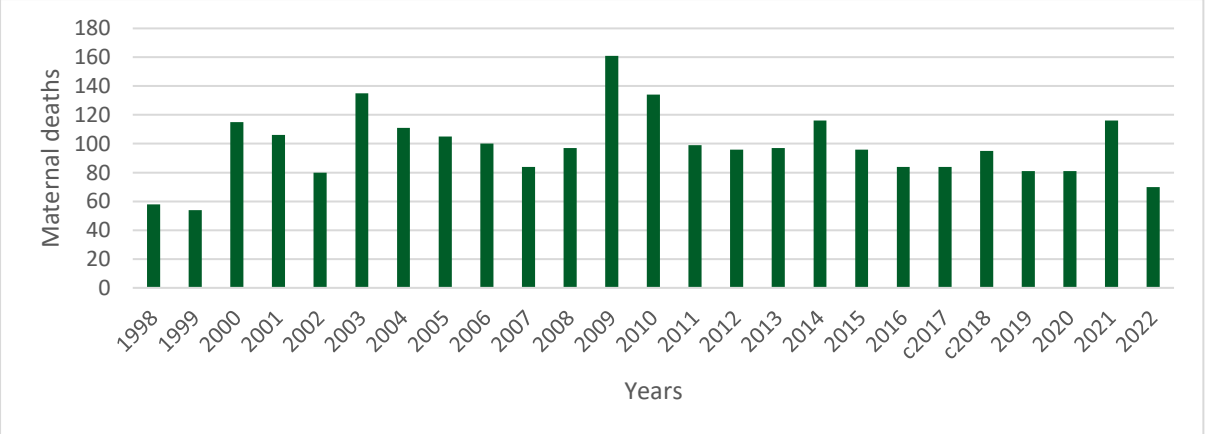


Figure two provides trends in number of North West maternal deaths from 1998 to 2022.

Figure 2. Trends in number maternal deaths, 1998-2022



The table above shows that deaths reported to the province were consistent in every year with fluctuations from year to year, the maximum number of deaths reported being 161 in 2009. A downward trend was observed over the years with a recent peak in 2021 due to the COVID-19 pandemic.

A similar trend is shown in iMMR (Figure 3)

Figure 3. Trends in iMMR, 2005 to 2022

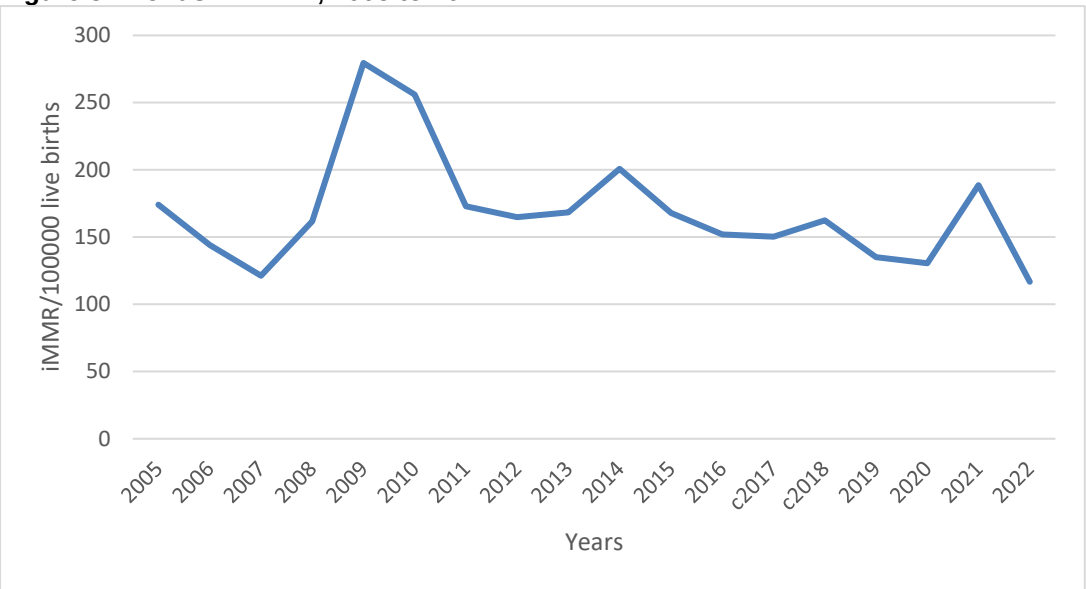
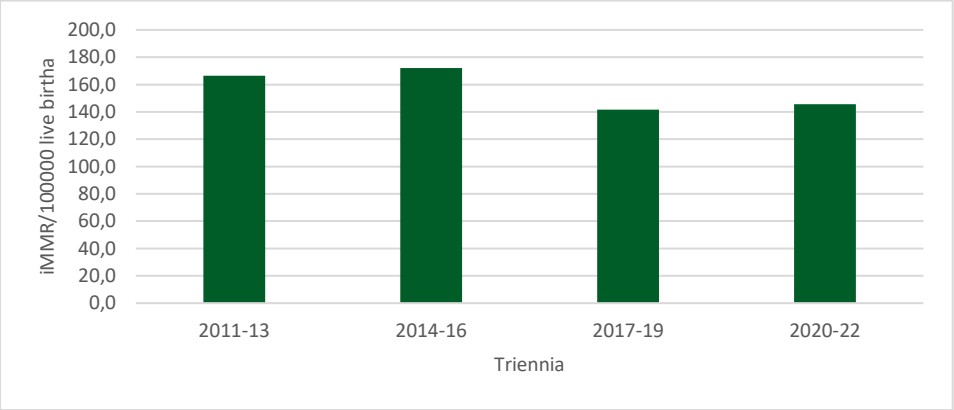
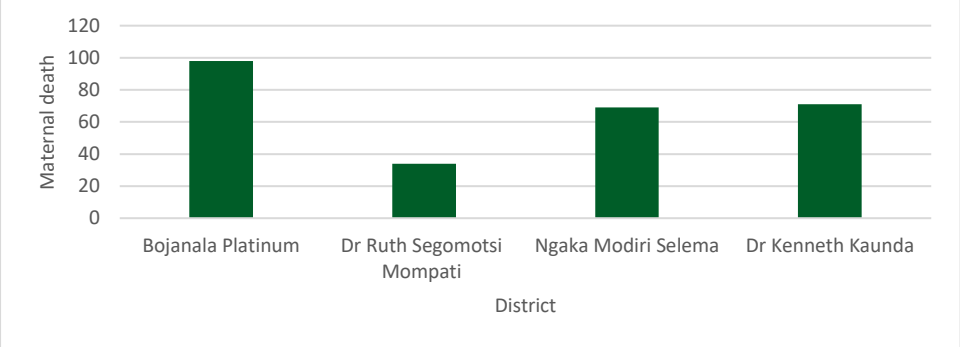


Figure 4. Trends in IMMR for four triennia, 2022-2022



The above table shows fluctuation of deaths in the 4 triennia, the downward trend in 2017-2019 being slightly reversed in 2020-2002.

Figure 5. Number Maternal deaths per district, 2020-2022



Bojanala District had the highest number of maternal deaths in this triennium, followed by Dr Kenneth Kaunda, Ngaka Modiri Molema then Dr Ruth Segomotsi Mompati District in that order.

Causes of maternal deaths

Table 2. Primary Obstetric Causes of Maternal death, 2020-2022

North West	2020	2021	2022	2020-2022
Medical and surgical disorders	13	15	7	35
Non-pregnancy-related infections	18	41	15	74
Ectopic pregnancy	4	1	1	6
Miscarriage	2	9	6	17
Pregnancy-related sepsis	4	2	3	9
Obstetric haemorrhage	16	24	12	52
Hypertension	17	14	15	46
Anaesthetic complications	1	0	4	5
Adverse drug reactions	0	0	0	0
Embolism	0	2	2	4
Acute collapse - cause unknown	1	4	2	7
Miscellaneous	0	0	0	0
Unknown	5	4	3	12
Maternal deaths	81	116	70	267
Coincidental cause	2	1	2	5
DDCP	83	117	72	272
Live births	62026	61528	59951	183505

Non-Pregnancy Related Infections is still the leading cause of maternal deaths in all the years 2020 to 2022, followed by Obstetric Haemorrhage then Hypertension, and Medical and Surgical disorders. COVID-19 deaths were classified as NPRI/other.

Table 3. COVID-19 maternal deaths, 2020-2022

COVID-19 maternal deaths	NW
2020	4
2021	20
2022	0
2020-2022	**24**

Table 3 Shows that COVID-19 deaths were high in 2021 as compared to 2020 when it started. COVID-19 was at the peak in 2021 in the province with more death as a result.

Figure 6. Trends in Primary Obstetric causes per year; 2020, 2021 and 2022

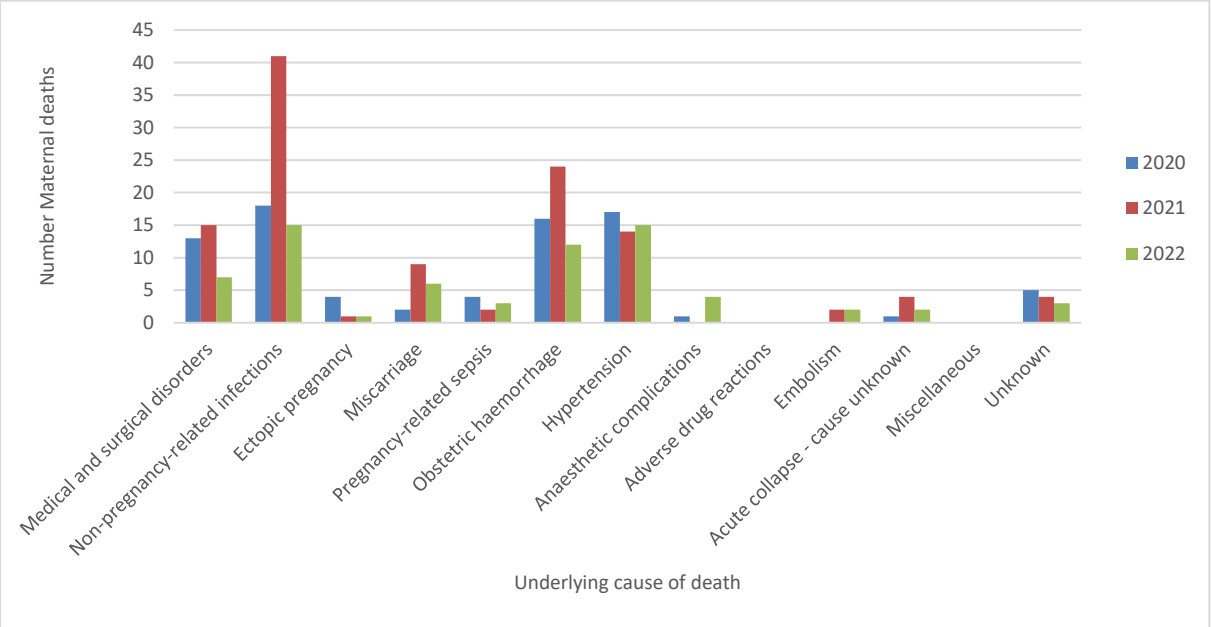


Figure 7. Pattern of Primary Obstetric causes per year; 2020,2021 and 2022

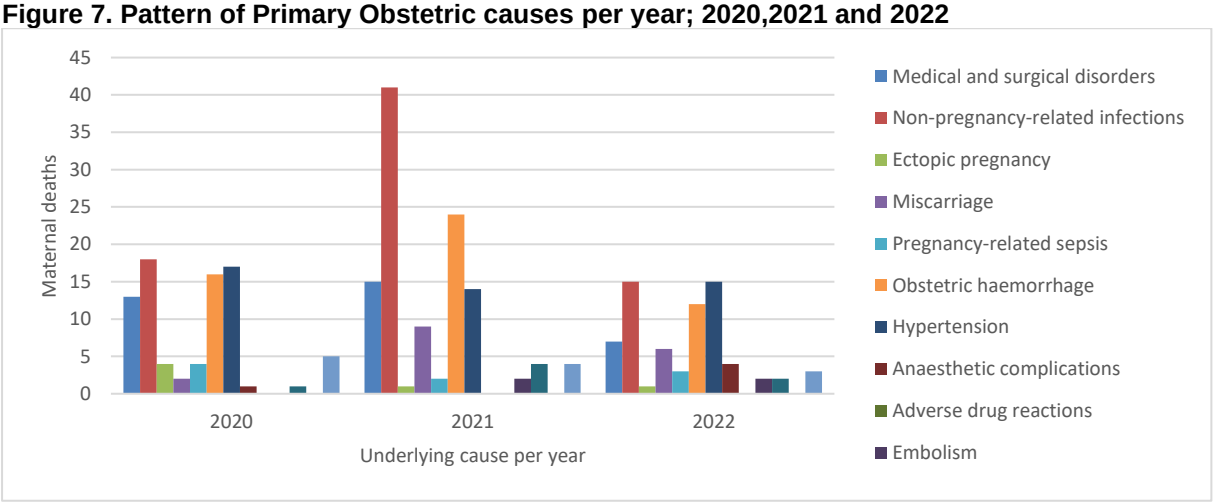


Figure 8. Trends in iMMR per cause per year during 2020-2022

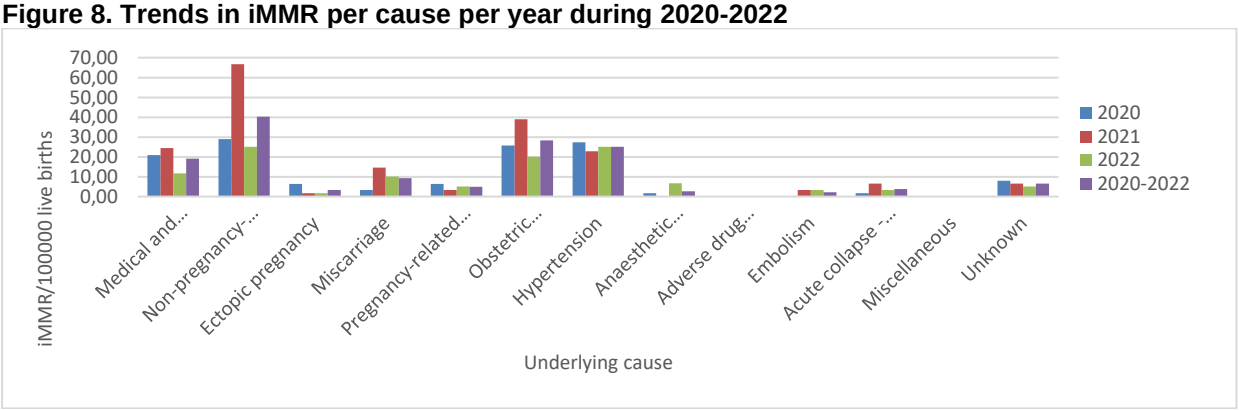


Figure 8 and Table 4 show that iMMR from NPRI, OH and M&S disorders all increased in 2021.

Table 4. iMMR for each Primary Obstetric Cause, 2020-2022

North West iMMR	2020	2021	2022	2020-2022
Medical and surgical disorders	20.96	24.38	11.68	19.07
Non-pregnancy-related infections	29.02	66.64	25.02	40.33
Ectopic pregnancy	6.45	1.63	1.67	3.27
Miscarriage	3.22	14.63	10.01	9.26
Pregnancy-related sepsis	6.45	3.25	5.00	4.90
Obstetric haemorrhage	25.80	39.01	20.02	28.34
Hypertension	27.41	22.75	25.02	25.07
Anaesthetic complications	1.61	0.00	6.67	2.72
Adverse drug reactions	0.00	0.00	0.00	0.00
Embolism	0.00	3.25	3.34	2.18
Acute collapse - cause unknown	1.61	6.50	3.34	3.81
Miscellaneous	0.00	0.00	0.00	0.00
Unknown	8.06	6.50	5.00	6.54
Maternal deaths	130.59	188.53	116.76	145.50
Coincidental cause	3.22	1.63	3.34	2.72
DDCP	133.81	190.16	120.10	148.22
Live births (2019)	62026	61528	59951	183505

Figure 9. Patterns of Primary Obstetric Causes per year, 2020-2022

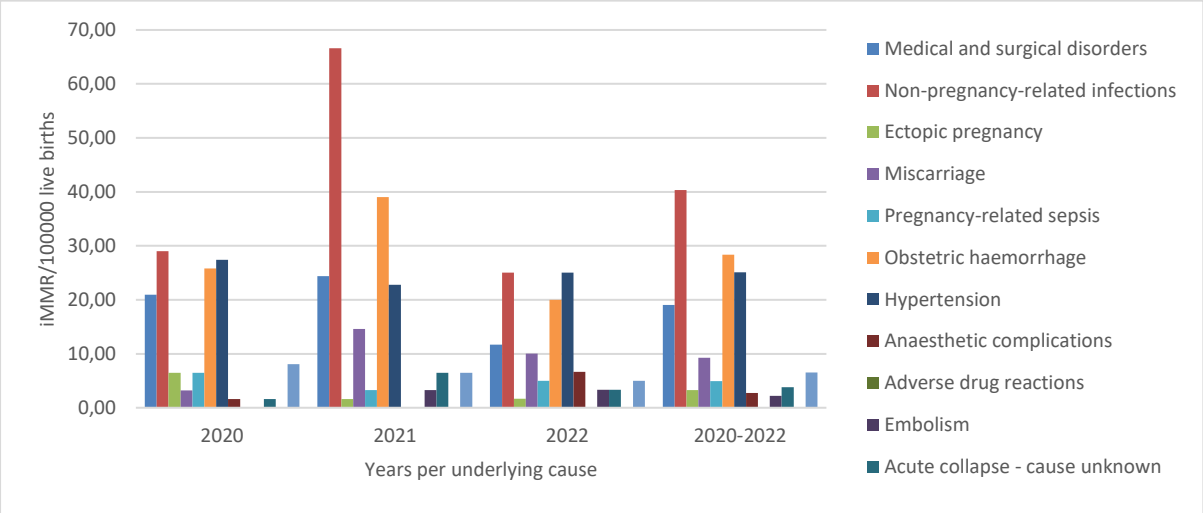


Table 5. Primary Obstetric Causes of death with Subcategories, 2020-2022

Primary obstetric problems	Number deaths
Coincidental cause	**5**
- MVA	1
- Other accidents	1
- Assault	1
- Other	2
Medical and surgical disorders	**35**

Primary obstetric problems	Number deaths
- Cardiomyopathy	6
- Rheumatic heart disease	
- Other cardiac disease	1
- Endocrine	3
- GIT	3
- CNS	3
- Respiratory	9
- Haematological	1
- Genito-urinary	
- Suicide	
- Substance abuse	
- Other psychiatric disease	
- Neoplasm	
- Auto-immune	
- Other	9
Non-pregnancy-related infections	**74**
- PCP pneumonia	12
- Other pneumonia	13
- TB	20
- UTI	
- Appendicitis	
- Malaria	
- Cryptococcal meningitis	
- Other meningitis	2
- Kaposi's sarcoma	
- Toxoplasmosis	1
- Hepatitis	
- Gastroenteritis	
- Wasting syndrome	
- Other	26
Ectopic pregnancy	**6**
- Less than 20 weeks	4
- More than 20 weeks (extrauterine pregnancy)	2
Miscarriage	**17**
- Septic miscarriage	10
- Haemorrhage (non-traumatic)	4
- Uterine trauma	
- GTD	
- Following legal TOP	3
Pregnancy-related sepsis	**9**
- Chorioamnionitis (ruptured membranes)	1
- Chorioamnionitis (intact membranes)	1
- Puerperal sepsis after NVD	3
- Puerperal sepsis after CD	3

Primary obstetric problems	Number deaths
- Bowel trauma at CD	1
Obstetric haemorrhage	**52**
- Abruption with hypertension	7
- Abruption without hypertension	3
- Placenta praevia	2
- Other APH not specified	2
- Ruptured uterus with previous CD	6
- Ruptured uterus without previous CD	3
- Uterine atony after vaginal delivery	5
- Vaginal trauma after vaginal delivery	
- Cervical trauma after vaginal delivery	
- Retained placenta after NVD (morb adherent)	2
- Retained placenta after NVD (not adherent)	6
- Inverted uterus after vaginal delivery	
- Other PPH not specified after vaginal delivery	3
- Bleeding during CD (morbidly adherent placenta)	2
- Bleeding during CD (not adherent placenta)	1
- Bleeding after Caesarean delivery	10
Hypertension	**46**
- Chronic hypertension	1
- Gestational hypertension	
- Pre-eclampsia with severe features	6
- Pre-eclampsia without severe features	2
- Eclampsia	28
- HELLP	9
- Liver rupture	
Anaesthetic complications	**5**
- General anaesthetic	1
- Spinal anaesthetic	4
Adverse drug reactions	**0**
- ARV medication	
- TB medication	
- Other medication	
- Herbal medication	
Embolism	**4**
- Pulmonary embolism	4
- Amniotic fluid embolism	
Acute collapse - cause unknown	**7**
Miscellaneous	0
- Hyperemesis gravidarum	
- Acute fatty liver	
Unknown	**12**
- Death at home or outside health services	8
- No primary cause found	3

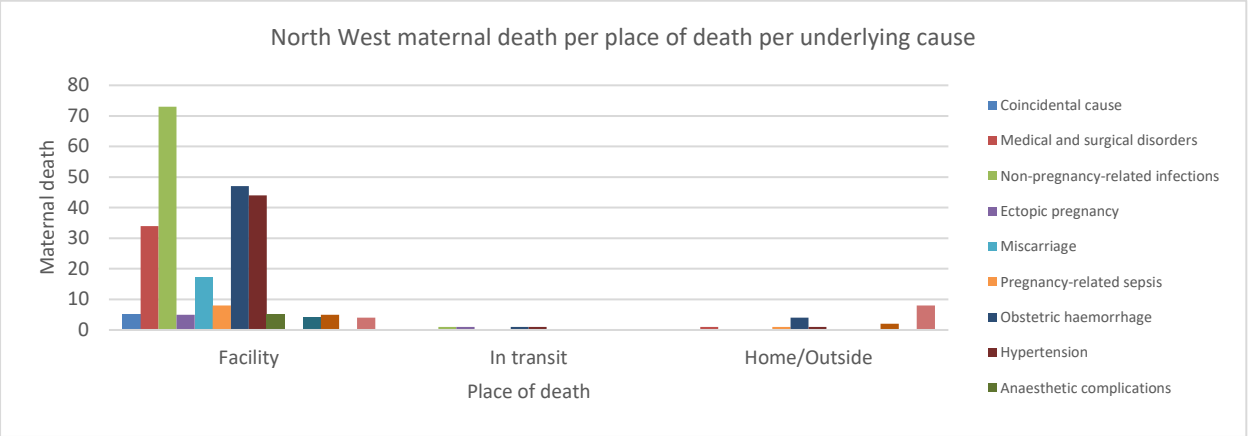
Primary obstetric problems	Number deaths
- Lack of information	1
Total:	**272**

Table 6. Final cause(s) of Maternal deaths, 2020-2022

Cause of death	Number	% of total
Circulatory system	111	40.8
- Hypovolaemic shock	66	24.3
- Septic shock	45	16.5
Respiratory failure	96	35.3
- Respiratory failure	96	35.3
Cardiac failure	48	17.6
- Pulmonary oedema	48	17.6
Embolism	9	3.3
- Acute collapse due to embolism	9	3.3
Renal failure	37	13.6
- Renal failure	37	13.6
Liver failure	16	5.9
- Liver failure	16	5.9
Cerebral complications	46	16.9
- Intracranial haemorrhage	23	8.5
- Cerebral oedema resulting in coning	6	2.2
- Meningitis	2	0.7
- Cerebral emboli	1	0.4
- Brain death following hypoxic event	11	4
- Unspecified	3	1.1
Metabolic	21	7.7
- Maternal ketoacidosis	4	1.5
- Electrolyte imbalance	9	3.3
- Lactic acidosis	6	2.2
- Other	2	0.7
Haematological	66	24.3
- DIC	42	15.4
- Severe anaemia	24	8.8
Immune system	33	12.1
- Immune system failure	33	12.1
Unknown	20	7.4
- Home death	10	3.7
- Unknown	10	3.7
Other	24	8.8
- Other	24	8.8
Total deaths:	**272**	

Figure 10 shows that more women died at the facility and few from outside the facility, then followed by those died in transit. That shows that our women are aware of the importance of seeking medical help although it might have been too late for them to be assisted when arriving at the facilities.

Figure 10. Primary Obstetric Cause and Location of death, 2020-2022



Tables 7 shows that Non-Pregnancy Related Infections is the leading cause of all the deaths that occurred at facility level, followed by Obstetric Haemorrhage, then Hypertension, Medical and Surgical Disorders and miscarriages respectively.

Table 7. Primary Obstetric Cause and Location of death, 2020-2022

Primary obstetric problems	Facility	In transit	Home/Outside	Total
Coincidental cause	5	0	0	5
Medical and surgical disorders	34	0	1	35
Non-pregnancy-related infections	73	1	0	74
Ectopic pregnancy	5	1	0	6
Miscarriage	17	0	0	17
Pregnancy-related sepsis	8	0	1	9
Obstetric haemorrhage	47	1	4	52
Hypertension	44	1	1	46
Anaesthetic complications	5	0	0	5
Adverse drug reactions	0	0	0	0
Embolism	4	0	0	4
Acute collapse - cause unknown	5	0	2	7
Miscellaneous	0	0	0	0
Unknown	4	0	8	12
Total	**251**	**4**	**17**	**272**

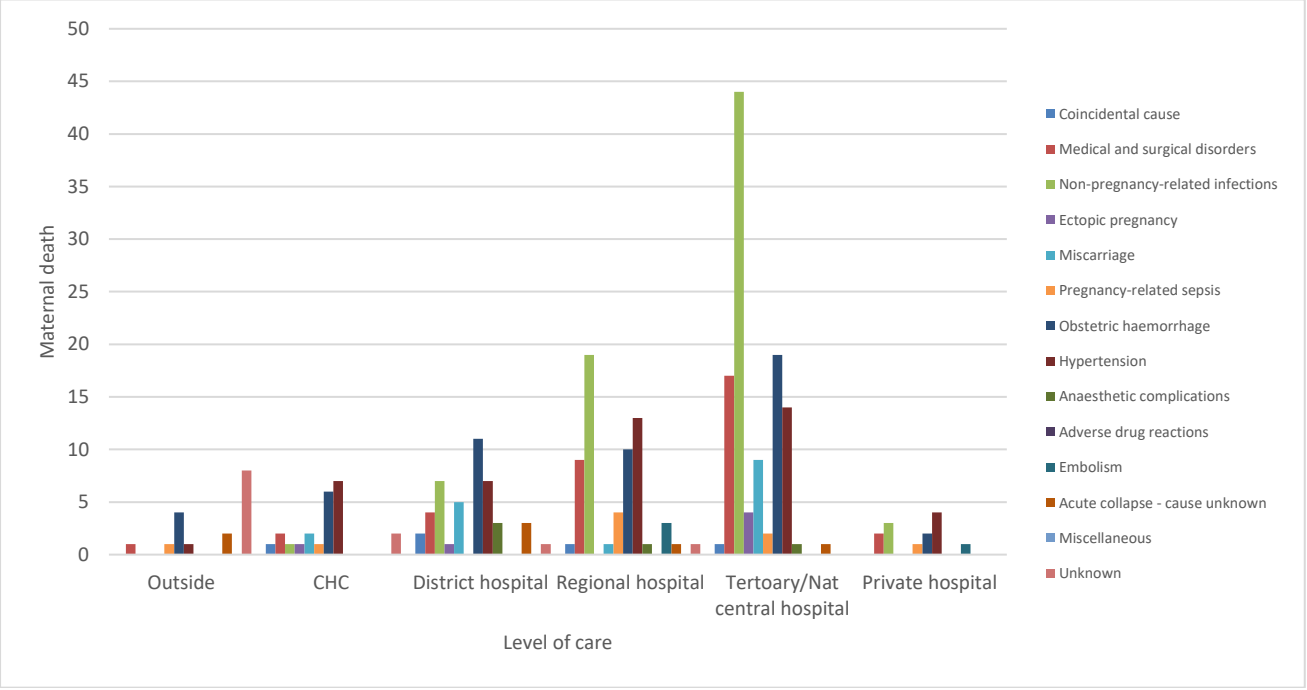
Table 8. Primary Obstetric Cause and Level of Care, 2020-2022

Primary obstetric problem	Outside	CHC	District hospital	Regional hospital	Tertiary/Nat central hospital	Private hospital	Total
Coincidental cause	0	1	2	1	1	0	5
Medical and surgical disorders	1	2	4	9	17	2	35
Non-pregnancy-related infections	0	1	7	19	44	3	74
Ectopic pregnancy	0	1	1	0	4	0	6

Primary obstetric problem	Outside	CHC	District hospital	Regional hospital	Tertiary/Nat central hospital	Private hospital	Total
Miscarriage	0	2	5	1	9	0	17
Pregnancy-related sepsis	1	1	0	4	2	1	9
Obstetric haemorrhage	4	6	11	10	19	2	52
Hypertension	1	7	7	13	14	4	46
Anaesthetic complications	0	0	3	1	1	0	5
Adverse drug reactions	0	0	0	0	0	0	0
Embolism	0	0	0	3	0	1	4
Acute collapse - cause unknown	2	0	3	1	1	0	7
Miscellaneous	0	0	0	0	0	0	0
Unknown	8	2	1	1	0	0	12
Total	**17**	**23**	**44**	**63**	**112**	**13**	**272**

Table 8 and Figure 10 show that most deaths occurred at tertiary Hospital followed by regional and district hospitals.

Figure 11. Primary Obstetric Cause and Level of Care, 2020-2022



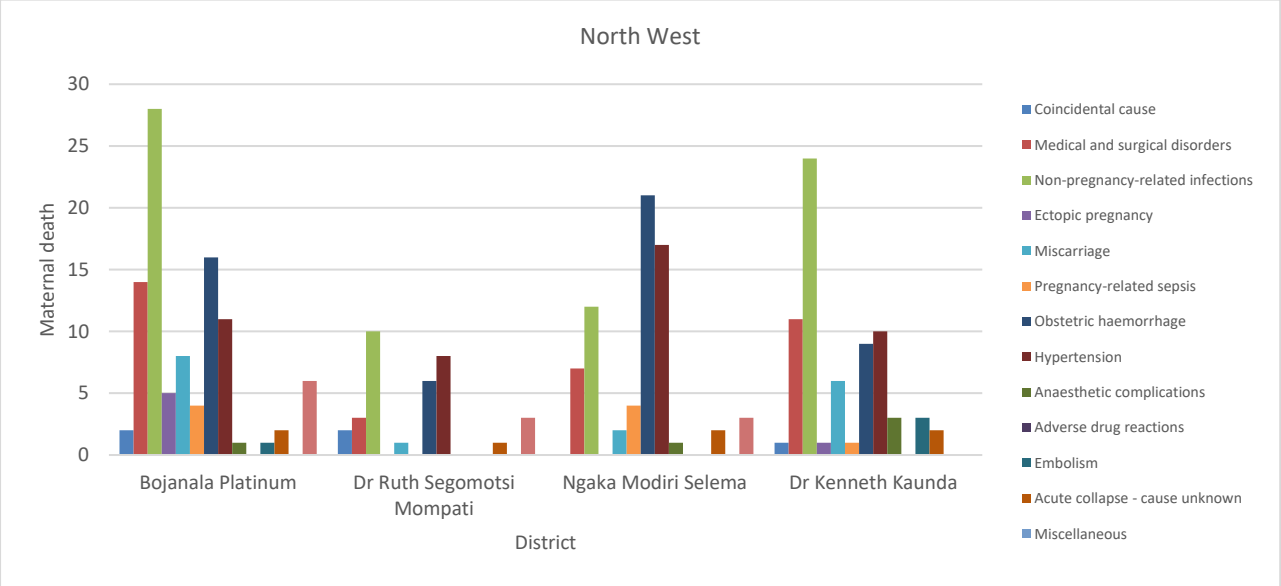
The above table shows that more women with Non-Pregnancy Related Infections died at Tertiary Hospital followed by Regional Hospital then District Hospital.

Table 9. Primary Obstetric Causes by District in North West, 2020-2022

Primary obstetric Cause	Bojanala Platinum	Dr Ruth Segomotsi Mompati	Ngaka Modiri Molema	Dr Kenneth Kaunda	Total Numbers
Coincidental cause	2	2	0	1	5
Medical and surgical disorders	14	3	7	11	35
Non-pregnancy-related infections	28	10	12	24	74
Ectopic pregnancy	5	0	0	1	6
Miscarriage	8	1	2	6	17
Pregnancy-related sepsis	4	0	4	1	9
Obstetric haemorrhage	16	6	21	9	52
Hypertension	11	8	17	10	46
Anaesthetic complications	1	0	1	3	5
Adverse drug reactions	0	0	0	0	0
Embolism	1	0	0	3	4
Acute collapse - cause unknown	2	1	2	2	7
Miscellaneous	0	0	0	0	0
Unknown	6	3	3	0	12
Total	**98**	**34**	**69**	**71**	**272**

Non-Pregnancy Related Infections is the leading cause of maternal deaths at Bojanala and Dr Kenneth Kaunda Districts; Obstetric Haemorrhage is a leading cause in Ngaka Modiri Molema followed by Bojanala District. Hypertension followed Obstetric Haemorrhage in Ngaka Modiri Molema and Bojanala, then Dr Kenneth Kaunda District.

Figure 12. Numbers of maternal death per district per Primary obstetric cause, 2020-2022



For the triennium, Non-Pregnancy Related Infections were the leading cause of death in Bojanala District, followed by Dr Kenneth Kaunda, Ngaka Modiri Molema then Dr Ruth Segomotsi Mompati in that order. Non-Pregnancy Related Infections were followed by Hypertension being the highest in Ngaka Modiri Molema District, Bojanala, Dr Kenneth Kaunda and Dr Ruth Segomotsi Mompati respectively.

Table 10. Primary Obstetric Cause and Maternal age,2020-2022

Primary obstetric problem	15-19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	Outside 10-44 range & unknown	Total
Coincidental cause	1	2	1	1	0	0	0	5
Medical and surgical disorders	4	4	11	6	8	2	0	35
Non-pregnancy-related infections	1	6	19	23	18	7	0	74
Ectopic pregnancy	0	1	1	4	0	0	0	6
Miscarriage	1	5	2	6	3	0	0	17
Pregnancy-related sepsis	2	3	0	3	1	0	0	9
Obstetric haemorrhage	2	15	4	10	19	2	0	52
Hypertension	4	9	9	9	10	5	0	46
Anaesthetic complications	1	1	0	2	1	0	0	5
Adverse drug reactions	0	0	0	0	0	0	0	0
Embolism	0	2	1	1	0	0	0	4
Acute collapse - cause unknown	0	1	3	3	0	0	0	7
Miscellaneous	0	0	0	0	0	0	0	0
Unknown	1	2	2	3	4	0	0	12
Total	**17**	**51**	**53**	**71**	**64**	**16**	**0**	**272**

The above table shows that more deaths occurred amongst women aged 30 to 34yrs followed by those in 35 to 39yrs, 25 to 29yrs then 20 to 24yrs respectively. The leading causes of death in those years were Non-Pregnancy Related Infections, Obstetric Haemorrhage and then Hypertension.

Figure 13. Primary Obstetric Cause and Maternal age, 2020-2022

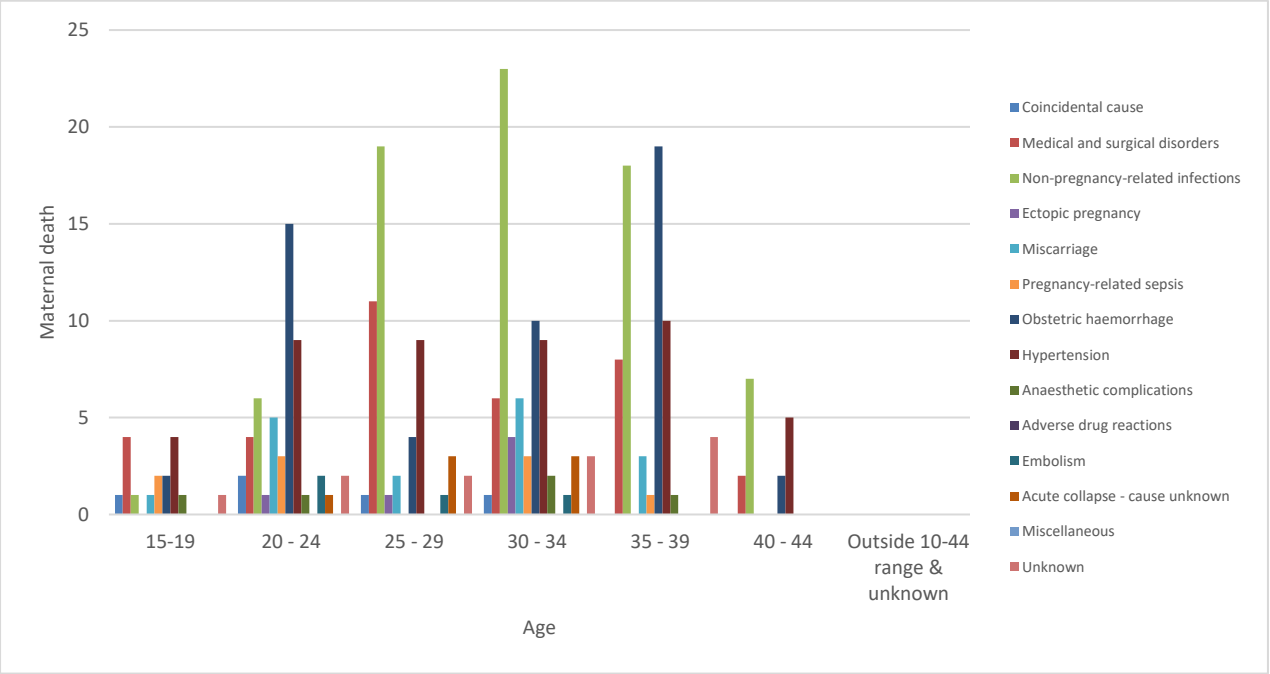


Table 11. Primary Obstetric Cause and Delivery Route, 2020-2022

Primary obstetric problems	Vaginal	CD	CD CHC	CD DH	CD RH	CD TH/NCH	CD Pvt
Coincidental cause	1	1	0	0	0	1	0
Medical and surgical disorders	8	9	0	0	4	4	1
Non-pregnancy-related infections	26	21	0	0	6	14	1
Miscarriage	0	0	0	0	0	0	0
Pregnancy-related sepsis	2	6	2	1	2	3	2
Obstetric haemorrhage	21	17	0	3	5	8	1
Hypertension	11	21	1	2	5	10	3
Anaesthetic complications	0	3	0	2	1	0	0
Adverse drug reactions	0	0	0	0	0	0	0
Embolism	2	2	0	0	2	0	0
Acute collapse - cause unknown	2	2	0	0	1	1	0
Miscellaneous	0	0	0	0	0	0	0
Unknown	2	1	0	0	1	0	0
Total	**75**	**83**	**3**	**8**	**27**	**41**	**8**

The highest number of women died were those who had Caesarean Delivery (CD) followed by vaginal delivery, with the highest number of CDs being at tertiary Hospital and followed by regional Hospital.

Table 12. Primary Obstetric Cause and HIV Status, 2020-2022

Primary obstetric problems	Negative	Positive	Declined test	Unknown	Total
Coincidental cause	3	0	0	2	5
Medical and surgical disorders	23	9	0	3	35

Primary obstetric problems	Negative	Positive	Declined test	Unknown	Total
Non-pregnancy-related infections	24	48	0	2	74
Ectopic pregnancy	0	3	0	3	6
Miscarriage	5	6	0	6	17
Pregnancy-related sepsis	6	3	0	0	9
Obstetric haemorrhage	32	14	0	6	52
Hypertension	29	12	0	5	46
Anaesthetic complications	4	1	0	0	5
Adverse drug reactions	0	0	0	0	0
Embolism	4	0	0	0	4
Acute collapse - cause unknown	6	0	0	1	7
Miscellaneous	0	0	0	0	0
Unknown	6	3	0	3	12
Total	**142**	**99**	**0**	**31**	**272**

The above table shows that more deaths occurred amongst women who were HIV negative, and the positivity rate had decreased amongst maternal deaths, but there were 31 with unknown HIV status.

Postmortems are done in the province, but more needs to be done for the unknown, acute collapse and embolism categories.

Table 13. Primary Obstetric Causes and Postmortems, 2020-2022

Primary obstetric problems	Post mortem	Not done
Coincidental cause	1	4
Medical and surgical disorders	8	27
Non-pregnancy-related infections	3	71
Ectopic pregnancy	2	4
Miscarriage	2	15
Pregnancy-related sepsis	2	7
Obstetric haemorrhage	12	40
Hypertension	3	43
Anaesthetic complications	3	2
Adverse drug reactions	0	0
Embolism	1	3
Acute collapse - cause unknown	3	4
Miscellaneous	0	0
Unknown	3	9
Total	**43**	**229**

AVOIDABLE FACTORS FOR MATERNAL DEATHS

Table 14. Classification of Avoidable factors, 2020-2022

	Number	% of total	% of cases at this level
PATIENT ORIENTED PROBLEMS			
- Avoidable factors identified	144	52.9	
- No avoidable factors	121	44.5	
- Lack of information	8	2.9	
ADMINISTRATIVE PROBLEMS			
- Avoidable factors identified	147	54.0	
- No avoidable factors	113	41.5	
- Lack of information	15	5.5	
RESUSCITATION PROBLEMS			
- Avoidable factors identified	158	58.1	
- No avoidable factors	80	29.4	
- Lack of information	34	12.5	
MEDICAL CARE - CHC			
- Managed at this level	168	61.8	
- Avoidable factors identified	117		69.6
- No avoidable factors	46		27.4
- Lack of information	6		3.6
MEDICAL CARE - DISTRICT HOSPITAL			
- Managed at this level	107	39.3	
- Avoidable factors identified	76		71.0
- No avoidable factors	28		26.2
- Lack of information	6		5.6
MEDICAL CARE - REGIONAL HOSPITAL			
- Managed at this level	81	29.8	
- Avoidable factors identified	62		76.5
- No avoidable factors	16		19.8
- Lack of information	5		6.2
MEDICAL CARE - TERTIARY & ABOVE			
- Managed at this level	113	41.5	
- Avoidable factors identified	70		61.9
- No avoidable factors	37		32.7
- Lack of information	7		6.2
MEDICAL CARE - PRIVATE HOSPITAL			
- Managed at this level	25	9.2	
- Avoidable factors identified	12		48.0
- No avoidable factors	12		48.0
- Lack of information	2		8.0
TIMING OF EMERGENCY			
- Early pregnancy	35	12.9	
- Antenatal period: 20w +	119	43.8	
- Intrapartum period	23	8.5	
- Postpartum period	92	33.8	
- Anaesthesia	3	1.1	
TIMING OF DEATH			
- Early pregnancy	26	9.6	
- Antenatal period: 20w +	65	23.9	
- Intrapartum period	6	2.2	
- Postpartum period	173	63.6	
- Anaesthesia	2	0.7	
IMPACT OF SUBOPTIMAL CARE			
- No suboptimal care identified	70	25.7	
- Suboptimal care, no impact on	15	5.5	

	Number	% of total	% of cases at this level
outcome			
- Suboptimal care, possible impact on outcome	126	46.3	
- Suboptimal care, probable impact on outcome	61	22.4	
Total:	**272**		

There were 68,7% of maternal deaths which were possible or probably preventable by better care within the health system; this needs to be attended to.

Table 15. Patient Orientated Avoidable factors, 2020-2022

Description	Number	% of cases
Lack of information	8	2.9
No avoidable factor	121	44.5
No antenatal care	53	19.5
Infrequent antenatal care	8	2.9
Delay in accessing medical help	88	32.4
Declined medication/surgery/advice	22	8.1
Family problem	2	0.7
Community problem	0	0
Unsafe abortion	5	1.8
Other	20	7.4
Total cases	**272**	

Delay in accessing medical help at 32,4% of patient related avoidable factors shows that more emphasis should be made on patient education to gain patient's cooperation.

Table 16. Administrative related avoidable factors, 2020-2022

Description	Number	% of cases
Lack of information	15	5.5
No avoidable factor	113	41.5
Transport problem: Home to institution	4	1.5
Transport problem: Institution to institution	10	3.7
Lack of accessibility: Barriers to entry	2	0.7
Lack of accessibility: Other	4	1.5
Delay in attending to patient (Overburdened service)	22	8.1
Delay in attending to patient (Reason unknown)	13	4.8
Lack of healthcare facilities: ICU	16	5.9
Lack of healthcare facilities: Blood/blood products	3	1.1
Lack of healthcare facilities: Other	3	1.1
Inadequate numbers of staff on duty	9	3.3
Appropriate skill not available on site / on standby	45	16.5
Communication problems: Technical	2	0.7

Description	Number	% of cases
Communication problems: Interpersonal	7	2.6
Other	54	19.9
Total cases	**272**	

Appropriate skill not available on site/ on standby was the highest in the administrative avoidable factors category, which showed that our facilities should appoint more killed personnel.

Table 17. Medical Care related avoidable factors, 2020-2022

Description	Number	% of all cases	% of cases at level
COMMUNITY HEALTH CENTRE			
Managed at this level	168	61.8	100
Lack of information	6	2.2	3.6
No avoidable factor	46	16.9	27.4
Initial assessment	84	30.9	50
Problem with recognition / diagnosis	57	21	33.9
Delay in referring the patient	26	9.6	15.5
Managed at inappropriate level	16	5.9	9.5
Incorrect management (Wrong diagnosis)	5	1.8	3
Sub-standard management (Correct diagnosis)	27	9.9	16.1
Not monitored / Infrequently monitored	2	0.7	1.2
Prolonged abnormal monitoring with no action taken	4	1.5	2.4
DISTRICT HOSPITAL			
Managed at this level	107	39.3	100
Lack of information	6	2.2	5.6
No avoidable factor	28	10.3	26.2
Initial assessment	35	12.9	32.7
Problem with recognition / diagnosis	44	16.2	41.1
Delay in referring the patient	21	7.7	19.6
Managed at inappropriate level	20	7.4	18.7
Incorrect management (Wrong diagnosis)	9	3.3	8.4
Sub-standard management (Correct diagnosis)	29	10.7	27.1
Not monitored / Infrequently monitored	8	2.9	7.5
Prolonged abnormal monitoring with no action taken	5	1.8	4.7
REGIONAL HOSPITAL			
Managed at this level	81	29.8	100
Lack of information	5	1.8	6.2
No avoidable factor	16	5.9	19.8
Initial assessment	25	9.2	30.9
Problem with recognition / diagnosis	26	9.6	32.1
Delay in referring the patient	3	1.1	3.7
Managed at inappropriate level	5	1.8	6.2
Incorrect management (Wrong diagnosis)	5	1.8	6.2
Sub-standard management (Correct	34	12.5	42

Description	Number	% of all cases	% of cases at level
diagnosis)			
Not monitored / Infrequently monitored	11	4	13.6
Prolonged abnormal monitoring with no action taken	8	2.9	9.9
TERTIARY HOSPITAL / ABOVE			
Managed at this level	113	41.5	100
Lack of information	7	2.6	6.2
No avoidable factor	37	13.6	32.7
Initial assessment	22	8.1	19.5
Problem with recognition / diagnosis	28	10.3	24.8
Delay in referring the patient	0	0	0
Managed at inappropriate level	0	0	0
Incorrect management (Wrong diagnosis)	10	3.7	8.8
Sub-standard management (Correct diagnosis)	37	13.6	32.7
Not monitored / Infrequently monitored	1	0.4	0.9
Prolonged abnormal monitoring with no action taken	11	4	9.7
PRIVATE HOSPITAL			
Managed at this level	25	9.2	100
Lack of information	2	0.7	8
No avoidable factor	12	4.4	48
Initial assessment	7	2.6	28
Problem with recognition / diagnosis	7	2.6	28
Delay in referring the patient	0	0	0
Managed at inappropriate level	0	0	0
Incorrect management (Wrong diagnosis)	3	1.1	12
Sub-standard management (Correct diagnosis)	2	0.7	8
Not monitored / Infrequently monitored	1	0.4	4
Prolonged abnormal monitoring with no action taken	0	0	0
Total cases	**272**		

Initial assessment and problem recognition/diagnosis are still high in almost all levels of care, more intervention needs to be done for this. Substandard care occurred more at regional and tertiary hospitals, which is a cause of concern as there are specialist at those levels.

Table 18. Resuscitation related avoidable factors, 2020-2022

Description	Number	% of cases
Lack of information	34	12.5
No avoidable factor	80	29.4
Airway problems	18	6.6
Breathing problems	29	10.7
Circulation problems	47	17.3
Drug problems	9	3.3
Investigation problems	2	0.7

Description	Number	% of cases
Monitoring problems	10	3.7
Not attempted	64	23.5
Total cases	**272**	

Summary and discussion of key findings on maternal deaths reported to MAMMAS

- Deaths reported to Province showed consistency in reporting every year with fluctuations from year to year, the maximum number of deaths reported being 161 in 2009. A downward trend in maternal deaths was however observed over the years up to 2019, until the recent triennium when there was an overall increase, due to the COVID-19 pandemic.
- The iMMR was 145.5 maternal deaths per 100,000 live births for the 2020-2022 triennium, a slight increase from 2017-2019, when it was 141.6.
- There was an increase of maternal deaths due to NPRIs in 2021 as a result of the pandemic COVID-19.
- In all the 3 years, (2020, 2021 and 2022) NPRIs was the leading cause of maternal deaths followed by Hypertension in 2020 and 2022 followed by Obstetric Haemorrhage and Medical and Surgical conditions.
- Deaths occurred more at tertiary Hospitals followed by regional, then district hospitals respectively with less deaths occurring at CHCs, reflecting better referrals.
- More women died at the facility and few from outside the facility, then in transit in that order. That shows that our women are aware of the importance of seeking medical help although it might have been too late for them to be assisted when arrived at the facilities.
- There was a significant drop in deaths occurring outside the facility in 2022 as compared to 2021 (7.7% down to 1.4%) whereas there was an increase in CHC deaths from 6.5% to 11.4% which showed that the community is responding in seeking medical help although they are still presenting late.
- More deaths occurred amongst women aged 30 to 34yrs followed by those in 35 to 39yrs, 25 to 29yrs then 20 to 24yrs respectively. The leading cause of death in those years were Non-Pregnancy Related Infections, Obstetric Haemorrhage and Hypertension in that order.
- A large number of deaths occurred in women that had received Antenatal Care and had booked before 20 weeks, which reflects sub-standard management that they received at PHC facilities during ANC visits, especially Hypertension management.
- Most of the women who died had tested negative for the retroviral disease (HIV negative), but of concern, was the large percentage (44.4%) of women whose viral load was 1000 copies/ml and more, which might have been due to women who defaulted treatment.
- It is of concern that more women who died were undelivered. Amongst those who delivered, most were by caesarean section.
- Most women were referred from the Community Health Centre to District and upward to Regional and Tertiary Hospitals which is a good practice that needed to be sustained.
- Notably, Non-Pregnancy Related Infections (NPRI's) have dropped from 41 (35.0%) in 2021 to 15 (20.8%) in 2022 and Obstetric Haemorrhage from 24 (20.5) in 2021 to 12 (16.7) in 2022, with an increase in Hypertension from 14 (12.0) in 2021 to 15 (20.8) in 2022 respectively.
- In 2022, CHC had problems on arriving at the diagnosis in 27.8% of women which resulted in delayed referral, furthermore when correct diagnosis was made, there was substandard management of the patients at 14.9% in Regional and 11.1% in Tertiary, District and CHC respectively despite correct diagnosis having been made.
- Most women died during PNC which showed that monitoring at PNC was not properly done.

Discussion

This chapter reviews the numbers of death each year over a 25 years period and the findings are that there is notable fluctuating trend in numbers over the period. This may be due to improved reporting or success on the part of the healthcare system to achieve the desired goal of "**No Woman should die whilst pregnant, giving birth or after birth"**.

There was a significant drop in deaths occurring at CHC. This should be encouraged and reinforced by organising meetings with well performing institutions, discuss performance and give positive feedback in order to boost staff morale. Staff must not be addressed only when there are problems even in good performance they should also be appraised.

Recommendations

The following three key aspects of a health system are essential:

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

These three basic building blocks of the Health System must be available to all pregnant women: especially the less informed and most disadvantaged people. When all these aspects are in place, rapid declines in the iMMR can be expected, as demonstrated by the reduction of deaths at CHCs and District Hospitals.

The North West Province is continuing with the implementation and monitoring of the NCCEMD's **5Hs** and **5Cs** recommendations to improve and save lives of the women at the reproductive age.

The 5 Hs are summarised as follows:

- **H**IV
- **H**aemorrhage
- **H**ypertension
- **H**ealth worker training and
- **H**ealth system strengthening

The last two (Health worker training and Health system strengthening) make up the three Basic Building Blocks of a health system as described above. They are essential to achieve the first three Hs (HIV, Haemorrhage, and Hypertension).

Implementation of the 5Hs is shown in the table below:

What	Priority activities to be implemented
Three Basic Building Blocks for the Health system	
Improve Health worker training	- Ensure In-service training, ESMOE, EOST and BANC Plus training, and sending nurses for advanced midwifery courses. - Continuing Professional Development of Medical Officers and Presentations to be conducted. - Evaluation of proper utilisation, recording and plotting of partogram to be continuously conducted. - Ensure onsite training with reinforcement strategy during training period. - Train HCP on HIV screening and treatment protocols. - Implement ESMOE and BANC Plus training at Nursing Colleges. - Enforce weekly fire drills at all delivery facilities. - O&G to manage pregnant women with medical conditions.
Strengthen Health system	- Implement Maternity dedicated inter-facility transport system within healthcare facilities and centralise maternity services with adequate human resources and equipment. - Identify, report and address the avoidable factors that contribute to maternal deaths. - Increase managerial accountability for reducing maternal deaths. - Strengthen clinical governance. - Ensure that hospitals practice non rotation of Maternity staff. - Conduct maternal mortality and morbidity meetings regularly, as planned and minutes to be documented. - Avail and communicate Referral criteria and routes to all delivery facilities. - Ensure functionality of established Maternity Waiting Homes in all the Districts. - Managers at all levels of care to ensure availability and accessibility of various modalities of contraceptives at all facilities. - Hospital and PHC senior managers to visit maternity units, attend M&M meetings and these activities to be part of their KPAs

What	Priority activities to be implemented
	- Share recommendations from assessor's meetings with various Districts at DMTs. - Senior managers to conduct consultative meetings with HCP (midwifes and Drs) to display support. - Continuously conduct in- service training on protocols and guidelines. - Continuously develop IEC material in local languages. - Continue Community Based Outreach Teams in all Wards. - Create more posts for Advanced Midwives at Regional Hospitals, District Hospitals and CHC's. - Continuing partnership with private facilities. - Audits to form part of facility managers PMAs - Continue monthly data verification by Programme Managers and Local Area Managers.
Reduce deaths due to HIV and TB	- Promote the "know your status" and "plan your pregnancy "messages. - Conducted Awareness campaigns to promote Early ANC booking and adherence to treatment. - Provide high quality antenatal care to all women during pregnancy. - In-service HCP training on the latest Guidelines on an ongoing basis. - Conduct active screening of HIV co-infections, counsel and treat especially TB. - Intensify management of HIV positive pregnant women Ensure that all eligible women receive ART to reduce mothers to child transmission of HIV infection. - Emphasise and discuss all areas of importance, substandard care and missed opportunities in mortality and morbidity meetings where patients have succumbed to non-pregnancy related infections. - Ensure adherence to protocols, guidelines and referral criteria.
Reduce deaths due to Haemorrhage	- Ensure availability of blood and blood products, e.g. Fresh Frozen Plasma (FFP) or Bioplasma in all delivery facilities. - Ensure availability of PPH boxes in all maternity units. - Continuation implementation of Post-Partum Haemorrhage monograph at all delivery facilities and updated ESMOE protocols including E Motive. - Impart skills on the basic nursing care to nurses especially pertaining to monitoring of vital signs in the first six hours after normal and caesarean section deliveries. - Emphasise Active management of the third stage of labour and recognise early signs of Haemorrhage at ESMOE trainings. - Ensure Adherence to protocols, guidelines and referral criteria.
Reduce deaths due to Hypertension	- Give all pregnant women Calcium supplementation during ANC. - Distribute and implement Early Warning Chart at all delivery facilities. - Ensure availability of Eclampsia boxes at all facilities performing deliveries and emphasis to be made on refilling them as soon as opened and used. - Emphasise proper management of Hypertension complications at ESMOE trainings. - Conduct awareness campaigns and community dialogues on quarterly basis at sub-District level to promote family planning and awareness to signs and symptoms of Imminent Eclampsia. - Ensure adherence to protocols, guidelines and referral criteria.

The **5Cs** give implementation strategies to move from the two Hs (Basic Building Blocks of the health system)

to achieve the three Hs (reduction in maternal deaths due the HIV/ TB, Hypertension and Haemorrhage. The **5Cs** are summarised as:

- **C**are: Commitment to Quality
- **C**overage
- **C**aesarean section safety
- **C**ontraception
- **C**ommunity involvement

Implementation of the 5Cs is as shown in the table below:

How	Who
Care: Commitment to quality	- Managers (especially Maternity Operational Managers) and DCST including O&G Specialists should supervise and evaluate HCP (midwives and Drs) to ensure that emergency drills are performed regularly and that they have appropriate skills. - Consultative meetings to be conducted with Healthcare Professionals to discuss issues around quality care. - HCPs should make themselves available for training, to participate in drills and to behave in a professional manner. - Operational managers to conduct in-service training continuously on protocols and guidelines. - Hospital and PHC senior managers should visit maternity units, attend M&M meetings and these activities must be included in their KPAs. - Provincial Maternal Death Assessors should share Recommendations from assessor's meetings with Districts at DMTs. - Audits to form part of facility managers and DCST PMAs - Monthly data verification by programme managers and Local Area Managers to be done at all levels of care. - Integration of wellness and ANC clinics to be done.
Coverage	- Senior managers should refurbish old facilities to improve accessibility to maternity services. - District senior managers and Hospital CEOs should monitor functionality of Maternity Waiting Homes. - Senior managers should Create advanced midwifery posts in all the Hospitals and CHC's for proper management of pregnant women. - The district managers and the Hospital CEOs should monitor the impact of the out-sourced ambulances for transportation of patients from District Hospitals to Regional Hospitals. - All HCP to be trained on BANC Plus Strategy to be able to identify problems early before complications occur. - Mentor Mothers programme to be rolled out to all facilities handling pregnant women. - Senior managers to finalise and provide the correct staff establishment according to areas of high priority (including retention strategies). - District senior managers and the DCST should monitor functionality of established High Risk Clinics at District Hospitals & CHCS.
Caesarean section safety	- Community Doctors and interns should be evaluated on anaesthetic skills at Regional Hospitals by Clinical managers and O&G Specialists to improve safety of caesarean section at District Hospitals. - Implementation of C/section and PPH monographs should be intensified at all Districts Hospitals. - DCSTs to continue training, monitoring and evaluating fire drills at all delivery facilities. - All Regional Hospital to have functional Maternity Operating Theatres which adhere to the DOH Safe CS miniumum standards.

How	Who
Contraception	- Managers at all levels of care to ensure availability and accessibility of various modalities of contraceptives. - Pregnancy awareness campaigns to be conducted at all Districts to promote contraception use to prevent unwanted pregnancies. - Ensure that all women have access to sexual and reproductive health services especially contraception. - HCP training on the new contraception policy, Intra Uterine Device and Implanon insertion to be continued to prevent unwanted pregnancies and illegal abortions. - All HCP to motivate pregnant women, teenagers and all women of childbearing age to prevent unwanted pregnancies by the use of contraceptives.
Community involvement	- Conduct awareness campaigns, community dialogues on quarterly basis at sub-District level to address maternal issues. - PHC Re-engineering teams to continue with Community Based Outreach at all Wards across the Province. - CHW's to intensify conducting Mother PNC within six days at all Wards. - WBOTs to continue the use of pregnancy screening tool to identify women requiring contraception and refer them appropriately. - Mentor Mothers to support women during pregnancy, delivery and post-natal. - Continue extensive consultation with multiple stakeholders, including Traditional Health Practitioners, Traditional Leaders, Church Leaders and broader community on maternal health issues. - Continue educating communities and pregnant women on the importance and the use of MoM-Connect. - Involve Ward Counsellors', Hospital Boards, and Community radio stations in the conveying of health information. - Involve Community members in the cleanliness of the Hospitals surroundings.

NB: These provincial Recommendations will be implemented alongside the NCCEMD national recommendations described in the 2020-2022 triennial report.

North West Provincial Assessors

Ms CN Modise	Provincial Maternal and Neonatal Health Coordinator
Dr HM Moatshe	O&G Specialist
Dr P Mokae	Specialist Anaesthetist
Ms VT Ditsele	Advanced Midwife
Dr NS Komane	O&G Specialist
Dr OI Adejayan	Family Physician
Ms KB Mooba	Advanced Midwife
Dr G Deaf	O&G Specialist
Ms ME Dintoe	Advanced Midwife
Ms KE Merementsi	Advanced Midwife
Ms M Siko	Advanced Midwife
Ms MJ Mamabolo	Advanced Midwife
Dr MG Mothupi	O&G Specialist
Ms BR Monei	Advanced Midwife

8.9 Western Cape

Key recommendations for the Western Cape
1. Pandemic preparedness to ensure women with obstetric emergencies have timeous care
2. Scale up E Motive approach for Early detection and treatment of PPH to all delivery facilities
3. Screening and early detection of TB to be improved
4. Integrated 6-week Postnatal clinics for mother and baby to be implemented
5. Medical/obstetric clinics to be promoted at regional and tertiary hospitals
6. Safe surgery and anaesthesia standards for CS to be audited and remediation done where indicated
7. Investigate inequities in outcomes between Metro West and East

Background to Western Cape maternity services

The Western Cape population is estimated at 7,231 000 (according to the 2022 mid-year population estimate by Statistics South Africa) which is 11.8% of the total SA population.

Within the Western Cape, there is a well-developed four-tiered system of maternity care with most deliveries taking place in district health facilities (district hospitals and midwife obstetric units). A package of care for the different levels (refined from existing national documents) as well as the skills needed to render the service and the equipment needed for each level of care was developed as a provincial policy document. In rural areas, the district hospitals do all deliveries and refer their specialist referrals to one of the three rural regional hospitals situated in Paarl, Worcester or George. All three of these hospitals have well developed outreach programmes with monthly visits to all the district hospitals that include morbidity and mortality meetings (PPIP), high risk obstetric clinics, specialist gynaecology clinics, and ESMOE training. Antenatal clinics refer complicated pregnancies to regional hospitals or to one of the two tertiary maternal and fetal medicine units, i.e. Groote Schuur or Tygerberg Hospitals.

In the metropolitan area of Cape Town, where two thirds of all the province's deliveries take place, 35% of all deliveries take place in midwife-only supported units (MOUs). The metro has four large district hospitals that provide maternity care (Karl Bremer, Helderberg, Khayelitsha and Mitchell's Plain Hospitals). A further 40% of deliveries take place at this level of care. The large metro district hospitals manage mainly referrals for poor progress in labour or suspected fetal distress from their respective MOUs, in addition to providing a district level package of care for gynaecology including emergency gynaecology.

The metro has three specialist hospitals (Mowbray, New Somerset, and Tygerberg Hospitals) which manage a further 20% of all deliveries at general specialist level and the remaining 5% of pregnancies with severe complications are referred to the tertiary/highly specialised units within the two central hospitals, Groote Schuur and Tygerberg. These hospitals are linked to two academic institutions, the University of Cape Town and Stellenbosch University respectively. Due to there being fewer district hospitals in the metro west area, New Somerset and Mowbray Maternity Hospitals also manage district level referrals from their MOUs and provide district level care to their surrounding areas.

There are six health districts in the Western Cape (Cape Town metro, West Coast, Cape Winelands, Overberg, Garden route and Central Karoo), but Cape Winelands has two regional hospitals, one on either side of the Limietberg mountains, and the geographical area of drainage therefore differs from the district boundaries. Paarl Hospital receives referrals from the West Coast and Winelands West; and Worcester Hospital from the Winelands East and Overberg areas. In addition, Saldanha Bay local municipality, although part of the West Coast sub-district, drains to New Somerset Hospital in the metro. Thus, for planning purposes there are five service drainage areas (George, Paarl, Worcester, Metro East, Metro West), each with a regional referral hospital and a clinical specialist as Head of General Specialist Services who is based at the regional hospital but provides clinical governance

oversight, outreach and support for the whole drainage area.

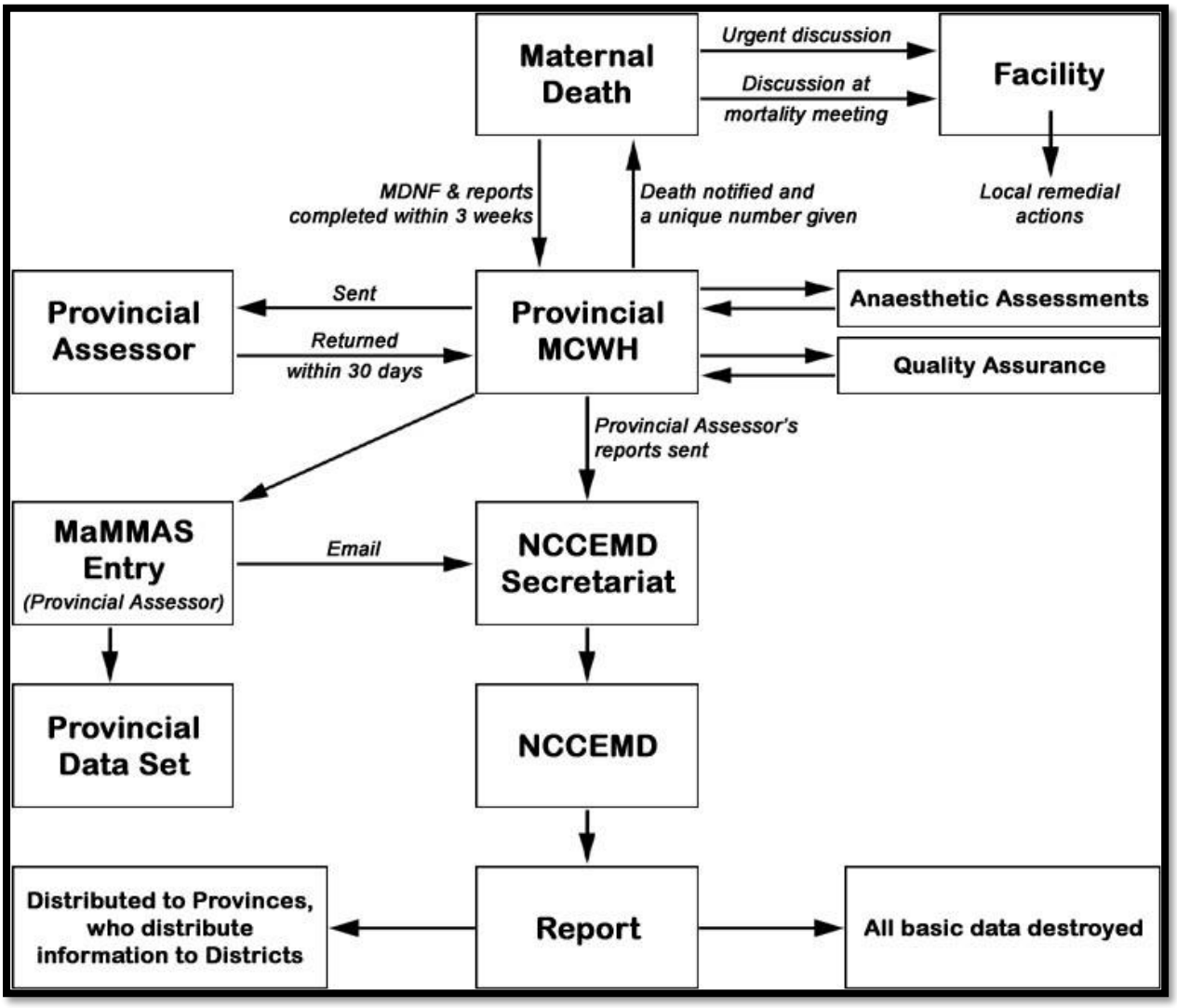
Each of the five service delivery areas in the province works towards planning the maternity service and in the metro two technical teams (one in the GSH drainage/Metro West and one in the TBH drainage/Metro East) plan and implement the district health maternal and neonatal service (now also working on women's and child health) and address issues in service delivery. These technical teams are referred to as Service Coordinating Working Groups. Clinical governance for maternity and neonatal care is provided by a Provincial Clinical Guidance Committee (PCGC) comprised of the two Academic heads of department, the five provincial heads of general specialist services (three rural and two metropolitan, one of which chairs the meeting on a rotational basis), the NCCEMD facilitator, Maternal-Fetal, Reproductive Medicine and Oncology sub-specialists, a family physician and nursing representative, the MCWH deputy director and a senior manager that serves as link with the executive committee of the department of health.

Five district specialist obstetricians have been appointed but there are no functioning DCST teams. ESMOE/EOST training is in process although restrictions associated with COVID-19 decreased the number of face-to-face training and simulation. From 2023 the province now has access to the K2 Perinatal training system, which is an online self-paced learning system available to doctors and nursing staff. This is deemed to replace some of the ESMOE content but should still be supplemented with regular simulation training in obstetric emergencies. The anaesthesia ESMOE module was revised with 7 new e-learning lectures followed by a hands-on skills training day.

Process of the confidential enquiry into maternal deaths

The process is summarised in Figure one. The data presented in this report is derived from the MAMMAs database which includes anonymised data of every single Death during Pregnancy Childbirth and the Puerperium (DDPCP) with an assessment of cause, contributory factors, and avoidability or substandard care. These assessments were done by the WC maternal death assessment team composed of obstetricians, midwives, anaesthetists and family physicians; and coordinated by the MCWH coordinator. They assess in small groups which review deaths from other districts (not their own) and meet two monthly to monitor the process and discuss emerging problems. In addition, district data is provided by the MCWH coordinator from the provincial database Sinjani.
This report covers Western Cape deaths only. It is important to recognise that this report includes the COVID-19 pandemic which began in 2020.

Figure 1: Process of National Confidential Enquiry into Maternal Deaths



Maternal mortality in the Western Cape, 2020-2022

During this triennium, there were 299427 live births and a total number of 267 maternal deaths recorded with an iMMR of 89.2. There were 283 Deaths During Pregnancy, Childbirth and the Puerperium (DDPCP) reported to the NCCEMD. When the 16 Coincidental deaths were excluded, there were 267 maternal deaths.

Table 1: Maternal Mortality Western Cape 2020-2022

Western Cape	Live births	MaMMAS deaths (DDPCP)	MaMMAS MD	DHIS MD	MaMMAS MD (corrected)	MaMMAs iMMR	MaMMAs iMMR (corrected)	DHIS iMMR
2020	106058	105	99	77	99	93.35	93.35	72.6
2021	98746	105	101	79	101	102.28	102.28	80.0
2022	94623	73	67	63	67	70.81	70.81	66.6

There was a marked increase in the number of deaths in this triennium compared to previous years, with 99 deaths in 2020 and 101 in 2021 which coincided with the COVID-19 pandemic. The number of deaths in 2022 decreased to 67 almost the level of 2019 preceding the pandemic, when there were 56. The iMMR was 93.3/100 000 in 2020, compared to 102,3/100 000 in 2021, and 70.8/100 000 in 2022. The high iMMR in 2020 and 2021 was related to the increased number of deaths during the COVID-19 pandemic.

Figure 2: Western Cape Maternal Deaths 1998-2022

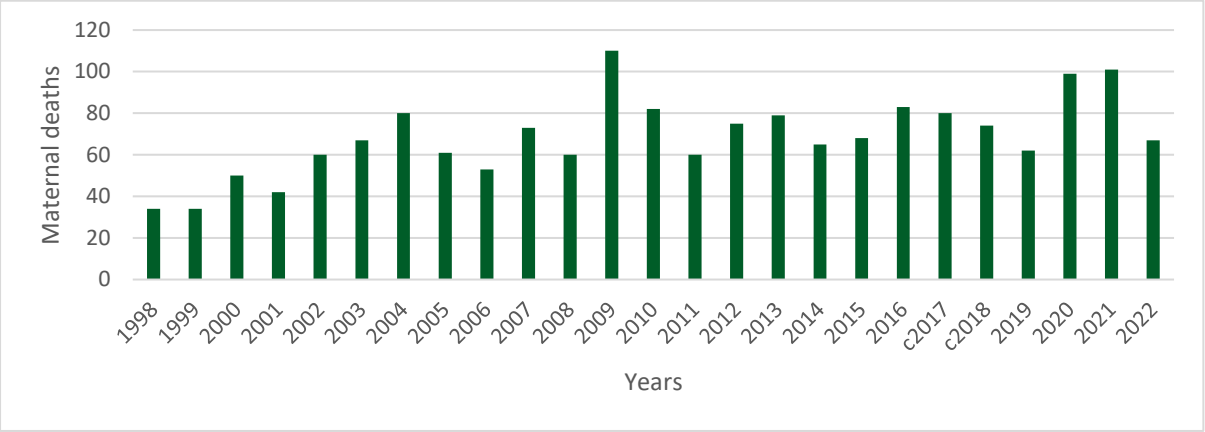
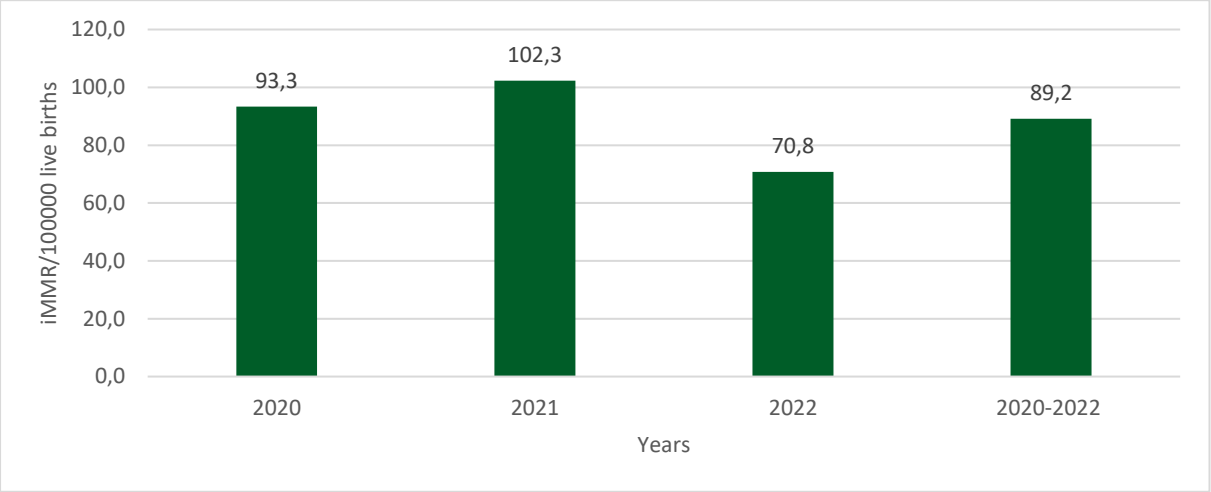
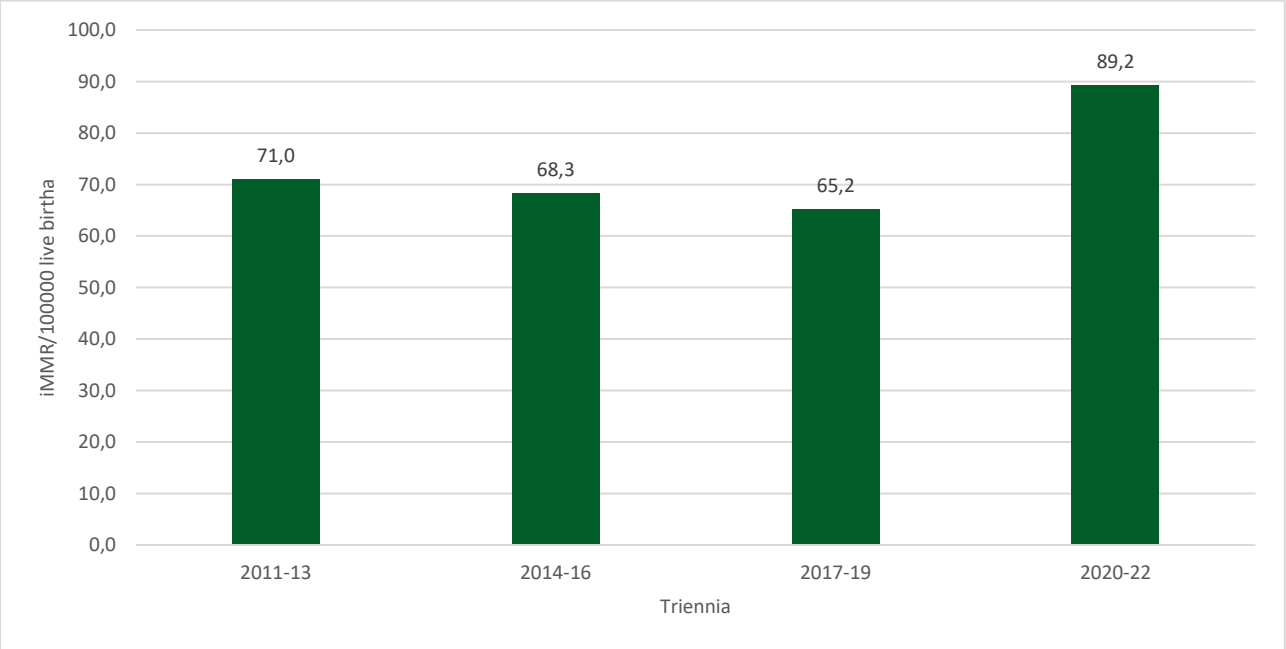


Figure 3 iMMR 2020-2022



The iMMR for the last 3 years has increased, and was the highest in 2021, this was mainly related to the COVID-19 mortalities. The iMMR for 2022 was 70.8, which was still higher than the previous 2 triennia, even though there were no reported COVID-19 deaths.

Figure 4 iMMR last 4 triennia



Demographic and clinical data

Place of death and Level of care

There were 283 DDPCP in the Western Cape Province across the six districts, with the highest number of deaths in the City of Cape Town. The numbers of deaths in this triennium have increased considerably since the last triennium. This triennium was characterised by the COVID-19 pandemic, which contributed to the surge in maternal deaths. Table 2 describes the number of deaths per district per triennium. The majority of deaths occurred at healthcare facility level. There were still some deaths that occurred at home and outside of hospital facilities. Deaths seldom occurred in transit. Out of the 283 deaths, 38 deaths occurred outside of a hospital facility, 12 deaths occurred in Community Healthcare centres, and 23 deaths occurred in Private hospitals. The majority of deaths occurred in Tertiary hospitals, compared to district and secondary hospitals (Table 3). The number of deaths outside and at CHCs remained relatively the same, but deaths at hospital facility level increased at all levels, including at private hospitals.

Table 2: Number of DDPCP per district by residence of the mother per triennium

District	2002-2004	2005-2007	2008-2010	2011-2013	2014-2016	2017-2019	2020-2022
Metro	124	119	157	167	133	136	**200**
Cape Winelands	17	18	26	18	27	33	**36**
Overberg	7	7	10	2	8	11	**3**
West Coast	9	13	11	10	16	11	**8**
Central Karoo	5	4	7	0	5	5	**7**
Garden Route	28	22	31	17	27	24	**29**
Total W Cape	**190**	**183**	**242**	**214**	**216**	**220**	**283**

Table 3 District iMMR and number MDs 2020-2022

District where death occurred	Nr	Number of deliveries	iMMR
Cape Winelands District Municipality	36	47629	75.58
Central Karoo District Municipality	7	2878	243.22
City of Cape Town Metropolitan Municipality	***200***	190889	104.77
Garden Route District Municipality	29	29883	97.05
Overberg District Municipality	3	13547	22.15
West Coast District Municipality	8	15602	51.28
Total	**283**	**300428**	**94.20**

The largest number of deaths occurred in the Cape Town Metro, a tot al 200, with an iMMR of 104.7. There was a discrepancy in the distribution in the Metro West area with 57 (29%) and Metro East 112 (56%) the remaining Metro deaths occurred in private practise. This makes the iMMR of the Metros' Metro West 57 and Metro East 116.9. The reason for the discrepancy is unclear from the data require further investigations. The highest iMMR was in the Central Karoo district, although the absolute numbers are small.

Table 4: Comparison of levels of care where DDPCP's occurred 2011-2022

Level	2011-2013		2014-2016		2017-2019		2020-2022	
	N	%	N	%	N	%	N	%
Home/outside facility	19	8.9	26	12	35	15.9	38	13.4
CHC or MOU	9	4.2	9	4.2	14	6.4	12	4.2
Level 1 (district)	36	16.8	43	19.9	32	14.5	48	16.9

Level	2011-2013		2014-2016		2017-2019		2020-2022	
	N	%	N	%	N	%	N	%
Level 2 (regional)	34	15.9	36	16.7	37	16.8	52	18.3
Level 3 (Central)	112	52.3	94	43.6	97	44.1	110	38.8
Private	4	1.9	8	3.7	5	2.3	23	8.1

Maternal age

Details of the number of maternal deaths per age category are shown in table 6. There was a reduction in the number of deaths in women below the age of 24, however, the number of deaths in women between 25 and 44 increased. These findings are also mostly likely explained by the COVID-19 pandemic as risk factors for severe COVID-19 were age-related.

Table 5: Number of maternal deaths per age group

Age	2014-2016 Number	2014-2016 %	2017-2019 Number	2017-2019 %	2020-2022 Number	2020-2022 %
<20	14	6.5	16	7.3	11	3.8
20-24	42	19.4	27	12.3	29	10.2
25-29	61	28.2	68	30.9	67	23.6
30-34	59	27.3	55	25.0	81	28.6
35-39	35	16.2	39	17.7	70	24.7
40-44	4	1.9	14	6.4	19	6.7
45+	0	0	1	0.5		
Unknown	1	0.5	0		6	2.1

Antenatal care attendance

Table 6: Antenatal care attendance by triennium

	2011-2013		2014-2016		2017-2019		2020-2022	
	N	%	N	%	N	%	N	%
Attended	145	67.8	157	72.7	149	67.7	199	70.3
Not Attended	42	19.6	35	16.2	45	20.5	45	15.9
Unknown	27	13	24	11.1	26	11.8	39	13.7

The number of women who attended antenatal clinic was 199, with the percentage (70%) remaining similar to the previous trienniums.

Parity

Proportionally there were less maternal deaths in nulliparous patients, this could possibly be related to COVID-19 mortality increasing with age.

Table 7: Maternal deaths by parity

Parity	2014-2016 N	2014-2016 %	2017-2019 N	2017-2019 %	2020-2022 N	2020-2022 %
0	55	25.5	62	28.2	64	22.6
1	64	29.6	47	21.4	76	26.8
2	51	23.6	47	21.4	60	21.2
3	20	9.3	22	10.0	40	14.1
4	5	2.3	13	5.9	16	5.6
5	3	1.4	4	1.8	5	1.7
6+	0	0	2	0.9	2	0.7
Unknown	18	8.3	23	10.5	20	7.0

HIV

The percentage of women who were HIV positive has decreased compared to different trienniums. The reason for this is unknown but could be due to the universal roll out of antiretroviral therapy, to all people living with HIV.

Table 8: HIV Status comparison 2011-2022

	2011-2013		2014-2016		2017-2019		2020-2022	
HIV Status	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Positive	86	40.2	66	30.6	64	29.1	80	28.2
Negative	96	44.9	118	54.6	126	57.3	165	58.3
Unknown	32	15	32	14.8	30	13.6	38	13.4

Causes of Maternal Deaths

Between 2020 and 2022 there were 299 427 live births, with the highest number of births in 2020. There were 99 maternal deaths in 2020, 101 in 2021 and 67 in 2022. The COVID-19 pandemic peaked between 2020 and 2021, which would explain the increase in the maternal mortality in 2020 and 2021. The leading cause of death remained non-pregnancy related infections, followed by medical and surgical disorders, then hypertension and obstetric haemorrhage. The maternal mortality rate for the triennium was 89.7/100 000. The year 2021 had the highest MMR. There were an additional 70 deaths due to COVID-19 in 2020 and 2021, which were not there in previous trienniums.

Table 9: Triennial Comparison of Causes of Death 2011 – 2022

	2011-2013		2014-2016		2017-2019		2020-2022	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Direct	**90**	**45**	**96**	**49.2**	**106**	**52.2**	**112**	**31.9**
Hypertension	36	18	26	13.3	25	12.3	32	11.3
Haemorrhage	14	7	21	10.8	21	10.3	28	9.9
Ectopic pregnancy	1	0.05	6	3.1	6	3	5	1.7
Miscarriage	5	2.5	4	2.1	3	1.5	3	1.1
Preg. Related Sepsis	16	8	13	6.7	17	8.4	12	4.2
Anaesthetic related	1	0.05	4	2.1	5	2.5	3	1.1
Embolism	10	5	13	6.7	16	7.9	15	5.6
Acute collapse	7	3.5	4	2.1	5	2.5	10	3.5
Adverse drug reactions	0		1		3	1.5	0	0
Miscellaneous	0		4	2.1	5	2.5	4	1.4
Indirect	**106**	**53**	**91**	**46.7**	**84**	**41.4**	**145**	**54.3**
Non-pregnancy-related Infection	67	33.5	46	23.6	49	24.1	110	41.2
Medical and Surgical Disorder	39	19.5	45	23.1	35	17.2	35*	12.3
Unknown/Other	**4**	**2**	**8**	**4.1**	**13**	**16.4**	**10**	**3.5**
Total Maternal Deaths	**200**	**100**	**195**	**100**	**203**	**100**	**267**	**100**
Coincidental	14		21		17		16	
DDCP	214		216		220		283	

Primary Cause of death
When looking at primary obstetric cause of death these were the leading single causes.

Table 10: Primary Cause of Death

Primary Obstetric Cause	Number (% of total n = 283)
COVID-19	70 (24.7)
Eclampsia	17 (6.0)
Cardiac (cardiomyopathy, Rheumatic heart disease, Other)	15 (5.3)
Embolism	15 (5.3)
Tuberculosis	13 (4.5)
Pregnancy related Sepsis	12 (4.2)
Acute Collapse	10 (3.5)
Bleeding after CS	9 (3.2)

When looking at the primary cause of death, other than COVID-19 which is discussed below, there were a high number of deaths related to Eclampsia. Tuberculosis, and Cardiac disease remain a concern. The high number of embolism deaths could also be related to COVID-19, or a higher detection rate due to increased access to diagnostic testing, and postmortem investigations.

Delivery route

There were 109 maternal deaths in women who had a caesarean section, compared to 76 women who had a vaginal delivery and 86 women who were undelivered. The caesarean delivery rate for the triennium was 29.8%. The largest proportions of deaths of women who were delivered by CD were in the NPRI, M&S and obstetric Heamorrhage categories.

Table: 11 Delivery outcomes per triennium

	2011-2013		2014-2016		2017-2019		2020-2022	
Route of delivery	N	%	N	%	N	%	N	%
Vaginal	57	28.3	51	23.6	60	27.3	76	26.9
Assisted	2	1	7	3.2	2	0.9	11	3.9
Caesarean deliveries	73	36.3	74	34.3	64	29.1	109	38.2
Ectopic					7	3.2	6	2.1
Undelivered	69	34.4	84	38.9	87	39.5	90	31.8

Caesarean delivery case fatality rates

The number of deaths who had a CD and the case fatality rate for CS increased significantly in 2020-2022. There were 38 women who died of NPRI who had a CS which can account for some of the increase, as in many women with severe COVID-19 delivery by CS was indicated to improve ventilation of the mother. Heamorrhage, hypertension and embolism were the other categories where there had high numbers of CD, see table 13. There was an increase in the caesarean section rate in the province, with the current rate of 29.8%, this is not taking the private sector into consideration see table 14. The bleeding at CD case fatality rate has increased in the province to 11/100 000 CD compared to 6.9 in the previous triennium, see table 15.

Table 12. Delivery route per cause of death

Primary obstetric problems	CD	%	Vaginal	%	Undelivered	%	TOTAL
Coincidental cause	0	0	1	7.14	13	92.86	14
Medical and surgical disorders	14	43.75	5	15.63	13	40.63	32
Non-pregnancy-related infections	39	37.50	28	26.92	37	35.58	104
Pregnancy-related sepsis	5	41.67	6	50.00	1	8.33	12
Obstetric haemorrhage	13	50.00	12	46.15	1	3.85	26
Hypertension	14	45.16	7	22.58	10	32.26	31
Anaesthetic complications	2	66.67	0	0.00	1	33.33	3
Embolism	8	53.33	4	26.67	3	20.00	15
Acute collapse - cause unknown	5	50.00	3	30.00	2	20.00	10

Table 13. Caesarean Section Case Fatality rates

	2014 - 2016	2017 – 2019	2020-2022
Total deliveries	296756	285896	306012
Caesarean deliveries	83353	80370	91123
CD rates	28.1%	28.1	29.8
CD deaths	74	64	109
CD Case Fatality Rate	88.8 per 100,000 CD	79.6 per 100,000 CD	119.6 Per 100,000 CD

Table 14. BLDACD and BLDACD rates per province 2020-2022

Province	CD 2020-2022 N	CD Rate 2020-2022 %	BLDACD death 2020-2022 N	BLDACD CFR 2020-22 per 100,000 CD	BLDACD CFR 2017-19 per 100,000 CD	BLDACD CFR 2014-16 per 100,000 CD
Western Cape	91123	29.8	10	11	6.9	15.6
South Africa	889497	28.8	198	22.3	23.6	31.7

NPRI and the Impact of COVID-19

NPRI remained the leading cause of death, 110 (36.74%) of all deaths. It was the leading cause in 2020 where 45 (42.43%) deaths were caused by NPRI and in 2021 there were 52 (52.55%), However in 2022, it was only the second most common cause with 13 (13.74%) deaths. There were 46 (41%) known to be HIV positive.

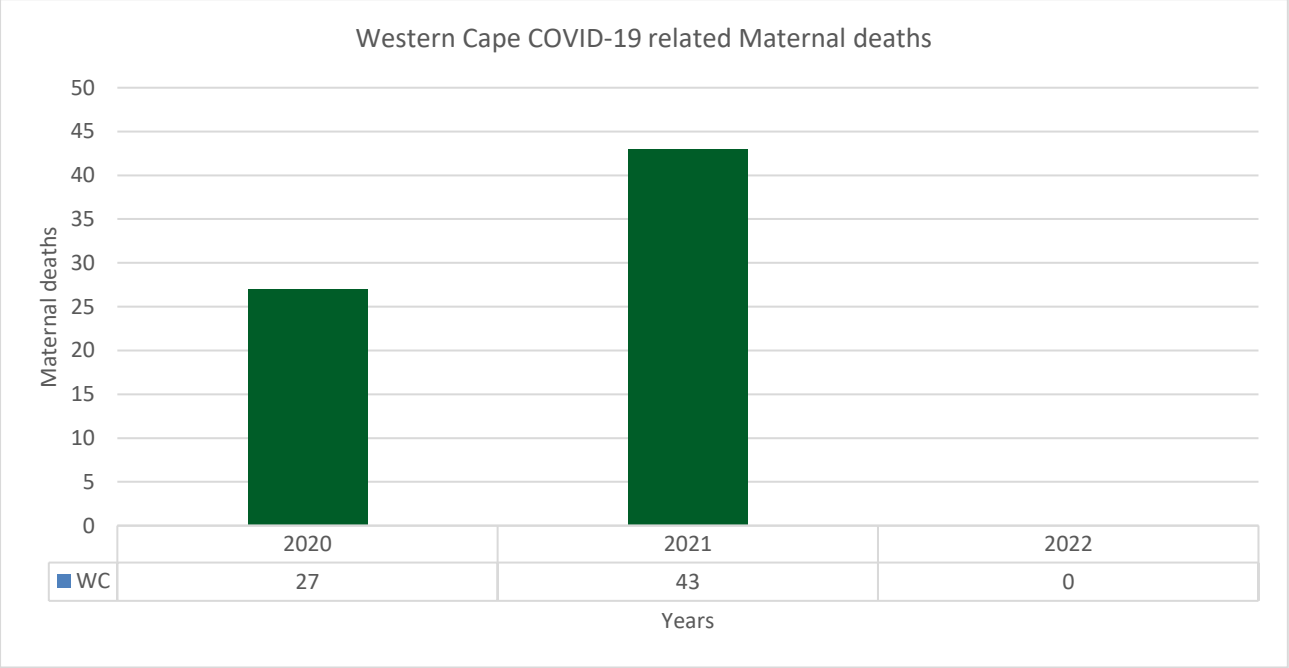
COVID-19 was the biggest underlying infection in this category with 70 (26.2%) maternal mortalities directly caused by COVID-19 infection. In 2020 there were 27 (29%) deaths from COVID-19, 2021 43 (42%). It is likely that these numbers are not fully representative of all the deaths as universal screening with PCR testing of all pregnant women was not feasible in the province. In the category of NPRI there were an additional 7 deaths from “Other Pneumonia” and 74 categorised as “Other” which includes the 70 specified as COVID-19. It is possible that COVID-19 could have contributed to both the unknown cause category (10 deaths) and the large number, 15, of embolism deaths, as these are both associated with COVID-19.

Table 15. Causes of Death, NPRI

Non-pregnancy-related infections	110	%
- PCP pneumonia	2	1.8
- Other pneumonia	7	6
- TB	13	11.8
- UTI	2	1.8
- Appendicitis	2	1.8
- Cryptococcal meningitis	2	1.8
- Other meningitis	5	4.5
- Gastroenteritis	2	1.8
- Wasting syndrome	1	0.9
- Other*	74	76
**COVID-19*	*70*	*63.6*

**COVID-19 related deaths were classified as NPRI/Other/COVID-19*

Figure 5: COVID-19 Mortalities per year



The deaths due to NPRI occurred at all levels of care include 12 (10%) in the private sector, 19 (17%) in district hospital, 25 (22%) at regional hospitals and 22 (40%) at tertiary level hospitals, there were also six outside facilities and four at community heath clinics.

The deaths occurred mainly in the Cape Town metro 77 (70%), with 15 (13%) in the Eden district and 14 (12.7%) in the Cape Winelands and four West Coast. There were none in the Central Karoo and Overberg which could be explained by the decrease incidence of COVID-19 in rural areas during the pandemic, or that these women were referred to higher levels of care.

Respiratory failure was the final cause of death in 38.2% of all deaths, as it is the most common mechanism of death related to COVID-19. With the roll-out of vaccinations and the decreased virulence of the later strains, there were no further deaths from COVID-19 in 2022.

Maternal deaths indirectly related to COVID-19

Several health system changes were implemented, to avail resources to the expected burden on the health system. Antenatal and intrapartum care were considered essential services and did not de-escalate during the pandemic However, health workers and patients' fear, access, transport and income loss at this time could have affected the quality and accessibility of antenatal care.

Avoidable factors missed opportunities and substandard care.

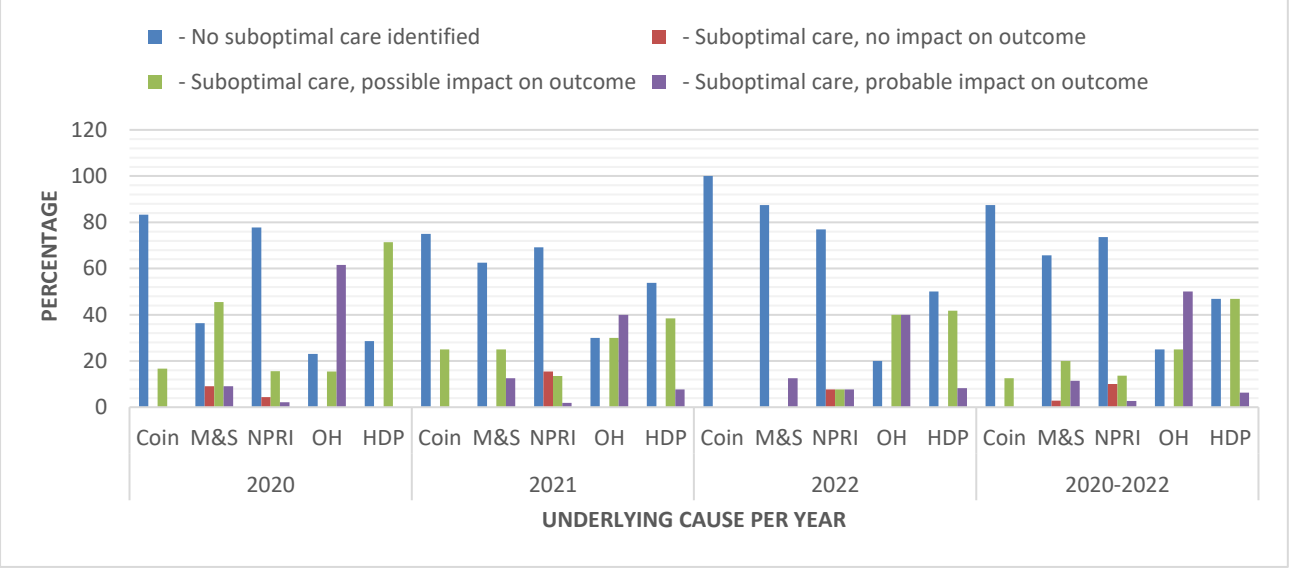
Maternal death assessor teams review all cases of maternal mortality to identify avoidable factors and substandard care. This is to highlight areas of improvement. In 179 (63%) of the deaths, no substandard care was identified, and in 34 (12%), it was deemed that suboptimal care had a probable impact on the outcome. These numbers were similar in the previous triennium.

Table 16: Impact of Suboptimal Care 2017-2019 vs 2020-22

Impact of suboptimal care	2020-22 (n)	%	2017-19 (2)	%
No suboptimal care identified	179	63.3	132	60
Suboptimal care, no impact on outcome	15	5.3	17	7.7
Suboptimal care, possible impact on outcome	55	19.4	40	18.2
Suboptimal care, probable impact on outcome	34	12.0	31	14.1
Total	**283**		**220**	

When the standard of care is reviewed by cause of death the distribution of suboptimal care per five leading causes is illustrated in Figure 6. For NPRI, in 81 (73%) of cases there was no suboptimal care identified, and only in 3 (2.7%) suboptimal care could have probably impacted the outcome. In M & S, there was suboptimal care in 12 (34%) cases; in four, it could have impacted the outcome. Alarmingly in the cases where OH was the cause of death, there were only 7 (25%) of cases with no suboptimal care and in 14 (50%), suboptimal care could have probably impacted the outcome.

Figure 6: Impact of Suboptimal Care per Underlying Cause



Avoidable Factors

There were no major differences in overall avoidability from the previous triennia. Patient orientated factors were slightly less, and administrative factors were significantly more than previous years. Likely reflecting the collateral effect of the COVID-19 pandemic. Avoidable factor by level of care remained similar with a trend to decrease as level of care increases, showing resilience and dedication of healthcare providers.

Table 17. Avoidable factors, missed opportunities and substandard care

Category	Percentage of avoidable factors in assessable cases			
	2011-2013	2014-2016	2017-2019	2020-2022
Patient orientated	31.8	29.6	39.1	26.9
Administrative factors	15.4	7.4	10.9	19.4
Health worker related emergency management problems				
- Primary level	29	37.5	27.5	28.5
- Secondary level	14.5	29.3	30.4	18.4
- Tertiary level	15.4	27.8	15.7	18.1
Resuscitation	36.9	32.4	30	32.9

With regards to patient orientated factors there were less avoidable factors identified as the previous triennium, and less cases where there were no antenatal care. This shows that women continued to seek care for their pregnancies despite the pandemic. Delay seeking help 47 (16.6%) was the most common factor followed by declining medical advice 21 (7%).

Table 18. Avoidable factors, missed opportunities and substandard care with respect to patient-orientated problems

	Percentage of assessable deaths with avoidable factors			
	2011-2013 (n=214)	2014-2016 (n=216)	2017-2019 (n=220)	2020-2022 (n=283)
No avoidable factors	53.7	57.9	47.7	55.1
No antenatal care	14.5	7.9	13.2	8.8
Infrequent antenatal care	2.8	4.2	9.5	2.1
Declined medication/surgery/advice	Not assessed	Not assessed	Not assessed	7.4
Delay in seeking medical help	15	9.7	17.3	16.6
Unsafe abortion	0	0.5	0	0
Other	0.9	5.1	4.1	0.7

Table 19. Avoidable factors, missed opportunities and substandard care with respect to administrative problems for all cases

Major Problems	2014-2016 n=216 (%)	2017-2019 n=220(%)	2020-2022 n=283(%)
No avoidable factor	181 (83)	182(82.7)	194(86.5)
Transport problem home to institution	0	2(0.9)	4(1.4)
Transport problem between institutions*	7(3)	4(1.8)	11(3.8)
Barriers to entry	1(0.4)	0	0
Lack of accessibility	0	1(0.4)	2(0.7)
Delay in attending to patient (Overburdened service)	Not assessed	Not assessed	11(3.8)
Lack of healthcare facilities	1(0.4)	4(1.8)	3(1)
Lack of ICU facilities	1(0.4)	3(1.3)	17(6)
Lack of blood products**	0	4(1.8)	2(0.7)
Lack of personnel	0		7(2.4)
Lack of appropriately trained staff	4	2	11

Major Problems	2014-2016 n=216 (%)	2017-2019 n=220(%)	2020-2022 n=283(%)
Communication problems	4	2	6
Other	2	5	2

The largest contributing factors to administrative problems were lack of ICU facilities 17 (6%), delay in attending patient (overburdened services) 11, lack of appropriately trained staff 11 and delays with inter-institution transport. It is likely that many of these coincided with the overburdened services during the COVID-19 pandemic.

Table 20: Medical Management Avoidable factors

Medical management problems	CHC/MOU N (%)	District N (%)	Regional N (%)	Tertiary N(%)	Private N (%)
Managed at Level	89 (100)	137(100)	87(100)	127(100)	30(100)
Lack of information	18(20.2)	15(10.9)	14(16.1)	12(9.4)	6 (20)
No avoidable factor	53(59.6)	85(62)	58 (66.7)	93 (73.2)	15 (50)
Initial assessment	1(1.1)	4(2.9)	2(2.3)	1(0.8)	0
Problem with recognition / diagnosis	8(9)	24(17.5)	7(8)	13(10.2)	7(23.3)
Delay in referring the patient	4(4.5)	9(6.6)	1(1.1)	0	2(6.7)
Managed at inappropriate level	3(3.4)	10(7.3)	2(2.3)	0	0
Incorrect management (Incorrect diagnosis)	2(2.2)	4(2.9)	3(3.4)	3(2.4)	4(13.3)
Sub-standard management (Correct diagnosis)	8(9)	10(7.3)	8(9.2)	12(9.4)	1(3.3)
Not monitored / Infrequently monitored	4(4.5)	1(0.7)	1(1.1)	2(1.6)	1(3.3)
Prolonged abnormal monitoring with no action taken	1(1.1)	1(0.7)	3(3.4)	4(3.1)	1(3.3)

The biggest contributing avoidable factor identified from the medical care was with problem recognition and diagnosis, table 21, this occurred at all levels of care, CHC 9%, 24 (17.5%) DH, 7 (8%) RH, 13 (10.2%) TH and 7 (23.3%) PH. This was followed by Substandard management and correct diagnosis.

Anaesthesia related mortalities 2020-2022

Compiled by Jonathan Burke and Esther Cloete (Records from MaMMAS and DRAMA databases)
There were a total of 91123 caesarean deliveries (CD), performed in the Western Cape public sector during this triennium. Of these 70% were performed in the City of Cape town metro geographical area. In 109 (39%) of the total 283 maternal deaths recorded for the triennium, an anaesthetic was administered.

DRAMA database avoidable factors *(In order of frequency)*

- Administrative:
  - District junior staff anaesthetising high-risk patients. In some situations this is inevitable but the importance of early consultation with the referring hospital for advice and management should be highlighted, as well as the fact that ESMOE training should be done regularly.
  - Lack of required drugs (bupivacaine with dextrose).
  - No access to theatre due to limited theatre capacity.
  - Delay in ambulance transfer to a higher level of care.
- Clinical decision-making: (In order of frequency)
  - Delay in recognition of symptoms or complications.

- CD spinal hypotension inadequate vasopressor use. Adrenalin dose inappropriate for hypotension management.
- Inadequate resuscitation fluids/blood products. No blood ordered pre-op with high haemorrhage risk.
- Ambulance transfer of critically ill patient who dies enroute.
- Pulmonary embolism deaths post-surgery. Are anaesthetists following the guidelines?

- Record keeping:
  - substandard records: fluid co-load, uterine displacement, testing of block height not recorded, drug administration, no notes on resuscitation.

In one record the spinal anaesthetic was assessed to have contributed to the death with obstetric haemorrhage assessed the primary cause. In three records the anaesthetic was assessed to be the primary cause of death

- two spinal anaesthetic deaths
- one general anaesthetic death

Spinal anaesthesia learning points and recommendations.

Hypotension following spinal anaesthesia is very common (80%). This is mostly due to the spinal anaesthetic induced sympathectomy resulting in vasodilatation. Anticipation and prevention of hypotension is key to good maternal outcomes.

- **Basic management**: Left lateral uterine displacement, 500ml - 1000ml fluid co-loading and aggressive vasopressor use to ensure haemodynamic goals of 80mmHg mean non-invasive blood pressure, heart rate of 80 beats per minute and maintaining O2 saturation above 96%. If aggressive vasopressor use is unsuccessful in restoring haemodynamic stability administer adrenalin boluses (10-20 microgram not 1mg)
- **Monitor** while standing next to the patient, finger on the pulse, communicate with the patient to assess cerebral perfusion and test the level of the block for the first 10-15 min after the spinal injection. Early recognition of block height and cardiorespiratory changes are vital to guide management.
- **Testing the block height** should include a bilateral hand grip test as a high spinal block above T4 level will be missed if only the thoracic nerves are tested. It is essential not to be distracted while monitoring the patient from the time the spinal is in until the corners of the uterus are sutured, and bleeding is under control.
- **Severe hypotension** will cause cerebral hypoperfusion, apnoea and hypoxia resulting in cardiac arrest. Rapid treatment of hypotension should prevent apnoea, hypoxia and arrest. In the case where the haemodynamic status has been restored and the patient is still not breathing manage as a high spinal by active opening of the airway, intubation and ventilation. Do not administer an induction agent like propofol to a hypotensive unconscious patient. Succinylcholine may be needed to assist with intubation.
- **High spinal** is a continuum of symptoms in the cardiovascular, respiratory and neurological systems. Patients with a potentially high spinal should be monitored meticulously and rapid conversion to intubation as needed. https://www.sajaa.co.za/index.php/sajaa/article/view/1791
- **Heavy Bupivacaine is out of stock, what do I do now?** When using isobaric bupivacaine the position is as important as with hyperbaric bupivacaine. It might cause greater hemodynamic instability in the patient as well as a lower level of spinal blockade. Hyperbaric bupivacaine has a slightly faster onset of action while Isobaric has a longer duration of action.
- **My patient is shorter than 1.5m, what volume do I add to my spinal anaesthetic?** Ideally, patients on the spectrums of weight and height should be referred to a higher level of care. If not possible use a dose of 0.06mg/cm hyperbaric bupivacaine for the very short <150 cm patient. This will be a dose of 1.8ml of Hyperbaric Bupivacaine 0.5% and instead of the standard recommendation of 2ml of Hyperbaric Bupivacaine.
- **Differential diagnosis for sudden collapse/arrest during spinal anaesthesia** Consider other causes for arrest: high spinal, hypoxia, venous thromboembolism, haemorrhage, anaphylaxis, eclampsia, cardiac conditions: mitral stenosis, cardiomyopathy, aortic dissection, and amniotic fluid embolism.
- **Peri-mortem caesarean section**.

General anaesthetic learning points and recommendations.

Airway complications are often unexpected, and it is not always possible to predict the high-risk airway.

- **Airway evaluation** for all patients coming to theatre should be standard of care.

- **Theatre preparation** for the unexpected difficult airway should include all emergency drugs, airway equipment with immediate access to a video laryngoscope for all obstetric general anaesthetics.
- **A plan for failed intubation** should be made and communicated to the team before induction, to awaken or to proceed with surgery.
- **Apnoeic oxygenation** via anaesthetic face mask, nasal prongs or nasopharyngeal airway is recommended for all general anaesthetics. It is however not effective if the airway is obstructed by the tongue and soft tissue. The method below can overcome the problem of airway obstruction and improve oxygenation during difficult intubation.
- **Cricoid pressure** can be reduced/released sightly if that contributes to difficult laryngoscopy.
- **Difficult airway scenario** algorithm training

Full guidelines available: https://das.uk.com/guidelines/obstetric_airway_guidelines_2015

Summary of findings from 2020-2022 W Cape report

During 2020-2022 there were an increase in the number of maternal deaths in the Western Cape as well as the country. Most of the excess deaths (24%) were directly from COVID-19. There was an increase from deaths due to obstetric Haemorrhage and hypertensive disorders specifically Eclampsia, and Embolism, this could be due to the increase Burdon on the health system, as well as the lack of regular ESMOE training during and after the COVID-19 pandemic. The case fatality rate for CD increased markedly, with an increases case fatality rate due to bleeding at CS. The leading causes of death in the Western Cape differ somewhat to that of the National report, with Medical and Surgical disorders and Embolism higher on the list, which is more in keeping with high-income countries. This could be due to improved care in some areas and perhaps the impact of the obesity pandemic; however, as BMI is not captured, this is not clear in the data. This should be assessed in future. Lack of ICU facilities and transport between facilities were administrative factors that contributed to deaths. Problem recognition and lack of appropriately trained staff were the highest occurring staff-related contributors.

Recommendations

Approach to Key Recommendations for the Western Cape 2020-2022
STANDARDISE: Denominators per live births in public sector but not private sector. Need to engage more with the private sector.
CONTINUE*:* Continue focus on safe Caesarean Delivery. TB remains a concern, early detection and screening should continue to be prioritised. Screening and prioritising thromboprophylaxis for women at high risk.
IMPLEMENT: E Motive as a new intervention, should be implemented as part of ESMOE. NASG- Not yet implemented needs to be procured. Postnatal policy which encourages integrated 6-week postnatal visits for mother and baby, has not yet been implemented, meaning women have inadequate postnatal surveillance. Add recording of BMI to assessor's sheet.
ADVOCATE: Capacity at regional hospital should increase, theatre facilities as well as healthcare workers. The high iMMR in Metro East needs further attention and thorough investigarion.
NEW FOCUS: Community Health Workers to empower women to seek help during the antenatal and post-natal periods. Improve clinical governance of the management of early pregnancy complications, by involving community health workers.

Table 21: 5 leading causes with problems and crosscutting issues for recommendations

Cause of death	Number (%)	Comments and Recommendations
1. NPRI	110(41.2%)	This remains the leading cause. Infectious diseases especially respiratory tract infections in pregnancy should be part of undergraduate and ESMOE training. Screening, treatment of TB and HIV should remain a priority.

Cause of death	Number (%)	Comments and Recommendations
2. M&S	35 (12.3%)	Collaboration with specialist clinics, and provision of contraception to women with high-risk conditions such as cardiac disease is essential.
3. Hypertension	32(11.3%)	Hypertensive burden remains high in the province, ESMOE training and vigilant management of women with pre-eclampsia and eclampsia is crucial.
4. Haemorrhage	28(9.9%)	Implementation of E-motive approach for PPH is recommended. Procurement and use of NASG should be implemented. Continued focus on Safe CS is needed
5. Embolism	15(5.6%)	Risk assessment for embolic disease and appropriate prophylaxis should become part of obstetric training and management.

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9. APPENDICES

Appendix 9.1. Validity of data and corrections made for suspected under-reporting

For each province, where the DHIS data was greater than the MaMMAS maternal deaths (DHIS>MaMMAS), MaMMAS data was corrected. MaMMAS MD was corrected to DHIS MD value. The percentage increase in MaMMAS data was used to correct the DDPCP

Table A.1. 2020-2022. Corrected maternal deaths, and iMMR *(© corrected)*

2020	Live births	MaMMAS deaths (DDPCP)	MaMMAS MD	DHIS MD	MaMMAS MD (corrected)	MaMMAs iMMR	MaMMAs iMMR (corrected)
© ec Eastern Cape Province	109077	146 (c168)	139	160	160	127.43	146.69
fs Free State Province	48452	93	89	70	89	183.69	183.69
© gp Gauteng Province	240270	260 (c276)	255	271	271	106.13	112.79
kz KwaZulu-Natal Province	214694	252	250	220	250	116.44	116.44
lp Limpopo Province	140542	167	166	157	166	118.11	118.11
mp Mpumalanga Province	92094	99	95	77	95	103.16	103.16
nc Northern Cape Province	22042	23	23	17	23	104.35	104.35
nw North West Province	62026	83	81	72	81	130.59	130.59
wc Western Cape Province	106058	105	99	77	99	93.35	93.35
South Africa	**1035255**	**1228 (c1266)**	**1197**	**1121**	**1234**	**115.62**	**119.20**

2021	Live births	MaMMAS deaths (DDCP)	MaMMAS MD	DHIS MD	MaMMAS MD (corrected)	MaMMAs iMMR	MaMMAs iMMR (corrected)
ec Eastern Cape Province	110909	154	153	151	153	137.95	137.95
fs Free State Province	49073	115	114	100	114	232.31	232.31
© gp Gauteng Province	227182	331 (c349)	323	341	341	142.18	150.10
kz KwaZulu-Natal Province	214224	280	276	274	276	128.84	128.84
lp Limpopo Province	135892	200	196	191	196	144.23	144.23
mp Mpumalanga Province	95700	168	167	142	167	174.50	174.50
nc Northern Cape Province	22528	43	43	38	43	190.87	190.87
nw North West Province	61528	117	116	97	116	188.53	188.53
wc Western Cape Province	98746	105	101	79	101	102.28	102.28
South Africa	**1015782**	**1513 (c1531)**	**1489**	**1413**	**1507**	**146.59**	**148.36**

2022	Live births	MaMMAS deaths (DDCP)	MaMMAS MD	DHIS MD	MaMMAS MD (corrected)	MaMMAs iMMR	MaMMAs iMMR (corrected)
ec Eastern Cape Province	103147	134	133	132	133	128.94	128.94
fs Free State Province	47336	59	55	50	55	116.19	116.19
© gp Gauteng Province	218619	216 (c272)	211	266	266	96.51	121.67
© kz KwaZulu-Natal Province	215381	181 (c197)	176	189	189	81.72	87.75
© lp Limpopo Province	124648	119 (c144)	118	143	143	94.67	114.72
mp Mpumalanga Province	82270	113	113	105	113	137.35	137.35
nc Northern Cape Province	22153	26	26	22	26	117.37	117.37
nw North West Province	59951	72	70	65	70	116.76	116.76
wc Western Cape Province	94623	73	67	63	67	70.81	70.81
South Africa	**968128**	**993 (c1090)**	**969**	**1035**	**1062**	**100.09**	**109.70**

Appendix 9.2. 2020-2022. iMMR per district

Province	District	Maternal death	Births in facility	iMMR
ec Eastern Cape Province	Alfred Nzo Districts	25	39696	62.98
ec Eastern Cape Province	Amathole+ Buffalo city	104	68147	152.61
ec Eastern Cape Province	Chris Hani	41	34172	119.98
ec Eastern Cape Province	Joe Gqabi District Municipality	2	14446	13.84
ec Eastern Cape Province	Nelson Mandela Bay Metropolitan	95	57787	164.40
ec Eastern Cape Province	Oliver Tambo	156	90883	171.65
ec Eastern Cape Province	Sarah Baartman	11	18589	59.17
ec Eastern Cape		**434**	**323720**	**134.07**
fs Free State Province	Fezile Dabi	40	22978	174.08
fs Free State Province	Lejweleputswa	64	31763	201.49
fs Free State Province	Mangaung Metropolitan Municipality	93	50040	185.85
fs Free State Province	Thabo Mofutsanyana	67	38699	173.13
fs Free State Province	Xhariep District Municipality	3	2481	120.92
fs Free State		**267**	**145961**	**182.93**
gp Gauteng Province	City of Johannesburg Metropolitan Municipality	281	229959	122.20
gp Gauteng Province	City of Tswhane Metropolitan	208	166893	124.63
gp Gauteng Province	Ekurhuleni Metropolitan Municipality	225	199582	112.74
gp Gauteng Province	Sedibeng District Municipality	42	44107	95.22
gp Gauteng Province	West Rand District Municipality	51	49004	104.07
gp Gauteng		**807**	**689545**	**117.03**
kz KwaZulu-Natal Province	kz Amajuba District Municipality	35	30625	114.29
kz KwaZulu-Natal Province	kz eThekwini Metropolitan Municipality	268	208212	128.71
kz KwaZulu-Natal Province	kz Harry Gwala District Municipality	19	24645	77.09
kz KwaZulu-Natal Province	kz iLembe District Municipality	26	36060	72.10
kz KwaZulu-Natal Province	kz King Cetshwayo District Municipality	90	65498	137.41
kz KwaZulu-Natal Province	kz Ugu District Municipality	47	43738	107.46
kz KwaZulu-Natal Province	kz uMgungundlovu District Municipality	116	60161	192.82
kz KwaZulu-Natal Province	kz Umkhanyakude District Municipality	14	49990	28.01
kz KwaZulu-Natal Province	kz Umzinyathi District Municipality	17	35468	47.93
kz KwaZulu-Natal Province	kz Uthukela District Municipality	37	41293	89.60
kz KwaZulu-Natal Province	kz Zululand District Municipality	44	52142	84.38
kz KwaZulu-Natal		**713**	**647832**	**110.06**
lp Limpopo Province	lp Capricorn District Municipality	237	87315	271.43
lp Limpopo Province	lp Mopani District Municipality	71	88089	80.60
lp Limpopo Province	lp Sekhukhune District Municipality	68	83243	81.69
lp Limpopo Province	lp Vhembe District Municipality	68	96139	70.73
lp Limpopo Province	lp Waterberg District Municipality	42	46296	90.72
lp Limpopo		**486**	**401082**	**121.17**
mp Mpumalanga Province	mp Ehlanzeni District Municipality	180	137657	130.76
mp Mpumalanga Province	mp Gert Sibande District Municipality	91	64866	140.29
mp Mpumalanga Province	mp Nkangala District Municipality	109	67541	161.38
mp Mpumalanga		**380**	**270064**	**140.71**
nc Northern Cape Province	nc Frances Baard District Municipality	40	25371	157.66
nc Northern Cape Province	nc John Taolo Gaetsewe District Municipality	23	14688	156.59
nc Northern Cape Province	nc Namakwa District Municipality	1	4622	21.64
nc Northern Cape Province	nc Pixley ka Seme District Municipality	7	8707	80.40
nc Northern Cape Province	nc Zwelentlanga Fatman Mgcawu District Municipality	21	13335	157.48
nc Northern Cape Province		**92**	**66723**	**137.88**
nw North West Province	nw Bojanala Platinum District Municipality	98	65861	148.80
nw North West Province	nw Dr Kenneth Kaunda District Municipality	71	38218	185.78
nw North West Province	nw Dr Ruth Segomotsi Mompati District Municipality	34	31165	109.10
nw North West Province	nw Ngaka Modiri Molema District Municipality	69	48261	142.97
nw North West Province		**272**	**183505**	**148.22**
wc Western Cape Province	wc Cape Winelands District Municipality	36	47629	75.58
wc Western Cape Province	wc Central Karoo District Municipality	7	2878	243.22
wc Western Cape Province	wc City of Cape Town Metropolitan Municipality	200	190889	104.77
wc Western Cape Province	wc Garden Route District Municipality	29	29883	97.05

Province	District	Maternal death	Births in facility	iMMR
wc Western Cape Province	wc Overberg District Municipality	3	13547	22.15
wc Western Cape Province	wc West Coast District Municipality	8	15602	51.28
wc Western Cape		**283**	**300428**	**94.20**
SA Total		**3734**	**3028860**	**123.28**

NOTE: Live births used to calculate the district iMMR is a recently updated version. Thus the total live births and therefore the iMMR per province and for SA total increased.

Appendix 9.3. 2020-2022. Causal Subcategories of death for each primary obstetric cause per province

Primary obstetric problems	Eastern Cape	Free State	Gauteng	Kwa-Zulu Natal	Limpopo	Mpumalanga	North West	Northern Cape	Western Cape	Total
Coincidental cause	**9**	**9**	**18**	**11**	**6**	**5**	**5**	**0**	**16**	**79**
- MVA	3	2	2	4	3	4	1		2	21
- Other accidents		1	1	1	1	1	1		4	10
- Assault	1	2	15	2			1			21
- Other	5	4		4	2		2		10	27
Medical and surgical disorders	**57**	**41**	**118**	**111**	**63**	**43**	**35**	**10**	**35**	**513**
- Cardiomyopathy	6	7	19	27	18	8	6	2	8	101
- Rheumatic heart disease	5	1	5	11				1	5	28
- Other cardiac disease	6	1	5	8		5	1		2	28
- Endocrine		1	9	6	6	2	3	1	3	31
- GIT	1	1	5	8	6	2	3		7	33
- CNS	5	2	9	13	4	2	3			38
- Respiratory	7	13	12	3	7	3	9	3	3	60
- Haematological	2	2	2	3	5	1	1	1	1	18
- Genito-urinary	1	2	1	1	1				1	7
- Suicide	7	1	4	4		7			3	26
- Substance abuse				1						1
- Other psychiatric disease			1	1						2
- Neoplasm	4		15	17		7				43
- Auto-immune		1	2	2	2	1				8
- Other	13	9	29	6	14	5	9	2	2	89
Non-pregnancy-related infections	**155**	**50**	**187**	**257**	**107**	**97**	**74**	**26**	**110**	**1063**
- PCP pneumonia	4	16	25	22	14	13	12	1	2	109
- Other pneumonia	11	6	21	25	5	16	13	6	7	110
- TB	43	4	20	45	17	12	20	3	13	177
- UTI	1					1			2	4
- Appendicitis			3	1		1			2	7
- Malaria				1	1					2
- Cryptococcal meningitis	1		1	10	9	1			2	24
- Other meningitis	11	2	4	9	6	5	2		5	44
- Kaposi's sarcoma			2	1	1	1				5
- Toxoplasmosis						1	1			2
- Hepatitis			1	1	1	1				4
- Gastroenteritis	3			2	4	1			2	12
- Wasting syndrome	2		4	4	1	1			1	13
- Other	79	22	106	136	48	43	26	16	74	550
Ectopic pregnancy	**8**	**9**	**26**	**20**	**18**	**7**	**6**	**4**	**5**	**103**
- Less than 20 weeks	6	9	22	17	18	7	4	4	4	91
- More than 20 weeks (extrauterine pregnancy)	2		4	3			2		1	12
Miscarriage	**19**	**4**	**49**	**31**	**21**	**19**	**17**	**3**	**3**	**166**
- Septic miscarriage	15	4	29	19	16	12	10		2	107
- Haemorrhage (non-traumatic)	3		8	7	2	5	4	2	1	32
- Uterine trauma			4	1	1					6
- GTD	1		7	2		2				12
- Following legal TOP			1	2	2		3	1		9
Pregnancy-related sepsis	**21**	**15**	**40**	**31**	**32**	**23**	**9**	**4**	**12**	**187**
- Chorioamnionitis (ruptured membranes)		1	3	3		1	1			9
- Chorioamnionitis (intact membranes)	1		1	1	1		1			5
- Puerperal sepsis after NVD	9	7	13	8	17	7	3	2	7	73
- Puerperal sepsis after CD	8	6	21	14	11	10	3	1	4	78
- Bowel trauma at CD	3	1	2	5	3	5	1	1	1	22
Obstetric haemorrhage	**55**	**45**	**137**	**95**	**91**	**82**	**52**	**14**	**28**	**599**
- Abruption with hypertension	5	4	12	12	1	10	7	2	2	55
- Abruption without hypertension	1	2	5	10	8	5	3	2	1	37
- Placenta praevia	4	2	6	2	1	3	2			20
- Other APH not specified	2	2	2	1	4	2	2			15

Primary obstetric problems	Eastern Cape	Free State	Gauteng	Kwa-Zulu Natal	Limpopo	Mpumalanga	North West	Northern Cape	Western Cape	Total
- Ruptured uterus with previous CD	6	2	9	10	5	4	6		1	43
- Ruptured uterus without previous CD	5	3	11	5	9	6	3	1	4	47
- Uterine atony after vaginal delivery	5	2	15	13	11	9	5	2		62
- Vaginal trauma after vaginal delivery	1	3	4	1	1	2		1		13
- Cervical trauma after vaginal delivery	2	5	4	2	6	1		1	1	22
- Retained placenta after NVD (morb adherent)	1	5	2	3	1	1	2	2	2	19
- Retained placenta after NVD (not adherent)	3	1	5	3		3	6	1	4	26
- Inverted uterus after vaginal delivery	2	1								3
- Other PPH not specified after vaginal delivery	4	2	5	5	8	9	3		3	39
- Bleeding during CD (morbidly adherent placenta)		1	10	5	2	4	2			24
- Bleeding during CD (not adherent placenta)	1	2	11	11	8	2	1		1	37
- Bleeding after Caesarean delivery	13	8	36	12	26	21	10	2	9	137
Hypertension	**67**	**52**	**120**	**63**	**87**	**54**	**46**	**18**	**32**	**539**
- Chronic hypertension	1	3	6	4	4		1	1	1	21
- Gestational hypertension	2	1	5	1	13	1		1	2	26
- Pre-eclampsia with severe features	17	10	25	19	4	17	6	5	5	108
- Pre-eclampsia without severe features	6	9	6	1	2		2	1	1	28
- Eclampsia	36	17	61	34	38	27	28	6	17	264
- HELLP	5	12	14	3	26	8	9	2	3	82
- Liver rupture			3	1		1		2	3	10
Anaesthetic complications	**11**	**5**	**7**	**12**	**19**	**14**	**5**	**1**	**3**	**77**
- General anaesthetic	1		2	2	6	4	1		1	17
- Spinal anaesthetic	10	5	5	10	13	10	4	1	2	60
Adverse drug reactions	**2**	**2**	**7**	**5**	**8**	**2**	**0**	**0**	**0**	**26**
- ARV medication			2		4					6
- TB medication				1		1				2
- Other medication	2	2	3		1					8
- Herbal medication			2	4	3	1				10
Embolism	**20**	**8**	**16**	**19**	**17**	**13**	**4**	**4**	**15**	**116**
- Pulmonary embolism	18	7	14	19	15	10	4	4	11	102
- Amniotic fluid embolism	2	1	2		2	3			4	14
Acute collapse - cause unknown	**6**	**0**	**27**	**13**	**3**	**5**	**7**	**1**	**10**	**72**
Miscellaneous	1	2	0	3	2	2	0	1	4	15
- Hyperemesis gravidarum	1	2		3	2	1				9
- Acute fatty liver						1		1	4	6
Unknown	**3**	**25**	**55**	**42**	**12**	**14**	**12**	**6**	**10**	**179**
- Death at home or outside health services	2	22	29	13	11	8	8	3	4	100
- No primary cause found		1	6	9		2	3		5	26
- Lack of information	1	2	20	20	1	4	1	3	1	53
Total:	**434**	**267**	**807**	**713**	**486**	**380**	**272**	**92**	**283**	**3734**

Appendix 9.4. 2020-2022. Final and Contributory causes of death for Primary Obstetric causes

2020-2022	ALL	M&S	Cardiac disease	NPRI	Ec	Miscarriage	PRS	OH	HDP	AR	ADR	Emb	AC	Miscellaneous	Unknown	Home	Coin
Circulatory system	**1479**	**72**	**17**	**213**	**92**	**159**	**176**	**595**	**73**	**14**	**3**	**7**	**7**	**2**	**13**	**3**	**33**
- Hypovolaemic shock	838	26	7	26	73	55	11	535	50	11	1	3	7	2	3	2	26
- Septic shock	641	46	10	187	19	104	165	60	23	3	2	4			10	1	7
Respiratory failure	**1364**	**128**	**50**	**805**	**14**	**34**	**32**	**40**	**119**	**41**	**6**	**45**	**15**	**1**	**14**	**4**	**16**
- Respiratory failure	1364	128	50	805	14	34	32	40	119	41	6	45	15	1	14	4	16
Cardiac failure	**538**	**40**	**117**	**84**	**9**	**15**	**15**	**41**	**169**	**15**	**1**	**16**	**6**	**1**	**4**	**1**	**4**
- Pulmonary oedema	538	40	117	84	9	15	15	41	169	15	1	16	6	1	4	1	4
Embolism	**193**	**11**	**26**	**27**	**3**	**7**	**4**	**7**	**19**	**2**	**0**	**75**	**9**	**0**	**0**	**1**	**2**
- Acute collapse due to embolism	193	11	26	27	3	7	4	7	19	2		75	9		0	1	2
Renal failure	**543**	**73**	**17**	**150**	**5**	**37**	**51**	**54**	**108**	**4**	**10**	**6**	**1**	**8**	**12**	**0**	**7**
- Renal failure	543	73	17	150	5	37	51	54	108	4	10	6	1	8	12		7
Liver failure	**251**	**48**	**2**	**59**	**0**	**12**	**21**	**20**	**51**	**0**	**11**	**5**	**0**	**5**	**12**	**0**	**5**
- Liver failure	251	48	2	59		12	21	20	51		11	5		5	12		5
Cerebral complications	**604**	**74**	**11**	**109**	**3**	**8**	**8**	**23**	**309**	**21**	**4**	**1**	**4**	**3**	**6**	**3**	**17**
- Intracranial haemorrhage	204	17	3		1	2		5	164	1	2			1	2	1	5
- Cerebral oedema resulting in coning	59	10	1	9		1	1	3	32	1					0		1
- Meningitis	69	6	1	60			2		2						0		
- Cerebral emboli	12	2	4	1		1	2								0		
- Brain death following hypoxic event	139	16	1	14		3	1	13	66	15	2	1	2		1		4
- Unspecified	121	23	1	25	2	1	2	2	45	4			2	2	3	2	7

2020-2022	ALL	M&S	Cardiac disease	NPRI	Ec	Miscarriage	PRS	OH	HDP	AR	ADR	Emb	AC	Miscellaneous	Unknown	Home	Coin
Metabolic	**527**	**94**	**17**	**156**	**9**	**41**	**37**	**65**	**61**	**5**	**7**	**1**	**1**	**15**	**9**	**0**	**9**
- Maternal ketoacidosis	134	22	5	37	1	11	10	14	20	4	2	1	1	2	1		3
- Electrolyte imbalance	187	36	5	66	2	12	9	22	17	1	3			10	2		2
- Thyroid crisis	11	2	1	1	1	1			4		1				3		3
- Lactic acidosis	150	25	5	36	4	16	13	24	18		1			2	0		
- Other	45	9	1	16	1	1	5	5	2					1	3		1
Haematological	**804**	**67**	**13**	**123**	**37**	**82**	**28**	**329**	**85**	**1**	**7**	**6**	**2**	**2**	**15**	**0**	**7**
- DIC	478	37	6	47	17	45	21	222	56		5	4	1	1	11		5
- Severe anaemia	326	30	7	76	20	37	7	107	29	1	2	2	1	1	4		2
Immune system	**372**	**26**	**3**	**252**	**8**	**8**	**26**	**20**	**14**	**1**	**2**	**7**	**1**	**1**	**0**	**2**	**1**
- Immune system failure	372	26	3	252	8	8	26	20	14	1	2	7	1	1	0	2	1
Maternal deaths	**6675**	**633**	**273**	**1978**	**180**	**403**	**398**	**1194**	**1008**	**104**	**51**	**169**	**46**	**38**	**85**	**14**	**101**
Unknown	**262**	**13**	**2**	**15**	**5**	**1**	**2**	**7**	**14**	**3**	**2**	**4**	**33**	**0**	**43**	**111**	**7**
- Home death	123	7	1	8	1	1		5	8			2	4		8	72	6
- Unknown	139	6	1	7	4		2	2	6	3	2	2	29		35	39	1
Other	**317**	**59**	**19**	**77**	**6**	**12**	**18**	**17**	**33**	**15**	**5**	**7**	**14**	**1**	**12**	**3**	**19**
- Other	317	59	19	77	6	12	18	17	33	15	5	7	14	1	12	3	19
Total	**3734**	**356**	**157**	**1063**	**103**	**166**	**187**	**599**	**539**	**77**	**26**	**116**	**72**	**15**	**79**	**100**	**79**
% of total deaths:		**9.6**	**4.1**	**28.5**	**2.8**	**4.4**	**5**	**16**	**14.4**	**2.1**	**0.7**	**3.1**	**1.9**	**0.4**	**2.1**	**2.7**	**2.1**

Appendix 9.5. Recommendations from Saving Mothers triennial report 2017-2019

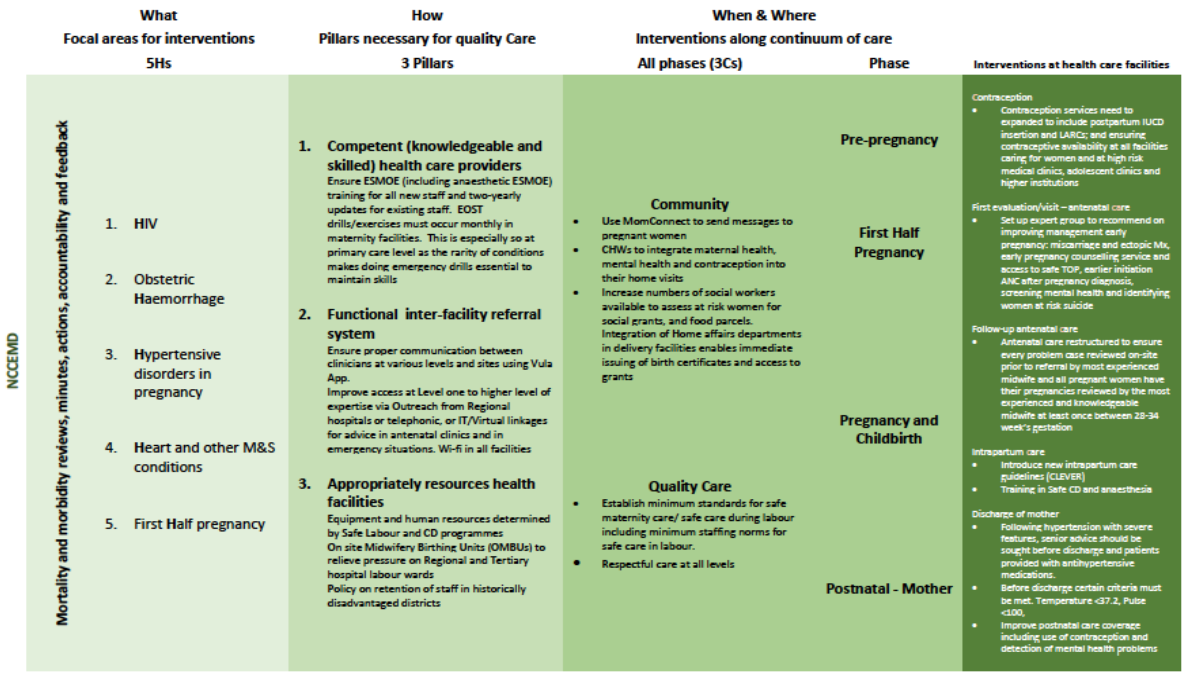
The recommendations assume that **every** site conduct **morbidity and mortality review** meetings, where **minutes** are kept, **actions** assigned to individuals and there is **feedback** at subsequent meetings to hold individuals to **account**.

Summary of crucial recommendations

- Contraception services need to expand to include postpartum IUCD insertion and LARCs; and ensuring contraceptive availability at all facilities caring for women and at high-risk medical clinics.
- Set up an expert group to recommend on improving management of early pregnancy and its complications: miscarriage and ectopic management, early pregnancy counselling service and access to safe TOP, earlier initiation of antenatal care after pregnancy diagnosis, screening for mental health issues and identifying women at risk of suicide.
- Antenatal care restructured to ensure every problem case reviewed on-site prior to referral by most experienced midwife and all pregnant women have their pregnancies reviewed by the most experienced and knowledgeable midwife at least once between 28-34 week's gestation.
- Establish On-site Midwife run Birthing Units (OMBUs) at all large district, regional and tertiary hospitals (conducting large numbers of births for women with no risk factors).
- Establish a Safe Labour criteria and evaluation programme like the Safe Caesarean Delivery (surgery and anaesthesia) programme and maintain focus on the Safe CD programme.
- Implement the updated PMTCT protocol for better HIV management and TB detection.
- Ensure ESMOE (including anaesthetic ESMOE) training for all new staff and two-yearly updates for existing staff. EOST drills/exercises must occur monthly in maternity facilities. This is especially so at primary care and district hospital level as the rarity of conditions makes doing emergency drills essential to maintain skills. Each hospital and CHC should have at least one on-site trainer able to run the relevant ESMOE modules and drills.
- Ensure functional communication channels exist for consultation with and referral to higher levels of care e.g. by using the "Vula App".
- Prior to discharge from a ward and facility, specific criteria must be met and documented.

The following poster summarises the crucial recommendations according to the five Hs (priority conditions), essential health system pillars and key interventions along the continuum of care.

Poster of key Recommendations from Saving Mothers triennial report 2017-2019



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