REPUBLIC OF KENYA

MINISTRY OF HEALTH

Saving Mothers Lives

Confidential Enquiry into Maternal Deaths in Kenya

First Report

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Acknowledgments

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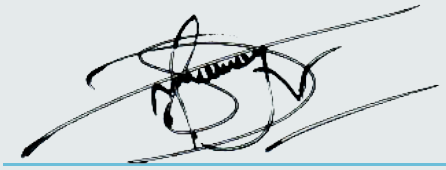

Dr. Kioko Jackson K. OGW
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List of abbreviations

ANC	Antenatal Care
BP	Blood Pressure
C/S	Cesarean Section
CEMD	Confidential Enquiry into Maternal Death
CEmONC	Comprehensive Emergency Obstetric and Newborn Care
CPD	Continuous Professional Development
CPR	Cardiopulmonary Resuscitation
CRVS	Civil Registration and Vital Statistics
DFID	Department for International Development
DHIS	District Health Information System
DHS	Demographic Health Survey
DIC	Disseminated Intravascular Coagulation
DPHK	Development Partners for Health in Kenya
FBO	Faith-based Organisations
FSB	Fresh Stillbirth
GA	Gestational Age
HAART	Highly Active Anti-Retroviral Therapy
Hb	Haemoglobin
HELLP	Haemolysis Elevated Liver Enzymes and Low Platelet levels
HIS	Health Information System
HIV	Human Immunodeficiency Virus
ICD	International Statistical Classification of Diseases and Related Health Problems
ICD-10	ICD, 10th revision
ICD-MM	The WHO application of ICD-10 to death during pregnancy, childbirth and the puerperium: ICD-maternal mortality
ICD-PM	The WHO application of ICD-10 to death during the perinatal period: ICD perinatal mortality
ICU	Intensive Care Unit
IU	International Units
IV	Intravenous
JKUAT	Jomo Kenyatta University College of Agriculture and Technology
KMPDB	Kenya Medical Practitioners and Dentists Board
KNCHR	Kenya National Commission on Human Rights
KOGS	Kenya Obstetrical and Gynaecological Society
LSTM	Liverpool School of Tropical Medicine
MAMAS	Maternal Mortality Audit System
MD	Maternal Death
mmHg	Millimetres of Mercury
MPDSR	Maternal Perinatal Death Surveillance and Response
MSB	Macerated Stillbirth
MVA	Manual Vacuum Aspiration
NCK	Nursing Council of Kenya
RMHSU	Reproductive and Maternal Health Services Unit
SPSS	Statistical Package for Social Sciences
TBA	Traditional Birth Attendant
UKaid	United Kingdom Agency for International Development
UNFPA	United Nations Population Fund
UNICEF	United Nations Children Education Fund
USAID	United States Agency for International Development
VDRL	Venereal Disease Research Laboratory
VE	Vaginal Examination
WHO	World Health Organization

Definition of terms

Associated factors	These are non-medical factors associated with maternal deaths based on the 3-delay model. They also include health system factors.
Confidential Enquiry into Maternal Death (CEMD)	A confidential enquiry into maternal death can be defined as a systematic multidisciplinary anonymous investigation of all or a representative sample of maternal death occurring at an area, regional (state) or national level which identifies the numbers, causes and avoidable or remediable factors associated with them. Through the lessons learnt from each woman's death, and through aggregating the data, confidential enquiries provide evidence of where the main problems in overcoming maternal mortality lie and an analysis of what can be done in practical terms, and highlight the key areas requiring recommendations for health sector and community action as well as guidelines for improving clinical outcomes.
Contributing conditions	Conditions that may have contributed to or may be associated with, but should not to be reported as sole condition on the death certificate or selected as the underlying cause of death. Contributing causes may predispose women to death, as either a pre-existing condition or a risk factor.
Direct maternal death	Direct obstetric deaths are those deaths resulting from obstetric complications of the pregnancy state (pregnancy, labour and the puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above.
ICD-10	International statistical classification of diseases and related health problems, Tenth revision (ICD-10). It's the standard tool to guide the collection, coding, tabulation and reporting of mortality statistics based on civil registration.
ICD-MM	The WHO Application of ICD-10 to death during pregnancy, childbirth, and the puerperium: ICD-Maternal Mortality (ICD-MM) is based upon the 10th revision of the ICD (ICD-10) and its coding rules. It is intended to facilitate the consistent collection, analysis and interpretation of information on maternal death.
Indirect maternal death	Maternal death resulting from previous existing disease or disease that developed during pregnancy and which was not due to direct obstetric causes, but which was aggravated by physiologic effects of pregnancy.

Maternal death	A maternal death is the death of a woman while pregnant or within 42 days of the termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.
Maternal and Perinatal Death Surveillance and Response (MPDSR)	MPDSR is a form of continuous surveillance that links the health information system and quality improvement processes from local to national levels, which includes the routine identification, notification, quantification and determination of causes and avoid ability of all maternal and perinatal deaths, as well as the use of this information to respond with actions that will prevent future death.
Maternal death assessors	A multi-disciplinary group of healthcare providers (different cadres) trained to assign the cause of death for each maternal death using the ICD-MM classification system.
Underlying cause of death	The disease or condition that initiated the morbid chain of events leading to death. The single identified cause of death should be as specific as possible. There can only be one underlying cause of death to which an ICD-10 code can be allocated.

Foreword

This is the first Confidential Enquiries into Maternal Death (CEMD) report for Kenya. The report focuses on maternal deaths that occurred in major county and national referral hospitals during the year 2014. This report recognises the fact that "every mother counts" and that understanding why a woman died during pregnancy and childbirth and taking steps to address sub-standard care are important 'first' step towards preventing other women dying in the same way.

The MPDSR process responds to the Global Strategy for Women's Children's and Adolescent's Health (2016-2030) which seeks to end preventable maternal, new-born, child and adolescent death and stillbirths. The Ministry of Health has developed national guidelines for Maternal and Perinatal Death Surveillance and Response (MPDSR) whose aim is to provide guidance on how to conduct reviews of maternal and newborn death and stillbirths as well as near misses at both facility and community levels, the reporting pathways and documentation of avoidable factors with a clear response to avoid future death.

CEMD is described as a systematic multidisciplinary anonymous investigation of all or a representative sample of maternal death occurring at an area, regional (state) or national level which identifies the numbers, causes and avoidable or remediable factors associated with them. The enquiry process highlights key areas requiring improvement as well as actionable recommendations to prevent future death.

Learning from experiences of CEMD conducted in the United Kingdom (MBRRACE-UK; Knight 2015) and Republic of South Africa (RSA 2015), the findings presented in this report have been drawn after intense reviews and discussions with multidisciplinary teams of health providers who were trained as national maternal death assessors. The assessors were trained to assign the cause of each death using the ICD-10 MM classification system. The maternal death assessors are composed of a mix of cadres including obstetrician gynaecologists, paediatricians, anaesthetists, surgeons, medical officers, clinical officers, midwives, health information officers and public health providers. The assessors were drawn from different organisations including professional organisations such the Kenya Obstetric and Gynaecological Society, Nursing Council of Kenya, Medical training institutions – including universities, Ministry of Health and County Health teams.

This reports highlights the leading causes of maternal death, identifies the contributing conditions as well as the associated factors. The report points out actionable recommendations at the different levels (policy, county, health facility and community/individual) to stimulate action to address avoidable factors to prevent future maternal death.

Dr Mohamed A. Sheikh
HEAD, DIVISION OF FAMILY HEALTH
Secretary, National MPDSR Committee

Key messages from the report

Overall findings

Fifty-one percent (484) of the 945 maternal deaths reported in the District Health Information System (DHIS) for the year 2014 were assessed and included in the analysis of this first CEMD report.

The median age of women who died was 27 years. The youngest woman who died was 14 years while the oldest was 47 years.

8.8% of the women who died were **young mothers aged below 20 years.**

Most women **(42.4%)** that died were having their **first or second pregnancy.**

Only 5 in 10 of women who died had **antenatal care (ANC).**

Only 1 in 5 who attended ANC **had at least 4 ANC visits.**

6 out of 10 deaths occurred in the **post partum period.**

2 out of 10 women who died were undelivered at the time of death.

5 out of 10 women who died **either had stillbirths or died before childbirth.**

The leading cause of maternal deaths for all women is obstetric haemorrhage.

2 out of 5 women died due to **obstetric haemorrhage.**

1 out of every 5 women died due to **non-obstetric complications mainly HIV/AIDS and Anaemia.**

Quality of Care

Sub-standard care was identified in 9 out of 10 women who **died**

One or more associated factors related to health worker, administration, patient and community factors were identified in majority (89.3%) of maternal deaths.

Delay in starting treatment (33%), inadequate clinical skills (28%) and inadequate monitoring (27%) were the most frequently identified health workforce-related factors.

Obstetricians were involved in the emergency care of 1 in 10 women who died.

Over 7 out of 10 deaths occurred out of office hours (between 5pm and 8am on weekdays, weekends and public holidays).

The majority (91%) of women who died of obstetric haemorrhage received suboptimal care, where different management would have resulted in a different outcome.

Half (50%) of all maternal deaths were among women who had been referred from another facility, mostly from level 4 to level 5 or 6 health facilities.

Poor record keeping/documentation was noted in most cases of assessed maternal deaths.

SECTION 1

Executive summary

The first CEMD in Kenya was conducted between July 2015 and June 2016 and it covered maternal deaths that occurred in 2014. The Centre for Maternal and Newborn Health, Liverpool School of Tropical Medicine supported the Kenya Ministry of Health to establish support systems (National Maternal, Perinatal Death Surveillance and Response (MPDSR) Committee, National MPDSR secretariat, National maternal death assessors and CEMD report writing Team) to conduct the CEMD and produce this report. The report was approved by the Kenya National MPDSR committee on the 12th of October 2016. A summary of the key findings, recommendations, lessons learnt and further research are presented below.

Summary of key findings

Fifty-one percent (484) of the 945 maternal deaths reported in the District Health Information System (DHIS) for the year 2014 were assessed and included in the analysis of the CEMD.

Demographic and obstetric characteristics

- The median age of women who died was 27 years. The youngest women who died was 14 years while the oldest was 47 years.
- **63.7% (308)** of women who died were having their first, second or fifth (or more) pregnancy.
- **50% (242)** of the women had been referred from other health facilities.

Pregnancy outcome

- **14% (70)** were undelivered, **8% (40)** had a pregnancy with an abortive outcome and **77% (374)** of women who died had given birth.

Timing of deaths

- Four in ten maternal deaths occurred after childbirth, two in ten maternal deaths occurred during childbirth.
- The period of death was not specified for **21% (104)** of maternal deaths.

Antenatal care

- **47.3% (229)** of the women who died received Antenatal Care (ANC), **11.4% (55)** did not receive ANC while records of **41.3% (200)** women did not have documentation of ANC attendance.
- Among the **229** women who had ANC, urinalysis was the least performed ANC test **(22.3% or 51).**
- HIV status was not recorded in **45.2% (219)** of the cases. Of the **265** deaths in which the HIV status was recorded, **73.6% (195)** were HIV negative, **26.4% (70)** were HIV positive.

Place of delivery

- Of the **374** women who delivered, **88.8% (332)** delivered in hospital, **7.5% (28)** delivered at home or on the way to hospital and the place of delivery was not specified for **3.7% (14).**

Mode of delivery and outcome

- Of the **374** women who delivered, **63.2% (236)** delivered vaginally (only **2%** or **7** by AVD) and **36.9% (138)** by cesarean section.
- Amongst women who gave birth, 5 in 10 women had a live birth and 3 in 10 had a stillbirth.

Underlying cause of maternal death

- 77.7% (376) were direct MDs while 19.8% (96) were indirect MDs.
- Obstetric haemorrhage 39.7% (192), non-obstetric complications/indirect MDs 19.8% (96) and hypertensive disorders associated with pregnancy 15.3% (74) were the most common causes of all maternal deaths.

Women who had stillbirths

- **25.6% (124)** of all women who died had a stillbirth.
- **54% (67)** died of obstetric haemorrhage and **21% (26)** died from hypertensive disorders in pregnancy, childbirth and the puerperium period.

Women who died before childbirth

- Of the 70 women who died before childbirth (Undelivered), most died from non-obstetric complications **40%** (28), hypertensive disorders in pregnancy, childbirth and the puerperium period **21.4% (15)** and obstetric haemorrhage **18.6% (13).**

Quality of care

- **73.3% (355)** maternal deaths occurred outside working hours (after 5pm to before 8am), on weekends and public holidays**. 26.7% (129)** died during weekday normal working hours (8am-5pm).
- Medical officers were involved in the management of **54.1% (262)** of women who died and obstetricians were involved in the care of only **11.4% (55)** of cases.
- Poor quality of care was identified in the care of **92.4% (447)** of women who died. Improving the care for **88.1% (394)** of women who died could have resulted in a better outcome.

Contributory and associated factors

- One or more associated factors were identified in **89.3% (432)** of the maternal deaths.
- One or more health worker related factors were identified in **75.4% (365)** of the maternal deaths.
- For **64.5% (317)** of the maternal deaths there was insufficient information to identify community associated factors.
- The most frequent health worker related factors identified were: delay in starting treatment **32.9% (159),** inadequate clinical skills **28.1% (136),** inadequate monitoring **26.9% (130),** and incomplete initial assessment **22.7% (110).**

Recommendations

Several recommendations for different levels of healthcare administration and management, and the community are as follows:

1. Leadership

While tremendous investments have been made in maternal and newborn health in Kenya, related health indicators do not match the investments. This report illustrates a need for accountability for results in maternal and newborn health by the highest level of leadership from the National and County governments.

2. National Level

- Develop relevant policy and legislative backup for the confidential enquiry into maternal death process by anchoring the MPDSR process in legislation - MNCH Bill.
- Strengthen the maternal death surveillance system to improve the notification of maternal deaths.
- Integrate a qualitative enquiry in the confidential enquiry into maternal death surveillance and response process.
- Standardize patient record documentation to improve quality of records at healthcare facility level.
- Explore use of electronic medical records in maternal and newborn health.
- Providers of maternity care should have regular and mandatory updates in emergency obstetric and newborn care.
- Expand on diagnostic capacity including laboratory services and point of care tests in MNCH.
- Embrace and scale up innovations that increase blood and blood products availability and safety e.g. delivering blood using drones.
- Rationalise staffing norms and models for remuneration of specialists through output-based modalities such as fee for service, capitation, and mixed method payment.
- Provide up-to-date treatment protocols in a user-friendly format including in electronic formats and applications for all maternity care providers.
- Develop policy to expand access to post abortion care (PAC) services.
- Strengthen adolescent sexual and reproductive health policies and implementation models to address teenage pregnancies.
- Embrace and scale up the use of technology to enhance access and availability of quality care in maternal and neonatal health (MNH).
- Institute mechanisms for perinatal death reviews in all health facilities and produce a national report biannually.

3. County level

County governments through the Department of Health should:

- Within a year, increase performance of facilities to above 70% with all signal functions in BEMONC and CEMONC facilities in each county; and, secure financial arrangements for county department of health especially MNH.
- Embrace and scale up innovations that increase blood and blood products availability and safety e.g. delivering blood using drones.
- Ensure capacity building and mentorship of healthcare workers at all levels of care and retention within the appropriate department for at least 2 years.
- Ensure specialists are available- rationalise working hours, remuneration and incentives.

- Improve data quality and use - stock taking of maternal and newborn health indicators against set targets.
- Link MNH to critical care - using available resources to improve care for women.

4. Health Facility Level

- Enforce and supervise proper documentation of the care provided to mothers in all health facilities.
- Maternity care providers should have regular (2 years) and mandatory updates in emergency obstetric and newborn care (including triage and referral), antenatal care (ANC) and postnatal care (PNC).
- Embrace and scale up innovations that increase blood and blood products availability and safety.
- Provide the minimum package of care in ANC and PNC to all clients at all levels of the health system (public and private).
- Improved monitoring of women in ANC, labour and in the post-partum period.
- Regular audit and feedback of care should be conducted to continuously improve the quality of care.
- Reorganization of care to ensure that high risk pregnancies are managed by specialist teams supported by appropriate resources (test reagents/kits, drugs, equipment, intensive care unit etc.).
- Training in the use of spinal anaesthesia and provision of resources needed is important especially at levels 3 and 4 hospitals.

4. Community Level

- Expand community level health services (level 1).
- Preventive and promotive health services.
- Data generation and use at community.
- Strengthen linkages between the community and the health facility.
- Referral of all women to the health facility.
- Strengthen community reporting of maternal deaths.

Lessons learnt

The first CEMD conducted in Kenya contains limited information on perinatal deaths. Consultations will be made with relevant stakeholders to map the resources required to include perinatal deaths in future reports. Some improvements to the assessor's forms have been identified, the form and MAMAs software have been updated and will be used in subsequent CEMDs.

Further research

Further research into factors associated with post-partum deaths, caesarean sections, quality of care for ANC and post-partum care is needed. Also, further exploration of the factors associated with deaths outside normal working hours is needed to develop measures to reverse the pattern observed. A system to ensure that community factors associated with maternal deaths need to developed as this will improve the quality of information available to the Enquiry.

Next steps

Adequate resources need to be allocated to disseminate, implement and monitor the recommendations. Also, a system for notification and review of perinatal deaths needs to be established.

Chapter 1

Introduction

Maternal and neonatal deaths are major public health problems. Estimates published in 2015 show that globally, an estimated 303,000 women die annually during pregnancy, childbirth or in the postnatal period, 2.6 million babies are stillborn and 2.7 million babies die within one month of birth[1]. Most of these deaths happen in low and middle income settings, are preventable and occur during labour and childbirth and in the first week after birth. Ensuring quality care is provided to every pregnant woman, mother, fetus and newborn during this period is critical for maternal and newborn survival.

There is renewed focus on maternal and child health through the launch of the Sustainable Development Goals (SDG). By 2030, the targets are to reduce the global maternal mortality ratio to less than 70 per 100,000 live births, global neonatal mortality to 12 per 1,000 live births and achieve access to quality essential healthcare services for all[2]. These targets are ambitious, and require renewed focus on approaches to improve the quality of care provided to women and newborns[3].

Country Background

The 2014 Kenya Demographic and Health Survey (KDHS) estimated the maternal mortality ratio (MMR) to be 362/100,000 live births, and neonatal mortality rate as 22/1000 live births (KDHS 2014)[4]. The MMR estimates show a wide disparity between regions and counties, for example Nairobi 212/100,000 and Mandera 3,795/100,000[5]. Late or inconsistent attendance at antenatal care clinic, variable quality of antenatal care, as well as poor access to skilled care during pregnancy, delivery and the postpartum period contribute to adverse outcomes for women and newborns[8]. Evidence shows that most of the causes of maternal death can be averted with early access to quality essential and emergency obstetric care. The maternal mortality ratio reported by the KDHS 2014 is less than the point estimate from the UN report (362 vs 510 but within the 80% uncertainty interval of 344-754). Although based on this point estimate provided by the Maternal Mortality Estimation Inter-agency Group (MMEIG), a 25.8% reduction in maternal mortality from 687 to 510 per 100,000 live births between 1990 and 2015 (WHO 2015). Clearly the estimated change in MMR will be different if the lower or upper limit of the uncertainty interval was used. With more reliable and accurate data the true change in MMR can be determined. Maternal and Perinatal Death Surveillance and Response (MDSR) is a mechanism to improve the availability, accuracy and reliability of maternal mortality data.

1 WHO (2015). Trends in Maternal Mortality: 1990-2015. Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva, World Health Organisation.

2 Every Woman, Every Child (2015). The Global Strategy for Women's, Children's and Adolescents' Health: 2016-2030. Sustainable Development Goals. Geneva, Every Woman, Every Child.

3 Van den Broek N. & Graham W. (2009), "Quality of care for maternal and newborn health: the neglected agenda", *BJOG: An International Journal of Obstetrics & Gynaecology,* vol. 116 (Suppl.1), pp. 18-21.

4 Kenya Demographic and Health Survey Report 2014. Nairobi, Kenya.

5 UNFPA Kenya 2014: Counties with the highest burden of maternal mortality. [Available online, accessed 7 January 2017 at http://kenya.unfpa.org/news/counties-highest-burden-maternal-mortality].

Maternal and Perinatal Deaths Surveillance and Response (MPDSR)

Maternal and perinatal deaths surveillance and response is a form continuous surveillance linking the health information system and quality improvement process from local, County to national level. MPDSR helps to quantify mortality as well as the identify causes and determine how maternal and perinatal deaths can be avoided.[10]

MDSR is a relatively new concept developed by the World Health Organization (WHO) as a follow up to the recommendations of the Commission for Information and Accountability (CoIA), that aims to provide targeted and timely response to maternal deaths.[3, 10]

The primary goal of MDSR is to eliminate preventable maternal mortality by strategically using information to guide public health actions and monitoring their impact. Information provided through MDSR guides immediate as well as longer term actions. MDSR provides an opportunity to strengthen vital registration and accurate counting of maternal deaths, to generate information on quality of care and to monitor improvements in quality of maternal health care.

The WHO recommends a phased approach to implementing MDSR. The recommended approach is to start small and scale up gradually – start with review of deaths in selected public health facilities before moving to communities, and scaling up slowly to eventually include all deaths in facilities and communities.[10]

The audit and feedback approaches[6] for quality improvement that are currently being used in Kenya[6] include:

- Community based maternal and perinatal death reviews.
- Facility-based maternal and perinatal death reviews.
- Confidential enquiry into maternal deaths.
- Facility-based near miss reviews.
- Clinical audits.

Whereas these approaches are recommended in the Kenya National Maternal and Perinatal Death Surveillance and response guidelines,[7] the extent to which they are implemented depends on specific projects (this determines the scope i.e. implementation sites and number of approaches). Kenya have added 'Perinatal' to MDSR to expand the national focus to perinatal reviews.

Aim and objectives of MPDSR

The specific objectives of MPDSR are:

- To document the number of maternal and perinatal deaths (stillbirths and early neonatal deaths).
- To gain understanding of the health system failures that may have led to maternal and perinatal deaths.
- Stimulate action to address avoidable factors to prevent future maternal and perinatal deaths.
- Raise awareness among health professionals, administrators, programme managers, policy makers and community members about avoidable factors (at healthcare facilities as well as in the community).

6 World Health Organization, 2004: Beyond the numbers: reviewing maternal deaths and complications to make pregnancy safer. Available online, accessed 7 January 2016 at http://apps.who.int/iris/bitstream/10665/42984/1/9241591838.pdf

7 Kenya Ministry of Health 2016. National guidelines for maternal and perinatal death surveillance and response. Nairobi, Kenya

Key principles of MPDSR

The key principles of MPDSR are as follows:

- Maternal deaths are notified within 24-hrs and perinatal death within 48 hrs after occurrence through the District Health Information System 2 (DHIS 2) by health records information officers. Reports are produced on a weekly basis by the Integrated Disease Surveillance and Response (IDSR).
- A zero-reporting principle is adopted, meaning that reports are submitted regularly (weekly) even if no death has occurred.
- A 'No blame' policy and approach.
- Death reviews focus on health systems not individuals.
- Documentation in patient case notes is the main source of information for facility based death reviews.
- Maternal and perinatal death reviews are conducted with seven days after the occurrence of a death.
- A verbal autopsy form is filled within 30 days of occurrence of a maternal death at the community.
- The verbal autopsy is conducted by the community MPDSR Committee.
- Relatives are the main source of information for verbal autopsy.
- Death audit data are anonymised and **CANNOT** be used for disciplinary or litigation purposes.
- The death reviews are considered as incomplete without response to prevent avoidable factors in the future.

Coordination of maternal death reviews in Kenya

In response to the high MMR, the Government of Kenya made maternal death notification mandatory in 2004, and put in place a maternal death review (MDR) system in the same year. However, to date the DHIS 2, and Civil Registration and Vital Statistics System (CRVS) have not adequately captured all maternal deaths in Kenya; it is estimated that only 15% of the maternal deaths that occurred in 2014 were recorded in the HMIS; and only 60% of all deaths are captured by the CRVS. The Government re-launched facility-based MDR in 2009, with an emphasis on identifying and correcting health system problems rather than faults in individuals' practice and management. Also, MPDSR tools such as notification and review forms were updated. In 2013, following the recommendations of CoIA for better reporting and accountability on maternal and child health,[8] WHO Geneva, launched the technical guidelines for MPDSR (WHO 2013).[9] In response to this, the government included maternal death as a notifiable event via the Health Management Information System (HMIS) and trained healthcare workers at all levels through nationwide orientation workshops.

To strengthen central level coordination of maternal death reviews, a national Maternal and Perinatal Death Surveillance and Response (MPDSR) Secretariat was established in the Division of Family Health to coordinate activities for setting up and implementing a system of confidential enquiry into maternal death at national level. Technical support was provided from the UK and South Africa. Such a system that reviews all data related to maternal death provides an opportunity for identifying problems with care, and making effective changes at family, community, health service and policy making levels. The system will promote timely reviews at healthcare facility level and more anonymised reviews at county, regional and national levels, per national guidelines.

8 UN Every Woman, Every Child: Keeping promises, measuring results on information and accountability for womens and children health. [Available online, accessed 7 January 2017 at http://www.who.int/topics/millennium_development_goals/accountability_commission/Commission_Report_advance_copy.pdf?ua=1

9 WHO (2013). Maternal Death Surveilance and Response. Technical guidance information for action to prevent maternal death.

The MPDSR Secretariat has adapted the WHO technical guidance on MDSR to establish a system for confidential review of all maternal and perinatal death and near misses, to use this information to guide decisions for action at all levels.

The Kenya National MPDSR guidelines[6] provide a framework on how to conduct maternal and perinatal death reviews and near miss reviews in the community as well as in health facilities. It adopts the process of forming MPDSR committees at different levels (community, sub-county, county and national). The MPDSR data tools (notification and review forms) have been integrated in the District Health Information System (DHIS) database, thus enabling routine notification, data collection and analysis. In addition, maternal and neonatal deaths are notifiable using the Integrated Disease Surveillance System. However, despite capacity building with health teams in all counties and sub-counties, there are gaps in the system. These gaps include inadequate use of maternal and perinatal death review processes; under reporting of the maternal deaths; lack of information on the response measures taken after a maternal audit and poor data quality.

Overview of confidential enquiry process in Kenya

Confidential enquiry into maternal death (CEMD) is a systematic multi-disciplinary anonymous investigation of a representative sample of all maternal deaths occurring the country (WHO, 2004).[10] The process identifies the numbers, causes and avoidable or remediable factors associated with the death. CEMD system was useful in confirming the national aggregated data reported from county, community and facility MPDSR committees. It involves, fresh assessment of source documents including patients' notes by independent assessors and discussions to reach consensus on the cause of death.

CEMD was started in Kenya in 2015, to complement other existing audit and feedback approaches such as maternal and perinatal death reviews.

The CEMD process involved the collection of maternal death files from facilities by National Ministry of Health staff and MPDSR secretariat staff. The case notes were anonymised by the secretariat and subsequently reviewed by independent multi-disciplinary teams of trained assessors comprising obstetricians, medical officers, midwives, anaesthetists and public health specialists. The reviews were independently conducted by individuals not involved in the care of the woman at the time of death. The assessors used individual maternal death files to populate the maternal death assessors' form, which was adapted from South Africa's CEMD review form. Consensus on the cause of death was reached through discussion and guided by the International Classification of Diseases 10th version, Maternal Mortality (ICD 10 MM) (WHO 2012).[11] The data were then stored in a database using the Maternal Mortality Audit System (MAMAS) software.

The CEMD in Kenya was supported through the National Maternal and Perinatal Death Surveillance and Response (MPDSR) Committee, the National MPDSR secretariat, teams of National maternal death assessors and the CEMD report writing committee. A brief description of the role and composition of each part of this support system is presented in Annex 1.

Objectives of this report

The main objective of this report is to describe the pattern of diseases and conditions causing maternal death and identify health system gaps related to these deaths for the year 2014. Specifically, this report seeks to:

- Identify the underlying cause of maternal deaths.
- Identify contributory and associated factors for each maternal death.

10 WHO (2004). Beyond the numbers. Reviewing maternal death and complications to make pregnancy safer. Geneva, World Health Organization.

11 WHO (2012). The WHO application of ICD-10 to death during pregnancy, childbirth and the puerperium: ICD-MM. Geneva, World Health Organization.

- Assess the quality of care received by women who have died during pregnancy and childbirth.
- Make recommendations to improve the quality of care provided to women during pregnancy, childbirth and the puerperium.

Report structure

The report is presented in 4 sections, **Section 1** includes the executive summary, introduction and methodology chapters (Chapters 1 and 2), **Section 2;** includes the general results (Chapter 3; overall/ general results) and ICD 10 MM group specific results (Chapters 5 to 8) with illustrative vignettes for each group. **Section 3** (Chapters 9-11 include discussion of the findings, strengths, limitations, lessons learnt, implications for future practice and international comparisons of the findings, conclusions, dissemination plan and the Annexes).

Chapter 2

Methodology

A description of how the CEMD was carried out, the methods used for review, and the process of analysis is presented in this chapter.

Review design and sampling

This was a review of a sample of maternal deaths that occurred in major referral public and private health facilities in all regions of Kenya during 2014. Preparations began in July 2014 with a national maternal and newborn health stakeholder's workshop. The workshop proposed the setting up of a National MPDSR Secretariat and National MPDSR Committee by the MoH through the Reproductive and Maternal Health Services Unit. The first national maternal death assessors workshop was conducted in July 2015 where review of case notes of women who died in the preceding year was found to be a good starting point. Reviewing case notes for the previous year seemed to be less threatening for healthcare managers and providers and enhanced the building of confidence of staff involved in the system.

Maternal deaths were identified from the District Health Information System (DHIS). In total, 946 maternal deaths were reported via the DHIS in 2014 from all healthcare facilities across Kenya; The DHIS only records facility based maternal deaths, and does not capture deaths that occur in the community.

A list of all 96 referral hospitals was drawn up (from the Master Health Facility List) which comprised 64 county referral hospitals, 16 sub-county hospitals and 2 national teaching and referral hospitals and 14 private and Faith-based Organisations (FBO) health facilities. Seventy-nine percent (745) of all maternal deaths recorded in 2014 through the DHIS-2 were from these 96 hospitals.

Data collection

Maternal death case notes retrieval

The MPDSR Secretariat, providing an oversight role, and working together and with staff from the Reproductive Maternal Health Services Unit (RMHSU) coordinated the process of case notes retrieval from the major referral hospitals in Kenya. The management of all referral hospitals included, consented to the process. Staff from RMHSU visited health facilities between July 2015 and May 2016 to retrieve case notes of any women who had died in these facilities during from 1st January to 31st December 2014. Over 2-3 visits, RMHSU staff carefully tracked the retrieval process by recording the number of case notes retrieved against a list of the number of maternal deaths that had been reported to have occurred at the facility. After retrieval, RMHSU staff made photocopies of all records available for each woman. These included referral notes and records from all health facilities where she had received care during and or following pregnancy and childbirth; laboratory and autopsy reports. Copies of these notes were then sent to the National MPDSR Secretariat office.

Anonymisation of maternal death case notes

On receipt of the retrieved case notes, staff at the MPDSR secretariat allocated each maternal death a unique number prior to anonymisation. In line with accepted standards for CEMD, maternal death case

notes were anonymised in preparation for multidisciplinary anonymous review by the National Maternal Death Assessors. Anonymisation involved removal of identifiers from the clinical notes such as the deceased woman's name and contact details, contact details of next of kin; names, addresses and logos of hospitals; names and signatures of staff who had attended to the deceased woman. National MPDSR Secretariat staff anonymised case notes manually by reading through the entire set of notes and using correction fluid to cover the identifying information. After anonymisation, each set of case notes was independently checked to ensure that all the identifiers had been removed from the records (Figure 1).

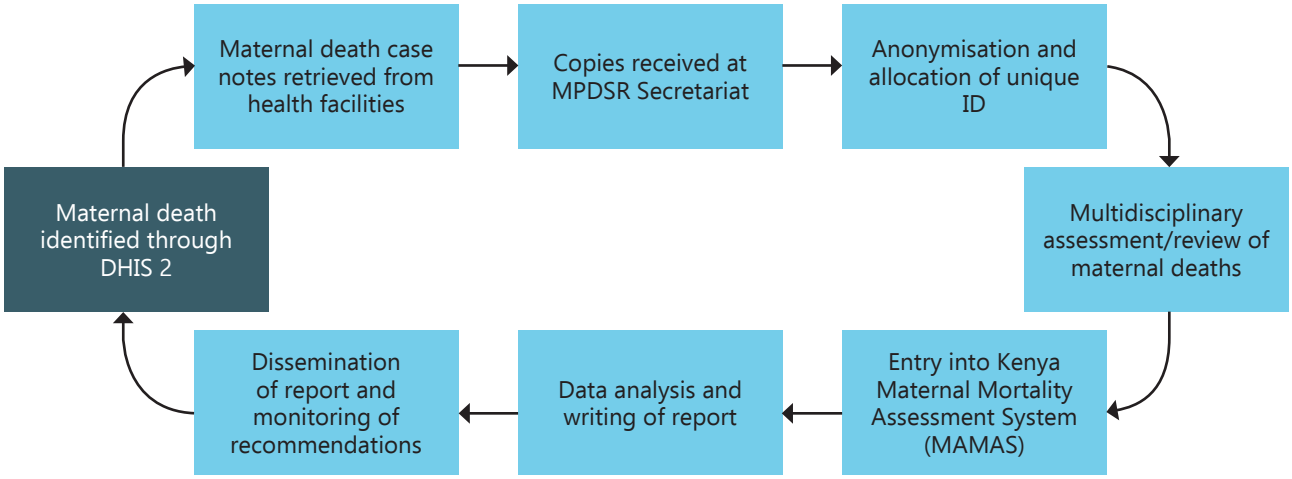


Figure 1: Overview of the Kenya CEMD process

Maternal death review process

The World Health Organization application of International statistical classification of diseases and related health problems, tenth revision (ICD-10) to deaths during pregnancy, childbirth and the puerperium- ICD maternal mortality (ICD-MM) is the standard tool to guide the collection, coding, tabulation and reporting of mortality statistics based on civil registration. In the ICD-10, deaths with a causal and/or temporal relationship to pregnancy are characterized and defined as maternal deaths due to direct or indirect causes, deaths during pregnancy, childbirth and puerperium, or late maternal deaths (**See page xi for definition of terms**).

a. Underlying cause of a maternal death

The underlying cause of a maternal death is the disease or condition that initiated the morbid chain of events leading to death. The single identified cause of death should be as specific as possible. Only one ICD-10 MM code was allocated to each underlying cause of death as per WHO criteria. **Table 1** presents the nine groups of causes of deaths during pregnancy, childbirth and the puerperium, with examples for each group.[1]

b. Contributory factors

Contributory factors are medical conditions that may have contributed to or may be associated with a maternal death, they are not reported as sole condition on the death certificate or selected as the underlying cause of death. Contributing causes may predispose women to death, as either a pre-existing condition or a risk factor.

1 WHO (2004). Beyond the numbers. Reviewing maternal death and complications to make pregnancy safer. Geneva, World Health Organization.

Table 1: Groups of underlying causes of death during pregnancy, childbirth and the puerperium in mutually exclusive, totally inclusive groups

Type	Group name/number	Examples
Maternal death: direct	1. Pregnancies with abortive outcome	Abortion, miscarriage, ectopic pregnancy and other conditions leading to maternal death and a pregnancy with abortive outcome
	2. Hypertensive disorders in pregnancy, childbirth, and the puerperium	Proteinuria and hypertensive disorders in pregnancy, childbirth and the puerperium
	3. Obstetric haemorrhage	Obstetric diseases or conditions directly associated with haemorrhage
	4. Pregnancy-related infection	Pregnancy-related, infection-based diseases or conditions
	5. Other obstetric complications	All other direct obstetric conditions not included in groups to 1–4
	6. Unanticipated complications of management	Severe adverse effects and other unanticipated complications of medical and surgical care during pregnancy, childbirth or the puerperium
Maternal death: indirect	7. Non-obstetric complications	Non-obstetric conditions • Cardiac disease (including pre-existing hypertension) • Endocrine conditions • Gastrointestinal tract conditions • Central nervous system conditions • Respiratory conditions • Genitourinary conditions • Autoimmune disorders • Skeletal diseases • Psychiatric disorders • Neoplasms • Infections that are not a direct result of pregnancy
Maternal death: unspecified	8. Unknown/undetermined	Maternal death during pregnancy, childbirth and the puerperium where the underlying cause is unknown or was not determined
Death during pregnancy, childbirth and the puerperium	9. Coincidental causes	Death during pregnancy, childbirth and the puerperium due to external causes

c. Associated factors

A list of non-medical factors associated with maternal deaths were developed using the 3-delay model[2]. The list developed was categorised into 4 groups (Health worker, administrative, patient/family and community factors, (Table 2). Associated factors under phase one delay (decision to seek care) and phase 2 delay (notifying and reaching medical facility) were categorised under patient/family and community group, while associated factors under phase 3 delay (quality of care) were categorised under the health worker and administrative group. This list was used to identify associated factors during the review process.

2 World Health Organization (2012), The WHO application of ICD-10 to deaths during pregnancy, childbirth and puerperium: ICD MM.

Factors related to the phase one delay and phase two delay were based on information available in the case notes only. The quality of this information depends on the type of information collected and documented from the deceased woman, her family members and care givers prior to arriving at the healthcare facility. Multiple sources of information regarding the maternal death were reviewed to determine the quality of care provided and the factors associated with receiving adequate and appropriate treatment were determined by the assessors (phase 3 delay)[3, 4].

3 Thaddeus, S. & Maine, D. 1994, "Too far to walk: Maternal mortality in context", Social science & medicine, vol. 38, no. 8, pp. 1091-1110.

4 Hulton, L.A., Matthews, Z. & Stones, R.W. 2000, "A framework for the evaluation of quality of care in maternity services" in What is Quality? Definition and Measurement University of Southampton, Southampton, pp. 9.

Table 2: Factors associated with maternal deaths

Health worker factors	Administrative factors	Patient/family factors	Community factors	Other factors
Inadequate antenatal care	Communication problem between health facilities	Delay in reporting to health facility	Failure to recognise danger signs	Other factors present
Inadequate clinical skills	Transport problems between health facilities	Lack of transport from home to facility	Failure to accept limitations	
Delay in deciding to refer	Lack of qualified staff	Unsafe traditional/cultural practices	Use of traditional medicine	
Initial assessment incomplete	Lack of antibiotics	Unsafe self-medication treatment	Lack of transport	
Inadequate resuscitation	Lack of uterotonic drugs	Delay in decision-making	Delay in deciding to refer	
Wrong diagnosis	Lack of antihypertensive/ anticonvulsants	Use of traditional medical practice	No information	
Wrong treatment	Lack of equipment for manual vacuum aspiration (MVA)	No antenatal care	No avoidable Traditional Birth Attendant(TBA)/community factor	
Unsafe medical treatment	Lack of equipment for assisted vaginal delivery (AVD)	Gender-based violence		
No treatment	Lack of equipment for newborn resuscitation (NR)	No information		
Delay in starting treatment	Lack of equipment for obstetric surgery	No avoidable patient/family factor		
Partograph incorrectly used/not used	Lack of laboratory facilities			
Inadequate monitoring	Lack of availability of blood transfusion			
Prolonged abnormal observation without action	Absence of trained staff on duty			
Lack of obstetric life-saving skills	Infrastructural problems			
No information	No information			
No avoidable health worker factor	No avoidable administrative factor			

d. Conducting maternal death review

The maternal death assessors form was adapted from forms used for confidential enquires in the United Kingdom and Republic of South Africa. Members of Confidential Enquiry teams in the United Kingdom and the Republic of South Africa, and the team from the Liverpool School of Tropical Medicine (LSTM) provided technical input to the development of the assessor's form and training of assessors. The assessor's form used for in-depth reviews consisted of seven sections: demographics, initial clinical diagnosis, and primary cause of death, contributory conditions, associated factors, clinical management and summary; the form was pretested during the assessors training workshops and updated prior to use for the 2014 CEMDs.

Multidisciplinary teams of trained assessors reviewed the anonymised case notes of the deceased women. The assessors were trained by National MPDSR Secretariat and LSTM team, on how to complete the maternal death assessors form and group the deaths based on the ICD-10 MM (WHO 2012).

For efficiency, rounds of assessors' review meetings were organised by region, between September 2015 and June 2016. At the review meetings, assessors conducted detailed assessments of maternal death, attributed cause of death based on WHO ICD-MM and completed a maternal death assessor form for each death. After initial training of 93 assessors, nine multidisciplinary review meetings were held.

Analysis of review findings

a. The Maternal Mortality Audit System (MAMAS)

The Kenya Maternal Mortality Audit System (MAMAS) is an electronic database that has been customised specifically to support the CEMD process in Kenya. The software is used to store, aggregate and analyse data related to maternal deaths. Each section of the assessor's form reflects a data entry field in the MAMAS software and conforms to ICD-10 MM guidelines.

The MAMAS software contains all the information found in the assessor's form. Once the assessor's form is completed, data was immediately entered into MAMAS by the National MPDSR Secretariat staff. The MAMAS software was designed to be operated from one computer at a time, the paper forms allowed assessors adequately complete the forms, making corrections as necessary before submitting final versions for entry into MAMAS.

b. Data analysis

The MAMAS software was used to obtain basic frequencies. For comprehensive analysis, data in the MAMAS was exported to SPSS 22 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.) for additional descriptive analysis.

Ethical considerations

The process of anonymisation ensures that information collected from patients is kept confidential. Anonymisation removes identifiers of health facilities, healthcare providers and women. This ensures that review and assessment of maternal death case notes is unbiased. During the review workshops the secretariat staff ensured that assessors were not assigned to review case notes from their respective health facilities. Assessors, anonymisers and the MPDSR Secretariat staff signed a confidentially statement, agreeing to keep all information used in the CEMD process confidential (i.e. not to discuss details of any case notes with persons outside of the confidential enquiry process). Additionally, the confidentiality statement states that the information obtained through the confidential enquiry system, cannot be used in a court of law or used for medical-legal purposes.

Quality assurance of data collected

RMHS staff retrieving case notes, collected information about the case from multiple sources within the health facility, to improve the quality of information available for review (nursing hand over notes, operation theatre, ANC notes etc.). Clear photocopies were produced and sent to the secretariat. Discussions among multidisciplinary teams of 3-4 staff with a cadre mix ensured that there was agreement and consistency on the underlying cause of death and quality of care provided.

After the data entry process, a proportion of entries were checked against the corresponding assessor form (specifically checking every 10th entry was reviewed for accuracy) by an independent staff. Consistency and accuracy of the data was also checked through cross-tabulations of selected outputs.

Most maternal death assessors' forms were complete. Where information was not available, assessors had the option of choosing "unknown" or "lack of information." Case notes with insufficient information were excluded from the review process.

SECTION 2

Chapter 3:
General results

Chapter 4:
Pregnancies with abortive outcome

Chapter 5:
Hypertensive disorders in pregnancy, childbirth, and the puerperium

Chapter 6:
Obstetric haemorrhage

Chapter 7:
Pregnancy-related infection

Chapter 8:
Non-obstetric complications

Chapter 3

Overall Results

Description of the data

This report is an in-depth qualitative review of maternal deaths that occurred in health facilities during the year 2014. A total of 945 maternal deaths in all regions were reported in the District Health Information System (DHIS-2) in 2014. The target set for the first CEMD report in Kenya, was to review 745 maternal deaths that occurred in 96 major referral hospitals (Comprehensive Emergency Obstetric Care Hospitals-CEmOC).

Sixty-seven percent (499) case notes from these CEmOC facilities were retrieved and anonymised by the MPDSR Secretariat staff. Of these, 484 (or 65% of the target) were reviewed by trained assessors. Fifteen case notes had insufficient documents/records for assessors to draw any conclusion about the quality of care. All case notes with sufficient information were entered in the MAMAS for analysis **(Table 3)** after the multidisciplinary reviews.

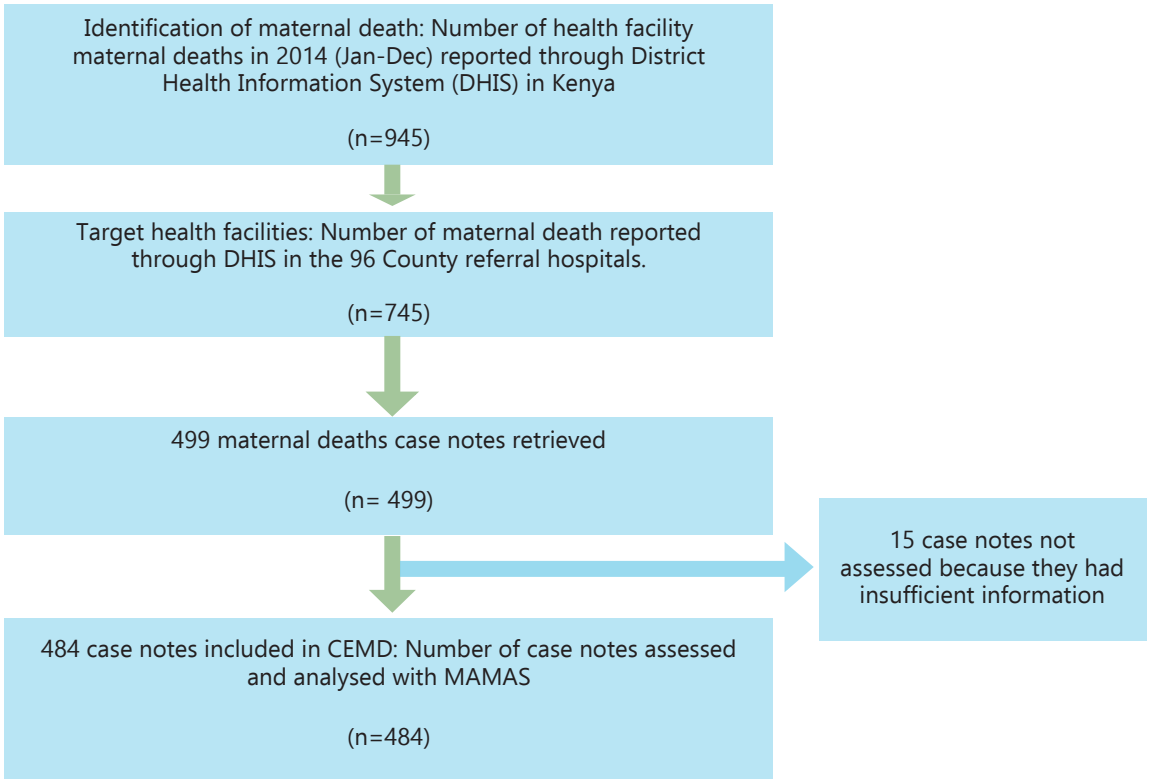
The results presented in this report are based on 51.2% (484) of all maternal deaths reported through the DHIS-2 in 2014 **(Figure 2)**.

About ninety-three percent (446) of the case notes reviewed were from public health facilities of which 62.1% (301) were from county referral hospitals **(Table 3)**.

Table 3: Number of case notes assessed by level of health care

Type of referral hospital	No of maternal death retrieved	Percent
Sub-County Hospitals	48	9.9
County/Secondary County Hospital	302	62.1
National Teaching Referral Hospital	96	19.8
Private/Faith-based Hospitals	38	7.8
Total	484	100

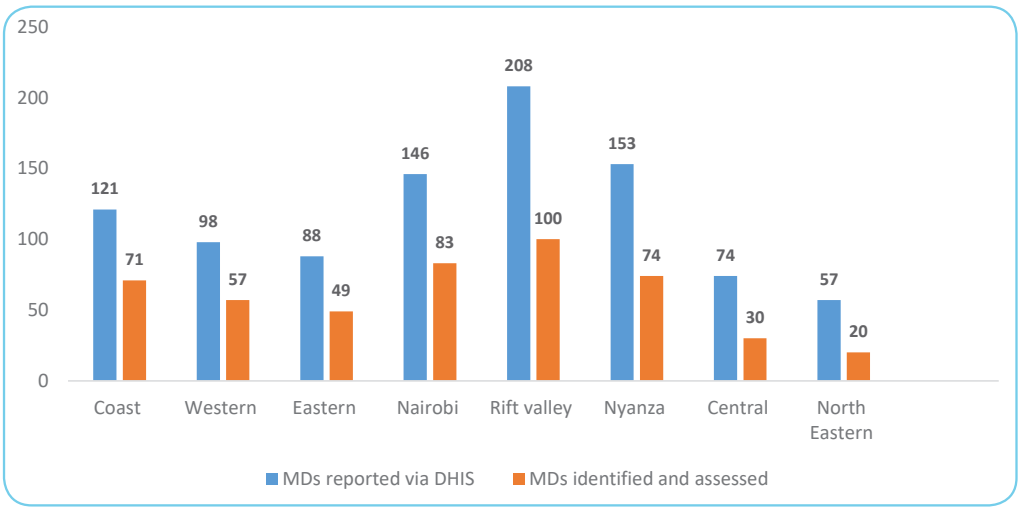
Figure 2: Kenya CEMD case notes retrieval process



Distribution of maternal death case notes assessed

The proportion of maternal deaths reported via DHIS2 compared to those assessed was highest in Coast region (59%) and lowest in the North Eastern (35%). Overall 51.2% (484) of all maternal deaths (MDs) reported from all regions were reviewed **(Table 3).**

Figure 3: Number of maternal death reported and assessed in each region



Staff involved with retrieval of case notes reported that successful retrieval of case notes was determined by good health facility record keeping, filling systems, and cooperation from the facility **management.**

Key findings: Maternal Mortality in Kenya in 2014

Demographic characteristics

- The mean age of women who died was 27.8 years with a standard deviation of 6.4 years. The median age was 27 years, the youngest women who died was 14 years while the oldest was 47 years.
- Most of the women who died where either Para 1; **20.9% (101)** or Para 2; **21.5% (104)** at the time of death.

Pregnancy outcome

- **77% (374)** of women who died had given birth, **8% (40)** had a pregnancy with an abortive outcome and **14% (70)** were undelivered.

Timing of deaths

- **37.4% (181)** of the MDs occurred in the post-partum period, **18.4% (89)** were intrapartum deaths and the period of death was not specified for **21% (104)** of MDs.

Antenatal care

- **41.3% (200)** of records for women who died did not have documentation of ANC attendance.
- **58.7% (284)** maternal death records had information on ANC attendance. Eighty-one percent **(229)** of these received ANC, **19% (55)** did not.
- Routine ANC profile tests were not performed as per the guidelines, with urinalysis being the least performed test.

Place of delivery

- Of the **374** women who delivered, **88.8% (332)** delivered in hospital, **7.5% (28)** delivered at home or on the way to hospital and the place of delivery was not specified for **3.7% (14).**

Mode of delivery and outcome

- Of the **374** women who delivered, **63.2% (236)** delivered vaginally (**2% or 7** by AVD) and **36.9% (138)** by C/S.
- Of the **374** who died after childbirth, **50.5% (189)** had a live birth, **33.2% (124)** had a stillbirth and the delivery outcome was unspecified for **16.3% (61)**.
- **70.8% (63)** of intrapartum deaths were delivered by caesarean sections and **70% (126)** of post-partum deaths delivered vaginally.

Underlying causes of maternal deaths

- **77.7% (376)** of deaths were direct MDs, **19.8% (96)** were indirect MDs and the underlying cause of death was undetermined in **2.5% (12)** of MDs.

- Within the regions, most direct MDs were from Rift Valley **21.3% (80)** while majority of indirect MDs were from Nyanza **24.7% (24)** and Nairobi regions **23.7% (23)**.
- **39.7% (192)** of direct maternal deaths were due to obstetric haemorrhage. The least common cause of direct MD was pregnancy with abortive outcomes **8.3% (40)**.
- Most of the 96 indirect MDs, were due to HIV-related complications **(22.9% or 22)** and Anaemia **(14.6% or 14).**

Women who had stillbirths

- **25.6% (124)** of women who died had a stillbirth.
- Of the women who had a stillbirth, most of them died of obstetric haemorrhage **54% (67)** and hypertensive disorders in pregnancy, childbirth and the puerperium period **21% (26).**

Women who died before childbirth

- **14.5% (70)** of women died before childbirth (undelivered).
- Of the women who died before child birth, most died of non-obstetric complications **40% (28),** hypertensive disorders in pregnancy, childbirth and the puerperium period **21.4% (15)** and obstetric haemorrhage **18.6% (13).**

Quality of care

- Most **73.3% (355)** maternal deaths occurred outside working hours (after 5pm to before 8am), on weekends and public holidays. **26.7% (129)** died during weekday normal working hours (8am-5pm).
- Medical officers were the highest cadre of staff involved in the management of **54% (262)** of women who died.
- Obstetrician/Gynaecologist were only involved in the management of 11.4% (55) of maternal death.
- Of the 484 maternal deaths assessed, **447 (92.4%)** received suboptimal care. Of these, **394 (88.1%)** received **suboptimal** care where different management **could have** made a difference to the outcome.
- In **7.6% (37)** of the maternal deaths the assessors could not identify any **suboptimal** care identified.
- Factors associated with maternal death included: health work force related factors were identified in **75.4% (365)** of maternal deaths, delay in starting treatment, inadequate clinical skills and inadequate monitoring were the most frequently identified health work force related factors.
- Contributory conditions identified included: Abnormalities of labour such as obstructed and prolonged labour in **13.2% (64)** of maternal deaths, and complications from caesarean section in **9.7% (47)** of maternal deaths.

Characteristics of women who died

The socio-demographic characteristics of women who died are presented in **Table 4**.

Table 4: Characteristics of women who died from direct and indirect MD and total

Characteristics	Categories	Direct (n=376) Frequency (%)	Indirect (n=96) Frequency (%)	Undetermined (n=12) Frequency (%)	Total (N=484) Frequency (%)
Age Group	<20	37(9.8)	5(5.2)	1(8.3)	43(8.9)
	20-24	83(22.1)	26(27.1)	3(25.0)	112(23.1)
	25-29	98(26.1)	33(34.4)	2(16.7)	133(27.5)
	30-34	84(22.3)	17(17.7)	3(25.0)	104(21.5)
	35-39	51(13.6)	9(9.4)	1(8.3)	61(12.6)
	40-44	18(4.8)	2(2.1)	1(8.3)	21(4.3)
	45+	1(0.3)	1(1.0)	0(0.0)	2(0.4)
	Missing	4(1.1)	3(3.1)	1(8.3)	8(1.7)
Parity	1	80(21.3)	21(21.6)	0(0.0)	101(20.9)
	2	77(20.5)	23(24.0)	4(33.8)	104(21.5)
	3	48(12.8)	23(24.0)	3(25.0)	74(15.3)
	4	56(14.9)	14(14.6)	0(0.0)	70(14.5)
	5 or more	88(23.4)	11(11.5)	5(33.3)	103(21.3)
	Missing	27(7.2)	4(4.2)	1(8.3)	32(6.6)

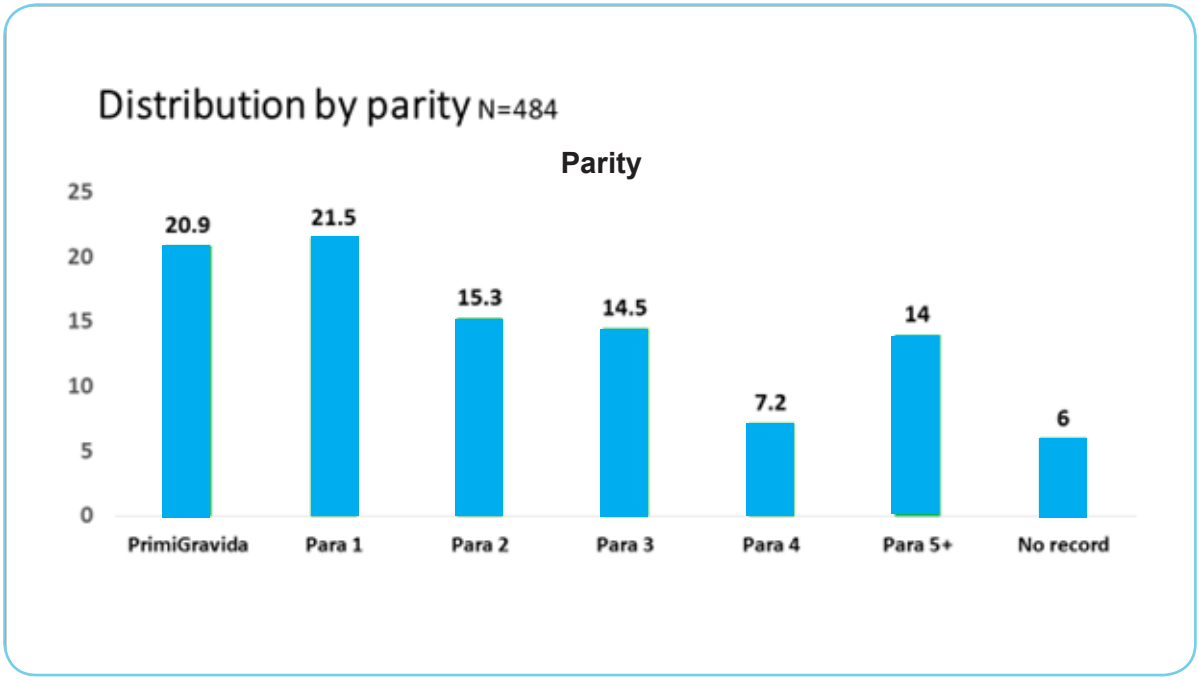
a. Age distribution

The mean age (standard deviation) of women who died was 27.8 years (6.4). The median age was 27 years, the youngest woman who died was 14 years while the oldest was 47 years. The age of 8 (1.7%) of the women was not recorded. Of the 484 maternal deaths assessed, 27.5% (133) were within the age group 25-29 years, 23.1% (112) were within the age group of 20-24 years and 21.5% (104) were aged between 30 and 34 years. The Kenya National Bureau of statistics (2014) reports a female population profile of 26.5%; <20 years, 11%; 20-24 years, 8%; 25-29 years, 7%; 30-34 years 5.2%; 35-39 years and 1.9%; 40-44 years.

b. Parity

42% (203) of women who died were Para 1 or 2 and 21.3% (103) were Para 5 or more **(Figure 4)**.

Figure 4: Distribution by Parity N=484



Underlying causes of Maternal Deaths

The underlying cause of death was grouped based on the ICD 10-MM classification.

77.7% (376) MDs were direct and 19.8% (96) were indirect. The cause of death could not be determined (unknown) for 2.5% (12) of the women who died **(Table 5).**

Table 5: Underlying causes of Maternal Death based on ICD-10 MM classification

Underlying cause of death	N=484 (Percent)
Direct Maternal deaths (376 or 77.7%)	
Obstetric haemorrhage	192 (39.7)
Hypertensive disorders in pregnancy, childbirth and postnatally	74 (15.3)
Pregnancies with abortive outcome	40 (8.3)
Pregnancy-related infection	47 (9.7)
Other obstetric complications	13 (2.7)
Unanticipated complications of management	9 (1.9)
Direct deaths without an obstetric code	1 (0.2)
Indirect maternal deaths: 19.8% (96)	
Non-obstetric complications	96 (19.8)
Maternal death unspecified	
Unknown/undetermined	12 (2.5)

Direct Maternal Deaths

The top 3 under lying cause of direct MDs were Obstetric haemorrhage 39.7% (192), hypertensive disorders 15.3% (74) and pregnancy-related infections 9.7% (47). Fifteen percent (29) of the deaths from obstetric haemorrhage were due to ruptured uterus and a detailed breakdown of the deaths from obstructed haemorrhage are presented in Chapter 6.

Indirect Maternal Death

19.8% (96) women died from indirect causes and 22.9% (22) were due to HIV (**Table 6).**

Table 6. Indirect causes of maternal death

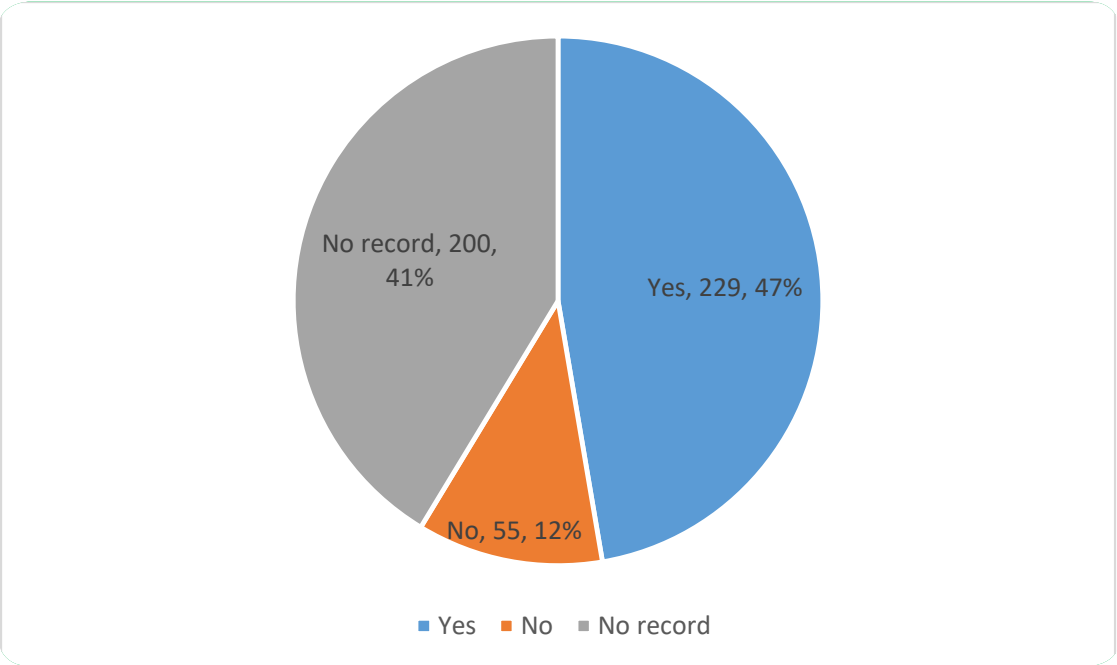
Cause of death	Frequency n=96	Percent
Human immunodeficiency [HIV] disease	22	22.9
Anaemia	14	14.6
Protozoal diseases e.g. Malaria	10	10.4
Diseases of the circulatory system	10	10.4
Tuberculosis	7	7.3
Diseases of the respiratory system	7	7.2
Other specified diseases and conditions	12	12.5
Other diseases of the blood & blood-forming organs & disorders involving the immune mechanism	4	4.2
Diseases of the digestive system	4	4.2
Mental disorders and diseases of the nervous system	3	3.1
Other maternal infectious and parasitic diseases	2	2.1
Pre-existing hypertension	1	1.0
Total	96	100

Antenatal care

a. ANC attendance

Information on ANC was available in 58.6% (284) of the case notes reviewed. Of these 80.6% (229) received ANC **(Figure 5)**. Antenatal records are contained within the patient held mother and child handbook and it is expected that this is also documented in files of all women managed in a health facility. However, after death the mother and child handbook may be left with family of the deceased if the new-born is alive. This may explain the high proportion (41%) of case notes reviewed without ANC records.

Figure 5: Percentage distribution of ANC attendance



a. Characteristics of women who received ANC

The records of 86.5% (198) of women who had ANC did not have information on gestational age at first antenatal care booking. Of the 31 records in which information was recorded, 45.2% (14) started ANC before 16 weeks **(Table 7)**.

The records of 57.6% (132) of women who had ANC did not have information on number of ANC visits. Of the 97 records in which information was recorded, 37.1% (36) had 4 or more visits.

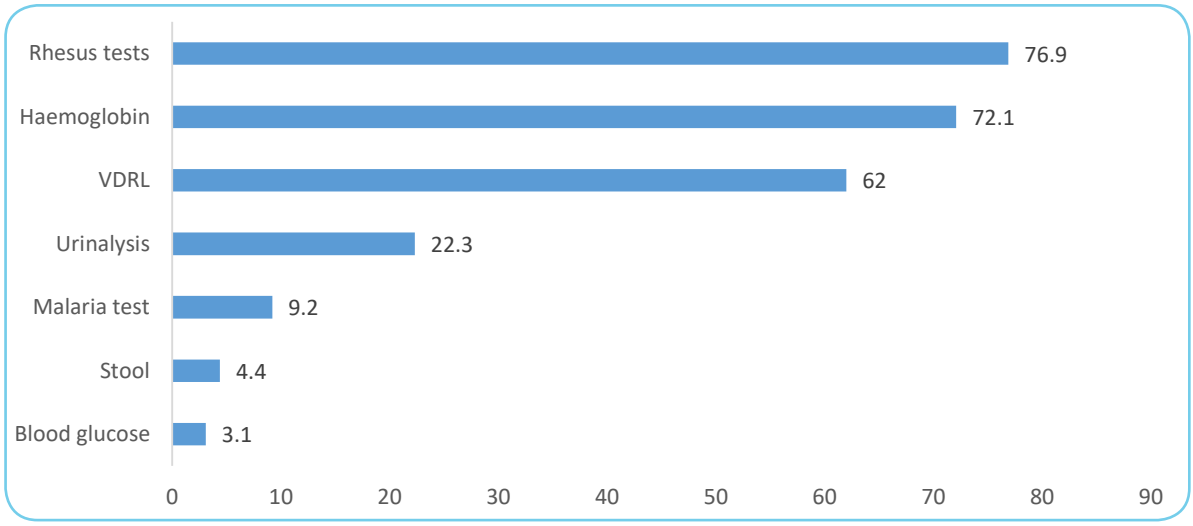
Table 7: Characteristics of women who received ANC

Characteristic	Categories	n=229	
		Frequency	Percent
Booked <16w	No	17	7.4
	Yes	14	6.1
	No record	198	86.5
	Total	229	100
No. of visits	One	16	7
	Two	23	10
	Three	22	9.6
	Four	23	10
	> Four	13	5.7
	No record	132	57.6
	Total	229	100

Among the 229 women who attended ANC, 76.9% (176) had Rhesus tests, 72.1% (165) had Haemoglobin tests, 62% (142), VDRL tests and only 22.3% (51) had Urinalysis tests.

Non-routine ANC tests (such as Malaria, stool and blood glucose) were performed for less than 10% (23) of maternal deaths with ANC records **(Figure 6)**.

Figure 6: Proportion of women where ANC tests were performed (n=229)



Pregnancy outcome

77% (374) of women who died had given birth, 8% (40) had a pregnancy with an abortive outcome and 14% (70) were undelivered.

Labour and childbirth

Place of delivery

Of the 374 women who delivered, 88.8% (332) delivered in hospital, 7.5% (28) delivered at home or on the way to hospital and the place of delivery was not specified for 3.7% (14) **(Table 8).**

Mode of delivery and delivery outcome

Of the 374 women who delivered, 63.2% (236) delivered vaginally (2% or 7 by AVD) and 36.9% (138) by C/S.

Of the 374 who died after childbirth, 50.5% (189) had a live birth, 33.2% (124) had a stillbirth and the delivery outcome was unspecified for 16.3% (61) **(Table 8)**.

60% (83) of those who had C/S had a live birth, 39% (54) had a stillbirth and the pregnancy outcome was unspecified for 1% (1).

Of the 236 who delivered vaginally, only 45% (106) had live births, 30% (70) had stillbirths and the delivery outcome was unspecified for 25% (60).

Table 8: Place of delivery, mode of delivery and pregnancy outcome (n=374)

Characteristic	Categories	Frequency	Percent
Place of delivery	Health Facility	332	88.7%
	Home	26	7%
	Born en route	2	0.5%
	Not specified	14	3.7%
Mode of Delivery	Vaginal Delivery	229	61.3%
	Assisted vaginal delivery	7	1.9%
	Caesarean section	138	36.9%
Pregnancy outcome	Live birth	189	50.5%
	Stillbirth	124	33.2%
	Not recorded	61	16.3%

Mode of delivery by timing of death

37.4% (181) of the MDs occurred in the post-partum period, 18.4% (89) were intrapartum deaths and the period of death was not specified for 21% (104) of MDs. 70.8% (63) of intrapartum deaths were delivered by caesarean sections and 70% (126) of post-partum deaths delivered vaginally **(Table 9)**.

Table 9: Mode of delivery by timing of Maternal Death

	Antepartum (GA 28 or more weeks and died undelivered)	Intrapartum (IP) n (%)	Postpartum (PP) n (%)	Not specified (IP or PP) n (%)	MDs <28 weeks gestation	Total
Vaginal delivery	N/A	23 (25.8%)	123 (68%)	83	N/A	229 (47.3%)
AVD	N/A	3 (3.4%)	3 (2%)	1	N/A	7 (1.4%)
C/S	N/A	63 (70.8%)	55 (30.4%)	20	N/A	138 (28.5%)
Undelivered	70 (14%)	N/A	N/A	N/A	N/A	70 (14.5%)
Not applicable	N/A	0		N/A	40 (8.3%)	40 (8.3%)
Total	70 (14%)	89 (18.4%)	181 (37.4%)	104 (21%)	40 (8.3%)	484 (100%)

Not applicable=deaths from pregnancies with abortive outcomes

Referral pattern

50% (242) of all maternal deaths were referrals from other health facilities. Of the 242 women who had been referred, 42.6% (103) were referred from level 4 health facilities, 9.9% (24) were referred from level 5 health facilities while 18.4% (44) of the women were referred from private/faith-based health facilities. 46.1% (223) of those who had been referred had been referred once 7% (17) were referred twice **(Table 10)**.

36.6% (38) of the referrals were due to complications arising from obstetric haemorrhage and 23.3% (24) due to non-obstetric complications. The main reasons for referrals were need for blood transfusion or specialised care such as dialysis and Intensive Care Unit (ICU).

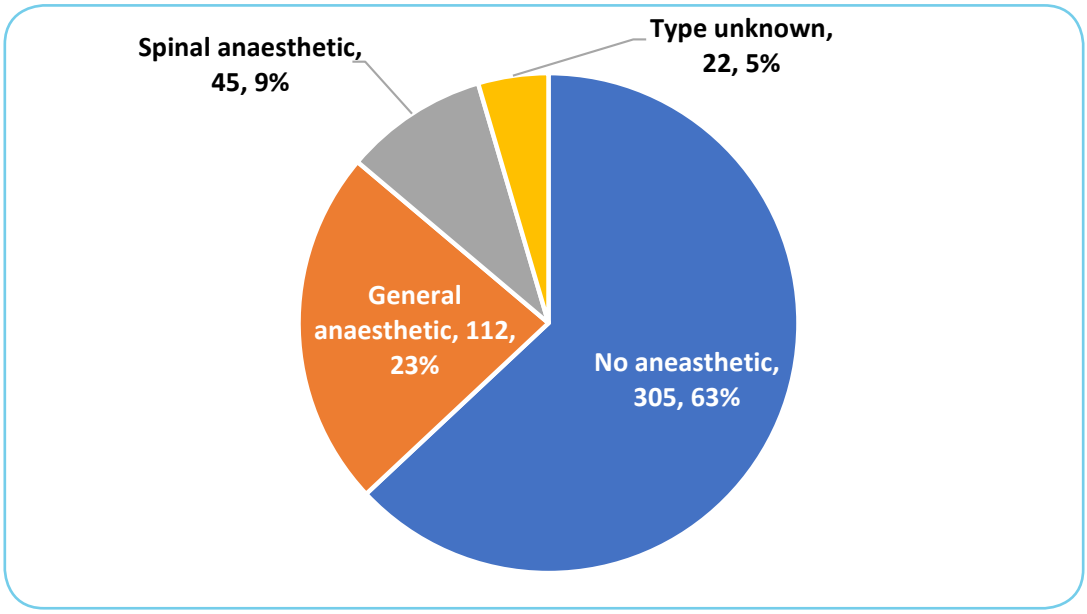
Table 10: Characteristics of referrals

Characteristic	Category	Frequency (Percent)
Level of referring facility **n=242**	Level 1	3(1.2)
	Level 2	20(8.3)
	Level 3	48(19.8)
	Level 4	103(42.6)
	Level 5	24(9.9)
	Private	44(18.2)
No. of prior referrals **N=484**	None	242(50.0)
	Once	223(46.1)
	Twice	17(3.5)
	Not recorded	2(0.4)

Use of anaesthesia

General anaesthesia was the most common type of anaesthesia used amongst women who died. 23% (112) of all women who died had general anaesthesia and 9% (45) had spinal anaesthesia **(Figure 7)** 28.5% (138) of women who died had caesarean section, 0.4% (2) had laparotomy for ectopic pregnancy while had 2.1% (10) had laparotomy for other indications.

Figure 7: Type of anaesthesia received by women who died in year 2014



Special circumstances

a. Women who had stillbirths

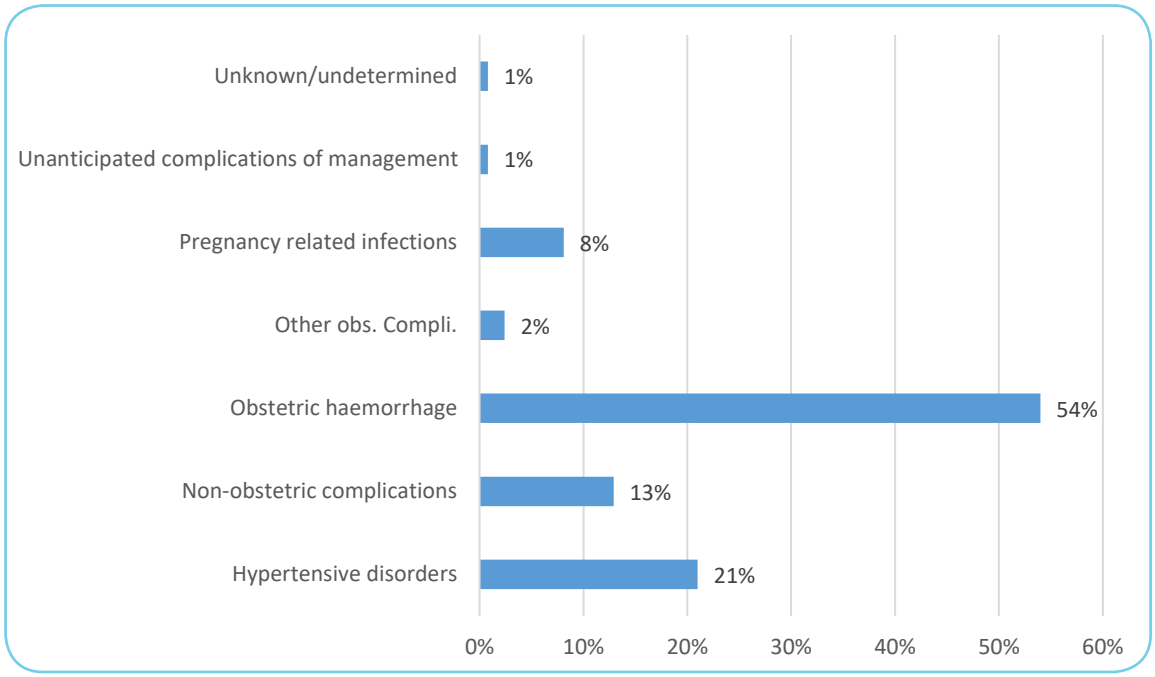
33.1% (124) of the women who died but delivered had a stillbirth. 33.1% (41) of the women who had stillbirths were aged 25-29 years and 22.6% (28) were aged 30-34 years. 42.8% (53) of them had had their first or second delivery.

Of the women who died and had stillbirths, 54% (67) died of obstetric haemorrhage (39% or 26: Obstetric trauma including ruptured uterus, 24% or 16: antepartum haemorrhage, 5% or 3: intrapartum haemorrhage and 33% or 22 post-partum haemorrhage) and 21% (26) died of hypertensive disorders in pregnancy, childbirth and the puerperium period **(Figure 8)**.

Over half of the women who had a stillbirth received antenatal care 58.1 (72), while 12.1% (15) women did not receive antenatal care; 29.8% (37) of the records did not show the ANC attendance. Among women who attended ANC, antenatal tests done were Rhesus tests 79.2% (57), Hb 75% (54) and VDRL 62.5% (45). Urinalysis tests was only reported for 19.4% (14) of the women. Records also showed that 48.4% (60) of the women were HIV negative, 9.7% (12) were positive while the HIV status was not recorded for 41.9% (52) of the women **(Annex 3a)**.

Over half 54% (67) of the women were referred to the hospital where they died. The referrals were from Level 4; 41.8% (28) and Level 3; 19.4% (13). Assessors concluded that 81% (100) of the women received suboptimal care were different management would have made a difference to the maternal outcome.

Figure 8: Percentage distribution of underlying cause of death among women who had stillbirths



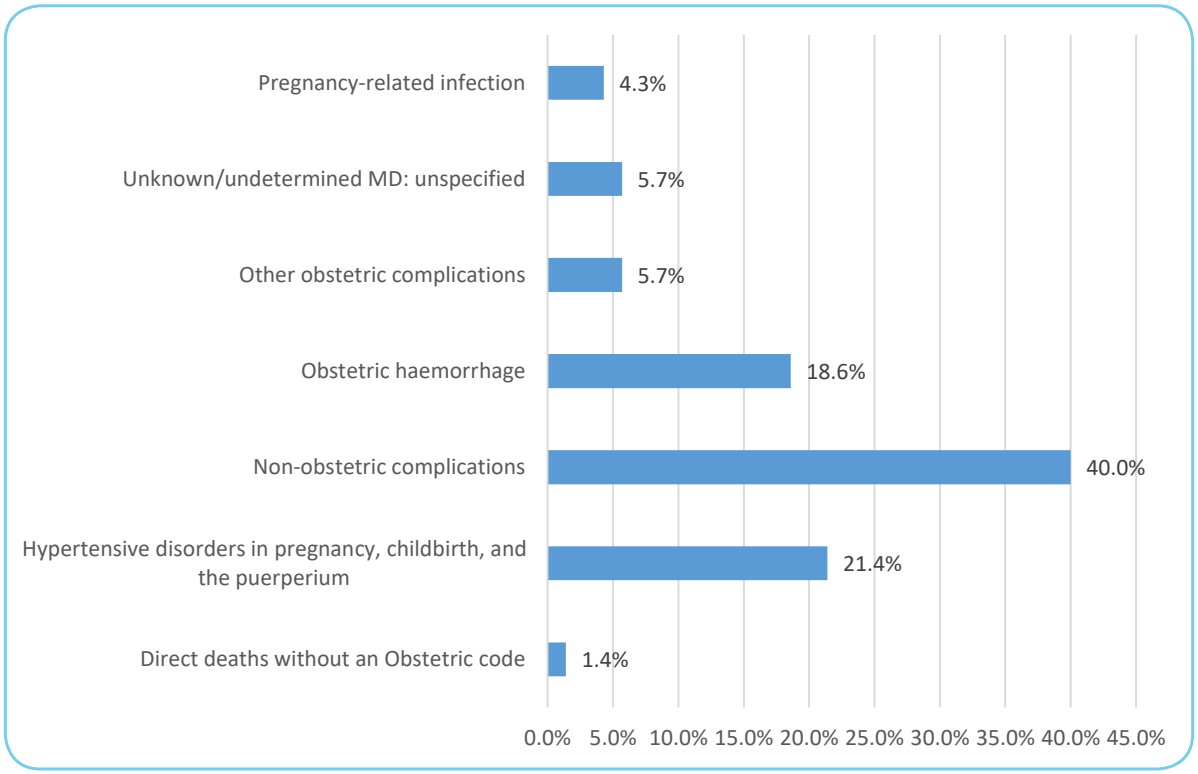
a. Women who died before childbirth (undelivered)

14.5% (70) of the women died before childbirth, 47.1% (33) were referred to the facility where they died. Most referrals were from Level 4; 15.7% (11) and Level 3; 8.6% (6) facilities. Only 6% (4) of women who died were less than 20 years and 57% (40) were 25-34 years old. Most women who died before child birth died of non-obstetric complications 40% (28), hypertensive disorders 21.4% (15) and obstetric haemorrhage 18.6% (13) **(Figure 9)**.

42.9% (30) of the women who died before childbirth received antenatal care, while 10% (7) women did not receive antenatal care; 47.1% (33) of them had no ANC records. Some antenatal tests done for those who received ANC include Rhesus tests 73% (22), HB 67% (20), VDRL 60% (18) and only 30% (9) had a urinalysis test **(Annex 3b)**.

Assessors concluded that 84.3% (59) of the women received suboptimal care where different management would have made a difference to the maternal outcome.

Figure 9: Percentage distribution of underlying cause of death among women who died before childbirth



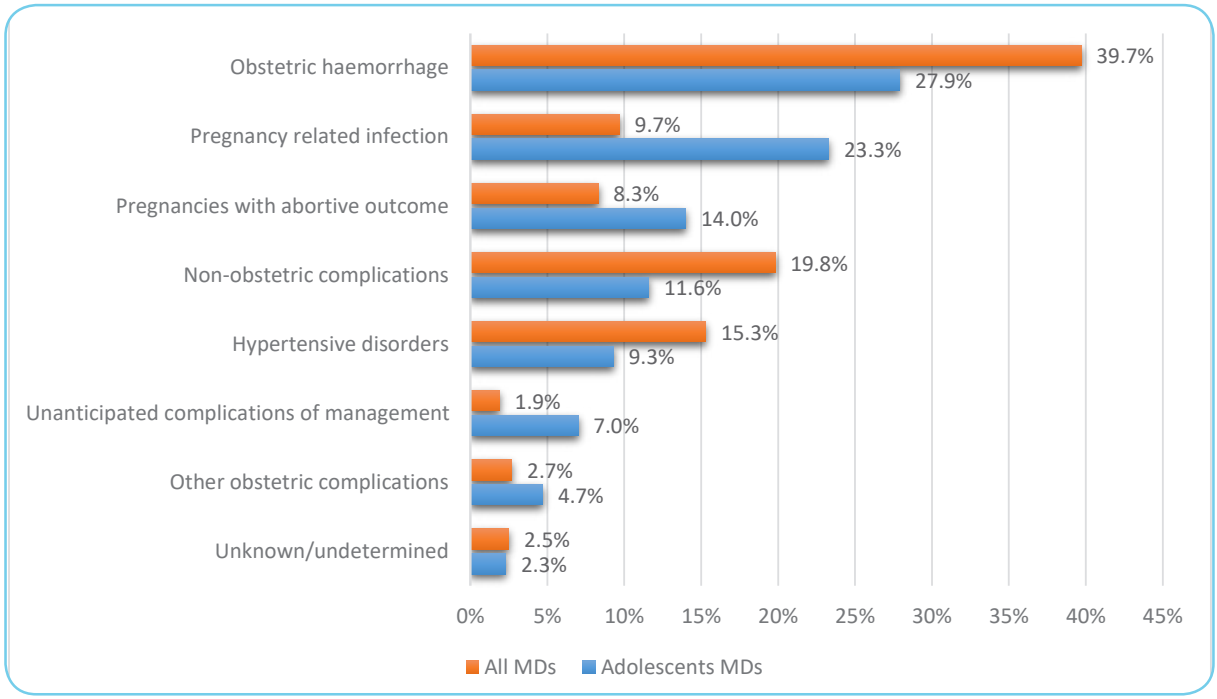
b. Maternal death among adolescents

8.9% (43) of the women who died were less than 20 years of age. 62.8% (27) of them were having their first and 20.9% (9) were having their second pregnancy. One of them was having her 4th pregnancy. 34.9% (15) of them attended antenatal care, 11.6% (5) were HIV positive while the HIV status of 67.4% (29) was not recorded.

37.2% (16) had live births, 25.6% (11) had stillbirths, 16.3% (7) had miscarriages and 16.3% (7) of the adolescents died before childbirth (undelivered). The pregnancy outcome of 4.7% (2) of the adolescents was not recorded. Four of the adolescents were delivered by unskilled attendants. Most 60.5% (26) of the adolescents were referred to the health facility where the death occurred.

81.4% (35) of the deaths in adolescents, were direct maternal deaths and 11.6% (5) were indirect maternal deaths. 27.9% (12) died of obstetric haemorrhage, **(Figure 10)**. Suboptimal care was reported by assessors for 38 (88%) adolescent mothers. Majority of the emergencies among adolescent mothers occurred during the postpartum period (48.8%), intrapartum period (32.6%) and early pregnancy (11.6%).

Figure 10: Underlying cause of death among adolescent compared to all MDs in 2014 (%)



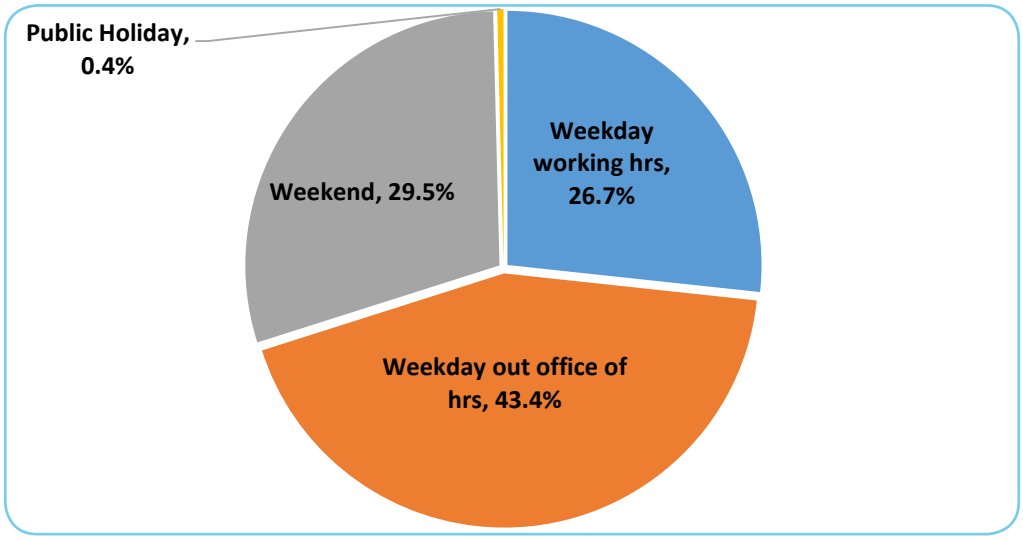
When compared to all MDs, more adolescents died from pregnancy-related infections and pregnancies with abortive outcomes **(Figure 10)**.

Quality of care

a. Time of death

Of the 484 deaths assessed, 210 (43.4%) occurred on weekdays out of normal working hours (5.00pm-8.00am), 143 (29.5%) occurred on the weekends, 129 (26.7%) occurred on weekdays working hours (8 am to 5 pm) and 2 (0.6%) occurred on public holidays. Cumulatively, **73.3% of the death occurred outside of working hours (Figure 11).**

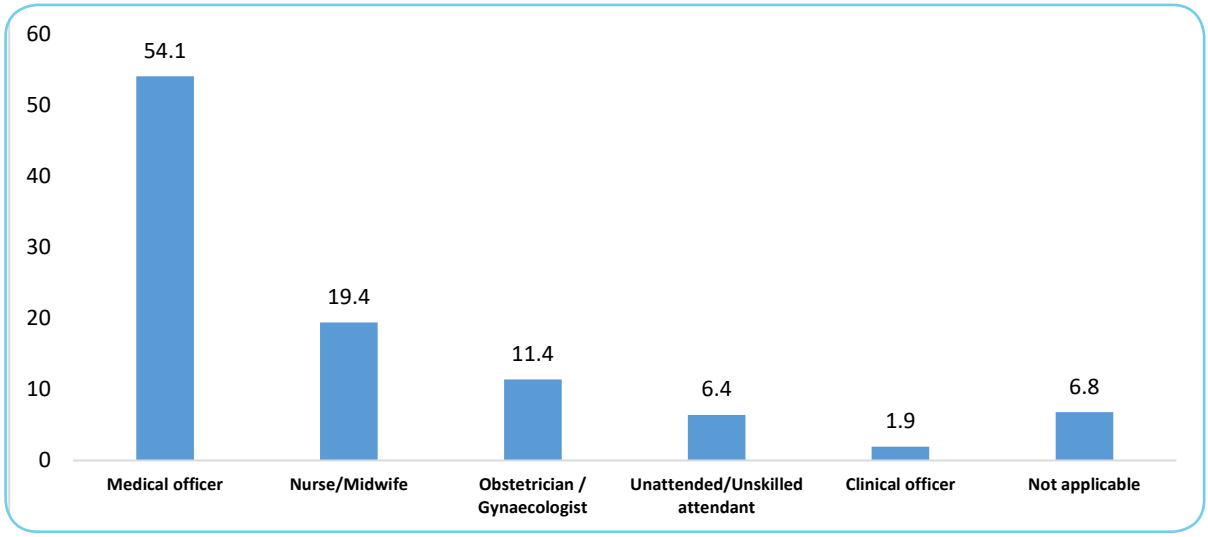
Figure 11: Period of death by working hours



b. Cadre of healthcare provider

The highest cadre of healthcare provider (HCP) involved in the management, at the facility where death was recorded were mostly medical officers 262 (54.1%). Obstetricians/Gynaecologists were only involved in the management of 55 (11.4%) women; 31 (6.4%) of the women were unattended or managed by unskilled healthcare providers **(Figure 12).**

Figure 12: Highest cadre of HCP involved in the management of women who died (%)



c. Associated factors

Key findings

- One or more associated factors were identified in 89.3% (432) maternal deaths.
- Health work force related factors were identified in 75.4% (365) maternal deaths.
- Delay in starting treatment, inadequate clinical skills and inadequate monitoring were the most frequently identified health workforce related factors.

- Incorrect management after correct diagnosis, infrequent monitoring, prolonged abnormal observation without action and problem with recognition/diagnosis were the most frequently identified gap across all levels of care except for the level 3 (health centre) where the most identified gaps were delay in referring to a higher level, managed at inappropriate level and inadequate initial assessment.
- Assessors concluded that 92.4% (447) of the women who died had received sub-standard care.

One or more associated factors were identified in 432 (89.3%) of women who died. Of the 484 deaths assessed, one or more health work force related factors were identified in 75.4% (365) of the women. One or more patient/family, administrative and community factors were identified in 42%, 35% and 6% of the deaths respectively. There was however no information that could have helped in the assessment of the presence or absence of community factors for 64.5% (312) of maternal deaths. It was also difficult to identify associated factors from case notes only especially if no community/family interviews were done. **Table 11** shows the summary of the associated factors identified.

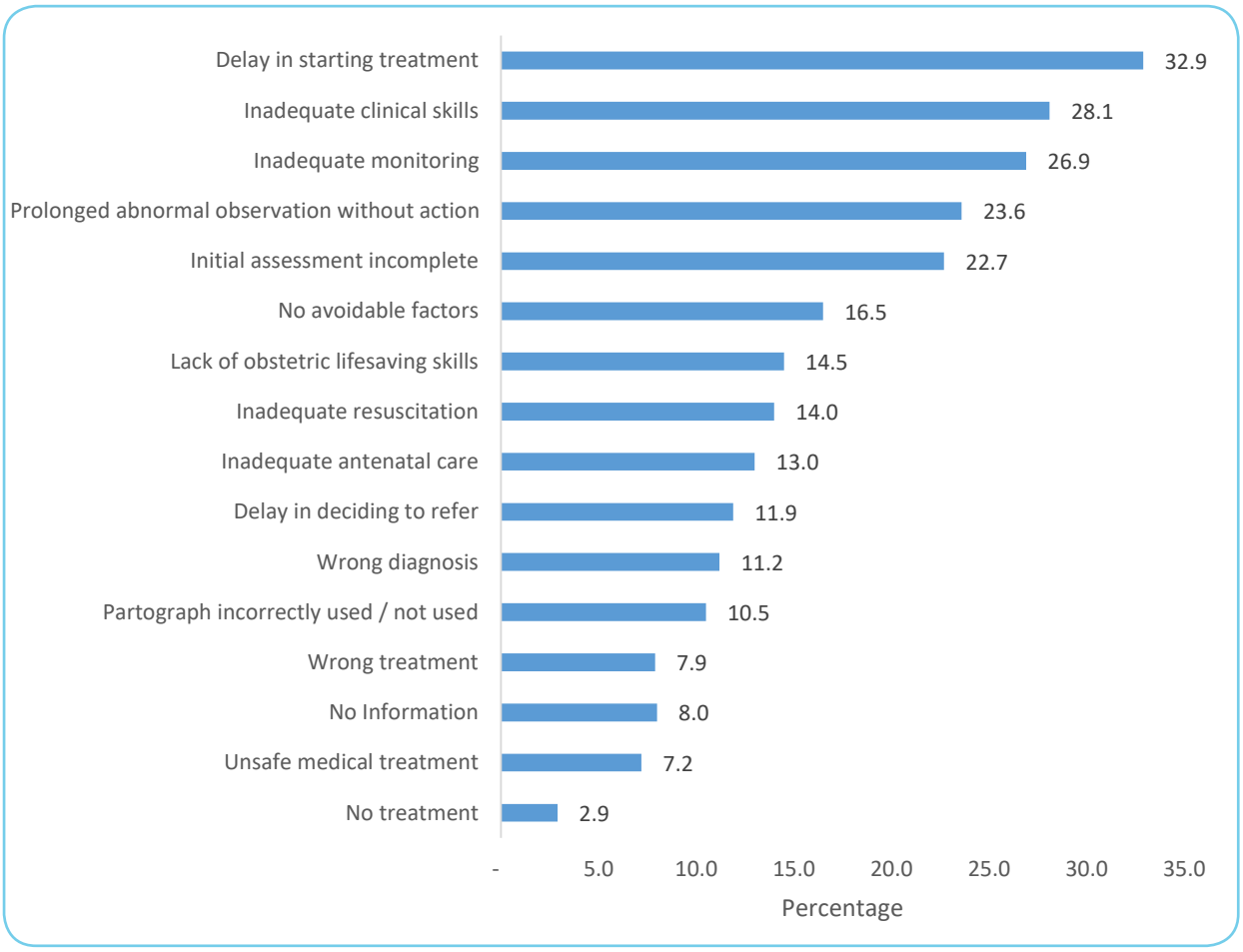
Table 11: Associated factors identified

Health worker factors	Frequency	Percent
One or more factors identified	365	75.4
No information	39	8.1
No factors identified	80	16.5
Administrative factors	**Frequency**	**Percent**
One or more factors identified	169	34.9
No information	131	27.1
No factors identified	184	38
Patient/family factors	**Frequency**	**Percent**
One or more factors identified	203	41.9
No information	149	30.8
No factors identified	132	27.3
Community factors	**Frequency**	**Percent**
One or more factors identified	29	6
No information	312	64.5
No factors identified	143	29.5
Total maternal deaths	484	

a. Health work force related factors

The main health workforce related factors identified were: delay in starting treatment 32.9% (159), inadequate clinical skills 28.1% (136), inadequate monitoring 26.9% (130), prolonged abnormal observation without action 23.6% (114) and incomplete initial assessment 22.7% (22.7) **(Figure 13)**.

Figure 13: Health workforce related factors



b. Administrative Factors

There was no information that could be used to identify presence or absence of administrative factors associated with the death in 27.1% (131) maternal deaths. Among the 353 cases in which information was available, 47.9% (169) had avoidable administrative factors to spur corrective action, no avoidable administrative factors were found in 52.1% (184) of the cases. **Table 12** shows a summary of the administrative factors identified.

Table 12: Summary of administrative factors identified

Administrative factors	Frequency	Percent (n=353)
Absence of trained staff on duty	44	12.5
Infrastructural problems	44	12.5
Lack of equipment for obstetric surgery	41	11.6
Lack of availability of blood transfusion	39	11.0
Lack of qualified staff	32	9.1
Transport problems between health facilities	13	3.7
Communication problem between health facilities	12	3.4
Lack of laboratory facilities	10	2.8

Administrative factors	Frequency	Percent (n=353)
Lack of antibiotics	9	2.5
Lack of uterotonic drugs	4	1.1
Lack of antihypertensive/anticonvulsants	4	1.1
Lack of equipment for MVA	1	0.3
Lack of equipment for AVD	1	0.3
No avoidable factors identified	184	52.1

c. Patient/family Factors

Of the 335 maternal deaths in which information was available, the 42.4% (142) of deaths were associated with delay in reporting to health facilities and delay in decision making 32.8% (110). There were no avoidable patient/family factors identified in 39.4% (132) of the deaths. **Table 13** shows the summary of the patient/family factors associated with all maternal deaths.

Table 13: Summary of patient/family factors

Patient/family factors	Frequency	Percent (n=335)
Delay in reporting to health facility	142	42.4
Delay in decision-making	110	32.8
No antenatal care	40	11.9
Unsafe traditional/cultural practices	25	7.5
Unsafe self-medication treatment	19	5.7
Use of traditional medical practice	13	3.9
Lack of transport from home to facility	2	0.6
No avoidable factors	132	39.4

Community factors

Community related factors were only assessed based on information available in patient case notes. Failure to recognise danger signs and delay in deciding to refer were the main community factors identified. There was no information that could be used to assess the presence of community factors in 64.5% (312) of the deaths. There were no avoidable community factors identified in 83% (143) of maternal deaths **(Table 14)**.

Table 14: Summary of community factors

Community factors	Frequency	Percent (n=172)
Failure to recognise danger signs	21	12.2
Delay in deciding to refer	19	11.0
Failure to accept limitations	4	2.3
Use of traditional medicine	3	1.7
No avoidable factors	143	83.1

d. Gaps noted in the care at different levels of health care

In identifying the gaps at the different levels of care, all the facilities that provided care (including the referring facilities) were considered.

e. Health facility levels where women received care

The 484 women who died received care at different levels of health care. Some had received care in more than one level of care. 50.8% (246) of women who died received care at county referral hospitals while 16.6% (82) of the women received care at private/faith-based health facilities **(Table 15)**.

Table 15: Levels of health care where women received care

Level of Care	Frequency	Percent (n=484)
Community	5	1.0
Dispensary	10	2.1
Health Centre	48	9.9
Sub-County Hospital	96	19.8
County Hospital	246	50.8
Secondary Referral Hospital	100	20.7
National Teaching and Referral Hospital	95	19.6
Private/faith-based	82	16.9

f. Gaps identified at National Teaching and Referral Hospital level

Table 16 shows a summary of the gaps identified at the National Teaching and Referral Hospitals. Of the 95 women who were managed at the National Teaching and Referral Hospitals, the major gaps identified included: incorrect management after making correct diagnosis 32.6% (31), prolonged abnormal observation without action 29.5% (28) and no/infrequent monitoring 22.1% (21). No avoidable factors were identified in 30.5% (29) of the cases.

Table 16: Gaps identified at National Teaching and Referral Hospital

Gaps identified	Frequency	Percent (n=95)
Incorrect management after making correct diagnosis	31	32.6
Prolonged abnormal observation noted but no action taken	28	29.5
No/infrequent monitoring	21	22.1
Lack of information	15	15.8
Problem with recognition/diagnosis	13	13.7
Incorrect diagnosis and management	8	8.4
Initial assessment	7	7.4
Managed at inappropriate level	1	1.1
No avoidable factors	29	30.5

g. Gaps identified at secondary referral hospital level

A total of 100 mothers received care at the secondary referral hospital. The major gaps identified at this level were: Incorrect management after making correct diagnosis: 54% (54), no/infrequent monitoring 45% (45) and prolonged abnormal observation without action 34% (34). There were no avoidable factors identified in 15% (15) of the cases **(Table 17)**.

Table 17: Gaps Identified at secondary referral hospitals

Gaps identified	Frequency	Percent (n=100)
Incorrect management after making correct diagnosis	54	54
No/infrequent monitoring	45	45
Prolonged abnormal observation noted but no action taken	34	34
Problem with recognition/diagnosis	20	20
Initial assessment	18	18
Incorrect diagnosis and management	15	15
Delay in referring the patient	8	8
Managed at inappropriate level	5	5
Lack of information	4	4
No avoidable factors	15	15

h. Gaps identified at county referral hospital level

A total of 50.8% (246) of the mothers who died received care at county referral hospitals. Of the 246, the main gaps identified were: Incorrect management after making correct diagnosis 44.3% (109), no/infrequent monitoring 33.7% (83) and prolonged abnormal observation without action 29.7% (73). There were no avoidable actors identified in 16.3% (40) of the cases **(Table 18)**.

Table 18: Gaps identified at the county referral hospitals

Gaps Identified at county referral hospitals	Frequency	Percent (n=246)
Incorrect management after making correct diagnosis	109	44.3
No/infrequent monitoring	83	33.7
Prolonged abnormal observation noted but no action taken	73	29.7
Problem with recognition/diagnosis	54	22
Initial assessment	49	19.9
Incorrect diagnosis and management	34	13.8
Lack of information	32	13
Delay in referring the patient	20	8.1
Managed at inappropriate level	8	3.3
No avoidable factors	40	16.3

i. Gaps identified at sub-county hospital level

Of the 19.8% (96) of the mothers who received care at the sub-county hospitals, the main gaps identified were: Incorrect management after making correct diagnosis 40.6% (39), prolonged abnormal

observation noted but no action taken 21.9% (21) and problem with recognition/diagnosis 21.9% (21). There were no avoidable factors identified in 15.6% (15) of the death **(Table 19)**.

Table 19: Gaps Identified at sub-County hospitals

Gaps identified at sub-county hospitals	Frequency	Percent (n=96)
Incorrect management after making correct diagnosis	39	40.6
Problem with recognition/diagnosis	21	21.9
Prolonged abnormal observation noted but no action taken	21	21.9
Lack of information	17	17.7
Initial assessment	16	16.7
No/infrequent monitoring	16	16.7
Delay in referring the patient	14	14.6
Incorrect diagnosis and management	11	11.5
Managed at inappropriate level	10	10.4
No avoidable factors	15	15.6

j. Gaps identified at health centre level

A total of 9.9% (48) of the mothers received care at health centres. Delays in referring the patients was the major gap identified 39.6% (19). Other significant gaps identified include managed at inappropriate level 25% (12) and incomplete initial assessment 16.7% (8). There was no information to assess the gaps at health centres in 29.2% (14) of the cases. No avoidable factors were identified in 16.7% (8) of the cases. **Table 20** shows a summary of the gaps identified at health centres.

Table 20: Gaps identified at health centres

Problem identified at health centres	Frequency	Percent (n=48)
Delay in referring the patient	19	39.6
Lack of information	14	29.2
Managed at inappropriate level	12	25.0
Initial assessment incomplete	8	16.7
Incorrect management after making correct diagnosis	7	14.6
Prolonged abnormal observation noted but no action taken	7	14.3
Problem with recognition/diagnosis	6	12.5
Incorrect diagnosis and management	6	12.5
No/infrequent monitoring	6	12.5
No avoidable factors	8	16.7

k. Gaps identified in private/faith-based health facilities

Of the 82 cases that received care in private/faith-based health facilities, the main gaps identified were: incorrect management (correct diagnosis made) for 32.9% (27) problem with recognition/diagnosis 23.2% (19) and incomplete initial assessment 19.5% (16). There was no information for assessment of the gaps in 20.7% (17) of the death. There were also no avoidable factors identified in 17 (20.7%) of the women who died **(Table 21)**.

Table 21: Gaps identified at private/faith-based health managed facilities

Gaps identified in private/faith-based health facilities	Frequency	Percent (n=82)
Incorrect management after making correct diagnosis	27	32.9
Problem with recognition/diagnosis	19	23.2
Lack of information	17	20.7
Initial assessment Incomplete	16	19.5
Prolonged abnormal observation noted but no action taken	14	17.1
No/infrequent monitoring	13	15.9
Delay in referring the patient	11	13.4
Incorrect diagnosis and management	11	13.4
Managed at inappropriate level	9	11
No avoidable factors	17	20.7

l. Contributory conditions

Assessors identified at least 3 contributory conditions per maternal death assessed. These are health conditions that are **unlikely** to cause death but may have contributed to the death. Conditions may be pre-existing or develop during the sequence of events leading to death. The most common contributory factors are presented in **Table 22.** The full list of contributory factors identified is presented in **Annex 4**.

Table 22: Most common contributory conditions identified

Contributory factors	Frequency	Percentage
Other complications of labour and delivery, not elsewhere classified	77	16.1
Prolonged labour	64	13.4
Complications following abortion, ectopic and molar pregnancy	56	11.7
Complications arising during caesarean section	47	9.9

m. Overall quality of care

Assessors made an overall assessment of quality of care provided to women who died in 2014 and found that 81.4% (394) women received suboptimal care where different management could have made a difference to the outcome. No suboptimal care was identified in the management of 7.6% (37) of women who died **(Table 23)**. Overall **92.4% (447)** of the women who died did not receive the highest quality of care.

n. Overall quality of care received by underlying cause of death

Ninety-one percent (175) of women who died of obstetric haemorrhage received suboptimal care where different management could have resulted in a different outcome. 22.9% (22) of maternal deaths due to non-obstetric complications had suboptimal care but this was not likely to have made a difference to the outcome **(Table 23)**.

Table 23: Overall quality of care received by underlying cause of death

Quality of care	Pregnancies with abortive outcome n (%)	Hypertensive disorders n (%)	Obstetric haemorrhage n (%)	Pregnancy- related infection n (%)	Other obstetric complications n (%)	Unanticipated complication of management n (%)	Non-obstetric complications n (%)	Unknown/ undetermined n (%)	Direct deaths without an Obstetric code n (%)	n (%)
No QoC issues identified	2(5.0)	7(9.5)	9(4.7)	6(12.8)	1(7.7)	1(11.1)	9(9.3)	2(16.7)	0(0)	37(7.6)
Suboptimal care but with no impact on outcome	7(17.5)	8(10.8)	8(4.2)	6(12.8)	1(7.7)	0(0)	22(22.9)	1(8.3)	0(0)	53 (11.0)
Suboptimal care with possible impact on outcome	25(62.5)	41(55.4)	92(47.9)	21(44.7)	4(30.8)	5(55.6)	45(46.9)	6(50)	1(100)	240 (49.6)
Suboptimal care with probable impact on outcome	6(15.0)	18(24.3)	83(43.2)	14(29.8)	7(53.8)	3(33.3)	20(20.8)	3(25)	0(0)	154 (31.8)
Total	40 (8.3)	74(15.3)	192(39.7)	47(9.7)	13(2.7)	9(1.9)	96(19.8)	12(2.5)	1(0.2)	484(100)

Chapter 4

Group 1: Pregnancy with abortive outcomes

Key findings

- 8.3% (40) of all 2014 maternal death assessed were due to pregnancies with abortive complications.
- **20% (8)** MDs were due to induced abortion, **12.5% (8)** spontaneous abortion, **5% (2)** ectopic pregnancy and **2.5% (1)** hydatidiform mole.
- **14%** of deaths amongst adolescents were due to pregnancies with an abortive outcome compared to **8.3%** in all women who died in 2014.
- **35% (14)** were aged 25-29 years; and **35% (14)** of the women were either having their first or second pregnancy **17.5% (7)**.
- There was poor documentation of treatment for pregnancies due to abortive outcome, the main treatment was not specified for **70% (28)** MDs in this group.

Referral pattern

- **55% (22)** of the women were referred from another health facility.

Antenatal care

- **77.5% (31)** of women did not have documentation of antenatal care attendance in their files/case notes; while **22.5% (9)** did not attend antenatal care.

Quality of care

- Sub-standard care was noted in almost **8 out of 10 women** who died of pregnancy with abortive outcomes.
- The most common administrative associated factors identified were lack of availability of blood transfusion **15% (6),** absence of trained staff on duty **7.5% (3)** and lack of equipment for surgery **5% (2)**.
- The most common patient/family factor was delay in reporting to the health facility **45% (18%),** delay in decision making **32.5% (13)** and unsafe self-medication treatment **22.5% (9).**
- Most of the women who died of pregnancy with abortive outcomes were managed by medical officers **55% (22),** clinical officers **7.5% (3)** and obstetrician/gynaecologist **7.5% (3).**

Introduction

In Kenya, abortion is defined as the termination of pregnancy less than 28 weeks of gestation[1].

8.3% (40) of all 2014 maternal deaths assessed were due to pregnancies with abortive complications. 60% (24) of the deaths in this category were due to unspecified abortion. There was poor documentation of treatment for pregnancies due to abortive outcome, the main treatment was not specified for 70% (28) MDs in this group **(Table 24)**.

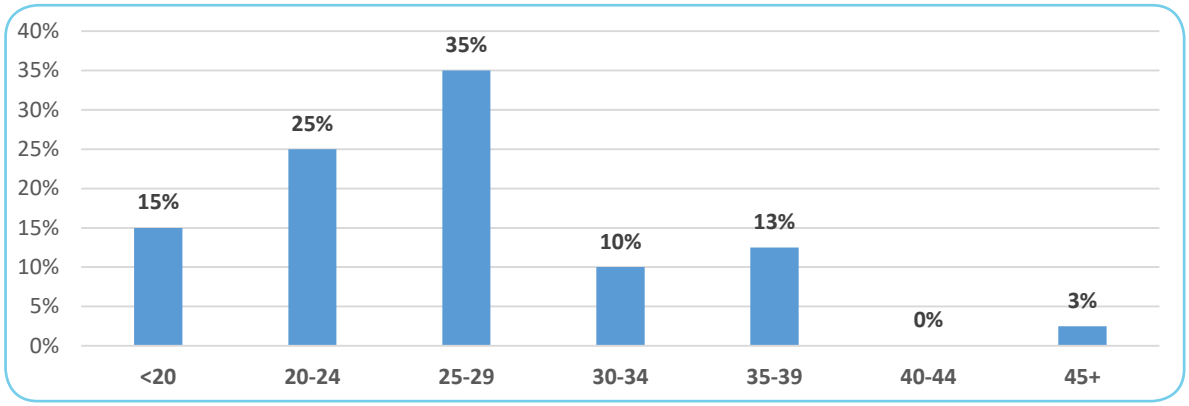
Table 24: Maternal death due to pregnancy with abortive outcomes

Underlying Cause	Uterine evacuation	No uterine evacuation or surgery	Not specified	Total
Ectopic pregnancy	-	1	1	2 (5%)
Hydatidiform mole			1	1 (2.5%)
Induced abortion		3	5	8 (20%)
Spontaneous abortion	2		3	5 (12.5%)
Unspecified abortion	5	1	18	24 (60%)
Total	7 (17.5%)	5 (12.5%)	28 (70%)	40 (100%)

Characteristics of women who died

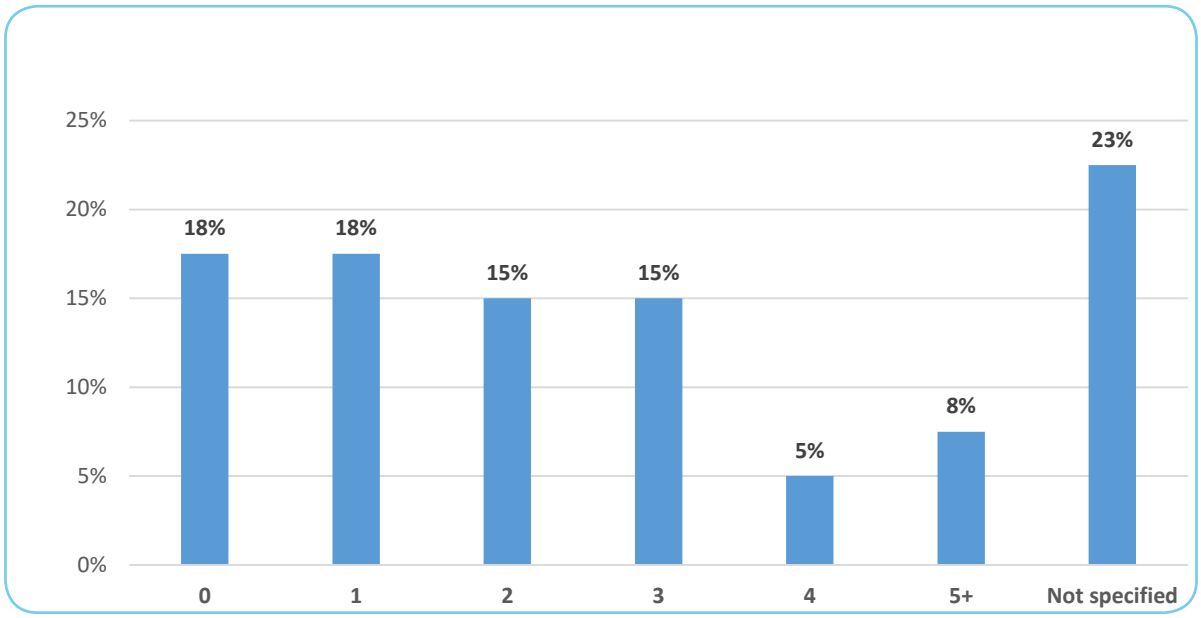
Of the 40 women who died of pregnancy with abortive outcomes, 35% (14) were aged 25-29 years while 15% (6) of the women were below 20 years, one woman was over 45 years **(Figure 14)**. 36% (14) of the women were either having their first or second pregnancy. Parity was not recorded in a quarter of MDs **(Figure 15)**.

Figure 14: Percentage age distribution of women who died from pregnancies with abortive outcomes (n=40)



1 Ministry of Public Health and Sanitation, and Ministry of Medical Services National Guidelines for Quality Obstetric and Perinatal Care, accessed online on 12 April 2017, at https://www.k4health.org/sites/default/files/National%20Guidelines%20for%20Quality%20Obstetrics%20and%20Perinatal%20Care.pdf.

Figure 15: Percentage parity distribution of women who died from pregnancies with abortive outcomes (n=40)



Antenatal care attendance and HIV status

While Assessors did not find documentation of the women's ANC attendance in most case notes 77.5% (31); there was documentation showing that 22.5% (9) of the women did not attend ANC.

The HIV status of women who died from pregnancy with abortive outcomes was also not recorded in the case notes of 82.5% (33) women; for those whose records were available, 17.5% (7) women were HIV negative.

Quality of care

a. Highest cadre of health worker involved in management

Most of the women who died of pregnancy with abortive outcomes were managed by medical officers 55% (22), clinical officers 7.5% (3) and obstetrician/gynaecologist 7.5% (3). Majority of the deaths occurred at county referral hospitals 32.5% (13) and National Teaching/Referral Hospitals 35% (14); 55% (22) of the women were referred from another health facility.

Associated factors

Health worker factors

The most common health worker associated factors identified with pregnancies with abortive outcome maternal deaths was inadequate clinical skills 32.5% (13), delay in starting treatment 27.5% (11) and inadequate monitoring 25% (10) **(Table 25)**.

Table 25: Health worker associated factors identified

Health worker associated factors	Pregnancies with abortive outcome (n=40)	
	Frequency	Percent
Inadequate clinical skills	13	32.5
Delay in starting treatment	11	27.5
Inadequate monitoring	10	25
Initial assessment incomplete	9	22.5
Prolonged abnormal observation without action	9	22.5
Inadequate resuscitation	7	17.5
Inadequate antenatal care	4	10
Delay in deciding to refer	4	10
Unsafe medical treatment	4	10
Lack of obstetric lifesaving skills	2	5
No information	2	5
Wrong diagnosis	1	2.5
Wrong treatment	1	2.5
No treatment	1	2.5
No avoidable factors	12	30

Administrative factors

No avoidable administrative factor was identified in half of maternal deaths from pregnancies with abortive outcomes. Lack of availability of blood transfusion 15% (6) and absence of trained staff on duty 7.5% (3) and lack of equipment for surgery 5% (2) were found to be associated with maternal deaths **(Table 26)**.

Table 26: Summary of administrative factors identified

Administrative Factor	Pregnancies with abortive outcome (n=40)	
	Frequency	Percent
Lack of availability of blood transfusion	6	15
Lack of qualified staff	3	7.5
Absence of trained staff on duty	3	7.5
Lack of equipment for obstetric surgery	2	5
Lack of antibiotics	1	2.5
Lack of equipment for MVA	1	2.5
Lack of laboratory facilities	1	2.5
No information	6	15
No avoidable factors	20	50

Patient/family factors

Patient/family factors that were identified among women who died of complications due to abortive outcomes were; delay in reporting to the health facility 45% (18%), delay in decision making 32.5% (13) and unsafe self-medication treatment 22.5% (9) **(Table 27)**.

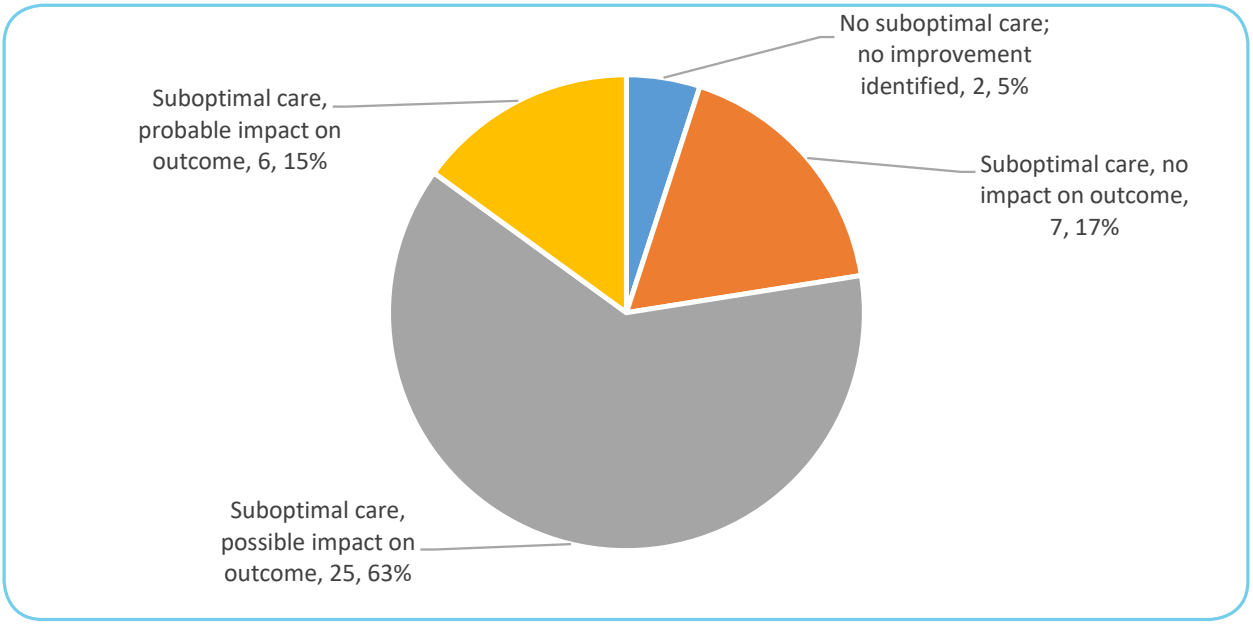
Table 27: Summary of patient/family factors

Patient/family factors	Pregnancies with abortive outcome (n=40)	
	Frequency	Percent
Delay in reporting to health facility	18	45.0
Delay in decision-making	13	32.5
Unsafe self-medication treatment	9	22.5
Unsafe traditional/cultural practices	6	15.0
No antenatal care	5	12.5
Use of traditional medical practice	2	5.0
No information	9	22.5
No avoidable factors	3	7.5

a. Overall assessment of quality of care

Assessors concluded that 77.5% (31) of the women who died of complications due to abortion received suboptimal care where different management **may have** made a difference to the outcome. No quality of care issues were identified for 5% (2) of MDs from pregnancies with abortive outcomes. **(Figure 16)**.

Figure 16: Suboptimal care among women who died of pregnancy with abortive outcomes



Discussion

Twenty percent (8) of the MDs were due to induced abortions and the specific cause of death was not provided for 60% (24) of the MDs. According to the 2008/09 KDHS, unsafe abortion is the leading cause of maternal mortality in Kenya. WHO in 2008 estimated a higher proportion of maternal deaths in East Africa due to unsafe abortion compared to the 20% found in this enquiry.

The results of this report indicate that younger women and women of low parity are dying from abortion and its complications. This is in line with KDHS (2014) report where maternal mortality is higher at the peak childbearing ages (20s and 30s). According to the Australian Report on Pregnancy Outcomes, the

highest abortion rate is seen among women aged 20-24 years followed by teenage women 15-19 years (Chan et al, 2006). Similar findings in age group was noted in a study done by Mohamed et al (2015) in Kenya, where higher rates of induced abortion were found to occur within the age group 20-24 years.

Majority of deaths from abortive outcomes occurred at county and national teaching/referral hospitals. These facilities are expected to be well equipped and have adequate resources to handle emergencies.

Sub-standard care where different management was likely to would have made a difference to the outcome was seen in 31 (77.5%) of the cases **(Vignettes 1-4: Pregnancy with abortive complications).**

Case summaries by assessors based on patients' records show that majority of patients report late to health facilities with complications arising from unsafe abortion, sometimes delay in seeking health care for up to 10 days. As seen from abortive complications cases 1-4, women report to the health facility when they have already developed complications such as infection and are in shock due to excess bleeding. The correct management protocol is also not followed such as early involvement of senior doctors, starting broad spectrum parenteral antibiotics, blood transfusion and evacuation under general anaesthesia for septic incomplete abortion.

Vignette 1: Pregnancy with abortive complications case 1

Abortive complications 1:

A 21-year-old Para 1+0 G 3, GA 20 weeks admitted from home with a history of bleeding per vagina and lower abdominal pains for one day. On examination, she was hemodynamically stable, she had a tender abdomen with a fundal height of 12 weeks and on vaginal examination, the cervix was open and blood clots were found in the vaginal and at the os. A diagnosis of inevitable abortion was made and she was started on 20 iu of syntocinon, IV Ceftriaxone, IV Metronidazole, and tramadol. Patient also investigated for Malaria parasites which was negative and Hb which was 5g/dl. A few hours later, a repeat speculum examination was carried out, that showed a prolapsing cord. A second dose of syntocinon 20 iu was set up and regular vital signs observations continued.

On day 2 she was found to be severely pale during Doctors Ward round, was tachypnoeic, and Glasgow Coma Scale was 10/15. On VE cord not pulsating and fresh blood clots from the vagina. A higher dose of IV syntocinon 40iu in normal saline was started again and a second dose of 40 iu repeated 1 hour later after which patient expelled a foetus but started bleeding profusely. Manual vacuum aspiration was done to remove retained products of conception. The patient was now sick looking, severely pale, cold extremities and Blood pressure was 77/35 mmHg. Cervix was 7 cm dilated, uterus not contracted and active bleeding from the cervical os. A medical officer reviewed patient and ordered 3 units of blood transfusion, in addition to the one she was having. She was continued IV fluids, oxygen and she had repeat MVA to continue until there were no products of conception. Bleeding continued despite above measures.

Senior doctor consulted and instructed that bimanual compression of uterus should be carried out as well as administration of 600mcg of misoprostol rectally. But she collapsed and died shortly afterwards.

Assessors identified gaps in the quality of care provided and concluded that a different management approach will have had a better outcome. Specifically, they noted the wrong assessment of the patient on admission (haemodynamically stable but Hb or 5g/dl, with history of active bleeding), the patient will have benefited from review by a senior team member on admission, adequate blood transfusion and uterine evacuation under general anaesthesia. Poor assessment, wrong management approach, including a delay in contacting a senior physician were factors associated with this MD.

Vignette 2: Pregnancy with abortive complications case 2

Abortive complications 2:

A 35-year old Para 6+0, G 7, GA 8 weeks, was admitted with vaginal bleeding for 2 days at home. On examination, she was in shock, there was vaginal bleeding, a foul-smelling discharge and products of conception in situ. A diagnosis of incomplete septic abortion was made. MVA was done she was started on treatment which included: IV ceftriaxone, IV metronidazole and diclofenac. One hour after admission, condition deteriorated, she was severely pale, her BP=72/36mmhg, blood transfusion was commenced. However, her BP became un-recordable, resuscitation attempts were unsuccessful and she died shortly after wards.

The Assessors concluded that there was sub-standard care and that the outcome may have been different if another management approach was used. Assessors also acknowledged that earlier presentation may have made a difference but the correct treatment protocol for septic incomplete abortion was not followed. Adequate resuscitation including blood transfusion, parenteral antibiotics and followed by uterine evaluated by an experienced physician under anaesthesia may have made a difference in the outcome.

Vignette 3: Pregnancy with abortive complications case 3

Abortive complications 3:

An 18-year-old at GA 16 weeks presented in a private health facility as a referral from a primary level facility. She complained of vaginal bleeding for 10 days. On examination, she was fully conscious though in respiratory distress, saturating at 78%, pulse rate 130 beats per minute and blood pressure 70/50 mmHg. She was given 2 litres of intra venous fluids over 20minutes and oxygen 10 litres/min after which oxygen saturation picked up to 100%. On abdominal examination, there was a tender and non-firm mass of about 20 weeks. Speculum exam showed active bleeding with products of conception in cervical OS which the doctor attempted to remove with a ring forceps. Ultrasound showed a bulky uterus with heterogeneity and a diagnosis of retained products of conception was made.

A decision was then made to take patient to theatre for dilatation and curettage and 5 units of type specific and crossed blood prepared. After a period of 12 hours' patient was taken to operating room and a decision was made do an explorative laparotomy with possible hysterectomy. Intraoperatively, patient had cardiac arrest 6 times. Upon opening the uterus, patient was found to have overwhelming sepsis. After the sixth cardiac arrest CPR was undertaken and continued for 25 minutes. No cardiac rhythm was established and there was systole. Patient was pronounced dead and skin and fascia closed.

Assessors found gaps in the quality of care provided but acknowledged a delay in the patient seeking care. The patient was resuscitated as per protocol but documentation did not show assessment for sepsis. If the patient had sepsis on admission, administration of broad spectrum parenteral antibiotics, adequate blood transfusion prior to exploratory laparotomy may have made a difference in the outcome.

Vignette 4: Pregnancy with abortive complications case 4

Abortive complications 4:

A 20-year-old Para 1+0, G2 was admitted to the hospital at 16 weeks' gestation as a referral from a level 4 facility with vaginal bleeding and lower abdominal pains. She had been attended in a private clinic for backache and lower abdominal pains, and given herbal medication both orally and per vagina after which she developed PV bleeding.

She was then taken to a level 4 facility. On admission, she was confused, still bleeding, mildly Jaundiced, B.P 110/70mmHg, on abdominal examination her fundal height 21 weeks and no foetal heart sounds were heard and her HB was 12.3g/dl. She was admitted for 1 day and managed with misoprostol (which failed) and Metronidazole.

She was then referred to the level 6 facility due to acute liver failure? Hepatic encephalopathy for intensive care in the high dependency unit (HDU)/intensive care unit (ICU). Patient was seen 12 hours later in casualty and was sick looking, severely jaundiced, Glasgow Coma Scale 13/15, abdomen distended, tender and fundal height of 18/40 weeks. On vaginal examination, cervix was 2cm dilated and some hard-foreign bodies were removed form cervical os, actively bleeding (dark blood) which was foul smelling.

A diagnosis multiple organ failure due to septic abortion was made. Patient reviewed by ICU doctor and started on blood transfusion, warm saline, misoprostol 400mg per rectum, antibiotics and oxygen, while awaiting ICU bed for intubation and ventilator support. Patient later intubated in casualty 21 hours after admission and started on ventilator support but 3 hours later patient develops cardiopulmonary arrest, resuscitation attempted but not successful. Patient confirmed dead.

Assessors found gaps in the quality of care provide. Referral to the level 6 hospitals could have been earlier.

Recommendations

1. Policy level and county level

a. There is need to expand access to Post Abortion Care (PAC) services at the referral hospital level (3-6).

b. Develop and implement strategies to reduce unmet need for family planning and increase contraceptive prevalence rate.

2. Health facility level

a. Improve capacity for early and accurate diagnosis, and adherence to treatment protocols.

b. Senior medical doctors should be involved early in the management of complications with abortive outcomes.

c. Equip facilities to be able to provide safe abortion services.

3. Community level

a. Education and awareness on dangers of unsafe abortion, importance of seeking health care early. These should also be highlighted in health messages targeting adolescents and young people.

Conclusion

Maternal deaths arising from pregnancy with abortive outcomes affects mostly younger women in Kenya. Sub-standard care was noted in almost **8 out of 10** women who died of pregnancy with abortive outcomes. The capacity of the health providers in post abortion care needs to be enhanced so that appropriate diagnosis, prompt treatment based on evidence-based guidelines and early involvement of senior medical doctors is in place for all cases. Comprehensive post abortion care with community involvement, improving primary prevention and encouraging early presentation will further reduce the risk of death from complications of abortion.

Chapter 5

Group 2: Hypertensive disorders in pregnancy, childbirth and the puerperium

Key findings

- **15.3% (74)** of maternal deaths were due to hypertensive disorders in pregnancy.
- **78.4% (58)** of maternal deaths from hypertensive disorders, were due to eclampsia.
- **36.5% (27)** of the women who died of hypertensive disorders were aged 25-29 years.
- **31.1% (23)** of the women were having their first pregnancy.
- **20.3% (15)** of the women who died of hypertensive disorders were undelivered and **1.4% (1)** had an ectopic pregnancy.

Referral pattern

- **48.6% (36)** of women who died from hypertensive disorders were referred from other health facilities while **51.4% (38)** died at their point of first admission. About **38% (28)** of the women died at the county referral hospital (level 5).

Antenatal Care

- **76.5% (36)** of women who died had received antenatal care and **23.4% (11)** did not.
- Only **27.8% (10)** of those who had ANC had urine analysis tests.

Mode of delivery and delivery outcome

- Of the **58** women who had given birth but died, **43% (25)** had unassisted vaginal delivery, **34.5% (20)** had a caesarean section, only one had assisted vaginal delivery **(1.7%),** and the mode of delivery was not recorded for **20.6% (12).**
- **35.1% (26)** of the women who died of hypertensive disorders had stillbirths and **41.9% (32)** of the women had a live birth.

Quality of care

- For **58.1% (43)** of maternal deaths, medical officers were the highest cadre involved in the management of the case. Obstetricians were only involved in management of **16.3% (12)** of deaths from hypertensive disorders.
- Assessors concluded that only **79.7% (59)** of the women who died received suboptimal care and that a different management may have made a difference to the outcome.

- Assessors also concluded that **9.5% (7)** of the women who died received optimal care and no improvements in the quality of care provided were identified.

Introduction

15.3% (74) of all maternal deaths that occurred in the year 2014 were due to hypertensive disorders in pregnancy, childbirth and the puerperium period.

Among the different hypertensive disorders, 78.4% (58) of the deaths were due to eclampsia and 20.3% (15) were due to pre-eclampsia **(Table 28)**.

Table 28: Causes of maternal death for women who died from hypertensive disorders of pregnancy, childbirth and the puerperium

Complication	Frequency	Percent (n=74)
Eclampsia	58	78.4
Pre-eclampsia	15	20.3
Pre-eclampsia superimposed on chronic hypertension	1	1.4

Characteristics of women who died from hypertensive disorders

36.5% (27) of the women who died of hypertensive disorders were aged 25 years **(Figure 17)** and 31.1% (23) of them were having their first pregnancy **(Figure 18)**.

Figure 17: Age distribution of women who died from hypertensive disorders

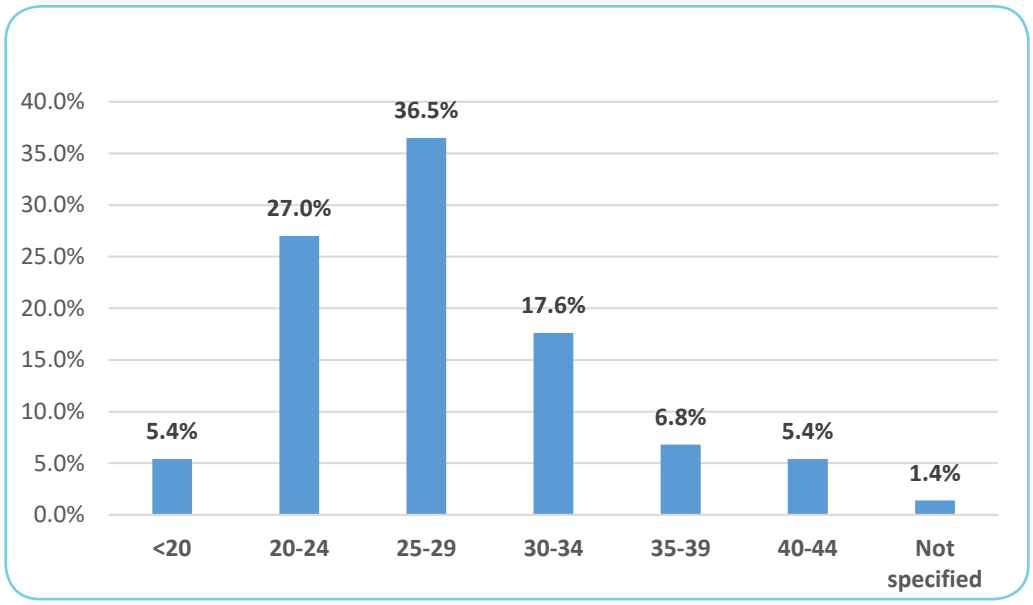
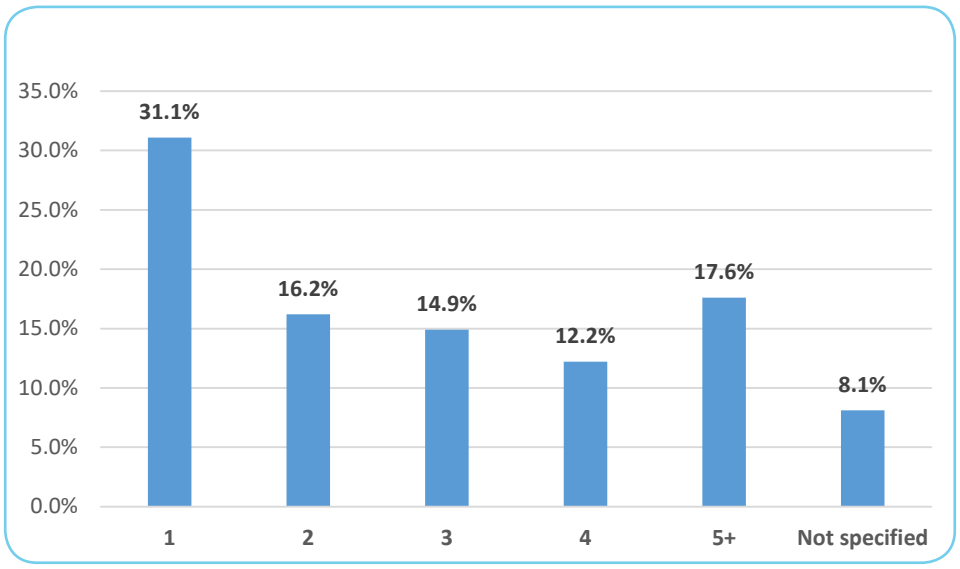


Figure 18: Parity distribution of women who died from hypertensive disorders



Antenatal attendance

The ANC records were available for review in the case notes of only 64% (47) of women who died from hypertensive disorders of pregnancy. Of these 76.5% (36) received ante natal care and 23.4% (11) did not. Of those who had ANC, only 27.8% (10) had urinalysis test results.

HIV status

The HIV status of 51.4% (38) of the women was negative, 2.7% (2) were HIV positive and there was no record on the HIV status of 45.9% (34) of the women.

Pregnancy outcome

Twenty percent (15) of the women who died of hypertensive disorders were undelivered and 1.4% (1) had an ectopic pregnancy (died of a cardiovascular accident after surgery). Of the 58 women who gave birth, 35.1% (26) had stillbirths and 41.9% (32) of the women had a live birth.

Labour and childbirth

Mode of delivery

Of the 58 women who had given birth but died, 43% (25) had unassisted vaginal delivery, 34.5% (20) had a caesarean section, only one had assisted vaginal delivery (1.7%), and the mode of delivery was not recorded for 20.6% (12).

Place of childbirth

Almost all women (59.4% or 44) who died due to hypertensives disorders delivered in hospital, only 1.4% (1) delivered at home. There was good opportunity for good quality care for most women who died.

About 19% (14) of the women who died of hypertensive disorders and delivered, were at the county referral hospital (level 4) and 13.5% (10) at the secondary referral hospital (level 5).

Referral and place of death

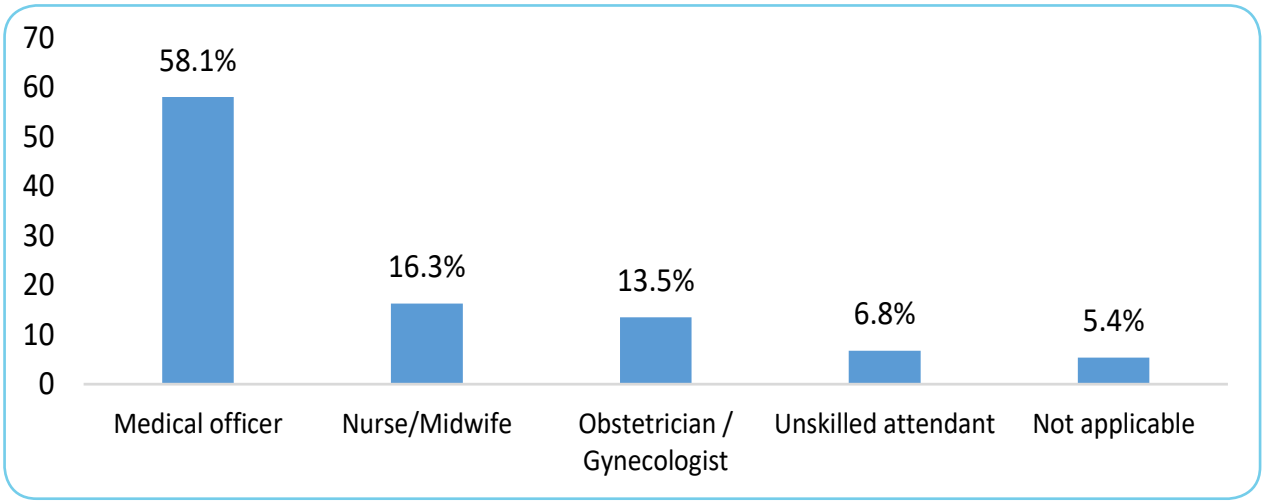
Several levels of referral hospitals were included in the sample and these hospitals should have the capacity to provide comprehensive emergency obstetric care services. However, 48.6% (36) of women who died from hypertensive disorders were referred from other health facilities while 51.4% (38) died at their point of first admission. About 38% of women died at the county referral hospital, 25.7% (19) at the National Teaching and Referral Hospital, 17.6% (13) at a secondary referral hospital, 12.2% (9) at private/faith-based hospitals and 6.8% (5) at sub-county hospitals.

Quality of care

a. Highest cadre of health worker involved in management

Medical officers were the highest cadre involved in the management of 58.1% (43) of women who died of hypertensive disorders. Obstetricians were involved in 13.5% (10) and nurses/midwives were involved in 16.3% (12) **(Figure 19**).

Figure 19: Highest cadre of healthcare worker that managed women who died of hypertensive disorders



b. Associated factors

Health worker factors

The most common healthcare worker associated factors identified were delay in starting treatment (36.5% or 27), initial assessment (31.1% or 23) and inadequate monitoring (31.1% or 23) **(Table 29).**

Table 29: Health worker associated factors identified

Health worker associated factors	Hypertensive disorders in pregnancy, childbirth, and the puerperium	
	n=74	Percent
Delay in starting treatment	27	36.5
Prolonged abnormal observation without action	24	32.4
Initial assessment incomplete	23	31.1
Inadequate monitoring	23	31.1
Inadequate clinical skills	18	24.3
Delay in deciding to refer	16	21.6
Lack of obstetric lifesaving skills	15	20.3
Incorrect management after making correct diagnosis	14	18.9
Inadequate antenatal care	13	17.6
Inadequate resuscitation	12	16.2
Incorrect diagnosis and management	12	16.2
Partograph incorrectly/not used	7	9.5
Unsafe medical treatment	5	6.8
No treatment	1	1.4
No information	1	1.4
No avoidable factors	14	18.9

Administrative factors

Administrative factors associated with women who died of hypertensive disorders that were identified included; lack of equipment for obstetric surgery (14.9% (11), absence of trained staff on duty 8.1% (6) and poor communication between healthcare facilities 6.8% (5) **(Table 30)**.

Table 30: Summary of administrative factors identified

Administrative Factor	Hypertensive disorders in pregnancy, childbirth, and the puerperium	
	n=74	Percent
Lack of equipment for obstetric surgery	11	14.9
Absence of trained staff on duty	6	8.1
Communication problem between health facilities	5	6.8
Lack of antihypertensive/anticonvulsants	3	4.1
Lack of laboratory facilities	2	2.7
Transport problems between health facilities	2	2.7
Lack of qualified staff	2	2.7
Lack of antibiotics	1	1.4
Lack of uterotonic drugs	1	1.4
No information	16	21.6
No avoidable factors	29	39.2

Patient/family factors

The patient/family associated factors identified were delay in reporting to healthcare facility 27% (20), and delay in decision-making 25.7% (19) **(Table 31)**.

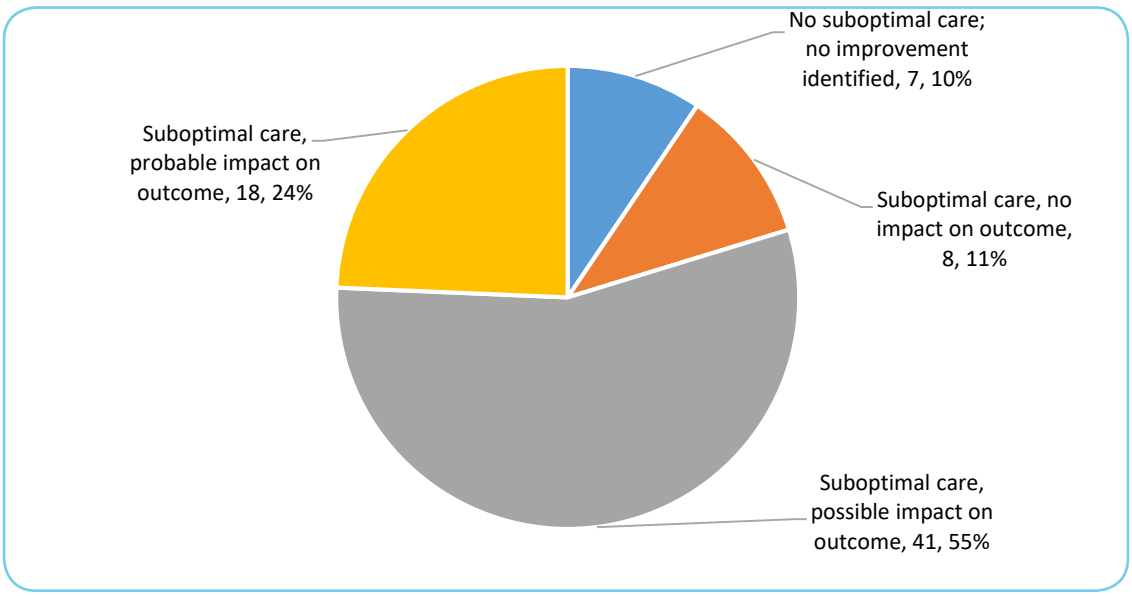
Table 31: Summary of patient/family factors

Patient/family factors	Hypertensive disorders in pregnancy, childbirth, and the puerperium	
	n=74	Percent
Delay in reporting to health facility	20	27.0
Delay in decision-making	19	25.7
Unsafe traditional/cultural practices	7	9.5
No antenatal care	6	8.1
No antenatal care	6	8.1
Lack of transport from home to facility	1	1.4
Unsafe self-medication treatment	1	1.4
Use of traditional medical practice	1	1.4
No information	25	33.8
No avoidable factors	19	25.7

c. Overall assessment of quality of care

The assessors concluded that for 79.7% (59) of the women who died received suboptimal care where a different management could have made a difference to the outcome. For 9.5% (7) of the cases the care provided was assessed as optimal and no further improvement in care was likely to have made a difference to the outcome **(Figure 20)**.

Figure 20: Quality of care for women who died of hypertensive disorders in pregnancy, child birth and puerperium



Vignette 5: Hypertensive disorders case 1

Hypertensive disorders 1

A 24-year-old, para 0+0, G 1, GA 39 weeks was admitted with complains of raised blood pressure (BP) identified at her workplace. On admission, her BP was 180/90mmHg and urine analysis revealed proteinuria 3+. She also had a history of headaches. A diagnosis of severe pre-eclampsia was made and she was put on Aldomet tablets and a stat does of magnesium sulphate 4grams stat intravenously was administered followed by an infusion of 1 gram per hour. Induction of labour is done with two doses misoprostol and later augmented with syntocinon. She had a convulsion during induction but this could not be controlled. A diagnosis of prolonged latent phase with persistent convulsions was made. She had an emergency caesarean section 18 hours after admission. Reduced urinary output was observed 12 hours post operatively. A diagnosis of acute renal failure with HELLP syndrome was made and she was immediately started on frusemide injection, heamacel infusion and 3 units of blood was transfused. A consult was sent to the renal and intensive care unit teams to review the patient. The patient did not improve and died 2 days after the caesarean section.

Assessors identified gaps in quality of care provided, specifically management of blood pressure on admission, decision on mode of delivery, management of oliguria and delayed involvement of renal and ICU team in the management. Assessors concluded that this woman had substandard care and that a different course of management could have made a difference in the outcome.

Vignette 6: Hypertensive disorders case 2

Hypertensive disorders 2

A 26-year-old Para 1+0 G 2, GA 35 weeks was admitted with complains of epigastric pain, headache and reduced foetal movement for one day. On examination, her BP was 220/170 mmHg, fundal height was consistent with 30 weeks gestation with a singleton pregnancy and cephalic presentation. On vaginal exam, her cervix was 3cm dilated. A diagnosis of pre-eclampsia was made and she was immediately started on IM magnesium sulphate loading dose and continuation dose, IV hydralazine, oral Aldomet and Nifedipine.

Her BP and urine output were monitored. Labour was induced with 25mg of misoprostol sublingually. 12 hours after admission the patient spontaneously delivered a macerated stillbirth with minimal blood loss. She immediately became restless, her pulse rate 120/min, BP 90/60mmHg, and was febrile. She was given a bolus of 50% dextrose, IV fluids, oral Nifedipine was stopped and oral feeding was commenced. Her vital signs stabilized and she was transferred to the post-natal ward for observation. Her blood pressure was stabilized but one day later patient was noted to have jaundice, she was weak, had nausea and vomiting. A diagnosis of puerperal sepsis was made and patient is transfused with one unit of blood. She continued with antihypertensive medications, antibiotics and oxygen for 4 days without much improvement. A decision was made to refer her to a teaching/referral hospital for ICU care but she died in the ambulance before reaching the referral hospital.

Assessors identified gap in quality of care provided, specifically a wrong diagnosis was made (pre-eclampsia rather than severe pre-eclampsia), wrong treatment for high blood pressure (to drugs to rapidly lower blood pressure, in addition to oral aldomet), and wrong delivery option (with imminent eclampsia, reduced fetal movement and cervix 3cm, C/S may have been a better option), wrong treatment options when the patient went into shock (50% dextrose), the patient was not fully investigated to rule out HELLP syndrome and a decision to refer was delayed. Assessors concluded that this woman had substandard care and that a different course of management could have made a difference in the outcome.

Vignette 7: Hypertensive disorders case 3

Hypertensive disorders 3

A 28-year-old lady, para 2+0, G 3, GA 33 weeks was admitted to a private/FBO facility with a history of drainage of liquor. On initial examination woman was in 'fair general condition', no pallor, or jaundice, fundus at 28 weeks on palpation and foetal heart heard and regular. No record of BP taken. On VE/ speculum exam, cervix was about 1cm dilated. She was put on bedrest, Ceftriaxone, Buscopan, Salbutamol, Phenobarbitone and Nifedipine. The following day, the woman requested to be discharged on claims that she was to attend a Hypertensive clinic in another facility. She was discharged against medical advice. 19 hours later, the woman presented back to the facility accompanied by her relatives with a cyanosed baby in breech presentation, partially delivered up to the neck and fitting continuously. She had gone into labour 2 hours after discharge from hospital, taken to a sub-county hospital where she started convulsing and was referred to the mission hospital without an accompanying health worker or any pre-referral management. On examination, mother had difficulty in breathing, BP 187/113. IV magnesium Sulphate commenced immediately, Hydralazine and oxygen therapy but mother went into cardiopulmonary arrest, started gasping, resuscitation attempted but unsuccessful. She was pronounced dead.

Assessors identified gap in quality of care provided, specifically a wrong documentation of essential vital signs such as BP, diagnosis was unclear on admission (including lack of ANC records), wrong treatment for probable severe pre-eclampsia and pre-term PROM (no evidence for the value of phenobarbitone and Buscopan). At the next managing hospital, the care was also sub-standard (non-application of the management protocol for eclampsia and referral guidelines). Assessors concluded that this woman had substandard care and that a different course of management could have made a difference in the outcome.

Discussion points

Deaths from hypertensive disorders were the third leading underlying cause of maternal deaths in 2014. Early diagnosis and appropriate management of hypertension in pregnancy reduces the risk of maternal deaths due to severe pre-eclampsia, eclampsia or related complications.

Almost 4 out of every 10 maternal deaths from hypertensive disorders had no records to assess ANC attendance. Only 77% (36) of those who had ANC records for review had attended ANC. Booking before 20 weeks with blood pressure measurement and urine analysis, repeated at each ANC improves the likelihood of early detection of pre-eclampsia. This may have made a difference in some of the cases **(Vignettes 5-7: Hypertensive disorders).**

Although all women who died from hypertensive disorders where managed at county referral hospitals, which are usually staffed with specialists, obstetricians were only involved in the management of less than 15% of women. Early and greater involvement of specialists may have improved the quality of care provided.

Over 5 in every 10 maternal deaths occurred in the post-partum period, this is usually the period of least vigilance as the baby has been delivered and seemingly no apparent danger is possible. Most women died during the intrapartum and immediate post-partum periods, usually at these periods the women are still being cared for in hospital.

Almost 8 out of 10 women received **suboptimal care** where different management **may** have made a difference to the outcomes.

The vignettes provide examples of wrong or late diagnosis, lack of adherence to evidence-based protocols **(Vignettes 5, 6, & 7: Hypertensive disorders)**, failure to recognise severe complications associated with eclampsia and severe pre-eclampsia **(Vignette 6: Hypertensive disorders)** and lack of adherence to referral guidelines **(Vignette 7: Hypertensive disorders)**.

Recommendations for care

1. Health worker knowledge and training

a. Updated training at all levels for skilled healthcare workers on diagnosis and management of hypertensive disorders. This is likely to improve adherence to evidence-based treatment and referral protocols.

2. Improving organisation of care

a. There needs to be improved recording and documentation of care provided at ANC. This should include blood pressure measurement and urine analysis.

b. With most deaths occurring at country referral hospitals, timely and appropriate care at this level will reduce treatment delays and reduce the risk of death.

c. Obstetricians should be involved early in all cases of obstetric emergencies, this will reduce the risk of sub-standard care, improve adherence to evidence-based management protocols.

d. Appropriate intrapartum and post-partum blood pressure checks will improve the quality of care .

3. Referral and facility infrastructure

a. Decision to refer should be taken early and patients should be supported by skilled attendants with appropriate and adequate medications during transfer.

4. Women, families and community

Public education on the benefits of early ANC booking, danger signs of pregnancy, the need for early presentation to hospital and adherence to treatment plans.

Chapter 6

Group 3: Obstetric haemorrhage

Key findings

- **40% (192)** of all maternal deaths were due to obstetric haemorrhage
- Of the 192 maternal deaths, **49% (94)** were due to uterine atony and **15.1%** were due to uterine rupture.
- 30-34 years **(29.2%)** of women who were aged 30-34 years and **26% (50)** were in their 6th pregnancy.
- **6.8% (13)** of women who died due to obstetric haemorrhage were undelivered.

Referral pattern

- **53.6% (103)** who died were referrals from Level 4 (county hospitals) **36.5% (38)** and level 3 sub-county hospitals **30.8% (32).**
- **90 (46.4%)** of the women died in their place of first admission.

Antenatal care

- **64.1% (123)** of the women who died attended had ANC and **6.3% (12)** had not.

Mode of delivery and delivery outcome

- Of the **179** women who died but had childbirth, **46.9% (84)** women had unassisted vaginal delivery, **2.2% (4)** had assisted vaginal deliveries, **44.1% (79)** had a caesarean section and the mode of delivery was not recorded for **6.7% (12)** of them.
- **47.9% (92)** of the women who died had live births, **34.9% (67)** had stillbirths and delivery outcome was not recorded for **10.4% (20)**

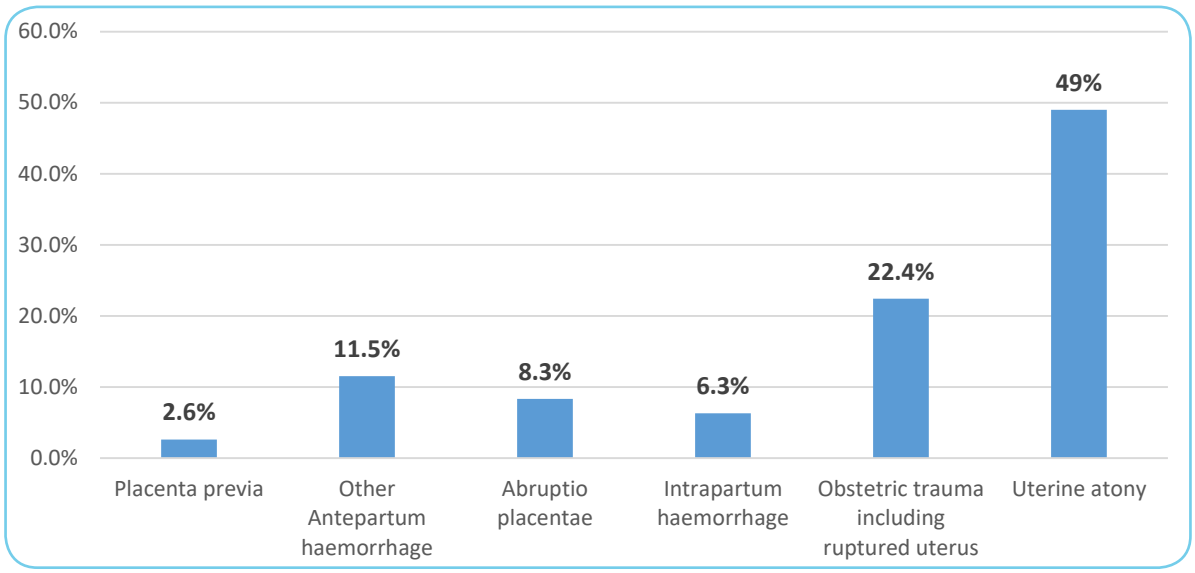
Quality of care

- Medical officers were the highest cadre involved in the management of **55.2% (106)** of the women who died and obstetricians were involved in managing **13.5% (26)** of women who died due to obstetric haemorrhage.
- The Assessors concluded that **91% (175)** of women who died of obstetric haemorrhage received suboptimal care where a different management could have made a difference to the outcome.

Introduction

Forty percent (192) of all the 2014 maternal death assessed were due to obstetric haemorrhage, 49% (94) of these were due to uterine atony, 2.6% (5) were due to placenta praevia **(Figure 21)** and 15.1% (29) of the deaths from obstetric haemorrhage were due to ruptured uterus.

Figure 21: Causes of death of women who died of obstetric haemorrhage



Other antepartum haemorrhage includes APH with coagulation defect and unspecified APH after excluding APH specified classified elsewhere (intrapartum haemorrhage, placenta previa and premature separation of placenta).

Characteristics of women who died due to obstetric haemorrhage

29.2% (56) of women who died of obstetric haemorrhage were aged 30-34 years, 21.9% (42) were aged 25-29 years and 19.3% (37) were aged 35-39 years. For all deaths, irrespective of cause, the peak number of deaths was in the age group 25-29 years, while for obstetric haemorrhage the peak age for deaths is 30-34 years. One in 4 women who died of haemorrhage was para 5 (or more) compared to 1 in 5 women who died from all causes was para 1 or 2.

Antenatal care attendance and HIV status

64.1% (123) of women who died due to obstetric haemorrhage attended ANC while only 6.3% (12) had not attended ANC. The record of ANC attendance for 29.7% (57) of the women was not in the case notes; 70% (86) of those who attended ANC had rhesus tests done.

Most women who died of obstetric haemorrhage were HIV negative (52.1%). Nineteen women (9.9%) were HIV positive while the HIV status of 38% (73) of the women was not recorded in the files.

Pregnancy outcome

About 7% (13) of the women died before childbirth. 47.9% (92) of the women who died had live births, 34.9% (67) had stillbirths and delivery outcome was not recorded for 10.4% (20).

Labour and childbirth

Mode of delivery

Of the 179 women who died but had childbirth, 46.9% (84) women had unassisted vaginal delivery, 2.2% (4) had assisted vaginal deliveries, 44.1% (79) had a caesarean section and the mode of delivery was not recorded for 6.7% (12) of them.

Place of childbirth

Most of the deliveries occurred at the County Referral Hospitals (36.5%), with 15.1% (29) at secondary county referral hospitals, 12.5% (24) at sub-county hospitals and 5.7% (15) of the deliveries occurred at private hospitals.

Referral and place of death

Fifty-four percent (103) of women who died were referred from level 4 county hospitals, and 36.5% (38) level 3 sub-county hospitals 30.8% (32) health facilities **(Table 32)**.

Table 32: Referring facility for women who died of obstetric haemorrhage

Referring facility	Frequency	Percent
Level 1	1	1.0
Level 2	10	9.7
Level 3	32	31.1
Level 4	38	36.9
Level 5	7	6.8
Private/faith-based hospital	15	14.6
TOTAL	103	100

Quality of care

a. Highest cadre of health worker involved in management

The highest cadre of healthcare worker who provided care for women that died of obstetric haemorrhage were medical officers (55.2%), nurse/midwives (22.9%), and obstetrician/gynaecologists (13.5%). Nine (4.6%) of the women were unattended or delivered under unskilled care.

b. Associated factors

Health worker factors

The common healthcare worker associated factors identified were delay in starting treatment 42.2% (81), inadequate clinical skills 36.5% (70) and inadequate monitoring 28.1% (54) **(Table 33)**.

Table 33: Health worker associated factors identified

Health worker associated factors	Obstetric haemorrhage (n=192)	
	Frequency	Percent
Delay in starting treatment	81	42.2
Inadequate clinical skills	70	36.5
Inadequate monitoring	54	28.1
Prolonged abnormal observation without action	51	26.6
Lack of obstetric lifesaving skills	45	23.4
Initial assessment incomplete	39	20.3

Health worker associated factors	Obstetric haemorrhage (n=192)	
	Frequency	Percent
Inadequate resuscitation	30	15.6
Partograph incorrectly/not used	29	15.1
Inadequate antenatal care	25	13
Delay in deciding to refer	24	12.5
Incorrect diagnosis and management	21	10.9
Incorrect management after making correct diagnosis	15	7.8
Unsafe medical treatment	14	7.3
No treatment	5	2.6
No information	12	6.3
No avoidable factors	21	10.9

Administrative factors

For women who died of obstetric haemorrhage, associated administrative factors identified were lack of blood for transfusion 15.1% (29) and absence of trained staff on duty 10.9% (21) **(Table 34)**.

Table 34: Summary of administrative factors identified

Administrative Factor	Obstetric haemorrhage (n=192)	
	Frequency	Percent
Lack of availability of blood transfusion	29	15.1
Absence of trained staff on duty	21	10.9
Lack of qualified staff	18	9.4
Lack of equipment for obstetric surgery	17	8.9
Transport problems between health facilities	7	3.6
Communication problem between health facilities	5	2.6
Lack of uterotonic drugs	3	1.6
Lack of antibiotics	2	1
Lack of laboratory facilities	2	1
Lack of equipment for AVD	1	0.5
No information	53	27.6
No avoidable factors	60	31.3

Patient/family factors

Patient/family associated factors identified were delay in reporting to healthcare facility 26.6% (51), and delay in decision-making 21.9% (42) **(Table 35)**.

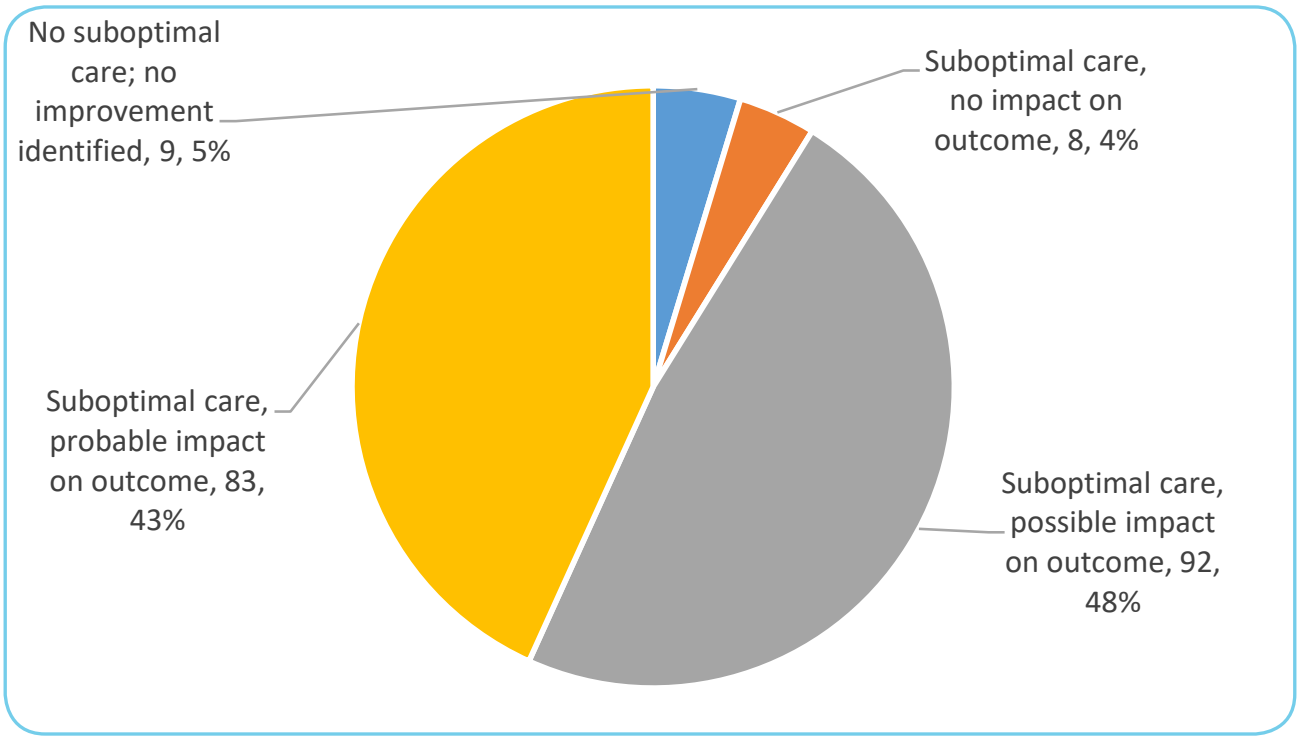
Table 35: Summary of patient/family factors identified

Patient/family factors	Obstetric haemorrhage (n=192)	
	Frequency	Percent
Delay in reporting to health facility	51	26.6
Delay in decision-making	42	21.9
No antenatal care	9	4.7
Use of traditional medical practice	8	4.2
Unsafe traditional/cultural practices	7	3.6
Unsafe self-medication treatment	3	1.6
Lack of transport from home to facility	1	0.5
No information	64	33.3
No avoidable factors	61	31.8

c. Overall assessment of quality of care

The Assessors concluded that 91% (175) of women who died of obstetric haemorrhage received suboptimal care where a different management could have made a difference to the outcome. For 5% (9) of the women, no suboptimal care was identified **(Figure 22)**.

Figure 22: Suboptimal care among women who died of obstetric haemorrhage



Discussion

Obstetric haemorrhage remains the leading underlying cause of maternal death in Kenya. In this report, important characteristics of women who died of obstetric haemorrhage included: maternal age, parity and gravidity. A significant proportion of the women had a stillbirth or were undelivered pointing to the gaps in the quality of care women received at the point of service delivery.

For 5 out of 10 women who died of obstetric haemorrhage causes, the haemorrhage occurred during the postpartum period **(Vignettes 1-4: Obstetric haemorrhage)**.

The Assessors concluded that 9 out of 10 women who died of obstetric haemorrhage had received substandard care and that a different management may have resulted in a different outcome. Delays in starting treatment, incorrect diagnosis, lack of adherence to treatment protocols **(Vignettes 1, 2 & 4: Obstetric haemorrhage)**, lack of blood transfusion facilities **(Vignette 3: Obstetric haemorrhage), late referrals (Vignettes 1-3: Obstetric haemorrhage)** were some of the associated factors with maternal deaths from obstetric haemorrhage.

Women who die of obstetric haemorrhage are generally referrals from level 4 and level 3 facilities. This points to the need of having level 4 hospital fully functioning as comprehensive emergency obstetric care units, 24 hours a day 7 days a week. Such facilities should have midwives, medical doctors with the ability to perform caesarean section, anaesthesia and safe blood transfusion available. Post-partum haemorrhage due to uterine atony is the commonest cause of death and all skilled healthcare workers should be able to prevent, recognise the complication, resuscitate and treat adequately based on Kenya National protocols and guidelines (**Vignettes 1, 2 & 4: Obstetric haemorrhage)** Where necessary prompt referral to Comprehensive EmOC facilities should be effected **(Vignettes 1&3: Obstetric haemorrhage).**

Massive haemorrhage can lead to death within two hours, so early presentation and prompt care is important. Almost half of the deaths occurred at the place of first admission, so early recognition of complication by women and their families, prompt presentation to healthcare facilities and good quality care at healthcare facilities is likely to reduce the risk of death.

Vignette 8: Obstetric Haemorrhage case 1

Obstetric Haemorrhage 1:

A 36-year-old para 3+0, para 3+0, G4, gestation age 37 weeks, who is a known hypertensive presented to a health centre where she had a vaginal delivery (head and placenta together) to a macerated stillbirth. She was diagnosed with placenta praevia during her pregnancy.

She developed postpartum haemorrhage immediately after delivery. She was started on IV fluids immediately after delivery, no record of oxytocin used in her management but uterine massage was done and she was promptly referred to a county referral hospital (CRH). However, the ambulance took 3 hours to get to the health centre and another one hour to the CRH. At the CRH it was noted that she had bled for 5hrs. Examination on admission showed a thready pulse, BP was 80/40 mmHg with frank blooding per vagina.

Two large IV lines were fixed, oxytocin put up, blood transfusion commenced, misoprostol and uterine massage done but she was still bleeding. Doctor informed and advised a speculum to be done and be informed promptly of the results. Patient condition deteriorated while being transfused; resuscitation attempts were unsuccessful.

The assessors found gaps in the care provided at the primary referring unit (lack of adherence to treatment protocol), delay in the availability of ambulance for referral was a key associated factor, and at CRH; incorrect diagnosis at the CRH (she had developed disseminated intravascular coagulopathy), lack of review by senior clinician and lack of adherence to treatment protocol for DIC. Promptly addressing these gaps in the quality of care probably may have resulted in a different outcome.

Vignette 9: Obstetric haemorrhage case 2

Obstetric Haemorrhage 2:

A 33-year-old, para 4+0, G5 housewife, presented to the facility at term with history of frequent lower abdominal pain which has been increasing in intensity. She had Hb of 7.4g/dl. After 2hrs of labour, foetal heart rate reduced from 140bpm to 120bpm and induction with syntocinon was started. After about 4hrs of labour she had a spontaneous delivery of a live male Infant weighing 3500gms with APGAR score of 6/1 min., 7/5min., 8/10min.

The Placenta was delivered 5 minutes later but she started bleeding profusely. Uterine massage was done, clots removed, normal saline (1.5Ls) given with syntocinon 40i.u but active bleeding continued. Blood was taken for GXM and she was transfused with 1 unit of blood. Examination under anaesthesia revealed active bleeding, and a cervical tear at 3 O'clock extending to the uterus.

Explorative laparotomy was done and an intra operative diagnosis of uterine rupture with massive haemorrhage was made. Subtotal hysterectomy and left salpingo oophorectomy was done. Haemostasis was achieved and abdominal wall closed. Fours after survey she was wheeled to the ward in a coma and it was noted in her records that this could have been due to effect of ketamine used for general anaesthesia. She was still being transfused but there was no urine output. There was no record of observation or frequent post operation monitoring. Her condition deteriorated and she died 5 hours after survey.

The Assessors concluded that there was suboptimal care. They cited insufficient blood transfusion and poor post-operative management and poor monitoring and scanty documentation. The patient would have benefited from management within an intensive care unit post operatively.

Vignette 10: Obstetric haemorrhage case 3

Obstetric Haemorrhage 3:

A 20-year-old, para 1+1 G 3, was admitted at term from home with a 9-hour history of lower abdominal pains. On examination, the cervix was 2 cm dilated, membranes intact and fully effaced. Labour progressed on well and 2.5hrs later, she had spontaneous rupture of membranes, and a spontaneous vertex delivery to a live male infant with Apgar score 8/1, 8/5, 10/10 and birth weight of 3660gms. Oxytocin 10iu was given immediately after delivery but patient continued to bleed. Syntocinon 40 iu was repeated but patient continued to bleed. Misoprostol tablets 600mg was administered per rectum but the bleeding persisted.

The medical doctor was informed to come and review the patient, who found a severely pale patient, with BP=100/60mmHg and her uterus was well contracted and no cervical tear was identified. Blood for grouping and cross matching was taken, in addition to continuation of IV fluids, plasma expanders, and oxygen via face mask were administered. Also, a urethral catheter was passed and she was kept warm. Her BP later dropped to 80/52mmhg. Patient was noted to be bleeding from puncture sites and her blood was not clotting. Her blood group was O+ve. Laboratory department called and said there was no blood available at the hospital and other neighbouring hospitals. Patient was prepared for possible transfer to a higher-level facility for urgent transfusion and ICU care. One hour later, patient died while en-route to the referral facility.

The assessors concluded that the quality of care provided could have been better and this may have made a difference in the outcome. Although the correct treatment protocol for post-partum haemorrohage was followed initially, no grouping and cross matching of blood was done, when she was eventually grouped, there was no blood for blood transfusion. A diagnosis of massive obstetric haemorrhage in a facility without active blood transfusion services should have triggered a referral. The patient developed a DIC before referral was

Recommendations for care

1. Health worker knowledge and training

a. Most deaths were referrals and there is a need for staff to be trained in management of obstetric haemorrhage and implementation of the national emergency obstetric care protocols.

b. Relevant job aids and tools for self-directed training/updates in emergency obstetric care should be developed. This is likely to enhance knowledge and skills required to respond to obstetric emergencies.

2. Improving organisation of care

a. Implement ANC protocol, to minimise Anaemia in pregnancy and thereby reducing the effect of post-partum blood loss.

b. The administrative authorities at national and county levels should ensure that more experienced care providers (obstetricians) are involved earlier in the management of obstetric complications.

c. The Ministry of Health should ensure that tools such as early warning scores charts, are available for intrapartum and post-partum monitoring of women in maternity units. This should include adequate training of care provides on how to use these tools.

d. There should be increased awareness of post-partum haemorrhage, close monitoring and early intervention to prevent deaths in the part partum period.

3. Referral and facility infrastructure

County health authorities should ensure:

a. County and Sub-county hospitals function optimally as CEmOC hospitals,

b. Adequate staffing levels including obstetricians,

c. Adequate capacity of the referral hospitals to provide anaesthesia and blood,

d. Adequate resuscitation and treatment is available at lower levels of care and,

e. An efficient system for prompt referral to higher levels of care is established.

4. Women, families and community

a. MoH should ensure that women and their families are education on danger signs of pregnancy and early presentation to health facilities for care.

Vignette 11: Obstetric haemorrhage case 4

Obstetric Haemorrhage 4:

A 21-year-old, para 0+1 G 2 presented at term with history of lower abdominal pains. On vaginal examination, she was 8cm dilated and her membranes ruptured spontaneously. Impression of cord prolapse, breech presentation and twin gestation was made. She was prepared for Caesarean section but delivered live twins before operation, both breech presentation (1st twin live male 2300gms- 7/1, 8/5, 9/10: 2nd twin live female 2400gms- 6/1, 7/5, and 10/10). Soon after third stage, she convulsed twice (each lasting 5 minutes) and started bleeding, her BP=129/85mmHg; pulse 184bpm. Diagnosis of postpartum eclampsia and postpartum haemorrhage due to uterine atony was made.

Examination under anaesthesia found 2nd degree perineal and cervical tears. Laparotomy with B-Lynch suture was applied; cervical tear and perineal tear were repaired. Patient's tissues noted to be oozing blood which was non-clotting. Impression of Disseminated Intravascular Coagulation (DIC) made. Patient transfused with 4 units of packed red cells, 1 unit of fresh frozen plasma, and 4Ls of normal saline in addition to syntocinon 10 iu in normal saline, cytotec (misoprostol) 600mg per rectal start, tranexamic acid iv 1000mg start and Ergometrine iv 0.5mg start. Vaginal pack left in situ. Patients pupils noted to be dilated and fixed and BP recordable. Failure of reversal from anaesthesia noted. However, patient was breathing spontaneously; a decision to refer for ICU care and DIC management made. Patient died while in ambulance awaiting referral.

The Assessors noted that good care was provided at the facility but that fresh whole blood, more units if fresh frozen plasma and an intensive care unit onsite may have made a difference to the outcome.

Conclusion

Obstetric haemorrhage remains the leading cause of maternal death in Kenya and women with obstetric haemorrhage receive sub-standard care.

Timely presentation and management will reduce the risk of death. Improving the capacity of level 3 and 4 hospitals to prevent and treat obstetric haemorrhage as well as manage complications from obstetric haemorrhage will significantly reduce treatment delays. Competent healthcare providers backed by specialist obstetricians 24 hours a day and 7 days a week, adequate blood transfusion services are likely to make a difference in the standards of care. Prompt presentation to EmOC resourced healthcare facility, staffed by competent healthcare providers at levels 1 and 2, can ensure that complications are recognised early, women are resuscitated and transferred early and that the referral united is communicated with in advance of the arrival of the client.

Chapter 7

Group 4: Pregnancy-related infections

Key findings

- **9.7% (47)** of maternal deaths were due to pregnancy-related infection.
- **53.2% (10)** of maternal deaths were due to puerperal sepsis.
- **27.7%** were aged between 20-24 years and **34% (16)** of the women were having their first pregnancy.
- **6.4% (3)** died before childbirth.

Referral pattern

- **46.8% (22)** of women who died were referred, while **53.2% (25)** died at the point of first admission.
- **31.9% (15)** of the women delivered at level 3 and 4 hospitals while **8.5%** gave birth at level 5 and level 6 hospitals.

Antenatal Care

- There were no records of ANC attendance for **61.7% (29)** of the women who died.
- For the **18** women, whose ANC record was available, **21.3% (10)** attended ANC while **17% (8)** did not attend ANC.

Mode of delivery and delivery outcome

- Of the 44 women who delivered, **59.1% (26)** women had unassisted vaginal deliveries, **27.3% (12)** were delivered by caesarean section and the mode of delivery was unspecified for **13.3% (6).**
- Of the **44** women who delivered **63.6% (28)** had live births, **22.7% (10)** had a stillbirth and the delivery outcome was not recorded for **13.6% (6)**.

Quality of care

- Twenty-one of the women received suboptimal care where different management might have made a difference to the outcomes **(44%).** For **14** of the women, different management would have made a difference to the outcome **(30%)**.

Introduction

9.7% (47) of maternal deaths were due to pregnancy-related infection **(Table 36)**. The most common pregnancy-related infection was puerperal sepsis 53.2% (25). Other puerperal sepsis such as infection of obstetric surgical wound, other infection of genital tract following delivery and urinary tract infection following delivery accounted for 31.9% (15) of MDs from pregnancy-related sepsis.

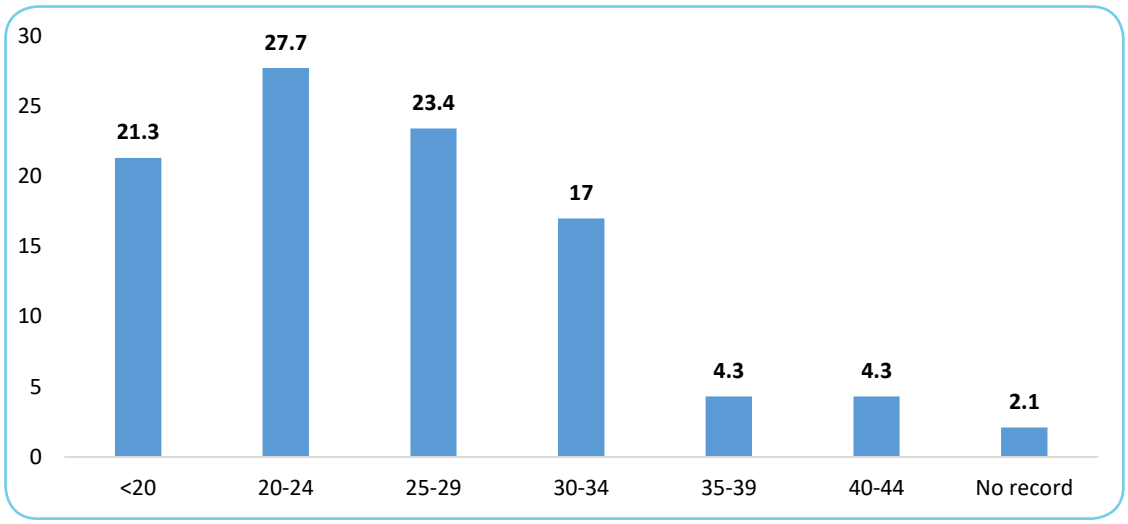
Table 36: Causes of death for women who died of pregnancy-related infections

Pregnancy-related infections	Frequency n=47	Percent
Puerperal sepsis	25	53.2
Other puerperal infections	15	31.9
Infections of genito-urinary tract in pregnancy	7	14.9

Characteristics of women who died from pregnancy-related infections

The highest proportion of deaths MDs due to pregnancy-related infections were in the 20-24 years age group **(Figure 23)** and in primiparous women (34% or 16).

Figure 23: Percentage age distribution of women who died of Pregnancy-related infection (n=47)



Antenatal attendance and HIV status

There were no records of ANC attendance for 61.7% (29) of the women who died. For the 18 women, whose ANC record was available, 21.3% (10) attended ANC while 17% (8) did not attend ANC.

The HIV status of women was not recorded for 59.6% (28) of the deaths. For the 19 women, whose HIV status was recorded, 23.4% (11) tested positive while eight 17% (8) tested negative.

Pregnancy outcome

6.4% (3) died before childbirth. Of the 44 women who delivered 63.6% (28) had live births, 22.7% (10) had a stillbirth and the delivery outcome was not recorded for 13.6% (6). The pregnancy outcome for all women who died is presented in **Figure 24.**

Labour and childbirth

Mode of delivery

Of the 44 women who delivered, 59.1% (26) had unassisted vaginal deliveries, 27.3% (12) were delivered by caesarean section and the mode of delivery was unspecified for 13.3% (6).

Thirty two percent (15) of the women who died, delivered at the county referral (level 4) and secondary county (level 5) referral hospitals **(Figure 24).**

Figure 24: Pregnancy outcome of women who died of pregnancy-related infections (%)

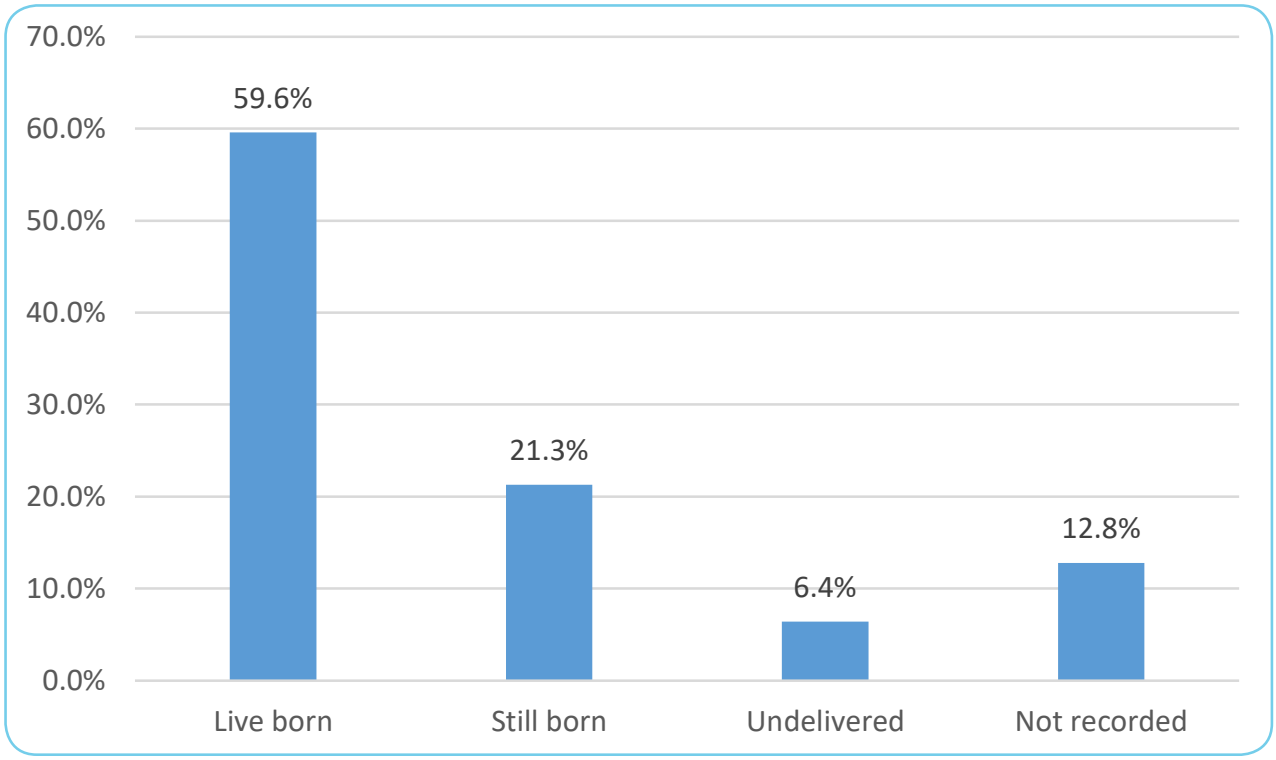
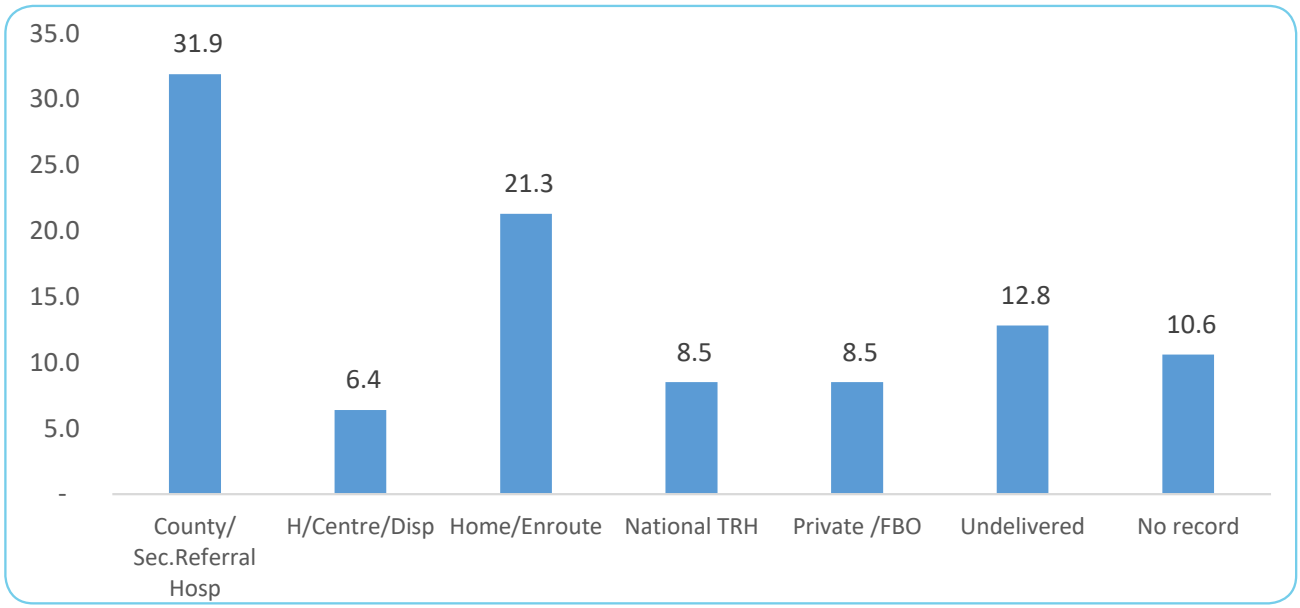


Figure 25: Place of delivery of women who died of pregnancy-related infections (%)



Referral and place of death

46.8% (22) of women who died were referred, while 53.2% (25) died at the point of first admission. Of the 22 women who were referred, half (10) were from Level 4 health facilities, 5 from private/faith-based health facilities, 3 from Level 5 health facilities and 4 from both Level 2 and Level 3 health facilities.

Quality of care

1. Highest cadre of health worker involved in management

a. Among women who died of pregnancy-related infection, medical officers were the highest cadre involved in the care of 44.7% (21) of the women and obstetricians involved in care of 4.3% (2). Nurse/Midwives were the highest cadre involved in managing 21.1% (10) women. A good proportion of the women 23.4% (11) were unattended during delivery.

2. Associated factors

Health worker factors

a. Healthcare worker associated factors identified for women who died of pregnancy-related infection were inadequate monitoring 29.8% (14), delay in starting treatment 23.4% (11) and incomplete initial assessment 21.3% (10) (**Table 37**)

Table 37: Health worker associated factors identified

Health worker associated factors	Pregnancy-related infection (n=47)	
	Frequency	Percent
Inadequate monitoring	14	29.8
Delay in starting treatment	11	23.4
Initial assessment incomplete	10	21.3
Inadequate clinical skills	7	14.9
Prolonged abnormal observation without action	5	10.6
Incorrect diagnosis and management	5	10.6
Inadequate antenatal care	4	8.5
Delay in deciding to refer	3	6.4
No treatment	3	6.4
Partograph incorrectly/not used	3	6.4
Incorrect management after making correct diagnosis	2	4.3
Inadequate resuscitation	1	2.1
Unsafe medical treatment	1	2.1
Lack of obstetric lifesaving skills	1	2.1
No information	7	14.9
No avoidable factors	9	19.1

Administrative factors

Administrative associated factors identified were the lack of equipment for obstetric surgery 6.4%(3) and lack of qualified staff 4.3% (2) **(Table 38).** There was no information to identify administrative factors in 34% (16) of the files.

Table 38: Summary of administrative factors identified

Administrative Factor	Pregnancy-related infection (n=47)	
	Frequency	Percent
Lack of equipment for obstetric surgery	3	6.4
Lack of qualified staff	2	4.3
Absence of trained staff on duty	2	4.3
Communication problem between health facilities	1	2.1
Transport problems between health facilities	1	2.1
Lack of antibiotics	1	2.1
Lack of laboratory facilities	1	2.1
No information	16	34.0
No avoidable factors	20	42.6

1. Patient/family factors

Patient/family associated factors identified were delay in reporting to healthcare facility 46.8% (22), and delay in decision-making 34% (16). For 25.5% (12) of the files, there was no information in the files to identify any patient/family factor associated with the death **(Table 39)**.

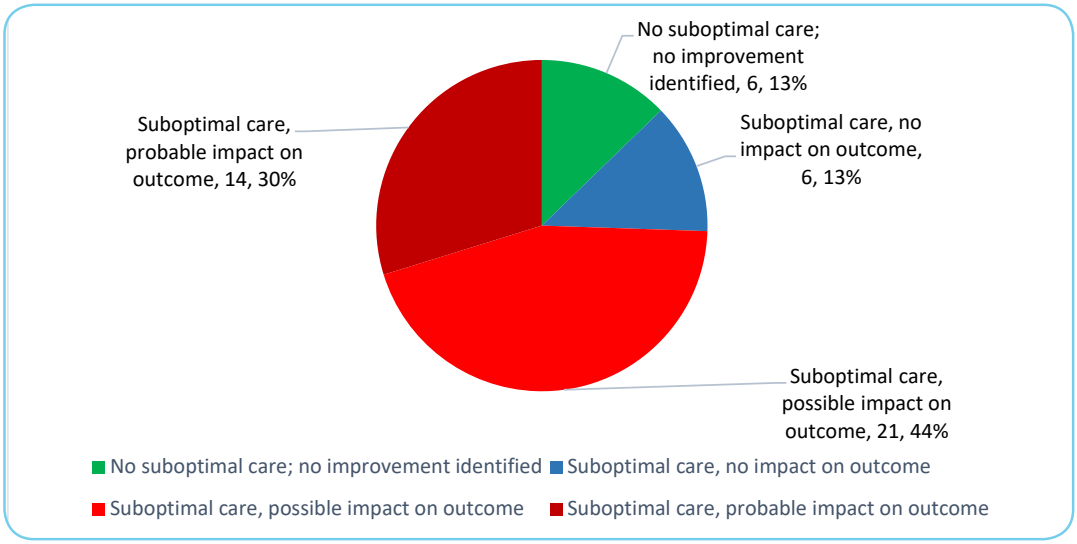
Table 39: Summary of patient/family factors identified

Patient/family factors	Pregnancy-related infection (n=47)	
	Frequency	Percent
Delay in reporting to health facility	22	46.8
Delay in decision-making	16	34.0
No antenatal care	4	8.5
Unsafe traditional/cultural practices	4	8.5
Unsafe self-medication treatment	2	4.3
Use of traditional medical practice	2	4.3
No information	12	25.5
No avoidable factors	6	12.8

a. Overall quality of care

The Assessors concluded that 74% (35) of the patients received suboptimal care where a different management could have made a difference to the outcome. For 13% (6) of the women no suboptimal care was identified in the care received **(Figure 26)**.

Figure 26: Quality of care of women who died of pregnancy-related infections



Vignette 12: Pregnancy-related infections case 1

Pregnancy-related infections 1:

A 23-year-old Para 1+0, G1 presented to the Level 4 hospital with complains of abdominal pains and dizziness. She had been recently being discharged (from the same hospital) after an emergency C/S as part of management for severe pre-eclampsia and prolonged labour.

A diagnosis of puerperal sepsis with peritonitis and Anaemia (Hb-7.7g/dl) was made. An explorative laparotomy was carried out during which pus was drained and gapping uterine incision found was repaired. However, she continued to deteriorate, the wound was still discharging pus on the 6th postoperative day. Her family were very concerned about her level of deterioration but there was no documented plan to referral her or investigate her further. She died on the 7th post-operative day

Assessors found a gap in the management of this case. There was a delay in referral from level 4 hospital after there was no improvement after the laparotomy. The assessors concluded that at level 5 or 6 hospitals sufficient expertise and resources are usually available to manage such cases and this may have made a difference in the outcome.

Vignette 13: Pregnancy-related infections case 2

Pregnancy-related infections, case 2:

A 17-year-old woman, Para 1+0, G1 a referred from a level 4 to level 5 hospital, where she had a vacuum delivery to a macerated five days after discharge. On admission, she was found to be semi-conscious, jaundiced and a diagnosis of puerperal sepsis was made. Medical doctor called but said she was conducting another C/S in theatre. Ureteral catheter was inserted and about 600mls of bloody urine was drained but NG tube insertion was unsuccessful. She was put on intravenous antibiotics (Metronidazole, Crystalline penicillin and gentamycin). 9 hrs after admission and before being seen by a medical doctor, patient became restless, started coughing black coffee and resuscitation attempts were unsuccessful. There was no documentation that the obstetric consultant was called to review her.

The Assessors found gaps in the quality of care provided. Although initial steps were correctly taken to resuscitate the woman, a review by the medical team was delayed and the obstetrician never reviewed before she died after 24 hours on admission. Such review and management in an intensive care unit may have made a difference in the outcome.

Vignette 14: Pregnancy-related sepsis case 3

Pregnancy-related infections case 3:

33-year-old para 3+0, G4 known sero-reactive woman on HAART, had an emergency C/S due to two previous scars. Her baby died in newborn care unit but she was discharged three days post C/S in good condition.

She however presented back 10 days after the C/S to same facility (level 4) with wound dehiscence and burst abdomen. Mother was referred to Level 6 facility where the second surgery to debride and repair the incision site was done two days after presentation. Intraoperatively there was septic burst abdomen and gapping uterine incision, pus draining from wound site. She deteriorated post operatively and Chest X-ray showed right sided pleural effusion.

19 days after admission patient was found to be no-responsive in bed, resuscitation was attempted but was unsuccessful.

The assessors were satisfied with the quality of care provided at this level 4 facility. Although the patient had been on antiretroviral treatment, HIV infection may have contributed to the sepsis that she developed and eventually died of. Delay in seeking care was identified as an associated factor in this MD.

Discussion

For about 75% (35) women who died of pregnancy-related infection, different management could have resulted in a different outcome. Four out of 10 women that died from pregnancy-related sepsis, delivered at level 3-6 health facilities. Inadequate patient monitoring, delay in starting treatment and incomplete assessments were the most common health worker factor.

Early presentation **(Vignette 3: Pregnancy-related infections)**, diagnosis and treatment at these referral hospitals could make a difference in outcome. Early involvement of specialist teams, obstetrician, infection physicians etc., **(Vignettes 1 & 2; pregnancy-related infections)**; early and appropriate investigations such as microbiology cultures **(Vignette 4: pregnancy-related infections)** could have made a difference in the outcome of these cases.

Infection prevention protocols and early warning signs monitoring charts could improve prevention and early detection of sepsis in the postpartum period, especially after surgery.

Recommendations for care

1. Health worker knowledge and training

Healthcare workers should be updated in surveillance for sepsis in the post-partum period and sepsis management protocol.

2. Improving organisation of care

Regular audit and feedback of care for pregnancy-related sepsis should be conducted with the referral hospitals to continuously improve the quality of care.

3. Referral and facility infrastructure

Education of women and family members on danger signs related to sepsis and the need to present early to hospital.

Chapter 8

Group 5: Non-obstetric complications

Key findings

- **19.8% (96)** of all maternal deaths that occurred in 2014 were due to non-obstetric complications.
- Four common causes of death from non-obstetric complications were HIV **(22.9%)**, Anaemia **14.6% (14),** protozoa diseases such as Malaria **10.4% (10)** and diseases of the circulatory system **10.4% (10)**.
- **29.1% (28)** were undelivered.

Referral pattern

- **47.9% (46)** of women who died were referred from other healthcare facilities.
- **52.2% (24)** of women who died were referred from level 4 health facilities, **10.9% (5)** were referred from level 3 facilities, **8.7% (4)** were referred from level 5 health facilities, and **6.5% (3)** were referred from level 1 and 2 health facilities.

Antenatal Care

- **39.6% (38)** attended ANC while **13.5% (13)** did not attend ANC. Records of **45 (46.9%)** of the women did not indicate their ANC attendance.
- **35.4% (34)** of the women who died from non-obstetric complications were HIV positive, **30.2% (29)** were HIV negative and for **34.4% (33)** of the women, there was no record of their HIV status.

Mode of delivery and delivery outcome

- A third of the women who died **(32)** had live births while **16.7% (16)** had stillbirths. The delivery outcome was not recorded for **20.8% (20)** women.

Quality of care

- The review of the records showed that **67.0% (65)** of the patients received suboptimal care where different management could have made a difference to the outcomes.

Introduction

19.8% (96) of all maternal death that occurred in 2014 were due to non-obstetric complications. HIV 22.9% (22) and Anaemia 14.4% (14) were the leading causes of death of women who died of non-obstetric complications **(Table 40)**.

Table 40: Non-obstetric causes complicating pregnancy, childbirth and the puerperium

Cause of death	Frequency n=96	Percent
Human immunodeficiency virus (HIV) disease	22	22.9
Protozoal diseases e.g. Malaria	10	10.4
Tuberculosis	7	7.3
Other maternal infectious and parasitic diseases	2	2.1
Anaemia	14	14.6
Other diseases of the blood & blood-forming organs & disorders involving the immune mechanism	4	4.2
Diseases of the circulatory system	10	10.4
Other diseases of the respiratory system	7	7.2
Mental disorders and diseases of the nervous system	3	3.1
Other specified diseases and conditions	5	5.2
Diseases of the digestive system	4	4.2
Not specified	1	1.0

Characteristics of women who died of non-obstetric complications

About 35% (33) of women who died of non-obstetric complications were aged 25-29 years, 27.1% (26) were 20-24 years and those less than 20 years accounted for 5.2% (5). Most women were having their first 21.9% (21), second 24% (23) or third 24% (23) pregnancy.

Antenatal attendance and HIV status

Of the 96 women who died from non-obstetric complications, 39.6% (38) attended ANC while 13.5% (13) did not. Records of 46.9% (45) of the women did not indicate their ANC attendance.

35.4% (34) of the women who died from non-obstetric related complications were HIV positive, 30.2% (29) were HIV negative and for 34.4% (33) of the women, there was no record of their HIV status.

Of the 484 maternal deaths assessed, HIV status was not recorded in 45.2% (219), 40.3% (195) were HIV negative, 14.5% (70) were HIV positive **(Table 41)**.

Among women who died from direct causes, the HIV status of majority 47.9% (180) was not recorded; 42.6% (160) were HIV negative while 9.6% (36) were HIV positive.

Table 41: HIV status of women who died in 2014

Characteristic	Categories	Direct MD (n=376) Frequency (%)	Indirect MD (n=96) Frequency (%)	Maternal death unspecified (n=12) Frequency (%)	Total (N=484) Frequency (%)
HIV status	Negative	160 (42.6%)	29 (30.2%)	6 (50.0%)	195 (40.3%)
	Positive	36 (9.6%)	34 (35.4%)	0 (0.0%)	70 (14.5%)
	Unknown	180 (47.9%)	33 (34.4%)	6 (50.0%)	219 (45.2%)

For the 70 women who were HIV positive, the viral load was checked for 11.4% (8) but it was not possible to determine if viral load was checked in 65% (46) of maternal deaths, due to incomplete documentation **(Table 41).**

Among the HIV positive women, 52.9% (37) were on treatment using current national guidelines; the treatment options for 22.9% (16) was not recorded while 21.4% (15) were not on any treatment.

Table 42: HIV Viral load checking and treatment information for HIV positive women (n=70)

	Categories	Frequency	Percent
HIV Viral load checked (n= 24)	No	16	22.9
	Yes	8	11.4
HIV treatment (n= 54)	Current National Guidelines	37	52.9
	Other treatment	2	2.9
	No treatment	15	21.4

Labour and childbirth

Twenty-nine percent (28) of women died before childbirth (undelivered), 33.3% (32) had live births while 16.7% (16) had stillbirths and the pregnancy outcome was not recorded for 20.8% (20) women.

Place of birth

27.1% (26) of women who died delivered at a county/secondary county hospital, 9.4% (9) delivered at National referral hospitals, 7.3% (7) delivered at a private or faith-based health facility and 3.1% (3) delivered at home or on the way to hospital.

Referral pattern

47.9% (46) of women who died were referred from other healthcare facilities. 52.2% (24) of women who died were referred from level 4 health facilities, 10.9% (5) were referred from level 3 facilities and 6.5% (3) were referred from level 1 or 2 health facilities, 8.7% (4) were referred from level 5 facilities and 21.7% (10) were referred from private health facilities.

Quality of care

a. Highest cadre of health worker involved in management

Medical officers were the highest cadre involved in the delivery of 42.7% (41) of the women who died of non-obstetric complications and obstetricians involved in care of 12.5% (12). Midwives were the highest cadre involved in the management 23% (22) of the women during childbirth. 3.1% (3) had childbirth under unskilled care.

b. Associated factors

Health worker factors

Health worker factors associated with death due to non-obstetric complications that were identified included; were delay in starting treatment 25% (24), incomplete initial assessment 22.9% (22) and inadequate clinical skills 20.8% (20) **(Table 43)**.

Table 43: Health worker associated factors identified

Health worker associated factors	Non-obstetric complications (n=96)	
	Frequency	Percent
Delay in starting treatment	24	25.0
Initial assessment incomplete	22	22.9
Inadequate clinical skills	20	20.8
Inadequate monitoring	19	19.8
Prolonged abnormal observation without action	19	19.8
Inadequate resuscitation	15	15.6
Inadequate antenatal care	15	15.6
Incorrect diagnosis and management	11	11.5
Delay in deciding to refer	9	9.4
Unsafe medical treatment	7	7.3
Partograph incorrectly/not used	7	7.3
Incorrect management after making correct diagnosis	5	5.2
No treatment	3	3.1
Lack of obstetric lifesaving skills	3	3.1
No information	11	11.5
No avoidable factors	18	18.8

Administrative factors

Administrative associated factors identified was absence of trained staff on duty 8.3% (8), lack of qualified staff 4.2% (4). For most of the case notes 31.3% (30), there was no sufficient information to identify any administrative factors (Table 44).

Table 44: Summary of administrative factors identified

Administrative Factor	Non-obstetric complications (n=96)	
	Frequency	Percent
Absence of trained staff on duty	8	8.3
Lack of qualified staff	4	4.2
Lack of antibiotics	4	4.2
Lack of equipment for obstetric surgery	4	4.2
Lack of laboratory facilities	4	4.2
Lack of availability of blood transfusion	3	3.1
Communication problem between health facilities	1	1.0
Transport problems between health facilities	1	1.0
Lack of antihypertensive/anticonvulsants	1	1.0
No information	30	31.3
No avoidable factors	43	44.8

Patient/family factors

Patient/family factors identified were delay in reporting to healthcare facility 22.9% (22), lack of ANC care 16.7% (16) and delay in decision-making 14.6% (14) **(Table 45).**

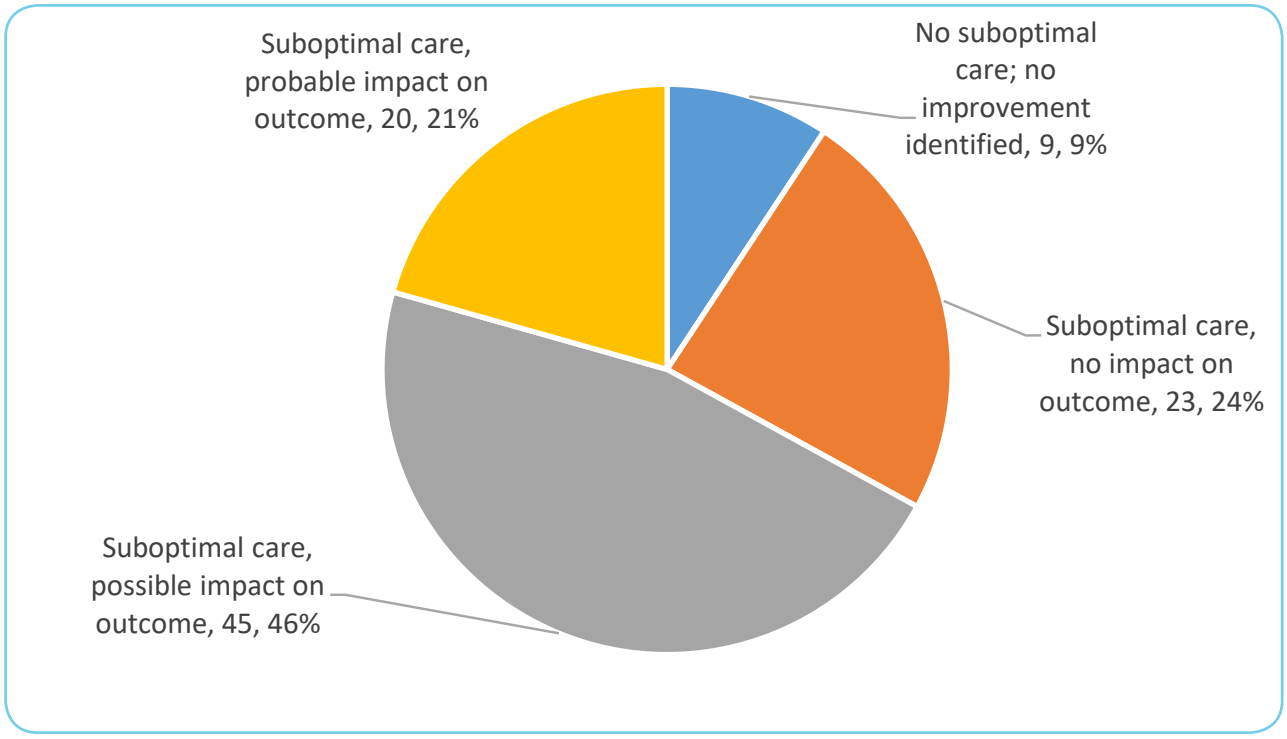
Table 45: Summary of patient/family factors identified

Patient/family factors	Non-obstetric complications (n=96)	
	Frequency	Percent
Delay in reporting to health facility	22	22.9
No antenatal care	16	16.7
Delay in decision-making	14	14.6
Unsafe self-medication treatment	3	3.1
Unsafe traditional/cultural practices	1	1.0
No information	26	27.1
No avoidable factors	33	34.4

c. Overall assessment of quality of care

Assessors concluded that for 67% (65) of women who died from non-obstetric complications, the women received suboptimal care where a different management may have made a difference to the outcome. For 9% (9) of the women no suboptimal care was identified **(Figure 27)**.

Figure 27: Quality of care of women who died of non-obstetric complications



Vignette 15: Non-obstetric complications case 1

Non-obstetric Complication Case 1:

A 22-year-old, primi gravida, GA 28 weeks was admitted with a diagnosis of pulmonary tuberculosis (PTB) and Pneumocystis carinii. She was very ill on admission and was commenced on oxygen to aid her breathing. Her temp of 35 degrees, pulse 90b/m and blood pressure was 100/60mmhg. HIV test was done and was found to be reactive. An impression of sepsis in pregnancy secondary to URTI was made. One day after admission patient went into respiratory distress, collapsed and died after a failed resuscitation

The assessors concluded that a better quality of care could have been provided. Early diagnosis of HIV, early ANC booking and antiretroviral treatment may have resulted in a different outcome.

Vignette 16: Non-obstetric complications case 2

Non-obstetric Complication Case 2:

A 24-year-old, para 1+0, G1, admitted as a referral from a Level 4 health facility where she had been admitted with history of productive cough, shortness of breath, drenching night sweats and swollen legs. She was a known HIV positive patient who has not been compliant with her treatment plan. She had a spontaneous vaginal delivery, 5 days earlier to a live male infant weighing 2400gms. A provisional diagnosis of severe pneumonia/PCP was made. Patient had been on IV drugs Crystalline penicillin, gentamycin, ceftriaxone, prednisone and folic acid which were later changed after 5 days to metronidazole, Ceftriaxone and frusemide with no improvement after 1 week on admission. She was then referred to a higher-level facility for Intensive Care Unit management. Eight hours after admission to ICU, she was found non-responsive in bed. All resuscitation attempts failed.

The assessors concluded that better quality of care provided could have made a difference. There were no records of investigations to determine the correct diagnosis or CD4 count and she was never re-instituted on.

Vignette 17: Non-obstetric complications case 3

Non-obstetric Complication Case 3:

A 30-year-old woman, para 6+2, G9, GA 37 weeks, referred from a sub-county hospital (level 4) for emergency caesarean section due to prolonged labour (5 days history of labour). On examination, cervical dilatation was 8cm, Foetal Heart Rate was 140 b/min, meconium Grade III and a diagnosis of prolonged labour due to big baby was made. Her Hb was 6.9g/dl, BP 130/70mmHg. Three hours after decision was made to have an emergency CS, patient taken to theatre. Patient was prepared for emergency CS and spinal anaesthesia administered. Life male Infant extracted with score of 6/1, 7/5, 9/10 and patient put on IV antibiotics, IVFs and blood transfusion. Two hours after surgery, patient became restless, noisy and put on diazepam. After another 2 hours patient found non-responsive in bed and confirmed dead.

The assessors identified several opportunities to provide good quality care in this case. The patient had severe Anaemia that could have been identified and treated during ANC in this grand multiparous woman. Adequate blood transfusion peri operatively and good post-operative monitoring could have also made a difference in the outcome.

Vignette 18: Non-obstetric complications case 4

Non-obstetric Complication Case 4:

24-year-old para 2+0 G 3, presented at 24-week gestation with 4-day history of vomiting, diarrhoea and loss of consciousness. She was a known HIV positive patient who had not kept her ANC appointments or adhered to ARV medications. On examination, there was no fetal heart and a diagnosis of intrauterine fetal death (IUFD) with severe AIDs was made. She was immediately referred from the level 4 facility where she presented, to a level 5 facility.

On examination at the Level 5 facility, she was found to be very ill looking, unconscious, with severe oral thrush, neck stiffness, BP=90/50mmHg. A diagnosis of advanced AIDS with meningitis and IUFD was made. She was started on IV ceftrioxone, metronidazole, Fluconazole, normal saline intravenous fluids. A plan was made for induction of labour once she was stable and for physician review. Investigation planned included, CT scan, LFTs, U/E. Induction commenced with three doses of misoprostol. Patient was for renal review but died before being reviewed by the renal team.

Assessors concluded that adequate care was provided in this case but that early voluntary testing and counselling, antiretroviral therapy, compliance with treatment plan and ANC will have made a difference in the outcome.

Discussion

Non-obstetric complications are the major cause of indirect maternal deaths. Two out of ten women of the assessed 2014 maternal deaths were due to non-obstetric complications. HIV and Anaemia were the major causes of death in this group.

Early ANC booking, VCT for HIV, early commencement of highly active antiretroviral therapy (HAART) will reduce Maternal-to-Child-Transmission of HIV and improve maternal health. Interventions to improve treatment compliance and reduce the number of HIV positive pregnant women lost during ANC is likely to have made a difference **(Vignettes 1-4: Non-obstetric complications).**

Similar results were reported in the CEMD for Republic of South Africa where HIV infection was found to be the most common underlying condition associated with maternal death in 65.3% of the women. Studies conducted at the Kenyatta National Hospital also found HIV to be the commonest non-obstetric cause of maternal deaths followed by Anaemia (Oyieke et al., 2006). A verbal autopsy study conducted in the informal settlements of Nairobi also found HIV/AID, tuberculosis and Anaemia to be the major indirect cause of maternal deaths (Ziraba et al., 2009).

Recommendations for care

1. Health worker knowledge and training

a. There needs to be a reorientation of healthcare workers at every level on the need for proper documentation and maintenance of medical records. This is a fundamental prerequisite for auditing and quality improvement.

b. Healthcare workers must be trained to provide quality ANC services that optimises the opportunities for early detection and treatment as well as prevention of diseases. This includes prompt referral to the appropriate level of care.

c. Healthcare workers should be trained on the protocols for early referrals from one level to the other, even in the ANC period.

d. Relevant national policies to facilitate the implementation of these recommendations are needed.

2. Improving organisation of care

a. Services need to be re-organised to ensure that pregnancies that are high risk, are manged by specialist teams supported by appropriate resources (test reagents/kits, drugs, etc.).

3. Referral and facility infrastructure

a. Clear referral protocols, to ensure that high risk cases are referred to the appropriate level of care right from the ANC period.

Conclusion

Non-obstetric complications are the major cause of indirect maternal deaths. HIV, Anaemia and Malaria were amongst the 4 leading causes of death from non-obstetric complications. Almost half of the women that died did not have ANC records in their case notes. For 3 out 10 women who died of non-obstetric complications there was no record of their HIV status. The death of 7 out of 10 women who died could have been prevented using a different management approach.

In many settings, globally, HIV infection when detected early can be manged as a chronic condition, maternal to child transmission can be minimised and long term improvements in maternal health can be realised. ANC provides an opportunity for minimising the risk of Anaemia, through providing nutritional advice, iron and folic acid supplementation, early detection and treatment of Anaemia, prevention and early treatment for Malaria. Like with other complications, senior medical staff should be involved early managing obstetric complications but also in caring for women with HIV, chronic Anaemia and severe forms of Malaria.

SECTION 3

Chapter 9:
Discussion and conclusion

Chapter 10:
Recommendation

Chapter 11:
Annexes

Chapter 9

Discussion and conclusion

Main findings

Fifty-one percent **(484)** of the **945** maternal deaths reported in the District Health Information System (DHIS) for the year 2014 were assessed.

Demographic and obstetric characteristics

- The median age of women who died was 27 years. The youngest women who died was 14 years while the oldest was 47 years.
- **63.7% (308)** of women who died were having first, second or fifth (or more) pregnancy.
- **50% (242)** of the women had been referred from other health facilities; mostly Level 4 (sub-County hospitals) to level 5 and 6 health facilities.

Pregnancy outcome

- **77% (374)** of women who died had given birth, **8% (40)** had a pregnancy with an abortive outcome and **14% (70)** were undelivered.

Timing of deaths

- **37.4% (181)** of the MDs occurred in the post-partum period, **18.4% (89)** were intrapartum deaths and the period of death was not specified for **21% (104)** of MDs.

Antenatal care

- **47.3% (229)** of the women who died received Antenatal Care (ANC), **11.4% (55)** did not receive ANC while records of **41.3% (200)** women did not have documentation of ANC attendance.
- Among the **229** women who had ANC, Rhesus test was done for **76.9% (176)** women, Haemoglobin (Hb) tests for **72.1% (165)** and Venereal Disease Research Laboratory (VDRL) tests for **62.5% (142)**. Urinalysis was performed for only **22.3% (51)** of the women.
- HIV status was not recorded in **45.2% (219)** of the cases. Of the **265 deaths in which the HIV status was recorded, 73.6% (195) were HIV negative, 26.4% (70) w**ere HIV positive.

Place of delivery

- Of the **374** women who delivered, **88.8% (332)** delivered in hospital, **7.5% (28)** delivered at home or on the way to hospital and the place of delivery was not specified for **3.7% (14).**

Mode of delivery and outcome

- Of the **374** women who delivered, **63.2% (236)** delivered vaginally (**2% or 7** by AVD) and **36.9% (138)** by C/S.
- Of the **374** who died after childbirth, **50.5% (189)** had a live birth, **33.2% (124)** had a stillbirth and the delivery outcome was unspecified for **16.3% (61)**.

Underlying cause of maternal death

- **77.7% (376)** were direct MDs while **19.8% (96)** were indirect MDs.
- Obstetric haemorrhage **39.7% (192),** non-obstetric complications/indirect MDs **19.8% (96)** and hypertensive disorders associated with pregnancy **15.3% (74)** were the most common causes of all maternal deaths.

Women who had stillbirths

- **25.6% (124)** of all women who died had a stillbirth.
- Of the women who had a stillbirth, most of them died of obstetric haemorrhage **54% (67)** and hypertensive disorders in pregnancy, childbirth and the puerperium period **21% (26).**

Women who died before childbirth

- **14.5% (70)** of women died before childbirth (undelivered).
- Most died from non-obstetric complications **40% (28),** hypertensive disorders in pregnancy, childbirth and the puerperium period **21.4% (15)** and obstetric haemorrhage **18.6% (13).**

Quality of care

- **73.3% (355)** maternal deaths occurred outside working hours (after 5pm to before 8am), on weekends and public holidays. **26.7% (129)** died during weekday normal working hours (8am-5pm).
- Medical officers were involved in the management of **54.1% (262)** of women who died and obstetricians were involved in the care of only **11.4% (55)** of cases.
- Of the **484** maternal deaths assessed, **447 (92.4%)** received suboptimal care, **394 (81.4%)** received **suboptimal** care where different management **could have** made a difference to the outcome.
- In **7.6% (37)** of the maternal deaths, the assessors could not identify any **suboptimal** care identified.
- The most frequent gaps in care of women who died at all levels of care were incorrect management when a correct diagnosis was made, infrequent monitoring and prolonged abnormal observation noted but no action was taken.

Contributory and associated factors

- Of the 484 maternal deaths assessed, one or more associated factors were identified in **89.3% (432)** of the maternal deaths.
- One or more health worker related factors were identified in **75.4% (365)** of the maternal deaths.
- One or more patient/family and administrative factors were identified in **42% (203)** and **35% (169)** of maternal deaths respectively.

- For **64.5% (317)** of the maternal deaths there was insufficient information to identify community associated factors.

Strengths of the first Kenya CEMD report

The set-up of the CEMD system in Kenya took a systematic approach to organise structures for sustainability (National MPDSR committee, National MPDSR secretariat embedded within MoH), to improve the quality of maternal death reviews (robust training of multidisciplinary team of assessors, performing reviews on anonymised case notes), improve the confidence and participation of healthcare professionals in the system and improve the quality of maternal death reviews at healthcare facility level. The Ministry of Health Kenya provided a strong backing for the National MPDSR committee. The inauguration of this multidisciplinary team appointed by the Cabinet Secretary for Health, chaired by the Director of Medical Services was a demonstration of the government commitment to improving the quality of maternal and newborn health in Kenya.

Although several reproductive health stakeholders/partners support facility based MDRs, poor capacity to accurately identify the underlying cause of death, associated and contributory factors limits the quality of effective response at both healthcare facility level and national level. Similar challenges in using the WHO ICD 10 MM classification of cause of maternal deaths have been reported previously.[1] Training of healthcare professionals on the ICD 10 MM, using multidisciplinary teams to perform reviews on anonymised case notes was a strategy effectively implemented during the first CEMD in Kenya, to overcome this problem. However, despite these measures, the underlying cause of death could not be determined for 2.7% (13) of the maternal deaths, due to insufficient case note records.

A structured tool for performing in-depth reviews (assessments) of maternal deaths, the Kenya maternal deaths assessors form was developed, tried and refined over the period of reviewing the case notes from 2014. The electronic tool that mirrors the assessors form but has additional capacity for storing, aggregating and analysis of data extracted from case notes, was also developed and refined.

The Kenya CEMD for the first time provides an in-depth analysis of the pattern of underlying cause of death, contributory cause of death and associated cause of death across Kenya. This is a vital ingredient for an effective National response (the missing 'R 'in MDSR in resource poor countries)

Having legal backing to the CEMD that ensures that it is kept separate from litigation process associated with quality of patient care, adequate funding is provided to complement donor funds and eventually fund the entire enquiry by 2019 is required. This will increase participation and confidence and improve the ownership of the system by Kenyan healthcare professionals and Ministry of Health.

A separate and detailed section of lessons learnt is provided below.

Limitations of the first Kenya CEMD Report

This first report is for maternal deaths that occurred at referral hospitals in the year 2014. Some of the required actions may no longer be relevant; however, this provides a good starting point to review the current situation of quality of care and bench mark against future reviews. It is anticipated that the next review will include 2015 and 2016 MDs, and reported in 2017. A recommendation on the frequency of reporting, for example every 1 or 2 years should be made in 2017, at which point comparison of current capacity to manage the process can be determined.

The sample was representative of the main referral public hospitals where obstetric emergencies are managed in Kenya (92% of all or 446 deaths reviewed). A few mission and private healthcare facilities (7.8% or 38) were included in the Enquiry.

An active process of case notes retrieval was used. This can be a costly process and other more efficient

[1] Owolabi H, Ameh CA, Bar-Zeev S, Adaji S, Kachale F, van den Broek N. Establishing cause of maternal death in Malawi via facility-based review and application of the ICD-MM classification. BJOG 2014; 121 (Suppl. 4): 95–101.

mechanism needs to be explored. The lowest proportion of case notes retrieved was in North Eastern (35%) and Central Regions (41%) and the highest proportion of case notes retrieved were from Coast (59%) and Western Regions (58%). While this represents a good start, support from country health administrative authorities is needed to ensure that a minimum of 80% case not retrieval is achieved for the next Kenya CEMD.

The assessors did not directly collect information from the community to complement information from the case notes. There was no information in the case notes for 64.4% of the maternal deaths to assess the contribution of community factors to the maternal death.

Timing of death was not specified in many cases and this was due to the coding used in the software, the assessors' forms and related instructions for assessors. The assessors form and MAMAS software have been updated and will be used for the second CEMD analysis and report.

Lessons learnt in conducting the CEMD in Kenya

Operationalising MPDSR in Kenya, including establishing the National MPDSR Committee and Secretariat and coordinating a confidential review of maternal death has been a complex and demanding process, requiring effort and commitment across all levels of the health system. We share here the challenges, lessons learnt and suggestions for the National Committee as well as other countries considering setting up such a process.

a. National committee set-up

The composition of the national committee is an important consideration, to ensure representation of key organisations able to support the effort of the Secretariat and oversee the work of the national assessors. Identifying and getting all partners to agree to a committee at national level with representatives from government and private stakeholders can be difficult, especially when there is no precedent or experience in running such a committee. The Kenya experience shows that leadership from the Ministry of Health was integral to getting the committee established, being as inclusive as possible with all key stakeholders in health invited to be members, and having guidelines or a Terms of Reference for members are all important considerations.

b. Retrieving case notes

In Kenya, the national MPDSR Secretariat has primary responsibility for collating case notes of maternal death and preparation and organisation of information prior to national meetings to assess maternal death. The Secretariat has experienced several critical challenges in retrieving case notes, which are common to other countries implementing MDSR. Managers at facilities are sometimes uncooperative, and there is often resistance at county level to release case notes of women who have died. Case notes are sometimes missing at facility level, and those received by the secretariat are at time incomplete and contain inadequate information. These problems may arise because of a lack of awareness of the MPDSR process, lack of trust and suspicion about what the notes will be used for, and linked to this, the fear of blame against persons involved in the care of the women. There is also no legal mandate in Kenya to retrieve case notes, so the process is entirely based on goodwill from the county health managers. Suggestions to improve this include developing a clear and systematic way of retrieving files from the outset. In Kenya, this is currently done by a team of RHMSU staff, supported by the MoH, who visit facilities to collect the maternal death files. While this system works for now, in the long-term facilities will need to be encouraged to take responsibility for routinely sending case notes to the Secretariat following a maternal death. This will likely require further sensitisation of facility staff to the MPDSR process and how notes are used, advocacy by the national assessors, as well as official support from the MoH.

c. Anonymising case notes

Another critical activity required for the national confidential enquiry of maternal death is anonymisation of the case notes retrieved. This is a time consuming and meticulous process that requires dedicated staff and therefore has resource implications. In Kenya, this is currently done by hand by staff specifically employed for the task within the Secretariat. There are inefficiencies in terms of the time taken to do this, as well as problems with too much and too little anonymisation. Suggestions to overcome these problems include scanning case notes at source (i.e. facility level), emailing scanned copies to the dedicated team, who then use an electronic process to block out relevant details in the notes. This needs to be supported with clear guidelines on what types of information should be anonymised. Clearly there are resource implications for making the process electronic, but the investment would save time, reduce the need for physical storage space, and perhaps improve accuracy of anonymisation.

d. Confidential review process

In Kenya, the pool of national assessors is multidisciplinary, including different cadres of healthcare providers, as well as representatives of national professional organisations and teaching institutions; the assessors meet regularly to review maternal death case notes in detail and identify underlying causes of death as well as contributing factors. The assessors describe the confidential review process as a steep learning curve; the assessment meetings require time away from work, and there is a need for adequate sensitisation and training. Assessors sometimes work with incomplete notes that contain scanty details of case management, documentation of ANC and referral notes are often missing, and it is sometimes unclear where to find certain information. In the longer term, more sensitisation is needed at county and facility level to ensure the notes received are complete and accurate, as well as a mechanism to retrieve referral and ANC notes. MPDSR is in the process of being 'institutionalised' as an activity at county or facility level and this will require further training in the process of maternal death review and how it is linked to national MPDSR.

e. Assessors' experiences

The process of reviewing or assessing in detail the case notes of women who have died is an emotional experience, which can affect assessors who may sometimes feel they need to suppress their feelings about the death to remain professional. Assessors in Kenya suggested de-briefing meetings would be helpful to deal with their emotional reactions. They also mentioned the time taken to participate in review meetings and the workload involved, and suggested the Secretariat invest in a larger pool of assessors and create a national database to share the workload among a greater number of trained assessors.

Next steps

This is the first National Confidential Enquiry into Maternal Death report for Kenya. While the report highlights the underlying cases of facility-based maternal death, the associated factors and identifies gaps in quality of care further research in the following areas are recommended.

a. Publication of the findings in peer reviewed journals

The Secretariat will be coordinating the drafting of papers from this report for publication in peer reviewed journals.

b. Review of perinatal death

The World Health Organization defines *perinatal period* as that period commencing at 22 completed weeks (28 weeks for developing counties) of gestation and ends seven completed days after birth.[2] Perinatal mortality refers to the number of stillbirths and deaths in the first week of life (early neonatal mortality). Perinatal and maternal health are closely linked. The 2014 CEMD includes data on stillbirths but has no information on death of the newborn within the first week of life.

During the next months, the National MPDSR Secretariat will be engaged in discussions with relevant stakeholders including the Child and Adolescent Health Unit of the Ministry of Health, Kenya Paediatric Association, Nursing Council of Kenya (NCK), training institutions and representatives from county hospitals to define the process of perinatal death reviews. This will include strengthening or developing a system for notification of perinatal deaths, describing the retrieval of perinatal death case notes and the accompanying maternal case notes, identifying and training perinatal death review assessors, designing a perinatal death assessors form, identifying the causes of perinatal death using the WHO application of ICD-10 to deaths during the perinatal period (ICD-PM),[3] conducting the perinatal deaths assessments through planned assessors workshops, entering the data into the Kenya Perinatal Death Mortality Audit Software database (to be developed) and producing a national report. This is an intense process which will require additional funding and resources including additional staff at the secretariat.

c. Death occurring during the postpartum period

There is need for further disaggregation of deaths occurring during the postpartum period to understand the time-frame for example if the death occurred during early (initial acute phase), mid sub-acute phase (up to 6 weeks) and late (up to six months).

There is also need to understand the condition of the client during admission and as they enter the health system to show whether the client was stable or unstable.

The assessors form has been updated with relevant fields to collect this information for the 2015 and 2016 reviews.

d. Women who died after undergoing caesarean section

For women who died after undergoing caesarean section, there is need for more in-depth analysis of the data to identify factors associated with the outcome of the caesarean section. To understand contextual issues, the results from further quantitative analysis can be explored further by conducting interviews with managers and health providers within comprehensive emergency obstetric care facilities, without compromising the confidentiality of the enquiry.

e. Conducting community based maternal death reviews (verbal autopsy)

This report shows that majority of women who reported to hospital with a diagnosis of puerperal sepsis and died had given birth at home. However, this report does not include data on community based maternal death reviews, this is important to understand events at home, before presentation. Considering that a significant number of maternal death occur at home (38%), there is need for linking community maternal death to the CEMD process by conducting verbal autopsies at selected community units.

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[2] World Health Organization: Maternal and Perinatal deaths. Available from http://www.who.int/maternal_child_adolescent/topics/maternal/maternal_perinatal/en/Accessed 26 October 2016

[3] WHO 2016. The WHO application of ICD-10 to deaths during the perinatal period. http://www.who.int/reproductivehealth/publications/monitoring/icd-10-perinatal-deaths/en/

International comparison

The Republic of South Africa (RSA) has the most developed CEMD system in Africa (17 years)[4] and recently published their 6th triennium report (2011-2013).[5] Malawi was the second sub-Saharan country to conduct a CEMD with the first report published in 2014 covering the period 2008-2012.[6] Maternal deaths at community level were not included in both CEMD in RSA and Malawi.

South Africa has 91% health facility delivery, conducts facility based maternal death reviews and CEMD only. The success of the CEMD in RSA is based on the strong support by the Department for Health, like in Kenya, and strong participation and leadership for the process provided by the obstetricians through their professional association. The RSA CEMD system was developed from the system in the UK. The UK has the best experience with CEMD globally (operational since 1952). Another significant factor for the success of CEMD in RSA has been the relevant legislation put in place prior to the start of the process in 1997, as well as relevant policies to promote maternal health (Free Maternal Health Services Act 1994, Choice of Termination of Pregnancy Act 1996).

The surveillance system for maternal deaths in RSA is backed up by legislation while that in Malawi is not, this may be a reason why previous efforts to conduct a CEMD in Malawi was less successful.[7] The last RSA report (2011-2013) included 4452 cases and Malawi (2008-2012) included 1433 cases. In Malawi, Maternal Death Audit 2 Forms (completed at healthcare facility level) were reviewed by the Confidential Enquiry while in RSA, national assessors at provincial level, review anonymised case notes. A previous study in Malawi which reviewed the quality of reviews at facility level, using the ICD 10 MM as a bench mark found lack of agreement between underlying cause of death reported by healthcare workers using the MDN2 form and those assigned by researchers. The review recommended training of healthcare workers on use of ICD 10 MM and development of a tool to facilitate the application of ICD 10 MM in assigning underlying cause of maternal deaths. These measures are likely to improve the accuracy of information collection during facility based maternal death reviews.

The majority of the maternal deaths reported in Kenya occurred in the post-partum period (62.2%), this was like the findings in Malawi (62%). In both Malawi and Kenya, there were more direct causes of maternal deaths (77.7% and 57.3% respectively) compared to indirect causes (19.8% and 42.7% respectively).

Obstetric Haemorrhage was the leading cause of death in Kenya (39.7%) but non-obstetric complications was the leading cause of deaths in RSA (mainly due to HIV) and in Malawi (Anaemia and Malaria).

The proportion of women who died but delivered vaginally or by instrumental vaginal delivery were similar for Kenya and Malawi but a higher proportion of women who died in Kenya (36.9%) were delivered by cesarean section compared to Malawi (32.6%).

Healthcare worker factors associated with death were similar in Malawi, RSA and Kenya: delay in starting treatment, inadequate clinical skills, inadequate monitoring, and prolonged abnormal observation without acting and incomplete initial assessment. Other factors associated with late presentation and referral from one level of care to another were also significant contributory factors in all 3 CEMDs.

Recommendations from the RSA report centred on capacity building of healthcare workers, improving resources for care at healthcare facilities and improving efficiency of referrals. The Malawi CEMD report recommendation included strengthening of MDR at healthcare facilities and the quality of documentation and records.

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[4] Moodley J, Pattinson RC, Fawcus S, Schoon MG, Moran N, Shweni PM on behalf of the National Committee on Confidential Enquiries into Maternal Deaths in South Africa. The confidential enquiry into maternal deaths in South Africa: a case study. BJOG 2014; 121 (Suppl. 4): 53–60.

[5] Saving Mothers 2011-2013. Sixth Report ON THE Confidential Enquiries into Maternal Death in South Africa. NCCEMDS, DOH RSA.

[6] Malawi 2014: Report on the Confidential Enquiry into Maternal Deaths in Malawi (2008-2012).

Chapter 10

Recommendations

Recommendations for different levels of healthcare administration and management, and the community are as follows:

1. Leadership

While tremendous investments have been made in maternal and newborn health in Kenya, related health indicators do not match the investments. This report illustrates a need for accountability for results in maternal and newborn health by the highest level of leadership from the National and County governments.

2. National Level

i. Develop relevant policy and legislative backup for the confidential enquiry into maternal death process by anchoring the MPDSR process in legislation - MNCH Bill.

ii. Strengthen the maternal death surveillance system to improve the notification of maternal deaths.

iii. Integrate a qualitative enquiry in the confidential enquiry into maternal death surveillance and response process.

iv. Standardize patient record documentation to improve quality of records at healthcare facility level.

v. Explore use of electronic medical records in maternal and newborn health.

vi. Providers of maternity care should have regular and mandatory updates in emergency obstetric and newborn care.

vii. Expand on diagnostic capacity including laboratory services and point of care tests in MNCH.

viii. Embrace and scale up innovations that increase blood and blood products availability and safety e.g. delivering blood using drones.

ix. Rationalise staffing norms and models for remuneration of specialists through output-based modalities such as fee for service, capitation, and mixed method payment.

x. Provide up-to-date treatment protocols in a user-friendly format including in electronic formats and applications for all maternity care providers.

xi. Develop policy to expand access to post abortion care (PAC) services.

xii. Strengthen adolescent sexual and reproductive health policies and implementation models to address teenage pregnancies.

xiii. Embrace and scale up the use of technology to enhance access and availability of quality care in maternal and neonatal health (MNH).

xiv. Institute mechanisms for perinatal death reviews in all health facilities and produce a national report biannually.

3. County level

County governments through the Department of Health should:

i. Within a year, increase performance of facilities to above 70% with all signal functions in BEMONC and CEMONC facilities in each county; and, secure financial arrangements for county department of health especially MNH.

ii. Embrace and scale up innovations that increase blood and blood products availability and safety e.g. delivering blood using drones.

iii. Ensure capacity building and mentorship of healthcare workers at all levels of care and retention within the appropriate department for at least 2 years.

iv. Ensure specialists are available- rationalise working hours, remuneration and incentives.

v. Improve data quality and use - stock taking of maternal and newborn health indicators against set targets.

vi. Link MNH to critical care - using available resources to improve care for women.

4. Health Facility Level

i. Enforce and supervise proper documentation of the care provided to mothers in all health facilities.

ii. Maternity care providers should have regular (2 years) and mandatory updates in emergency obstetric and newborn care (including triage and referral), antenatal care (ANC) and postnatal care (PNC).

iii. Embrace and scale up innovations that increase blood and blood products availability and safety.

iv. Provide the minimum package of care in ANC and PNC to all clients at all levels of the health system (public and private).

v. Improved monitoring of women in ANC, labour and in the post-partum period.

vi. Regular audit and feedback of care should be conducted to continuously improve the quality of care.

vii. Reorganization of care to ensure that high risk pregnancies are managed by specialist teams supported by appropriate resources (test reagents/kits, drugs, equipment, intensive care unit etc.).

viii. Training in the use of spinal anaesthesia and provision of resources needed is important especially at levels 3 and 4 hospitals.

4. Community Level

i. Expand community level health services (level 1).

ii. Preventive and promotive health services.

iii. Data generation and use at community.

iv. Strengthen linkages between the community and the health facility.

v. Referral of all women to the health facility.

vi. Strengthen community reporting of maternal deaths.

Chapter 11

Annexes

Annex 1: Kenya Confidential Enquiry into Maternal Deaths Support System

The Confidential Enquiry into Maternal deaths in Kenya was supported through the National Maternal and Perinatal Death Surveillance and Response (MPDSR) Committee, the National MPDSR secretariat, group of National maternal death assessors and the CEMD report writing committee. A description of the role and composition of each part of this support system is provided below.

a. The National MPDSR Committee

The 2016 National Maternal Perinatal Death Surveillance and Response (MPDSR) guidelines provides guidance introduces the setting up of a National MPDSR committee; a Ministerial advisory committee established by the Cabinet Secretary of Health through a gazette notice (**Box 1:** Terms of Reference).

Box 1: Kenya National MPDSR Committee Terms of Reference

Leadership

The Director of Medical Services, chairs the committee and co-opts other members as need arises.

Purpose of the National MPDSR Committee

The National Committee on Maternal, Perinatal Death Surveillance and Response (MPDSR) is a non-statutory, ministerial advisory committee established by the Cabinet Secretary of Health through a gazette notice.

The primary purpose of the National Committee is to coordinate all MPDSR activities at a central level and to promote the notification and response to all maternal and perinatal death in Kenya. The committee also oversees the writing of periodic Confidential Enquiry into Maternal Death Reports that include practical recommendations for national response and submits the report to the Cabinet Secretary for Health.

Roles and responsibilities of the National MPDSR Committee:

- A Ministerial advisory committee established by the Cabinet Secretary of Health through a gazette notice.
- Provide oversight of all MPDSR activities in the country
- Promote the notification, review and response to all maternal and perinatal death in Kenya.
- Review/evaluate National MPDSR activities implementation
- Review/approve MPDSR reports and make recommendations
- Resource mobilization for maternal and newborn health
- Identifies and uses opportunities to embed MPDSR into the national Legal framework.

- Receives and adopts the Confidential Enquiry Report into Maternal Death from the MPDSR secretariat
- Submits a copy of the Confidential Enquiry Report into Maternal Death to the Cabinet Secretary, Ministry of Health for presentation to the Joint Senate and Parliamentary Committee on Health
- Advocates for continued visibility of maternal and perinatal health at the highest policy level as well as for resource mobilisation.
- Reviews and adopts TORs for the independent assessors
- Receives and appoints Independent Assessors from a list presented by the MPDSR Secretariat
- Meets bi-annually

National MPDSR Secretariat

The National MPDSR Secretariat is based at the reproductive and maternal health services unit, Division of Family Health. The composition of the MPDSR Secretariat includes:

1. Head, Division of Family Health
2. Head, Reproductive and Maternal Health Services Unit
3. Maternal Newborn Health and Monitoring and Evaluation program managers and officers
4. Head, Newborn, Child and Adolescent Health Unit
5. Head, Community Health Services Unit
6. Head, Health Management Information Systems
7. Head, Standard Quality and Regulations
8. Head, Health Promotion
9. Development partners and implementing partners
10. National MPDSR Coordinator
11. Administrative/Logistics Assistant

The secretariat will operate under the coordination of the National MPDSR Coordinator, a program officer and logistics officer. Under the guidance of the National MPDSR committee, the functions of the MPDSR Secretariat include the following:

1. Coordination of MPDSR including its integration with existing systems and processes.
2. Review of county surveillance reports and produce six monthly summary reports.
3. Monitor progress of implementation of recommendations at national, county and facility level.
4. Promote the notification and response to all maternal death as well as the systematic review of perinatal death in Kenya.
5. Undertake regular evaluation of the MPDSR reporting system at national, county and facility level.
6. Produce a national MPDSR annual report.
7. Periodic update of MPDSR guidelines, tools and training materials.
8. Coordinate the collation and assessment of data on maternal and perinatal death.
9. To identify and train national maternal and perinatal death assessors who will review maternal and perinatal death through national review meetings annually.
10. Maintain a database of assessed maternal and perinatal death in the electronic Kenya maternal Morbidity and Mortality Audit System (MAMMAS) software.
11. To build capacity of the MPDSR committee to produce regular National maternal death reports with key recommendations for national response.
12. Conduce operational research to generate evidence to improve implementation of MPDSR.
13. Advocate for the establishment of a legal framework that protects the entire MPDSR process as well as the assessors.

14. To coordinate of all National MPDSR committee meetings, acting as secretariat to this committee.

National Assessors

National MPDSR assessors are healthcare providers with specialty in obstetrics, paediatrics, midwifery, anaesthesia and public health. National assessors are selected to represent various bodies and institutions such as: KMDPB, KOGS, Nursing Council, the private health sector, teaching and referral hospitals and county hospitals. The assessors are trained to provide the following roles through regular national review meetings facilitated through the National MPDSR secretariat:

- To conduct independent, detailed assessments of maternal death and correctly attribute cause of death based on WHO ICD-MM.
- Use the assessors form to conduct detailed assessments of maternal death.
- Explore, document and find out the attributable/preventable factors to maternal and perinatal death.
- Aggregate, analyse, interpret data and write reports on maternal and perinatal death.

The functions of the committee include

- Provide oversight of all MPDSR activities in the country.
- Promote the notification, review and response to all maternal and perinatal death.
- Review/evaluate National MPDSR activities implementation and approve reports.
- Resource mobilization.
- Institute a legal framework for MPDSR.

The Committee is constituted of 24 members who represent different organisations including: the public health sector, population and development, civil registration, professional associations, training institutions, regulatory bodies, private hospitals, county health management, development partners, religious bodies and human rights institutions. The committee meets twice a year. The institutions represented are shown in (**Table 46)** below,

Table 46: National MPDSR Committee Members

Organisation(s)	Position and institution represented	Name of Representative
1. Public Health Sector	1. Director of Medical Services	Dr Kioko Jackson K
	2. Head, Department of Preventive and Promotive Health Services	Dr David Soti
	3. Head, Division of Family Health (Secretary)	Dr Patrick Amoth Dr Mohamed A Sheikh
	4. Head, Reproductive and Maternal Health Services Unit	Dr Bartilol Kigen Dr JO Gondi
	5. Senior State Counsel - Ministry of Health	Betty Soi
2. Population and Development	6. National Council for Population and Development (NCPD)	Dr. Josephine Kibaru Mbae
3. Civil Registration	7. Director Civil Registration Services	Judy Kilobi Otieno Willy Wambua

4. Professional Associations Representatives	8. Chair, Kenya Obstetrical and Gynaecological Society (KOGS)	Dr Anne Kihara Dr Elly Odongo
	9. Chair, Kenya Paediatric Association	Dr Thomas Ngwiri
	10. Chair, Kenya Medical Association	Dr Jacqueline Kitulu Dr Simon Kogondu (Rep)
	11. Chair, Kenya Midwives Association	Mrs. Louisa Muteti
5. Training Institutions	12. Dean College of Health Sciences, University of Nairobi	Prof. Fredrick Were
	13. College of Health Sciences, University of Nairobi, Obstetrics and Gynaecology Department	Prof. Omondi Ogutu
6. Regulatory Bodies	14. Chair, Kenya Medical and Dentists Practitioners Board	Dr. Fredrick Kairithia (Rep)
	15. The Registrar, Nursing Council of Kenya	Mrs. Edna Tallam
7. Private Hospitals	16. Chief Executive Officer, Kenya Healthcare Federation (KHF)	Ms. Faith Muigai
8. County Health Management	17. Chair, CEC Health Committee	Dr. Andrew Mulwa Dr Elizabeth Ogaja (Secretary)
9. Development Partners	18. Chair, Development Partners of Health in Kenya (DPHK)	Ms. Gift Malunga UNFPA Country Representative)
	19. Country Representative –WHO	Dr. Rudi Eggers
	20. Country Representative –UNICEF	Werner Schultink
	21. Head, DFID Kenya	Louise Robinson – Health & HIV Advisor Milka Choge – Health Advisor
	22. USAID - Senior Health Advisor	Dr Sheila Macharia
10. Religious Bodies	23. Chair, Inter-Religious Council of Kenya	Dr Francis Kuria
11. Human Rights	24. Kenya National Commission on Human Rights (KNCHR)	Koome Miriti James

Administrative Staff

No	Name	Designation	Organisation
1	Veneranda Kamanu	Assistant Logistics Assistant (ALA)	Liverpool School of Tropical Medicine
2	Florence Ireri	Senior Office Administrator	Reproductive Maternal Health Services Unit
3	Nancy Wangechi	Secretarial Assistant	Reproductive Maternal Health Services Unit

b. The National MPDSR secretariat

The National MPDSR Secretariat is based at the reproductive and maternal health services unit within the Division of Family Health. The composition of the MPDSR Secretariat includes: Head, Division of Family Health; Head, Reproductive and Maternal Health Services Unit; Maternal New-born Health, Monitoring and Evaluation program managers and new-born health; Head, New-born, Child and Adolescent Health Unit; Head, Health Management Information Systems and Disease surveillance and Response Unit. The secretariat is managed by a National Coordinator and an administrative assistant. The functions of the MPDSR Secretariat include the following:

- Central level coordination of MPDSR activities
- Promote the notification of, and response to, all maternal death
- Coordinate the collation and assessment of data on maternal and perinatal death and production of national report (s)
- Periodic update of MPDSR guidelines, tools and training materials
- Appoint and build capacity of national maternal and perinatal death assessors
- Maintain a database of assessed maternal and perinatal death in the electronic Kenya Maternal Mortality Audit System (MAMAS) software
- Coordinate all National MPDSR committee meetings.

c. National maternal death assessors

Maternal death assessors are self-motivated healthcare professionals who are dedicated to improving the quality of maternal and newborn health nationally through confidential enquires. They serve on a voluntary basis and consist of medical officers, obstetricians, paediatricians, midwives, anaesthetists and public health specialists. Assessors represent various bodies and institutions such as the Kenya Medical and Dentists Practitioners Board (KMDPB), Kenya Obstetrics and Gynaecological Society (KOGS), Nursing Council of Kenya (NCK), Kenya Nurses and Midwives Association-Kenya Chapter, Kenya Clinical Officers Association, National teaching and referral hospitals, county referral hospital, private and Faith-based hospitals **(Table 47)**. So far the MPDSR Secretariat has trained a total of 93 maternal death assessors. Assessors are tasked to do the following:

- Conduct independent, detailed assessments of maternal death and correctly attribute cause of death based on WHO ICD-MM
- Explore and document the attributable/preventable factors to maternal and perinatal death
- Aggregate, analyse, interpret data and write reports on maternal and perinatal death
- The Kenya National assessors were supported by a team from UK and South Africa.

Table 47: List of maternal death assessors

S/ No	Name	Cadre	Hospital/Organisation	County
1	Dr Abdirahim Ibrahim	Medical officer	Wajir Country Referral hospital	Wajir
2	Martan Sugow Noor	Nursing Officer	Wajir County Referral Hospital	Wajir East
3	Henry Kiplagat Ng'eny	Nurse/Midwife	Wajir County Referral Hospital	Wajir East
4	Issack Golo	Nurse/Midwife	Mandera Referral Hospital	Mandera
5	Fatuma Abdi Adan	Nurse/Midwife	Mandera County Referral Hospital	Mandera
6	Hassan Mohamed Odo	Clinical Officer	Mandera County Health Office	Mandera
7	Aisha Hussein	Nurse	Mandera county	Mandera
8	Dr Kamami Samuel Mwangi	Medical officer	Mpeketoni Sub County Hospital	Lamu
9	Jackline Mose	Nurse/Midwife	Lamu County Hospital	Lamu West
10	Christine Bokayo Arero	Nurse/Midwife	Marsabit County Referral Hospital	Marsabit
11	Hoko Halake Runcha	Clinical Officer	Marsabit County Referral Hospital	Marsabit
12	Maria Goretti Elema		Marsabit County Referral Hospital	Marsabit
13	Dr. Wako Abdullahi	Medial Officer	Isiolo County Referral Hospital	Isiolo
14	Dr. Mohamed Dika	Medical Officer	Isiolo County Referral Hospital	Isiolo
15	Lewis M. Miriti	Nurse/Midwife	Isiolo County Referral Hospital	Isiolo
16	Dr Joyce Wangari	Medical Officer	Migori County Referral Hospital	Migori
17	Eline Awinja	Nursing Officer	Isebania Sub-County Hospital	Migori
18	Mohamed Salat Dagane	Nurse/Midwife	Garissa County Office	Garissa
19	Fatuma Iman	Nurse/Midwife	Garissa County Office	Garissa
20	Dr. Hussein Iman Sigat	Medical Officer	Iftin County Hospital	Garissa
21	Dr. Omar Mohamed	Obstetrician Gynaecologist	Moi Teaching & Referral Hospital	Uasin Gishu
22	Dr. Nyongesa Paul	Obstetrician Gynaecologist Medical Officer	Moi Teaching & Referral Hospital	Uasin Gishu
23	Everlyne Rotich	Nurse/Midwife	Moi Teaching & Referral Hospital	Uasin Gishu
24	Jacqueline Mutheu Kituku	Nurse/Midwife	Moi Teaching and Referral Hospital	Uasin Gishu
25	DR. Tonui P. K	Obstetrician Gynaecologist	Moi Teaching & Referral Hospital	Uasin Gishu
26	Moses Kimtai Kimeto	Records Officer	Moi Teaching & Referral Hospital	Uasin Gishu
27	Dr Ameyo Bonventure	Medical Officer	Lodwar County Referral Hospital	Turkana Central
28	Mitei Clara Kerich	Nurse/Midwife	PGH Nakuru	Nakuru West
29	Dr. Solomon Sirma	Obstetrician Gynaecologist	Nakuru County Hospital	Nakuru West

S/ No	Name	Cadre	Hospital/Organisation	County
30	Mary Madome	Registered Nurse	Trans Nzoia West	Trans Nzoia West
31	Dorcas Chemoiywo	Registered Nurse	Kabarnet County Referral Hospital	Baringo Central
32	Geoffrey K. Koskei	Nurse officer	Longisa County Hospital	Bomet East
33	Dr Miriam Wanjala	Medical Officer	Tenwek Hospital	Bomet
34	Catherine Mutinda	Nursing	Nanyuki Teaching and Referral Hospital	Laikipia East
35	Lucy Kimani	Nurse	Olkalou hospital	Olkalou Sub County
36	Dr Anne Gathoni Kabii	Paediatrician	Mukurweini Hospital	Nyeri
37	Dr. Fredrick Kairithia	Obstetrician Gynaecologist	Kijabe Mission Hospital	Kiambu
38	Dr. Kigondu Simon	Obstetrician Gynaecologist	Murang'a County Hospital	Murang'a
39	Cecilia Wachira	Nurse/Midwife	Kerugoya County Referral Hospital	Kirinyaga Central
40	Margaret Njagi	Nurse/Midwife	Thika LV Hospital	Thika
41	Dr. David Kariuki	Obstetrician Gynaecologist	Kiambu District Hospital	Kiambu
42	Ann Waikwa	Nurse	Provincial General Hospital Nyeri	Nyeri
43	Gladys Afandi	Nurse/Midwife	Nursing Council of Kenya	Nairobi
44	Raheli Misiko Mukhwana	Nurse/Midwife	Kenyatta National Hospital	Nairobi
45	Florence Waigumo Kigano	Nurse/Midwife	Pumwani Maternity Hospital	Nairobi
46	Lydia Nthambi Maingi	Health Information Officer	Kenyatta National Hospital	Nairobi
47	Dr. Musalia	Obstetrician Gynaecologist	Kenyatta National Hospital	Nairobi
48	Tecla Ngotie	Registered Nurse/ Midwife	Kenyatta National Hospital	Nairobi
49	Prof Zahida Quereshi	Medical Officer	University of Nairobi - Kenyatta National Hospital	Nairobi
50	Dr. Mathias. O. Aketch	Obstetric Gynaecologist	Jomo Kenyatta University	Kiambu
51	Dr Jacqueline Andhoga	Anaesthesiologist	Jomo Kenyatta University	Nairobi
52	Dr Lazarus Omondi Kumba	Obstetrician Gynaecologist	Pumwani Maternity Hospital	Kamukunji
53	Dr. Leonard Okoko	Obstetrician Gynaecologist	Pumwani Maternity Hospital	Kamukunji
54	Lucy Ng'ethe	Anaestesologist	Pumwani Hospital	Starehe
55	Della Komora	Nurse/Midwife	Mama Lucy Kibaki Hospital	Embakasi
56	Patrick Warutere	Health Records Officer	Ministry Headquarters	Nairobi

S/ No	Name	Cadre	Hospital/Organisation	County
57	Rachel M. Mutui	Nurse/Midwife	Mbagathi Hospital	Langata
58	Dr Amos Oyoko	Medical Officer	MoH/UNFPA	Nairobi
59	Josephine Kanaa Mutua	Nurse/Midwife	Pumwani Maternity Hospital	Nairobi
60	Angelo N. Nyaga	Nurse/Midwife	Embu Level 5 Hospital	Embu West
61	Joseph Mulwa	Nurse/Midwife	Kitui County Hospital	Kitui Central
62	Louisa R.S. Muteti	Midwife	Makueni	Makueni
63	Dr Abdi Ahmed	Surgeon	Machakos Hospital	Machakos
64	Risper Atieno Omondi	Nurse/Midwife	JOOTRH Kisumu	Kisumu
65	Dr Nicholas Nyasoro	Obstetrician Gynaecologist	Jaramogi Ogiga odinga Teaching and Referral Hospital	Kisumu
66	Lucy Oloo Otieno	Nurse/Midwife	Aga Khan Hospital	Kisumu East
67	Rhodah S. Mochama	Registered Nurse/ Midwife	Kisii Teaching and Referral Hospital	Kisii
68	Dr. Julius Ondigo	Obstetrician Gynaecologist	Suba District Hospital	Homabay
69	Hellen Raganga	Kenya Registered Health Nurse	Siaya County Referral Hospital	Alego Usonga
70	Dr Enock Ondari	Obstetrician Gynaecologist	Kisii Hospital	Kisii Central
71	Ruth Ashika Wangwe	Registered Nurse/ Midwife	Kisii Teaching and Referral Hospital	Kisii Central
72	Pamela Osoro	Nurse/Midwife	Kisii Teaching and Referral Hospital	Kisii Central
73	Phanice S. Shivachi	Nurse/Midwife	Tabaka Mission Hospital	Kisii Central
74	Eunice Masamo	Nurse/Midwife	County office	Taita Taveta
75	Dr Ngugi Peris Wairimu	Medical officer	Moi Teaching and Referral Hospital	Taita Taveta
76	Dr Nafsi Jin	Obstetrician Gynaecologist	Coast General Hospital	Coast
77	Dr Eric Wanjala	Obstetrician Gynaecologist	Kilifi County Hospital	Kilifi North
78	Lodrick Luhombo Lyuba	Nurse/Midwife	Kakamega County General Referral Hospital	Kakamega
79	Catherine Mulwale	Nurse/Midwife	Bungoma County Hospital	Bungoma
80	Priscah Wekesa	Nurse/Midwife	Webuye County Hospital	Bungoma
81	Charity K. Riungu	Nurse/Midwife	Vihiga County Hospital	Vihiga
82	Dr Sande Charo	Medical Doctor	Busia Country Referral Hospital	Busia/ Matayas
83	Dr. Anisa Omar	Paediatrician	Neonatal, Child & Adolescent Health Unit	Nairobi
84	Allan Govaga	Registered Clinical Officer	Neonatal, Child & Adolescent Health Unit	Nairobi

S/ No	Name	Cadre	Hospital/Organisation	County
85	Annie Gituto	Nurse/Midwife	Reproductive Maternal Health and Service Unit (RMHSU)	Nairobi
86	Dr Elizabeth Mgamb	Monitoring and Evaluation Manager	RMHSU	Nairobi
87	Elizabeth Washika	Registered Clinical Officer	RMHSU	Nairobi
88	Eunice Wachira	Nurse	RMHSU	Nairobi
89	Tecla Kogo	Program Officer	RMHSU	Nairobi
90	Dr Wangui Muthigani	Program Manager	RMHSU	Nairobi
91	Dr Violet Adeke	Medical officer	RMHSU	Nairobi
92	Joyce Onyango	Program Officer	RMHSU	Nairobi
93	Naomi Shiyonga	Program Officer	RMHSU	Nairobi

Table 48: Assessors from LSTM Kenya and UK Team

S/No	Names	Position	Office
1	Dr Charles Ameh	Senior Clinical Lecturer	LSTM-UK
2	Dr Helen Owolabi	Research Assistant	LSTM-UK
3	Dr Florence Mgawadere	Senior Research Associate	LSTM-UK
4	Dr Helen Smith	Senior Researcher	LSTM-UK
5	Professor James Neilson	Professor	UK CEMD, University of Liverpool and UK Volunteer
6	Dr Sophie Webster	Consultant Obstetrician	National Health service UK, RCOG and UK Volunteer
7	Dr Johan Coetzee	Consultant Obstetrician and National CEMD RSA assessor	Republic of South Africa
8	Dr Pamela Miloya Godia	National MPDSR Coordinator/Senior Technical Officer -MPDSR	LSTM Kenya
9	Judith Maua	Senior Technical Officer	LSTM Kenya
10	Joyce Mutuku	Lead Technical Officer	LSTM Kenya
11	Agnes Gichogo	Technical Officer	LSTM Kenya
12	Sylvia Gichuru	Technical Officer	LSTM Kenya

d. Report writing committee

This report was drafted by a team of 18 persons drawn from the pool of maternal death assessors who have participated in the maternal death review process **(Table 49)**. The team drafted the report by holding two workshops to produce the first draft of the report. The report was reviewed internally by teams from the Reproductive and Maternal Health Services Unit (RMHSU), the MPDSR secretariat and the LSTM-UK team.

The report was thereafter peer-reviewed by selected editors from the UK, WHO Kenya and UNFPA Kenya.

Table 49: MPDSR Report writing and editorial team

S/ No.	Name	Profession	Institution	Chapter(s)/Role
1	Joyce Oyango	M/E	MoH	Introduction, Background
2	Dr Pamela Godia	National MPDSR Coordinator	LSTM/ MoH	Introduction, Background, Methodology, Database support, G5, G6 Drafting and editing of whole report
3	Dr Elizabeth Mgamb	M/E Manager/ Epidemiologist	MoH	Statistical support, Data analysis, Methodology Drafting and editing of whole report
4	Dr Violet Adeke	Medical doctor	MoH	Statistical support, Methodology Drafting and editing of whole report
5	Dr Helen Smith	Lecturer Researcher	LSTM	Full document review, Methods
6	Dr Charles Ameh	Obstetrician Gynaecologist, Senior Clinical Lecturer and Researcher	LSTM	Final editing and full document review, Methods, G5, G6
7	Dr Paul Nyongesa	Obstetrician Gynaecologist	MRTH	General results, G3: Hemorrhage, G5: Other Obs. complications
8	Dr Jackline Adhoga	Anesthetist	JKUAT	General results, G3: Hemorrhage: G5: Other Obs. complications
9	Eline Awinja	Midwife	Isebania SCH	General results, G3: Hemorrhage, G5: Other Obs. complications
10	Evelyn Rotich	Midwifery Lecturer	MRTH	G1: Pregnancy with abortive outcome, G7: Non-Obstetric Complications
11	Dr Joyce Wangari Nganga	Medical Officer	Migori CH	G1: Pregnancy with abortive outcome, G7: Non-Obstetric Complications
12	Dr David Kariuki	Obstetrics and gynecologist	Kiambu	G1: Pregnancy with abortive outcome, G7: Non-Obstetric Complications
13	Dr Simon M. Kigondu	Obstetrics and gynecologist	Muranga CH	G4: Pregnancy-related infections
14	Dr Samuel Kamami	Medical doctor	Lamu	G4: Pregnancy-related infections
15	Annie Gituto	Midwife	MoH	G4: Pregnancy-related infections
16	Dr M Aketch	Obstetrician Gynaecologist	JKUAT	G2: Hypertensive disorders: G5, G6
17	Dr Jackline Adhoga	Anesthetist	JKUAT	General results, G3: Hemorrhage: G5: Other Obstetric complications
18	Elizabeth Washika	Clinical Officer	MoH	G2: Hypertensive disorders, G5, G6
19	Dr Jeanne Patrick	Public Health Specialist	MoH	Adolescent health sections
20	Dr Wangui Muthigani	Public Health Specialist	MoH	Final editing and full document review

Annex 2: Socio-demographic characteristics of mothers, compared to causes of death for women who died in 2014

Characteristic	Variable	Obstetric haemorrhage n= 192	Pregnancy with abortive outcomes n=40	Hypertensive disorders n=74	Non-obstetric complications n=96	Pregnancy-related infections n=47
		Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Age Group	<20	12 (6.3)	6 (15.0)	4 (5.4)	5 (5.2)	10 (21.3)
	20-24	32 (16.7)	10 (25.0)	20 (27.0)	26 (27.1)	13 (27.7)
	25-29	42 (21.9)	14 (35.0)	27 (36.5)	33 (34.4)	11 (23.4)
	30-34	56 (29.2)	4 (10.0)	13 (17.6)	17 (17.7)	8 (17.0)
	35-39	37 (19.3)	5 (12.5)	5 (6.8)	9 (9.4)	2 (4.3)
	40-44	11 (5.7)	0 (0.0)	4 (5.4)	2 (2.1)	2 (4.3)
	45+	0 (0.0)	1 (2.5)	0 (0.0)	1 (1.0)	0 (0.0)
	Not recorded	2 (1.0)	0 (0.0)	1 (1.4)	3 (3.1)	1 (2.1)
Parity	0	26 (13.5)	7 (17.5)	23 (31.1)	21 (21.9)	14 (29.8)
	1	46 (24.0)	7 (17.5)	12 (16.2)	23 (24.0)	9 (19.1)
	2	14 (7.3)	6 (15.0)	11 (14.9)	23 (23.7)	9 (19.1)
	3	30 (15.6)	6 (15.0)	9 (12.2)	14 (14.4)	9 (19.1)
	4	19 (9.9)	2 (5.0)	5 (6.8)	6 (6.3)	2 (4.3)
	5	19 (9.9)	1 (2.5)	4 (5.4)	2 (2.1)	0 (0.0)
	6+	28 (14.6)	2 (5.0)	4 (5.4)	3 (3.1)	2 (4.3)
	Not recorded	10 (5.2)	9 (22.5)	6 (8.1)	4 (4.2)	2 (4.3)
Gravidity	1	22 (11.5)	7 (17.5)	23 (31.1)	19 (19.8)	16 (34.0)
	2	39 (20.3)	7 (17.5)	11 (14.9)	22 (22.9)	5 (10.6)
	3	17 (8.9)	4 (10.0)	12 (16.2)	24 (25.0)	10 (21.3)
	4	34 (17.7)	5 (12.5)	8 (10.8)	12 (12.5)	9 (19.1)
	5	20 (10.4)	4 (10.0)	5 (6.8)	9 (9.4)	3 (6.4)
	6+	50 (26.0)	4 (10.0)	9 (12.2)	6 (6.3)	2 (4.3)
	Not recorded	10 (5.2)	9 (22.5)	6 (8.1)	4 (4.2)	2 (4.3)
Region	Central	14 (7.3)	2 (5.0)	5 (6.8)	5 (5.2)	2 (4.3)
	Coast	39 (20.3)	0 (0.0)	14 (18.9)	10 (10.4)	4 (8.5)
	Eastern	23 (12.0)	9 (22.5)	4 (5.4)	5 (4.2)	5 (10.6)
	Nairobi	17 (8.9)	12 (30.0)	14 (18.9)	23 (24.0)	12 (25.5)
	North Eastern	13 (6.8)	0 (0.0)	1 (1.4)	4 (4.2)	0 (0.0)
	Nyanza	28 (14.6)	6 (15.0)	8 (10.8)	24 (25.0)	6 (12.8)
	Rift valley	34 (17.7)	9 (22.5)	20 (27.0)	17 (17.7)	12 (25.5)
	Western	24 (12.5)	2 (5.0)	8 (10.8)	9 (9.4)	6 (12.8)
Period of death	Public holiday	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)	0 (0.0)
	Weekday out of hours	104 (54.2)	17 (42.5)	22 (29.7)	37 (38.5)	16 (34.0)
	Weekday working hours (8-5)	42 (21.9)	10 (25.0)	26 (35.1)	26 (27.1)	13 (27.7)
	Weekend	46 (24.0)	13 (32.5)	26 (35.1)	32 (33.3)	18 (38.3)

Characteristic	Variable	Obstetric haemorrhage n= 192	Pregnancy with abortive outcomes n=40	Hypertensive disorders n=74	Non-obstetric complications n=96	Pregnancy-related infections n=47
		Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Received antenatal care	No	12 (6.3)	9 (22.5)	11 (14.9)	13 (13.5)	8 (17.0)
	Not recorded	57 (29.7)	31 (77.5)	27 (36.5)	45 (46.9)	29 (61.7)
	Yes	123 (64.1)	0 (0.0)	36 (48.6)	38 (39.6)	10 (21.3)
HIV status	Negative	100 (52.1)	7 (17.5)	38 (51.4)	29 (30.2)	8 (17.0)
	Positive	19 (9.9)	0 (0.0)	2 (2.7)	34 (35.4)	11 (23.4)
	Not recorded	73 (38.0)	33 (82.5)	34 (45.9)	33 (34.4)	28 (59.6)
Pregnancy outcome	Ectopic pregnancy	0 (0.0)	2 (5.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Live birth	92 (47.9)	0 (0.0)	21 (28.4)	32 (33.3)	28 (59.6)
	Miscarriage	0 (0)	36 (90.0)	0 (0.0)	2 (2.1)	2 (4.3)
	Stillbirth	67 (34.9)	0 (0.0)	26 (35.1)	16 (16.7)	10 (21.3)
	Undelivered	23 (12.0)	2 (5.0)	26 (36.1)	44 (45.8)	6 (12.8)
	Not recorded	10 (5.2)	0 (0.0)	1 (1.4)	2 (2.1)	1 (2.1)
Delivery mode	Assisted vaginal	4 (2.1)	0 (0.0)	1 (1.4)	0 (0.0)	1 (2.1)
	Caesarean section	79 (41.1)	0 (0.0)	20 (27.0)	9 (9.4)	12 (25.5)
	Ectopic pregnancy	0 (0.0)	1 (2.5)	1 (1.4)	0 (0.0)	0 (0.0)
	Not applicable	12 (6.3)	28 (70.0)	12 (16.2)	19 (19.8)	5 (10.6)
	Undelivered	13 (6.8)	4 (10.0)	15 (20.3)	28 (29.2)	3 (6.4)
	Vaginal	84 (43.8)	7 (17.5)	25 (33.8)	40 (41.7)	26 (55.3)
Delivery period	Not applicable	22 (11.5)	29 (72.5)	25 (33.8)	43 (44.8)	6 (12.8)
	Not recorded	23 (12.0)	6 (15.0)	15 (20.3)	16 (16.7)	21 (44.7)
	Weekday out of hours	61 (31.8)	2 (5.0)	11 (14.9)	19 (19.8)	6 (12.8)
	Weekday working hours	48 (25.0)	1 (2.5)	10 (13.5)	13 (13.5)	9 (19.1)
	Weekend	38 (19.8)	2 (5.0)	13 (17.6)	5 (5.2)	5 (10.6)
Delivery place	County Referral Hospital	70 (36.5)	3 (7.5)	14 (18.9)	16 (16.7)	14 (29.8)
	Dispensary	1 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.1)
	Health Centre	9 (4.7)	0 (0.0)	0 (0.0)	1 (1.0)	2 (4.3)
	Home	10 (5.2)	1 (2.5)	5 (6.8)	2 (2.1)	8 (17.0)
	National Teaching/ Referral Hospital	10 (5.2)	3 (7.5)	5 (6.8)	9 (9.4)	4 (8.5)
	Not applicable	24 (12.5)	26 (65.0)	26 (35.1)	43 (44.8)	6 (12.8)
	On the way/before arrival at facility	1 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.3)
	Other	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)	1 (2.1)
	Private/Faith-based facility	11 (5.7)	4 (10.0)	7 (9.5)	7 (7.3)	4 (8.5)
	Secondary Referral Hospital	29 (15.1)	0 (0.0)	10 (13.5)	10 (10.4)	1 (2.1)
	Sub-County Hospital	24 (12.5)	1 (2.5)	7 (9.5)	0 (0.0)	0 (0.0)
	TBA	1 (0.5)	0 (0.0)	0 (0.0)	1 (1.0)	0 (0.0)
	Not recorded	2 (1.0)	2 (5.0)	0 (0.0)	6 (6.3)	4 (8.5)

Characteristic	Variable	Obstetric haemorrhage n= 192	Pregnancy with abortive outcomes n=40	Hypertensive disorders n=74	Non-obstetric complications n=96	Pregnancy-related infections n=47
		Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
Managed by	Clinical officer	2 (1.0)	3 (7.5)	0 (0.0)	3 (3.1)	1 (2.1)
	Medical officer	106 (55.2)	22 (55.0)	43 (58.1)	41 (42.7)	21 (44.7)
	Midwife	38 (19.8)	1 (2.5)	11 (14.9)	18 (18.8)	5 (10.6)
	Not applicable	5 (2.6)	6 (15.0)	4 (5.4)	15 (15.6)	2 (4.3)
	Nurse	6 (3.1)	2 (5.0)	1 (1.4)	4 (4.2)	5 (10.6)
	Obstetrician/Gynaecologist	26 (13.5)	3 (7.5)	10 (13.5)	12 (12.5)	2 (4.3)
	Unattended	2 (1.0)	2 (5.0)	0 (0.0)	1 (1.0)	2 (4.3)
	Unskilled attendant	7 (3.6)	1 (2.5)	5 (6.8)	2 (2.1)	9 (19.1)
Referral	No	89 (46.4)	18 (45.0)	38 (51.4)	50 (52.1)	25 (53.2)
	Yes	103 (53.6)	22 (55.0)	36 (48.6)	46 (47.9)	22 (46.8)
Place of death	County Referral Hospital	85 (44.3)	13 (32.5)	28 (37.8)	32 (33.3)	20 (42.6)
	Dispensary	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Health Centre	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	National Teaching/ Referral Hospital	17 (8.9)	14 (35.0)	19 (25.7)	28 (29.2)	13 (27.7)
	On the way/before arrival at facility	5 (2.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Private/Faith-based facility	8 (4.2)	2 (5.0)	9 (12.2)	11 (11.5)	7 (14.9)
	Secondary Referral Hospital	48 (25.0)	6 (15.0)	13 (17.6)	24 (25.0)	5 (10.6)
	Sub-County Hospital	29 (15.1)	5 (12.5)	5 (6.8)	1 (1.0)	2 (4.3)
Received anaesthetic?	General anaesthetic	68 (35.4)	8 (20.0)	17 (23.0)	6 (6.3)	6 (12.8)
	No anaesthetic	38 (19.8)	10 (25.0)	21 (28.4)	42 (43.8)	11 (23.4)
	Not Applicable	55 (28.6)	19 (47.5)	30 (40.5)	42 (43.8)	22 (46.8)
	Spinal anaesthetic	24 (12.5)	0 (0.0)	4 (5.4)	3 (3.1)	2 (4.3)
	Type not recorded	7 (3.6)	3 (7.5)	2 (2.7)	3 (3.1)	6 (12.8)

Annex 3a: Characteristics of women who had stillbirths

Characteristic	Category	Women who had stillbirth	
		n=124	%
Parity	0	24	19.4
	1	29	23.4
	2	16	12.9
	3	18	14.5
	4	11	8.9
	5	11	8.9
	6+	11	8.9
	Missing	4	3.2
Age		n=124	%
	<20	11	8.9
	20-24	18	14.5
	25-29	41	33.1
	30-34	28	22.6
	35-39	20	16.1
	40-44	5	4
	45+	0	-
	No record	1	0.8
Received antenatal care		n=124	%
	Yes	72	58.1
	No	15	12.1
	Unknown	37	29.8
If received ANC, tests performed		n=72	%
	HB	54	75
	Rhesus test	57	79.2
	Malaria	4	5.6
	VDRL	45	62.5
	Stool	4	5.6
	Urinalysis	14	19.4
HIV status		n=124	%
	Negative	60	48.4
	Positive	12	9.7
	Unknown	52	41.9
Was she referred?		n=124	%
	Yes	67	54
	No	57	46
Referring facility level		n=67	%
	Level 1	1	1.5
	Level 2	4	6
	Level 3	13	19.4
	Level 4	28	41.8
	Level 5	7	10.4
	Private	14	20.9

Characteristic	Category	Women who had stillbirth	
		n=124	%
Underlying cause of death		n=124	%
	Direct deaths without an Obstetric code	0	0
	Hypertensive disorders in pregnancy, childbirth, and the puerperium	26	21
	Non-obstetric complications	16	12.9
	Obstetric haemorrhage	67	54
	Other obstetric complications	3	2.4
	Pregnancies with abortive outcome	0	0
	Pregnancy-related infection	10	8.1
	Unanticipated complications of management	1	0.8
	Undetermined	1	0.8
Suboptimal care received?		n=124	%
	No suboptimal care; no improvement identified	11	8.9
	Suboptimal care, no impact on outcome	13	10.5
	Suboptimal care, possible impact on outcome	64	51.6
	Suboptimal care, probable impact on outcome	36	29

Annex 3b: Characteristics of women who died before childbirth

Characteristic	Category	Women who died before childbirth	
		n=70	%
Parity	0	16	22.9%
	1	14	20.0%
	2	14	20.0%
	3	11	15.7%
	4	3	4.3%
	5	4	5.7%
	6+	3	4.3%
	Missing	5	7.1%
Age		n=70	%
	<20	4	5.7%
	20-24	15	21.4%
	25-29	20	28.6%
	30-34	20	28.6%
	35-39	9	12.9%
	40-44	1	1.4%
	45+	0	0.0%
	No record	1	1.4%

Characteristic	Category	Women who died before childbirth	
		n=70	%
Received antenatal care		n=70	%
	Yes	30	42.9%
	No	7	10.0%
	Unknown	33	47.1%
If received ANC, tests performed		n=30	%
	HB	20	67%
	Rhesus test	22	73%
	Malaria	4	13%
	VDRL	18	60%
	Stool	2	7%
	Urinalysis	9	30%
HIV status		n=70	
	Negative	21	30%
	Positive	14	20%
	Unknown	35	50%
Was she referred?		n=70	%
	Yes	33	47.1%
	No	37	52.9%
Referring facility level		n=33	%
	Level 1	1	1.4%
	Level 2	3	4.3%
	Level 3	6	8.6%
	Level 4	11	15.7%
	Level 5	5	7.1%
	Private	7	10.0%
Underlying cause of death		n=70	%
	Direct deaths without an Obstetric code	1	1.4%
	Hypertensive disorders in pregnancy, childbirth, and the puerperium	15	21.4%
	Non-obstetric complications	28	40.0%
	Obstetric haemorrhage	13	18.6%
	Other obstetric complications	4	5.7%
	Pregnancies with abortive outcome	4	5.7%
	Pregnancy-related infection	3	4.3%
	Unanticipated complications of management	0	0.0%
	Undetermined	2	2.9%
Suboptimal care received?		n=70	%
	No suboptimal care; no improvement identified	3	4.3%
	Suboptimal care, no impact on outcome	8	11.4%
	Suboptimal care, possible impact on outcome	38	54.3%
	Suboptimal care, probable impact on outcome	21	30%

Annex 4: Contributory conditions

Contributory condition	Number	Percentage of total
Complications following abortion and ectopic and molar pregnancy	**56**	**11.5**
Genital tract and pelvic infection following abortion and ectopic and molar pregnancy	6	1.2
Delayed or excessive haemorrhage following abortion and ectopic and molar pregnancy	11	2.3
Shock following abortion and ectopic and molar pregnancy	17	3.5
Renal failure following abortion and ectopic and molar pregnancy	8	1.6
Metabolic disorders following abortion and ectopic and molar pregnancy	1	0.2
Damage to pelvic organs and tissues following abortion and ectopic and molar pregnancy	6	1.2
Other venous complications following abortion and ectopic and molar pregnancy	1	0.2
Other complications following abortion and ectopic and molar pregnancy	2	0.4
Complication following abortion and ectopic and molar pregnancy, unspecified	4	0.8
Excessive vomiting in pregnancy	**5**	**1**
Other vomiting complicating pregnancy	2	0.4
Vomiting of pregnancy, unspecified	3	0.6
Venous complications in pregnancy	**1**	**0.2**
Varicose veins of lower extremity in pregnancy	1	0.2
Maternal care for other conditions predominantly related to pregnancy	**13**	**2.7**
Other specified pregnancy-related conditions	7	1.4
Pregnancy-related condition, unspecified	6	1.2
Abnormal findings on antenatal screening of mother	**21**	**4.3**
Abnormal haematological finding on antenatal screening of mother	10	2.1
Abnormal biochemical finding on antenatal screening of mother	1	0.2
Abnormal ultrasonic finding on antenatal screening of mother	1	0.2
Abnormal radiological finding on antenatal screening of mother	2	0.4
Abnormal chromosomal and genetic finding on antenatal screening of mother	1	0.2
Other abnormal findings on antenatal screening of mother	5	1
Abnormal finding on antenatal screening of mother, unspecified	1	0.2
Complications of anaesthesia during pregnancy	**2**	**0.4**
Spinal and epidural anaesthesia-induced headache during pregnancy	2	0.4
Multiple gestation	**10**	**2.1**
Twin pregnancy	8	1.6
Triplet pregnancy	2	0.4

Contributory condition	Number	Percentage of total
Maternal care for known or suspected malpresentation of fetus	**9**	**1.9**
Maternal care for breech presentation	1	0.2
Maternal care for transverse and oblique lie	4	0.8
Maternal care for multiple gestation with malpresentation of one fetus or more	2	0.4
Maternal care for compound presentation	2	0.4
Maternal care for known or suspected abnormality of pelvic organs	**5**	**1**
Maternal care due to uterine scar from previous surgery	1	0.2
Maternal care for other abnormalities of cervix	1	0.2
Maternal care for other abnormalities of gravid uterus	1	0.2
Maternal care for other abnormalities of pelvic organs	1	0.2
Maternal care for abnormality of pelvic organ, unspecified	1	0.2
Maternal care for known or suspected foetal abnormality and damage	**4**	**0.8**
Maternal care for (suspected) central nervous system malformation in fetus	3	0.6
Maternal care for (suspected) damage to fetus from viral disease in mother	1	0.2
Maternal care for other known or suspected foetal problems	**18**	**3.7**
Maternal care for intrauterine death	17	3.5
Maternal care for other specified foetal problems	1	0.2
Other disorders of amniotic fluid and membranes	**3**	**0.6**
Oligohydramnios	1	0.2
Disorder of amniotic fluid and membranes, unspecified	2	0.4
Premature rupture of membranes	**8**	**1.6**
Premature rupture of membranes, onset of labour within 24 hours	1	0.2
Premature rupture of membranes, onset of labour after 24 hours	4	0.8
Premature rupture of membranes, unspecified	3	0.6
Placental disorders	**12**	**2.5**
Other placental disorders	5	1
Placental disorder, unspecified	7	1.4
False labour	**1**	**0.2**
False labour before 37 completed weeks of gestation	1	0.2
Preterm labour and delivery	**16**	**3.3**
Preterm labour without delivery	2	0.4
Preterm spontaneous labour with preterm delivery	12	2.5

Contributory condition	Number	Percentage of total
Preterm delivery without spontaneous labour	2	0.4
Failed induction of labour	**5**	**1**
Failed medical induction of labour	5	1
Abnormalities of forces of labour	**4**	**0.8**
Primary inadequate contractions	2	0.4
Precipitate labour	2	0.4
Long labour	**31**	**6.4**
Prolonged first stage (of labour)	21	4.3
Prolonged second stage (of labour)	9	1.9
Delayed delivery of second twin, triplet, etc.	1	0.2
Obstructed labour due to malposition and malpresentation of fetus	**10**	**2.1**
Obstructed labour due to breech presentation	1	0.2
Obstructed labour due to face presentation	2	0.4
Obstructed labour due to shoulder presentation	2	0.4
Obstructed labour due to compound presentation	2	0.4
Obstructed labour due to other malposition and malpresentation	2	0.4
Obstructed labour due to malposition and malpresentation, unspecified	1	0.2
Obstructed labour due to maternal pelvic abnormality	**5**	**1**
Obstructed labour due to generally contracted pelvis	2	0.4
Obstructed labour due to other maternal pelvic abnormalities	1	0.2
Obstructed labour due to maternal pelvic abnormality, unspecified	2	0.4
Other obstructed labour	**33**	**6.8**
Obstructed labour due to shoulder dystocia	2	0.4
Obstructed labour due to unusually large fetus	1	0.2
Obstructed labour due to other abnormalities of fetus	1	0.2
Failed trial of labour, unspecified	2	0.4
Other specified obstructed labour	4	0.8
Obstructed labour, unspecified	23	4.7
Labour and delivery complicated by foetal stress distress	**29**	**6**
Labour and delivery complicated by foetal heart rate anomaly	10	2.1
Labour and delivery complicated by meconium in amniotic fluid	9	1.9
Labour and delivery complicated by foetal heart rate anomaly with meconium in amniotic fluid	4	0.8
Labour and delivery complicated by biochemical evidence of foetal stress	1	0.2
Labour and delivery complicated by other evidence of foetal stress	2	0.4
Labour and delivery complicated by foetal stress, unspecified	3	0.6

Contributory condition	Number	Percentage of total
Labour and delivery complicated by umbilical cord complications	**4**	**0.8**
Labour and delivery complicated by prolapse of cord	2	0.4
Labour and delivery complicated by cord around neck, with compression	2	0.4
Perineal laceration during delivery	**11**	**2.3**
First degree perineal laceration during delivery	1	0.2
Second degree perineal laceration during delivery	1	0.2
Third degree perineal laceration during delivery	3	0.6
Fourth degree perineal laceration during delivery	1	0.2
Perineal laceration during delivery, unspecified	5	1
Other complications of labour and delivery, not elsewhere classified	**77**	**15.8**
Maternal distress during labour and delivery	4	0.8
Shock during or following labour and delivery	66	13.6
Pyrexia during labour, not elsewhere classified	3	0.6
Delayed delivery after spontaneous or unspecified rupture of membranes	2	0.4
Vaginal delivery following previous caesarean section	2	0.4
Single spontaneous delivery	**18**	**3.7**
Spontaneous vertex delivery	15	3.1
Spontaneous breech delivery	2	0.4
Single spontaneous delivery, unspecified	1	0.2
Single delivery by forceps and vacuum extractor	**2**	**0.4**
Vacuum extractor delivery	2	0.4
Single delivery by caesarean section	**47**	**9.7**
Delivery by elective caesarean section	3	0.6
Delivery by emergency caesarean section	38	7.8
Delivery by caesarean hysterectomy	1	0.2
Other single delivery by caesarean section	3	0.6
Delivery by caesarean section, unspecified	2	0.4
Other assisted single delivery	**7**	**1.4**
Breech extraction	2	0.4
Other manipulation-assisted delivery	1	0.2
Delivery of viable fetus in abdominal pregnancy	1	0.2
Other specified assisted single delivery	2	0.4
Assisted single delivery, unspecified	1	0.2

Contributory condition	Number	Percentage of total
Multiple delivery	**3**	**0.6**
Multiple delivery, all spontaneous	1	0.2
Multiple delivery, all by caesarean section	1	0.2
Other multiple delivery	1	0.2
Complications specific to multiple gestation	**4**	**0.8**
Continuing pregnancy after intrauterine death of one fetus or more	1	0.2
Other complications specific to multiple gestation	3	0.6
Complications of anaesthesia during the puerperium	**3**	**0.6**
Spinal and epidural anaesthesia-induced headache during the puerperium	3	0.6

Annex 5: Detailed cause of MD by ICD 10 MM group

Table 52: Sub-groups of MDs due to obstetric haemorrhage, detailed description and mode of delivery

Sub Group	Detailed description	Mode of delivery					Total
		Assisted vaginal	Caesare-an section	Not speci-fied	Undeliv-ered	Vaginal	
Placenta praevia	Placenta praevia with haemorrhage		2	0	2		
	Not specified		0	1	0		4
	Total		**2**	**1**	**2**		1
Premature separation of placenta [abruptio placentae]	Other premature separation of placenta		2		1	0	3
	Premature separation of placenta, unspecified		6		1	0	7
	Not specified		4		1	1	6
	Total		**12**		**3**	**1**	**16 (8.3%)**
Antepartum haemor-rhage, not elsewhere classified	Antepartum haemorrhage with coagulation defect	0	1	0	0	0	1
	Antepartum haemorrhage, unspecified	0	3	5	4	1	13
	Other antepartum haemorrhage	0	5	1	0	0	6
	Not specified	1	0	0	1	0	2
	Total	**1**	**9**	**6**	**5**	**1**	**22 (11.5%)**
Labour and delivery complicated by intrapartum haemorrhage, not elsewhere classified	Intrapartum haemorrhage with coagulation defect		1	0			1
	Intrapartum haemorrhage, unspecified		6	1			7
	Other intrapartum haemorrhage		3	0			3
	Not specified		1	0			1
	Total		**11**	**1**			**12 (6.3%)**

Sub Group	Detailed description	Mode of delivery					Total
		Assisted vaginal	Caesare-an section	Not speci-fied	Undeliv-ered	Vaginal	
Other obstetric trauma	Obstetric laceration of cervix	1	2	0	0	11	14
	Rupture of uterus before onset of labour	0	1	0	0	0	1
	Rupture of uterus during labour	0	17	3	3	5	28
	Total	**1**	**20**	**3**	**3**	**16**	**43**
Postpartum haemorrhage	Delayed and secondary postpartum haemor-rhage	0	0	0		2	2
	Other immediate postpartum haemorrhage	1	15	0		26	42
	Postpartum coagulation defects	0	2	0		4	6
	Third-stage haemorrhage	0	7	1		32	40
	Not specified	1	1	0		2	4
	Total	**2**	**25**	**1**		**66**	**94 (49%)**
Total		**4 (2.1%)**	**79 (41.1%)**	**12 (6.3%)**	**13 (6.8%)**	**84 (43.8%)**	**192**

Table 53: Sub-groups of MDs due to hypertensive disorders in pregnancy, childbirth, and the puerperium, detailed description and mode of delivery

Sub Group	Detailed description	Mode of delivery						Total
		Assisted vaginal	Caesarean section	Ectopic pregnancy	Not specified	Undelivered	Vaginal	
Eclampsia	Eclampsia in labour	1	4	-	3	3	4	15
	Eclampsia in pregnancy	0	11	-	5	7	7	30
	Eclampsia in the puerperium	0	1	-	1	0	6	8
	Eclampsia, unspecified as to time	0	0	-	0	0	1	1
	Not specified	0	1	-	1	1	1	4
	Total	**1**	**17**	**-**	**10**	**11**	**19**	**58**
Pre-eclampsia	HELLP syndrome		0	1	0	2	3	6
	Severe pre-eclampsia		2	0	2	2	3	9
	Total		**2**	**1**	**2**	**4**	**6**	**15**
Pre-eclampsia superimposed on chronic hypertension			1					1
	Total		**1**					**1**
Total		**1 (1.4%)**	**20 (27%)**	**1 (1.4%)**	**12 (16.2%)**	**15 (20%)**	**25 (33.8%)**	**74**

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